Salinas Valley Groundwater Basin
180/400-Foot Aquifer Subbasin
2022 GSP Amendment 1

Salinas Valley Basin
Groundwater Sustainability Agency

(Approved by Salinas Valley Basin Groundwater Sustainability Agency Board of Directors on September 8, 2022)

Prepared by:

MONTGOMERY
& ASSOCIATES
Water Resource Consultants

Chapter 1
Appendix 1-A

SVBGSA Joint Exercise of Powers Agreement

JOINT EXERCISE OF POWERS AGREEMENT

establishing the

SALINAS VALLEY BASIN GROUNDWATER SUSTAINABILITY AGENCY

JOINT EXERCISE OF POWERS AGREEMENT

establishing the

SALINAS VALLEY BASIN GROUNDWATER SUSTAINABILITY AGENCY

THIS JOINT EXERCISE OF POWERS AGREEMENT ("Agreement') establishing the Salinas Valley Basin Groundwater Sustainability Agency ("Agency") is made and entered into as of 12/22/16 ("Effective Date"), by and among the public agencies listed on the attached Exhibit "A" (collectively "Members" and individually "Member") for the purpose of forming a Groundwater Sustainable Agency ("GSA") and achieving groundwater sustainability in the Salinas Valley Groundwater Basin.

RECITALS

WHEREAS, in the fall of 2014 the California legislature adopted, and the Governor signed into law, three bills (SB 1168, AB 1739, and SB 1319) collectively referred to as the "Sustainable Groundwater Management Act" ("SGMA"), that initially became effective on January 1, 2015, and that has been amended from time-to-time thereafter; and

WHEREAS, the stated purpose of SGMA, as set forth in California Water Code section 10720.1, is to provide for the sustainable management of groundwater basins at a local level by providing local groundwater agencies with the authority, and technical and financial assistance necessary, to sustainably manage groundwater; and

WHEREAS, SGMA requires the designation of Groundwater Sustainability Agencies ("GSAs") for the purpose of achieving groundwater sustainability through the adoption and implementation of Groundwater Sustainability Plans ("GSPs") or an alternative plan for all medium and high priority basins as designated by the California Department of Water Resources; and

WHEREAS, SGMA requires that the Basin have a designated GSA by no later than June 30, 2017, and an adopted GSP by no later than January 31, 2020, if a high or medium priority basin in critical overdraft, and no later than January 31, 2022, if a high or medium priority basin; and

WHEREAS, SGMA authorizes a combination of local agencies to form a GSA by entering into a joint powers agreement as authorized by the Joint Exercise of Powers Act (Chapter 5 of Division 7 of Title 1 of the California Government Code) ("Act"); and

WHEREAS, each Member is a local agency, as defined by SGMA, within that portion of the Salinas Valley Groundwater Basin ("Basin" and as more fully described below) within Monterey County, which is designated basin number 3-004 in Department of Water Resources Bulletin No. 118 (update 2016), and consisting of seven sub-basins plus that portion of the Paso Robles sub-basin within Monterey County (but not including the adjudicated portion of the

Seaside sub-basin), each of which is designated as either a high or medium priority basin, and one of which (the 180/400 ft. aquifer) is designated in critical overdraft; and

WHEREAS, the Members are therefore authorized to create the Agency for the purpose of jointly exercising those powers granted by the Act, SGMA, and any additional powers which are common among them; and

WHEREAS, the Members, individually and collectively, have the goal of cost effective sustainable groundwater management that considers the interests and concerns of all beneficial uses and users of groundwater within and adjacent to the Basin; and

WHEREAS, the Members hereby enter into this Agreement to establish the Agency to serve as a GSA for the Basin and undertake the management of groundwater resources pursuant to SGMA; and

WHEREAS, the Members intend to cooperate with adjacent GSAs such as any GSA formed over a portion of the Paso Robles sub-basin (3-04.06) within San Luis Obispo County, and the Pajaro Valley Water Management Agency; and

WHEREAS, the Members intend to study the potential for state legislation to, among other amendments, amend the WRA Act to modify the governance structure of the WRA in a form similar to the governance of the Agency established herein and to establish that agency as the statutorily designated GSA for the Basin, or establish a new entity to be so designated;

NOW THEREFORE,

In consideration of the matters recited and the mutual promises, covenants, and conditions set forth in this Agreement, the Members hereby agree as follows:

Article I: Definitions

Section 1.1 – Definitions.

As used in this Agreement, unless the context requires otherwise, the meaning of the terms hereinafter set forth shall be as follows:

(a) "Act" means the Joint Exercise of Powers Act, set forth in Chapter 5 of Division 7 of Title 1 of the California Government Code, sections 6500, *et seq*., as may be amended from time-to-time.

(b) "Agreement" means this Joint Exercise of Powers Agreement establishing the Salinas Valley Basin Groundwater Sustainability Agency.

(c) "Agency" means the Salinas Valley Basin Groundwater Sustainability Agency, which is a separate entity created by this Agreement pursuant to the provisions of the Act and SGMA.

(d) "Agricultural Directors" means the four Directors representing agricultural interests, as more fully set forth in rows (f) – (i) of Exhibit B of this Agreement.

(e) "Agricultural Association" means the Salinas Basin Agricultural Water Association.

(f) "Alternate Director" means an Alternate Director appointed pursuant to Section 6.6 of this Agreement.

(g) "Appointing Authority" means the entity authorized to appoint Primary and Alternate Directors pursuant to Sections 6.2, 6.3 and 6.6 of this Agreement and as identified in Exhibit B to this Agreement.

(h) "Basin" means that portion of the Salinas Valley Groundwater Basin, newly designated no. 3-004 in the Department of Water Resources' Bulletin No. 118 (update 2016), within the County of Monterey and that includes the following sub-basins: 1) 180/400 Foot Aquifer (No. 3-004.01); 2) East Side Aquifer (3-004.02); 3) Forebay Aquifer (3-004.04); 4) Upper Valley Aquifer (3-004.05); 5) Langley Area (3-004.09); 7) the newly designated Monterey sub-basin (3-004.10); and, 8) the portion of the Paso Robles Area (3-004.06) in Monterey County; but not including that portion of the Seaside Area that has been adjudicated, all as their boundaries may be modified from time to time through the procedures described in California Water Code section 10722.2 or by the Department of Water Resources under its separate authority, and not including any other area for which a GSA has been established pursuant to SGMA.

(i) "Board of Directors" or "Board" means the governing body of the Agency as established by Section 6.1 of this Agreement.

(j) "Brown Act" means the California Open Meeting Law, Government Code section 54950 *et seq.*

(k) "Bylaws" means the bylaws adopted by the Board of Directors pursuant to Section 6.8 of this Agreement to govern the day-to-day operations of the Agency.

(l) "Cause" means a conviction of a crime i) of moral turpitude, or ii) involving fraud, misrepresentation, or financial mismanagement, or iii) a finding by an administrative body or agency, or a court of law, that the person has violated any conflict of interest provision of federal, state or local law.

(m) "City Selection sub-Committee" means a subcommittee of the Monterey County City Selection Committee, established by Government Code section 50270 et seq, and consisting of the mayors of the following cities: Gonzales, Soledad, Greenfield, and King City.

(n) "County" means the County of Monterey.

(o) "CPUC" means the California Public Utilities Commission.

(p) "CPUC Regulated Water Company" means an investor owned water company operating in the Basin that has been granted a certificate of public convenience and necessity by the CPUC and is regulated by the CPUC.

(q) "Determination Date" means the date on which the Agency votes to notify the State of its intent to become a GSA as provided in Water Code sections 10723 (a) and (b).

(r) "Director" or "Directors" means Primary and Alternate Directors as set forth in Section 6.6 of this Agreement.

(s) "Director Position(s)" means those eleven Board positions, singularly or plural, established pursuant to Section 6.1 of this Agreement.

(t) "Disadvantaged Community" means a disadvantaged community or economically distressed area as those terms are defined in Water Code section 79702 (as may be amended from time-to-time) within the Basin.

(u) "Effective Date" means the date by which two Members have executed this Agreement which date shall be set forth in the introductory paragraph of this Agreement.

(v) "Fiscal Year" means that period of 12 months beginning July 1 and ending June 30 of each calendar year.

(w) "Groundwater Sustainability Agency" or "GSA" has the meaning set forth in California Water Code section 10721(j).

(x) "Groundwater Sustainability Plan" or "GSP" has the meaning set forth in California Water Code section 10721(k).

(y) "GSA Eligible Entity or Entities" means those entities eligible to become a GSA pursuant to SGMA.

(z) "Initial Board" means the initial Board of Directors established pursuant to Section 6.2, below.

(aa) "Initial Contribution" means the required contribution of Members as set forth in Section 10.4 of this Agreement.

(bb) "Local Agency" or "Local Agencies" has the meaning set forth in California Water Code Section 10721(n).

(cc) "Local small water system" means a system for the provision of piped water for human consumption that serves at least two, but not more than four, service connections, including any collection, treatment, storage, and distribution facilities under control of the operator of such system which are used primarily in connection with such system, and any collection or pretreatment storage facilities not under the control of the operator which are used primarily in connection with such system; it does not include two or more service connections, which supply dwelling units occupied by members of the same family, on one parcel, all as set forth in Monterey County Code section 15.04.020 (g).

(dd) "Majority Vote" means the affirmative vote of six Directors then present and voting at a meeting of the Board.

(ee) "Member" or "Members" means the GSA Eligible Entities listed in the attached Exhibit "A" that have executed this Agreement, including any new Members that may subsequently join this Agency with the authorization of the Board, pursuant to Section 5.2 of this Agreement.

(ff) "Mutual Water Company" has the meaning set forth in Corporations Code section 14300.

(gg) "Permanent Board" means the permanent Board of Directors established pursuant to Section 6.3 of this Agreement.

(hh) "Permanent Director" means a Director appointed to the Permanent Board.

(ii) "Permanent Director Position" means a Director Position on the Permanent Board.

(jj) "Primary Director" means a Primary Director appointed pursuant to Sections 6.4 of this Agreement.

(kk) "Public Water System" means a system for the provision of water for human consumption through pipes or other constructed conveyances that has 15 or more service connections or regularly serves at least 25 individuals daily at least 60 days out of the year. A public water system includes the following: (1) Any collection, treatment, storage, and distribution facilities under control of the operator of the system that are used primarily in connection with the system, (2) Any collection or pretreatment storage facilities not under the control of the operator that are used primarily in connection with the system, or (3) Any water system that treats water on behalf of one or more public water systems for the purpose of rendering it safe for human consumption, all as set forth in Health and Safety Code section 116275 (h).

(ll) "South County Cities" means the cities of Gonzales, Soledad, Greenfield and King City.

(mm) "State" means the State of California.

(nn) "State Small Water System" means a system for the provision of piped water to the public for human consumption that serves at least five, but not more than 14, service connections and does not regularly serve drinking water to more than an average of 25 individuals daily for more than 60 days out of the year, as set forth in California Health and Safety Code section 116275 (n).

(oo) "Super Majority Vote" means the affirmative vote of eight Directors then present and voting at a meeting of the Board.

(pp) "Super Majority Plus Vote" means the affirmative vote of eight Directors then present and voting at a meeting of the Board but including the affirmative vote of three of the Agricultural Directors.

(qq) "Sustainable Groundwater Management Act" or "SGMA" means the comprehensive groundwater legislation collectively enacted and referred to as the "Sustainable Groundwater Management Act" as codified in California Water Code Sections 10720 *et seq.* and as may be amended from time-to-time.

(rr) "WRA" means the Water Resources Agency of the County of Monterey.

Unless otherwise indicated, all statutory references are to the statutory codes of the State.

Article II: The Agency

Section 2.1 – Agency Established.

There is hereby established a joint powers agency known as the Salinas Valley Basin Groundwater Sustainability Agency. The Agency shall be, to the extent provided by law, a public entity separate from the Members of this Agreement.

Section 2.2 – Purpose Of The Agency.

The purpose of Agency is to cooperatively carry out the requirements of SGMA including, but not limited to, serving as the GSA for the Basin and developing, adopting and implementing a GSP that achieves groundwater sustainability in the Basin, all through the exercise of powers granted to a GSA by SGMA and those powers common to the members as provided in the Act.

Article III: Term

Section 3.1 – Term.

This Agreement shall become operative on the Effective Date. Subject to the terms of Sections 11.6, 11.7 and 11.8, below, this Agreement shall remain in effect unless terminated pursuant to Section 11.10, below.

Article IV: Powers

Section 4.1 – Powers.

The Agency shall possess the ability to exercise those powers specifically granted by the Act, SGMA, and the common powers of its Members related to the purposes of the Agency, including, but not limited to, the following:

a) To designate itself the GSA for the Basin pursuant to SGMA.

b) To adopt rules, regulations, policies, bylaws and procedures governing the operation of the Agency and the adoption and implementation of the GSP.

c) To develop, adopt and implement a GSP for the Basin pursuant to SGMA.

d) To retain or employ consultants, advisors, independent contractors, agents and employees.

e) To obtain legal, financial, accounting, technical, engineering, and other services needed to carry out the purposes of this Agreement.

f) To conduct studies, collect and monitor all data related and beneficial to the development, adoption and implementation of the GSP for the Basin.

g) To perform periodic reviews of the GSP including submittal of annual reports.

h) To register and monitor wells.

i) To issue revenue bonds or other appropriate public or private debt and incur debts, liabilities or obligations.

j) To levy taxes, assessments, charges and fees as provided in SGMA or as otherwise provided by law.

k) To regulate and monitor groundwater extractions as permitted by SGMA, provided that this provision does not extend to a Member's operation of its system to distribute water once extracted or otherwise obtained, unless and to the extent required by other laws now in existence or as may otherwise be adopted.

l) To establish and administer projects and programs for the benefit of the Basin.

m) To cooperate, act in conjunction, and contract with the United States, the State, or any agency thereof, counties, municipalities, special districts, groundwater sustainability agencies, public and private corporations of any kind (including without limitation, investor-owned utilities), and individuals, or any of them, for any and all purposes necessary or convenient for the full exercise of the powers of the Agency.

n) To accumulate operating and reserve funds and invest the same as allowed by law for the purposes of the Agency.

o) To apply for and accept grants, contributions, donations and loans under any federal, state or local programs for assistance in developing or implementing any of its projects or programs in connection with any project untaken in the Agency's name for the purposes of the Agency.

p) To acquire by negotiation, lease, purchase, construct, hold, manage, maintain, operate and dispose of any buildings, property, water rights, works or improvements within and without the respective jurisdictional boundaries of the Members necessary to accomplish the purposes describe herein.

q) To sue or be sued in its own name.

r) To invest funds as allowed by law.

s) Any additional powers conferred under SGMA or the Act, or under applicable law, insofar as such powers are needed to accomplish the purposes of SGMA, including all powers granted to the Agency under Article 4 of the Act which are in addition to the common powers of the Members, including the power to issue bonds or otherwise incur debts, liabilities or obligations to the extent authorized by the Act or any other applicable provision of law and to pledge any property or revenues of the rights thereto as security for such bonds and other indebtedness.

t) Any power necessary or incidental to the foregoing powers in the manner and according to the procedures provided for under the law applicable to the Members to this Agreement and to perform all other acts necessary or proper to fully carry out the purposes of this Agreement.

Section 4.2 – Exercise Of Powers.

In accordance with Section 6509 of the Act, the foregoing powers shall be subject to the restrictions upon the manner of exercising such powers pertaining to the County.

Section 4.3 – Water Rights And Consideration Of All Beneficial Uses And Users Of Groundwater In The Basin.

As set forth in Water Code section 10723.2 the GSA shall consider the interests of all beneficial uses and users of groundwater in the Basin, as well as those responsible for implementing the GSP. Additionally, as set forth in Water Code section 10720.5(a) any GSP adopted pursuant to this Agreement shall be consistent with Section 2 of Article X of the California Constitution and nothing in this Agreement modifies the rights or priorities to use or store groundwater consistent with Section 2 of Article X of the California Constitution, with the exception that no extraction of groundwater between January 1, 2015 and the date the GSP is adopted may be used as evidence of, or to establish or defend against, any claim of prescription. Likewise, as set forth in Water Code section 10720.5(b) nothing in this Agreement or any GSP adopted pursuant to this Agreement determines or alters surface water rights or groundwater rights under common law or any provision of law that determines or grants surface water rights.

Section 4.4 – Preservation Of Police Powers.

Nothing set forth in this Agreement shall be deemed to modify or otherwise limit a Member's police powers in any way, or any authority to regulate groundwater under existing law or any amendment thereto.

Article V: Membership

Section 5.1 – Members.

The Members of the Agency shall be the entities listed on the attached Exhibit A so long as their membership has not been withdrawn or terminated pursuant to the provisions of Article XI of this Agreement. GSA Eligible Entities shall have until the Determination Date to execute this Agreement and pay their Initial Contribution, and become Members. Any GSA Eligible Entity that has not executed this Agreement and paid their Initial Contribution by the Determination Date shall be subject to the process described in Section 5.2, below, to become a Member.

Section 5.2 – New Members.

New Members may be added to the Agency by the unanimous vote of all other Members so long as: 1) the new Member is a GSA Eligible Entity; and, 2) the new Member agrees to or has met any other conditions that the existing Members may establish from time-to-time.

Once an application is approved unanimously by the existing Members the attached Exhibit A shall be amended to reflect the new Member.

Article VI: Directors And Officers

Section 6.1 – Board Of Directors.

The Agency shall be governed and administered by an eleven (11) member Board of Directors which is hereby established. All voting power of the Agency shall reside in the Board.

Section 6.2 – Initial Board of Directors.

An Initial Board shall be composed of the Director Positions with the qualifications and Appointing Authority as described in Exhibit B. The nominating groups identified in Section 6.5, below, may, but are not required to, provide nominations to the relevant Appointing Authority for the Initial Board; however, any such nomination must be received by the respective Appointing Authority no later than January 31, 2017. If such nominations are received no later than the time specified the Appointing Authorities shall follow the respective procedures for appointment to the Permanent Board set forth in Section 6.5, below. If such nominations are not received by the time specified, the Appointing Authority may make appointments to the Initial Board as it determines in its sole discretion.

The Initial Board shall serve only until September 30, 2017, at which time a Permanent Board shall be appointed as described below.

Section 6.3 – Permanent Board.

Subject to the Appointment and Nominating procedures set forth in Section 6.5, below, beginning on October 1, 2017, a Permanent Board shall be established consisting of the Director Positions with the qualifications and Appointing Authority as described in Exhibit B. With the exception of the CPUC Regulated Water Company Director Position, each Permanent Director Position shall have a term consisting of three (3) years and shall hold office until their successor is appointed by their Appointing Authority and the Agency has been notified of the succession. The terms of Permanent Director Positions shall be staggered, with Director Positions identified in rows (a), (c), (f), (h) and (j) of exhibit C serving three (3) year terms from initial appointment, and those identified in rows (b), (d), (g), (i), and (k) serving two (2) year terms from initial appointment, and thereafter serving three (3) year terms. The CPUC Regulated Water Company Director Position shall serve a term of two (2) years, and a Director shall hold office until their successor is appointed and the Agency has been notified of the succession. Notwithstanding the actual date of their initial appointment, for purposes of establishing the terms of Permanent Directors such initial appointment shall be deemed to have commenced on the July 1 preceding such initial appointment, and the terms of Directors shall thereafter commence on July 1 of the respective appointing year. Each Director Position shall require an affirmative appointment by the Appointing Authority for every term.

Section 6.4 – General Qualifications.

a) Each Director, whether on the Initial Board or Permanent Board, must have the following general qualifications:

i. General education and/or knowledge, interest in and experience relating to the control, storage, and beneficial use of groundwater.

ii. General understanding and knowledge of the Basin and all its beneficial users.

iii. Working knowledge and understanding of how to develop strategic plans, policies, programs, and financing/funding mechanisms.

iv. Genuine commitment to collaboratively work together to (i) achieve groundwater sustainability through the adoption and implementation of a GSP for the Basin, and all its beneficial uses; and (ii) provide for the ongoing sustainable management of the Basin.

v. General knowledge and understanding of one or more of the different facets (administration, financial, legal, organizational, personnel, etc.) needed for a successful and productive organization.

vi. Ability to commit the time necessary, estimated at a minimum 15-20 hours per month, to responsibly fulfill their commitment to the organization. This includes, but is not limited to: (i) Board meetings, (ii) Board training, (iii) analyzing financial statements and technical reports, (iv) reviewing Board documents before Board meetings, (v) attending Board meetings, and (vi) serving on committees to which they are assigned.

vii. A permanent resident within the Basin, or a representative of an agency with jurisdiction, or a business or organization with a presence, within the Basin.

b) Nominating groups and Appointing Authorities, as described in Section 6.5, should endeavor to avoid nominating or appointing a person to a Director Position that, because of his or her employment or other financial interest, is likely to be disqualified from a substantial number of decisions to be made by the Board on the basis of conflict-of-interest requirements.

<u>Section 6.5 – Appointments and Nominations for Director Positions on the Permanent Board.</u>

The appointment and nominating process for each Primary and Alternate Director Positions on the Permanent Board shall be as follows:

a) City of Salinas Director Position.

The City of Salinas shall appoint the Director Position listed in Row (a) of Exhibit B, the specific qualifications of such Director Position to be at the discretion of the City of Salinas.

b) South County Cities Director Position.

The Director Position listed in Row (b) of Exhibit B shall be filled by a representative from one of the four cities listed therein. The City Selection sub-Committee shall determine which city shall be the Appointing Authority for each term of the Director Position. The specific qualifications of such Director Position shall be at the discretion of that city designated the Appointing Authority. If the City Selection sub-Committee cannot reach agreement on a city to be the Appointing Authority for this Director Position, the County Board of Supervisors shall decide which city shall be the Appointing Authority.

c) Other GSA Eligible Entity Director Position.

i. Representative of the entities listed on Exhibit C shall be eligible to participate in the nominating process for the Other GSA Eligible Entity Director Position listed in Row (c) of Exhibit B.

ii. The representatives collectively by agreement among themselves shall make nominations to the Appointing Authority for the persons to fill both the Primary and Alternate Director Positions when the term of such position are expiring or are vacant.

iii. The representatives shall nominate one or more persons to fill both the Primary and Alternate Director Positions. If more than one person is nominated the representatives shall indicate the preferred nominee.

iv The Appointing Authority shall appoint the nominee (if only one) or appoint from among the nominees; the Appointing Authority may reject a nominee only for Cause. If the representatives cannot or do not forward any nominations the Appointing Authority shall make the appointment based upon its own determination.

v. The representatives may also advise the Appointing Authority regarding the removal of their nominee from the Director Positions for Cause. If the Appointing Authority determines that Cause exists such Director shall be removed and a new Director appointed to fill out the remaining term of the removed Director. The representatives may also request that their nominee in the Director Position be removed for any reason or no reason. If such request is made the Appointing Authority shall remove the Director and a new Director appointed to fill out the remaining term of the removed Director.

vi. From time-to-time entities may ask to be removed from Exhibit C. If such request is made the Appointing Authority shall notify the other Members and the Board, and Exhibit C shall be modified accordingly.

vii. From time-to-time other entities may request to be included on Exhibit C. The then-existing representatives shall inform the Appointing Authority if such requests are acceptable. If accepted by the representatives the Appointing Authority shall notify the other Members and the Board, and Exhibit C shall be modified accordingly.

d) Disadvantaged Community, or Public Water System Systems, including Mutual Water Companies serving residential customers, Director Position.

i. Representative of the entities listed on Exhibit D shall be eligible to participate in the nominating process for the Disadvantaged Community, or Public Water System Systems, including Mutual Water Companies serving residential customers, Director Position listed in Row (d) of Exhibit B.

ii. The representatives by agreement among themselves shall collectively make nominations to the Appointing Authority for the persons to fill both the Primary and Alternate Director Positions when the term of such positions are expiring or are vacant.

iii. The representatives shall nominate one or more persons to fill both the Primary and Alternate Director Positions. If more than one person is nominated the representatives shall indicate the preferred nominee.

iv. The Appointing Authority shall appoint the nominee (if only one) or appoint from among the nominees; the Appointing Authority may reject a nominee only for Cause. If the representatives cannot or do not forward any nominations the Appointing Authority shall make the appointment based upon its own determination.

v. The representatives may also advise the Appointing Authority regarding the removal of their nominee from the Director Positions for Cause. If the Appointing Authority determines that Cause exists such Director shall be removed and a new Director appointed to fill out the remaining term of the removed Director. The representatives may also request that their nominee in the Director Position may be removed for any reason or no reason. If such request is made the Appointing Authority shall remove the Director and a new Director appointed to fill out the remaining term of the removed Director.

vi. From time-to-time entities may ask to be removed from Exhibit D. If such request is made the Appointing Authority shall notify the other Members and the Board, and Exhibit D shall be modified accordingly.

vii. From time-to-time other entities may request to be included on Exhibit D. The then-existing representatives shall inform the Appointing Authority if such requests are acceptable. If accepted by the representatives the Appointing Authority shall notify the other Members and the Board, and Exhibit D shall be modified accordingly.

e) CPUC Regulated Water Company Director Position.

i. Representative of the entities listed on Exhibit E must meet the requirements of Section 1.1 (o) and shall be eligible to participate in the nominating process for the CPUC Regulated Water Company Director Position listed in Row (e) of Exhibit B.

ii. The representatives by agreement among themselves shall collectively make nominations to the Appointing Authority for the persons to fill both the Primary and Alternate Director Positions when the term of such position are expiring or are vacant.

iii. The representatives shall nominate one or more persons to fill both the Primary and Alternate Director Positions. If more than one person is nominated the representatives shall indicate the preferred nominee.

iv The Appointing Authority shall appoint the nominee (if only one) or appoint from among the nominees; the Appointing Authority may reject a nominee only for Cause. If the representatives cannot or do not forward any nominations the Appointing Authority shall make the appointment of an employee or agent of a CPUC Regulated Water Company listed on Exhibit E based upon its own determination.

v. The representatives may also advise the Appointing Authority regarding the removal of their nominee from the Director Position for Cause, although such authority to remove shall rest solely with the Appointing Authority.

vi. From time-to-time entities may ask to be removed from Exhibit E. If such request is made the Appointing Authority shall notify the other Members and the Board, and Exhibit E shall be modified accordingly.

vii. From time-to-time other entities may request to be included on Exhibit E. The then-existing representatives shall inform the Appointing Authority if such requests are acceptable. If accepted by the representatives the Appointing Authority shall notify the other Members and the Board, and Exhibit E shall be modified accordingly.

f) Agriculture Director Positions.

i. The Agricultural Association shall be eligible to participate in the nominating process for the Agriculture Director Positions listed in Rows (f) – (i) of Exhibit B. The Agricultural Association shall be solely responsible for its membership.

ii. The Agricultural Association shall make nominations to the Appointing Authority for the persons to fill each Primary and Alternate Director Position when the terms of such positions are expiring or are vacant.

iii. The Agricultural Association shall nominate at least two persons to fill each Director Position; the Agricultural Association shall indicate the preferred nominee for each Director Position.

iv The Appointing Authority shall appoint from among the nominees for each Director Position; the Appointing Authority may reject a nominee only for Cause. If the Agricultural Association cannot or does not forward any nominations the Appointing Authority shall make the appointment based upon its own determination.

v. The Agricultural Association may also advise the Appointing Authority regarding the removal of a nominee from a Director Position for Cause. If the Appointing Authority determines that Cause exists such Director shall be removed and a new Director appointed to fill out the remaining term of the removed Director. The Agricultural Association may also request that their nominee in a Director Position may be removed for any reason or no reason. If such request is made the Appointing Authority shall remove the Director and a new Director appointed to fill out the remaining term of the removed Director.

g) Environment Director Position.

i. Representative of the entities listed on Exhibit F shall be eligible to participate in the nominating process for the Environment Director Position listed in Row (j) of Exhibit B.

ii. The representatives by agreement among themselves shall collectively make nominations to the Appointing Authority for the persons to fill both the Primary and Alternate Director Positions when the term of such positions are expiring or are vacant.

iii. The representatives shall nominate at least two persons to fill both the Primary and Alternate Director Positions and the representatives shall indicate the preferred nominee.

iv The Appointing Authority shall appoint from among the nominees; the Appointing Authority may reject a nominee only for Cause. If the representatives cannot or do not forward any nominations the Board shall solicit applications from interested persons. At an open public meeting, the Board shall select qualified applicants whose names shall be forwarded to the Appointing Authority. The Board may indicate a preferred nominee. The Appointing Authority shall make the appointment from the list of candidates in its sole discretion. If the Board cannot, or does not, forward a list of candidates, the Appointing Authority shall make the appointment based upon its own determination.

v. The representatives may also advise the Appointing Authority regarding the removal of their nominee from the Director Position for Cause. If the Appointing Authority determines that Cause exists such Director shall be removed and a new Director appointed to fill out the remaining term of the removed Director. The representatives may also request that their nominee in the Director Position may be removed for any reason or no reason. If such request is made the Appointing Authority shall remove the Director and a new Director appointed to fill out the remaining term of the removed Director.

vi. From time-to-time entities may ask to be removed from Exhibit F. If such request is made the Appointing Authority shall notify the other Members and the Board, and Exhibit F shall be modified accordingly.

vii. From time-to-time other entities may request to be included on Exhibit F. The then-existing representatives shall inform the Appointing Authority if such requests are acceptable. If accepted by the representatives the

Appointing Authority shall notify the other Members and the Board, and Exhibit F shall be modified accordingly.

h) Public Member Director Position.

i. The Public Member Primary and Alternate Director Positions listed in Row (k) of Exhibit B shall be filled by application to the Board when the term of such position is expiring or is vacant.

ii. Board staff shall process the applications to an open and public meeting of the Board.

iii. At the public hearing, the Board shall select the qualified applicants whose names shall be forwarded to the Appointing Authority. The Board may indicate a preferred nominee.

iv The Appointing Authority shall appoint from among the nominees in its sole discretion. If the Board cannot or does not forward any nominations the Appointing Authority shall make the appointment based upon its own determination.

v. The Board may also advise the Appointing Authority regarding the removal of the Public Member Director for Cause, although such authority to remove shall rest solely with the Appointing Authority.

Section 6.6 – Primary Directors And Alternates.

Subject to the Appointing and Nominating procedures set forth in Section 6.5, above, each Appointing Authority shall appoint one Primary Director and one Alternate Director for each Director Position. With the exception of the Chairperson and Vice-Chairperson duties as more fully described in Section 6.7, below, the Alternate Director shall serve and assume the rights and duties of the Primary Director when the Primary Director is unable to attend or participate in a Board meeting. Unless appearing as a substitute for a Primary Director, Alternate Directors shall have no vote, and shall not participate in any discussions or deliberations of the Board, but may appear at Board meetings as members of the public. The Primary and Alternate Directors may be removed by their Appointing Authority only for Cause only upon the recommendation of or consultation with the nominating body for that Director Position, or upon the request of the nominating body for that Director Position. In the event that a Primary or Alternate Director is removed from their position, that Director Position shall become vacant and the Appointing Authority for that Director Position shall appoint a new Primary or Alternate Director pursuant to the provisions of Section 6.5 who shall fill the remaining term of that Director Position. In the event that a Director resigns from a Director Position, the Board shall notify the nominating body for that Director Position and the Appointing Authority for that Director Position shall appoint a new Primary or Alternate Director pursuant to the provisions of Section 6.5 who shall fill the remaining term of that Director Position.

Section 6.7 – Officers Of The Board.

a) Designation.

Officers of the Board shall consist of a Chairperson and Vice-Chairperson who shall be selected from the Primary Directors. The Chairperson shall preside at all meetings of the Board. Notwithstanding the appointment of an Alternate Director for the Chairperson, the Vice-Chairperson shall perform the duties of the Chairperson in the absence or disability of the Chairperson; however, the Alternate Director may otherwise attend and participate in the meeting as a substitute for the absent Primary Director. The Chairperson and Vice-Chairperson shall exercise and perform such other powers and duties as may be assigned by the Board. In the absence of both the Chairperson and Vice-Chairperson, and notwithstanding the appointment of an Alternate Director for the Director Position serving as Vice-Chairperson, the Board shall elect a Chairperson Pro-Tem from the Primary Directors to preside at a meeting; however, the Alternate Director for the Vice-Chairperson may otherwise attend and participate in the meeting as a substitute for the absent Primary Director.

b) Election.

The Board shall elect officers at the initial meeting of the Board, described in Section 7.1, below. The Primary Director appointed by the City of Salinas shall be designated as the Chairperson Pro Tem to convene and preside at the initial meeting of the Board, described in Section 7.1, until a Chairperson is elected by the Board. The Chairperson so elected shall serve in such capacity until June 30 of the succeeding calendar year. Thereafter, the Board shall annually elect the officers of the Board from the Primary Directors. Officers of the Board shall hold office for a term of one year commencing on July 1 of each calendar year and they may serve for multiple consecutive terms. Officers of the Board may be removed and replaced at any time, with or without cause, by a Majority Vote. In the event that an officer loses their position as a Primary Director, that officer position shall become vacant and the Board shall elect a new officer from existing Primary Directors to serve the remaining officer term.

Section 6.8 – Bylaws.

The Board shall adopt Bylaws governing the conduct of meetings and the day-to-day operations of the Agency on or before the first anniversary of the Effective Date.

Section 6.9 – Official Seal And Letterhead.

The Board may adopt, and/or amend, an official seal and letterhead for the Agency.

Section 6.10 – Conflict of Interest.

Directors shall be subject to the provisions of the California Political Reform Act, California Government Code section 81000 et seq, and all other laws governing conflicts of interests. Directors shall file the statements required by Government Code section 87200, et seq.

Article VII: Board Meetings And Actions

Section 7.1 – Initial Meeting.

The initial meeting of the Board shall be held at either the County Board of Supervisors chambers, located at 168 W. Alisal Street in Salinas, or at the Salinas City Council chambers, located at 200 Lincoln Avenue in Salinas within thirty days (30) days of the Effective Date of this Agreement. The date and time of the meeting shall be prominently publicized and noticed in addition to any requirements of the Brown Act in an effort to maximize public participation.

Section 7.2 – Regular Meeting Schedule.

At its initial meeting, and annually before July 1 of each calendar year thereafter, the Board shall establish a schedule of regular meetings, including time and place, at a location overlying the Basin. The Board may vote to change the regular meeting location, time and place, and may call special or emergency meetings, provided that the new, special or emergency meeting location remains at a place overlying the Basin, unless otherwise authorized by the Brown Act.

Section 7.3 – Principal Office.

At its initial meeting the Board shall establish a principal office for the Agency, which shall be located at a place overlying the Basin. The Board may change the principal office from time to time as the Board sees fit so long as that principal office remains at a location overlying the Basin.

Section 7.4 – Conduct Of Board Meetings.

Meetings of the Board of Directors shall be noticed, held, and conducted in accordance with the provisions of the Brown Act and such By-laws as the Board may adopt that are consistent with the Brown Act.

Section 7.5 – Quorum.

A quorum of the Board shall consist of a majority of the Director Positions.

Section 7.6 – Voting.

Each Director Position shall have one vote. In all cases, when a quorum is present, a Majority Vote shall be required to conduct business, unless a Super Majority Vote or a Super Majority Plus Vote is required.

Section 7.7 – Super Majority Vote Requirement.

Items that require a Super Majority Vote include the following unless otherwise required by law:

a) Approval of a GSP;

b) Amendment of budget and transfer of appropriations;

c) Withdrawal of Members pursuant to Section 11.6 (d); and,

d) Termination of Members pursuant to Section 11.7 (c).

Section 7.8 – Super Majority Plus Vote Requirement.

Items that require a Super Majority Plus Vote include the following unless otherwise required by law:

a) Decisions to impose fees not requiring a vote of the electorate or property owners;

b) Proposals to submit to the electorate or property owners (as required by law) decisions to impose fees or taxes; and

c) Limitations on well extractions (pumping limits).

Section 7.9 – Conflict Of Interest Code.

At the initial meeting of Board, the Board shall begin the process for adoption and filing of a Conflict of Interest Code pursuant to the provisions of the Political Reform Act of 1974 (Government Code section 81000 et seq.).

Article VIII: Board Committees

Section 8.1 – Committees Of The Board.

a) Board Committees.

The Board may from time-to-time establish one or more standing or ad hoc committees consisting of Directors to assist in carrying out the purposes and objects of the Agency, including but not limited to a Budget and Finance Committee, Planning Committee, and an Executive Committee. The Board shall determine the purpose and need for such committees. Meetings of standing committees shall be subject to the requirements of the Brown Act.

b) Advisory Committee.

The Board shall establish an advisory committee consisting of Directors and non-Directors. The advisory committee shall be designed to ensure participation by and input to the Board of those constituencies set forth in Water Code section 10723.2 whose interests are not directly represented on the Board. The Board shall determine the number and qualifications of committee members.

Article IX: Operations And Management

Section 9.1 – Initial Administrative And Legal Services.

One or more of the Members shall provide initial administrative, legal and other support services to the Agency at no charge until the appointment of the Permanent Board as provided in Section 6.3, above. The Members shall collectively determine which of the Members shall provide such services.

Section 9.2 – Contracting Administrative And Legal Services.

The Agency may engage one or more Members to provide administrative or legal services following the conclusion of the initial administrative and legal services described in Section 9.1 of this Agreement, on terms and conditions acceptable to the Board. Any Member so engaged shall have such responsibilities as are set forth in the contract for such Member's services.

Section 9.3 – Executive Director.

The Agency may appoint an Executive Director from time-to-time under terms and conditions to be determined by the Board. The Executive Director shall report to and serve at the pleasure of the Board. The Executive Director shall be responsible for the general administration of the Agency, the preparation and implementation of a GSP, and such other duties as may be determined by the Board. If the Board has contracted for administrative services as described in Section 9.2, above, and appoints an Executive Director, the Executive Director shall be responsible for the oversight and control of such contracted administrative services pursuant to the policies and directives established by the Board.

Section 9.4 – Legal Counsel And Other Officers.

a) General Counsel

The Agency may appoint a General Counsel from time-to-time under terms and conditions to be determined by the Board. The General Counsel shall report to and serve at the pleasure of the Board. The General Counsel shall be responsible for the general oversight of the Agency's legal affairs, including litigation. The Board may contract with other counsel for specialized legal services under the supervision of the General Counsel.

b) Treasurer and Auditor

The City of Salinas shall serve as the initial Treasurer and Auditor for the Agency upon its formation, and shall discharge the duties set forth in Sections 6505 and 6505.5 of the Act. Subsequent to formation of the Agency, the Board may appoint a separate Treasurer or separate Auditor pursuant to Section 6505.6 of the Act, and those officers shall discharge the duties set forth in Sections 6505 and 6505.5 of the Act, respectively. The Board may change such Auditor or Treasurer from time-to-time provided such chance is consistent with the Act.

c) Custodian of Property

The Public Works Director of the City of Salinas ("PW Director") shall serve as the initial Custodian of the Agency's Property as set forth in Section 6505.1 of the Act upon the Agency's formation. The PW Director shall file an official bond as described in Government Code section 1450 et seq. in the amount of $50,000, the premium of which shall be paid by the Agency. Subsequent to the formation of the Agency, the Board may designate a different Custodian provided such Custodian files an official bond in an amount required by the Board.

b) Other Officers

Subject to the limits of the Agency's approved budget, the Board may establish other officer positions and appoint and contract for the services of such other officers as it may deem necessary or convenient for the business of the Agency, all of whom shall serve at the pleasure of the Board.

Section 9.5 – Employees.

Subject to the limits of the Agency's approved budget, the Agency may hire employees to discharge the duties and responsibilities of the Agency, subject to the general oversight and control of the Executive Director.

Section 9.6 – Independent Contractors.

Subject to the limits of the Agency's approved budget, the Board may contract for the services of such consultants, advisers and independent contractors as it may deem necessary or convenient for the business of the Agency.

Article X: Financial Provisions

Section 10.1 – Fiscal Year.

The Fiscal Year of the Agency shall be July 1 – June 30.

Section 10.2 – Establishment Of Funds.

The Board shall establish and maintain such funds and accounts as may be required by generally accepted government accounting practices. The Agency shall maintain strict accountability of all funds and report all receipts and disbursements of the Agency on no less than a quarterly basis.

Section 10.3 – Budgets.

a) Initial Budgets

The initial budget of the Agency for the Fiscal Year ending June 30, 2017, shall not exceed $50,000. The budgets of the Agency for Fiscal Years 2017 – 2018 and 2018 – 2019 shall not exceed $1,100,000 each unless otherwise agreed to by the unanimous vote of the Members as described in Section 10.4, below.

b) Regular Budgets

Beginning for Fiscal Year 2019 – 2020, no later than sixty (60) days prior to the end of each Fiscal Year, the Board shall adopt a budget for the Agency for the ensuing Fiscal Year. The Board may authorize mid-year budget adjustments, as needed by Super Majority Vote.

Section 10.4 – Initial Contributions.

a) Fiscal Years 2017 – 2018 and 2018 - 2019

In order to provide the necessary capital to initially fund the Agency during Fiscal Year 2017 - 2018, the Members identified below shall each provide the listed Initial Contribution to the Agency's Treasurer/Auditor no later than July 7, 2017:

1) County:	$670,000
2) WRA:	$ 20,000
3) City of Salinas:	$330,000
4) City of Gonzales:	$ 20,000
5) City of Soledad:	$ 35,000
6) City of Greenfield:	$ 35,000
7) City of King:	$ 30,000
8) Castroville CSD	$ 20,000

In order to provide the necessary capital to fund the Agency during Fiscal Year 2018 – 2019, the Members identified below shall each provide the listed Initial Contribution to the Agency's Treasurer/Auditor no later than July 6, 2018:

1) County:	$670,000
2) WRA:	$ 20,000
3) City of Salinas:	$330,000
4) City of Gonzales:	$ 20,000
5) City of Soledad:	$ 35,000
6) City of Greenfield:	$ 35,000
7) City of King:	$ 30,000
8) Castroville CSD	$ 20,000

b) Additional Initial Contributions

New Members not listed above executing this Agreement no later than the Determination Date shall pay a minimum Initial Contribution of twenty thousand dollars ($20,000) per year for the two fiscal years. New Members not listed above executing this Agreement after the

Determination Date shall pay a minimum Initial Contribution of fifty thousand dollars ($50,000) per year for the two fiscal years.

Should the Board determine that additional funding for each of Fiscal Years 2017 – 2018 and 2018 – 2019 is necessary for Agency operations the Board shall adopt a resolution requesting each of the Members to consider additional funding and demonstrating in detail 1) the need for the funding, and 2) the purposes for which the additional funding will be utilized. Such requested funding shall be in the same proportion as the Initial Contributions set forth in Section 10.4 (a) unless the Members unanimously agree otherwise.

Upon receipt of the resolution requesting additional funding representatives of the Members may meet and confer regarding the request; however, each Member shall consider and act upon the request no later than 30 (thirty) days following the adoption of the resolution by the Board.

c) Reimbursement of Initial Contributions

To the extent the Agency is able to secure other funding sources, and to the extent permitted by law, the Agency shall reimburse these Initial Contributions to the Members on a proportionate basis in relation to their cumulative Initial Contributions to the Agency.

Section 10.5 – Payments To The Agency.

All costs and expenses of the Agency may be funded from: (i) voluntary contributions from third parties; (ii) grants; (iii) contributions from Members from time to time to supplement financing of the activities of the Agency; (iv) advances or loans from the Members or other sources; (v) bond revenue; and, (vi) taxes, assessments, fees and/or charges levied by the Agency under the provisions of SGMA or as otherwise authorized by law.

Section 10.6 – Directors' Stipends and Expenses.

Directors shall be eligible to receive a stipend in the amount of $ 100 for each Board meeting actually attended plus mileage to and from Board meetings. In addition, Directors shall be reimbursed for the actual and necessary expenses incurred in the discharge of their duties pursuant to an adopted Board policy. Directors are not required to accept the stipend or mileage, or expenses, and may decline the same by written notice to the Board.

Article XI: Relationship Of Agency And Its Members

Section 11.1 – Separate Entity.

In accordance with Sections 6506 and 6507 of the Act, the Agency shall be a public entity separate and apart from the Members.

Section 11.2 – Liabilities.

In accordance with Section 6507 of the Act, the debt, liabilities and obligations of the Agency shall be the debts, liabilities and obligations of the Agency alone and not of its Members. The Members do not intend hereby to be obligated either jointly or severally for the debts, liabilities or obligations of the Agency, except as may be specifically provided for in California Government Code Section 895.2 as amended or supplemented.

Section 11.3 – Insurance.

The Agency shall procure appropriate policies of insurance providing coverage to the Agency and its Directors, officers and employees for general liability, errors and omissions, property, workers compensation, and any other coverage the Board deems appropriate. Such policies shall name the Members, their officers and employees as additional insureds.

Section 11.4 – Indemnity.

Funds of the Agency may be used to defend, indemnify, and hold harmless the Agency, each Member, each Director, and any officers, agents and employees of the Agency for their actions taken within the course and scope of their duties while acting on behalf of the Agency. To the fullest extent permitted by law, the Agency agrees to save, indemnify, defend and hold harmless each Member from any liability, claims, suits, actions, arbitration proceedings, administrative proceedings, regulatory proceedings, losses, expenses or costs of any kind, whether actual, alleged or threatened, including attorney's fees and costs, court costs, interest, defense costs, and expert witness fees, where the same arise out of, or are attributable in whole or in part, to negligent acts or omissions of the Agency or its employees, officers or agents or the employees, officers or agents of any Member, while acting within the course and scope of an Member relationship with the Agency. Notwithstanding the foregoing, the sole negligence, gross negligence, or intentional acts of any Member is exempted from this Section 11.3 - Indemnity.

Section 11.5 – Agreements With Members

The Agency intends to carry out activities in furtherance of its purposes consistent with the powers established by this Agreement and with the participation of all Members. Notwithstanding the foregoing, the Board shall have the authority to approve any agreements with one or more Members in order to further the purposes of the Agency, including, but not limited to, the commencement of a condemnation action within the jurisdictional boundary of the agreeing Member or Members.

Section 11.6 – Withdrawal Of Members.

a) Any Member shall the have the ability to withdraw by providing ninety (90) days written notice of its intention to withdraw. Said notice shall be given to the Board and to each of the other Members. If such Member is an Appointing Authority, the Member's withdrawal shall not be effective unless and until the non-withdrawing Members agree to an amendment to this

Agreement providing for the composition of and appointment to the Board.

b) A Member shall not be fiscally liable for any contribution to an adopted budget provided that the Member provides written notice ninety (90) days prior to the adoption of the budget of its intention to withdraw.

c) In the event of a withdrawal, this Agreement shall continue in full force and effect among the remaining members as set forth in Section 11.8, below.

d) Notwithstanding the foregoing, Members shall not have the ability to withdraw if there is outstanding bonded debt or other long term liability of the Agency unless and until it is determined by the Board by Super Majority Vote that the withdrawal of the Member shall not adversely affect the ability of the Agency to perform its financial obligations pursuant to the bonded debt or other liability. The Board shall communicate its finding to the non-withdrawing Members who may approve the withdrawal by unanimous vote.

Section 11.7 – Termination Of Members.

a) As an alternative to pursuing litigation against a Member for failure to meet its funding obligations set forth in this Agreement or as may be adopted by the Board from time to time, the Board may vote to terminate such Member. The Board shall transmit its determination to the Members who may approve the termination by unanimous vote of the Members not proposed to be terminated. If such Member is an Appointing Authority, the Member's termination shall not be effective unless and until the non-terminated Members agree to an amendment to this Agreement providing for the composition of and appointment to the Board.

b) In the event of a termination, this Agreement shall continue in full force and effect among the remaining members as set forth in Section 11.8, below.

c) Notwithstanding the foregoing, Members may not be terminated if there is outstanding bonded debt or other long term liability of the Agency unless and until it is determined by the Board by Super Majority Vote that the termination of the Member shall not adversely affect the ability of the Agency to perform its financial obligations pursuant to the bonded debt or other liability. The Board shall communicate its finding to the Members who may approve the termination by unanimous vote of the Members not proposed to be terminated.

Section 11.8 – Continuing Obligations: Withdrawal Or Termination.

a) Provided that at least two Members remain, the withdrawal or termination of one or more Members shall not terminate this Agreement or result in the dissolution of the Agency; this Agreement shall remain in full force and effect among the remaining Members; and the Agency shall remain in operation.

b) Except as provided in Section 11.6 (b), any withdrawal or termination of a Member shall not relieve the Member of its financial obligations under this Agreement in effect prior to the effective date of the withdrawal or termination.

Section 11.9 – Disposition Of Money Or Property Upon Board Determination Of Surplus.

Upon determination by the Board that any surplus money is on hand, such surplus money shall be returned to the then existing Members in proportion to their cumulative contributions to the Agency, or such surplus money may be deposited in a Board designated reserve account. Upon determination by the Board that any surplus properties, works, rights and interests of the Agency are on hand, the Board shall first offer any such surplus for sale to the Members and such sale shall be based on highest bid received. If no such sale is consummated, the Board shall offer the surplus properties, works, rights and interests of the Agency for sale in accordance with applicable law to any governmental agency, private entity or persons for good and adequate consideration.

Section 11.10 – Termination And Dissolution.

a) Mutual Consent

i) Except as otherwise provided in this Section 11.10 (a), this Agreement may be terminated and the Agency dissolved at any time upon the unanimous approval of the Members provided that provision has been made by the Members for the payment, refunding, retirement, or other disposition of any bonded debt or other long term liability in the name of the Agency.

ii) Upon Dissolution of the Agency, each then existing Member shall receive a proportionate share, based upon the cumulative contributions of all then remaining Members, of any remaining assets after all Agency liabilities and obligations have been paid in full. The distribution of remaining assets may be made "in kind" or assets may be sold and the proceeds thereof distributed to the Members. The Agency shall remain in existence for such time as is required to determine such distribution, and the Board, or other person or entity appointed by the Members, shall be responsible for its determination. Such distribution shall occur within a reasonable time after a decision to terminate this Agreement and dissolve the Agency has been approved by the Members. No former Member that previously withdrew or was terminated as of the effective date of the decision to terminate this Agreement and dissolve the Agency shall be entitled to a distribution upon dissolution.

b) Insufficient Members

Subject to the provisions of Sections 11.6 and 11.7, should Members either be terminated or withdraw such that only one Member remains, this Agreement shall terminate and the Agency dissolved. In such event the last remaining Member shall be entitled to all assets of the Agency.

c) Failure to be Financially Sustainable

In the event that the Agency does not take the necessary actions to create a sustainable revenue stream necessary to fully finance its operating budget by the end of Fiscal Year 2018 – 2019 this Agreement shall terminate and the Agency shall be dissolved, unless otherwise agreed to by amendment to this Agreement approved unanimously by all then-existing Members. In the event of such termination and dissolution, the process of dissolution shall begin on July 1, 2019, and proceed as set forth in Section 11.10 (a) (ii), above.

d) Legislative Determination

Should the State adopt legislation specifying that the Basin should be managed by a statutorily designated entity this Agreement shall terminate and the Agency shall be dissolved upon such terms and conditions as the legislation may designate. Upon such dissolution, the assets and liabilities of the Agency shall be disposed of in the manner specified by the legislation. If the legislation does not so specify, the assets and liabilities of the Agency shall be disposed of in the manner provided in Section 11.10 (a), above.

Article XII: Miscellaneous Provisions

Section 12.1 – Complete Agreement.

The foregoing constitutes the full and complete Agreement of the Members. This Agreement supersedes all prior agreements and understandings, whether in writing or oral, related to the subject matter of this Agreement that are not set forth in writing herein.

Section 12.2 – Amendment.

This Agreement may be amended from time-to-time by the unanimous consent of the Members, acting through their governing bodies. Such amendments shall be in the form of a writing signed by each Member.

Section 12.3 – Successors And Assigns.

The rights and duties of the Members may not be assigned or delegated without the written consent of all other Members. Any attempt to assign or delegate such rights or duties in contravention of this Agreement shall be null and void. Any assignment or delegation permitted under the terms of this Agreement shall be consistent with the terms of any contracts, resolutions or indentures of the Agency then in effect.

This Agreement shall inure to the benefit of and be binding upon the successors and assigns of the Members hereto. This section does not prohibit a Member from entering into an independent agreement with another person, entity, or agency regarding the financing of that Member's contributions to the Agency or the disposition of proceeds, which that Member receives under this Agreement so long as such independent agreement does not affect, or purport to affect, the rights and duties of the Agency or the Members under this Agreement.

Section 12.4 – Dispute Resolution.

In the event there are disputes and/or controversies relating to the interpretation, construction, performance, termination, breach of, or withdrawal from this Agreement, the Members involved shall in good faith meet and confer within twenty-one (21) calendar days after written notice has been sent to all the Members. In the event that the Members involved in the dispute ("Disputing Members") are not able to resolve the dispute through informal negotiation, the Disputing Members agree to submit such dispute to formal mediation before litigation. If Disputing Members cannot agree upon the identity of a mediator within ten (10) business days after a Disputing Member requests mediation, then the non-Disputing Members shall select a mediator to mediate the dispute. The Disputing Members shall share equally in the cost of the mediator who ultimately mediates the dispute, but neither of the Disputing Members shall be entitled to collect or be reimbursed for other related costs, including but not limited to attorneys' fees. If mediation proves unsuccessful and litigation of any dispute occurs, the prevailing Member shall be entitled to reasonable attorneys' fees, costs and expenses in addition to any other relief to which the Member may be entitled. If a Disputing Members refuses to participate in mediation prior to commencing litigation, that Member shall have waived its right to attorneys' fees and costs as the prevailing party.

Section 12.5 – Execution In Parts Or Counterparts.

This Agreement may be executed in parts or counterparts, each part or counterpart being an exact duplicate of all other parts or counterparts, and all parts or counterparts shall be considered as constituting one complete original and may be attached together when executed by the Members hereto. Facsimile or electronic signatures shall be binding.

Section 12.6 – Member Authorization.

The governing bodies of the Members have each authorized execution of this Agreement, as evidenced by their respective signatures below.

Section 12.7 – No Predetermination Or Irrevocable Commitment of Resources.

Nothing herein shall constitute a determination by the Agency or any Members that any action shall be undertaken or that any unconditional or irrevocable commitment of resources shall be made, until such time as the required compliance with all local, state, or federal laws, including without limitation the California Environmental Quality Act, National Environmental Policy Act, or permit requirements, as applicable, have been completed.

Section 12.8 – Notices.

Notices authorized or required to be given pursuant to this Agreement shall be in writing and shall be deemed to have been given when mailed, postage prepaid, or delivered during working hours to the addresses set forth for each of the Members hereto on Exhibit "A" of this Agreement, or to such other changed addresses communicated to the Agency and the Members in writing.

Section 12.9 – Severability And Validity Of Agreement.

Should the participation of any Member, or any part, term or provision of this Agreement, be decided by the courts or the legislature to be illegal, in excess of that Member's authority, in conflict with any law of the State, or otherwise rendered unenforceable or ineffectual, the validity of the remaining portions, terms or provisions of this Agreement shall not be affected thereby and each Member hereby agrees it would have entered into this Agreement upon the same remaining terms as provided herein.

Section 12.10 – Singular Includes Plural.

Whenever used in this Agreement, the singular form of any term includes the plural form and the plural form includes the singular form.

IN WITNESS WHEREOF, the Members hereto, pursuant to resolutions duly and regularly adopted by their respective governing boards, have caused their names to be affixed by their proper and respective officers as of the day and year so indicated.

COUNTY OF MONTEREY

By Janet B Parker

Chair of the Board of Supervisors

Dated: 12-22-16

APPROVED AS TO FORM

CHARLES J. MCKEE, County Counsel

By

LESLIE J. GIRARD

WATER RESOURCES AGENCY OF THE COUNTY OF MONTEREY

By

Chair ~~of the~~ Board of Supervisors of the Water Resources Agency

Dated: 1-31-2017

APPROVED AS TO FORM

CHARLES J. MCKEE, County Counsel

By

CITY OF SALINAS

By____________________________

Mayor

Dated: ________________________

Section 12.10 – Singular Includes Plural.

Whenever used in this Agreement, the singular form of any term includes the plural form and the plural form includes the singular form.

IN WITNESS WHEREOF, the Members hereto, pursuant to resolutions duly and regularly adopted by their respective governing boards, have caused their names to be affixed by their proper and respective officers as of the day and year so indicated.

COUNTY OF MONTEREY

By______________________________
Chair of the Board of Supervisors

Dated: ______________________

APPROVED AS TO FORM

CHARLES J. MCKEE, County Counsel

By______________________________

WATER RESOURCES AGENCY OF THE COUNTY OF MONTEREY

By______________________________
Chair of the Board of Supervisors of the Water Resources Agency

Dated: ______________________

APPROVED AS TO FORM

CHARLES J. MCKEE, County Counsel

By______________________________

CITY OF SALINAS

By______________________________
Mayor

Dated: 12-20-16

APPROVED AS TO FORM

CHRISTOPHER CALLIHAN, City Attorney

By_______________________

CITY OF SOLEDAD

By_______________________
Mayor

Dated: ___________________

APPROVED AS TO FORM

__________________, City Attorney

By_______________________

CITY OF GONZALES

By_______________________
Mayor

Dated: ___________________

APPROVED AS TO FORM

__________________, City Attorney

By_______________________

CITY OF GREENFIELD

By_______________________
Mayor

Dated: ___________________

APPROVED AS TO FORM

CHRISTOPHER CALLIHAN, City Attorney

By_______________________________

CITY OF SOLEDAD

By_______________________________
Mayor

Dated: 03/03/17

APPROVED AS TO FORM

Michael Rodriquez, City Attorney

By_______________________________

CITY OF GONZALES

By_______________________________
Mayor

Dated: ____________________

APPROVED AS TO FORM

____________________, City Attorney

By_______________________________

CITY OF GREENFIELD

By_______________________________
Mayor

Dated: ____________________

CITY OF GONZALES

By Maria Orozco
Maria Orozco, Mayor

Dated: 2/21/17

APPROVED AS TO FORM

By
Michael F. Rodriquez, City Attorney

Dated: 2-21-2017

APPROVED AS TO FORM

____________________, City Attorney

By________________________________

CITY OF KING

By________________________________

Mayor

Dated: 3-24-2017

APPROVED AS TO FORM

____________________, City Attorney

By 3-24-2017

CASTROVILLE COMMUNITY SERVICES

By________________________________

Chair of the Board of Directors

APPROVED AS TO FORM

____________________, District Counsel

MONTEREY REGIONAL WATER POLLUTION CONTROL AGENCY

By________________________________

Chair of the Board of Directors

APPROVED AS TO FORM

____________________, Agency Counsel

APPROVED AS TO FORM

_________________, City Attorney

By_____________________________

CITY OF KING

By_____________________________
Mayor

Dated: ____________________

APPROVED AS TO FORM

_________________, City Attorney

By_____________________________

CASTROVILLE COMMUNITY SERVICES

By_____________________________
Chair of the Board of Directors

APPROVED AS TO FORM

_________________ District Counsel

APPROVED AS TO FORM

____________________, City Attorney

By____________________________________

CITY OF KING

By____________________________________

Mayor

Dated: ____________________________

APPROVED AS TO FORM

____________________, City Attorney

By____________________________________

CASTROVILLE COMMUNITY SERVICES

By____________________________________

Chair of the Board of Directors

APPROVED AS TO FORM

____________________, District Counsel

MONTEREY REGIONAL WATER POLLUTION CONTROL AGENCY

By Gloria De La Rosa

Chair of the Board of Directors

APPROVED AS TO FORM

Robert R. Wellington, Agency Counsel

EXHIBIT A

MEMBERS

COUNTY OF MONTEREY
County Administrative Officer
168 W. Alisal St., Salinas, CA 93901

WATER RESOURCES AGENCY OF MONTEREY COUNTY
General Manager

CITY OF SALINAS
City Manager

CITY OF SOLEDAD
City Manager

CITY OF GONZALES
City Manager

CITY OF GREENFIELD
City Manager

CITY OF KING (KING CITY)
City Manager

CASTROVILLE COMMUNITY SERVICES DISTRICT
General Manager

EXHIBIT B

BOARD OF DIRECTORS

	Director	Representing	Specific Qualifications	Appointing Authority
a)	City of Salinas.	City of Salinas.	To be determined by the Appointing Authority.	Salinas City Council.
b)	South County Cities.	Cities of Gonzales, Soledad, Greenfield, and King City.	To be determined by the Appointing Authority.	Appropriate City Council as recommended by the City Selection sub-Committee.
c)	Other GSA Eligible Entity.	GSA Eligible Entities but not including the cities of Salinas, Gonzales, Soledad, Greenfield or King City.	Must be a representative of a GSA Eligible Entity but not including the cities of Salinas, Gonzales, Soledad, Greenfield or King City.	Monterey County Board of Supervisors.
d)	Disadvantaged Community, or Public Water System, including Mutual Water Companies serving residential customers.	Unincorporated Disadvantaged Communities, or Public Water Systems, including Mutual Water Companies serving residential customers only.	Must be a resident of a Disadvantaged Community in the unincorporated area, or a representative Public Water System, including Mutual Water Companies serving residential customers only.	Castroville Community Services District.
e)	CPUC Regulated Water Company.	CPUC Regulated Water Companies in the Basin.	Must be a representative of a CPUC Regulated Water	Salinas City Council.

			Company.	
f)	Agriculture.	Agricultural interests.	Must be an individual that is: 1) engaged in, and derives the majority of his or her gross income or revenue from, commercial agricultural production or operations; or 2) designated by an entity this is engaged in commercial agricultural production or operations, and the individual derives the majority of his or her gross income or revenue from agricultural production or operations, including as an owner, lessor, lessee, manager, officer, or substantial shareholder of a corporate entity.	Monterey County Board of Supervisors.
g)	Agriculture.	Agricultural interests.	Same as (f).	Monterey County Board of Supervisors.
h)	Agriculture.	Agricultural interests.	Same as (f).	Monterey County Board of Supervisors.
i)	Agriculture.	Agricultural interests.	Same as (f).	Monterey County Board of Supervisors.
j)	Environment.	Environmental users and interests.	Must be a representative of an	Monterey County

			established environmental organization that has a presence or is otherwise active in the Basin.	Board of Supervisors.
k)	Public Member.	Interests not otherwise represented on the Board.	A rural residential well owner; an industrial processor; a Local Small or State Small Water System; or other mutual water company.	Monterey County Board of Supervisors.

EXHIBIT C

OTHER GSA ELIGIBLE ENTITY DIRECTOR POSITION NOMINATING GROUP

COUNTY OF MONTEREY

WATER RESOURCES AGENCY OF MONTEREY COUNTY

MONTEREY REGIONAL WATER POLLUTION CONTROL AGENCY

EXHIBIT D

DISADVANTAGED COMMUNITY, OR PUBLIC WATER SYSTEM, INCLUDING MUTUAL WATER COMPANIES SERVING RESIDENTIAL CUSTOMERS DIRECTOR POSITION NOMINATING GROUP

CASTROVILLE COMMUNITY SERVICES DISTRICT (Group Contact)
Eric Tynan, General Manager
11499 Geil St.
Castroville, CA 95012
(831) 633-2560 phone
(831) 633-3102 fax
info@castrovillecsd.org

ENVIRONMENTAL JUSTICE COALITION FOR WATER

SAN JERARDO COOPERATIVE

SAN ARDO WATER DISTRICT

SAN VICENTE MUTUAL WATER COMPANY

EXHIBIT E

CPUC REGULATED WATER COMPANY DIRECTOR POSITION NOMINATING GROUP

ALISAL WATER CORPORATION DBA ALCO WATER SERVICE (Group Contact)
Thomas R. Adcock, President
249 Williams Road
Salinas, CA 93905
831-424-0441 phone
831-424-0611 fax
tom@alcowater.com

CALIFORNIA WATER SERVICE COMPANY

EXHIBIT F

ENVIRONMENT DIRECTOR POSITION NOMINATING GROUP

SUSTAINABLE MONTEREY COUNTY

LEAGUE OF WOMEN VOTERS OF MONTEREY COUNTY

LANDWATCH MONTEREY COUNTY

FRIENDS AND NEIGHBORS OF ELKHORN SLOUGH

CALIFORNIA NATIVE PLANT SOCIETY, MONTEREY CHAPTER

TROUT UNLIMITED

SURFRIDERS

THE NATURE CONSERVANCY

CARMEL RIVER STEELHEAD ASSOCIATION

Chapter 1
Appendix 1-B

Coordination Agreement

Before the Board of Directors of the
Salinas Valley Basin Sustainable Groundwater Management Agency

Resolution No. 2017-16

Resolution approving a Coordination Agreement between Marina Coast Water District and the Salinas Valley Basin Ground Water Sustainability Agency for the management of the Monterey Subbasin.)))

WHEREAS, the Marina Coast Water District has filed with the Department of Water Resources to become the Ground Water Sustainability Agency for the Monterey Subbasin; and,

WHEREAS, this filing has created the need for Marina Coast and the Salinas Valley Basin to coordinate management activities in the Monterey Subbasin; and

WHEREAS, the Marina Coast Water District and the Salinas Valley Basin Ground Water Sustainability Agency developed an agreement that is mutually acceptable for managing this basin; and,

WHEREAS, the proposed Coordination agreement will allow for Grant Applications that will fund Ground Water Sustainability planning in the subbasin;

NOW, THEREFORE, BE IT RESOLVED, by the Board of Directors of the Salinas Valley Basin Groundwater Sustainability Agency as follows:

The above recitals are true and correct.

The attached Coordination agreement between Marina Coast Water District and the Salinas Valley Basin Ground Water Sustainability Agency is hereby approved.

The General Manager and Agency Counsel are hereby authorized and directed to take such other and further actions as may be necessary or appropriate to implement the intent and purposes of this resolution.

PASSED AND ADOPTED on this 9th day of November 2017 by the following vote, to-wit:

AYES: Directors Alejo, Brennan, Granillo, Lipe, McHatten, McIntyre, Pereira, Secondo, Stefani, and Chair Gunter

NOES: None

ABSENT: Director Calcagno

ABSTAIN: None

I, Ann Camel, Clerk of the Board of Directors of the Salinas Valley Basin Groundwater Sustainability Agency, State of California, hereby certify that the foregoing is a true copy of an original order of said Board of Directors duly made and entered in the minutes thereof.

Dated: 11/9/17

Ann Camel, Clerk of the Board of Directors of the Salinas Valley Basin Groundwater Sustainability Agency,
County of Monterey, State of California

Ann Camel

PROPOSITION 1 Coordination Agreement

THIS PROPOSITION 1 COORDINATION AGREEMENT (the "Agreement") is made effective as of November 9, 2017 by the Marina Coast Water District Groundwater Sustainability Agency ("MCWD") and the Salinas Valley Basin Groundwater Sustainability Agency ("SVBGSA") regarding proposals for Sustainable Groundwater Planning ("SGWP") Grant Program funds, authorized by the Water Quality, Supply, and Infrastructure Improvement Act of 2014 ("Proposition 1") within the Monterey Subbasin and the 180/400 foot Subbasin, with reference to the following facts:

A. Eligibility criteria for Category 2 proposals for SGWP Grant Program funds, authorized by Proposition 1, only accept one application per Basin/Subbasin; and

B. An eligible agency may be part of the Proposition 1 application as a project proponent, but must identify a single entity that will act as the grant applicant and submit a basin-wide application and receive the grant on behalf of the basin; and

C. If multiple applications are received within a basin for Category 2 projects, DWR will contact the applicants and request that the Parties consolidate one single application for the basin to be submitted before the close of the open filing period; and

D. The applicant must include a Proposal level "Summary" highlighting each project contained in the Proposal and must demonstrate that it encompasses the entire basin or describes why a portion of the basin is not covered in the Proposal.

E. Applicants requesting funding for Category 2 Proposition 1 application must provide documentation of any communications with beneficial users of groundwater in the basin that may potentially be affected by implementation of the project, including, but not limited to DACs, SDACs, agricultural water users, municipal water users, wildlife refuges, or other stakeholders.

F. The Filing Period Closes November 13, 2017 for proposals for SGWP Grant Program funds; and

G. Proposition 1 requires a minimum cost share of 50% of the total project cost.

THEREFORE, in consideration of the facts recited above the Parties agree to the following with regards to Proposition 1 applications:

1. The Parties agree that MCWD shall be the Party responsible for submitting a grant application/proposal to DWR for a Category 2, Tier 2 Groundwater Sustainability Plan grant for the Monterey Subbasin and MCWD shall be the grantee if the proposal is successful. MCWD shall be responsible for the cost of preparing the grant. MCWD will coordinate with SVBGSA and obtain input from SVBGSA in preparation of the grant application/proposal for the Monterey Subbasin.

2. The Parties further agree that SVBGSA shall be the Party responsible for submitting a grant application/proposal to DWR for a Category 2, Tier 1 Groundwater Sustainability Plan grant for the 180/400 Foot Aquifer Subbasin and SVBGSA shall be the grantee if the proposal is successful. SVBGSA shall be responsible for the cost of preparing the grant. SVBGSA will coordinate with MCWD and obtain input from MCWD in preparation of the grant application/proposal for the 180/400 Foot Aquifer Subbasin.

3. A coordination committee including representatives from MCWD and SVBGSA shall be formed for each subbasin.

4. The parties agree that they shall share all data necessary to facilitate the completion of the Proposition 1 applications/proposals.

5. The Proposition 1 application for the Monterey Subbasin will include:

a) A project for the preparation of the GSP by MCWD for the Marina Subarea and the Ord Subarea, as shown on attached Exhibit "A;" and

b) A project for the preparation of a GSP by SVBGSA for the Corral de Tierra Subarea, also as shown on attached Exhibit "A".

6. The Marina, Ord and Corral de Tierra subareas shall be managed as follows:

a) If MCWD is allowed under the Sustainable Groundwater Management Act ("SGMA") to include the Ord Subarea within its Groundwater Sustainability Agency boundaries, MCWD shall manage the Marina and Ord Subareas as part of its GSA under the GSP described in Section 5 (a), above.

b) If MCWD is not allowed under SGMA to include the Ord Subarea within its Groundwater Sustainability Agency boundaries, the Ord Subarea may be designated by the SVBGSA as a Management Area within the boundaries of its GSA, and MCWD shall be allowed to manage the Ord Subarea under the GSP described in Section 5 (a), above.

c) SVBGSA shall manage the Corral de Tierra Subarea.

7. The GSP Project for the Monterey Subbasin will include review and potential refinement of the portion of the Salinas Valley Integrated Hydrologic Model ("SVIHM") that addresses the Monterey Subbasin and nearby subbasins. SVIHM is being developed by the USGS for the entire Salinas River Valley Basin.

8. MCWD will provide matching grant funds for development of the GSP and for SVIHM model review and refinement for the Marina Subarea and Ord Subarea of the Monterey Subbasin. Notwithstanding anything to the contrary, in the event MCWD is prevented from including the Ord Subarea within its GSP or the SVBGSA elects to include the Ord Subarea within its own GSP for the Monterey Subbasin, then SVBGSA shall reimburse

MCWD for all matching funds which MCWD has provided or expended proportionately for the Ord subarea after the effective date of this agreement, and SVBGSA shall be responsible for all matching funds applicable to the Ord Subarea for purposes of the SGWP Grant Program.

9. SVBGSA and MCWD may include additional project(s) in each other's grant applications for the Monterey and 180/400 Foot Aquifer Subbasins if they provide all required information in the appropriate format and demonstrate matching funds by an agreed upon timeframe.

10. The Parties acknowledge that the submission deadline for any Proposition 1 application is November 13, 2017. As such, the Parties agree to the following schedule for coordination of grant applications for the Monterey and 180/400 Foot Aquifer Subbasins:

- Proposition 1 Applicant to share draft Proposition 1 application with other Party (10/20/2017)
- Proposition 1 Applicant to receive feedback on Draft Proposition 1 application from other Party (by 10/27/2017)
- Proposition 1 Applicant to obtain complete information from other Party for any independent Projects (for which other Party is providing matching funds) for inclusion in in Draft Proposition I application (10/27/2017)
- Submit Prop 1 application to DWR by 11/13/2017

In the event either Party fails to provide any of the required information to the submitting Party by the identified dates, then this Agreement shall terminate and either Party may submit a Proposition 1 application on their own behalf, without regard to the other Party.

11. Assuming agreement is reached between the Parties regarding the Proposition 1 applications for the Monterey Subbasin and 180/400 Foot Aquifer Subbasin, the Parties will provide letters of support for each other's Proposition 1 grant applications for the 180/400 Foot Aquifer Subbasin and the Monterey Subbasin by November 3, 2017.

Agreed and acknowledged on November 21, 2017, by the signatures below:

SALINAS VALLEY BASIN
GROUNDWATER SUSTAINABILITY AGENCY

By: [signature]
Gary Petersen
Title: General Manager

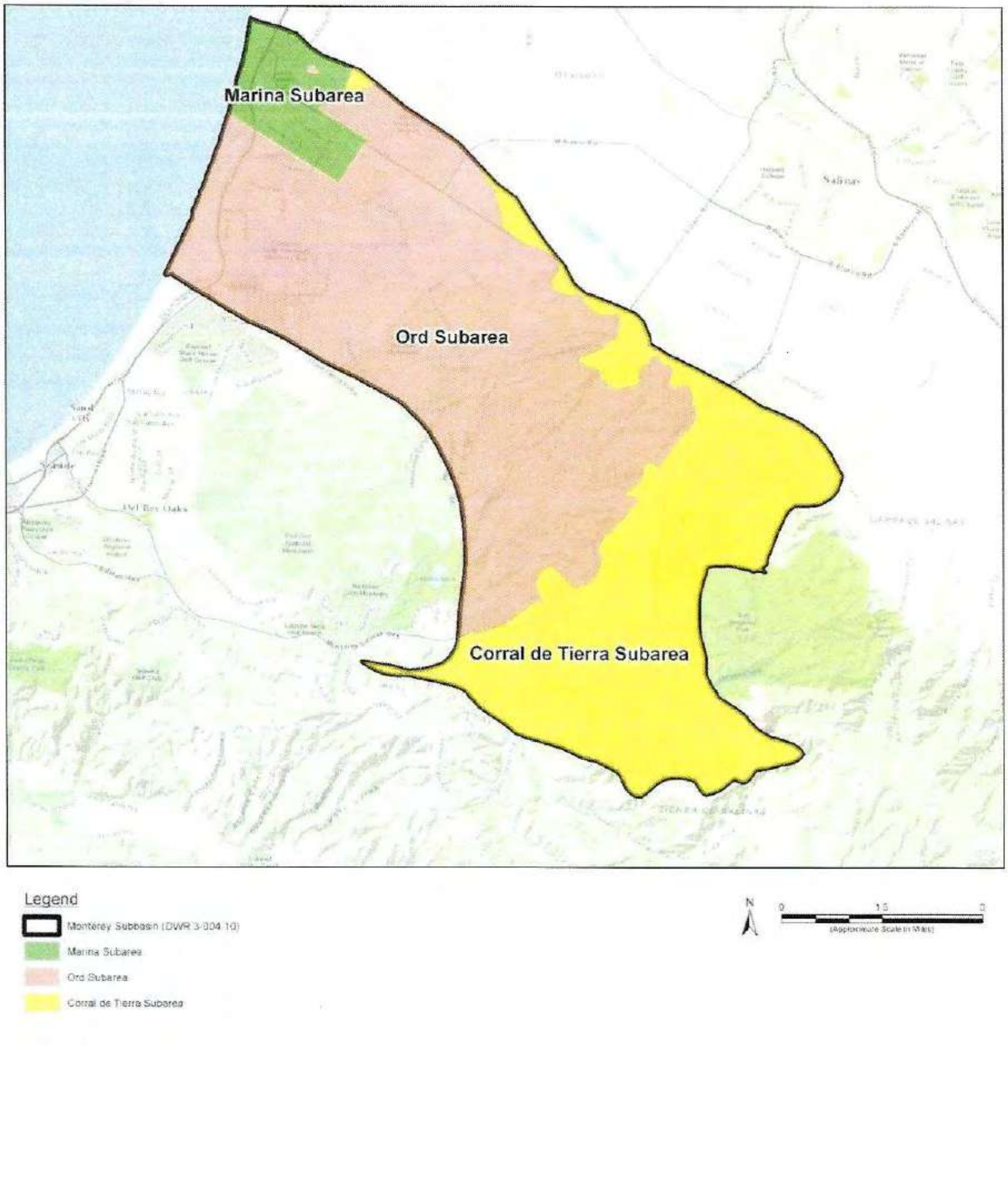
APPROVED AS TO FORM:
[signature]
Leslie J. Girard
SVBGSA Agency Counsel

MARINA COAST WATER DISTRICT
GROUNDWATER SUSTAINABILITY AGENCY

By: [signature]
Keith Van Der Maaten
Title: General Manager

APPROVED AS TO FORM:
Roger K. Masuda
Roger K. Masuda
MCWDGSA Agency Counsel

EXHIBIT A. MONTEREY BASIN SUBAREAS



Before the Board of Directors of the
Salinas Valley Basin Sustainable Groundwater Management Agency

Resolution No. 2018-11	)
Authorizing Execution of a Framework	)
Agreement for the Monterey Basin	)
Groundwater Sustainability Plan between the	)
Marina Coast Water District Groundwater	)
Sustainability Agency and the Salinas Valley	)
Basin Groundwater Sustainability Agency	)

WHEREAS, the Sustainable Groundwater Management Act (SGMA) of 2014, Water Code Sections 10720-10736.6 was signed into law September 16, 2014; and,

WHEREAS, SGMA gives local agencies authorities and powers to manage groundwater; and,

WHEREAS, Groundwater Sustainability Plans, in conformance with SGMA, for the 180/400 Aquifer and the Monterey subbasins are required by January 31, 2020 and 2022 respectively; and,

WHEREAS, SGMA requires a coordinated Groundwater Sustainability Plan (GSP) or GSPs among or between adjacent GSAs and adjacent subbasins; and,

WHEREAS, GSP development requires collaboration amongst GSAs and other local or regional water management groups at the groundwater subbasin level and encourages collaboration across groundwater subbasin boundaries; and,

WHEREAS, the Marina Coast Water District Groundwater Sustainability Agency (MCWDGSA) and the Salinas Valley Groundwater Sustainability Agency previously entered into a Proposition 1 Coordination Agreement regarding cooperation and coordination on the application for and receipt of Proposition 1grant funds to fund the development of GSPs for the Monterey Subbasin and the 180/400 Foot Aquifer Subbasin; and,

WHEREAS, the proposed Framework Agreement's intent is that one GSP will be developed for the entire Monterey Subbasin (i.e. the Monterey Subbasin GSP), which will contain three management areas that generally encompass the Marina Subarea, the Ord Subarea (both of which are generally located north of State Route 68), and the Corral de Tierra Subarea (located generally south of State Route 68); and,

WHEREAS, the Framework Agreement clarifies that the MCWDGSA will prepare the GSP components for the Marina Management Area and the Ord Management Area, and SVBGSA will prepare the GSP components for the Corral de Tierra Management Area and the GSP for the entire 180/400 Foot Aquifer Subbasin; and,

WHEREAS, the Agreement requires the MCWDGSA and the SVBGSA to actively consult with each other and include each other for review of draft work products during the GSP development process for the 180/400 Foot Aquifer Subbasin and the Monterey Subbasin; NOW, THEREFORE,

BE IT RESOLVED, by the Board of Directors of the Salinas Valley Basin Groundwater Sustainability Agency, that the General Manager is hereby authorized and directed to execute the Framework Agreement for the Monterey Groundwater Basin Groundwater Sustainability Plan between the Marina Coast Water District Groundwater Sustainability Agency and Salinas Valley Basin Groundwater Sustainability Agency attached hereto as Exhibit A.

BE IT FURTHER RESOLVED, that the General Manager and Agency Counsel are hereby authorized and directed to take such further actions as may be necessary or appropriate to implement the intent and purposes of this Resolution.

PASSED AND ADOPTED on this 13th day of December 2018 by the following vote, to-wit:

AYES: Directors Alejo, Brennan, Calcagno, Granillo, Gunter, Lipe, McIntyre, Pereira, Secondo, Stefani, and Chairperson McHatten

NOES: None

ABSENT: None

ABSTAIN: None

I, Ann Camel, Clerk of the Board of Directors of the Salinas Valley Basin Groundwater Sustainability Agency, State of California, hereby certify that the foregoing is a true copy of an original order of said Board of Directors duly made and entered in the minutes thereof.

Dated: 12/13/18

Ann Camel, Clerk of the Board of Directors of the Salinas Valley Basin Groundwater Sustainability Agency,
County of Monterey, State of California

Ann Camel

FRAMEWORK AGREEMENT

This Framework Agreement is made effective as of 12/13/18 by the Marina Coast Water District Groundwater Sustainability Agency (MCWD) and Salinas Valley Basin Groundwater Sustainability Agency (SVBGSA) (collectively, the "Parties") regarding Groundwater Sustainability Plan (GSP) development for the Monterey Subbasin and the 180/400 Foot Aquifer Subbasin, with reference to the following:

RECITALS

A. On September 16, 2014 Governor Jerry Brown signed into law Senate Bills 1168 and 1319 and Assembly Bill 1739, known collectively as the Sustainable Groundwater Management Act (the "Act"), effective January 1, 2015; and

B. The Act was amended by Senate Bill 13, effective January 1, 2016; and

C. The legislative intent of the Act is to provide sustainable management of groundwater basins, to enhance local management of groundwater, to establish minimum standards for sustainable groundwater management, and to provide local agencies with the authority and the technical and financial assistance necessary to sustainably manage groundwater; and

D. The Act requires formation of one or more groundwater sustainability agencies ("GSAs") that will be responsible for developing a single or multiple groundwater sustainability plan ("GSP") for a groundwater basin; and

E. The purpose of this Framework Agreement is to outline the process to be used by the Parties to work collaboratively to develop one GSP for the entire Monterey Subbasin and one GSP for the entire 180/400 Foot Aquifer Subbasin (the "GSPs"). It is further intended to guide the Parties' coordination during GSP development in the Monterey Subbasin and the 180/400 Foot Aquifer Subbasin and further intended to, in part, implement the intent and purposes of the Coordination Agreement between the Parties dated November 21, 2017.

F. The Parties recognize that a detailed approach is to be developed by the Parties' technical staff under these guidelines to make sure that the elements of the GSPs are appropriately coordinated to support sustainable management.

NOW, THEREFORE, in consideration of the promises, terms, conditions and covenants contained herein, the Parties to this Agreement hereby agree as follows:

1. Overarching Approach. The Parties agree that one GSP will be developed for the entire Monterey Subbasin (i.e. the Monterey Subbasin GSP), which will contain three management areas that generally encompass the Marina Subarea, the Ord Subarea (both of which are generally located north of State Route 68), and the Corral de Tierra Subarea (located generally south of State

Route 68). The Parties recognize that the exact boundaries of the management areas are to be confirmed. Consistent with the Proposition 1 Grant Work Plans:

(a) MCWD GSA will prepare the GSP components for the Marina Management Area and the Ord Management Area;

(b) SVBGSA will prepare the GSP components for the Corral de Tierra Management Area.

(c) The Parties further agree that SVBGSA will prepare a GSP for the entire 180/400 Foot Aquifer Subbasin.

(d) The Parties agree that they will actively consult with each other, and include each other for review of draft work products during the GSP development process for the 180/400 Foot Aquifer Subbasin and the Monterey Subbasin.

2. Schedule. The Parties agree to develop a detailed approach and schedule for development of the GSPs. The detailed approach and schedule for the Monterey Subbasin GSP should outline the process of preparing separate and common GSP components, as well as identify the timing of data sharing and review of key work products. The detailed approach and schedule for the 180/400 Foot Aquifer should identify the process and timing of consultation and review for key work products. The Parties recognize that a successful GSP relies on involving each other for early input and providing draft work products to the other Party for timely review, and further recognize that the GSP for the 180/400 Foot Aquifer Subbasin must be filed with DWR no later than January 31, 2020, and the GSP for the Monterey Subbasin must be filed no later than January 31, 2022.

3. Coordination Committees; Stakeholder Engagement. The Parties agree to form a Steering Committee that oversees activities under this agreement. The Steering Committee shall include the General Manager and one Board Member from each Party, who will update each Party's Board of Directors. Staff and consultants from each Party may participate in the Steering Committee as necessary. In addition, the Parties agree to form a Technical Committee that consists of staff and/or technical consultants to perform activities under this agreement. The Steering Committee and Technical Committee shall each hold regular meetings pursuant to schedules described in Attachment A and may hold special meetings and workshops as necessary.

The Parties agree to work collaboratively to develop and implement stakeholder engagement plans for the GSPs and ensure regular, productive communication between the Parties, stakeholders, and stakeholder representatives. Each Party is responsible for guiding efforts within their respective plan preparation areas in both basins, e.g., MCWD for the Marina and Ord Subareas of the Monterey Subbasin, and SVBGSA for the Corral de Tierra Subarea of the Monterey Subbasin as well as the 180/400 Foot Subbasin

4. Data Management and Exchange. (a) The Parties agree to develop and maintain coordinated data management system(s) that meet the requirement California Code of Regulations (CCR) Title 23, Section 352.6, such as a single DMS or separate DMSs with coordinated schema to facilitate data sharing.

(b) Each Party shall be responsible for the collection of information to support GSP analyses within their respective plan preparation areas, including but not limited to data to support groundwater conditions assessment, hydrogeologic conceptual model development, numerical model development, and water budget analysis.

(c) The Parties agree, to the fullest extent permitted by law, to make all data necessary to facilitate development of the GSPs available to the other Party and conduct information exchange, either through a formal or informal request, in a timely fashion. To the extent it is necessary to make a written request for information to another Party, each Party shall designate a representative to respond to information requests and provide the name and contact information of the designee to the Coordination Committee. Nothing in this Agreement shall be construed to prohibit any Party from voluntarily exchanging information with any other Party by any other mechanism separate from the Coordination Committee.

(d) It is understood and agreed that a Party to this Agreement may provide the other Party with confidential information. To ensure the protection of such confidential information and in consideration of the agreement to exchange said information, appropriate arrangements may be made to restrict or prevent disclosure.

(e) It is further understood that information to be exchanged may include data obtained from the Monterey County Water Resources Agency (MCWRA) under agreements with the MCWRA. The Parties agree to make the data obtained from MCWRA available for information exchange to the extent permitted by law, and as long as provision of such exchanges follow the terms of agreement with MCWRA.

(f) The Parties agree to consider the development of a Uniform Data Sharing and Confidentiality Agreement with MCWRA so that there will be uniform rules among the three agencies as to how and what data is to be shared, what data shall be considered confidential, and how confidential data is to be secured, protected, shared, and released.

5. Water Budget. The Parties agree to prepare coordinated water budgets and basin setting information for the Monterey and 180/400 Foot Aquifer Subbasins, as required by 23 CCR 354.18. The Parties agree to work to reach consensus on inputs, assumptions, and methodology, as well as review and potential refinement of the portion of the Salinas Valley Integrated Hydrological Model that addresses the Monterey Subbasin and 180/400 Foot Aquifer Subbasins.

6. Monitoring Network. The Parties agree to develop coordinated monitoring network objectives for the Monterey and 180/400 Foot Aquifer Subbasins. The monitoring network shall facilitate the collection of data necessary to characterize groundwater and related surface water conditions and evaluate changing conditions that occur from implementation of the GSPs in each Management Area.

7. Proposition 1 Grant Administration. The Parties agree to coordinate grant administration for GSP development in the Monterey Subbasin. Pursuant to the provisions of the Proposition 1 Sustainable Groundwater Planning Grant Agreement for the Monterey Subbasin,

MCWD will submit invoices, deliverables and other grant administration materials to DWR on behalf of SVBGSA and will redistribute SVBGSA's potion of grant reimbursements to SVBGSA. However, MCWD will not be responsible for verifying the format or information within SVBGSA's submittals. SVBGSA is responsible for timely providing MCWD the information necessary for preparation of quarterly progress reports and grant completion reports.

8. Indemnification. Each Party agrees to defend, indemnify and hold harmless the other Party, and their officers, employees and agents, from against any and all demands, claims, causes of action, suits, judgements, liabilities, liens, losses, damages, expenses, fines, penalties and assessments (collectively, "damages") arising out of or related to the preparation, consideration and approval of a GSP or GSP components by the indemnifying Party for its respective management area, except in the case of a claim or litigation by one Party against the other. The Parties agree to cooperate in the defense of any claim or lawsuit arising out of such actions to the extent permitted by law.

9. Termination. Either Party by majority vote of its governing body may terminate this Framework Agreement for any reason or no reason upon at least nine (9) months' prior written notice to the other Party. Such notice may be made by personal delivery or first class U.S. Mail (postage prepaid), and shall be deemed delivered upon actual receipt of the notice by the other Party. Such notice shall be addressed to the General Manager of the non-noticing Party. Within thirty (30) days of delivery of the notice, the Steering Committee representatives shall personally meet and attempt in good faith to resolve the dispute.

Notwithstanding anything to the contrary herein, this Framework Agreement shall not be terminated (the "effective termination date") unless and until the parties shall have entered into intra-basin coordination agreements in accordance with Water Code §10727.6 and 23 CCR §357.4 for each parties' respective GSP for their respective portions of the 180/400 Foot Aquifer and the Monterey Subbasin. The intra-basin coordination agreement must address any necessary approvals resulting in grant changes from DWR as a result of changing from a single GSP for each of the sub-basins to coordinated multiple GSP's for each of the sub-basins.

Until the effective termination date, each Party shall continue to develop their respective portions of the GS Plans pursuant to the Proposition 1 Coordination Agreement. The Parties shall obtain any necessary approvals for resulting grant changes from DWR. All reimbursements required by that agreement shall be due and payable on the effective termination date.

IN WITNESS WHEREOF, MCWD and SVBGSA execute this Framework Agreement effective as of the date first written above.

Marina Coast Water District Groundwater Sustainability Agency,

By: [signature]

Date: 1/4/19

APPROVED AS TO FORM

Roger K. Masuda

Roger Masuda
MCWDGSA General Counsel

Salinas Valley Basin Groundwater Sustainability Agency,

By: ______________________________

Date: ______________________________

APPROVED AS TO FORM

____

Leslie J. Girard
SVBGSA General Counsel

APPROVED AS TO FORM

____
Roger Masuda
MCWDGSA General Counsel

Salinas Valley Basin Groundwater Sustainability Agency,

By: ______________________________

Date: 12/13/18

APPROVED AS TO FORM

____
Leslie J. Girard
SVBGSA General Counsel

ATTACHMENT A
Regular Committee Meeting Schedules

The Steering Committee for coordinating GSP development in the 180/400 Foot Aquifer and Monterey Subbasins will meet quarterly beginning the fourth quarter of 2018. Meetings of the Steering Committee shall be subject to the California Open Meeting Law ("Brown Act"). The first meeting of the Committee shall be called by the General Manager of the SVBGSA, who shall preside pro tem at the start of the meeting. At the initial meeting the Committee shall choose a chairperson and set a regular schedule of meetings as required by the Brown Act.

The Technical Committee will meet regularly every other month starting September 2018, exact time and location to be determined. Meetings of the Technical Committee are not subject to the Brown Act. During the Technical Committee meetings, GSA staff and technical consultants will

- Provide status update regarding work progress and schedule;
- Exchange data and information available at the time of the meeting;
- Coordinate development and review of work products; and
- Present and discuss technical topics.

November 19, 2018

Resolution No. 2018-GSA02
Resolution of the Board of Directors
Marina Coast Water District Groundwater Sustainability Agency
Authorizing the General Manager to Execute a Framework Agreement for the
Monterey Groundwater Basin Groundwater Sustainability Plan between the
Marina Coast Water District Groundwater Sustainability Agency and the
Salinas Valley Basin Groundwater Sustainability Agency

RESOLVED by the Board of Directors ("Directors") of the Marina Coast Water District Groundwater Sustainability Agency ("District"), at a regular meeting duly called and held on November 19, 2018, at 211 Hillcrest Avenue, Marina, California as follows:

WHEREAS, the Sustainable Groundwater Management Act (SGMA) of 2014, Water Code Sections 10720-10736.6 was signed into law September 16, 2014; and,

WHEREAS, the District formed Groundwater Sustainability Agencies for the Central Marina and Ord Community Service Areas in portions of the Monterey Subbasin and the 180/400 Subbasin in conformance with the SGMA; and,

WHEREAS, SGMA gives local agencies, such as the District, additional authorities and powers to manage groundwater; and,

WHEREAS, the District is committed to sustainable management of its groundwater resources; and,

WHEREAS, the Groundwater Sustainability Plans for the District GSAs in conformance with SGMA for the 180/400 Aquifer and the Monterey subbasins are required by 2020 and 2022 respectively; and,

WHEREAS, the District has commenced Groundwater Sustainability Planning and that doing so is consistent with the goals and objectives stated in the District's Strategic Plan; and,

WHEREAS, SGMA requires a coordinated a Groundwater Sustainability Plan (GSP) or GSPs among or between adjacent GSAs and adjacent subbasins; and,

WHEREAS, GSP development requires collaboration amongst GSAs and other local or regional water management groups at the groundwater subbasin level and encourages collaboration across groundwater subbasin boundaries; and,

WHEREAS, the Framework Agreement's intent is that one GSP will be developed for the entire Monterey Subbasin (i.e. the Monterey Subbasin GSP), which will contain three management areas that generally encompass the Marina Subarea, the Ord Subarea (both of which are generally located north of State Route 68), and the Corral de Tierra Subarea (located generally south of State Route 68); and,

WHEREAS, the Agreement clarifies that the MCWDGSA will prepare the GSP components for the Marina Management Area and the Ord Management Area and SVBGSA will prepare the GSP components for the Corral de Tierra Management Area and that the SVBGSA will prepare a GSP for the entire 180/400 Foot Aquifer Subbasin; and,

WHEREAS, the Agreement directs both the MCWDGSA and the SVBGSA will actively consult with each other and include each other for review of draft work products during the GSP development process for the 180/400 Foot Aquifer Subbasin and the Monterey Subbasin.

NOW, THEREFORE, BE IT RESOLVED, that the Board of Directors of the Marina Coast Water District does hereby Authorize the General Manager to execute a Framework Agreement for the Monterey Groundwater Basin Groundwater Sustainability Plan between the Marina Coast Water District Groundwater Sustainability Agency and Salinas Valley Basin Groundwater Sustainability Agency.

PASSED AND ADOPTED on Novwember 19, 2018 by the Board of Directors of the Marina Coast Water District by the following roll call vote:

Ayes:	Directors	Cortez, Lee, Shriner, Moore
Noes:	Directors	None
Absent:	Directors	Gustafson
Abstained:	Directors	None

Thomas P. Moore

Thomas P. Moore, President

ATTEST:

Keith Van Der Maaten, Secretary

CERTIFICATE OF SECRETARY

The undersigned Secretary of the Board of the Marina Coast Water District Groundwater Sustainability Agency hereby certifies that the foregoing is a full, true and correct copy of Resolution No. 2018-GSA02 adopted November 19, 2018.

Keith Van Der Maaten, Secretary

COOPERATION AGREEMENT AMONG GROUNDWATER SUSTAINABILITY AGENCIES IN THE 180/400 FOOT AQUIFER SUBBASIN

This COOPERATION AGREEMENT ("Agreement") establishing cooperation among the 180/400 Foot Aquifer Subbasin Groundwater Sustainability Agencies ("GSAs") and providing for management is made and entered into and effective upon the date when the last Member signs this Agreement ("Effective Date") by and among the County of Monterey acting in the capacity of its Groundwater Sustainability Agency (" MCGSA") and the Salinas Valley Basin Groundwater Sustainability Agency ("SVBGSA"). Either MCGSA or SVBGSA are also referred to as a "Member" or collectively as "Members".

Recitals

WHEREAS, in 2014, the California legislature adopted, and the Governor signed into law, three bills (SB 1168, AB 1739, and SB 1319) collectively referred to as the "Sustainable Groundwater Management Act" ("SGMA"), that initially became effective on January 1, 2015, and that has been amended from time-to-time thereafter; and

WHEREAS, the stated purpose of SGMA, as set forth in California Water Code Section 10720.1, is to provide for the sustainable management of groundwater basins at a local level by providing local groundwater agencies with the authority, and technical and financial assistance necessary, to sustainably manage groundwater; and

WHEREAS, SGMA requires the designation of Groundwater Sustainability Agencies ("GSAs") for the purpose of achieving groundwater sustainability through the adoption and implementation of Groundwater Sustainability Plans ("GSPs") or an alternative plan for all medium and high priority basins as designated by the California Department of Water Resources ("DWR"); and

WHEREAS, each Member is a GSA, as defined by SGMA, duly organized and existing under and by virtue of the laws of the State of California, and each Member has water supply, water management or land use responsibilities within the 180/400 Foot Aquifer Subbasin ("Subbasin"), which is designated subbasin number 3-004.01 in the most recent edition of DWR Bulletin Number 118; and

WHEREAS, the California Department of Water Resources ("DWR") on or about December 18, 2019 recognized County of Monterrey as the exclusive GSA for an approximately 400-acre parcel within the Subbasin currently owned by RMC Pacific Materials, LLC and depicted in Exhibit A attached hereto (the "CEMEX Site"); and

WHEREAS, the SVBGSA is the exclusive GSA for the majority of the Subbasin, excluding the CEMEX Site and one other small area, also depicted in Exhibit A attached hereto; and

WHEREAS, Section 107027 (b) of SGMA allows for a single groundwater sustainability plan covering a basin to be adopted by one GSA or multiple GSAs; and

WHEREAS, members of this Agreement intend for a single GSP to be adopted for the entire Subbasin; and

WHEREAS, SVBGSA has prepared a draft GSP for the entire Subbasin, including the CEMEX Site; and

WHEREAS, Section 10720.7 of SGMA requires all basins designated as high or medium priority basins by the DWR in its Bulletin 118 be managed under a single GSP or coordinated GSPs pursuant to SGMA; and

WHEREAS, the Members have determined that the sustainable management of the Subbasin pursuant to SGMA may best be achieved through the cooperation of the Members operating through this Agreement; and

WHEREAS, the Members agree that this Agreement does not establish nor is it intended to establish a GSA; and

WHEREAS, the Members desire, through this Agreement, to enter into this Agreement for the purpose of organizing the various GSAs in the Subbasin and cooperating in the development and implementation of a single GSP for the Subbasin; and

WHEREAS, the governing board of each Member has determined it to be in the Member's best interest and in the public interest that this Agreement be executed;

NOW THEREFORE, in consideration of the matters recited and the mutual promises, covenants, and conditions set forth in this Agreement, the Members hereby agree as follows:

TERMS OF AGREEMENT

ARTICLE 1. DEFINITIONS

As used in this Agreement, unless context requires otherwise, the meanings of the terms set forth below shall be as follows:

1.1. "Agreement" means this Cooperation Agreement.

1.2. "CEMEX Site" has the meaning set forth in the recitals above.

1.3. "Committee" means any committee established pursuant to Article 8 of this Agreement.

1.4. "Coordination Agreement" means a legal agreement adopted between two or more GSAs that provides the basis for coordinating multiple GSAs or GSPs within a basin. Coordination Agreements are required if multiple GSAs in a basin prepare multiple GSPs.

1.5. "County GSA" or MCGSA means the County of Monterey Groundwater Sustainability Agency.

1.6. "Effective Date" means the date on which the last Member executes this Agreement.

1.7. "GSA Workgroup has the meaning set forth in Article 7 of this Agreement.

1.8. "GSA" means a groundwater sustainability agency.

1.9. "GSP" means a groundwater sustainability plan.

1.10. "Management Area" refers to an area within a basin for which a GSP may identify different minimum thresholds, measurable objectives, monitoring, or projects and management actions unique to that area based on differences in water use sector, water source type, geology, aquifer characteristics, or other factors.

1.11. "Member" means each party to this Agreement that satisfies the requirements of Article 6 of this Agreement, including any new members pursuant to Article 6 of this Agreement.

1.12. "Member's Governing Body" means the board of directors, board of supervisors, council, trustees or other voting body that controls the individual public agencies that are Members.

1.13. "Project Agreement" has the meaning assigned to it in Article 11 of this Agreement.

1.14. "SGMA" has the meaning assigned to it in the first Recital of the Agreement.

1.15. "Specific Project" means a project undertaken by some, but not all Members, pursuant to Article 11 of this Agreement.

1.16. "SVBGSA" means Salinas Valley Basin Groundwater Sustainability Agency.

1.17. "State" means the State of California.

1.18. "Subbasin" means the 180/400 Foot Salinas Aquifer Subbasin, to reflect the most recent Bulletin 118 boundaries and as currently shown on the map attached to this Agreement as Exhibit B, which is incorporated herein by this reference. (DWR basin 3-004.01).

ARTICLE 2. PURPOSE OF THE AGREEMENT

2.1. The purposes of this Agreement are to: (a) develop, adopt, and implement a single, legally sufficient GSP for the Subbasin in order to implement SGMA requirements and achieve the sustainability goals outlined in the GSP; (b) cooperatively carry out the purposes of SGMA in the Subbasin; (c) coordinate basin-wide public involvement and stakeholder outreach and engagement in implementing the Subbasin GSP; (d) specify the terms under which MCGSA designates SVBGSA to manage the CEMEX Site under SGMA and implement the SVBGSA's GSP for the CEMEX Site, as well as the Subbasin and (e) to maintain mutual respect for the autonomy of individual Members and preservation of each Member's separate legal authorities, powers, duties and rights as separate public agencies and GSAs, except as set forth in this Agreement.

ARTICLE 3. TERM

3.1. This Agreement shall become effective on the Effective Date and shall continue in full force and effect until terminated pursuant to the provisions of Article 13.

ARTICLE 4. PRESERVATION OF POWERS

4.1 Preservation of Powers. Each Member retains its powers granted through SGMA or otherwise afforded by law. Each Member reserves its rights, in its sole and absolute discretion, and all Members confirm that nothing contained herein shall:

4.1.1. Alter any water right, contract right, or any similar right held by any Member or any Member's landowners or customers, or amend a Member's water delivery practice, course of dealing, or conduct.

4.1.2. Limit or interfere with any Member's rights and authorities over its own internal matters, including, but not limited to, a Member's legal rights to surface water supplies and assets, groundwater supplies and assets, facilities, operations, water management, and water supply matters.

4.1.3. Modify or limit any Member's police powers, land use authorities, well permitting or any other authority.

ARTICLE 5. BASIN COOPERATION

5.1. Each Member recognizes the benefits of cooperation amongst the GSAs within the Subbasin and, to that end, will in good faith, and with the consent of each Member's governing body, take actions to help effect the timely adoption of a single GSP for the entire Subbasin. Therefore, the members consent that each may adopt a single GSP for the entire Subbasin pursuant to Section 10727(b) of SGMA.

5.2. MCGSA designates SVBGSA as the manager of the CEMEX Site for groundwater management purposes under SGMA, including the implementation and enforcement, if necessary, of the GSP. SVBGSA agrees to undertake all reasonable and necessary actions to comply with SGMA at the CEMEX Site, including but not limited to taking actions to review, adopt and implement the GSP, including filing of annual reports and documents required by SGMA. SVBGSA further agrees to schedule and conduct all required or requested meetings of SVBGSA or MCGSA for adoption, implementation and management of the GSP. SVBGSA also agrees to assist MCGSA in the development and adoption process of the GSP, including but not limited to analysis and response to comments on the GSP as well as drafting amendments to the GSP.

5.3. MCGSA authorizes SVBGSA to exercise any and all legal authorities in compliance with applicable law for the CEMEX Site. In the event MCGSA disagrees with SVBGSA's use of legal authority affecting the CEMEX Site, MCGSA may promptly, and no later than sixty (60) calendar days following the disputed action, provide notice of disagreement and proceed to dispute resolution in accordance with Article 9.2.

5.4. Nothing herein is intended to or shall be construed as a waiver, relinquishment, abandonment, or infringement of the legal authorities of the County GSA for the CEMEX Site, or of any other legal authority of the County of Monterey.

5.5. The Members shall, whenever and as often as reasonably requested to do so by any other Member, execute, acknowledge, and deliver or cause to be executed, acknowledged, and delivered, any and all documents and instruments as may be necessary, expedient or proper in the reasonable opinion of the requesting Member to carry out the purposes and intent of this Agreement.

ARTICLE 6. MEMBERS

6.1. Initial Members. The initial Members of this Agreement shall be the County of Monterey Groundwater Sustainability Agency and Salinas Valley Groundwater Sustainability Agency.

6.2. New Members. Additional Parties may join the Agreement and become a Member provided that the prospective new member: (a) is an established GSA in the Subbasin as provided by SGMA (Water Code §10723); (b) pays its share of all previously incurred costs, if any; (c) pays all applicable fees and charges, if any; and (d) receives unanimous consent to join from the existing Members, evidenced by the execution of a written amendment to this Agreement signed by all Members, including the new public agency.

ARTICLE 7. GSA Workgroup

7.1. Formation of the GSA Workgroup. This Agreement shall hereby establish the GSA Workgroup that will meet upon the request of any Member. Without amending this Agreement, the composition of the GSA Workgroup may be altered from time to time to reflect the withdrawal of any Member and/or the admission of any new Member. The GSA Workgroup shall consist of the following representatives, who shall be appointed in the manner set forth in Article 7:

7.1.1. One (1) representative appointed by the governing body of each Member, who shall be a member of the governing body of the Member (each, a "Member Director").

7.1.2. One (1) alternate representative appointed by the governing body of each Member, who may be a member of the governing body or designee of the Member (each, an "Alternate Member Director").

7.2. Purpose of the GSA Workgroup. The purpose of the GSA Workgroup shall be to establish: (a) a GSA cooperation forum of Member Directors; (c) a mechanism whereby Members raise, and attempt in good faith to resolve, disputes that may occur between and among Members pursuant Article 9.2 of this Agreement; and (d) if necessary, a mechanism to make advisory recommendations to the Members concerning implementation of the GSP for the CEMEX Site.

7.3. Alternate Member Directors. Alternate Member Directors shall not participate as a Member Director in any discussions or deliberations of the GSA Workgroup unless appearing as a substitute for a Member Director due to absence. If the Member Director is not present, the Alternate Member Director appointed to act in his/her place shall have the authority to act in his/her absence. Alternate Member Directors are encouraged to attend all GSA Workgroup meetings and stay informed on current issues before the GSA Workgroup.

7.4. Terms. The term for each member of the GSA Workgroup is four (4) years and these individuals may be reappointed. Each Member Director and Alternate Member Director shall serve at the pleasure of the appointing Member's governing body and may be removed from the GSA Workgroup by the appointing Member's governing body at any time. If, at any time, a vacancy occurs on the GSA Workgroup, a replacement shall be appointed by the appropriate Member to fill the unexpired term of the previous Member Director's seat pursuant to this Article 7 and within ninety (90) days of the date that such position becomes vacant.

7.5. Removal of GSA Workgroup Members. A Director who no longer meets the qualifications set forth in Article 7.1 is automatically removed from the GSA Workgroup. Upon removal of a Member Director, the Alternate Member Director shall serve as a Member Director until a new Member Director is appointed.

ARTICLE 8. OTHER COMMITTEE FORMATION

8.1. Other Committees. The GSA Workgroup may, upon unanimous vote, form additional committees to assist in the implementation of this Agreement and SGMA, including committees comprised of staff or consultant representatives from the Members. Committee meetings shall be noticed to and open to other Members.

ARTICLE 9. DECISION-MAKING AND DISPUTE RESOLUTION

9.1. Decision-making Authority. Topics where the Members desire coordinated decision-making will be considered by the GSA Workgroup, and the Member Directors will strive for unanimous recommendations that will be presented to each Member's governing body for consideration. Such topics include, but are not limited to, implementation of the GSP, including adaptive management measures, and associated financial arrangements. When unable to reach unanimous recommendations, the GSA Workgroup will outline the areas in which it does not agree, providing some explanation to inform the respective GSAs' governing bodies. The recommendations of the GSA Workgroup notwithstanding, ultimate decision-making authority for topics considered by the GSA Workgroup resides with each Member's governing body in accordance with Article 4.1.

9.2. Dispute Resolution. It is the desire of Members to informally resolve all disputes and controversies related to this Agreement, whenever possible, at the least possible level of formality and cost. If a dispute occurs, staff representatives of the disputing Members shall meet and confer in an attempt to resolve the matter. If informal resolution cannot be achieved, the matter will be referred to the GSA Workgroup for further good faith efforts to resolve the dispute. With unanimous consent, the GSA Workgroup may engage the services of a trained mediator or retain technical consultants to assist with dispute resolution. In the event the GSA Workgroup is unable to resolve the dispute, any Member may resort to available legal and equitable remedies to resolve disputes.

ARTICLE 10. MANAGEMENT AREAS

10.1. Formation of Management Areas. The Members do not, at this time, contemplate management areas. However, the Members reserve the right to amend the GSP to create Management Areas within the Subbasin. A Management Area could be defined along the boundaries of one or more Member's jurisdictional boundaries, or it could be defined along other boundaries. In accordance with SGMA, any definition of Management Areas would be for the purposes of enhancing the ability of the GSAs to achieve and maintain sustainable groundwater management in the Subbasin. If Management Areas are formed, the following shall apply:

10.1.1. Common and Management Areas Chapters. The GSP will be organized so that there are GSP chapters or sections that address issues common to all Members followed by Management Area chapters or sections that may include specific minimum thresholds, measurable objectives, monitoring protocols and projects. All chapters must be consistent with the Subbasin sustainability goals.

10.1.2. Management Area Lead Responsibilities and Coordination. Each of the Members will have the responsibility to cooperatively develop their relevant Management Area chapter(s) for inclusion into the GSP. The development of all Management Area chapters will be coordinated through the GSA Workgroup to ensure consistency and efficiency.

10.1.3. Retention of Powers Granted through SGMA. If Management Areas are formed for the CEMEX Site, County GSA shall have the sole right to: 1) approve the sections or chapters of the GSP related to Sustainable Criteria and Projects and Actions as applicable within the CEMEX Site Management Area; 2) consider the interests of beneficial uses and users as required by Water code §10723.4 and GSP regulation §354.10; and 3) exercise the powers, without limitation, conferred upon a GSA by SGMA.

10.1.4. Failure to Submit Management Area Chapter. In the event of a failure by any Member to develop and submit a Management Area chapter within the deadline set by mutual agreement, failure to comply may lead to withdrawal or termination of this Agreement pursuant to Article 13 of this Agreement, or other legal remedies available to the Members.

ARTICLE 11. SPECIFIC PROJECTS

11.1. Member Specific Projects. In addition to the general activities undertaken by all Members, any Member may initiate a Specific Project to implement or comply with SGMA or the GSP. The Member proposing a Specific Project shall provide advance notice of their intent to undertake such project to the GSA Workgroup prior to committing to the Specific Project. The other Members shall promptly and not later than (60) days later respond to the Member proposing the Specific Project with notice of intent to participate or to not participate in the Specific Project. Upon notice of intent to participate, the affected Members shall negotiate a Project Agreement as set forth in section 11.2, below. If the other Members are not interested in participating in the Specific Project, then the proposing Member may individually pursue the Specific Project pursuant to section 11.3, below.

11.2. Project Agreement. Prior to undertaking any Specific Project in Article 11.1 for which a notice to intent to participate is made, the Members electing to participate in the Specific Project shall enter into a Project Agreement. A Member may elect not to participate in a Specific Project by providing notice and not entering into the Project Agreement. Each Project Agreement shall provide the terms and conditions by which the Members that enter into the Project Agreement will participate in the Project. All assets, rights, benefits, and obligations attributable to the Specific Project shall be assets, rights, benefits, and obligations of those Members that have entered into the Project Agreement. Any debts, liabilities, obligations, or indebtedness incurred in regard to a particular Specific Project shall be the debts, liabilities, obligations, and indebtedness of those Members that have executed the Project Agreement in accordance with the terms thereof and shall not be the debts, liabilities, obligations, and indebtedness of those Members that have not executed the Project Agreement.

11.3. Specific Projects Undertaken by One Member. All assets, rights, benefits and obligations attributable to Specific Projects undertaken by one Member shall be the assets, rights, benefits and obligations of that Member. Any debts, liability, obligations, or indebtedness incurred in regard to such Specific Projects shall be the debts, liabilities, obligations and indebtedness of the Member undertaking the Specific Project.

ARTICLE 12. FINANCIAL PROVISIONS

12.1. The Members acknowledge that the cost of the GSP was previously funded in a fair and equitable manner and no party shall seek reimbursement from the other for any cost incurred for the completion of the GSP. Following GSP adoption, as needed, continuing cooperation may be funded by Member contributions. If the Members decide that cost-sharing is required for any contract or expenditure made pursuant to this Agreement, any cost-sharing allocations shall be agreed to in writing by the Members in advance of executing any contracts with consultants, vendors, or other contractors or incurring any expense. Any such contracts shall be drafted in a manner that reflects that consultants, vendors, or contractors hired to perform work under this Agreement are working on behalf of the Members and will be expected to work with the Members on a collective basis and with each Member on an individual basis, as needed. Such contracts shall be made enforceable by the Members. The contracts shall include appropriate indemnity and insurance provisions agreed upon by the Members. In the event a Member acts as the official contracting party and executes a contract on behalf of the Members (the "Contracting Party"), the Contracting Party shall:

12.1.1. comply with all applicable local, state, and federal laws including, without limitation, the California Public Contract Code and California Labor Code;

12.1.2. provide the other Members a reasonable opportunity to review any bids received and to review and provide input on any draft contract prior to its execution;

12.1.3. not approve any change orders that increase the cost of the original contract by more than 10% without prior consultation and written consent of the other Members;

12.1.4. provide diligent oversight of the work conducted by any contractor, vendor, or consultant under contract executed pursuant to this Agreement; and

12.1.5. maintain complete, accurate, and clearly identifiable records with respect to all contracts executed, and provide to the other Members, upon reasonable request, all records, documents, reports, conclusions, work product, and other information related in any way to any contract executed on behalf of the Members pursuant to this Agreement.

ARTICLE 13. WITHDRAWAL AND TERMINATION

13.1. Withdrawal. A Member may unilaterally withdraw from this Agreement by providing notice of withdrawal, in writing, to the other Members. Notices of withdrawal submitted after the GSP has been adopted by the GSAs and transmitted to DWR shall not be effective until the Members have met, conferred and satisfactorily resolved issues associated with withdrawal to ensure that the withdrawal does not cause the Subbasin to be noncompliant with SGMA and potentially subject the Subbasin to probationary status, including, if applicable, the Members negotiating and adopting a Coordination Agreement under SGMA.

13.2. Termination of Agreement. This Agreement may be rescinded by unanimous written consent of all Members.

13.3. Right of Member in Event of Withdrawal or Termination. Upon withdrawal or termination of a Member, the Member shall be entitled to use all relevant, non-confidential data or other information developed by any Member or the Members under SGMA or used in the implementation of the GSP.

13.4. Financial Obligations. Upon withdrawal or termination of a Member, the Member shall remain responsible for any outstanding financial obligation agreed to pursuant to Article 11 or 12.

ARTICLE 14. MISCELLANEOUS

14.1. No Predetermination or Irretrievable Commitment of Resources. Nothing in this Agreement shall constitute a determination by any of its Members that any action shall be undertaken or that any unconditional or irretrievable commitment of resources shall be made, until such time as the required compliance with all local, state, or federal laws, including without limitation the California Environmental Quality Act, National Environmental Policy Act, or permit requirements, as applicable, has been completed.

14.2. Notices. Notices hereunder shall be sufficient if delivered via electronic mail, First-Class mail or facsimile transmission to the addresses as specified in Exhibit A.

14.3. Amendment. This Agreement may be amended at any time, by unanimous agreement of the Members, provided that before any amendments shall be operative or valid, they shall be in writing and signed by all Members hereto.

14.4. Agreement Complete. This Agreement constitutes the full and complete agreement of the Members. This Agreement supersedes all prior agreements and understandings, whether in writing or oral, related to the subject matter of this Agreement that are not set forth in writing herein.

14.5. Severability. If any provision of this Agreement is determined to be invalid or unenforceable, the remaining provisions will remain in force and unaffected to the fullest extent permitted by law and regulation.

14.6. Execution in Counterparts. The Parties intend to execute this Agreement in one or more counterparts each of which shall be considered an original Agreement.

14.7. Withdrawal by Operation of Law. Should the participation of any Member to this Agreement be decided by the courts to be illegal or in excess of that Member's authority or in conflict with any law, the validity of this Agreement as to the remaining Members shall not be affected thereby.

14.8. Assignment. The rights and duties of the Members may not be assigned or delegated without the written consent of all other Members. Any attempt to assign or delegate such rights or duties in contravention of this Agreement shall be null and void.

14.9. Binding on Successors. This Agreement shall inure to the benefit of, and be binding upon, the successors or assigns of the Members.

14.10. Venue. This Agreement shall be governed by and construed in accordance with the laws of the State of California, and any action related to the terms of this Agreement will be filed in Monterey County Superior Court.

14.11. GSA Status. By execution hereof, each Member represents that it is a legal entity authorized to be a Groundwater Sustainability Agency pursuant to California Water Code §§ 10723 and/or 10724.

14.12. Indemnity. In lieu of the provisions of Government Code section 895.6, and pursuant to Government Code section 895.4, each Member agrees to defend, indemnify and hold harmless the other Member, and its officers, employees and agents, from any and all claims, suits, judgments, damages, penalties, costs, expenses, liabilities and losses (including without limitation, sums paid in settlement of claims, actual attorneys' fees, paralegal fees, consultant fees, engineering fees, expert fees, and any other professional fees) that arise from or are related in any way to each Member, its employees, officers, or other agents in the operation and/or performance of this Agreement; provided, however, that no Member shall indemnify or hold harmless another Member for that other Member's own negligent acts, errors, or omissions, or willful misconduct, in the operation and/or performance of this Agreement. This indemnity shall survive the termination of this Agreement and the withdrawal of any Member to this Agreement.

14.13. Joint Defense. In the event of any challenge to the Subbasin GSP as it relates to the CEMEX Site, or made subject to a claim or penalty regarding the same, the Members shall meet and confer to determine whether to further coordinate and cooperate by undertaking joint defense, including utilizing a common interest/joint defense agreement.

IN WITNESS WHEREOF, the parties hereto, pursuant to resolutions duly and regularly adopted by their respective governing boards, have caused their names to be affixed by their proper and respective officers as of the date of execution of this Agreement.

By:______________________________ Date: 1/29/2020
Chair, County of Monterey GSA

By:______________________________ Date: 1-30-20
Chair, SVBGSA

APPROVED AS TO FORM AND LEGALITY

By:______________________________ Date: 1-29-20

By:______________________________ Date: 1-29-2020

Chapter 2
Appendix 2-A

Public Comments on the 180/400-Foot Aquifer Subbasin 2022 GSP Update and Comment Responses

180/400-Foot Aquifer Subbasin Groundwater Sustainability Plan: 2022 Update

Comment Letters

1. Gularte. 20211221
2. Farrow. 20211230
3. Virsik. 20220107
4. Cremers. 20220120
5. Farrow. 20220208
6. Isakson. 20220222
7. Seaside Watermaster. 20220314
8. Farrow. 20220412
9. Sang. 20220425
10. Virsik. 20220510
11. Community Water Center. 20220513
12. Hastings. 20220513
    a. Hastings. 20210812
    b. Hastings and Guillen. 20211015
    c. Abrams and Brown. 20211015
    d. Hastings and Guillen. 20211208
    e. Abrams and Brown. 20211208
    f. Hastings and Guillen. 20220309
    g. Hastings and Guillen. 20220415
13. NMFS. 20220519 (attached)
14. Gularte. 20220526

NOTICE OF PERMISSION TO USE GROUNDWATER

(Civil Code SubSec. 813)

To: Salinas Valley Basin Groundwater Sustainability Agency; County of Monterey; State of California; and to any other appropriator of groundwater in the Salinas Valley Groundwater Basin.

1. Notice is hereby given by the undersigned, Wayne Gularte, the holder of record title completely or undividedly to the real property described below:
   Monterey County of the State of California, assessor parcel numbers 139-085-020, 139-086-006, 139-431-019, 167-032-011, 167-033-001, 223-011-015, 223-011-016 and 223-011-021.
   These properties overlie what is commonly known as the Salinas Valley Groundwater Basin. My lessees and I now extract and will continue to extract groundwater from the Salinas Valley Groundwater Basin for reasonable beneficial use on overlying land, based on overlying right to that groundwater.

2. The right of the public and any person to make any use whatsoever of the groundwater described above or any portion of it is by permission, and subject to control, of owner: (SubSection 813, Civil Code).

3. I am not aware of credible scientific studies of the Salinas Valley Groundwater basin which shows an overdraft. However, to the extent that a condition of groundwater overdraft is found to exist now or in the future, this notice is given in accordance with Civil Code SubSection 813, to establish conclusive evidence that subsequent use of the groundwater during the time this notice is in effect by the public or any user for any purpose is permissive and with consent in any judicial proceeding involving the issue as to whether all or any portion of such groundwater has been dedicated to public use or whether any user has a prescriptive right in such groundwater or any portion of it.

4. Such consent to the use for the purpose described is given subject to the right of the undersigned, pursuant to Civil Code Subsection 813, to revoke such consent by notice to the County of Monterey, State of California recorder's office.

Dated: 12/20/2021

Signed: [signature]

Witness: [signature]

m | r | wolfe
& associates, p.c.
attorneys-at-law

December 30, 2021

Via email

Members of the 180/400-Foot Aquifer Subbasin Committee
Salinas Valley Basin Groundwater Sustainability Agency
P.O. Box 1350
Carmel Valley, CA 93924

Re: **Proposed change to storage reduction Sustainable Management Criteria**

Dear Committee Members:

I write on behalf of LandWatch Monterey County regarding the proposed change to the sustainable management criteria (SMC) for reduction in groundwater storage. LandWatch asks that the 180/400 GSP continue to specify the minimum threshold for reduction in groundwater storage in terms of extractions and be set at the "total volume of groundwater that can be withdrawn from the basin without causing conditions that may lead to undesirable results," as is required by the SGMA regulations. (23 CCR, § 354.28(c)(2).)

A. SGMA requires the groundwater storage SMC's to be specified in terms of extractions. Staff have not clarified the intent of the proposed storage SMCs or explained how they would be used to manage the subbasin.

Currently the minimum threshold (MT) and measurable objective (MO) are based on extractions and set at the level of 112,000 AFY. (180/400 GSP, p. 8-26.) An undesirable result would occur if extractions exceeded the MT/MO in an average hydrological year.

Staff has now proposed that the MT be based instead on groundwater level changes for the non-seawater-intruded area plus seawater intrusion for the seawater-intruded area.[1] Staff has not proposed actual numeric levels for the proposed thresholds other than that they be of "similar intent to original GSP." Staff do not specify the intent of the existing SMCs except to note that the existing SMCs provide "a logical basis for managing extractions" and "direct implementation of regulations that state pumping is the metric to use."[2] Again, the regulation in question is 23 CCR section 354.28(c)(2), which expressly provides that the MT must be specified as "a total volume of groundwater that can be withdrawn from the basin without causing conditions that may lead to undesirable

[1] See Montgomery & Associates, Technical Memorandum, December 24, 2021, available at pdf pages 8-10 of https://d3n9y02raazwpg.cloudfront.net/svbgsa/e2b432e9-634c-11ec-85e3-0050569183fa-ed9fe6eb-9410-446c-8e20-bb140a046169-1640737167.pdf; see also or presentation slides at pdf pages 39-43.

[2] Id., pdf page 40.

results." The obvious management intent of this regulation is to provide a basis for pumping allocations. Allocations remain a central part of the 180/400 GSP.

It is unclear how the GSA would use storage SMCs based on groundwater levels changes and seawater intrusion data to manage the subbasin or pumping volumes. Staff acknowledge that under the new method it is "almost impossible to show a significant correlation between groundwater elevations and 'a total volume that can be extracted.'"[3] As staff have acknowledged, the regulations "state pumping is the metric to be used."[4] The regulations facilitate basin management by directly connecting allowed extractions to undesirable results. Before changing the existing storage SMC's the GSA must explain how the proposed GSP would be used for subbasin management.

B. The GSA should not set a groundwater reduction SMC that is based on groundwater levels below sea level.

As LandWatch has previously objected, the 180/400 GSP improperly sets groundwater level SMCs below sea level, and thus at a value that fails to support attainment of the SMCs for seawater intrusion. i.e., halting intrusion at the 2017 line of advancement.

SGMA requires that each minimum threshold must avoid *each* undesirable result because it requires that "basin conditions at each minimum threshold will avoid undesirable results for each of the sustainability indicators." (23 CCR § 354.28(b)(2), emphasis added.) For example, the groundwater level minimum threshold must be "supported by" the "[p]otential effects on other sustainability indicators." (23 CCR § 354.28(c)(1)(B), emphasis added.) This means that each minimum threshold, especially the groundwater level minimum threshold, must be coordinated to ensure that all undesirable results are avoided.

The existing GSP acknowledges that its extraction-based SMC for storage reduction is based on its estimate of the long term sustainable yield of the subbasin and that, to halt seawater intrusion, "there may be a number of years when pumping might be held below the minimum threshold to achieve necessary rises in groundwater elevation." (180/400 GSP, p. 8-26.) The GSP explains that the existing storage reduction SMC set at long-term sustainable yield would not hinder maintenance of the seawater intrusion SMC:

> Pumping at or below the sustainable yield will maintain or raise average groundwater elevations in the Subbasin. Therefore, the minimum threshold for reduction in groundwater storage will not result in a significant or unreasonable increase in seawater intrusion.

(180/400 GSP, p. 8-27.)

---

[3] Id., pdf page 42.
[4] Id., pdf page 40.

However, the proposed change to the groundwater storage SMCs that would rely on groundwater elevations instead of extractions may result in an SMC that would hinder attainment and maintenance of the seawater intrusion – if it permits groundwater levels below sea level. This would further commit the GSA to the proposed capital-intensive pumping barrier project, a project which the GSA has not yet found to be feasible technically or economically.

As LandWatch has objected, the GSP deferred the identification of the projects or management actions to halt seawater intrusion by equivocating between (1) the "temporary pumping reductions . . . necessary to achieve the higher groundwater elevations that help mitigate seawater intrusion" or (2) a $102 million coastal pumping barrier requiring perpetual pumping with an annual $9.8 million O&M budget to avoid these temporary pumping reductions. (180/400 GSP, pp. 8-26, 9-52 to 9-55, 9-87.) Under the barrier scenario, the GSP claims that sustainability can be attained with groundwater levels below sea level without the temporary pumping reductions needed to restore protective groundwater elevations. (180/400 GSP, response to comment 8-139.)

Staff's current proposal to abandon the existing extraction-based SMCs appears to facilitate adoption of the pumping barrier project by effectively setting different MTs for storage reduction for the seawater-intruded area and the non-seawater-intruded area. If the storage reduction SMCs for the non-seawater intruded area were based on the existing groundwater levels SMCs, which are below sea-level, then the storage reduction SMC would also fail to support the protective elevation approach to attainment of the seawater intrusion SMC. Even if such a change were lawful, the GSA should not adopt it without understanding and justifying the GSA's commitment to the potentially infeasible pumping barrier approach.

Yours sincerely,

M. R. WOLFE & ASSOCIATES, P.C.

John Farrow

JHF:hs

cc: SVBGSA Board of Directors, board@svbgsa.org
Donna Meyers, meyersd@svbgsa.org
Emily Gardner, gardnere@svbgsa.org
Gary Petersen, peterseng@svbgsa.org
Les Girard, GirardLJ@co.monterey.ca.us

Gmail

Emily Gardner <gardnere@svbgsa.org>

180/400 GSP Amendment Chapter 6 draft

1 message

Thomas S. Virsik <thomasvirsiklaw@gmail.com> Fri, Jan 7, 2022 at 4:13 PM
To: GSPcomments@svbgsa.org

The within comment is based on the materials available for the 6 January 2022 180/400 Committee meeting. Chapter 6 was not addressed at the meeting and will be on the agenda of a later special meeting. Nevertheless, please note the following concerns based on the material as published:

The overall comment is that certain implicit math involved in the multiple water budgets (in the draft Chapter and in the PP) lack integrity. The premise of these comments is that a water budget is at its core a series of inputs and outputs or positive and negative values that result in a sum or delta seen as a gain or loss.

Page 192 contains a historical water budget where math suggests the delta is more than a negative 30K. The future water budgets on page 193 reflect even greater deltas of approximately negative 46 and 49 K. Those delta or summation values are not included in the water budget presentations, however (the same chart data appears in several other locations).

Page 229 (Table 6-13) from draft Chapter 6 shows the future water budgets, this time with a storage loss sum of a negative (loss) of 600 -- orders of magnitude different than what the math reflects. The notes to Table 6-13 explain that model error was unacceptably high and thus one can conclude the 600 was not a model-generated value, but I have been unable to find how the 600 delta was actually calculated. Leaving aside issues of accuracy of the model or of the 600 figure, Table 6-13 comes across as unreliable or worse. That the model is not sufficiently accurate (so far) is one thing, but a "600" af loss in a table that reflects tens of thousands of acre-feet of deficit even on a casual glance is jarring.

The narrative at page 230 about the historical overdraft of 600 - even if taken at face value -- does not provide justification for concluding it must be the same number when the inputs and outputs substantially change in the future. The tables and lack of explanation challenge credibility that the same loss occurs when conditions change in the future, especially when that is not true for other GSP's.

That the projected loss may in reality be closer to some amount of thousands is highly germane to considering projects and actions in later chapters, not to mention implementation issues such as costs and feasibility of design and financing. To fix a 600 AAF problem one may need only to impose nearly imperceptible controls on overall water use whereas a loss of thousands requires different tools.

I urge the GSA to review especially the projected water budgets and their seemingly arbitrary reliance on a value chosen when considering a different set of inputs and outputs. Also or in the alternative, the justification for the 600 number may need to be better detailed and then applied, if justified, to the future water budgets.

Thank you for your consideration.

--

Thomas S. Virsik
Attorney at Law
2363 Mariner Square Drive, Suite 240
Alameda, CA 94501
Tel. (510) 521-3565
Fax (510) 748-8997

Gmail

Emily Gardner <gardnere@svbgsa.org>

numbers question

Grant Cremers <Grant.Cremers@delicato.com> Thu, Jan 20, 2022 at 12:40 PM
To: Emily Gardner <gardnere@svbgsa.org>
Cc: Donna Meyers <meyersd@svbgsa.org>

Emily,

I did not want to go too into the weeds today, but there are a few other numbers that look interesting. The water year 2016 was a dry-normal year but the deep percolation of water was about 33% more than the historic average. This is hard for me to understand and if this number is incorrect it is on the plus side and is then understating the true deficit of the sub-basin. The other interesting number is the 9,000 acre feet of tile runoff. I don't know how many acres of tiled ground there is, but my guess is that it is 30,000 or more. A total of only 9000 acre feet of out flow seems low. If this number is erroneously low it would further contribute to a larger deficit. I bring these items up because the loss of storage number had a wide range and these areas could be contributing. Also, we don't have a real understanding of how much water we need to solve our problems. Once we have that number it needs to tie back to the other numbers in the water budget and it will give us direction on what we need to do to solve the problem.

Grant

DELICATO Family Wines

Grant Cremers General Manager Coastal Operations

Office / 831 386-5613

Mobile / 831 717-7325

Email / grant.cremers@delicato.com

Web / www.delicato.com

51955 Oasis Road, King City, CA 93930

m|r|wolfe
& associates, p.c.
attorneys-at-law

February 8, 2022

Via email
Members of the 180/400-Foot Aquifer Subbsasin Committee
Salinas Valley Basin Groundwater Sustainability Agency
P.O. Box 1350
Carmel Valley, CA 93924
GSPcomments@svbgsa.org

Re: 180/400-Foot Aquifer GSP Update – Chapters 5-6 re Groundwater Conditions and Water Budget

Dear Committee Members:

I write on behalf of LandWatch Monterey County regarding Chapters 5 and 6 of the 2022 180/400-Foot Aquifer GSP Update. Chapter 5 describes groundwater conditions and Chapter 6 provides historical and future water budgets.

The water budget chapter purports to provide the historical water budget in Table 6-8 based on the Salinas Valley Integrated Hydrologic Model (SVIHM) and to provide the future water budget in Table 6-13 based on the Salinas Valley Operational Model (SVOM). However, the water budget chapter rejects the modeled results for critical parameters, including groundwater pumping, seawater intrusion, and storage loss, and substitutes "adjusted" figures instead. It remains unclear how the calibration of the model's other parameters could possibly remain valid after these adjustments. The bottom line results for loss of storage in Tables 6-8 and 6-13 based on these adjusted values are simply inconsistent with the other values in these tables. The tables do not add up; and the water balances are not balanced.

Furthermore, Chapter 6 ultimately does not even use its modeled results to determine either historic or future sustainable yields. All of the values used in determining sustainable yields are based on estimates made outside of the modeling process.

In effect, the modeled results are meaningless.

Finally, Chapter 6 fails to provide a clear statement of the overdraft condition. SGMA requires that the water budget provide a clear statement of the magnitude of the overdraft. (23 CCR, § 354.18(b)(5).) The overdraft figure must be clearly stated because SGMA requires that the GSP include a "quantification of demand reduction or other methods for the mitigation of overdraft." (23 CCR, § 354.44(b)(2).) Chapter 6 repeatedly implies that the overdraft is only 600 AFY. This implication is inconsistent with the estimate in

Chapter 5 that the overdraft includes both that 600 AFY storage loss that is estimated based on groundwater elevation changes south of the seawater intruded area and an additional 12,600 AFY storage loss that is estimated based on the average annual volumes of seawater intrusion. The water budget must include this total overdraft, as defined by Bulletin 118.

Detailed comments follow.

1. **Historical budget**

"ADJUSTED" PUMPING DATA ARE INTERNALLY INCONSISTENT: The historical water budget discussion states that somehow the SVIHM "estimates only approximately 71% of the pumping reported in the GEMS database." (Section 6.3.2.) Since Table 6-2 identifies the source of the SVIHM input data for groundwater pumping as "reported data for historical, municipal, and agricultural pumping," it is difficult to understand how model only "estimates" 71% of these reported data.

It is also difficult to understand how any of the modeled results, particularly the bottom line net storage gain or loss in the Table 6-8 historical budget, could remain accurate after the SVIHM's estimated 94,300 AFY of pumping is simply adjusted to 132,800 AFY in the tables purporting to reflect the modeled results. (Tables 6-5, 6-6, 6-8.) Presumably the SVIHM model should be calibrated so that its modeled results are consistent with reported data. It is difficult to understand how any of the SVIHM's results that cannot be directly correlated to measured data can be taken seriously when there is apparently a 38,500 AFY error in its "estimated" groundwater pumping. For example, both percolation of irrigation water and evapotranspiration would presumably increase substantially if pumping were increased by 38,500 AFY. However, the tabulated results for evapotranspiration was not changed after the "adjustment" for actual pumping was made (Table 6-5), and there is no indication that percolation of irrigation water was adjusted either (Table 6-4).

SEAWATER INTRUSION IS INCONSISTENT WITH THE LEVEL ADOPTED BY THE GSP: The historic budget presented in Table 6-8 uses the "preliminary" SVIHM estimate of seawater intrusion of 2,900 AFY. (Section 6.3.2.) However, based on the change in the mapped seawater intruded area analyzed in Chapter 5, "this GSP considers 12,600 AF/yr. to be the annual rate of storage loss due to seawater intrusion."[1] (Section

[1] Chapter 5 separately estimates storage loss for areas south of the seawater intruded area based on groundwater level declines, arriving at an average annual storage loss for this area of 560 AFY (rounded to 600 AFY in Chapter 6). (Chapter 5, p. 5-27.) It is clear that Chapter 5 treats both the 12,550 AFY volume of seawater intrusion and the 600 AFY based on groundwater level declines as forms of storage declines: the "total annual average change in groundwater storage is the sum of the changes in groundwater storage due to groundwater elevation changes and seawater intrusion." (Chapter 5, p. 5-

6.3.2.) The 12,600 AFY figure is the rounded seawater intrusion value taken from Chapter 5:

> This analysis considers the average historic change in storage due to seawater intrusion to be -12,550 AF/yr., which is the total of the 180- Foot and 400-Foot Aquifers storage changes. <u>This storage loss is in addition to the change in groundwater storage due to changes in groundwater elevations</u>.

(Chapter 5, p. 5-37.) It is difficult to understand why the Table 6-8 historical water budget relies on the SVIHM's preliminary estimate of 2,900 AFY of seawater intrusion instead of the 12,600 AFY seawater intrusion figure that "this GSP considers . . . to be the annual rate of storage loss due to seawater intrusion." (Section 6.3.2.)

And again, it appears that the SVIHM model was not calibrated to the data that can be measured.

STORAGE LOSS IS INTERNALLY INCONSISTENT: The bottom line storage loss in the historic budget presented in Table 6-8 is 600 AFY. This number apparently represents the "decline in groundwater storage <u>based on measured groundwater elevations</u> from 1944 through 2019 . . . estimated to be 600 AF/yr. in the Subbasin, as described in Section 5.2.2." (Section 6.3.2.) Again, this number excludes the loss of storage due to seawater intrusion, which Chapter 5 estimates to represent 12,550 AFY. (Chapter 5, p. 5-37.)

Equally problematically, like the groundwater pumping figure, the 600 AFY loss of storage number is <u>not</u> derived from the SVIHM, purportedly because the model "contains significant variability and uncertainty." (Section 6.3.2.) The variability is not unexpected in a subbasin that experiences wet and dry years. The uncertainty is not explained. It should be.

Since the 600 AFY figure is simply plugged into Table 6-8, it is not consistent with the rest of the data in Table 6-8. But the point of a water budget analysis is to present set of inflows and outflows that <u>balance</u>. Accordingly, the net storage loss in Table 6-8 ought to represent the sum of the positive signed inflow values and the negative signed outflow values. The fact that the 600 AFY storage loss figure is inconsistent with the rest of the data is evident from the fact that the summation of the rest of the data would indicate a storage loss of 53,100 AFY, not 600 AFY. The 600 AFY value simply bears no consistent relation to the other reported values.

As discussed further below, the 600 AFY figure also dramatically understates overdraft, notwithstanding the implications in Chapter 6 that the overdraft is only 600 AFY.

37.) As discussed below, this total storage loss is a measure of overdraft ad defined by Bulletin 118.

2. Future budget

"ADJUSTED" VALUES ARE INTERNALLY INCONSISTENT: The future water budget summarized in Table 6-13 is presented as a "simulated" version and an "adjusted" version. Again, the "adjusted" version uses historical average pumping instead of the model's estimate of pumping, a 36,100 AFY difference. (Table 6-13 [compare results for adjusted and simulated future year 2030].) Again, the "adjusted" version's net storage loss of 600 AFY is simply inconsistent with the rest of the "adjusted" values, which if summed up would indicate storage loss of 46,300 AFY.

As with the historical budget, the future budgets, both simulated and adjusted, use a value for seawater intrusion that is inconsistent with the value derived in Chapter 5 by actually measuring the area subject to intrusion.

So neither the simulated nor the adjusted versions are calibrated to either the groundwater pumping measurement or the seawater intrusion estimate.

The apparent rationale for presenting the adjusted version is that the adjusted future water budget's estimate of change in storage is somehow "more reasonable" than the simulated version's:

> As described for the historical water budget, data indicate that the Subbasin has historically been in overdraft (on the order of 600 AF/yr. decline), as described in Section 5.2.2. Even though the SVOM anticipates -10,500 and -11,300 AF/yr. change in storage for 2030 and 2070, respectively, the adjusted historical decline in storage is used with the adjusted pumping estimates to provide a likely more reasonable estimate for projected sustainable yield.

(Section 6.4.3.) Chapter 6 does not explain <u>why</u> the lower 600 AFY estimate of change in storage is more reasonable. It should.

In effect, Chapter 6 presents some modeled values and some measured values and makes no effort to use them consistently in a balanced water budget for either historical or future conditions. It appears that the modeled results in Tables 6-8 and 6-13 have little if any informational value.

3. Sustainable yield

Chapter 6 determines sustainable yield without using any of the values estimated or simulated by the SVIHM or SVOM. Table 6-9 determines historical sustainable yield based on

- GEMS reported pumping values of 114,800 AFY to 136,600 AFY, not the SVIHM's estimate of 94,500 AFY;

- the 600 AFY storage loss estimated by analysis of groundwater elevation changes, not the SVIHM's estimate of 14,800 AFY; and
- the 12,600 AFY seawater intrusion estimated based on the change in the mapped seawater intruded area analyzed in Chapter 5, not the SVIHM's estimate of 2,900 AFY.

Similarly, Table 6-15's estimate of future sustainable yield uses the same data sources and takes nothing from the SVOM.

The purported rationale for ignoring the modeled values is to maintain consistency with the sustainable yield for historic conditions:

> To retain consistency with the historical sustainable yield, projected sustainable yield can be estimated by summing all the average groundwater extractions, subtracting the average loss in storage, and subtracting the average seawater intrusion. This represents the change in pumping that results in no change in storage of useable groundwater, assuming no other projects or management actions are implemented

Again, although Chapter 6 presents modeled values for some water budget components, it makes no effort to use these values to determine sustainable yield. And it fails to provide any explanation for rejecting the modeled results.

4. Overdraft

SGMA requires an express quantification of overdraft. (23 CCR, § 354.18(b)(5).) The purpose of this requirement is to ensure that the GSP actually mitigates that overdraft:

> If overdraft conditions are identified through the analysis required by Section 354.18, the Plan shall describe projects or management actions, including a quantification of demand reduction or other methods, for the mitigation of overdraft.

(23 CCR, § 354.44(b)(2).)

Nowhere does Chapter 6 provide an unequivocal quantification of overdraft for either historical or future conditions. Instead, Chapter 6 repeatedly implies that the 600 AFY loss of storage, calculated based on groundwater elevation changes for the areas not yet subject to seawater intrusion, represents the entire overdraft. This approach is misleading because it omits the loss of storage due to seawater intrusion, which Chapter 5 estimates to be 12,600 AFY.

First, chapter 6 rejects the modeled estimates of overdraft, even though these estimates at least appear to be in the same neighborhood as an overdraft figure that includes both forms of storage loss: the loss represented by groundwater level declines south of the intrusion area and the loss represented by the seawater intrusion itself. Chapter 6 states that "Averaged over the historical period, the preliminary SVIHM estimates that the 180/400- Foot Aquifer Subbasin is in overdraft by 14,800AF/yr." However, the discussion immediately characterizes this number as suspect because “this simulated overdraft contains significant variability and uncertainty.” Chapter 6 does not mention the number again. Chapter 6 also claims that the future model overestimates overdraft:

> As discussed earlier, the current, preliminary version of the SVIHM, and by inference the SVOM, appears to overestimate the historical overdraft in the Subbasin and therefore underestimate the historical sustainable yield.

(Section 6.4.4.) However, Chapter 6 fails to explain why the model may be inaccurate or to provide a clear alternative statement of the magnitude of the overdraft.

Instead, Chapter 6 misleadingly implies in its note to the Table 6-8 historical budget that only the net storage change of 600 AFY estimated for the areas south of the seawater intruded areas counts as overdraft: “The net storage value is the estimated historical overdraft based on observed groundwater levels, as described in Sections 5.2.2 and 6.3.2."

And in its discussion of future conditions, Chapter 6 again implies that the overdraft is only 600 AFY:

> As described for the historical water budget, <u>data indicate that the Subbasin has historically been in overdraft (on the order of 600 AF/yr. decline</u>), as described in Section 5.2.2. Even though the SVOM anticipates -10,500 and -11,300 AF/yr. change in storage for 2030 and 2070, respectively, the adjusted historical decline in storage is used with the adjusted pumping estimates to provide a likely more reasonable estimate for projected sustainable yield.

(Section 6.4.3, emphasis added.) Again, this discussion implies that the only portion of the overdraft that needs to be considered is the 600 AFY storage loss in areas south of the intruded area and that the portion of the overdraft that causes seawater intrusion somehow does not count.

But pumping that causes seawater intrusion <u>is</u> part of the overdraft. Bulletin 118 defines overdraft as follows:

> Overdraft is “the condition of a groundwater basin or subbasin in which the amount of water withdrawn by pumping exceeds the amount of water that recharges the basin over a period of years, during which the water supply conditions approximate average conditions. Overdraft can be characterized by groundwater levels that decline over a period of years and never fully recover, even in wet years.

> Moreover, groundwater overdraft can cause adverse effects including chronic decline of groundwater levels, loss of stored groundwater, intrusion of seawater into coastal basins, land subsidence, degradation of water quality, stream flow depletion, degradation of groundwater-dependent ecosystems, and increased pumping costs.

(DWR, Bulletin 118, California's Groundwater Update 2020, p. 4-24.) SGMA expressly adopts the Bulletin 118 definition of overdraft. (23 CCR, § 354.18(b)(5) [If overdraft conditions occur, as defined in Bulletin 118, the water budget shall include a quantification of overdraft over a period of years during which water year and water supply conditions approximate average conditions].)

Clearly, the magnitude of the overdraft is not even approximated by the 600 AFY figure. At a minimum, Chapter 6 should acknowledge an overdraft condition based on the difference between its sustainable yield estimates and groundwater pumping since that is the amount by which pumping exceeds average long term recharge, an approach consistent with the definition of overdraft in Bulletin 118. Based on the sustainable yield data in Table 6-15, the difference between sustainable yield and pumping, i.e., the apparent overdraft, is 13,200 AFY under 2030 conditions. This is an order of magnitude higher than the 600 AFY overdraft reported for the non-seawater intruded area.

5. Intersubbasin flows

The Monterey Subbasin GSP reports subsurface flows of 9,393 to the 180/400. (Monterey GSP, p. 6-23.) Unaccountably, the 180/400 GSP reports only 1,900 AFY. (Table 6-7.) This discrepancy should be resolved.

Yours sincerely,

M. R. WOLFE & ASSOCIATES, P.C.

John Farrow

JHF:hs

cc: SVBGSA Board of Directors, board@svbgsa.org
Donna Meyers, meyersd@svbgsa.org
Emily Gardner, gardnere@svbgsa.org
Les Girard, GirardLJ@co.monterey.ca.us
Michael DeLapa

Salinas Valley Water Coalition
33 El Camino Real • Greenfield, CA 93927
(831) 674-3783 • FAX (831) 674-3835

TRANSMITTED VIA EMAIL

22 February, 2022

Salinas Valley Basin Groundwater Sustainability Agency
Board of Directors

Re: Salinas Valley Basin GSA 180/400 GSP Update

Dear SVBGSA Board Members;

As members of the public, the Salinas Valley Water Coalition Board and members haves been actively participating in the development of the SVBGSA 180/400 Aquifer Groundwater Sustainability Plan Update (180/400 GSP). We offer the following comments to the 180/400 GSP, for your consideration:

Global Comments:

1. The 180/400 GSP states that the historical and current water budgets were developed using a provisional version of the Salinas Valley Integrated Hydrologic Model (SVIHM) developed by the USGS. It also states that future water budgets are being developed using a provisonal version of the Salinas Valley Operational Model (SVOM), developed by the USGS and Monterey County Water Resources Agency (MCWRA). The GSP admits the model has not received final approval, and no warranty, expressed or implied, has been made by the USGS as to the calibration-validation of the model. Additionally, the SVBGSA has stated in public forums that the USGS model has a recognized error of 30%+ for estimated groundwater pumping, as well as underestimating seawater intrusion. They have subsequently stated that the data 'errors' have been resolved, however such information has not been shared publicly. This is unacceptable and until and unless the model calibration shows more accurate model runs, the outputs from such runs should not be published in any quasi-regulatory document, such as the GSPs, irrespective of the disclaimers included therein. Moreover, because the model is provisional, any results from model runs must not be used to establish water budgets, standards, limitations, etc.. Nor is it appropriate to use the model results to take any regulatory or other related actions. Until and unless the model has demonstrated accuracy, any

discussions related to model run results will only be provisional and shouldn't be relied on for management actions or projects.

2. The 180/400 GSP fails to provide a statement of overdraft as required by SGMA. The 180/400 is a critically over drafted basin and as such it is imperative that it is understood and clear as to the extent of this overdraft. We need to understand the starting point and overdraft baseline so it can be understood what management actions and/or projects need to be accomplished in order to achieve sustainability and to measure the success of these projects or management actions. We ask that a clear statement of overdraft is provided and included in the 180/400 GSP Update.

3. The water budget set in Chapter 6 fails to provide meaningful numbers as it is fraught with statements of errors as discussed in item #1 above. The various tables include simulated subbasin boundary flows, "flows entering and exiting the Subbasin by watershed and neighboring subbasin". As stated above, it is clearly stated within this 180/400 GSP as well as the other adopted GSP's within the Salinas Valley, that the model has a recognized error of 30% +/- for estimated groundwater pumping, hence the amount of subbasin boundary flows are not accurate and should not be relied upon in any manner, including the development of management actions and/or projects, until such time as the model is corrected and has been publicly released and vetted.

4. An overarching failure of the 180/400 GSP, as well as the other SVBGSA's GSPs, particularly for setting standards for determining undesirable results, is the lack of acknowledgement of the significant role MCWRA plays on the entire groundwater system through its control of Nacimiento and San Antonio dams-reservoirs. For example, the discussions on inflows fail to mention the primary factor that impacts the inflow numbers for all of the subbasins is the control of water releases from the Nacimiento and San Antonio reservoirs by the MCWRA that significantly impacts streambed recharge. There must be a recognition that the entire Salinas Valley Groundwater Basin system (outside the influence of the Arroyo Seco Cone) is "artificially controlled". Establishing standards for undesirable results without accounting for the artificially controlled groundwater system by an outside agency is not reasonable.

Thank you for your consideration,

Nancy Isakson

Nancy Isakson, President

Salinas Valley Water Coalition

COMMENTS FROM THE SEASIDE BASIN WATERMASTER CONCERNING THE 2022 UPDATE OF THE GROUNDWATER SUSTAINABILITY PLAN FOR THE 180/400-FOOT AQUIFER SUBBASIN OF THE SALINAS VALLEY GROUNDWATER BASIN

The Seaside Basin Watermaster raises the following concerns that it feels should be addressed in the 2022 update to the Groundwater Sustainability Plan (GSP) for the 180/400-foot Aquifer Subbasin:

- No explanation is provided as to how the time line for recovery of declined groundwater levels was developed. The estimated costs to implement the numerous projects and management actions identified in this GSP and the GSP for the 180/400-foot subbasin run into the hundreds of millions of dollars, and some are likely to encounter extensive environmental and permitting issues. Some may potentially be determined to be infeasible, either from a financial or a permitting standpoint. Thus, implementing them will be a formidable task. This leaves us concerned that the recovery timeline is more a "wish" and a "hope" than something for which there is reasonable assurance of being achieved. We feel that the feasibility for the timeline for recovery of declined groundwater levels should be discussed and justified in the GSP.

- Many projects identified in the GSPs for the subbasins within the Salinas Valley Groundwater Basin involve using recycled wastewater to replace groundwater that is currently being pumped to meet demands. It appears that most, if not all, of these recycled water projects rely on wastewater coming into the Monterey One Water Regional Wastewater Treatment Plant. The total flow into that plant is already needed to supply the Castroville Seawater Intrusion Project (CSIP) and the Pure Water Monterey and Pure Water Monterey Expansion Projects. Thus, there may not be enough recycled water to supply all of these other GSP projects. We feel this is an issue that needs to be addressed in this GSP and in the GSPs for the other subbasins of the Salinas Valley Groundwater Basin.

- We are concerned about the amount of water that is currently being lost from the Seaside Subbasin to the Monterey Subbasin due to the downward hydraulic gradient from the Seaside Subbasin to the Monterey Subbasin. The Final Draft GSP for the Monterey Subbasin shows significant ongoing loss of groundwater from the Seaside Subbasin even when/if the Minimum Thresholds are achieved in the Monterey and 180/400-foot Aquifer Subbasins. This loss of water appears largely to be the result of declining groundwater levels in the 180/400-foot Aquifer Subbasin.

  The attached Table 6-5 from the Final Draft GSP for the Monterey Subbasin shows these projected interbasin flows. Table 6-5 has column headings including Minimum Threshold, Measurable Objective, and Seawater Intrusion Protective Boundary Conditions. According to one of the principal authors of the portion of this GSP pertaining to the Marina-Ord subarea, it is the intent of the MCWDGSA, via this GSP, is to achieve the Measurable Objective Sustainable Management Criteria (SMC) set forth in the GSP, recognizing that this may not be possible, but at least that is the desire/intent. We understand that there are no SMCs specified for inflows and outflows, and the inflows and outflows shown in Table 6-5 are not SMCs. However, the inflows and outflows identified on Table 6-5 are the predicted inflows and outflows from the Monterey Subbasin based upon water levels that are achieved under the SMCs contained in the 180/400 Foot Aquifer Subbasin.

It is our understanding that the "Seawater Intrusion Protective Boundary Condition" in Table 6-5 refers to groundwater levels that would have to be achieved within the 180/400 Foot Aquifer Subbasin to stop seawater intrusion in the absence of an injection or extraction barrier. To cite from the GSP:

They are groundwater levels along the entire boundary of the Monterey Subbasin and 180/400-Foot Aquifer Subbasin which are predicted to be protective against further seawater intrusion within the 180-and 400- Foot aquifers. These Seawater Intrusion Protective elevations are projected over the 20-year GSP implementation period (i.e., between 2022 and 2042). In the absence of the installation of a hydraulic injection and/or extraction barrier, which is one of the projects described in the 180/400-Foot Aquifer GSP, these SWI protective elevations represent the minimum groundwater elevations that would be needed in the coastal portions of the 180/400-Foot Aquifer Subbasin to stop further seawater intrusion consistent with the MTs for seawater intrusion established in the 180/400-Foot Aquifer Subbasin GSP.

It is our further understanding that the 180/400-foot Aquifer Subbasin GSP does not commit the SVBGSA to achieving the Seawater Intrusion Protective groundwater elevations in order to create the Seawater Intrusion Protective Boundary Condition. Rather, the SVBGSA does commit to stopping further seawater intrusion as an SMC, so if no injection or extraction barrier is constructed this is likely the only other way of meeting that SMC. This means that if the extraction barrier is not constructed, then presumably the SVBGSA would have to achieve the Seawater Intrusion Protective groundwater elevations shown in Table 6-5. However, discussions at the meetings of the 180/400-foot Aquifer Subbasin GSP Implementation Committee suggest that the SVBGSA will strive to construct the extraction barrier, if that is determined to be feasible. This is likely because raising groundwater levels in the 180/400-foot Aquifer Subbasin high enough to achieve the Seawater Intrusion Protective groundwater elevations would be extremely difficult, if even possible.

If the extraction barrier is constructed, then it is our understanding that the Monterey Subbasin is committed to achieving SMCs that would result in the interbasin groundwater flows listed under the column heading for the Minimum Thresholds listed in Table 6-5. Under this condition the annual loss of groundwater from the Seaside Subbasin to the Monterey Subbasin is projected to be 2,513 AFY. If the Measurable Objective is achieved the loss is projected to be 1,361 AFY.

The outflows from the Seaside Subbasin into the Marina-Ord portion of the Monterey Subbasin are of concern because they are so great that they may prevent the Seaside Subbasin from achieving sustainability unless large amounts of replenishment water are injected on an ongoing basis into the Seaside Subbasin. Such replenishment water would be needed in order to achieve protective groundwater elevations that will protect the Seaside Subbasin from seawater intrusion and thereby help make it sustainable.

The GSPs state that each of the boundary condition scenarios in Table 6-5 is predicated on the assumption that the 180/400- Foot Aquifer Subbasin will be managed to its SMCs over the 50-year projected model period, and that it has been assumed that the Seaside Subbasin will be managed such that groundwater levels remain stable at 2017 levels into the future.

Assuming that the 180/400- Foot Aquifer Subbasin will be managed to its SMCs is a significant assumption. That Subbasin will face very significant financial, permitting, and other challenges to achieve its groundwater level and seawater intrusion SMCs, and it may be unable to fully accomplish them.

We feel that the 180/400-foot Aquifer Subbasin GSP needs to address the concerns of the Seaside Subbasin regarding the loss of groundwater to the Monterey Subbasin resulting from declining groundwater levels in the 180/400-foot Aquifer Subbasin, and its impact on the Seaside Subbasin's ability to become sustainable.

Table 6-5. Comparison of Projected Water Budget Results Under "No Project" Scenarios with Variable Boundary Conditions and 2030 Climate Condition, Marina-Ord Area WBZ

Net Annual Groundwater Flows (a) (AFY)	Historical Annual Inflows/Outflows (WY 2004-2018)	Projected Annual Inflows/Outflows (b) 2030 Climate Conditions		
		Minimum Threshold Boundary Conditions	Measurable Objective Boundary Conditions	Seawater Intrusion Protective Boundary Conditions
Recharge				
• Rainfall, leakage, irrigation	**6,144**	**6,823**	**6,823**	**6,823**
Well Pumping				
• Well Pumping	**-4,346**	**-8,767**	**-8,767**	**-8,767**
Net Inter-Basin Flow				
• Seaside Subbasin	1,310	2,513	1,361	-347
• 180/400-Foot Aquifer Subbasin	-8,633	-3,849	-1,927	1,171
• Ocean (Presumed Freshwater)	-524	-725	-752	-794
• Ocean (Presumed Seawater)	2,872	2,939	2,369	1,308
	-4,975	**878**	**1,051**	**1,338**
Net Intra-basin Flow				
• Corral de Tierra Area (Water Budget Zone)	**1,544**	**923**	**1,026**	**985**
Net Surface Water Exchange				
• Salinas River Exchange	**0**	**0**	**0**	**0**
NET ANNUAL CHANGE IN GROUNDWATER STORAGE	**-1,632**	**-143**	**133**	**379**

Notes:

(a) The Marina-Ord Area Zone Budget includes inflows to and outflows from the portion of Corral de Tierra that is north of Reservation Rd.

(b) Positive values indicate a net inflow and negative values indicate a net outflow.

m | r | wolfe
& associates, p.c.
attorneys-at-law

April 12, 2022

Via email
Board of Directors
Salinas Valley Basin Groundwater Sustainability Agency
P.O. Box 1350
Carmel Valley, CA 93924

Re: 180/400-Foot Aquifer Subbasin GSP Update

Dear Members of the Board:

LandWatch Monterey County (LandWatch) offers the following comments on the draft 180/400-Foot Aquifer Subbasin Groundwater sustainability Plan Update (GSP Update).

LandWatch's comments point to areas in which GSP Update creates roadblocks to management of the subbasin through actions to control extractions.

- First, the decision to abandon the existing extraction-based Minimum Threshold (MT) for storage loss and to adopt an MT based on groundwater levels will frustrate adoption of management actions intended to control extractions because, as staff admit, it is "almost impossible to show a significant correlation between groundwater elevations and 'a total volume that can be extracted.'"[1]

- Second, setting sustainable management criteria based on groundwater levels below sea level prematurely abandons the strategy of restoring and maintaining protective groundwater elevations to control seawater intrusion. This leaves the GSA reliant on the proposed pumping barrier as the sole means to control seawater intrusion, even though this project has not been demonstrated to be feasible either technically or economically.

LandWatch's comments also point out that the SVIHM and SVOM modeling in Chapter 6 is not calibrated with empirical data and presents a water balance that does not in fact balance. In addition, the reports of the modeling output are affirmatively misleading: extractions are stated at the maximum, measured level, but seawater intrusion is stated at the minimum, modeled value, even though the GSP Update admits that this value is not supported. Since the modeling is not even used to determine sustainable yields, it should

[1] 180/400 GSP Update – Chapter 5 and SMC Discussion, January 2022, pdf page 29, available at https://legistarweb-production.s3.amazonaws.com/uploads/attachment/pdf/1188101/180_400_Update_Ch_5_SMC_discussion_Presentation_20220106.pdf.

be relegated to an appendix and the GSP Update should simply acknowledge that no meaningful modeling is yet available.

Finally, LandWatch objects again that the GSP Update fails to state overdraft conditions clearly by presenting a single measure of overdraft that includes overdraft represented by falling groundwater levels and overdraft represented by seawater intrusion. Instead, the GSP Update repeatedly mischaracterizes overdraft as consisting of only the 800 AFY attributable to falling groundwater levels, ignoring the additional 12,600 AFY overdraft component represented by seawater intrusion. The total overdraft figure, 13,400 AFY, must be clearly stated because the GSP must identify "projects and management actions, including a quantification of demand reductions or other methods, for the mitigation of overdraft." (23 CCR, § 354.44(b)(5).)

LandWatch made these comments in two letters to the 180/400-Foot Aquifer Subbasin Committee dated December 30, 2021 and February 8, 2022 commenting on the draft chapters as they were released to that Committee.[2] As discussed below, the GSP has not been revised to address these comments. In some instances, the response to comments document posted by staff states that the GSP Update will be revised, yet no revisions were in fact made.[3] Since a GSP must demonstrate that the GSA "has adequately responded to comments that raise credible technical or policy issues with the Plan," LandWatch asks that the current GSP draft be revised to address these comments. (23 CCR, § 355.4(b)(10).)

1. **SGMA <u>requires</u> the groundwater storage loss SMCs to be specified in terms of extractions, not groundwater levels. Groundwater levels may be used as a <u>monitoring</u> proxy, but not as a substitute for the storage loss SMCs themselves. Nor is there authority to use seawater intrusion as a substitute for the storage loss SMCs. Furthermore, the GSP does not demonstrate the required significant correlation between groundwater elevations, seawater intrusion, and storage loss because it relies on the SVIHM, which is not correlated with these data.**

We reiterate the comments made in our December 30, 2021 letter regarding sustainable management criteria (SMCs). In summary, we objected that specifying the storage loss minimum threshold (SMC) in terms of changes to groundwater levels and seawater intrusion is inconsistent with 23 CCR Section 354.28(c)(2), which expressly provides that the minimum threshold (MT) must be specified as an extraction limit, i.e., by identifying

[2] These letters are available at https://svbgsa.org/wp-content/uploads/2022/03/Comment-Letters-for-Update_20220224.pdf.

[3] See 180/400 GSP Update – Comments and Actions, March 2022, available at https://svbgsa.org/wp-content/uploads/2022/03/180_400_Update_Comments-and-Actions.pdf.

"a total volume of groundwater that can be withdrawn from the basin without causing conditions that may lead to undesirable results."

Under the 180/400 GSP previously approved by DWR, the minimum threshold (MT) and measurable objective (MO) are based on extractions and are set at the purportedly sustainable yield level of 112,000 AFY. (180/400 GSP, p. 8-26.) An undesirable result would occur if extractions exceeded the MT/MO in an average hydrological year.

The obvious management intent of the mandate in 23 CCR Section 354.28(c)(2) to set the storage loss SMC in terms of an extraction limit is to provide a clear basis for pumping allocations and other management action that would limit pumping. The GSP Update's use of a proxy for the storage loss SMCs instead of basing them on extraction limits can only complicate, and likely frustrate, the implementation of management actions that would limit pumping, e.g., through fallowing, land retirement, or pumping allocations and controls.

And in fact, it remains unclear how the GSA would use storage SMCs based on groundwater levels changes and seawater intrusion data to manage the subbasin or pumping volumes. Staff acknowledge that under the new method it is "almost impossible to show a significant correlation between groundwater elevations and 'a total volume that can be extracted.'"[4] As staff have acknowledged, DWR's regulations "state pumping is the metric to be used."[5] The regulations facilitate basin management by directly connecting allowed extractions to undesirable results. Even if it were allowable to use a proxy for storage loss SMCs, the GSA has failed to explain how the proposed proxy-based SMCs could be used for subbasin management.

The draft GSP Update argues that the substitution of groundwater levels and seawater intrusion metrics for the extraction-based storage loss SMC is permissible because the regulations permit use of groundwater elevations as a monitoring proxy:

> The GSP Regulations § 354.36 (b) states that: "Groundwater elevations may be used as a proxy for monitoring other sustainability indicators if the Agency demonstrates the following: (1) Significant correlation exists between groundwater elevations and the sustainability indicators for which groundwater elevation measurements serve as a proxy."

(Draft GSP Update, p. 8-30, emphasis added.) Section 354.36(b) is part of the regulations governing monitoring, which do not supersede the separate regulations

---

[4] 180/400 GSP Update – Chapter 5 and SMC Discussion, January 2022, pdf page 29, available at https://legistarweb-production.s3.amazonaws.com/uploads/attachment/pdf/1188101/180_400_Update_Ch_5_SMC_discussion_Presentation_20220106.pdf.

[5] *Id.*, pdf page 28.

governing sustainable management criteria. Although the GSA may use groundwater elevations to monitor storage loss, nothing in Section 354.36(b) permits the GSA to simply **substitute** a groundwater level SMC for the storage loss SMC, which must be expressed in terms of an extraction limit per Section 354.28(c)(2).

Furthermore, the GSP fails to demonstrate the "significant correlation" between groundwater elevations and storage loss that is required by Section 354.36(b) even to use the groundwater levels as a monitoring proxy. Here is the GSP's discussion of that correlation:

> Figure 8-6 compares the Subbasin's cumulative change in storage, plotted on the black line, with the average annual change in groundwater elevation, plotted on the blue line. The groundwater elevation change data are derived from the groundwater level monitoring network; the cumulative change in groundwater storage is derived from the SVIHM. Although the data come from 2 sources, the data generally show similar patterns between 1980 and 2016. The decrease in storage modeled by the SVIHM from 1983 to 1998 is not exactly reflected in the change in groundwater elevations, because the modeled storage is dependent on the simulated groundwater elevations in the SVIHM. However, from 1998 to 2016, the cumulative change in storage and annual change in groundwater elevations seem to be more closely related as verified on Figure 8-7.
>
> Figure 8-7 shows a scatter plot of cumulative change in storage and annual average change in groundwater elevation. The blue data points show data for the entire model period from 1980 to 2016 and the orange data points show data from 1998 to 2016. Although, the data for the entire model period demonstrate a weak correlation (R2 =0.3748), a more significant positive correlation exists between groundwater elevations and the amount of groundwater in storage between 1998 and 2016 (R2 =0.8334). The correlation for the 1998 to 2016 period is sufficient to show that groundwater elevations are an adequate proxy for groundwater storage. The data presented on Figure 8-6 and Figure 8-7 are used to establish groundwater elevation as proxies for groundwater in storage for the portion of the Subbasin that is not seawater intruded.

(GSP Update, p. 8-30.)

First, the data do not come from the same sources. Groundwater elevations are from the monitoring network but the storage loss is from the SVIHM model.

Second, the SVIHM model itself is not available to the public and the GSP admits that it is not adequately correlated with observed data. As discussed below, the water balance discussion in Chapter 6 demonstrates that the SVIHM model is not calibrated or correlated with extractions and seawater intrusion and does not accurately predict storage loss. Thus, Chapter 6 presents a modeled water balance in Table 6-8 derived from the SVIHM that simply does not balance. The sum of the line items in Table 6-8 add up to indicate a net storage loss of 54,100 AFY, but Table 6-8 purports to identify the bottom line net storage loss as only 800 AFY. As discussed below, the GSP concludes that the 800 AFY storage loss figure is the best available data, but it is not derived from the SVIHM model. It makes no sense to use a storage loss estimate from the SVIHM to assess the significance of the groundwater and storage loss correlation when the GSP admits that the SVIHM does not accurately model storage loss.

Third, the GSP Update admits that "uncertainties exist in groundwater storage estimates from both the SVIHM and the analyses using groundwater level measurements." (GSP Update, p. 6-21.) The GSP reports a wide range of conflicting storage loss estimates based on groundwater levels, and it also admits that its own storage loss estimate based on groundwater levels "is likely underestimated because it does not account for conditions in the Deep Aquifers, due to lack of data." (GSP Update, p. 6-21.) Thus, there can be no confidence in a groundwater based storage loss estimate, even for monitoring purposes.

Fourth, the GSP's discussion of the purported correlation of the groundwater level data and the modeled storage loss estimates shows only a "weak correlation" over the model period and only a "more significant" correlation in the most recent period. (GSP Update, p. 8-30.) The GSP does not explain how a correlation that is merely "more significant" than a weak correlation attains the regulatory mandate of a "significant correlation."

Furthermore, the GSP's rationale for using groundwater levels as a proxy for monitoring storage loss, cites only the first condition in Section 354.36(b), the condition requiring a significant correlation. Section 354.36(b) also requires that the GSA demonstrate that "[m]easurable objectives established for groundwater elevation shall include a reasonable margin of operational flexibility taking into consideration the basin setting to avoid undesirable results for the sustainability indicators for which groundwater elevation measurements serve as a proxy." (23 CCR § 354.36(b)(2).) The GSP simply does not address this requirement. There is nothing in the methodology used to set the measurable objective for groundwater elevation that even addresses storage loss. The methodology was simply to select a conveniently achievable groundwater level without any consideration of storage loss:

> The methodology for establishing measurable objectives is described in detail in Section 8.6.2.1. A year from the relatively recent past was selected for setting measurable objectives to ensure that objectives are achievable. Figure 8-3 shows that there was a slow downward trend in average groundwater elevations through 2003. Since 2003, water elevations have consistently decreased at a more rapid rate. Groundwater elevations from 2003 were selected as representative of the measurable objectives for the 180/400-Foot Aquifer Subbasin.

(GSP Update, p. 8-21; see also p. 8-14 [Section 8.6.2.1 groundwater level SMCs not set with reference to storage loss].) And the GSP's discussion of the relation of the groundwater level SMC to storage loss is completely circular:

> Reduction in groundwater storage. The chronic lowering of groundwater levels minimum thresholds are identical to the groundwater storage minimum thresholds. Thus, the groundwater level minimum thresholds will not result in an undesirable loss of groundwater storage.

(GSP Update, p. 8-18.) The GSA cannot conclude that there can be no undesirable storage loss result simply by equating the storage loss criterion with the groundwater elevation criterion. In sum, the GSP contains no information to show that the groundwater elevation SMCs contain "a reasonable margin of operational flexibility taking into consideration the basin setting to avoid undesirable results for" storage loss. Section 354.36(b)(2) has not been met.

Finally, nothing in the Regulations permits the GSA to use seawater intrusion as a proxy even for monitoring storage loss. Section 354.36(b), cited by the GSP Update as justification for the new storage loss SMCs, permits only the use of groundwater levels as a proxy – and, again, only a proxy for monitoring purposes, not a proxy for the storage loss minimum threshold, which must be expressed as "a total volume of groundwater that can be withdrawn from the basin without causing conditions that may lead to undesirable results." (23 CCR, § 354.28(c)(2).)
.

2. **The GSA should not set a groundwater level SMC that is based on groundwater levels below sea level because that level will not mitigate seawater intrusion.**

We reiterate the comments made in our December 30, 2021 letter. In summary, we objected that the GSP improperly sets groundwater level-based SMCs below sea level, and therefore at a value that fails to support attainment of the SMC for seawater intrusion. We objected that accepting groundwater levels below sea level effectively abandons the sustainability strategy of restoring and maintaining groundwater levels at a protective elevation to halt seawater intrusion and commits the GSA to implement the unproven and costly pumping barrier approach to controlling seawater intrusion. This commitment is premature in light of the fact that the GSA has not determined either the technical or economic feasibility of the pumping barrier.

SGMA requires that each minimum threshold must avoid *each* undesirable result because it requires that "basin conditions at each minimum threshold will avoid undesirable results for each of the sustainability indicators." (23 CCR § 354.28(b)(2), emphasis added.) For example, the groundwater level minimum threshold must be "supported by" the "[p]otential effects on other sustainability indicators." (23 CCR § 354.28(c)(1)(B), emphasis added.) This means that each minimum threshold, especially the groundwater level minimum threshold, must be coordinated to ensure that all undesirable results are avoided.

The groundwater level SMCs set at levels below sea level fail to support the seawater intrusion SMCs because they fail to establish and maintain protective elevations.

Similarly, the proposed new storage loss SMCs, based on the same groundwater elevations, do not support the seawater intrusion threshold.

The existing 180/400 GSP approved by DWR acknowledges that its extraction-based SMC for storage reduction is based on its estimate of the long term sustainable yield of the subbasin and that, to halt seawater intrusion, "there may be a number of years when pumping might be held below the minimum threshold to achieve necessary rises in groundwater elevation." (180/400 GSP, p. 8-26.) The approved GSP explains that the existing storage reduction SMC set at long-term sustainable yield would not hinder maintenance of the seawater intrusion SMC:

> Pumping at or below the sustainable yield will maintain or raise average groundwater elevations in the Subbasin. Therefore, the minimum threshold for reduction in groundwater storage will not result in a significant or unreasonable increase in seawater intrusion.

(180/400 GSP, p. 8-27.) However, the change to the groundwater storage SMCs that would rely on groundwater elevations as a proxy instead of relying on sustainable yield extractions may result in an SMC that would hinder attainment and maintenance of the seawater intrusion because it permits groundwater levels below sea level. This would further commit the GSA to the proposed capital-intensive pumping barrier project, a project which the GSA has not yet found to be feasible technically or economically.

As LandWatch has objected, the current GSP deferred the identification of the projects or management actions to halt seawater intrusion by equivocating between (1) the "temporary pumping reductions . . . necessary to achieve the higher groundwater elevations that help mitigate seawater intrusion" or (2) a $102 million coastal pumping barrier requiring perpetual pumping with an annual $9.8 million O&M budget to avoid these temporary pumping reductions. (180/400 GSP, pp. 8-26, 9-52 to 9-55, 9-87.) Under the barrier scenario, the GSP claims that sustainability can be attained with groundwater levels below sea level without the temporary pumping reductions needed to restore protective groundwater elevations. (180/400 GSP, response to comment 8-139.)

The GSP Update's abandonment of the existing extraction-based SMCs would effectively require adoption of the pumping barrier project by setting groundwater level based SMCs below sea-level, an approach that precludes the protective elevation approach to attainment of the seawater intrusion SMC. Even if such a change were lawful, the GSA should not adopt it without understanding the technical and economic feasibility of the pumping barrier approach.

3. **Historical and future water budget tables contain inconsistent line items and do not balance due to inclusion of "adjusted" data that is not reconciled with the modeled data. The admittedly inadequate modeling tables, which are not even used to determine sustainable yield, should be moved to an appendix because they are affirmatively misleading**.

As we objected in our February 8, 2022 comments, the modeling of the historic water budget using the SVIHM and the modeling of the future budget using the SVOM, are not calibrated or reconciled with observed data. Thus, for example, the historic budget in Table 6-8 and the future budget in Table 6-13 use "adjusted," i.e., observed, groundwater pumping, which is tens of thousands of acre-feet greater than the modeled value. The GSP Update does not and cannot explain this calibration failure.

As a result, the line items in the historical water budget in Table 6-8 do not balance, i.e., does not add up to the bottom line "net storage gain" figure. The sum of the line items in Table 6-8 indicates a net storage loss of 54,100 AFY, but Table 6-8 purports to identify the bottom line net storage loss as only 800 AFY. Similarly, the sum of the line items for the "adjusted" 2030 future budget in Table 6-13 indicate a storage loss of 46,500 AFY, not the bottom line 800 AFY storage loss that has been simply plugged into the table.

The GSP does not even <u>use</u> the SVIHM or SVOM modeling to determine sustainable yield. Instead, Table 6-9 determines historic sustainable yield solely on the basis of the following observed data and analysis, which is <u>not</u> the output of the SVIHM model:

- GEMS reported pumping values of 114,800 AFY to 136,600 AFY, not the SVIHM's modeled estimate of 94,500 AFY;

- the 800 AFY storage loss estimated by analysis of groundwater elevation changes, not the SVIHM's modeled estimate of 14,800 AFY; and

- the 12,600 AFY seawater intrusion estimated based on the change in the mapped seawater intruded area analyzed in Chapter 5, not the SVIHM's modeled estimate of 2,900 AFY.

Similarly, Table 6-15's estimate of future sustainable yield uses the same data sources and takes nothing from the SVOM model. The comment responses admit that in order "[t]o base the sustainable yield on the best available data, the sustainable yield draws on observed data." In fact, the sustainable yield calculation draws <u>exclusively</u> on observed data and uses <u>none</u> of the modeled data.

The water budget results in Tables 6-8 and 6-13 are affirmatively misleading because they selectively present the modeled results instead of the observed results when the modeled results tend to understate the severity of existing conditions. For example, the higher GEMS pumping data, which tends to suggest that sustainability can be attained a higher pumping levels. Or for example, Tables 6-8 and 6-13 both use the modeled seawater intrusion result of 2,900 AFY instead of the observed seawater intrusion result of 12,550 AFY determined in Chapter 5. (GSP, p. 3-31, Table 5-3 [observed seawater intrusion].) The response to our comments states that Tables 6-8 and 6-13 will be updated to provide the "observed seawater intrusion rate that is considered more accurate," but this was not done. It is fundamentally misleading to use the lower seawater intrusion figure in Tables 6-8 and 6-13 because it is admittedly not "the best available data" and because it directly conflicts with the seawater intrusion data in Tables 6-9 and 6-15, which determine sustainable yield.

Tables 6-8 and 6-13 are internally inconsistent in the sense that they do not add up, i.e., they are not in balance. The comment responses acknowledge that "a water budget conceptually should balance" and they admit that the modeling does not provide "the best available data." The GSP should be revised to acknowledge that meaningful modeling is still not available, to confine its discussion in Chapter 6 to the observed data that are used to determine sustainable yield, and to relegate the discussion of modeling to an appendix.

4. The water budget fails to provide a clear statement of the magnitude of overdraft, even though the comment responses said this would be clarified.

As we objected in our February 8, 2022 comments, the GSP fails to provide an unequivocal quantification of overdraft for either historical or future conditions. SGMA requires an express quantification of overdraft, i.e., "a quantification of overdraft over a period of years during which water year and water supply conditions approximate average conditions." (23 CCR, § 354.18(b)(5).) The purpose of this requirement is to ensure that the GSP actually mitigates that overdraft:

> If overdraft conditions are identified through the analysis required by Section 354.18, the Plan shall describe projects or management actions, including a quantification of demand reduction or other methods, for the mitigation of overdraft.

(23 CCR, § 354.44(b)(2).)

We objected that the GSP repeatedly implied that the overdraft amounts to just the 600 AFY that was estimated to represent the net storage change for the areas south of the seawater intruded areas. We pointed out that this ignores the fact that seawater intrusion must also be included in the determination of overdraft pursuant to Bulletin 118 and 23 CCR Section 354.18(b)(5).

The response to our comments acknowledges that "[c]hange in groundwater storage is the change in storage due to seawater intrusion and change in storage due to groundwater levels outside the seawater-intruded area." The response also states that Chapter 6 "will be revised to more explicitly point out which numbers are the overdraft numbers." This was not done.

Instead, Chapter 6 continues to imply that overdraft consists only of the change in storage due to change in groundwater levels south of the seawater intruded areas, which has been revised from 600 AFY to 800 AFY. For example,

- Table 6-8 lists the nets storage changes as 800 AFY and then notes that "[t]he net storage value is the estimated historical overdraft based on observed groundwater levels, as described in Sections 5.2.2 and 6.3.2." This entirely omits seawater intrusion from the overdraft figure. Seawater intrusion is estimated to be 12,550 AFY, a figure that dwarfs the 800 AFY reported. (GSP, p. 3-31, Table 5-3.)

- Section 6.4.3 states "[a]s described in Section 5.2.2 for the historical water budget, data indicate that the Subbasin has historically been in overdraft (on the order of 800 AF/yr. decline)." Again, seawater intrusion is omitted.

- Section 6.4.4 states "[a]s described for the historical sustainable yield, data indicate that the Subbasin has historically been in overdraft (on the order of 800 AF/yr. decline, not including the Deep Aquifers). This historical decline in storage is used with the adjusted SVOM pumping estimates to provide a likely more reasonable estimate for projected sustainable yield. Therefore, although change in storage projected by the preliminary SVOM is on the order of -11,000 AF/yr., the historical average change in storage in Table 6-15 is set to a decline of 800 AF/yr." Again, seawater intrusion is omitted.

Nowhere does the water budget state clearly that the overdraft consists of both the loss of storage south of the seawater intrusion area plus the seawater intrusion. Nowhere is the magnitude of that overdraft stated as the sum of the 800 AFY loss of storage south of the seawater intruded area plus the 12,550 AFY average seawater intrusion, totaling 13,350 AFY.

Chapter 6 should explicitly and clearly acknowledge an overdraft condition based on the difference between its sustainable yield estimates and groundwater pumping since that is the amount by which pumping exceeds average long term recharge, an approach consistent with the definition of overdraft in Bulletin 118. Based on the sustainable yield data in Table 6-15, the difference between sustainable yield and pumping, i.e., the portion of pumping that represents overdraft, is 13,400 AFY under 2030 conditions. This is an order of magnitude higher than the 800 AFY overdraft reported for the non-seawater intruded area.

Yours sincerely,

M. R. WOLFE & ASSOCIATES, P.C.

John Farrow

JHF:hs

cc: Donna Meyers, meyersd@svbgsa.org
Emily Gardner, gardnere@svbgsa.org
Michael DeLapa

Gmail

Emily Gardner <gardnere@svbgsa.org>

Fw: Opinion about 180-400 subbasin

Yahoo Mail <sangjames@yahoo.com> Mon, Apr 25, 2022 at 6:05 AM
Reply-To: Yahoo Mail <sangjames@yahoo.com>

[redacted]

----- Forwarded Message -----
From: Yahoo Mail <sangjames@yahoo.com>
To: James Sang <sangjames@yahoo.com>
Sent: Monday, April 25, 2022, 03:52:51 AM PDT
Subject: Opinion about 180-400 subbasin

Hello everyone!

This is my opinion about the 180-400 subbasin. I don't like any of the projects except for CSIP. I like this project because Monterey One
Water takes waste water and makes it useable for agriculture and this project is expandable . I don't like fallowing the land, retiring agricultural land, Salinas River diversions at Chualar and Soledad, winter water releases from San Antonio, connecting Nacimiento Dam with San Antonio Dam, building flood plains, Cutting the Arundo weed on Salinas River is ok, not because this stops water loss from transpiration but because I don't want to see a 30 foot reed in front of my vision.

My thoughts:

1. Do not fallow any growers land. This keeps the grower from making an income, this would force him to lay off employees and reduces the economic activity in our area. When aquifer water levels or groundwater levels or well water levels are getting too low, show the grower how to replenish the groundwater that he is using. The grower can replenish the water he uses by subsoil plowing around his well or anywhere on his property during our rainy season of December, January and February. After the rainy season, the grower can start growing his crops again. The amount of land that he should subsoil plow should equal the water that he pumps. If the gower uses 50 acre feet of water per season, then the grower should subsoil plow 50 acres if our rainfall equals 12 inches per year. Our rainfall ranges from 20 inches to 5 inches per year. An example of how to subsoil in shown in You Tube video (Deep Soil Ripping for Water Conservation by Megan Clayton.)

2. Monterey County well permit department can help with recharging our water aquifers by requiring new well applicants to subsoil plow around his old well and unused land to harvest the rainwater before the applicant can get a new well drilling permit.

3. Monterey County Board of Supervisors can develop a policy of subsoil plowing all unused land Monterey County to harvest rain water. This can quickly recharge all of our water aquifers quickly . Monterey County has thousands of acres

that can be subsoil plowed for water harvesting. An example of water harvesting was done by Don Camaron from Terranova Ranch Inc. which is west of Fresno. He manages a farm in the Central Valley. He did not get any rain for over 3 years. He thought of building a canal from the King River to his land. When the rains came he flooded his fields up to 1 and 1/2 feet. This was able to raise the water table 40 feet!! He caught 2 million acre feet of water!! Wonderful story. You can watch it on You Tube video (Central Valley Farmer's Bold Water Experiment for California by NBC Bay Area).!!!!!

4. One of the problems with the water diversion projects , water release from the dams and flood plains is that the issue of climate change was not considered. If CO2 levels rise and water precipitation is reduced, these projects will not work. The flood plains require a certain amount of rainfall, but what if this does not come? The same problem occurs with the water diversion plans from Chualar and Soledad! If the dams do not have enough water there will be no water releases! The following is from Monterey County Weekly , April 14, 2022 (" Yet, an exceptionally dry winter has depleted the lakes reserves. With no rain in sight, water agency staff are preparing to recommend no irrigation releases for the 2022 season, a first since the severe drought of 2012-2016. Agency general manager Brent Buche says the Salinas Valley can do one irrigation season with no recharge, but any more and the groundwater table will drop to where landowners won't be able to draw water from their wells", Please google ("Unusually low rain prompts water officials to reconsider dam releases for growers ") by Christopher Neely.

5. The other problem with the proposed projects is the amount of time that it will take to complete a project. It takes over 4 years to teach people how to harvest water from their roofs. Over 8 years to get rid of Arundo weeds. Over 8 years for the diversion projects. Over 10 to 15 years for the connection of San Antonio dam to Nacimiento Dam. During this time, many growers will not have enough water to continue.

6. I read that SVBGSA plans on reducing the amount of water allocated to Monterey sub-basin. The reason that this subbasin is overdrawn is mainly because 9000 acre feet of water is flowing into the 180-400 sub-basin, not because the sub-basin is overusing it's groundwater. This water overdraft can be solved by asking the Monterey County to subsoil plow enough land to harvest the required water to cover the deficit!

7. The other advantages of subsoil plowing are reducing the chance of wild fires, increasing the chances of precipitation , the reduction of CO2 levels and the cooling of the earth! The reduction of wild fires will be caused by the greening of the vegetation because of the increased moisture in the soil.

James Sang sangjames@yahoo.com Sent from Yahoo Mail on Android

Thomas S. Virsik
ATTORNEY AT LAW

Via email: GSPcomments@svbgsa.org
10 May 2022

To: Salinas Valley Basin Groundwater Sustainability Agency (GSA)

Re: Public Comment 180/400-Foot Aquifer Subbasin Groundwater Sustainability Plan (GSP) Update

INTRO

The draft Update chapters and especially the process involved reflect substantial and dedicated efforts by staff (internal and consulting) as well as many stakeholders hours. It is apparent that many comments and suggestions to date have been considered in one way or another. The below reflects additional comments and at least one concern. Note that these comments take at face value the series of caveats in the presentation given in March 2022 entitled 180/400 Subbasin Update – Comments and Actions that can be found among the robust array of update documents on the SVBGSA 180/400 GSP webpage. The presentation, inter alia, acknowledges a need to provide more detail and clarity for certain Tables and sections of especially the critical Chapter 6 (water budgets) Update. The "track-changes" documents confirm that those promised further efforts are indeed not yet part of the drafts to be presently reviewed. Accordingly, no comments are yet provided on those still-in-process updates to the Update.

EDIT LEVEL COMMENTS

The fourth sentence of Section 3.11.2 requires revision. While it's not critical to any conclusion or metrics in the Update, it makes no sense as drafted:

> Because Soledad is a member of the SVBGSA, management actions taken by the SVBGSA or the SVBGSA has a cooperation agreement with their water district will be in alignment with the concerns and plans of that city and the County.

A sentence in Section 9.1 is somewhat inconsistent with the language of the five GSP's submitted in 2022 and should be slightly edited for accuracy.

> This GSP is developed as part of an integrated effort by the SVBGSA to achieve <u>or maintain</u> groundwater sustainability in all 6 subbasins of the Salinas Valley under its authority. (Emphasis reflects suggested edit.)

2223 Santa Clara Avenue, Suite B1, Alameda, California 94501 | 510.521.3565 TEL | 510.748.8997 FAX | thomasvirsiklaw@gmail.com

UPDATES MISSING IN UPDATE

Due to the passage of time, certain portions of the Update draft are no longer accurate and should be modified to reflect readily available more current information.

Section 8.6.4.2 recites the state of certain SMC's as of 2020 but the 2021 Annual Report is now available to update the SMC metrics and the undesirable results reflected thereby.

Section 9.4.4 is in a similar situation. It recites certain metrics about the Interlake Tunnel project ("ILT") proposed by the MCWRA, relying on 2020 MCWRA material. The MCWRA updated its information with more recent modeling in early 2022, which is readily available as it was publicly presented to the Board of Supervisors of the MCWRA on March 22, 2022. See https://monterey.granicus.com/player/clip/4477?view_id=5&redirect=true. All ILT metrics in the Update should be cross-checked to verify they recite the more current projections of cost and actual water benefit.

UPDATE LACKS CLARITY ON CRITICAL SGMA ASPECT

During the several presentations of the daft Update materials, staff spoke of the "heavy lift" required to get to sustainability. The Update does not use that term but repeats the overall point multiple times. See section 9.9 (emphasis added):

> As shown in Chapter 6, the 180/400-Foot Aquifer Subbasin has historically been in overdraft, and is projected to still be in overdraft throughout the GSP planning horizon unless projects and management actions bring extraction and the sustainable yield in line. The long-term overdraft in the Subbasin is projected to be 13,400 AF/yr. after sustainability is met.

The same can be found in section 6.4.4 (emphasis added):

> Projected sustainable yield is the long-term pumping that can be sustained once all undesirable results have been addressed. However, it is not the amount of pumping needed to stop undesirable results before sustainability is reached

To its great credit, the GSA proclaims that it will hold pumping levels to the long-term sustainable yield, being 111K (or 112K per the 2021 Annual Report). See section 8.7.2:

> Although not the metric for establishing change in groundwater storage, the GSAs [sic] are committed to pumping at or less than the Subbasin's long-term sustainable yield.

The Update is, however, silent on what/how the GSA will ensure in the 2020-2025 short-term that the sustainable yield will not be exceeded. Chapter 10, introduction:

> This chapter describes how the GSP for the 180/400-Foot Aquifer Subbasin will be implemented. The chapter serves as a roadmap for addressing all of the activities needed for GSP implementation between 2020 and 2040 but focuses on the activities between 2020 and 2025.

To make a commitment to keep pumping within the long-term sustainable yield without identifying a means to do so comes across as pointless or even disingenuous, especially as the 2021 Annual Report reflects groundwater use of over 115K, i.e., beyond the long-term sustainable yield. The Update should clarify that (1) the "heavy lift" required to reach sustainability will (as presently drafted) entail at minimum current/immediate restrictions on pumping beyond the long-term sustainable yield or (2) that the GSA is no longer committed to keep pumping with the sustainable yield until after the 20-year SGMA drop-dead deadline is reached.

Clarity on the GSA's commitment or lack thereof will assist the relevant stakeholders to plan, petition, or seek redress as appropriate.

Very truly yours,

Thomas S. Virsik
Thomas S. Virsik

COMMUNITY WATER CENTER
EL CENTRO COMUNITARIO POR EL AGUA

May 13, 2022

Salinas Valley Basin Groundwater Sustainability Agency
Attn: Donna Meyers, General Manager

Submitted electronically to:

Salinas Valley Basin Groundwater Sustainability Agency

Donna Meyers, General Manager

Salinas Valley Basin Groundwater Sustainability Agency Board of Directors

Re: Comments on the Draft 180/400ft Aquifer Subbasin Groundwater Sustainability Plan Update

Dear Salinas Valley Basin Groundwater Sustainability Agency:

The current draft of the Salinas Valley Basin Groundwater Sustainability Agency (SVB GSA) 180/400ft Aquifer Groundwater Sustainability Plan (GSP) Update does not meet statutory requirements nor DWR's expressed standards and Recommended Corrective Actions as articulated in the 180/400ft Aquifer GSP Determination released in June of 2021.[1] The Department noted, "the recommended corrective actions included in the Staff Report are important to addressing certain technical or policy issues that were raised and, if not addressed before future, subsequent plan evaluations, may preclude approval of the Plan in those future evaluations."

While SVB GSA has taken some steps to improve descriptions and figures within the GSP, significant gaps remain and in some cases the Draft Update includes steps backwards in terms of addressing the needs of all beneficial uses and users within the subbasin. The GSP still does not provide a clear path to halt seawater intrusion, key information will be lost via the change in domestic well impact analysis methodology, andstate and small water systems have been removed as a monitoring system data gap which was identified in the previous GSP.

SVB GSA should reconsider some of the changes that have been made in this update, and must further improve the GSP in order to effectively consider all beneficial users in the 180/400ft Aquifer Subbasin. Our comments are elaborated below and in the appended Technical Review.

I. <u>Background and Overview</u>

In November 2019, CWC and San Jerardo cooperative submitted comments to the SVB GSA on the draft 180/400 foot aquifer GSP. To date, all substantive comments in this draft GSP have not been addressed. We remained engaged in SVB GSA's management during GSP development for the remaining Subbasins

[1] Department of Water Resources. (2021). Statement of Findings Regarding the Approval of the 180/400 Foot Aquifer Subbasin Groundwater Sustainability Plan. Available for download at: https://sgma.water.ca.gov/portal/gsp/status. *See* Recommended Actions.

2020-2022, offering verbal comments and submitting substantial written comments that have also largely been unaddressed.

DWR has since emphasized the role of GSAs in managing groundwater in a way which reflects all the beneficial uses and users in the basin, outlined in Sections III and IV below, calling for better protections of drinking water users and water quality in Consultation Initiation Letters and Determination Letters.

Despite this, impacts to beneficial users, including families reliant on domestic wells, are happening now and there are no immediate plans to address them. Of note, the GSP includes an implementation schedule on Figure 9-13 in Section 9.5.5.6, and estimates 10 years from approval of the project until the primary strategy to halt seawater intrusion, the Seawater Intrusion Extraction Barrier, would be operable. In the meantime, SVB GSA does not propose any interim mitigation measures for the Severely Disadvantaged Community (SDAC) of Castroville or other domestic well communities already impacted by seawater intrusion. It could take years for the project to be approved and then 10 more for the project to be completed, further extending the timeline for its benefits to be felt by communities. Meanwhile, SVB GSA refuses to enact pumping restrictions to raise the groundwater levels that would slow or halt seawater intrusion. This inaction cannot possibly be justified as a logical response to the requirement to consider all beneficial uses and users in the subbasin, as drinking water needs are being swiftly and potentially irreparably impaired.

We are disappointed that this version of the GSP provides a worse domestic well impact analysis and a more limited water quality monitoring network than the one described in the original GSP. This is despite CWC's direct involvement with the GSA and multiple requests for improvement in both. See comments in Sections III and V below.

In our November 2019 comments on the draft 180/400 foot aquifer GSP, our top recommendation was that "**The GSP Should Include Immediate Actions To Take Effect in 2020 While Projects Are Being Developed."** We wrote:

> The GSP should be revised to lay out a clear and robust plan to achieve sustainability. The GSP delays any decisions on approving projects or actions to address conditions of critical overdraft in the 180/400 foot aquifer subbasin until 2023 and later. This is not acceptable as a significant portion of the drinking water supplies in the subbasin, including drinking water systems serving disadvantaged communities in Castroville and Moss Landing, are already impacted or are at imminent risk of seawater intrusion impacts. The GSA should immediately adopt management actions to slow seawater intrusion and protect vulnerable communities and drinking water supplies.

Now, more than two years later, the GSA has taken no direct action to halt seawater intrusion nor direct action to protect or mitigate impacts to drinking water wells in Castroville. As of early April 2022, all wells at Castroville Community Services District (Castroville CSD) continue to be impacted and/or threatened by seawater intrusion. Castroville has had to destroy one of their wells due to high levels of chloride and they are currently applying for grant funding to address high chloride levels in another well, which makes that water unusable. They are on the frontlines of seawater intrusion—and without better monitoring and immediate action—all of their current wells will be impacted. The GSA convenes a Seawater Intrusion Advisory Group, but the GSA has not taken any actions to protect Castroville's water in the past two years nor are there any immediate plans to prevent or mitigate impacts in the 2022 Update of the GSP.

This GSP should be revised to include, at a minimum, the following measures to protect Castroville's wells and other vulnerable drinking water wells in the 180/400ft Aquifer Subbasin:

- Immediate regulation of pumping from nearby wells, including CSIP wells, located in close proximity to Castroville CSD.
- Immediately implement Governor Newsom's March 28 Executive Order on drought, including a plan for coordinating with Monterey County to analyze potential impacts of proposed new wells on drinking water supplies and include a moratorium on drilling of new wells (with the exception of replacement drinking water wells) in seawater intruded areas, including the deep aquifer.[2]
- Immediately implement and fund a well mitigation program (see Section IV below).
- Improve the monitoring network in and around vulnerable drinking water wells including in seawater intruded areas and in areas with high drinking water contaminants (see Section V below).

II. The Human Right to Water Must Be Upheld in SGMA Planning and Implementation.

California passed AB 685 in 2012, becoming the first state to officially recognize the human right to water.[3] The statute declares, "every human being has the right to safe, clean, affordable, and accessible water adequate for human consumption, cooking, and sanitary purposes."[4] DWR's Regulations for SGMA also instruct that the Department "shall consider the state policy regarding the human right to water when implementing these regulations."[5] We note that this policy applies to DWR as it takes actions to approve or deny submitted GSPs, including updates to plans. The GSP must be protective of the human right to water because DWR has a duty to uphold the Human Right to Water.

Furthermore, SGMA requires that each GSA, "shall consider the interests of all beneficial uses and users of groundwater, as well as those responsible for implementing groundwater sustainability plans. These interests include, but are not limited to ... Domestic well owners
[and] Disadvantaged communities, including, but not limited to, those served by private domestic wells or small community water systems."[6]

Of particular note in this Update, the revised **Domestic Well Impact Analysis** is less representative and potentially obfuscates impacts to domestic well users. As part of this update, the GSP now limits the analysis to just 14 out of 294 wells (i.e., less than 5%). This is a significant step backwards from the analysis in the previous version of the GSP which utilized Public Land Survey System (PLSS) sections

---

[2] Governor's Exec. Order No. N-7-22, para. 9, (Mar. 28, 2022).
[3] Cal. Water Code § 106.3.
[4] Cal. Water Code § 106.3(a).
[5] Cal. Code of Regulations §350.4.
https://water.ca.gov/LegacyFiles/groundwater/sgm/pdfs/GSP_Emergency_Regulations.pdf. *See also*, Cal. Water Code §106.3(b).
[6] Cal. Water Code § 10723.2.

(i.e., within a 1-square mile grid) to establish reasonable expectations for groundwater levels at a wide range of well sites. SVB GSA should revert back to their original analysis strategy, upon which their Approval from DWR was at least in part predicated.

Changing such an integral portion of the GSA's analysis of impacts to beneficial users threatens to up-end the previous Approval from DWR. DWR accepted the Plan's assessment of impacts that minimum thresholds would have on domestic wells using the previous methodology, but instructed that the GSA "should inventory and better define the location of active wells in the Basin, and document known impacts to drinking water users caused by groundwater management, should they occur, in subsequent annual reports and periodic updates."[7] This Update does not provide an inventory, improved definition of the location of active wells, nor add to the documentation of known impacts to drinking water users. Instead, the Update reduces the amount of information available regarding potential impacts to domestic well users by excluding 95% of known domestic wells from its domestic well impact analysis. Please see Page 9 of the appended Technical Review for further information on this detrimental change and our recommendations for how to remedy the issue.

As expanded upon below and in the appended Technical Analysis, corrections must be made to the Draft Updated 180/400ft Aquifer GSP in order to avoid infringement of the Human Right to Water and to ensure that all beneficial uses and users are considered.

III. <u>The Updated 180/400ft Aquifer GSP Fails to Prevent Further Degradation of Water Quality, in Violation of SGMA.</u>

Water quality is an integral part of SGMA as one of the six Undesirable Results that GSAs are tasked with preventing to achieve sustainability.[8] Further, the SVB GSP must reflect the best available science.[9] Impacts from extraction, including due to overdraft and projects and management actions undertaken by the GSA, fall under the purview of the GSA and should be tracked and remedied according to the GSP. Thus, the GSP must include plans to respond to problems should they arise. If, for example, a contaminant plume were to begin migrating based on pumping patterns, a GSA project, or a GSA management action, the GSA is not permitted to allow that problem to progress unchecked. DWR has clarified that water quality is a meaningful component of GSA management and has specifically given corrective instructions to SVB GSA, as cited in our prior comments. DWR's 180/400 foot Aquifer Determination states:

> [S]taff find that the approach to focus only on water quality impacts associated with GSP implementation, i.e., GSP-related projects, is **inappropriately narrow.** Department staff recognize that GSAs are not responsible for improving existing degraded water quality conditions. **GSAs are required; however, to manage future groundwater**

[7] Department of Water Resources. (2021). Statement of Findings Regarding the Approval of the 180/400 Foot Aquifer Subbasin Groundwater Sustainability Plan. P. 25. Available for download at: https://sgma.water.ca.gov/portal/gsp/status.

[8] Cal. Water Code § 10721, subd. (x)(4). "Undesirable result" means one or more of the following effects caused by groundwater conditions occurring throughout the basin: ...(4) Significant and unreasonable degraded water quality, including the migration of contaminant plumes that impair water supplies.

[9] 23 CCR § 355.4(b)(1).

> **extraction to ensure that groundwater use subject to its jurisdiction does not significantly and unreasonably exacerbate existing degraded water quality conditions.**[10]

DWR clarifies further:

> Where natural and other human factors are contributing to water quality degradation, the GSAs may have to confront complex technical and scientific issues regarding the **causal role of groundwater extraction and other groundwater management activities**, as opposed to other factors, in any continued degradation; but **<u>the analysis should be on whether groundwater extraction is causing the degradation</u> in contrast to only looking at whether a specific project or management activity results in water quality degradation.**[11]

DWR clearly identifies the responsibility of the GSA to manage future groundwater extraction in order to prevent significant and unreasonable degradation of water quality conditions. DWR does not limit this duty to merely apply when the GSA regulates groundwater pumping for the purpose of maintaining sustainable groundwater levels, but rather mandates an affirmative duty for the GSA to manage extraction in order to avoid exacerbating existing degraded water quality conditions. Contrary to staff arguments, SVB GSA's jurisdiction does not hinge on whether or not a Subbasin Committee decides to instate allocations or pumping restrictions. SVB GSA does not have the power to discard this authority or opt out of the duty to regulate pumping if such regulation is necessary to avoid the Six Undesirable Results of SGMA. SVB GSA is failing to limit pumping at current rates and is merely relying on a tiered payment structure to deter overpumping. Water quality degradation will likely be exacerbated by current pumping rates in violation of SGMA's requirement that the GSA policies not harm water quality.

SVB GSA does not meet DWR's standards in the proposed 180/400ft Aquifer Update. SVB GSA must establish a viable plan to prevent the exacerbation of degraded water quality conditions in the basin. SVB GSA claims that if they refrain from regulating pumping, then the exacerbation of water quality degradation in the basin no longer falls under their responsibility, but this is inverted logic. If extraction rates that the GSA allows to occur result in water quality degradation, then that is within the GSA's responsibility to address. The GSA has explicit statutory authority and responsibility to prevent significant and unreasonable water quality degradation, it cannot simply ignore the problems within the basin.[12] In line with this responsibility, DWR has instructed GSAs to map out where water quality issues exist in the basin, and to prevent new impacts from occurring.[13] This includes managing contaminant plumes that may migrate or increase in concentration due to extraction rates and locations.

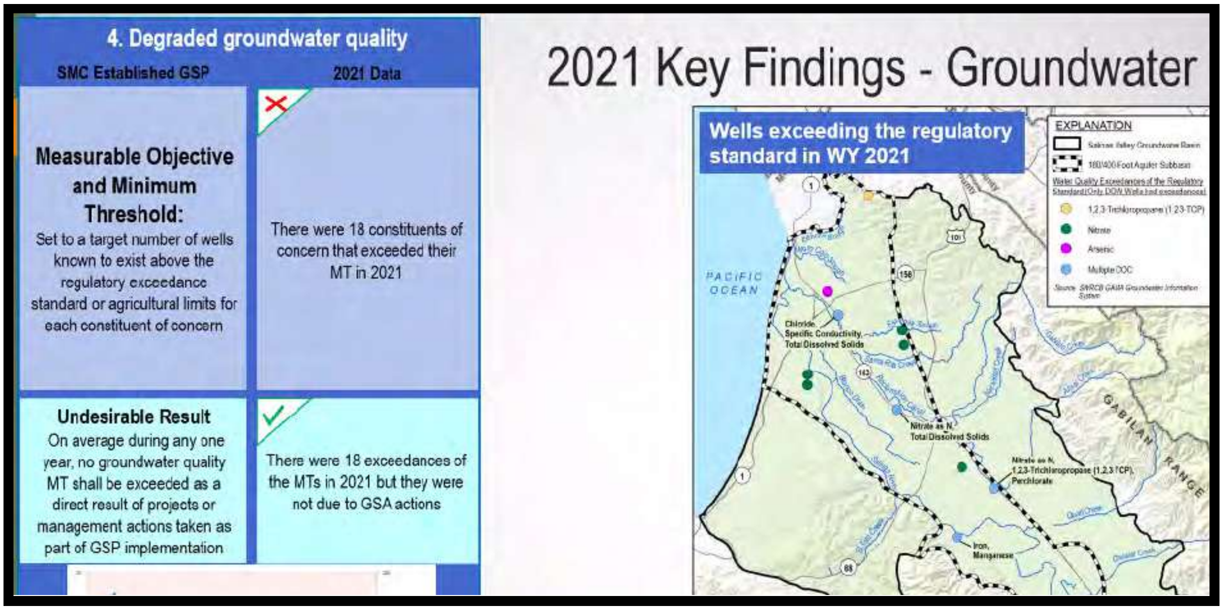
---

[10] Department of Water Resources. (2021). *Statement of Findings Regarding the Approval of the 180/400 Foot Aquifer Subbasin Groundwater Sustainability Plan.* Pp. 26-27. (Internal citations omitted; emphasis added). Available for download at: https://sgma.water.ca.gov/portal/gsp/status.

[11] *Id.*

[12] Cal Water Code § 10721, subd. (x)(4).

[13] Dept. of Water Resources, 180/400 Foot Aquifer Groundwater Sustainability Plan Determination, (June 3, 2021), pp. 26-27.



[14]

As shared with the public on April 7, 2022 during the 180/400ft Aquifer Subbasin Implementation Committee Meeting and captured in the figure directly above, the GSA concludes that they are not responsible for exacerbation of water quality degradation because they have not implemented any projects or management actions to date and have refrained from regulating groundwater pumping. This is an erroneous interpretation of the SGMA statute and incongruent with DWR's interpretation of SGMA, both of which task the GSA with preventing undesirable results, including the significant and unreasonable degradation of water quality, throughout the planning and implementation phase, which began in 2015. As restated by DWR, "SGMA defines sustainable groundwater management as the management and use of groundwater in a manner that can be maintained during the planning and implementation horizon without causing undesirable results."[15]

The current best available science[16] clearly links decreasing groundwater levels, including through overpumping of groundwater, to exacerbated degradation of groundwater quality. The U.S. Geological Survey (USGS) analyzed trends of increased pumping in California's Central Valley and further degradation of water quality and concluded that they are interlinked.[17] There is no reason to assume that

---

[14] SVB GSA. April 7, 2022. 180/400ft Aquifer Subbasin Implementation Committee. Presentation slide showing 18 exceedances of Water Quality but concluding that no Undesirable Result occurred because "they were not due to GSA actions."

[15] DWR Cuyama Consultation Initiation Letter. P. 1, citing Water Code § 10721(v). Available at: https://sgma.water.ca.gov/portal/.

[16] 23 CCR § 355.4(b)(1). "When evaluating whether a Plan is likely to achieve the sustainability goal for the basin, the Department shall consider the following:
(1) Whether the assumptions, criteria, findings, and objectives, including the sustainability goal, undesirable results, minimum thresholds, measurable objectives, and interim milestones are reasonable and supported by the best available information and best available science."

[17] U.S. Geological Survey (USGS). (Sept 2021). *Increased Pumping in California's Central Valley During Drought Worsens Groundwater Quality.* California State Water Resources Control Board's Groundwater Ambient Monitoring and Assessment Program (GAMA). Available at:

the Central Coast would be subject to a hydrology so distinct as to negate the applicability of this finding to SVB GSA's groundwater management. Because of this established correlation, in instances of further water quality degradation, particularly when resulting in impacts to drinking water wells, SVB GSA has the burden of proof to show that exacerbated water quality degradation is *not* linked to pumping practices, and identify the responsible source. If extraction practices are exacerbating water quality degradation, then it is the GSA's responsibility to regulate that pumping so as to prevent impacts to beneficial uses and users.

Furthermore, the proposed Water Quality Coordination Group[18], while potentially a step in the right direction, does not adequately address the GSA's responsibility to manage groundwater extraction to avoid Undesirable Results. In addition to "develop[ing] a process for determining when groundwater management and extraction are resulting in degraded water quality in the Subbasin,"[19] SVB GSA must establish clear management actions to address the potential exacerbation of water quality issues resulting from its own projects and management actions, or due to extraction practices within the subbasin. If the GSA intends to collaborate with other regulatory agencies who also deal with water quality issues as a way to fulfill its obligations, the GSA should formalize the roles and responsibilities, for example, by entering into a Joint Powers Agreement (JPA) or a formal Memorandum of Understanding (MOU) and detail what actions the GSA will take to prevent further water quality degradation. Otherwise, DWR cannot determine whether the plan is sustainable.[20] As currently drafted, the Water Quality Coordination Group outlines minimal engagement with other agencies, and a review of water quality conditions resulting in a report. These proposed actions are not sufficient to ensure that the GSA is equipped to prevent or react to exacerbated water quality should those impacts occur. A clear plan of action by the GSA in order to prevent further water quality degradation is required.
As it currently stands, the GSP Update does not contain a plan to prevent further water quality degradation in the subbasin, and therefore is in violation of SGMA.

IV. <u>The Omission of Domestic Well Mitigation Violates the Human Right to Water.</u>

Drinking water users are beneficial users under SGMA, therefore GSPs must account for how drinking water access will be preserved during sustainable groundwater management. Additionally, the Human Right to Water Law (as described above) requires DWR to ensure that all its regulations uphold Californians' Human Right to Water. Because GSAs are regulated by DWR—specifically, their GSPs are reviewed and approved or rejected by DWR—GSPs also must meet the standard of upholding the Human Right to Water.

Domestic wells often have unique characteristics that make their successful management distinct from agricultural wells. GSPs must demonstrate how they will protect drinking water wells, and set out contingency plans for replacement water should all else fail.

---

https://www.usgs.gov/news/increased-pumping-california-s-central-valley-during-drought-worsens-groundwater-quality.

[18] *See* Updated 180/400ft Aquifer GSP, Section 9.7.4. Available at: https://svbgsa.org/wp-content/uploads/2022/04/Ch-9-10-180400-Update-1.pdf.

[19] *Id*.

[20] Cal. Water Code §§ 10721, subd.(x)(4) and 10723.6.

In the Consultation Initiation letter to Merced GSA, DWR instructed that, "[t]he GSAs should revise the GSP to **describe how they would address drinking water impacts caused by continued overdraft** during the period between the start of GSP implementation and achieving the sustainability goal. If the GSP does not include projects or management actions to address those impacts, the GSP should contain a thorough discussion, with supporting facts and rationale, explaining how and why the GSA determined not to include specific actions to mitigate drinking water impacts from continued groundwater lowering below pre-SGMA levels." (Merced, p. 6; Potential Deficiency 1d). Paul Gosselin, who leads the Sustainable Groundwater Management Office, has indicated that successfully arguing such a justification is "a very high mountain to climb."[21]

DWR elaborated this stance in the East Kaweah GSP Determination Letter as follows:

> "While SGMA does not require all impacts to groundwater uses and users be mitigated, **the GSA should consider including projects and management actions strategies describing how they may support drinking water impacts that may occur due to continued overdraft during the period between the start of GSP implementation and achievement of the sustainability goal will be addressed**. If **mitigation strategies** are not included, the GSP should contain a thorough discussion, with supporting facts and rationale, explaining how and why the GSA determined not to include specific actions to mitigate drinking water impacts from continued groundwater lowering below 2015 levels."[22]

DWR further clarified the standard for mitigation plans in the East Kaweah GSP Determination Letter:

> If the GSAs intend to rely on mitigation actions to address impacts that would occur as a result of the continued lowering of groundwater levels as a means to support the reasonableness of their sustainable management criteria, then the GSPs should be revised to include specific details of the mitigation measures that will be enacted, including the schedule for implementation and other details that will allow the Department to assess their feasibility and likely effectiveness.[23]

DWR has indicated that the Department will release guidance on domestic well mitigation this year and has in the meantime instructed GSAs to refer to the Framework for a Drinking Water Well Impact Mitigation Program developed by Self-Help Enterprises, Leadership Counsel for Justice & Accountability, and Community Water Center. The Framework identifies as core components 1) a representative drinking water well monitoring network, 2) an adaptive management trigger system as a protective warning system, 3) an accurate water well impact model, 4) development through public outreach and education, 5) mitigation measures including responsive changes in groundwater

[21] Gosselin, Paul. (Nov 2021). It would be a "very high mountain to climb" to justify why drinking water wells going dry wouldn't be considered an unreasonable result. Available at: https://sjvwater.org/groundwater-plan-managers-not-rattled-by-states-initial-negative-reviews/. PDF available at: https://drive.google.com/file/d/1yWkaKwXGBAZ7x4Ph1SwC9WLDWQMji8Tz/view.
https://drive.google.com/file/d/1yWkaKwXGBAZ7x4Ph1SwC9WLDWQMji8Tz/view?usp=sharing

[22] DWR GSP Determination Letter for Cuyama Valley GSA. Pp. 17-18. Available at: https://sgma.water.ca.gov/portal/.

[23] DWR GSP Determination Letter for EKGSA. P. 13. Available at: https://sgma.water.ca.gov/portal/.

management (ie pumping patterns, projects, and management actions) to halt impacts before residents lose access to their drinking water, as well as interim and long-term solutions to ensure continuous access to safe, clean and affordable drinking water in the case of impacts to domestic wells in the basin due to pumping practices and/or projects and management actions.

To date, SVB GSA has failed to plan for impacts to domestic wells in the basin based on their management decisions and ensure that the Human Right to Water is upheld for residents, in violation of California's Human Right to Water Law and the requirement to consider all beneficial uses and users under SGMA.

V. SVB GSA's Inadequate Representative Monitoring in the 180/400ft Aquifer Subbasin Does Not Capture All Beneficial Uses and Users in the Subbasin.

As established above, SGMA requires GSAs to consider all beneficial users and if a GSA is not gathering data representative of all impacted wells, then they are not adequately measuring and considering impacts to all beneficial users. Domestic wells in particular tend to be more shallow, thus more vulnerable to lowering groundwater conditions. Additionally, domestic wells are relied upon for drinking, cooking, and hygiene needs, thus requiring a higher level of water quality in order to meet their intended beneficial uses. Monitoring for domestic well uses must be adequately sensitive to these conditions. SGMA requires that GSP establish a monitoring network to collect "sufficient spatial and temporal data from each applicable principal aquifer to determine groundwater quality trends for water quality indicators, as determined by the Agency, to address known water quality issues"[24] For example, to provide valid representative data, the well should be of a similar depth to the domestic well(s) in a given community or cluster of wells. CWC recommends that a monitoring well be located no more than 1.5 miles distant max (ideally 1 mile) in order to capture this critical data in a way that is truly representative, particularly for water quality monitoring, including the detection of chlorides resulting from seawater intrusion.

For example, Castroville CSD owns and operates an extremely vulnerable drinking water system (CA2710005) that serves approximately 7,250 residents in the unincorporated, severely disadvantaged community of Castroville. Castroville CSD has wells that have already been impacted by seawater intrusion - making them unusable. They have one well in the deep aquifer that must be blended with another more shallow well in order to reach acceptable temperature levels for potable water. Water levels in this deep well are declining. The CSD has installed an award winning arsenic treatment system due to levels of arsenic in one well with source water exceeding 20 parts per billion (ppb), which is more than double the drinking water standard. Recent science demonstrates that the way groundwater is managed (groundwater levels and pumping rates) can cause inert arsenic to be released from sediments into groundwater in its aqueous form.[25]

---

[24] 23 CCR Section 354.34.

[25] Stanford, 2019. A Guide to Water Quality Requirements Under the Sustainable Groundwater Management Act.

Community Water Center, 2019. Guide to Protecting Drinking Water Quality Under the Sustainable Groundwater Management Act. Available at: https://d3n8a8pro7vhmx.cloudfront.net/communitywatercenter/pages/293/attachments/original/1559328858/Guide_to_Protecting_Drinking_Water_Quality_Under_the_Sustainable_Groundwater_Management_Act.pdf?1559328858

The GSA should clearly describe how it will establish a representative monitoring network in areas of the subbasin with vulnerable drinking water supplies and DACs, and how this monitoring network will address existing pumping data limitations. As the GSA has acknowledged in prior public meetings, one of the biggest challenges to the 180/400 Foot Aquifer GSP implementation is the confidentiality of pumping data. It is required by SGMA that the monitoring networks be representative. Therefore, to the extent that relevant pumping and other monitoring data is confidential or otherwise lacking, the GSP should be revised to include a plan for gathering that data, to include deadlines and any funding that may be required. Please refer to pages 10-13 of the appended Technical Review for further recommendations.

VI. Incomplete Incorporation of Climate Change Models Renders the Water Budget Unreliable, Thus Threatening a Path to Sustainability.

SGMA requires a GSP to quantify the water budget in sufficient detail in order to build local understanding of how historic changes have affected the six sustainability indicators in the basin.[26] Ultimately, this information is intended to be used to predict how these same variables may affect or guide future management actions.[27] GSAs must provide adequate water budget information to demonstrate that the GSP adheres to all SGMA and GSP regulation requirements, that the GSA will be able to achieve the sustainability goal within 20 years, and be able to maintain sustainability over the 50 year planning and implementation horizon.[28]

Including climate change scenarios in water planning is an important step for California's increased resiliency. However, which scenarios to include is a critical question. Climate change is affecting when, where, and how the state receives precipitation.[29] Impacts to water supply, particularly drinking water supply, could be devastating if planning is inadequate or too optimistic. **SVB GSA must include water budget analyses based on DWR's 2070 DEW and WMW scenarios in order to analyze the full range of likely scenarios[30] that the region faces.** The calculations of sustainable yield and the water budget in this chapter may *overestimate the actual sustainable yield and water availability of the subbasin*. We highlight points of concern below and provide recommended changes.

In Section 6.4 of the GSP Update, SVB GSA explains that "[p]rojected water budgets are extracted from the SVOM, which simulates future hydrologic conditions with assumed climate change. Two projected

---

Community Water Center and Stanford University, 2019. Factsheet "Groundwater Quality in the Sustainable Groundwater Management Act (SGMA): Scientific Factsheet on Arsenic, Uranium, and Chromium." Available at: https://d3n8a8pro7vhmx.cloudfront.net/communitywatercenter/pages/293/attachments/original/1560371896/CWC_FS_GrndwtrQual_06.03.19a.pdf?1560371896.

[26] 23 CCR § 354.18.
[27] California Department of Water Resources (DWR), 2016. Best Management Practices for the Sustainable Management of Groundwater, Modeling (BMP #5), December 2016.
[28] 23 CCR § 354.24.
[29] Union of Concerned Scientists. Troubled Waters: Preparing for Climate Threats to California's Water System, 2020. https://www.ucsusa.org/resources/troubled-waters#top.
[30] Terminology used in the California Climate Change Assessment, 2019. (Table 3). https://www.energy.ca.gov/sites/default/files/2019-11/Statewide_Reports-SUM-CCCA4-2018-013_Statewide_Summary_Report_ADA.pdf.

water budgets are presented, one incorporating estimated 2030 climate change projections and one incorporating estimated 2070 climate change projections. … The climate change projections are based on data provided by DWR (2018)," making reference to DWR's 2018 Climate Change Guidance.[31] DWR's Guidance makes recommendations to GSAs for how to conduct their climate change analysis while preparing water budgets. DWR also provides climate data for a 2030 Central Tendency scenario and 2070 Central Tendency, 2070 Dry-Extreme Warming (DEW), and 2070 Wet-Moderate Warming (WMW) scenarios. While DWR's Guidance should be improved with more specific guidelines and requirements, the current Guidance specifically encourages GSAs to analyze the more extreme DEW and WMW projections for 2070 to plan for likely events that may have costly outcomes.

Currently, the SVB GSA's exclusive use of the "central tendency" climate scenario predicts an increase in surface water availability, as represented in the table in Section 6.4.3. The Projected Groundwater Budgets show increases in deep percolation of stream flow, deep percolation of precipitation, and irrigation. The GSP is relying on this presumed increase for its water budget. However, the 2070 DEW scenario provided by DWR could likely result in a significant decrease in precipitation and increase in evapotranspiration, which would have substantial effects on the water budget. By analyzing only the central tendency scenario and not other likely scenarios such as the extremely dry and wet scenarios provided by DWR, the SVB GSA is ignoring the specific 2070 DEW and WMW scenarios provided by DWR as well as an increasing trend in drought frequency. In doing so, the GSP could be overestimating groundwater recharge or underestimating water demands, inadequately planning, and jeopardizing groundwater sustainability. This will waste precious time to prepare and reduce the vulnerability of the basin's agriculture and already vulnerable communities.

As quoted below, DWR's guidance (2018) states that the central tendency scenarios *might* be considered most likely future conditions -- that is not a clear endorsement of a higher statistical probability. It appears that they are calling it the central tendency merely because it falls in the middle of the other two projections, not because it is significantly more probable.

DWR (2018) explicitly encourages GSAs to plan for more stressful future conditions:

> "GSAs should understand the uncertainty involved in projecting future conditions. The recommended 2030 and 2070 central tendency scenarios describe what might be considered most likely future conditions; there is an approximately equal likelihood that actual future conditions will be more stressful or less stressful than those described by the recommended scenarios. Therefore, GSAs are encouraged to plan for future conditions that are more stressful than those evaluated in the recommended scenarios by analyzing the 2070 DEW and 2070 WMW scenarios."[32]

---

[31] California Department of Water Resources (DWR), 2018. Guidance for Climate Change Data Use During Groundwater Sustainability Plan Development. https://data.cnra.ca.gov/dataset/sgma-climate-change-resources/resource/f824eb68-1751-4f37-9a15-d9edbc854e1f?inner_span=True.

[32] California Department of Water Resources (DWR), 2018. Guidance for Climate Change Data Use During Groundwater Sustainability Plan Development. Section 4.7.1. https://data.cnra.ca.gov/dataset/sgma-climate-change-resources/resource/f824eb68-1751-4f37-9a15-d9edbc854e1f?inner_span=True. (In red is a statement about the central tendency scenarios referenced in SVB GSA public meetings and email communications by the GSA's engineering consultant, and in blue is the important text accompanying it, urging GSAs to analyze the more extreme scenarios. CWC staff cited this complete paragraph in email communications with the consultant and GSA staff on April 8, 2021. CWC also raised this point at Forebay

Including the DEW and WMW climate scenarios as part of the 2070 water budget analysis is necessary to meet the statutory requirement to use the "best available information and best available science."[33] Sustainable planning must include planning for foreseeable negative and challenging scenarios. The extreme scenarios provided by DWR are certainly foreseeable, as they have been modeled and made available to the GSA for analysis.

In order to adequately consider impacts to all beneficial users, SVB GSA must include the 2070 DEW and WMW scenarios, because shallow drinking water wells in the area are particularly vulnerable to various extreme conditions, especially drought, which will be drastically more severe under these plausible climate scenarios.

Share water budget results based on the 2070 central tendency, DEW and WMW scenarios that DWR has provided with the 180/400ft Aquifer Implementation Committee, Subbasin committees, Advisory Committee, and GSA board. This should be done at a *minimum* to see what the difference in outcomes could be, and to provide a transparent process for selecting the preferred scenario. This analysis is particularly important because of the drastic differences between the dry and wet scenarios for this region. Drought and/or intensified rainfall (more water falling over a shorter period of time) would pose severe challenges[34] to plans for recharge, which is a critical component of SVB GSA's plan to reach sustainability.

Plan for potential adverse climate conditions when determining Projects and Management Actions. The results of limited-scope planning will be detrimental to beneficial users throughout the SVB GSA. "If water planning continues to fail to account for the full range of likely climate impacts, California risks wasted water investments, unmet sustainability goals, and increased water supply shortfalls."[35] This is true not just generally across California, but also specifically on the Central Coast. "Without effective adaptations, projected future extreme droughts will challenge the management of the Central Coast region's already stressed water supplies, including existing local surface storage and groundwater recharge as well as imported surface water supplies from the State Water Project which will become less reliable, and more expensive."[36]

In its current form, the water budget for the GSP does not adequately incorporate the risks of climate change on future groundwater management. This Update, which is a 5-year update which the GSA is choosing to submit early, should reflect the most recent best available science, which shows that we are in

---

and Upper Valley Subbasin Committee meetings in March and at the April SVB GSA Board Meeting, as well as in subsequent official comment letters).

[33] See 23 CCR § 355.4(b)(1).

[34] Union of Concerned Scientists. Inter-model agreement on projected shifts in California hydroclimate characteristics critical to water management. 2020, p. 13. https://link.springer.com/content/pdf/10.1007/s10584-020-02882-4.pdf.

[35] See Union of Concerned Scientists. Troubled Waters (2020) cited above.

[36] Regional Climate Change Assessment for the Central Coast, 2019. (Discussing drought pp. 21-23. Internal citations omitted). https://www.energy.ca.gov/sites/default/files/2019-11/Reg_Report-SUM-CCCA4-2018-006_CentralCoast_ADA.pdf.

a devastating drought throughout California,[37] and the Central Coast is not immune from drought conditions.

VII. CWC Extends Support for Further Consultation

Thank you for reviewing this letter and for the consideration of our comments on the draft GSP Update. We appreciate the work of Staff and the Board to develop the GSP to this point and we look forward to working with the SVB GSA to ensure that the GSP is protective of the drinking water sources of vulnerable, and often underrepresented, groundwater stakeholders. Please do not hesitate to contact us with any questions or concerns. We also look forward to meeting with you in the future to further discuss issues raised in these and past comments.

Sincerely,

Justine Massey

Justine Massey
Policy Manager and Attorney

Heather Lukacs

Heather Lukacs
Director of Community Solutions

[37] *See e.g.* LA Times. February 2022. "Western megadrought is worst in 1200 years, intensified by climate change, study finds" Available at: https://www.latimes.com/environment/story/2022-02-14/western-megadrought-driest-in-1200-years.

Focused Technical Review:

Salinas Valley Groundwater Basin: 180/400-Foot Aquifer Subbasin Groundwater Sustainability Plan (GSP) Draft 2022 Update

As shown on Figure 1, a significant proportion of the 180/400-Foot Aquifer Subbasin (subbasin) is designated as Disadvantaged Communities (DACs), totaling a population of roughly 50,000 people based on California Department of Water Resources (DWR)-provided Census data.[1] Members of these DACs and other communities receive their drinking water from roughly 500 domestic wells, 49 state small water systems, and 129 local small water systems[2] located within the subbasin as well as a variety of public water systems, including approximately 30 separate community water systems.[3,4]

Figure 1 also shows the Minimum Threshold (MT) contours for seawater intrusion for the 180-Foot and 400-Foot Aquifers. These MT contours represent "the 2017 extent of the 500 mg/L [milligrams per liter] chloride concentration isocontour" (Section 8.8.2 of the draft 2022 GSP update) and "because even localized seawater intrusion is not acceptable, the basin-wide undesirable result is zero exceedances of [these] minimum thresholds" (Section 8.8.4.1). Localized seawater intrusion appears to continue, based on current (2020) chloride concentration isocontours for the 180-Foot Aquifer (Figure 8-8), those for the 400-Foot Aquifer (Figure 8-9), and even more recent (2021) contours prepared by the Monterey County Water Resources Agency (MCWRA)[5]. Based on these data, a significant portion of the drinking water supply in the subbasin is at imminent risk of seawater intrusion impacts if seawater intrusion is not halted, including: 1) a high concentration of domestic well users located east of Moss Landing and north of Castroville, 2) domestic well users in and around the DAC of Boronda, 3) public supply wells located near Castroville (a DAC), and 4) public supply wells located near Salinas (which includes DACs).

The Groundwater Leadership Forum (GLF) – comprised of the Community Water Center (CWC), Clean Water Action/Clean Water fund, Local Government Commission, Audubon California, The Nature Conservancy, and the Union of Concerned Scientists – raised the issues identified below to the Salinas Valley Basin Groundwater Sustainability Agency (GSA) in a comment letter submitted on the draft (2020) Groundwater Sustainability Plan

[1] Several Census Block Groups and Tracts extend beyond the boundary of the subbasin, and thus not all of the population represented by the Tract lies within the basin. In addition to the DACs identified through the DWR-provided DAC Mapping tool (based on 2011-2016 estimates), the community of Moss Landing, which had insufficient data when the tool was developed, has been determined to be a DAC. Thus, the total population based on DWR-provided census data for the Block Groups and Tracts located within and across subbasin boundaries, and Moss Landing is 49,244.

[2] Local small water systems serve drinking water to 2-4 connections and state small water systems serve drinking water to 5-14 connections. These small water systems are regulated by the Monterey County Department of Environmental Health Drinking Water Protection Services https://www.co.monterey.ca.us/government/departments-a-h/health/environmental-health/drinking-water-protection/state-and-local.

[3] Domestic well counts are based on a dataset developed by the U.C. Berkeley Water Equity Science Shop: *UC Berkeley Water Equity Science Shop Domestic well locations version 1.0, 2019,* Authors: Clare Pace, Carolina Balazs, Lara Cushing, Rachel Morello-Frosch.

[4] Small water system information is based on a shapefile constructed by the Central Coast Regional Water Quality Control Board (CCRWQCB) in 2013, updated in 2017 by the CCRWQCB, and updated by the Water Equity Science Shop at UC Berkeley in 2022. All data was provided by the Monterey County Environmental Health Bureau, who regulates all state and local small water systems in Monterey County.

[5] https://www.co.monterey.ca.us/government/government-links/water-resources-agency/programs/seawater-intrusion-monitoring

(GSP). The GSA made some changes to the draft (2022) GSP update (hereafter referred to as the GSP) in response to these comments; however, as described below, we believe that issues with the GSP still remain, and as currently written, we do not believe the GSP lays out a clear plan to achieve or maintain sustainability in the subbasin with adequate consideration of all the beneficial uses and users of groundwater. We appreciate that some of the discrepancies identified in comments submitted on prior GSP versions (e.g., inconsistencies in key well information presented in the original GSP Tables 7-2 and 7-4) have been addressed. However, our most significant and substantial comments remain to be addressed (e.g., how the groundwater level minimum thresholds are expected to prevent continued seawater intrusion and impacts to communities such as Castroville, adequate representation of sustainable yield, insufficiencies in the monitoring networks to adequately understand and protect domestic wells and small water systems, etc.).

The GSP states that a provisional version of the groundwater flow model, the Salinas Valley Integrated Hydrologic Model (SVIHM), was prepared by the United States Geological Survey (USGS) and made available to the GSA to support the water budget and alternative projects evaluation. Several evaluations and decisions presented in the GSP are incomplete based on current limitations of the SVIHM. As evident by many of the comments identified below, these limitations resulted in a lack of clarity regarding future projects, and the evaluation of their impact in supporting the GSA to achieve the sustainability goal for the subbasin (CCR 23 § 355.4(b)). The GSA is required to "describe projects or management actions, including a quantification of demand reduction or other methods, for the mitigation of overdraft" that are "supported by best available information and best available science," per CCR 23 § 354.44.

On June 3, 2021, DWR issued a determination letter[6] that approved the 2020 GSP with "recommended corrective actions that [DWR] believes will enhance the GSP and facilitate future evaluation by [DWR]" (*page 1 of the letter*). The determination letter includes an attached "Statement of Findings" and a more detailed "Groundwater Sustainability Plan Assessment Staff Report" (referred to as "staff report"). The five recommended corrective actions proposed by DWR are:

1. "SVBGSA should provide additional information on the required, ongoing communications elements required in the GSP Regulations, and describe how those required elements fit into phase four of the GSA's Engagement and Outreach Strategy, including engagement of irrigation, drinking water supply, and environmental beneficial users as identified in the [GSP]." (*page 36 of 37 of the staff report*)
2. "Investigate the hydraulic connectivity of the Salinas River, the non-principal shallow aquifer, and the principal aquifers. Identify specific locations where the Salinas River gains or loses water to the groundwater system. Based on results of the investigation, provide updated discussion of the potential for management of the principal aquifers to impact beneficial uses and users of groundwater in the shallow aquifer, including that the GSA should document known impacts to drinking water users, should they occur, or surface water." (*page 36 of 37 of the staff report*)
3. "SVBGSA should clarify its plan to conduct necessary field reconnaissance for GDE identification. Update future iterations of the GSP with the results of the field studies to identify GDEs in the Subbasin." (*page 36 of 37 of the staff report*)
4. "Define what constitutes [']average hydrogeologic conditions['] and how the [']long-term average over all hydrogeologic conditions['] will be calculated for the consideration of undesirable results for reduction of groundwater storage and depletions of interconnected surface water." (*pages 36-37 of 37 of the staff report*)

[6] https://sgma.water.ca.gov/portal/gsp/assessments/29

5. "Coordinate with the appropriate groundwater users, including drinking water, environmental, and irrigation users as identified in the [GSP], and water quality regulatory agencies and programs in the Subbasin to understand and develop a process for determining if groundwater management and extraction is resulting in degraded water quality in the Subbasin." (*page 37 of 37 of the staff report*)

While moving forward with implementation of the GSP, it is important for the SVBGSA to consider that "while the issues addressed by the recommended corrective actions do not, at this time, preclude approval of the [GSP], [DWR] recommends that the issues be addressed to ensure the [GSP]'s implementation continues to be consistent with SGMA and [DWR] is able to assess progress in achieving the sustainability goal within the basin." (*page 9 of 37 of the staff report*). "Lastly, [DWR]'s review and approval of the [GSP] is a continual process. Both SGMA and the GSP Regulations provide the Department with the ongoing authority and duty to review the implementation of the [GSP]. […] The passage of time or new information may make what is reasonable and feasible at the time of this review to not be so in the future. The emphasis of [DWR]'s periodic reviews will be to assess the progress toward achieving the sustainability goal for the basin and whether [GSP] implementation adversely affects the ability of adjacent basins to achieve their sustainability goals" (*page 10 of 37 of the staff report; emphasis added).*

For these, and the reasons discussed further below, we believe that even though it was approved by DWR, the GSP does not lay out a clear and robust plan to achieve sustainability or protect drinking water supplies for vulnerable beneficial uses and users of groundwater.

Groundwater Conditions

- Based on the seawater intrusion maps developed by the MCWRA, there is significant uncertainty regarding the extent of seawater intrusion in the northern and southern portions of the impacted area for both the 180-Foot and 400-Foot Aquifers.[7,8] These uncertainties are not reflected in the GSP's presentation of MCWRA's historical seawater intrusion boundaries (Figure 5-23 and 5-24), or in the GSP's adoption of these boundaries as the basis for its seawater intrusion MTs. Therefore, it is not known how far seawater has actually intruded in the areas of Castroville and north of Castroville (DACs) and it is not known to what degree the proposed seawater intrusion MTs are protective of beneficial users in these areas. **This uncertainty is not clearly and transparently reflected in the GSP, which is of particular significance because these data are used as the basis for MTs. This uncertainty must be incorporated in order to reflect the best available information and best available science, per CCR 23 § 355.4(b)(1).**

- The review of the water quality data in the groundwater conditions section of the GSP (Section 5.4) is very limited and focused almost entirely on nitrate. The GSP identifies numerous constituents that have been detected in groundwater above drinking water standards, but, with the exception of nitrate, does not present this data spatially or even in tabular format. Although the GSP sets water quality MTs for these constituents (Table 8-5), the supporting data are not presented, and no analyses of spatial or temporal water quality trends are presented. This does not present a clear and transparent assessment of current water quality conditions in the subbasin with respect to drinking water beneficial use (CCR 23 § 354.16(d)). **The GSP does not include specific discussions supported by maps and charts, of the**

[7] MCWRA Historical Seawater Intrusion Maps, April 2018.
180-Foot Aquifer: https://www.co.monterey.ca.us/home/showdocument?id=63713
400-Foot Aquifer: https://www.co.monterey.ca.us/home/showdocument?id=63715
[8] MCWRA 2021 500 mg/L chloride areas for the 180-Foot Aquifer (pages 32-33 of 39) and for the 400-Foot Aquifer (pages 34-36 of 39) https://www.co.monterey.ca.us/home/showpublisheddocument/110369/637835357480370000

spatial or temporal water quality trends for constituents that have exceeded drinking water standards and may affect drinking water beneficial users, as required under CCR 23 § 354.16(d).[9]

Water Budget and Sustainable Yield

- The GSP identifies three principal aquifers, i.e., the 180-Foot Aquifer, the 400-Foot Aquifer, and the Deep Aquifers, and notes that the subbasin's "aquitards and aquifers have long been recognized in a multitude of studies and reports" (Section 4.4.1). However, despite this, the GSP lumps all three aquifers together in its evaluation of the SVIHM-based water budgets, and does not appear to account for lag times and/or flows between aquifers, or the effects of differential pumping rates and changes in pumping rates or locations between aquifers. Furthermore, the GSP identifies significant limitations in the SVIHM based on significant discrepancies between measured and simulated estimates of seawater intrusion rates/extents and pumping volumes in this historical and current water budgets. For example, "comparing SVIHM output to Groundwater Extraction Management System (GEMS) data reveals that, on average, the preliminary SVIHM estimates only approximately 71% of the pumping reported" (Section 6.3.2), and "seawater inflows are always [simulated] between 2,000 and 4,000 AF/yr [which] are less than calculated in Chapter 5 [between 8,250 and 13,500 AF/yr]" (Section 6.3.2). These discrepancies appear to have lead the GSP to conclude that the SVIHM overestimates overdraft rates, as indicated in Section 6.3.3: "The SVIHM estimated the historical annual decline in storage to be 14,800 AF/yr. However, this decline is greater than estimated using groundwater level data, and this GSP considers the average annual historical decline in storage to be 600 AF/yr." This is a huge discrepancy between model calculated overdraft and the estimated overdraft based on contoured groundwater level measurements. Similar concerns are expressed in recent comment letters[10] on the GSP. The GSP states that "as GSP implementation proceeds, the SVIHM will be updated and recalibrated with new data to better inform model simulations of historical, current, and projected water budgets. Model assumptions and uncertainty will be described in future updates to this chapter after model documentation is released by the USGS" (Section 6.2). **Given this, it is not clear that the projected water budget, as developed in the GSP, is sufficiently robust and representative of subbasin conditions for purposes of fully assessing sustainable yield or compliance with sustainability criteria, and does not reflect the best available science (CCR 23 § 354.18(e)). We believe these significant limitations in the projected water budget, if not adequately addressed, may preclude approval by DWR in future reviews of the GSP (i.e., five-year updates such as this one).**
- The GSP future water budgets are based on the DWR 2030 and 2070 central tendency scenarios, which showed warmer and wetter climate and increased precipitation due to climate change. The GSP states that "more analysis needs to be done with regards to future recharge" (Section 6.4.3). **CWC recommends that the GSP incorporate 2070 extremely wet and dry climate scenarios and determine whether the planned projects and management actions still lead to sustainability under these scenarios.** It is important for the GSP to integrate multiple scenarios of climate change and quantify the uncertainty due to different climate change outcomes, particularly when the central tendency scenarios provide an "optimistic" outcome of added recharge. **CWC also requests that the GSA make the SVIHM available to the public as soon as possible for the transparency of water budgets.**

---

[9] Stanford, 2019. *A Guide to Water Quality Requirements Under the Sustainable Groundwater Management Act,* Spring 2019.

[10] https://svbgsa.org/wp-content/uploads/2022/03/Comment-Letters-for-Update_20220224.pdf

- The projected sustainable yield values presented in Table 6-15 of the GSP reflect a roughly 10% reduction in groundwater pumping, but still reflect an annual change in storage deficit of approximately 800 acre-feet per year (AFY) under 2070 conditions. It is not clear how the sustainable yield of a subbasin already severely impacted by seawater intrusion can include continued decline in storage, particularly when the proposed inland groundwater flow gradients under the water level sustainable management criteria (SMCs) will allow for continued seawater intrusion into the subbasin. The GSP notes that "although the sustainable yield values provide guidance for achieving sustainability, simply reducing pumping to within the sustainable yield is not proof of sustainability." (Section 6.4.4). Therefore, this sustainable yield value also does not take into account the effects of a hydraulic barrier, which the GSP highlights as necessary to achieve the seawater intrusion SMCs.[11] **Thus, the sustainable yield values presented in Section 6.4.4 do not appear to be reflective of the sustainability conditions outlined elsewhere in the GSP, and is inconsistent with the requirement that "minimum thresholds for reduction of groundwater storage shall be supported by the sustainable yield of the basin" (CCR 23 § 354.28(c)(2)).** It is important that the sustainable yield values take into consideration all factors that will lead to long-term sustainability of the subbasin, especially given that these values form the basis for demand planning (the top priority management action in Table 9-1), which "can be used as the basis for pumping fees, which can raise funds for projects and management actions," as described in Section 9.4.1.

Sustainable Management Criteria

- In its discussion of the relationship between the water level MTs to other sustainability indicators, Section 8.6.2.3 of the GSP indicates that:

  "The chronic lowering of groundwater level minimum thresholds are set above historical lows. Therefore, the groundwater elevation minimum thresholds are intended to not exacerbate, and may help control, the rate of seawater intrusion. Seawater intrusion may be managed by either lowering groundwater elevations to capture seawater intrusion or raising groundwater elevations to drive seawater intrusion towards the coast. Because it has not been determined if lower or higher groundwater elevations will be used to manage seawater intrusion; the groundwater elevation minimum threshold was not set solve [sic] seawater intrusion, but rather to not exacerbate seawater intrusion."

However, as shown in Figures 8-1 and 8-2 of the GSP, the proposed water level MTs are set at 0 feet above mean sea level (ft MSL) along the coastline, and decrease farther east for both the 180- and 400-Foot Aquifers. Figures 8-1 and 8-2 are excerpted below and shown alongside the August 2020 groundwater level contours (Figures 5-2 and 5-4 from the GSP). As illustrated here, while the groundwater flow gradient would be less steep under the projected future conditions, the direction is consistent with the conditions that have resulted in seawater intrusion. Given that the inland water level MTs are below sea level, an easterly groundwater flow gradient will remain and seawater intrusion will continue, predicated on successful implementation of a barrier project. Based on analysis of the GSP figures mentioned above and Figure 2 of this review, several small water systems (east of Castroville and north of Salinas) are close to the seawater intrusion area and located where some of the deepest groundwater levels occur (i.e., where high potential for further seawater intrusion exists). **While the rate of seawater intrusion would likely be slower than observed historically, even if the water level**

[11] The GSP identifies a seawater intrusion extraction (pumping) barrier and estimates that operation will require withdrawing up to 30,000 AFY of groundwater, which would then be conveyed to discharge into the Pacific Ocean or to a new or existing desalination plant (Section 9.5.5).

MTs were met today, seawater intrusion will continue within the subbasin, threatening the drinking water supplies for DACs and other vulnerable populations. Therefore, even if the water level MTs are met, the seawater intrusion MTs will be exceeded, as seawater intrusion continues inland. **Thus, the SMCs for seawater intrusion and chronic lowering of groundwater levels are in opposition of each other, and the GSP does not adequately describe the "relationship between the minimum thresholds for each sustainability indicator, including an explanation of how the Agency has determined that basin conditions at each minimum threshold will avoid undesirable results for each of the sustainability indicators," pursuant to CCR 23 § 354.28(b)(2).**

Comparison of Current Water Level Gradient to MT Water Level Gradient – 180-Foot Aquifer

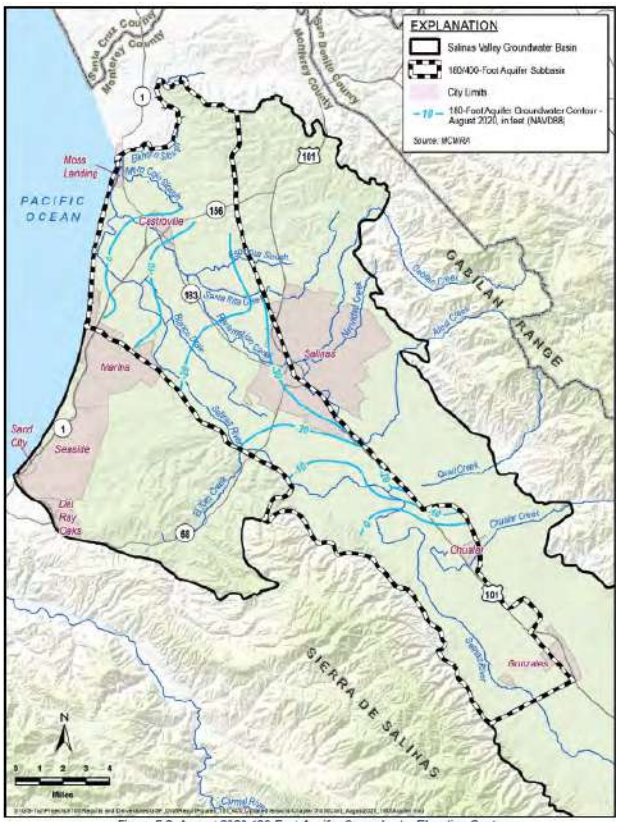


Figure 5-2. August 2020 180-Foot Aquifer Groundwater Elevation Contours

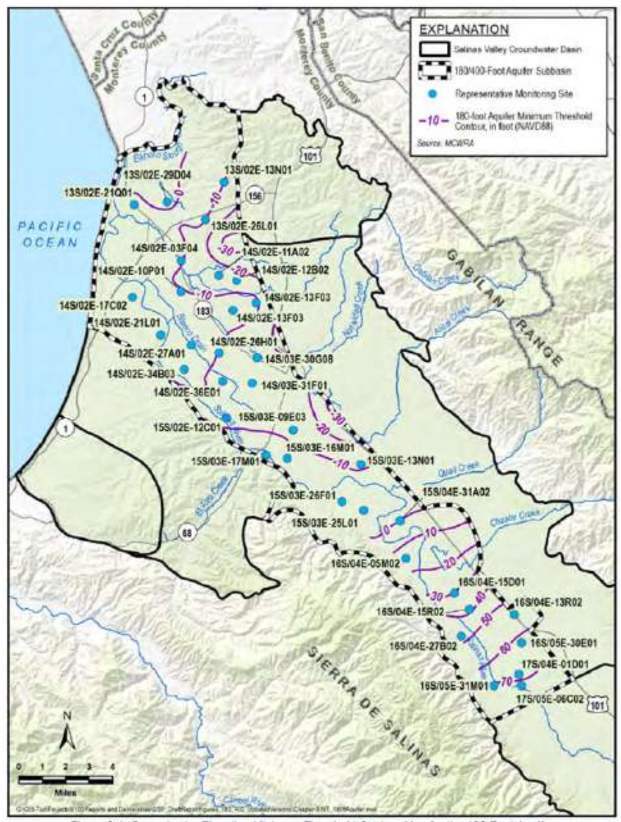


Figure 8-1. Groundwater Elevation Minimum Threshold Contour Map for the 180-Foot Aquifer

Comparison of Current Water Level Gradient to MT Water Level Gradient – 400-Foot Aquifer

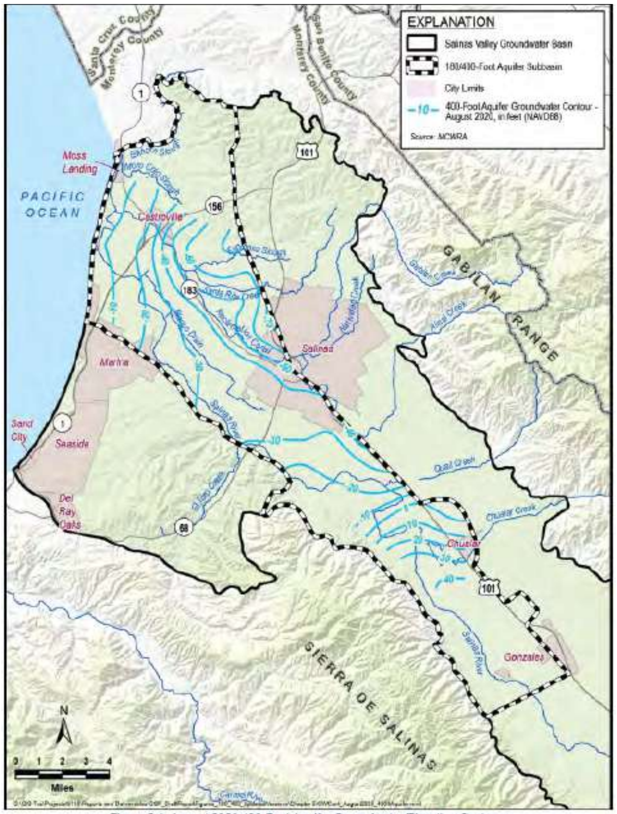


Figure 5-4. August 2020 400-Foot Aquifer Groundwater Elevation Contours

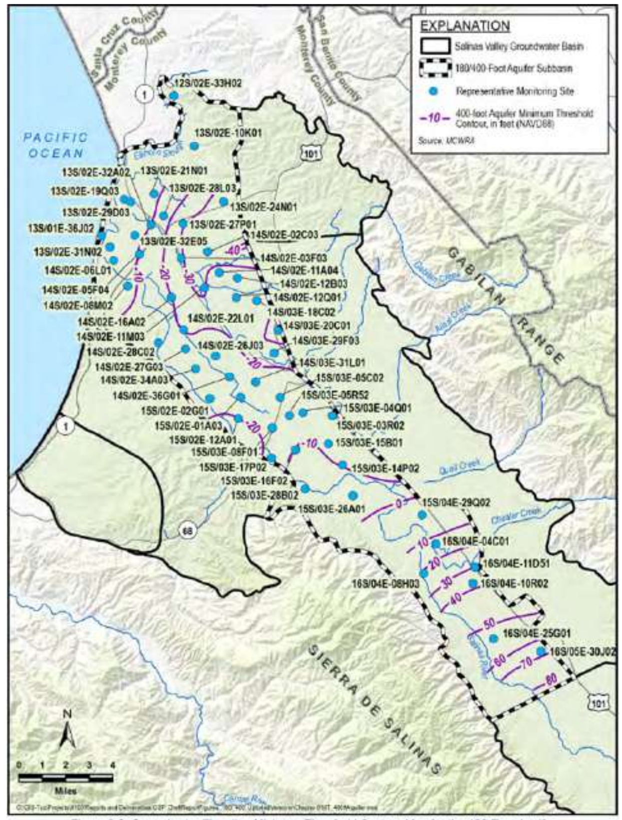


Figure 8-2. Groundwater Elevation Minimum Threshold Contour Map for the 400-Foot Aquifer

- Charts 2a and 2b below reflect the proposed SMCs (per Table 8-3 of the GSP) for the 180-Foot and 400-Foot Aquifer water level representative monitoring wells (RMWs) located in and near the areas of seawater intrusion (wells identified on excerpted Figures 8-1 and 8-2 above). The GSP identifies these values as interim milestones. If the measurable objectives (MOs) are met, this represents a relatively small decline in water levels from current conditions in most wells, and in some wells an increase in water levels. However, the MTs in most cases represent a substantial decline in water levels from current conditions, to levels well below sea level. Comparison of these groundwater level SMC in the 2022 GSP with the original GSP indicate the GSA generally raised MTs above original values, which is a step in the right direction, however, most MTs are still below sea level. **Given that current conditions are resulting in significant seawater intrusion conditions, it is unclear from the GSP how such declines in water levels will result in sustainability for the beneficial uses and users of the subbasin, how seawater intrusion will be limited to 2017 conditions (i.e., the seawater intrusion MTs), and ultimately how the subbasin sustainability goal will be met (CCR 23 § 355.4(b)).**

Chart 2a – SMCs for 180-Foot Aquifer Water Level RMWs Near Coast

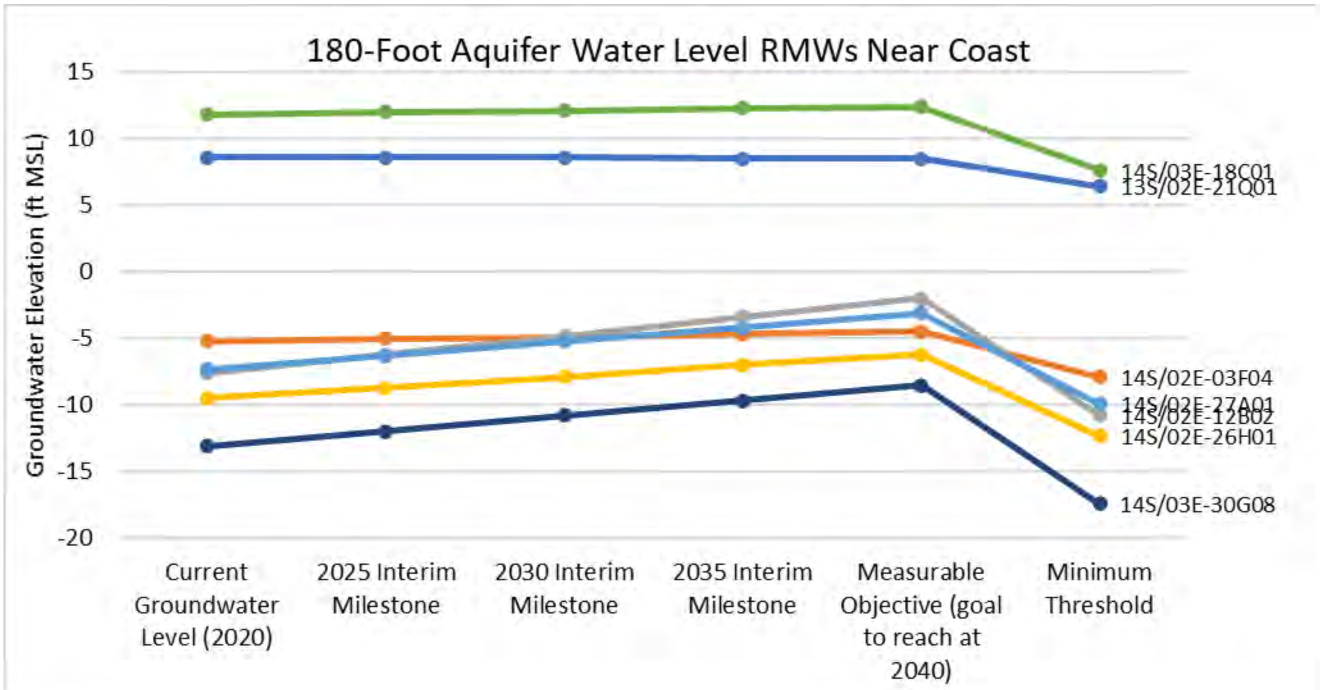
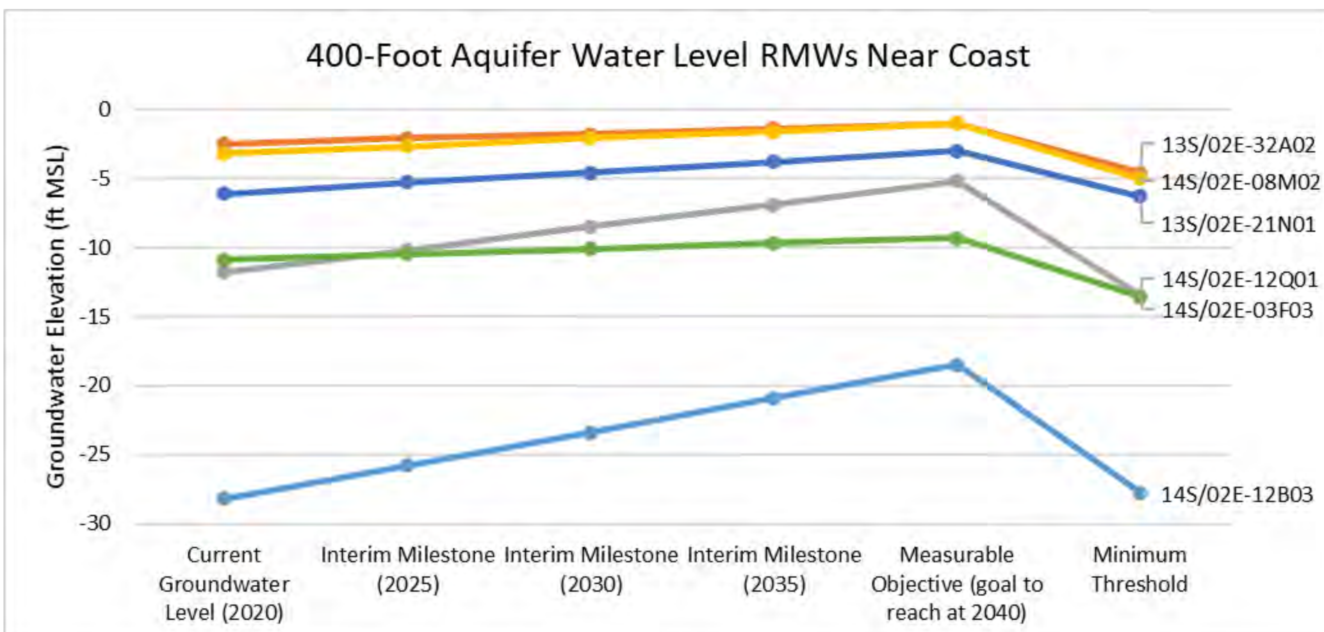


Chart 2b – SMCs for 400-Foot Aquifer Water Level RMWs Near Coast



- As mentioned above, in its discussion of the relationship between the water level MTs to other sustainability indicators, Section 8.6.2.3 of the GSP states that "The chronic lowering of groundwater level minimum thresholds are set above historical lows. Therefore, the groundwater elevation minimum thresholds are intended to not exacerbate, and may help control, the rate of seawater intrusion." As shown in Charts 2a and 2b, above, and based on the data presented in Table 8-3 of the GSP, this statement does not appear to be because minimum thresholds are still largely set below sea level (i.e., GSP Figures 8-1 and 8-2). The implications of groundwater levels remaining below sea level are evident based on continued seawater intrusion illustrated by the 2020 and 2021 MWCRA chloride contours, which constitute as exceedances in the MTs for both principal aquifers. **Therefore, this statement appears to be inaccurate and the conclusion that "groundwater elevation minimum thresholds will not exacerbate, and may help control, seawater intrusion" should be further clarified.**

- Since the original 2020 180/400 Foot Aquifer GSP, the GSA has updated the analysis of groundwater level minimum threshold impacts on domestic wells (Section 8.6.2.2). As part of this update, **"the [current domestic well impact] analysis only included 14 wells with accurate locations out of the total 294 [DWR Online System for Well Completion Reports (OSWCR) database] domestic wells."** The adjustments (limitations) identified in Section 8.6.2.2 are:

    - "The OSWCR database may include wells that have been abandoned, destroyed, or replaced, such as if the user switched to a water system, and abandoned or destroyed wells would have no detrimental impacts from lowered groundwater levels."

    - "Only wells likely to be in the principal aquifers were considered, since some domestic wells may draw water from shallow, perched groundwater that is not managed under this GSP."

    - "Wells in the Deep Aquifers were not included because there was not enough 2015 or 2003 groundwater elevation data to contour the minimum thresholds or measurable objectives."

    - "Only wells that had accurate locations were included, since some wells in the OSWCR database are not accurately located, it could lead to inaccurate estimations of depth to water in the wells."

    - "The depth to water is derived from a smoothly interpolated groundwater elevation contour map. Errors in the map may result in errors in groundwater elevation at the selected domestic wells."

  However, many of these key assumptions and identified limitations should be further addressed for the analysis to be a sufficiently thorough analysis that is representative of domestic wells actually used in the basin. **In particular, the GSP limits the analysis to just 14 out of 294 wells (i.e., less than 5%) on the basis that only 14 wells have "accurate locations;" however, the GSP does not explain how it was determined that only 14 wells have accurate locations. It is noted that while domestic wells may not have precise locations in the OSWCR database, nearly all wells have locations identified within Public Land Survey System (PLSS) sections (i.e., within a 1-square mile grid). Furthermore, Monterey County maintains well records outside of the DWR OSWCR system. It is our understanding that Monterey County has more accurate and detailed information that could be utilized by the GSA.**

  Additionally, the statement that "Errors in the map may result in errors in groundwater elevation at the selected domestic wells" should be further explained to communicate where significant errors are expected in the groundwater elevation contour maps that were used to determine that "83% of domestic wells in the 180-Foot Aquifer will have at least 25 feet of water in them as long as groundwater elevations remain above minimum thresholds; and all domestic wells in the 180-Foot

Aquifer will have at least 25 feet of water in them when measurable objectives are achieved. In the 400-Foot Aquifer, 88% of domestic wells will have at least 25 feet of water in them if groundwater elevations remain above minimum thresholds and when measurable objectives are achieved" (Section 8.6.2.2). **The domestic well impact analysis should be updated to 1) include information from well completion reports in the Monterey County Environmental Health Department records, 2) evaluate impacts to domestic wells with locations available a PLSS section-level, 3) include a sensitivity analysis of the potential range of error within a PLSS Section (i.e., calculate the difference between the minimum and maximum contoured groundwater elevations and ground surface elevations within each PLSS Section and present the results), 4) include the information used for the domestic well impact analysis in the GSP for full transparency of the assessment, and 5) apply this analysis to the other Salinas Valley Basin subbasins.**

- California established and adopted a Maximum Contaminant Level (MCL) for hexavalent chromium in 2014, which was later repealed. The SWRCB is currently in the process of establishing a new MCL for hexavalent chromium, and currently has established a Public Health Goal for this constituent. **Given that a new MCL is forthcoming, and hexavalent chromium has been established as a public health risk in drinking water, the GSA should include hexavalent chromium as a contaminant of concern for purposes of water quality monitoring, and identify a plan to add contaminants of *emerging* concern to the monitoring program as regulatory limits are established.**
- Degraded water quality SMCs should be set for every public drinking water well and a representative network of drinking water wells that rely on more shallow aquifers. It is essential to track the same wells each year in the monitoring network. If a well is no longer active, it should be removed from the network. The GSP does not clearly identify which wells are included in the monitoring network, which wells have data for a given constituent, or which wells are exceeding the regulatory standard. **In order for the public to be able to understand to what extent the water quality monitoring network is representative of drinking water users, the GSP should clearly identify the total number of wells in each category that will be included in the water quality monitoring network, the well locations and identifying names, and identify the SMCs in Table 8-4. The GSP should also identify the number of wells exceeding the measurable objectives and minimum thresholds based on the most recent sample, for each constituent.**

Monitoring Network

- The GSP states that "the boundaries of the Subbasin, combined with those of the Monterey and Seaside subbasins, are generally consistent with MCWRA's Pressure Subarea" (Section 3.1) and "the assessment of groundwater elevation conditions is largely based on data collected by MCWRA from 1944 through the present" (Section 5.1.1). As shown in Figure 3-8 and 5-14 from the GSP (excerpted below), while the Pressure Subarea does cover a substantial portion of the basin, the portion that it does not cover is the area with the majority of the domestic wells within the basin. Further, "the groundwater elevation contours only cover the portions of the basin monitored by MCWRA. Contours do not always extend to subbasin margins" (Section 5.1.2). The GSP acknowledges that "these are data gaps that will be addressed during GSP implementation" (Section 5.1.2). **CWC appreciates that the GSA acknowledges these data gaps and recommends a clear timeline and plan for the monitoring network to be expanded to represent potentially vulnerable drinking water users in this area.**

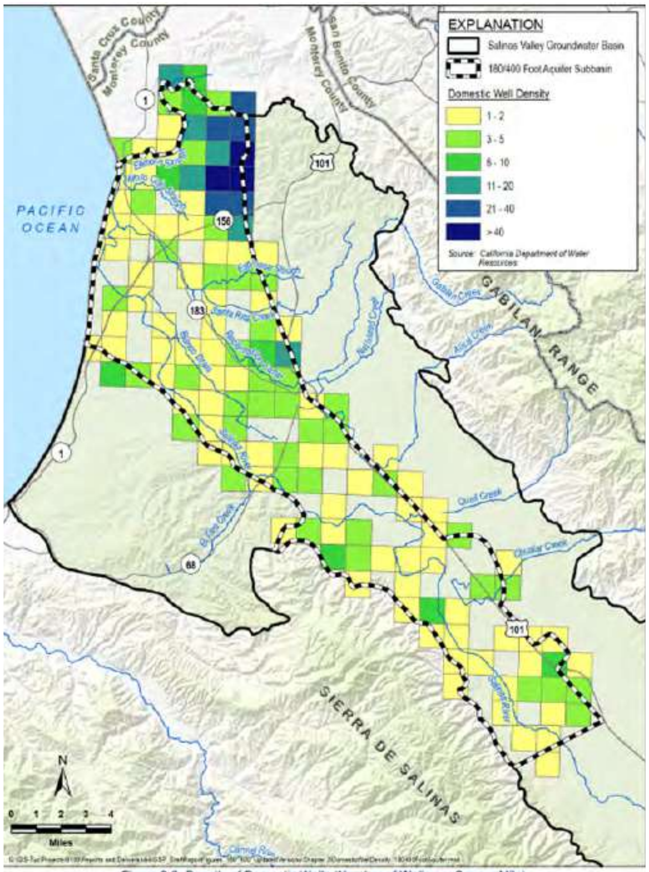


Figure 3-8. Density of Domestic Wells (Number of Wells per Square Mile)

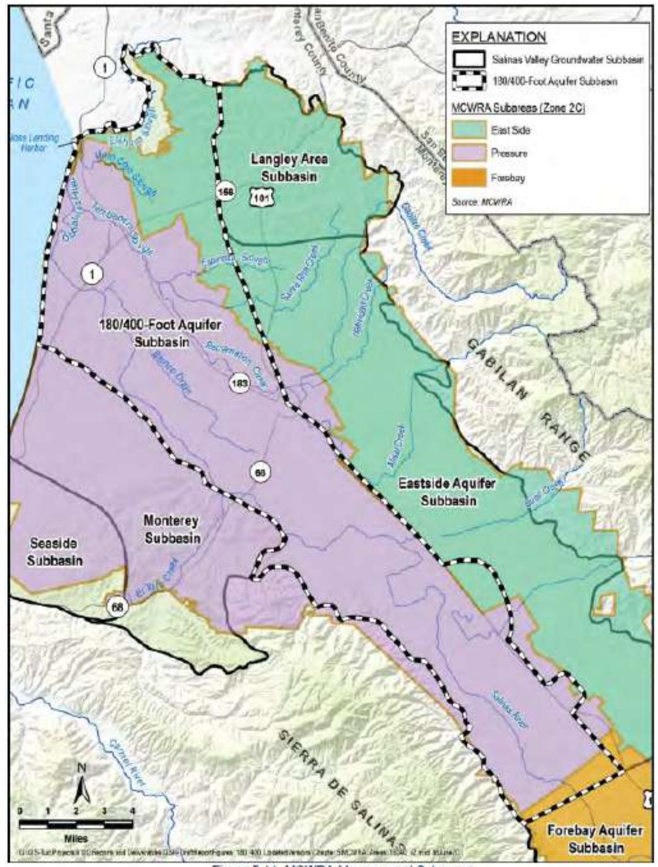


Figure 5-14. MCWRA Management Subareas

- **CWC appreciates the GSA adding eleven monitoring wells in the Deep Aquifers in the draft 2022 GSP Update.** However, further efforts are needed to continue to expand the Deep Aquifers monitoring network, as the GSP stated in Section 7.2.2: “visual inspection of the geographic distribution of the well network in the Deep Aquifers indicate that additional wells are necessary to adequately characterize the Subbasin.” We concur with DWR’s recommendation that “the GSA provide detailed updates on yearly progress toward expanding the monitoring network in its annual reports and that future iterations of **the GSP include more detail on how and when data gaps related to monitoring network expansion will be addressed**” (Staff Report Page 29 of 37).
- Figure 3 (of this Technical Review) shows the RMWs for water levels as well as the locations of domestic wells, public supply wells, DACs and public water systems in the subbasin, and the seawater intrusion MO and MTs. The GSP now includes some water level RMWs in the northernmost portion of the subbasin, in an area with a high concentration of domestic well users. CWC appreciates the GSA adding two additional monitoring wells to the 180-Foot Aquifer monitoring network and three additional wells to the 400-Foot Aquifer monitoring network in attempt to address this data gap**; however, the level uncertainty and variability in groundwater levels should be explained to justify if the current monitoring network is sufficient in this important area of beneficial users. The current monitoring network and potential need for additional monitoring wells should be justified based on an improved domestic well impact analysis, as previously explained in this technical review.**

- As discussed above under the Groundwater Conditions section, the GSP's seawater intrusion maps show significant uncertainty regarding the seawater intrusion extent, particularly in the areas of Castroville and north of Castroville. **The GSP should acknowledge this data gap and increase monitoring network density between the seawater intrusion front and areas of drinking water beneficial users.**

- Figures 4A and 4B show the estimated water level decline from current conditions that would occur at each RMW if water levels reach the MTs for the 180-Foot and 400-Foot Aquifers, respectively. As shown in Figure 4B, the MT for RMW 13S/02E-27P01, located along the 2017 seawater intrusion line/MT near Castroville, is about 16 feet below current (Fall 2019 of water year 2020) groundwater conditions. Comparison of these groundwater level SMC in the 2022 GSP with the original 2020 GSP indicate that the GSA generally raised MTs above original MT values, which is a step in the right direction and CWC appreciates the GSA making improvements in regards to this concern, however, most MTs are still below sea level. **The GSP does not explain how continued water level declines in areas already or imminently impacted by seawater intrusion will result in sustainable conditions for beneficial users, as required per CCR 23 §354.28(b)(2).**

- The GSP shows where wells will be used as water quality RMWs by general type of well (i.e., Public Water System Supply, On-Farm Domestic, and Irrigation Supply) on Figures 7-7 and 7-8, lists MTs per well type in Tables 8-5 and 8-6, states that the MOs are the same as the MTs (Section 8.9.3), and references the monitoring frequency as implemented in the State Water Resources Control Board (SWRCB) Division of Drinking Water and Irrigated Land Reporting Program (ILRP). **CWC appreciates the GSA incorporating this information; however, significant deficiencies in the degraded water quality monitoring network remain, as explained in the following bullet**.

- The GSP definition for degraded water quality identifies constituents of concern (COCs) as those that "have an established level of concern such as an MCL or SMCL for drinking water, or a level known to affect crop production" and "have been found in the Subbasin at levels above the level of concern" (Section 8.9.2). Further, the list of monitored COCs is dependent on the water quality constituent that each type of well is monitored for independent of the Sustainable Groundwater Management Act (SGMA). As illustrated in Tables 8-5 and 8-6 of the GSP, many COCs have been detected in municipal supply wells, while water quality impacts to domestic wells and wells that serve small water systems are not well understood or communicated in the GSP. **Given this selective sampling and establishment of MOs and MTs for water quality constituents, the GSP does not present a monitoring network that is sufficient to monitor for impacts to beneficial users who rely on domestic wells and small water systems for drinking water (pursuant to CCR 23 § 354.34(b)(2)) and the GSP does not fully evaluate how these selective MTs will affect the interests of these beneficial users (pursuant to CCR 23 §354.28(b)(4)).**

- CWC notes that state and local small water systems wells still are not being monitored under the GSP[2]. In its review of the prior GSP, DWR cited that "the [GSP] identifies the lack of well construction information (e.g., the depth of well screens or the total depth of the well) for **many groundwater quality monitoring wells as a data gap**. The implementation chapter of the Plan simply states that '[d]uring implementation, the SVBGSA will obtain any missing well information, select wells to include in monitoring network, and finalize the water quality network.' **[DWR] recommend[s] the SVBGSA provide updates on the progress toward filling this data gap in its annual reports and that more details be provided in the first five-year assessment of the Plan**." (Staff Report pages 30-31 of 37). The GSP (Section 7.5) now mentions that "the SWRCB is undertaking the [Safe and Affordable Funding for

Equity and Resilience] SAFER Program to collect their groundwater quality data from [state small] water systems and make it readily available. Once that [SAFER] data is readily available, SVBGSA **may** add small system wells to its groundwater quality monitoring network." The water wells used to supply the state and local small water systems and that are monitored for water quality (i.e., per the Monterey County Environmental Health Department records) are the most representative monitoring sites for evaluating potential impacts to these beneficial users. **The GSP language should be revised to say that it will add small water system wells to its monitoring network, or explain how the monitoring network could be considered sufficient to monitor the potential impacts to small water system beneficial users per CCR 23 § 354.34(b)(2) if they are excluded from the network.**

- CWC appreciates that the GSP Update reconciled prior discrepancies in well depths and spatial coordinates for representative monitoring sites in the groundwater level and seawater intrusion monitoring networks in the original GSP Tables 7-2 and 7-4.

- Because changes in changes in storage for each principal aquifer (the 180-Foot Aquifer and 400-Foot Aquifer [and Deep Aquifers]) are required in annual reports, **comparisons of changes in storage for each aquifer, based on the monitoring networks, should be compared with the SVIHM simulated changes in storage for each principal aquifer, because there is considerable uncertainty in the SVIHM results, which are the basis for projected water budgets and evaluation of projects and management actions.** This uncertainty between measured and simulated changes in storage for the subbasin is illustrated by Figure 8-6 of the GSP.

Projects and Management Actions

- The GSP identifies an estimated groundwater storage deficit of 10,500 AFY under 2030 conditions and 11,300 AFY under 2070 conditions (Table 6-13).[12] For the 2030 conditions presented in Table 6-14, this represents roughly 9% of agricultural pumping and 8% of total pumping in the subbasin. In order to arrest and roll back seawater intrusion to 2017 levels, significant projects and management actions will need to be implemented, several of which would require significant changes in locations and volumes of groundwater recharge and pumping to implement; these flows are not reflected in the subbasin water budget. The hydraulic (groundwater extraction) barrier project option "will be approximately 5 miles in length between Castroville and the Salinas River [and] as currently scoped, the intrusion barrier comprises 18 extraction wells; although this number may change as the project is refined […] nine wells will be located in the 180-Foot Aquifer and 9 wells will be located in the 400-Foot Aquifer" (Section 9.5.5). The GSP estimates that operation of such a barrier will require withdrawing up to 30,000 AFY of groundwater from the subbasin, which would then be conveyed to discharge into the Pacific Ocean or to a new or existing desalting facility (Section 9.5.5). While it is clear that achieving the seawater intrusion MTs is predicated upon successful implementation of the hydraulic barrier, the GSP does not consider and fully articulate impacts of these hydraulic barrier options on the projected water budget or sustainable yield. Implementation of an extraction barrier will, by definition, change the localized groundwater flow gradients. An extraction barrier will result in localized seaward flow gradients inland of the barrier, and some portion (likely significant) of the estimated 30,000 AFY extracted will be freshwater from the subbasin. Based on the numbers presented in the GSP, implementation of a pumping barrier will exacerbate the existing overdraft conditions and result in an annual storage deficit on the order of 41,000 AFY under 2070 climate change conditions. This

[12] The projected water budget annual deficits are approximately 18 times greater than the annual storage decline associated with the "sustainable yield" in Table 6-15.

represents approximately 36% of the agricultural pumping and approximately 33% of the total pumping in the subbasin, based on Table 6-14. **Therefore, by not fully incorporating analysis of the potential projects into the water budget analysis, the GSP significantly underrepresents the actual deficit and needs of the subbasin in order achieve sustainability. Thus, the GSP has not demonstrated that the identified projects and management actions are feasible, likely to prevent undesirable results, or will ensure that the subbasin is operated within its sustainable yield, per CCR 23 § 355.4(b)(5). Further, the GSP does not present a reasonable assessment of overdraft conditions and include a reasonable means to mitigate overdraft, per CCR 23 § 355.4(b)(6).**

- The GSP contemplates "Fallowing, Fallow Bank, and Agricultural Land Retirement" as a management action (Section 9.4.2), but does not actually quantify the scale or expected benefit of such a management action. The GSP states "Because it is unknown how many landowners will willingly enter the land retirement program, it is difficult to quantify the expected benefits at this time…direct correlation between agricultural land retirement and changes in groundwater levels is likely not possible because this is only one among many management actions and projects that will be implemented in the Subbasin" (Section 9.4.2.2). As identified above, the future overdraft conditions including implementation of the pumping barrier represents approximately 36% of agricultural pumping. The GSP also identifies several potential recharge projects to augment the groundwater supply, but these projects, along with the pumping barrier, require construction of infrastructure and will take years to implement even under the best circumstances. In order to achieve the seawater intrusion MTs and to avoid further degradation of the subbasin, more immediate action is necessary. **Thus, to provide greater clarity for the public and DWR, the GSP should: 1) more transparently lay out and quantify the deficit that needs to be addressed by projects and management actions; 2) provide a clear plan for implementing pumping restrictions and agricultural land retirement with specific targets and timeframes; 3) clearly articulate how much pumping will need to be reduced in the subbasin; and 4) quantify and present the degree of continued seawater intrusion that will occur before the projects and management actions are fully implemented.**

- Based upon the schedules presented in the GSP, the projects and management actions presented in Sections 9 and 10 of the GSP will not be fully implemented for a period of several years. Moreover, some of the more impactful projects are not yet well defined, which coupled with the typical planning and permitting process for project implementation that can extend over several years, underscores concerns regarding the estimated implementation schedule. In addition, the projects are identified as contingent upon the availability of funding. Meanwhile, the pumping of groundwater continues at rates exceeding the identified sustainable rates, and the estimated seawater intrusion lines presented as MTs in the GSP are apparently based upon a chloride isoconcentration contour of 500 mg/L based upon data obtained in 2017 (five years ago). Activities proposed in the GSP in the next five years largely include additional data collection and inter-agency coordination. Both of these activities are important and necessary for informing decision-making and planning, but more immediate actions are required to prevent continued overdraft and seawater intrusion. **Collectively, the proposed projects, and implementation schedule, especially when coupled with the linkage to available funding, are insufficient to prevent further loss of freshwater in the basin due to seawater intrusion into the subbasin. The delay in project implementation will result in continued loss of the resource.**

- As described above, critical areas of uncertainty remain in the current process SVBGSA has employed in the GSP for evaluating water budgets and sustainable yield in regards to projects and management actions. Particularly: 1) groundwater model errors are significant (i.e., the discrepancy between simulated and analytical values of seawater intrusion rates/extents, pumping volumes, and overestimated overdraft), which resulted in the GSA making post hoc adjustments in the water budget components that yield internally inconsistent water budgets, and 2) the estimated benefits and impacts (i.e., changes annual inflows and/or outflows) due to project and management actions have not been evaluated in the context of a groundwater model, which precludes the ability to demonstrate how these projects address undesirable results and overdraft conditions. Moreover, these uncertainties and internal inconsistencies prevent robust evaluation of potential implications for the ability for neighboring subbasins to achieve their sustainability goals. **We reiterate the importance of the GSA's intent to continue to refine the groundwater model (as stated in Section 6.2) and its assessment of the efficacy of projects and management actions. As stated in GSP Section 9.9, "The amount of water needed to mitigate seawater intrusion depends on the approach taken". Therefore, the GSA needs to prioritize refining its highly conceptual projects in the GSP. The approach to seawater intrusion appears critical in determining the path of project implementation in this subbasin.**

- The GSP includes an implementation action to form a Water Quality Coordination Group (Table 9-1 and Section 9.7.4) – **See Section III, page 7 in the letter above for more extensive comments on our position on this issue.**

Recommended Corrective Actions from the DWR Determination Letter

- Of the five corrective actions recommended by DWR in its determination letter for the 2020 GSP, one (Recommended Corrective Action 5) is pertinent to the concerns described above, the GSA should "<u>coordinate with the appropriate groundwater users, including drinking water</u>, environmental, and irrigation users as identified in the Plan, <u>and water quality regulatory agencies and programs</u> in the Subbasin <u>to understand and develop a process for determining if groundwater management and extraction is resulting in degraded water quality in the Subbasin</u>." (Staff Report page 37 of 37; emphasis added). **We agree with DWR that it is important for the GSA to develop and incorporate a process for determining if degraded water quality is a result of groundwater management and extractions in the GSP, with input from beneficial users and regulatory agencies/programs.** For example, if the extraction hydraulic barrier project is implemented to address seawater intrusion, this action would be expected to cause "changes in groundwater elevation [which] could change groundwater gradients, which could cause poor quality groundwater to flow toward production and domestic wells that would not have otherwise been impacted" (Section 8.6.2.3).

Attachments

Figure 1 – Seawater Intrusion SMCs Relative to Domestic Wells, Public Supply Wells, DACs, and Community Water Systems

Figure 2 – 2021 Seawater Intrusion Extent in 180-ft Aquifer Relative to Domestic Wells and Small Water Systems

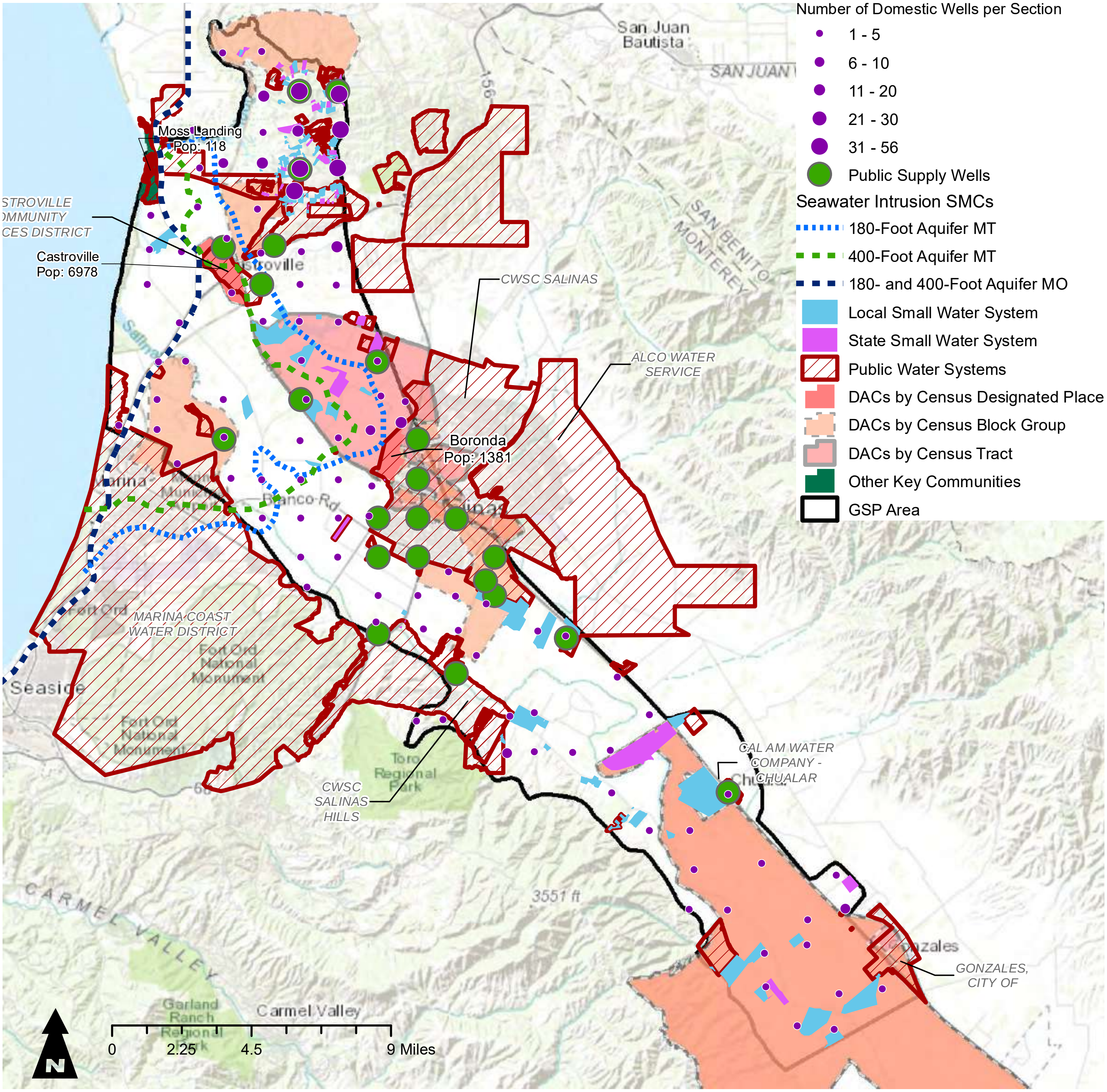
Figure 3 – Representative Monitoring Network for GW Levels Relative to Domestic Wells, Public Supply Wells, DACs, and Community Water System

Figure 4A – Estimated Water Level Decline at Minimum Thresholds in the 180-Foot Aquifer

Figure 4B – Estimated Water Level Decline at Minimum Thresholds in the 400-Foot Aquifer

Figure 1 - Seawater Intrusion SMCs Relative to Domestic Wells, Public Supply Wells, DACs, and Community Water Systems

Salinas Valley Basin GSA

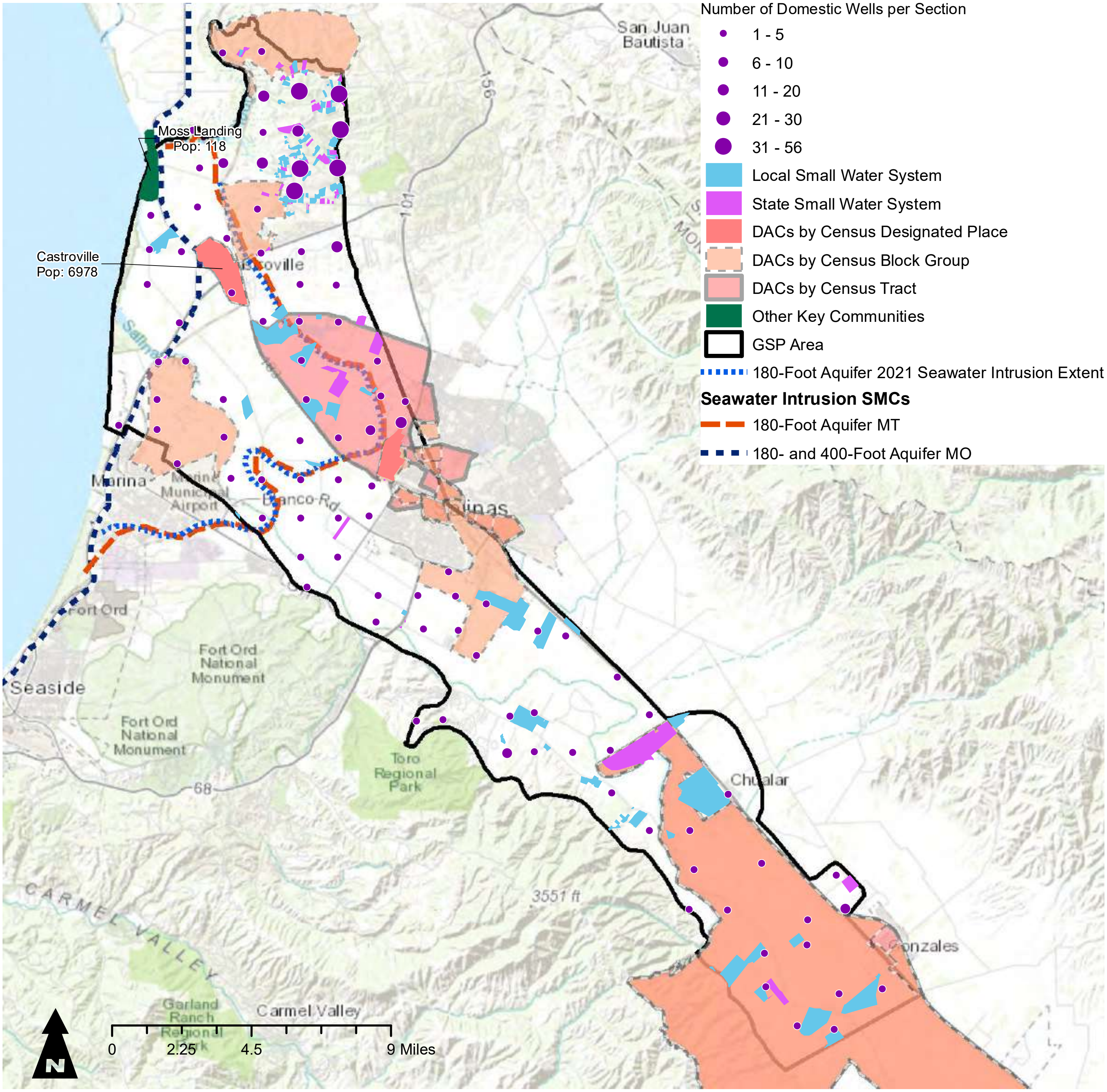


Notes
1. All locations are approximate.

References
1. Domestic Well Densities: Research to develop the CWC Vulnerability Tool draft as of August 6, 2019.
2. Public supply well data: DWR Well Completion Reports downloaded on August 30, 2018 from https://atlas-dwr.opendata.arcgis.com/datasets/.
3. Disadvantaged and other key community data (place, tract, and block group): downloaded on August 6, 2019 from the DAC Mapping Tool: https://gis.water.ca.gov/app/dacs/.
4. Public Water System data: downloaded on August 6, 2019 from Tracking California: https://trackingcalifornia.org/water/map-viewer. The dataset includes "community" and "non-community" water systems.
5. Seawater Intrusion MOs and MTs: Figure 8-2 and Section 8.7.3 of the 180/400-Foot Aquifer Subbasin GSP - Draft 2022 Update.
6. Small water system information is based on a shapefile constructed by Larry Harlan in 2013, updated in 2017 by Ostermeyer, and updated by Clare Pace in 2022.

Figure 2 - 2021 Seawater Intrusion Extent in 180-ft Aquifer Relative to Domestic Wells and Small Water Systems

Salinas Valley Basin GSA

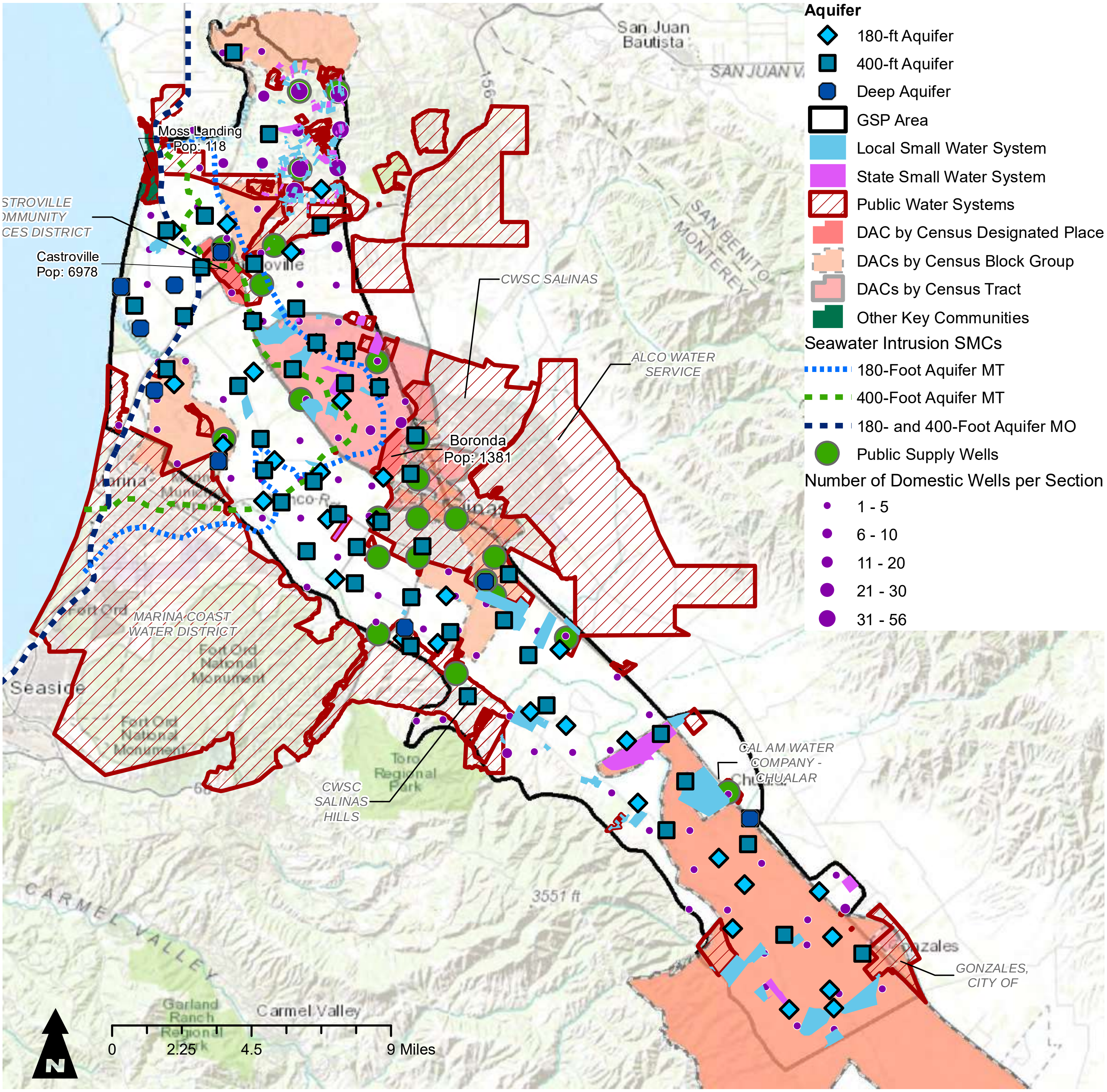


Notes
1. All locations are approximate.

References
1. Domestic Well Densities: Research to develop the CWC Vulnerability Tool draft as of August 6, 2019.
2. Public supply well data: DWR Well Completion Reports downloaded on August 30, 2018 from https://atlas-dwr.opendata.arcgis.com/datasets/.
3. Disadvantaged and other key community data (place, tract, and block group): downloaded on August 6, 2019 from the DAC Mapping Tool: https://gis.water.ca.gov/app/dacs/.
4. Small water system information is based on a shapefile constructed by Larry Harlan in 2013, updated in 2017 by Ostermeyer, and updated by Clare Pace in 2022.
5. Seawater Intrusion MOs and MTs: Figure 8-8 and Section 8.7.3 of the 180/400-Foot Aquifer Subbasin GSP - Draft 2022 Update.
6. 180-Foot Aquifer 2021 Seawater Intrusion Extent: Figure 5-25 of the 180/400-Foot Aquifer Subbasin GSP - Draft 2022 Update.

Figure 3 - Representative Monitoring Network for GW Levels Relative to Domestic Wells, Public Supply Wells, DACs, and Community Water Systems

Salinas Valley Basin GSA



Notes

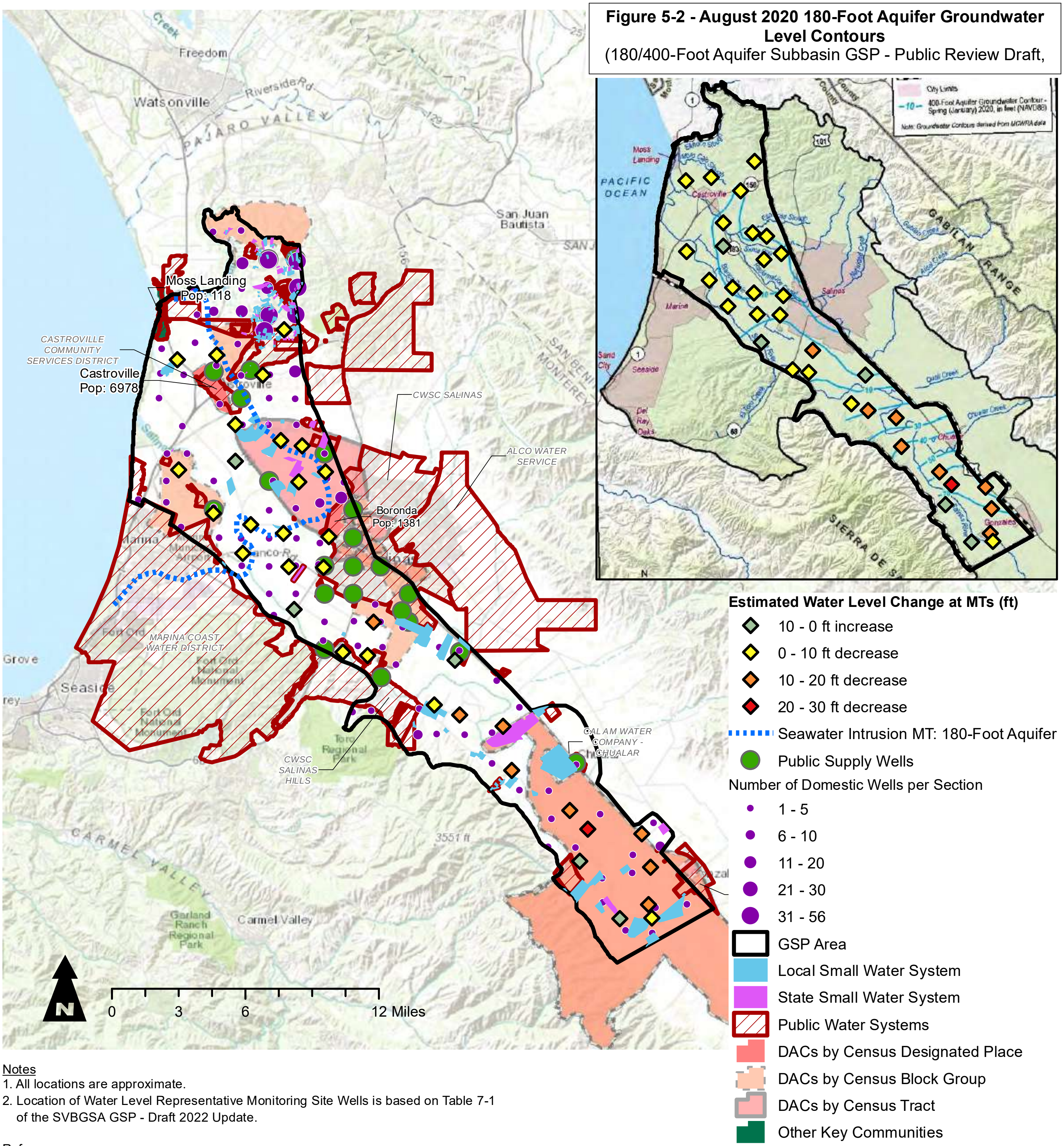
1. All locations are approximate.
2. Location of Water Level Representative Monitoring Site Wells is based on Table 7-1 of the SVBGSA GSP - Draft 2022 Update.

References

1. Domestic Well Densities: Research to develop the CWC Vulnerability Tool draft as of August 6, 2019.
2. Public supply well data: DWR Well Completion Reports downloaded on August 30, 2018 from https://atlas-dwr.opendata.arcgis.com/datasets/.
3. Disadvantaged and other key community data (place, tract, and block group): downloaded on August 6, 2019 from the DAC Mapping Tool: https://gis.water.ca.gov/app/dacs/.
4. Public Water System data: downloaded on August 6, 2019 from Tracking California: https://trackingcalifornia.org/water/map-viewer. The dataset includes "community" and "non-community" water systems.
5. Water Level RMW locations: Table 7-1 of the 180/400-Foot Aquifer Subbasin GSP - Draft 2022 Update.
6. Seawater Intrusion MOs and MTs: Figure 8-8, Figure 8-9, and Section 8.7.3 of the 180/400-Foot Aquifer Subbasin GSP - Draft 2022 Update.
7. Small water system information is based on a shapefile constructed by Larry Harlan in 2013, updated in 2017 by Ostermeyer, and updated by Clare Pace in 2022.

Figure 4A - Estimated Water Level Decline at Minimum Thresholds in the 180-Foot Aquifer

Salinas Valley Basin GSA

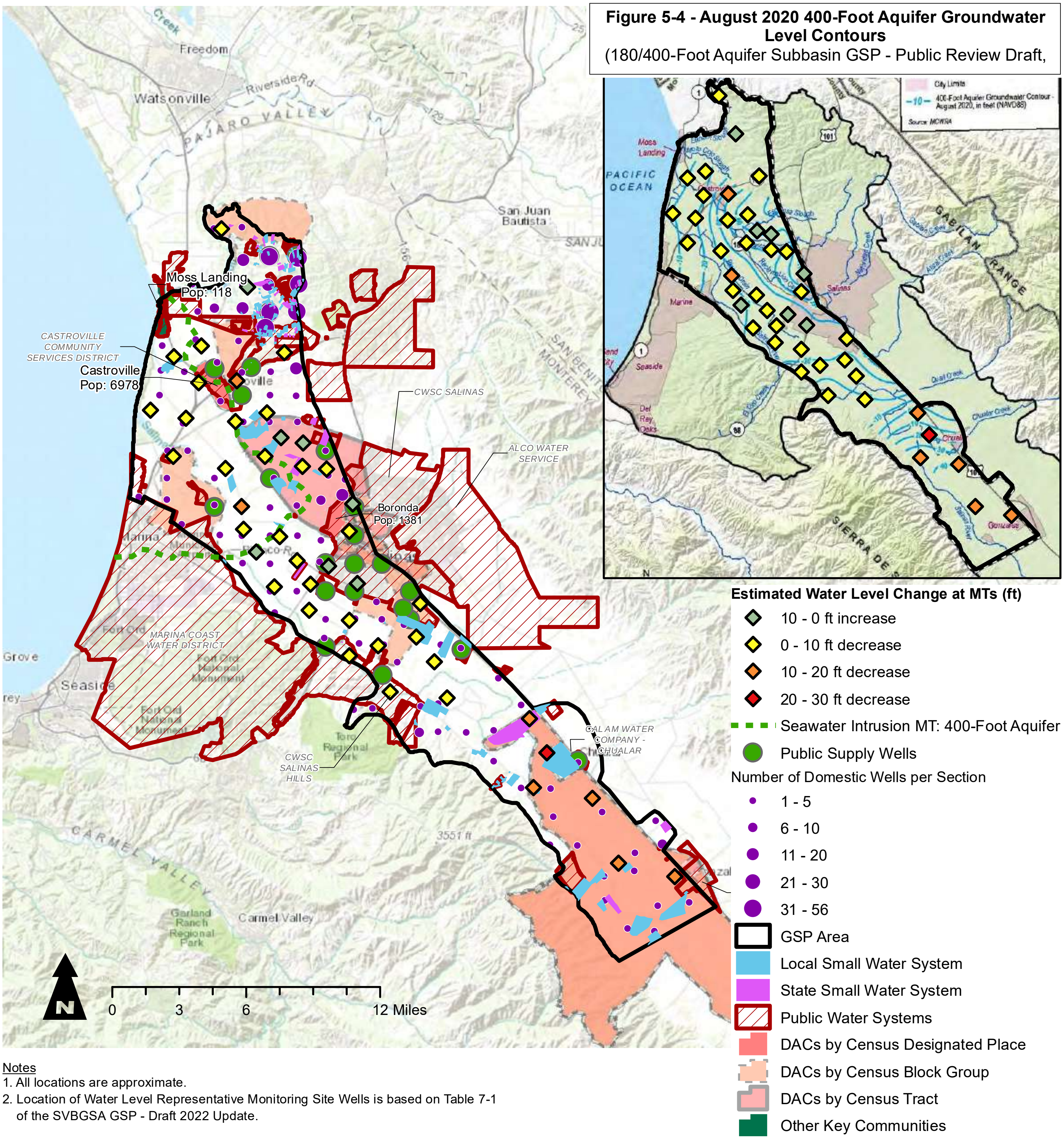


Notes
1. All locations are approximate.
2. Location of Water Level Representative Monitoring Site Wells is based on Table 7-1 of the SVBGSA GSP - Draft 2022 Update.

References
1. Domestic Well Densities: Research to develop the CWC Vulnerability Tool draft as of August 6, 2019.
2. Public supply well data: DWR Well Completion Reports downloaded on August 30, 2018 from https://atlas-dwr.opendata.arcgis.com/datasets/.
3. Disadvantaged and other key community data (place, tract, and block group): downloaded on August 6, 2019 from the DAC Mapping Tool: https://gis.water.ca.gov/app/dacs/.
4. Public Water System data: downloaded on August 6, 2019 from Tracking California: https://trackingcalifornia.org/water/map-viewer. The dataset includes "community" and "non-community" water systems.
5. Water Level RMW locations, MTs, and contour map: Table 7-1, Table 8-2, and Figure 5-2 of the 180/400-Foot Aquifer Subbasin GSP - Draft 2022 Update.
6. Seawater Intrusion MTs for the 180-Foot Aquifer: Figure 8-8 of the 180/400-Foot Aquifer Subbasin GSP - Draft 2022 Update.
7. Small water system information is based on a shapefile constructed by Larry Harlan in 2013, updated in 2017 by Ostermeyer, and updated by Clare Pace in 2022.

Figure 4B - Estimated Water Level Decline at Minimum Thresholds in the 400-Foot Aquifer

Salinas Valley Basin GSA



Notes

1. All locations are approximate.
2. Location of Water Level Representative Monitoring Site Wells is based on Table 7-1 of the SVBGSA GSP - Draft 2022 Update.

References

1. Domestic Well Densities: Research to develop the CWC Vulnerability Tool draft as of August 6, 2019.
2. Public supply well data: DWR Well Completion Reports downloaded on August 30, 2018 from https://atlas-dwr.opendata.arcgis.com/datasets/.
3. Disadvantaged and other key community data (place, tract, and block group): downloaded on August 6, 2019 from the DAC Mapping Tool: https://gis.water.ca.gov/app/dacs/.
4. Public Water System data: downloaded on August 6, 2019 from Tracking California: https://trackingcalifornia.org/water/map-viewer. The dataset includes "community" and "non-community" water systems.
5. Water Level RMW locations, MTs, and contour map: Table 7-1, Table 8-2, and Figure 5-4 of the 180/400-Foot Aquifer Subbasin GSP - Draft 2022 Update.
6. Seawater Intrusion MTs for the 400-Foot Aquifer: Figure 8-9 of the 180/400-Foot Aquifer Subbasin GSP - Draft 2022 Update.
7. Small water system information is based on a shapefile constructed by Larry Harlan in 2013, updated in 2017 by Ostermeyer, and updated by Clare Pace in 2022.

Brownstein Hyatt Farber Schreck, LLP
805.963.7000 main
1021 Anacapa Street, 2nd Floor
Santa Barbara, California 93101

May 13, 2022

Stephanie O. Hastings
Attorney at Law
805.882.1415 direct
shastings@bhfs.com

VIA E-MAIL – MEYERSD@SVBGSA.ORG; BOARD@SVBGSA.ORG; PRISO@MCWD.ORG; BRIGGSBP@CO.MONTEREY.CA.US; GSP-COMMENTS@CO.MONTEREY.CA.US

Donna Meyers
General Manager
Salinas Valley Basin Groundwater Sustainability Agency
P.O. Box 1350
Carmel Valley, CA 93924

Remleh Scherzinger
General Manager
c/o Paula Riso
Executive Assistant/Clerk to the Board
Marina Coast Water District Groundwater Sustainability Agency
11 Reservation Road
Marina, CA 93933-2099

Brian Briggs
Deputy County Counsel
County of Monterey Groundwater Sustainability Agency
169 W Alisal Street, 3rd Floor
Salinas, CA 93901

RE: Comments on the Draft Groundwater Sustainability Plan Update for the 180/400-Foot Aquifer Subbasin (3-004.01)

Dear Ms. Meyers, Mr. Scherzinger and Mr. Briggs:

This office represents the Salinas Basin Water Alliance (Alliance). The Alliance is a California nonprofit mutual benefit corporation formed to preserve the viability of agriculture and the agricultural community in the greater Salinas Valley. Alliance members include agricultural businesses and families that own and farm more than 80,000 acres within the Salinas Valley. The Alliance appreciates the opportunity to provide comments to the Salinas Valley Basin Groundwater Sustainability Agency (SVBGSA), the Marina Coast Water District Groundwater Sustainability Agency (MCWDGSA), and the County of Monterey Groundwater Sustainability Agency on the Groundwater Sustainability Plan (GSP)

Update (GSP Update) for the 180/400-Foot Aquifer Subbasin of the Salinas Valley Groundwater Basin (Basin).

During the preparation of the GSPs for the Upper Valley, Forebay, Eastside, Langley, and Monterey Subbasins, the Alliance submitted numerous comments to SVBGSA, MCWDGSA, and the Arroyo Seco GSA, which, among other things, highlight how the GSPs failed to analyze and consider the flow of groundwater among and between the Subbasins (i.e., interbasin flows) and how pumping and management in each Subbasin impacts those flows. This analysis and understanding is necessary to achieve sustainable management of the Basin's groundwater resources and to fairly allocate the burdens of management throughout the Basin. Despite the Alliance's comments, the GSAs failed to address this issue in the final, adopted GSPs and, as such, the Alliance submitted a comment letter to the California Department of Water Resources (DWR) on April 15, 2022 reiterating these concerns.

The Alliance requests that the Alliance comment letters highlighting these issues be included in the administrative record for the GSP Update, including the following letters: August 11, 2021 aquilogic, Inc. Technical Memorandum; August 12, 2021 Brownstein Comment Letter; October 15, 2021 aquilogic, Inc. Technical Memorandum; October 15, 2021 Brownstein Comment Letter; December 8, 2021 aquilogic, Inc. Technical Memorandum; December 8, 2021 Brownstein Comment Letter; March 9, 2022 Brownstein Comment Letter; and, April 15, 2022 Brownstein Comment Letter to DWR.

These comments continue to be relevant to the GSP Update because the SVBGSA still has not conducted an analysis of interbasin flows in the Basin and how pumping and management in each Subbasin impacts these flows. Until such time, the 180/400-Foot Aquifer Subbasin GSP should not be updated as the GSPs cannot propose integrated, equitable management of the Basin absent this information. Accordingly, the Alliance requests that the GSAs conduct this analysis of interbasin flows and update each of the GSPs once that analysis is complete.

If you have any questions, please do not hesitate to contact me by phone at (805) 882-1415 or via email at shastings@bhfs.com.

Respectfully submitted,

Stephanie Osler Hastings

Brownstein Hyatt
Farber Schreck

Stephanie O. Hastings
Attorney at Law
805.882.1415 tel
shastings@bhfs.com

August 12, 2021

VIA E-MAIL – BOARD@SVBGSA.ORG

Board of Directors
Salinas Valley Basin Groundwater Sustainability Agency
P.O. Box 1350
Carmel Valley, CA 93924

RE: Preliminary Comment on Draft GSPs for the Eastside, Forebay, Langley, Monterey and Upper Valley Subbasins of the Salinas Valley Basin

Dear Chair Pereira and Members of the Board of Directors:

This office represents the Salinas Basin Water Alliance ("Alliance"), a California nonprofit mutual benefit corporation formed to preserve the viability of agriculture and the agricultural community in the greater Salinas Valley. Alliance members include agricultural businesses and families that own and farm more than 80,000 acres within the Salinas Valley. Many Alliance members have been farming in the Salinas Valley for generations. As such, the Alliance has a significant interest in the long-term sustainability of the Salinas Valley Basin.

The Alliance greatly appreciates the difficult work this Board, together with the Salinas Valley Basin Groundwater Sustainability Agency (GSA) staff and consultant team, has undertaken to implement the Sustainable Groundwater Management Act (SGMA) in Monterey County, including the time-consuming but extremely beneficial engagement with all stakeholders. The Alliance applauds the Salinas Valley Basin GSA's recent success in obtaining approval of the Department of Water Resources (DWR) for the first groundwater sustainability plan (GSP) required to be prepared for the six Salinas Valley Subbasins within the jurisdiction of the Salinas Valley Basin GSA. Further, the Alliance acknowledges and wholeheartedly supports the Board's commitment to coordinate and implement all of the GSPs for the Salinas Valley Basin within its jurisdiction in an integrated manner pursuant to the proposed Integrated Sustainability Plan, or as it may otherwise be titled.[1] It is with this objective—integrated groundwater management—in mind that the

[1] See Joint Exercise of Powers Agreement Establishing the Salinas Valley Basin GSA § 2.2 ("The purpose of Agency is to . . . develop[], adopt[], and implement[] a GSP that achieves groundwater sustainability in the Basin."); § 4.1(c) (The JPA has the power to "develop, adopt and implement a GSP for the Basin.); § 4.1(l) (The JPA has the power to "establish and administer projects and programs for the benefit of the Basin."); Salinas Valley Groundwater Basin 180/400 Foot Aquifer Subbasin Groundwater Sustainability Plan [180/400 GSP] at 9-10 ("This GSP is part of an integrated plan for managing groundwater in all six subbasins of the Salinas Valley Groundwater Basin that are managed by the SVBGSA. The projects and management actions described in this GSP constitute an integrated management program for the entire Valley."); 180/400 GSP at 10-14 ("The SVBGSA oversees all or part of six subbasins in the Salinas Valley Groundwater Basin. Implementing the 180/400-Foot Aquifer Subbasin GSP must be integrated with the implementation of the five other GSPs in the Salinas Valley Groundwater Basin . . . The implementation

Alliance offers these preliminary comments on the draft GSPs for the Eastside, Forebay, Langley, Monterey and Upper Valley Subbasins.[2]

As this Board well knows, SGMA not only requires the Salinas Valley Basin GSA to develop a GSP for each priority subbasin within its jurisdiction to ensure the long-term sustainability of those subbasins, but it also mandates that the GSA consider the impacts each GSP may have on the ability of adjacent subbasins to achieve their sustainability goal.[3] In enacting SGMA, the legislature intended to provide for the sustainable management of all groundwater basins and expressly provided for the coordination of management between and among basins.[4] Any GSP that interferes with an adjacent basin's sustainability goal cannot satisfy SGMA.[5] Moreover, in the event the GSPs for the subbasins disproportionately allocate the burden of sustainability across the Salinas Valley Basin, they could impair groundwater users' rights in and to the Salinas Valley Basin in violation of SGMA and common law water rights.[6]

The Alliance's preliminary review of the draft GSPs suggests that there are significant data gaps and uncertainty with respect to the quantification of flows between subbasins within the Salinas Valley Basin that should be addressed.[7] Specifically, the Alliance is concerned that the existing water budget analyses in the draft GSPs may not provide a complete picture of the downgradient impacts caused by groundwater pumping. Accordingly, the Alliance requests that the Salinas Valley Basin GSA conduct additional simulations with the Salinas Valley Integrated Hydrologic Model (SVIHM) that are specifically focused on the issue of inter-subbasin groundwater flows, as more specifically described in aquilogic's August 11, 2021 memorandum attached to this letter. In light of the fact that the Integrated Sustainability Plan appears to have been delayed until after completion of the subbasin GSPs, the requested additional simulations should be conducted prior to the Salinas Valley Basin GSA's adoption of the subbasin GSPs.

The requested additional model simulations are consistent with and support SGMA's and DWR's requirements that all GSPs be based on the best available science.[8] They will enable an understanding of

---

schedule reflects the significant integration and coordination needed to implement all six GSPs in a unified manner."); see also Salinas Valley Groundwater Basin Draft Upper Valley Aquifer Subbasin Groundwater Sustainability Plan at 10-16; Salinas Valley Groundwater Basin Draft Eastside Aquifer Subbasin Groundwater Sustainability Plan at 9-1, 10-7, 10-8, 10-16; Salinas Valley Groundwater Basin Draft Forebay Aquifer Subbasin Groundwater Sustainability Plan at 2-4, 9-2, 9-4, 10-7, 10-9, 10-17; Salinas Valley Groundwater Basin Draft Langley Aquifer Subbasin Groundwater Sustainability Plan at 2-4, 9-1, 9-4, 10-8, 10-9, 10-16.

[2] Following publication of the final draft GSPs for these subbasins, the Alliance may have additional comments.

[3] Wat. Code § 10733(c).

[4] Wat. Code §§ 10720.1(a); 10727; 10727.6

[5] See Wat. Code § 10733(c); 23 Cal. Code Regs. §§ 350.4, 351(h), 354.8(d), 354.18(b)(3), (c)(2)(B), (e), 354.28(b)(3), 354.44(a)(6), (c), 355.4(b)(7), 356.4(j), 357.2(b)(3); DWR, Monitoring Networks and Identification of Data Gaps BMP at pp. 6, 8, 27; DWR, Water Budget BMP at pp. 7, 12, 16, 17, 36; DWR, Modeling BMP at pp. 21-22; DWR, Sustainable Management Criteria BMP at pp. 9, 31.

[6] Wat. Code 10720.1(b) (declaring legislature's intention to preserve the security of water rights in the state to the greatest extent possible consistent with the sustainable management of groundwater); see also Water Code §§ 10720.5(b).

[7] 23 Cal. Code Regs. § 351.

[8] See 23 CCR § 354.18 ("A quantitative assessment of the historical water budget, starting with the most recently available information and extending back a minimum of 10 years, ***or as is sufficient to calibrate and reduce the uncertainty of the tools and methods used*** to estimate and project future water budget information and future aquifer response to proposed sustainable groundwater management practices over the planning and implementation horizon." (emphasis added).)

the amount of Basin-wide groundwater discharge that is and has been captured by pumping, which, depending on the results, may require modification of each subbasin's proposed water budget. In the absence of this analysis, there is a significant level of uncertainty in the water budgets that has the potential to undermine the adequacy of the GSPs and also to impair the Salinas Valley Basin GSA's ability to achieve its sustainability goal in each subbasin and throughout the Salinas Valley Basin within its jurisdiction.[9]

The Alliance has endeavored to make this comment and request at the earliest opportunity to allow the Salinas Valley Basin GSA sufficient time to conduct the additional SVIHM simulations. The Alliance does not wish to delay the successful completion and adoption of the subbasin GSPs. Rather, the Alliance anticipates that the additional simulations can feasibly be accomplished and incorporated into the draft GSPs consistent with the Salinas Valley Basin GSA's goal of adopting the subbasin GSPs in accordance with SGMA's deadlines.

The Alliance appreciates the Board's careful consideration of this issue and urges the Board to direct the Salinas Valley Basin GSA staff and consultant team to undertake the requested further analyses and incorporate the results into the draft GSP for each of the subbasins. The Alliance strongly believes that removing existing uncertainties with respect to inter-subbasin flows is a critical component to ensuring both transparency in the GSP development process and equity in the resulting plans, both of which are essential to promoting healthy Basin-wide dialogue and collaboration in obtaining sustainable groundwater management of the Salinas Valley Basin within the Salinas Valley Basin GSA's jurisdiction.

As the Board may direct, the Alliance would welcome the opportunity to discuss the requested additional consideration of inter-subbasin flows in more detail with the Salinas Valley Basin GSA's staff and consultant team.

Respectfully submitted,

Stephanie Osler Hastings

Attachment: August 11, 2021 aquilogic, inc. memorandum

cc: Donna Meyers, Senior Consultant / General Manager (meyersd@svbgsa.org)
Emily Gardner, Senior Advisor / Deputy General Manager (gardnere@svbgsa.org)
Derrik Williams, Montgomery & Assoc. (dwilliams@elmontgomery.com)
Leslie Girard, Monterey County Counsel (GirardLJ@co.monterey.ca.us)

[9] DWR's June 3, 2021 determination that it does not appear that the GSP for the 180-400 Aquifer Subbasin will adversely affect the ability of an adjacent basin to implement its GSP or impede achievement of sustainability goals in an adjacent basin does not mean that the Salinas Valley GSA should assume that DWR will reach the same conclusion with respect to the remaining subbasin GSPs.

aquilogic, Inc.
environment ● water ● strategy

245 Fischer Avenue, Suite D-2
Costa Mesa, CA 92626
Tel. +1.714.770.8040
Web: www.aquilogic.com

August 11, 2021

MEMORANDUM

To: Stephanie Hastings, Brownstein Hyatt Farber Schreck (BHFS)
Sent via email: SHastings@bhfs.com
From: Robert H. Abrams, PhD, PG, CHg, Principal Hydrogeologist, aquilogic, Inc.
Anthony Brown, CEO & Principal Hydrologist, aquilogic, Inc.

Subject: Assessment of Groundwater Flows between Subbasins of the Salinas Valley Groundwater Basin (SVGB)
Project No.: 018-09

Aquilogic, Inc. (**aquilogic**) is pleased to provide this memorandum on behalf of our mutual client, the Salinas Basin Water Alliance (SBWA), outlining the justification and necessity for conducting additional simulations with the Salinas Valley Integrated Hydrologic Model (SVIHM),[1] which is being used by the Salinas Valley Basin Groundwater Sustainability Agency (SVBGSA) for groundwater sustainability plan (GSP) development.

Aquilogic hypothesizes that pumping has captured significant portions of groundwater discharge that would otherwise migrate as underflow from the Upper Valley Subbasin to the Forebay Subbasin, from the Forebay Subbasin to the 180/400-Ft Aquifer Subbasin and East Side Subbasin, and potentially from the 180/400-Ft Aquifer Subbasin to the Monterey Subbasin and the Salinas River. Our primary concern is that the existing water budget analyses in at least three of the SVBGSA's draft GSPs may not provide a complete picture of the downgradient impacts caused by groundwater pumping.[2]

It should be noted that groundwater sustainability was a pertinent issue for water managers long before the advent of California's Sustainable Groundwater Management Act. There is

---

[1] The SVIHM is a provisional, unpublished model not currently available to the general public.
[2] Bredehoeft, J.D., Papadopulos, S.S., and Cooper, H.H. Jr. (1982). The water budget myth. *In* Scientific Basis of Water Resource Management, Studies in Geophysics, 51-57. Washington, D.C. National Academy Press;
Bredehoeft, J.D. (1997). Safe yield and the water budget myth. Ground Water, Vol. 35, No. 6, p. 929;
Bredehoeft, J.D. (2002). The water budget myth revisited: why hydrogeologists model. Ground Water, Vol. 40, No. 4, p. 340-345;
Bredehoeft, J.D. and Durbin, T. (2009). Groundwater development: the time to full capture problem. Ground Water, Vol. 47, No. 4, p. 506-514;
Bredehoeft, J.D. (2011). Monitoring regional groundwater extraction: the problem. Ground Water, Vol. 49, No. 6, p. 808-814.

ample support in the groundwater literature for considering multiple aspects of sustainability and undesirable results, including economic and social impacts and the contravention of water rights.[3]

ADDITIONAL SIMULATIONS

As stated in "SVIHM Frequently Asked Questions,"[4] one of the many questions that can be addressed by a model is: How much groundwater flows between subareas? Clearly, the SVIHM developers recognized the importance of this question and anticipated that it would be asked. On behalf of the SBWA, **aquilogic** requests that the SVBGSA utilize the SVIHM to conduct additional simulations that are specifically focused on the issue of inter-subbasin groundwater flows. The requested simulations will enable an improved understanding of the amount of Valley-wide groundwater discharge that is and has been captured by pumping, which may be needed to ensure the adequacy of the GSPs for each of the subbasins and important to their implementation.

Aquilogic recommends a type of "superposition" analysis, in which the results of two simulations are compared. In such an analysis, the two simulations are identical except for the process under examination, in this case groundwater pumping. Pumping would be selectively turned off in one simulation and left as currently configured in the SVIHM in the other simulation. A similar superposition analysis was done to assess pumping-induced streamflow depletion, as described in Chapter 5 of the GSPs for the Forebay Subbasin and the East Side Subbasin.

The inter-subbasin flows would then be compared, which would semi-quantitatively estimate the impact of pumping, within the limiting assumptions and uncertainties associated with the SVIHM. Ideally, the analysis should be conducted with the initial conditions of the no-pumping scenario representing a "full" SVGB. The analysis would provide an estimate of the impact of pumping on inter-subbasin groundwater flows.

Specifically, using the calibrated SVIHM historical model, **aquilogic** recommends the following outline for conducting simulations, the details of which would be worked out in consultation with the SVBGSA:

1. Develop reasonable initial conditions for the hydraulic head distribution for the no-pumping simulation. This entails turning off all pumping in the model domain while

---

[3] Todd, D.K. (1959). Groundwater Hydrology. Wiley, New York, 336 p.;
Domenico, P. (1972). Concepts and Models in Groundwater Hydrology. McGraw-Hill, New York, 405 p.;
Freeze, R.A. and Cherry, J.A. (1979). Groundwater. Prentice-Hall, 604 p.;
Alley, W.M., Reilly, T.E., and Franke, O.L. (1999). Sustainability of ground-water resources. U.S. Geological Survey Circular 1186, 79 p.

[4] https://www.co.monterey.ca.us/home/showdocument?id=31292

leaving all other inflows and outflows unchanged. Because the time for simulated water levels to recover may be longer than the SVIHM simulation period of 51 years (1967-2018), the simulation may have to be run multiple times before an average steady-state condition can be achieved. In this case, the hydraulic head distribution at the last time step of the previous simulation would be used as the initial condition of the subsequent simulation. This process would be repeated until the hydraulic head distribution at the last time step of a subsequent simulation is substantially identical to the last time step of the previous simulation. This would indicate that an average steady-state condition is being simulated. We assume here that the surface water inflows and reservoir releases for the 1967-2018 period would be sufficient to eventually "refill" the SVGB after several model runs.

2. When the average, no-pumping steady-state condition has been achieved with the modified SVIHM, simulated groundwater flow should occur from the East Side Subbasin to the 180/400-Ft Subbasin, and from the 180/400-Ft Subbasin to Monterey Bay, conditions that are now reversed.

3. From the final results of the no-pumping simulation, in which average steady-state conditions have been achieved, compute the inter-subbasin groundwater flows between each adjoining subbasin. Compare these flows with the inter-subbasin flows from the historical, unmodified SVIHM. The differences in inter-subbasin flows and induced recharge from the surface water system represent a semi-quantitative estimate of the impact of Valley-wide pumping.

4. Additional superposition analyses can be conducted to assess the impact of one subbasin's pumping on basin-wide groundwater levels and inter-subbasin groundwater flows, by turning on pumping in one subbasin at a time in the modified SVIHM (and leaving pumping turned off in all other subbasins) and comparing the results to the scenario with no pumping throughout the SVGB. The differences in inter-subbasin flows and groundwater levels represent a semi-quantitative estimate of the impact of one subbasin's pumping on the other subbasins.

Friday, October 15, 2021

Salinas Valley Basin Groundwater Sustainability Agency SVBGSA Public Comments Form

Name	Stephanie Hastings
Organization	Brownstein Hyatt Farber Schreck, LLP
Email Address	SHastings@bhfs.com
Subbasin	Langley · Eastside · Forebay · Upper Valley · Monterey · Whole Basin
Comments	Please see the attached correspondence submitted on behalf of the Salinas Basin Water Alliance. The exhibits are available on our sharefile at: https://bhfs.sharefile.com/d-scb50238ba04e4b4294bdf73ac89d25ee
File Upload	pdf 2021.10.15 Comment Letter to SVBGSA re Dr...

Stephanie O. Hastings
Attorney at Law
805.882.1415 tel
shastings@bhfs.com

October 15, 2021

VIA E-MAIL – MEYERSD@SVBGSA.ORG; BOARD@SVBGSA.ORG; PRISO@MCWD.ORG; CITYCLERK@CI.GREENFIELD.CA.US

Donna Meyers
General Manager
Salinas Valley Basin Groundwater Sustainability Agency
P.O. Box 1350
Carmel Valley, CA 93924

Remleh Scherzinger
General Manager
c/o Paula Riso
Executive Assistant/Clerk to the Board
Marina Coast Water District Groundwater Sustainability Agency
11 Reservation Road
Marina, CA 93933-2099

Curtis Weeks
General Manager
c/o City Clerk
Arroyo Seco Groundwater Sustainability Agency
599 El Camino Real
Greenfield, CA 93927

RE: Draft Groundwater Sustainability Plans for the Upper Valley, Forebay, Eastside, Langley, and Monterey Subbasins of the Salinas Valley Groundwater Basin

Dear Ms. Meyers, Mr. Scherzinger, and Mr. Weeks:

This office represents the Salinas Basin Water Alliance (*Alliance*), a California nonprofit mutual benefit corporation formed to preserve the viability of agriculture and the agricultural community in the greater Salinas Valley. *Alliance* members include agricultural businesses and families that own and farm more than 80,000 acres within the Salinas Valley. Many *Alliance* members have been farming in the Salinas Valley for generations. As such, the *Alliance* has a significant interest in the long-term sustainability of the water supplies in the Salinas Valley. As mentioned in our preliminary comment letter on the draft Groundwater Sustainability Plans (GSP) for the Upper Valley, Forebay, Eastside, Langley, and Monterey Subbasins dated August 12, 2021, the *Alliance* greatly appreciates the Salinas Valley Basin Groundwater Sustainability

Agency (SVBGSA) staff and consultant team's efforts to implement the Sustainable Groundwater Management Act (SGMA) in the Salinas Valley Groundwater Basin (Basin) and in each of the six subbasins within the jurisdiction of the SVBGSA. The *Alliance* likewise appreciates the efforts undertaken by the Marina Coast Water District Groundwater Sustainability Agency (MCWDGSA) and the Arroyo Seco Groundwater Sustainability Agency (ASGSA) to implement SGMA in the Monterey and Forebay Subbasins, respectively.

The *Alliance* offers these comments, as well as the comments of aquilogic, Inc. attached hereto as **Exhibit A**, on the draft GSPs for the Upper Valley, Forebay, Eastside, Langley, and Monterey Subbasins.[1] These comments are submitted to the SVBGSA as the exclusive groundwater sustainability agency for the Upper, Eastside, and Langley Subbasins, and one of the groundwater sustainability agencies that will adopt the GSPs for the Forebay and Monterey Subbasins. These comments are also submitted to the MCWDGSA and the ASGSA as groundwater sustainability agencies that will adopt the GSPs for the Monterey Subbasin and Forebay Subbasin, respectively. Please include this letter, the aquilogic, Inc. memorandum ("aquilogic Memo"), and the other attachments hereto in the record of proceedings for the GSP of each of these subbasins.

I. <u>THE DRAFT GSPS MUST BE INTEGRATED TO SATISFY SGMA</u>

SGMA's goal is to provide for the sustainable management of priority groundwater basins throughout the State.[2] "Sustainable management" is defined as the "management and use of groundwater in a manner that can be maintained during the planning and implementation horizon without causing undesirable results"—e.g., chronic lowering of groundwater levels, significant and unreasonable reduction of groundwater storage, significant and unreasonable seawater intrusion, and depletions of interconnected surface water that have significant and unreasonable adverse impacts on beneficial uses of the surface water.[3] In order to achieve this goal, groundwater sustainability agencies must coordinate groundwater management within each basin[4] and with each adjacent basin.[5]

Coordination requires GSPs to maintain consistency or analyze inconsistencies in the data and modeling used to develop the GSPs, the minimum thresholds and measurable objectives set in the GSPs, and the

---

[1] The *Alliance* notes that several of the draft GSPs are being revised by the GSA during the public review process. An additional public comment period must be provided once the draft GSPs have been finalized for adoption. Informed public input cannot be provided on documents that are still subject to change.
[2] Wat. Code, § 10720.1.
[3] Wat. Code, § 10721(v), (x).
[4] SGMA defines "basin" as "a groundwater basin or subbasin identified and defined in Bulletin 118." (Wat. Code, § 10721(b); see also 23 Code Regs. ("GSP Regs."), § 341(g) ["The term 'basin' shall refer to an area specifically defined as a basin or 'groundwater basin' in Bulletin 118, and shall refer generally to an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom, as further defined or characterized in Bulletin 118"; "The term 'subbasin' shall refer to an area specifically defined as a subbasin or 'groundwater subbasin' in Bulletin 118, and shall refer generally to any subdivision of a basin based on geologic and hydrologic barriers or institutional boundaries, as further described or defined in Bulletin 118."].)
[5] Wat. Code, §§ 10727, 10727.6.

projects and management actions proposed in the GSPs.[6] DWR will review each GSP to ensure it satisfies this requirement—i.e., that the GSP does not adversely affect the "ability of an adjacent basin to implement their groundwater sustainability plan or impedes achievement of sustainability goals in an adjacent basin."[7] Any GSP that cannot meet this standard will not satisfy SGMA.[8]

The consultant that prepared the draft GSPs for the Upper, Forebay, Eastside, and Langley Subbasins has acknowledged the importance of integrated management of surface water and groundwater throughout the Basin:

> It has long been acknowledged that the water resources of the Salinas Valley consist of an integrated surface water and groundwater system . . . This acknowledged surface water/groundwater integration underpins the approach the SVBGSA is taking to achieving groundwater sustainability throughout the Valley; the Salinas River is an integral part of groundwater management and managing groundwater cannot be divorced from the Salinas River's operations. Similarly, groundwater management plays an important role in maintaining Salinas River flows. Larger areas of low groundwater levels in the Salinas Valley will induce more leakage from the Salinas River – reducing Salinas River flows. Maintaining adequately high groundwater levels will help maintain Salinas River flows. These higher groundwater levels that help maintain Salinas River flows is one of the desired outcomes of our groundwater management and is a benefit to surface water users. Groundwater sustainability can lead to long-term reliability in surface water supplies . . .
>
> The Salinas River operations, Salinas River flows, and ability to use water from the River will be clearly influenced by the decisions made during GSP development and implementation. Balanced groundwater management that

---

[6] See e.g., Wat. Code, § 10727.6; GSP Regs., § 354.28(b) ("The description of minimum thresholds shall include the following: . . . (3) How minimum thresholds have been selected to avoid causing undesirable results in adjacent basins or affecting the ability of adjacent basins to achieve sustainability goals."); see also *id.* at §§ 350.4(b), 354.28(b), 354.34(i), 354.38(e), 354.44(b)(6)-(7), 357.2; Department of Water Resources (DWR) Sustainable Management Criteria BMP, pp. 12-17 (Considerations when establishing minimum thresholds for each sustainability indicator includes the adjacent basin's minimum thresholds); DWR Modeling BMP, pp. 21-22; DWR Water Budget BMP, pp. 12, 16, 17, 36.
[7] Wat. Code, § 10733(c).
[8] *Ibid.*; GSP Regs., §§ 350.4, 354.8(d), 354.14, 354.18, 354.28(b)(3), 354.44(b)(6), 354.44(c), 355.4(b), 356.4(j), 357.2(b)(3); DWR Monitoring Networks and Identification of Data Gaps BMP, pp. 6, 8, 27; DWR Water Budget BMP, pp. 7, 12, 16, 17, 36; DWR Modeling BMP, pp. 21-22; DWR Sustainable Management Criteria BMP, pp. 9, 31.

> maintains consistent groundwater levels will provide surface water reliability for the Valley's surface water users.[9]

A Senior Hydrologist with the Monterey County Water Resources Agency (MCWRA) similarly commented:

> Additionally, as was experienced and monitored throughout the Basin during the most recent drought period, lowering of the groundwater table has a significant impact on the Agency's ability to operate the reservoirs to a controlled range of flows at the Salinas River Diversion Facility. As such, overdraft of the groundwater basin, resulting in a reduction in groundwater levels significantly impacted surface water flows, depleting the availability of surface water to riparian water uses.[10]

Close coordination of the draft GSPs for the subbasins is critical as each of the GSPs acknowledge a significant hydrologic and hydraulic connection with adjacent subbasins.[11] In other words, groundwater management in the Upper Valley impacts groundwater management in the Forebay Subbasin, which impacts groundwater management in the 180/400-Foot Aquifer, Eastside, Langley, and Monterey Subbasins, and there is a direct link between groundwater in the Basin and surface water in the Salinas River.

Given the integration of the Basin's surface and groundwater supplies (e.g., that pumping in one subbasin impacts surface and subsurface flows to an adjacent subbasin), SGMA mandates the coordination and integration of the GSPs for the subbasins within SVBGSA's jurisdiction—the GSPs must be integrated in their planning, development, and implementation to ensure the objectives of SGMA are satisfied, the interests of all beneficial users throughout the Basin are considered, and the burden of sustainability is equitably allocated across the Basin.[12] Indeed, the SVBGSA has acknowledged this obligation in its Joint Exercise of Powers Agreement[13] and, as the groundwater sustainability agency for the 180/400-Foot Aquifer, Monterey,

---

[9] Feb. 26, 2019 Letter from Derrik Williams to Leslie Girard, attached hereto as **Exhibit B**.

[10] March 4, 2019 Memorandum from Howard Franklin to Leslie Girard and Gary Petersen, attached hereto as **Exhibit C**.

[11] Draft Upper Valley Subbasin GSP, § 4.3.1.1; Draft Forebay Subbasin GSP, § 4.3.1.1; Draft Eastside Subbasin GSP, § 4.3.1.1; Draft Langley Subbasin GSP, § 4.3.1.1; Draft Monterey Subbasin GSP, § 4.2.3; aquilogic Memo, pp. 2-3, attached hereto as **Exhibit A**.

[12] Wat. Code, § 10723.2; see also DWR Water Budget BMP, pp. 16-17 ("For many basins within the . . . Salinas Valley . . . not all lateral boundaries for contiguous basins serve as a barrier to groundwater or surface water flow . . . In situations where a basin is adjacent or contiguous to one or more additional basins, or when a stream or river serves as the lateral boundary between two basins, it is necessary to coordinate and share water budget data and assumptions. This is to ensure compatible sustainability goals and accounting of groundwater flows across basins, as described in § 357.2 (Interbasin Agreements) of the GSP Regulations."

[13] See Joint Exercise of Powers Agreement Establishing the Salinas Valley Basin GSA, § 2.2 ("The purpose of Agency is to . . . develop[], adopt[], and implement[] a GSP that achieves groundwater sustainability in the Basin."); § 4.1(c) (The JPA has the power to "develop, adopt and implement a GSP for the Basin."); *id.* at § 4.1(l) (The JPA has the power to "establish and administer projects and programs for the benefit of the Basin."); *id.* at § 4.3 ("As set forth in Water Code section 10723.3, the GSA shall consider the interests of all beneficial uses and users of groundwater in the Basin, as well as those responsible for implementing the

Eastside, Langley, Forebay, and Upper Subbasins, the SVBGSA is uniquely qualified to ensure coordination and integration among these subbasins. The SVBGSA previously proposed an integrated GSP that would incorporate the GSPs for each of the six subbasins, but appears to have abandoned or significantly delayed that commitment. As a result, the draft GSPs do not adequately coordinate and integrate their data, minimum thresholds and measurable objectives, and projects and management actions and do not analyze potential impacts on the adjacent subbasins. The draft GSPs must analyze and address these issues before they can be adopted, or delineate a plan for adding this information to the GSPs as soon as possible.

II. THE DRAFT GSPs DO NOT SUFFICIENTLY ANALYZE AND ADDRESS SUSTAINABLE GROUNDWATER MANAGEMENT THROUGHOUT THE BASIN

The *Alliance* supports integrated groundwater management throughout the Basin—such management is critical to the sustainable and equitable management of the integrated water resources throughout the Basin. In accordance with SGMA, this management should utilize consistent data and modeling, analyze impacts of groundwater production on adjacent subbasins, estimate sustainable yields and set minimum thresholds in consideration of impacts to adjacent subbasins, and coordinate projects and management actions throughout the Basin. As described further below, the draft GSPs as currently presented do not meet these thresholds dictated by SGMA.

A. Each Draft GSP Fails to Analyze Inconsistencies in the Data and Modeling Utilized By the Draft GSPs for Adjacent Subbasins

As an initial matter, the draft GSPs for the subbasins utilize differing modeling/estimation techniques that produce inconsistent data throughout the Basin and prevent integration of groundwater management absent additional analysis.

For example, the 180/400-Foot Aquifer Subbasin GSP's historical and current water budgets were created "by aggregating data and analyses from previous reports and publicly available sources" while the future

GSP. Additionally, as set forth in Water Code section 10720.5(a) any GSP adopted pursuant to this Agreement shall be consistent with Section 2 of Article X of the California Constitution and nothing in this Agreement modifies the rights or priorities to use or store groundwater consistent with Section 2 of Article X of the California Constitution . . . Likewise, as set forth in Water Code section 10720.5(b) nothing in this Agreement or any GSP adopted pursuant to this Agreement determines or alters surface water rights or groundwater rights under common law or ay provision of law that determines or grants surface water rights."); 180/400-Foot Aquifer Subbasin GSP, p. 9-10 ("This GSP is part of an integrated plan for managing groundwater in all six subbasins of the Salinas Valley Groundwater Basin that are managed by the SVBGSA. The projects and management actions described in this GSP constitute an integrated management program for the entire Valley."); *id.* at 10-14 ("The SVBGSA oversees all or part of six subbasins in the Salinas Valley Groundwater Basin. Implementing the 180/400-Foot Aquifer Subbasin GSP must be integrated with the implementation of the five other GSPs in the Salinas Valley Groundwater Basin . . . The implementation schedule reflects the significant integration and coordination needed to implement all six GSPs in a unified manner."); see also Draft Upper Valley GSP, p. 10-16; Draft Eastside Subbasin GSP, pp. 9-1, 10-7, 10-8, 10-16; Draft Forebay Subbasin GSP, pp. 2-4, 9-2, 9-4, 10-7, 10-9, 10-17; Draft Langley Subbasin GSP, pp. 2-4, 9-1, 9-4, 10-8, 10-9, 10-16.

water budget was created using the Salinas Valley Integrated Hydrologic Model (SVIHM).[14] The draft GSPs for the Eastside, Langley, Forebay, and Upper Valley Subbasins take a different approach—the historical and current water budgets were developed using a "provisional version" of the SVIHM, while future water budgets were developed using "an evaluation version" of the Salinas Valley Operational Model (SVOM).[15] And the draft Monterey Subbasin GSP utilizes a third approach—employing the Monterey Subbasin Groundwater Flow Model for the historic, current, and projected water budgets.[16]

What is more, each of these approaches uses different time periods: (1) the 180/400-Foot Aquifer Subbasin GSP analyzes a historical period of 1995 to 2014 and a current period of 2015 to 2017[17]; (2) the draft GSPs for the Langley, Eastside, Forebay, and Upper Valley Subbasins analyze a historical period of 1980 through 2016 and a current period of 2016[18]; and, (3) the draft Monterey Subbasin GSP analyzes a historical period of 2004 to 2018 and a current period of 2015 to 2018.[19]

The inconsistency in the water-budget approaches for each subbasin must be addressed in the draft GSPs. Absent such an analysis, the draft GSPs cannot adequately analyze a subbasin's potential to impact an adjacent subbasin or foster integrated groundwater management throughout the Basin.[20] Further, this absence of analysis prevents informed input on the draft GSPs by interested parties.[21]

This issue is best exemplified in the inconsistencies between the 180/400-Foot Aquifer Subbasin GSP and the draft Forebay Subbasin GSP. The 180/400-Foot Aquifer Subbasin GSP estimates that the 180/400-Foot Aquifer Subbasin receives (historically and currently) 17,000 acre-feet per year (AFY) of subsurface flow from the Forebay Subbasin.[22] However, the draft Forebay Subbasin GSP estimates that this amount was 3,100 AFY historically and 2,900 AFY currently. These numbers in the draft Forebay GSP are likely

---

[14] 180/400-Foot Aquifer Subbasin GSP, p. 6-1.
[15] See each referenced draft GSP, pp. 6-1-2. The GSA's use of the SVIHM and SVOM models for the draft GSPs does not satisfy the modeling requirements in the GSP Regulations. Section 352.4(f) of the GSP Regulations state that the models used to develop GSPs must "include publicly available supporting documentation" and "consist of public domain open-source software." The GSPs acknowledge that these requirements are not satisfied, and the draft GSPs state that "[d]etails regarding source data, model construction and calibration, and results for future budgets will be summarized in more detail once the model and associated documentation are available." (See, e.g., Draft Upper Valley Aquifer Subbasin GSP, pp. 6-1-2.) Interested parties cannot provide informed comments and input on the draft GSPs until the GSAs incorporate use of models that satisfy the GSP Regulations.
[16] Draft Monterey Subbasin GSP, p. 6-7.
[17] 180/400-Foot Aquifer Subbasin GSP, p. 6-1.
[18] See each referenced draft GSP, pp. 6-7-8.
[19] Draft Monterey Subbasin GSP, p. 6-5.
[20] See DWR, Water Budget BMP, p. 9 ("Building a coordinated understanding of the interrelationship between changing water budget components and aquifer response will allow local water resource managers to effectively identify future management actions and projects most likely to achieve and maintain the sustainability goal for the basin.").
[21] The draft GSPs also do not explain why different years are used to set minimum thresholds and measurable objectives in each subbasin, or how those inconsistencies impact sustainable groundwater management. (See aguilogic, Inc. Memo, p. 3, attached hereto as **Exhibit A**.)
[22] 180/400-Foot Aquifer Subbasin GSP, p. 6-16.

overestimates (i.e., the 180/400-Foot Aquifer is estimated to receive less subsurface flow from the Forebay Subbasin than the stated numbers) as the SVIHM utilized to provide the estimates in the draft Forebay Subbasin GSP only accounted for approximately 65% of the groundwater pumping in the Forebay Subbasin.[23] The discrepancy in interbasin flow needs to be addressed in the draft Forebay Subbasin GSP, or identified as a data gap that will be addressed through additional modeling as soon as possible. Without such information, the draft GSP cannot analyze how its implementation will impact the implementation of the 180/400-Foot Aquifer Subbasin GSP.

In sum, the draft GSPs must identify and analyze the inconsistencies in the modeling simulations and the time periods used for the water budgets in each of the GSPs in order to satisfy SGMA.[24] The *Alliance* identified a potential solution to this issue in its correspondence to the SVBGSA dated August 12, 2021, wherein the *Alliance* requested that the GSA conduct additional simulations with the SVIHM that are specifically focused on the issue of interbasin groundwater flows in order to understand the amount of Basin-wide groundwater discharge that is and has been captured by pumping. After adjusting the modelling simulations with GEMS data, the SVBGSA could integrate the data into the draft GSPs and provide an informed analysis of how each draft GSP will impact adjacent subbasins. Based upon the text of the draft GSPs, it appears that this modelling has already been completed in some capacity. In each of the draft GSPs for the Langley, Eastside, Forebay, and Upper Valley Subbasins, the GSPs state a "model simulation without any groundwater pumping in the model . . . was compared to the model simulation with groundwater pumping" to understand depletion of interconnected surface water.[25] However, the draft GSPs do not extrapolate this data to analyze impacts on surface or subsurface interbasin flows or adjacent subbasins. The *Alliance* understands that the SVBGSA is undertaking additional modeling for an update to the draft GSPs and strongly recommends that the SVBGSA incorporate the *Alliance's* requested modeling simulations into the update. If not, the *Alliance* urges the SVBGSA to commit to adding this information prior to adoption of the draft GSPs or committing to a timeline in which it will be added shortly thereafter. Without this information, the GSPs cannot not analyze each of the issues required to be addressed by SGMA.

B. The Draft GSPs Do Not Adequately Analyze Impacts to Adjacent Subbasins

As discussed above, a GSP must not adversely affect "the ability of an adjacent basin to implement their [GSP] or impede[] achievement of sustainability goals in an adjacent basin."[26] The GSP Regulations specify that minimum thresholds should be selected to "avoid causing undesirable results in adjacent basins or affecting the ability of adjacent basins to achieve sustainability goals."[27] And the GSP Regulations require DWR to evaluate a GSP to ensure it satisfies these objectives.[28] The draft GSPs as currently presented do not satisfy these requirements.

---

[23] Draft Forebay Subbasin GSP, pp. 6-19, 21.
[24] See, e.g., DWR Water Budget BMP, pp. 16-17.
[25] See, e.g., Draft Forebay Subbasin GSP, p. 5-30.
[26] Wat. Code, § 10733.
[27] GSP Regs., § 354.28(b)(3).
[28] GSP Regs., § 355.4(b)(7).

1. The Draft Eastside Subbasin and Langley Subbasin GSPs

The Eastside Subbasin and Langley Subbasin GSPs largely require similar analysis and information to satisfy SGMA. The GSPs do not account for impacts to adjacent subbasins in defining sustainable yields or setting minimum thresholds and measurable objectives. Each of these issues is addressed in detail below.

a. *The GSPs do not account for impacts to adjacent subbasins in defining sustainable yields*

SGMA defines "sustainable yield" as "the maximum quantity of water, calculated over a base period representative of long-term conditions in the basin and including any temporary surplus, that can be withdrawn annually from a groundwater supply without causing an undesirable result."[29] Further, the sustainable yield must be defined in a manner that will not result in undesirable results in adjacent subbasins.[30] Here, the sustainable yields in the draft GSPs for both the Eastside and Langley Subbasins do not account for impacts on interbasin flow to the 180/400-Foot Aquifer Subbasin.

For example, the draft Eastside Subbasin GSP states that a pumping depression east of the City of Salinas creates a hydraulic gradient towards the depression, with groundwater flowing towards the pumping depression and away from the boundary with the 180/400-Foot Aquifer Subbasin.[31] This depression has reversed the natural downgradient groundwater flow from the Eastside Subbasin to the 180/400-Foot Aquifer Subbasin, drawing 3,600 AFY historically and 5,400 AFY currently of groundwater from the 180/400-Foot Aquifer Subbasin.[32] This amount is likely substantially underestimated as the SVIHM only accounts for 81% of groundwater pumping in the Subbasin.[33] Despite this unnatural hydraulic gradient and the pull of groundwater from the 180/400-Foot Aquifer Subbasin, the draft Eastside Subbasin GSP includes this interbasin flow in its calculation of sustainable yield,[34] but the draft GSP does not analyze how estimated sustainable yield will impact groundwater management in the 180/400-Foot Aquifer Subbasin.

Similarly, the draft Langley Subbasin GSP states that a pumping depression has formed in the center of the Langley Subbasin as a result of a pumping trough.[35] Groundwater is drawn towards the pumping depression and away from the 180/400-Foot Aquifer Subbasin despite the natural downward gradient flow towards the 180/400-Foot Aquifer and Eastside Subbasins.[36] The draft Langley Subbasin GSP then estimates that,

[29] Wat. Code, § 10721(w).
[30] See Wat. Code, § 10733.
[31] Draft Eastside Subbasin GSP, p. 5-11.
[32] *Id.* at pp. 6-19-20 ("Groundwater pumping near the [C]ity of Salinas has created a cone of depression . . . that draws in groundwater into the Eastside Aquifer Subbasin from the 180/400-Foot Aquifer Subbasin, which is naturally slightly downgradient in the Salinas area. Estimated groundwater inflows from the 180/400-Foot Aquifer Subbasin have slightly increased since 1980.").
[33] *Id.* at p. 6-17. The 180/400-Foot Aquifer Subbasin GSP estimates the outflow to the Eastside and Langley Subbasins amounts to 8,000 AFY. (*Id.* at p. 6-19.)
[34] *Id.* at pp. 6-22-24, Table 6-10.
[35] Draft Langley Subbasin GSP, p. 5-7.
[36] *Id.* at p. 5-18, Figure 5-11.

despite this reversal in groundwater elevations, the 180/400-Foot Aquifer Subbasin has historically received 3,700 AFY and currently receives 2,900 AFY in interbasin flow from the Langley Subbasin, while the Eastside Subbasin has historically received 1,100 AFY and currently receives 1,700 AFY in interbasin flow from the Langley Subbasin.[37] However, the draft Langley Subbasin GSP fails to analyze how the pumping depression in the Langley Subbasin has impacted and will continue to impact these interbasin flows—e.g., what are the outflows to the 180/400-Foot Aquifer and Eastside Subbasins if the pumping depression were ameliorated? Again, the draft GSP includes these unnatural interbasin flows in its calculation of the sustainable yield without analyzing the impacts on adjacent subbasins.[38]

Without understanding how groundwater production impacts interbasin flows, the draft GSPs cannot accurately estimate the sustainable yield of the subbasins and their impact on adjacent subbasins.[39] As discussed above, this issue can be addressed by undertaking the additional modeling simulations requested by the *Alliance* and revising the draft GSPs accordingly. This additional information should be added prior to the adoption of the draft GSPs, or the draft GSPs should commit to a timeline under which this information will be added as soon as possible after adoption of the draft GSPs.

b. *The GSPs do not analyze how their minimum thresholds and measurable objectives will impact adjacent subbasins*

The draft GSPs also do not consider impacts to adjacent subbasins in their setting of minimum thresholds and measurable objectives, as required by SGMA.[40]

For example, the draft Eastside Subbasin GSP sets the minimum threshold for groundwater elevations at 2015 levels.[41] As shown in Figure 8-1, these levels are only nominally above historic lows (approximately 6 feet higher) and barely above the lowest elevation since the introduction of the CSIP and Salinas Valley Water Project.[42] Consequently, these groundwater elevations will still produce a significant pumping

---

[37] *Id.* at p. 6-19.
[38] *Id.* at pp. 6-21-23.
[39] See DWR Water Budget BMP, p. 17 (To evaluate the impact on adjacent basin, "this will necessitate GSA coordination and sharing of water budget data, methodologies, and assumptions between contiguous basins including: • Accurate accounting and forecasting of surface water and groundwater flows across the basin boundaries.").
[40] GSP Regs., § 354.28(b)(3) ("The description of minimum thresholds shall include the following: . . . (3) How minimum thresholds have been selected to avoid causing undesirable results in adjacent basins or affecting the ability of adjacent basins to achieve sustainability goals."); see also GSP Regs., § 355.4(b)(7); DWR Sustainable Management Criteria BMP, p. 9; DWR Sustainable Management Criteria BMP, p. 10 ("The purpose of the specific requirements is to ensure consistency within groundwater basins and between adjacent groundwater basins.").
[41] Draft Eastside Subbasin GSP, p. 8-7.
[42] *Id.* at p. 8-13.

depression east of the City of Salinas that will draw water away from the boundary with the 180/400-Foot Aquifer Subbasin.[43]

Similarly, the draft Langley Subbasin GSP sets the minimum threshold for groundwater elevations at 2019 levels—the lowest elevations since the introduction of the CSIP and Salinas Valley Water Project and only nominally above the historic lows in the Subbasin.[44] These levels will continue to produce a significant pumping depression east of the City of Salinas that will draw water away from the boundary with the 180/400-Foot Aquifer Subbasin.[45] Despite the maintenance of these unnatural gradients, neither draft GSP analyzes how these minimum thresholds will impact adjacent subbasins (e.g., the 180/400-Foot Aquifer Subbasin).

The draft GSPs for the Eastside and Langley Subbasins merely include the statement that: "Minimum thresholds for the [subbasins] will be reviewed relative to information developed for the neighboring subbasins' GSPs to ensure that these minimum thresholds will not prevent the neighboring subbasins from achieving sustainability."[46] This statement is not evidence and it does not ensure the management of the subbasins will avoid impacts to adjacent subbasins.[47] As discussed above, this issue can be addressed by undertaking the additional modeling simulations requested by the *Alliance* and revising the draft GSPs accordingly.

The lack of analysis is concerning as both draft GSPs acknowledge that low groundwater elevations within the Langley and Eastside Subbasins may exacerbate seawater intrusion in the 180/400-Foot Aquifer Subbasin.[48] But the draft GSPs only mention this issue in concluding: "The chronic lowering of groundwater

---

[43] *Id.* at p. 8-10, Figure 8-3. The same issue applies to the draft Eastside Subbasin GSP's measurable objective for groundwater elevations—it maintains a pumping depression that reverses the natural hydraulic gradient towards the 180/400-Foot Aquifer Subbasin but fails to explain how the measurable objective will not impact the 180/400-Foot Aquifer Subbasin. (See e.g., Draft Eastside Subbasin GSP, p. 8-19.)
[44] Draft Langley Subbasin GSP, pp. 8-8, 8-13.
[45] *Id.* at p. 8-10. Again, the same issue applies to the draft Langley Subbasin GSP's measurable objective for groundwater elevations—it maintains a pumping depression that reverses the natural hydraulic gradient towards the 180/400-Foot Aquifer Subbasin but fails to explain how the measurable objective will not impact the 180/400-Foot Aquifer Subbasin. (See e.g., Draft Langley Subbasin GSP, p. 8-19.)
[46] *Id.* at p. 8-6; Draft Eastside Subbasin GSP, p. 8-16.
[47] See Joint Exercise of Powers Agreement Establishing the SVBGSA, § 4.3 ("As set forth in Water Code section 10723.3, the GSA shall consider the interests of all beneficial uses and users of groundwater in the Basin, as well as those responsible for implementing the GSP. Additionally, as set forth in Water Code section 10720.5(a) any GSP adopted pursuant to this Agreement shall be consistent with Section 2 of Article X of the California Constitution and nothing in this Agreement modifies the rights or priorities to use or store groundwater consistent with Section 2 of Article X of the California Constitution . . . Likewise, as set forth in Water Code section 10720.5(b) nothing in this Agreement or any GSP adopted pursuant to this Agreement determines or alters surface water rights or groundwater rights under common law or ay provision of law that determines or grants surface water rights.").
[48] See Draft Langley Subbasin GSP, pp. 3-18, 4-32, 5-18 (Figure 5-11 "shows the groundwater elevations that are persistently below sea levels that, when paired with a pathway, enable seawater intrusion. The groundwater elevation contours show that groundwater is drawn toward the depression at the northern end of the Eastside Aquifer Subbasin. If the magnitude of this depression increases, it could potentially draw seawater intrusion into the Langley Subbasin."), 5-20 (Figure 5-11); Draft Eastside Subbasin GSP, pp. 3-17,

level minimum thresholds are set above historic lows. Therefore, the groundwater elevation minimum thresholds are intended to not exacerbate, and may help control, the rate of seawater intrusion."[49] That statement must be revised to acknowledge that the pumping depressions in the Langley and Eastside Subbasins will remain even if the groundwater elevation minimum thresholds and measurable objectives are achieved, and the seawater minimum thresholds set by the draft Langley and Eastside Subbasin GSPs only protect against seawater intrusion in their respective subbasins, not against seawater intrusion in adjacent subbasins like the 18/400-Foot Aquifer Subbasin.[50]

In sum, the draft Langley and Eastside Subbasin GSPs in their current form do not account for potential impacts to adjacent subbasins in setting their minimum thresholds and measurable objectives. As a result, the draft GSPs cannot provide any evidence that their implementation will not impair implementation of a GSP in an adjacent subbasin—e.g., the 180/400-Foot Aquifer Subbasin GSP's seawater intrusion minimum threshold, which requires seawater intrusion to be maintained at 2017 levels, and measurable objective, which requires the seawater intrusion isocontour to be pushed back to Highway 1.[51] This analysis should be added to the draft GSPs prior to adoption by the SVBGSA, or the draft GSPs should provide a commitment to incorporating this information within a time certain.[52]

c. *There is no support for using groundwater elevations as a proxy for groundwater storage minimum thresholds*

As mentioned above, the sustainable yield of the basin is the amount of water that can be withdrawn annually without causing an undesirable result, such as the "significant and unreasonable reduction of groundwater storage."[53] The GSP Regulations permit a minimum threshold for groundwater elevations to be used as the minimum threshold for other sustainability indicators, "where the Agency can demonstrate that the representative value is a reasonably proxy . . . as supported by adequate evidence."[54] Here, both the draft Eastside Subbasin GSP and the Langley Subbasin GSP utilize groundwater elevation minimum thresholds

4-35 ("the groundwater elevations in the northwestern portion of the Eastside Subbasin (near the City of Salinas) are below sea level, creating a groundwater gradient away from the coast and towards the Eastside Subbasin"), 5-26-29 .

[49] Draft Langley Subbasin GSP, p. 8-15; Draft Eastside Subbasin GSP, p. 8-15.

[50] Draft Langley Subbasin GSP, p. 8-28; Draft Eastside Subbasin GSP, p. 8-29.

[51] See 180/400-Foot Aquifer Subbasin GSP, pp. 8-32-37.

[52] A report prepared for MCWRA has highlighted the significant impact pumping in the Eastside and Langley Subbasins has on seawater intrusion in the 180/400-Foot Aquifer Subbasin. (See November 19, 2013, Technical Memorandum, Protective Elevations to Control Sea Water Intrusion in the Salinas Valley, attached hereto as **Exhibit D**.) The report states: "At one time (before excessive pumping), the East Side Subarea was one of the natural sources of recharge to the adjacent Pressure Subarea with ground water flowing from the northeast to the southwest. However, historical groundwater level declines have resulted in a reversal of the gradient." (*Id.* at p. 3.) The report then states that: "Artificial recharge in the East Side Subarea would reduce subsurface inflow from the Pressure Subarea and eventually restore the historical northeast to southwest recharge. Both northwest underflow from the Forebay Subarea as well as southwest recharge from the East Side Subarea would help control seawater intrusion." (*Id.* at pp. 6-7.) See also aquilogic Memo, pp. 8-12, attached hereto as **Exhibit A**.

[53] Wat. Code, § 10721(w), (x).

[54] GSP Regs., § 354.28(d); DWR Sustainable Management Criteria BMP, pp. 17-18.

as proxies for groundwater storage minimum thresholds.[55] However, there is insufficient evidence to support that approach.

In particular, each of the draft GSPs sets groundwater elevations at near historic lows, and show a substantial trend in declining groundwater storage over the historic period.[56] The minimum threshold groundwater elevations, in other words, have resulted in overdraft of the subbasins.[57] And by setting the minimum thresholds at historic low groundwater elevations, the draft GSPs will facilitate continued decline in groundwater storage.[58] In fact, because there is no commitment to pump at the sustainable yield of the subbasins, it is possible that production in the subbasins could increase over historic and current amounts so long as the subbasins do not experience another significant drought and still comply with the groundwater elevation minimum thresholds. The SVBGSA's prior actions seem to imply that utilizing groundwater elevations as a proxy in this scenario is improper—the 180/400-Foot Aquifer Subbasin GSP set the groundwater storage minimum threshold to production at the projected sustainable yield.[59] The draft GSP must explain why this different approach will suffice now.

2. The Draft Forebay and Upper Valley Subbasin GSPs

The draft Forebay and Upper Valley Subbasin GSPs lack the same analysis as the draft GSPs for the Eastside and Langley Subbasins—they do not adequately consider impacts to adjacent subbasins. These issues begin with the draft GSPs' water budget and estimate of sustainable yield, and cascade through the minimum thresholds, measurable objectives, and projects and management actions.

As discussed above, SGMA requires GSPs to define a sustainable yield for each basin that will avoid undesirable results and impacts to adjacent basins. The sustainable yields defined in the draft GSPs for the Forebay and Upper Valley Subbasins do not meet this threshold. Both draft GSPs conclude that the subbasins have not been in overdraft historically, but they do not analyze how groundwater pumping within the subbasins (151,100 to 174,500 AFY in the Forebay Subbasin and 108,500 to 129,600 AFY in the Upper Valley) impacts surface and subsurface flows to adjacent subbasins.[60]

---

[55] Draft Eastside Subbasin GSP, p. 8-23; Draft Langley Subbasin GSP, p. 8-22.
[56] See discussion *supra;* Draft Eastside Subbasin GSP, p. 5-21; Draft Langley Subbasin GSP, p. 5-16.
[57] *Ibid*.
[58] See, e.g., Wat. Code, § 10721(x)(1) ("Overdraft during a period of drought is not sufficient to establish a chronic lowering of groundwater levels if extractions and groundwater recharge are managed as necessary to ensure that reductions in groundwater levels or storage during a period of drought are offset by increases in groundwater levels or storage during other periods.").
[59] 180/400-Foot Aquifer Subbasin GSP, p. 8-25 ("The total volume of groundwater that can be annually withdrawn from the Subbasin without leading to a long-term reduction in groundwater storage or interfering with other sustainability indicators is the calculated sustainable yield of the Subbasin."); see also DWR GSP Assessment Staff Report, p. 25 ("The Plan describes how setting the minimum threshold as the long-term sustainable yield for the Subbasin is a reasonable, protective approach against overdraft and the long-term reduction of groundwater storage.").
[60] Draft Forebay Subbasin GSP, pp. 6-45-46; Draft Upper Valley Subbasin GSP, pp. 6-22-23.

For example, the draft Forebay Subbasin GSP states that the SVIHM, which undercounts groundwater pumping by 35%, estimates the Forebay Subbasin received 90,300 AFY historically through stream exchange, currently receives 77,800 AFY, and 31,800 AFY of that stream exchange on average is caused by groundwater pumping.[61] Similarly, the draft Upper Valley Subbasin GSP states that the SVIHM, which under counts groundwater pumping by 24%, estimates the Upper Valley Subbasin received 89,100 AFY historically through stream exchange, currently receives 65,500 AFY, and 1,100 AFY of that stream exchange on average is caused by groundwater pumping.[62] This recharge is substantially induced by the operation of the Nacimiento and San Antonio Reservoirs; prior to that time groundwater storage was significantly decreasing in the subbasins.[63] However, neither draft GSP analyzes: (a) how streamflow recharges the subbasins during drought years, offering instead averages over the historical period, and (b) how groundwater pumping impacts natural surface or subsurface flows to adjacent subbasins—i.e., without pumping, how much groundwater would flow to the downgradient subbasin? Instead, the draft GSPs use the average stream exchange amounts to facilitate a “finding” that the subbasins are presently managed within their sustainable yield. Without understanding how pumping impacts streamflow during drought years and interbasin surface and subsurface flow, the draft GSPs cannot reasonably estimate sustainable yield in the subbasins or analyze how implementation of the draft GSPs will impact adjacent subbasins’ GSPs.

The failure to analyze impacts to adjacent subbasins becomes more apparent in the draft GSPs’ discussion of minimum thresholds. The draft Forebay Subbasin GSP sets the minimum threshold for groundwater elevations at 2015 groundwater levels, only a few feet above the historic low, while the draft Upper Valley Subbasin GSP sets the minimum threshold for groundwater elevations at “5 feet below the lowest ground elevation between 2012 and 2016,” significantly below the historic low.[64] These minimum thresholds are not reasonable—set at levels experienced at the bottom of a historic drought, or even lower—and cannot be qualified as sustainable groundwater management.[65] The draft Upper Valley GSP admits as much, stating: “The groundwater elevations during the 2012 to 2016 drought in the Upper Valley Aquifer Subbasin are the lowest groundwater elevations seen in the Subbasin and are considered significant and unreasonable.”[66]

---

[61] Draft Forebay Subbasin GSP, pp. 5-30, 6-23. Note that the draft GSPs may also underestimate streamflow depletion by only analyzing stream cells that are connected to groundwater more than 50% of the time. (See aquilogic Memo, p. 5, attached hereto as **Exhibit A**.)
[62] Draft Upper Valley Subbasin GSP, pp. 5-31, 6-22.
[63] Draft Upper Valley Subbasin GSP, p. 5-18; Draft Forebay Subbasin GSP, p. 5-17; see also Hydrogeology and Water Supply of Salinas Valley, pp. 15-16, attached hereto as **Exhibit D**.
[64] Draft Forebay Subbasin GSP, pp. 8-8, 8-14; Draft Upper Valley Subbasin GSP, pp. 8-7, 8-12 (emphasis added).
[65] Wat. Code, § 10720.1 (“In enacting this part, it is the intent of the Legislature to do all of the following: (a) To provide for the sustainable management of groundwater basins. . . . (c) To establish minimum standards for sustainable groundwater management.”]; GSP Regs., § 355.4(b) (“When evaluating whether a Plan is likely to achieve the sustainability goal for the basin, the Department shall consider the following: (1) Whether the assumptions, criteria, findings, and objectives, including the sustainability goal, undesirable results, minimum thresholds, measurable objectives, and interim milestones are reasonable and supported by the best available information and best available science. . . .”).
[66] Draft Upper Valley Subbasin GSP, p. 8-10 (emphasis added).

Moreover, the draft GSPs do not analyze how the minimum thresholds will impact flows in the Salinas River or adjacent subbasins. Rather, this analysis appears to be deferred to the future. The draft GSPs state that: "Minimum thresholds . . . will be reviewed relative to information developed for neighboring subbasins' GSPs to ensure that these minimum thresholds will not prevent the neighboring subbasin from achieving sustainability."[67] As discussed above, this issue can be addressed by undertaking the additional modeling simulations requested by the *Alliance* and revising the draft GSPs accordingly. This additional information should be added prior to the adoption of the draft GSPs, or the draft GSPs should commit to a timeline under which this information will be added as soon as possible after adoption of the draft GSPs.

These same concerns are raised with respect to the groundwater storage minimum thresholds. The draft Upper Valley Subbasin GSP uses the groundwater elevation minimum threshold as a proxy, which is permitted, as discussed above, as long as it is supported by adequate evidence.[68] However, there is no evidence supporting that approach as the groundwater elevation minimum threshold suffers the flaws discussed above, and evidence in the draft GSP relating groundwater elevations to groundwater storage shows groundwater storage at historic lows by a wide margin when groundwater levels were 5 feet above the groundwater elevation minimum threshold in 2016.[69] Similarly, the draft Forebay Subbasin GSP sets the minimum threshold for groundwater storage based upon the groundwater elevation minimum threshold: "The minimum threshold groundwater elevation contours . . . were used to estimate the amount of groundwater in storage when groundwater elevations are held at the minimum threshold levels."[70] Again, there is no evidence supporting that approach as the groundwater elevation minimum threshold is flawed as discussed above, and evidence in the draft GSP shows the groundwater elevation minimum threshold results in historic lows in groundwater storage.[71] In fact, the groundwater elevation minimum thresholds allow for additional production in the subbasins over historic and current amounts so long as the subbasins do not experience another significant drought. There is no commitment in the draft GSPs that the production in the subbasins will be restricted to the estimated sustainable yield in the subbasins, and there is no model simulation showing the minimum threshold for groundwater elevations will prevent continued decline in groundwater storage.

Finally, the draft GSPs also utilize groundwater elevations as proxies to set the minimum thresholds for depletion of interconnected surface water.[72] But again, there is no evidence supporting this approach. These groundwater elevation proxies are at or near historic lows, and there is no evidence proving these elevations will prevent the depletion of interconnected surface water that would have a significant and unreasonable impact on beneficial uses. Rather, the draft GSPs merely state that these levels will not impact beneficial uses because there is not currently any litigation over surface water uses, and due to the operation of the Nacimiento Reservoir.[73] However, this statement does not acknowledge that decreased groundwater

[67] Draft Upper Valley Subbasin GSP, p. 8-14; Draft Forebay Subbasin GSP, p. 8-17.
[68] Draft Upper Valley Subbasin GSP, p. 8-20.
[69] Draft Upper Valley Subbasin GSP, pp. 5-13, 5-18.
[70] Draft Forebay Subbasin GSP, p. 8-24.
[71] Draft Forebay Subbasin GSP, p. 5-17.
[72] See Draft Upper Valley Subbasin GSP, p. 8-39; Draft Forebay Subbasin GSP 8-42.
[73] Draft Forebay Subbasin GSP, pp. 8-44-45; Draft Upper Valley Subbasin GSP, pp. 8-41-42.

elevations will increase depletion of the Salinas River, and reduce flow to downstream uses, including those uses in adjacent subbasins.[74] Lastly, the draft GSPs do not analyze how these minimum thresholds for depletion of interconnected surface water will impact adjacent subbasins.

In sum, the draft Forebay and Upper Valley GSPs require additional data and analysis to satisfy SGMA. These issues must be addressed before the GSPs are adopted, or the draft GSPs must be provide for their provision by a date certain.[75]

3. The Inadequacies in the Draft GSPs Addressed Above Threaten to Impinge Upon Water Rights

As stated previously, each of the groundwater sustainability agencies has an obligation to consider the interests of all beneficial users of the Basin[76] when implementing SGMA. Moreover, SGMA does not "determine[] or alter[] surface water rights or groundwater rights under common law or any provision of law that determines or grants surface water rights."[77]

By not analyzing potential impacts to adjacent subbasins in each draft GSP, the groundwater sustainability agencies disproportionately allocate the burden of sustainability across the Basin and threaten to impair groundwater users' rights in and to the Basin. This approach violates SGMA and must be addressed before the groundwater sustainability agencies adopt the draft GSPs or, as discussed above, through a commitment in the draft GSPs to modify or update their contents within a time certain.

III. THE DRAFT GSPS MUST INCORPORATE PROJECTS AND MANAGEMENT ACTIONS TO ACHIEVE SUSTAINABILITY

The GSP Regulations require each GSP to "include a description of the projects and management actions the Agency has determined will achieve the sustainability goal for the basin, including projects and management actions to respond to changing conditions in the basin."[78] Because the draft GSPs are lacking the data and analysis described in Section II above, the draft GSPs cannot meet this requirement (e.g., the draft GSPs' lack of analysis of impacts to adjacent basins prevents an adequate proposal of projects and management actions to achieve sustainability). Further, without understanding impacts on interbasin surface and subsurface flow and how implementation of the draft GSPs will impact adjacent subbasins, the groundwater sustainability agencies will be unable to properly assess the benefits associated with any future projects or management actions—e.g., if they propose projects involving dam operations, how can the groundwater sustainability agencies assess the benefits of those projects to the Lower Valley? Accordingly,

[74] aquilogic Memo, pp. 3-8, attached hereto as **Exhibit A**; DWR Water Budget BMP, pp. 4-5.
[75] See also aquilogic Memo, pp. 3-8, attached hereto as **Exhibit A**.
[76] Wat. Code, § 10723.2
[77] Wat. Code, § 10720.5(b); see also Wat. Code, § 10720.1(a) and (b).
[78] GSP Regs., § 354.44(a).

the *Alliance* reserves the right to comment on the draft GSPs' proposed projects and management actions once the issues described above have been addressed.

However, as a preliminary note, the draft GSPs as currently presented do not include sufficient projects or management actions to achieve sustainable groundwater management Basin-wide. Rather, the draft GSPs appear to foist the burden of sustainable groundwater management on the Eastside, Langley, 180/400-Foot Aquifer, and Monterey Subbasins, while avoiding consequential projects and management actions in the Forebay and Upper Valley Subbasins. Indeed, the draft GSPs for the Eastside, Langley, and Monterey Subbasins each include a management action for pumping allocations and controls, but no such management action is included in the draft Forebay Subbasin or Upper Valley Subbasin GSPs.[79] Instead, the draft Forebay Subbasin and Upper Valley Subbasin GSPs include management actions that only superficially impact the subbasins—e.g., the proposed Subbasin "Sustainable Management Criteria Technical Advisory Committees," which require the formation of a "TAC for each Subbasin" that will "develop recommendations to correct negative trends in groundwater conditions and continue to meet the measurable objectives."[80] This issue must be addressed in the next draft of the GSPs.

The *Alliance* also notes that the draft GSPs do not mention the project proposed in the Hydrogeology and Water Supply of Salinas Valley White Paper prepared by the Salinas Valley Groundwater Basin Hydrology Conference for MCWRA in 1995 ("Salinas Valley White Paper"), which is attached hereto as **Exhibit E**. The "Conference" was a "panel of 10 geologists, hydrogeologists, and engineers familiar with Salinas Valley ground water basin" that was convened to "reach agreement on the basic physical characteristics of the basin, and the surface and ground water flow within the basin."[81] The Conference had a "remarkable unanimity of opinion" on the understanding of the "physical characteristics of the basin, the hydrologic system, the interaction between surface water and ground water, and definition of the specific ground water problems in the basin."[82] The Conference agreed that this understanding pointed "compellingly toward an already identified *regional* solution to the Valley's groundwater water resources problem" and recommended pursuing that solution.[83]

> The need for conjunctive operation of surface water and ground water storage was recognized as early as 1946. In 1946, the California Department of Water Resources published a report on Salinas Valley that described the occurrence of seawater intrusion and declining ground water levels. The report recommended a project to eliminate these problems that included development of surface water and ground water storage. Surface water storage was to be accomplished by the construction of dams on tributaries to Salinas River, and ground water storage was to be accomplished by ground water transfers from the Forebay Area to the Pressure Area and East [S]ide Area. The Department

[79] See Draft Eastside Subbasin GSP, § 9.4.12; Draft Langley Subbasin GSP, § 9.4.5; Draft Monterey Subbasin GSP, § 9.4.8; see also 180/400-Foot Aquifer Subbasin GSP, § 9.2 [water charges framework].
[80] Draft Upper Valley Subbasin GSP, § 9.4.1; Draft Forebay Subbasin GSP, § 9.4.1.
[81] *Id.* at p. 5.
[82] *Ibid.*
[83] *Ibid.*

> recommended transfer facilities that include wells in the Forebay Area, conveyance facilities from the Forebay Area to the Pressure and East Side Areas, and distribution facilities within the Pressure and East Side Areas. In such a conjunctive operation, the increased extraction in the Forebay Area and conveyance of water to the Pressure and East Side Areas would vacate ground water storage in the Forebay Area. This empty storage space would be refilled by additional infiltration from Salinas River . . . Part of the recommended facilities for surface water and ground water storage have been completed by the construction of the dams for San Antonio and Nacimiento reservoirs, but the facilities for the effective use of groundwater storage have not been completed. The operation of San Antonio and Nacimiento reservoirs has produced benefits to [S]alinas Valley, but the ultimate benefits that would result from the construction and operation of transfer facilities have not been realized. **The panel concluded that the facilities recommended in 1946 by the California Department of Water Resources should be completed immediately** . . . The result of partially completing the project has been an uneven distribution of benefits throughout the Valley. The Forebay Area and Upper Valley Areas have enjoyed relatively large benefits from San Antonio and Nacimiento reservoirs that would have been shared equally with the Pressure and East Side Areas if the intended transfer facilities had been built. In the absence of the transfer facilities, seawater intrusion into the Pressure Area and water-level declines within the East Side Area have not been mitigated.[84]

The Conference noted that this solution is practical as the "water resources problem in Salinas Valley is not a water supply problem. It is a water distribution problem. The basin has enough surface and ground water to meet existing and projected future average annual agricultural, and municipal and industrial water demand through the year 2030. The problem lies in managing those supplies to meet water demands at all locations in the Valley at all times."[85] This project is an example of integrated groundwater management for the Basin as a whole and should be included in the list of projects and management actions in each of the draft GSPs.[86]

IV. CONCLUSION

The *Alliance* appreciates the opportunity to provide these comments on the draft GSPs, as well as the groundwater sustainability agencies' consideration of the *Alliance*'s input. At present, the draft GSPs do not provide a sufficient basis for integrated management of the Basin given their inconsistent analytical approaches and inadequate analysis of impacts on adjacent subbasins. The *Alliance* makes these comments with the hope that these issues can be addressed through additional engagement prior to the adoption of the GSPs. It is critical that the groundwater sustainability agencies lay the foundation now for the integrated sustainable management of the Basin; without such a foundation, the agencies will not be able to satisfy their obligations under SGMA.

---

[84] Salinas Valley White Paper, pp. 15-16, attached hereto as **Exhibit E (**emphasis added).
[85] *Id.* at p. 7.
[86] See aquilogic Memo, pp. 12-13, attached hereto as **Exhibit A**.

Respectfully submitted,

Stephanie Osler Hastings
Christopher R. Guillen

Exhibits:

A. October 15, 2021 aquilogic, inc. memorandum
B. February 26, 2019 Letter from Derrik Williams to Les Girard
C. March 4, 2019 Memorandum from Howard Franklin to Gary Petersen & Les Girard
D. November 19, 2013 Technical Memorandum re Protective Elevations to Control Sea Water Intrusion in the Salinas Valley
E. June 1995 Salinas Valley Ground Water Basin Hydrology Conference White Paper re Hydrogeology and Water Supply of Salinas Valley

cc: Emily Gardner, Senior Advisor / Deputy General Manager (gardnere@svbgsa.org)
Derrik Williams, Montgomery & Assoc. (dwilliams@elmontgomery.com)
Leslie Girard, Monterey County Counsel (GirardLJ@co.monterey.ca.us)

23184613

aquilogic, Inc.
environment • water • strategy

245 Fischer Avenue, Suite D-2
Costa Mesa, CA 92626
Tel. +1.714.770.8040
Web: www.aquilogic.com

October 15, 2021

MEMORANDUM

To: Donna Meyers, Salinas Valley Basin Groundwater Sustainability Agency
Remleh Scherzinger, Marina Coast Water District Groundwater Sustainability Agency
Curtis Weeks, Arroyo Seco Groundwater Sustainability Agency

From: Robert H. Abrams, PhD, PG, CHg, Principal Hydrogeologist, aquilogic, Inc.
Anthony Brown, CEO & Principal Hydrologist, aquilogic, Inc.

Subject: Comments on Draft Groundwater Sustainability Plans for the Eastside Aquifer, Forebay Aquifer, Upper Valley Aquifer, Langley Area, and Monterey Subbasins of the Salinas Valley Groundwater Basin

Project No.: 018-09

Aquilogic, Inc. (**aquilogic**) is pleased to provide this memorandum on behalf of the Salinas Basin Water Alliance (SBWA). The curricula vitae for Mr. Brown and Dr. Abrams are provided in **Attachment A**. The memorandum provides our comments on the following draft Groundwater Sustainability Plans (GSPs) prepared by the Salinas Valley Basin Groundwater Sustainability Agency (SVBGSA):

- Upper Valley Aquifer Subbasin (Upper Valley)
- Forebay Aquifer Subbasin (Forebay)
- Eastside Aquifer Subbasin (Eastside)
- Langley Area Subbasin (Langley), and
- Monterey Subbasin (Monterey)

The draft GSP for the Monterey was prepared jointly with the Marina Coast Water District (MCWD) GSA.

Aquilogic's analysis of the five draft GSPs found a significant deficiency with four of the five plans: The impact of the draft GSPs on adjacent subbasins is not sufficiently evaluated in the draft GSPs for the Upper Valley, Forebay, Eastside, and Langley. These impacts may hinder or prevent adjacent subbasins from achieving sustainability. The impacts on adjacent subbasins occur because all subbasins in the Salinas Valley Groundwater Basin (SVGB) are hydrologically and hydraulically connected. The impacts are caused by two factors: (1) unreasonably low minimum thresholds (MTs) for the chronic lowering of groundwater levels and (2) groundwater extractions that reduce flows to adjacent subbasins or reverse natural hydraulic gradients.

These two factors are linked because the unreasonably low MTs allow groundwater extractions to continue at or above their current magnitude.

The draft GSPs relied on the Salinas Valley Integrated Hydrologic Model (SVIHM) and the Salinas Valley Operational Model (SVOM) for much of their content. The SVIHM and the SVOM are not publicly available at this time. Thus, stakeholder review of the GSPs, especially the content that relies heavily on the models, is hampered by an inability to access, evaluate, and run these models. **Aquilogic** reserves the right to supplement our comments at a later date as the models, model data, assumptions, and results become available.

Connected Subbasins

It has long been recognized and accepted that the subbasins comprising the SVGB are hydraulically connected, with groundwater flowing between adjacent subbasins (Division of Water Resources [DWR], 1946; Salinas Valley Ground Water Basin Hydrology Conference [SVGWBHC], 1995; Monterey County Water Resources Agency [MCWRA], 2001; Kennedy/Jenks, 2004). For example, MCWRA (2001) states that the Salinas Valley hydrologic subareas, which are generally coincident with the six subbasins under the purview of the SVBGSA, are "*…hydrologically and hydraulically connected…*" and that "*[l]andowners and other water users pumping groundwater* [from the Valley] *are drawing water from the same groundwater basin*." In other words, what happens in one subbasin can affect the other subbasins. There are numerous sections within the GSPs (see **Attachment B**) that state "the GSP needs to consider potential for groundwater flow between these adjacent subbasins." However, the GSPs generally do not consider these flows in terms of impacts on adjacent subbasins, nor do the GSPs assess the impact on adjacent subbasins of reaching or exceeding the MTs and measurable objectives (MOs) in one or more subbasins.

Other statements in the GSPs regarding subbasin boundaries are incorrect or contradictory. For example, page 4-10 of the draft Eastside GSP states: "*The southeastern boundary* [of the Eastside] *with the adjacent Forebay Subbasin is near the town of Gonzales (DWR, 2004). It is extended from the approximate southern limit of the regional clay layers that are the defining characteristic of the southern extent of the 180/400-Foot Aquifer Subbasin. There may be reasonable hydraulic connectivity with the Forebay Subbasin, although the principal aquifers change from relatively unconfined to confined near this boundary*." The last sentence of this passage conflicts with the statement on page 4-18 of the draft Eastside GSP, where it is stated: "*In addition to the fact that aquifer material cannot be correlated between boreholes, no evidence exists for a discrete confining layer in the Subbasin (Brown and Caldwell, 2015)*."

Another example of a contradictory statement regarding subbasin boundaries occurs on page 4-10 of the draft Eastside GSP, as well as on page 4-9 of the 180/400 GSP, where it is stated: "*Previous studies of groundwater flow across this boundary* [i.e., between the Eastside and

180/400] *indicate that there is restricted hydraulic connectivity between the subbasins*." The references for these previous studies should be provided, because this statement is an apparent contradiction with other statements in the draft Eastside GSP (e.g., p. 4-21 of the draft GSP, "*Subsurface recharge is primarily from inflow from the adjacent Forebay and 180/400-Foot Aquifer Subbasins to the south and west, respectively (DWR, 2004)*." The apparent uncertainty regarding the nature of the boundary between the Eastside and 180/400 should be listed as an identified data gap on page 4-35 of the draft Eastside GSP.

A detailed list of additional statements from the GSPs that establish and describe the subbasin interconnections is provided as **Attachment B**.

Minimum Thresholds and Groundwater Extractions

As described below, the evidence presented in the draft GSPs indicates that groundwater extractions in the Upper Valley deplete inter-subbasin groundwater flows to the Forebay. Groundwater extractions in the Forebay deplete inter-subbasin groundwater flows to the 180/400 and Eastside and streamflow to the 180/400. Groundwater extractions in the Eastside and Langley reduce groundwater levels in those subbasins to the point where they cause, or have the potential to cause, groundwater flow from the 180/400 to the Eastside and Langley, which is the reverse of the natural groundwater flow direction (i.e., the natural flow direction is from higher topographic elevation to lower topographic elevation). These conditions are likely exacerbating seawater intrusion (SWI) in the 180/400 and hinder or may even prevent that subbasin from achieving sustainability. Additionally, extractions in the 180/400, combined with inter-subbasin flow from the 180/400 to the Eastside, and potentially from the 180/400 to the Langley, has lowered groundwater levels to the point where groundwater is induced to flow from the Monterey to the 180/400.

These conditions are likely to persist indefinitely because the draft GSPs set unreasonably low MTs for the chronic lowering of groundwater levels, and projects and management actions, in general, appear to be insufficient to overcome these problems. Moreover, the unreasonably low MTs facilitate groundwater extractions at current or increased rates in the Upper Valley, Forebay, Eastside, and potentially the Langley, despite the issues described in the previous paragraph.

MTs and MOs have been set to differing levels in adjacent basins. The GSPs do not explain why such differences are appropriate and why or how they would lead to achieving sustainability throughout the SVGB. **Aquilogic** finds no significant analysis or discussion in the draft GSPs for the Upper Valley, Forebay, Eastside, or Langley on the impact of differing MTs and MOs or on the potential impacts of alternative MTs and MOs.

Upper Valley

The draft GSP for the Upper Valley states that locally defined significant and unreasonable groundwater elevations in the subbasin include groundwater levels that "*[a]re at or below the observed groundwater elevations during the 2012 to 2016 drought*."[1] However, the MT for the chronic lowering of groundwater levels is set five feet *lower* than the lowest level recorded between the drought years of 2012 and 2016.[2] In terms of the cumulative change in average groundwater levels, the MT is five feet *lower* than the 2016 level, which was the lowest average groundwater level ever recorded.[3] The 2016 level has never been exceeded since record keeping began in 1944, and that level occurred only because of the 2012-2016 drought. The next lowest level occurred in 1990, also during a severe drought, and was 8.5 feet higher than the 2016 level.[3] Nevertheless, groundwater levels have in general been stable over time in the Upper Valley due to the operation of Nacimiento and San Antonio reservoirs (SVGWBHC, 1995).[3]

Aquilogic finds that the history of groundwater levels in the Upper Valley[3] indicates the MT for chronic lowering of groundwater levels will only be exceeded if: (1) there is an unprecedented increase in groundwater extractions, and/or (2) an unprecedented, severe drought occurs. Importantly, the very low MT for groundwater levels facilitates increased groundwater extractions in the Upper Valley (perhaps significantly increased extractions), without triggering the "undesirable result" defined in the draft GSP.[4] By setting the MT for chronic lowering of groundwater levels at five feet lower than the historic low, undesirable results may occur. Further, the potential impact of increased pumping in the Upper Valley is ignored. Increased pumping could lower groundwater levels down to the MT, which would have impacts on the remainder of the SVGB.

SVBGSA acknowledges that groundwater extractions estimated by the SVIHM are only 76% of reported extractions in the Upper Valley.[5] The extractions estimated for the historical water budget were consequently updated to reflect this discrepancy, but the other groundwater budget components, some of which are linked to groundwater extractions, were not updated, although they should have been prior to completing the draft GSP.[6] Because of this, the following discussion relies on the SVIHM-calculated groundwater-budget components, for comparison purposes. It should be noted that the impacts described below could be determined to be even more significant, if and when pumping in the model is fixed.

---

[1] Page 8-7 of the draft Upper Valley GSP.
[2] Table 8-1, page 8-6 of the draft Upper Valley GSP
[3] Figure 8-2, page 8-12 of the draft Upper Valley GSP
[4] Increased extractions might be limited by the MT for depletion of interconnected surface water (ISW), which is set to 2016 groundwater levels in shallow wells near ISW. However, it follows that 2016 shallow-well groundwater levels are also likely to be the lowest levels in recorded history.
[5] Page 6-17 of the draft Upper Valley GSP
[6] Our understanding is that the USGS is working on resolving SVIHM issues such as these.

Prior to construction of Nacimiento and San Antonio reservoirs, groundwater levels in the Upper Valley were declining substantially.[7] In response to conservation releases from these two reservoirs, which flow to the Salinas River, groundwater levels in the Upper Valley began recovering in 1957 and have since stabilized. During the draft GSP's historical period (i.e., 1980-2016, post operation of the reservoirs), groundwater extractions (-91,600 acre-feet per year [AFY]) in the Upper Valley were supported by net stream exchange (89,100 AFY).[8]

On average, the draft GSP states that pumping in the Upper Valley does not substantially increase stream depletion. Although the draft GSP concludes that only an average of 1,100 AFY of stream depletion is caused by pumping (mostly limited to the Salinas River),[9,10] it should be noted that **aquilogic** believes the depletion value may be higher, because the method employed by SVBGSA to estimate stream depletion with the SVIHM does not account for stream cells that are connected to groundwater for less than 50% of the model period and, as noted above, the SVIHM underestimates pumping by 24%. It is expected that stream cells connected to groundwater for less than 50% of the model period (e.g., 48%) would also contribute to stream depletion. Furthermore, limiting the stream-depletion discussion in the draft GSP to the historical average obscures the higher stream depletions that would occur during drought years. Without understanding drought year depletion, the impact on adjacent basins during droughts cannot be assessed. Despite these limitations in the model results, **aquilogic** opines that *decreases* in current groundwater extractions in the Upper Valley would result in proportional *increases* in subsurface flow from the Upper Valley to the Forebay, as illustrated by the following discussion.[11]

The draft GSP's estimated stream depletion (due to pumping) is only 1% of the net stream exchange, which implies that streamflow infiltration along the Salinas River in the Upper Valley would be of the same order with or without pumping. The infiltration occurs due to the relatively high streambed conductivity and hydraulic conductivity of the surrounding aquifer, in conjunction with a hydraulic gradient that is directed away from the streambed and into the Upper Valley aquifer. Because of these conditions, and the fact that 99% of the net stream exchange occurs without the influence of groundwater extractions, **aquilogic** finds that the absence of pumping would not result in significant groundwater discharge into the Salinas River in the Upper Valley. Therefore, on average, Upper Valley pumping captures groundwater that would otherwise flow to the adjacent Forebay. On average, for the historical period, the Forebay receives only 7,700 AFY of subsurface flow from the Upper Valley.[12] This amount would

---

[7] Figure 5-8, page 5-13 of the draft Upper Valley GSP
[8] Table 6-10, page 6-22 of the draft Upper Valley GSP
[9] Table 5-4, page 5-31 of the draft Upper Valley GSP
[10] Figure 4-11, page 4-26 of the draft Upper Valley GSP
[11] The SBWA has previously asked the SVBGSA to conduct simulations with the SVIHM that would address this issue (see Attachment C).
[12] Table 6-6, p. 6-17 of the draft Forebay GSP

be higher if groundwater extractions in the Upper Valley were lower, which constitutes an impact on the adjacent Forebay. This impact cascades through the Forebay and into the 180/400 and the Eastside, and potentially the Monterey, and should be analyzed in the draft GSP.[11]

It should not be ignored that if groundwater extractions were to increase enough in the Upper Valley (relative to the historical average), groundwater levels could be lowered to the point where they are at or near the MT for the chronic lowering of groundwater levels (and the MT for depletion of ISW), which would result in substantially more stream depletion due to pumping than is revealed by limiting the analysis to historical averages. The draft Upper Valley GSP does not, but should, analyze this.

In summary, the draft Upper Valley GSP does not consider the undesirable results that would occur if the MTs were reached or exceeded, both within the Upper Valley and within downstream subbasins. This issue should be addressed before the Upper Valley GSP is finalized.

Forebay

In the draft GSP for the Forebay, the MT for the chronic lowering of groundwater levels is set to 2015 levels.[13] In terms of the cumulative change in average groundwater levels, this is the second lowest level on record.[14] The 2015 level has been exceeded once in recorded history, in 2016, when the average groundwater level was four feet lower. These low levels occurred only due to the 2012-2016 drought. The next lowest level occurred in 1991, also during a severe drought, and was 14.5 feet higher than the 2016 level.[14] Nevertheless, average groundwater levels have generally been stable over time in the Forebay due to the operation of Nacimiento and San Antonio reservoirs (SVGWBHC, 1995).[14]

Aquilogic finds that the history of groundwater levels in the Forebay[14] indicates the MT for chronic lowering of groundwater levels will only be exceed if: (1) there is an unprecedented increase in groundwater extractions, and/or (2) a severe drought occurs. Importantly, the very low MT for groundwater levels facilitates increased groundwater extractions in the Forebay under average conditions (perhaps significantly increased extractions), without triggering the “undesirable result” defined in the draft GSP.[15] By setting the MTs at 2015 levels, four feet above the historic low, undesirable results may occur. Further, the potential impact of increased pumping in the Forebay is ignored. Increased pumping could lower groundwater levels down to the MT, which would have impacts on the remainder of the SVGB.

[13] Table 8-1, page 8-6 of the draft Forebay GSP
[14] Figure 8-2, page 8-14 of the draft Forebay GSP
[15] Increased extractions might be limited by the MT for depletion of ISW. The MT for depletion of ISW is set by proxy to 2015 groundwater levels, for shallow groundwater near locations of ISW, which are also likely at or near historic lows.

SVBGSA acknowledges that groundwater extractions estimated by the SVIHM are only 65% of reported extractions in the Forebay.[16] The extractions estimated for the historical water budget were consequently updated to reflect this discrepancy, but the other groundwater budget components, some of which are linked to groundwater extractions, were not updated, although they should have been prior to completing the draft GSP. Because of this, the following discussion relies on the SVIHM-calculated groundwater-budget components, for comparison purposes. It should be noted that the impacts described below could be determined to be even more significant, if and when pumping in the model is fixed.

Prior to construction of Nacimiento and San Antonio reservoirs, groundwater levels in the Forebay were declining substantially.[17] In response to conservation releases from these two reservoirs, which flow to the Salinas River, groundwater levels in the Forebay began recovering in 1957 and have since stabilized. During the draft GSP's historical period (i.e., 1980-2016, post operation of the reservoirs), groundwater extractions (-108,700 AFY) in the Forebay were supported by net stream exchange (90,300 AFY).[18]

On average, pumping in the Forebay substantially increases stream depletion. According to the draft Forebay GSP, an average of 29,700 AFY of stream depletion along the Salinas River is caused by Forebay pumping.[19] It should be noted that **aquilogic** believes the depletion value may be higher, because the method employed by SVBGSA to estimate stream depletion with the SVIHM does not account for stream cells that are connected to groundwater for less than 50% of the model period, and as noted above, the SVIHM underestimates pumping by 35%. It is expected that stream cells connected to groundwater less than 50% of the model period (e.g., 48%) would also contribute to stream depletion. Furthermore, limiting the stream depletion discussion in the draft GSP to the historical average obscures the higher stream depletions that would occur during drought years. Without understanding drought year depletion, the impact on adjacent basins during droughts cannot be assessed. Despite these limitations in the model results, **aquilogic** opines that *decreases* in groundwater extractions in the Forebay would cause *increases* in subsurface flow from the Forebay to the Eastside and 180/400 and *increases* in surface flow from the Forebay to the 180/400, as illustrated by the following discussion.[11]

The reported stream depletion (due to pumping) value is 33% of the net stream exchange, which implies that substantial streamflow is captured by groundwater pumping in the Forebay. The draft Forebay GSP states that 31% of the stream depletion along the Salinas River occurs during the principal conservation period for reservoir releases,[19] and therefore is a desired outcome.[20] However, the draft GSP should also acknowledge that streamflow not depleted in

[16] Page 6-19 of the draft Forebay GSP
[17] Figure 5-7, page 5-11 of the draft Forebay GSP
[18] Table 6-12, page 6-23 of the draft Forebay GSP
[19] Table 5-4, page 5-30 of the draft Forebay GSP
[20] Page 8-42 of the draft Forebay GSP

the Forebay would flow to the 180/400, where streamflow infiltration of reservoir releases is also a desired outcome. **Aquilogic** finds that it is possible, but unlikely, that the absence of pumping would result in significant groundwater discharge into the Salinas River in the Forebay. Therefore, on average, Forebay pumping captures groundwater that would otherwise flow to the adjacent 180/400 and Eastside and captures streamflow that would otherwise flow to the 180/400. These inter-subbasin flows would be higher if Forebay pumping were lower, which constitutes an impact on the adjacent 180/400 and Eastside. The proportion of unpumped groundwater that would become subsurface flow to adjacent subbasins, relative to surface flow to the adjacent 180/400, is currently unknown but could be estimated with the SVIHM. The SBWA has repeatedly asked the SVBGSA to conduct simulations that would address this issue (see **Attachment C**). Regardless, the impacts on adjacent subbasins should be analyzed in the draft GSP.

It should not be ignored that if groundwater extractions were to increase enough in the Forebay (relative to the historical average), groundwater levels could be lowered to the point where they are at or near the MT for the chronic lowering of groundwater levels (and the MT for depletion of ISW), which would result in substantially more stream depletion due to pumping than is revealed by limiting the analysis to historical averages. The draft Forebay GSP does not, but should, analyze this.

In summary, the draft Forebay GSP does not consider the undesirable results that would occur within downstream subbasins if the MTs were reached or exceeded. This issue should be addressed before the Forebay GSP is finalized.

Eastside

In the draft GSP for the Eastside, the MT for the chronic lowering of groundwater levels is set to 2015 levels.[21] In terms of the cumulative change in average groundwater levels, this level has only been exceeded during the drought years of 1990-1993 and 2016.[22] That is, these low levels occurred only due to severe droughts. The MTs for reductions in groundwater storage and depletion of ISW in the Eastside are also set to 2015 groundwater levels, by proxy.[21,23]

Declining groundwater storage is documented in the Eastside,[24,25] although the magnitude is uncertain. The average storage decline initially estimated in the draft Eastside GSP is 3,400 AFY

---

[21] Table 8-1, page 8-6 of the draft Eastside GSP
[22] Figure 8-3, page 8-13 of the draft Eastside GSP
[23] However, the SVIHM-simulated cumulative change in storage does not correlate well with the average change in groundwater elevation (Figure 8-6, page 8-25 of the draft Eastside GSP). This is particularly true for the 1991-1998 period, during which groundwater levels were increasing, but the model shows ongoing storage declines.
[24] Figure 5-14, page 5-21 of the draft Eastside GSP
[25] Figure 6-10, page 6-21 of the draft Eastside GSP

for the years 1944-2019, based on groundwater elevation changes and an assumed storage coefficient.[26] Brown and Caldwell (2015) reported an average decline in groundwater storage in the Eastside of 5,000 AFY between 1944 and 2013.[27] On the other hand, the SVIHM calculates an average groundwater storage decline of 21,700 AFY from 1980 to 2016.[28] The draft Eastside GSP states that the SVIHM storage-decline estimate is "*…more consistent with drought year estimates than the long-term historical average estimates*," because it is similar in magnitude to the 25,000 AFY to 35,000 AFY storage decline estimated by Brown and Caldwell (2015) for the drought years of 1984-1991.[27] Because of these uncertainties, the draft Eastside GSP adopts an average of available estimates and states that the historical loss of groundwater storage is 10,000 AFY.[29] However, SVBGSA acknowledges that SVIHM-estimated groundwater pumping in the Eastside is only 81% of reported extractions,[30] which **aquilogic** interprets to mean that the SVIHM estimate of storage decline is also likely underestimated. Improving the estimated change in groundwater storage should be a priority for the SVBGSA, so that potential future changes in storage can be more readily assessed.

As noted, the draft Eastside GSP indicates that "undesirable results" for the chronic lowering of groundwater levels can be avoided in the Eastside by maintaining average groundwater levels at or above 2015 levels. Despite not triggering an "undesirable result,", **aquilogic** finds that groundwater elevation maps for 2015 show persistent and widespread groundwater flow from the 180/400 to Eastside in the Salinas area (i.e., southwest to northeast, at and near the subbasin boundary).[31,32] Importantly, the natural groundwater flow direction in this area is northeast to southwest (i.e., from higher topographic elevation to lower topographic elevation). The 2015 groundwater elevations show a reversal of the natural flow direction which, as stated, induces groundwater flow from the 180/400 to the Eastside. This flow direction is likely exacerbating SWI in the 180/400 and will likely continue to do so into the future. By setting the MTs at 2015 levels, which are near historic lows, undesirable results may occur. Further, the potential impact of increased pumping in the Eastside is ignored. Increased pumping could lower groundwater levels down to the MT, which would have impacts on the remainder of the SVGB.

Because the MTs for chronic lowering of groundwater levels, reduction of groundwater storage, and depletion of ISW are set to 2015 groundwater levels, **aquilogic** finds that sustainability, in terms of these three sustainability indicators (SIs), may come at the expense of the 180/400's ability to achieve sustainability for its SIs, particularly for SWI. The MT for SWI in the 180/400 is

[26] Pages 5-19 to 5-20 of the draft Eastside GSP
[27] Page 6-22 of the draft Eastside GSP
[28] Table 6-10, page 6-22 of the draft Eastside GSP
[29] Page 6-23 of the draft Eastside GSP
[30] Page 6-17 of the draft Eastside GSP
[31] https://www.co.monterey.ca.us/home/showpublisheddocument/31286/636355521174600000
[32] https://www.co.monterey.ca.us/home/showpublisheddocument/31284/636355520821470000

the 2017 extent of the 500 mg/L chloride isocontour.[33] This MT has already been exceeded,[34] which constitutes an undesirable result.[33] If average groundwater levels in the Eastside persist at the MT (i.e., 2015 groundwater levels), it may not be possible for the 180/400 to avoid undesirable results in terms of SWI. Note that the most promising project in the 180/400 for limiting SWI, a proposed SWI extraction barrier, will not address existing inland SWI.[35] Furthermore, the MT for SWI in the Eastside is the 500 mg/L chloride isocontour at the Subbasin boundary which, based on the current locations of that isocontour in the 180-Foot Aquifer and the 400-Foot Aquifer,[34] will not discourage Eastside pumping for many years, a scenario that may prevent the 180/400 from achieving sustainability.

Aquilogic finds that the measurable objective (MO) for chronic lowering of groundwater levels in the Eastside, which is set to 1999 groundwater levels, also allows continued groundwater flow from the 180/400 to the Eastside.[36] The sole groundwater contour map prepared for 1999 by the MCWRA shows that, similar to 2015, there was also persistent and widespread groundwater flow from the 180/400 to the Eastside,[37] as do maps from other sources,[38] particularly in and around the City of Salinas. Such southwest-to-northeast groundwater flow in 1999, which as noted is the reverse of the natural groundwater flow direction, likely exacerbated seawater intrusion in the 180/400, and would likely continue to do so even if the MOs for the chronic lowering of groundwater levels in the Eastside are achieved. To illustrate, there were substantial increases in SWI between 1997 and 1999, and between 1999 and 2001, in both the 180-Foot Aquifer[39] and the 400-Foot Aquifer.[40] Pumping in the 180/400 plays a role in ongoing SWI in the 180/400; however, northeastward groundwater flow to the Eastside in and around Salinas also plays a role. It should be noted that these increases in SWI in the 180/400 occurred during a time when groundwater levels were *increasing* in the Eastside (i.e., 1995-1999).[22] These issues—the potential for the Eastside MTs and MOs to exacerbate SWI in the 180/400—should be addressed in the draft GSP before the SVBGSA considers the document for adoption.

Aquilogic opines that, under the MTs set by the draft GSP, groundwater extractions in the Eastside could likely continue at their current magnitude, or perhaps even at a greater magnitude, despite the ongoing concerns described above. This opinion is supported by recent data. The draft Eastside GSP states that, "*[a]n undesirable result for chronic lowering of groundwater levels does not currently exist*…"[41] due to all representative monitoring sites being

---

[33] Table 8-1, page 8-6 of the 180/400 GSP
[34] Figures 11 and 12, pages 27 and 28 of the 180/400-Foot Aquifer Subbasin WY 2020 Annual Report
[35] Page 9-52 of the 180/400 GSP
[36] 1999 groundwater levels are also used for the reduction in groundwater storage and depletion of ISW MOs, by proxy.
[37] https://www.co.monterey.ca.us/home/showpublisheddocument/19504/636232633785900000
[38] Figures 8-4 and 8-5, pages 8-19 and 8-20 of the draft Eastside GSP
[39] https://www.co.monterey.ca.us/home/showpublisheddocument/100287/637514182745270000
[40] https://www.co.monterey.ca.us/home/showpublisheddocument/100289/637514807577300000
[41] Page 8-22 of the draft Eastside GSP

above their MTs in 2019. Because two other SIs use groundwater levels as proxies,[21] and due to other conditions related to the remaining SIs, the Eastside is currently sustainable, despite a history of chronic loss of groundwater storage and reversed groundwater flow that threatens to make sustainability in the 180/400 unachievable. It appears that the draft GSP could facilitate increased pumping, further impacting the 180/400, as groundwater contour maps for 2019 show the same persistent reversed groundwater flow from the 180/400 to the Eastside in and around Salinas that was observed in 1999 and 2015.[42] As previously noted, the draft Eastside GSP ignores the potential impact that increased pumping in the Eastside, which could lower groundwater levels down to the MT, may have on the remainder of the SVGB.

In summary, the Eastside GSP does not consider the undesirable results that would occur if the MTs and MOs were reached or exceeded, both within the Eastside and within the 180/400. This issue should be addressed before the Eastside GSP is finalized.

Langley

The MT for the chronic lowering of groundwater levels in the Langley is difficult to evaluate in a historical context, due to a lack of data. It is set at 2019 groundwater levels,[43] but in terms of the cumulative change in average groundwater levels,[44] there are no values for 2015 or for the drought years 1989-1991. The 2019 levels are among the lowest on record, and the lowest levels since 1994, but values on the order of 1-2 feet lower have been recorded.

Simulations with the SVIHM indicate net subsurface flow out of the Langley to the 180/400.[45] However, **aquilogic** finds that groundwater in the southwestern portion of the Langley flows from the 180/400 to the Langley,[46] which risks exacerbating SWI in the 180/400 and possibly preventing 180/400 from achieving sustainability in terms of SWI. Furthermore, the SWI MO and MT for the Langley state that the 500 mg/L chloride isocontour must not cross the Langley boundary from the 180/400.[43] If the 500 mg/L isocontour were to approach or cross the subbasin boundary, the SWI MT in the 180/400 would have been exceeded long before SWI MT in the Langley would be exceeded, a scenario that may prevent the 180/400 from achieving sustainability and could facilitate increased pumping in the Langley. Again, these issues should be analyzed before the GSP is finalized.

Monterey

The MT for the chronic lowering of groundwater levels in the Monterey is also difficult to evaluate, in part because changes to MTs and MOs occurred after the draft GSP was issued and

[42] https://www.co.monterey.ca.us/home/showpublisheddocument/87229/637177055290800000
[43] Table 8-1, page 8-6 of the draft Langley GSP
[44] Figure 8-2 of the draft Langley GSP
[45] Table 6-8, page 6-19 of the draft Langley GSP
[46] Figure 5-11, page 5-20 of the draft Langley GSP

the matter is still unresolved. In the Marina-Ord management area, the MT is set to the lowest groundwater level between 1995 and 2015.[47] It is our understanding that this MT will not change. In the Corral de Tierra management area, the draft GSP states that the MT for the chronic lowering of groundwater levels is set to 2015 groundwater levels.[47] However, it is our understanding, gleaned from public meetings, that that this level was changed to 2008 levels at a recent subbasin meeting and that the matter will be discussed in an upcoming subbasin meeting.

Descriptions of the Deep Aquifers in the draft Monterey GSP suggest that "*[t]here is a strong likelihood of flow through these confining layers (MCWRA, 2018).*"[48] **Aquilogic** believes this statement is speculative and not supported by water quality data. A detailed study of the Deep Aquifers by the SVBGSA will commence in the near future, which will likely provide additional insight into the nature of the confining layers in the Deep Aquifers. Until that study is completed, the draft GSP should avoid speculation.

The draft GSP for the Monterey used the Monterey Subbasin Groundwater Flow Model (MBGWFM) to determine historical, current, and projected water budgets, rather than the SVIHM. Under historical groundwater conditions, there is a net flow of groundwater out of the Monterey and into the 180/400.[49] For the projected water budget, multiple simulations were conducted with the MBGWFM to assess, among other things, the impact of possible future conditions in the 180/400. Under all reasonably foreseeable groundwater conditions in the 180/400, groundwater outflow from Monterey to 180/400 continues to occur.[50] These conditions could hinder or prevent the Monterey from achieving sustainability, and the draft GSP should address this more thoroughly.

Projects and Management Actions

Potential projects and management actions are listed and described in each of the draft GSPs and the 180/400 GSP for the SVGB in Monterey County. While lengthy, the list is not exhaustive. Furthermore, there has not been a comprehensive effort to simulate project benefits with the available models; thus, the potential effectiveness of many of the proposed projects and management actions is unknown.

Missing from the analysis of potential projects is perhaps the one project that could balance all or most of the water demands in the Monterey County portion of the SVGB. That project is the surface conveyance of groundwater extracted from the Forebay to be delivered to the Eastside and 180/400. This project was first proposed in DWR Bulletin 52 in 1946 as the second

[47] Table 8-1, page 8-11 of the draft Monterey GSP
[48] Page 36 of Chapter 4 of the draft Monterey GSP
[49] Table 6-1, page 6-20 of the draft Monterey GSP
[50] Table 6-4, page 6-44 of the draft Monterey GSP.

component of a larger project that included impoundment of surface water to provide conservation releases to the Salinas River. The surface impoundments were built: Nacimiento and San Antonio reservoirs. The groundwater extraction facilities and surface conveyance were never constructed. SVGWBHC (1995) found the 1946 solution, "…*so compelling we could not refrain from recommending it*." SVGWBHC (1995) also stated that, "*More recent studies conducted by MCWRA since 1946 have reaffirmed and endorsed the original concepts*." In addition, SVGWBHC stated:[51]

> "*We urge the MCWRA to focus its attention on the completion of the original plan by the construction and operation of water transfer facilities. The MCWRA should avoid diverting its attention to suggested alternatives that are less viable economically or less effective technically. These less viable and less effective alternatives would not provide the same benefits as the original plan, would be more expensive, and the projected price of water would be significantly higher for all parties.*
>
> *The panel believes strongly that Salinas Valley is fortunate that an in-Valley solution is available. We urge the Salinas Valley community to support the MCWRA in this effort to distribute the available water supplies for more efficient water management and lasting benefits for all residents of the Valley*."

In the era of the Sustainable Groundwater Management Act (SGMA), one need only replace "MCWRA" with "SVBGSA" in the above quote.

Delivery of Forebay groundwater extractions from such a project to the 180/400 for SWI mitigation and to the Eastside for overdraft mitigation has the potential to restore the natural groundwater flow direction in the Eastside by providing in-lieu recharge. Significantly, delivery of this water to the 180/400 may have the potential to restore SWI protective elevations, as described in Geoscience (2013), also via in-lieu recharge, and may also be able to provide water to a SWI injection barrier in the 180/400.

Aquilogic strongly encourages the SVBGSA to consider including this project in all of the GSPs.

[51] Page 18 of SVGWHC (1995)

References Cited

Brown and Caldwell (2015). State of the Salinas River Groundwater Basin. Prepared by Brown and Caldwell for the Monterey County Water Resources Agency. January. https://www.co.monterey.ca.us/home/showpublisheddocument/19586/636232667593230000, accessed September 30, 2021.

DWR (1946). Salinas basin investigation. Department of Public Works, Division of Water Resources. Bulletin 52. (Note, a subset of Bulletin 52 that contains the relevant information, Bulletin 52-B, can be found here: https://www.co.monterey.ca.us/home/showpublisheddocument/19576/636232667537000000, accessed September 30, 2021.)

Geoscience (2013). Protective elevations to control sea water intrusion in the Salinas Valley. Prepared by Geoscience for the Monterey County Water Resources Agency. November. https://www.co.monterey.ca.us/home/showpublisheddocument/19642/636232715345100000, accessed October 4, 2021.

Kennedy/Jenks (2004). Final report: Hydrostratigraphic analysis of the northern Salinas Valley. Prepared by Kennedy/Jenks Consultants for the Monterey County Water Resources Agency. May. https://www.co.monterey.ca.us/home/showpublisheddocument/19582/636232667568400000, accessed September 30, 2021.

SVGWBHC (1995). Hydrogeology and water supply of Salinas Valley: A white paper prepared by Salinas Valley Ground Water Basin Hydrology Conference for the Monterey County Water Resources Agency. June. https://www.co.monterey.ca.us/home/showpublisheddocument/19584/636232667576070000, accessed September 29, 2021.

MCWRA (2001). Draft environmental impact report / environmental impact statement for the Salinas Valley Water Project. Prepared by the Monterey County Water Resources Agency and the U.S. Army Corps of Engineers. June. https://www.co.monterey.ca.us/home/showpublisheddocument/24180/636281210678370000, accessed September 30, 2021.

Attachment A

185 San Leandro Way
San Francisco, CA 94127, USA
Mobile Tel. +1.949.939.7160
Web: www.aquilogic.com

CURRICULUM VITAE

September 2021

Anthony Brown

Principal Hydrologist

mobile: +1.949.939.7160
email: anthony.brown@aquilogic.com

Disciplines

Hydrology, Hydrogeology, Water Resources, Water Quality, Water Supply, Drinking Water Treatment, Contaminant Source Identification, Contaminant Fate and Transport, Soil and Groundwater Remediation, Environmental Liability Management, Legal and Regulatory Strategy.

Education

M.Sc.	Engineering Hydrology, Imperial College London, 1989
D.I.C.	Postgraduate diploma in Civil Engineering, Imperial College London, 1988
B.A.	Geography, King's College London, 1985

Professional Experience

Anthony is a versatile and proficient professional with over 30 years of experience in hydrology, hydrogeology, water resources, water quality, fate and transport of contaminants, groundwater remediation, regulatory strategy, water resources evaluation, and water supply engineering.

Anthony has conducted and managed numerous groundwater resources projects, including:

- resource evaluation, development and management
- water balance, storage capacity and safe yield analysis
- water rights disputes and adjudication
- marginal groundwater development (e.g., brackish water)
- aquifer storage and recovery (ASR)
- indirect potable reuse (IPR).

He has also implemented hundreds of hazardous waste site investigations, including sites with multiple potentially responsible parties (PRPs), complex hydrogeology and fate and transport, fractured rock, multiple contaminants, and co-mingled plumes. This work has included detailed Remedial Investigation (RI) or Phase II characterization studies, groundwater flow and solute transport modeling, Preliminary Endangerment Assessments, Human Health Risk Assessments,

and remedial feasibility studies (FS), remedial system design and implementation. Anthony has been involved in the design, testing, and permitting of drinking water treatment systems for impaired (contaminated) water sources.

Anthony has provided expert services to many prominent water and environmental law firms, the Attorneys General of California, New Jersey, Pennsylvania, Maryland, Ohio, North Carolina, and Puerto Rico, several County District Attorneys, and numerous City Attorneys' Offices.

Through his work for water utilities impacted by gasoline constituents (e.g. MTBE), chlorinated solvents (e.g. PCE, TCE), solvent stabilizers (e.g. 1,4-dioxane), soil fumigants (e.g. 1,2,3-TCP), chlorofluorocarbons (e.g. Freon 11, 12 and 113), perfluorinated compounds (i.e., PFAS), the rocket propellants perchlorate and NDMA, and hexavalent chromium, arsenic and other metals, Anthony has become a recognized expert in the fate, transport, and remediation of these compounds, and the protection of source waters from contamination by such recalcitrant chemicals.

Amongst other technical areas of expertise, he has also provided expert advice related to:

- groundwater resource development
- groundwater basin management
- California Sustainable Groundwater Management Act (SGMA)
- water rights and the development of physical solutions
- groundwater discharges and the Clean Water Act
- compliance with the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) and National Contingency Plan (NCP)
- cleanup under the Resource Conservation and Recovery Act (RCRA)
- the environmental impact of oil field contaminants and their mitigation
- source identification and mitigation of bacteria and fecal contamination in coastal waters
- source identification and persistence of microplastics in coastal waters.

Through his extensive experience on "high-profile" projects, Anthony has developed an excellent working relationship with private and public sector clients, Federal, State, and local elected officials and government agency staff, the legal community, professional organizations, non-profit environmental organizations, and his colleagues in the environmental and water resources professions.

Anthony has also testified before the U.S. Senate and briefed White House staff, federal, State, and local elected officials and regulators, independent commissions, professional groups, academic institutions, and the news media (including CBS 60 Minutes, National Public Radio [NPR] and local newspapers) on groundwater issues.

Beyond his US experience, Anthony has worked on projects in the United Kingdom, Ireland, Canada, Mexico, Costa Rica, Columbia, Ecuador, Yemen, Egypt, and Nepal.

U.S. Senate Testimony and Briefings for Elected Officials

- Testimony before the U.S. Senate Committee on Environment and Public Works on "the Appropriate Role of States and the Federal Government in Protecting Groundwater", on April 18, 2018.
- Briefing for White House Officials and the Council on Environmental Quality on "the Impact of MTBE on Water Resources of the United States", in October 1997.
- Briefing for U.S. Senators Feinstein and Boxer on "MTBE Contamination of the City of Santa Monica Water Supply", in October 1997.
- Briefing for Assistant Administrators and other leadership at the US Environmental Protection Agency (EPA) on "the Impact of MTBE on Water Resources of the United States", in October 1997.
- Briefing of State Senator Sheila Kuehl, several Assembly members, leadership at the California Environmental Protection Agency (CalEPA) and State Water Resources Control Board (SWRCB) on "MTBE Contamination of the City of Santa Monica Water Supply", in 1997-1998

Anthony has also briefed the following on the impact of fuel oxygenates, chlorinated solvents, rocket propellants, metals, oil field activities, and bacteria on water quality:

- USEPA staff (Region IX)
- State Senators and Assembly Members
- State regulators
- Local officials (Mayors, council and board members, City attorneys, etc.)
- Independent Commissions
- Professional bodies (ABA, ACS, ACWA, AEHS, AGWA, NGWA, GRA, etc.)
- Academic institutions and many other organizations
- Media outlets (NPR, CBS 60 Minutes, local TV stations)

Expert Consulting and Witness Services

Anthony is a respected, credible, and highly effective expert witness. He has testified at trial on 11 occasions, including three times in Federal court. Anthony is currently scheduled to testify in another seven trials during the next 18 months. Overall, he has been retained as an expert in over 60 matters related to water rights, water resources management, and water pollution. Anthony has provided deposition testimony in 27 of these matters and these depositions have lasted from one to 32 days in length.

Active:

- Retained (but not disclosed) in numerous cases (>200) related to the impact on water supplies by a group of emerging contaminants (consolidated in multi-district litigation [MDL])
- Lanier Parkway Associates vs. Hercules Chemical (Ashland) (the impact of benzene and chlorobenzene contamination from a chemical facility on an adjacent commercial property) – Superior Court of Glynn County, Georgia (expert affidavit)
- Retained (but not disclosed) by a confidential investor-owned water utility client addressing the impact of Per and polyfluorinated substances (PFAS) on water supplies in two northeastern states
- College Park East vs. Midway City Sanitary District et al (groundwater contamination by chlorinated solvents at a former dry cleaner) - US District Court, Central District of California (discovery)
- TC Rich et al vs. Shaikh et al (chlorinated solvent contamination at a former small batch chemical distributor in Los Angeles) - US District Court, Central District of California (expert report)
- Mojave Pistachios et al vs. Indian Wells Valley Groundwater Authority (IWVGA) (challenge to the Groundwater Sustainability Plan [GSP] and associated pumping fees in a groundwater basin in eastern Kern County) – California Superior Court, Kern County (discovery)
- James J. Kim vs. L. Tarnol et al (chlorinated solvent contamination at a former dry cleaner in Glendale) – California Superior Court, Los Angeles County (discovery)
- City of Oxnard v. Fox Canyon Groundwater Management Agency (water rights dispute) – California Superior Court, Los Angeles County (discovery)
- City of Arcadia vs. Dow Chemical et al (1,2,3-TCP contamination of groundwater resources and water supply wells) – US District Court, Central District of California (expert report)
- Friends of Riverside Airport vs. Department of the Army et al (poly-chlorinated biphenyl [PCB] contamination of soil at a former wastewater treatment plant in Riverside, California) US District Court, Central District of California (expert report, deposition)
- Stoll vs. Ewing et al (chlorinated solvent contamination at a former dry cleaner in Pleasanton) - US District Court, Northern District of California (discovery)
- San Luis Obispo Coastkeeper et al vs. Santa Maria Valley Water Conservation District et al (dispute over surface water flows to enhance steelhead habitat in the Santa Maria River watershed, Santa Barbara County) – US District Court, Central District of California (discovery)
- Mojave Pistachios vs. Indian Wells Valley Water District (IWVWD) et al (water rights dispute in eastern Kern County between agricultural interests and public water purveyors) – California Superior Court, Kern County (discovery)
- Goleta Water District vs. Slippery Rock Ranch (water rights dispute in central California between an avocado ranch adjacent to an adjudicated groundwater basin) – California Superior Court, Santa Barbara (expert report, deposition, trial scheduled for May 2021)

- Santa Barbara Channel-keeper et al vs. City of San Buenaventura et al (adjudication of surface water and groundwater rights in the Ventura River watershed, Ventura County) – California Superior Court, Los Angeles (expert report)
- Las Posas Valley Water Rights Coalition et al vs. Fox Canyon Groundwater Management Agency et al (adjudication of groundwater rights in the Las Posas Groundwater Basin, Ventura County) – California Superior Court, Santa Barbara (expert report, deposition pending, trial scheduled for 2022)
- Black Warrior Riverkeeper et al vs. Drummond Coal (acid mine drainage from a former coal mine impacting a tributary of the Black Warrior River, Alabama) – US Federal Court, Middle District of Alabama, Birmingham (expert report, deposition, trial scheduled for October 2021)
- City of Riverside vs. Goodrich et al (perchlorate contamination of groundwater resources and water supply wells) - California Superior Court (expert declaration, deposition, further deposition pending)
- Commonwealth of Pennsylvania vs. ExxonMobil, et al (State-wide assessment of impact and damages associated with MTBE and TBA releases) – US Federal Court, Southern District of New York (expert reports)
- State of Maryland vs. ExxonMobil et al (State-wide assessment of impact and damages associated with MTBE and TBA releases in Maryland) – US Federal Court, Southern District of New York (discovery)
- Steinbeck Winery et al vs. City of Paso Robles et al (Quiet title action brought by a group of wineries against the public water agencies to adjudicate water rights) - California Superior Court, San Jose (deposition, Phase 2 and Phase 3 trial testimony, Phase 4 pending)
- Various individuals vs. San Luis Obispo County et al (Trichloroethene [TCE] contamination in groundwater and water supply wells in a community adjacent to a County-operated airport) – California Superior Court, San Luis Obispo (litigation stayed)
- Commonwealth of Puerto Rico vs. Shell Oil Co., et al (Island-wide assessment of impact and damages associated with MTBE and TBA releases in Puerto Rico) – US Federal Court, Southern District of New York (expert report, deposition, trial pending)
- City of Fresno vs. Shell Chemical et al (1,2,3-TCP contamination of groundwater resources and water supply wells) – California Superior Court (discovery)
- New Jersey Department of Environmental Protection (NJDEP) vs. Sunoco et al (State-wide assessment of impact and damages associated with MTBE and TBA releases in New Jersey) – US Federal Court, Southern District of New York (expert report, deposition, hearing testimony, trial pending)
- Orange County Water District (OCWD) vs. Sabic Innovative Plastics et al (Chlorinated solvent, 1,4-dioxane and perchlorate contamination of groundwater resources from various sites in Orange County, California) – California Superior Court, Orange County (expert report, deposition [32 days], trial testimony)

- City of Modesto vs. Vulcan Chemical et al (perchloroethylene [PCE] releases from numerous dry cleaners contaminating drinking water wells and groundwater resources) – California Superior Court, San Francisco (expert reports, deposition [25 days], trial testimony, returned by Appeals Court)

Past:

- City of Upland vs. Dow Chemical et al (1,2,3-TCP contamination of groundwater resources and water supply wells) – US District Court, Central District of California (expert report, settled)
- Borrego Water District (water rights dispute and physical solution) – California Superior Court, San Diego (stipulated adjudication)
- Charleston Waterkeeper and South Carolina Coastal Conservation League vs. Frontier Logistics (lawsuit over polyethylene nurdle pollution in and around Charleston Harbor) - US District Court, Charleston District of South Carolina (expert report, settled)
- San Miguel Electric Cooperative vs. Peeler Ranch (contamination of soil, surface water and groundwater beneath a ranch from a lignite mine and coal-fired power plant) – Texas Superior Court, 218th District (expert report, deposition, hearing testimony, settled)
- City of Hemet vs. Dow Chemical et al (1,2,3-TCP contamination of groundwater resources and water supply wells) – US Federal Court, Southern District of California (expert report, settled)
- Sierra Club et al vs. Dominion Energy (contamination of groundwater and surface water resources by coal combustion residuals [CCRs] from ash ponds) – US Federal Court, Eastern District of Virginia (deposition, trial testimony)
- Sunny Slope Water Company vs. Dow Chemical et al (1,2,3-TCP contamination of groundwater resources and water supply wells) – California Superior Court, Los Angeles County (settled)
- Greenfield et al vs. Ametek Aerospace et al (solvent contamination in groundwater beneath three mobile home parks) – US Federal Court, Southern District of California, San Diego (expert report, deposition, settled)
- Golden State Water Company vs. Dow Chemical et al (1,2,3-TCP contamination of groundwater resources and water supply wells in Nipomo and Claremont) – US Federal Court, Southern District of California (expert report, settled)
- National Association for the Advancement of Colored People (NAACP) vs. Duke Energy (coal ash contamination of groundwater, sediments, and surface waters at the Belews Creek coal-fired power plant) – US Federal Court, Middle District of North Carolina (expert report, settled)
- City of Atwater vs. Shell Chemical et al (1,2,3-TCP contamination of groundwater resources and water supply wells) – California Superior Court (expert report, deposition, trial testimony)
- State of Vermont vs. ExxonMobil et al (State-wide assessment of impact and damages associated with MTBE and TBA releases in Vermont) – US Federal Court, Southern District of New York (settled)

- Trujillo et al vs. Ametek Aerospace et al (solvent contamination in groundwater beneath an elementary school) – US Federal Court, Southern District of California, San Diego (expert report, deposition, settled)
- Roanoke River Basin Association vs. Duke Energy (coal ash contamination of groundwater, sediments, and surface waters at two coal-fired power plants: Mayo and Roxboro) – US Federal Court, Middle District of North Carolina (expert report, deposition, settled)
- OCWD vs. Unocal et al (MTBE and TBA contamination of groundwater resources from service station sites in Orange County, California) – US Federal Court, Southern District of New York (expert report, deposition, settled)
- State of North Carolina vs. Duke Energy (administrative hearing related to coal ash contamination at six power plants) – North Carolina Superior Court (settled)
- City of Clovis vs. Dow Chemical et al (1,2,3-TCP contamination of groundwater resources and water supply wells) – California Superior Court (expert report, deposition, trial testimony)
- San Juan Hills Golf Course vs. City of San Juan Capistrano et al (suit filed over groundwater pumping in the San Juan Basin) – California Superior Court, Orange County (settled)
- City of Tulare vs. Dow Chemical et al (1,2,3-TCP contamination of groundwater resources and water supply wells) – California Superior Court (settled)
- State of California vs. Columbia Casualty Company et al (perchlorate and solvent contamination at the Stringfellow Acid Waste disposal pits in Glen Avon) – California Superior Court (expert report, settled)
- City of Delano vs. Crop Production Services (CPS) et al (Nitrate contamination of water supply wells) - California Superior Court (settled)
- Laborers' International Union of North America Local Union No. 783 v. Santa Margarita Water District et al. (Review of the groundwater hydrology of the Cadiz project, San Bernardino County) - California Superior Court, Orange County (independent expert report, settled)
- Southern California Water Company vs. Aerojet General Corp. (TCE, perchlorate and NDMA contamination of drinking water supplies in Rancho Cordova, California) – California Superior Court, Sacramento District (expert report, deposition, settled)
- The City of Stockton Redevelopment Agency (RDA) vs. Conoco-Phillips et al (petroleum hydrocarbon contamination at former oil terminals) – California Superior Court (deposition, settled)
- PK Investments vs. Barry Avenue Plating (hexavalent chromium and solvent contamination of soil and groundwater) - California Superior Court, Los Angeles District (deposition, settled)
- City of Santa Monica, California vs. Shell et al (MTBE contamination of drinking water supplies) – California Superior Court, Orange County District (expert report, deposition, settled)
- State of California vs. Joint Underwriters (perchlorate and solvent contamination at the Stringfellow Acid Waste disposal pits in Glen Avon) – California Superior Court (expert report, deposition, settled)

- Community of Broad Creek, North Carolina vs. BP Amoco et al (MTBE, benzene and 1,2-DCA contamination of private water supply wells) – North Carolina Superior Court (deposition, settled)
- South Tahoe Public Utility District, California vs. ARCO et al (MTBE contamination of drinking water supplies) - California Superior Court, San Francisco (expert report, deposition, trial testimony)
- Private well owners in 18 reformulated gasoline (RFG) states vs. various oil companies (class action related to MTBE) - US Federal Court, New York District (deposition, class certification hearing)
- Individual plaintiffs vs. Lockheed Corporation (TCE and perchlorate contamination of drinking water supplies in Redlands, California) – California Superior Court, Los Angeles District (deposition, settled)
- City of Norwalk vs. Five Point U-Serve et al (1.2-DCA contamination of a municipal drinking water well) – California Superior Court (deposition, case dismissed)
- Forest City Corp. vs. Prudential Real Estate (PCE contamination of soil and groundwater) – California Superior Court, Los Angeles District (deposition, trial testimony)
- Huhtamaki vs. Ameripride (chlorinated solvent contamination at a commercial dry cleaner/ laundry facility) – California Superior Court, Sacramento District (expert report, deposition, settled)
- Consolidated Electrical Distributors (CED) vs. Hebdon Electronics et al (chlorinated solvent contamination in fractured granite) - California Superior Court, North San Diego District (expert report, deposition, trial testimony)
- Southern California Water Company vs. various parties (water rights petition and adjudication for the American River, Sacramento, California) – State Water Resources Control Board, Sacramento
- The City of Santa Monica, California vs. ExxonMobil Corporation (MTBE contamination of drinking water supplies) – California Superior Court (designated, settled, retained as consultant to both parties for remedy implementation)
- The town of Glenville, California vs. various parties (MTBE contamination of drinking water supplies in Kern County, California) - California Superior Court (designated, settled)
- Great Oaks Water Company vs. Chevron and Tosco (MTBE contamination of drinking water supplies in San Jose, California) - California Superior Court (designated, settled)
- Orange County District Attorney's Office vs. ARCO et al (Underground Storage Tank [UST] violations, and MTBE contamination of soil and groundwater) - California Superior Court (designated, settled)
- Cambria Community Services District (CCSD) vs. Chevron et al (MTBE impact to drinking water supplies) in San Luis Obispo County, California - California Superior Court (designated, settled)
- Los Osos Community Services District (CCSD) vs. Chevron et al (MTBE impact to drinking water supplies) in San Luis Obispo County, California - California Superior Court (designated, settled)

- The town of East Alton, Illinois vs. various parties (MTBE contamination of drinking water supplies) – Illinois Superior Court, Jefferson County (designated, settled)
- The City of Dinuba vs. Tosco et al (MTBE contamination of groundwater resources) - California Superior Court (expert report, settled during deposition)
- Stella Stephens vs. Bazz-Houston et al (chlorinated solvent contamination at an active metal finishing facility in Garden Grove, California) - California Superior Court (designated, settled)
- Communities for a Better Environment (CBE) vs. Chrome Crankshaft (hexavalent chromium and TCE contamination beneath a chrome plating facility and adjacent school) - California Superior Court (designated, settled)
- California Attorney General's Office vs. Unocal (Natural Resource Damage Assessment [NRDA] at a former oil field in the central coast of California) - California Superior Court (designated, settled)
- Phillips Petroleum Corporation vs. private property owner (contamination from a former oil well in Signal Hill, California) - California Superior Court (designated, settled)
- Mobil Oil Corporation vs. private property owner (contamination from a former bulk fuel plant in the Bay Delta area) – California Superior Court (designated, settled)
- Mobil Oil Corporation vs. terminal operator (contamination from a former bulk fuel plant in Monterey area) – California Superior Court (designated, settled)

General Project Experience

Anthony has acted as the Principal in Charge, Project Manager (PM), Quality Assurance (QA) Manager and/or Principal Review for the following ongoing or recently completed projects:

Current Water Resources Projects

- Review of the Effect of Releases from a Reservoir on Surface Water Flows Intended to Enhance California Steelhead Habitat, and the Potential Impact on Groundwater Recharge – City of Santa Maria, Golden State Water Company
- An Investigation of the Hydrology of Perennial Spring in the Mojave Desert, as it Relates to Potential Impact from a Groundwater Resource Development Project - Three Valleys Municipal Water District
- Consulting Support Related to the Implementation of SGMA in the Pleasant Valley and Oxnard Plain Groundwater Basins, Pleasant Valley County Water District, Guadalasca Mutual Water Company.
- Consulting Support for a Surface Water and Groundwater Rights Dispute in the Ventura River Watershed – Group of Confidential Landowners
- Support Related to a New Car Manufacturing Plant in Huntsville, Alabama, and potential impact on habitat for an endangered species of fish – Center for Biological Diversity
- Review of the Groundwater Monitoring, Management, and Mitigation Plan (GMMMP) for the Cadiz Water Conservation Project – Three Valleys Municipal Water District

- Groundwater Consulting Support to an Agricultural Business in southeast Kern County Located within a Partially Adjudicated Basin – SunSelect
- Strategic Groundwater Consulting Support to a Large Golf Resort Located in a Desert Groundwater Basin Subject to Critical Overdraft under SGMA – Rams Hill GC
- Assessment of Water Resources at Oil Fields Throughout California and the Development of Produced Waters as an Alternate Water Supply – California Resources Corporation (CRC)
- Support Related to SGMA, Possible Adjudication, and Overall Groundwater Management Strategy for a Municipality in Southern California – Confidential Municipal Client
- Consulting Support for a Groundwater Rights Adjudication in the Las Posas Groundwater Basin, Ventura County – Group of Large Landowners
- Support Related to SGMA, Salinity Management, Alternate Water Sources, and Overall Groundwater Management Strategy for a Grower in the Bay-Delta – Wonderful Orchards
- Evaluation of the Feasibility of Using Brackish Groundwater and Oilfield Produced Water as an Alternate Water Supply for a Basin in Critical Overdraft – Northwest Kern Brackish and Oilfield (BOF) Water Study Group
- Support Related to SGMA, Possible Adjudication, and Overall Groundwater Management Strategy for a Large Water District in the Central Valley – Confidential Water District Client
- Water Rights Dispute Between a Water District and an Avocado Ranch in Central California – Slippery Rock Ranch
- Evaluation of the Feasibility of Using Brackish Groundwater as an Alternate Water Supply for a Closed Desert Basin in Critical Overdraft – Indian Wells Valley Brackish Water Study Group
- Development of a Plan for an Adjudication of Water Rights in a Desert Basin and the Principles of a Groundwater Management Plan (i.e., Physical Solution) – Confidential Water District Client
- Support Related to SGMA for Water Districts on the West Side of Kern County, Including the Creation of Defined Groundwater Management Areas – Westside District Water Authority
- Support to Agricultural Interests in the "White Areas" in Madera County with Respect to the Implementation of the California Sustainable Groundwater Management ACT (SGMA) – Madera County Farm Bureau
- Evaluation of Water Supply Options, Including New Water Supply Wells, for a Major Oilfield in West Fresno County – CRC
- Development of a Water Budget for a Baseline Period, and Evaluation of Native Safe Yield, Annual Operating Safe Yield, Historical Pumping, and Conditions of Overdraft as Part of a Water Rights Dispute in the Central Coast of California – City of Paso Robles
- Design and Permitting of an Aquifer Storage and Recovery (ASR) Project for Indirect Potable Reuse (IPR) of Tertiary Treated Municipal and Industrial Wastewater – City of Fresno
- Assessment of Increased Pumping at a Data Center and the Impact on Nearby Municipal Water Supply Wells in Charleston, South Carolina – Southern Environmental Law Center (SELC)

- Litigation Support and Development of Groundwater Management Approaches as an Alternative to Compliance with the Sustainable Groundwater Management Act – Confidential Water District Client, Southern California
- Groundwater Management Support to a Very Large Agribusiness with Over 170,000 Acres of Almonds, Pistachios, Mandarins, Pomegranates, and Grapes in the San Joaquin Valley - Wonderful Orchards
- Evaluation of Groundwater Conditions and Quality, and The Degree of Hydraulic Connection Between Groundwater Basins, as Part of a Water Rights Dispute in the Central Coast of California – City of Paso Robles
- Development of a Water Supply Well Drilling Ordinance and Valuation of Water Rights for a Confidential Municipality in Southern California
- Support for a Major Agricultural Interest with Holdings in Four Separate Groundwater Basins in Relation to the Implementation of SGMA – RTS Agribusiness
- Development of a New Water Supply Well Field, Including Compliance with California Division of Drinking Water (DDW) Policy 97-005 (Impaired Source Policy), and Evaluation of Groundwater Contamination at a Nearby Aerospace Facility – City of Torrance
- Evaluation of Aquifer Characteristics and Groundwater Conditions Related to the Reinjection of Oil Field Produced Water and Development of a Strategy to Obtain an Aquifer Exemption – Confidential Oil Company
- Development of a recycled water program (including possible aquifer storage and recovery [ASR]/salt-water intrusion program) using advanced treatment of a blend of brackish groundwater and urban storm-water – City of Santa Monica
- Membership of the Technical Advisory Committee (TAC) of a Cooperative Groundwater Group that will Become a Groundwater Sustainability Agency (GSA) – Indian Wells Valley
- Evaluation of Basin Hydrogeology, Groundwater Conditions, Water Quality, and Well Production in a Riparian Coastal Basin in Southern California – City of San Juan Capistrano
- Investigation and Development of Alternate Groundwater Supplies for an Agricultural Interest with Land Holdings in an Arid California Valley – Mojave Pistachios
- Development of a 50,000 acre-foot per year (AFY) ASR Project in the Eastern Portion of a Large Agricultural Valley in Southeast California – Confidential Client
- Review of the Groundwater Hydrology of the Cadiz Project – an independent expert report prepared for Orange County Superior Court in re: Laborers' International Union of North America Local Union No. 783 v. Santa Margarita Water District et al.

Petroleum Hydrocarbons

- Assessment of the Impact of MTBE/TBA Contamination of Water Resources in the State of Vermont, Including Contamination at Release Sites, Public Water Supply Wells, and Private Domestic Wells – State of Vermont

- Evaluation of Produced Water Management Options for Two Active Oil Fields in Southern California, including Treatment and Beneficial Use - CRC
- Assessment of the Impact of MTBE/TBA Contamination of Groundwater Resources in the State of Maryland, and Development of Costs to Address the Contamination at Release Sites, Public Water Supply Wells, and Private Domestic Wells – State of Maryland
- Investigation of Petroleum Hydrocarbon Contamination Related to Releases at a Pipeline that Crosses a Large Ranch in the Central Coast of California – Twin Oaks Ranch
- Assessment of Petroleum Contamination from a Large Pipeline Release that is Discharging to Two Streams and a Wetland in Belton, South Carolina – Southern Environmental Law Center (SELC)
- Evaluation of Contamination by Petroleum Hydrocarbons from a Pipeline Release at a Large Ranch/Winery in the Central Coast of California, and Development of a Conceptual Remedial Program and Costs to Implement – Santa Margarita Ranch, California
- Assessment of the Impact of MTBE/TBA Contamination of Groundwater Resources in the State of Pennsylvania, and Development of Costs to Address the Contamination at Release Sites, Public Water Supply Wells, and Private Domestic Wells – Commonwealth of Pennsylvania
- Investigation and Remediation of MTBE/TBA and Petroleum Hydrocarbon Contamination (using surfactant enhanced product recovery) at a Maintenance Facility in Hawthorne, California – Golden State Water Company
- Assessment of the Effectiveness of Site Investigation and Remediation Activities, Investigation of Off-Site Groundwater Contamination by MTBE/TBA, and Development of Remedial Programs (and Costs) at "Bellwether" Trial Sites - Orange County Water District
- Evaluation of Contaminant Conditions and Prior Site Investigation and Remediation Activity, Implementation of Off-site Investigations, and Development of Remedial Programs and Associated Costs to Address MTBE/TBA Contamination at Trial Sites in Puerto Rico – Commonwealth of Puerto Rico
- Assessment of Site Investigation and Remediation Activities, Investigation of Off-Site Groundwater MTBE/TBA Contamination, and Development of Remedial Programs (and Costs) at Trial Sites – New Jersey Department of Environmental Protection (NJDEP)
- Environmental Impact Report (EIR) and Baseline Environmental Assessment at a Proposed Oil Field Redevelopment Project, Southern Iraq - Confidential Client
- Development of a Remediation Approach and Costs for Soil and Groundwater Contamination at Two Former Petroleum Terminals – Stockton Redevelopment Agency
- Assessment of the Nature of Contamination and the Costs to Address this Contamination at a Former Municipal Landfill in San Diego County – Confidential Client
- Evaluation of Contaminant Sources, and the Fate and Transport of MTBE, 1,2-DCA and Benzene to Numerous Private Water Supply Wells in the Community of Broad Creek, North Carolina

- Assessment of the Effectiveness of Site Investigation and Remediation Activities to Address MTBE/TBA/Benzene Contamination at ARCO and Thrifty Service Stations Throughout Orange County, California - Orange County District Attorney's Office
- Evaluation of Contaminant Sources, Fate, Transport, and Impact of MTBE and TBA to Public Water Supplies, and the Costs to Treat these Contaminants, in the town of East Alton, Illinois
- Court Appointed Consultant to Develop Site Investigation Programs for MTBE/TBA/Benzene Contamination at 35 Thrifty Service Stations in Orange County
- Impact and Mitigation of Oil Field Contaminants at the Belmont Learning Center – Los Angeles Unified School District (LAUSD) - Belmont Commission
- Investigation, PRP Identification, Remediation and Restoration of Municipal Well Fields Impacted by MTBE Contamination – City of Santa Monica (Charnock Well Field), South Lake Tahoe Public Utility District (STPUD), Santa Clara Valley Water District (SCVWD), Great Oaks Water Company
- Oversight of Oil Company Investigation and Remediation Programs in Honolulu Harbor, Hawaii – US Environmental Protection Agency (USEPA)
- Assessment of Oil Field Contaminants in Relation to High Incidences of Leukemia and non-Hodgkins Lymphoma at a High School in Southern California – Confidential Client
- Evaluation of Fuel Releases and Their Impact upon Groundwater Resources at Service Stations, Bulk Plants, Fuel Terminals and Refineries Throughout California – Confidential Client
- Complete Restoration of Municipal Water Supply Wells Contaminated with MTBE – City of Santa Monica (Arcadia Well Field) and ExxonMobil Corporation
- Preliminary Environmental Assessment (PEA) at the Hull Middle School - located on a former oil field and landfill - Torrance Unified School District (TUSD), California
- Oversight of Investigation and Remediation Activities for a MTBE Release at a Service Station and the Potential Impact on a City's Water Distribution System – City of Oxnard, California
- Investigation of MTBE Contamination of Water Supply Wells and Other Petroleum Hydrocarbon Contamination at a Marine Fueling Depot on Catalina Island – Southern California Edison
- Impact of MTBE Releases at Service Stations and a Bulk Fuel Terminal on Drinking Water Wells and Groundwater Resources - City of Dinuba, California
- Oversight of a Court-ordered MTBE/TBA Plume Delineation Program at Gasoline Service Stations in Orange County, California – OCDA, California
- Oversight and Investigation of Remediation of MTBE Contamination Impacting Drinking Water Supplies in the Towns of Cambria and Los Osos/Baywood Park, California – Cambria Community Services District (CCSD), Los Osos Community Services district (LOCSD), Cal-cities Water Company
- Assessment of the Impact of an MTBE Release on Water Supply Wells, Sewers, and a Wastewater Treatment Plant – City of Morro Bay, California

- Investigation and Remediation of an MTBE Release in the Immediate Vicinity of a Drinking Water Supply Well - City of Cerritos, California
- Assessment of the Impact of Petroleum Hydrocarbon Contamination from a Wolverine Pipeline Release in Jackson, Michigan – Private Property Owner
- Investigation of Fuel Oil LNAPL and Hexavalent Chromium Contamination at a Former Clay Products Manufacturing Facility in Fremont, California – Mission Clay Products
- Assessment of the Impact of MTBE Releases on Water Supply Wells, and Oversight of Responsible Party (RP) Investigation and Remediation Activities - Soquel Creek Water District, California
- MTBE Contamination of Private Drinking Water Supplies and Development of Water Supply Treatment and Replacement Alternatives – Glenville, California
- Assessment of the Impact of MTBE on Drinking Water Supply Wells in Santa Clara County, California – Great Oaks Water Company (GOWC)
- Assessment of Data Gaps and Research Needs Regarding MTBE Impact to Water Resources – UK Environment Agency
- Investigation and Mitigation of the Impact of Oil Field Contaminants on a Large Apartment Complex in Marina del Rey, Los Angeles, California – Confidential Client
- Investigation and Remediation of Methane and Hydrogen Sulfide as Part of the Redevelopment of a Former Oil Field in Carson, California - Dominguez Energy/Carson Companies
- Assessment of Methane and Petroleum Hydrocarbon Contamination at a Former Oil Field in Santa Fe Springs, California – General Petroleum
- Natural Resource Damage Assessment (NRDA) at the Guadalupe Oil Field, California - State of California (Department of Fish and Game [DFG], Oil Spill Prevention and Response [OSPR], Attorney General and Regional Water Quality Control Board [RWQCB])
- Assessment of the Impact of Oil Field Activities on Surface Water and Groundwater Resources in the Central Coast of California – State of California
- Groundwater Investigation and Remediation at Four Petroleum Terminals in Wilmington, Carson, and San Pedro, California - GATX
- Research into Technologies for Treatment of MTBE in Water - Association of California Water Agencies (ACWA) / Western States Petroleum Association (WSPA) / Oxygenated Fuels Association (OFA)
- Characterization and Remediation of a Hydrocarbon Release (including MTBE) from a Refined Product Pipeline in Fractured Bedrock in Illinois – Shell
- Investigation and Remediation of Petroleum Hydrocarbon Contamination Beneath a City Maintenance Yard and City Bus Yard – City of Santa Monica, California
- Investigation and Remediation of a Gasoline Release (including MTBE) in Fractured Bedrock Resulting from a Catastrophic Tank Failure – Intrawest Ski Resorts, California

- Assessment of LNAPL, Aromatic Hydrocarbon, and Chlorinated Solvent Contamination Beneath a Former Waste Disposal Facility in Santa Fe Springs, California – Confidential Client
- Investigation of Soil and Groundwater Contamination at a Fueling Facility at a Municipal Airport – City of Santa Monica, California
- Pipeline Leak Investigation and Remedial Design - Mobil Pipeline, Ft. Tejon, California
- Investigation of a Petroleum Release in Fractured Bedrock - Chevron, Julian, California
- Contribution of Multiple Sources to Groundwater Contamination – Mobil Oil Corporation, La Palma, California
- Forensic Assessment of a Gasoline Release – Mobil Oil Corporation, Santa Monica, California
- Investigation of a Diesel Fuel Release – General Petroleum, Point Hueneme, California
- Service Station Investigations and Remediation (> 60 sites) - Mobil Oil Corporation, World Oil, Los Angeles County Metropolitan Transportation Authority (LACMTA), and Others
- Assessment of a Crude Release from a Former Pipeline - Mobil Oil, Gorman, California
- Remediation of 2,000,000-gallon (7,560 m^3) LNAPL Spill - Gulf Strachan Gas Plant, Alberta

Chlorinated Solvents

- Evaluation of Groundwater Contamination at an Aerospace Facility in El Cajon, the Threat to Water Supply Wells, and Vapor Intrusion Concerns at Overlying Properties – Confidential Client
- Investigation of Groundwater Contamination and Potential Sources for TCE Contamination in Groundwater and Water Supply Wells in a Community Adjacent to a County-Operated Airport – Confidential Client
- Evaluation of Poly-Chlorinated Biphenyls (PCBs) in Storm Water and the Impact on Groundwater Resources and the Use of Treated Storm Water for Aquifer Recharge and Saline Intrusion Barriers – Confidential Municipal Clients
- Assessment of the Effectiveness of Site Investigation and Remediation Activities, Investigation of Off-Site Groundwater Contamination, and Development of Remedial Programs (and Costs) at Solvent "Source Sites" in the South Basin Groundwater Protection Project (SBGPP) - Orange County Water District
- Consulting Support to a Community Adjacent to the Santa Susana Field Laboratory (SSFL), a Facility Previously Used to Test Rockets – Bell Canyon Homeowners Association
- Investigation of Groundwater Contamination by Perfluorinated Compounds (e.g., PFOA, PFOS) and its Impact on Public Water Supplies in Southeastern North Carolina – Confidential Client
- Investigation of Chlorinated Solvent and Petroleum Hydrocarbon Contamination, and Implementation of an Extended Remediation Pilot Study, at a Small-Batch Chemical Distribution Facility in Santa Fe Springs, California – Angeles Chemical Corporation

- Evaluation of Contaminant Distribution and Fate, and Development of a Remedial Approach and Costs, for Chlorinated Solvent Contamination in Groundwater at a Light Industrial Facility in Northridge, California, – Confidential Client
- Project Management Consultant (PMC) for the Hazardous Substances Account Act (HSAA) Program (i.e., State-CERCLA) as part of the SBGPP – Orange County Water District
- Assessment of Conceptual Hydrogeology and the Sources of 1,2-DCA and PCE Contamination of a Large Public Water Supply Well – Confidential Client
- Investigation and Remediation of Chlorinated Solvent Contamination in Soil and Groundwater Beneath a Metal Finishing Facility in Inglewood, California – Bodycote Hinterliter and Joseph Collins Estate.
- Investigation and Remediation of Soil and Groundwater Contamination at a Former Wood Treating Facility – Port of Los Angeles
- Assessment of the Nature of PCE Releases from Dry Cleaning Facilities, the Impact Upon Groundwater Resources, and the Cost of Remediation – City of Modesto, California
- Investigation of Chlorinated Solvent Contamination in Soil, Groundwater and Drinking Water Supplies Beneath Various Facilities in Lodi, California – Confidential Client
- Investigation of TCE and Hexavalent Chromium Contamination at the Suva School in Montebello, California – Communities for a Better Environment
- Remediation of Chlorinated Solvents, Including Vinyl Chloride, in Soil and Groundwater Beneath a Former Aerospace Facility in West Los Angeles, California – Playa Vista Capital
- Assessment of Chlorinated Solvent and Hexavalent Chromium Contamination at an Active Metal Finishing Facility in the City of Garden Grove, California – Confidential Client
- Investigation and Remediation of Hexavalent Chromium and TCE Contamination at an Active Plating Facility in West Los Angeles – confidential client
- Contamination of Drinking Water Supplies by TCE and Perchlorate from an Aerospace Manufacturing Facility in Redlands, California – Individual Plaintiffs
- Investigation and Remediation of Hexavalent Chromium, TCE, and Gasoline LNAPL Contamination at an Active Plating Facility in Santa Fe Springs, California – Confidential Client
- Investigation and Remediation of Hexavalent Chrome and TCE Contamination at the Los Angeles Academy (formerly Jefferson) Middle School, Los Angeles, California – Jefferson Site PRP Group
- Evaluation of Groundwater and Contaminant Conditions at an Active Municipal Landfill in Los Angeles County, California – Browning Ferris Industries (BFI)
- Investigation of Chlorinated Solvent Contamination in Groundwater Beneath a Municipal Airport – City of Santa Monica, California
- Resource Conservation and Recovery Act (RCRA) Facility Assessment and Closure for a Large Aerospace Facility in Hawthorne, California – Northrop Grumman Corporation

- Characterization of Complex Hydrogeology and Contaminant Fate and Transport (with Poly-chlorinated Biphenyls [PCBs] and Chlorinated Solvents) in Karstic Bedrock at a Site on the National Priority List (NPL) in Missouri – MEW PRP Steering Committee
- Design of a Groundwater Remediation Program for Chlorinated Solvent, Perchlorate and Other Contaminants Utilizing Existing Drinking Water Wells – San Gabriel Valley Water Company (SGVWC)
- Investigation of a Chlorinated Solvent Release in Fractured Bedrock – Consolidated Electrical Distributors, San Diego, California
- Contamination of Drinking Water Supplies by TCE from an Aerospace Manufacturing Facility in Redlands, California – Individual Plaintiffs
- Investigation of a Chlorinated Solvent Release at an Active Chemical Terminal - GATX, San Pedro, California
- Technical and Regulatory Assistance, and RP Oversight and Review, Chlorinated Solvent Contamination Beneath a Former Aerospace Facility – City of Burbank, California
- Investigation and Remedial Design for a Chlorinated Solvent Release at an Active Machine Shop – Mighty USA, Los Angeles, California
- Remediation of Chlorinated Solvents in Groundwater as Part of a Rail Freight Transfer Terminal Development - Port of Los Angeles, California
- Remedial Evaluation of PCE Contamination at a Former Scientific Instruments Manufacturing Facility – Forest City, Irvine, California
- Evaluation of a Chlorinated Solvent Release at a Dry Cleaners - Los Angeles City Attorney, West Los Angeles, California
- Assessment of a Chlorinated Solvent Release from Former Dry Cleaners – DeLoretto Plaza, Santa Barbara, California
- Characterization and Remediation of LNAPL at an Active Chemical Refinery - ICI, Teeside, UK

Perchlorate

- Investigation of Regional Perchlorate Contamination of Groundwater Resources in the Central Basin of Los Angeles – Water Replenishment District of Southern California (WRD)
- Investigation of regional groundwater contamination by perchlorate in the Rialto-Colton, Bunker Hill, and North Riverside Basins, and impact to water supply wells – City of Riverside
- Assessment of the Effectiveness of Site Investigation and Remediation Activities, Investigation of Off-Site Groundwater Contamination, and Development of Remedial Programs (and Costs) at Perchlorate Release Sites in the South Basin Groundwater Protection Project (SBGPP) - Orange County Water District
- Hydrogeologic Investigation, Source Identification, Water Supply Well Impact Assessment, and Drinking Water Treatment for Perchlorate – City of Morgan Hill, California
- Evaluation of the Fate and Transport of Perchlorate and NDMA Contamination and its Impact on Water Supplies in Rancho Cordova, California – Southern California Water Company

- Hydrogeologic Investigation, Water Supply Well Impact Assessment, Regulatory Assistance, and Responsible Party (RP) Oversight for Perchlorate Contamination – City of Gilroy, California
- Regulatory and Technical Assistance, RP Oversight and Review, Water Resource Impact Assessment for Perchlorate Contamination – City of Santa Clarita, California
- Design of a Groundwater Remediation Program for Chlorinated Solvent, Perchlorate and Other Contaminants Utilizing Existing Drinking Water Wells – San Gabriel Valley Water Company (SGVWC), San Gabriel Valley Superfund Site, California
- Evaluation of the Off-site Migration of Perchlorate and TCE Contamination from a Rocket Testing Facility in Simi Hills, California – City of Calabasas, County of Los Angeles
- Investigation of Potential Perchlorate Source Sites, Source Contribution, Contaminant Pathway Assessment, and Drinking Water Treatment – Fontana Water Company, West Valley Water District, Fontana, California
- Evaluation of Previous Environmental Investigations, Contaminant Transport and Remediation Options for Perchlorate and Solvent Contamination at the Stringfellow Acid Waste Disposal Pits in Glen Avon, California – Joint Underwriters

Hexavalent Chromium

- Investigation and Remediation of Hexavalent Chrome and TCE Contamination at the Los Angeles Academy (formerly Jefferson) Middle School, Los Angeles – Jefferson Site PRP Group
- Investigation and Remediation of Hexavalent Chromium and TCE Contamination at an Active Plating Facility in West Los Angeles – Confidential Client
- Hydrogeologic Investigation of Hexavalent Chromium Contamination in the Northern Area of the Central Basin in Los Angeles County – Water Replenishment (WRD)
- Investigation of TCE and Hexavalent Chrome Contamination at the Suva School in Montebello, California – Communities for a Better Environment
- Investigation of Fuel Oil LNAPL and Hexavalent Chromium Contamination at a Former Clay Products Manufacturing Facility in Fremont, California – Mission Clay Products
- Investigation and Remediation of Hexavalent Chromium, TCE, and Gasoline LNAPL Contamination at an Active Plating Facility in Santa Fe Springs California – Confidential Client

Other Projects

- Investigation of the Source, Magnitude, Extent and Fate of Polyethylene Nurdle Pollution in and Around Charleston Harbor – Charleston Waterkeeper and South Carolina Coastal Conservation League
- Review and Critique of Proposed Coal Ash Pond Closure at the Tennessee Valley Authority (TVA) Gallatin Power Plant - SELC
- Evaluation of Surface Water and Groundwater Pollution by Boron and Other Metals and Salts Associated with Coal Ash at Georgia Power's Plant Scherer Generating Station - SELC

- Assessment of the Impact of 1,2,3-TCP Contamination from Soil Fumigant Applications on Municipal Water Supplies – City of Arcadia
- Investigation of PCB Contamination at a Former Wastewater Treatment Plant at a Former US Army Camp – City of Riverside
- Investigation of the Fate, Transport, and Persistence of 1,2,3-TCP Contamination of Groundwater and Municipal Water Supply Wells – City of Upland
- Assessment of Sediment, Surface Water, and Groundwater Contamination Associated with Coal Ash at the Belews Creek Coal-Fired Power Plants in North Carolina, and an Evaluation of Closure Options for Coal Ash Basins – NAACP
- Assessment of the Impact of 1,2,3-TCP Contamination from Soil Fumigant Applications on Municipal Water Supplies – Sunny Slope Water Company
- Investigation of Sources and Fate and Transport of 1,2,3-TCP Contamination in Groundwater and its Impact on Potable Water Supply Wells in and around the City of Claremont – Golden State Water Company
- Evaluation of disposal and/or treatment options for produced waters at three active oil fields in Kern County – California Resources Corporation
- Assessment of 1,2,3-TCP Contamination of Groundwater and Potable Water Supply Wells in the Nipomo Area of Central California – Golden State Water Company
- Evaluation of potential water resources impacts from a proposed coal ash landfill located within a flood plain near Laredo Texas – confidential ranch owner
- Investigation of the Fate, Transport, and Persistence of 1,2,3-TCP Contamination of Groundwater and Municipal Water Supply Wells – City of Hemet
- Investigation of elevated concentrations total dissolved solids (TDS) and dissolved metals in surface water and groundwater related to an active lignite mine and coal-fired power plant at a large ranch in southeast Texas – Peeler Ranch
- Assessment of soil, groundwater, and surface water contamination associated with a Former Manufactured Gas Plant (MGP) in South Carolina – Southern Environmental Law Center (SELC)
- Evaluation of Contaminated Groundwater and Surface Waters by 1,4-dioxane, Perfluorinated Compounds [PFCs], and Gen-X at a Chemical Manufacturing Facility in North Carolina – Cape Fear Riverkeeper
- Investigation of 1,2,3-TCP Contamination of Groundwater and Municipal Water Supply Wells – City of Fresno
- Evaluation of Surface Water, Sediment, and Groundwater Contamination and Assessment of Remedial Actions at a Former Manufactured Gas Plant in South Carolina – Confidential Client
- Evaluation of Flow Conditions and Water Quality in Surface Water and Groundwater at an Active Coal-Fired Power Plant in North Carolina, including Three-Dimensional Groundwater Flow and Solute Transport Modeling – Sierra Club

- Assessment of 1,2,3-TCP Contamination of Groundwater Resources and Water Supply Wells in Clovis, California, and Development of Well-head Treatment Programs and Associated Costs - City of Clovis
- Investigation of Surface Water and Groundwater Impacted by Acid Mine Drainage (AMD) from a Former Coal Mine in Alabama, Including Geophysical Mapping, Piezometer Installation, and Soil, Sediment, and Surface Water Sampling – Black Warrior Riverkeeper
- Evaluation of Groundwater and Surface Water Contamination by Coal Combustion Residuals (CCRs) from Ash Ponds at Power Generation Facilities in Eastern Virginia – Sierra Club
- Investigation of 1,2,3-TCP Contamination of Groundwater and Municipal Water Supply Wells – City of Atwater
- Evaluation of Contaminant Sources and Hydrogeologic Pathways for 1,2,3-TCP Contamination of Water Supply Wells - City of Tulare
- Identification of Potential Sources of Nitrate Contamination at a Municipal Water Supply Well – Water Replenishment District of Southern California (WRD)
- Assessment of Sediment, Surface Water, and Groundwater Contamination Associated with Coal Ash at Two Coal-Fired Power Plants in North Carolina, and an Evaluation of Closure Options for Coal Ash Basins – Roanoke River Basin Association
- Assessment of the Volume and Quality of Storm Water and Shallow Groundwater (from Dewatering) at a Large Condominium Complex, as part of a City's MS-4 Storm Water Permitting – Coronado
- Investigation of Nitrate Contamination of Groundwater Resources and Water Supply Wells in Delano, California, and Development of Well-head Treatment Programs and Associated Costs - City of Delano
- Evaluation of Contaminant Conditions and Closure Plans for Coal Ash Basins at Two Coal-Fired Power Plants in Virginia – Sierra Club
- Evaluation of Groundwater and Surface Water Contamination by CCRs from Ash Ponds at a Former Power Generation Facility in Central Virginia – Sierra Club and Potomac Riverkeeper
- Negotiation of Private Agreements Between Water Utilities and RPs – City of Santa Monica, STPUD, City of Morro Bay, SGVWC, GOWC, City of Oxnard, OCDA
- Evaluation of Power Plant Intake and Outfall Structures on Fecal Coliform Plume Dynamics and Resulting Beach Closures, Huntington Beach, California – California Energy Commission
- Investigation of Bacteria and Fecal Contamination in Groundwater Beneath the Downtown Area of Huntington Beach, California – City of Huntington Beach
- Investigation of the Source(s) and Transport of Enterococcus and Fecal Bacteria to the Near Shore Waters of Huntington Beach, California – City of Huntington Beach, County of Orange, Orange County Sanitation District (OCSD)
- Characterization and Remediation, Former Town Gas Sites - British Gas Properties, U.K.
- Aquifer Characterization, Contaminant Assessment, Slurry Wall Design and Installation, Soil Excavation and Water Treatment System Design - Port of Los Angeles, California

Professional History

aquilogic, Inc., CEO and Principal Hydrologist, 2011 to present.
exp, Executive Vice-President, Chief Business Development Officer, 2010 to 2011
WorleyParsons, Senior VP, Strategy & Development, 2006 to 2010.
Komex Environmental Ltd., Chief Executive Officer, Principal Shareholder, Director, 1999 to 2005.
Komex•H2O Science•Inc., President and Principal Hydrologist, 1992 to 1999.
Remedial Action Corporation, Project Manager and Geohydrologist, 1989 to 1992.
Lanco Engineering, Project Manager, 1985 to 1987, and 1988.
Royal Geographical Society, Kosi Hills Resource Conservation Project, Nepal: Project Director, 1983 to 1985

Teaching

Anthony has recently taught the following classes:

- Environmental Aspects of Soil Engineering and Geology - a ten-week course at the University of California, Irvine
- Site Characterization and Remediation of Environmental Pollutants - two lectures as part of the course at Imperial College London
- Methyl Tertiary Butyl Ether: Implications for European Groundwater - a one day seminar for the UK Environment Agency (UKEA)
- Successful Remediation Strategies – a two-day course for the NGWA
- Understanding Environmental Contamination in Real Estate, and one day class for the International Right-of-Way Association (IRWA)
- Project Development and the Environmental Process, a one-day class for the IRWA
- Environmental Awareness, a one-day class for the IRWA
- Regional Fuels Management Workshop, a two-day workshop for the USEPA.

Publications

In addition to his teaching experience, Anthony has prepared over 1000 written project reports, and has written, presented and published many articles regarding the following:

- The implementation of the SGMA in California
- Groundwater law in California
- The development of alternate water supplies, notably brackish groundwater
- Aquifer storage and recovery and other groundwater augmentation actions
- The Clean Water Act and groundwater contamination
- Contamination of groundwater and drinking water supplies by fuel oxygenates, chlorinated solvents, rocket propellants, PFCs, and metals
- Contaminant fate and transport in fractured or heterogeneous media
- The impact of oil field activities on the environment

- Source water assessment and protection
- Public health and toxicology
- Risk analysis and assessment
- Environmental economics
- General water resources and environmental issues

The following is a list of publications and presentations:

Brown, A., 2021. Science in the Court Room: Expert Witness Testimony in Contamination Cases. American Groundwater Trust California PFAS Webinar, March 2021.

Brown, A., 2021. Sources of 1,2,3-TCP and its Persistence in California Groundwater. American Groundwater Trust 1,2,3-TCP Webinar, February 2021.

Brown, A., 2020. Groundwater and the Clean Water Act. American Groundwater Trust California Groundwater Conference, Ontario, February 2020.

Brown, A., and T. Watson, 2020. Produced Water – A New California Resource. Produced Water Society Annual Seminar, Houston, February 2020.

Brown, A., 2019. Perspectives on the Future of the Water Business. Environmental Business International, Industry Summit, San Diego, March 2019.

Brown, A., 2019. Paso Robles – The First Jury Trial over Water Rights in California. American Groundwater Trust California Groundwater Conference, Ontario, February 2019.

Brown, A., 2018. Emerging Contaminants – Where Do They Come From? American Groundwater Trust Conference on Emerging Contaminants, Chino Basin, March 2018.

Brown, A., 2017. Contaminated Groundwater as a Resource. State Bar of California Environmental Law Conference, Yosemite, October 2017.

Stone A. and A. **Brown**, 2017 (organizers). Groundwater Law – An American Groundwater Trust Conference. UC Hastings Law School, San Francisco, May 18, 2017

Brown, A. 2016. The SGMA Cookbook – Implementing the Sustainable Groundwater Management Act. Association of California Water Agencies (ACWA), Spring Conference, Monterey, CA, April 2016.

Stone A. and A. **Brown**, 2016 (organizers). Groundwater Law – An American Groundwater Trust Conference. Loyola Law School, Los Angeles, April 26, 2016

Stone A. and A. **Brown**, 2015 (organizers). Groundwater Law – An American Groundwater Trust Conference. Doubletree San Francisco Airport, May 15, 2015

Brown, A., 2015. Challenges Implementing the California Sustainable Groundwater Management Act (SGMA). Bar Association of San Diego County, May 5, 2015.

Brown, A., 2015. Technical and Other Issues Implementing the California Sustainable Groundwater Management Act (SGMA). Ventura Association of Water Agencies, March 19, 2015.

Brown, A., 2015. Outlook for Environmental Services in the Global Energy and Resources Sectors. Environmental Business Journal, Environmental Industry Summit, San Diego, March 11-13, 2015.

Brown, A., 2015. The Effect of $50 Oil on the Environmental Services Sector. Environmental Business Journal Conference, San Diego, March 11-13, 2015.

Brown, A. 2014. Hydrology and the Law: The Role of Science in the Resolution of Legal Issues for Water Quality and Damages Issues. Law Seminars International, Santa Monica, CA. October 2014

Stone A. and A. **Brown**, 2014 (organizers). Groundwater Law – An American Groundwater Trust Conference. Marriott Marina del Rey, May 20-21, 2014

Brown, A. 2014. Environmental Issues with Hydraulic Fracturing. Los Angeles County Bar Association (LACBA), Spring Symposium, Los Angeles, CA. April 2014.

Brown, A. 2014. Environmental Services in the Global Energy & Resources Sectors. Environmental Business Journal, Environmental Industry Summit, San Diego, March 2014.

Brown, A. 2013. Dealing with Emerging Groundwater Contaminants. Association of California Water Agencies (ACWA), Fall Conference, Los Angeles, November 2013.

Brown, A., 2013. Outlook for Environmental Services in the Global Energy and Resources Sectors. Environmental Business Journal, Environmental Industry Summit, San Diego, March 2013.

Brown, A., Colopy, J, and Johnson, T, 2007. Groundwater Science in the Courtroom: Observations from the Expert Witness Chair. Groundwater Resource Association of California (GRAC), Groundwater Law Conference, San Francisco, June 2007.

Brown, A. 2005. Emerging Water Contaminants. California Special Districts Association (CSDA), Annual Conference, Palm Springs, May 2005.

Brown, A. 2005. The Interplay of Science and Policy at Contaminated Sites. Los Angeles County Bar Association (LACBA), Spring Symposium, Los Angeles, CA. April 2005.

Brown, A., M. Trudell, G. Steensma, and J. Dottridge, 2005. European Experiences with Artificial Aquifer Recharge. Groundwater Resource Association of California (GRAC), Aquifer Storage Conference, Sacramento, March 2005.

Brown, A. 2004. Viagra, Estrogen, Prozac, and Other Emerging Contaminants: have you checked your groundwater lately? American Groundwater Trust (AGWT), Legal Issues Conference, Los Angeles, November 2004.

Brown, A. 2004. The Use of Groundwater Models in Complex Litigation. American Groundwater Trust (AGWT), Groundwater Models in the Courtroom Symposium, May 2004.

Brown, A. 2004. Emerging Groundwater Contaminants: MTBE as a Case Study. Association of California Water Agencies (ACWA), Spring Conference, Los Angeles, May 2004.

Rohrer, J., A. **Brown**, S. Ross, 2004. MTBE and Perchlorate, Lessons Learned from Recent Groundwater Contaminants. California Special Districts Association (CSDA), Annual Conference, Palm Springs, May 2004.

Hagemann, M., A. **Brown**, and J. Klein, 2002. An Estimate of Costs to Address MTBE Releases from Underground Storage Tanks and to Treat Drinking Water Supplies Impacted by MTBE. NGWA, Conference on MTBE: Assessment, Remediation, and Public Policy, Orange, CA. June 2002

Hagemann, M., A. **Brown**, and J. Klein, 2002. From Tank to Tap: A Chronology of MTBE in Groundwater. NGWA, Conference on Litigation Ethics, and Public Awareness, Washington, D.C., August 2002

Major, W., A. **Brown**, S. Roberts, L. Paprocki, and A. Jones, 2001. The Effects of Leaking Sanitary Sewer Infrastructure on Groundwater and Near Shore Ocean Water Quality in Huntington Beach, California. California Shore and Beach Preservation Association and California Coastal Coalition – Restoring the Beach: Science, Policy and Funding Conference. San Diego, California, November 8-10, 2001.

Ross, S.D., A. Gray, and A. **Brown,** 2001. Remediation of Ether Oxygenates at Drinking Water Supplies and Release Sites. Can-Am 6th Annual Conference of National Groundwater Association Banff, Alberta, Canada. July 2001.

Gray, A.L. and A. **Brown**, 2000. The Fate, Transport, and Remediation of Tertiary-Butyl-Alcohol (TBA) in Ground Water. Proceedings of the NGWA/API 2000 Petroleum Hydrocarbons and Organic Chemicals in Groundwater: Prevention, Detection, and Remediation. Anaheim, November 14-17, 2000.

Hardisty, P.E., J. Dottridge and A. **Brown**, 2000. MTBE in Ground Water in the United Kingdom and Europe. Proceedings of the NGWA/API 2000 Petroleum Hydrocarbons and Organic Chemicals in Groundwater: Prevention, Detection, and Remediation. Anaheim, November 14-17, 2000.

Brown, A., B. Eisen, W. Major, and A. Zawadzki, 2000. Geophysical, Hydrogeological and Sediment Investigations of Bacterial Contamination in Huntington Beach, California. California Shore and Beach Preservation Association – Preserving Coastal Environments Conference. Monterey, California, November 2-4, 2000.

Hardisty, P.E., G.M. Hall, A. **Brown** and H.S. Wheater, 2000. Natural Attenuation of MTBE in Fractured Media. 2nd National Conference on Natural Attenuation in Contaminated Land and Groundwater. Sheffield, U.K., June 2000.

Brown, A., 2000. Treatment of Drinking Water Impacted with MTBE. Mealey's MTBE Conference. Marina del Rey, California. May 11-12, 2000.

Brown, A., 2000. Other Fuel Oxygenates in Groundwater. Mealey's MTBE Conference. Marina del Rey, California. May 11-12, 2000.

Brown, A., 2000. The Fate, Transport and Remediation of TBA in Groundwater. Mealey's MTBE Conference. Marina del Rey, California. May 11-12, 2000.

Brown, A., 2000. MTBE Contamination of the City of Santa Monica Water Supply: Recap. Mealey's MTBE Conference. Marina del Rey, California. May 11-12, 2000.

Mooder, R.B., M.D. Trudell, and A. **Brown**, 2000. A Theoretical Analysis of MTBE Leaching from Reformulated Gasoline in Contact with Groundwater. American Chemical Society, Div. of Environmental Chemistry, 219th ACS National Meeting. San Francisco, March 26-30, 2000.

Trudell, M.R., K.D. Mitchell, R.B. Mooder, and A. **Brown**, 2000. Modeling MTBE Transport for Evaluation of Migration Pathways in Groundwater. American Chemical Society, Div. of Environmental Chemistry, 219th ACS National Meeting. San Francisco, March 26-30, 2000.

Brown, A., 1999. How LUST Policy Led to the Current MTBE Problem. Submitted for the Government Conference on the Environment. Anaheim, CA. August 1999.

Trudell, M.R., K.D. Mitchell, R.B. Mooder and, A. **Brown**, 1999. Modeling MTBE transport for evaluation of migration pathway scenarios. In proceedings, 6th International Petroleum Environmental Conference, Houston TX, November 16-19, 1999. Integrated Petroleum Environmental Consortium, University of Tulsa, OK.

Gray, A.L., A. **Brown**, R.A. Rodriguez, 1999. Treatment of a Groundwater Impacted with MTBE By-Products**.** In proceedings, 6th International Petroleum Environmental Conference, Houston TX, November 16-19, 1999. Integrated Petroleum Environmental Consortium, University of Tulsa, OK.

Gray, A.L., A. **Brown**, M.M. Nainan, and R.A. Rodriguez, 1999. Restoring a Public Drinking Water Supply Contaminated with MTBE. In proceedings, 6th International Petroleum Environmental Conference, Houston TX, November 16-19, 1999. Integrated Petroleum Environmental Consortium, University of Tulsa, OK.

Ausburn M.P., A. **Brown**, D. A. Reid, and S.D. Ross, 1999. Environmental Aspects of Crude Oil Releases to the Subsurface. In proceedings, 6th International Petroleum Environmental Conference, Houston TX, November 16-19, 1999. Integrated Petroleum Environmental Consortium, University of Tulsa, OK.

Hardisty, P.E., A. **Brown**, and H. Wheater, 1999. Using Economic Analysis to Support Remedial Goal Setting and Remediation Technology Selection. In proceedings, 6th International Petroleum Environmental Conference, Houston TX, November 16-19, 1999. Integrated Petroleum Environmental Consortium, University of Tulsa, OK.

Brown, A., and J.J. Clark, 1999. MTBE: Air Today, Gone Tomorrow! California Environmental Law and Remediation Reporter. Argent Communications Group. Foresthill, CA. Volume 9 (2): pp 21 - 30.

Brown, A., P.E. Hardisty, and H. Wheater, 1999. The Impact of Fuel Oxygenates on Water Resources. A one-day course for the UK Environment Agency. London, UK. June 1999

Brown, A., K.D. Mitchell, C. Mendoza and M.R. Trudell, 1999. Modeling MTBE transport and remediation strategies for contaminated municipal wells. Battelle In-Situ and On-Site Bioremediation, Fifth International Symposium, San Diego, CA. April 19-22, 1999.

Brown, A., 1999. LUST Policy and Its Part in the MTBE Problem. USEPA National Underground Storage Tank Conference. Daytona Beach, FL. March 15-17, 1999.

Brown, A., T.E. Browne, and R.A. Rodriguez, 1999. Restoration Program for MTBE Contamination of the City of Santa Monica Arcadia Well Field. Ninth Annual Conference on Soil and Groundwater Contamination, Oxnard, CA. March 1999.

Brown, A., 1999. Moderator of a Panel Session - Judging Oil Spill Response Performance: The Challenge of Competing Perspectives. International Oil Spill Conference. Seattle, WA. March 8-11, 1999.

Brown, A., 1999. MTBE: Asleep at the Wheel! Editorial in the Newsletter of the Los Angeles County Bar Association, Environmental Section. February 1999.

Brown, A., J.S. Devinny, T.E. Browne and R.A. Rodriguez, 1998. Restoration of a Public Drinking Water Supply Impacted by Methyl *tertiary* Butyl Ether (MTBE) Contamination. Proceedings of the NGWA/API 1998 Petroleum Hydrocarbons and Organic Chemicals in Groundwater: Prevention, Detection, and Remediation, November 11-13, 1998, Houston, TX.

Brown, A., 1998. Petroleum and the Environment: A Consultants Perspective. USEPA Regional Fuels Management Workshop, November 3-4, 1998, Shell Beach, CA.

Brown, A., 1998. How Much Does Remediation Really Cost? Presented at the Southern California Chapter of the Appraisal Institute, Summer Seminar Spectacular: Damages, Diminution and Mitigation. Anaheim, California, August 13, 1998.

Brown, A., J.S. Devinny, A.L. Gray and R.A. Rodriguez, 1998. A Review of Potential Technologies for the Remediation of Methyl *tertiary* Butyl Ether (MTBE) In Groundwater. International Petroleum and the Environment Conference, Albuquerque, NM. October 1998.

Brown, A., A.L. Gray, and T.E. Browne, 1998. Remediation of MTBE at Leaking Underground Storage Tank (LUST) Sites. The UST Clean-up Fund Conference, Austin, TX. June 22, 1998.

Brown, A., J.R.C. Farrow, R.A. Rodriguez, and B.J. Johnson, 1998. Methyl *tertiary* Butyl Ether (MTBE) Contamination of the City of Santa Monica Drinking Water Supply: An Update. Proceedings of the National Ground Water Association (NGWA) Southwest Focused Conference: MTBE and Perchlorate, June 3-5, 1998, Anaheim, California.

Patterson, G, B. Groveman, J. Lawrence, and **A. Brown**, 1998. The Legal Implications, Claims, and Courses of Action for Water Purveyors Impacted by MTBE and Perchlorate. Proceedings of the NGWA Southwest Focused Ground Water Conference: Discussing the Issue of MTBE and Perchlorate in Ground Water. June 3-4, 1998, Anaheim, California.

Clark, J.J., **A. Brown**, and R.A. Rodriguez, 1998. The Public Health Implications of MTBE and Perchlorate in Water: Risk Management Decisions for Water Purveyors. Proceedings of the NGWA Southwest Focused Ground Water Conference: Discussing the Issue of MTBE and Perchlorate in Ground Water. June 3-4, 1998, Anaheim, California.

Brown, A., J.S. Devinny, M.K. Davis, T.E. Browne, and R.A. Rodriguez, 1997. A Review of Potential Technologies for the Treatment of Methyl *tertiary* Butyl Ether (MTBE) in Drinking Water. Proceedings of the NGWA/API 1997 Petroleum Hydrocarbons and Organic Chemicals in Groundwater: Prevention, Detection, and Remediation, November 12-14, 1997, Houston, TX.

Brown, A., J.R.C. Farrow, R.A. Rodriguez, B.J. Johnson and A.J. Bellomo, 1997. Methyl *tertiary* Butyl Ether (MTBE) Contamination of the City of Santa Monica Drinking Water Supply.

Proceedings of the National Groundwater (NGWA) and American Petroleum Institute (API) 1997 Petroleum Hydrocarbons and Organic Chemicals in Groundwater: Prevention, Detection, and Remediation, November 12-14, 1996, Houston, Texas.

Brown, A., J.S. Devinny, M.K. Davis, T.E. Browne, and R.A. Rodriguez, 1997. A Review of Treatment Technologies for Methyl *tertiary* Butyl Ether (MTBE) in Drinking Water. Proceedings of the American Chemical Society (ACS) Conference on Chemistry and Spectroscopy, October 1997, Irvine, California.

Brown, A., J.S. Devinny, T.E. Browne and D. Chitwood, 1997. A Review of Alternative Technologies for the Removal of MTBE from Drinking Water. Association of California Water Agencies (ACWA) Workshop on MTBE, March 13, 1997, Ontario Airport Hilton, California.

Brown, A., 1997. Methyl tertiary Butyl Ether (MTBE) in Groundwater and its Impact on the City of Santa Monica Drinking Water Supply. California Groundwater Resource Association (GRA), January 22, 1997, Wyndham Garden Hotel, Costa Mesa, California.

Gray, A.L., **A. Brown**, B.J. Moore, and T.E. Browne, 1996. Respiration Testing for Bioventing and Biosparging Remediation of Petroleum Contaminated Soil and Groundwater. NGWA Outdoor Action Conference, Las Vegas, NV, May 1996.

Brown, A., and P.E. Hardisty, 1996. Use of Technical and Economic Analyses for Optimizing Technology Selection and Remedial Design: Examples from Hydrocarbon Contaminated Sites. Sixth West Coast Conference on Contaminated Soils and Groundwater, AEHS, March 1996.

Farrow, J.R.C., **A. Brown**, W. Burgess, R.E. Payne, 1995. High Vacuum Soil Vapor Extraction as a Means of Enhancing Contaminant Mass Recovery from Groundwater Zones of Low Transmissivity. Accepted for Proceedings of the Petroleum Hydrocarbons and Organic Chemicals in Groundwater, API/NGWA Conference. Houston, TX. November 1995.

Ausburn, M.P., **A. Brown**, M. Brewster, and P. Caloz, 1995. Use of Borehole Terrain Conductivity Logging to Delineate Multiple Ground Water Bearing Zones and Map Alluvial Fan Facies. California Groundwater Resource Association (GRA), Annual Conference, November 1995, Costa Mesa, California.

Hardisty, P.E., S.D. Ross, F.B. Claridge and **A. Brown**, 1995. Technical and Economic Analysis of Remedial Techniques for LNAPL in Fractured Rock. International Association of Hydrogeologists (IAH), October 1995, Solutions 95 Conference, Calgary, Canada.

Croft, R.G., **A. Brown**, P. Johnson, and J. Armstrong, 1994. Tracer Gas Use in Soil Vapor Extraction and Air Sparge Pilot Tests: Case Studies. HMRCI Superfund XV Conf. Proceedings, Washington D.C, November 1994.

Bauman, P.B., M. Brewster and **A. Brown**, 1994. Borehole Logging as an Aid to Hydrogeologic Characterization of Leaking Underground Storage Tank (LUST) Sites. Proceedings from the National Groundwater Association (NGWA), 8th National Outdoor Action Conference and Exposition, Minneapolis, Minnesota. May 1994.

Bauman, P.B., **A. Brown,** M. Brewster, and M. Lockhart, 1994. The use of Borehole Geophysics in the Characterization of Both Vadose and Saturated Zone Lithologies at LUST Sites.

Proceedings from the USEPA Technology Transfer at LUST Sites Conference, Urbana, Illinois. May 1994.

Bauman, P.B., J. Sallomy, **A. Brown** and M. Brewster, 1994. Unconventional Applications of Terrain Conductivity Logging to Groundwater Investigations. Proceedings of the Symposium on the Application of Geophysics at Environmental and Engineering Projects (SAGEEP), Boston, Massachusetts, 1994.

Brown, A., R.E. Payne, and P. Perlwitz, 1993. Air Sparge Pilot Testing at a Site Contaminated with Gasoline. Proceedings of the Petroleum Hydrocarbons and Organic Chemicals in Groundwater: Prevention, Detection, and Restoration. API/NGWA Conference, Houston, Texas. November 1993.

Brown, A., 1991. Air Permeability Testing for Vapor Extraction. Conference Proceedings; Petroleum Hydrocarbon Contaminated Soil, San Diego, California. March 1991.

Wheater, H., B. Beck, **A. Brown,** and S. Langan, 1991. The Hydrological Response of the Allt a' Mharcaidh Catchment, Inferences from Experimental Plots. Journal of Hydrology, Vol. 123; pp 163-1990.

Brown, A., 1986. The Final Report of the Kosi Hills Resource Conservation Project, Nepal 1984. Royal Geographical Society Student Expedition.

aquilogic, Inc.
environment • water • strategy

245 Fischer Avenue, Suite D-2
Costa Mesa, CA 92626, USA
Tel. +1.714.770.8040
Web: www.aquilogic.com

CURRICULUM VITAE

October 2021

Robert H. Abrams, PhD, PG, CHg

Principal Hydrogeologist

mobile: +1.650.743.0594
email: bob.abrams@aquilogic.com

Disciplines

Hydrogeology, Water Resources, Geology, Geostatistics, Analytical and Numerical Modeling, Water Quality, Groundwater and Vadose Zone Fluid Flow, Contaminant Fate and Transport.

Education

Ph.D. Hydrogeology, Stanford University, 1999
M.S. Hydrogeology, Stanford University, 1996
B.S. Geology, San Francisco University, 1991

Professional Registrations

Professional Geologist, CA (No. 8703)
Certified Hydrogeologist, CA (No. 931)
Licensed Geologist, North Carolina (No. 2639)

Professional Experience

Bob has over 20 years of professional experience in groundwater resource development, groundwater sustainability, groundwater banking, groundwater quality, and model design and evaluation. He has worked for the California Geological Survey, the U.S. Geological Survey, Stanford University, San Francisco State University, consulting firms, and as an independent consultant for public and private clients. Recent projects have included vadose zone characterization and modeling, evaluation of subsidence investigations, developing and reviewing integrated groundwater/surface water hydrologic models that include simulation of current and future land-use-based water demand and the impact of climate change, and preparation of Groundwater Sustainability Plans.

Project Experience

Summary of California Central Coast Projects

- Currently serving on the Seawater Intrusion Working Group (SWIG) and SWIG Technical Advisory Committee (TAC). Theses groups are tasked with evaluating and recommending

approaches for mitigating seawater intrusion in the 180/400-Foot Aquifer Subbasin – *Salinas Basin Groundwater Sustainability Agency, Carmel Valley, California, representing the Salinas Basin Water Alliance*.

- Currently serving on a Drought Technical Advisory Committee (TAC) charged with developing standards and guiding principles for determining release schedules and operations of Nacimiento and San Antonio reservoirs during multiyear droughts. The TAC is also charged with developing the release schedules during such droughts – *Monterey County Water Resources Agency, Salinas, California, representing Grower-Shipper Association of Central California.*
- Invited to participate in the Deep Aquifer Roundtable, a formal meeting attended by Salinas Valley hydrogeology experts to discuss approaches to monitoring and protecting the deepest portions of the Salinas Valley aquifer system – *Monterey County Water Resources Agency, Salinas, California*.
- Served on the Technical Advisory Committee for the development of the Salinas Valley Integrated Hydrologic Model, a new MODFLOW model constructed by Monterey County and the U.S. Geological Survey – *Monterey County Water Resources Agency, Salinas, California representing Grower-Shipper Association of Central California*.
- Well efficiency test results for multiple years and multiple wells were evaluated for a Salinas Valley grower and food processor. Quantitative and statistical analyses were used to assess well performance and make recommendations for potential well maintenance and repair activities – *Nunes Vegetables, Salinas, California*.
- The factors influencing nitrate concentrations in well-water from approximately 60 wells on 40 ranches were determined and an enhanced groundwater monitoring program was developed. Diverse and complex data sets were analyzed statistically and qualitatively to understand the geologic, hydrologic, and anthropogenic factors that variably influence well-water concentrations over short- and long-term timeframes. Specific recommendations for wellhead protection were also developed – *Costa Farms, Analysis of Observed Nitrate Concentration Trends in Irrigation Wells, Soledad, California*.
- Published reports and data from international and national seawater intrusion mitigation efforts were reviewed and analyzed. The analysis was to assess the feasibility, level of effort required, volumes of water necessary, and costs of implementation in the Salinas Valley of a seawater intrusion injection barrier using recycled water. Ongoing injection barrier projects in Orange County and L.A. County were selected for in-depth review to evaluate the feasibility of a similar project in Monterey County – *Tanimura & Antle, Salinas, California*.
- Publicly available groundwater quality data from a set of regularly sampled water-supply wells were evaluated statistically to develop an alternative to installation of new monitoring wells for a land application area that received wastewater from a food processing plant. The effort was driven by a Central Coast Regional Water Quality Control Board order requiring client to participate in the General Waste Discharge Requirements (WDRs) for Fruit and Vegetable

Processors, which has stricter monitoring requirements than the previous individual WDRs – *Dole Fresh Vegetables, Salinas, California*.

- Evaluated (with SEAWAT) the degree to which irrigation wells were drawing seawater inland and if groundwater withdrawals contributed to anoxic conditions in certain reaches of a river hydraulically connected to the aquifer – *El Sur Ranch, Seawater Intrusion and Impact of Irrigation Wells, Monterey County, California*.
- Monte Carlo hydraulic gradient analysis and stochastic 1D and 2D solute transport simulations (analytical solutions) were conducted based on regional groundwater maps and 13 years of monthly groundwater levels from dozens of production wells to determine the most likely MTBE source areas. A customized GIS framework was developed to evaluate source-area probability. Accepted by the Central Coast Regional Water Quality Control Board – *Monterey County Water Resources Agency, Salinas MTBE Investigation, Salinas, California.*
- Conducted a technical evaluation and provided detailed comments regarding the hydrologic analysis undertaken for the draft environmental impact report/environmental impact statement for the proposed Monterey Peninsula Water Supply Project (MPWSP) - *Third-Party Evaluation of Hydrologic Analysis Conducted for Monterey Peninsula Water Supply Project, City of Marina, California*.

Summary of Selected Recent Projects

- Designed and wrote custom computer programs to construct and test a facsimile of the USGS Central Valley Hydrologic Model (CVHM) that runs in Groundwater Vistas (GV), a graphical user interface. The computer programs generated input data for the facsimile model from CVHM MODFLOW packages that are not supported by GV. The facsimile model produces results that are nearly identical to CVHM – *Confidential Client*.
- Combined vadose-zone flow and transport modeling, groundwater flow modeling, and particle-tracking simulations to estimate the persistence of dissolved 1,2,3-trichloropropane in the subsurface. Multiple application areas were characterized using lithologic logs and water flux out of the root zone taken from C2VSimFG Beta. Custom computer programs were written to determine arrival time at a declining water table. MODFLOW and MODPATH were used to estimate travel time from the water table to receptor water-supply wells. Four regions in California (one in Central Valley, three in Southern California) were successfully analyzed with this methodology (settlements and jury awards). For the Central Valley region, the CVHM facsimile model (described above) was used – *Confidential Clients*.
- Co-wrote the Chapter Groundwater Sustainability Plan for the Westside Water Authority in Kern County. Extremely sparse data and modeling results from C2VSimFG-Kern were used to estimate current and future water budgets and groundwater availability – *Westside Water Authority*.

- Conducted environmental impact assessment simulations using the CVHM facsimile model described above to evaluate drawdown and subsidence caused by a proposed brackish groundwater water treatment project in Kern County – *Westside Water Authority*.
- Critically evaluated subsidence estimates along the Tule Subbasin portion of the Friant-Kern Canal (FKC) by reviewing historical USGS reports, InSAR data, geomechanical modeling, and the Tule Subbasin Groundwater Flow Model. This evaluation indicated that responsibility for FKC subsidence should be shared across the subbasin and not focused primarily on the Eastern Tule Groundwater Sustainability Agency – *Confidential Client*.
- Critically evaluated groundwater flow and solute transport models for three coal ash disposal sites in North Carolina. Primary questions included if the models simulated flow and transport properly and sufficiently to allow the sites' owner to claim no offsite groundwater quality impacts above water quality standards – *Southern Environmental Law Center*.
- Developed a new IWFM groundwater-surface water model, based on the Central-Valley-wide C2VSim model, for Stanislaus County to assess impacts in terms of foreseeable land-use changes and installation of new wells – *Stanislaus County, Regional Groundwater-Surface Water Model for PEIR, Modesto, California.*
- Assist Stanislaus County with evaluation of new major well permit applications based on a then-recently passed groundwater ordinance requiring evaluation under CEQA for potential pumping-induced impacts to the groundwater basin, such as lowered water levels in existing wells, land subsidence, and significant groundwater or surface water depletion – *Stanislaus County, Well Permit CEQA Analysis, Modesto, California*.

Summary of Other Selected Water Supply Projects

- Two local-scale groundwater flow (MODFLOW) and solute transport models (MT3DMS) were developed for two sub-regions of the USGS regional Antelope Valley MODFLOW model to evaluate the performance of a new groundwater bank. Updated geologic characterization was based on recent investigations by the USGS and sparse well logs. Groundwater bank performance was evaluated with respect to water quantity and quality for various operational strategies, including well placement and infiltration schedules – *Antelope Valley-East Kern Water Agency (AVEK), Groundwater Banking and Blending Study, Palmdale, California.*
- Developed and calibrated three-dimensional, groundwater flow (MODFLOW) and solute transport models (MT3DMS) to assess water sources for a new 20 MGD water treatment plant. A detailed geologic model was developed for this project to assess the extent of the deep target aquifer, evaluate the risk from a heavy industrial area, well locations, long-term performance, define the wellhead protection area, and optimize wellfield performance – *City of Longview, Design and Construction of a New Groundwater Source and Treatment Facility, Longview, Washington.*
- Pilot study to evaluate the feasibility of compressed air energy storage of renewable energy. Developed and implemented three-dimensional groundwater flow models (MODFLOW) to

evaluate the impact on nearby wells of compressed air injection into a depleted natural-gas reservoir – *Pacific Gas and Electric (subcontractor to Jacobson James and Associates), Compressed Air Energy Storage Pilot Project, San Joaquin County, California.*

- Developed hydrostratigraphic model of the Mesquite Lake groundwater subbasin as interpreted from existing well logs and USGS studies that had been performed to the west and north. The hydrostratigraphic model was used as input to a three-dimensional, transient groundwater flow model (MODFLOW) that assessed the volume of water available for a new municipal water treatment plant – *Twentynine Palms Water District, Groundwater Study for the Mesquite Lake Subbasin, Twentynine Palms, California.*
- Developed a calibrated two-dimensional, steady-state analytical groundwater flow model for the Rialto-Colton Basin. The calibrated model was used to delineate source areas for two impacted production wells for a CDPH 97-005 permit application – *West Valley Water District, Wellhead Treatment Project, Rialto, California.*
- Analyzed the results of aquifer tests of multiple water supply wells completed in a fractured-rock aquifer – *Lake Don Pedro Community Services District, California (subcontractor to SGI The Source Group)*.
- Analyzed the results of a complex aquifer-test dataset to determine aquifer properties and assess groundwater availability. Characterized groundwater quality and assessed regional impact of developing a new water supply – *Silver Oak Cellars (subcontractor to Taber Consultants), Aquifer Test Analysis and Groundwater Availability Study, Sonoma County, California.*
- A well and a spring were evaluated in terms of water quality, influence of surface water, source area, and zone of influence for a license application to operate a new private water supply – *Buster's on the Mountain (subcontractor to Taber Consultants), Hydrogeology Report for New Private Water Supply, Napa County, California*.
- Groundwater flow modeling, aquifer test results, and qualitative hydrogeological analyses were reviewed and critiqued for accuracy and completeness to assess the feasibility of a gravel mining operation adjacent to the upper reaches of a major river in Los Angeles and Ventura counties. The assessment formed the basis for communications with the State Water Resources Control Board regarding appropriative water rights. In the second phase of the project, a new MODFLOW model was developed to assess groundwater-surface water interactions – *Confidential Client (subcontractor to Todd Engineers), Groundwater Pumping Impacts on Streamflow, Los Angeles County, California.*
- Developed complex geologic model in the fold-thrust terrane of the Las Posas Basin in eastern Ventura County. The geologic model formed the foundation for preliminary wellfield design and estimation of available groundwater for desalter operations in a strictly managed aquifer – *Calleguas Municipal Water District, Somis Desalter Feasibility Study, Las Posas Basin, Ventura County, California*.

- Evaluated geologic, hydrologic, and hydrogeologic data to assess the suitability for establishing a groundwater banking operation. Provided recommendations on further field-based and modeling studies deemed necessary to address data and knowledge gaps – *Los Angeles Department of Water and Power, Evaluation of Proposed Water Storage/Transfer Potential in Fremont Valley Basin, Fremont Valley, California.*
- Evaluated the groundwater component of an existing water-budget model. Implemented changes to include the effects on water levels from climate and distant municipal pumping in deeper parts of the aquifer. The improvements facilitated the development and simulation of future "what-if" scenarios used to design an engineered wetland that used stormwater runoff and groundwater pumping to maintain lake levels – *San Francisco Public Utilities Commission, Lake Merced Water-Budget Model, San Francisco, California.*

Summary of Other Selected Water Quality Projects

- Developed three-dimensional, variably saturated flow and reactive transport models (MODFLOW-SURFACT) to assess the groundwater impact from arsenic and boron in recharged partially treated oilfield produced water. Transport through the unsaturated and saturated zones related to groundwater banking operations were simulated. Regulatory approval was granted by the Central Valley Regional Water Quality Control Board – *Cawelo Water District, Groundwater Banking Waste Discharge Requirements Support, Central Valley, California*.
- A calibrated transient three-dimensional model (MODFLOW and MT3DMS) of groundwater flow and solute transport was developed, calibrated, evaluated, to compare estimated timeframes to achieve RAOs for three alternatives. Site data were used to characterize the subsurface and estimate land application rates and water quality of applied water. Regulatory approval was granted by the Central Valley Regional Water Quality Control Board – *Hilmar Cheese Company, Groundwater Modeling for Cleanup and Abatement Order, Central Valley, California.*
- The results of two modeling efforts were reviewed to reassess contributions from responsible parties. A new metric, the Responsibility Factor (RF), was developed and applied to existing input data. The RFs were used to estimate relative contributions to the MEW Superfund site regional plume from several responsible parties – *Confidential Client (subcontractor to Montclair Environmental Management), Reassessment of Contributions to the MEW Superfund Site Regional Plume, Santa Clara County, California.*
- Mass flux calculations for TCE and PCE were conducted on behalf of a multi-PRP group. Calculations of mass flux through time were compared upgradient and downgradient of several sites within the Omega Superfund site regional plume to estimate the contribution from each individual site. These calculations were used as part of the basis for cost allocation among PRPs – *Confidential Client, Mass Flux Calculations for Cost Allocation, Omega Superfund Site, Santa Fe Springs, California.*
- A three-dimensional model (MODLFOW-SURFACT) of unsaturated zone and saturated zone flow and solute transport was developed and calibrated based on sparse discharge records

and well observations to assess the fate of a legacy of contaminated soil water being mobilized by increased discharge to the subsurface. The modeling was an integral part of a report of waste discharge and request for waste discharge requirements from the Central Valley Regional Water Quality Control Board – *California Dairies, Incorporated, Report of Waste Discharge, Central Valley, California.*

- A transient groundwater flow model (MODFLOW) was conceptualized, implemented, and calibrated for a major oil refinery. Linear programming was used to quantitatively minimize groundwater pumping and qualitatively optimize well placement for containment of subsurface LNAPL and BTEX-contaminated groundwater. Multiple capture zones of various sizes were analyzed for control of LNAPL hotspots and site-wide containment scenarios – *Sun Oil Company, Pumping-Rate Optimization and Capture Zone Analysis, Tulsa County, Oklahoma.*
- A groundwater flow and reactive solute transport model (MODFLOW and RT3D) was developed to evaluate remediation efforts at a chemical production facility. The efficacy of a permeable reactive barrier was evaluated by simulating sequential decay and transport of TCE and its daughter products. The model was post-verified in the field by analyzing the concentration histories of several observation wells – *Mohawk Laboratories, Analysis of Permeable Reactive Barrier, Sunnyvale, California.*
- Determined regional-scale risk to groundwater from potentially contaminating activities (PCA) in the Santa Clara Valley, Coyote, and Llagas subbasins, as part of a multifaceted effort. A regional-scale PCA-risk map was developed and combined with intrinsic aquifer sensitivity to generate a groundwater vulnerability map, which formed the basis of a web-based GIS tool for evaluating development projects and land-use changes – *Santa Clara Valley Water District, Groundwater Vulnerability Study, Santa Clara, California.*
- A Remedial Investigation (RI) Summary report was prepared under CERCLA guidelines, which included development of a conceptual model that incorporated regional and local hydrostratigraphy, source-area history, details of previous remedial investigations, and characterization of the basin-wide perchlorate and TCE groundwater contamination – *West Valley Water District, NCP Compliance Documents, Rialto, California.*
- The volume of LNAPLs beneath a refinery was estimated by modifying the analytical solutions for LNAPL recovery presented within API Publications 4682 and 4729, utilizing the van Genuchten relations for porous media. Results of the modeling work were used to design a LNAPL recovery system – *Sun Oil Company, LNAPL Spatial Distribution, Tulsa County, Oklahoma.*
- DNAPL Assessment Techniques, Klickitat County, WA. Developed internal White Paper describing techniques and thresholds for assessing DNAPL mobility at a fueling facility – *BNSF, Remediation Design Support, Park County, Montana*.
- Report of waste discharge and request for waste discharge requirements for land application of onsite waste and storm water. For submission to the Los Angeles Regional Water Quality Control Board – *Confidential Client, Report of Waste Discharge, Los Angeles County, California.*

- Developed and implemented groundwater flow and particle tracking models to evaluate well placement designs and optimize pumping rates for an in-situ groundwater recirculation and treatment zone. The recirculation zone was used to chemically treat groundwater contaminated with VOCs – *BNSF, Remediation Design Support, Park County, Montana.*
- Analyzed slug test data for multiple tests using several techniques to assess parameter uncertainty for a bedrock aquifer, for submission to Montana Department of Environmental Quality – *BNSF, Site Characterization for Remedial Investigation, Park County, Montana.*
- A 1D unsaturated zone flow and transport model was developed to assess the impact to groundwater of VOCs and metals present in the soil at the Facility. A future 100-year scenario was developed based on climate data from the past 100 years. Mass transport process of volatilization, linear sorption, and advection and dispersion were considered for this investigation – *SMTEK, Former Chemical Facility, Orange County, California.*

Summary of Other Selected Litigation Support Projects

- Implemented detailed regional, three-dimensional conceptual model for a 35-year period (MODFLOW and MT3DMS). Geologic data, crop-based time-variant DBCP application rates, pumping, recharge basins, and flow and transport in the unsaturated and saturated zones were used to evaluate whether label-recommended use of DBCP caused contamination in municipal wells and to establish likely source areas for high-concentration hot spots – *Sedgwick, Detert, Moran, and Arnold, Regional-Scale Pesticide Contamination Litigation Support, Fresno, California.*
- Designed and implemented three-dimensional models (LEACHM, MODFLOW, and MT3DMS) of unsaturated and saturated fluid flow and solute transport for periods of up to 150-years using soils and geologic data, rainfall records, pumping, and plant operational history to assess whether off-site groundwater contamination was caused by unanticipated releases of coal tar at numerous sites in the Midwest – *Jones, Day, Reavis, and Pogue, Former Manufactured-Gas Plant Sites, Litigation Support, Los Angeles, California.*
- The impact of different rainfall data disaggregation techniques on the results of fluid flow and solute transport simulations in the unsaturated zone was evaluated. Various disaggregation strategies were applied to simulations of contaminant fate at three former manufactured-gas plants – *Northern Indiana Public Service Company, Impact of Rainfall Data Disaggregation Techniques, Merrillville, Indiana.*
- Evaluated expert reports and thoroughly evaluated and verified a detailed water budget model. Assisted in preparation of expert report related to the application of the model – *Confidential Client, Water Budget Model Litigation Support, Pinal County, Arizona*.
- Evaluated expert reports and critiqued a detailed MODFLOW groundwater flow model for litigation of damages and fatalities from a landslide. Assisted in preparation of expert report – *Confidential Client, Landslide Initiation Litigation Support, British Columbia.*

Professional History

aquilogic, Inc., Principal Hydrogeologist, October 2020 to present.
aquilogic, Inc., Senior Hydrogeologist, February 2018 to October 2020.
Jacobson James & Associates, Inc., Principal Hydrogeologist, October 2015 to December 2017.
Independent Consultant, December 2012 to September 2015.
Kennedy/Jenks Consultants, Associate Hydrogeologist, March 2009 to November 2012.
Independent Consultant, July 2005 to February 2009.
San Francisco State University, Lecturer/Adjunct Professor, September 2003 to February 2009.
SGI The Source Group, Inc., Senior Hydrogeologist, August 2002 to June 2005.
Stanford University, Research Associate, September 2000 to July 2002
Independent Consultant/Graduate Student, October 1995 to July 2000.
U.S. Geological Survey/Graduate Student, Hydrologist, June 1992 to September 1995.

Research

- A new protocol and computer code were designed and implemented to simulate the development of redox zones in contaminated aquifers. Transport of dissolved constituents coupled to complex interactions between organic and inorganic compounds were simulated with consideration of reaction energetics, reaction-rate limitations, and advection and dispersion – *Stanford University/United States Geological Survey, Development and Fate of Redox Zones in Contaminated Aquifers, Falmouth, Massachusetts*.
- Interactions between surface water, soil-water, and groundwater were evaluated with a three-dimensional model of coupled saturated-unsaturated subsurface and surface fluid flow. Detailed rainfall data were incorporated into the model to determine the relative importance of different stormflow generation mechanisms – *Stanford University, Stormflow Generation, Chickasha, Oklahoma*.
- Conducted basin-scale modeling analysis of subsurface fluid flow in the Illinois Basin to evaluate the role of paleogroundwater flow versus fluid density in long-range, deep-basin petroleum migration – *United States Geological Survey, Basin-scale Analysis of Subsurface Fluid Flow, Illinois Basin*.
- Developed reactive solute transport models to evaluate zinc transport in a geochemically complex aquifer in Falmouth, MA. Coupled solute transport/geochemical modeling, laboratory experiments, and a two-site surface complexation model were used to represent the pH-dependent adsorption of dissolved zinc on aquifer sediments – *United States Geological Survey, Zinc Transport in a Geochemically Complex Aquifer, Falmouth, Massachusetts*.

Peer-Reviewed Publications

Abrams, R.H. and K. Loague. 2000. A compartmentalized solute transport model for redox zones in contaminated aquifers, 2, Field-scale simulations. Water Resources Research 36, 2015-2029.

Abrams, R.H. and K. Loague. 2000. A compartmentalized solute transport model for redox zones in contaminated aquifers, 1, Theory and development. Water Resources Research 36, 2001-2013.

Abrams, R.H., K. Loague, and D.B. Kent. 1998. Development and testing of a compartmentalized reaction network model for redox zones in contaminated aquifers. Water Resources Research 34, 1531-1541.

Abrams, R.H. and K. Loague. 2000. Legacies from three former manufactured-gas plants: Impacts on groundwater quality. Hydrogeology Journal 8, 594-607.

Kent, D.B., R.H. Abrams, J.A. Davis, J.A. Coston, and D.R. LeBlanc. 2000. Modeling the influence of variable pH on the transport of zinc in a contaminated aquifer using semi-empirical surface complexation models. Water Resources Research 36, 3411-3425.

Kent, D.B., R.H. Abrams, J.A. Davis, and J.A. Coston. 1999. Modeling the influence of adsorption on the fate and transport of metals in shallow ground water--Zinc contamination in the sewage plume on Cape Cod, MA. Morganwalp, D.W., and Buxton, H.T., eds., USGS WRI Report 99-4018C, 361-370.

Loague, K., R.H. Abrams, S.N. Davis, A. Nguyen, and I.T. Stewart. 1998. A case study simulation of DBCP groundwater contamination in Fresno County, California: 2. Transport in the saturated subsurface. Journal of Contaminant Hydrology 29, 137-163.

Loague, K., D. Lloyd, A. Nguyen, S.N. Davis, and R.H. Abrams. 1998. A case study simulation of DBCP groundwater contamination in Fresno County, California: 1. Leaching through the unsaturated subsurface. Journal of Contaminant Hydrology 29, 109-136.

Loague, K. and R.H. Abrams. 1999. DBCP contaminated groundwater in Fresno County: Hot Spots and nonpoint sources. Journal of Environmental Quality 28, 429-445.

Coston, J. A., R. H. Abrams, and D. B. Kent. 1998. Selected inorganic solutes, in water quality data and methods of analysis for samples collected near a plume of sewage-contaminated ground water, Ashumet Valley, Cape Cod, Massachusetts, 1993-1994. USGS WRI Report 97-4269.

Loague, K., C.S. Heppner, R.H. Abrams, A.E. Carr, J.E. VanderKwaak, and B.A. Ebel. 2005. Further testing of the Integrated Hydrology Model (InHM): Event-based simulations for a small rangeland catchment located near Chickasha, Oklahoma. Hydrological Processes 19, 1373–1398.

Loague, K. and R.H. Abrams. 2001. Stochastic-conceptual analysis of near-surface hydrologic response. Hydrological Processes 15, 2715-2728.

Loague, K., G.A. Gander, J.E. VanderKwaak, R.H. Abrams, and P.C. Kyriakidis. 2000. Technical Addendum for "Simulating hydrologic response for the R-5 catchment: A never-ending story". Floodplain Management 2, 57-64.

Loague, K., G.A. Gander, J.E. VanderKwaak, R.H. Abrams, and P.C. Kyriakidis. 2000. Simulating hydrologic response for the R-5 catchment: A never-ending story. Floodplain Management 1, 57-83.

Grose, T. L. T. and R. H. Abrams, 1992. Geologic map of the Grasshopper Valley 15' quadrangle, Lassen County, California. California Department of Conservation, Division of Mines & Geology Open-File Report 93-07.

Grose, T. L. T. and R. H. Abrams. 1991. Geologic map of the Karlo 15' quadrangle, Lassen County, California. California Department of Conservation, Division of Mines & Geology Open-File Report 91-23.

Attachment B

Attachment B

Statements in the Salinas Valley Basin Groundwater Sustainability Agency (SVBGSA) Groundwater Sustainability Plans (GSPs) establishing that the six Salinas Valley subbasins are interconnected.

- Upper Valley – Forebay boundary:
  - Page 4-10 of the draft Upper Valley GSP: "*There are no reported hydraulic barriers separating these subbasins and therefore the GSP needs to consider potential for groundwater flow between these adjacent subbasins*."
  - Page 4-10 of the draft Forebay GSP: "*There are no reported hydraulic barriers separating these subbasins*."
- Forebay – 180/400 boundary:
  - Page 4-10 of the draft Forebay GSP: "*There is no reported hydraulic barrier between the Forebay and the 180/400-Foot Aquifer Subbasin however the sediments are more stratified in the 180/400-Foot Aquifer Subbasin than in the Forebay Subbasi*n."
  - Page 4-9 of the 180/400 GSP: "*Previous studies of groundwater flow across this boundary indicate there is reasonable hydraulic connectivity with the Forebay Subbasin, although the principal aquifers change from relatively unconfined to confined near this boundary*."
- Forebay – Eastside boundary:
  - Page 4-10 of the draft Forebay GSP: "*The northwestern boundary with the adjacent 180/400-Foot and Eastside Aquifer Subbasins generally coincides with the southeastern limit of confining conditions in the 180/400-Foot Aquifer Subbasin, which is extrapolated to the Gabilan Range to define the boundary with the Eastside Aquifer Subbasin (DWR, 2004c)*."
  - Page 4-10 of the draft Eastside GSP: "*The southeastern boundary with the adjacent Forebay Subbasin is near the town of Gonzales (DWR, 2004). It is extended from the approximate southern limit of the regional clay layers that are the defining characteristic of the southern extent of the 180/400-Foot Aquifer Subbasin. There may be reasonable hydraulic connectivity with the Forebay Subbasin, although the principal aquifers change from relatively unconfined to confined near this boundary*."
    - The last sentence of this passage appears to be incorrect, as indicated on page 4-18 of the draft Eastside GSP: "*In addition to the fact that aquifer material cannot be correlated between boreholes, no evidence exists for a discrete confining layer in the Subbasin (Brown and Caldwell, 2015)*."
    - Further supporting evidence for hydraulic connection between the Eastside and Forebay is found on page 4-21 of the draft Eastside GSP: "*Subsurface recharge is primarily from inflow from the adjacent Forebay and 180/400-Foot Aquifer Subbasins to the south and west, respectively (DWR, 2004). This inflow is*

estimated to be 17,000 acre-feet (AF) on an annual basis. Total natural recharge is estimated to be 41,000 AF (DWR, 2004)."

- Eastside – 180/400 boundary:
  - o Page 4-21 of the draft Eastside GSP: "*Subsurface recharge is primarily from inflow from the adjacent Forebay and 180/400-Foot Aquifer Subbasins to the south and west, respectively (DWR, 2004). This inflow is estimated to be 17,000 acre-feet (AF) on an annual basis. Total natural recharge is estimated to be 41,000 AF (DWR, 2004)*."
  - o Also, on page 4-35 of the draft Eastside GSP: "*There is no recorded seawater intrusion in the Eastside Subbasin. Even though it is adjacent to the 180/400-Foot Aquifer Subbasin where seawater intrusion is occurring, the Subbasin, which is approximately 7 miles from the coastline, is not yet affected by seawater intrusion. However, there is a potential for seawater intrusion into the Subbasin*."
  - o Page 4-10 of the draft Eastside GSP and page 4-9 of the 180/400 GSP: "*Previous studies of groundwater flow across this boundary indicate that there is restricted hydraulic connectivity between the subbasins*."
    - ▪ The references for the previous studies should be provided because this statement is an apparent contradiction with other statements in the draft Eastside GSP.
    - ▪ Furthermore, page ES-8 of Kennedy/Jenks (2004) states, "*We note that ground water flow direction is from the Pressure Subarea to the East Side Subarea east of the City of Salinas and along the transition zone (Agency 1997*)."
    - ▪ Additionally, page 8 of SVGWBHC (1995) states, "*Ground water can move between the East Side and Pressure Areas, and between the Forebay and Pressure Areas, the Forebay and East Side Areas, and the Upper Valley and Forebay Areas*."
    - ▪ The apparent uncertainty regarding the nature of the boundary between the Eastside and 180/400 should be listed as an identified data gap on page 4-35 of the draft Eastside GSP.
- Eastside – Langley boundary:
  - o Page 4-10 of the draft Eastside GSP and page 4-10 of the draft Langley GSP: "*Although the Langley Subbasin is not on the valley floor, there are no reported hydraulic barriers separating these subbasins and therefore the GSP needs to consider potential for groundwater flow between these adjacent subbasins*."
- Langley – 180/400 boundary:
  - o Page 4-10 of the draft Langely GSP: "*Although the Langley Subbasin is not on the valley floor, there are no reported hydraulic barriers separating these two subbasins; therefore, this GSP needs to consider potential for groundwater flow between these adjacent subbasins*."
  - o Page 4-9 of the 180/400 GSP: "*Although the Langley Subbasin is not on the valley floor, there are no reported hydraulic barriers separating these two subbasins*."
- Monterey – 180/400 boundary:

- Page 9 of Chapter 4 of the draft Monterey GSP: "*The northeastern boundary with the 180/400-Foot Aquifer Subbasin is divided into two parts: the northern part coincides with a buried trace of the Reliz Fault (DWR, 2016); the southern part follows the contact between Aromas Sand / Paso Robles Formations (Qae/QT) and alluvium (Q). The Reliz Fault does not appear to be a barrier to groundwater flow between these subbasins (see Section 4.2.3)*."
- Page 4-9 of the 180/400 GSP: "*Although a groundwater divide is commonly found near the Subbasin boundary, there is potential for groundwater flow between these two subbasins*."
- It should be noted that for the simulations reported in Chapter 6 of the draft Monterey GSP, all reasonably possible boundary conditions, indicate groundwater flow from the Monterey to the 180/400.

Attachment C

aquilogic, Inc.
environment ● water ● strategy

245 Fischer Avenue, Suite D-2
Costa Mesa, CA 92626
Tel. +1.714.770.8040
Web: www.aquilogic.com

August 11, 2021

MEMORANDUM

To: Stephanie Hastings, Brownstein Hyatt Farber Schreck (BHFS)
Sent via email: SHastings@bhfs.com
From: Robert H. Abrams, PhD, PG, CHg, Principal Hydrogeologist, aquilogic, Inc.
Anthony Brown, CEO & Principal Hydrologist, aquilogic, Inc.

Subject: Assessment of Groundwater Flows between Subbasins of the Salinas Valley Groundwater Basin (SVGB)
Project No.: 018-09

Aquilogic, Inc. (**aquilogic**) is pleased to provide this memorandum on behalf of our mutual client, the Salinas Basin Water Alliance (SBWA), outlining the justification and necessity for conducting additional simulations with the Salinas Valley Integrated Hydrologic Model (SVIHM),[1] which is being used by the Salinas Valley Basin Groundwater Sustainability Agency (SVBGSA) for groundwater sustainability plan (GSP) development.

Aquilogic hypothesizes that pumping has captured significant portions of groundwater discharge that would otherwise migrate as underflow from the Upper Valley Subbasin to the Forebay Subbasin, from the Forebay Subbasin to the 180/400-Ft Aquifer Subbasin and East Side Subbasin, and potentially from the 180/400-Ft Aquifer Subbasin to the Monterey Subbasin and the Salinas River. Our primary concern is that the existing water budget analyses in at least three of the SVBGSA's draft GSPs may not provide a complete picture of the downgradient impacts caused by groundwater pumping.[2]

It should be noted that groundwater sustainability was a pertinent issue for water managers long before the advent of California's Sustainable Groundwater Management Act. There is

---

[1] The SVIHM is a provisional, unpublished model not currently available to the general public.
[2] Bredehoeft, J.D., Papadopulos, S.S., and Cooper, H.H. Jr. (1982). The water budget myth. *In* Scientific Basis of Water Resource Management, Studies in Geophysics, 51-57. Washington, D.C. National Academy Press;
Bredehoeft, J.D. (1997). Safe yield and the water budget myth. Ground Water, Vol. 35, No. 6, p. 929;
Bredehoeft, J.D. (2002). The water budget myth revisited: why hydrogeologists model. Ground Water, Vol. 40, No. 4, p. 340-345;
Bredehoeft, J.D. and Durbin, T. (2009). Groundwater development: the time to full capture problem. Ground Water, Vol. 47, No. 4, p. 506-514;
Bredehoeft, J.D. (2011). Monitoring regional groundwater extraction: the problem. Ground Water, Vol. 49, No. 6, p. 808-814.

ample support in the groundwater literature for considering multiple aspects of sustainability and undesirable results, including economic and social impacts and the contravention of water rights.[3]

ADDITIONAL SIMULATIONS

As stated in "SVIHM Frequently Asked Questions,"[4] one of the many questions that can be addressed by a model is: How much groundwater flows between subareas? Clearly, the SVIHM developers recognized the importance of this question and anticipated that it would be asked. On behalf of the SBWA, **aquilogic** requests that the SVBGSA utilize the SVIHM to conduct additional simulations that are specifically focused on the issue of inter-subbasin groundwater flows. The requested simulations will enable an improved understanding of the amount of Valley-wide groundwater discharge that is and has been captured by pumping, which may be needed to ensure the adequacy of the GSPs for each of the subbasins and important to their implementation.

Aquilogic recommends a type of "superposition" analysis, in which the results of two simulations are compared. In such an analysis, the two simulations are identical except for the process under examination, in this case groundwater pumping. Pumping would be selectively turned off in one simulation and left as currently configured in the SVIHM in the other simulation. A similar superposition analysis was done to assess pumping-induced streamflow depletion, as described in Chapter 5 of the GSPs for the Forebay Subbasin and the East Side Subbasin.

The inter-subbasin flows would then be compared, which would semi-quantitatively estimate the impact of pumping, within the limiting assumptions and uncertainties associated with the SVIHM. Ideally, the analysis should be conducted with the initial conditions of the no-pumping scenario representing a "full" SVGB. The analysis would provide an estimate of the impact of pumping on inter-subbasin groundwater flows.

Specifically, using the calibrated SVIHM historical model, **aquilogic** recommends the following outline for conducting simulations, the details of which would be worked out in consultation with the SVBGSA:

1. Develop reasonable initial conditions for the hydraulic head distribution for the no-pumping simulation. This entails turning off all pumping in the model domain while

[3] Todd, D.K. (1959). Groundwater Hydrology. Wiley, New York, 336 p.;
Domenico, P. (1972). Concepts and Models in Groundwater Hydrology. McGraw-Hill, New York, 405 p.;
Freeze, R.A. and Cherry, J.A. (1979). Groundwater. Prentice-Hall, 604 p.;
Alley, W.M., Reilly, T.E., and Franke, O.L. (1999). Sustainability of ground-water resources. U.S. Geological Survey Circular 1186, 79 p.

[4] https://www.co.monterey.ca.us/home/showdocument?id=31292

leaving all other inflows and outflows unchanged. Because the time for simulated water levels to recover may be longer than the SVIHM simulation period of 51 years (1967-2018), the simulation may have to be run multiple times before an average steady-state condition can be achieved. In this case, the hydraulic head distribution at the last time step of the previous simulation would be used as the initial condition of the subsequent simulation. This process would be repeated until the hydraulic head distribution at the last time step of a subsequent simulation is substantially identical to the last time step of the previous simulation. This would indicate that an average steady-state condition is being simulated. We assume here that the surface water inflows and reservoir releases for the 1967-2018 period would be sufficient to eventually "refill" the SVGB after several model runs.

2. When the average, no-pumping steady-state condition has been achieved with the modified SVIHM, simulated groundwater flow should occur from the East Side Subbasin to the 180/400-Ft Subbasin, and from the 180/400-Ft Subbasin to Monterey Bay, conditions that are now reversed.

3. From the final results of the no-pumping simulation, in which average steady-state conditions have been achieved, compute the inter-subbasin groundwater flows between each adjoining subbasin. Compare these flows with the inter-subbasin flows from the historical, unmodified SVIHM. The differences in inter-subbasin flows and induced recharge from the surface water system represent a semi-quantitative estimate of the impact of Valley-wide pumping.

4. Additional superposition analyses can be conducted to assess the impact of one subbasin's pumping on basin-wide groundwater levels and inter-subbasin groundwater flows, by turning on pumping in one subbasin at a time in the modified SVIHM (and leaving pumping turned off in all other subbasins) and comparing the results to the scenario with no pumping throughout the SVGB. The differences in inter-subbasin flows and groundwater levels represent a semi-quantitative estimate of the impact of one subbasin's pumping on the other subbasins.

MONTGOMERY
& ASSOCIATES
Water Resource Consultants

www.elmontgomery.com
1232 Park Street, Office B
Paso Robles, CA 93446

February 26, 2019

Mr. Les Girard
Agency Counsel
Salinas Valley Basin Groundwater Sustainability Agency
168 W. Alisal Street, 3rd Floor
Salinas, CA 93901

SUBJECT: OPINIONS ON SURFACE WATER BENEFITS FROM SALINAS VALLEY GROUNDWATER SUSTAINABILITY

Dear Mr. Girard:

You have requested our opinion with respect to the benefit surface water users (including those that rely upon diversion of any alleged underflow of the Salinas River) would receive from a balanced or sustainable groundwater basin. This request is in connection with the proposal of the Salinas Valley Basin Groundwater Sustainability Agency's (SVBGSA) consideration of charging a regulatory fee, known as the Groundwater Sustainability Fee ("Fee"), within its jurisdiction (the Salinas Valley Groundwater Basin (Basin) with limited exceptions).

As you know, the firm I work for, Montgomery & Associates, has been retained by the SVBGSA to prepare a Groundwater Sustainability Plan for the 180/400 ft. aquifer sub-basin. In particular, I have been retained as the project manager for this job. My resume is enclosed. I am familiar with the hydrology and geology of the Basin, and the interaction between groundwater and surface water in the Basin.

It has long been acknowledged that the water resources of the Salinas Valley consist of an integrated surface water and groundwater system. Historically, groundwater was the main source of water supply in the Valley and the Salinas River was the primary source of recharge for the groundwater supply (see, for example, Department of Water Resource Bulletin 52B). This assessment of a single water, integrated water source was recently confirmed in the January 2019 Report of Referee by the State Water Resources Control Board, issued as part of a reference proceeding arising from litigation in the Basin. In particular, Page 12 of the report states, "The dependency on the Salinas River as a source of recharge for the Basin and the hydrologic connection between surface water and groundwater results in a direct relationship between pumping and river flows; therefore, demonstrating that groundwater and surface water within the Salinas Valley constitute a single source." This is consistent with, and corroborates my understanding of the Salinas Valley hydrology.

This acknowledged surface water/groundwater integration underpins the approach the SVBGSA is taking to achieving groundwater sustainability throughout the Valley; the

Salinas River is an integral part of groundwater management and managing groundwater cannot be divorced from the Salinas River's operations. Similarly, groundwater management plays an important role in maintaining Salinas River flows. Larger areas of low groundwater levels in the Salinas Valley will induce more leakage from the Salinas River – reducing Salinas River flows. Maintaining adequately high groundwater levels will help maintain Salinas River flows. These higher groundwater levels that help maintain Salinas River flows is one of the desired outcomes of our groundwater management and is a benefit to surface water users. Groundwater sustainability can lead to long-term reliability in surface water supplies.

In particular, one Sustainability Indicator that must be addressed under SGMA is depletion of surface water bodies. Without the Sustainable Groundwater Management Act (SGMA), there is limited or no check on the amount that groundwater pumping can deplete the Salinas River. Developing these GSPs provides an opportunity for groundwater to be managed in a way the benefits surface water users and provides surface water reliability.

Groundwater management may be the most effective and primary method for managing future surface water reliability in the Valley. The two dams operated by the Monterey County Water Resources Agency (MCWRA are not operated for surface water reliability. The MCWRA website states that the operational pools of the Nacimiento and San Antonio Dams are for "groundwater recharge, fish passage, and operation of the Salinas valley Water Project." The dams are not necessarily operated to maintain flows in the Salinas River.

Based on our review of the integrated groundwater and surface water system in the Salinas Valley we conclude that users of surface water, including underflow, would receive clear benefits from groundwater sustainability because:

- The Salinas River has historically been viewed as primarily a source of groundwater recharge, not as an independent source of supply;
- The two dams operated by MCWRA are not operated to provide reliable surface water supplies;
- Managing groundwater levels can reduce surface water depletions, providing more reliable surface water supplies;
- Addressing surface water depletion and the resulting surface water flows is a required component of the GSPs;

The Salinas River operations, Salinas River flows, and ability to use water from the River will be clearly influenced by the decisions made during GSP development and implementation. Balanced groundwater management that maintains consistent groundwater levels will provide surface water reliability for the Valley's surface water users.

Finally, it is important to note that, for purposes of charging the Fee, the Salinas River has not yet been determined to include a "subterranean stream flowing through known and definite channels," thus the surface water/groundwater integration in the Basin makes it difficult to differentiate between the two where they interface. Thus, differentiating a fee based on whether surface water or groundwater is being pumped along that interface would be an extremely difficult, if not impossible, task.

Sincerely,
Derrik Williams
E.L. MONTGOMERY & ASSOCIATES

Derrik Williams, P.G., C.Hg., Principal Hydrogeologist/Director of California Business Development

Office: PASO ROBLES

Years Experience

Total: 30

Education

M.S., Hydrology, University of Arizona (1987)

B.S., Geology, University of California at Davis (1982)

Key Areas of Expertise

Groundwater basin management

3D groundwater flow and transport models

Groundwater recharge

Conjunctive water management

Aquifer test analysis

Interagency negotiation and coordination

Independent technical review

Derrik has more than 30 years of experience in applied geology and hydrogeology and excels at assisting clients with integrating technical analyses and institutional challenges to manage their water resources. His project experience includes managing, reviewing, and assisting on water supply, groundwater recharge, wastewater disposal, and hazardous waste remediation projects. Derrik is accomplished in analytical hydrogeology, with extensive interpretation and application of groundwater flow and transport models. He is an expert in aquifer test design and analysis and is experienced in all aspects of groundwater management.

Representative Projects

Water Resource Planning | Groundwater Management

SGMA Implementation • California Department of Water Resources •
Assisted DWR develop best management practices (BMP) for implementing SGMA and assist with developing Groundwater Sustainability Plans (GSPs). Met with DWR regularly to formulate statewide SGMA policy and draft policy documents. Helped develop DWR's guidance document for sustainable management criteria which was scheduled for release September 2017. [SACRAMENTO COUNTY, CA]

Basin Boundary Modification • Santa Margarita Groundwater Basin Boundary Modification • Scotts Valley Water District
Managed one of the most complex basin boundary modifications for SGMA's implementation. The basin boundary modification included both technical and jurisdictional modifications to promote sustainable groundwater management. Reviewed and interpreted relevant SGMA regulations for the client and hosted meetings with DWR and SWRCB to review and obtain agreement to the modification approach. Developed the technical justification to establish a new groundwater basin that encompasses all or parts of two existing groundwater basins, along with areas previously not considered groundwater basins. Assisted the client with required stakeholder outreach and water agency notification, and developed responses to concerns raised by neighboring water agencies. Presented the modification approach and technical work at numerous Boards of Directors meetings in Santa Cruz County. Directed the development of a 3D flow model to project groundwater inflow and dewatering requirements for a proposed gold mine [SANTA CRUZ COUNTY ,CA]

SGMA Support • SGMA Hydrology Tech Support • Santa Cruz Mid-County Groundwater Agency
Provides senior guidance for technical and policy support to the Groundwater Sustainability Agency (GSA) for the Santa Cruz Mid-County Basin regarding SGMA. This included the GSA formation process and an approved basin boundary modification that combined parts of four basins into a single basin

Professional Registrations

Registered Professional Geologist #6044, CA

Certified Professional Hydrogeologist #35, CA

Additional Training

Awards and Distinctions

and excluding areas that do not impact groundwater management. Led efforts with the newly formed GSA to finalize a schedule and scope for GSP development. The initial activities include presentations at stakeholder workshops to ensure all stakeholders understand the basin conditions and the requirements of SGMA. [SANTA CRUZ COUNTY, CA]

Groundwater Sustainability Agency Assessment • Butte County GSA Formation • Butte County Department of Water and Resource Conservation

Provided technical assistance regarding GSA development to Butte County as a subconsultant to Kearns and West Inc. Assisted Butte County assess the potential interest and concerns of various agencies and groups regarding GSA formation under SGMA. Helped develop the outreach materials to ensure that relevant information was collected to guide Butte County's GSA development. [BUTTE COUNTY, CA]

Groundwater Management • Seaside Basin Groundwater Management • Seaside Basin Watermaster

Helped develop both a Basin Management Action Plan and Seawater Intrusion Response Plan (SIRP) for the Watermaster in Monterey County. The Basin Management Action Plan identified specific data needs, water sources, and groundwater management actions and recommended an implementation strategy to the Watermaster. The SIRP was a companion document that included exhaustive statistical and graphical analyses of groundwater quality data to identify potential seawater intrusion. [MONTEREY COUNTY, CA]

Groundwater Management for the Soquel-Aptos Basin • General Hydrology • Soquel Creek Water District

Updated the groundwater management plan, investigated conjunctive use alternatives, provided well master plan EIR support, designed and installed monitoring wells, seawater intrusion monitoring, assisted with municipal well rehabilitation and restoration, and assisted with negotiating with neighboring agencies. [SANTA CRUZ COUNTY, CA]

Hydrologic Modeling | Groundwater Management

Managed Groundwater Model Update • Groundwater Model • Kings River Conservation District

Managed the groundwater model update for the Kings River Conservation District. The model is based on the State of California's Integrated Water Flow Model (IWFM). Important aspects of this model update include a reinterpretation of agricultural water demands throughout the region, and an update of the geologic structure that underpins the model. In particular, the client requested that the updated model parameters more accurately reflect our understanding of the basin's geologic structure. [FRESNO COUNTY, CA]

Lead Modeler • Seaside Basin Groundwater Model • Seaside Basin Watermaster

Served as project manager and lead modeler for the recently completed regional Seaside Basin groundwater model. The model was developed for the Seaside Groundwater Basin Watermaster. The model accurately simulates 22 years of historical water levels across a 76 square mile area near Monterey, California. An extensive update of the basin hydrostratigraphy was needed during the development phase of the model. The model is designed to compare benefits for various potential groundwater management actions planned to be carried out in the basin. [MONTEREY COUNTY, CA]

Technical Analysis • Regional Groundwater Model • United Water Conservation District
Provided technical oversight for an update of United Water Conservation District's regional groundwater model. The model was providing unrealistic results, and was unable to predict future conditions adequately. Identified simulated water balance problems that, when changed, improved model performance dramatically. Provided technical assistance to staff on using the model to evaluate water management alternatives by implementing various hydrologic scenarios in model runs. [VENTURA COUNTY, CA]

Groundwater Model Support • Groundwater Basin Water Supply Plan and Groundwater Model • Squaw Valley Public Service District (SVPSD)
Provided groundwater support to the SVPSD continuously since 2000, beginning with development of a basin-wide groundwater model that could be used for management and planning. As SVPSD's needs have changed, adapted the initial model to help address new concerns. Under Derrik's direction, the project team has studied groundwater management alternatives as the main option in a plan to increase the water supply. They have used the groundwater flow model to support the water supply analyses. The model has also been used to develop pumping strategies that maximize long-term basin yield, and to identify locations of new wells that the SVPSD may use to increase their water supply. [PLACER COUNTY, CA]

Basin Analysis • Basin Management Plan Analysis • Pajaro Valley Water Management Agency
Led analysis of groundwater management alternatives for Pajaro Valley Water Management Agency's (PVWMA) Basin Management Plan. Directed simulation of alternatives using the Pajaro Valley Hydrologic Model developed by the U.S. Geological Survey that incorporated the Farm Process program, which allows detailed and realistic simulations of agricultural pumping and water transfers. Evaluated and presented model results for the BMP's selected alternative that showed that the alternative will eliminate overdraft in the most productive aquifers and reduce seawater intrusion by more than 90% in those aquifers. [SANTA CRUZ COUNTY, CA]

Developed Numerical Groundwater Model • Groundwater Model • Los Osos Community Services District
Developed a water and nitrate balance of the basin, accounting for all known water recharge and nitrate sources. Incorporated the water and nitrate balance into a numerical groundwater model, used to predict future groundwater conditions. The model showed that the proposed sewer system significantly lowers nitrate levels in the shallow aquifer. Nitrate was shown to be migrating towards municipal wells, however, and will continue to impact these wells for decades into the future. [SAN LUIS OBISPO COUNTY, CA]

Impact Analysis • Groundwater Impact Analysis • San Benito County Water Agency | City of Hollister
Investigated groundwater impacts from changing wastewater quality in San Benito County. Helped develop, calibrate, and use a groundwater model of San Benito County to estimate groundwater impacts and changing salt loads near

the wastewater treatment ponds and at anticipated reclaimed water application sites. The modeling was used to develop alternative strategies to manage both salt loading and high groundwater levels. [SAN BENITO COUNTY, CA]

Developed Transport Model • Charnock Initial Regional Response Activities (CIRRA) Modeling • Environ Corporation
Helped develop and use a basin-wide flow and transport model for the Charnock Sub-Basin in Los Angeles County. Served as a senior consultant for this project, helped develop and guide the modeling program, calibrated the groundwater model, and provided quality assurance and quality control on the modeling process. [LOS ANGELES, CA]

Developed Groundwater Model • Regional Groundwater Flow Model • Santa Clara Valley Water District
Developed a groundwater flow model of the Northern Santa Clara Valley under a joint contract between the City of San Jose and the Santa Clara Valley Water District. The model is presently used by the SCVWD for future water planning. [SANTA CLARA COUNTY, CA]

Model Analysis • San Francisco Western Basin Groundwater Model • San Francisco Department of Public Works
Provided an independent review of the San Francisco Western Basin groundwater model. Produced a plan for field testing and expanding the groundwater model to include the influence of groundwater pumping in Daly City, Colma, and Burlingame on Lake Merced water levels. [SAN FRANCISCO COUNTY, CA]

Water Supply and Recharge | Groundwater Resource Development

Well Siting Study • SCWA Groundwater Assessment • Sonoma County Water Agency
Completed a well siting study for Sonoma County Water Agency's Reliability Assessment. Integrated hydrogeologic analyses of potential well sites with information on geologic hazards and existing and proposed water transmission facilities to identify optimum well locations. [SONOMA COUNTY, CA]

Designed Irrigation Wells • Golden Gate Park Replacement Wells • City of San Francisco
Managed the Golden Gate Park Replacement well project as part of a joint venture. Worked with the Department of Public Works and the Public Utility Commission to site and design two new irrigation wells. The irrigation wells were designed to meet DPW's goal of an assured water supply, while allowing PUC to use the wells as emergency potable supply. [SAN FRANCISCO COUNTY, CA]

Quantification of Interflow • Creek/Aquifer Interaction Study • Squaw Valley Public Service District (SVPSD)
Directed a unique study to establish and quantify the interflow between Squaw Creek and the adjoining shallow aquifers. The study used temperature monitoring techniques that directly estimate the flow rates between the Creek and the shallow aquifers. This project was funded by a California Department of Water Resources AB303 Local Groundwater Assistance Grant. [PLACER COUNTY, CA]

Water Supply and Recharge | Recharge & Recovery

Developed ASR System • Coastal Water Project Aquifer Storage and Recovery (ASR) • ASR Systems
Assisted with development of the ASR component of the Coastal Water Project (CWP) along the Monterey Peninsula. Helped design an ASR system that will provide peak flows to supplement supplies from the planned Moss Landing desalination plant and developed a groundwater model of the target injection zone, based on initial injection test results. [MONTEREY COUNTY, CA]

Feasibility program management • ASR Feasibility Study Management • Squaw Valley Public Service District (SVPSD)
Provided oversight of the field program that included a surface geophysical survey and installation of a monitoring well with a Sonic continuous coring rig. Reviewed the feasibility report that concluded that a suitable water storage interval for ASR in Squaw Valley is not present. [PLACER COUNTY, CA]

Developed Cost Estimates • ASR Well Costs • Sonoma County Water Agency
Developed well cost estimates for the groundwater banking program as part of a water supply EIR. Costs were developed for both new and retrofitted ASR wells. [SONOMA COUNTY, CA]

Technical Analysis • Water Supply Improvement Program • East Bay Municipal District
Coordinated the project, and performed technical analysis for the Water Supply Improvement Program. Assisted with siting and pre-design of injection and recovery facilities and served as the daily contact for EBMUD and the concerned water districts in California's Central Valley. [ALAMEDA COUNTY, CA]

Feasibility Study Implementation • Salinas Valley Reclaimed Water Injection and Recovery Program • Monterey Regional Water Pollution Control Agency
Implemented a feasibility study for reclaimed water injection/recovery (ASR) in the Salinas Valley. Developed a program for seasonally storing tertiary treated reclaimed water in the salt-water intruded portion of the Salinas Valley Aquifer. Coordinated meetings between local water agencies, city governments, the Water Pollution Control Agency, and regulatory agencies. [MONTEREY COUNTY, CA]

Geologic Assessment • Groundwater Assessment • Bear Valley | Fugro West
Conducted a geologic and hydrogeologic investigation showing that the existing wells were extracting groundwater in the most effective areas in the valley. A water budget was developed as part of the hydrogeologic investigation to estimate the amount of groundwater that could potentially be extracted from the valley. Additional wells were determined to be too expensive for the potential benefit. [ALPINE COUNTY, CA]

Hydrologic Modeling | Brackish Groundwater Development

Developed Flow Model • Saline Groundwater Intake and Disposal System Modeling and Design • City of Sand City
Developed a two-phase flow model of feedwater extraction and brine injection beneath the beach in Sand City for a planned desalination plant. The groundwater model was used to develop a unique arrangement of feedwater

wells and horizontal brine disposal wells that reduced environmental impacts on the National Marine Sanctuary. [MONTEREY COUNTY, CA]

Developed Flow and Transport Model • Desalination Brine Disposal Modeling • Marina Coast Water District
Developed a coupled density-dependent flow and transport model to help estimate and visualize the impacts from injecting brine from a small desalination plant beneath the sea floor. The model results suggested that the example brine discharge system created a subsurface brine mound that rose to the sea-floor surface, and entered the ocean at effectively full brine concentration. To obtain all the potential advantages of sea-floor injection, the injection system needed to inject brine over a larger area, at a lower injection rate. [MONTEREY COUNTY, CA]

Hydrologic Modeling | Recharge and Recovery

Developed Vadose Zone Model • Vadose Zone Modeling of Recharge with Reclaimed Water • Monterey County Regional Water Pollution Control Agency
Development of a vadose zone model for predicting travel times of water to the water table below a proposed recharge basin. The recharge basin was designed to infiltrate surplus reclaimed water from a regional wastewater treatment plant into a drinking water aquifer. The HYDRUS-2D model tested a series of likely hydraulic conductivity distributions based on field data to estimate a range of travel times. Model results showed that the testing program proposed for the recharge ponds would not result in the anticipated groundwater mounding. [MONTEREY COUNTY, CA]

Transport Model Development • Salinas Valley Reclaimed Water Injection and Recovery Program Modeling • Monterey Regional Water Pollution Control Agency
Employed a series of groundwater flow and contaminant transport models to study the effects of injecting reclaimed water into salt-water intruded aquifers beneath Salinas Valley. Used a local, variable density, contaminant transport model and a three-dimensional flow and transport model to demonstrate the impact of the injected reclaimed water on nearby water supply wells. [MONTEREY COUNTY, CA]

Hydrologic Modeling | Hydrologic Impact Study

Model Development • Avila Beach EIR Groundwater Model • Fugro West
Developed a flow and transport model of contamination beneath Avila Beach, California, where historical hydrocarbon contamination from leaking distribution pipes threatened the Pacific Ocean and the estuary of San Luis Creek. The groundwater model encompassed the entire town of Avila Beach, including the Pacific Ocean and San Luis Creek. Successfully demonstrated that significant impacts would result from proposed remediation. [SAN LUIS OBISPO COUNTY, CA]

Hydrologic Modeling | Contaminant Assessment & Remediation

Model Development • Groundwater TCE Plume Model • Scottsdale, Arizona
Retained as a neutral third party modeler for a TCE contaminated site with multiple potentially responsible parties. The model was used in negotiations with the USEPA to develop and implement remedial alternatives that ensure a

safe source of drinking water for the City, while preventing further degradation of the aquifers. [MARICOPA COUNTY, AZ]

Publications & Presentations

Presentations

Developing Groundwater Elevation Proxies for Surface Water Depletion Rates
Williams, D., 2017, Groundwater Resources Association Tools for SGMA Workshop, Modesto, CA, May 3

Using Cross-Sectional models to Develop Proxy Measurable Thresholds for Seawater Intrusion
Culkin, S., Tana., C., Williams, D., 2017, Groundwater Resources Association Tools for SGMA Workshop, Modesto, CA, May 4

Measuring Recharge from Ephemeral Streams
Williams, D., 2016, American Groundwater Act/American Ground Water Trust Annual Conference, Ontario, CA, Feb 17-18

First Steps in Inter-Basin Coordination for SGMA: Basin Boundary Modification Requests in Santa Cruz County
Tana, C., Culkin, S., Byler, N., Williams, D., 2016, Groundwater Resources Association of California Annual Conference, Concord, CA, September 28-29

Using Cross-Sectional Models to Develop Measurable Objectives for Seawater Intrusion
Culkin, S., Tana, C., Williams, D., 2016, California Water Environmental Modeling Forum Annual Meeting, Folsom, CA, April 11-13

Using Regional Models to Develop GSA Scale Models
Williams, D., Hundt, S., Bedakar, V., 2016, Groundwater Resources Association Role of Models and Data in Implementing SGMA, Davis, CA, February 8-9

ACWA's Groundwater Data Guidelines and SGMA
Williams, D., 2015, Association of California Water Agencies Legislative Summit, Davis, CA, June 1

Groundwater Analyses and Groundwater Models in the Sustainable Groundwater Management Act
Williams, D., 2015, American Groundwater Act/American Ground Water Trust Annual Conference, Ontario, CA, February 9-10

Eliminating Stream Depletion by Combining Time-Series Thermal Data with Aquifer Test Results
Hundt, S., King, G., Williams, D., 2014, California/Nevada American Water Works Association Whole Water Conference, Monterey, CA, June 24-26

Olympic Valley Creek/Aquifer Interaction Study
Williams, D., 2014, California/Nevada American Water Works Association Spring Conference, Anaheim, CA, March 25-28

Evaluating Water Quality with Data from Dynamic Tracer and Sampling Techniques Used in Production Wells
Tana, C., Byler, N., Quereshi, H., van Brocklin, D., Williams, D., 2014, California/Nevada American Water Works Association Spring Conference, Anaheim, CA, March 26

Beyond the Pavement: Groundwater Recharge Benefits from Urbanization
Williams, D., 2011, National Ground Water Association Cities, Suburbs, and Growth Areas Conference, Los Angeles, CA, August 8-9

Developing Drought Curtailment Criteria for a Groundwater Basin on a Model of Deep Recharge
Tana, C., King, G., Duncan, R., Williams, D., 2011, National Ground Water Association Cities, Suburbs, and Growth Areas Conference, Los Angeles, CA, August 8-9

Sustainability from the Ground Up: Groundwater Management in California, A Framework
Blacet, D., Parker, T., Aladjem, D., Williams, D. (reviewer), 2011, Association of California Water Agencies, April 2011

Managing Saltwater Intrusion with Protective Groundwater Elevation Constraints
Tana, C., King, G., Johnson, R., Lear, J., Williams, D., 2011, Proceedings from the 4th International Perspectives on Water Resources and Environment, Singapore

California Statewide Groundwater Elevation Monitoring(CASGEM) Workshop
Williams, D. (member of presenting team), 2010, California Department of Water Resources in conjunction with Association of California Water Agencies

Using PEST to Efficiently Implement Conceptual Model Changes in a Regional Groundwater Model
Tana, C., Williams, D., 2009, The PEST Conference, Potomac, MD, November 2-4

Using Uncertainty Analysis to Manage Seawater Intrusion
Tana, C., van Brocklin, D., Williams, D., 2009, The PEST Conference, Potomac, MD, November 2-4

Managing Seawater Intrusion without Knowing the Seawater Interface Location
Williams, D., van Brocklin, D., Tana, C., 2008, International Ground Water Modeling Center, Golden, CO, May 18-21

Successful and Unsuccessful Applications of Inverse Methods on a Regional Groundwater Model
Tana, C., Williams, D., 2007, Geological Society of America Annual Meeting, Denver, CO

Developing Sustainable Water Supplies from a Small Coastal Aquifer with both Onshore and Offshore Environmental Constraints
Williams, D., Feeney, M., 2003, The Second International Conference on Salt Water Intrusion and Coastal Aquifers in Monitoring, Modeling, and Management, Merida, Yucatan, Mexico, March 30-April 2

The Significance of Groundwater Gradient Magnitude on Flow Paths in Simulations of Heterogeneous Aquifers
Oliver, D., Williams, D., 2002, Bridging the Gap Between Measurement and Modeling in Heterogeneous Media, International Groundwater Symposium, Berkeley, CA, March 25-28

Publications

Conceptual Modeling of a Well Developed Alluvial Basin, in Subsurface Fluid Flow (Ground Water and Vadose Zone) Modeling
Williams, D., Johnson, N.M., Fowler, A.C., 1996, American Society of Testing and Materials, Philadephia, PA

WATER RESOURCES AGENCY

MEMORANDUM

Monterey County

DATE: March 4, 2019

TO: Gary Petersen, General Manager, SVBGSA
Leslie J. Girard, SVBGSA General Counsel

FROM: Howard Franklin, P.G.

SUBJECT: Opinion on Groundwater and Surface Water Interdependence in the Salinas Valley Groundwater Basin

As you know, I am currently employed as a Senior Hydrologist with the Monterey County Water Resources Agency ("Agency") and am a licensed professional geologist with the State of California. I have been employed by the Agency for over 23 years; a copy of my C.V. is enclosed. I also currently serve on the SVBGSA Advisory Committee, and am assisting in the development of the Salinas Valley Integrated Hydrologic Model (SVIHM) by the United States Geological Survey. The SVIHM will be utilized, in part, by the SVBGSA in preparing GSPs for the Salinas Valley Groundwater Basin ("Basin"). During my time with the Agency I have become familiar with the hydrology and hydrogeology of the Basin, and the relationship and interaction between groundwater and surface water in the Basin.

Regarding, the Salinas River within the Basin, the river does not meet the definition of a "subterranean stream, which is defined as groundwater that is flowing through known and definite channels." Although not a subterranean stream, the river is operated by the Agency with a specific objective of providing recharge to the Basin. Of an estimated 504,000 acre-feet per year of inflow to the Basin, approximately 50 percent occurs as stream recharge, most of which can be attributed to flows within the Salinas River channel. Surface water within the Salinas River channel is therefore a primary source of recharge to the Basin.

In much of the Basin, groundwater extraction and/or surface water diversions occurs from wells that are in direct communication with the shallow alluvial of the Salinas River channel. In these areas, it is difficult to differentiate between the extraction of groundwater and the diversion of surface waters. Additionally, as was experienced and monitored throughout the Basin during the most recent drought period, lowering of the groundwater table has a significant impact on the Agency's ability to operate the reservoirs to a controlled range of flows at the Salinas River Diversion Facility. As such, overdraft of the groundwater basin, resulting in a reduction in groundwater levels significantly impacted surface water flows, depleting the availability of surface water to riparian water users.

Groundwater and surface water users alike will benefit when projects designed to recharge the groundwater basin and provide water for fish passage, spawning and rearing, maintain groundwater levels. For this reason, within the Basin, groundwater and surface water can be regarded as an interdependent system.

Based on this interdependence, it is my opinion that both surface water and groundwater users in the Basin will benefit from projects operated to achieve a sustainable groundwater basin. It is also my opinion that the benefit received from a sustainable groundwater basin cannot easily be differentiated between the two user groups.

HOWARD B. FRANKLIN

Phone: (831) 755-4860 9442 Saddler Drive
franklinh@co.monterey.ca.us Gilroy, CA 95020

EDUCATION

MS University of Nevada, Reno, Hydrology/Hydrogeology August 1993
Thesis: "Applications of GIS Technology in Water Resource Investigations"
Advisor: John Warrick, PHD

BA Southern Illinois University, Carbondale, Biological Sciences May 1981
Minor: Geology
Minor: Geography (Cartography)
Minor: Microbiology

PROFESSIONAL QUALIFICATIONS

Manage and supervise professional geologist and engineers, scientist, technicians, general labor and administrative staff. Participate in strategic planning and budget development; Scope projects and develop budgets; Perform large scale and site specific scientific investigations; Oversee the development and implementation of complex basin wide integrated surface water groundwater models; Develop write and implement grant funded projects; Effectively planned and built heli-portable camps under extreme artic conditions.

Education, training and work experience in hydrology, hydrogeology, geology, geophysics, environmental science and water resource management. Licensed Professional Geologist in California (No. 8456).

Coordinated and implemented innovative projects in diverse environments; major metropolitan, agricultural, delta, desert, mountain and artic regions.

WORK EXPERIENCE

Monterey County Water Resources Agency, Salinas, California 1995 to present

- Hydrologist / Program Manager / Senior Water Resources Hydrologist

Reporting directly to the General Manager, plan, organize and manage the Hydrology section of the Monterey County Water Resources Agency; manage the most complex, innovative and large scale hydrogeologic investigations, projects and programs; prepare conceptual designs and investigations, manage detail design of project phases by other staff and engineers; conduct and guide subordinate supervisors in performance appraisals and employee counseling; select candidates for employment; prepare and manage program, project and section budgets; participate in the development of Agency wide budgets; represent the Agency at Board of Directors and County Board of Supervisor meetings; prepare grant applications; negotiate and administer contracts with vendors, agencies, and consultants; collaborate and coordinate with regulatory agencies; negotiate, prepare, review and administer agreements with other departments or public agencies; analyze proposed and current legislation and government policies, rules and regulations and develop strategic recommendations.

Parsons Engineering Science, Alameda, CA 1993 to 1995

- Hydrologist / Hydrogeologist

Performed hydrogeologic modeling, analysis, and report preparation of surface and ground water contamination sites. Developed geospatial database and performed analysis of major projects involving multiple sampling media. Utilized remote sensing technologies to locate and evaluate potential disposal sites on military instillations involving unexploded ordnance. Performed water resource evaluations, watershed characterizations, and geostatistical analysis projects.

Washoe County Department of Comprehensive Planning, Natural Resources Division, Reno, Nevada 1991 to 1993

- Graduate Intern

Developed, installed, and monitored a data collection network of rain gages, weirs, and weather stations for water resource evaluations. Performed streamflow measurements and snow pack surveys. Responsible for GIS data development and mapping.

Western Geophysical Company, International Division, Houston, Texas 1981 to 1991

- Exploration Manager

Managed the operation of geophysical exploration crews in extreme environments. Led projects in artic, coastal, delta, swamp, desert, mountain, agricultural, and urban regions. Supervised the coordination of air, aquatic, and terrestrial operations.

Global Marine Drilling, Inc, Homer, Louisiana Summers: 1978 and 1979

- Roustabout / Roughneck

Worked aboard the deep-sea exploration ship the Glomar Grand Isle performing duties in support of all drilling activities. Offshore Gulf Coast and South America.

PROFESSIONAL LICENSE

State of California Board for Professional Engineers, Land Surveyors, and Geologist
Licensed Professional Geologist (No. 8456) 2008 to Present

State of California, Cal/OSHA
Licensed Geophysical Blaster (Explosive purchase and use license) 1982 to 1985

PUBLICATIONS/REPORTS

- "Special Report: Recommendations to Address the Expansion of Seawater Intrusion in the Salinas Valley Groundwater Basin", October 2017

- Salinas Valley Water Project Annual Flow Report: Water Years 2010 - 2018

- Groundwater Elevation Contours: 1995,1997, 1999, 2001, 2003, 2005, 2007, 2009, 2011, 2013, 2015, 2017

- Seawater Intrusion Maps: 2011, 2013, 2015, 2017

- Groundwater Extraction Reports: 2011, 2012, 2013, 2014, 2015, 2016

- Quarterly Salinas Valley Water Conditions Reports: Water Years 2003 – 2018

- Water Resources Data Report: Water Years 1994 – 1997

- "Special Report: A GIS Analysis of the Effects of land Use Constraints and Water Delivery on Water Demands in North Monterey County", December 1996

PRESENTATIONS

- UCC Irrigation and Nutrient Meeting, February 2018: Presenter - "Update on Seawater Intrusion in the Salinas Valley"

- California Groundwater Resources Association Annual Conference, October 2013: Presenter - "Groundwater level Trends and the Implementation of Water Supply Projects in the Salinas Valley, CA"

- American Association of Petroleum Geologists, 1999 Pacific Section Convention: Oral and Poster Presentations – "Monterey County Water Resources Agency's use of GIS Technology in the Salinas Valley" and "The Benefits of Proper Data Capture and Management Practices at Monterey County Water Resources Agency"

PROFESSIONAL TRAINING

Unexploded Ordinance (UXO) – Remote Sensing Seminar
Colorado School of Mines, Golden, Colorado, September 1993

Workshop and seminar on location and management of UXO detection and risk utilizing remote sensing technologies.

Groundwater-Surface Water Interaction: California's Legal and Scientific Disconnect - Symposium
Groundwater Resources Association of California, June 2011
Groundwater and surface-water are connected in the physical system, but not in the legal system, and the regulatory framework places pseudo boundaries to define under the influence. A debate has been heating up over the past few years as to whether the legal and regulatory system need to be changed to reflect physical reality and to protect the environment from further damage, whether local management initiatives and practice can effectively address the challenges, or some sort of hybrid needs to be developed for parts of the state. Our esteemed speakers and panelists will debate the pros and cons of the current system, and discuss their vision for California's future groundwater policy.

Principals of Groundwater and Flow Transport Modeling – Short Course
Groundwater Resources Association of California, September 2001
Principles and practical aspects of groundwater modeling.

PROFESSIONAL AFFILIATIONS

- Groundwater Resources Association of California
- Monterey Bay Geological Society

TECHNICAL ADVISORY

Salinas Valley Groundwater Basin Investigation, Technical Advisory Committee, Monterey County Water Resources Agency, Salinas, California, 2010 to present.
Manage and coordinate participation of qualified professionals in support of the development of a Salinas Valley Integrated Hydrologic Model (SVIHM) built on the USGS Integrated Hydrologic Model, One-Water Hydrologic Flow Model (MODFLOW-OWHM) in cooperation with the U.S. Geological Survey.

Technical Advisory Committee: Seaside Watermaster, 2004 to present
Provide technical assistance and guidance to Seaside Adjudicated Basin Watermaster

Technical Advisory Committee: Pajaro Valley Water Management Agency, 2010 to 2014
Development of USGS Integrated Hydrologic Model, One-Water Hydrologic Flow Model (MODFLOW-OWHM) of the Pajaro Valley, Santa Cruz and Monterey Counties, California

Technical Advisory Committee (Computer Model Update Subcommittee): Paso Robles Groundwater Basin, San Luis Obispo County, California, 2008 – 2014

Provide technical assistance and guidance in support of the Paso Robles Groundwater Basin Investigation.

COMMUNITY SERVICE

City of Gilroy, California
2010 General Plan Update Committee, 2008 - 2010

South Santa Clara County Planning Advisory Committer
City of Gilroy Representative, Santa Clare County, California, 2009 - 2012

LANGUAGES

English: Native Language

COMPUTER SKILLS

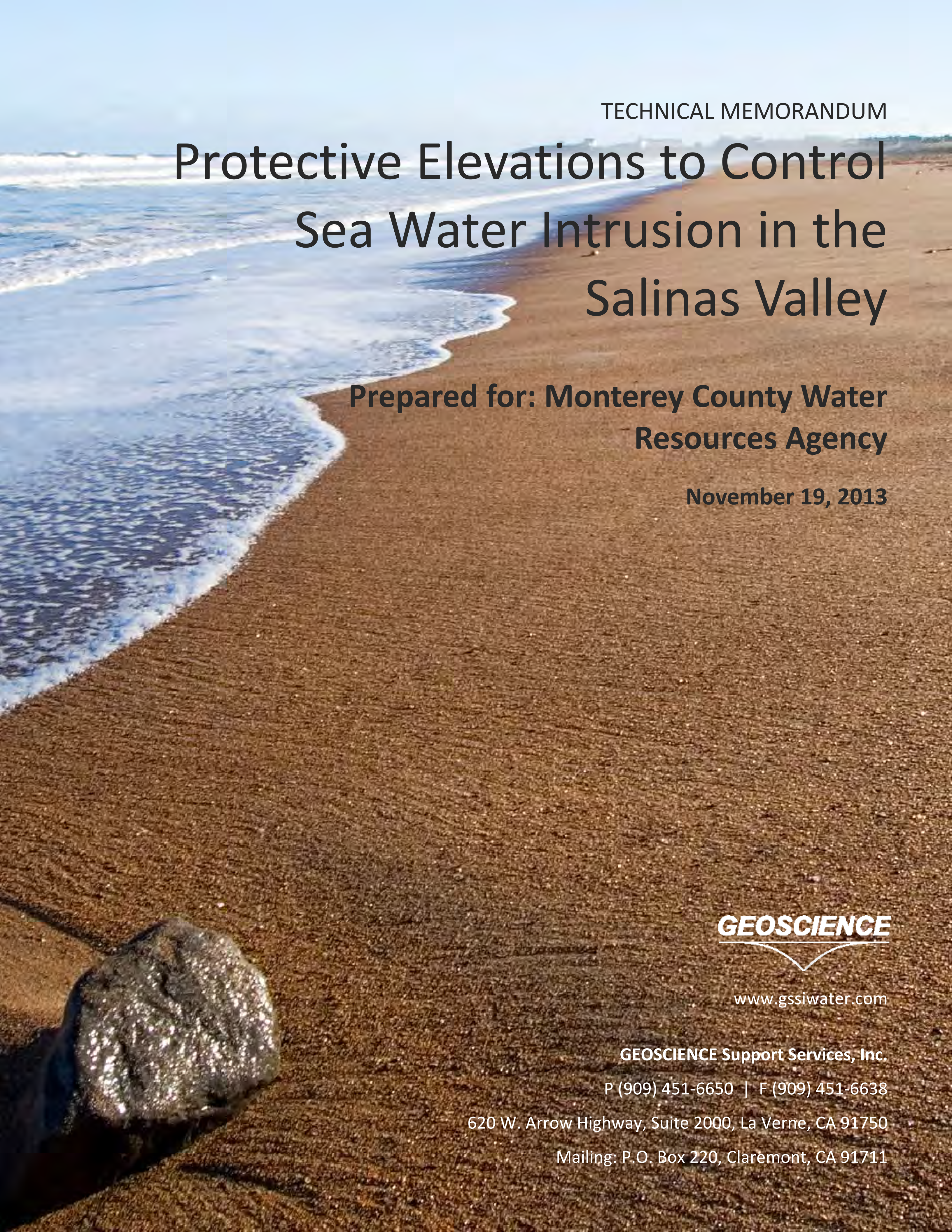
Programming: Python (limited) JavaScript (limited)

Applications: GIS, MS Office Suite (Proficiency in Word, Excel, PowerPoint, Access)

Platforms: MS Windows, iOS, Unix/Linux, Cloud, Social Media

OTHER

- LinkedIn: https://www.linkedin.com/pub/howard-b-franklin/b/3a6/b12
- PADI and NAUI Scuba Certified



TECHNICAL MEMORANDUM

Protective Elevations to Control Sea Water Intrusion in the Salinas Valley

Prepared for: Monterey County Water Resources Agency

November 19, 2013

GEOSCIENCE

www.gssiwater.com

GEOSCIENCE Support Services, Inc.

P (909) 451-6650 | F (909) 451-6638

620 W. Arrow Highway, Suite 2000, La Verne, CA 91750

Mailing: P.O. Box 220, Claremont, CA 91711

PROTECTIVE ELEVATIONS TO CONTROL SEA WATER INTRUSION IN THE SALINAS VALLEY, CA

FIGURES

TABLES

APPENDIX

PROTECTIVE ELEVATIONS TO CONTROL SEA WATER INTRUSION IN THE SALINAS VALLEY, CA

1.0 BACKGROUND

This technical memorandum was prepared in support of preventing revocation of Permit 11043 (State of California Division of Water Rights Permit for Diversion and Use of Water - Amended Permit 11043 dated 11-Jul-49). Permit 11043 allows for appropriation of water from the Salinas River in Monterey County California, the quantity of which shall not exceed 400 cfs with an annual maximum diversion amount not to exceed 168,538 acre-ft/yr. Beneficial uses of the diverted water would add to and complement existing projects or implement new projects such as:

- Increase Ground Water Levels in the Pressure Area to Control Sea Water Intrusion
- Provide Additional Recharge to the Forebay And East Side Areas
- Provide More Water to the Salinas Valley Water Project
- Expansion of CSIP Deliveries
- Reduce Pumping in Pressure Area (in Lieu Recharge)

This report addresses one of the potential beneficial uses, that is, using the diverted water to help increase ground water levels in the Pressure and East Side Subareas to control seawater intrusion. The high quality diverted water would also result in improvement of ground water quality by blending with native ground water.

2.0 DESCRIPTION OF AQUIFER SYSTEMS

Water-bearing materials in the northern portion of the Salinas Valley, from oldest to youngest, consist of the Pliocene Marine Purisima Formation, Plio-Pleistocene Paso Robles Formation, Pleistocene Aromas Red Sands and the Holocene Valley Fill materials (Greene, 1970). In the Salinas Valley, according to Hanson et al. (2002), the upper portion of the aquifer system is present in the Holocene river and dune deposits, Valley Fill, Pleistocene Aromas Sands and the Paso Robles Formation. These water-bearing deposits consist of sand and gravel units which form aquifers in the upper 1,000 ft bgs[1] . Between 1,000 ft and 2,000 ft, the Pliocene Purisima Formation contains permeable sedimentary deposits which form a deeper aquifer system.

Aquifers in the Salinas Valley Ground Water Basin have been named for the average depth at which they occur. Beneath the center of the Salinas Valley within nine miles of the coast, the “180-Foot Aquifer” lies at an approximate depth of 50 to 250 ft, and has a thickness of 50 to 150 ft (Greene, 1970). The 180-Foot aquifer may correlate in part with the older valley-fill and upper Aromas Sands (Kennedy/Jenks Consultants, 2004; DWR, 1973; and Greene, 1970) and underlies a confining layer known as the Salinas Valley Aquitard (DWR, 2003; Hanson et al., 2002). The Salinas Valley Aquitard varies in thickness from 25 ft to more than 100 ft near Nashua Road, five miles west of Salinas (DWR, 1973; Montgomery Watson, 1994). Zones of discontinuous aquifers and aquitards approximately 10 to 200 ft thick underlie the 180-Foot aquifer (DWR, 1973). The “400-Foot Aquifer” lies at an approximate depth between 200 to 400 ft bgs, has a thickness of 230 to 350 ft, and may correlate with the lower Aromas Red Sands or Paso Robles Formation (Hanson et al., 2002; Greene, 1970). A deeper aquifer, also referred to as the “900-Foot Aquifer,” is separated from the overlying 400-Foot aquifer by a blue marine clay aquitard (DWR, 2003) and may be correlated with the Paso Robles Formations (Hanson et al., 2002). Figure 1 and Figure 2 depict the 180-Foot and 400-Foot aquifers. The 900-Foot aquifer is not shown on Figure 1 or Figure 2.

Existing published reports contain geohydrologic cross-sections of varying detail and applicability – such as those available in Greene (1970), DWR (1973), Harding ESE (2001), Hanson et al. (2002), and Kennedy/Jenks (2004). Cross-sections prepared by Kennedy/Jenks (2004) were used to help evaluate the extent of the base of the 180-Foot and 400-Foot aquifers and are discussed in a subsequent section of this memorandum (also see Appendix A).

[1] Below ground surface

3.0 PRESSURE AND EAST SIDE HYDROLOGIC SUBAREAS

Hydrologic subareas of the Salinas Valley have been delineated based on sources of ground water - recharge as well as stratigraphy. Historically, recharge to the Northern Salinas Valley comes primarily from two hydrologic subareas: underflow from the southern Forebay Subarea and underflow from the northeast East Side Subarea. The East Side Subarea is bounded by the Pressure Subarea on the west and Forebay Subarea on the south.

The East Side Subarea is recharged by streams draining the Gabilan Range to the northeast and from direct precipitation during wet years. The 180-Foot and 400-Foot aquifer zones in the Pressure Subarea are not found in the East Side Subarea. However, the East Side Shallow and Deep Aquifers can be time-stratigraphically correlated to equivalent zones in the Pressure Subarea (i.e. 180-Foot and 400-Foot aquifers). Therefore, the Pressure and East Side are in fact, hydrologically connected.

At one time (before excessive pumping), the East Side Subarea was one of the natural sources of recharge to the adjacent Pressure Subarea with ground water flowing from the northeast to the southwest. However, historical ground water level declines have resulted in a reversal of the gradient. That is, ground water now flows from the Pressure Subarea to the East Side Subarea (i.e. from the southwest to the northeast—see Figures 3 and 4).

4.0 HISTORICAL INTRUSION OF SEA WATER IN THE 180-FOOT AND 400-FOOT AQUIFERS

In general, ground water flows from areas of recharge to areas of discharge and the Salinas Valley is no exception. In the main Salinas Valley, ground water flows in a northwesterly direction from the inland recharge areas (Forebay Subarea) to the coast. Ground water also historically flowed from the East Side Subarea southwesterly into the Pressure Subarea. This natural flow of fresh ground water (towards the ocean) controlled inland migration of salt water into coastal aquifers. However, historical pumping has lowered ground water levels in both the 180-Foot and 400-Foot aquifer systems such that there is a landward hydraulic gradient which has caused extensive sea water intrusion (see Figures 3 and 4). It is believed that the primary mechanism of seawater intrusion is through the submarine outcrops of the 180-Foot and 400-Foot aquifers offshore of Monterey Bay. These outcrops are in direct hydraulic continuity with the Pressure Zone 180-Foot and 400-Foot aquifers. Graphical plots published by Monterey County Water Resources Agency (MCWRA, 2012) delineating historical extent of seawater intrusion, are shown on Figures 5 and 6 for the 180-Foot and 400-Foot aquifers respectfully. An analysis of these figures shows that the rate of seawater intrusion has progressively slowed due to implementation of the Salinas Valley Water Project and the Monterey County Recycling Projects. However, intrusion continues (albeit at a slower rate), migrating inland and salinating fresh-water aquifer systems. The following table summarizes the rate of seawater intrusion in the northern Salinas Valley as measured from the MCWRA plots (Figures 5 and 6).

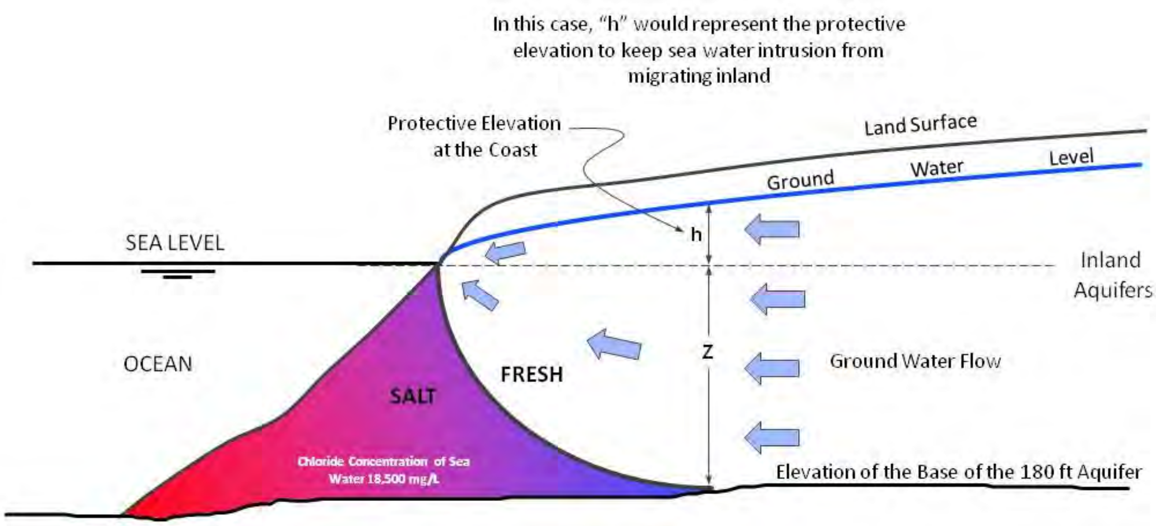
Table 1
Historical Rate of Sea Water Intrusion in the 180 and 400-Foot Aquifers, ft/yr

Time Interval	Aquifer	
	180-Foot	400-Foot
1944-1965	557	-
1959-1975	-	391
1965-1975	659	-
1975-1985	665	545
1985-1993	930	406
1993-1997	1028	1185
1997-1999	4086	1829
1999-2001	1418	1243
2001-2005	722	572
2005-2007	760	303
2007-2009	430	183
2009-2011	600	134

5.0 CONTROL OF SEA WATER INTRUSION – PROTECTIVE ELEVATIONS

Well over 100 years ago, two independent investigators Ghyben and Herzberg determined that salt water in aquifers was found at a depth below sea level of approximately 40 times the height of the fresh water above sea level (Todd, 1980). This distribution was due to the hydrostatic equilibrium between the densities of fresh water and seawater. The equation which explains this phenomenon is referred to as the Ghyben-Herzberg relation and assumes under hydrostatic conditions that the weight of a unit column of fresh water, extending from the ground water level to a point on the fresh/salt water interface, is balanced by a unit column of salt water extending from sea level to the same point on the interface. The figure below illustrates this principle.

Schematic Showing Protective Elevations and the Ghyben-Herzberg Relation



Ghyben-Herzberg Relation Z = 40h

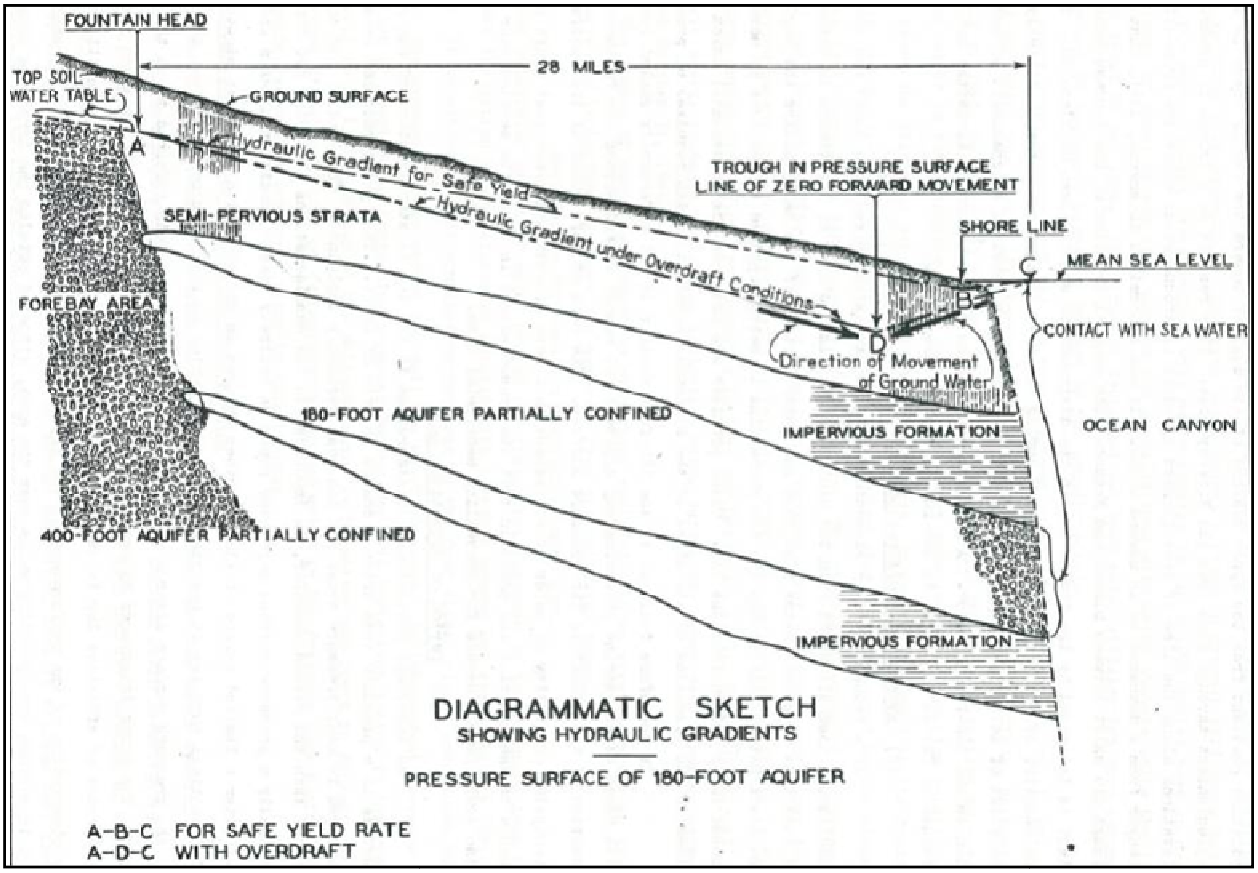
Protective elevations are defined as those ground water elevations which will keep the fresh/salt water interface from migrating inland. In the northern portion of Salinas Valley these elevations need to be above sea level and the flow of ground water towards the coast.

Ground water recharge (direct and in lieu), could be used to replenish storage and maintain a seaward hydraulic gradient. Additional recharge in the Forebay area would result in additional recharge to the northern pressure zone as underflow. Artificial recharge in the East Side Subarea would reduce subsurface inflow from the Pressure Subarea and eventually restore the historical northeast to southwest recharge. Both northwest underflow from the Forebay Subarea as well as southwest recharge from the East Side Subarea would help control seawater intrusion.

6.0 PROTECTIVE ELEVATIONS FOR THE 180-FOOT AND 400-FOOT AQUIFERS

One of the initial steps in the planning process for control of seawater intrusion is to quantify the protective elevations. As discussed above, in a simple hydrostatic case, protective elevations are defined as those ground water elevations (above sea level) which, due to density differences between fresh ground water and seawater, create a balance or equilibrium condition of the fresh water-salt water interface.

Schematic Showing Water Level Needed to Prevent Sea Water Intrusion (DWR, 1946)



The above sketch is from Plate 10 in DWR (1946) and shows the concept of establishing a seaward hydraulic gradient to prevent seawater intrusion. Near the coast it may be assumed that the chloride concentration is that of pure seawater (18,500 mg/L)[2] and the Ghyben-Herzberg 40:1 relation applies.

[2] http://shorestation.ucsd.edu/active/index_active.html

The extent of seawater intrusion varies in different aquifers due to a multitude of factors including aquifer depth, tidal influence, variation in hydrology and other water balance components. However, for planning purposes, the protective elevations as calculated in this technical memorandum are considered realistic for control of seawater intrusion. Protective elevations were calculated near the coast and merged with historical (1938) elevations obtained from Plates 8 and 9 (DWR, 1946).

Specifically, protective elevations for the 180-Foot and 400-Foot aquifers were calculated as follows:

1. The elevation of base of the 180-Foot and 400-Foot aquifers were obtained from recent geologic cross-sections and other publications (Figures 7, 8 and Appendix A).
2. The Ghyben-Herzberg relation of 40:1 was used to calculate the protective elevations at the Coast for each aquifer (see Figures 1 and 2).
3. Using the protective elevations at the coast and historical ground water flow directions as obtained from DWR Bulletin 52 (1946), the protective elevations were created assuming a seaward hydraulic gradient of 0.0002 (1 ft/mile) for both the 180-Foot and 400-Foot aquifers. This seaward hydraulic gradient is somewhat less than the historical gradient but as long as the coastal protective elevations are maintained by seaward flow, seawater intrusion can be controlled.

Figures 9 and 10 show the protective elevations and direction of ground water flow in the Northern Salinas Valley.

7.0 HISTORICAL DEPLETION OF STORAGE IN A PORTION OF THE 180-FOOT AND 400-FOOT AQUIFERS

The ground water storage depletion between the protective elevations (Figures 9 and 10) and current ground water elevations (Figures 3 and 4) was made for a portion of the 180-Foot and 400-Foot aquifers between the town of Salinas and the Coast. Historical ground water storage depletion was estimated by multiplying the historical change in hydraulic head by the area and aquifer storativity. For example, for the 180-Foot aquifer, the current ground water elevations (Figure 3) were subtracted from the protective elevations (Figure 9). This difference was then multiplied by the 180-Foot aquifer area and the storativity. Similarly, for the 400 Foot aquifer, the depletion in storage was calculated by subtracting current water levels (Figure 4) from protective elevations (Figure 10) and multiplying by the area and the 400-Foot aquifer storativity. Incremental areas and storativity values for each aquifer were obtained from the SVIGSM[3] model cells.

Keep in mind that since these aquifers are confined and semi-confined, the change in ground water storage is relatively small and is due to the compression of the aquifer and expansion of the water. This volume is several orders of magnitude lower than the water which would drain by gravity (from aquifer pore space) in an unconfined state. Table 2 summarizes historical change in ground water storage.

Table 2
Historical Depletion of Storage in a Portion of the 180-Foot and 400-Foot Aquifers Between the Town of Salinas and the Coast

Aquifer	Area Between the Coast and Salinas, acres	Average Decline of Water Level ft	Aquifer Storativity	Volume of Storage Depleted acre-ft
180-Foot	84,000	33	0.004	11,100
400-Foot	84,000	51	0.00009	400
			TOTAL	11,500

[3] Salinas Valley Integrated Ground Water-Surface Water Model

8.0 FLOW NEEDED TO MAINTAIN A SEAWARD HYDRAULIC GRADIENT

Table 2 (above) shows that a relatively small amount of water is necessary to replenish confined and semi-confined aquifer storage. More important in controlling seawater intrusion however, is the re-establishment of the coastal protective elevations and seaward hydraulic gradients. It is estimated that between 1970 and 1992 approximately 16,000 acre-ft/yr of intrusion occurred in the 180-Foot and 400-Foot aquifers (Montgomery Watson, 1994).

The amount, location and timing of ground water recharge (direct and in lieu), needed to maintain protective elevations and a seaward hydraulic gradient was determined using the SVIGSM. Based on model results, and assuming 2030 land use conditions, 12,000 acre-ft/yr will be required from the SVWP Phase I facilities and 48,000 acre-ft/yr will be required from the SVWP Phase II facilities. Given the hydrologic variability in the Salinas Valley area, in order to supply a total of 60,000 acre-ft/yr (on average), to the SVWP, it will be necessary to have the right to divert up to 135,000 acre-ft/yr from the Salinas River.

9.0 REFERENCES

California Department of Public Works, Water Resources Division (DWR), 1946. Salinas Basin Investigation, Bulletin 52.

California Department of Water Resources (DWR), 1973. Lower Salinas Valley Seawater Intrusion Investigation.

_____, 1977. North Monterey Water Resources Investigation. Prepared pursuant to cooperative agreement between Department of Water Resources and Monterey County Flood Control and Water Conservation District. March 23, 1977.

_____, 2003. California's Groundwater - Bulletin 118, Update 2003. October, 1, 2003.

Greene, Gary H., 1970. Geology of Southern Monterey Bay and its Relationship to Ground Water Basin and Sea Water Intrusion. U.S. Geologic Survey Open-File Report.

Hanson, R.T., R. Everett, M. Newhouse, S. Crawford, M.I. Pimental, and G. Smith, 2002. Geohydrology of a Deep-Aquifer Monitoring-Well Site at Marina, Monterey County, California. U.S.G.S. Water-Resources Investigations Report 02-4003. Prepared in cooperation with Monterey County Water Resources Agency.

Harding ESE, 2001. Hydrogeologic Investigation of the Salinas Valley Basin in the Vicinity of Fort Ord and Marina Salinas Valley, California. Prepared for Monterey County Water Resources Agency. April 28, 2001.

Johnson, M., 1983. Ground Water in North Monterey County, California, 1980. U.S.G.S. Water-Resources Investigations Report 83-4023. Prepared in cooperation with the Monterey County Flood Control and Water Conservation District. July 1983.

Kennedy/Jenks Consultants, 2004. Hydrostratigraphic Analysis of the Northern Salinas Valley.

Monterey County Water Resources Agency (MCWRA), 2012. Historic Seawater Intrusion Maps – 500 mg/L Chloride Areas. August 6, 2012. http://www.mcwra.co.monterey.ca.us/SVWP/01swi180.pdf; http://www.mcwra.co.monterey.ca.us/SVWP/01swi400.pdf Accessed 22-Jan-13

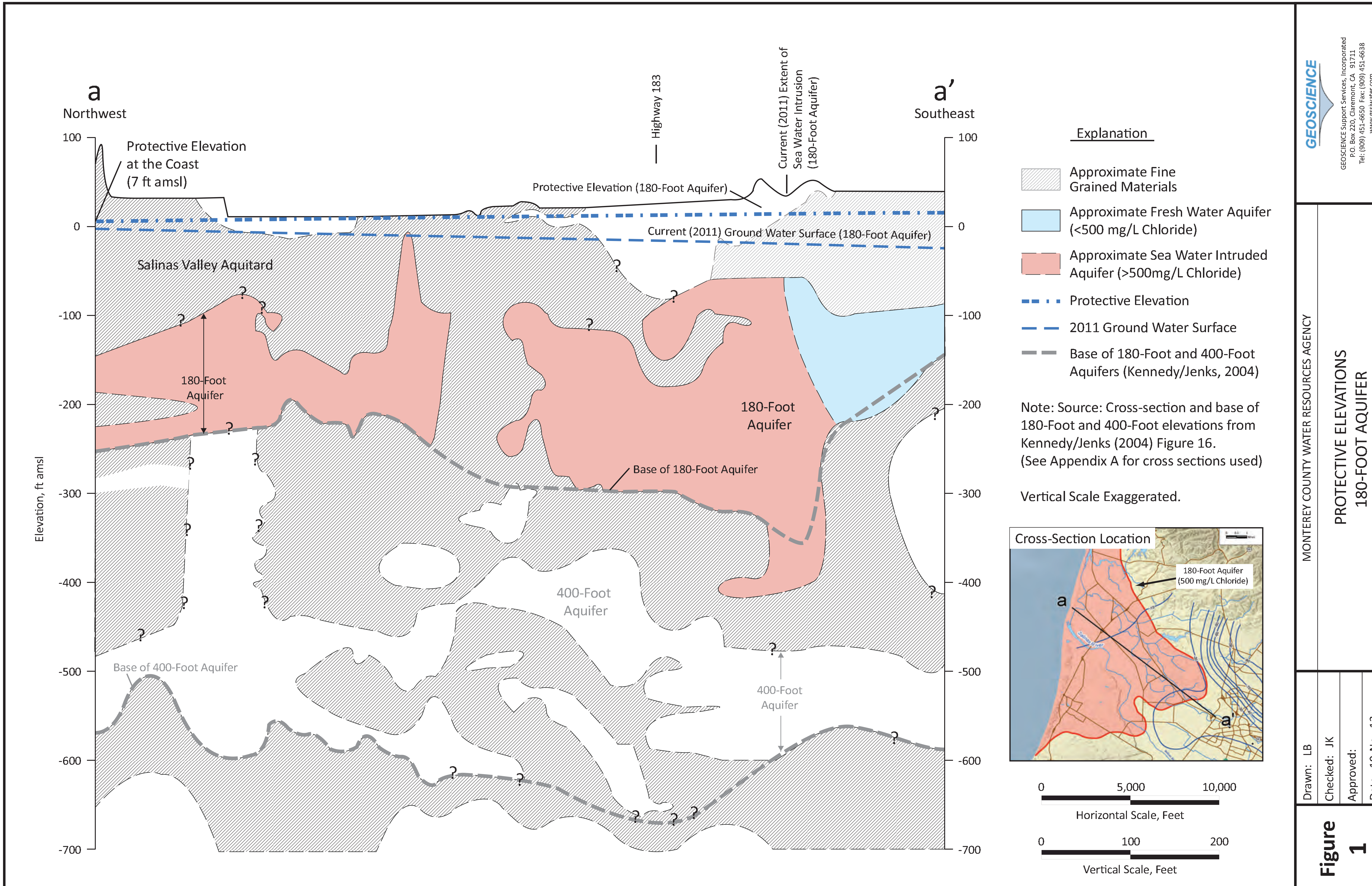
Montgomery Watson, 1994. Salinas River Basin Water Resources Management Plan Task 1.09 Salinas Valley Ground Water Flow and Quality Model Report. Prepared for Monterey County Water Resources Agency. February 1994.

Timothy J. Durbin, Inc., 2007. Groundwater Flow and Transport Model Seaside Groundwater Basin Monterey County, California. Prepared for RBF Consulting. October 26, 2007.

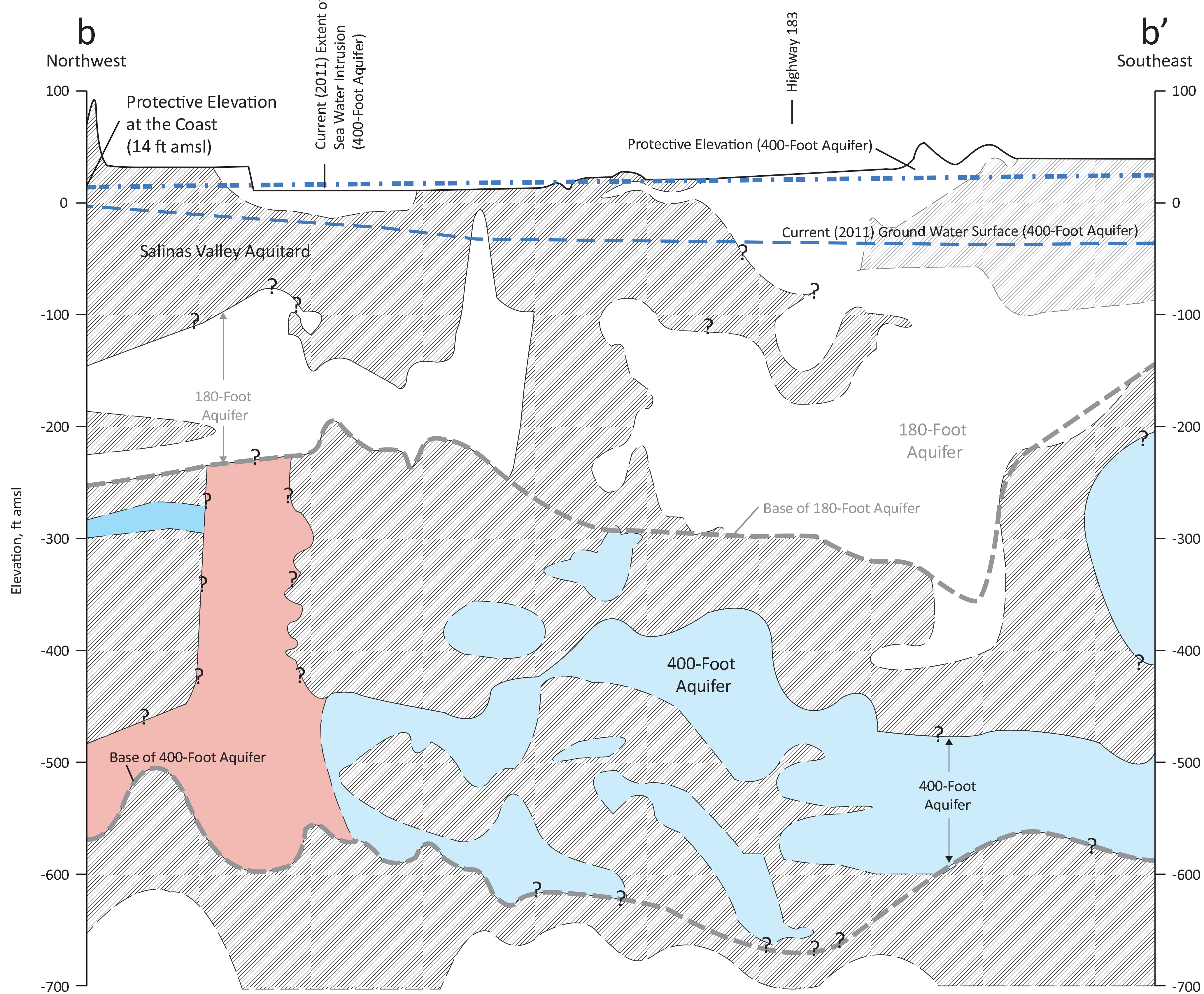
Todd, David K., 1980. Groundwater Hydrology, Second Edition. New York: John Wiley & Sons, 1980.

Yates, E.B., M.B. Feeney, and L.I. Rosenberg, 2005. Seaside Groundwater Basin: Update on Water Resource Conditions. Prepared for Monterey Peninsula Water Management District. April 14, 2005.

FIGURES



Projects\Downey-Brand\01) Salinas_Valley_Permit 11043\01) TM_Sea_Water_Intrusion\03) Revisions 19-Nov-13\01) TM figures\Fig_1_xsec_a-a_180_PE_11-13.ai



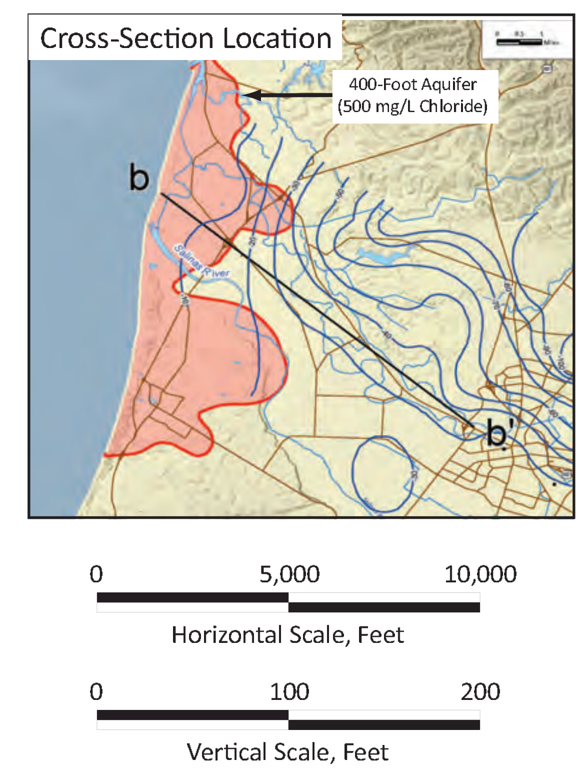
Explanation

- Approximate Fine Grained Materials
- Approximate Fresh Water Aquifer (<500 mg/L Chloride)
- Approximate Sea Water Intruded Aquifer (>500mg/L Chloride)
- Protective Elevation
- 2011 Ground Water Surface
- Base of 180-Foot and 400-Foot Aquifers (Kennedy/Jenks, 2004)

Note: Source: Cross-section and base of 180-Foot and 400-Foot elevations from Kennedy/Jenks (2004) Figure 16.
(See Appendix A for cross sections used)

Vertical Scale Exaggerated.

Cross-Section Location



GEOSCIENCE
GEOSCIENCE Support Services, Incorporated
P.O. Box 220, Claremont, CA 91711
Tel: (909) 451-6650 Fax: (909) 451-6638
www.gssiwater.com

MONTEREY COUNTY WATER RESOURCES AGENCY

PROTECTIVE ELEVATIONS
400-FOOT AQUIFER

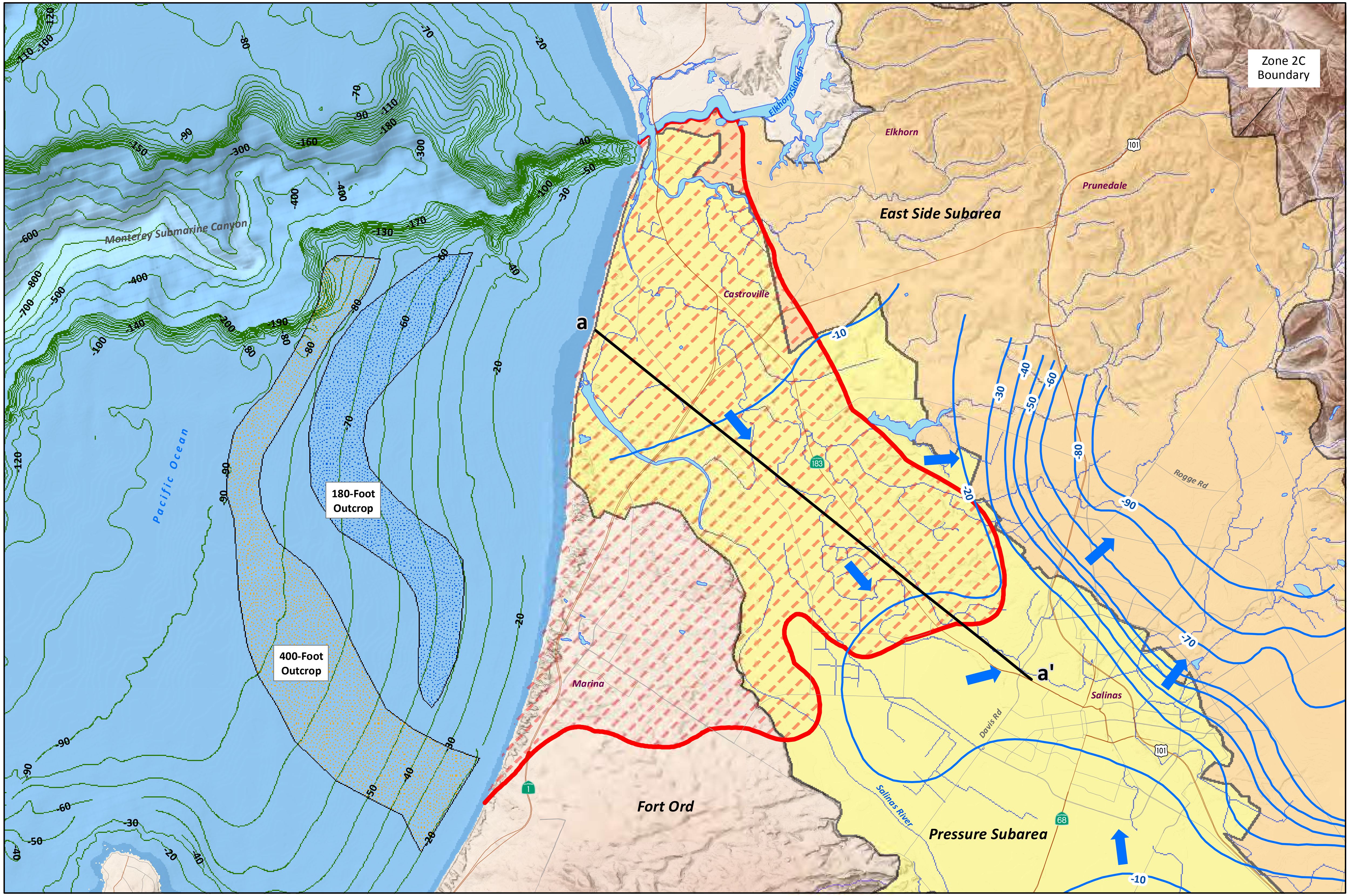
Drawn: LB
Checked: JK
Approved:
Date: 19-Nov-13

Figure 2

MONTEREY COUNTY WATER RESOURCES AGENCY

PROTECTIVE ELEVATIONS TO CONTROL SEA WATER INTRUSION IN THE SALINAS VALLEY, CA

CURRENT GROUND WATER ELEVATIONS 180-FOOT AQUIFER



EXPLANATION

- -50 — Ground Water Elevation, ft amsl in the 180-Foot Aquifer August 2011 (MCWRA, 2012)
- Ground Water Flow
- a ___ a' Geohydrologic Cross-Section (See Figure 1)
- Current Extent (2011) of Sea Water Intrusion in the 180-Foot Aquifer (>500 mg/L Chloride) (MCWRA, 2012)

Offshore Aquifer Outcrop (Green, 1970; DWR, 1973)

- 180-Foot Aquifer
- 400-Foot Aquifer
- -10 — Elevation of Sea Floor, meters (Wong, F.L. and Eittreim, S.L., 2001)

19-Nov-13

Prepared by: DWB. Map Projection: State Plane 1983, Zone IV.

NORTH

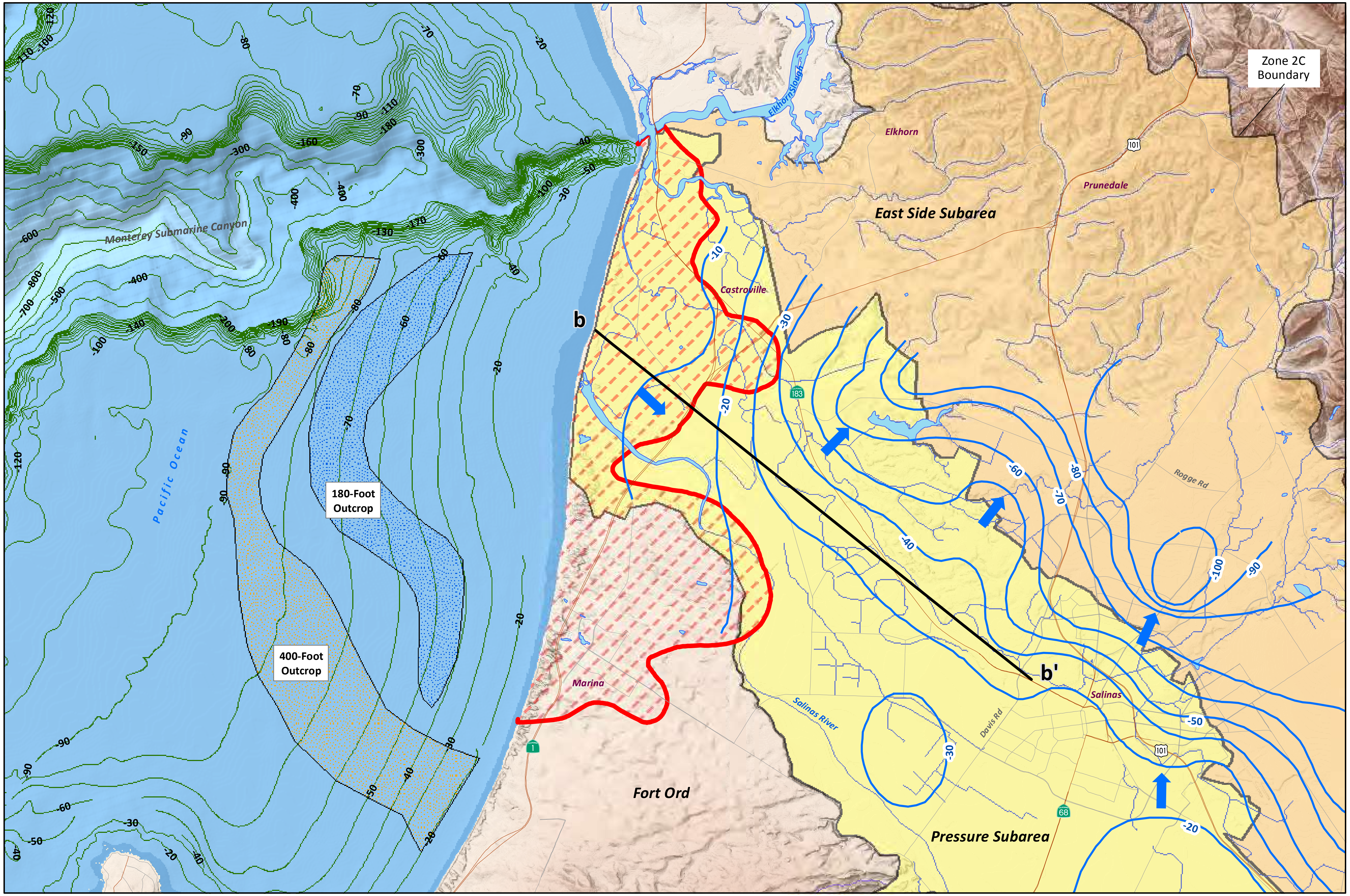
0 2 4 Miles

GEOSCIENCE
GEOSCIENCE Support Services, Inc.
P.O. Box 220, Claremont, CA 91711
Tel: (909) 451-6650 Fax: (909) 451-6638
www.gssiwater.com

Figure 3

GIS_proj/downey_brand_mont_water_rights_1-13/5_Fig_3_2011_GWE_180ft_11-13.mxd

CURRENT GROUND WATER ELEVATIONS 400-FOOT AQUIFER



EXPLANATION

- -50 — Ground Water Elevation, ft amsl in the 180-Foot Aquifer August 2011 (MCWRA, 2012)
- Ground Water Flow
- b — b' Geohydrologic Cross-Section (See Figure 1)
- Current Extent (2011) of Sea Water Intrusion in the 180-Foot Aquifer (>500 mg/L Chloride) (MCWRA, 2012)

Offshore Aquifer Outcrop (Green, 1970; DWR, 1973)

- 180-Foot Aquifer
- 400-Foot Aquifer
- -10 — Elevation of Sea Floor, meters (Wong, F.L. and Eittreim, S.L., 2001)

19-Nov-13

Prepared by: DWB. Map Projection: State Plane 1983, Zone IV.

NORTH

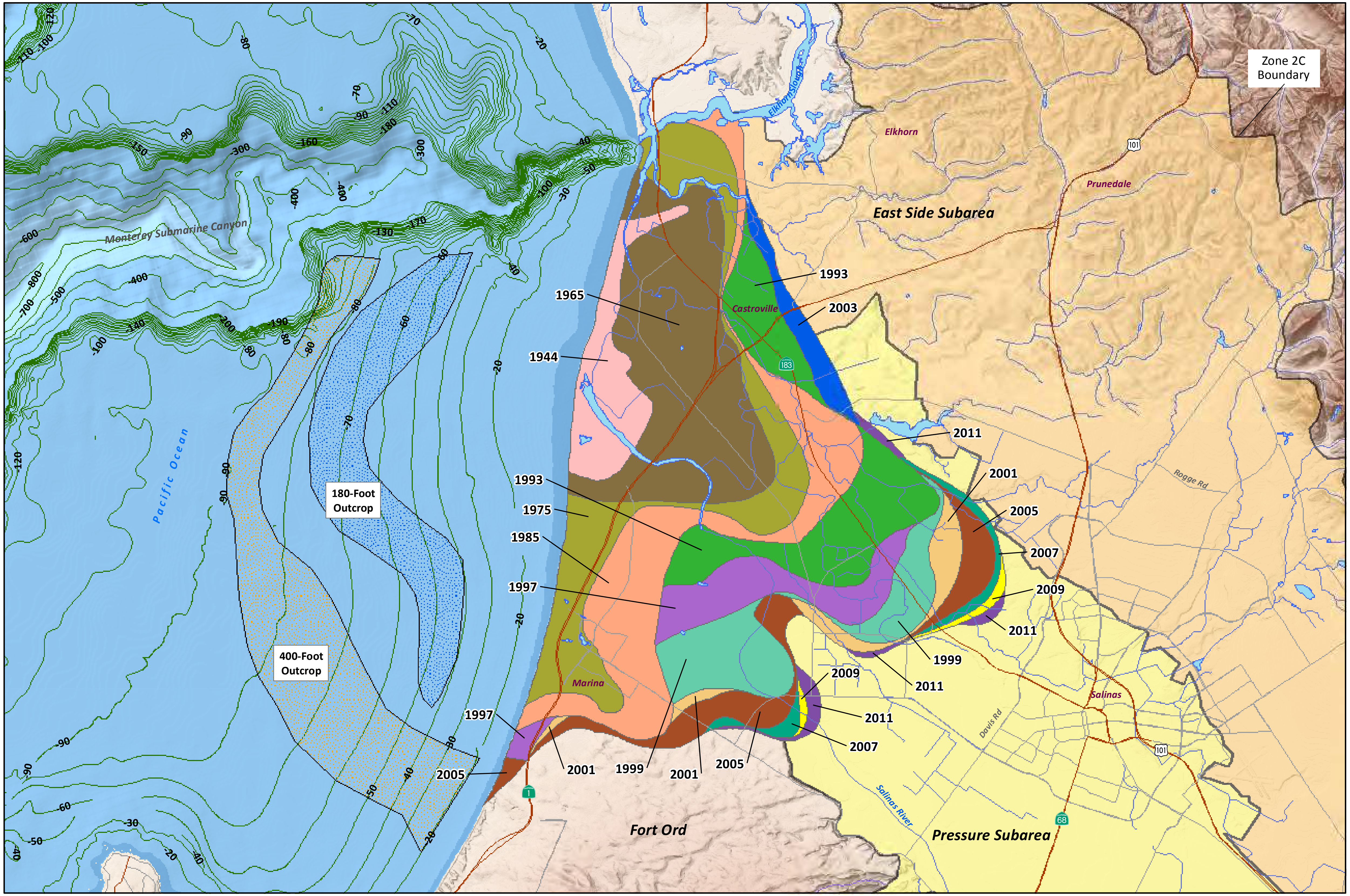
0 2 4 Miles

GEOSCIENCE
GEOSCIENCE Support Services, Inc.
P.O. Box 220, Claremont, CA 91711
Tel: (909) 451-6650 Fax: (909) 451-6638
www.gssiwater.com

Figure 4

GIS_proj/downey_brand_mont_water_rights_1-13/5_Fig_4_2011_GWE_400ft_11-13.mxd

HISTORICAL SEA WATER INTRUSION 180-FOOT AQUIFER



EXPLANATION

Historical Sea Water Intrusion (>500 mg/L Chloride) (MCRWA, 2012)

1944	2001
1965	2003
1975	2005
1985	2007
1993	2009
1997	2011
1999	

Offshore Aquifer Outcrop (Green, 1970; DWR, 1973)

180-Foot Aquifer

400-Foot Aquifer

-10 Elevation of Sea Floor, meters (Wong, F.L. and Eittreim, S.L., 2001)

19-Nov-13

Prepared by: DWB. Map Projection: State Plane 1983, Zone IV.

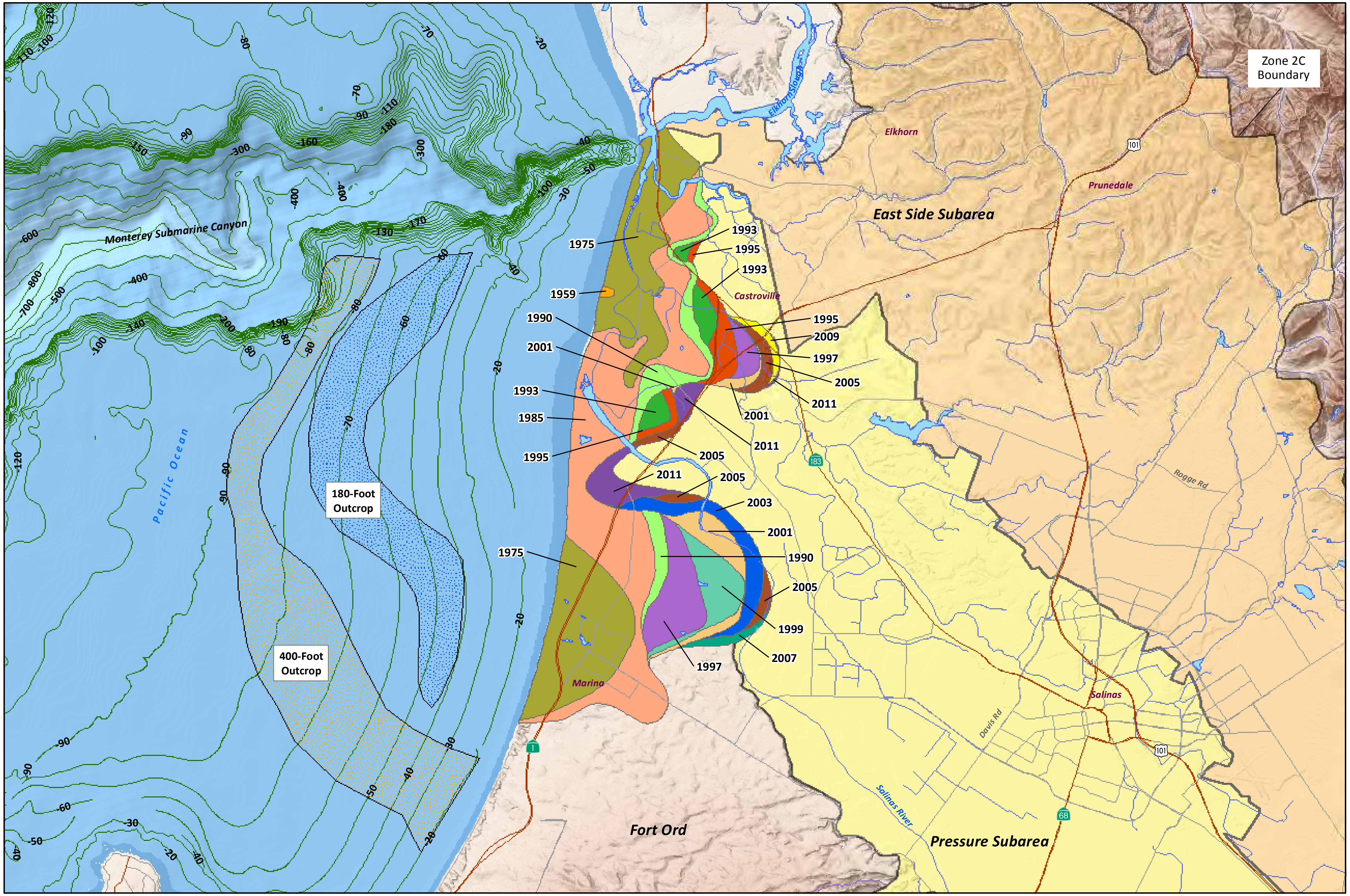
NORTH

0 2 4 Miles

GEOSCIENCE
GEOSCIENCE Support Services, Inc.
P.O. Box 220, Claremont, CA 91711
Tel: (909) 451-6650 Fax: (909) 451-6638
www.gssiwater.com

Figure 5

HISTORICAL SEA WATER INTRUSION 400-FOOT AQUIFER



EXPLANATION

Historical Sea Water Intrusion (>500 mg/L Chloride) (MCRWA, 2012)

	1959		1999
	1975		2001
	1985		2003
	1990		2005
	1993		2007
	1995		2009
	1997		2011

Offshore Aquifer Outcrop (Green, 1970; DWR, 1973)

180-Foot Aquifer

400-Foot Aquifer

-10 Elevation of Sea Floor, meters (Wong, F.L. and Eittreim, S.L., 2001)

19-Nov-13

Prepared by: DWB. Map Projection: State Plane 1983, Zone IV.

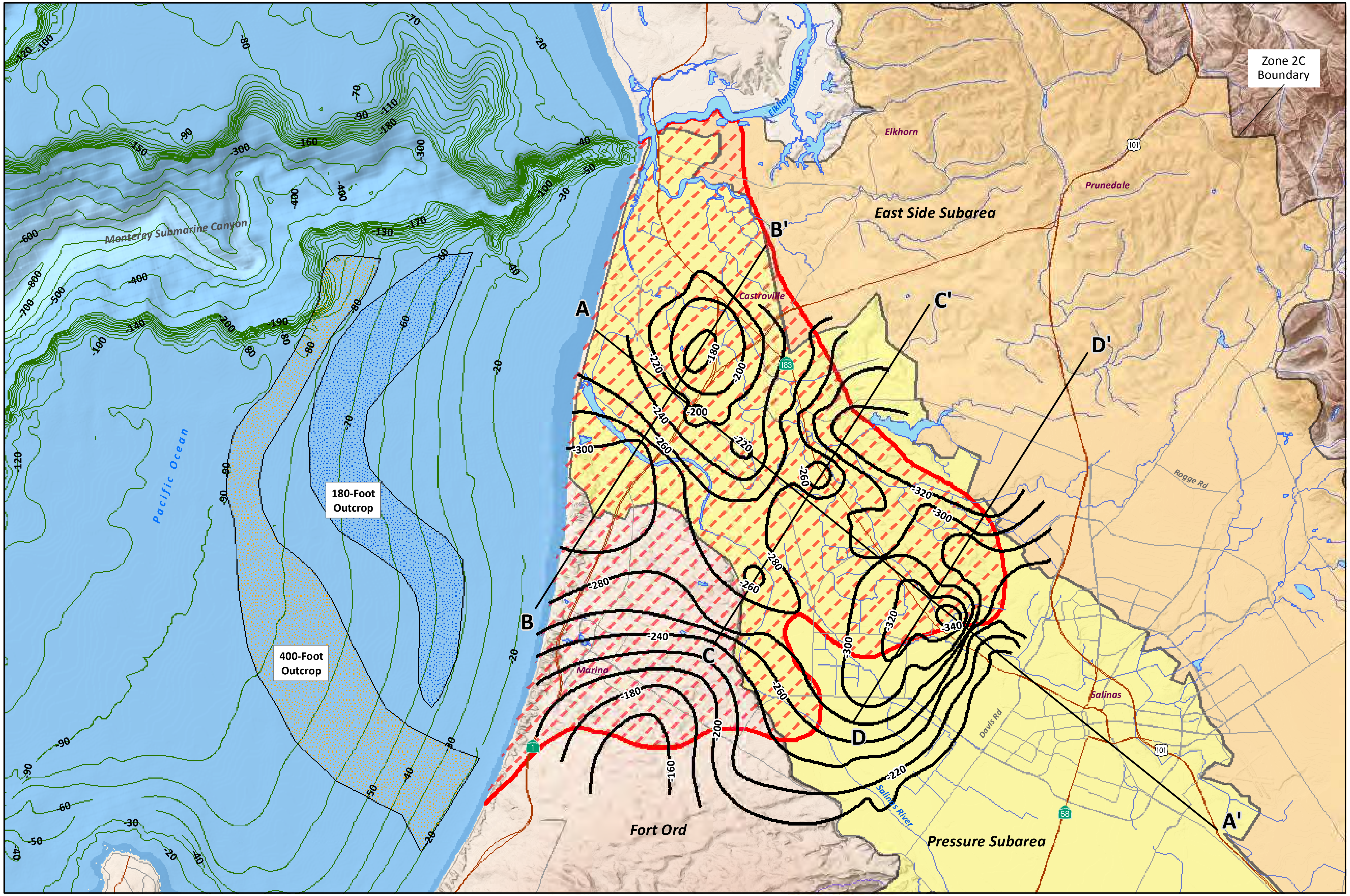
NORTH

0 2 4 Miles

GEOSCIENCE
GEOSCIENCE Support Services, Inc.
P.O. Box 220, Claremont, CA 91711
Tel: (909) 451-6650 Fax: (909) 451-6638
www.gssiwater.com

Figure 6

BASE OF THE 180-FOOT AQUIFER



EXPLANATION

-50 Base of 180-Foot Aquifer, ft amsl (Interpolated from geologic cross-section prepared by Kennedy/Jenks, 2004)

A ____ A' Geologic Cross-Section Location Used as Aquifer Base Elevation Control (Kennedy/Jenks, 2004. See Appendix A)

Current Extent (2011) of Sea Water Intrusion in the 180-Foot Aquifer (>500 mg/L Chloride) (MCWRA, 2012)

Offshore Aquifer Outcrop (Green, 1970; DWR, 1973)

180-Foot Aquifer

400-Foot Aquifer

-10 Elevation of Sea Floor, meters (Wong, F.L. and Eittreim, S.L., 2001)

NORTH

0 2 4 Miles

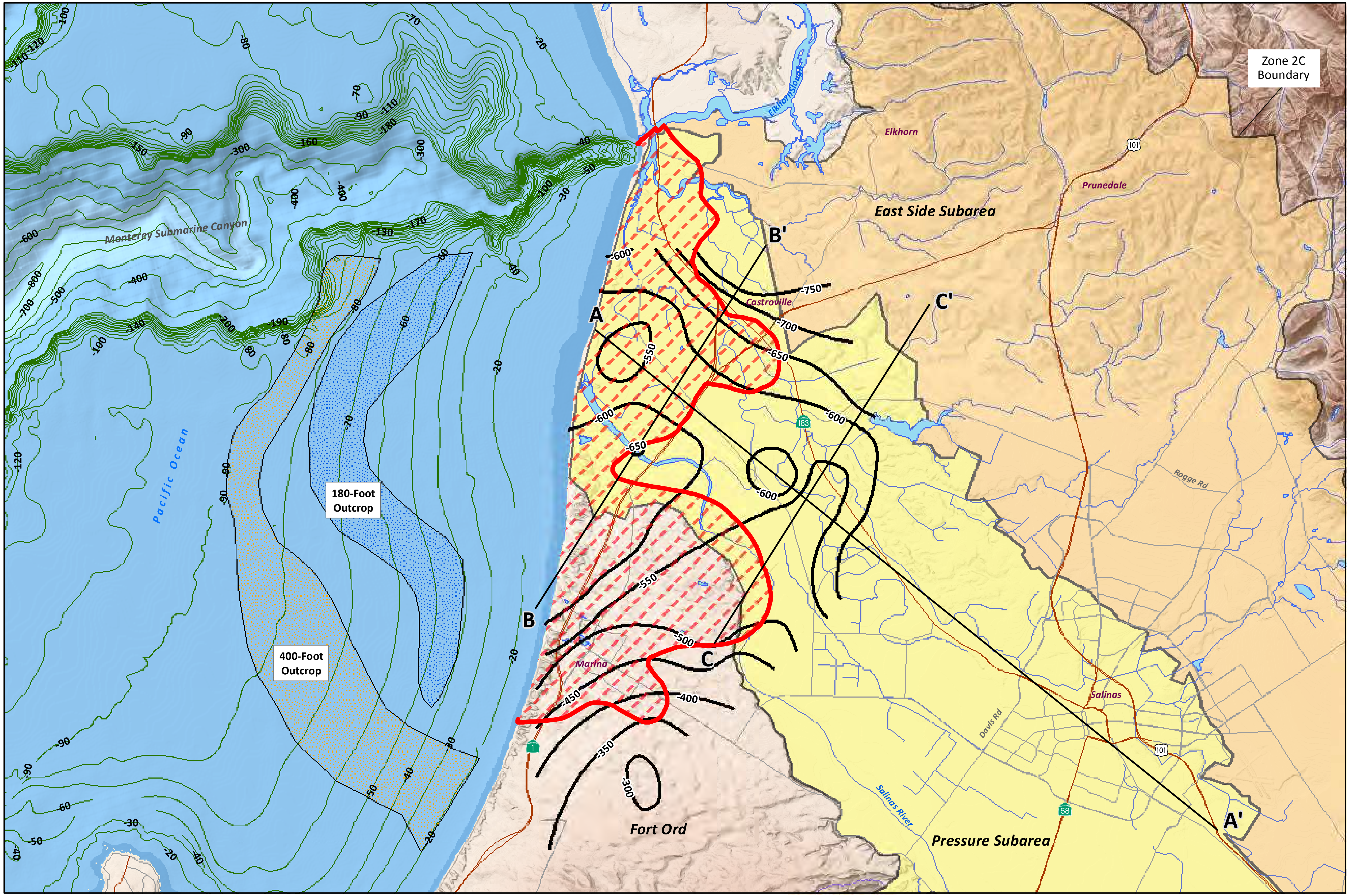
19-Nov-13

Prepared by: DWB. Map Projection: State Plane 1983, Zone IV.

GEOSCIENCE
GEOSCIENCE Support Services, Inc.
P.O. Box 220, Claremont, CA 91711
Tel: (909) 451-6650 Fax: (909) 451-6638
www.gssiwater.com

Figure 7

GIS_proj/downey_brand_mont_water_rights_1-13/5_Fig_7_base_180ft_11-13.mxd



BASE OF THE 400-FOOT AQUIFER

EXPLANATION

-500 Base of 400-Foot Aquifer, ft amsl (Interpolated from geologic cross-section prepared by Kennedy/Jenks, 2004)

A ____ A' Geologic Cross-Section Location Used as Aquifer Base Elevation Control (Kennedy/Jenks, 2004. See Appendix A)

Current Extent (2011) of Sea Water Intrusion in the 180-Foot Aquifer (>500 mg/L Chloride) (MCWRA, 2012)

Offshore Aquifer Outcrop (Green, 1970; DWR, 1973)

180-Foot Aquifer

400-Foot Aquifer

-10 Elevation of Sea Floor, meters (Wong, F.L. and Eittreim, S.L., 2001)

19-Nov-13

Prepared by: DWB. Map Projection: State Plane 1983, Zone IV.

NORTH

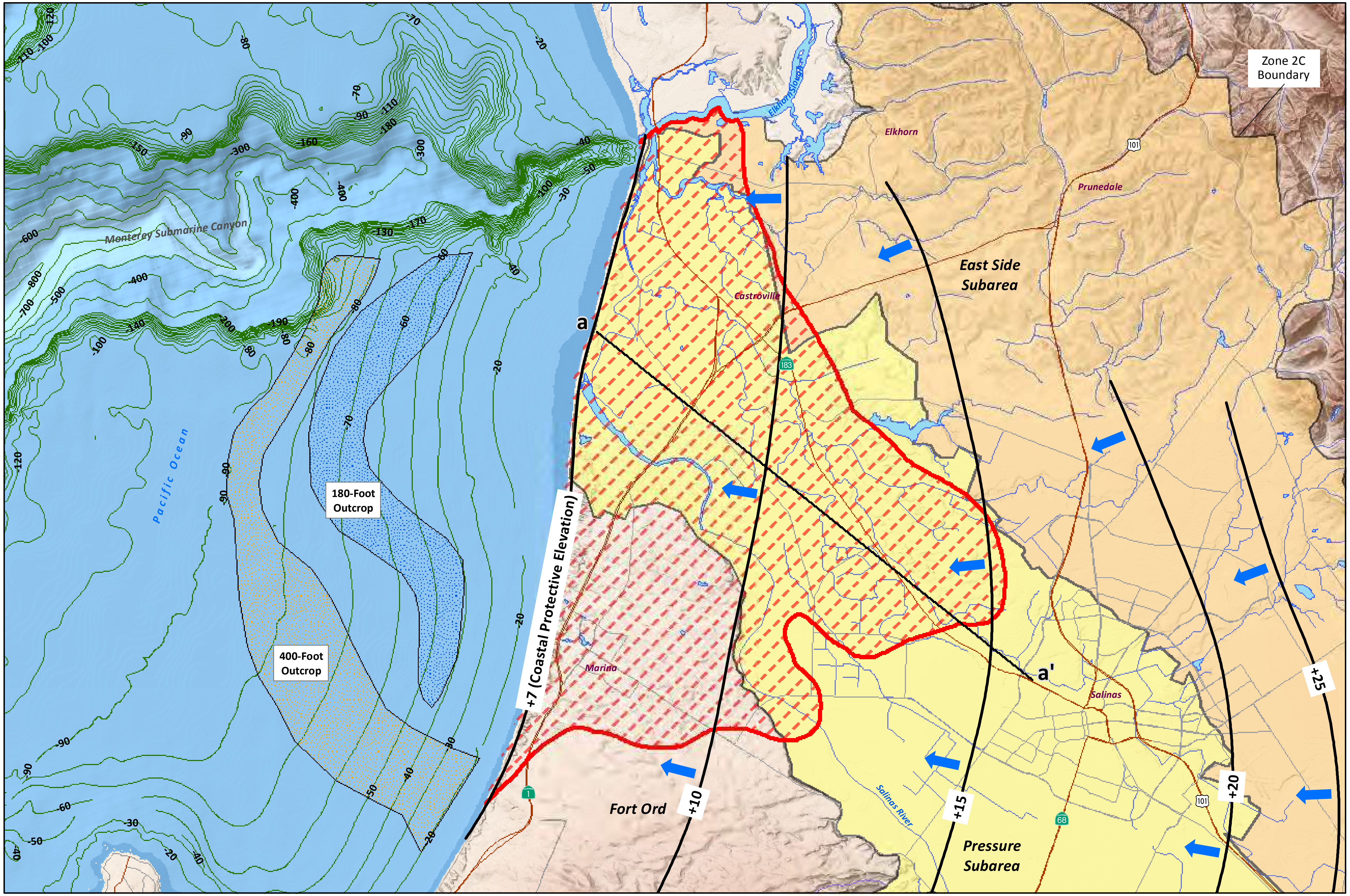
0 2 4 Miles

GEOSCIENCE

GEOSCIENCE Support Services, Inc.
P.O. Box 220, Claremont, CA 91711
Tel: (909) 451-6650 Fax: (909) 451-6638
www.gssiwater.com

Figure 8

PROTECTIVE ELEVATIONS 180-FOOT AQUIFER



EXPLANATION

—10— Minimum Protective Elevations for the 180-Foot Aquifer, ft amsl. Assumes 0.0002 (1 ft/mi) and 1938 ground water directions as per DWR (1946)

Ground Water Flow

a ____ a' Geohydrologic Cross-Section Used to Assess Protective Elevations (modified from Kennedy/Jenks, 2004)

Current Extent (2011) of Sea Water Intrusion in the 180-Foot Aquifer (>500 mg/L Chloride) (MCWRA, 2012)

Offshore Aquifer Outcrop (Green, 1970; DWR, 1973)

180-Foot Aquifer

400-Foot Aquifer

—-10— Elevation of Sea Floor, meters (Wong, F.L. and Eittreim, S.L., 2001)

19-Nov-13

Prepared by: DWB. Map Projection: State Plane 1983, Zone IV.

NORTH

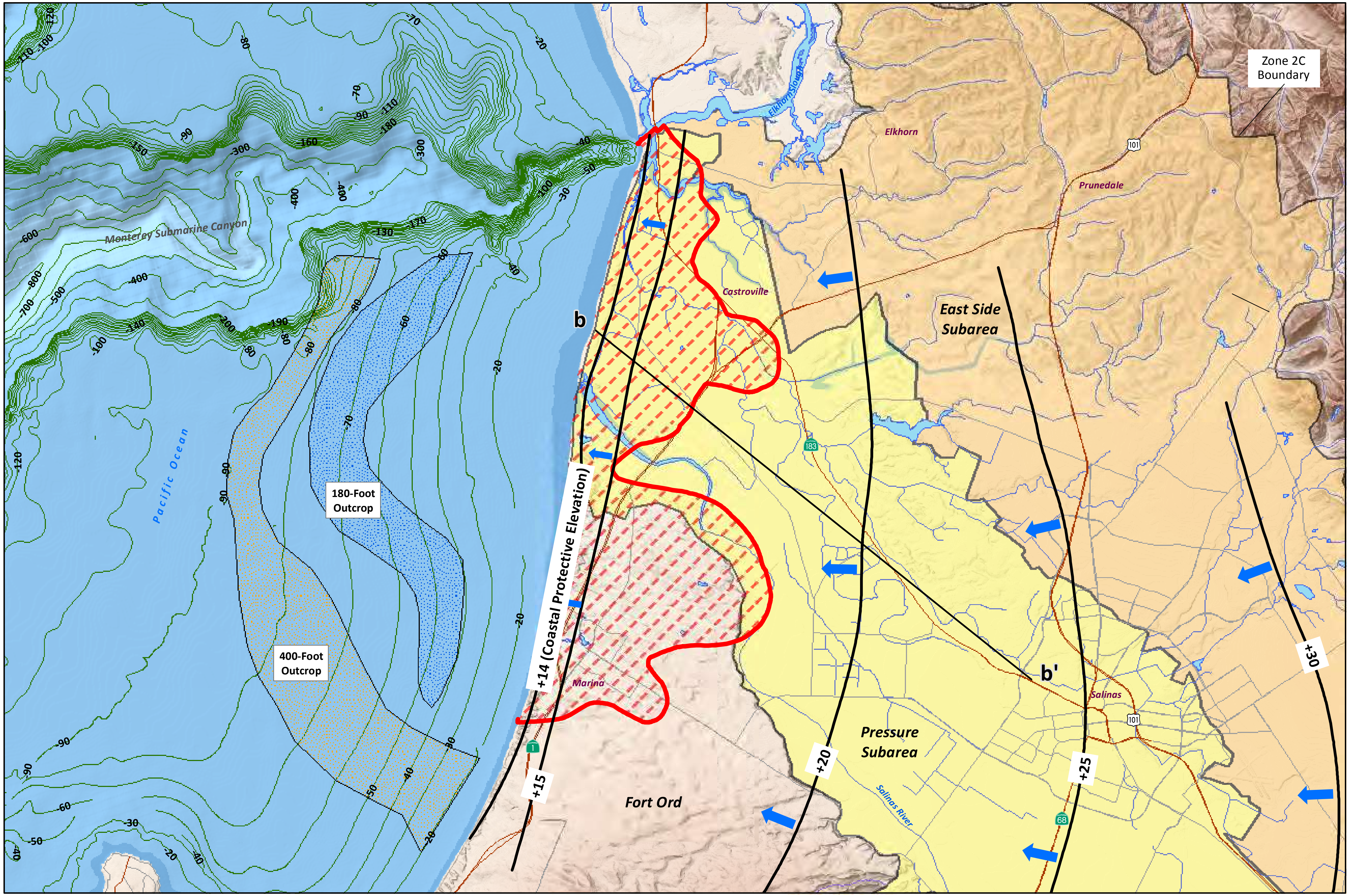
0 2 4 Miles

GEOSCIENCE
GEOSCIENCE Support Services, Inc.
P.O. Box 220, Claremont, CA 91711
Tel: (909) 451-6650 Fax: (909) 451-6638
www.gssiwater.com

Figure 9

GIS_proj/downey_brand_mont_water_rights_1-13/5_Fig_9_xsec_I-I_180ft_11-13.mxd

PROTECTIVE ELEVATIONS 400-FOOT AQUIFER



EXPLANATION

—20— Minimum Protective Elevations for the 400-Foot Aquifer, ft amsl
Assumes 0.0002 (1 ft/mi) and 1938 ground water directions as per DWR (1946)

Ground Water Flow

b ____ b' Geohydrologic Cross-Section Used to Assess Protective Elevations (modified from Kennedy/Jenks, 2004)

Current Extent (2011) of Sea Water Intrusion in the 400-Foot Aquifer (>500 mg/L Chloride) (MCWRA, 2012)

Offshore Aquifer Outcrop (Green, 1970; DWR, 1973)

180-Foot Aquifer

400-Foot Aquifer

—10— Elevation of Sea Floor, meters (Wong, F.L. and Eittreim, S.L., 2001)

NORTH

0 2 4 Miles

19-Nov-13

Prepared by: DWB. Map Projection: State Plane 1983, Zone IV.

GEOSCIENCE
GEOSCIENCE Support Services, Inc.
P.O. Box 220, Claremont, CA 91711
Tel: (909) 451-6650 Fax: (909) 451-6638
www.gssiwater.com

Figure 10

APPENDIX A

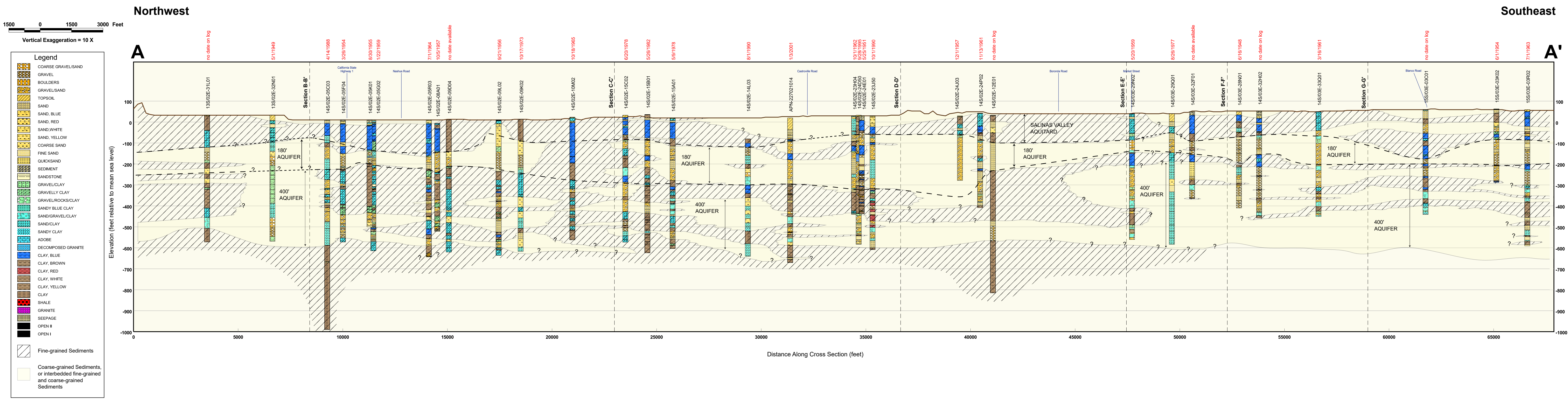
Cross-Sections Used to Delineate Base of 180-Foot and 400-Foot Aquifers

GEOSCIENCE

APPENDIX A

CROSS-SECTIONS USED TO DELINEATE BASE OF 180-FOOT AND 400-FOOT AQUIFERS

CONTENTS



Kennedy/Jenks Consultants

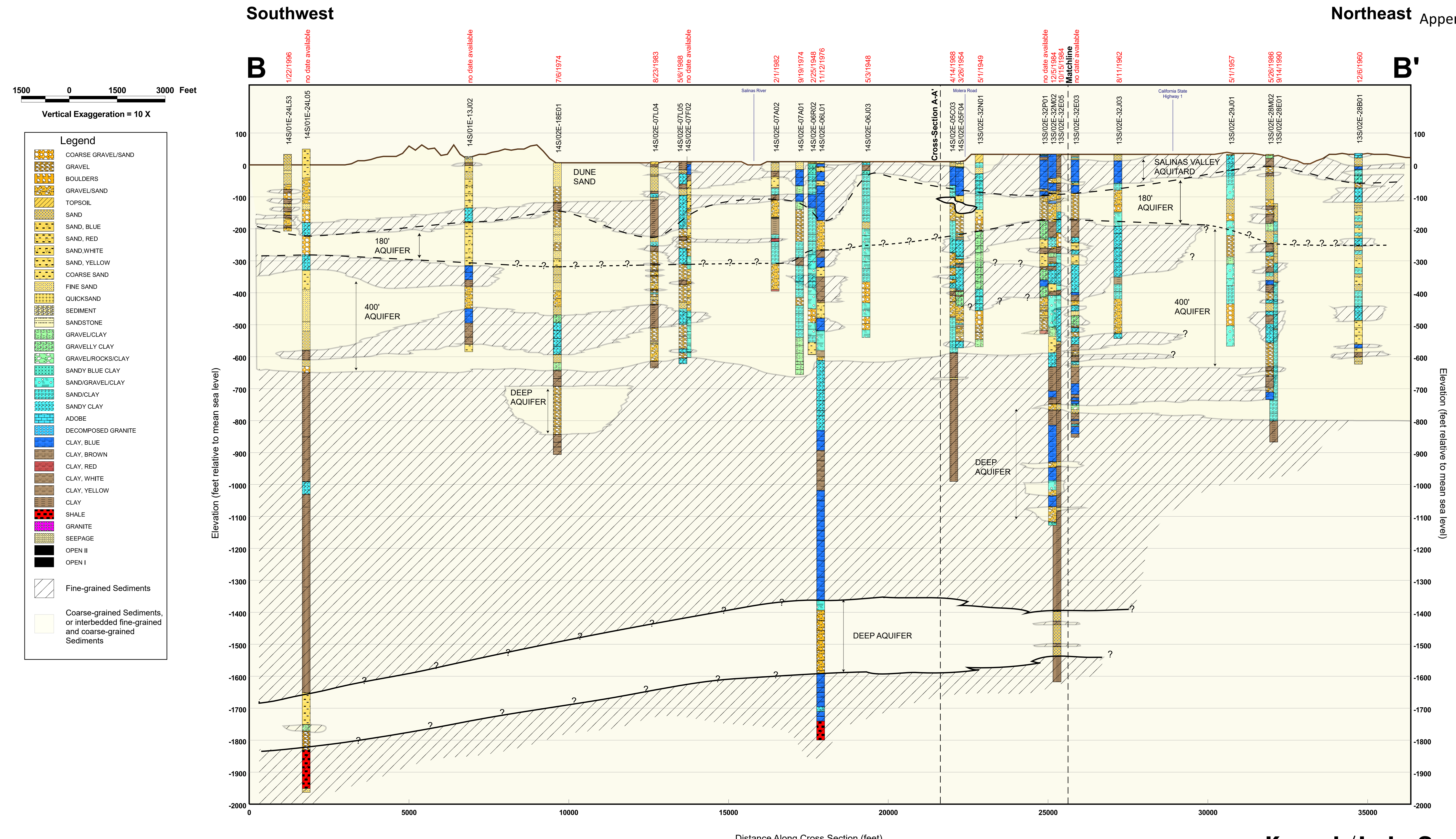
Monterey County Water Resources Agency
Salinas, California

Cross-Section A-A'

K/J 035901.00
May 2004

Figure 3

H:\mcwra_swi\Report_200405\figure_03.pdf



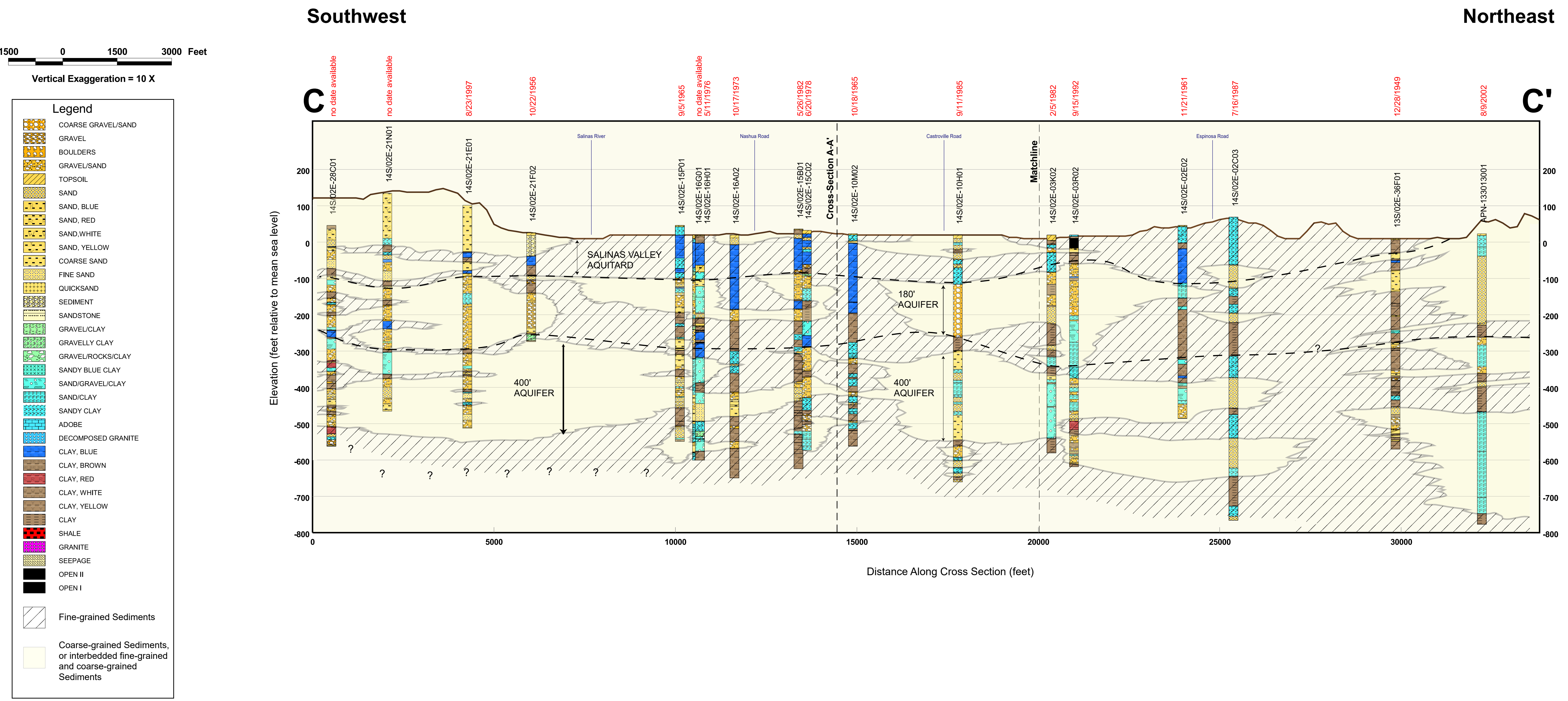
Kennedy/Jenks Consultants

Monterey County Water Resources Agency
Salinas, California

Cross-Section B-B'

K/J 035901.00
May 2004

Figure 4



Kennedy/Jenks Consultants

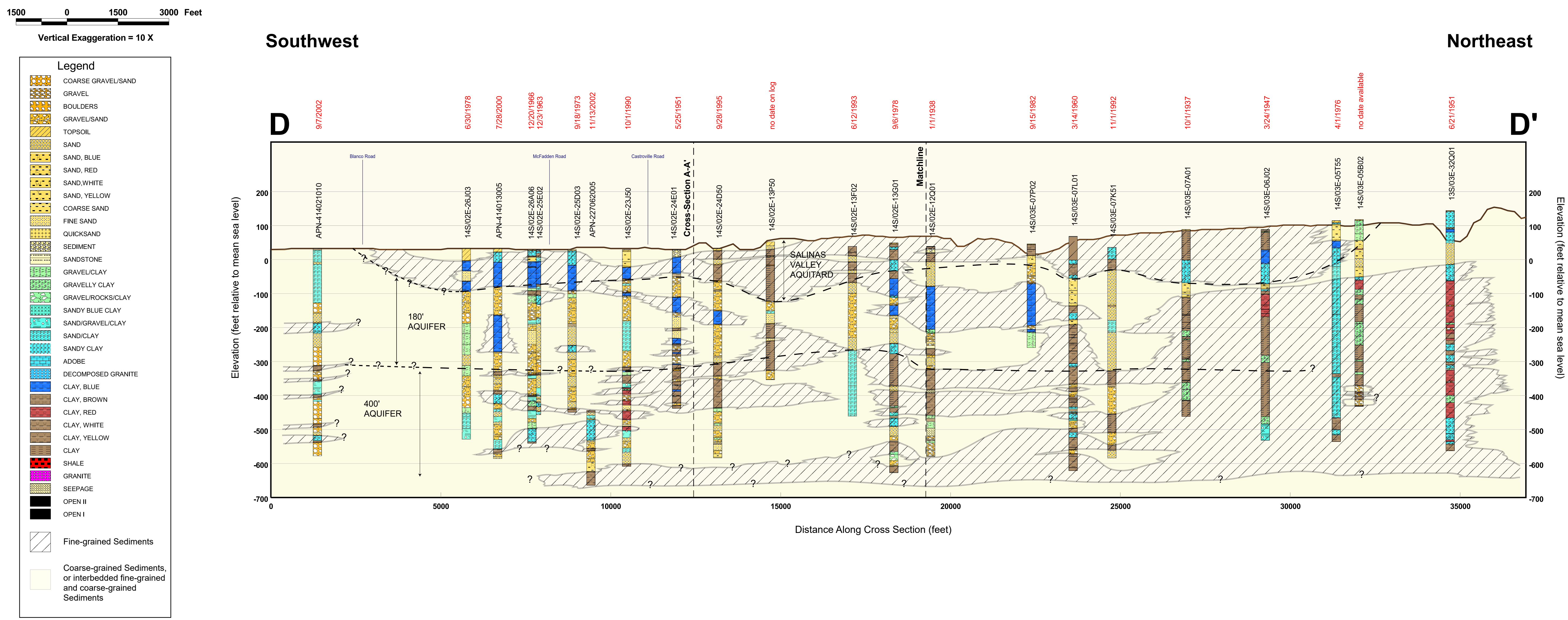
Monterey County Water Resources Agency
Salinas, California

Cross-Section C-C'

K/J 035901.00
May 2004

Figure 5

H:\mcwra_swi\Report_200405\figure_05.pdf



Kennedy/Jenks Consultants

Monterey County Water Resources Agency
Salinas, California

Cross-Section D-D'

K/J 035901.00
May 2004

Figure 6

H:\mcwra_swi\Report_200405\figure_06.pdf

GEOSCIENCE Support Services, Inc. | P (909) 451-6650 | F (909) 451-6638
620 W. Arrow Highway, Suite 2000, La Verne, CA 91750 | Mailing: P.O. Box 220, Claremont, CA 91711

HYDROGEOLOGY AND WATER SUPPLY

OF SALINAS VALLEY

A White Paper prepared by

Salinas Valley Ground Water Basin
Hydrology Conference

For
Monterey County Water Resources Agency

June 1995

TABLE OF CONTENTS

CONCLUSIONS

- No member of this panel has any substantive disagreement with the conclusions of previous reports.
- The panel reached unanimous agreement on all major issues.
- Data that are available have been useful in determining regional and local surface water and ground water relationships and quality.
- Based on all the studies completed to date, there appears to be an adequate supply of water within Salinas Valley to meet all existing and projected future requirements.
- Despite this abundance, past and present water distribution and management practices have caused seawater intrusion, declining ground water levels in the East Side Area, and nitrate contamination.
- The solution for the seawater intrusion and declining ground water levels in Salinas Valley that was recommended in 1946 is so compelling we could not refrain from recommending it.
- Some form of extraction and conveyance system should be constructed.
- More recent studies conducted by Monterey County Water Resources Agency (MCWRA) since 1946 have reaffirmed and endorsed the original concepts.
- Residents of Salinas Valley are fortunate that an in-valley conjunctive use solution is available to them.

RECOMMENDATIONS

Monterey County Water Resources Agency should:

- Complete the extraction facilities and conveyance system, similar to those that were outlined in California Department of Water Resources Bulletin 52 in 1946, that are integral components of a total project.

- Continue studies to determine the relationships between fertilizer application, irrigation practices, plant growth, movement of water past the root zone, and ground water contamination under growing conditions prevalent in Salinas Valley.

- Use these studies to develop and demonstrate improved irrigation and fertilizer management methods that farmers can adopt with confidence.

- Continue to evaluate seawater intrusion monitoring data.

- MCWRA should continue their surface water and ground water monitoring program for quantity and quality. The data should be evaluated to ensure that the information is adequate for effective management of water resources.

INTRODUCTION

Purpose and Scope

The Monterey County Water Resources Agency (MCWRA) convened a panel of 10 geologists, hydrogeologists, and engineers familiar with Salinas Valley ground water basin to attempt to reach agreement on the basic physical characteristics of the basin, and the surface and ground water flow within the basin. Agreement on the completeness and accuracy of existing data and previous hydrogeological studies was seen as an important first step in identifying and implementing a technically sound solution acceptable to the public that would stop seawater intrusion that began some 60 years ago.

Mike Armstrong, General Manager of MCWRA, instructed the panel to review and, if possible, reach consensus on the hydrogeological characteristics of the basin, define clearly the water resources problems in the basin, and determine surface water and ground water flow within the basin. We were not requested to discuss specific local projects or political and institutional aspects of the problems.

The panel met in a closed-door session in Monterey on May 24 and 25, 1995. The session was closed to the public and the press to enable the panelists to discuss and explore ideas and opinions freely without worrying about statements, questions, and hypotheses being repeated out of context.

Members of the panel believe the process worked very well. This report presents our findings, conclusions, and recommendations. We were able to achieve more than our original scope of work. There was remarkable unanimity of opinion on our understanding of the physical characteristics of the basin, the hydrologic system, the interaction between surface water and ground water, and definition of the specific ground water problems in the basin.

In summary, the facts we agreed upon point so compellingly toward an already identified *regional* solution to the Valley's ground water resources problems that the panel has included a potential solution. We have included a strong recommendation in this White Paper for implementing that regional solution.

Panel Members

The panel consisted of 9 members and 1 facilitator/editor:

Mr. Carl Hauge, California Department of Water Resources, Sacramento, facilitator/editor.

Dr. Steven Bachman, Integrated Water Technologies, Santa Barbara.

Mr. Tim Durbin, HCI Hydrologic Consultants, Davis.

Mr. Martin Feeney, Fugro West, Monterey.

Mr. Joseph Scalmanini, Luhdorff and Scalmanini, Woodland.

Mr. Jim Schaaf, Schaaf & Wheeler, San Jose (attended May 25 only).

Dr. Dennis Williams, GEOSCIENCE, Claremont.

Mr. Gus Yates, Jones & Stokes Associates, Sacramento.

Dr. Young Yoon, Montgomery Watson, Sacramento.

Mr. Matt Zidar, Monterey County Water Resources Agency, Salinas.

Previous Reports

One of the first reports published on the hydrology of Salinas Valley was California Department of Water Resources Bulletin 52, *Salinas Basin Investigation*, released in 1946. Bulletin 52 recommended construction of a project consisting of dams to provide additional recharge and yield throughout the Valley, ground water extraction facilities, and a water conveyance facility to transport some of the additional yield to the area near the coast.

Other recent reports include:

Durbin, T.J. Kapple, G.W., and Freckleton, J.R., 1978, *Two-dimensional and three-dimensional digital flow models of the Salinas Valley ground water basin, California*; U.S. Geological Survey Water-Resources Investigation 78-113, 134 p.

Leedshill-Herkenhoff, Inc., 1985, *Salinas Valley Seawater Intrusion Study.*

Montgomery Watson, 1994, *Salinas River Basin Water Resources Management Plan, Task 1.09 SalinasValley Groundwater Flow and Quality Model Report.*

Todd, D.K., Consulting Engineers, Inc., 1989, *Sources of Saline Intrusion in the 400-Foot Aquifer, Castroville Area, California.*

Yates, E.B., 1988, *Simulated Effects of Ground-Water Management Alternatives for the Salinas Valley, California,* United States Geological Survey Water Resources Investigation Report 87-4066.

PROBLEM STATEMENT

The water resources problem in Salinas Valley is not a water supply problem. It is a water distribution problem. The basin has enough surface and ground water to meet existing and projected future average annual agricultural, and municipal and industrial (M & I) water demand through the year 2030. The problem lies in managing those supplies to meet water demands at all locations in the Valley at all times.

The overall water resources problem has three principal components:

- Seawater intrusion

  Seawater intrusion occurs near the coast principally because extraction of fresh ground water in the northern part of Salinas Valley exceeds recharge in the northern part of the Valley.

  In recent decades, the annual volume of intrusion has ranged from 2,000 to 30,000 acre feet per year (afy) and has averaged 17,000 acre feet per year.

  Seawater has advanced about 6 miles inland.

  About 20,000 acres of agricultural land near the coast are underlain by one or more aquifers that contain water too salty to use for irrigation.

- Declining ground water levels in the East Side Area

  Ground water levels continue to decline in the East Side Area.

  Lower ground water levels in the East Side Area induce additional recharge from the Pressure Area and the Forebay Area but also cause conditions for potential movement of additional seawater inland into the coastal area.

- Nitrate contamination

  Nitrate has contaminated ground water to varying concentrations throughout the Valley, but the level of contamination is especially high in the East Side, Forebay, and Upper Valley Areas.

  The maximum contaminant level (MCL) for drinking water is 45 mg/l as nitrate. In 50 percent of the wells sampled throughout the Valley, nitrate exceeds 45 mg/l; in some wells nitrate has reached several hundred mg/l.

High concentrations of nitrate limit beneficial use of the ground water for potable uses and for some agricultural uses.

An additional long-range problem is the build up of salts in the basin that is occurring because there is no subsurface outflow from the basin. Although the impacts of such a condition are manifested much more slowly than other problems, there is a long-term increase in salt concentration within the aquifer system. At some time in the future, such a build up will render the aquifer system unusable for certain beneficial uses.

These water resources problems result in economic and institutional consequences primarily because of water quality standards and the loss of supply associated with violation of those standards. The severity of the economic and institutional problems is not the same for all 3 of the problems and is dependent on the specific location and the use of the water.

The variability of precipitation and runoff is an important component of water supply planning and management. Water supply issues may appear to be non-existent when the *average* annual water supply is used for planning purposes. But in dry years, which are also a part of that average, those same supply issues become critical.

DESCRIPTION OF THE BASIN

Hydrogeology

The Salinas Valley ground water basin is one hydrologic unit. Four subareas based on differences in local hydrogeology and recharge have been identified: Upper Valley Area, Forebay Area, East Side Area and Pressure Area (which includes the area near the coast). All information collected to date indicates there are no barriers to the horizontal flow between these subareas, although aquifer characteristics decrease the rate of ground water flow in certain parts of the basin (for example, from the Pressure Area to the East Side Area, and especially from the Forebay Area to the Pressure Area). Ground water can move between the East Side and Pressure Areas, and between the Forebay and Pressure Areas, the Forebay and East Side Areas, and the Upper Valley and Forebay Areas. The "boundaries" between these areas have been identified as zones of transition between different depositional environments in past millennia.

While Salinas Valley ground water basin is one hydrologic unit, the impacts of ground water use are not distributed uniformly throughout the Valley. The impacts of ground water extraction occur mostly within the local area of the extraction. The impacts diminish rapidly with distance from the extraction, and the impacts tend to be very small at large distances from the extraction.

The alluvial fill in Salinas Ground Water Basin encompasses approximately 344,000 acres. The Upper Valley and Forebay Areas are unconfined and in direct hydraulic connection with Salinas River. The Upper Valley Area covers an area of approximately 92,000 acres near the south end of Salinas Valley from Greenfield to Bradley. Primary ground water recharge to the Upper Valley Area occurs from percolation in the channel of Salinas River.

The Forebay Area from Gonzales to Greenfield, consists of approximately 87,000 acres (including Arroyo Seco Cone) of unconsolidated alluvium. Principal recharge to the Forebay Area is from percolation of water from Salinas River and Arroyo Seco Cone, and ground water outflow from the Upper Valley.

Arroyo Seco Cone is located on the west side of southern Salinas Valley and is a part of the Forebay Area. Arroyo Seco Cone receives recharge from percolation in channels of Arroyo Seco and tributaries. The Cone covers approximately 26,000 acres of the Forebay Areas. The Arroyo Seco Cone may provide some opportunity for additional recharge.

The Pressure Area covers an area of approximately 91,000 acres between Gonzales and Monterey Bay. The Pressure Area is composed primarily of confined and semi-confined aquifers separated by clay layers (aquitards) that limit the amount of vertical recharge. Three primary water bearing strata have been identified in the Pressure Zone: the 180 Foot Aquifer, the 400 Foot Aquifer, and the Deep Zone. These aquifers are separated by aquitards, although some vertical recharge occurs locally where the aquitards are thin or missing. The uppermost aquitards allow some limited recharge from Salinas River directly to the 180-foot aquifer in the area near Spreckels. The areas of thin or missing aquitards also allow some interconnection between the shallow (180 foot) and deeper (400 foot) aquifers.

The exact nature of the connection between the Deep Zone and the ocean is unknown. Seawater intrusion has not been detected in Deep Zone wells, but there is no evidence indicating that the Deep Zone is not connected to the ocean. Lacking this evidence, it must be assumed that the deep zone, like the 180-foot and 400-foot aquifers above it, is connected to the ocean and vulnerable to seawater intrusion if ground water levels fall below sea level. Similarly, the aquitards between the 400-foot and the Deep Zone are subject to leakage of degraded water downward to the Deep Zone as the water level is lowered.

The Deep Zone is currently undefined both geologically and areally. In some locations, it is considered to be Purisima Formation, in others, lower Paso Robles Formation. Some recent evidence suggests that it may be Santa Margarita Formation. Water levels in Deep Zone wells have fallen approximately 60 feet since the late 1970s and are now substantially below sea level. Total extraction over this period of time has averaged less than 5,000 acre-feet per year. Water quality in the Deep Zone is unsuitable for agriculture because of extremely high sodium-adsorption ratios (SAR).

The East Side Area consists of 74,000 acres and contains unconfined and semiconfined aquifers in the northern portion of the Basin that historically received recharge from percolation from stream channels on the west slope of the Gabilan Range. As a result of extraction in excess of recharge, the decline in ground water level in the East Side Area has induced subsurface recharge from the Pressure Area, as well as from Salinas River and the Forebay Area. This inflow is now a larger source of recharge than the stream channels coming from the Gabilan Range.

Sources of Recharge

Ground water recharge in Salinas Valley is principally from infiltration from Salinas River, Arroyo Seco Cone, and, to a much lesser extent, from deep percolation of rainfall. Minor amounts are derived from infiltration from small streams and inflow from bedrock areas adjoining the basin. Deep percolation of applied irrigation water is the second largest component of the ground water budget, but because it represents recirculation of existing ground water rather than an inflow of "new" water, it is not considered a source of recharge for this discussion. Seawater intrusion is another source of inflow to the basin, but because it is not usable fresh water it is also excluded as a source of recharge for this discussion.

Infiltration from Salinas River and deep percolation of rainfall would occur under natural conditions, but both are increased by present water use patterns in the Valley. Ground water extraction increases the amount of infiltration from the river upstream of Salinas. Irrigation increases the amount of rainfall that percolates past the root zone by increasing antecedent soil moisture at the beginning of the rainy season. The low permeability of the Salinas Valley aquitard in the Pressure Area decreases but does not altogether eliminate deep percolation of rainfall and irrigation return flow directly to the 180-foot aquifer in the Pressure Area.

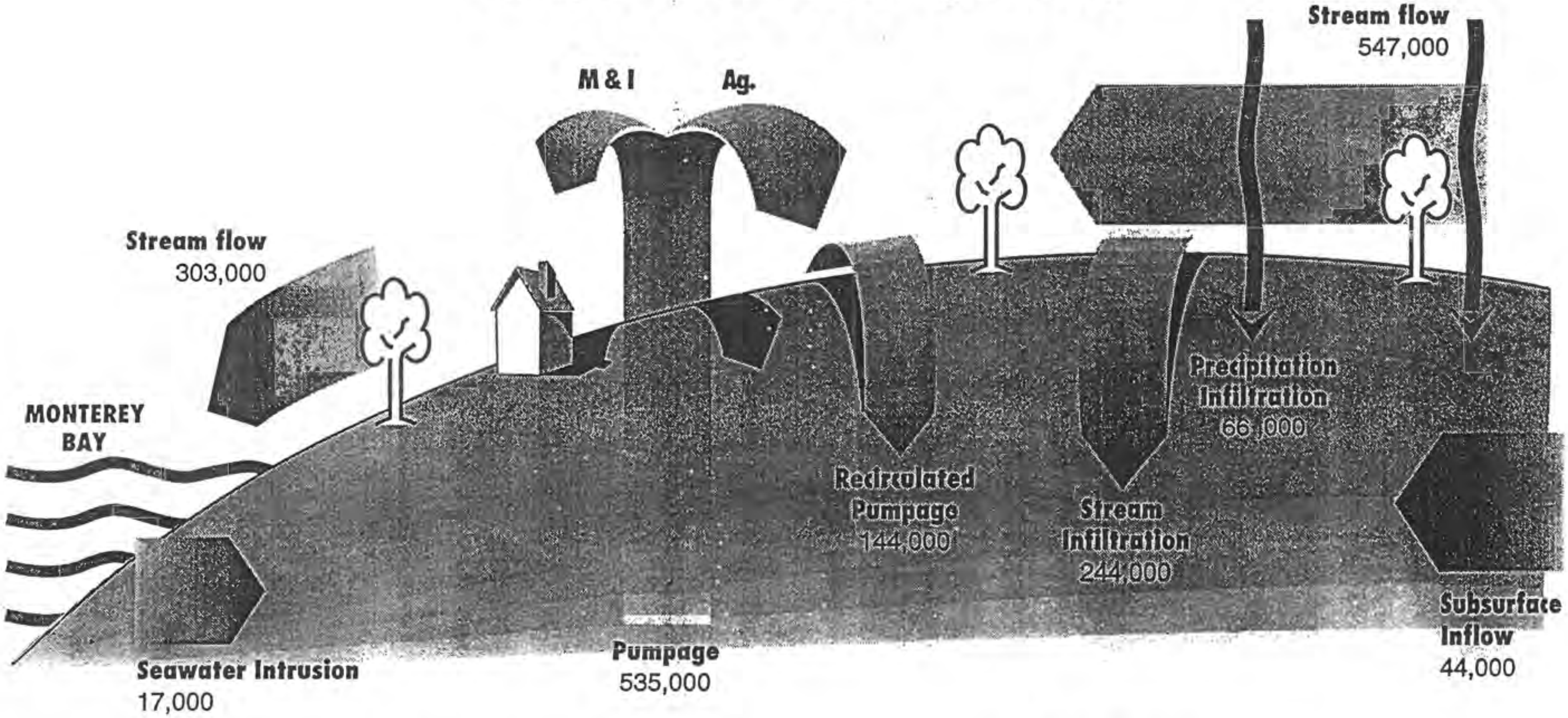
Figure 1 shows estimates of the average annual amounts of recharge derived from each source during 1970-1992 for the entire Valley. Average annual recharge, including irrigation return flow and seawater intrusion, totals 514,000 afy.

The estimates of items in the water budget are derived from a combination of direct measurement and extrapolation using three different and independently designed ground water models. It is important to recognize that the models include all available measured data and that all three of the modeling efforts completed to date have resulted in very similar estimates of the average annual basin-wide water budget. Our confidence in the general magnitude and proportion of flows in the budget is fairly high.

The water budget shown in Figure 1 is an average annual budget indicative of the long-term balance of components of the budget. It does not reveal the large amount of variation in annual flows in the water budget. These annual variations are an important factor in management of water resources and must be considered in any solution to water management in Salinas Valley.

The water budget indicates that ground water storage in the Valley has declined by 460,000 acre feet from 1970 to 1992, an average rate of 20,000 afy. However this decline was

Average Annual Basin-Wide Surface and Ground-Water Flows in Salinas Valley (AFY, 1970-1992 average flows)



Change in Ground Water Storage = -20,000 AFY

caused largely by the 1987 through 1992 drought.

Infiltration of water from Salinas River is relatively constant from year to year, partly because river flows are partially regulated by Nacimiento and San Antonio reservoirs and partly because ground water extraction--which induces a substantial amount of infiltration from the river--also remains fairly constant. In contrast, rainfall recharge is much more variable, with little, if any, recharge occurring in below-average rainfall years and large amounts occurring in wet years.

In the Upper Valley and Forebay Areas recharge from Salinas River is a rapid process, so that the effects of dry years on ground water levels are rapidly reversed in subsequent normal and wet years. After declining somewhat during the 1976-1977 and 1986-1992 droughts, water levels in the Upper Valley and Forebay Areas recovered fully within 1 to 2 years following the resumption of normal streamflow, including reservoir releases. This demonstrates the feasibility of conjunctively using ground water storage capacity in those areas to increase overall system yield.

BASIN MANAGEMENT

Seawater Intrusion

Analysis of water samples from wells in the Pressure Area has indicated that seawater has been intruding the aquifers for the last 60 or so years. The intrusion has moved progressively landward within the 180-foot and 400-foot aquifers during this time. To date, there has been no observed intrusion in the Deep Zone. The intrusion has moved as much as 6 miles inland in the 180-foot aquifer and 2 miles inland in the 400-foot aquifer, rendering wells in the intruded area unusable and decreasing usable basin storage. Between 1970 and 1992, the annual decrease in usable basin storage for ground water because of seawater intrusion has amounted to an average of 17,000 acre feet per year. While the average is 17,000 acre feet per year, it has varied from 2,000 acre feet per year to 30,000 acre feet per year. The cumulative total of seawater intrusion during the period 1970 to 1992 is about 374,000 acre feet.

Seawater intrudes coastal aquifers when ground water levels in the aquifers in contact with seawater decline below sea level. When this occurs, the normal gradient that produces ground water discharge into Monterey Bay is reversed. This reversal of ground water gradient in the Pressure Area resulted from extraction of ground water in excess of recharge in that Area. Seawater has intruded the aquifer in response to the reversed gradient that was caused by lowered ground water levels.

This saline water can move both horizontally within the aquifer or vertically through breaches in the various aquitards or through improperly constructed wells, wells that were abandoned but not destroyed, or through failed well casings. Most of the salinity is caused by intrusion of seawater through the offshore outcrops of the aquifers. An additional source of salinity may be the dewatering of salty marine clays within or between the aquifers in response to the lowered pressure levels in the aquifer system.

If the intrusion of seawater is left unchecked, seawater will continue to advance inland, eventually contaminating the East Side and Pressure Areas as far inland as Salinas. This will degrade the water supply of additional agricultural areas and will also degrade municipal drinking water supplies.

The only effective solution to controlling seawater intrusion in Salinas Basin is the re-establishment of higher ground water levels by relieving pumping stresses in the coastal portion of the aquifer. This can most efficiently be achieved by the cessation of pumping and the delivery of an alternative source of water to this area. This solution will allow recovery of water levels in the aquifer, thereby halting the advance of seawater intrusion and restoring normal aquifer pressures. The re-establishment of these conditions will also control the other possible sources of saline degradation such as the dewatering of marine clays and interaquifer leakage.

If a solution other than the delivery of water to the coastal area is to be considered, additional information regarding the components of the saline intrusion may be advisable.

Overdraft

In general, the term overdraft has been used to describe conditions where extraction from a ground water basin exceeds the perennial yield over a period of time, resulting in undesirable conditions. Undesirable conditions may include subsidence, seawater or other saline water intrusion, lower ground water level, and depletion of the supply. Perennial yield is sometimes called the safe yield or the sustained yield of the basin.

In Salinas Valley, the undesirable conditions lowered ground water levels and seawater intrusion. The conditions are the result of:

a) the physical characteristics of ground water occurrence in the Valley,

b) physical connection between the aquifers and seawater,

c) areal distribution of extraction from the aquifer system, and

d) water use practices.

These conditions require that management of ground water in different parts of the Valley recognize local hydrogeologic issues specific to each area.

There is a difference between total ground water in storage and usable ground water storage. The **total** storage of ground water in Salinas Valley is in the millions of acre feet. The **usable** storage is only a portion of the total volume in storage because all of the ground water is not available for extraction without causing some of the undesirable impacts that were listed above. Usable storage can be greatly influenced by the distribution of extraction and recharge facilities, water management practices, and physical facilities for storage and distribution of surface water and ground water.

Valley-wide, the ground water basin is only slightly out of balance because total inflow to the aquifer system is less than total outflow. Fresh water inflow consists of recharge from precipitation, streamflow, and recirculated irrigation water. Outflow consists of ground water extraction, which totals 20,000 afy more than total fresh water inflow.

Seawater is another source of inflow because of the lowering of ground water levels near the coast. The high chloride content, however, makes this water unusable. The average seawater intrusion totals about 17,000 afy. Thus, the Valley-wide water budget shows an average fresh water deficit of 37,000 afy.

In addition to the overdraft in the East Side Area and seawater intrusion in the Pressure Area, 2 other factors exacerbate the ground water supply problem in the Valley. First, nitrate concentrations in ground water are increasing in many areas of the Valley. Second, the basin is hydraulically closed to subsurface outflow, leading to long-term salt accumulation.

The undesirable conditions in the Valley include: seawater intrusion near the coast, decreasing ground water in storage in the East Side Area, nitrate increases in the Forebay and Upper Valley Area, and the salt build-up caused because the Valley is hydraulically closed. These conditions are occurring despite the fact that an essentially full aquifer system has existed under the major portion of the Valley.

The solution to these problems lies in focused relief of the pumping stresses. Such relief could include reduced local extraction in the areas where intrusion and declining water levels are occurring, development of a supplemental water supply to replace the reduced extraction, while maintaining current beneficial uses.

Nitrate

Nitrate contamination of ground water poses a significant threat to the beneficial use of ground water for drinking water and for some agricultural water uses. Nitrate concentrations exceed drinking water standards in many parts of the basin. The principal source of nitrates to ground water is almost certainly excess fertilizer that is leached by rainfall and applied irrigation water. Nitrates also originate from animal and human waste. The contribution of nitrate from various sources has been estimated at 90 percent from agriculture and 10 percent from urban sources. Contamination by nitrate has been observed in the unconfined aquifer and in some locations in the 180-foot aquifer of the Pressure Area.

Nitrate contamination can best be controlled by integrated on-farm fertilizer and water management practices. Such practices may require the voluntary implementation of improved water and fertilizer management by growers, possibly with incentives from MCWRA.

Water Conservation

There are probably some water supply benefits that can be achieved by implementing agricultural and urban water conservation measures. In agriculture, the potential savings would be achieved by decreasing direct evaporative losses during irrigation and by minimizing outflow of irrigation return flow from coastal areas to Monterey Bay. The potential for agricultural conservation of irrigation water is closely linked with interactions in the plant root zone, crop yield, and salt build-up. Any attempt to improve irrigation efficiency must evaluate each of these factors.

Water conservation by itself would not be sufficient to solve the problems of seawater intrusion near the coast and overdraft in the East Side Area.

PROBLEM SOLUTION

Seawater Intrusion and Overdraft

The only reasonable and effective solution for controlling seawater intrusion and overdraft in Salinas Valley is re-establishment of higher ground water levels by relieving pumping stresses in the aquifers in the Pressure and East Side Areas. The 2 alternatives for relieving pumping stresses are either 1) fallow land in the Pressure and East Side Areas, or 2) deliver an alternate supply of water to replace the reduced pumpage. If present agricultural and urban beneficial uses of water are to continue, the obvious solution is some sort of program to deliver water in lieu of ground water extraction. The Castroville Seawater Intrusion Project is a step in this direction, but it will not provide enough water to replace current extraction sufficiently to halt seawater intrusion.

Two approaches could be used to relieve overdraft in the East Side Area. One approach would be to allow water levels to continue declining. They would eventually stabilize near a level low enough to induce increased inflow from the Forebay and Pressure Areas at a rate sufficient to balance ground water extractions. This approach would result in high ground water extraction costs for the indefinite future and continued seawater intrusion in the Pressure Area.

An alternative approach would be to deliver in-lieu water to the East Side Area by means of a surface conveyance facility. This approach would decrease local ground water extraction costs and avoid the intrusion risk but would incur construction and pumping costs for the surface water facility.

The water-supply problem in Salinas Valley is the result of a water distribution problem. The water supply in Salinas Valley is the streamflow runoff from Salinas River watershed and the deep infiltration of precipitation on the Salinas Valley floor. However, a substantial part of this water supply is not captured at present and discharges to Monterey Bay from Salinas River. This discharge occurs mostly during storm periods, and the largest part of the discharge occurs during extreme flood events. The water-management solution to stop overdraft consists of facilities and management practices that use part of the discharge to Monterey Bay from Salinas River, while providing protection for instream uses in the River and in wetlands.

Valley-wide water management in Salinas Valley could best be accomplished by the conjunctive use of surface water and ground water storage. Storage could be used to retain some storm runoff from Salinas Valley watershed and the stored water could be made available for beneficial use within Salinas Valley. At present, runoff is stored in San Antonio and Nacimiento Reservoirs and within the ground water basin, but the current use of ground water storage is not adequate to resolve the problems of seawater intrusion into the Pressure Area and water-level declines within the East Side Area. More intensive management is required to address such conjunctive operation of surface water and ground water storage.

The need for conjunctive operation of surface water and ground water storage was recognized as early as 1946. In 1946, the California Department of Water Resources published a report on Salinas Valley that described the occurrence of seawater intrusion and declining ground water levels. The report recommended a project to eliminate these problems that included development of surface water and ground water storage. Surface water storage was to be accomplished by the construction of dams on tributaries to Salinas River, and ground water storage was to be accomplished by ground water transfers from the Forebay Area to the Pressure Area and East side Area. The Department recommended transfer facilities that included wells in the Forebay Area, conveyance facilities from the Forebay Area to the Pressure and East Side Areas, and distribution facilities within the Pressure and East Side Areas.

In such a conjunctive operation, the increased extraction in the Forebay Area and conveyance of water to the Pressure and East Side Areas would vacate ground water storage in the Forebay Area. This empty storage space would be refilled by additional infiltration from Salinas River. This mode of operation would effectively capture some of the water that presently flows to the ocean and would make it available for conveyance to the Pressure and East Side areas. The well-documented rapid recovery of ground water levels in the Forebay and Upper Valley Areas following recent drought years demonstrates the physical feasibility of this type of conjunctive use.

Part of the recommended facilities for surface water and ground water storage have been completed by the construction of the dams for SanAntonio and Nacimiento reservoirs, but the facilities for the effective use of ground water storage have not been completed. The operation of San Antonio and Nacimiento reservoirs has produced benefits to salinas Valley, but the ultimate benefits that would result from the construction and operation of transfer facilities have not been realized.

The panel concluded that the facilities recommended in 1946 by the California Department of Water Resources should be completed immediately. The Department recommended both dams and transfer facilities. Since that time, additional studies conducted by MCWRA have served to reaffirm and validate the original recommendations.

The dams that were recommended have been constructed, but the companion transfer facilities have not been constructed. The result of partially completing the project has been an uneven distribution of benefits throughout the Valley. The Forebay Area and Upper Valley Areas have enjoyed relatively large benefits from San Antonio and Nacimiento reservoirs that would have been shared equally with the Pressure and East Side Areas if the intended transfer facilities had been built. In the absence of the transfer facilities, seawater intrusion into the Pressure Area and water-level declines within the East Side Area have not been mitigated.

Instead, within the Forebay Area ground water levels are 20 to 30 feet higher than would have occurred without the dams. The Upper Valley Area has also benefited from somewhat higher ground water levels, and has used the yield of the 2 reservoirs to significantly increase the amount of irrigated land in this Area. Benefits have accrued also to the Pressure Area where seawater intrusion is 30 percent less than would have occurred. Benefits to the Pressure and East Side Areas have been relatively small

When Nacimiento and San Antonio dams were built, the effect of the additional water on seawater intrusion could not be predicted, and a "wait and see" attitude was adopted. Since the 2 dams have been operating, it has become clear that the Forebay Area has benefitted from essentially "full" ground water storage, but the ground water flow into the Pressure and East Side Areas has not been sufficient to stop the seawater intrusion and overdraft in these 2 areas. The remaining components of the solution proposed originally, an overland transfer of water directly to the intruded and overdrafted areas, are necessary to solve those problems.

The California Department of Water Resources recommended an effective plan for water-supply management within the Salinas Valley. That plan has been partly implemented. We recommend in the strongest terms that the transfer component be implemented immediately. Transfer of ground water from the Forebay Area to the Pressure and East Side Areas is the only feasible approach to eliminating seawater intrusion into the Pressure Area and water-level declines within the East Side Area. As recommended by the Department and others, transfers would be accomplished by extraction within the Forebay Area, conveyance of the extracted ground water to the Pressure Area, and distribution of water within the Pressure and East Side Areas.

The transfer facilities would produce minor water level declines within the Forebay Area. However, studies estimate that the solution can be accomplished by limiting the average decline to about 5 feet, and maximum localized decline to about 20 feet. The Forebay Area has enjoyed an average water-level rise of 25 feet due to operation of San Antonio and Nacimiento reservoirs. With transfer facilities, the average annual water-level rise, relative to pre-project conditions within the Forebay Area, would still be about 20 feet, seawater intrusion into the Pressure Area would be eliminated or severely curtailed, and water-level declines would be stopped within the East Side Area. With transfers, benefits would be distributed more uniformly throughout the Valley. Without transfers, the benefits would continue to be weighted toward the Forebay and Upper Valley Areas.

Nitrate

MCWRA knows enough about the nitrate problem to recommend initial steps to manage it. However, additional study is needed to understand the complex interrelationships of crop, irrigation, fertilizer, and soil management under conditions prevalent in Salinas Valley. Additional research into the plant-water-soil-nutrient relationships on specific soils in Salinas Valley will be required to maintain an acceptable salt balance and acceptable crop yields.

Critical information is not available to encourage growers to adopt best management practices for the mitigation of nitrate contamination of ground water. An intensive program must be undertaken by MCWRA to provide information on the effectiveness of practices for the management of soils for water conservation and the mitigation of nitrate contamination. Information is available to make initial steps toward developing best management practices, but additional information is critical to the long-term success of improved soils management.

Water Conservation

Some water supply benefits can probably be achieved by implementing agricultural and urban water conservation measures. In agriculture, the potential savings would be achieved by decreasing direct evaporative loss during irrigation and minimizing outflow of irrigation return flow from coastal areas to Monterey Bay, while maintaining a favorable salt balance.

On-farm management of irrigation needs to be done jointly with management of fertilizer application and salt leaching requirements. We recommend that MCWRA undertake studies to further understand these interrelated issues and develop best management practices tailored to growing conditions in Salinas Valley.

However, water conservation by itself would not be sufficient to solve the problems of seawater intrusion near the coast and overdraft in the East Side Area.

LAST WORD

The solution to the water resource problems within the Salinas Valley has been known since at least 1946. The solution that was proposed then by the California Department of Water Resources recognized that sufficient supplemental water could be developed within the basin. That proposal also recognized the need to transfer water from the Forebay Area to the Pressure and East Side Areas. The solution proposed in 1946 remains the best solution even today.

We urge the MCWRA to focus its attention on the completion of the original plan by the construction and operation of water transfer facilities. The MCWRA should avoid diverting its attention to suggested alternatives that are less viable economically or less effective technically. These less viable and less effective alternatives would not provide the same benefits as the original plan, would be more expensive, and the projected price of water would be significantly higher for all parties.

The panel believes strongly that Salinas Valley is fortunate that an in-Valley solution is available. We urge the Salinas Valley community to support the MCWRA in this effort to distribute the available water supplies for more efficient water management and lasting benefits for all residents of the Valley.

Brownstein

Brownstein Hyatt Farber Schreck, LLP
805.963.7000 main
1021 Anacapa Street, 2nd Floor
Santa Barbara, California 93101

December 8, 2021

Stephanie O. Hastings
Attorney at Law
805.882.1415 direct
shastings@bhfs.com

VIA E-MAIL – BOARD@SVBGSA.ORG; MEYERSD@SVBGSA.ORG; PRISO@MCWD.ORG; CITYCLERK@CI.GREENFIELD.CA.US

Board of Directors
Salinas Valley Basin Groundwater Sustainability Agency
c/o Donna Meyers
General Manager
P.O. Box 1350
Carmel Valley, CA 93924

Board of Directors
Marina Coast Water District Groundwater Sustainability Agency
c/o Paula Riso
Executive Assistant/Clerk to the Board
11 Reservation Road
Marina, CA 93933-2099

Governing Board
Arroyo Seco Groundwater Sustainability Agency
General Manager
c/o City Clerk
599 El Camino Real
Greenfield, CA 93927

RE: Groundwater Sustainability Plans for the Upper Valley, Forebay, Eastside, Langley, and Monterey Subbasins of the Salinas Valley Groundwater Basin

To the Boards of the Salinas Valley Basin Groundwater Sustainability Agencies:

On behalf of the Salinas Basin Water Alliance (*Alliance*),[1] this office submits these written comments on the Groundwater Sustainability Plans (GSP) for the Upper Valley, Forebay, Eastside, Langley, and

[1] The *Alliance* is a California nonprofit mutual benefit corporation formed to preserve the viability of agriculture and the agricultural community in the greater Salinas Valley. Alliance members include agricultural businesses and families that own and farm more than 80,000 acres within the Salinas Valley.

Monterey Subbasins of the Salinas Valley Groundwater Basin proposed for adoption by the Salinas Valley Basin Groundwater Sustainability Agency (SVBGSA), the Arroyo Seco Groundwater Sustainability Agency (ASGSA), and the Marina Coast Water District Groundwater Sustainability Agency (MCWDGSA) (collectively, the "GSAs").

Over the course of the GSPs' development, the *Alliance* has made numerous comments, including an October 15, 2021 letter (October 15 Letter) from this firm and an October 15, 2021 technical memorandum from aquilogic, Inc., detailing the GSPs' failure to comply with the Sustainable Groundwater Management Act (SGMA) and the *Alliance's* concerns with respect to the GSAs' approach to groundwater management in the Basin. The *Alliance* appreciates the SVBGSA's efforts to respond to the *Alliance*'*s* comments.[2] However, the *Alliance* hereby reiterates its prior comment that the SVBGSA should undertake additional modeling simulations to (a) analyze the impact of any projects or management actions on adjacent subbasins, *and* (b) understand how groundwater pumping impacts interbasin flows, prior to adoption of the GSPs. If the requested additional analysis cannot feasibly be accomplished prior to adoption of the GSPs and their submission to the Department of Water Resources, the Alliance implores the SVGBSA, at the time of and as a condition of adoption, to commit to undertaking the required analysis as soon as feasible. The Alliance is informed and believes that the SVGSA has the technical capacity to perform the requested simulations, that such simulations and analysis could be conducted in less than 30 days (potentially far less), and that the costs (e.g., consultant fees) would be nominal and easily incorporated into the SVGSA's budget for GSP preparation.

Until such time as this additional modeling is completed and the results are incorporated into the GSPs, the GSPs will continue to fail SGMA's requirements and will have the potential to inequitably distribute the burdens of groundwater management on pumpers within the Basin. As explained in detail in the October 15 Letter and below, these failures include, but are not limited to, the following:

1. <u>The GSPs Are Not Integrated</u>: SGMA requires the GSPs to be integrated in their planning, development, and implementation; integration ensures the objectives of SGMA are satisfied, the interests of all beneficial users throughout the Basin are considered, and the burden of sustainability is equitably allocated across the Basin. Integration is essential here as the surface water and groundwater resources within the Basin are generally interconnected. SVBGSA previously acknowledged this fact, proposing an integrated GSP to cover the entire Basin. However, the draft GSPs circulated for public comments were not integrated in any manner, containing numerous inconsistencies in their data, water budgets, and sustainable management criteria. Further, SVBGSA has now scrapped the integrated GSP in place of the development of a separate "Integrated Implementation Plan" without a guarantee that the "Implementation Plan" will address the numerous existing inconsistencies in the GSPs. In fact, the revisions to the GSPs made since submittal

[2] The SVBGSA has distributed a document reflecting responses to comments submitted on the draft GSPs. Please confirm that these responses will be included in the final GSPs and the submittal to the Department of Water Resources.

of the October 15 Letter confirm that the GSPs' inconsistencies will remain unaddressed through implementation, with the Upper Valley Subbasin GSP stating the Implementation Plan must be "consistent with" the GSPs, and deleting language suggesting projects and management actions will be considered on a Basin-wide level as opposed to a subbasin level. (See Upper Valley GSP, pp. 2-4, 9-2-3.) In other words, if the contents of the Implementation Plan are dictated by the confines of the GSPs, the Plan cannot address conflicts between the various GSPs and the GSPs will remain uncoordinated.

2. Additional Modeling Is Required: In prior comment letters,[3] the *Alliance* identified the need for additional modeling to support the GSPs. In particular, the *Alliance's* comments highlighted how the GSPs cannot adequately set sustainable management criteria and analyze impacts to adjacent subbasins without identifying the amount of Basin-wide groundwater discharge that is and has been captured by pumping. This information could be obtained by running additional model scenarios that do not include any pumping to analyze how interbasin flow responds accordingly. The *Alliance* requests the GSAs' future consideration of these analyses. However, the GSPs will remain insufficient until that time—the GSPs cannot adequately set sustainable management criteria and analyze impacts to adjacent basins and subbasins absent that information. This is especially significant as the GSPs for the Forebay and Upper Valley Subbasins fail to acknowledge that pumping in those subbasins impacts flows to the Eastside and 180/400-Foot Aquifer Subbasins in any manner.

3. The GSPs Do Not Analyze Impacts to Adjacent Subbasins: The GSPs define their water budgets and sustainable yields, and set their sustainable management criteria without consideration for impacts to adjacent subbasins. For example, in the Eastside and Langley Subbasin GSPs, the groundwater level minimum thresholds are set at or near historic lows and permit pumping depressions that reverse the natural flow of groundwater towards the 180/400-Foot Aquifer Subbasin to persist. Similarly, the Forebay and Upper Valley Subbasin GSPs erroneously conclude that the subbasins are presently sustainable,[4] and set their minimum thresholds near or, in the case of the Upper Valley GSP, below the historic lows.[5] However, the GSPs fail to include any analysis of how (a) pumping in these

---

[3] See October 15 Letter and August 12, 2021 letter re "Preliminary Comment on draft GSPs for the Eastside, Forebay, Langley, Monterey and Upper Valley Subbasins of the Salinas Valley Basin."

[4] The revisions to draft GSP reemphasize this point, claiming the GSP will be implemented to "maintain" sustainability in the subbasin as opposed to "achieve" sustainability.

[5] The SVBGSA attempts to rationalize the Upper Valley Subbasin's groundwater elevation minimum threshold in the revised GSP, claiming the threshold was set five feet below historic lows because it "would ensure a minimum 5-foot span between the minimum threshold and measurable objective to provide operational flexibility." (Upper Valley Subbasin GSP, p. 8-7.) This reasoning is flawed—the GSP is using water levels in five out of the 18 representative wells to justify an unreasonably low groundwater elevation minimum threshold especially considering Figure 8-2 shows a cumulative change of over 20 feet between the groundwater elevation measurable

subbasins impacts flows to adjacent subbasins, or (b) how implementing the sustainable management criteria, including the minimum thresholds, will impact adjacent subbasins. The October 15 Letter explains in detail how these failures create cascading faults in the GSPs.

4. The GSPs Must Be Revised to Address These Concerns: As a result of the GSPs' failures discussed above, the GSPs disproportionately allocate the burden of sustainability across the Basin and threaten to impair groundwater users' rights in and to the Basin. This approach violates SGMA and could result in projects and management actions being implemented in one subbasin as a result of groundwater management in another subbasin.

The *Alliance* appreciates the GSAs' collective efforts to implement SGMA and achieve sustainable groundwater management throughout the Basin.

Respectfully submitted,

Stephanie Osler Hastings
Christopher R. Guillen

cc: Emily Gardner, Senior Advisor / Deputy General Manager (gardnere@svbgsa.org)
Derrik Williams, Montgomery & Assoc. (dwilliams@elmontgomery.com)
Leslie Girard, Monterey County Counsel (GirardLJ@co.monterey.ca.us)

23459249.4

objective and the historic low experienced in groundwater elevations experienced in 2016. Moreover, the GSP utilizes the same standards for minimum thresholds and measurable objectives as for other sustainable management criteria (see groundwater quality).

aquilogic, Inc.
environment ● water ● strategy

245 Fischer Avenue, Suite D-2
Costa Mesa, CA 92626
Tel. +1.714.770.8040
Web: www.aquilogic.com

December 8, 2021

MEMORANDUM

To: Board of Directors, Salinas Valley Basin Groundwater Sustainability Agency
Board of Directors, Marina Coast Water District Groundwater Sustainability Agency
Governing Board, Arroyo Seco Groundwater Sustainability Agency

From: Robert H. Abrams, PhD, PG, CHg, Principal Hydrogeologist, aquilogic, Inc.
Anthony Brown, CEO & Principal Hydrologist, aquilogic, Inc.

Subject: Comments on Groundwater Sustainability Plans for the Eastside Aquifer, Forebay Aquifer, Upper Valley Aquifer, Langley Area, and Monterey Subbasins of the Salinas Valley Groundwater Basin

Project No.: 018-09

Aquilogic, Inc. (**aquilogic**) is pleased to provide this memorandum on behalf of the Salinas Basin Water Alliance (Alliance). The curricula vitae for Mr. Brown and Dr. Abrams are provided in **Attachment A**. This memorandum transmits our comments on Salinas Valley Basin Groundwater Sustainability Agency's (SVBGSA) responses to **aquilogic**'s 10/15/2021 memorandum on the subject draft Groundwater Sustainability Plans (GSPs).

The 10/15/2021 **aquilogic** memorandum was included as an attachment to the 10/15/2021 letter from Brownstein Hyatt Farber and Schreck (Brownstein) to the SVBGSA and other parties. The SVBGSA's Comment Letter Responses table for each of the subbasins did not respond directly to the **aquilogic** memorandum. However, some of our comments were represented in the Brownstein letter, and the SVBGSA responded to several aspects of the Brownstein letter. We have yet to evaluate all of the responses from SVBGSA to the letter from Brownstein and the accompanying 10/15/21 **aquilogic** memorandum. However, at this time, we have identified the two responses below where we can provide follow-up comments in this memorandum.

Comments on SVBGSA Responses

In partial response to section II. A. of the Brownstein letter, the SVBGSA states,

> *"SVBGSA ran a no pumping scenario with the SVIHM to determine locations of surface water depletion due to pumping; however, it is a static model that does not shed light on how intersubbasin flow would have changed. It is a static dataset that reflects how reservoirs were actually operated, not how they would*

> *have been operated with no pumping. The Integrated Implementation Committee will consider the flow and relationship between subbasins early in 2022*."

Aquilogic disagrees that the so-called "static" model cannot provide insight into the changes in inter-subbasin flows that occurred as groundwater extractions began and subsequently increased in the Salinas Valley Groundwater Basin (SVGB). The Alliance has requested an in-depth analysis of such flows (see 8/11/2021 **aquilogic** memorandum). The Alliance request is for concept development and hypothesis testing simulations, which can be accomplished with "what-if" model scenarios as proposed in the 8/11/2021 **aquilogic** memorandum (also included as Attachment C of the 10/15/2021 **aquilogic** memorandum. The request is not for a re-creation of past or hypothetical conditions. Historic reservoir releases are sufficient to conduct the simulation analyses. The questions being asked by such analyses are related to "order of magnitude" estimates of how much groundwater and surface water is captured by pumping, not a specific accounting of water budget components for a hypothetical scenario.

In partial response to section II. B. 1. a of the Brownstein letter, the SVBGSA states,

> "*The boundary with the Eastside Subbasin generally represents the furthest extents of the alluvial fans, which are characterized by clays and other fine sediments. These sediments frequently act as an impediment to flow, if not fully a barrier in certain locations. Subsequently, the gradient relationship is not the only influence to groundwater flow between the 180/400-Foot and Eastside Subbasins, and needs to be considered along with all subsurface characteristics. While there is a relationship between the groundwater contours developed for the 180/400 and Eastside Subbasins, the contours themselves are not fully representative of flow between the subbasins*."

Aquilogic understands and agrees that the boundary between the Eastside Subbasin (Eastside) and the 180/400-Foot Aquifer Subbasin (180/400) represents a geological facies change from alluvial fans on the east to fluvial and marine deposits on the west. However, the draft Eastside GSP does not provide evidence, references, or analyses indicating impediments or full barriers to groundwater flow at this subbasin boundary. The SVBGSA is correct that the presence of a hydraulic gradient does not necessarily indicate groundwater flow. However, multiple previous publications state that the natural direction of groundwater flow has been reversed and groundwater from the 180/400 currently recharges the Eastside. In fact, this reversal in the natural direction of groundwater flow is acknowledged multiple times in the Eastside GSP (Eastside GSP, p. 4-35, 6-19 ["*Groundwater pumping near the city of Salinas has created a cone of depression . . . that draws in groundwater into the Eastside Subbasin from the 180/400-Foot Aquifer Subbasin, which is naturally slightly downgradient in the Salinas area*."]).

Groundwater elevation contour maps have been prepared and presented by the Monterey County Water Resources Agency (MCWRA) and the SVBGSA. Although they are regional in nature, these maps do not show perturbations in the contour lines that would be indicative of impediments or barriers to groundwater flow. Indeed, the contour lines generally show consistent magnitudes of hydraulic gradients (i.e., spacing between the contour lines) without abrupt shifts in direction. This observation is a first line of evidence. The nature of groundwater flow in the vicinity of this subbasin boundary is a data gap that should be identified as such in the Eastside GSP. In the absence of evidence, the SVBGSA should use the best available data, all of which suggest that groundwater currently flows from the 180/400 to the Eastside. Flow at and near the subbasin boundary may be at slower rates than flow in other parts of the 180/400, but no evidence or discussion one way or the other is provided in the draft Eastside GSP. Therefore, it is premature for the SVBGSA to dismiss the possibility that pumping in the Eastside may impact or exacerbate sustainability indicators in the 180/400.

Attachment A

aquilogic, Inc.
environment • water • strategy

185 San Leandro Way
San Francisco, CA 94127, USA
Mobile Tel. +1.949.939.7160
Web: www.aquilogic.com

CURRICULUM VITAE

September 2021

Anthony Brown

Principal Hydrologist

mobile: +1.949.939.7160
email: anthony.brown@aquilogic.com

Disciplines

Hydrology, Hydrogeology, Water Resources, Water Quality, Water Supply, Drinking Water Treatment, Contaminant Source Identification, Contaminant Fate and Transport, Soil and Groundwater Remediation, Environmental Liability Management, Legal and Regulatory Strategy.

Education

M.Sc. Engineering Hydrology, Imperial College London, 1989
D.I.C. Postgraduate diploma in Civil Engineering, Imperial College London, 1988
B.A. Geography, King's College London, 1985

Professional Experience

Anthony is a versatile and proficient professional with over 30 years of experience in hydrology, hydrogeology, water resources, water quality, fate and transport of contaminants, groundwater remediation, regulatory strategy, water resources evaluation, and water supply engineering.

Anthony has conducted and managed numerous groundwater resources projects, including:

- resource evaluation, development and management
- water balance, storage capacity and safe yield analysis
- water rights disputes and adjudication
- marginal groundwater development (e.g., brackish water)
- aquifer storage and recovery (ASR)
- indirect potable reuse (IPR).

He has also implemented hundreds of hazardous waste site investigations, including sites with multiple potentially responsible parties (PRPs), complex hydrogeology and fate and transport, fractured rock, multiple contaminants, and co-mingled plumes. This work has included detailed Remedial Investigation (RI) or Phase II characterization studies, groundwater flow and solute transport modeling, Preliminary Endangerment Assessments, Human Health Risk Assessments,

and remedial feasibility studies (FS), remedial system design and implementation. Anthony has been involved in the design, testing, and permitting of drinking water treatment systems for impaired (contaminated) water sources.

Anthony has provided expert services to many prominent water and environmental law firms, the Attorneys General of California, New Jersey, Pennsylvania, Maryland, Ohio, North Carolina, and Puerto Rico, several County District Attorneys, and numerous City Attorneys' Offices.

Through his work for water utilities impacted by gasoline constituents (e.g. MTBE), chlorinated solvents (e.g. PCE, TCE), solvent stabilizers (e.g. 1,4-dioxane), soil fumigants (e.g. 1,2,3-TCP), chlorofluorocarbons (e.g. Freon 11, 12 and 113), perfluorinated compounds (i.e., PFAS), the rocket propellants perchlorate and NDMA, and hexavalent chromium, arsenic and other metals, Anthony has become a recognized expert in the fate, transport, and remediation of these compounds, and the protection of source waters from contamination by such recalcitrant chemicals.

Amongst other technical areas of expertise, he has also provided expert advice related to:

- groundwater resource development
- groundwater basin management
- California Sustainable Groundwater Management Act (SGMA)
- water rights and the development of physical solutions
- groundwater discharges and the Clean Water Act
- compliance with the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) and National Contingency Plan (NCP)
- cleanup under the Resource Conservation and Recovery Act (RCRA)
- the environmental impact of oil field contaminants and their mitigation
- source identification and mitigation of bacteria and fecal contamination in coastal waters
- source identification and persistence of microplastics in coastal waters.

Through his extensive experience on "high-profile" projects, Anthony has developed an excellent working relationship with private and public sector clients, Federal, State, and local elected officials and government agency staff, the legal community, professional organizations, non-profit environmental organizations, and his colleagues in the environmental and water resources professions.

Anthony has also testified before the U.S. Senate and briefed White House staff, federal, State, and local elected officials and regulators, independent commissions, professional groups, academic institutions, and the news media (including CBS 60 Minutes, National Public Radio [NPR] and local newspapers) on groundwater issues.

Beyond his US experience, Anthony has worked on projects in the United Kingdom, Ireland, Canada, Mexico, Costa Rica, Columbia, Ecuador, Yemen, Egypt, and Nepal.

U.S. Senate Testimony and Briefings for Elected Officials

- Testimony before the U.S. Senate Committee on Environment and Public Works on "the Appropriate Role of States and the Federal Government in Protecting Groundwater", on April 18, 2018.
- Briefing for White House Officials and the Council on Environmental Quality on "the Impact of MTBE on Water Resources of the United States", in October 1997.
- Briefing for U.S. Senators Feinstein and Boxer on "MTBE Contamination of the City of Santa Monica Water Supply", in October 1997.
- Briefing for Assistant Administrators and other leadership at the US Environmental Protection Agency (EPA) on "the Impact of MTBE on Water Resources of the United States", in October 1997.
- Briefing of State Senator Sheila Kuehl, several Assembly members, leadership at the California Environmental Protection Agency (CalEPA) and State Water Resources Control Board (SWRCB) on "MTBE Contamination of the City of Santa Monica Water Supply", in 1997-1998

Anthony has also briefed the following on the impact of fuel oxygenates, chlorinated solvents, rocket propellants, metals, oil field activities, and bacteria on water quality:

- USEPA staff (Region IX)
- State Senators and Assembly Members
- State regulators
- Local officials (Mayors, council and board members, City attorneys, etc.)
- Independent Commissions
- Professional bodies (ABA, ACS, ACWA, AEHS, AGWA, NGWA, GRA, etc.)
- Academic institutions and many other organizations
- Media outlets (NPR, CBS 60 Minutes, local TV stations)

Expert Consulting and Witness Services

Anthony is a respected, credible, and highly effective expert witness. He has testified at trial on 11 occasions, including three times in Federal court. Anthony is currently scheduled to testify in another seven trials during the next 18 months. Overall, he has been retained as an expert in over 60 matters related to water rights, water resources management, and water pollution. Anthony has provided deposition testimony in 27 of these matters and these depositions have lasted from one to 32 days in length.

Active:

- Retained (but not disclosed) in numerous cases (>200) related to the impact on water supplies by a group of emerging contaminants (consolidated in multi-district litigation [MDL])
- Lanier Parkway Associates vs. Hercules Chemical (Ashland) (the impact of benzene and chlorobenzene contamination from a chemical facility on an adjacent commercial property) – Superior Court of Glynn County, Georgia (expert affidavit)
- Retained (but not disclosed) by a confidential investor-owned water utility client addressing the impact of Per and polyfluorinated substances (PFAS) on water supplies in two northeastern states
- College Park East vs. Midway City Sanitary District et al (groundwater contamination by chlorinated solvents at a former dry cleaner) - US District Court, Central District of California (discovery)
- TC Rich et al vs. Shaikh et al (chlorinated solvent contamination at a former small batch chemical distributor in Los Angeles) - US District Court, Central District of California (expert report)
- Mojave Pistachios et al vs. Indian Wells Valley Groundwater Authority (IWVGA) (challenge to the Groundwater Sustainability Plan [GSP] and associated pumping fees in a groundwater basin in eastern Kern County) – California Superior Court, Kern County (discovery)
- James J. Kim vs. L. Tarnol et al (chlorinated solvent contamination at a former dry cleaner in Glendale) – California Superior Court, Los Angeles County (discovery)
- City of Oxnard v. Fox Canyon Groundwater Management Agency (water rights dispute) – California Superior Court, Los Angeles County (discovery)
- City of Arcadia vs. Dow Chemical et al (1,2,3-TCP contamination of groundwater resources and water supply wells) – US District Court, Central District of California (expert report)
- Friends of Riverside Airport vs. Department of the Army et al (poly-chlorinated biphenyl [PCB] contamination of soil at a former wastewater treatment plant in Riverside, California) US District Court, Central District of California (expert report, deposition)
- Stoll vs. Ewing et al (chlorinated solvent contamination at a former dry cleaner in Pleasanton) - US District Court, Northern District of California (discovery)
- San Luis Obispo Coastkeeper et al vs. Santa Maria Valley Water Conservation District et al (dispute over surface water flows to enhance steelhead habitat in the Santa Maria River watershed, Santa Barbara County) – US District Court, Central District of California (discovery)
- Mojave Pistachios vs. Indian Wells Valley Water District (IWVWD) et al (water rights dispute in eastern Kern County between agricultural interests and public water purveyors) – California Superior Court, Kern County (discovery)
- Goleta Water District vs. Slippery Rock Ranch (water rights dispute in central California between an avocado ranch adjacent to an adjudicated groundwater basin) – California Superior Court, Santa Barbara (expert report, deposition, trial scheduled for May 2021)

- Santa Barbara Channel-keeper et al vs. City of San Buenaventura et al (adjudication of surface water and groundwater rights in the Ventura River watershed, Ventura County) – California Superior Court, Los Angeles (expert report)
- Las Posas Valley Water Rights Coalition et al vs. Fox Canyon Groundwater Management Agency et al (adjudication of groundwater rights in the Las Posas Groundwater Basin, Ventura County) – California Superior Court, Santa Barbara (expert report, deposition pending, trial scheduled for 2022)
- Black Warrior Riverkeeper et al vs. Drummond Coal (acid mine drainage from a former coal mine impacting a tributary of the Black Warrior River, Alabama) – US Federal Court, Middle District of Alabama, Birmingham (expert report, deposition, trial scheduled for October 2021)
- City of Riverside vs. Goodrich et al (perchlorate contamination of groundwater resources and water supply wells) - California Superior Court (expert declaration, deposition, further deposition pending)
- Commonwealth of Pennsylvania vs. ExxonMobil, et al (State-wide assessment of impact and damages associated with MTBE and TBA releases) – US Federal Court, Southern District of New York (expert reports)
- State of Maryland vs. ExxonMobil et al (State-wide assessment of impact and damages associated with MTBE and TBA releases in Maryland) – US Federal Court, Southern District of New York (discovery)
- Steinbeck Winery et al vs. City of Paso Robles et al (Quiet title action brought by a group of wineries against the public water agencies to adjudicate water rights) - California Superior Court, San Jose (deposition, Phase 2 and Phase 3 trial testimony, Phase 4 pending)
- Various individuals vs. San Luis Obispo County et al (Trichloroethene [TCE] contamination in groundwater and water supply wells in a community adjacent to a County-operated airport) – California Superior Court, San Luis Obispo (litigation stayed)
- Commonwealth of Puerto Rico vs. Shell Oil Co., et al (Island-wide assessment of impact and damages associated with MTBE and TBA releases in Puerto Rico) – US Federal Court, Southern District of New York (expert report, deposition, trial pending)
- City of Fresno vs. Shell Chemical et al (1,2,3-TCP contamination of groundwater resources and water supply wells) – California Superior Court (discovery)
- New Jersey Department of Environmental Protection (NJDEP) vs. Sunoco et al (State-wide assessment of impact and damages associated with MTBE and TBA releases in New Jersey) – US Federal Court, Southern District of New York (expert report, deposition, hearing testimony, trial pending)
- Orange County Water District (OCWD) vs. Sabic Innovative Plastics et al (Chlorinated solvent, 1,4-dioxane and perchlorate contamination of groundwater resources from various sites in Orange County, California) – California Superior Court, Orange County (expert report, deposition [32 days], trial testimony)

- City of Modesto vs. Vulcan Chemical et al (perchloroethylene [PCE] releases from numerous dry cleaners contaminating drinking water wells and groundwater resources) – California Superior Court, San Francisco (expert reports, deposition [25 days], trial testimony, returned by Appeals Court)

Past:

- City of Upland vs. Dow Chemical et al (1,2,3-TCP contamination of groundwater resources and water supply wells) – US District Court, Central District of California (expert report, settled)
- Borrego Water District (water rights dispute and physical solution) – California Superior Court, San Diego (stipulated adjudication)
- Charleston Waterkeeper and South Carolina Coastal Conservation League vs. Frontier Logistics (lawsuit over polyethylene nurdle pollution in and around Charleston Harbor) - US District Court, Charleston District of South Carolina (expert report, settled)
- San Miguel Electric Cooperative vs. Peeler Ranch (contamination of soil, surface water and groundwater beneath a ranch from a lignite mine and coal-fired power plant) – Texas Superior Court, 218th District (expert report, deposition, hearing testimony, settled)
- City of Hemet vs. Dow Chemical et al (1,2,3-TCP contamination of groundwater resources and water supply wells) – US Federal Court, Southern District of California (expert report, settled)
- Sierra Club et al vs. Dominion Energy (contamination of groundwater and surface water resources by coal combustion residuals [CCRs] from ash ponds) – US Federal Court, Eastern District of Virginia (deposition, trial testimony)
- Sunny Slope Water Company vs. Dow Chemical et al (1,2,3-TCP contamination of groundwater resources and water supply wells) – California Superior Court, Los Angeles County (settled)
- Greenfield et al vs. Ametek Aerospace et al (solvent contamination in groundwater beneath three mobile home parks) – US Federal Court, Southern District of California, San Diego (expert report, deposition, settled)
- Golden State Water Company vs. Dow Chemical et al (1,2,3-TCP contamination of groundwater resources and water supply wells in Nipomo and Claremont) – US Federal Court, Southern District of California (expert report, settled)
- National Association for the Advancement of Colored People (NAACP) vs. Duke Energy (coal ash contamination of groundwater, sediments, and surface waters at the Belews Creek coal-fired power plant) – US Federal Court, Middle District of North Carolina (expert report, settled)
- City of Atwater vs. Shell Chemical et al (1,2,3-TCP contamination of groundwater resources and water supply wells) – California Superior Court (expert report, deposition, trial testimony)
- State of Vermont vs. ExxonMobil et al (State-wide assessment of impact and damages associated with MTBE and TBA releases in Vermont) – US Federal Court, Southern District of New York (settled)

- Trujillo et al vs. Ametek Aerospace et al (solvent contamination in groundwater beneath an elementary school) – US Federal Court, Southern District of California, San Diego (expert report, deposition, settled)
- Roanoke River Basin Association vs. Duke Energy (coal ash contamination of groundwater, sediments, and surface waters at two coal-fired power plants: Mayo and Roxboro) – US Federal Court, Middle District of North Carolina (expert report, deposition, settled)
- OCWD vs. Unocal et al (MTBE and TBA contamination of groundwater resources from service station sites in Orange County, California) – US Federal Court, Southern District of New York (expert report, deposition, settled)
- State of North Carolina vs. Duke Energy (administrative hearing related to coal ash contamination at six power plants) – North Carolina Superior Court (settled)
- City of Clovis vs. Dow Chemical et al (1,2,3-TCP contamination of groundwater resources and water supply wells) – California Superior Court (expert report, deposition, trial testimony)
- San Juan Hills Golf Course vs. City of San Juan Capistrano et al (suit filed over groundwater pumping in the San Juan Basin) – California Superior Court, Orange County (settled)
- City of Tulare vs. Dow Chemical et al (1,2,3-TCP contamination of groundwater resources and water supply wells) – California Superior Court (settled)
- State of California vs. Columbia Casualty Company et al (perchlorate and solvent contamination at the Stringfellow Acid Waste disposal pits in Glen Avon) – California Superior Court (expert report, settled)
- City of Delano vs. Crop Production Services (CPS) et al (Nitrate contamination of water supply wells) - California Superior Court (settled)
- Laborers' International Union of North America Local Union No. 783 v. Santa Margarita Water District et al. (Review of the groundwater hydrology of the Cadiz project, San Bernardino County) - California Superior Court, Orange County (independent expert report, settled)
- Southern California Water Company vs. Aerojet General Corp. (TCE, perchlorate and NDMA contamination of drinking water supplies in Rancho Cordova, California) – California Superior Court, Sacramento District (expert report, deposition, settled)
- The City of Stockton Redevelopment Agency (RDA) vs. Conoco-Phillips et al (petroleum hydrocarbon contamination at former oil terminals) – California Superior Court (deposition, settled)
- PK Investments vs. Barry Avenue Plating (hexavalent chromium and solvent contamination of soil and groundwater) - California Superior Court, Los Angeles District (deposition, settled)
- City of Santa Monica, California vs. Shell et al (MTBE contamination of drinking water supplies) – California Superior Court, Orange County District (expert report, deposition, settled)
- State of California vs. Joint Underwriters (perchlorate and solvent contamination at the Stringfellow Acid Waste disposal pits in Glen Avon) – California Superior Court (expert report, deposition, settled)

- Community of Broad Creek, North Carolina vs. BP Amoco et al (MTBE, benzene and 1,2-DCA contamination of private water supply wells) – North Carolina Superior Court (deposition, settled)
- South Tahoe Public Utility District, California vs. ARCO et al (MTBE contamination of drinking water supplies) - California Superior Court, San Francisco (expert report, deposition, trial testimony)
- Private well owners in 18 reformulated gasoline (RFG) states vs. various oil companies (class action related to MTBE) - US Federal Court, New York District (deposition, class certification hearing)
- Individual plaintiffs vs. Lockheed Corporation (TCE and perchlorate contamination of drinking water supplies in Redlands, California) – California Superior Court, Los Angeles District (deposition, settled)
- City of Norwalk vs. Five Point U-Serve et al (1.2-DCA contamination of a municipal drinking water well) – California Superior Court (deposition, case dismissed)
- Forest City Corp. vs. Prudential Real Estate (PCE contamination of soil and groundwater) – California Superior Court, Los Angeles District (deposition, trial testimony)
- Huhtamaki vs. Ameripride (chlorinated solvent contamination at a commercial dry cleaner/ laundry facility) – California Superior Court, Sacramento District (expert report, deposition, settled)
- Consolidated Electrical Distributors (CED) vs. Hebdon Electronics et al (chlorinated solvent contamination in fractured granite) - California Superior Court, North San Diego District (expert report, deposition, trial testimony)
- Southern California Water Company vs. various parties (water rights petition and adjudication for the American River, Sacramento, California) – State Water Resources Control Board, Sacramento
- The City of Santa Monica, California vs. ExxonMobil Corporation (MTBE contamination of drinking water supplies) – California Superior Court (designated, settled, retained as consultant to both parties for remedy implementation)
- The town of Glenville, California vs. various parties (MTBE contamination of drinking water supplies in Kern County, California) - California Superior Court (designated, settled)
- Great Oaks Water Company vs. Chevron and Tosco (MTBE contamination of drinking water supplies in San Jose, California) - California Superior Court (designated, settled)
- Orange County District Attorney's Office vs. ARCO et al (Underground Storage Tank [UST] violations, and MTBE contamination of soil and groundwater) - California Superior Court (designated, settled)
- Cambria Community Services District (CCSD) vs. Chevron et al (MTBE impact to drinking water supplies) in San Luis Obispo County, California - California Superior Court (designated, settled)
- Los Osos Community Services District (CCSD) vs. Chevron et al (MTBE impact to drinking water supplies) in San Luis Obispo County, California - California Superior Court (designated, settled)

- The town of East Alton, Illinois vs. various parties (MTBE contamination of drinking water supplies) – Illinois Superior Court, Jefferson County (designated, settled)
- The City of Dinuba vs. Tosco et al (MTBE contamination of groundwater resources) - California Superior Court (expert report, settled during deposition)
- Stella Stephens vs. Bazz-Houston et al (chlorinated solvent contamination at an active metal finishing facility in Garden Grove, California) - California Superior Court (designated, settled)
- Communities for a Better Environment (CBE) vs. Chrome Crankshaft (hexavalent chromium and TCE contamination beneath a chrome plating facility and adjacent school) - California Superior Court (designated, settled)
- California Attorney General's Office vs. Unocal (Natural Resource Damage Assessment [NRDA] at a former oil field in the central coast of California) - California Superior Court (designated, settled)
- Phillips Petroleum Corporation vs. private property owner (contamination from a former oil well in Signal Hill, California) - California Superior Court (designated, settled)
- Mobil Oil Corporation vs. private property owner (contamination from a former bulk fuel plant in the Bay Delta area) – California Superior Court (designated, settled)
- Mobil Oil Corporation vs. terminal operator (contamination from a former bulk fuel plant in Monterey area) – California Superior Court (designated, settled)

General Project Experience

Anthony has acted as the Principal in Charge, Project Manager (PM), Quality Assurance (QA) Manager and/or Principal Review for the following ongoing or recently completed projects:

Current Water Resources Projects

- Review of the Effect of Releases from a Reservoir on Surface Water Flows Intended to Enhance California Steelhead Habitat, and the Potential Impact on Groundwater Recharge – City of Santa Maria, Golden State Water Company
- An Investigation of the Hydrology of Perennial Spring in the Mojave Desert, as it Relates to Potential Impact from a Groundwater Resource Development Project - Three Valleys Municipal Water District
- Consulting Support Related to the Implementation of SGMA in the Pleasant Valley and Oxnard Plain Groundwater Basins, Pleasant Valley County Water District, Guadalasca Mutual Water Company.
- Consulting Support for a Surface Water and Groundwater Rights Dispute in the Ventura River Watershed – Group of Confidential Landowners
- Support Related to a New Car Manufacturing Plant in Huntsville, Alabama, and potential impact on habitat for an endangered species of fish – Center for Biological Diversity
- Review of the Groundwater Monitoring, Management, and Mitigation Plan (GMMMP) for the Cadiz Water Conservation Project – Three Valleys Municipal Water District

- Groundwater Consulting Support to an Agricultural Business in southeast Kern County Located within a Partially Adjudicated Basin – SunSelect
- Strategic Groundwater Consulting Support to a Large Golf Resort Located in a Desert Groundwater Basin Subject to Critical Overdraft under SGMA – Rams Hill GC
- Assessment of Water Resources at Oil Fields Throughout California and the Development of Produced Waters as an Alternate Water Supply – California Resources Corporation (CRC)
- Support Related to SGMA, Possible Adjudication, and Overall Groundwater Management Strategy for a Municipality in Southern California – Confidential Municipal Client
- Consulting Support for a Groundwater Rights Adjudication in the Las Posas Groundwater Basin, Ventura County – Group of Large Landowners
- Support Related to SGMA, Salinity Management, Alternate Water Sources, and Overall Groundwater Management Strategy for a Grower in the Bay-Delta – Wonderful Orchards
- Evaluation of the Feasibility of Using Brackish Groundwater and Oilfield Produced Water as an Alternate Water Supply for a Basin in Critical Overdraft – Northwest Kern Brackish and Oilfield (BOF) Water Study Group
- Support Related to SGMA, Possible Adjudication, and Overall Groundwater Management Strategy for a Large Water District in the Central Valley – Confidential Water District Client
- Water Rights Dispute Between a Water District and an Avocado Ranch in Central California – Slippery Rock Ranch
- Evaluation of the Feasibility of Using Brackish Groundwater as an Alternate Water Supply for a Closed Desert Basin in Critical Overdraft – Indian Wells Valley Brackish Water Study Group
- Development of a Plan for an Adjudication of Water Rights in a Desert Basin and the Principles of a Groundwater Management Plan (i.e., Physical Solution) – Confidential Water District Client
- Support Related to SGMA for Water Districts on the West Side of Kern County, Including the Creation of Defined Groundwater Management Areas – Westside District Water Authority
- Support to Agricultural Interests in the “White Areas” in Madera County with Respect to the Implementation of the California Sustainable Groundwater Management ACT (SGMA) – Madera County Farm Bureau
- Evaluation of Water Supply Options, Including New Water Supply Wells, for a Major Oilfield in West Fresno County – CRC
- Development of a Water Budget for a Baseline Period, and Evaluation of Native Safe Yield, Annual Operating Safe Yield, Historical Pumping, and Conditions of Overdraft as Part of a Water Rights Dispute in the Central Coast of California – City of Paso Robles
- Design and Permitting of an Aquifer Storage and Recovery (ASR) Project for Indirect Potable Reuse (IPR) of Tertiary Treated Municipal and Industrial Wastewater – City of Fresno
- Assessment of Increased Pumping at a Data Center and the Impact on Nearby Municipal Water Supply Wells in Charleston, South Carolina – Southern Environmental Law Center (SELC)

- Litigation Support and Development of Groundwater Management Approaches as an Alternative to Compliance with the Sustainable Groundwater Management Act – Confidential Water District Client, Southern California
- Groundwater Management Support to a Very Large Agribusiness with Over 170,000 Acres of Almonds, Pistachios, Mandarins, Pomegranates, and Grapes in the San Joaquin Valley - Wonderful Orchards
- Evaluation of Groundwater Conditions and Quality, and The Degree of Hydraulic Connection Between Groundwater Basins, as Part of a Water Rights Dispute in the Central Coast of California – City of Paso Robles
- Development of a Water Supply Well Drilling Ordinance and Valuation of Water Rights for a Confidential Municipality in Southern California
- Support for a Major Agricultural Interest with Holdings in Four Separate Groundwater Basins in Relation to the Implementation of SGMA – RTS Agribusiness
- Development of a New Water Supply Well Field, Including Compliance with California Division of Drinking Water (DDW) Policy 97-005 (Impaired Source Policy), and Evaluation of Groundwater Contamination at a Nearby Aerospace Facility – City of Torrance
- Evaluation of Aquifer Characteristics and Groundwater Conditions Related to the Reinjection of Oil Field Produced Water and Development of a Strategy to Obtain an Aquifer Exemption – Confidential Oil Company
- Development of a recycled water program (including possible aquifer storage and recovery [ASR]/salt-water intrusion program) using advanced treatment of a blend of brackish groundwater and urban storm-water – City of Santa Monica
- Membership of the Technical Advisory Committee (TAC) of a Cooperative Groundwater Group that will Become a Groundwater Sustainability Agency (GSA) – Indian Wells Valley
- Evaluation of Basin Hydrogeology, Groundwater Conditions, Water Quality, and Well Production in a Riparian Coastal Basin in Southern California – City of San Juan Capistrano
- Investigation and Development of Alternate Groundwater Supplies for an Agricultural Interest with Land Holdings in an Arid California Valley – Mojave Pistachios
- Development of a 50,000 acre-foot per year (AFY) ASR Project in the Eastern Portion of a Large Agricultural Valley in Southeast California – Confidential Client
- Review of the Groundwater Hydrology of the Cadiz Project – an independent expert report prepared for Orange County Superior Court in re: Laborers' International Union of North America Local Union No. 783 v. Santa Margarita Water District et al.

Petroleum Hydrocarbons

- Assessment of the Impact of MTBE/TBA Contamination of Water Resources in the State of Vermont, Including Contamination at Release Sites, Public Water Supply Wells, and Private Domestic Wells – State of Vermont

- Evaluation of Produced Water Management Options for Two Active Oil Fields in Southern California, including Treatment and Beneficial Use - CRC
- Assessment of the Impact of MTBE/TBA Contamination of Groundwater Resources in the State of Maryland, and Development of Costs to Address the Contamination at Release Sites, Public Water Supply Wells, and Private Domestic Wells – State of Maryland
- Investigation of Petroleum Hydrocarbon Contamination Related to Releases at a Pipeline that Crosses a Large Ranch in the Central Coast of California – Twin Oaks Ranch
- Assessment of Petroleum Contamination from a Large Pipeline Release that is Discharging to Two Streams and a Wetland in Belton, South Carolina – Southern Environmental Law Center (SELC)
- Evaluation of Contamination by Petroleum Hydrocarbons from a Pipeline Release at a Large Ranch/Winery in the Central Coast of California, and Development of a Conceptual Remedial Program and Costs to Implement – Santa Margarita Ranch, California
- Assessment of the Impact of MTBE/TBA Contamination of Groundwater Resources in the State of Pennsylvania, and Development of Costs to Address the Contamination at Release Sites, Public Water Supply Wells, and Private Domestic Wells – Commonwealth of Pennsylvania
- Investigation and Remediation of MTBE/TBA and Petroleum Hydrocarbon Contamination (using surfactant enhanced product recovery) at a Maintenance Facility in Hawthorne, California – Golden State Water Company
- Assessment of the Effectiveness of Site Investigation and Remediation Activities, Investigation of Off-Site Groundwater Contamination by MTBE/TBA, and Development of Remedial Programs (and Costs) at "Bellwether" Trial Sites - Orange County Water District
- Evaluation of Contaminant Conditions and Prior Site Investigation and Remediation Activity, Implementation of Off-site Investigations, and Development of Remedial Programs and Associated Costs to Address MTBE/TBA Contamination at Trial Sites in Puerto Rico – Commonwealth of Puerto Rico
- Assessment of Site Investigation and Remediation Activities, Investigation of Off-Site Groundwater MTBE/TBA Contamination, and Development of Remedial Programs (and Costs) at Trial Sites – New Jersey Department of Environmental Protection (NJDEP)
- Environmental Impact Report (EIR) and Baseline Environmental Assessment at a Proposed Oil Field Redevelopment Project, Southern Iraq - Confidential Client
- Development of a Remediation Approach and Costs for Soil and Groundwater Contamination at Two Former Petroleum Terminals – Stockton Redevelopment Agency
- Assessment of the Nature of Contamination and the Costs to Address this Contamination at a Former Municipal Landfill in San Diego County – Confidential Client
- Evaluation of Contaminant Sources, and the Fate and Transport of MTBE, 1,2-DCA and Benzene to Numerous Private Water Supply Wells in the Community of Broad Creek, North Carolina

- Assessment of the Effectiveness of Site Investigation and Remediation Activities to Address MTBE/TBA/Benzene Contamination at ARCO and Thrifty Service Stations Throughout Orange County, California - Orange County District Attorney's Office
- Evaluation of Contaminant Sources, Fate, Transport, and Impact of MTBE and TBA to Public Water Supplies, and the Costs to Treat these Contaminants, in the town of East Alton, Illinois
- Court Appointed Consultant to Develop Site Investigation Programs for MTBE/TBA/Benzene Contamination at 35 Thrifty Service Stations in Orange County
- Impact and Mitigation of Oil Field Contaminants at the Belmont Learning Center – Los Angeles Unified School District (LAUSD) - Belmont Commission
- Investigation, PRP Identification, Remediation and Restoration of Municipal Well Fields Impacted by MTBE Contamination – City of Santa Monica (Charnock Well Field), South Lake Tahoe Public Utility District (STPUD), Santa Clara Valley Water District (SCVWD), Great Oaks Water Company
- Oversight of Oil Company Investigation and Remediation Programs in Honolulu Harbor, Hawaii – US Environmental Protection Agency (USEPA)
- Assessment of Oil Field Contaminants in Relation to High Incidences of Leukemia and non-Hodgkins Lymphoma at a High School in Southern California – Confidential Client
- Evaluation of Fuel Releases and Their Impact upon Groundwater Resources at Service Stations, Bulk Plants, Fuel Terminals and Refineries Throughout California – Confidential Client
- Complete Restoration of Municipal Water Supply Wells Contaminated with MTBE – City of Santa Monica (Arcadia Well Field) and ExxonMobil Corporation
- Preliminary Environmental Assessment (PEA) at the Hull Middle School - located on a former oil field and landfill - Torrance Unified School District (TUSD), California
- Oversight of Investigation and Remediation Activities for a MTBE Release at a Service Station and the Potential Impact on a City's Water Distribution System – City of Oxnard, California
- Investigation of MTBE Contamination of Water Supply Wells and Other Petroleum Hydrocarbon Contamination at a Marine Fueling Depot on Catalina Island – Southern California Edison
- Impact of MTBE Releases at Service Stations and a Bulk Fuel Terminal on Drinking Water Wells and Groundwater Resources - City of Dinuba, California
- Oversight of a Court-ordered MTBE/TBA Plume Delineation Program at Gasoline Service Stations in Orange County, California – OCDA, California
- Oversight and Investigation of Remediation of MTBE Contamination Impacting Drinking Water Supplies in the Towns of Cambria and Los Osos/Baywood Park, California – Cambria Community Services District (CCSD), Los Osos Community Services district (LOCSD), Cal-cities Water Company
- Assessment of the Impact of an MTBE Release on Water Supply Wells, Sewers, and a Wastewater Treatment Plant – City of Morro Bay, California

- Investigation and Remediation of an MTBE Release in the Immediate Vicinity of a Drinking Water Supply Well - City of Cerritos, California
- Assessment of the Impact of Petroleum Hydrocarbon Contamination from a Wolverine Pipeline Release in Jackson, Michigan – Private Property Owner
- Investigation of Fuel Oil LNAPL and Hexavalent Chromium Contamination at a Former Clay Products Manufacturing Facility in Fremont, California – Mission Clay Products
- Assessment of the Impact of MTBE Releases on Water Supply Wells, and Oversight of Responsible Party (RP) Investigation and Remediation Activities - Soquel Creek Water District, California
- MTBE Contamination of Private Drinking Water Supplies and Development of Water Supply Treatment and Replacement Alternatives – Glenville, California
- Assessment of the Impact of MTBE on Drinking Water Supply Wells in Santa Clara County, California – Great Oaks Water Company (GOWC)
- Assessment of Data Gaps and Research Needs Regarding MTBE Impact to Water Resources – UK Environment Agency
- Investigation and Mitigation of the Impact of Oil Field Contaminants on a Large Apartment Complex in Marina del Rey, Los Angeles, California – Confidential Client
- Investigation and Remediation of Methane and Hydrogen Sulfide as Part of the Redevelopment of a Former Oil Field in Carson, California - Dominguez Energy/Carson Companies
- Assessment of Methane and Petroleum Hydrocarbon Contamination at a Former Oil Field in Santa Fe Springs, California – General Petroleum
- Natural Resource Damage Assessment (NRDA) at the Guadalupe Oil Field, California - State of California (Department of Fish and Game [DFG], Oil Spill Prevention and Response [OSPR], Attorney General and Regional Water Quality Control Board [RWQCB])
- Assessment of the Impact of Oil Field Activities on Surface Water and Groundwater Resources in the Central Coast of California – State of California
- Groundwater Investigation and Remediation at Four Petroleum Terminals in Wilmington, Carson, and San Pedro, California - GATX
- Research into Technologies for Treatment of MTBE in Water - Association of California Water Agencies (ACWA) / Western States Petroleum Association (WSPA) / Oxygenated Fuels Association (OFA)
- Characterization and Remediation of a Hydrocarbon Release (including MTBE) from a Refined Product Pipeline in Fractured Bedrock in Illinois – Shell
- Investigation and Remediation of Petroleum Hydrocarbon Contamination Beneath a City Maintenance Yard and City Bus Yard – City of Santa Monica, California
- Investigation and Remediation of a Gasoline Release (including MTBE) in Fractured Bedrock Resulting from a Catastrophic Tank Failure – Intrawest Ski Resorts, California

- Assessment of LNAPL, Aromatic Hydrocarbon, and Chlorinated Solvent Contamination Beneath a Former Waste Disposal Facility in Santa Fe Springs, California – Confidential Client
- Investigation of Soil and Groundwater Contamination at a Fueling Facility at a Municipal Airport – City of Santa Monica, California
- Pipeline Leak Investigation and Remedial Design - Mobil Pipeline, Ft. Tejon, California
- Investigation of a Petroleum Release in Fractured Bedrock - Chevron, Julian, California
- Contribution of Multiple Sources to Groundwater Contamination – Mobil Oil Corporation, La Palma, California
- Forensic Assessment of a Gasoline Release – Mobil Oil Corporation, Santa Monica, California
- Investigation of a Diesel Fuel Release – General Petroleum, Point Hueneme, California
- Service Station Investigations and Remediation (> 60 sites) - Mobil Oil Corporation, World Oil, Los Angeles County Metropolitan Transportation Authority (LACMTA), and Others
- Assessment of a Crude Release from a Former Pipeline - Mobil Oil, Gorman, California
- Remediation of 2,000,000-gallon (7,560 m^3) LNAPL Spill - Gulf Strachan Gas Plant, Alberta

Chlorinated Solvents

- Evaluation of Groundwater Contamination at an Aerospace Facility in El Cajon, the Threat to Water Supply Wells, and Vapor Intrusion Concerns at Overlying Properties – Confidential Client
- Investigation of Groundwater Contamination and Potential Sources for TCE Contamination in Groundwater and Water Supply Wells in a Community Adjacent to a County-Operated Airport – Confidential Client
- Evaluation of Poly-Chlorinated Biphenyls (PCBs) in Storm Water and the Impact on Groundwater Resources and the Use of Treated Storm Water for Aquifer Recharge and Saline Intrusion Barriers – Confidential Municipal Clients
- Assessment of the Effectiveness of Site Investigation and Remediation Activities, Investigation of Off-Site Groundwater Contamination, and Development of Remedial Programs (and Costs) at Solvent "Source Sites" in the South Basin Groundwater Protection Project (SBGPP) - Orange County Water District
- Consulting Support to a Community Adjacent to the Santa Susana Field Laboratory (SSFL), a Facility Previously Used to Test Rockets – Bell Canyon Homeowners Association
- Investigation of Groundwater Contamination by Perfluorinated Compounds (e.g., PFOA, PFOS) and its Impact on Public Water Supplies in Southeastern North Carolina – Confidential Client
- Investigation of Chlorinated Solvent and Petroleum Hydrocarbon Contamination, and Implementation of an Extended Remediation Pilot Study, at a Small-Batch Chemical Distribution Facility in Santa Fe Springs, California – Angeles Chemical Corporation

- Evaluation of Contaminant Distribution and Fate, and Development of a Remedial Approach and Costs, for Chlorinated Solvent Contamination in Groundwater at a Light Industrial Facility in Northridge, California, – Confidential Client
- Project Management Consultant (PMC) for the Hazardous Substances Account Act (HSAA) Program (i.e., State-CERCLA) as part of the SBGPP – Orange County Water District
- Assessment of Conceptual Hydrogeology and the Sources of 1,2-DCA and PCE Contamination of a Large Public Water Supply Well – Confidential Client
- Investigation and Remediation of Chlorinated Solvent Contamination in Soil and Groundwater Beneath a Metal Finishing Facility in Inglewood, California – Bodycote Hinterliter and Joseph Collins Estate.
- Investigation and Remediation of Soil and Groundwater Contamination at a Former Wood Treating Facility – Port of Los Angeles
- Assessment of the Nature of PCE Releases from Dry Cleaning Facilities, the Impact Upon Groundwater Resources, and the Cost of Remediation – City of Modesto, California
- Investigation of Chlorinated Solvent Contamination in Soil, Groundwater and Drinking Water Supplies Beneath Various Facilities in Lodi, California – Confidential Client
- Investigation of TCE and Hexavalent Chromium Contamination at the Suva School in Montebello, California – Communities for a Better Environment
- Remediation of Chlorinated Solvents, Including Vinyl Chloride, in Soil and Groundwater Beneath a Former Aerospace Facility in West Los Angeles, California – Playa Vista Capital
- Assessment of Chlorinated Solvent and Hexavalent Chromium Contamination at an Active Metal Finishing Facility in the City of Garden Grove, California – Confidential Client
- Investigation and Remediation of Hexavalent Chromium and TCE Contamination at an Active Plating Facility in West Los Angeles – confidential client
- Contamination of Drinking Water Supplies by TCE and Perchlorate from an Aerospace Manufacturing Facility in Redlands, California – Individual Plaintiffs
- Investigation and Remediation of Hexavalent Chromium, TCE, and Gasoline LNAPL Contamination at an Active Plating Facility in Santa Fe Springs, California – Confidential Client
- Investigation and Remediation of Hexavalent Chrome and TCE Contamination at the Los Angeles Academy (formerly Jefferson) Middle School, Los Angeles, California – Jefferson Site PRP Group
- Evaluation of Groundwater and Contaminant Conditions at an Active Municipal Landfill in Los Angeles County, California – Browning Ferris Industries (BFI)
- Investigation of Chlorinated Solvent Contamination in Groundwater Beneath a Municipal Airport – City of Santa Monica, California
- Resource Conservation and Recovery Act (RCRA) Facility Assessment and Closure for a Large Aerospace Facility in Hawthorne, California – Northrop Grumman Corporation

- Characterization of Complex Hydrogeology and Contaminant Fate and Transport (with Poly-chlorinated Biphenyls [PCBs] and Chlorinated Solvents) in Karstic Bedrock at a Site on the National Priority List (NPL) in Missouri – MEW PRP Steering Committee
- Design of a Groundwater Remediation Program for Chlorinated Solvent, Perchlorate and Other Contaminants Utilizing Existing Drinking Water Wells – San Gabriel Valley Water Company (SGVWC)
- Investigation of a Chlorinated Solvent Release in Fractured Bedrock – Consolidated Electrical Distributors, San Diego, California
- Contamination of Drinking Water Supplies by TCE from an Aerospace Manufacturing Facility in Redlands, California – Individual Plaintiffs
- Investigation of a Chlorinated Solvent Release at an Active Chemical Terminal - GATX, San Pedro, California
- Technical and Regulatory Assistance, and RP Oversight and Review, Chlorinated Solvent Contamination Beneath a Former Aerospace Facility – City of Burbank, California
- Investigation and Remedial Design for a Chlorinated Solvent Release at an Active Machine Shop – Mighty USA, Los Angeles, California
- Remediation of Chlorinated Solvents in Groundwater as Part of a Rail Freight Transfer Terminal Development - Port of Los Angeles, California
- Remedial Evaluation of PCE Contamination at a Former Scientific Instruments Manufacturing Facility – Forest City, Irvine, California
- Evaluation of a Chlorinated Solvent Release at a Dry Cleaners - Los Angeles City Attorney, West Los Angeles, California
- Assessment of a Chlorinated Solvent Release from Former Dry Cleaners – DeLoretto Plaza, Santa Barbara, California
- Characterization and Remediation of LNAPL at an Active Chemical Refinery - ICI, Teeside, UK

Perchlorate

- Investigation of Regional Perchlorate Contamination of Groundwater Resources in the Central Basin of Los Angeles – Water Replenishment District of Southern California (WRD)
- Investigation of regional groundwater contamination by perchlorate in the Rialto-Colton, Bunker Hill, and North Riverside Basins, and impact to water supply wells – City of Riverside
- Assessment of the Effectiveness of Site Investigation and Remediation Activities, Investigation of Off-Site Groundwater Contamination, and Development of Remedial Programs (and Costs) at Perchlorate Release Sites in the South Basin Groundwater Protection Project (SBGPP) - Orange County Water District
- Hydrogeologic Investigation, Source Identification, Water Supply Well Impact Assessment, and Drinking Water Treatment for Perchlorate – City of Morgan Hill, California
- Evaluation of the Fate and Transport of Perchlorate and NDMA Contamination and its Impact on Water Supplies in Rancho Cordova, California – Southern California Water Company

- Hydrogeologic Investigation, Water Supply Well Impact Assessment, Regulatory Assistance, and Responsible Party (RP) Oversight for Perchlorate Contamination – City of Gilroy, California
- Regulatory and Technical Assistance, RP Oversight and Review, Water Resource Impact Assessment for Perchlorate Contamination – City of Santa Clarita, California
- Design of a Groundwater Remediation Program for Chlorinated Solvent, Perchlorate and Other Contaminants Utilizing Existing Drinking Water Wells – San Gabriel Valley Water Company (SGVWC), San Gabriel Valley Superfund Site, California
- Evaluation of the Off-site Migration of Perchlorate and TCE Contamination from a Rocket Testing Facility in Simi Hills, California – City of Calabasas, County of Los Angeles
- Investigation of Potential Perchlorate Source Sites, Source Contribution, Contaminant Pathway Assessment, and Drinking Water Treatment – Fontana Water Company, West Valley Water District, Fontana, California
- Evaluation of Previous Environmental Investigations, Contaminant Transport and Remediation Options for Perchlorate and Solvent Contamination at the Stringfellow Acid Waste Disposal Pits in Glen Avon, California – Joint Underwriters

Hexavalent Chromium

- Investigation and Remediation of Hexavalent Chrome and TCE Contamination at the Los Angeles Academy (formerly Jefferson) Middle School, Los Angeles – Jefferson Site PRP Group
- Investigation and Remediation of Hexavalent Chromium and TCE Contamination at an Active Plating Facility in West Los Angeles – Confidential Client
- Hydrogeologic Investigation of Hexavalent Chromium Contamination in the Northern Area of the Central Basin in Los Angeles County – Water Replenishment (WRD)
- Investigation of TCE and Hexavalent Chrome Contamination at the Suva School in Montebello, California – Communities for a Better Environment
- Investigation of Fuel Oil LNAPL and Hexavalent Chromium Contamination at a Former Clay Products Manufacturing Facility in Fremont, California – Mission Clay Products
- Investigation and Remediation of Hexavalent Chromium, TCE, and Gasoline LNAPL Contamination at an Active Plating Facility in Santa Fe Springs California – Confidential Client

Other Projects

- Investigation of the Source, Magnitude, Extent and Fate of Polyethylene Nurdle Pollution in and Around Charleston Harbor – Charleston Waterkeeper and South Carolina Coastal Conservation League
- Review and Critique of Proposed Coal Ash Pond Closure at the Tennessee Valley Authority (TVA) Gallatin Power Plant - SELC
- Evaluation of Surface Water and Groundwater Pollution by Boron and Other Metals and Salts Associated with Coal Ash at Georgia Power's Plant Scherer Generating Station - SELC

- Assessment of the Impact of 1,2,3-TCP Contamination from Soil Fumigant Applications on Municipal Water Supplies – City of Arcadia
- Investigation of PCB Contamination at a Former Wastewater Treatment Plant at a Former US Army Camp – City of Riverside
- Investigation of the Fate, Transport, and Persistence of 1,2,3-TCP Contamination of Groundwater and Municipal Water Supply Wells – City of Upland
- Assessment of Sediment, Surface Water, and Groundwater Contamination Associated with Coal Ash at the Belews Creek Coal-Fired Power Plants in North Carolina, and an Evaluation of Closure Options for Coal Ash Basins – NAACP
- Assessment of the Impact of 1,2,3-TCP Contamination from Soil Fumigant Applications on Municipal Water Supplies – Sunny Slope Water Company
- Investigation of Sources and Fate and Transport of 1,2,3-TCP Contamination in Groundwater and its Impact on Potable Water Supply Wells in and around the City of Claremont – Golden State Water Company
- Evaluation of disposal and/or treatment options for produced waters at three active oil fields in Kern County – California Resources Corporation
- Assessment of 1,2,3-TCP Contamination of Groundwater and Potable Water Supply Wells in the Nipomo Area of Central California – Golden State Water Company
- Evaluation of potential water resources impacts from a proposed coal ash landfill located within a flood plain near Laredo Texas – confidential ranch owner
- Investigation of the Fate, Transport, and Persistence of 1,2,3-TCP Contamination of Groundwater and Municipal Water Supply Wells – City of Hemet
- Investigation of elevated concentrations total dissolved solids (TDS) and dissolved metals in surface water and groundwater related to an active lignite mine and coal-fired power plant at a large ranch in southeast Texas – Peeler Ranch
- Assessment of soil, groundwater, and surface water contamination associated with a Former Manufactured Gas Plant (MGP) in South Carolina – Southern Environmental Law Center (SELC)
- Evaluation of Contaminated Groundwater and Surface Waters by 1,4-dioxane, Perfluorinated Compounds [PFCs], and Gen-X at a Chemical Manufacturing Facility in North Carolina – Cape Fear Riverkeeper
- Investigation of 1,2,3-TCP Contamination of Groundwater and Municipal Water Supply Wells – City of Fresno
- Evaluation of Surface Water, Sediment, and Groundwater Contamination and Assessment of Remedial Actions at a Former Manufactured Gas Plant in South Carolina – Confidential Client
- Evaluation of Flow Conditions and Water Quality in Surface Water and Groundwater at an Active Coal-Fired Power Plant in North Carolina, including Three-Dimensional Groundwater Flow and Solute Transport Modeling – Sierra Club

- Assessment of 1,2,3-TCP Contamination of Groundwater Resources and Water Supply Wells in Clovis, California, and Development of Well-head Treatment Programs and Associated Costs - City of Clovis
- Investigation of Surface Water and Groundwater Impacted by Acid Mine Drainage (AMD) from a Former Coal Mine in Alabama, Including Geophysical Mapping, Piezometer Installation, and Soil, Sediment, and Surface Water Sampling – Black Warrior Riverkeeper
- Evaluation of Groundwater and Surface Water Contamination by Coal Combustion Residuals (CCRs) from Ash Ponds at Power Generation Facilities in Eastern Virginia – Sierra Club
- Investigation of 1,2,3-TCP Contamination of Groundwater and Municipal Water Supply Wells – City of Atwater
- Evaluation of Contaminant Sources and Hydrogeologic Pathways for 1,2,3-TCP Contamination of Water Supply Wells - City of Tulare
- Identification of Potential Sources of Nitrate Contamination at a Municipal Water Supply Well – Water Replenishment District of Southern California (WRD)
- Assessment of Sediment, Surface Water, and Groundwater Contamination Associated with Coal Ash at Two Coal-Fired Power Plants in North Carolina, and an Evaluation of Closure Options for Coal Ash Basins – Roanoke River Basin Association
- Assessment of the Volume and Quality of Storm Water and Shallow Groundwater (from Dewatering) at a Large Condominium Complex, as part of a City's MS-4 Storm Water Permitting – Coronado
- Investigation of Nitrate Contamination of Groundwater Resources and Water Supply Wells in Delano, California, and Development of Well-head Treatment Programs and Associated Costs - City of Delano
- Evaluation of Contaminant Conditions and Closure Plans for Coal Ash Basins at Two Coal-Fired Power Plants in Virginia – Sierra Club
- Evaluation of Groundwater and Surface Water Contamination by CCRs from Ash Ponds at a Former Power Generation Facility in Central Virginia – Sierra Club and Potomac Riverkeeper
- Negotiation of Private Agreements Between Water Utilities and RPs – City of Santa Monica, STPUD, City of Morro Bay, SGVWC, GOWC, City of Oxnard, OCDA
- Evaluation of Power Plant Intake and Outfall Structures on Fecal Coliform Plume Dynamics and Resulting Beach Closures, Huntington Beach, California – California Energy Commission
- Investigation of Bacteria and Fecal Contamination in Groundwater Beneath the Downtown Area of Huntington Beach, California – City of Huntington Beach
- Investigation of the Source(s) and Transport of Enterococcus and Fecal Bacteria to the Near Shore Waters of Huntington Beach, California – City of Huntington Beach, County of Orange, Orange County Sanitation District (OCSD)
- Characterization and Remediation, Former Town Gas Sites - British Gas Properties, U.K.
- Aquifer Characterization, Contaminant Assessment, Slurry Wall Design and Installation, Soil Excavation and Water Treatment System Design - Port of Los Angeles, California

Professional History

aquilogic, Inc., CEO and Principal Hydrologist, 2011 to present.

exp, Executive Vice-President, Chief Business Development Officer, 2010 to 2011

WorleyParsons, Senior VP, Strategy & Development, 2006 to 2010.

Komex Environmental Ltd., Chief Executive Officer, Principal Shareholder, Director, 1999 to 2005.

Komex•H2O Science•Inc., President and Principal Hydrologist, 1992 to 1999.

Remedial Action Corporation, Project Manager and Geohydrologist, 1989 to 1992.

Lanco Engineering, Project Manager, 1985 to 1987, and 1988.

Royal Geographical Society, Kosi Hills Resource Conservation Project, Nepal: Project Director, 1983 to 1985

Teaching

Anthony has recently taught the following classes:

- Environmental Aspects of Soil Engineering and Geology - a ten-week course at the University of California, Irvine
- Site Characterization and Remediation of Environmental Pollutants - two lectures as part of the course at Imperial College London
- Methyl Tertiary Butyl Ether: Implications for European Groundwater - a one day seminar for the UK Environment Agency (UKEA)
- Successful Remediation Strategies – a two-day course for the NGWA
- Understanding Environmental Contamination in Real Estate, and one day class for the International Right-of-Way Association (IRWA)
- Project Development and the Environmental Process, a one-day class for the IRWA
- Environmental Awareness, a one-day class for the IRWA
- Regional Fuels Management Workshop, a two-day workshop for the USEPA.

Publications

In addition to his teaching experience, Anthony has prepared over 1000 written project reports, and has written, presented and published many articles regarding the following:

- The implementation of the SGMA in California
- Groundwater law in California
- The development of alternate water supplies, notably brackish groundwater
- Aquifer storage and recovery and other groundwater augmentation actions
- The Clean Water Act and groundwater contamination
- Contamination of groundwater and drinking water supplies by fuel oxygenates, chlorinated solvents, rocket propellants, PFCs, and metals
- Contaminant fate and transport in fractured or heterogeneous media
- The impact of oil field activities on the environment

- Source water assessment and protection
- Public health and toxicology
- Risk analysis and assessment
- Environmental economics
- General water resources and environmental issues

The following is a list of publications and presentations:

Brown, A., 2021. Science in the Court Room: Expert Witness Testimony in Contamination Cases. American Groundwater Trust California PFAS Webinar, March 2021.

Brown, A., 2021. Sources of 1,2,3-TCP and its Persistence in California Groundwater. American Groundwater Trust 1,2,3-TCP Webinar, February 2021.

Brown, A., 2020. Groundwater and the Clean Water Act. American Groundwater Trust California Groundwater Conference, Ontario, February 2020.

Brown, A., and T. Watson, 2020. Produced Water – A New California Resource. Produced Water Society Annual Seminar, Houston, February 2020.

Brown, A., 2019. Perspectives on the Future of the Water Business. Environmental Business International, Industry Summit, San Diego, March 2019.

Brown, A., 2019. Paso Robles – The First Jury Trial over Water Rights in California. American Groundwater Trust California Groundwater Conference, Ontario, February 2019.

Brown, A., 2018. Emerging Contaminants – Where Do They Come From? American Groundwater Trust Conference on Emerging Contaminants, Chino Basin, March 2018.

Brown, A., 2017. Contaminated Groundwater as a Resource. State Bar of California Environmental Law Conference, Yosemite, October 2017.

Stone A. and A. **Brown**, 2017 (organizers). Groundwater Law – An American Groundwater Trust Conference. UC Hastings Law School, San Francisco, May 18, 2017

Brown, A. 2016. The SGMA Cookbook – Implementing the Sustainable Groundwater Management Act. Association of California Water Agencies (ACWA), Spring Conference, Monterey, CA, April 2016.

Stone A. and A. **Brown**, 2016 (organizers). Groundwater Law – An American Groundwater Trust Conference. Loyola Law School, Los Angeles, April 26, 2016

Stone A. and A. **Brown**, 2015 (organizers). Groundwater Law – An American Groundwater Trust Conference. Doubletree San Francisco Airport, May 15, 2015

Brown, A., 2015. Challenges Implementing the California Sustainable Groundwater Management Act (SGMA). Bar Association of San Diego County, May 5, 2015.

Brown, A., 2015. Technical and Other Issues Implementing the California Sustainable Groundwater Management Act (SGMA). Ventura Association of Water Agencies, March 19, 2015.

Brown, A., 2015. Outlook for Environmental Services in the Global Energy and Resources Sectors. Environmental Business Journal, Environmental Industry Summit, San Diego, March 11-13, 2015.

Brown, A., 2015. The Effect of $50 Oil on the Environmental Services Sector. Environmental Business Journal Conference, San Diego, March 11-13, 2015.

Brown, A. 2014. Hydrology and the Law: The Role of Science in the Resolution of Legal Issues for Water Quality and Damages Issues. Law Seminars International, Santa Monica, CA. October 2014

Stone A. and A. **Brown**, 2014 (organizers). Groundwater Law – An American Groundwater Trust Conference. Marriott Marina del Rey, May 20-21, 2014

Brown, A. 2014. Environmental Issues with Hydraulic Fracturing. Los Angeles County Bar Association (LACBA), Spring Symposium, Los Angeles, CA. April 2014.

Brown, A. 2014. Environmental Services in the Global Energy & Resources Sectors. Environmental Business Journal, Environmental Industry Summit, San Diego, March 2014.

Brown, A. 2013. Dealing with Emerging Groundwater Contaminants. Association of California Water Agencies (ACWA), Fall Conference, Los Angeles, November 2013.

Brown, A., 2013. Outlook for Environmental Services in the Global Energy and Resources Sectors. Environmental Business Journal, Environmental Industry Summit, San Diego, March 2013.

Brown, A., Colopy, J, and Johnson, T, 2007. Groundwater Science in the Courtroom: Observations from the Expert Witness Chair. Groundwater Resource Association of California (GRAC), Groundwater Law Conference, San Francisco, June 2007.

Brown, A. 2005. Emerging Water Contaminants. California Special Districts Association (CSDA), Annual Conference, Palm Springs, May 2005.

Brown, A. 2005. The Interplay of Science and Policy at Contaminated Sites. Los Angeles County Bar Association (LACBA), Spring Symposium, Los Angeles, CA. April 2005.

Brown, A., M. Trudell, G. Steensma, and J. Dottridge, 2005. European Experiences with Artificial Aquifer Recharge. Groundwater Resource Association of California (GRAC), Aquifer Storage Conference, Sacramento, March 2005.

Brown, A. 2004. Viagra, Estrogen, Prozac, and Other Emerging Contaminants: have you checked your groundwater lately? American Groundwater Trust (AGWT), Legal Issues Conference, Los Angeles, November 2004.

Brown, A. 2004. The Use of Groundwater Models in Complex Litigation. American Groundwater Trust (AGWT), Groundwater Models in the Courtroom Symposium, May 2004.

Brown, A. 2004. Emerging Groundwater Contaminants: MTBE as a Case Study. Association of California Water Agencies (ACWA), Spring Conference, Los Angeles, May 2004.

Rohrer, J., A. **Brown**, S. Ross, 2004. MTBE and Perchlorate, Lessons Learned from Recent Groundwater Contaminants. California Special Districts Association (CSDA), Annual Conference, Palm Springs, May 2004.

Hagemann, M., A. **Brown**, and J. Klein, 2002. An Estimate of Costs to Address MTBE Releases from Underground Storage Tanks and to Treat Drinking Water Supplies Impacted by MTBE. NGWA, Conference on MTBE: Assessment, Remediation, and Public Policy, Orange, CA. June 2002

Hagemann, M., A. **Brown**, and J. Klein, 2002. From Tank to Tap: A Chronology of MTBE in Groundwater. NGWA, Conference on Litigation Ethics, and Public Awareness, Washington, D.C., August 2002

Major, W., A. **Brown**, S. Roberts, L. Paprocki, and A. Jones, 2001. The Effects of Leaking Sanitary Sewer Infrastructure on Groundwater and Near Shore Ocean Water Quality in Huntington Beach, California. California Shore and Beach Preservation Association and California Coastal Coalition – Restoring the Beach: Science, Policy and Funding Conference. San Diego, California, November 8-10, 2001.

Ross, S.D., A. Gray, and A. **Brown,** 2001. Remediation of Ether Oxygenates at Drinking Water Supplies and Release Sites. Can-Am 6th Annual Conference of National Groundwater Association Banff, Alberta, Canada. July 2001.

Gray, A.L. and A. **Brown**, 2000. The Fate, Transport, and Remediation of Tertiary-Butyl-Alcohol (TBA) in Ground Water. Proceedings of the NGWA/API 2000 Petroleum Hydrocarbons and Organic Chemicals in Groundwater: Prevention, Detection, and Remediation. Anaheim, November 14-17, 2000.

Hardisty, P.E., J. Dottridge and A. **Brown**, 2000. MTBE in Ground Water in the United Kingdom and Europe. Proceedings of the NGWA/API 2000 Petroleum Hydrocarbons and Organic Chemicals in Groundwater: Prevention, Detection, and Remediation. Anaheim, November 14-17, 2000.

Brown, A., B. Eisen, W. Major, and A. Zawadzki, 2000. Geophysical, Hydrogeological and Sediment Investigations of Bacterial Contamination in Huntington Beach, California. California Shore and Beach Preservation Association – Preserving Coastal Environments Conference. Monterey, California, November 2-4, 2000.

Hardisty, P.E., G.M. Hall, A. **Brown** and H.S. Wheater, 2000. Natural Attenuation of MTBE in Fractured Media. 2nd National Conference on Natural Attenuation in Contaminated Land and Groundwater. Sheffield, U.K., June 2000.

Brown, A., 2000. Treatment of Drinking Water Impacted with MTBE. Mealey's MTBE Conference. Marina del Rey, California. May 11-12, 2000.

Brown, A., 2000. Other Fuel Oxygenates in Groundwater. Mealey's MTBE Conference. Marina del Rey, California. May 11-12, 2000.

Brown, A., 2000. The Fate, Transport and Remediation of TBA in Groundwater. Mealey's MTBE Conference. Marina del Rey, California. May 11-12, 2000.

Brown, A., 2000. MTBE Contamination of the City of Santa Monica Water Supply: Recap. Mealey's MTBE Conference. Marina del Rey, California. May 11-12, 2000.

Mooder, R.B., M.D. Trudell, and A. **Brown**, 2000. A Theoretical Analysis of MTBE Leaching from Reformulated Gasoline in Contact with Groundwater. American Chemical Society, Div. of Environmental Chemistry, 219th ACS National Meeting. San Francisco, March 26-30, 2000.

Trudell, M.R., K.D. Mitchell, R.B. Mooder, and A. **Brown**, 2000. Modeling MTBE Transport for Evaluation of Migration Pathways in Groundwater. American Chemical Society, Div. of Environmental Chemistry, 219th ACS National Meeting. San Francisco, March 26-30, 2000.

Brown, A., 1999. How LUST Policy Led to the Current MTBE Problem. Submitted for the Government Conference on the Environment. Anaheim, CA. August 1999.

Trudell, M.R., K.D. Mitchell, R.B. Mooder and, A. **Brown**, 1999. Modeling MTBE transport for evaluation of migration pathway scenarios. In proceedings, 6th International Petroleum Environmental Conference, Houston TX, November 16-19, 1999. Integrated Petroleum Environmental Consortium, University of Tulsa, OK.

Gray, A.L., A. **Brown**, R.A. Rodriguez, 1999. Treatment of a Groundwater Impacted with MTBE By-Products**.** In proceedings, 6th International Petroleum Environmental Conference, Houston TX, November 16-19, 1999. Integrated Petroleum Environmental Consortium, University of Tulsa, OK.

Gray, A.L., A. **Brown**, M.M. Nainan, and R.A. Rodriguez, 1999. Restoring a Public Drinking Water Supply Contaminated with MTBE. In proceedings, 6th International Petroleum Environmental Conference, Houston TX, November 16-19, 1999. Integrated Petroleum Environmental Consortium, University of Tulsa, OK.

Ausburn M.P., A. **Brown**, D. A. Reid, and S.D. Ross, 1999. Environmental Aspects of Crude Oil Releases to the Subsurface. In proceedings, 6th International Petroleum Environmental Conference, Houston TX, November 16-19, 1999. Integrated Petroleum Environmental Consortium, University of Tulsa, OK.

Hardisty, P.E., A. **Brown**, and H. Wheater, 1999. Using Economic Analysis to Support Remedial Goal Setting and Remediation Technology Selection. In proceedings, 6th International Petroleum Environmental Conference, Houston TX, November 16-19, 1999. Integrated Petroleum Environmental Consortium, University of Tulsa, OK.

Brown, A., and J.J. Clark, 1999. MTBE: Air Today, Gone Tomorrow! California Environmental Law and Remediation Reporter. Argent Communications Group. Foresthill, CA. Volume 9 (2): pp 21 - 30.

Brown, A., P.E. Hardisty, and H. Wheater, 1999. The Impact of Fuel Oxygenates on Water Resources. A one-day course for the UK Environment Agency. London, UK. June 1999

Brown, A., K.D. Mitchell, C. Mendoza and M.R. Trudell, 1999. Modeling MTBE transport and remediation strategies for contaminated municipal wells. Battelle In-Situ and On-Site Bioremediation, Fifth International Symposium, San Diego, CA. April 19-22, 1999.

Brown, A., 1999. LUST Policy and Its Part in the MTBE Problem. USEPA National Underground Storage Tank Conference. Daytona Beach, FL. March 15-17, 1999.

Brown, A., T.E. Browne, and R.A. Rodriguez, 1999. Restoration Program for MTBE Contamination of the City of Santa Monica Arcadia Well Field. Ninth Annual Conference on Soil and Groundwater Contamination, Oxnard, CA. March 1999.

Brown, A., 1999. Moderator of a Panel Session - Judging Oil Spill Response Performance: The Challenge of Competing Perspectives. International Oil Spill Conference. Seattle, WA. March 8-11, 1999.

Brown, A., 1999. MTBE: Asleep at the Wheel! Editorial in the Newsletter of the Los Angeles County Bar Association, Environmental Section. February 1999.

Brown, A., J.S. Devinny, T.E. Browne and R.A. Rodriguez, 1998. Restoration of a Public Drinking Water Supply Impacted by Methyl *tertiary* Butyl Ether (MTBE) Contamination. Proceedings of the NGWA/API 1998 Petroleum Hydrocarbons and Organic Chemicals in Groundwater: Prevention, Detection, and Remediation, November 11-13, 1998, Houston, TX.

Brown, A., 1998. Petroleum and the Environment: A Consultants Perspective. USEPA Regional Fuels Management Workshop, November 3-4, 1998, Shell Beach, CA.

Brown, A., 1998. How Much Does Remediation Really Cost? Presented at the Southern California Chapter of the Appraisal Institute, Summer Seminar Spectacular: Damages, Diminution and Mitigation. Anaheim, California, August 13, 1998.

Brown, A., J.S. Devinny, A.L. Gray and R.A. Rodriguez, 1998. A Review of Potential Technologies for the Remediation of Methyl *tertiary* Butyl Ether (MTBE) In Groundwater. International Petroleum and the Environment Conference, Albuquerque, NM. October 1998.

Brown, A., A.L. Gray, and T.E. Browne, 1998. Remediation of MTBE at Leaking Underground Storage Tank (LUST) Sites. The UST Clean-up Fund Conference, Austin, TX. June 22, 1998.

Brown, A., J.R.C. Farrow, R.A. Rodriguez, and B.J. Johnson, 1998. Methyl *tertiary* Butyl Ether (MTBE) Contamination of the City of Santa Monica Drinking Water Supply: An Update. Proceedings of the National Ground Water Association (NGWA) Southwest Focused Conference: MTBE and Perchlorate, June 3-5, 1998, Anaheim, California.

Patterson, G, B. Groveman, J. Lawrence, and **A. Brown**, 1998. The Legal Implications, Claims, and Courses of Action for Water Purveyors Impacted by MTBE and Perchlorate. Proceedings of the NGWA Southwest Focused Ground Water Conference: Discussing the Issue of MTBE and Perchlorate in Ground Water. June 3-4, 1998, Anaheim, California.

Clark, J.J., **A. Brown**, and R.A. Rodriguez, 1998. The Public Health Implications of MTBE and Perchlorate in Water: Risk Management Decisions for Water Purveyors. Proceedings of the NGWA Southwest Focused Ground Water Conference: Discussing the Issue of MTBE and Perchlorate in Ground Water. June 3-4, 1998, Anaheim, California.

Brown, A., J.S. Devinny, M.K. Davis, T.E. Browne, and R.A. Rodriguez, 1997. A Review of Potential Technologies for the Treatment of Methyl *tertiary* Butyl Ether (MTBE) in Drinking Water. Proceedings of the NGWA/API 1997 Petroleum Hydrocarbons and Organic Chemicals in Groundwater: Prevention, Detection, and Remediation, November 12-14, 1997, Houston, TX.

Brown, A., J.R.C. Farrow, R.A. Rodriguez, B.J. Johnson and A.J. Bellomo, 1997. Methyl *tertiary* Butyl Ether (MTBE) Contamination of the City of Santa Monica Drinking Water Supply.

Proceedings of the National Groundwater (NGWA) and American Petroleum Institute (API) 1997 Petroleum Hydrocarbons and Organic Chemicals in Groundwater: Prevention, Detection, and Remediation, November 12-14, 1996, Houston, Texas.

Brown, A., J.S. Devinny, M.K. Davis, T.E. Browne, and R.A. Rodriguez, 1997. A Review of Treatment Technologies for Methyl *tertiary* Butyl Ether (MTBE) in Drinking Water. Proceedings of the American Chemical Society (ACS) Conference on Chemistry and Spectroscopy, October 1997, Irvine, California.

Brown, A., J.S. Devinny, T.E. Browne and D. Chitwood, 1997. A Review of Alternative Technologies for the Removal of MTBE from Drinking Water. Association of California Water Agencies (ACWA) Workshop on MTBE, March 13, 1997, Ontario Airport Hilton, California.

Brown, A., 1997. Methyl tertiary Butyl Ether (MTBE) in Groundwater and its Impact on the City of Santa Monica Drinking Water Supply. California Groundwater Resource Association (GRA), January 22, 1997, Wyndham Garden Hotel, Costa Mesa, California.

Gray, A.L., **A. Brown**, B.J. Moore, and T.E. Browne, 1996. Respiration Testing for Bioventing and Biosparging Remediation of Petroleum Contaminated Soil and Groundwater. NGWA Outdoor Action Conference, Las Vegas, NV, May 1996.

Brown, A., and P.E. Hardisty, 1996. Use of Technical and Economic Analyses for Optimizing Technology Selection and Remedial Design: Examples from Hydrocarbon Contaminated Sites. Sixth West Coast Conference on Contaminated Soils and Groundwater, AEHS, March 1996.

Farrow, J.R.C., **A. Brown**, W. Burgess, R.E. Payne, 1995. High Vacuum Soil Vapor Extraction as a Means of Enhancing Contaminant Mass Recovery from Groundwater Zones of Low Transmissivity. Accepted for Proceedings of the Petroleum Hydrocarbons and Organic Chemicals in Groundwater, API/NGWA Conference. Houston, TX. November 1995.

Ausburn, M.P., **A. Brown**, M. Brewster, and P. Caloz, 1995. Use of Borehole Terrain Conductivity Logging to Delineate Multiple Ground Water Bearing Zones and Map Alluvial Fan Facies. California Groundwater Resource Association (GRA), Annual Conference, November 1995, Costa Mesa, California.

Hardisty, P.E., S.D. Ross, F.B. Claridge and **A. Brown**, 1995. Technical and Economic Analysis of Remedial Techniques for LNAPL in Fractured Rock. International Association of Hydrogeologists (IAH), October 1995, Solutions 95 Conference, Calgary, Canada.

Croft, R.G., **A. Brown**, P. Johnson, and J. Armstrong, 1994. Tracer Gas Use in Soil Vapor Extraction and Air Sparge Pilot Tests: Case Studies. HMRCI Superfund XV Conf. Proceedings, Washington D.C, November 1994.

Bauman, P.B., M. Brewster and **A. Brown**, 1994. Borehole Logging as an Aid to Hydrogeologic Characterization of Leaking Underground Storage Tank (LUST) Sites. Proceedings from the National Groundwater Association (NGWA), 8th National Outdoor Action Conference and Exposition, Minneapolis, Minnesota. May 1994.

Bauman, P.B., **A. Brown,** M. Brewster, and M. Lockhart, 1994. The use of Borehole Geophysics in the Characterization of Both Vadose and Saturated Zone Lithologies at LUST Sites.

Proceedings from the USEPA Technology Transfer at LUST Sites Conference, Urbana, Illinois. May 1994.

Bauman, P.B., J. Sallomy, **A. Brown** and M. Brewster, 1994. Unconventional Applications of Terrain Conductivity Logging to Groundwater Investigations. Proceedings of the Symposium on the Application of Geophysics at Environmental and Engineering Projects (SAGEEP), Boston, Massachusetts, 1994.

Brown, A., R.E. Payne, and P. Perlwitz, 1993. Air Sparge Pilot Testing at a Site Contaminated with Gasoline. Proceedings of the Petroleum Hydrocarbons and Organic Chemicals in Groundwater: Prevention, Detection, and Restoration. API/NGWA Conference, Houston, Texas. November 1993.

Brown, A., 1991. Air Permeability Testing for Vapor Extraction. Conference Proceedings; Petroleum Hydrocarbon Contaminated Soil, San Diego, California. March 1991.

Wheater, H., B. Beck, **A. Brown,** and S. Langan, 1991. The Hydrological Response of the Allt a' Mharcaidh Catchment, Inferences from Experimental Plots. Journal of Hydrology, Vol. 123; pp 163-1990.

Brown, A., 1986. The Final Report of the Kosi Hills Resource Conservation Project, Nepal 1984. Royal Geographical Society Student Expedition.

aquilogic, Inc.
environment • water • strategy

245 Fischer Avenue, Suite D-2
Costa Mesa, CA 92626, USA
Tel. +1.714.770.8040
Web: www.aquilogic.com

CURRICULUM VITAE

October 2021

Robert H. Abrams, PhD, PG, CHg

Principal Hydrogeologist

mobile: +1.650.743.0594
email: bob.abrams@aquilogic.com

Disciplines

Hydrogeology, Water Resources, Geology, Geostatistics, Analytical and Numerical Modeling, Water Quality, Groundwater and Vadose Zone Fluid Flow, Contaminant Fate and Transport.

Education

Ph.D. Hydrogeology, Stanford University, 1999
M.S. Hydrogeology, Stanford University, 1996
B.S. Geology, San Francisco University, 1991

Professional Registrations

Professional Geologist, CA (No. 8703)
Certified Hydrogeologist, CA (No. 931)
Licensed Geologist, North Carolina (No. 2639)

Professional Experience

Bob has over 20 years of professional experience in groundwater resource development, groundwater sustainability, groundwater banking, groundwater quality, and model design and evaluation. He has worked for the California Geological Survey, the U.S. Geological Survey, Stanford University, San Francisco State University, consulting firms, and as an independent consultant for public and private clients. Recent projects have included vadose zone characterization and modeling, evaluation of subsidence investigations, developing and reviewing integrated groundwater/surface water hydrologic models that include simulation of current and future land-use-based water demand and the impact of climate change, and preparation of Groundwater Sustainability Plans.

Project Experience

Summary of California Central Coast Projects

- Currently serving on the Seawater Intrusion Working Group (SWIG) and SWIG Technical Advisory Committee (TAC). Theses groups are tasked with evaluating and recommending

approaches for mitigating seawater intrusion in the 180/400-Foot Aquifer Subbasin – *Salinas Basin Groundwater Sustainability Agency, Carmel Valley, California, representing the Salinas Basin Water Alliance*.

- Currently serving on a Drought Technical Advisory Committee (TAC) charged with developing standards and guiding principles for determining release schedules and operations of Nacimiento and San Antonio reservoirs during multiyear droughts. The TAC is also charged with developing the release schedules during such droughts – *Monterey County Water Resources Agency, Salinas, California, representing Grower-Shipper Association of Central California.*
- Invited to participate in the Deep Aquifer Roundtable, a formal meeting attended by Salinas Valley hydrogeology experts to discuss approaches to monitoring and protecting the deepest portions of the Salinas Valley aquifer system – *Monterey County Water Resources Agency, Salinas, California*.
- Served on the Technical Advisory Committee for the development of the Salinas Valley Integrated Hydrologic Model, a new MODFLOW model constructed by Monterey County and the U.S. Geological Survey – *Monterey County Water Resources Agency, Salinas, California representing Grower-Shipper Association of Central California*.
- Well efficiency test results for multiple years and multiple wells were evaluated for a Salinas Valley grower and food processor. Quantitative and statistical analyses were used to assess well performance and make recommendations for potential well maintenance and repair activities – *Nunes Vegetables, Salinas, California*.
- The factors influencing nitrate concentrations in well-water from approximately 60 wells on 40 ranches were determined and an enhanced groundwater monitoring program was developed. Diverse and complex data sets were analyzed statistically and qualitatively to understand the geologic, hydrologic, and anthropogenic factors that variably influence well-water concentrations over short- and long-term timeframes. Specific recommendations for wellhead protection were also developed – *Costa Farms, Analysis of Observed Nitrate Concentration Trends in Irrigation Wells, Soledad, California*.
- Published reports and data from international and national seawater intrusion mitigation efforts were reviewed and analyzed. The analysis was to assess the feasibility, level of effort required, volumes of water necessary, and costs of implementation in the Salinas Valley of a seawater intrusion injection barrier using recycled water. Ongoing injection barrier projects in Orange County and L.A. County were selected for in-depth review to evaluate the feasibility of a similar project in Monterey County – *Tanimura & Antle, Salinas, California*.
- Publicly available groundwater quality data from a set of regularly sampled water-supply wells were evaluated statistically to develop an alternative to installation of new monitoring wells for a land application area that received wastewater from a food processing plant. The effort was driven by a Central Coast Regional Water Quality Control Board order requiring client to participate in the General Waste Discharge Requirements (WDRs) for Fruit and Vegetable

Processors, which has stricter monitoring requirements than the previous individual WDRs – *Dole Fresh Vegetables, Salinas, California*.

- Evaluated (with SEAWAT) the degree to which irrigation wells were drawing seawater inland and if groundwater withdrawals contributed to anoxic conditions in certain reaches of a river hydraulically connected to the aquifer – *El Sur Ranch, Seawater Intrusion and Impact of Irrigation Wells, Monterey County, California*.
- Monte Carlo hydraulic gradient analysis and stochastic 1D and 2D solute transport simulations (analytical solutions) were conducted based on regional groundwater maps and 13 years of monthly groundwater levels from dozens of production wells to determine the most likely MTBE source areas. A customized GIS framework was developed to evaluate source-area probability. Accepted by the Central Coast Regional Water Quality Control Board – *Monterey County Water Resources Agency, Salinas MTBE Investigation, Salinas, California.*
- Conducted a technical evaluation and provided detailed comments regarding the hydrologic analysis undertaken for the draft environmental impact report/environmental impact statement for the proposed Monterey Peninsula Water Supply Project (MPWSP) - *Third-Party Evaluation of Hydrologic Analysis Conducted for Monterey Peninsula Water Supply Project, City of Marina, California*.

Summary of Selected Recent Projects

- Designed and wrote custom computer programs to construct and test a facsimile of the USGS Central Valley Hydrologic Model (CVHM) that runs in Groundwater Vistas (GV), a graphical user interface. The computer programs generated input data for the facsimile model from CVHM MODFLOW packages that are not supported by GV. The facsimile model produces results that are nearly identical to CVHM – *Confidential Client*.
- Combined vadose-zone flow and transport modeling, groundwater flow modeling, and particle-tracking simulations to estimate the persistence of dissolved 1,2,3-trichloropropane in the subsurface. Multiple application areas were characterized using lithologic logs and water flux out of the root zone taken from C2VSimFG Beta. Custom computer programs were written to determine arrival time at a declining water table. MODFLOW and MODPATH were used to estimate travel time from the water table to receptor water-supply wells. Four regions in California (one in Central Valley, three in Southern California) were successfully analyzed with this methodology (settlements and jury awards). For the Central Valley region, the CVHM facsimile model (described above) was used – *Confidential Clients*.
- Co-wrote the Chapter Groundwater Sustainability Plan for the Westside Water Authority in Kern County. Extremely sparse data and modeling results from C2VSimFG-Kern were used to estimate current and future water budgets and groundwater availability – *Westside Water Authority*.

- Conducted environmental impact assessment simulations using the CVHM facsimile model described above to evaluate drawdown and subsidence caused by a proposed brackish groundwater water treatment project in Kern County – *Westside Water Authority*.
- Critically evaluated subsidence estimates along the Tule Subbasin portion of the Friant-Kern Canal (FKC) by reviewing historical USGS reports, InSAR data, geomechanical modeling, and the Tule Subbasin Groundwater Flow Model. This evaluation indicated that responsibility for FKC subsidence should be shared across the subbasin and not focused primarily on the Eastern Tule Groundwater Sustainability Agency – *Confidential Client*.
- Critically evaluated groundwater flow and solute transport models for three coal ash disposal sites in North Carolina. Primary questions included if the models simulated flow and transport properly and sufficiently to allow the sites' owner to claim no offsite groundwater quality impacts above water quality standards – *Southern Environmental Law Center*.
- Developed a new IWFM groundwater-surface water model, based on the Central-Valley-wide C2VSim model, for Stanislaus County to assess impacts in terms of foreseeable land-use changes and installation of new wells – *Stanislaus County, Regional Groundwater-Surface Water Model for PEIR, Modesto, California.*
- Assist Stanislaus County with evaluation of new major well permit applications based on a then-recently passed groundwater ordinance requiring evaluation under CEQA for potential pumping-induced impacts to the groundwater basin, such as lowered water levels in existing wells, land subsidence, and significant groundwater or surface water depletion – *Stanislaus County, Well Permit CEQA Analysis, Modesto, California*.

Summary of Other Selected Water Supply Projects

- Two local-scale groundwater flow (MODFLOW) and solute transport models (MT3DMS) were developed for two sub-regions of the USGS regional Antelope Valley MODFLOW model to evaluate the performance of a new groundwater bank. Updated geologic characterization was based on recent investigations by the USGS and sparse well logs. Groundwater bank performance was evaluated with respect to water quantity and quality for various operational strategies, including well placement and infiltration schedules – *Antelope Valley-East Kern Water Agency (AVEK), Groundwater Banking and Blending Study, Palmdale, California.*
- Developed and calibrated three-dimensional, groundwater flow (MODFLOW) and solute transport models (MT3DMS) to assess water sources for a new 20 MGD water treatment plant. A detailed geologic model was developed for this project to assess the extent of the deep target aquifer, evaluate the risk from a heavy industrial area, well locations, long-term performance, define the wellhead protection area, and optimize wellfield performance – *City of Longview, Design and Construction of a New Groundwater Source and Treatment Facility, Longview, Washington.*
- Pilot study to evaluate the feasibility of compressed air energy storage of renewable energy. Developed and implemented three-dimensional groundwater flow models (MODFLOW) to

evaluate the impact on nearby wells of compressed air injection into a depleted natural-gas reservoir – *Pacific Gas and Electric (subcontractor to Jacobson James and Associates), Compressed Air Energy Storage Pilot Project, San Joaquin County, California.*

- Developed hydrostratigraphic model of the Mesquite Lake groundwater subbasin as interpreted from existing well logs and USGS studies that had been performed to the west and north. The hydrostratigraphic model was used as input to a three-dimensional, transient groundwater flow model (MODFLOW) that assessed the volume of water available for a new municipal water treatment plant – *Twentynine Palms Water District, Groundwater Study for the Mesquite Lake Subbasin, Twentynine Palms, California.*
- Developed a calibrated two-dimensional, steady-state analytical groundwater flow model for the Rialto-Colton Basin. The calibrated model was used to delineate source areas for two impacted production wells for a CDPH 97-005 permit application – *West Valley Water District, Wellhead Treatment Project, Rialto, California.*
- Analyzed the results of aquifer tests of multiple water supply wells completed in a fractured-rock aquifer – *Lake Don Pedro Community Services District, California (subcontractor to SGI The Source Group)*.
- Analyzed the results of a complex aquifer-test dataset to determine aquifer properties and assess groundwater availability. Characterized groundwater quality and assessed regional impact of developing a new water supply – *Silver Oak Cellars (subcontractor to Taber Consultants), Aquifer Test Analysis and Groundwater Availability Study, Sonoma County, California.*
- A well and a spring were evaluated in terms of water quality, influence of surface water, source area, and zone of influence for a license application to operate a new private water supply – *Buster's on the Mountain (subcontractor to Taber Consultants), Hydrogeology Report for New Private Water Supply, Napa County, California*.
- Groundwater flow modeling, aquifer test results, and qualitative hydrogeological analyses were reviewed and critiqued for accuracy and completeness to assess the feasibility of a gravel mining operation adjacent to the upper reaches of a major river in Los Angeles and Ventura counties. The assessment formed the basis for communications with the State Water Resources Control Board regarding appropriative water rights. In the second phase of the project, a new MODFLOW model was developed to assess groundwater-surface water interactions – *Confidential Client (subcontractor to Todd Engineers), Groundwater Pumping Impacts on Streamflow, Los Angeles County, California.*
- Developed complex geologic model in the fold-thrust terrane of the Las Posas Basin in eastern Ventura County. The geologic model formed the foundation for preliminary wellfield design and estimation of available groundwater for desalter operations in a strictly managed aquifer – *Calleguas Municipal Water District, Somis Desalter Feasibility Study, Las Posas Basin, Ventura County, California*.

- Evaluated geologic, hydrologic, and hydrogeologic data to assess the suitability for establishing a groundwater banking operation. Provided recommendations on further field-based and modeling studies deemed necessary to address data and knowledge gaps – *Los Angeles Department of Water and Power, Evaluation of Proposed Water Storage/Transfer Potential in Fremont Valley Basin, Fremont Valley, California.*
- Evaluated the groundwater component of an existing water-budget model. Implemented changes to include the effects on water levels from climate and distant municipal pumping in deeper parts of the aquifer. The improvements facilitated the development and simulation of future "what-if" scenarios used to design an engineered wetland that used stormwater runoff and groundwater pumping to maintain lake levels – *San Francisco Public Utilities Commission, Lake Merced Water-Budget Model, San Francisco, California.*

Summary of Other Selected Water Quality Projects

- Developed three-dimensional, variably saturated flow and reactive transport models (MODFLOW-SURFACT) to assess the groundwater impact from arsenic and boron in recharged partially treated oilfield produced water. Transport through the unsaturated and saturated zones related to groundwater banking operations were simulated. Regulatory approval was granted by the Central Valley Regional Water Quality Control Board – *Cawelo Water District, Groundwater Banking Waste Discharge Requirements Support, Central Valley, California*.
- A calibrated transient three-dimensional model (MODFLOW and MT3DMS) of groundwater flow and solute transport was developed, calibrated, evaluated, to compare estimated timeframes to achieve RAOs for three alternatives. Site data were used to characterize the subsurface and estimate land application rates and water quality of applied water. Regulatory approval was granted by the Central Valley Regional Water Quality Control Board – *Hilmar Cheese Company, Groundwater Modeling for Cleanup and Abatement Order, Central Valley, California.*
- The results of two modeling efforts were reviewed to reassess contributions from responsible parties. A new metric, the Responsibility Factor (RF), was developed and applied to existing input data. The RFs were used to estimate relative contributions to the MEW Superfund site regional plume from several responsible parties – *Confidential Client (subcontractor to Montclair Environmental Management), Reassessment of Contributions to the MEW Superfund Site Regional Plume, Santa Clara County, California.*
- Mass flux calculations for TCE and PCE were conducted on behalf of a multi-PRP group. Calculations of mass flux through time were compared upgradient and downgradient of several sites within the Omega Superfund site regional plume to estimate the contribution from each individual site. These calculations were used as part of the basis for cost allocation among PRPs – *Confidential Client, Mass Flux Calculations for Cost Allocation, Omega Superfund Site, Santa Fe Springs, California.*
- A three-dimensional model (MODLFOW-SURFACT) of unsaturated zone and saturated zone flow and solute transport was developed and calibrated based on sparse discharge records

and well observations to assess the fate of a legacy of contaminated soil water being mobilized by increased discharge to the subsurface. The modeling was an integral part of a report of waste discharge and request for waste discharge requirements from the Central Valley Regional Water Quality Control Board – *California Dairies, Incorporated, Report of Waste Discharge, Central Valley, California.*

- A transient groundwater flow model (MODFLOW) was conceptualized, implemented, and calibrated for a major oil refinery. Linear programming was used to quantitatively minimize groundwater pumping and qualitatively optimize well placement for containment of subsurface LNAPL and BTEX-contaminated groundwater. Multiple capture zones of various sizes were analyzed for control of LNAPL hotspots and site-wide containment scenarios – *Sun Oil Company, Pumping-Rate Optimization and Capture Zone Analysis, Tulsa County, Oklahoma.*
- A groundwater flow and reactive solute transport model (MODFLOW and RT3D) was developed to evaluate remediation efforts at a chemical production facility. The efficacy of a permeable reactive barrier was evaluated by simulating sequential decay and transport of TCE and its daughter products. The model was post-verified in the field by analyzing the concentration histories of several observation wells – *Mohawk Laboratories, Analysis of Permeable Reactive Barrier, Sunnyvale, California.*
- Determined regional-scale risk to groundwater from potentially contaminating activities (PCA) in the Santa Clara Valley, Coyote, and Llagas subbasins, as part of a multifaceted effort. A regional-scale PCA-risk map was developed and combined with intrinsic aquifer sensitivity to generate a groundwater vulnerability map, which formed the basis of a web-based GIS tool for evaluating development projects and land-use changes – *Santa Clara Valley Water District, Groundwater Vulnerability Study, Santa Clara, California.*
- A Remedial Investigation (RI) Summary report was prepared under CERCLA guidelines, which included development of a conceptual model that incorporated regional and local hydrostratigraphy, source-area history, details of previous remedial investigations, and characterization of the basin-wide perchlorate and TCE groundwater contamination – *West Valley Water District, NCP Compliance Documents, Rialto, California.*
- The volume of LNAPLs beneath a refinery was estimated by modifying the analytical solutions for LNAPL recovery presented within API Publications 4682 and 4729, utilizing the van Genuchten relations for porous media. Results of the modeling work were used to design a LNAPL recovery system – *Sun Oil Company, LNAPL Spatial Distribution, Tulsa County, Oklahoma.*
- DNAPL Assessment Techniques, Klickitat County, WA. Developed internal White Paper describing techniques and thresholds for assessing DNAPL mobility at a fueling facility – *BNSF, Remediation Design Support, Park County, Montana*.
- Report of waste discharge and request for waste discharge requirements for land application of onsite waste and storm water. For submission to the Los Angeles Regional Water Quality Control Board – *Confidential Client, Report of Waste Discharge, Los Angeles County, California.*

- Developed and implemented groundwater flow and particle tracking models to evaluate well placement designs and optimize pumping rates for an in-situ groundwater recirculation and treatment zone. The recirculation zone was used to chemically treat groundwater contaminated with VOCs – *BNSF, Remediation Design Support, Park County, Montana.*
- Analyzed slug test data for multiple tests using several techniques to assess parameter uncertainty for a bedrock aquifer, for submission to Montana Department of Environmental Quality – *BNSF, Site Characterization for Remedial Investigation, Park County, Montana.*
- A 1D unsaturated zone flow and transport model was developed to assess the impact to groundwater of VOCs and metals present in the soil at the Facility. A future 100-year scenario was developed based on climate data from the past 100 years. Mass transport process of volatilization, linear sorption, and advection and dispersion were considered for this investigation – *SMTEK, Former Chemical Facility, Orange County, California.*

Summary of Other Selected Litigation Support Projects

- Implemented detailed regional, three-dimensional conceptual model for a 35-year period (MODFLOW and MT3DMS). Geologic data, crop-based time-variant DBCP application rates, pumping, recharge basins, and flow and transport in the unsaturated and saturated zones were used to evaluate whether label-recommended use of DBCP caused contamination in municipal wells and to establish likely source areas for high-concentration hot spots – *Sedgwick, Detert, Moran, and Arnold, Regional-Scale Pesticide Contamination Litigation Support, Fresno, California.*
- Designed and implemented three-dimensional models (LEACHM, MODFLOW, and MT3DMS) of unsaturated and saturated fluid flow and solute transport for periods of up to 150-years using soils and geologic data, rainfall records, pumping, and plant operational history to assess whether off-site groundwater contamination was caused by unanticipated releases of coal tar at numerous sites in the Midwest – *Jones, Day, Reavis, and Pogue, Former Manufactured-Gas Plant Sites, Litigation Support, Los Angeles, California.*
- The impact of different rainfall data disaggregation techniques on the results of fluid flow and solute transport simulations in the unsaturated zone was evaluated. Various disaggregation strategies were applied to simulations of contaminant fate at three former manufactured-gas plants – *Northern Indiana Public Service Company, Impact of Rainfall Data Disaggregation Techniques, Merrillville, Indiana.*
- Evaluated expert reports and thoroughly evaluated and verified a detailed water budget model. Assisted in preparation of expert report related to the application of the model – *Confidential Client, Water Budget Model Litigation Support, Pinal County, Arizona*.
- Evaluated expert reports and critiqued a detailed MODFLOW groundwater flow model for litigation of damages and fatalities from a landslide. Assisted in preparation of expert report – *Confidential Client, Landslide Initiation Litigation Support, British Columbia.*

Professional History

aquilogic, Inc., Principal Hydrogeologist, October 2020 to present.
aquilogic, Inc., Senior Hydrogeologist, February 2018 to October 2020.
Jacobson James & Associates, Inc., Principal Hydrogeologist, October 2015 to December 2017.
Independent Consultant, December 2012 to September 2015.
Kennedy/Jenks Consultants, Associate Hydrogeologist, March 2009 to November 2012.
Independent Consultant, July 2005 to February 2009.
San Francisco State University, Lecturer/Adjunct Professor, September 2003 to February 2009.
SGI The Source Group, Inc., Senior Hydrogeologist, August 2002 to June 2005.
Stanford University, Research Associate, September 2000 to July 2002
Independent Consultant/Graduate Student, October 1995 to July 2000.
U.S. Geological Survey/Graduate Student, Hydrologist, June 1992 to September 1995.

Research

- A new protocol and computer code were designed and implemented to simulate the development of redox zones in contaminated aquifers. Transport of dissolved constituents coupled to complex interactions between organic and inorganic compounds were simulated with consideration of reaction energetics, reaction-rate limitations, and advection and dispersion – *Stanford University/United States Geological Survey, Development and Fate of Redox Zones in Contaminated Aquifers, Falmouth, Massachusetts*.
- Interactions between surface water, soil-water, and groundwater were evaluated with a three-dimensional model of coupled saturated-unsaturated subsurface and surface fluid flow. Detailed rainfall data were incorporated into the model to determine the relative importance of different stormflow generation mechanisms – *Stanford University, Stormflow Generation, Chickasha, Oklahoma*.
- Conducted basin-scale modeling analysis of subsurface fluid flow in the Illinois Basin to evaluate the role of paleogroundwater flow versus fluid density in long-range, deep-basin petroleum migration – *United States Geological Survey, Basin-scale Analysis of Subsurface Fluid Flow, Illinois Basin*.
- Developed reactive solute transport models to evaluate zinc transport in a geochemically complex aquifer in Falmouth, MA. Coupled solute transport/geochemical modeling, laboratory experiments, and a two-site surface complexation model were used to represent the pH-dependent adsorption of dissolved zinc on aquifer sediments – *United States Geological Survey, Zinc Transport in a Geochemically Complex Aquifer, Falmouth, Massachusetts*.

Peer-Reviewed Publications

Abrams, R.H. and K. Loague. 2000. A compartmentalized solute transport model for redox zones in contaminated aquifers, 2, Field-scale simulations. Water Resources Research 36, 2015-2029.

Abrams, R.H. and K. Loague. 2000. A compartmentalized solute transport model for redox zones in contaminated aquifers, 1, Theory and development. Water Resources Research 36, 2001-2013.

Abrams, R.H., K. Loague, and D.B. Kent. 1998. Development and testing of a compartmentalized reaction network model for redox zones in contaminated aquifers. Water Resources Research 34, 1531-1541.

Abrams, R.H. and K. Loague. 2000. Legacies from three former manufactured-gas plants: Impacts on groundwater quality. Hydrogeology Journal 8, 594-607.

Kent, D.B., R.H. Abrams, J.A. Davis, J.A. Coston, and D.R. LeBlanc. 2000. Modeling the influence of variable pH on the transport of zinc in a contaminated aquifer using semi-empirical surface complexation models. Water Resources Research 36, 3411-3425.

Kent, D.B., R.H. Abrams, J.A. Davis, and J.A. Coston. 1999. Modeling the influence of adsorption on the fate and transport of metals in shallow ground water--Zinc contamination in the sewage plume on Cape Cod, MA. Morganwalp, D.W., and Buxton, H.T., eds., USGS WRI Report 99-4018C, 361-370.

Loague, K., R.H. Abrams, S.N. Davis, A. Nguyen, and I.T. Stewart. 1998. A case study simulation of DBCP groundwater contamination in Fresno County, California: 2. Transport in the saturated subsurface. Journal of Contaminant Hydrology 29, 137-163.

Loague, K., D. Lloyd, A. Nguyen, S.N. Davis, and R.H. Abrams. 1998. A case study simulation of DBCP groundwater contamination in Fresno County, California: 1. Leaching through the unsaturated subsurface. Journal of Contaminant Hydrology 29, 109-136.

Loague, K. and R.H. Abrams. 1999. DBCP contaminated groundwater in Fresno County: Hot Spots and nonpoint sources. Journal of Environmental Quality 28, 429-445.

Coston, J. A., R. H. Abrams, and D. B. Kent. 1998. Selected inorganic solutes, in water quality data and methods of analysis for samples collected near a plume of sewage-contaminated ground water, Ashumet Valley, Cape Cod, Massachusetts, 1993-1994. USGS WRI Report 97-4269.

Loague, K., C.S. Heppner, R.H. Abrams, A.E. Carr, J.E. VanderKwaak, and B.A. Ebel. 2005. Further testing of the Integrated Hydrology Model (InHM): Event-based simulations for a small rangeland catchment located near Chickasha, Oklahoma. Hydrological Processes 19, 1373–1398.

Loague, K. and R.H. Abrams. 2001. Stochastic-conceptual analysis of near-surface hydrologic response. Hydrological Processes 15, 2715-2728.

Loague, K., G.A. Gander, J.E. VanderKwaak, R.H. Abrams, and P.C. Kyriakidis. 2000. Technical Addendum for "Simulating hydrologic response for the R-5 catchment: A never-ending story". Floodplain Management 2, 57-64.

Loague, K., G.A. Gander, J.E. VanderKwaak, R.H. Abrams, and P.C. Kyriakidis. 2000. Simulating hydrologic response for the R-5 catchment: A never-ending story. Floodplain Management 1, 57-83.

Grose, T. L. T. and R. H. Abrams, 1992. Geologic map of the Grasshopper Valley 15' quadrangle, Lassen County, California. California Department of Conservation, Division of Mines & Geology Open-File Report 93-07.

Grose, T. L. T. and R. H. Abrams. 1991. Geologic map of the Karlo 15' quadrangle, Lassen County, California. California Department of Conservation, Division of Mines & Geology Open-File Report 91-23.

Brownstein

Brownstein Hyatt Farber Schreck, LLP
805.963.7000 main
1021 Anacapa Street, 2nd Floor
Santa Barbara, California 93101

March 9, 2022

Stephanie O. Hastings
Attorney at Law
805.882.1415 direct
shastings@bhfs.com

VIA E-MAIL – BOARD@SVBGSA.ORG; MEYERSD@SVBGSA.ORG

Board of Directors
Salinas Valley Basin Groundwater Sustainability Agency
c/o Donna Meyers
General Manager
P.O. Box 1350
Carmel Valley, CA 93924

RE: March 10, 2022 Board Meeting—Agenda Item 5.c—Draft Fiscal Year 2022 Staff Two Year Work Plan

To the Boards of the Salinas Valley Basin Groundwater Sustainability Agency:

This office represents the Salinas Basin Water Alliance (Alliance), a California nonprofit mutual benefit corporation formed to preserve the viability of agriculture and the agricultural community in the greater Salinas Valley. Alliance members include agricultural businesses and families that own and farm more than 80,000 acres within the Salinas Valley. The Alliance submits this comment letter to express its significant concern with the Salinas Valley Basin Groundwater Sustainability Agency's (GSA) draft Fiscal Year 2022 Staff Two Year Work Plan (Work Plan). As explained in further detail below, the Work Plan fails to include additional basin-wide modeling simulations, and the corresponding update to each of the Salinas Valley Subbasin Groundwater Sustainability Plans (GSPs),[1] the GSA committed to conducting before undertaking any projects or management actions. Absent this additional modeling, any projects or management actions undertaken by the GSA will violate the provisions of the Sustainable Groundwater Management Act (SGMA). To rectify this issue, the Alliance proposes the GSA adopt the revised Work Plan attached hereto as **Attachment A**.

I. THE GSA COMMITTED TO UNDERTAKING ADDITIONAL MODELING ANALYSES AND REVISING THE GSPS TO ADDRESS INADEQUACIES IN THE GSPS

As explained in the Alliance's comment letters dated October 15, 2021 and December 8, 2021, the GSPs are not integrated in any manner; they contain numerous inconsistencies in their data, water budgets,

[1] The "GSPs" refer to the Groundwater Sustainability Plans for the Upper Valley Subbasin, Forebay Subbasin, Eastside Subbasin, Langley Subbasin, 180/400-Foot Aquifer Subbasin, and the Monterey Subbasin.

and sustainable management criteria. These inconsistencies are concerning as the surface water and groundwater resources within the Salinas Valley are interconnected and, absent integration, the burdens of sustainable groundwater management may be inequitably apportioned throughout the Salinas Valley. The GSA previously acknowledged the need for integrated groundwater management and proposed an integrated Valley-wide GSP. However, the GSA subsequently scrapped that plan and developed the inconsistent, subbasin specific GSPs.

The GSA's failure to integrate the GSPs led to the adoption of GSPs that run afoul of SGMA. Most pressing is the failure to analyze how each of the GSPs will impact groundwater management in an adjacent subbasin (i.e., how implementation of the Forebay GSP will impact the 180/400-Foot Aquifer Subbasin). More specifically, the GSPs fail to include the required analysis of how (a) pumping in these subbasins impacts flows to adjacent subbasins, or (b) how implementing the sustainable management criteria, including the minimum thresholds, will impact adjacent subbasins.

After reviewing the Alliance's detailed comment letters, the GSA properly acknowledged the faults in the GSPs and committed to addressing the issues through additional modeling simulations and revisions to the GSPs. Specifically, each of the GSPs includes the following statement:

> The SVBGSA agrees that impacts on adjoining basins or subbasins must be addressed before implementing any management actions or projects. SVBGSA plans to conduct these analyses, which will include, among other things, updating the water budgets and sustainable management criteria in the 5-year updates if necessary, to account for inter-basin flows and impacts on adjoining basins or subbasins, when an appropriate tool becomes available.
>
> SVBGSA additionally agrees that the superposition approach included in the comment is a reasonable approach for addressing any action's or project's impact on inter-basin flows. This type of approach lessens the influence of model errors by addressing changes between simulations, and not absolute values in any simulation. SVBGSA will use this approach to address both intra and inter-basin impacts from any action or project.
>
> SVBGSA further agrees that the additional simulations proposed in the comment letter will facilitate a deeper understanding of the Salinas Valley Groundwater Basin, even though the additional simulations are not associated with specific actions or projects. To that end, SVBGSA staff will propose to the SVBGSA Board of Directors that the requested simulations would be informative, that these simulations be conducted before the next GSP assessment, and that the additional simulations will provide essential background understanding that will allow a thorough vetting of any potential management actions or projects. If and when approved by the

> SVBGSA Board of Directors, SVBGSA staff will work with all interested parties and stakeholders through the Integrated Implementation Committee to develop the assumptions and approaches for these simulations.

(See e.g., Forebay GSP, Response to Comment 36 (emphasis added).) In other words, the GSA agreed in its response to comment, which are incorporated into each of the GSPs, that (a) the GSPs do not analyze impacts to adjacent subbasins as required by SGMA, and (b) that additional modeling work must be conducted and the GSPs' water budgets and sustainability management criteria must be updated to address this issue.

II. THE WORK PLAN FAILS TO FULFILL THE GSA'S COMMITMENT TO ADDRESS THE INADEQUACIES IN THE GSPS

Despite the GSA's commitment to address the issues identified by the Alliance, the GSA now proposes the Work Plan that fails to fulfill this commitment and therefore is inconsistent with the GSPs themselves. Significantly, the Work Plan states the following:

> Planning work will continue during the two-year work plan on the Integrated Implementation Plan. The first phase of the plan will be completed early in the fiscal year and that will include basin wide (within SVBGSA jurisdiction) groundwater conditions and basin wide monitoring networks. This work will include analysis of inter-subbasin flow in existing model runs and in comparison to the current understanding of the hydrostratigraphy and subbasin connectivity as described in the GSPs.

(Emphasis added.) This is not what the GSA committed to in the GSPs—it limits the GSA's additional analysis to *existing model runs*, which the GSA already acknowledged fail to analyze impacts on inter-subbasin flow, like how pumping in each subbasin impacts flows to adjacent subbasins, and how implementing the sustainable management criteria, including the minimum thresholds, will impact adjacent subbasins. In other words, the GSA cannot rely on its past, inadequate work to fulfill its commitment in the GSPs.

Moreover, the failure to include the additional modeling simulations in the Work Plan taints the rest of the work proposed in the Work Plan. For one, the Work Plan states that work is "important especially within the subbasins that require actions and/or projects to reach sustainability, and identifies the 180/400-Foot Aquifer, Monterey, Eastside, and Langley Subbasins as "priority subbasins." However, the GSA cannot know which subbasins are "sustainable", in terms of how pumping affects adjacent and downgradient subbasins, without conducting the additional modeling the GSPs acknowledge is required. Similarly, the Work Plan proposes certain demand management proposals for some, but not all of the subbasins—the Corral de Tierra, Langley, Eastside and 180/400 Subbasins. This determination is premature, at best—e.g., the Work Plan incorrectly assumes that demand management actions will be required in only a subset of the subbasins before undertaking the required additional modeling of inter-subbasin impacts—and in conflict with the GSPs. The GSA cannot adequately assess what demand management is appropriate until it understands how groundwater pumping in the Forebay and Upper Valley Subbasins is impacting the Corral de Tierra, Langley, Eastside and 180/400 Subbasins.

III. CONCLUSION

For the reasons stated above, the Work Plan cannot be approved as presently proposed by GSA staff. The Alliance has proposed revisions to the Work Plan that reflect the GSA's commitment to conducting additional required analyses and the associated follow-on activities, including revisions of the GSPs as appropriate, especially before any consideration of demand management activities in any subbasin. (See Attachment A.)

The Alliance urges the Board to carefully consider these comments and to adopt a Work Plan that is consistent with the GSPs and their acknowledgement of the necessity to undertake inter-subbasin flow analyses. Given the importance of undertaking this work prior to implementation of any projects or management actions, this work should be prioritized.

Respectfully submitted,

Stephanie Osler Hastings
Christopher R. Guillen

cc: Emily Gardner, Senior Advisor / Deputy General Manager (gardnere@svbgsa.org)
Derrik Williams, Montgomery & Assoc. (dwilliams@elmontgomery.com)
Leslie Girard, Monterey County Counsel (GirardLJ@co.monterey.ca.us)

ATTACHMENT A

Salinas Valley Basin
Groundwater Sustainability Agency

Board of Directors
STAFF REPORT

MEETING DATE: March 10, 2022

AGENDA ITEM: 5.c

SUBJECT: Proposed Two-Year Work Plan for FY

2022 and FY 2023 **RECOMMENDATION:** Approve Two-Year

Work Plan for FY 2022 and FY 2023

BACKGROUND:
The JPA Agreement Section 10.3(b) states: "Beginning for Fiscal year 2019-20, no later than sixty (60) days prior to the end of each Fiscal Year, the Board shall adopt a budget for the Agency for the ensuing Fiscal Year." Staff have developed a two-year Work Plan for FY 2022/2022 and 2023/2024 to reflect the emerging duties of the Salinas Valley Basin Groundwater Sustainability Agency (Agency) as it transitions from planning related work to implementation of the 6 Groundwater Sustainability Plans (GSPs). Upon the adoption of the two-year work plan, staff will prepare the Agency budget for presentation to the Board by April 2022.

The guiding considerations in developing the two-year work include the following:

- The Sustainable Groundwater Management Act (SGMA) requires compliance and reporting annually for all basins that are medium, high, and critically overdrafted. It is important to remember that SGMA is a regulatory program and as such the Agency must plan and complete actions required to maintain or address basin sustainability.

- SGMA requires that data gaps and guiding scientific information be addressed in subsequent years after completing a GSP. Examples of this include conducting further aquifer properties tests, expanding monitoring networks, and completing modeling analysis including additional modeling required to examine the effects of groundwater pumping on adjacent and downgradient subbasins.

- The 6 GSPs completed in the past two years outline approximately $4,000,000 in necessary monitoring and further analysis for SVBGSA's adopted GSPs. This includes completing Annual Reports every year for all subbasins, and maintaining a Data Management System and
3 web-based access to maps and data for public users.

- The 6 GSP identified four implementation actions that will be completed during the two-year Work Plan period. These include Groundwater Extraction Management System (GEMS) expansion and enhancement, establishing a Dry Well Notification System, convening the Water Quality Coordination Group, and creating the Land Use Jurisdiction Coordination Program.

- SVBGSA will receive a minimum of $7,600,000 from the SGMA Round 1 Implementation Grant by the start of the fiscal year. This funding will establish funding for data expansion, monitoring, and program development for the 180/400-Foot Aquifer Subbasin which Staff and consultants will manage and complete. The SGMA Round 1 Implementation Grant also will provide funding to conduct engineering feasibility studies on several projects proposed for the 180/400-Foot Aquifer Subbasin. This work requires project management by Agency staff.

DISCUSSION:
The attached two-year work plan outlines the activities to be completed in fiscal years 2022 and 2023. Staff brought this work plan to the Budget and Finance Committee on March 3, 2022 for initial review and for recommendations on completing a draft Agency budget to complete the work plan. Comments received included support for a two-year budget to encompass the identified needs of the work plan and a suggestion that a five-year financial plan makes sense for tracking implementation progress and outcomes for the GSPs. Staff will prepare a two-year Agency budget for review in April.

FISCAL IMPACT:
None.

ATTACHMENT(S):
Attachment A - Draft Two-Year Work Plan for FY 2022 and 2023

PREPARED BY:
Donna Meyers, General Manager

Salinas Basin Water Alliance
Proposed Revisions
March 9, 2022

Two-Year Work Plan for Fiscal Years 2022 and 2023

DRAFT

March 4, 2022

The Salinas Valley Basin Groundwater Sustainability Agency (Agency) has prepared a two-year work plan for fiscal years 2022 and 2023 for consideration by the SVBGSA Board of Directors. The Two-Year Work Plan presented focuses on the following work areas now that the groundwater sustainability plans (GSPs) have been completed.

SVBGSA Work Areas

COMPLIANCE REPORTING AND DATA MANAGEMENT AND EXPANSION

- The Agency begins fiscal year 2022 with immediate requirements for data reporting and compliance. The Agency must complete Annual Reports and update the Data Management System and Web Map hosting annually to meet compliance with SGMA. The Agency will complete six Annual Reports during each fiscal year during the 2-year work plan, two of which will be completed in coordination with other Groundwater Sustainability Agencies (GSAs), Marina Coast Water District GSA and the Arroyo Seco GSA.

- Agency staff is recommending data collection expansion efforts in fiscal year 2022 and 2023 to addresses data gaps as required by SGMA. This effort will include additional bi-annual monitoring points, conducting aquifer properties tests in the basins and expanding the monitoring network with additional wells. Data gaps are required to be filled in all subbasins, ~~however, this work is important~~ especially ~~within the subbasins that require actions and/or projects to reach sustainability~~additional modeling required to evaluate how (a) how pumping in each subbasin impacts flows to adjacent subbasins, and (b) how implementing the sustainable management criteria, including the minimum thresholds, will impact adjacent subbasins.

Additional scientific information about the basins will lead to enhanced knowledge about the subbasins which will in turn assist with project development and management actions on the required timeline and in the appropriate places within the basins. Benefits and costs of project options will be available for stakeholder discussion early in the process.

- It will be also important during the two-year work plan period to work with Monterey Country Water Resources Agency (MCWRA) to develop data sharing agreements, begin expansion of the GEMS system, and coordinate on basin management efforts. Staff level coordination will continue, and an interagency MOU will be completed during the work plan period.
- Completion and publication of the USGS suite of models will be critical during the two-year work plan period. The goal will be to have the SVIHM and SVOM models publicly published in early 2023.
- Well registration will be a focus during the two-year work plan period. This work will begin in the 180/400-Foot Aquifer Subbasin and will involve close coordination with MCWRA and the Monterey County Environmental Health Bureau.
- The Water Quality Coordination Group will be convened annually during the work plan period.
- The Dry Well Notification System will be created during the work plan period.
- The Land Use Jurisdiction Coordination Program will be further refined with program actions approved by the Board of Directors.

PLANNING AND PROJECT INTEGRATION

- Planning work will continue during the two-year work plan on the Integrated Implementation Plan. The first phase of the plan will be completed early in the fiscal year and that will include basin wide (within SVBGSA jurisdiction) groundwater conditions and basin wide monitoring networks. This work will include analysis of inter-subbasin flow in existing model runs and in ~~comparison~~new model runs required to examine the effects of groundwater pumping on adjacent and downgradient subbasins. The new and existing model runs will be compared to the current understanding of the hydrostratigraphy and subbasin connectivity as described in the GSPs. The second phase will be initiated and will include updates based on feasibility analyses conducted at the subbasin level for projects ~~potentially benefiting multiple~~required to achieve sustainability in each of the subbasins. This phase will include additional modeling work using newly collected data (i.e. Deep Aquifers Study), newly developed models (i.e. Seawater Intrusion Model), and prioritized project concepts. These model simulations will examine project impacts, comparing recent conditions to conditions with a project where conditions include groundwater elevations, calculation of storage, inter-subbasin subsurface flow, interconnected surface water and others.

Salinas Basin Water Alliance Proposed Revisions March 9, 2022

- An examination of the legal basis and constraints for a Demand Management Program will be presented to the stakeholders and the Board. Stakeholder outreach on demand management strategies will be initiated in each of the ~~Corral de Tierra, Langley, Eastside and 180/400-Foot Subbasins~~subbasins. Core policy considerations will be identified, as the functional components of the program, relevant SGMA statutes, and the intended approach for the program. A report of facilitated stakeholder agreements on program type, guiding policy, and recommended type of demand-side management will be completed for ~~the 180/400-Foot Subbasin and initiated in the other three~~all subbasins.
- The Deep Aquifer Study will be completed during the work plan period. Agency partners and stakeholders will discuss and plan for the operationalization of management recommendations.

ENGINEERING AND PROJECT DEVELOPMENT

- The initial construction phases of the CSIP optimization project will be initiated during the work plan period. This work will be funded by the SGMA Round 1 Implementation Grant and will be done in partnership with Monterey One Water and MCWRA.
- Feasibility studies will be completed for the seawater extraction barrier, winter-release with aquifer storage and recovery in the 180/400-Foot Aquifer Subbasin, and seasonal storage in the southern portion of the 180/400-Foot Aquifer Subbasin.

FUNDING DEVELOPMENT AND LONG-TERM FINANCIAL PLAN

- Administer and complete projects in the SGMA Round 1 Implementation Grant for the 180/400-Foot Aquifer and apply for the SGMA Round 2 Implementation Grant for the high and medium priority basins.
- Present proposed fee structure for Board of Directors consideration through update of GSPs in 2027.

~~Priority Subbasins~~

Priorities

As the Agency begins implementation, the above work areas will be the organizing framework to move all 6 GSPs forward towards the goal of sustainability and compliance with SGMA requirements. ~~Due to the variability in the GSPs with regards to immediacy of actions needed to reach sustainability, staff is recommending that the following GSPs receive the bulk of staff efforts during the two-year work period. However, staff~~Staff is prioritizing the completion of the Integrated Implementation Plan early in the fiscal year and ~~that will include~~ additional modeling using newly collected data as described above to better understand inter-subbasin conditions.

Salinas Basin Water Alliance
Proposed Revisions
March 9, 2022

This

~~3~~

work will assist in understanding basinwide conditions and integration priorities in keeping with the current Board policy of maintaining an integrated basinwide approach for the Agency. ~~Management actions such as convening subbasin TACs or developing demand management frameworks for Forebay and Upper Valley subbasins could also be initiated during the annual work period depending on aquifer conditions and additional data analysis.~~

- ~~180/400-Foot Aquifer Subbasin~~
- ~~Monterey Subbasin~~
- ~~Eastside Subbasin~~
- ~~Langley Subbasin~~

Critical work that should be completed includes:

- Completing new modeling on intersubbasin flow and updating GSPs' water budgets and sustainability management criteria as required
- Project feasibility assessment including engineering analysis and refinement of cost and benefits estimates.
- Further stakeholder engagement through Subbasin Implementation Committees on project preferences and timelines.
- Prioritization of projects and actions.
- Conducting a funding analysis.

In addition to the compliance activities that are required to occur in all 6 subbasins, the ~~work in the~~ priority ~~subbasins~~work will be crucial to develop a predictable and well-informed pathway forward to reach subbasin sustainability by the SGMA deadlines.

Detailed Work Plan for FY 2022 and FY 2023

Compliance Reporting and Data Management and Expansion	**Timeline**
Complete new modeling on intersubbasin flow	June 2022
Complete Annual Reports for all 6 subbasins	April 1, 2022 and April 1, 2023
Annual Update to Data Management System/Web Map	2022 and 2023
Initiate GEMS Expansion Annual Monitoring for specific constituents/identified needs Well Registration and Metering in ~~180/400-Foot Aquifer Subbasin~~all subbasins Dry Well Notification System GDE Field Verification Land Use Jurisdiction Coordination Program – define program actions **Planning and Project Integration** Complete Deep Aquifer Study and Operationalize Recommendations Complete Basin-wide Integrated Implementation Plan Complete Demand Management Recommendations ~~for 180/400, Corral de Tierra Management Area, Eastside and Langely~~ Stakeholder Engagement – Langley Outreach and Communication Plan Stakeholder Engagement – Implementation Committees Stakeholder Engagement – Water Quality Coordination Group Stakeholder Engagement – DACs and SDACS – Outreach and Communication Plan	Complete by June 2024 Annual activity Complete by June 2024 Complete by June 2023 Complete by June 2023 Complete by June 2023 Complete by June 2024 August 2022 Complete by June 2024 Initiate June 2022 Convene in April 2022 Annual Meeting December 2022 & 2023 Initiate August 2022
Engineering and Project Development	
Seawater Intrusion Pumping Barrier Feasibility Study with Cost/Benefit Assessment	Initiate June 2022
Winter Release with Aquifer Storage and Recovery Feasibility Analysis for 180/400	Initiate June 2022
CSIP Optimization – Distribution Systems and Water Scheduling	Complete June 2024
M1W Dry Chlorine Scrubber Installation	Complete June 2024
Funding Development and Long-Term Financial Plan	
Round 1 and Round 2 SGMA Implementation Grant implementation	May 2022 – June 2024
Present 5-year Fee Structure to the Board of Directors	May 2022

Brownstein

Brownstein Hyatt Farber Schreck, LLP
805.963.7000 main
1021 Anacapa Street, 2nd Floor
Santa Barbara, California 93101

April 15, 2022

Stephanie O. Hastings
Attorney at Law
805.882.1415 direct
shastings@bhfs.com

VIA SGMA PORTAL

Craig Altare, P.G.
Supervising Engineering Geologist
Groundwater Sustainability Plan Review Section Manager
Department of Water Resources
1416 Ninth Street
Sacramento, CA 95814

RE: Comments on the Submitted Groundwater Sustainability Plans for the Upper Valley Aquifer Subbasin (3-004.05), Forebay Aquifer Subbasin (3-004.04), Eastside Aquifer Subbasin (3-004.02), Langley Area Subbasin (3-004.09), and Monterey Subbasin (3-004.10)

Dear Mr. Altare:

On behalf of the Salinas Basin Water Alliance (Alliance), this office submits these written comments on the Groundwater Sustainability Plans (GSPs) for the Upper Valley, Forebay, Eastside, Langley, and Monterey Subbasins of the Salinas Valley Groundwater Basin (Basin) adopted by the Salinas Valley Basin Groundwater Sustainability Agency (SVBGSA), the Arroyo Seco Groundwater Sustainability Agency (ASGSA), and the Marina Coast Water District Groundwater Sustainability Agency (MCWDGSA) (collectively, the “GSAs”) to aid the Department of Water Resources (DWR) in its evaluation and assessment of the GSPs.

The Alliance is a California nonprofit mutual benefit corporation formed to preserve the viability of agriculture and the agricultural community in the greater Salinas Valley. Alliance members include agricultural businesses and families that own and farm more than 80,000 acres within the Salinas Valley. The Alliance has been an active participant throughout the development, adoption, and implementation of the GSPs and submitted numerous written comments to the GSAs on the GSPs, individually and collectively, during that process. The Alliance’s previously submitted comments on the GSPs (collectively, “Alliance Comments”) are attached hereto and incorporated herein for DWR’s consideration.[1]

As the Alliance Comments explain in greater detail, there are significant issues with the GSPs that limit compliance with both the spirit and the letter of the Sustainable Groundwater Management Act

---

[1] Some, but not all, of the Alliance Comments are included in the GSPs themselves.

(SGMA) and, if not corrected, will ultimately prevent sustainability within the Basin. In summary, the Alliance has four primary concerns:

First, the GSPs are not integrated. The GSPs fail to account for the physical reality of the interconnected subbasins and abandon original commitments and efforts to integrate and coordinate all of the subbasins within the SVBGSA's jurisdiction, an effort which contributed to DWR's approval of the 180/400 Foot Aquifer Subbasin GSP.[2] Further, they contain numerous inconsistencies in their data, water budgets, and sustainable management criteria. These inconsistencies, which are especially concerning because the surface water and groundwater resources within the Salinas Valley are interconnected, must be corrected.

Second, additional modeling of inter-subbasin flow is needed to support the GSPs. Adequate sustainable management criteria cannot be established without identifying the amount of groundwater discharge that is and has been captured by pumping but that otherwise would replenish adjacent subbasins. The Alliance's technical consultant, aquilogic, Inc. has recommended that additional modeling be undertaken for this purpose. The Alliance first raised this issue and requested that the GSA conduct additional modeling to determine groundwater discharge captured by pumping and potential inter-basin effects as early as Spring 2021, well in advance of GSP adoption. Yet the additional analyses were not included in the GSPs and should have been.

Third, the GSPs do not analyze impacts to adjacent basins as required by SGMA. For example, in the Eastside and Langley Subbasin GSPs, the groundwater level minimum thresholds are set at or near historic lows and permit pumping depressions that reverse the natural flow of groundwater towards the 180/400 Foot Aquifer Subbasin to persist. Similarly, the Forebay and Upper Valley Subbasin GSPs erroneously conclude that the subbasins are presently sustainable, and set their minimum thresholds near or, in the case of the Upper Valley GSP, below the historic lows.

Fourth, because of the above-referenced failures and lack of coordination between and among the GSPs within the SVBGSA's jurisdiction, which includes the 180/400 Foot Aquifer Subbasin GSP, the GSPs disproportionally allocate the burden of sustainability across the Salinas Valley and threaten to impair groundwater users' rights, in violation of SGMA. Importantly, the GSAs cannot adopt projects and management actions required to achieve sustainability without first addressing the issues summarized here and exhaustively detailed in the Alliance's Comments.

In response to the Alliance Comments, the SVBGSA properly acknowledged the shortcomings of the GSPs in this manner and committed to addressing these issues by undertaking the additional modeling simulations and revising the GSPs.

---

[2] Statement of Findings Regarding the Approval of the 180/400 Foot Aquifer Subbasin Groundwater Sustainability Plan at 2; Groundwater Sustainability Plan Assessment Staff Report – 180/400 Foot Aquifer Subbasin at 31–35.

> The SVBGSA agrees that impacts on adjoining basins or subbasins must be addressed before implementing any management actions or projects. SVBGSA plans to conduct these analyses, which will include, among other things, updating the water budgets and sustainable management criteria in the 5-year updates if necessary, to account for inter-basin flows and impacts on adjoining basins or subbasins, when an appropriate tool becomes available.
>
> SVBGSA additionally agrees that the superposition approach included in the comment is a reasonable approach for addressing any action's or project's impact on inter-basin flows. This type of approach lessens the influence of model errors by addressing changes between simulations, and not absolute values in any simulation. SVBGSA will use this approach to address both intra and inter-basin impacts from any action or project.
>
> SVBGSA further agrees that the additional simulations proposed in the comment letter will facilitate a deeper understanding of the Salinas Valley Groundwater Basin, even though the additional simulations are not associated with specific actions or projects. To that end, SVBGSA staff will propose to the SVBGSA Board of Directors that the requested simulations would be informative, that these simulations be conducted before the next GSP assessment, and that the additional simulations will provide essential background understanding that will allow a thorough vetting of any potential management actions or projects. If and when approved by the SVBGSA Board of Directors, SVBGSA staff will work with all interested parties and stakeholders through the Integrated Implementation Committee to develop the assumptions and approaches for these simulations.

(Attachment E, p. 4.) The Alliance applauds the SVGSA's commitment to undertake this additional analysis and encourages the SVBGSA to prioritize this work. Following the SVBGSA's adoption of the GSPs, the Alliance and other stakeholders have met and conferred with the SVBGSA staff and technical consultants on numerous occasions to develop a proposed scope of work for the additional inter-subbasin modeling analysis. The Alliance remains committed to assisting the SVBGSA in this required additional work and has made aquilogic, Inc. available to the SVGBSA for that purpose. However, the Alliance is concerned that to date the SVBGSA has not followed through with its commitments and the GSPs remain inadequate as a result.

The Alliance submits these comments to DWR for its consideration in its own review and requests that DWR direct the SVBGSA, and the other GSAs as applicable, to revise all of the GSPs, including the

180/400 Foot Aquifer Subbasin GSP,[3] to address each of the issues raised by the Alliance Comments in order to comply with SGMA.

If you have any questions, please do not hesitate to contact me by phone at (805) 882-1415 or via email at shastings@bhfs.com.

Respectfully submitted,

Stephanie Osler Hastings

Attachments:

A. August 12, 2021 Brownstein Comment Letter
    a. August 11, 2021 aquilogic, inc. Memorandum

B. October 15, 2021 Brownstein Comment Letter
    a. October 15, 2021 aquilogic, inc. Memorandum
        A. Anthony Brown Curriculum Vitae & Robert H. Abrams Curriculum Vitae
        B. Statements in the Salinas Valley Basin Groundwater Sustainability Agency (SVBGSA) Groundwater Sustainability Plans (GSPs) establishing that the six Salinas Valley subbasins are interconnected.
        C. August 11, 2021 aquilogic, inc. Memorandum
    b. February 26, 2019 Letter from Derrik Williams to Les Girard
        A. Derrik Williams Resume
    c. March 4, 2019 Memorandum from Howard Franklin to Gary Peterson & Les Girard
        A. Howard B. Franklin Resume
    d. November 19, 2013 Technical Memorandum re Protective Elevations to Control Sea Water Intrusion in the Salinas Valley
    e. June 1995 Salinas Valley Ground Water Basin Hydrology Conference White Paper re Hydrogeology and Water Supply of Salinas Valley

C. December 8, 2021 Brownstein Comment Letter

D. December 8, 2021 aquilogic, inc. Memorandum

[3] SVBGSA is currently in process of updating the 180/400 Foot Aquifer Subbasin GSP to bring it onto the same five-year update schedule as the other five subbasin GSPs.

   a. Anthony Brown Curriculum Vitae & Robert H. Abrams Curriculum Vitae

E. Excerpts from Upper Valley Subbasin GSP Appendix 2-A.3 Comments on the Draft GSP: Comment Letters Responses[4]

F. March 9, 2022 Brownstein Comment Letter
   a. Alliance Revised Fiscal Year 2022 Staff Two Year Work Plan

[4] Because the Alliance submitted the same comments to each GSP, responses to the Alliance's Comments are identical in the corresponding appendices in each of the GSPs.

ATTACHMENT A

August 12, 2021

Brownstein Comment Letter

Brownstein Hyatt
Farber Schreck

August 12, 2021

Stephanie O. Hastings
Attorney at Law
805.882.1415 tel
shastings@bhfs.com

VIA E-MAIL – BOARD@SVBGSA.ORG

Board of Directors
Salinas Valley Basin Groundwater Sustainability Agency
P.O. Box 1350
Carmel Valley, CA 93924

RE: Preliminary Comment on Draft GSPs for the Eastside, Forebay, Langley, Monterey and Upper Valley Subbasins of the Salinas Valley Basin

Dear Chair Pereira and Members of the Board of Directors:

This office represents the Salinas Basin Water Alliance ("Alliance"), a California nonprofit mutual benefit corporation formed to preserve the viability of agriculture and the agricultural community in the greater Salinas Valley. Alliance members include agricultural businesses and families that own and farm more than 80,000 acres within the Salinas Valley. Many Alliance members have been farming in the Salinas Valley for generations. As such, the Alliance has a significant interest in the long-term sustainability of the Salinas Valley Basin.

The Alliance greatly appreciates the difficult work this Board, together with the Salinas Valley Basin Groundwater Sustainability Agency (GSA) staff and consultant team, has undertaken to implement the Sustainable Groundwater Management Act (SGMA) in Monterey County, including the time-consuming but extremely beneficial engagement with all stakeholders. The Alliance applauds the Salinas Valley Basin GSA's recent success in obtaining approval of the Department of Water Resources (DWR) for the first groundwater sustainability plan (GSP) required to be prepared for the six Salinas Valley Subbasins within the jurisdiction of the Salinas Valley Basin GSA. Further, the Alliance acknowledges and wholeheartedly supports the Board's commitment to coordinate and implement all of the GSPs for the Salinas Valley Basin within its jurisdiction in an integrated manner pursuant to the proposed Integrated Sustainability Plan, or as it may otherwise be titled.[1] It is with this objective—integrated groundwater management—in mind that the

[1] See Joint Exercise of Powers Agreement Establishing the Salinas Valley Basin GSA § 2.2 ("The purpose of Agency is to . . . develop[], adopt[], and implement[] a GSP that achieves groundwater sustainability in the Basin."); § 4.1(c) (The JPA has the power to "develop, adopt and implement a GSP for the Basin.); § 4.1(l) (The JPA has the power to "establish and administer projects and programs for the benefit of the Basin."); Salinas Valley Groundwater Basin 180/400 Foot Aquifer Subbasin Groundwater Sustainability Plan [180/400 GSP] at 9-10 ("This GSP is part of an integrated plan for managing groundwater in all six subbasins of the Salinas Valley Groundwater Basin that are managed by the SVBGSA. The projects and management actions described in this GSP constitute an integrated management program for the entire Valley."); 180/400 GSP at 10-14 ("The SVBGSA oversees all or part of six subbasins in the Salinas Valley Groundwater Basin. Implementing the 180/400-Foot Aquifer Subbasin GSP must be integrated with the implementation of the five other GSPs in the Salinas Valley Groundwater Basin . . . The implementation

Alliance offers these preliminary comments on the draft GSPs for the Eastside, Forebay, Langley, Monterey and Upper Valley Subbasins.[2]

As this Board well knows, SGMA not only requires the Salinas Valley Basin GSA to develop a GSP for each priority subbasin within its jurisdiction to ensure the long-term sustainability of those subbasins, but it also mandates that the GSA consider the impacts each GSP may have on the ability of adjacent subbasins to achieve their sustainability goal.[3] In enacting SGMA, the legislature intended to provide for the sustainable management of all groundwater basins and expressly provided for the coordination of management between and among basins.[4] Any GSP that interferes with an adjacent basin's sustainability goal cannot satisfy SGMA.[5] Moreover, in the event the GSPs for the subbasins disproportionately allocate the burden of sustainability across the Salinas Valley Basin, they could impair groundwater users' rights in and to the Salinas Valley Basin in violation of SGMA and common law water rights.[6]

The Alliance's preliminary review of the draft GSPs suggests that there are significant data gaps and uncertainty with respect to the quantification of flows between subbasins within the Salinas Valley Basin that should be addressed.[7] Specifically, the Alliance is concerned that the existing water budget analyses in the draft GSPs may not provide a complete picture of the downgradient impacts caused by groundwater pumping. Accordingly, the Alliance requests that the Salinas Valley Basin GSA conduct additional simulations with the Salinas Valley Integrated Hydrologic Model (SVIHM) that are specifically focused on the issue of inter-subbasin groundwater flows, as more specifically described in aquilogic's August 11, 2021 memorandum attached to this letter. In light of the fact that the Integrated Sustainability Plan appears to have been delayed until after completion of the subbasin GSPs, the requested additional simulations should be conducted prior to the Salinas Valley Basin GSA's adoption of the subbasin GSPs.

The requested additional model simulations are consistent with and support SGMA's and DWR's requirements that all GSPs be based on the best available science.[8] They will enable an understanding of

schedule reflects the significant integration and coordination needed to implement all six GSPs in a unified manner."); see also Salinas Valley Groundwater Basin Draft Upper Valley Aquifer Subbasin Groundwater Sustainability Plan at 10-16; Salinas Valley Groundwater Basin Draft Eastside Aquifer Subbasin Groundwater Sustainability Plan at 9-1, 10-7, 10-8, 10-16; Salinas Valley Groundwater Basin Draft Forebay Aquifer Subbasin Groundwater Sustainability Plan at 2-4, 9-2, 9-4, 10-7, 10-9, 10-17; Salinas Valley Groundwater Basin Draft Langley Aquifer Subbasin Groundwater Sustainability Plan at 2-4, 9-1, 9-4, 10-8, 10-9, 10-16.

[2] Following publication of the final draft GSPs for these subbasins, the Alliance may have additional comments.

[3] Wat. Code § 10733(c).

[4] Wat. Code §§ 10720.1(a); 10727; 10727.6

[5] See Wat. Code § 10733(c); 23 Cal. Code Regs. §§ 350.4, 351(h), 354.8(d), 354.18(b)(3), (c)(2)(B), (e), 354.28(b)(3), 354.44(a)(6), (c), 355.4(b)(7), 356.4(j), 357.2(b)(3); DWR, Monitoring Networks and Identification of Data Gaps BMP at pp. 6, 8, 27; DWR, Water Budget BMP at pp. 7, 12, 16, 17, 36; DWR, Modeling BMP at pp. 21-22; DWR, Sustainable Management Criteria BMP at pp. 9, 31.

[6] Wat. Code 10720.1(b) (declaring legislature's intention to preserve the security of water rights in the state to the greatest extent possible consistent with the sustainable management of groundwater); see also Water Code §§ 10720.5(b).

[7] 23 Cal. Code Regs. § 351.

[8] See 23 CCR § 354.18 ("A quantitative assessment of the historical water budget, starting with the most recently available information and extending back a minimum of 10 years, ***or as is sufficient to calibrate and reduce the uncertainty of the tools and methods used*** to estimate and project future water budget information and future aquifer response to proposed sustainable groundwater management practices over the planning and implementation horizon." (emphasis added).)

the amount of Basin-wide groundwater discharge that is and has been captured by pumping, which, depending on the results, may require modification of each subbasin's proposed water budget. In the absence of this analysis, there is a significant level of uncertainty in the water budgets that has the potential to undermine the adequacy of the GSPs and also to impair the Salinas Valley Basin GSA's ability to achieve its sustainability goal in each subbasin and throughout the Salinas Valley Basin within its jurisdiction.[9]

The Alliance has endeavored to make this comment and request at the earliest opportunity to allow the Salinas Valley Basin GSA sufficient time to conduct the additional SVIHM simulations. The Alliance does not wish to delay the successful completion and adoption of the subbasin GSPs. Rather, the Alliance anticipates that the additional simulations can feasibly be accomplished and incorporated into the draft GSPs consistent with the Salinas Valley Basin GSA's goal of adopting the subbasin GSPs in accordance with SGMA's deadlines.

The Alliance appreciates the Board's careful consideration of this issue and urges the Board to direct the Salinas Valley Basin GSA staff and consultant team to undertake the requested further analyses and incorporate the results into the draft GSP for each of the subbasins. The Alliance strongly believes that removing existing uncertainties with respect to inter-subbasin flows is a critical component to ensuring both transparency in the GSP development process and equity in the resulting plans, both of which are essential to promoting healthy Basin-wide dialogue and collaboration in obtaining sustainable groundwater management of the Salinas Valley Basin within the Salinas Valley Basin GSA's jurisdiction.

As the Board may direct, the Alliance would welcome the opportunity to discuss the requested additional consideration of inter-subbasin flows in more detail with the Salinas Valley Basin GSA's staff and consultant team.

Respectfully submitted,

Stephanie Osler Hastings

Attachment: August 11, 2021 aquilogic, inc. memorandum

cc: Donna Meyers, Senior Consultant / General Manager (meyersd@svbgsa.org)
Emily Gardner, Senior Advisor / Deputy General Manager (gardnere@svbgsa.org)
Derrik Williams, Montgomery & Assoc. (dwilliams@elmontgomery.com)
Leslie Girard, Monterey County Counsel (GirardLJ@co.monterey.ca.us)

[9] DWR's June 3, 2021 determination that it does not appear that the GSP for the 180-400 Aquifer Subbasin will adversely affect the ability of an adjacent basin to implement its GSP or impede achievement of sustainability goals in an adjacent basin does not mean that the Salinas Valley GSA should assume that DWR will reach the same conclusion with respect to the remaining subbasin GSPs.

aquilogic, Inc.
environment ● water ● strategy

245 Fischer Avenue, Suite D-2
Costa Mesa, CA 92626
Tel. +1.714.770.8040
Web: www.aquilogic.com

August 11, 2021

MEMORANDUM

To: Stephanie Hastings, Brownstein Hyatt Farber Schreck (BHFS)
Sent via email: SHastings@bhfs.com
From: Robert H. Abrams, PhD, PG, CHg, Principal Hydrogeologist, aquilogic, Inc.
Anthony Brown, CEO & Principal Hydrologist, aquilogic, Inc.

Subject: Assessment of Groundwater Flows between Subbasins of the Salinas Valley Groundwater Basin (SVGB)
Project No.: 018-09

Aquilogic, Inc. (**aquilogic**) is pleased to provide this memorandum on behalf of our mutual client, the Salinas Basin Water Alliance (SBWA), outlining the justification and necessity for conducting additional simulations with the Salinas Valley Integrated Hydrologic Model (SVIHM),[1] which is being used by the Salinas Valley Basin Groundwater Sustainability Agency (SVBGSA) for groundwater sustainability plan (GSP) development.

Aquilogic hypothesizes that pumping has captured significant portions of groundwater discharge that would otherwise migrate as underflow from the Upper Valley Subbasin to the Forebay Subbasin, from the Forebay Subbasin to the 180/400-Ft Aquifer Subbasin and East Side Subbasin, and potentially from the 180/400-Ft Aquifer Subbasin to the Monterey Subbasin and the Salinas River. Our primary concern is that the existing water budget analyses in at least three of the SVBGSA's draft GSPs may not provide a complete picture of the downgradient impacts caused by groundwater pumping.[2]

It should be noted that groundwater sustainability was a pertinent issue for water managers long before the advent of California's Sustainable Groundwater Management Act. There is

---

[1] The SVIHM is a provisional, unpublished model not currently available to the general public.
[2] Bredehoeft, J.D., Papadopulos, S.S., and Cooper, H.H. Jr. (1982). The water budget myth. *In* Scientific Basis of Water Resource Management, Studies in Geophysics, 51-57. Washington, D.C. National Academy Press;
Bredehoeft, J.D. (1997). Safe yield and the water budget myth. Ground Water, Vol. 35, No. 6, p. 929;
Bredehoeft, J.D. (2002). The water budget myth revisited: why hydrogeologists model. Ground Water, Vol. 40, No. 4, p. 340-345;
Bredehoeft, J.D. and Durbin, T. (2009). Groundwater development: the time to full capture problem. Ground Water, Vol. 47, No. 4, p. 506-514;
Bredehoeft, J.D. (2011). Monitoring regional groundwater extraction: the problem. Ground Water, Vol. 49, No. 6, p. 808-814.

ample support in the groundwater literature for considering multiple aspects of sustainability and undesirable results, including economic and social impacts and the contravention of water rights.[3]

ADDITIONAL SIMULATIONS

As stated in "SVIHM Frequently Asked Questions,"[4] one of the many questions that can be addressed by a model is: How much groundwater flows between subareas? Clearly, the SVIHM developers recognized the importance of this question and anticipated that it would be asked. On behalf of the SBWA, **aquilogic** requests that the SVBGSA utilize the SVIHM to conduct additional simulations that are specifically focused on the issue of inter-subbasin groundwater flows. The requested simulations will enable an improved understanding of the amount of Valley-wide groundwater discharge that is and has been captured by pumping, which may be needed to ensure the adequacy of the GSPs for each of the subbasins and important to their implementation.

Aquilogic recommends a type of "superposition" analysis, in which the results of two simulations are compared. In such an analysis, the two simulations are identical except for the process under examination, in this case groundwater pumping. Pumping would be selectively turned off in one simulation and left as currently configured in the SVIHM in the other simulation. A similar superposition analysis was done to assess pumping-induced streamflow depletion, as described in Chapter 5 of the GSPs for the Forebay Subbasin and the East Side Subbasin.

The inter-subbasin flows would then be compared, which would semi-quantitatively estimate the impact of pumping, within the limiting assumptions and uncertainties associated with the SVIHM. Ideally, the analysis should be conducted with the initial conditions of the no-pumping scenario representing a "full" SVGB. The analysis would provide an estimate of the impact of pumping on inter-subbasin groundwater flows.

Specifically, using the calibrated SVIHM historical model, **aquilogic** recommends the following outline for conducting simulations, the details of which would be worked out in consultation with the SVBGSA:

1. Develop reasonable initial conditions for the hydraulic head distribution for the no-pumping simulation. This entails turning off all pumping in the model domain while

[3] Todd, D.K. (1959). Groundwater Hydrology. Wiley, New York, 336 p.;
Domenico, P. (1972). Concepts and Models in Groundwater Hydrology. McGraw-Hill, New York, 405 p.;
Freeze, R.A. and Cherry, J.A. (1979). Groundwater. Prentice-Hall, 604 p.;
Alley, W.M., Reilly, T.E., and Franke, O.L. (1999). Sustainability of ground-water resources. U.S. Geological Survey Circular 1186, 79 p.

[4] https://www.co.monterey.ca.us/home/showdocument?id=31292

leaving all other inflows and outflows unchanged. Because the time for simulated water levels to recover may be longer than the SVIHM simulation period of 51 years (1967-2018), the simulation may have to be run multiple times before an average steady-state condition can be achieved. In this case, the hydraulic head distribution at the last time step of the previous simulation would be used as the initial condition of the subsequent simulation. This process would be repeated until the hydraulic head distribution at the last time step of a subsequent simulation is substantially identical to the last time step of the previous simulation. This would indicate that an average steady-state condition is being simulated. We assume here that the surface water inflows and reservoir releases for the 1967-2018 period would be sufficient to eventually "refill" the SVGB after several model runs.

2. When the average, no-pumping steady-state condition has been achieved with the modified SVIHM, simulated groundwater flow should occur from the East Side Subbasin to the 180/400-Ft Subbasin, and from the 180/400-Ft Subbasin to Monterey Bay, conditions that are now reversed.

3. From the final results of the no-pumping simulation, in which average steady-state conditions have been achieved, compute the inter-subbasin groundwater flows between each adjoining subbasin. Compare these flows with the inter-subbasin flows from the historical, unmodified SVIHM. The differences in inter-subbasin flows and induced recharge from the surface water system represent a semi-quantitative estimate of the impact of Valley-wide pumping.

4. Additional superposition analyses can be conducted to assess the impact of one subbasin's pumping on basin-wide groundwater levels and inter-subbasin groundwater flows, by turning on pumping in one subbasin at a time in the modified SVIHM (and leaving pumping turned off in all other subbasins) and comparing the results to the scenario with no pumping throughout the SVGB. The differences in inter-subbasin flows and groundwater levels represent a semi-quantitative estimate of the impact of one subbasin's pumping on the other subbasins.

ATTACHMENT B
October 15, 2021
Brownstein Comment Letter

Brownstein Hyatt
Farber Schreck

October 15, 2021

Stephanie O. Hastings
Attorney at Law
805.882.1415 tel
shastings@bhfs.com

VIA E-MAIL – MEYERSD@SVBGSA.ORG; BOARD@SVBGSA.ORG; PRISO@MCWD.ORG; CITYCLERK@CI.GREENFIELD.CA.US

Donna Meyers
General Manager
Salinas Valley Basin Groundwater Sustainability Agency
P.O. Box 1350
Carmel Valley, CA 93924

Remleh Scherzinger
General Manager
c/o Paula Riso
Executive Assistant/Clerk to the Board
Marina Coast Water District Groundwater Sustainability Agency
11 Reservation Road
Marina, CA 93933-2099

Curtis Weeks
General Manager
c/o City Clerk
Arroyo Seco Groundwater Sustainability Agency
599 El Camino Real
Greenfield, CA 93927

RE: Draft Groundwater Sustainability Plans for the Upper Valley, Forebay, Eastside, Langley, and Monterey Subbasins of the Salinas Valley Groundwater Basin

Dear Ms. Meyers, Mr. Scherzinger, and Mr. Weeks:

This office represents the Salinas Basin Water Alliance (*Alliance*), a California nonprofit mutual benefit corporation formed to preserve the viability of agriculture and the agricultural community in the greater Salinas Valley. *Alliance* members include agricultural businesses and families that own and farm more than 80,000 acres within the Salinas Valley. Many *Alliance* members have been farming in the Salinas Valley for generations. As such, the *Alliance* has a significant interest in the long-term sustainability of the water supplies in the Salinas Valley. As mentioned in our preliminary comment letter on the draft Groundwater Sustainability Plans (GSP) for the Upper Valley, Forebay, Eastside, Langley, and Monterey Subbasins dated August 12, 2021, the *Alliance* greatly appreciates the Salinas Valley Basin Groundwater Sustainability

Agency (SVBGSA) staff and consultant team's efforts to implement the Sustainable Groundwater Management Act (SGMA) in the Salinas Valley Groundwater Basin (Basin) and in each of the six subbasins within the jurisdiction of the SVBGSA. The *Alliance* likewise appreciates the efforts undertaken by the Marina Coast Water District Groundwater Sustainability Agency (MCWDGSA) and the Arroyo Seco Groundwater Sustainability Agency (ASGSA) to implement SGMA in the Monterey and Forebay Subbasins, respectively.

The *Alliance* offers these comments, as well as the comments of aquilogic, Inc. attached hereto as **Exhibit A**, on the draft GSPs for the Upper Valley, Forebay, Eastside, Langley, and Monterey Subbasins.[1] These comments are submitted to the SVBGSA as the exclusive groundwater sustainability agency for the Upper, Eastside, and Langley Subbasins, and one of the groundwater sustainability agencies that will adopt the GSPs for the Forebay and Monterey Subbasins. These comments are also submitted to the MCWDGSA and the ASGSA as groundwater sustainability agencies that will adopt the GSPs for the Monterey Subbasin and Forebay Subbasin, respectively. Please include this letter, the aquilogic, Inc. memorandum ("aquilogic Memo"), and the other attachments hereto in the record of proceedings for the GSP of each of these subbasins.

I. <u>THE DRAFT GSPS MUST BE INTEGRATED TO SATISFY SGMA</u>

SGMA's goal is to provide for the sustainable management of priority groundwater basins throughout the State.[2] "Sustainable management" is defined as the "management and use of groundwater in a manner that can be maintained during the planning and implementation horizon without causing undesirable results"—e.g., chronic lowering of groundwater levels, significant and unreasonable reduction of groundwater storage, significant and unreasonable seawater intrusion, and depletions of interconnected surface water that have significant and unreasonable adverse impacts on beneficial uses of the surface water.[3] In order to achieve this goal, groundwater sustainability agencies must coordinate groundwater management within each basin[4] and with each adjacent basin.[5]

Coordination requires GSPs to maintain consistency or analyze inconsistencies in the data and modeling used to develop the GSPs, the minimum thresholds and measurable objectives set in the GSPs, and the

---

[1] The *Alliance* notes that several of the draft GSPs are being revised by the GSA during the public review process. An additional public comment period must be provided once the draft GSPs have been finalized for adoption. Informed public input cannot be provided on documents that are still subject to change.
[2] Wat. Code, § 10720.1.
[3] Wat. Code, § 10721(v), (x).
[4] SGMA defines "basin" as "a groundwater basin or subbasin identified and defined in Bulletin 118." (Wat. Code, § 10721(b); see also 23 Code Regs. ("GSP Regs."), § 341(g) ["The term 'basin' shall refer to an area specifically defined as a basin or 'groundwater basin' in Bulletin 118, and shall refer generally to an aquifer or stacked series of aquifers with reasonably well-defined boundaries in a lateral direction, based on features that significantly impede groundwater flow, and a definable bottom, as further defined or characterized in Bulletin 118"; "The term 'subbasin' shall refer to an area specifically defined as a subbasin or 'groundwater subbasin' in Bulletin 118, and shall refer generally to any subdivision of a basin based on geologic and hydrologic barriers or institutional boundaries, as further described or defined in Bulletin 118."].)
[5] Wat. Code, §§ 10727, 10727.6.

projects and management actions proposed in the GSPs.[6] DWR will review each GSP to ensure it satisfies this requirement—i.e., that the GSP does not adversely affect the "ability of an adjacent basin to implement their groundwater sustainability plan or impedes achievement of sustainability goals in an adjacent basin."[7] Any GSP that cannot meet this standard will not satisfy SGMA.[8]

The consultant that prepared the draft GSPs for the Upper, Forebay, Eastside, and Langley Subbasins has acknowledged the importance of integrated management of surface water and groundwater throughout the Basin:

> It has long been acknowledged that the water resources of the Salinas Valley consist of an integrated surface water and groundwater system . . . This acknowledged surface water/groundwater integration underpins the approach the SVBGSA is taking to achieving groundwater sustainability throughout the Valley; the Salinas River is an integral part of groundwater management and managing groundwater cannot be divorced from the Salinas River's operations. Similarly, groundwater management plays an important role in maintaining Salinas River flows. Larger areas of low groundwater levels in the Salinas Valley will induce more leakage from the Salinas River – reducing Salinas River flows. Maintaining adequately high groundwater levels will help maintain Salinas River flows. These higher groundwater levels that help maintain Salinas River flows is one of the desired outcomes of our groundwater management and is a benefit to surface water users. Groundwater sustainability can lead to long-term reliability in surface water supplies . . .
>
> The Salinas River operations, Salinas River flows, and ability to use water from the River will be clearly influenced by the decisions made during GSP development and implementation. Balanced groundwater management that

---

[6] See e.g., Wat. Code, § 10727.6; GSP Regs., § 354.28(b) ("The description of minimum thresholds shall include the following: . . . (3) How minimum thresholds have been selected to avoid causing undesirable results in adjacent basins or affecting the ability of adjacent basins to achieve sustainability goals."); see also *id.* at §§ 350.4(b), 354.28(b), 354.34(i), 354.38(e), 354.44(b)(6)-(7), 357.2; Department of Water Resources (DWR) Sustainable Management Criteria BMP, pp. 12-17 (Considerations when establishing minimum thresholds for each sustainability indicator includes the adjacent basin's minimum thresholds); DWR Modeling BMP, pp. 21-22; DWR Water Budget BMP, pp. 12, 16, 17, 36.
[7] Wat. Code, § 10733(c).
[8] *Ibid.*; GSP Regs., §§ 350.4, 354.8(d), 354.14, 354.18, 354.28(b)(3), 354.44(b)(6), 354.44(c), 355.4(b), 356.4(j), 357.2(b)(3); DWR Monitoring Networks and Identification of Data Gaps BMP, pp. 6, 8, 27; DWR Water Budget BMP, pp. 7, 12, 16, 17, 36; DWR Modeling BMP, pp. 21-22; DWR Sustainable Management Criteria BMP, pp. 9, 31.

> maintains consistent groundwater levels will provide surface water reliability for the Valley's surface water users.[9]

A Senior Hydrologist with the Monterey County Water Resources Agency (MCWRA) similarly commented:

> Additionally, as was experienced and monitored throughout the Basin during the most recent drought period, lowering of the groundwater table has a significant impact on the Agency's ability to operate the reservoirs to a controlled range of flows at the Salinas River Diversion Facility. As such, overdraft of the groundwater basin, resulting in a reduction in groundwater levels significantly impacted surface water flows, depleting the availability of surface water to riparian water uses.[10]

Close coordination of the draft GSPs for the subbasins is critical as each of the GSPs acknowledge a significant hydrologic and hydraulic connection with adjacent subbasins.[11] In other words, groundwater management in the Upper Valley impacts groundwater management in the Forebay Subbasin, which impacts groundwater management in the 180/400-Foot Aquifer, Eastside, Langley, and Monterey Subbasins, and there is a direct link between groundwater in the Basin and surface water in the Salinas River.

Given the integration of the Basin's surface and groundwater supplies (e.g., that pumping in one subbasin impacts surface and subsurface flows to an adjacent subbasin), SGMA mandates the coordination and integration of the GSPs for the subbasins within SVBGSA's jurisdiction—the GSPs must be integrated in their planning, development, and implementation to ensure the objectives of SGMA are satisfied, the interests of all beneficial users throughout the Basin are considered, and the burden of sustainability is equitably allocated across the Basin.[12] Indeed, the SVBGSA has acknowledged this obligation in its Joint Exercise of Powers Agreement[13] and, as the groundwater sustainability agency for the 180/400-Foot Aquifer, Monterey,

---

[9] Feb. 26, 2019 Letter from Derrik Williams to Leslie Girard, attached hereto as **Exhibit B**.

[10] March 4, 2019 Memorandum from Howard Franklin to Leslie Girard and Gary Petersen, attached hereto as **Exhibit C**.

[11] Draft Upper Valley Subbasin GSP, § 4.3.1.1; Draft Forebay Subbasin GSP, § 4.3.1.1; Draft Eastside Subbasin GSP, § 4.3.1.1; Draft Langley Subbasin GSP, § 4.3.1.1; Draft Monterey Subbasin GSP, § 4.2.3; aquilogic Memo, pp. 2-3, attached hereto as **Exhibit A**.

[12] Wat. Code, § 10723.2; see also DWR Water Budget BMP, pp. 16-17 ("For many basins within the . . . Salinas Valley . . . not all lateral boundaries for contiguous basins serve as a barrier to groundwater or surface water flow . . . In situations where a basin is adjacent or contiguous to one or more additional basins, or when a stream or river serves as the lateral boundary between two basins, it is necessary to coordinate and share water budget data and assumptions. This is to ensure compatible sustainability goals and accounting of groundwater flows across basins, as described in § 357.2 (Interbasin Agreements) of the GSP Regulations."

[13] See Joint Exercise of Powers Agreement Establishing the Salinas Valley Basin GSA, § 2.2 ("The purpose of Agency is to . . . develop[], adopt[], and implement[] a GSP that achieves groundwater sustainability in the Basin."); § 4.1(c) (The JPA has the power to "develop, adopt and implement a GSP for the Basin."); *id.* at § 4.1(l) (The JPA has the power to "establish and administer projects and programs for the benefit of the Basin."); *id.* at § 4.3 ("As set forth in Water Code section 10723.3, the GSA shall consider the interests of all beneficial uses and users of groundwater in the Basin, as well as those responsible for implementing the

Eastside, Langley, Forebay, and Upper Subbasins, the SVBGSA is uniquely qualified to ensure coordination and integration among these subbasins. The SVBGSA previously proposed an integrated GSP that would incorporate the GSPs for each of the six subbasins, but appears to have abandoned or significantly delayed that commitment. As a result, the draft GSPs do not adequately coordinate and integrate their data, minimum thresholds and measurable objectives, and projects and management actions and do not analyze potential impacts on the adjacent subbasins. The draft GSPs must analyze and address these issues before they can be adopted, or delineate a plan for adding this information to the GSPs as soon as possible.

II. THE DRAFT GSPs DO NOT SUFFICIENTLY ANALYZE AND ADDRESS SUSTAINABLE GROUNDWATER MANAGEMENT THROUGHOUT THE BASIN

The *Alliance* supports integrated groundwater management throughout the Basin—such management is critical to the sustainable and equitable management of the integrated water resources throughout the Basin. In accordance with SGMA, this management should utilize consistent data and modeling, analyze impacts of groundwater production on adjacent subbasins, estimate sustainable yields and set minimum thresholds in consideration of impacts to adjacent subbasins, and coordinate projects and management actions throughout the Basin. As described further below, the draft GSPs as currently presented do not meet these thresholds dictated by SGMA.

A. Each Draft GSP Fails to Analyze Inconsistencies in the Data and Modeling Utilized By the Draft GSPs for Adjacent Subbasins

As an initial matter, the draft GSPs for the subbasins utilize differing modeling/estimation techniques that produce inconsistent data throughout the Basin and prevent integration of groundwater management absent additional analysis.

For example, the 180/400-Foot Aquifer Subbasin GSP's historical and current water budgets were created "by aggregating data and analyses from previous reports and publicly available sources" while the future

---

GSP. Additionally, as set forth in Water Code section 10720.5(a) any GSP adopted pursuant to this Agreement shall be consistent with Section 2 of Article X of the California Constitution and nothing in this Agreement modifies the rights or priorities to use or store groundwater consistent with Section 2 of Article X of the California Constitution . . . Likewise, as set forth in Water Code section 10720.5(b) nothing in this Agreement or any GSP adopted pursuant to this Agreement determines or alters surface water rights or groundwater rights under common law or ay provision of law that determines or grants surface water rights."); 180/400-Foot Aquifer Subbasin GSP, p. 9-10 ("This GSP is part of an integrated plan for managing groundwater in all six subbasins of the Salinas Valley Groundwater Basin that are managed by the SVBGSA. The projects and management actions described in this GSP constitute an integrated management program for the entire Valley."); *id.* at 10-14 ("The SVBGSA oversees all or part of six subbasins in the Salinas Valley Groundwater Basin. Implementing the 180/400-Foot Aquifer Subbasin GSP must be integrated with the implementation of the five other GSPs in the Salinas Valley Groundwater Basin . . . The implementation schedule reflects the significant integration and coordination needed to implement all six GSPs in a unified manner."); see also Draft Upper Valley GSP, p. 10-16; Draft Eastside Subbasin GSP, pp. 9-1, 10-7, 10-8, 10-16; Draft Forebay Subbasin GSP, pp. 2-4, 9-2, 9-4, 10-7, 10-9, 10-17; Draft Langley Subbasin GSP, pp. 2-4, 9-1, 9-4, 10-8, 10-9, 10-16.

water budget was created using the Salinas Valley Integrated Hydrologic Model (SVIHM).[14] The draft GSPs for the Eastside, Langley, Forebay, and Upper Valley Subbasins take a different approach—the historical and current water budgets were developed using a "provisional version" of the SVIHM, while future water budgets were developed using "an evaluation version" of the Salinas Valley Operational Model (SVOM).[15] And the draft Monterey Subbasin GSP utilizes a third approach—employing the Monterey Subbasin Groundwater Flow Model for the historic, current, and projected water budgets.[16]

What is more, each of these approaches uses different time periods: (1) the 180/400-Foot Aquifer Subbasin GSP analyzes a historical period of 1995 to 2014 and a current period of 2015 to 2017[17]; (2) the draft GSPs for the Langley, Eastside, Forebay, and Upper Valley Subbasins analyze a historical period of 1980 through 2016 and a current period of 2016[18]; and, (3) the draft Monterey Subbasin GSP analyzes a historical period of 2004 to 2018 and a current period of 2015 to 2018.[19]

The inconsistency in the water-budget approaches for each subbasin must be addressed in the draft GSPs. Absent such an analysis, the draft GSPs cannot adequately analyze a subbasin's potential to impact an adjacent subbasin or foster integrated groundwater management throughout the Basin.[20] Further, this absence of analysis prevents informed input on the draft GSPs by interested parties.[21]

This issue is best exemplified in the inconsistencies between the 180/400-Foot Aquifer Subbasin GSP and the draft Forebay Subbasin GSP. The 180/400-Foot Aquifer Subbasin GSP estimates that the 180/400-Foot Aquifer Subbasin receives (historically and currently) 17,000 acre-feet per year (AFY) of subsurface flow from the Forebay Subbasin.[22] However, the draft Forebay Subbasin GSP estimates that this amount was 3,100 AFY historically and 2,900 AFY currently. These numbers in the draft Forebay GSP are likely

[14] 180/400-Foot Aquifer Subbasin GSP, p. 6-1.
[15] See each referenced draft GSP, pp. 6-1-2. The GSA's use of the SVIHM and SVOM models for the draft GSPs does not satisfy the modeling requirements in the GSP Regulations. Section 352.4(f) of the GSP Regulations state that the models used to develop GSPs must "include publicly available supporting documentation" and "consist of public domain open-source software." The GSPs acknowledge that these requirements are not satisfied, and the draft GSPs state that "[d]etails regarding source data, model construction and calibration, and results for future budgets will be summarized in more detail once the model and associated documentation are available." (See, e.g., Draft Upper Valley Aquifer Subbasin GSP, pp. 6-1-2.) Interested parties cannot provide informed comments and input on the draft GSPs until the GSAs incorporate use of models that satisfy the GSP Regulations.
[16] Draft Monterey Subbasin GSP, p. 6-7.
[17] 180/400-Foot Aquifer Subbasin GSP, p. 6-1.
[18] See each referenced draft GSP, pp. 6-7-8.
[19] Draft Monterey Subbasin GSP, p. 6-5.
[20] See DWR, Water Budget BMP, p. 9 ("Building a coordinated understanding of the interrelationship between changing water budget components and aquifer response will allow local water resource managers to effectively identify future management actions and projects most likely to achieve and maintain the sustainability goal for the basin.").
[21] The draft GSPs also do not explain why different years are used to set minimum thresholds and measurable objectives in each subbasin, or how those inconsistencies impact sustainable groundwater management. (See aguilogic, Inc. Memo, p. 3, attached hereto as **Exhibit A**.)
[22] 180/400-Foot Aquifer Subbasin GSP, p. 6-16.

overestimates (i.e., the 180/400-Foot Aquifer is estimated to receive less subsurface flow from the Forebay Subbasin than the stated numbers) as the SVIHM utilized to provide the estimates in the draft Forebay Subbasin GSP only accounted for approximately 65% of the groundwater pumping in the Forebay Subbasin.[23] The discrepancy in interbasin flow needs to be addressed in the draft Forebay Subbasin GSP, or identified as a data gap that will be addressed through additional modeling as soon as possible. Without such information, the draft GSP cannot analyze how its implementation will impact the implementation of the 180/400-Foot Aquifer Subbasin GSP.

In sum, the draft GSPs must identify and analyze the inconsistencies in the modeling simulations and the time periods used for the water budgets in each of the GSPs in order to satisfy SGMA.[24] The *Alliance* identified a potential solution to this issue in its correspondence to the SVBGSA dated August 12, 2021, wherein the *Alliance* requested that the GSA conduct additional simulations with the SVIHM that are specifically focused on the issue of interbasin groundwater flows in order to understand the amount of Basin-wide groundwater discharge that is and has been captured by pumping. After adjusting the modelling simulations with GEMS data, the SVBGSA could integrate the data into the draft GSPs and provide an informed analysis of how each draft GSP will impact adjacent subbasins. Based upon the text of the draft GSPs, it appears that this modelling has already been completed in some capacity. In each of the draft GSPs for the Langley, Eastside, Forebay, and Upper Valley Subbasins, the GSPs state a “model simulation without any groundwater pumping in the model . . . was compared to the model simulation with groundwater pumping” to understand depletion of interconnected surface water.[25] However, the draft GSPs do not extrapolate this data to analyze impacts on surface or subsurface interbasin flows or adjacent subbasins. The *Alliance* understands that the SVBGSA is undertaking additional modeling for an update to the draft GSPs and strongly recommends that the SVBGSA incorporate the *Alliance’s* requested modeling simulations into the update. If not, the *Alliance* urges the SVBGSA to commit to adding this information prior to adoption of the draft GSPs or committing to a timeline in which it will be added shortly thereafter. Without this information, the GSPs cannot not analyze each of the issues required to be addressed by SGMA.

B. The Draft GSPs Do Not Adequately Analyze Impacts to Adjacent Subbasins

As discussed above, a GSP must not adversely affect “the ability of an adjacent basin to implement their [GSP] or impede[] achievement of sustainability goals in an adjacent basin.”[26] The GSP Regulations specify that minimum thresholds should be selected to “avoid causing undesirable results in adjacent basins or affecting the ability of adjacent basins to achieve sustainability goals.”[27] And the GSP Regulations require DWR to evaluate a GSP to ensure it satisfies these objectives.[28] The draft GSPs as currently presented do not satisfy these requirements.

---

[23] Draft Forebay Subbasin GSP, pp. 6-19, 21.
[24] See, e.g., DWR Water Budget BMP, pp. 16-17.
[25] See, e.g., Draft Forebay Subbasin GSP, p. 5-30.
[26] Wat. Code, § 10733.
[27] GSP Regs., § 354.28(b)(3).
[28] GSP Regs., § 355.4(b)(7).

1. The Draft Eastside Subbasin and Langley Subbasin GSPs

The Eastside Subbasin and Langley Subbasin GSPs largely require similar analysis and information to satisfy SGMA. The GSPs do not account for impacts to adjacent subbasins in defining sustainable yields or setting minimum thresholds and measurable objectives. Each of these issues is addressed in detail below.

a. *The GSPs do not account for impacts to adjacent subbasins in defining sustainable yields*

SGMA defines "sustainable yield" as "the maximum quantity of water, calculated over a base period representative of long-term conditions in the basin and including any temporary surplus, that can be withdrawn annually from a groundwater supply without causing an undesirable result."[29] Further, the sustainable yield must be defined in a manner that will not result in undesirable results in adjacent subbasins.[30] Here, the sustainable yields in the draft GSPs for both the Eastside and Langley Subbasins do not account for impacts on interbasin flow to the 180/400-Foot Aquifer Subbasin.

For example, the draft Eastside Subbasin GSP states that a pumping depression east of the City of Salinas creates a hydraulic gradient towards the depression, with groundwater flowing towards the pumping depression and away from the boundary with the 180/400-Foot Aquifer Subbasin.[31] This depression has reversed the natural downgradient groundwater flow from the Eastside Subbasin to the 180/400-Foot Aquifer Subbasin, drawing 3,600 AFY historically and 5,400 AFY currently of groundwater from the 180/400-Foot Aquifer Subbasin.[32] This amount is likely substantially underestimated as the SVIHM only accounts for 81% of groundwater pumping in the Subbasin.[33] Despite this unnatural hydraulic gradient and the pull of groundwater from the 180/400-Foot Aquifer Subbasin, the draft Eastside Subbasin GSP includes this interbasin flow in its calculation of sustainable yield,[34] but the draft GSP does not analyze how estimated sustainable yield will impact groundwater management in the 180/400-Foot Aquifer Subbasin.

Similarly, the draft Langley Subbasin GSP states that a pumping depression has formed in the center of the Langley Subbasin as a result of a pumping trough.[35] Groundwater is drawn towards the pumping depression and away from the 180/400-Foot Aquifer Subbasin despite the natural downward gradient flow towards the 180/400-Foot Aquifer and Eastside Subbasins.[36] The draft Langley Subbasin GSP then estimates that,

---

[29] Wat. Code, § 10721(w).
[30] See Wat. Code, § 10733.
[31] Draft Eastside Subbasin GSP, p. 5-11.
[32] *Id.* at pp. 6-19-20 ("Groundwater pumping near the [C]ity of Salinas has created a cone of depression . . . that draws in groundwater into the Eastside Aquifer Subbasin from the 180/400-Foot Aquifer Subbasin, which is naturally slightly downgradient in the Salinas area. Estimated groundwater inflows from the 180/400-Foot Aquifer Subbasin have slightly increased since 1980.").
[33] *Id.* at p. 6-17. The 180/400-Foot Aquifer Subbasin GSP estimates the outflow to the Eastside and Langley Subbasins amounts to 8,000 AFY. (*Id.* at p. 6-19.)
[34] *Id.* at pp. 6-22-24, Table 6-10.
[35] Draft Langley Subbasin GSP, p. 5-7.
[36] *Id.* at p. 5-18, Figure 5-11.

despite this reversal in groundwater elevations, the 180/400-Foot Aquifer Subbasin has historically received 3,700 AFY and currently receives 2,900 AFY in interbasin flow from the Langley Subbasin, while the Eastside Subbasin has historically received 1,100 AFY and currently receives 1,700 AFY in interbasin flow from the Langley Subbasin.[37] However, the draft Langley Subbasin GSP fails to analyze how the pumping depression in the Langley Subbasin has impacted and will continue to impact these interbasin flows—e.g., what are the outflows to the 180/400-Foot Aquifer and Eastside Subbasins if the pumping depression were ameliorated? Again, the draft GSP includes these unnatural interbasin flows in its calculation of the sustainable yield without analyzing the impacts on adjacent subbasins.[38]

Without understanding how groundwater production impacts interbasin flows, the draft GSPs cannot accurately estimate the sustainable yield of the subbasins and their impact on adjacent subbasins.[39] As discussed above, this issue can be addressed by undertaking the additional modeling simulations requested by the *Alliance* and revising the draft GSPs accordingly. This additional information should be added prior to the adoption of the draft GSPs, or the draft GSPs should commit to a timeline under which this information will be added as soon as possible after adoption of the draft GSPs.

b. *The GSPs do not analyze how their minimum thresholds and measurable objectives will impact adjacent subbasins*

The draft GSPs also do not consider impacts to adjacent subbasins in their setting of minimum thresholds and measurable objectives, as required by SGMA.[40]

For example, the draft Eastside Subbasin GSP sets the minimum threshold for groundwater elevations at 2015 levels.[41] As shown in Figure 8-1, these levels are only nominally above historic lows (approximately 6 feet higher) and barely above the lowest elevation since the introduction of the CSIP and Salinas Valley Water Project.[42] Consequently, these groundwater elevations will still produce a significant pumping

---

[37] *Id.* at p. 6-19.
[38] *Id.* at pp. 6-21-23.
[39] See DWR Water Budget BMP, p. 17 (To evaluate the impact on adjacent basin, "this will necessitate GSA coordination and sharing of water budget data, methodologies, and assumptions between contiguous basins including: • Accurate accounting and forecasting of surface water and groundwater flows across the basin boundaries.").
[40] GSP Regs., § 354.28(b)(3) ("The description of minimum thresholds shall include the following: . . . (3) How minimum thresholds have been selected to avoid causing undesirable results in adjacent basins or affecting the ability of adjacent basins to achieve sustainability goals."); see also GSP Regs., § 355.4(b)(7); DWR Sustainable Management Criteria BMP, p. 9; DWR Sustainable Management Criteria BMP, p. 10 ("The purpose of the specific requirements is to ensure consistency within groundwater basins and between adjacent groundwater basins.").
[41] Draft Eastside Subbasin GSP, p. 8-7.
[42] *Id.* at p. 8-13.

depression east of the City of Salinas that will draw water away from the boundary with the 180/400-Foot Aquifer Subbasin.[43]

Similarly, the draft Langley Subbasin GSP sets the minimum threshold for groundwater elevations at 2019 levels—the lowest elevations since the introduction of the CSIP and Salinas Valley Water Project and only nominally above the historic lows in the Subbasin.[44] These levels will continue to produce a significant pumping depression east of the City of Salinas that will draw water away from the boundary with the 180/400-Foot Aquifer Subbasin.[45] Despite the maintenance of these unnatural gradients, neither draft GSP analyzes how these minimum thresholds will impact adjacent subbasins (e.g., the 180/400-Foot Aquifer Subbasin).

The draft GSPs for the Eastside and Langley Subbasins merely include the statement that: "Minimum thresholds for the [subbasins] will be reviewed relative to information developed for the neighboring subbasins' GSPs to ensure that these minimum thresholds will not prevent the neighboring subbasins from achieving sustainability."[46] This statement is not evidence and it does not ensure the management of the subbasins will avoid impacts to adjacent subbasins.[47] As discussed above, this issue can be addressed by undertaking the additional modeling simulations requested by the *Alliance* and revising the draft GSPs accordingly.

The lack of analysis is concerning as both draft GSPs acknowledge that low groundwater elevations within the Langley and Eastside Subbasins may exacerbate seawater intrusion in the 180/400-Foot Aquifer Subbasin.[48] But the draft GSPs only mention this issue in concluding: "The chronic lowering of groundwater

---

[43] *Id.* at p. 8-10, Figure 8-3. The same issue applies to the draft Eastside Subbasin GSP's measurable objective for groundwater elevations—it maintains a pumping depression that reverses the natural hydraulic gradient towards the 180/400-Foot Aquifer Subbasin but fails to explain how the measurable objective will not impact the 180/400-Foot Aquifer Subbasin. (See e.g., Draft Eastside Subbasin GSP, p. 8-19.)
[44] Draft Langley Subbasin GSP, pp. 8-8, 8-13.
[45] *Id.* at p. 8-10. Again, the same issue applies to the draft Langley Subbasin GSP's measurable objective for groundwater elevations—it maintains a pumping depression that reverses the natural hydraulic gradient towards the 180/400-Foot Aquifer Subbasin but fails to explain how the measurable objective will not impact the 180/400-Foot Aquifer Subbasin. (See e.g., Draft Langley Subbasin GSP, p. 8-19.)
[46] *Id.* at p. 8-6; Draft Eastside Subbasin GSP, p. 8-16.
[47] See Joint Exercise of Powers Agreement Establishing the SVBGSA, § 4.3 ("As set forth in Water Code section 10723.3, the GSA shall consider the interests of all beneficial uses and users of groundwater in the Basin, as well as those responsible for implementing the GSP. Additionally, as set forth in Water Code section 10720.5(a) any GSP adopted pursuant to this Agreement shall be consistent with Section 2 of Article X of the California Constitution and nothing in this Agreement modifies the rights or priorities to use or store groundwater consistent with Section 2 of Article X of the California Constitution . . . Likewise, as set forth in Water Code section 10720.5(b) nothing in this Agreement or any GSP adopted pursuant to this Agreement determines or alters surface water rights or groundwater rights under common law or ay provision of law that determines or grants surface water rights.").
[48] See Draft Langley Subbasin GSP, pp. 3-18, 4-32, 5-18 (Figure 5-11 "shows the groundwater elevations that are persistently below sea levels that, when paired with a pathway, enable seawater intrusion. The groundwater elevation contours show that groundwater is drawn toward the depression at the northern end of the Eastside Aquifer Subbasin. If the magnitude of this depression increases, it could potentially draw seawater intrusion into the Langley Subbasin."), 5-20 (Figure 5-11); Draft Eastside Subbasin GSP, pp. 3-17,

level minimum thresholds are set above historic lows. Therefore, the groundwater elevation minimum thresholds are intended to not exacerbate, and may help control, the rate of seawater intrusion."[49] That statement must be revised to acknowledge that the pumping depressions in the Langley and Eastside Subbasins will remain even if the groundwater elevation minimum thresholds and measurable objectives are achieved, and the seawater minimum thresholds set by the draft Langley and Eastside Subbasin GSPs only protect against seawater intrusion in their respective subbasins, not against seawater intrusion in adjacent subbasins like the 18/400-Foot Aquifer Subbasin.[50]

In sum, the draft Langley and Eastside Subbasin GSPs in their current form do not account for potential impacts to adjacent subbasins in setting their minimum thresholds and measurable objectives. As a result, the draft GSPs cannot provide any evidence that their implementation will not impair implementation of a GSP in an adjacent subbasin—e.g., the 180/400-Foot Aquifer Subbasin GSP's seawater intrusion minimum threshold, which requires seawater intrusion to be maintained at 2017 levels, and measurable objective, which requires the seawater intrusion isocontour to be pushed back to Highway 1.[51] This analysis should be added to the draft GSPs prior to adoption by the SVBGSA, or the draft GSPs should provide a commitment to incorporating this information within a time certain.[52]

c. *There is no support for using groundwater elevations as a proxy for groundwater storage minimum thresholds*

As mentioned above, the sustainable yield of the basin is the amount of water that can be withdrawn annually without causing an undesirable result, such as the "significant and unreasonable reduction of groundwater storage."[53] The GSP Regulations permit a minimum threshold for groundwater elevations to be used as the minimum threshold for other sustainability indicators, "where the Agency can demonstrate that the representative value is a reasonably proxy . . . as supported by adequate evidence."[54] Here, both the draft Eastside Subbasin GSP and the Langley Subbasin GSP utilize groundwater elevation minimum thresholds

4-35 ("the groundwater elevations in the northwestern portion of the Eastside Subbasin (near the City of Salinas) are below sea level, creating a groundwater gradient away from the coast and towards the Eastside Subbasin"), 5-26-29 .

[49] Draft Langley Subbasin GSP, p. 8-15; Draft Eastside Subbasin GSP, p. 8-15.

[50] Draft Langley Subbasin GSP, p. 8-28; Draft Eastside Subbasin GSP, p. 8-29.

[51] See 180/400-Foot Aquifer Subbasin GSP, pp. 8-32-37.

[52] A report prepared for MCWRA has highlighted the significant impact pumping in the Eastside and Langley Subbasins has on seawater intrusion in the 180/400-Foot Aquifer Subbasin. (See November 19, 2013, Technical Memorandum, Protective Elevations to Control Sea Water Intrusion in the Salinas Valley, attached hereto as **Exhibit D**.) The report states: "At one time (before excessive pumping), the East Side Subarea was one of the natural sources of recharge to the adjacent Pressure Subarea with ground water flowing from the northeast to the southwest. However, historical groundwater level declines have resulted in a reversal of the gradient." (*Id.* at p. 3.) The report then states that: "Artificial recharge in the East Side Subarea would reduce subsurface inflow from the Pressure Subarea and eventually restore the historical northeast to southwest recharge. Both northwest underflow from the Forebay Subarea as well as southwest recharge from the East Side Subarea would help control seawater intrusion." (*Id.* at pp. 6-7.) See also aquilogic Memo, pp. 8-12, attached hereto as **Exhibit A**.

[53] Wat. Code, § 10721(w), (x).

[54] GSP Regs., § 354.28(d); DWR Sustainable Management Criteria BMP, pp. 17-18.

as proxies for groundwater storage minimum thresholds.[55] However, there is insufficient evidence to support that approach.

In particular, each of the draft GSPs sets groundwater elevations at near historic lows, and show a substantial trend in declining groundwater storage over the historic period.[56] The minimum threshold groundwater elevations, in other words, have resulted in overdraft of the subbasins.[57] And by setting the minimum thresholds at historic low groundwater elevations, the draft GSPs will facilitate continued decline in groundwater storage.[58] In fact, because there is no commitment to pump at the sustainable yield of the subbasins, it is possible that production in the subbasins could increase over historic and current amounts so long as the subbasins do not experience another significant drought and still comply with the groundwater elevation minimum thresholds. The SVBGSA's prior actions seem to imply that utilizing groundwater elevations as a proxy in this scenario is improper—the 180/400-Foot Aquifer Subbasin GSP set the groundwater storage minimum threshold to production at the projected sustainable yield.[59] The draft GSP must explain why this different approach will suffice now.

2. The Draft Forebay and Upper Valley Subbasin GSPs

The draft Forebay and Upper Valley Subbasin GSPs lack the same analysis as the draft GSPs for the Eastside and Langley Subbasins—they do not adequately consider impacts to adjacent subbasins. These issues begin with the draft GSPs' water budget and estimate of sustainable yield, and cascade through the minimum thresholds, measurable objectives, and projects and management actions.

As discussed above, SGMA requires GSPs to define a sustainable yield for each basin that will avoid undesirable results and impacts to adjacent basins. The sustainable yields defined in the draft GSPs for the Forebay and Upper Valley Subbasins do not meet this threshold. Both draft GSPs conclude that the subbasins have not been in overdraft historically, but they do not analyze how groundwater pumping within the subbasins (151,100 to 174,500 AFY in the Forebay Subbasin and 108,500 to 129,600 AFY in the Upper Valley) impacts surface and subsurface flows to adjacent subbasins.[60]

---

[55] Draft Eastside Subbasin GSP, p. 8-23; Draft Langley Subbasin GSP, p. 8-22.
[56] See discussion *supra;* Draft Eastside Subbasin GSP, p. 5-21; Draft Langley Subbasin GSP, p. 5-16.
[57] *Ibid*.
[58] See, e.g., Wat. Code, § 10721(x)(1) ("Overdraft during a period of drought is not sufficient to establish a chronic lowering of groundwater levels if extractions and groundwater recharge are managed as necessary to ensure that reductions in groundwater levels or storage during a period of drought are offset by increases in groundwater levels or storage during other periods.").
[59] 180/400-Foot Aquifer Subbasin GSP, p. 8-25 ("The total volume of groundwater that can be annually withdrawn from the Subbasin without leading to a long-term reduction in groundwater storage or interfering with other sustainability indicators is the calculated sustainable yield of the Subbasin."); see also DWR GSP Assessment Staff Report, p. 25 ("The Plan describes how setting the minimum threshold as the long-term sustainable yield for the Subbasin is a reasonable, protective approach against overdraft and the long-term reduction of groundwater storage.").
[60] Draft Forebay Subbasin GSP, pp. 6-45-46; Draft Upper Valley Subbasin GSP, pp. 6-22-23.

For example, the draft Forebay Subbasin GSP states that the SVIHM, which undercounts groundwater pumping by 35%, estimates the Forebay Subbasin received 90,300 AFY historically through stream exchange, currently receives 77,800 AFY, and 31,800 AFY of that stream exchange on average is caused by groundwater pumping.[61] Similarly, the draft Upper Valley Subbasin GSP states that the SVIHM, which under counts groundwater pumping by 24%, estimates the Upper Valley Subbasin received 89,100 AFY historically through stream exchange, currently receives 65,500 AFY, and 1,100 AFY of that stream exchange on average is caused by groundwater pumping.[62] This recharge is substantially induced by the operation of the Nacimiento and San Antonio Reservoirs; prior to that time groundwater storage was significantly decreasing in the subbasins.[63] However, neither draft GSP analyzes: (a) how streamflow recharges the subbasins during drought years, offering instead averages over the historical period, and (b) how groundwater pumping impacts natural surface or subsurface flows to adjacent subbasins—i.e., without pumping, how much groundwater would flow to the downgradient subbasin? Instead, the draft GSPs use the average stream exchange amounts to facilitate a "finding" that the subbasins are presently managed within their sustainable yield. Without understanding how pumping impacts streamflow during drought years and interbasin surface and subsurface flow, the draft GSPs cannot reasonably estimate sustainable yield in the subbasins or analyze how implementation of the draft GSPs will impact adjacent subbasins' GSPs.

The failure to analyze impacts to adjacent subbasins becomes more apparent in the draft GSPs' discussion of minimum thresholds. The draft Forebay Subbasin GSP sets the minimum threshold for groundwater elevations at 2015 groundwater levels, only a few feet above the historic low, while the draft Upper Valley Subbasin GSP sets the minimum threshold for groundwater elevations at "5 feet below the lowest ground elevation between 2012 and 2016," significantly below the historic low.[64] These minimum thresholds are not reasonable—set at levels experienced at the bottom of a historic drought, or even lower—and cannot be qualified as sustainable groundwater management.[65] The draft Upper Valley GSP admits as much, stating: "The groundwater elevations during the 2012 to 2016 drought in the Upper Valley Aquifer Subbasin are the lowest groundwater elevations seen in the Subbasin and are considered significant and unreasonable."[66]

---

[61] Draft Forebay Subbasin GSP, pp. 5-30, 6-23. Note that the draft GSPs may also underestimate streamflow depletion by only analyzing stream cells that are connected to groundwater more than 50% of the time. (See aquilogic Memo, p. 5, attached hereto as **Exhibit A**.)
[62] Draft Upper Valley Subbasin GSP, pp. 5-31, 6-22.
[63] Draft Upper Valley Subbasin GSP, p. 5-18; Draft Forebay Subbasin GSP, p. 5-17; see also Hydrogeology and Water Supply of Salinas Valley, pp. 15-16, attached hereto as **Exhibit D**.
[64] Draft Forebay Subbasin GSP, pp. 8-8, 8-14; Draft Upper Valley Subbasin GSP, pp. 8-7, 8-12 (emphasis added).
[65] Wat. Code, § 10720.1 ("In enacting this part, it is the intent of the Legislature to do all of the following: (a) To provide for the sustainable management of groundwater basins. . . . (c) To establish minimum standards for sustainable groundwater management."]; GSP Regs., § 355.4(b) ("When evaluating whether a Plan is likely to achieve the sustainability goal for the basin, the Department shall consider the following: (1) Whether the assumptions, criteria, findings, and objectives, including the sustainability goal, undesirable results, minimum thresholds, measurable objectives, and interim milestones are reasonable and supported by the best available information and best available science. . . .").
[66] Draft Upper Valley Subbasin GSP, p. 8-10 (emphasis added).

Moreover, the draft GSPs do not analyze how the minimum thresholds will impact flows in the Salinas River or adjacent subbasins. Rather, this analysis appears to be deferred to the future. The draft GSPs state that: "Minimum thresholds . . . will be reviewed relative to information developed for neighboring subbasins' GSPs to ensure that these minimum thresholds will not prevent the neighboring subbasin from achieving sustainability."[67] As discussed above, this issue can be addressed by undertaking the additional modeling simulations requested by the *Alliance* and revising the draft GSPs accordingly. This additional information should be added prior to the adoption of the draft GSPs, or the draft GSPs should commit to a timeline under which this information will be added as soon as possible after adoption of the draft GSPs.

These same concerns are raised with respect to the groundwater storage minimum thresholds. The draft Upper Valley Subbasin GSP uses the groundwater elevation minimum threshold as a proxy, which is permitted, as discussed above, as long as it is supported by adequate evidence.[68] However, there is no evidence supporting that approach as the groundwater elevation minimum threshold suffers the flaws discussed above, and evidence in the draft GSP relating groundwater elevations to groundwater storage shows groundwater storage at historic lows by a wide margin when groundwater levels were 5 feet above the groundwater elevation minimum threshold in 2016.[69] Similarly, the draft Forebay Subbasin GSP sets the minimum threshold for groundwater storage based upon the groundwater elevation minimum threshold: "The minimum threshold groundwater elevation contours . . . were used to estimate the amount of groundwater in storage when groundwater elevations are held at the minimum threshold levels."[70] Again, there is no evidence supporting that approach as the groundwater elevation minimum threshold is flawed as discussed above, and evidence in the draft GSP shows the groundwater elevation minimum threshold results in historic lows in groundwater storage.[71] In fact, the groundwater elevation minimum thresholds allow for additional production in the subbasins over historic and current amounts so long as the subbasins do not experience another significant drought. There is no commitment in the draft GSPs that the production in the subbasins will be restricted to the estimated sustainable yield in the subbasins, and there is no model simulation showing the minimum threshold for groundwater elevations will prevent continued decline in groundwater storage.

Finally, the draft GSPs also utilize groundwater elevations as proxies to set the minimum thresholds for depletion of interconnected surface water.[72] But again, there is no evidence supporting this approach. These groundwater elevation proxies are at or near historic lows, and there is no evidence proving these elevations will prevent the depletion of interconnected surface water that would have a significant and unreasonable impact on beneficial uses. Rather, the draft GSPs merely state that these levels will not impact beneficial uses because there is not currently any litigation over surface water uses, and due to the operation of the Nacimiento Reservoir.[73] However, this statement does not acknowledge that decreased groundwater

[67] Draft Upper Valley Subbasin GSP, p. 8-14; Draft Forebay Subbasin GSP, p. 8-17.
[68] Draft Upper Valley Subbasin GSP, p. 8-20.
[69] Draft Upper Valley Subbasin GSP, pp. 5-13, 5-18.
[70] Draft Forebay Subbasin GSP, p. 8-24.
[71] Draft Forebay Subbasin GSP, p. 5-17.
[72] See Draft Upper Valley Subbasin GSP, p. 8-39; Draft Forebay Subbasin GSP 8-42.
[73] Draft Forebay Subbasin GSP, pp. 8-44-45; Draft Upper Valley Subbasin GSP, pp. 8-41-42.

elevations will increase depletion of the Salinas River, and reduce flow to downstream uses, including those uses in adjacent subbasins.[74] Lastly, the draft GSPs do not analyze how these minimum thresholds for depletion of interconnected surface water will impact adjacent subbasins.

In sum, the draft Forebay and Upper Valley GSPs require additional data and analysis to satisfy SGMA. These issues must be addressed before the GSPs are adopted, or the draft GSPs must be provide for their provision by a date certain.[75]

3. <u>The Inadequacies in the Draft GSPs Addressed Above Threaten to Impinge Upon Water Rights</u>

As stated previously, each of the groundwater sustainability agencies has an obligation to consider the interests of all beneficial users of the Basin[76] when implementing SGMA. Moreover, SGMA does not "determine[] or alter[] surface water rights or groundwater rights under common law or any provision of law that determines or grants surface water rights."[77]

By not analyzing potential impacts to adjacent subbasins in each draft GSP, the groundwater sustainability agencies disproportionately allocate the burden of sustainability across the Basin and threaten to impair groundwater users' rights in and to the Basin. This approach violates SGMA and must be addressed before the groundwater sustainability agencies adopt the draft GSPs or, as discussed above, through a commitment in the draft GSPs to modify or update their contents within a time certain.

III. THE DRAFT GSPS MUST INCORPORATE PROJECTS AND MANAGEMENT ACTIONS TO ACHIEVE SUSTAINABILITY

The GSP Regulations require each GSP to "include a description of the projects and management actions the Agency has determined will achieve the sustainability goal for the basin, including projects and management actions to respond to changing conditions in the basin."[78] Because the draft GSPs are lacking the data and analysis described in Section II above, the draft GSPs cannot meet this requirement (e.g., the draft GSPs' lack of analysis of impacts to adjacent basins prevents an adequate proposal of projects and management actions to achieve sustainability). Further, without understanding impacts on interbasin surface and subsurface flow and how implementation of the draft GSPs will impact adjacent subbasins, the groundwater sustainability agencies will be unable to properly assess the benefits associated with any future projects or management actions—e.g., if they propose projects involving dam operations, how can the groundwater sustainability agencies assess the benefits of those projects to the Lower Valley? Accordingly,

[74] aquilogic Memo, pp. 3-8, attached hereto as **Exhibit A**; DWR Water Budget BMP, pp. 4-5.
[75] See also aquilogic Memo, pp. 3-8, attached hereto as **Exhibit A**.
[76] Wat. Code, § 10723.2
[77] Wat. Code, § 10720.5(b); see also Wat. Code, § 10720.1(a) and (b).
[78] GSP Regs., § 354.44(a).

the *Alliance* reserves the right to comment on the draft GSPs' proposed projects and management actions once the issues described above have been addressed.

However, as a preliminary note, the draft GSPs as currently presented do not include sufficient projects or management actions to achieve sustainable groundwater management Basin-wide. Rather, the draft GSPs appear to foist the burden of sustainable groundwater management on the Eastside, Langley, 180/400-Foot Aquifer, and Monterey Subbasins, while avoiding consequential projects and management actions in the Forebay and Upper Valley Subbasins. Indeed, the draft GSPs for the Eastside, Langley, and Monterey Subbasins each include a management action for pumping allocations and controls, but no such management action is included in the draft Forebay Subbasin or Upper Valley Subbasin GSPs.[79] Instead, the draft Forebay Subbasin and Upper Valley Subbasin GSPs include management actions that only superficially impact the subbasins—e.g., the proposed Subbasin "Sustainable Management Criteria Technical Advisory Committees," which require the formation of a "TAC for each Subbasin" that will "develop recommendations to correct negative trends in groundwater conditions and continue to meet the measurable objectives."[80] This issue must be addressed in the next draft of the GSPs.

The *Alliance* also notes that the draft GSPs do not mention the project proposed in the Hydrogeology and Water Supply of Salinas Valley White Paper prepared by the Salinas Valley Groundwater Basin Hydrology Conference for MCWRA in 1995 ("Salinas Valley White Paper"), which is attached hereto as **Exhibit E**. The "Conference" was a "panel of 10 geologists, hydrogeologists, and engineers familiar with Salinas Valley ground water basin" that was convened to "reach agreement on the basic physical characteristics of the basin, and the surface and ground water flow within the basin."[81] The Conference had a "remarkable unanimity of opinion" on the understanding of the "physical characteristics of the basin, the hydrologic system, the interaction between surface water and ground water, and definition of the specific ground water problems in the basin."[82] The Conference agreed that this understanding pointed "compellingly toward an already identified *regional* solution to the Valley's groundwater water resources problem" and recommended pursuing that solution.[83]

> The need for conjunctive operation of surface water and ground water storage was recognized as early as 1946. In 1946, the California Department of Water Resources published a report on Salinas Valley that described the occurrence of seawater intrusion and declining ground water levels. The report recommended a project to eliminate these problems that included development of surface water and ground water storage. Surface water storage was to be accomplished by the construction of dams on tributaries to Salinas River, and ground water storage was to be accomplished by ground water transfers from the Forebay Area to the Pressure Area and East [S]ide Area. The Department

[79] See Draft Eastside Subbasin GSP, § 9.4.12; Draft Langley Subbasin GSP, § 9.4.5; Draft Monterey Subbasin GSP, § 9.4.8; see also 180/400-Foot Aquifer Subbasin GSP, § 9.2 [water charges framework].
[80] Draft Upper Valley Subbasin GSP, § 9.4.1; Draft Forebay Subbasin GSP, § 9.4.1.
[81] *Id.* at p. 5.
[82] *Ibid.*
[83] *Ibid.*

> recommended transfer facilities that include wells in the Forebay Area, conveyance facilities from the Forebay Area to the Pressure and East Side Areas, and distribution facilities within the Pressure and East Side Areas. In such a conjunctive operation, the increased extraction in the Forebay Area and conveyance of water to the Pressure and East Side Areas would vacate ground water storage in the Forebay Area. This empty storage space would be refilled by additional infiltration from Salinas River . . . Part of the recommended facilities for surface water and ground water storage have been completed by the construction of the dams for San Antonio and Nacimiento reservoirs, but the facilities for the effective use of groundwater storage have not been completed. The operation of San Antonio and Nacimiento reservoirs has produced benefits to [S]alinas Valley, but the ultimate benefits that would result from the construction and operation of transfer facilities have not been realized. **The panel concluded that the facilities recommended in 1946 by the California Department of Water Resources should be completed immediately** . . . The result of partially completing the project has been an uneven distribution of benefits throughout the Valley. The Forebay Area and Upper Valley Areas have enjoyed relatively large benefits from San Antonio and Nacimiento reservoirs that would have been shared equally with the Pressure and East Side Areas if the intended transfer facilities had been built. In the absence of the transfer facilities, seawater intrusion into the Pressure Area and water-level declines within the East Side Area have not been mitigated.[84]

The Conference noted that this solution is practical as the "water resources problem in Salinas Valley is not a water supply problem. It is a water distribution problem. The basin has enough surface and ground water to meet existing and projected future average annual agricultural, and municipal and industrial water demand through the year 2030. The problem lies in managing those supplies to meet water demands at all locations in the Valley at all times."[85] This project is an example of integrated groundwater management for the Basin as a whole and should be included in the list of projects and management actions in each of the draft GSPs.[86]

IV. <u>CONCLUSION</u>

The *Alliance* appreciates the opportunity to provide these comments on the draft GSPs, as well as the groundwater sustainability agencies' consideration of the *Alliance*'s input. At present, the draft GSPs do not provide a sufficient basis for integrated management of the Basin given their inconsistent analytical approaches and inadequate analysis of impacts on adjacent subbasins. The *Alliance* makes these comments with the hope that these issues can be addressed through additional engagement prior to the adoption of the GSPs. It is critical that the groundwater sustainability agencies lay the foundation now for the integrated sustainable management of the Basin; without such a foundation, the agencies will not be able to satisfy their obligations under SGMA.

---

[84] Salinas Valley White Paper, pp. 15-16, attached hereto as **Exhibit E (**emphasis added).
[85] *Id.* at p. 7.
[86] See aquilogic Memo, pp. 12-13, attached hereto as **Exhibit A**.

Respectfully submitted,

Stephanie Osler Hastings
Christopher R. Guillen

Exhibits:

A. October 15, 2021 aquilogic, inc. memorandum
B. February 26, 2019 Letter from Derrik Williams to Les Girard
C. March 4, 2019 Memorandum from Howard Franklin to Gary Petersen & Les Girard
D. November 19, 2013 Technical Memorandum re Protective Elevations to Control Sea Water Intrusion in the Salinas Valley
E. June 1995 Salinas Valley Ground Water Basin Hydrology Conference White Paper re Hydrogeology and Water Supply of Salinas Valley

cc: Emily Gardner, Senior Advisor / Deputy General Manager (gardnere@svbgsa.org)
Derrik Williams, Montgomery & Assoc. (dwilliams@elmontgomery.com)
Leslie Girard, Monterey County Counsel (GirardLJ@co.monterey.ca.us)

23184613

EXHIBIT A

aquilogic, Inc.
environment • water • strategy

245 Fischer Avenue, Suite D-2
Costa Mesa, CA 92626
Tel. +1.714.770.8040
Web: www.aquilogic.com

October 15, 2021

MEMORANDUM

To: Donna Meyers, Salinas Valley Basin Groundwater Sustainability Agency
Remleh Scherzinger, Marina Coast Water District Groundwater Sustainability Agency
Curtis Weeks, Arroyo Seco Groundwater Sustainability Agency

From: Robert H. Abrams, PhD, PG, CHg, Principal Hydrogeologist, aquilogic, Inc.
Anthony Brown, CEO & Principal Hydrologist, aquilogic, Inc.

Subject: Comments on Draft Groundwater Sustainability Plans for the Eastside Aquifer, Forebay Aquifer, Upper Valley Aquifer, Langley Area, and Monterey Subbasins of the Salinas Valley Groundwater Basin

Project No.: 018-09

Aquilogic, Inc. (**aquilogic**) is pleased to provide this memorandum on behalf of the Salinas Basin Water Alliance (SBWA). The curricula vitae for Mr. Brown and Dr. Abrams are provided in **Attachment A**. The memorandum provides our comments on the following draft Groundwater Sustainability Plans (GSPs) prepared by the Salinas Valley Basin Groundwater Sustainability Agency (SVBGSA):

- Upper Valley Aquifer Subbasin (Upper Valley)
- Forebay Aquifer Subbasin (Forebay)
- Eastside Aquifer Subbasin (Eastside)
- Langley Area Subbasin (Langley), and
- Monterey Subbasin (Monterey)

The draft GSP for the Monterey was prepared jointly with the Marina Coast Water District (MCWD) GSA.

Aquilogic's analysis of the five draft GSPs found a significant deficiency with four of the five plans: The impact of the draft GSPs on adjacent subbasins is not sufficiently evaluated in the draft GSPs for the Upper Valley, Forebay, Eastside, and Langley. These impacts may hinder or prevent adjacent subbasins from achieving sustainability. The impacts on adjacent subbasins occur because all subbasins in the Salinas Valley Groundwater Basin (SVGB) are hydrologically and hydraulically connected. The impacts are caused by two factors: (1) unreasonably low minimum thresholds (MTs) for the chronic lowering of groundwater levels and (2) groundwater extractions that reduce flows to adjacent subbasins or reverse natural hydraulic gradients.

These two factors are linked because the unreasonably low MTs allow groundwater extractions to continue at or above their current magnitude.

The draft GSPs relied on the Salinas Valley Integrated Hydrologic Model (SVIHM) and the Salinas Valley Operational Model (SVOM) for much of their content. The SVIHM and the SVOM are not publicly available at this time. Thus, stakeholder review of the GSPs, especially the content that relies heavily on the models, is hampered by an inability to access, evaluate, and run these models. **Aquilogic** reserves the right to supplement our comments at a later date as the models, model data, assumptions, and results become available.

Connected Subbasins

It has long been recognized and accepted that the subbasins comprising the SVGB are hydraulically connected, with groundwater flowing between adjacent subbasins (Division of Water Resources [DWR], 1946; Salinas Valley Ground Water Basin Hydrology Conference [SVGWBHC], 1995; Monterey County Water Resources Agency [MCWRA], 2001; Kennedy/Jenks, 2004). For example, MCWRA (2001) states that the Salinas Valley hydrologic subareas, which are generally coincident with the six subbasins under the purview of the SVBGSA, are "*…hydrologically and hydraulically connected…*" and that "*[l]andowners and other water users pumping groundwater* [from the Valley] *are drawing water from the same groundwater basin*." In other words, what happens in one subbasin can affect the other subbasins. There are numerous sections within the GSPs (see **Attachment B**) that state "the GSP needs to consider potential for groundwater flow between these adjacent subbasins." However, the GSPs generally do not consider these flows in terms of impacts on adjacent subbasins, nor do the GSPs assess the impact on adjacent subbasins of reaching or exceeding the MTs and measurable objectives (MOs) in one or more subbasins.

Other statements in the GSPs regarding subbasin boundaries are incorrect or contradictory. For example, page 4-10 of the draft Eastside GSP states: "*The southeastern boundary* [of the Eastside] *with the adjacent Forebay Subbasin is near the town of Gonzales (DWR, 2004). It is extended from the approximate southern limit of the regional clay layers that are the defining characteristic of the southern extent of the 180/400-Foot Aquifer Subbasin. There may be reasonable hydraulic connectivity with the Forebay Subbasin, although the principal aquifers change from relatively unconfined to confined near this boundary*." The last sentence of this passage conflicts with the statement on page 4-18 of the draft Eastside GSP, where it is stated: "*In addition to the fact that aquifer material cannot be correlated between boreholes, no evidence exists for a discrete confining layer in the Subbasin (Brown and Caldwell, 2015)*."

Another example of a contradictory statement regarding subbasin boundaries occurs on page 4-10 of the draft Eastside GSP, as well as on page 4-9 of the 180/400 GSP, where it is stated: "*Previous studies of groundwater flow across this boundary* [i.e., between the Eastside and

180/400] *indicate that there is restricted hydraulic connectivity between the subbasins*." The references for these previous studies should be provided, because this statement is an apparent contradiction with other statements in the draft Eastside GSP (e.g., p. 4-21 of the draft GSP, "*Subsurface recharge is primarily from inflow from the adjacent Forebay and 180/400-Foot Aquifer Subbasins to the south and west, respectively (DWR, 2004)*." The apparent uncertainty regarding the nature of the boundary between the Eastside and 180/400 should be listed as an identified data gap on page 4-35 of the draft Eastside GSP.

A detailed list of additional statements from the GSPs that establish and describe the subbasin interconnections is provided as **Attachment B**.

Minimum Thresholds and Groundwater Extractions

As described below, the evidence presented in the draft GSPs indicates that groundwater extractions in the Upper Valley deplete inter-subbasin groundwater flows to the Forebay. Groundwater extractions in the Forebay deplete inter-subbasin groundwater flows to the 180/400 and Eastside and streamflow to the 180/400. Groundwater extractions in the Eastside and Langley reduce groundwater levels in those subbasins to the point where they cause, or have the potential to cause, groundwater flow from the 180/400 to the Eastside and Langley, which is the reverse of the natural groundwater flow direction (i.e., the natural flow direction is from higher topographic elevation to lower topographic elevation). These conditions are likely exacerbating seawater intrusion (SWI) in the 180/400 and hinder or may even prevent that subbasin from achieving sustainability. Additionally, extractions in the 180/400, combined with inter-subbasin flow from the 180/400 to the Eastside, and potentially from the 180/400 to the Langley, has lowered groundwater levels to the point where groundwater is induced to flow from the Monterey to the 180/400.

These conditions are likely to persist indefinitely because the draft GSPs set unreasonably low MTs for the chronic lowering of groundwater levels, and projects and management actions, in general, appear to be insufficient to overcome these problems. Moreover, the unreasonably low MTs facilitate groundwater extractions at current or increased rates in the Upper Valley, Forebay, Eastside, and potentially the Langley, despite the issues described in the previous paragraph.

MTs and MOs have been set to differing levels in adjacent basins. The GSPs do not explain why such differences are appropriate and why or how they would lead to achieving sustainability throughout the SVGB. **Aquilogic** finds no significant analysis or discussion in the draft GSPs for the Upper Valley, Forebay, Eastside, or Langley on the impact of differing MTs and MOs or on the potential impacts of alternative MTs and MOs.

Upper Valley

The draft GSP for the Upper Valley states that locally defined significant and unreasonable groundwater elevations in the subbasin include groundwater levels that "*[a]re at or below the observed groundwater elevations during the 2012 to 2016 drought*."[1] However, the MT for the chronic lowering of groundwater levels is set five feet *lower* than the lowest level recorded between the drought years of 2012 and 2016.[2] In terms of the cumulative change in average groundwater levels, the MT is five feet *lower* than the 2016 level, which was the lowest average groundwater level ever recorded.[3] The 2016 level has never been exceeded since record keeping began in 1944, and that level occurred only because of the 2012-2016 drought. The next lowest level occurred in 1990, also during a severe drought, and was 8.5 feet higher than the 2016 level.[3] Nevertheless, groundwater levels have in general been stable over time in the Upper Valley due to the operation of Nacimiento and San Antonio reservoirs (SVGWBHC, 1995).[3]

Aquilogic finds that the history of groundwater levels in the Upper Valley[3] indicates the MT for chronic lowering of groundwater levels will only be exceeded if: (1) there is an unprecedented increase in groundwater extractions, and/or (2) an unprecedented, severe drought occurs. Importantly, the very low MT for groundwater levels facilitates increased groundwater extractions in the Upper Valley (perhaps significantly increased extractions), without triggering the "undesirable result" defined in the draft GSP.[4] By setting the MT for chronic lowering of groundwater levels at five feet lower than the historic low, undesirable results may occur. Further, the potential impact of increased pumping in the Upper Valley is ignored. Increased pumping could lower groundwater levels down to the MT, which would have impacts on the remainder of the SVGB.

SVBGSA acknowledges that groundwater extractions estimated by the SVIHM are only 76% of reported extractions in the Upper Valley.[5] The extractions estimated for the historical water budget were consequently updated to reflect this discrepancy, but the other groundwater budget components, some of which are linked to groundwater extractions, were not updated, although they should have been prior to completing the draft GSP.[6] Because of this, the following discussion relies on the SVIHM-calculated groundwater-budget components, for comparison purposes. It should be noted that the impacts described below could be determined to be even more significant, if and when pumping in the model is fixed.

---

[1] Page 8-7 of the draft Upper Valley GSP.
[2] Table 8-1, page 8-6 of the draft Upper Valley GSP
[3] Figure 8-2, page 8-12 of the draft Upper Valley GSP
[4] Increased extractions might be limited by the MT for depletion of interconnected surface water (ISW), which is set to 2016 groundwater levels in shallow wells near ISW. However, it follows that 2016 shallow-well groundwater levels are also likely to be the lowest levels in recorded history.
[5] Page 6-17 of the draft Upper Valley GSP
[6] Our understanding is that the USGS is working on resolving SVIHM issues such as these.

Prior to construction of Nacimiento and San Antonio reservoirs, groundwater levels in the Upper Valley were declining substantially.[7] In response to conservation releases from these two reservoirs, which flow to the Salinas River, groundwater levels in the Upper Valley began recovering in 1957 and have since stabilized. During the draft GSP's historical period (i.e., 1980-2016, post operation of the reservoirs), groundwater extractions (-91,600 acre-feet per year [AFY]) in the Upper Valley were supported by net stream exchange (89,100 AFY).[8]

On average, the draft GSP states that pumping in the Upper Valley does not substantially increase stream depletion. Although the draft GSP concludes that only an average of 1,100 AFY of stream depletion is caused by pumping (mostly limited to the Salinas River),[9,10] it should be noted that **aquilogic** believes the depletion value may be higher, because the method employed by SVBGSA to estimate stream depletion with the SVIHM does not account for stream cells that are connected to groundwater for less than 50% of the model period and, as noted above, the SVIHM underestimates pumping by 24%. It is expected that stream cells connected to groundwater for less than 50% of the model period (e.g., 48%) would also contribute to stream depletion. Furthermore, limiting the stream-depletion discussion in the draft GSP to the historical average obscures the higher stream depletions that would occur during drought years. Without understanding drought year depletion, the impact on adjacent basins during droughts cannot be assessed. Despite these limitations in the model results, **aquilogic** opines that *decreases* in current groundwater extractions in the Upper Valley would result in proportional *increases* in subsurface flow from the Upper Valley to the Forebay, as illustrated by the following discussion.[11]

The draft GSP's estimated stream depletion (due to pumping) is only 1% of the net stream exchange, which implies that streamflow infiltration along the Salinas River in the Upper Valley would be of the same order with or without pumping. The infiltration occurs due to the relatively high streambed conductivity and hydraulic conductivity of the surrounding aquifer, in conjunction with a hydraulic gradient that is directed away from the streambed and into the Upper Valley aquifer. Because of these conditions, and the fact that 99% of the net stream exchange occurs without the influence of groundwater extractions, **aquilogic** finds that the absence of pumping would not result in significant groundwater discharge into the Salinas River in the Upper Valley. Therefore, on average, Upper Valley pumping captures groundwater that would otherwise flow to the adjacent Forebay. On average, for the historical period, the Forebay receives only 7,700 AFY of subsurface flow from the Upper Valley.[12] This amount would

---

[7] Figure 5-8, page 5-13 of the draft Upper Valley GSP
[8] Table 6-10, page 6-22 of the draft Upper Valley GSP
[9] Table 5-4, page 5-31 of the draft Upper Valley GSP
[10] Figure 4-11, page 4-26 of the draft Upper Valley GSP
[11] The SBWA has previously asked the SVBGSA to conduct simulations with the SVIHM that would address this issue (see Attachment C).
[12] Table 6-6, p. 6-17 of the draft Forebay GSP

be higher if groundwater extractions in the Upper Valley were lower, which constitutes an impact on the adjacent Forebay. This impact cascades through the Forebay and into the 180/400 and the Eastside, and potentially the Monterey, and should be analyzed in the draft GSP.[11]

It should not be ignored that if groundwater extractions were to increase enough in the Upper Valley (relative to the historical average), groundwater levels could be lowered to the point where they are at or near the MT for the chronic lowering of groundwater levels (and the MT for depletion of ISW), which would result in substantially more stream depletion due to pumping than is revealed by limiting the analysis to historical averages. The draft Upper Valley GSP does not, but should, analyze this.

In summary, the draft Upper Valley GSP does not consider the undesirable results that would occur if the MTs were reached or exceeded, both within the Upper Valley and within downstream subbasins. This issue should be addressed before the Upper Valley GSP is finalized.

Forebay

In the draft GSP for the Forebay, the MT for the chronic lowering of groundwater levels is set to 2015 levels.[13] In terms of the cumulative change in average groundwater levels, this is the second lowest level on record.[14] The 2015 level has been exceeded once in recorded history, in 2016, when the average groundwater level was four feet lower. These low levels occurred only due to the 2012-2016 drought. The next lowest level occurred in 1991, also during a severe drought, and was 14.5 feet higher than the 2016 level.[14] Nevertheless, average groundwater levels have generally been stable over time in the Forebay due to the operation of Nacimiento and San Antonio reservoirs (SVGWBHC, 1995).[14]

Aquilogic finds that the history of groundwater levels in the Forebay[14] indicates the MT for chronic lowering of groundwater levels will only be exceed if: (1) there is an unprecedented increase in groundwater extractions, and/or (2) a severe drought occurs. Importantly, the very low MT for groundwater levels facilitates increased groundwater extractions in the Forebay under average conditions (perhaps significantly increased extractions), without triggering the "undesirable result" defined in the draft GSP.[15] By setting the MTs at 2015 levels, four feet above the historic low, undesirable results may occur. Further, the potential impact of increased pumping in the Forebay is ignored. Increased pumping could lower groundwater levels down to the MT, which would have impacts on the remainder of the SVGB.

---

[13] Table 8-1, page 8-6 of the draft Forebay GSP

[14] Figure 8-2, page 8-14 of the draft Forebay GSP

[15] Increased extractions might be limited by the MT for depletion of ISW. The MT for depletion of ISW is set by proxy to 2015 groundwater levels, for shallow groundwater near locations of ISW, which are also likely at or near historic lows.

SVBGSA acknowledges that groundwater extractions estimated by the SVIHM are only 65% of reported extractions in the Forebay.[16] The extractions estimated for the historical water budget were consequently updated to reflect this discrepancy, but the other groundwater budget components, some of which are linked to groundwater extractions, were not updated, although they should have been prior to completing the draft GSP. Because of this, the following discussion relies on the SVIHM-calculated groundwater-budget components, for comparison purposes. It should be noted that the impacts described below could be determined to be even more significant, if and when pumping in the model is fixed.

Prior to construction of Nacimiento and San Antonio reservoirs, groundwater levels in the Forebay were declining substantially.[17] In response to conservation releases from these two reservoirs, which flow to the Salinas River, groundwater levels in the Forebay began recovering in 1957 and have since stabilized. During the draft GSP's historical period (i.e., 1980-2016, post operation of the reservoirs), groundwater extractions (-108,700 AFY) in the Forebay were supported by net stream exchange (90,300 AFY).[18]

On average, pumping in the Forebay substantially increases stream depletion. According to the draft Forebay GSP, an average of 29,700 AFY of stream depletion along the Salinas River is caused by Forebay pumping.[19] It should be noted that **aquilogic** believes the depletion value may be higher, because the method employed by SVBGSA to estimate stream depletion with the SVIHM does not account for stream cells that are connected to groundwater for less than 50% of the model period, and as noted above, the SVIHM underestimates pumping by 35%. It is expected that stream cells connected to groundwater less than 50% of the model period (e.g., 48%) would also contribute to stream depletion. Furthermore, limiting the stream depletion discussion in the draft GSP to the historical average obscures the higher stream depletions that would occur during drought years. Without understanding drought year depletion, the impact on adjacent basins during droughts cannot be assessed. Despite these limitations in the model results, **aquilogic** opines that *decreases* in groundwater extractions in the Forebay would cause *increases* in subsurface flow from the Forebay to the Eastside and 180/400 and *increases* in surface flow from the Forebay to the 180/400, as illustrated by the following discussion.[11]

The reported stream depletion (due to pumping) value is 33% of the net stream exchange, which implies that substantial streamflow is captured by groundwater pumping in the Forebay. The draft Forebay GSP states that 31% of the stream depletion along the Salinas River occurs during the principal conservation period for reservoir releases,[19] and therefore is a desired outcome.[20] However, the draft GSP should also acknowledge that streamflow not depleted in

[16] Page 6-19 of the draft Forebay GSP
[17] Figure 5-7, page 5-11 of the draft Forebay GSP
[18] Table 6-12, page 6-23 of the draft Forebay GSP
[19] Table 5-4, page 5-30 of the draft Forebay GSP
[20] Page 8-42 of the draft Forebay GSP

the Forebay would flow to the 180/400, where streamflow infiltration of reservoir releases is also a desired outcome. **Aquilogic** finds that it is possible, but unlikely, that the absence of pumping would result in significant groundwater discharge into the Salinas River in the Forebay. Therefore, on average, Forebay pumping captures groundwater that would otherwise flow to the adjacent 180/400 and Eastside and captures streamflow that would otherwise flow to the 180/400. These inter-subbasin flows would be higher if Forebay pumping were lower, which constitutes an impact on the adjacent 180/400 and Eastside. The proportion of unpumped groundwater that would become subsurface flow to adjacent subbasins, relative to surface flow to the adjacent 180/400, is currently unknown but could be estimated with the SVIHM. The SBWA has repeatedly asked the SVBGSA to conduct simulations that would address this issue (see **Attachment C**). Regardless, the impacts on adjacent subbasins should be analyzed in the draft GSP.

It should not be ignored that if groundwater extractions were to increase enough in the Forebay (relative to the historical average), groundwater levels could be lowered to the point where they are at or near the MT for the chronic lowering of groundwater levels (and the MT for depletion of ISW), which would result in substantially more stream depletion due to pumping than is revealed by limiting the analysis to historical averages. The draft Forebay GSP does not, but should, analyze this.

In summary, the draft Forebay GSP does not consider the undesirable results that would occur within downstream subbasins if the MTs were reached or exceeded. This issue should be addressed before the Forebay GSP is finalized.

Eastside

In the draft GSP for the Eastside, the MT for the chronic lowering of groundwater levels is set to 2015 levels.[21] In terms of the cumulative change in average groundwater levels, this level has only been exceeded during the drought years of 1990-1993 and 2016.[22] That is, these low levels occurred only due to severe droughts. The MTs for reductions in groundwater storage and depletion of ISW in the Eastside are also set to 2015 groundwater levels, by proxy.[21,23]

Declining groundwater storage is documented in the Eastside,[24,25] although the magnitude is uncertain. The average storage decline initially estimated in the draft Eastside GSP is 3,400 AFY

---

[21] Table 8-1, page 8-6 of the draft Eastside GSP

[22] Figure 8-3, page 8-13 of the draft Eastside GSP

[23] However, the SVIHM-simulated cumulative change in storage does not correlate well with the average change in groundwater elevation (Figure 8-6, page 8-25 of the draft Eastside GSP). This is particularly true for the 1991-1998 period, during which groundwater levels were increasing, but the model shows ongoing storage declines.

[24] Figure 5-14, page 5-21 of the draft Eastside GSP

[25] Figure 6-10, page 6-21 of the draft Eastside GSP

for the years 1944-2019, based on groundwater elevation changes and an assumed storage coefficient.[26] Brown and Caldwell (2015) reported an average decline in groundwater storage in the Eastside of 5,000 AFY between 1944 and 2013.[27] On the other hand, the SVIHM calculates an average groundwater storage decline of 21,700 AFY from 1980 to 2016.[28] The draft Eastside GSP states that the SVIHM storage-decline estimate is "…*more consistent with drought year estimates than the long-term historical average estimates*," because it is similar in magnitude to the 25,000 AFY to 35,000 AFY storage decline estimated by Brown and Caldwell (2015) for the drought years of 1984-1991.[27] Because of these uncertainties, the draft Eastside GSP adopts an average of available estimates and states that the historical loss of groundwater storage is 10,000 AFY.[29] However, SVBGSA acknowledges that SVIHM-estimated groundwater pumping in the Eastside is only 81% of reported extractions,[30] which **aquilogic** interprets to mean that the SVIHM estimate of storage decline is also likely underestimated. Improving the estimated change in groundwater storage should be a priority for the SVBGSA, so that potential future changes in storage can be more readily assessed.

As noted, the draft Eastside GSP indicates that "undesirable results" for the chronic lowering of groundwater levels can be avoided in the Eastside by maintaining average groundwater levels at or above 2015 levels. Despite not triggering an "undesirable result,", **aquilogic** finds that groundwater elevation maps for 2015 show persistent and widespread groundwater flow from the 180/400 to Eastside in the Salinas area (i.e., southwest to northeast, at and near the subbasin boundary).[31,32] Importantly, the natural groundwater flow direction in this area is northeast to southwest (i.e., from higher topographic elevation to lower topographic elevation). The 2015 groundwater elevations show a reversal of the natural flow direction which, as stated, induces groundwater flow from the 180/400 to the Eastside. This flow direction is likely exacerbating SWI in the 180/400 and will likely continue to do so into the future. By setting the MTs at 2015 levels, which are near historic lows, undesirable results may occur. Further, the potential impact of increased pumping in the Eastside is ignored. Increased pumping could lower groundwater levels down to the MT, which would have impacts on the remainder of the SVGB.

Because the MTs for chronic lowering of groundwater levels, reduction of groundwater storage, and depletion of ISW are set to 2015 groundwater levels, **aquilogic** finds that sustainability, in terms of these three sustainability indicators (SIs), may come at the expense of the 180/400's ability to achieve sustainability for its SIs, particularly for SWI. The MT for SWI in the 180/400 is

---

[26] Pages 5-19 to 5-20 of the draft Eastside GSP
[27] Page 6-22 of the draft Eastside GSP
[28] Table 6-10, page 6-22 of the draft Eastside GSP
[29] Page 6-23 of the draft Eastside GSP
[30] Page 6-17 of the draft Eastside GSP
[31] https://www.co.monterey.ca.us/home/showpublisheddocument/31286/636355521174600000
[32] https://www.co.monterey.ca.us/home/showpublisheddocument/31284/636355520821470000

the 2017 extent of the 500 mg/L chloride isocontour.[33] This MT has already been exceeded,[34] which constitutes an undesirable result.[33] If average groundwater levels in the Eastside persist at the MT (i.e., 2015 groundwater levels), it may not be possible for the 180/400 to avoid undesirable results in terms of SWI. Note that the most promising project in the 180/400 for limiting SWI, a proposed SWI extraction barrier, will not address existing inland SWI.[35] Furthermore, the MT for SWI in the Eastside is the 500 mg/L chloride isocontour at the Subbasin boundary which, based on the current locations of that isocontour in the 180-Foot Aquifer and the 400-Foot Aquifer,[34] will not discourage Eastside pumping for many years, a scenario that may prevent the 180/400 from achieving sustainability.

Aquilogic finds that the measurable objective (MO) for chronic lowering of groundwater levels in the Eastside, which is set to 1999 groundwater levels, also allows continued groundwater flow from the 180/400 to the Eastside.[36] The sole groundwater contour map prepared for 1999 by the MCWRA shows that, similar to 2015, there was also persistent and widespread groundwater flow from the 180/400 to the Eastside,[37] as do maps from other sources,[38] particularly in and around the City of Salinas. Such southwest-to-northeast groundwater flow in 1999, which as noted is the reverse of the natural groundwater flow direction, likely exacerbated seawater intrusion in the 180/400, and would likely continue to do so even if the MOs for the chronic lowering of groundwater levels in the Eastside are achieved. To illustrate, there were substantial increases in SWI between 1997 and 1999, and between 1999 and 2001, in both the 180-Foot Aquifer[39] and the 400-Foot Aquifer.[40] Pumping in the 180/400 plays a role in ongoing SWI in the 180/400; however, northeastward groundwater flow to the Eastside in and around Salinas also plays a role. It should be noted that these increases in SWI in the 180/400 occurred during a time when groundwater levels were *increasing* in the Eastside (i.e., 1995-1999).[22] These issues—the potential for the Eastside MTs and MOs to exacerbate SWI in the 180/400—should be addressed in the draft GSP before the SVBGSA considers the document for adoption.

Aquilogic opines that, under the MTs set by the draft GSP, groundwater extractions in the Eastside could likely continue at their current magnitude, or perhaps even at a greater magnitude, despite the ongoing concerns described above. This opinion is supported by recent data. The draft Eastside GSP states that, "*[a]n undesirable result for chronic lowering of groundwater levels does not currently exist*…"[41] due to all representative monitoring sites being

---

[33] Table 8-1, page 8-6 of the 180/400 GSP
[34] Figures 11 and 12, pages 27 and 28 of the 180/400-Foot Aquifer Subbasin WY 2020 Annual Report
[35] Page 9-52 of the 180/400 GSP
[36] 1999 groundwater levels are also used for the reduction in groundwater storage and depletion of ISW MOs, by proxy.
[37] https://www.co.monterey.ca.us/home/showpublisheddocument/19504/636232633785900000
[38] Figures 8-4 and 8-5, pages 8-19 and 8-20 of the draft Eastside GSP
[39] https://www.co.monterey.ca.us/home/showpublisheddocument/100287/637514182745270000
[40] https://www.co.monterey.ca.us/home/showpublisheddocument/100289/637514807577300000
[41] Page 8-22 of the draft Eastside GSP

above their MTs in 2019. Because two other SIs use groundwater levels as proxies,[21] and due to other conditions related to the remaining SIs, the Eastside is currently sustainable, despite a history of chronic loss of groundwater storage and reversed groundwater flow that threatens to make sustainability in the 180/400 unachievable. It appears that the draft GSP could facilitate increased pumping, further impacting the 180/400, as groundwater contour maps for 2019 show the same persistent reversed groundwater flow from the 180/400 to the Eastside in and around Salinas that was observed in 1999 and 2015.[42] As previously noted, the draft Eastside GSP ignores the potential impact that increased pumping in the Eastside, which could lower groundwater levels down to the MT, may have on the remainder of the SVGB.

In summary, the Eastside GSP does not consider the undesirable results that would occur if the MTs and MOs were reached or exceeded, both within the Eastside and within the 180/400. This issue should be addressed before the Eastside GSP is finalized.

Langley

The MT for the chronic lowering of groundwater levels in the Langley is difficult to evaluate in a historical context, due to a lack of data. It is set at 2019 groundwater levels,[43] but in terms of the cumulative change in average groundwater levels,[44] there are no values for 2015 or for the drought years 1989-1991. The 2019 levels are among the lowest on record, and the lowest levels since 1994, but values on the order of 1-2 feet lower have been recorded.

Simulations with the SVIHM indicate net subsurface flow out of the Langley to the 180/400.[45] However, **aquilogic** finds that groundwater in the southwestern portion of the Langley flows from the 180/400 to the Langley,[46] which risks exacerbating SWI in the 180/400 and possibly preventing 180/400 from achieving sustainability in terms of SWI. Furthermore, the SWI MO and MT for the Langley state that the 500 mg/L chloride isocontour must not cross the Langley boundary from the 180/400.[43] If the 500 mg/L isocontour were to approach or cross the subbasin boundary, the SWI MT in the 180/400 would have been exceeded long before SWI MT in the Langley would be exceeded, a scenario that may prevent the 180/400 from achieving sustainability and could facilitate increased pumping in the Langley. Again, these issues should be analyzed before the GSP is finalized.

Monterey

The MT for the chronic lowering of groundwater levels in the Monterey is also difficult to evaluate, in part because changes to MTs and MOs occurred after the draft GSP was issued and

[42] https://www.co.monterey.ca.us/home/showpublisheddocument/87229/637177055290800000
[43] Table 8-1, page 8-6 of the draft Langley GSP
[44] Figure 8-2 of the draft Langley GSP
[45] Table 6-8, page 6-19 of the draft Langley GSP
[46] Figure 5-11, page 5-20 of the draft Langley GSP

the matter is still unresolved. In the Marina-Ord management area, the MT is set to the lowest groundwater level between 1995 and 2015.[47] It is our understanding that this MT will not change. In the Corral de Tierra management area, the draft GSP states that the MT for the chronic lowering of groundwater levels is set to 2015 groundwater levels.[47] However, it is our understanding, gleaned from public meetings, that that this level was changed to 2008 levels at a recent subbasin meeting and that the matter will be discussed in an upcoming subbasin meeting.

Descriptions of the Deep Aquifers in the draft Monterey GSP suggest that "*[t]here is a strong likelihood of flow through these confining layers (MCWRA, 2018).*"[48] **Aquilogic** believes this statement is speculative and not supported by water quality data. A detailed study of the Deep Aquifers by the SVBGSA will commence in the near future, which will likely provide additional insight into the nature of the confining layers in the Deep Aquifers. Until that study is completed, the draft GSP should avoid speculation.

The draft GSP for the Monterey used the Monterey Subbasin Groundwater Flow Model (MBGWFM) to determine historical, current, and projected water budgets, rather than the SVIHM. Under historical groundwater conditions, there is a net flow of groundwater out of the Monterey and into the 180/400.[49] For the projected water budget, multiple simulations were conducted with the MBGWFM to assess, among other things, the impact of possible future conditions in the 180/400. Under all reasonably foreseeable groundwater conditions in the 180/400, groundwater outflow from Monterey to 180/400 continues to occur.[50] These conditions could hinder or prevent the Monterey from achieving sustainability, and the draft GSP should address this more thoroughly.

Projects and Management Actions

Potential projects and management actions are listed and described in each of the draft GSPs and the 180/400 GSP for the SVGB in Monterey County. While lengthy, the list is not exhaustive. Furthermore, there has not been a comprehensive effort to simulate project benefits with the available models; thus, the potential effectiveness of many of the proposed projects and management actions is unknown.

Missing from the analysis of potential projects is perhaps the one project that could balance all or most of the water demands in the Monterey County portion of the SVGB. That project is the surface conveyance of groundwater extracted from the Forebay to be delivered to the Eastside and 180/400. This project was first proposed in DWR Bulletin 52 in 1946 as the second

[47] Table 8-1, page 8-11 of the draft Monterey GSP
[48] Page 36 of Chapter 4 of the draft Monterey GSP
[49] Table 6-1, page 6-20 of the draft Monterey GSP
[50] Table 6-4, page 6-44 of the draft Monterey GSP.

component of a larger project that included impoundment of surface water to provide conservation releases to the Salinas River. The surface impoundments were built: Nacimiento and San Antonio reservoirs. The groundwater extraction facilities and surface conveyance were never constructed. SVGWBHC (1995) found the 1946 solution, "*…so compelling we could not refrain from recommending it*." SVGWBHC (1995) also stated that, "*More recent studies conducted by MCWRA since 1946 have reaffirmed and endorsed the original concepts*." In addition, SVGWBHC stated:[51]

> "*We urge the MCWRA to focus its attention on the completion of the original plan by the construction and operation of water transfer facilities. The MCWRA should avoid diverting its attention to suggested alternatives that are less viable economically or less effective technically. These less viable and less effective alternatives would not provide the same benefits as the original plan, would be more expensive, and the projected price of water would be significantly higher for all parties.*
>
> *The panel believes strongly that Salinas Valley is fortunate that an in-Valley solution is available. We urge the Salinas Valley community to support the MCWRA in this effort to distribute the available water supplies for more efficient water management and lasting benefits for all residents of the Valley*."

In the era of the Sustainable Groundwater Management Act (SGMA), one need only replace "MCWRA" with "SVBGSA" in the above quote.

Delivery of Forebay groundwater extractions from such a project to the 180/400 for SWI mitigation and to the Eastside for overdraft mitigation has the potential to restore the natural groundwater flow direction in the Eastside by providing in-lieu recharge. Significantly, delivery of this water to the 180/400 may have the potential to restore SWI protective elevations, as described in Geoscience (2013), also via in-lieu recharge, and may also be able to provide water to a SWI injection barrier in the 180/400.

Aquilogic strongly encourages the SVBGSA to consider including this project in all of the GSPs.

[51] Page 18 of SVGWHC (1995)

References Cited

Brown and Caldwell (2015). State of the Salinas River Groundwater Basin. Prepared by Brown and Caldwell for the Monterey County Water Resources Agency. January. https://www.co.monterey.ca.us/home/showpublisheddocument/19586/636232667593230000, accessed September 30, 2021.

DWR (1946). Salinas basin investigation. Department of Public Works, Division of Water Resources. Bulletin 52. (Note, a subset of Bulletin 52 that contains the relevant information, Bulletin 52-B, can be found here: https://www.co.monterey.ca.us/home/showpublisheddocument/19576/636232667537000000, accessed September 30, 2021.)

Geoscience (2013). Protective elevations to control sea water intrusion in the Salinas Valley. Prepared by Geoscience for the Monterey County Water Resources Agency. November. https://www.co.monterey.ca.us/home/showpublisheddocument/19642/636232715345100000, accessed October 4, 2021.

Kennedy/Jenks (2004). Final report: Hydrostratigraphic analysis of the northern Salinas Valley. Prepared by Kennedy/Jenks Consultants for the Monterey County Water Resources Agency. May. https://www.co.monterey.ca.us/home/showpublisheddocument/19582/636232667568400000, accessed September 30, 2021.

SVGWBHC (1995). Hydrogeology and water supply of Salinas Valley: A white paper prepared by Salinas Valley Ground Water Basin Hydrology Conference for the Monterey County Water Resources Agency. June. https://www.co.monterey.ca.us/home/showpublisheddocument/19584/636232667576070000, accessed September 29, 2021.

MCWRA (2001). Draft environmental impact report / environmental impact statement for the Salinas Valley Water Project. Prepared by the Monterey County Water Resources Agency and the U.S. Army Corps of Engineers. June. https://www.co.monterey.ca.us/home/showpublisheddocument/24180/636281210678370000, accessed September 30, 2021.

Attachment A

185 San Leandro Way
San Francisco, CA 94127, USA
Mobile Tel. +1.949.939.7160
Web: www.aquilogic.com

CURRICULUM VITAE

September 2021

Anthony Brown

Principal Hydrologist

mobile: +1.949.939.7160
email: anthony.brown@aquilogic.com

Disciplines

Hydrology, Hydrogeology, Water Resources, Water Quality, Water Supply, Drinking Water Treatment, Contaminant Source Identification, Contaminant Fate and Transport, Soil and Groundwater Remediation, Environmental Liability Management, Legal and Regulatory Strategy.

Education

M.Sc.	Engineering Hydrology, Imperial College London, 1989
D.I.C.	Postgraduate diploma in Civil Engineering, Imperial College London, 1988
B.A.	Geography, King's College London, 1985

Professional Experience

Anthony is a versatile and proficient professional with over 30 years of experience in hydrology, hydrogeology, water resources, water quality, fate and transport of contaminants, groundwater remediation, regulatory strategy, water resources evaluation, and water supply engineering.

Anthony has conducted and managed numerous groundwater resources projects, including:

- resource evaluation, development and management
- water balance, storage capacity and safe yield analysis
- water rights disputes and adjudication
- marginal groundwater development (e.g., brackish water)
- aquifer storage and recovery (ASR)
- indirect potable reuse (IPR).

He has also implemented hundreds of hazardous waste site investigations, including sites with multiple potentially responsible parties (PRPs), complex hydrogeology and fate and transport, fractured rock, multiple contaminants, and co-mingled plumes. This work has included detailed Remedial Investigation (RI) or Phase II characterization studies, groundwater flow and solute transport modeling, Preliminary Endangerment Assessments, Human Health Risk Assessments,

and remedial feasibility studies (FS), remedial system design and implementation. Anthony has been involved in the design, testing, and permitting of drinking water treatment systems for impaired (contaminated) water sources.

Anthony has provided expert services to many prominent water and environmental law firms, the Attorneys General of California, New Jersey, Pennsylvania, Maryland, Ohio, North Carolina, and Puerto Rico, several County District Attorneys, and numerous City Attorneys' Offices.

Through his work for water utilities impacted by gasoline constituents (e.g. MTBE), chlorinated solvents (e.g. PCE, TCE), solvent stabilizers (e.g. 1,4-dioxane), soil fumigants (e.g. 1,2,3-TCP), chlorofluorocarbons (e.g. Freon 11, 12 and 113), perfluorinated compounds (i.e., PFAS), the rocket propellants perchlorate and NDMA, and hexavalent chromium, arsenic and other metals, Anthony has become a recognized expert in the fate, transport, and remediation of these compounds, and the protection of source waters from contamination by such recalcitrant chemicals.

Amongst other technical areas of expertise, he has also provided expert advice related to:

- groundwater resource development
- groundwater basin management
- California Sustainable Groundwater Management Act (SGMA)
- water rights and the development of physical solutions
- groundwater discharges and the Clean Water Act
- compliance with the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) and National Contingency Plan (NCP)
- cleanup under the Resource Conservation and Recovery Act (RCRA)
- the environmental impact of oil field contaminants and their mitigation
- source identification and mitigation of bacteria and fecal contamination in coastal waters
- source identification and persistence of microplastics in coastal waters.

Through his extensive experience on "high-profile" projects, Anthony has developed an excellent working relationship with private and public sector clients, Federal, State, and local elected officials and government agency staff, the legal community, professional organizations, non-profit environmental organizations, and his colleagues in the environmental and water resources professions.

Anthony has also testified before the U.S. Senate and briefed White House staff, federal, State, and local elected officials and regulators, independent commissions, professional groups, academic institutions, and the news media (including CBS 60 Minutes, National Public Radio [NPR] and local newspapers) on groundwater issues.

Beyond his US experience, Anthony has worked on projects in the United Kingdom, Ireland, Canada, Mexico, Costa Rica, Columbia, Ecuador, Yemen, Egypt, and Nepal.

U.S. Senate Testimony and Briefings for Elected Officials

- Testimony before the U.S. Senate Committee on Environment and Public Works on "the Appropriate Role of States and the Federal Government in Protecting Groundwater", on April 18, 2018.
- Briefing for White House Officials and the Council on Environmental Quality on "the Impact of MTBE on Water Resources of the United States", in October 1997.
- Briefing for U.S. Senators Feinstein and Boxer on "MTBE Contamination of the City of Santa Monica Water Supply", in October 1997.
- Briefing for Assistant Administrators and other leadership at the US Environmental Protection Agency (EPA) on "the Impact of MTBE on Water Resources of the United States", in October 1997.
- Briefing of State Senator Sheila Kuehl, several Assembly members, leadership at the California Environmental Protection Agency (CalEPA) and State Water Resources Control Board (SWRCB) on "MTBE Contamination of the City of Santa Monica Water Supply", in 1997-1998

Anthony has also briefed the following on the impact of fuel oxygenates, chlorinated solvents, rocket propellants, metals, oil field activities, and bacteria on water quality:

- USEPA staff (Region IX)
- State Senators and Assembly Members
- State regulators
- Local officials (Mayors, council and board members, City attorneys, etc.)
- Independent Commissions
- Professional bodies (ABA, ACS, ACWA, AEHS, AGWA, NGWA, GRA, etc.)
- Academic institutions and many other organizations
- Media outlets (NPR, CBS 60 Minutes, local TV stations)

Expert Consulting and Witness Services

Anthony is a respected, credible, and highly effective expert witness. He has testified at trial on 11 occasions, including three times in Federal court. Anthony is currently scheduled to testify in another seven trials during the next 18 months. Overall, he has been retained as an expert in over 60 matters related to water rights, water resources management, and water pollution. Anthony has provided deposition testimony in 27 of these matters and these depositions have lasted from one to 32 days in length.

Active:

- Retained (but not disclosed) in numerous cases (>200) related to the impact on water supplies by a group of emerging contaminants (consolidated in multi-district litigation [MDL])
- Lanier Parkway Associates vs. Hercules Chemical (Ashland) (the impact of benzene and chlorobenzene contamination from a chemical facility on an adjacent commercial property) – Superior Court of Glynn County, Georgia (expert affidavit)
- Retained (but not disclosed) by a confidential investor-owned water utility client addressing the impact of Per and polyfluorinated substances (PFAS) on water supplies in two northeastern states
- College Park East vs. Midway City Sanitary District et al (groundwater contamination by chlorinated solvents at a former dry cleaner) - US District Court, Central District of California (discovery)
- TC Rich et al vs. Shaikh et al (chlorinated solvent contamination at a former small batch chemical distributor in Los Angeles) - US District Court, Central District of California (expert report)
- Mojave Pistachios et al vs. Indian Wells Valley Groundwater Authority (IWVGA) (challenge to the Groundwater Sustainability Plan [GSP] and associated pumping fees in a groundwater basin in eastern Kern County) – California Superior Court, Kern County (discovery)
- James J. Kim vs. L. Tarnol et al (chlorinated solvent contamination at a former dry cleaner in Glendale) – California Superior Court, Los Angeles County (discovery)
- City of Oxnard v. Fox Canyon Groundwater Management Agency (water rights dispute) – California Superior Court, Los Angeles County (discovery)
- City of Arcadia vs. Dow Chemical et al (1,2,3-TCP contamination of groundwater resources and water supply wells) – US District Court, Central District of California (expert report)
- Friends of Riverside Airport vs. Department of the Army et al (poly-chlorinated biphenyl [PCB] contamination of soil at a former wastewater treatment plant in Riverside, California) US District Court, Central District of California (expert report, deposition)
- Stoll vs. Ewing et al (chlorinated solvent contamination at a former dry cleaner in Pleasanton) - US District Court, Northern District of California (discovery)
- San Luis Obispo Coastkeeper et al vs. Santa Maria Valley Water Conservation District et al (dispute over surface water flows to enhance steelhead habitat in the Santa Maria River watershed, Santa Barbara County) – US District Court, Central District of California (discovery)
- Mojave Pistachios vs. Indian Wells Valley Water District (IWVWD) et al (water rights dispute in eastern Kern County between agricultural interests and public water purveyors) – California Superior Court, Kern County (discovery)
- Goleta Water District vs. Slippery Rock Ranch (water rights dispute in central California between an avocado ranch adjacent to an adjudicated groundwater basin) – California Superior Court, Santa Barbara (expert report, deposition, trial scheduled for May 2021)

- Santa Barbara Channel-keeper et al vs. City of San Buenaventura et al (adjudication of surface water and groundwater rights in the Ventura River watershed, Ventura County) – California Superior Court, Los Angeles (expert report)
- Las Posas Valley Water Rights Coalition et al vs. Fox Canyon Groundwater Management Agency et al (adjudication of groundwater rights in the Las Posas Groundwater Basin, Ventura County) – California Superior Court, Santa Barbara (expert report, deposition pending, trial scheduled for 2022)
- Black Warrior Riverkeeper et al vs. Drummond Coal (acid mine drainage from a former coal mine impacting a tributary of the Black Warrior River, Alabama) – US Federal Court, Middle District of Alabama, Birmingham (expert report, deposition, trial scheduled for October 2021)
- City of Riverside vs. Goodrich et al (perchlorate contamination of groundwater resources and water supply wells) - California Superior Court (expert declaration, deposition, further deposition pending)
- Commonwealth of Pennsylvania vs. ExxonMobil, et al (State-wide assessment of impact and damages associated with MTBE and TBA releases) – US Federal Court, Southern District of New York (expert reports)
- State of Maryland vs. ExxonMobil et al (State-wide assessment of impact and damages associated with MTBE and TBA releases in Maryland) – US Federal Court, Southern District of New York (discovery)
- Steinbeck Winery et al vs. City of Paso Robles et al (Quiet title action brought by a group of wineries against the public water agencies to adjudicate water rights) - California Superior Court, San Jose (deposition, Phase 2 and Phase 3 trial testimony, Phase 4 pending)
- Various individuals vs. San Luis Obispo County et al (Trichloroethene [TCE] contamination in groundwater and water supply wells in a community adjacent to a County-operated airport) – California Superior Court, San Luis Obispo (litigation stayed)
- Commonwealth of Puerto Rico vs. Shell Oil Co., et al (Island-wide assessment of impact and damages associated with MTBE and TBA releases in Puerto Rico) – US Federal Court, Southern District of New York (expert report, deposition, trial pending)
- City of Fresno vs. Shell Chemical et al (1,2,3-TCP contamination of groundwater resources and water supply wells) – California Superior Court (discovery)
- New Jersey Department of Environmental Protection (NJDEP) vs. Sunoco et al (State-wide assessment of impact and damages associated with MTBE and TBA releases in New Jersey) – US Federal Court, Southern District of New York (expert report, deposition, hearing testimony, trial pending)
- Orange County Water District (OCWD) vs. Sabic Innovative Plastics et al (Chlorinated solvent, 1,4-dioxane and perchlorate contamination of groundwater resources from various sites in Orange County, California) – California Superior Court, Orange County (expert report, deposition [32 days], trial testimony)

- City of Modesto vs. Vulcan Chemical et al (perchloroethylene [PCE] releases from numerous dry cleaners contaminating drinking water wells and groundwater resources) – California Superior Court, San Francisco (expert reports, deposition [25 days], trial testimony, returned by Appeals Court)

Past:

- City of Upland vs. Dow Chemical et al (1,2,3-TCP contamination of groundwater resources and water supply wells) – US District Court, Central District of California (expert report, settled)
- Borrego Water District (water rights dispute and physical solution) – California Superior Court, San Diego (stipulated adjudication)
- Charleston Waterkeeper and South Carolina Coastal Conservation League vs. Frontier Logistics (lawsuit over polyethylene nurdle pollution in and around Charleston Harbor) - US District Court, Charleston District of South Carolina (expert report, settled)
- San Miguel Electric Cooperative vs. Peeler Ranch (contamination of soil, surface water and groundwater beneath a ranch from a lignite mine and coal-fired power plant) – Texas Superior Court, 218th District (expert report, deposition, hearing testimony, settled)
- City of Hemet vs. Dow Chemical et al (1,2,3-TCP contamination of groundwater resources and water supply wells) – US Federal Court, Southern District of California (expert report, settled)
- Sierra Club et al vs. Dominion Energy (contamination of groundwater and surface water resources by coal combustion residuals [CCRs] from ash ponds) – US Federal Court, Eastern District of Virginia (deposition, trial testimony)
- Sunny Slope Water Company vs. Dow Chemical et al (1,2,3-TCP contamination of groundwater resources and water supply wells) – California Superior Court, Los Angeles County (settled)
- Greenfield et al vs. Ametek Aerospace et al (solvent contamination in groundwater beneath three mobile home parks) – US Federal Court, Southern District of California, San Diego (expert report, deposition, settled)
- Golden State Water Company vs. Dow Chemical et al (1,2,3-TCP contamination of groundwater resources and water supply wells in Nipomo and Claremont) – US Federal Court, Southern District of California (expert report, settled)
- National Association for the Advancement of Colored People (NAACP) vs. Duke Energy (coal ash contamination of groundwater, sediments, and surface waters at the Belews Creek coal-fired power plant) – US Federal Court, Middle District of North Carolina (expert report, settled)
- City of Atwater vs. Shell Chemical et al (1,2,3-TCP contamination of groundwater resources and water supply wells) – California Superior Court (expert report, deposition, trial testimony)
- State of Vermont vs. ExxonMobil et al (State-wide assessment of impact and damages associated with MTBE and TBA releases in Vermont) – US Federal Court, Southern District of New York (settled)

- Trujillo et al vs. Ametek Aerospace et al (solvent contamination in groundwater beneath an elementary school) – US Federal Court, Southern District of California, San Diego (expert report, deposition, settled)
- Roanoke River Basin Association vs. Duke Energy (coal ash contamination of groundwater, sediments, and surface waters at two coal-fired power plants: Mayo and Roxboro) – US Federal Court, Middle District of North Carolina (expert report, deposition, settled)
- OCWD vs. Unocal et al (MTBE and TBA contamination of groundwater resources from service station sites in Orange County, California) – US Federal Court, Southern District of New York (expert report, deposition, settled)
- State of North Carolina vs. Duke Energy (administrative hearing related to coal ash contamination at six power plants) – North Carolina Superior Court (settled)
- City of Clovis vs. Dow Chemical et al (1,2,3-TCP contamination of groundwater resources and water supply wells) – California Superior Court (expert report, deposition, trial testimony)
- San Juan Hills Golf Course vs. City of San Juan Capistrano et al (suit filed over groundwater pumping in the San Juan Basin) – California Superior Court, Orange County (settled)
- City of Tulare vs. Dow Chemical et al (1,2,3-TCP contamination of groundwater resources and water supply wells) – California Superior Court (settled)
- State of California vs. Columbia Casualty Company et al (perchlorate and solvent contamination at the Stringfellow Acid Waste disposal pits in Glen Avon) – California Superior Court (expert report, settled)
- City of Delano vs. Crop Production Services (CPS) et al (Nitrate contamination of water supply wells) - California Superior Court (settled)
- Laborers' International Union of North America Local Union No. 783 v. Santa Margarita Water District et al. (Review of the groundwater hydrology of the Cadiz project, San Bernardino County) - California Superior Court, Orange County (independent expert report, settled)
- Southern California Water Company vs. Aerojet General Corp. (TCE, perchlorate and NDMA contamination of drinking water supplies in Rancho Cordova, California) – California Superior Court, Sacramento District (expert report, deposition, settled)
- The City of Stockton Redevelopment Agency (RDA) vs. Conoco-Phillips et al (petroleum hydrocarbon contamination at former oil terminals) – California Superior Court (deposition, settled)
- PK Investments vs. Barry Avenue Plating (hexavalent chromium and solvent contamination of soil and groundwater) - California Superior Court, Los Angeles District (deposition, settled)
- City of Santa Monica, California vs. Shell et al (MTBE contamination of drinking water supplies) – California Superior Court, Orange County District (expert report, deposition, settled)
- State of California vs. Joint Underwriters (perchlorate and solvent contamination at the Stringfellow Acid Waste disposal pits in Glen Avon) – California Superior Court (expert report, deposition, settled)

- Community of Broad Creek, North Carolina vs. BP Amoco et al (MTBE, benzene and 1,2-DCA contamination of private water supply wells) – North Carolina Superior Court (deposition, settled)
- South Tahoe Public Utility District, California vs. ARCO et al (MTBE contamination of drinking water supplies) - California Superior Court, San Francisco (expert report, deposition, trial testimony)
- Private well owners in 18 reformulated gasoline (RFG) states vs. various oil companies (class action related to MTBE) - US Federal Court, New York District (deposition, class certification hearing)
- Individual plaintiffs vs. Lockheed Corporation (TCE and perchlorate contamination of drinking water supplies in Redlands, California) – California Superior Court, Los Angeles District (deposition, settled)
- City of Norwalk vs. Five Point U-Serve et al (1.2-DCA contamination of a municipal drinking water well) – California Superior Court (deposition, case dismissed)
- Forest City Corp. vs. Prudential Real Estate (PCE contamination of soil and groundwater) – California Superior Court, Los Angeles District (deposition, trial testimony)
- Huhtamaki vs. Ameripride (chlorinated solvent contamination at a commercial dry cleaner/ laundry facility) – California Superior Court, Sacramento District (expert report, deposition, settled)
- Consolidated Electrical Distributors (CED) vs. Hebdon Electronics et al (chlorinated solvent contamination in fractured granite) - California Superior Court, North San Diego District (expert report, deposition, trial testimony)
- Southern California Water Company vs. various parties (water rights petition and adjudication for the American River, Sacramento, California) – State Water Resources Control Board, Sacramento
- The City of Santa Monica, California vs. ExxonMobil Corporation (MTBE contamination of drinking water supplies) – California Superior Court (designated, settled, retained as consultant to both parties for remedy implementation)
- The town of Glenville, California vs. various parties (MTBE contamination of drinking water supplies in Kern County, California) - California Superior Court (designated, settled)
- Great Oaks Water Company vs. Chevron and Tosco (MTBE contamination of drinking water supplies in San Jose, California) - California Superior Court (designated, settled)
- Orange County District Attorney's Office vs. ARCO et al (Underground Storage Tank [UST] violations, and MTBE contamination of soil and groundwater) - California Superior Court (designated, settled)
- Cambria Community Services District (CCSD) vs. Chevron et al (MTBE impact to drinking water supplies) in San Luis Obispo County, California - California Superior Court (designated, settled)
- Los Osos Community Services District (CCSD) vs. Chevron et al (MTBE impact to drinking water supplies) in San Luis Obispo County, California - California Superior Court (designated, settled)

- The town of East Alton, Illinois vs. various parties (MTBE contamination of drinking water supplies) – Illinois Superior Court, Jefferson County (designated, settled)
- The City of Dinuba vs. Tosco et al (MTBE contamination of groundwater resources) - California Superior Court (expert report, settled during deposition)
- Stella Stephens vs. Bazz-Houston et al (chlorinated solvent contamination at an active metal finishing facility in Garden Grove, California) - California Superior Court (designated, settled)
- Communities for a Better Environment (CBE) vs. Chrome Crankshaft (hexavalent chromium and TCE contamination beneath a chrome plating facility and adjacent school) - California Superior Court (designated, settled)
- California Attorney General's Office vs. Unocal (Natural Resource Damage Assessment [NRDA] at a former oil field in the central coast of California) - California Superior Court (designated, settled)
- Phillips Petroleum Corporation vs. private property owner (contamination from a former oil well in Signal Hill, California) - California Superior Court (designated, settled)
- Mobil Oil Corporation vs. private property owner (contamination from a former bulk fuel plant in the Bay Delta area) – California Superior Court (designated, settled)
- Mobil Oil Corporation vs. terminal operator (contamination from a former bulk fuel plant in Monterey area) – California Superior Court (designated, settled)

General Project Experience

Anthony has acted as the Principal in Charge, Project Manager (PM), Quality Assurance (QA) Manager and/or Principal Review for the following ongoing or recently completed projects:

Current Water Resources Projects

- Review of the Effect of Releases from a Reservoir on Surface Water Flows Intended to Enhance California Steelhead Habitat, and the Potential Impact on Groundwater Recharge – City of Santa Maria, Golden State Water Company
- An Investigation of the Hydrology of Perennial Spring in the Mojave Desert, as it Relates to Potential Impact from a Groundwater Resource Development Project - Three Valleys Municipal Water District
- Consulting Support Related to the Implementation of SGMA in the Pleasant Valley and Oxnard Plain Groundwater Basins, Pleasant Valley County Water District, Guadalasca Mutual Water Company.
- Consulting Support for a Surface Water and Groundwater Rights Dispute in the Ventura River Watershed – Group of Confidential Landowners
- Support Related to a New Car Manufacturing Plant in Huntsville, Alabama, and potential impact on habitat for an endangered species of fish – Center for Biological Diversity
- Review of the Groundwater Monitoring, Management, and Mitigation Plan (GMMMP) for the Cadiz Water Conservation Project – Three Valleys Municipal Water District

- Groundwater Consulting Support to an Agricultural Business in southeast Kern County Located within a Partially Adjudicated Basin – SunSelect
- Strategic Groundwater Consulting Support to a Large Golf Resort Located in a Desert Groundwater Basin Subject to Critical Overdraft under SGMA – Rams Hill GC
- Assessment of Water Resources at Oil Fields Throughout California and the Development of Produced Waters as an Alternate Water Supply – California Resources Corporation (CRC)
- Support Related to SGMA, Possible Adjudication, and Overall Groundwater Management Strategy for a Municipality in Southern California – Confidential Municipal Client
- Consulting Support for a Groundwater Rights Adjudication in the Las Posas Groundwater Basin, Ventura County – Group of Large Landowners
- Support Related to SGMA, Salinity Management, Alternate Water Sources, and Overall Groundwater Management Strategy for a Grower in the Bay-Delta – Wonderful Orchards
- Evaluation of the Feasibility of Using Brackish Groundwater and Oilfield Produced Water as an Alternate Water Supply for a Basin in Critical Overdraft – Northwest Kern Brackish and Oilfield (BOF) Water Study Group
- Support Related to SGMA, Possible Adjudication, and Overall Groundwater Management Strategy for a Large Water District in the Central Valley – Confidential Water District Client
- Water Rights Dispute Between a Water District and an Avocado Ranch in Central California – Slippery Rock Ranch
- Evaluation of the Feasibility of Using Brackish Groundwater as an Alternate Water Supply for a Closed Desert Basin in Critical Overdraft – Indian Wells Valley Brackish Water Study Group
- Development of a Plan for an Adjudication of Water Rights in a Desert Basin and the Principles of a Groundwater Management Plan (i.e., Physical Solution) – Confidential Water District Client
- Support Related to SGMA for Water Districts on the West Side of Kern County, Including the Creation of Defined Groundwater Management Areas – Westside District Water Authority
- Support to Agricultural Interests in the "White Areas" in Madera County with Respect to the Implementation of the California Sustainable Groundwater Management ACT (SGMA) – Madera County Farm Bureau
- Evaluation of Water Supply Options, Including New Water Supply Wells, for a Major Oilfield in West Fresno County – CRC
- Development of a Water Budget for a Baseline Period, and Evaluation of Native Safe Yield, Annual Operating Safe Yield, Historical Pumping, and Conditions of Overdraft as Part of a Water Rights Dispute in the Central Coast of California – City of Paso Robles
- Design and Permitting of an Aquifer Storage and Recovery (ASR) Project for Indirect Potable Reuse (IPR) of Tertiary Treated Municipal and Industrial Wastewater – City of Fresno
- Assessment of Increased Pumping at a Data Center and the Impact on Nearby Municipal Water Supply Wells in Charleston, South Carolina – Southern Environmental Law Center (SELC)

- Litigation Support and Development of Groundwater Management Approaches as an Alternative to Compliance with the Sustainable Groundwater Management Act – Confidential Water District Client, Southern California
- Groundwater Management Support to a Very Large Agribusiness with Over 170,000 Acres of Almonds, Pistachios, Mandarins, Pomegranates, and Grapes in the San Joaquin Valley - Wonderful Orchards
- Evaluation of Groundwater Conditions and Quality, and The Degree of Hydraulic Connection Between Groundwater Basins, as Part of a Water Rights Dispute in the Central Coast of California – City of Paso Robles
- Development of a Water Supply Well Drilling Ordinance and Valuation of Water Rights for a Confidential Municipality in Southern California
- Support for a Major Agricultural Interest with Holdings in Four Separate Groundwater Basins in Relation to the Implementation of SGMA – RTS Agribusiness
- Development of a New Water Supply Well Field, Including Compliance with California Division of Drinking Water (DDW) Policy 97-005 (Impaired Source Policy), and Evaluation of Groundwater Contamination at a Nearby Aerospace Facility – City of Torrance
- Evaluation of Aquifer Characteristics and Groundwater Conditions Related to the Reinjection of Oil Field Produced Water and Development of a Strategy to Obtain an Aquifer Exemption – Confidential Oil Company
- Development of a recycled water program (including possible aquifer storage and recovery [ASR]/salt-water intrusion program) using advanced treatment of a blend of brackish groundwater and urban storm-water – City of Santa Monica
- Membership of the Technical Advisory Committee (TAC) of a Cooperative Groundwater Group that will Become a Groundwater Sustainability Agency (GSA) – Indian Wells Valley
- Evaluation of Basin Hydrogeology, Groundwater Conditions, Water Quality, and Well Production in a Riparian Coastal Basin in Southern California – City of San Juan Capistrano
- Investigation and Development of Alternate Groundwater Supplies for an Agricultural Interest with Land Holdings in an Arid California Valley – Mojave Pistachios
- Development of a 50,000 acre-foot per year (AFY) ASR Project in the Eastern Portion of a Large Agricultural Valley in Southeast California – Confidential Client
- Review of the Groundwater Hydrology of the Cadiz Project – an independent expert report prepared for Orange County Superior Court in re: Laborers' International Union of North America Local Union No. 783 v. Santa Margarita Water District et al.

Petroleum Hydrocarbons

- Assessment of the Impact of MTBE/TBA Contamination of Water Resources in the State of Vermont, Including Contamination at Release Sites, Public Water Supply Wells, and Private Domestic Wells – State of Vermont

- Evaluation of Produced Water Management Options for Two Active Oil Fields in Southern California, including Treatment and Beneficial Use - CRC
- Assessment of the Impact of MTBE/TBA Contamination of Groundwater Resources in the State of Maryland, and Development of Costs to Address the Contamination at Release Sites, Public Water Supply Wells, and Private Domestic Wells – State of Maryland
- Investigation of Petroleum Hydrocarbon Contamination Related to Releases at a Pipeline that Crosses a Large Ranch in the Central Coast of California – Twin Oaks Ranch
- Assessment of Petroleum Contamination from a Large Pipeline Release that is Discharging to Two Streams and a Wetland in Belton, South Carolina – Southern Environmental Law Center (SELC)
- Evaluation of Contamination by Petroleum Hydrocarbons from a Pipeline Release at a Large Ranch/Winery in the Central Coast of California, and Development of a Conceptual Remedial Program and Costs to Implement – Santa Margarita Ranch, California
- Assessment of the Impact of MTBE/TBA Contamination of Groundwater Resources in the State of Pennsylvania, and Development of Costs to Address the Contamination at Release Sites, Public Water Supply Wells, and Private Domestic Wells – Commonwealth of Pennsylvania
- Investigation and Remediation of MTBE/TBA and Petroleum Hydrocarbon Contamination (using surfactant enhanced product recovery) at a Maintenance Facility in Hawthorne, California – Golden State Water Company
- Assessment of the Effectiveness of Site Investigation and Remediation Activities, Investigation of Off-Site Groundwater Contamination by MTBE/TBA, and Development of Remedial Programs (and Costs) at "Bellwether" Trial Sites - Orange County Water District
- Evaluation of Contaminant Conditions and Prior Site Investigation and Remediation Activity, Implementation of Off-site Investigations, and Development of Remedial Programs and Associated Costs to Address MTBE/TBA Contamination at Trial Sites in Puerto Rico – Commonwealth of Puerto Rico
- Assessment of Site Investigation and Remediation Activities, Investigation of Off-Site Groundwater MTBE/TBA Contamination, and Development of Remedial Programs (and Costs) at Trial Sites – New Jersey Department of Environmental Protection (NJDEP)
- Environmental Impact Report (EIR) and Baseline Environmental Assessment at a Proposed Oil Field Redevelopment Project, Southern Iraq - Confidential Client
- Development of a Remediation Approach and Costs for Soil and Groundwater Contamination at Two Former Petroleum Terminals – Stockton Redevelopment Agency
- Assessment of the Nature of Contamination and the Costs to Address this Contamination at a Former Municipal Landfill in San Diego County – Confidential Client
- Evaluation of Contaminant Sources, and the Fate and Transport of MTBE, 1,2-DCA and Benzene to Numerous Private Water Supply Wells in the Community of Broad Creek, North Carolina

- Assessment of the Effectiveness of Site Investigation and Remediation Activities to Address MTBE/TBA/Benzene Contamination at ARCO and Thrifty Service Stations Throughout Orange County, California - Orange County District Attorney's Office
- Evaluation of Contaminant Sources, Fate, Transport, and Impact of MTBE and TBA to Public Water Supplies, and the Costs to Treat these Contaminants, in the town of East Alton, Illinois
- Court Appointed Consultant to Develop Site Investigation Programs for MTBE/TBA/Benzene Contamination at 35 Thrifty Service Stations in Orange County
- Impact and Mitigation of Oil Field Contaminants at the Belmont Learning Center – Los Angeles Unified School District (LAUSD) - Belmont Commission
- Investigation, PRP Identification, Remediation and Restoration of Municipal Well Fields Impacted by MTBE Contamination – City of Santa Monica (Charnock Well Field), South Lake Tahoe Public Utility District (STPUD), Santa Clara Valley Water District (SCVWD), Great Oaks Water Company
- Oversight of Oil Company Investigation and Remediation Programs in Honolulu Harbor, Hawaii – US Environmental Protection Agency (USEPA)
- Assessment of Oil Field Contaminants in Relation to High Incidences of Leukemia and non-Hodgkins Lymphoma at a High School in Southern California – Confidential Client
- Evaluation of Fuel Releases and Their Impact upon Groundwater Resources at Service Stations, Bulk Plants, Fuel Terminals and Refineries Throughout California – Confidential Client
- Complete Restoration of Municipal Water Supply Wells Contaminated with MTBE – City of Santa Monica (Arcadia Well Field) and ExxonMobil Corporation
- Preliminary Environmental Assessment (PEA) at the Hull Middle School - located on a former oil field and landfill - Torrance Unified School District (TUSD), California
- Oversight of Investigation and Remediation Activities for a MTBE Release at a Service Station and the Potential Impact on a City's Water Distribution System – City of Oxnard, California
- Investigation of MTBE Contamination of Water Supply Wells and Other Petroleum Hydrocarbon Contamination at a Marine Fueling Depot on Catalina Island – Southern California Edison
- Impact of MTBE Releases at Service Stations and a Bulk Fuel Terminal on Drinking Water Wells and Groundwater Resources - City of Dinuba, California
- Oversight of a Court-ordered MTBE/TBA Plume Delineation Program at Gasoline Service Stations in Orange County, California – OCDA, California
- Oversight and Investigation of Remediation of MTBE Contamination Impacting Drinking Water Supplies in the Towns of Cambria and Los Osos/Baywood Park, California – Cambria Community Services District (CCSD), Los Osos Community Services district (LOCSD), Cal-cities Water Company
- Assessment of the Impact of an MTBE Release on Water Supply Wells, Sewers, and a Wastewater Treatment Plant – City of Morro Bay, California

- Investigation and Remediation of an MTBE Release in the Immediate Vicinity of a Drinking Water Supply Well - City of Cerritos, California
- Assessment of the Impact of Petroleum Hydrocarbon Contamination from a Wolverine Pipeline Release in Jackson, Michigan – Private Property Owner
- Investigation of Fuel Oil LNAPL and Hexavalent Chromium Contamination at a Former Clay Products Manufacturing Facility in Fremont, California – Mission Clay Products
- Assessment of the Impact of MTBE Releases on Water Supply Wells, and Oversight of Responsible Party (RP) Investigation and Remediation Activities - Soquel Creek Water District, California
- MTBE Contamination of Private Drinking Water Supplies and Development of Water Supply Treatment and Replacement Alternatives – Glenville, California
- Assessment of the Impact of MTBE on Drinking Water Supply Wells in Santa Clara County, California – Great Oaks Water Company (GOWC)
- Assessment of Data Gaps and Research Needs Regarding MTBE Impact to Water Resources – UK Environment Agency
- Investigation and Mitigation of the Impact of Oil Field Contaminants on a Large Apartment Complex in Marina del Rey, Los Angeles, California – Confidential Client
- Investigation and Remediation of Methane and Hydrogen Sulfide as Part of the Redevelopment of a Former Oil Field in Carson, California - Dominguez Energy/Carson Companies
- Assessment of Methane and Petroleum Hydrocarbon Contamination at a Former Oil Field in Santa Fe Springs, California – General Petroleum
- Natural Resource Damage Assessment (NRDA) at the Guadalupe Oil Field, California - State of California (Department of Fish and Game [DFG], Oil Spill Prevention and Response [OSPR], Attorney General and Regional Water Quality Control Board [RWQCB])
- Assessment of the Impact of Oil Field Activities on Surface Water and Groundwater Resources in the Central Coast of California – State of California
- Groundwater Investigation and Remediation at Four Petroleum Terminals in Wilmington, Carson, and San Pedro, California - GATX
- Research into Technologies for Treatment of MTBE in Water - Association of California Water Agencies (ACWA) / Western States Petroleum Association (WSPA) / Oxygenated Fuels Association (OFA)
- Characterization and Remediation of a Hydrocarbon Release (including MTBE) from a Refined Product Pipeline in Fractured Bedrock in Illinois – Shell
- Investigation and Remediation of Petroleum Hydrocarbon Contamination Beneath a City Maintenance Yard and City Bus Yard – City of Santa Monica, California
- Investigation and Remediation of a Gasoline Release (including MTBE) in Fractured Bedrock Resulting from a Catastrophic Tank Failure – Intrawest Ski Resorts, California

- Assessment of LNAPL, Aromatic Hydrocarbon, and Chlorinated Solvent Contamination Beneath a Former Waste Disposal Facility in Santa Fe Springs, California – Confidential Client
- Investigation of Soil and Groundwater Contamination at a Fueling Facility at a Municipal Airport – City of Santa Monica, California
- Pipeline Leak Investigation and Remedial Design - Mobil Pipeline, Ft. Tejon, California
- Investigation of a Petroleum Release in Fractured Bedrock - Chevron, Julian, California
- Contribution of Multiple Sources to Groundwater Contamination – Mobil Oil Corporation, La Palma, California
- Forensic Assessment of a Gasoline Release – Mobil Oil Corporation, Santa Monica, California
- Investigation of a Diesel Fuel Release – General Petroleum, Point Hueneme, California
- Service Station Investigations and Remediation (> 60 sites) - Mobil Oil Corporation, World Oil, Los Angeles County Metropolitan Transportation Authority (LACMTA), and Others
- Assessment of a Crude Release from a Former Pipeline - Mobil Oil, Gorman, California
- Remediation of 2,000,000-gallon (7,560 m^3) LNAPL Spill - Gulf Strachan Gas Plant, Alberta

Chlorinated Solvents

- Evaluation of Groundwater Contamination at an Aerospace Facility in El Cajon, the Threat to Water Supply Wells, and Vapor Intrusion Concerns at Overlying Properties – Confidential Client
- Investigation of Groundwater Contamination and Potential Sources for TCE Contamination in Groundwater and Water Supply Wells in a Community Adjacent to a County-Operated Airport – Confidential Client
- Evaluation of Poly-Chlorinated Biphenyls (PCBs) in Storm Water and the Impact on Groundwater Resources and the Use of Treated Storm Water for Aquifer Recharge and Saline Intrusion Barriers – Confidential Municipal Clients
- Assessment of the Effectiveness of Site Investigation and Remediation Activities, Investigation of Off-Site Groundwater Contamination, and Development of Remedial Programs (and Costs) at Solvent "Source Sites" in the South Basin Groundwater Protection Project (SBGPP) - Orange County Water District
- Consulting Support to a Community Adjacent to the Santa Susana Field Laboratory (SSFL), a Facility Previously Used to Test Rockets – Bell Canyon Homeowners Association
- Investigation of Groundwater Contamination by Perfluorinated Compounds (e.g., PFOA, PFOS) and its Impact on Public Water Supplies in Southeastern North Carolina – Confidential Client
- Investigation of Chlorinated Solvent and Petroleum Hydrocarbon Contamination, and Implementation of an Extended Remediation Pilot Study, at a Small-Batch Chemical Distribution Facility in Santa Fe Springs, California – Angeles Chemical Corporation

- Evaluation of Contaminant Distribution and Fate, and Development of a Remedial Approach and Costs, for Chlorinated Solvent Contamination in Groundwater at a Light Industrial Facility in Northridge, California, – Confidential Client
- Project Management Consultant (PMC) for the Hazardous Substances Account Act (HSAA) Program (i.e., State-CERCLA) as part of the SBGPP – Orange County Water District
- Assessment of Conceptual Hydrogeology and the Sources of 1,2-DCA and PCE Contamination of a Large Public Water Supply Well – Confidential Client
- Investigation and Remediation of Chlorinated Solvent Contamination in Soil and Groundwater Beneath a Metal Finishing Facility in Inglewood, California – Bodycote Hinterliter and Joseph Collins Estate.
- Investigation and Remediation of Soil and Groundwater Contamination at a Former Wood Treating Facility – Port of Los Angeles
- Assessment of the Nature of PCE Releases from Dry Cleaning Facilities, the Impact Upon Groundwater Resources, and the Cost of Remediation – City of Modesto, California
- Investigation of Chlorinated Solvent Contamination in Soil, Groundwater and Drinking Water Supplies Beneath Various Facilities in Lodi, California – Confidential Client
- Investigation of TCE and Hexavalent Chromium Contamination at the Suva School in Montebello, California – Communities for a Better Environment
- Remediation of Chlorinated Solvents, Including Vinyl Chloride, in Soil and Groundwater Beneath a Former Aerospace Facility in West Los Angeles, California – Playa Vista Capital
- Assessment of Chlorinated Solvent and Hexavalent Chromium Contamination at an Active Metal Finishing Facility in the City of Garden Grove, California – Confidential Client
- Investigation and Remediation of Hexavalent Chromium and TCE Contamination at an Active Plating Facility in West Los Angeles – confidential client
- Contamination of Drinking Water Supplies by TCE and Perchlorate from an Aerospace Manufacturing Facility in Redlands, California – Individual Plaintiffs
- Investigation and Remediation of Hexavalent Chromium, TCE, and Gasoline LNAPL Contamination at an Active Plating Facility in Santa Fe Springs, California – Confidential Client
- Investigation and Remediation of Hexavalent Chrome and TCE Contamination at the Los Angeles Academy (formerly Jefferson) Middle School, Los Angeles, California – Jefferson Site PRP Group
- Evaluation of Groundwater and Contaminant Conditions at an Active Municipal Landfill in Los Angeles County, California – Browning Ferris Industries (BFI)
- Investigation of Chlorinated Solvent Contamination in Groundwater Beneath a Municipal Airport – City of Santa Monica, California
- Resource Conservation and Recovery Act (RCRA) Facility Assessment and Closure for a Large Aerospace Facility in Hawthorne, California – Northrop Grumman Corporation

- Characterization of Complex Hydrogeology and Contaminant Fate and Transport (with Poly-chlorinated Biphenyls [PCBs] and Chlorinated Solvents) in Karstic Bedrock at a Site on the National Priority List (NPL) in Missouri – MEW PRP Steering Committee
- Design of a Groundwater Remediation Program for Chlorinated Solvent, Perchlorate and Other Contaminants Utilizing Existing Drinking Water Wells – San Gabriel Valley Water Company (SGVWC)
- Investigation of a Chlorinated Solvent Release in Fractured Bedrock – Consolidated Electrical Distributors, San Diego, California
- Contamination of Drinking Water Supplies by TCE from an Aerospace Manufacturing Facility in Redlands, California – Individual Plaintiffs
- Investigation of a Chlorinated Solvent Release at an Active Chemical Terminal - GATX, San Pedro, California
- Technical and Regulatory Assistance, and RP Oversight and Review, Chlorinated Solvent Contamination Beneath a Former Aerospace Facility – City of Burbank, California
- Investigation and Remedial Design for a Chlorinated Solvent Release at an Active Machine Shop – Mighty USA, Los Angeles, California
- Remediation of Chlorinated Solvents in Groundwater as Part of a Rail Freight Transfer Terminal Development - Port of Los Angeles, California
- Remedial Evaluation of PCE Contamination at a Former Scientific Instruments Manufacturing Facility – Forest City, Irvine, California
- Evaluation of a Chlorinated Solvent Release at a Dry Cleaners - Los Angeles City Attorney, West Los Angeles, California
- Assessment of a Chlorinated Solvent Release from Former Dry Cleaners – DeLoretto Plaza, Santa Barbara, California
- Characterization and Remediation of LNAPL at an Active Chemical Refinery - ICI, Teeside, UK

Perchlorate

- Investigation of Regional Perchlorate Contamination of Groundwater Resources in the Central Basin of Los Angeles – Water Replenishment District of Southern California (WRD)
- Investigation of regional groundwater contamination by perchlorate in the Rialto-Colton, Bunker Hill, and North Riverside Basins, and impact to water supply wells – City of Riverside
- Assessment of the Effectiveness of Site Investigation and Remediation Activities, Investigation of Off-Site Groundwater Contamination, and Development of Remedial Programs (and Costs) at Perchlorate Release Sites in the South Basin Groundwater Protection Project (SBGPP) - Orange County Water District
- Hydrogeologic Investigation, Source Identification, Water Supply Well Impact Assessment, and Drinking Water Treatment for Perchlorate – City of Morgan Hill, California
- Evaluation of the Fate and Transport of Perchlorate and NDMA Contamination and its Impact on Water Supplies in Rancho Cordova, California – Southern California Water Company

- Hydrogeologic Investigation, Water Supply Well Impact Assessment, Regulatory Assistance, and Responsible Party (RP) Oversight for Perchlorate Contamination – City of Gilroy, California
- Regulatory and Technical Assistance, RP Oversight and Review, Water Resource Impact Assessment for Perchlorate Contamination – City of Santa Clarita, California
- Design of a Groundwater Remediation Program for Chlorinated Solvent, Perchlorate and Other Contaminants Utilizing Existing Drinking Water Wells – San Gabriel Valley Water Company (SGVWC), San Gabriel Valley Superfund Site, California
- Evaluation of the Off-site Migration of Perchlorate and TCE Contamination from a Rocket Testing Facility in Simi Hills, California – City of Calabasas, County of Los Angeles
- Investigation of Potential Perchlorate Source Sites, Source Contribution, Contaminant Pathway Assessment, and Drinking Water Treatment – Fontana Water Company, West Valley Water District, Fontana, California
- Evaluation of Previous Environmental Investigations, Contaminant Transport and Remediation Options for Perchlorate and Solvent Contamination at the Stringfellow Acid Waste Disposal Pits in Glen Avon, California – Joint Underwriters

Hexavalent Chromium

- Investigation and Remediation of Hexavalent Chrome and TCE Contamination at the Los Angeles Academy (formerly Jefferson) Middle School, Los Angeles – Jefferson Site PRP Group
- Investigation and Remediation of Hexavalent Chromium and TCE Contamination at an Active Plating Facility in West Los Angeles – Confidential Client
- Hydrogeologic Investigation of Hexavalent Chromium Contamination in the Northern Area of the Central Basin in Los Angeles County – Water Replenishment (WRD)
- Investigation of TCE and Hexavalent Chrome Contamination at the Suva School in Montebello, California – Communities for a Better Environment
- Investigation of Fuel Oil LNAPL and Hexavalent Chromium Contamination at a Former Clay Products Manufacturing Facility in Fremont, California – Mission Clay Products
- Investigation and Remediation of Hexavalent Chromium, TCE, and Gasoline LNAPL Contamination at an Active Plating Facility in Santa Fe Springs California – Confidential Client

Other Projects

- Investigation of the Source, Magnitude, Extent and Fate of Polyethylene Nurdle Pollution in and Around Charleston Harbor – Charleston Waterkeeper and South Carolina Coastal Conservation League
- Review and Critique of Proposed Coal Ash Pond Closure at the Tennessee Valley Authority (TVA) Gallatin Power Plant - SELC
- Evaluation of Surface Water and Groundwater Pollution by Boron and Other Metals and Salts Associated with Coal Ash at Georgia Power’s Plant Scherer Generating Station - SELC

- Assessment of the Impact of 1,2,3-TCP Contamination from Soil Fumigant Applications on Municipal Water Supplies – City of Arcadia
- Investigation of PCB Contamination at a Former Wastewater Treatment Plant at a Former US Army Camp – City of Riverside
- Investigation of the Fate, Transport, and Persistence of 1,2,3-TCP Contamination of Groundwater and Municipal Water Supply Wells – City of Upland
- Assessment of Sediment, Surface Water, and Groundwater Contamination Associated with Coal Ash at the Belews Creek Coal-Fired Power Plants in North Carolina, and an Evaluation of Closure Options for Coal Ash Basins – NAACP
- Assessment of the Impact of 1,2,3-TCP Contamination from Soil Fumigant Applications on Municipal Water Supplies – Sunny Slope Water Company
- Investigation of Sources and Fate and Transport of 1,2,3-TCP Contamination in Groundwater and its Impact on Potable Water Supply Wells in and around the City of Claremont – Golden State Water Company
- Evaluation of disposal and/or treatment options for produced waters at three active oil fields in Kern County – California Resources Corporation
- Assessment of 1,2,3-TCP Contamination of Groundwater and Potable Water Supply Wells in the Nipomo Area of Central California – Golden State Water Company
- Evaluation of potential water resources impacts from a proposed coal ash landfill located within a flood plain near Laredo Texas – confidential ranch owner
- Investigation of the Fate, Transport, and Persistence of 1,2,3-TCP Contamination of Groundwater and Municipal Water Supply Wells – City of Hemet
- Investigation of elevated concentrations total dissolved solids (TDS) and dissolved metals in surface water and groundwater related to an active lignite mine and coal-fired power plant at a large ranch in southeast Texas – Peeler Ranch
- Assessment of soil, groundwater, and surface water contamination associated with a Former Manufactured Gas Plant (MGP) in South Carolina – Southern Environmental Law Center (SELC)
- Evaluation of Contaminated Groundwater and Surface Waters by 1,4-dioxane, Perfluorinated Compounds [PFCs], and Gen-X at a Chemical Manufacturing Facility in North Carolina – Cape Fear Riverkeeper
- Investigation of 1,2,3-TCP Contamination of Groundwater and Municipal Water Supply Wells – City of Fresno
- Evaluation of Surface Water, Sediment, and Groundwater Contamination and Assessment of Remedial Actions at a Former Manufactured Gas Plant in South Carolina – Confidential Client
- Evaluation of Flow Conditions and Water Quality in Surface Water and Groundwater at an Active Coal-Fired Power Plant in North Carolina, including Three-Dimensional Groundwater Flow and Solute Transport Modeling – Sierra Club

- Assessment of 1,2,3-TCP Contamination of Groundwater Resources and Water Supply Wells in Clovis, California, and Development of Well-head Treatment Programs and Associated Costs - City of Clovis
- Investigation of Surface Water and Groundwater Impacted by Acid Mine Drainage (AMD) from a Former Coal Mine in Alabama, Including Geophysical Mapping, Piezometer Installation, and Soil, Sediment, and Surface Water Sampling – Black Warrior Riverkeeper
- Evaluation of Groundwater and Surface Water Contamination by Coal Combustion Residuals (CCRs) from Ash Ponds at Power Generation Facilities in Eastern Virginia – Sierra Club
- Investigation of 1,2,3-TCP Contamination of Groundwater and Municipal Water Supply Wells – City of Atwater
- Evaluation of Contaminant Sources and Hydrogeologic Pathways for 1,2,3-TCP Contamination of Water Supply Wells - City of Tulare
- Identification of Potential Sources of Nitrate Contamination at a Municipal Water Supply Well – Water Replenishment District of Southern California (WRD)
- Assessment of Sediment, Surface Water, and Groundwater Contamination Associated with Coal Ash at Two Coal-Fired Power Plants in North Carolina, and an Evaluation of Closure Options for Coal Ash Basins – Roanoke River Basin Association
- Assessment of the Volume and Quality of Storm Water and Shallow Groundwater (from Dewatering) at a Large Condominium Complex, as part of a City's MS-4 Storm Water Permitting – Coronado
- Investigation of Nitrate Contamination of Groundwater Resources and Water Supply Wells in Delano, California, and Development of Well-head Treatment Programs and Associated Costs - City of Delano
- Evaluation of Contaminant Conditions and Closure Plans for Coal Ash Basins at Two Coal-Fired Power Plants in Virginia – Sierra Club
- Evaluation of Groundwater and Surface Water Contamination by CCRs from Ash Ponds at a Former Power Generation Facility in Central Virginia – Sierra Club and Potomac Riverkeeper
- Negotiation of Private Agreements Between Water Utilities and RPs – City of Santa Monica, STPUD, City of Morro Bay, SGVWC, GOWC, City of Oxnard, OCDA
- Evaluation of Power Plant Intake and Outfall Structures on Fecal Coliform Plume Dynamics and Resulting Beach Closures, Huntington Beach, California – California Energy Commission
- Investigation of Bacteria and Fecal Contamination in Groundwater Beneath the Downtown Area of Huntington Beach, California – City of Huntington Beach
- Investigation of the Source(s) and Transport of Enterococcus and Fecal Bacteria to the Near Shore Waters of Huntington Beach, California – City of Huntington Beach, County of Orange, Orange County Sanitation District (OCSD)
- Characterization and Remediation, Former Town Gas Sites - British Gas Properties, U.K.
- Aquifer Characterization, Contaminant Assessment, Slurry Wall Design and Installation, Soil Excavation and Water Treatment System Design - Port of Los Angeles, California

Professional History

aquilogic, Inc., CEO and Principal Hydrologist, 2011 to present.
exp, Executive Vice-President, Chief Business Development Officer, 2010 to 2011
WorleyParsons, Senior VP, Strategy & Development, 2006 to 2010.
Komex Environmental Ltd., Chief Executive Officer, Principal Shareholder, Director, 1999 to 2005.
Komex•H2O Science•Inc., President and Principal Hydrologist, 1992 to 1999.
Remedial Action Corporation, Project Manager and Geohydrologist, 1989 to 1992.
Lanco Engineering, Project Manager, 1985 to 1987, and 1988.
Royal Geographical Society, Kosi Hills Resource Conservation Project, Nepal: Project Director, 1983 to 1985

Teaching

Anthony has recently taught the following classes:

- Environmental Aspects of Soil Engineering and Geology - a ten-week course at the University of California, Irvine
- Site Characterization and Remediation of Environmental Pollutants - two lectures as part of the course at Imperial College London
- Methyl Tertiary Butyl Ether: Implications for European Groundwater - a one day seminar for the UK Environment Agency (UKEA)
- Successful Remediation Strategies – a two-day course for the NGWA
- Understanding Environmental Contamination in Real Estate, and one day class for the International Right-of-Way Association (IRWA)
- Project Development and the Environmental Process, a one-day class for the IRWA
- Environmental Awareness, a one-day class for the IRWA
- Regional Fuels Management Workshop, a two-day workshop for the USEPA.

Publications

In addition to his teaching experience, Anthony has prepared over 1000 written project reports, and has written, presented and published many articles regarding the following:

- The implementation of the SGMA in California
- Groundwater law in California
- The development of alternate water supplies, notably brackish groundwater
- Aquifer storage and recovery and other groundwater augmentation actions
- The Clean Water Act and groundwater contamination
- Contamination of groundwater and drinking water supplies by fuel oxygenates, chlorinated solvents, rocket propellants, PFCs, and metals
- Contaminant fate and transport in fractured or heterogeneous media
- The impact of oil field activities on the environment

- Source water assessment and protection
- Public health and toxicology
- Risk analysis and assessment
- Environmental economics
- General water resources and environmental issues

The following is a list of publications and presentations:

Brown, A., 2021. Science in the Court Room: Expert Witness Testimony in Contamination Cases. American Groundwater Trust California PFAS Webinar, March 2021.

Brown, A., 2021. Sources of 1,2,3-TCP and its Persistence in California Groundwater. American Groundwater Trust 1,2,3-TCP Webinar, February 2021.

Brown, A., 2020. Groundwater and the Clean Water Act. American Groundwater Trust California Groundwater Conference, Ontario, February 2020.

Brown, A., and T. Watson, 2020. Produced Water – A New California Resource. Produced Water Society Annual Seminar, Houston, February 2020.

Brown, A., 2019. Perspectives on the Future of the Water Business. Environmental Business International, Industry Summit, San Diego, March 2019.

Brown, A., 2019. Paso Robles – The First Jury Trial over Water Rights in California. American Groundwater Trust California Groundwater Conference, Ontario, February 2019.

Brown, A., 2018. Emerging Contaminants – Where Do They Come From? American Groundwater Trust Conference on Emerging Contaminants, Chino Basin, March 2018.

Brown, A., 2017. Contaminated Groundwater as a Resource. State Bar of California Environmental Law Conference, Yosemite, October 2017.

Stone A. and A. **Brown**, 2017 (organizers). Groundwater Law – An American Groundwater Trust Conference. UC Hastings Law School, San Francisco, May 18, 2017

Brown, A. 2016. The SGMA Cookbook – Implementing the Sustainable Groundwater Management Act. Association of California Water Agencies (ACWA), Spring Conference, Monterey, CA, April 2016.

Stone A. and A. **Brown**, 2016 (organizers). Groundwater Law – An American Groundwater Trust Conference. Loyola Law School, Los Angeles, April 26, 2016

Stone A. and A. **Brown**, 2015 (organizers). Groundwater Law – An American Groundwater Trust Conference. Doubletree San Francisco Airport, May 15, 2015

Brown, A., 2015. Challenges Implementing the California Sustainable Groundwater Management Act (SGMA). Bar Association of San Diego County, May 5, 2015.

Brown, A., 2015. Technical and Other Issues Implementing the California Sustainable Groundwater Management Act (SGMA). Ventura Association of Water Agencies, March 19, 2015.

Brown, A., 2015. Outlook for Environmental Services in the Global Energy and Resources Sectors. Environmental Business Journal, Environmental Industry Summit, San Diego, March 11-13, 2015.

Brown, A., 2015. The Effect of $50 Oil on the Environmental Services Sector. Environmental Business Journal Conference, San Diego, March 11-13, 2015.

Brown, A. 2014. Hydrology and the Law: The Role of Science in the Resolution of Legal Issues for Water Quality and Damages Issues. Law Seminars International, Santa Monica, CA. October 2014

Stone A. and A. **Brown**, 2014 (organizers). Groundwater Law – An American Groundwater Trust Conference. Marriott Marina del Rey, May 20-21, 2014

Brown, A. 2014. Environmental Issues with Hydraulic Fracturing. Los Angeles County Bar Association (LACBA), Spring Symposium, Los Angeles, CA. April 2014.

Brown, A. 2014. Environmental Services in the Global Energy & Resources Sectors. Environmental Business Journal, Environmental Industry Summit, San Diego, March 2014.

Brown, A. 2013. Dealing with Emerging Groundwater Contaminants. Association of California Water Agencies (ACWA), Fall Conference, Los Angeles, November 2013.

Brown, A., 2013. Outlook for Environmental Services in the Global Energy and Resources Sectors. Environmental Business Journal, Environmental Industry Summit, San Diego, March 2013.

Brown, A., Colopy, J, and Johnson, T, 2007. Groundwater Science in the Courtroom: Observations from the Expert Witness Chair. Groundwater Resource Association of California (GRAC), Groundwater Law Conference, San Francisco, June 2007.

Brown, A. 2005. Emerging Water Contaminants. California Special Districts Association (CSDA), Annual Conference, Palm Springs, May 2005.

Brown, A. 2005. The Interplay of Science and Policy at Contaminated Sites. Los Angeles County Bar Association (LACBA), Spring Symposium, Los Angeles, CA. April 2005.

Brown, A., M. Trudell, G. Steensma, and J. Dottridge, 2005. European Experiences with Artificial Aquifer Recharge. Groundwater Resource Association of California (GRAC), Aquifer Storage Conference, Sacramento, March 2005.

Brown, A. 2004. Viagra, Estrogen, Prozac, and Other Emerging Contaminants: have you checked your groundwater lately? American Groundwater Trust (AGWT), Legal Issues Conference, Los Angeles, November 2004.

Brown, A. 2004. The Use of Groundwater Models in Complex Litigation. American Groundwater Trust (AGWT), Groundwater Models in the Courtroom Symposium, May 2004.

Brown, A. 2004. Emerging Groundwater Contaminants: MTBE as a Case Study. Association of California Water Agencies (ACWA), Spring Conference, Los Angeles, May 2004.

Rohrer, J., A. **Brown**, S. Ross, 2004. MTBE and Perchlorate, Lessons Learned from Recent Groundwater Contaminants. California Special Districts Association (CSDA), Annual Conference, Palm Springs, May 2004.

Hagemann, M., A. **Brown**, and J. Klein, 2002. An Estimate of Costs to Address MTBE Releases from Underground Storage Tanks and to Treat Drinking Water Supplies Impacted by MTBE. NGWA, Conference on MTBE: Assessment, Remediation, and Public Policy, Orange, CA. June 2002

Hagemann, M., A. **Brown**, and J. Klein, 2002. From Tank to Tap: A Chronology of MTBE in Groundwater. NGWA, Conference on Litigation Ethics, and Public Awareness, Washington, D.C., August 2002

Major, W., A. **Brown**, S. Roberts, L. Paprocki, and A. Jones, 2001. The Effects of Leaking Sanitary Sewer Infrastructure on Groundwater and Near Shore Ocean Water Quality in Huntington Beach, California. California Shore and Beach Preservation Association and California Coastal Coalition – Restoring the Beach: Science, Policy and Funding Conference. San Diego, California, November 8-10, 2001.

Ross, S.D., A. Gray, and A. **Brown,** 2001. Remediation of Ether Oxygenates at Drinking Water Supplies and Release Sites. Can-Am 6th Annual Conference of National Groundwater Association Banff, Alberta, Canada. July 2001.

Gray, A.L. and A. **Brown**, 2000. The Fate, Transport, and Remediation of Tertiary-Butyl-Alcohol (TBA) in Ground Water. Proceedings of the NGWA/API 2000 Petroleum Hydrocarbons and Organic Chemicals in Groundwater: Prevention, Detection, and Remediation. Anaheim, November 14-17, 2000.

Hardisty, P.E., J. Dottridge and A. **Brown**, 2000. MTBE in Ground Water in the United Kingdom and Europe. Proceedings of the NGWA/API 2000 Petroleum Hydrocarbons and Organic Chemicals in Groundwater: Prevention, Detection, and Remediation. Anaheim, November 14-17, 2000.

Brown, A., B. Eisen, W. Major, and A. Zawadzki, 2000. Geophysical, Hydrogeological and Sediment Investigations of Bacterial Contamination in Huntington Beach, California. California Shore and Beach Preservation Association – Preserving Coastal Environments Conference. Monterey, California, November 2-4, 2000.

Hardisty, P.E., G.M. Hall, A. **Brown** and H.S. Wheater, 2000. Natural Attenuation of MTBE in Fractured Media. 2nd National Conference on Natural Attenuation in Contaminated Land and Groundwater. Sheffield, U.K., June 2000.

Brown, A., 2000. Treatment of Drinking Water Impacted with MTBE. Mealey's MTBE Conference. Marina del Rey, California. May 11-12, 2000.

Brown, A., 2000. Other Fuel Oxygenates in Groundwater. Mealey's MTBE Conference. Marina del Rey, California. May 11-12, 2000.

Brown, A., 2000. The Fate, Transport and Remediation of TBA in Groundwater. Mealey's MTBE Conference. Marina del Rey, California. May 11-12, 2000.

Brown, A., 2000. MTBE Contamination of the City of Santa Monica Water Supply: Recap. Mealey's MTBE Conference. Marina del Rey, California. May 11-12, 2000.

Mooder, R.B., M.D. Trudell, and A. **Brown**, 2000. A Theoretical Analysis of MTBE Leaching from Reformulated Gasoline in Contact with Groundwater. American Chemical Society, Div. of Environmental Chemistry, 219th ACS National Meeting. San Francisco, March 26-30, 2000.

Trudell, M.R., K.D. Mitchell, R.B. Mooder, and A. **Brown**, 2000. Modeling MTBE Transport for Evaluation of Migration Pathways in Groundwater. American Chemical Society, Div. of Environmental Chemistry, 219th ACS National Meeting. San Francisco, March 26-30, 2000.

Brown, A., 1999. How LUST Policy Led to the Current MTBE Problem. Submitted for the Government Conference on the Environment. Anaheim, CA. August 1999.

Trudell, M.R., K.D. Mitchell, R.B. Mooder and, A. **Brown**, 1999. Modeling MTBE transport for evaluation of migration pathway scenarios. In proceedings, 6th International Petroleum Environmental Conference, Houston TX, November 16-19, 1999. Integrated Petroleum Environmental Consortium, University of Tulsa, OK.

Gray, A.L., A. **Brown**, R.A. Rodriguez, 1999. Treatment of a Groundwater Impacted with MTBE By-Products**.** In proceedings, 6th International Petroleum Environmental Conference, Houston TX, November 16-19, 1999. Integrated Petroleum Environmental Consortium, University of Tulsa, OK.

Gray, A.L., A. **Brown**, M.M. Nainan, and R.A. Rodriguez, 1999. Restoring a Public Drinking Water Supply Contaminated with MTBE. In proceedings, 6th International Petroleum Environmental Conference, Houston TX, November 16-19, 1999. Integrated Petroleum Environmental Consortium, University of Tulsa, OK.

Ausburn M.P., A. **Brown**, D. A. Reid, and S.D. Ross, 1999. Environmental Aspects of Crude Oil Releases to the Subsurface. In proceedings, 6th International Petroleum Environmental Conference, Houston TX, November 16-19, 1999. Integrated Petroleum Environmental Consortium, University of Tulsa, OK.

Hardisty, P.E., A. **Brown**, and H. Wheater, 1999. Using Economic Analysis to Support Remedial Goal Setting and Remediation Technology Selection. In proceedings, 6th International Petroleum Environmental Conference, Houston TX, November 16-19, 1999. Integrated Petroleum Environmental Consortium, University of Tulsa, OK.

Brown, A., and J.J. Clark, 1999. MTBE: Air Today, Gone Tomorrow! California Environmental Law and Remediation Reporter. Argent Communications Group. Foresthill, CA. Volume 9 (2): pp 21 - 30.

Brown, A., P.E. Hardisty, and H. Wheater, 1999. The Impact of Fuel Oxygenates on Water Resources. A one-day course for the UK Environment Agency. London, UK. June 1999

Brown, A., K.D. Mitchell, C. Mendoza and M.R. Trudell, 1999. Modeling MTBE transport and remediation strategies for contaminated municipal wells. Battelle In-Situ and On-Site Bioremediation, Fifth International Symposium, San Diego, CA. April 19-22, 1999.

Brown, A., 1999. LUST Policy and Its Part in the MTBE Problem. USEPA National Underground Storage Tank Conference. Daytona Beach, FL. March 15-17, 1999.

Brown, A., T.E. Browne, and R.A. Rodriguez, 1999. Restoration Program for MTBE Contamination of the City of Santa Monica Arcadia Well Field. Ninth Annual Conference on Soil and Groundwater Contamination, Oxnard, CA. March 1999.

Brown, A., 1999. Moderator of a Panel Session - Judging Oil Spill Response Performance: The Challenge of Competing Perspectives. International Oil Spill Conference. Seattle, WA. March 8-11, 1999.

Brown, A., 1999. MTBE: Asleep at the Wheel! Editorial in the Newsletter of the Los Angeles County Bar Association, Environmental Section. February 1999.

Brown, A., J.S. Devinny, T.E. Browne and R.A. Rodriguez, 1998. Restoration of a Public Drinking Water Supply Impacted by Methyl *tertiary* Butyl Ether (MTBE) Contamination. Proceedings of the NGWA/API 1998 Petroleum Hydrocarbons and Organic Chemicals in Groundwater: Prevention, Detection, and Remediation, November 11-13, 1998, Houston, TX.

Brown, A., 1998. Petroleum and the Environment: A Consultants Perspective. USEPA Regional Fuels Management Workshop, November 3-4, 1998, Shell Beach, CA.

Brown, A., 1998. How Much Does Remediation Really Cost? Presented at the Southern California Chapter of the Appraisal Institute, Summer Seminar Spectacular: Damages, Diminution and Mitigation. Anaheim, California, August 13, 1998.

Brown, A., J.S. Devinny, A.L. Gray and R.A. Rodriguez, 1998. A Review of Potential Technologies for the Remediation of Methyl *tertiary* Butyl Ether (MTBE) In Groundwater. International Petroleum and the Environment Conference, Albuquerque, NM. October 1998.

Brown, A., A.L. Gray, and T.E. Browne, 1998. Remediation of MTBE at Leaking Underground Storage Tank (LUST) Sites. The UST Clean-up Fund Conference, Austin, TX. June 22, 1998.

Brown, A., J.R.C. Farrow, R.A. Rodriguez, and B.J. Johnson, 1998. Methyl *tertiary* Butyl Ether (MTBE) Contamination of the City of Santa Monica Drinking Water Supply: An Update. Proceedings of the National Ground Water Association (NGWA) Southwest Focused Conference: MTBE and Perchlorate, June 3-5, 1998, Anaheim, California.

Patterson, G, B. Groveman, J. Lawrence, and **A. Brown**, 1998. The Legal Implications, Claims, and Courses of Action for Water Purveyors Impacted by MTBE and Perchlorate. Proceedings of the NGWA Southwest Focused Ground Water Conference: Discussing the Issue of MTBE and Perchlorate in Ground Water. June 3-4, 1998, Anaheim, California.

Clark, J.J., **A. Brown**, and R.A. Rodriguez, 1998. The Public Health Implications of MTBE and Perchlorate in Water: Risk Management Decisions for Water Purveyors. Proceedings of the NGWA Southwest Focused Ground Water Conference: Discussing the Issue of MTBE and Perchlorate in Ground Water. June 3-4, 1998, Anaheim, California.

Brown, A., J.S. Devinny, M.K. Davis, T.E. Browne, and R.A. Rodriguez, 1997. A Review of Potential Technologies for the Treatment of Methyl *tertiary* Butyl Ether (MTBE) in Drinking Water. Proceedings of the NGWA/API 1997 Petroleum Hydrocarbons and Organic Chemicals in Groundwater: Prevention, Detection, and Remediation, November 12-14, 1997, Houston, TX.

Brown, A., J.R.C. Farrow, R.A. Rodriguez, B.J. Johnson and A.J. Bellomo, 1997. Methyl *tertiary* Butyl Ether (MTBE) Contamination of the City of Santa Monica Drinking Water Supply.

Proceedings of the National Groundwater (NGWA) and American Petroleum Institute (API) 1997 Petroleum Hydrocarbons and Organic Chemicals in Groundwater: Prevention, Detection, and Remediation, November 12-14, 1996, Houston, Texas.

Brown, A., J.S. Devinny, M.K. Davis, T.E. Browne, and R.A. Rodriguez, 1997. A Review of Treatment Technologies for Methyl *tertiary* Butyl Ether (MTBE) in Drinking Water. Proceedings of the American Chemical Society (ACS) Conference on Chemistry and Spectroscopy, October 1997, Irvine, California.

Brown, A., J.S. Devinny, T.E. Browne and D. Chitwood, 1997. A Review of Alternative Technologies for the Removal of MTBE from Drinking Water. Association of California Water Agencies (ACWA) Workshop on MTBE, March 13, 1997, Ontario Airport Hilton, California.

Brown, A., 1997. Methyl tertiary Butyl Ether (MTBE) in Groundwater and its Impact on the City of Santa Monica Drinking Water Supply. California Groundwater Resource Association (GRA), January 22, 1997, Wyndham Garden Hotel, Costa Mesa, California.

Gray, A.L., **A. Brown**, B.J. Moore, and T.E. Browne, 1996. Respiration Testing for Bioventing and Biosparging Remediation of Petroleum Contaminated Soil and Groundwater. NGWA Outdoor Action Conference, Las Vegas, NV, May 1996.

Brown, A., and P.E. Hardisty, 1996. Use of Technical and Economic Analyses for Optimizing Technology Selection and Remedial Design: Examples from Hydrocarbon Contaminated Sites. Sixth West Coast Conference on Contaminated Soils and Groundwater, AEHS, March 1996.

Farrow, J.R.C., **A. Brown**, W. Burgess, R.E. Payne, 1995. High Vacuum Soil Vapor Extraction as a Means of Enhancing Contaminant Mass Recovery from Groundwater Zones of Low Transmissivity. Accepted for Proceedings of the Petroleum Hydrocarbons and Organic Chemicals in Groundwater, API/NGWA Conference. Houston, TX. November 1995.

Ausburn, M.P., **A. Brown**, M. Brewster, and P. Caloz, 1995. Use of Borehole Terrain Conductivity Logging to Delineate Multiple Ground Water Bearing Zones and Map Alluvial Fan Facies. California Groundwater Resource Association (GRA), Annual Conference, November 1995, Costa Mesa, California.

Hardisty, P.E., S.D. Ross, F.B. Claridge and **A. Brown**, 1995. Technical and Economic Analysis of Remedial Techniques for LNAPL in Fractured Rock. International Association of Hydrogeologists (IAH), October 1995, Solutions 95 Conference, Calgary, Canada.

Croft, R.G., **A. Brown**, P. Johnson, and J. Armstrong, 1994. Tracer Gas Use in Soil Vapor Extraction and Air Sparge Pilot Tests: Case Studies. HMRCI Superfund XV Conf. Proceedings, Washington D.C, November 1994.

Bauman, P.B., M. Brewster and **A. Brown**, 1994. Borehole Logging as an Aid to Hydrogeologic Characterization of Leaking Underground Storage Tank (LUST) Sites. Proceedings from the National Groundwater Association (NGWA), 8th National Outdoor Action Conference and Exposition, Minneapolis, Minnesota. May 1994.

Bauman, P.B., **A. Brown,** M. Brewster, and M. Lockhart, 1994. The use of Borehole Geophysics in the Characterization of Both Vadose and Saturated Zone Lithologies at LUST Sites.

Proceedings from the USEPA Technology Transfer at LUST Sites Conference, Urbana, Illinois. May 1994.

Bauman, P.B., J. Sallomy, **A. Brown** and M. Brewster, 1994. Unconventional Applications of Terrain Conductivity Logging to Groundwater Investigations. Proceedings of the Symposium on the Application of Geophysics at Environmental and Engineering Projects (SAGEEP), Boston, Massachusetts, 1994.

Brown, A., R.E. Payne, and P. Perlwitz, 1993. Air Sparge Pilot Testing at a Site Contaminated with Gasoline. Proceedings of the Petroleum Hydrocarbons and Organic Chemicals in Groundwater: Prevention, Detection, and Restoration. API/NGWA Conference, Houston, Texas. November 1993.

Brown, A., 1991. Air Permeability Testing for Vapor Extraction. Conference Proceedings; Petroleum Hydrocarbon Contaminated Soil, San Diego, California. March 1991.

Wheater, H., B. Beck, **A. Brown,** and S. Langan, 1991. The Hydrological Response of the Allt a' Mharcaidh Catchment, Inferences from Experimental Plots. Journal of Hydrology, Vol. 123; pp 163-1990.

Brown, A., 1986. The Final Report of the Kosi Hills Resource Conservation Project, Nepal 1984. Royal Geographical Society Student Expedition.

aquilogic, Inc.
environment • water • strategy

245 Fischer Avenue, Suite D-2
Costa Mesa, CA 92626, USA
Tel. +1.714.770.8040
Web: www.aquilogic.com

CURRICULUM VITAE

October 2021

Robert H. Abrams, PhD, PG, CHg

Principal Hydrogeologist

mobile: +1.650.743.0594
email: bob.abrams@aquilogic.com

Disciplines

Hydrogeology, Water Resources, Geology, Geostatistics, Analytical and Numerical Modeling, Water Quality, Groundwater and Vadose Zone Fluid Flow, Contaminant Fate and Transport.

Education

Ph.D. Hydrogeology, Stanford University, 1999
M.S. Hydrogeology, Stanford University, 1996
B.S. Geology, San Francisco University, 1991

Professional Registrations

Professional Geologist, CA (No. 8703)
Certified Hydrogeologist, CA (No. 931)
Licensed Geologist, North Carolina (No. 2639)

Professional Experience

Bob has over 20 years of professional experience in groundwater resource development, groundwater sustainability, groundwater banking, groundwater quality, and model design and evaluation. He has worked for the California Geological Survey, the U.S. Geological Survey, Stanford University, San Francisco State University, consulting firms, and as an independent consultant for public and private clients. Recent projects have included vadose zone characterization and modeling, evaluation of subsidence investigations, developing and reviewing integrated groundwater/surface water hydrologic models that include simulation of current and future land-use-based water demand and the impact of climate change, and preparation of Groundwater Sustainability Plans.

Project Experience

Summary of California Central Coast Projects

- Currently serving on the Seawater Intrusion Working Group (SWIG) and SWIG Technical Advisory Committee (TAC). Theses groups are tasked with evaluating and recommending

approaches for mitigating seawater intrusion in the 180/400-Foot Aquifer Subbasin – *Salinas Basin Groundwater Sustainability Agency, Carmel Valley, California, representing the Salinas Basin Water Alliance*.

- Currently serving on a Drought Technical Advisory Committee (TAC) charged with developing standards and guiding principles for determining release schedules and operations of Nacimiento and San Antonio reservoirs during multiyear droughts. The TAC is also charged with developing the release schedules during such droughts – *Monterey County Water Resources Agency, Salinas, California, representing Grower-Shipper Association of Central California.*
- Invited to participate in the Deep Aquifer Roundtable, a formal meeting attended by Salinas Valley hydrogeology experts to discuss approaches to monitoring and protecting the deepest portions of the Salinas Valley aquifer system – *Monterey County Water Resources Agency, Salinas, California*.
- Served on the Technical Advisory Committee for the development of the Salinas Valley Integrated Hydrologic Model, a new MODFLOW model constructed by Monterey County and the U.S. Geological Survey – *Monterey County Water Resources Agency, Salinas, California representing Grower-Shipper Association of Central California*.
- Well efficiency test results for multiple years and multiple wells were evaluated for a Salinas Valley grower and food processor. Quantitative and statistical analyses were used to assess well performance and make recommendations for potential well maintenance and repair activities – *Nunes Vegetables, Salinas, California*.
- The factors influencing nitrate concentrations in well-water from approximately 60 wells on 40 ranches were determined and an enhanced groundwater monitoring program was developed. Diverse and complex data sets were analyzed statistically and qualitatively to understand the geologic, hydrologic, and anthropogenic factors that variably influence well-water concentrations over short- and long-term timeframes. Specific recommendations for wellhead protection were also developed – *Costa Farms, Analysis of Observed Nitrate Concentration Trends in Irrigation Wells, Soledad, California*.
- Published reports and data from international and national seawater intrusion mitigation efforts were reviewed and analyzed. The analysis was to assess the feasibility, level of effort required, volumes of water necessary, and costs of implementation in the Salinas Valley of a seawater intrusion injection barrier using recycled water. Ongoing injection barrier projects in Orange County and L.A. County were selected for in-depth review to evaluate the feasibility of a similar project in Monterey County – *Tanimura & Antle, Salinas, California*.
- Publicly available groundwater quality data from a set of regularly sampled water-supply wells were evaluated statistically to develop an alternative to installation of new monitoring wells for a land application area that received wastewater from a food processing plant. The effort was driven by a Central Coast Regional Water Quality Control Board order requiring client to participate in the General Waste Discharge Requirements (WDRs) for Fruit and Vegetable

Processors, which has stricter monitoring requirements than the previous individual WDRs – *Dole Fresh Vegetables, Salinas, California*.

- Evaluated (with SEAWAT) the degree to which irrigation wells were drawing seawater inland and if groundwater withdrawals contributed to anoxic conditions in certain reaches of a river hydraulically connected to the aquifer – *El Sur Ranch, Seawater Intrusion and Impact of Irrigation Wells, Monterey County, California*.
- Monte Carlo hydraulic gradient analysis and stochastic 1D and 2D solute transport simulations (analytical solutions) were conducted based on regional groundwater maps and 13 years of monthly groundwater levels from dozens of production wells to determine the most likely MTBE source areas. A customized GIS framework was developed to evaluate source-area probability. Accepted by the Central Coast Regional Water Quality Control Board – *Monterey County Water Resources Agency, Salinas MTBE Investigation, Salinas, California.*
- Conducted a technical evaluation and provided detailed comments regarding the hydrologic analysis undertaken for the draft environmental impact report/environmental impact statement for the proposed Monterey Peninsula Water Supply Project (MPWSP) - *Third-Party Evaluation of Hydrologic Analysis Conducted for Monterey Peninsula Water Supply Project, City of Marina, California*.

Summary of Selected Recent Projects

- Designed and wrote custom computer programs to construct and test a facsimile of the USGS Central Valley Hydrologic Model (CVHM) that runs in Groundwater Vistas (GV), a graphical user interface. The computer programs generated input data for the facsimile model from CVHM MODFLOW packages that are not supported by GV. The facsimile model produces results that are nearly identical to CVHM – *Confidential Client*.
- Combined vadose-zone flow and transport modeling, groundwater flow modeling, and particle-tracking simulations to estimate the persistence of dissolved 1,2,3-trichloropropane in the subsurface. Multiple application areas were characterized using lithologic logs and water flux out of the root zone taken from C2VSimFG Beta. Custom computer programs were written to determine arrival time at a declining water table. MODFLOW and MODPATH were used to estimate travel time from the water table to receptor water-supply wells. Four regions in California (one in Central Valley, three in Southern California) were successfully analyzed with this methodology (settlements and jury awards). For the Central Valley region, the CVHM facsimile model (described above) was used – *Confidential Clients*.
- Co-wrote the Chapter Groundwater Sustainability Plan for the Westside Water Authority in Kern County. Extremely sparse data and modeling results from C2VSimFG-Kern were used to estimate current and future water budgets and groundwater availability – *Westside Water Authority*.

- Conducted environmental impact assessment simulations using the CVHM facsimile model described above to evaluate drawdown and subsidence caused by a proposed brackish groundwater water treatment project in Kern County – *Westside Water Authority*.
- Critically evaluated subsidence estimates along the Tule Subbasin portion of the Friant-Kern Canal (FKC) by reviewing historical USGS reports, InSAR data, geomechanical modeling, and the Tule Subbasin Groundwater Flow Model. This evaluation indicated that responsibility for FKC subsidence should be shared across the subbasin and not focused primarily on the Eastern Tule Groundwater Sustainability Agency – *Confidential Client*.
- Critically evaluated groundwater flow and solute transport models for three coal ash disposal sites in North Carolina. Primary questions included if the models simulated flow and transport properly and sufficiently to allow the sites' owner to claim no offsite groundwater quality impacts above water quality standards – *Southern Environmental Law Center*.
- Developed a new IWFM groundwater-surface water model, based on the Central-Valley-wide C2VSim model, for Stanislaus County to assess impacts in terms of foreseeable land-use changes and installation of new wells – *Stanislaus County, Regional Groundwater-Surface Water Model for PEIR, Modesto, California.*
- Assist Stanislaus County with evaluation of new major well permit applications based on a then-recently passed groundwater ordinance requiring evaluation under CEQA for potential pumping-induced impacts to the groundwater basin, such as lowered water levels in existing wells, land subsidence, and significant groundwater or surface water depletion – *Stanislaus County, Well Permit CEQA Analysis, Modesto, California*.

Summary of Other Selected Water Supply Projects

- Two local-scale groundwater flow (MODFLOW) and solute transport models (MT3DMS) were developed for two sub-regions of the USGS regional Antelope Valley MODFLOW model to evaluate the performance of a new groundwater bank. Updated geologic characterization was based on recent investigations by the USGS and sparse well logs. Groundwater bank performance was evaluated with respect to water quantity and quality for various operational strategies, including well placement and infiltration schedules – *Antelope Valley-East Kern Water Agency (AVEK), Groundwater Banking and Blending Study, Palmdale, California.*
- Developed and calibrated three-dimensional, groundwater flow (MODFLOW) and solute transport models (MT3DMS) to assess water sources for a new 20 MGD water treatment plant. A detailed geologic model was developed for this project to assess the extent of the deep target aquifer, evaluate the risk from a heavy industrial area, well locations, long-term performance, define the wellhead protection area, and optimize wellfield performance – *City of Longview, Design and Construction of a New Groundwater Source and Treatment Facility, Longview, Washington.*
- Pilot study to evaluate the feasibility of compressed air energy storage of renewable energy. Developed and implemented three-dimensional groundwater flow models (MODFLOW) to

evaluate the impact on nearby wells of compressed air injection into a depleted natural-gas reservoir – *Pacific Gas and Electric (subcontractor to Jacobson James and Associates), Compressed Air Energy Storage Pilot Project, San Joaquin County, California.*

- Developed hydrostratigraphic model of the Mesquite Lake groundwater subbasin as interpreted from existing well logs and USGS studies that had been performed to the west and north. The hydrostratigraphic model was used as input to a three-dimensional, transient groundwater flow model (MODFLOW) that assessed the volume of water available for a new municipal water treatment plant – *Twentynine Palms Water District, Groundwater Study for the Mesquite Lake Subbasin, Twentynine Palms, California.*
- Developed a calibrated two-dimensional, steady-state analytical groundwater flow model for the Rialto-Colton Basin. The calibrated model was used to delineate source areas for two impacted production wells for a CDPH 97-005 permit application – *West Valley Water District, Wellhead Treatment Project, Rialto, California.*
- Analyzed the results of aquifer tests of multiple water supply wells completed in a fractured-rock aquifer – *Lake Don Pedro Community Services District, California (subcontractor to SGI The Source Group)*.
- Analyzed the results of a complex aquifer-test dataset to determine aquifer properties and assess groundwater availability. Characterized groundwater quality and assessed regional impact of developing a new water supply – *Silver Oak Cellars (subcontractor to Taber Consultants), Aquifer Test Analysis and Groundwater Availability Study, Sonoma County, California.*
- A well and a spring were evaluated in terms of water quality, influence of surface water, source area, and zone of influence for a license application to operate a new private water supply – *Buster's on the Mountain (subcontractor to Taber Consultants), Hydrogeology Report for New Private Water Supply, Napa County, California*.
- Groundwater flow modeling, aquifer test results, and qualitative hydrogeological analyses were reviewed and critiqued for accuracy and completeness to assess the feasibility of a gravel mining operation adjacent to the upper reaches of a major river in Los Angeles and Ventura counties. The assessment formed the basis for communications with the State Water Resources Control Board regarding appropriative water rights. In the second phase of the project, a new MODFLOW model was developed to assess groundwater-surface water interactions – *Confidential Client (subcontractor to Todd Engineers), Groundwater Pumping Impacts on Streamflow, Los Angeles County, California.*
- Developed complex geologic model in the fold-thrust terrane of the Las Posas Basin in eastern Ventura County. The geologic model formed the foundation for preliminary wellfield design and estimation of available groundwater for desalter operations in a strictly managed aquifer – *Calleguas Municipal Water District, Somis Desalter Feasibility Study, Las Posas Basin, Ventura County, California*.

- Evaluated geologic, hydrologic, and hydrogeologic data to assess the suitability for establishing a groundwater banking operation. Provided recommendations on further field-based and modeling studies deemed necessary to address data and knowledge gaps – *Los Angeles Department of Water and Power, Evaluation of Proposed Water Storage/Transfer Potential in Fremont Valley Basin, Fremont Valley, California.*
- Evaluated the groundwater component of an existing water-budget model. Implemented changes to include the effects on water levels from climate and distant municipal pumping in deeper parts of the aquifer. The improvements facilitated the development and simulation of future "what-if" scenarios used to design an engineered wetland that used stormwater runoff and groundwater pumping to maintain lake levels – *San Francisco Public Utilities Commission, Lake Merced Water-Budget Model, San Francisco, California.*

Summary of Other Selected Water Quality Projects

- Developed three-dimensional, variably saturated flow and reactive transport models (MODFLOW-SURFACT) to assess the groundwater impact from arsenic and boron in recharged partially treated oilfield produced water. Transport through the unsaturated and saturated zones related to groundwater banking operations were simulated. Regulatory approval was granted by the Central Valley Regional Water Quality Control Board – *Cawelo Water District, Groundwater Banking Waste Discharge Requirements Support, Central Valley, California*.
- A calibrated transient three-dimensional model (MODFLOW and MT3DMS) of groundwater flow and solute transport was developed, calibrated, evaluated, to compare estimated timeframes to achieve RAOs for three alternatives. Site data were used to characterize the subsurface and estimate land application rates and water quality of applied water. Regulatory approval was granted by the Central Valley Regional Water Quality Control Board – *Hilmar Cheese Company, Groundwater Modeling for Cleanup and Abatement Order, Central Valley, California.*
- The results of two modeling efforts were reviewed to reassess contributions from responsible parties. A new metric, the Responsibility Factor (RF), was developed and applied to existing input data. The RFs were used to estimate relative contributions to the MEW Superfund site regional plume from several responsible parties – *Confidential Client (subcontractor to Montclair Environmental Management), Reassessment of Contributions to the MEW Superfund Site Regional Plume, Santa Clara County, California.*
- Mass flux calculations for TCE and PCE were conducted on behalf of a multi-PRP group. Calculations of mass flux through time were compared upgradient and downgradient of several sites within the Omega Superfund site regional plume to estimate the contribution from each individual site. These calculations were used as part of the basis for cost allocation among PRPs – *Confidential Client, Mass Flux Calculations for Cost Allocation, Omega Superfund Site, Santa Fe Springs, California.*
- A three-dimensional model (MODLFOW-SURFACT) of unsaturated zone and saturated zone flow and solute transport was developed and calibrated based on sparse discharge records

and well observations to assess the fate of a legacy of contaminated soil water being mobilized by increased discharge to the subsurface. The modeling was an integral part of a report of waste discharge and request for waste discharge requirements from the Central Valley Regional Water Quality Control Board – *California Dairies, Incorporated, Report of Waste Discharge, Central Valley, California.*

- A transient groundwater flow model (MODFLOW) was conceptualized, implemented, and calibrated for a major oil refinery. Linear programming was used to quantitatively minimize groundwater pumping and qualitatively optimize well placement for containment of subsurface LNAPL and BTEX-contaminated groundwater. Multiple capture zones of various sizes were analyzed for control of LNAPL hotspots and site-wide containment scenarios – *Sun Oil Company, Pumping-Rate Optimization and Capture Zone Analysis, Tulsa County, Oklahoma.*
- A groundwater flow and reactive solute transport model (MODFLOW and RT3D) was developed to evaluate remediation efforts at a chemical production facility. The efficacy of a permeable reactive barrier was evaluated by simulating sequential decay and transport of TCE and its daughter products. The model was post-verified in the field by analyzing the concentration histories of several observation wells – *Mohawk Laboratories, Analysis of Permeable Reactive Barrier, Sunnyvale, California.*
- Determined regional-scale risk to groundwater from potentially contaminating activities (PCA) in the Santa Clara Valley, Coyote, and Llagas subbasins, as part of a multifaceted effort. A regional-scale PCA-risk map was developed and combined with intrinsic aquifer sensitivity to generate a groundwater vulnerability map, which formed the basis of a web-based GIS tool for evaluating development projects and land-use changes – *Santa Clara Valley Water District, Groundwater Vulnerability Study, Santa Clara, California.*
- A Remedial Investigation (RI) Summary report was prepared under CERCLA guidelines, which included development of a conceptual model that incorporated regional and local hydrostratigraphy, source-area history, details of previous remedial investigations, and characterization of the basin-wide perchlorate and TCE groundwater contamination – *West Valley Water District, NCP Compliance Documents, Rialto, California.*
- The volume of LNAPLs beneath a refinery was estimated by modifying the analytical solutions for LNAPL recovery presented within API Publications 4682 and 4729, utilizing the van Genuchten relations for porous media. Results of the modeling work were used to design a LNAPL recovery system – *Sun Oil Company, LNAPL Spatial Distribution, Tulsa County, Oklahoma.*
- DNAPL Assessment Techniques, Klickitat County, WA. Developed internal White Paper describing techniques and thresholds for assessing DNAPL mobility at a fueling facility – *BNSF, Remediation Design Support, Park County, Montana*.
- Report of waste discharge and request for waste discharge requirements for land application of onsite waste and storm water. For submission to the Los Angeles Regional Water Quality Control Board – *Confidential Client, Report of Waste Discharge, Los Angeles County, California.*

- Developed and implemented groundwater flow and particle tracking models to evaluate well placement designs and optimize pumping rates for an in-situ groundwater recirculation and treatment zone. The recirculation zone was used to chemically treat groundwater contaminated with VOCs – *BNSF, Remediation Design Support, Park County, Montana.*
- Analyzed slug test data for multiple tests using several techniques to assess parameter uncertainty for a bedrock aquifer, for submission to Montana Department of Environmental Quality – *BNSF, Site Characterization for Remedial Investigation, Park County, Montana.*
- A 1D unsaturated zone flow and transport model was developed to assess the impact to groundwater of VOCs and metals present in the soil at the Facility. A future 100-year scenario was developed based on climate data from the past 100 years. Mass transport process of volatilization, linear sorption, and advection and dispersion were considered for this investigation – *SMTEK, Former Chemical Facility, Orange County, California.*

Summary of Other Selected Litigation Support Projects

- Implemented detailed regional, three-dimensional conceptual model for a 35-year period (MODFLOW and MT3DMS). Geologic data, crop-based time-variant DBCP application rates, pumping, recharge basins, and flow and transport in the unsaturated and saturated zones were used to evaluate whether label-recommended use of DBCP caused contamination in municipal wells and to establish likely source areas for high-concentration hot spots – *Sedgwick, Detert, Moran, and Arnold, Regional-Scale Pesticide Contamination Litigation Support, Fresno, California.*
- Designed and implemented three-dimensional models (LEACHM, MODFLOW, and MT3DMS) of unsaturated and saturated fluid flow and solute transport for periods of up to 150-years using soils and geologic data, rainfall records, pumping, and plant operational history to assess whether off-site groundwater contamination was caused by unanticipated releases of coal tar at numerous sites in the Midwest – *Jones, Day, Reavis, and Pogue, Former Manufactured-Gas Plant Sites, Litigation Support, Los Angeles, California.*
- The impact of different rainfall data disaggregation techniques on the results of fluid flow and solute transport simulations in the unsaturated zone was evaluated. Various disaggregation strategies were applied to simulations of contaminant fate at three former manufactured-gas plants – *Northern Indiana Public Service Company, Impact of Rainfall Data Disaggregation Techniques, Merrillville, Indiana.*
- Evaluated expert reports and thoroughly evaluated and verified a detailed water budget model. Assisted in preparation of expert report related to the application of the model – *Confidential Client, Water Budget Model Litigation Support, Pinal County, Arizona*.
- Evaluated expert reports and critiqued a detailed MODFLOW groundwater flow model for litigation of damages and fatalities from a landslide. Assisted in preparation of expert report – *Confidential Client, Landslide Initiation Litigation Support, British Columbia.*

Professional History

aquilogic, Inc., Principal Hydrogeologist, October 2020 to present.
aquilogic, Inc., Senior Hydrogeologist, February 2018 to October 2020.
Jacobson James & Associates, Inc., Principal Hydrogeologist, October 2015 to December 2017.
Independent Consultant, December 2012 to September 2015.
Kennedy/Jenks Consultants, Associate Hydrogeologist, March 2009 to November 2012.
Independent Consultant, July 2005 to February 2009.
San Francisco State University, Lecturer/Adjunct Professor, September 2003 to February 2009.
SGI The Source Group, Inc., Senior Hydrogeologist, August 2002 to June 2005.
Stanford University, Research Associate, September 2000 to July 2002
Independent Consultant/Graduate Student, October 1995 to July 2000.
U.S. Geological Survey/Graduate Student, Hydrologist, June 1992 to September 1995.

Research

- A new protocol and computer code were designed and implemented to simulate the development of redox zones in contaminated aquifers. Transport of dissolved constituents coupled to complex interactions between organic and inorganic compounds were simulated with consideration of reaction energetics, reaction-rate limitations, and advection and dispersion – *Stanford University/United States Geological Survey, Development and Fate of Redox Zones in Contaminated Aquifers, Falmouth, Massachusetts*.
- Interactions between surface water, soil-water, and groundwater were evaluated with a three-dimensional model of coupled saturated-unsaturated subsurface and surface fluid flow. Detailed rainfall data were incorporated into the model to determine the relative importance of different stormflow generation mechanisms – *Stanford University, Stormflow Generation, Chickasha, Oklahoma*.
- Conducted basin-scale modeling analysis of subsurface fluid flow in the Illinois Basin to evaluate the role of paleogroundwater flow versus fluid density in long-range, deep-basin petroleum migration – *United States Geological Survey, Basin-scale Analysis of Subsurface Fluid Flow, Illinois Basin*.
- Developed reactive solute transport models to evaluate zinc transport in a geochemically complex aquifer in Falmouth, MA. Coupled solute transport/geochemical modeling, laboratory experiments, and a two-site surface complexation model were used to represent the pH-dependent adsorption of dissolved zinc on aquifer sediments – *United States Geological Survey, Zinc Transport in a Geochemically Complex Aquifer, Falmouth, Massachusetts*.

Peer-Reviewed Publications

Abrams, R.H. and K. Loague. 2000. A compartmentalized solute transport model for redox zones in contaminated aquifers, 2, Field-scale simulations. Water Resources Research 36, 2015-2029.

Abrams, R.H. and K. Loague. 2000. A compartmentalized solute transport model for redox zones in contaminated aquifers, 1, Theory and development. Water Resources Research 36, 2001-2013.

Abrams, R.H., K. Loague, and D.B. Kent. 1998. Development and testing of a compartmentalized reaction network model for redox zones in contaminated aquifers. Water Resources Research 34, 1531-1541.

Abrams, R.H. and K. Loague. 2000. Legacies from three former manufactured-gas plants: Impacts on groundwater quality. Hydrogeology Journal 8, 594-607.

Kent, D.B., R.H. Abrams, J.A. Davis, J.A. Coston, and D.R. LeBlanc. 2000. Modeling the influence of variable pH on the transport of zinc in a contaminated aquifer using semi-empirical surface complexation models. Water Resources Research 36, 3411-3425.

Kent, D.B., R.H. Abrams, J.A. Davis, and J.A. Coston. 1999. Modeling the influence of adsorption on the fate and transport of metals in shallow ground water--Zinc contamination in the sewage plume on Cape Cod, MA. Morganwalp, D.W., and Buxton, H.T., eds., USGS WRI Report 99-4018C, 361-370.

Loague, K., R.H. Abrams, S.N. Davis, A. Nguyen, and I.T. Stewart. 1998. A case study simulation of DBCP groundwater contamination in Fresno County, California: 2. Transport in the saturated subsurface. Journal of Contaminant Hydrology 29, 137-163.

Loague, K., D. Lloyd, A. Nguyen, S.N. Davis, and R.H. Abrams. 1998. A case study simulation of DBCP groundwater contamination in Fresno County, California: 1. Leaching through the unsaturated subsurface. Journal of Contaminant Hydrology 29, 109-136.

Loague, K. and R.H. Abrams. 1999. DBCP contaminated groundwater in Fresno County: Hot Spots and nonpoint sources. Journal of Environmental Quality 28, 429-445.

Coston, J. A., R. H. Abrams, and D. B. Kent. 1998. Selected inorganic solutes, in water quality data and methods of analysis for samples collected near a plume of sewage-contaminated ground water, Ashumet Valley, Cape Cod, Massachusetts, 1993-1994. USGS WRI Report 97-4269.

Loague, K., C.S. Heppner, R.H. Abrams, A.E. Carr, J.E. VanderKwaak, and B.A. Ebel. 2005. Further testing of the Integrated Hydrology Model (InHM): Event-based simulations for a small rangeland catchment located near Chickasha, Oklahoma. Hydrological Processes 19, 1373–1398.

Loague, K. and R.H. Abrams. 2001. Stochastic-conceptual analysis of near-surface hydrologic response. Hydrological Processes 15, 2715-2728.

Loague, K., G.A. Gander, J.E. VanderKwaak, R.H. Abrams, and P.C. Kyriakidis. 2000. Technical Addendum for "Simulating hydrologic response for the R-5 catchment: A never-ending story". Floodplain Management 2, 57-64.

Loague, K., G.A. Gander, J.E. VanderKwaak, R.H. Abrams, and P.C. Kyriakidis. 2000. Simulating hydrologic response for the R-5 catchment: A never-ending story. Floodplain Management 1, 57-83.

Grose, T. L. T. and R. H. Abrams, 1992. Geologic map of the Grasshopper Valley 15' quadrangle, Lassen County, California. California Department of Conservation, Division of Mines & Geology Open-File Report 93-07.

Grose, T. L. T. and R. H. Abrams. 1991. Geologic map of the Karlo 15' quadrangle, Lassen County, California. California Department of Conservation, Division of Mines & Geology Open-File Report 91-23.

Attachment B

Attachment B

Statements in the Salinas Valley Basin Groundwater Sustainability Agency (SVBGSA) Groundwater Sustainability Plans (GSPs) establishing that the six Salinas Valley subbasins are interconnected.

- Upper Valley – Forebay boundary:
  - Page 4-10 of the draft Upper Valley GSP: "*There are no reported hydraulic barriers separating these subbasins and therefore the GSP needs to consider potential for groundwater flow between these adjacent subbasins*."
  - Page 4-10 of the draft Forebay GSP: "*There are no reported hydraulic barriers separating these subbasins*."
- Forebay – 180/400 boundary:
  - Page 4-10 of the draft Forebay GSP: "*There is no reported hydraulic barrier between the Forebay and the 180/400-Foot Aquifer Subbasin however the sediments are more stratified in the 180/400-Foot Aquifer Subbasin than in the Forebay Subbasi*n."
  - Page 4-9 of the 180/400 GSP: "*Previous studies of groundwater flow across this boundary indicate there is reasonable hydraulic connectivity with the Forebay Subbasin, although the principal aquifers change from relatively unconfined to confined near this boundary*."
- Forebay – Eastside boundary:
  - Page 4-10 of the draft Forebay GSP: "*The northwestern boundary with the adjacent 180/400-Foot and Eastside Aquifer Subbasins generally coincides with the southeastern limit of confining conditions in the 180/400-Foot Aquifer Subbasin, which is extrapolated to the Gabilan Range to define the boundary with the Eastside Aquifer Subbasin (DWR, 2004c)*."
  - Page 4-10 of the draft Eastside GSP: "*The southeastern boundary with the adjacent Forebay Subbasin is near the town of Gonzales (DWR, 2004). It is extended from the approximate southern limit of the regional clay layers that are the defining characteristic of the southern extent of the 180/400-Foot Aquifer Subbasin. There may be reasonable hydraulic connectivity with the Forebay Subbasin, although the principal aquifers change from relatively unconfined to confined near this boundary*."
    - The last sentence of this passage appears to be incorrect, as indicated on page 4-18 of the draft Eastside GSP: "*In addition to the fact that aquifer material cannot be correlated between boreholes, no evidence exists for a discrete confining layer in the Subbasin (Brown and Caldwell, 2015)*."
    - Further supporting evidence for hydraulic connection between the Eastside and Forebay is found on page 4-21 of the draft Eastside GSP: "*Subsurface recharge is primarily from inflow from the adjacent Forebay and 180/400-Foot Aquifer Subbasins to the south and west, respectively (DWR, 2004). This inflow is*

estimated to be 17,000 acre-feet (AF) on an annual basis. Total natural recharge is estimated to be 41,000 AF (DWR, 2004)."

- Eastside – 180/400 boundary:
  - Page 4-21 of the draft Eastside GSP: "*Subsurface recharge is primarily from inflow from the adjacent Forebay and 180/400-Foot Aquifer Subbasins to the south and west, respectively (DWR, 2004). This inflow is estimated to be 17,000 acre-feet (AF) on an annual basis. Total natural recharge is estimated to be 41,000 AF (DWR, 2004)*."
  - Also, on page 4-35 of the draft Eastside GSP: "*There is no recorded seawater intrusion in the Eastside Subbasin. Even though it is adjacent to the 180/400-Foot Aquifer Subbasin where seawater intrusion is occurring, the Subbasin, which is approximately 7 miles from the coastline, is not yet affected by seawater intrusion. However, there is a potential for seawater intrusion into the Subbasin*."
  - Page 4-10 of the draft Eastside GSP and page 4-9 of the 180/400 GSP: "*Previous studies of groundwater flow across this boundary indicate that there is restricted hydraulic connectivity between the subbasins*."
    - The references for the previous studies should be provided because this statement is an apparent contradiction with other statements in the draft Eastside GSP.
    - Furthermore, page ES-8 of Kennedy/Jenks (2004) states, "*We note that ground water flow direction is from the Pressure Subarea to the East Side Subarea east of the City of Salinas and along the transition zone (Agency 1997*)."
    - Additionally, page 8 of SVGWBHC (1995) states, "*Ground water can move between the East Side and Pressure Areas, and between the Forebay and Pressure Areas, the Forebay and East Side Areas, and the Upper Valley and Forebay Areas*."
    - The apparent uncertainty regarding the nature of the boundary between the Eastside and 180/400 should be listed as an identified data gap on page 4-35 of the draft Eastside GSP.
- Eastside – Langley boundary:
  - Page 4-10 of the draft Eastside GSP and page 4-10 of the draft Langley GSP: "*Although the Langley Subbasin is not on the valley floor, there are no reported hydraulic barriers separating these subbasins and therefore the GSP needs to consider potential for groundwater flow between these adjacent subbasins*."
- Langley – 180/400 boundary:
  - Page 4-10 of the draft Langely GSP: "*Although the Langley Subbasin is not on the valley floor, there are no reported hydraulic barriers separating these two subbasins; therefore, this GSP needs to consider potential for groundwater flow between these adjacent subbasins*."
  - Page 4-9 of the 180/400 GSP: "*Although the Langley Subbasin is not on the valley floor, there are no reported hydraulic barriers separating these two subbasins*."
- Monterey – 180/400 boundary:

- Page 9 of Chapter 4 of the draft Monterey GSP: "*The northeastern boundary with the 180/400-Foot Aquifer Subbasin is divided into two parts: the northern part coincides with a buried trace of the Reliz Fault (DWR, 2016); the southern part follows the contact between Aromas Sand / Paso Robles Formations (Qae/QT) and alluvium (Q). The Reliz Fault does not appear to be a barrier to groundwater flow between these subbasins (see Section 4.2.3)*."
- Page 4-9 of the 180/400 GSP: "*Although a groundwater divide is commonly found near the Subbasin boundary, there is potential for groundwater flow between these two subbasins*."
- It should be noted that for the simulations reported in Chapter 6 of the draft Monterey GSP, all reasonably possible boundary conditions, indicate groundwater flow from the Monterey to the 180/400.

Attachment C

aquilogic, Inc.
environment ● water ● strategy

245 Fischer Avenue, Suite D-2
Costa Mesa, CA 92626
Tel. +1.714.770.8040
Web: www.aquilogic.com

August 11, 2021

MEMORANDUM

To: Stephanie Hastings, Brownstein Hyatt Farber Schreck (BHFS)
Sent via email: SHastings@bhfs.com
From: Robert H. Abrams, PhD, PG, CHg, Principal Hydrogeologist, aquilogic, Inc.
Anthony Brown, CEO & Principal Hydrologist, aquilogic, Inc.

Subject: Assessment of Groundwater Flows between Subbasins of the Salinas Valley Groundwater Basin (SVGB)
Project No.: 018-09

Aquilogic, Inc. (**aquilogic**) is pleased to provide this memorandum on behalf of our mutual client, the Salinas Basin Water Alliance (SBWA), outlining the justification and necessity for conducting additional simulations with the Salinas Valley Integrated Hydrologic Model (SVIHM),[1] which is being used by the Salinas Valley Basin Groundwater Sustainability Agency (SVBGSA) for groundwater sustainability plan (GSP) development.

Aquilogic hypothesizes that pumping has captured significant portions of groundwater discharge that would otherwise migrate as underflow from the Upper Valley Subbasin to the Forebay Subbasin, from the Forebay Subbasin to the 180/400-Ft Aquifer Subbasin and East Side Subbasin, and potentially from the 180/400-Ft Aquifer Subbasin to the Monterey Subbasin and the Salinas River. Our primary concern is that the existing water budget analyses in at least three of the SVBGSA's draft GSPs may not provide a complete picture of the downgradient impacts caused by groundwater pumping.[2]

It should be noted that groundwater sustainability was a pertinent issue for water managers long before the advent of California's Sustainable Groundwater Management Act. There is

---

[1] The SVIHM is a provisional, unpublished model not currently available to the general public.
[2] Bredehoeft, J.D., Papadopulos, S.S., and Cooper, H.H. Jr. (1982). The water budget myth. *In* Scientific Basis of Water Resource Management, Studies in Geophysics, 51-57. Washington, D.C. National Academy Press;
Bredehoeft, J.D. (1997). Safe yield and the water budget myth. Ground Water, Vol. 35, No. 6, p. 929;
Bredehoeft, J.D. (2002). The water budget myth revisited: why hydrogeologists model. Ground Water, Vol. 40, No. 4, p. 340-345;
Bredehoeft, J.D. and Durbin, T. (2009). Groundwater development: the time to full capture problem. Ground Water, Vol. 47, No. 4, p. 506-514;
Bredehoeft, J.D. (2011). Monitoring regional groundwater extraction: the problem. Ground Water, Vol. 49, No. 6, p. 808-814.

ample support in the groundwater literature for considering multiple aspects of sustainability and undesirable results, including economic and social impacts and the contravention of water rights.[3]

ADDITIONAL SIMULATIONS

As stated in "SVIHM Frequently Asked Questions,"[4] one of the many questions that can be addressed by a model is: How much groundwater flows between subareas? Clearly, the SVIHM developers recognized the importance of this question and anticipated that it would be asked. On behalf of the SBWA, **aquilogic** requests that the SVBGSA utilize the SVIHM to conduct additional simulations that are specifically focused on the issue of inter-subbasin groundwater flows. The requested simulations will enable an improved understanding of the amount of Valley-wide groundwater discharge that is and has been captured by pumping, which may be needed to ensure the adequacy of the GSPs for each of the subbasins and important to their implementation.

Aquilogic recommends a type of "superposition" analysis, in which the results of two simulations are compared. In such an analysis, the two simulations are identical except for the process under examination, in this case groundwater pumping. Pumping would be selectively turned off in one simulation and left as currently configured in the SVIHM in the other simulation. A similar superposition analysis was done to assess pumping-induced streamflow depletion, as described in Chapter 5 of the GSPs for the Forebay Subbasin and the East Side Subbasin.

The inter-subbasin flows would then be compared, which would semi-quantitatively estimate the impact of pumping, within the limiting assumptions and uncertainties associated with the SVIHM. Ideally, the analysis should be conducted with the initial conditions of the no-pumping scenario representing a "full" SVGB. The analysis would provide an estimate of the impact of pumping on inter-subbasin groundwater flows.

Specifically, using the calibrated SVIHM historical model, **aquilogic** recommends the following outline for conducting simulations, the details of which would be worked out in consultation with the SVBGSA:

1. Develop reasonable initial conditions for the hydraulic head distribution for the no-pumping simulation. This entails turning off all pumping in the model domain while

[3] Todd, D.K. (1959). Groundwater Hydrology. Wiley, New York, 336 p.;
Domenico, P. (1972). Concepts and Models in Groundwater Hydrology. McGraw-Hill, New York, 405 p.;
Freeze, R.A. and Cherry, J.A. (1979). Groundwater. Prentice-Hall, 604 p.;
Alley, W.M., Reilly, T.E., and Franke, O.L. (1999). Sustainability of ground-water resources. U.S. Geological Survey Circular 1186, 79 p.

[4] https://www.co.monterey.ca.us/home/showdocument?id=31292

leaving all other inflows and outflows unchanged. Because the time for simulated water levels to recover may be longer than the SVIHM simulation period of 51 years (1967-2018), the simulation may have to be run multiple times before an average steady-state condition can be achieved. In this case, the hydraulic head distribution at the last time step of the previous simulation would be used as the initial condition of the subsequent simulation. This process would be repeated until the hydraulic head distribution at the last time step of a subsequent simulation is substantially identical to the last time step of the previous simulation. This would indicate that an average steady-state condition is being simulated. We assume here that the surface water inflows and reservoir releases for the 1967-2018 period would be sufficient to eventually "refill" the SVGB after several model runs.

2. When the average, no-pumping steady-state condition has been achieved with the modified SVIHM, simulated groundwater flow should occur from the East Side Subbasin to the 180/400-Ft Subbasin, and from the 180/400-Ft Subbasin to Monterey Bay, conditions that are now reversed.

3. From the final results of the no-pumping simulation, in which average steady-state conditions have been achieved, compute the inter-subbasin groundwater flows between each adjoining subbasin. Compare these flows with the inter-subbasin flows from the historical, unmodified SVIHM. The differences in inter-subbasin flows and induced recharge from the surface water system represent a semi-quantitative estimate of the impact of Valley-wide pumping.

4. Additional superposition analyses can be conducted to assess the impact of one subbasin's pumping on basin-wide groundwater levels and inter-subbasin groundwater flows, by turning on pumping in one subbasin at a time in the modified SVIHM (and leaving pumping turned off in all other subbasins) and comparing the results to the scenario with no pumping throughout the SVGB. The differences in inter-subbasin flows and groundwater levels represent a semi-quantitative estimate of the impact of one subbasin's pumping on the other subbasins.

EXHIBIT B

MONTGOMERY
& ASSOCIATES
Water Resource Consultants

www.elmontgomery.com
1232 Park Street, Office B
Paso Robles, CA 93446

February 26, 2019

Mr. Les Girard
Agency Counsel
Salinas Valley Basin Groundwater Sustainability Agency
168 W. Alisal Street, 3rd Floor
Salinas, CA 93901

SUBJECT: OPINIONS ON SURFACE WATER BENEFITS FROM SALINAS VALLEY GROUNDWATER SUSTAINABILITY

Dear Mr. Girard:

You have requested our opinion with respect to the benefit surface water users (including those that rely upon diversion of any alleged underflow of the Salinas River) would receive from a balanced or sustainable groundwater basin. This request is in connection with the proposal of the Salinas Valley Basin Groundwater Sustainability Agency's (SVBGSA) consideration of charging a regulatory fee, known as the Groundwater Sustainability Fee ("Fee"), within its jurisdiction (the Salinas Valley Groundwater Basin (Basin) with limited exceptions).

As you know, the firm I work for, Montgomery & Associates, has been retained by the SVBGSA to prepare a Groundwater Sustainability Plan for the 180/400 ft. aquifer sub-basin. In particular, I have been retained as the project manager for this job. My resume is enclosed. I am familiar with the hydrology and geology of the Basin, and the interaction between groundwater and surface water in the Basin.

It has long been acknowledged that the water resources of the Salinas Valley consist of an integrated surface water and groundwater system. Historically, groundwater was the main source of water supply in the Valley and the Salinas River was the primary source of recharge for the groundwater supply (see, for example, Department of Water Resource Bulletin 52B). This assessment of a single water, integrated water source was recently confirmed in the January 2019 Report of Referee by the State Water Resources Control Board, issued as part of a reference proceeding arising from litigation in the Basin. In particular, Page 12 of the report states, "The dependency on the Salinas River as a source of recharge for the Basin and the hydrologic connection between surface water and groundwater results in a direct relationship between pumping and river flows; therefore, demonstrating that groundwater and surface water within the Salinas Valley constitute a single source." This is consistent with, and corroborates my understanding of the Salinas Valley hydrology.

This acknowledged surface water/groundwater integration underpins the approach the SVBGSA is taking to achieving groundwater sustainability throughout the Valley; the

Salinas River is an integral part of groundwater management and managing groundwater cannot be divorced from the Salinas River's operations. Similarly, groundwater management plays an important role in maintaining Salinas River flows. Larger areas of low groundwater levels in the Salinas Valley will induce more leakage from the Salinas River – reducing Salinas River flows. Maintaining adequately high groundwater levels will help maintain Salinas River flows. These higher groundwater levels that help maintain Salinas River flows is one of the desired outcomes of our groundwater management and is a benefit to surface water users. Groundwater sustainability can lead to long-term reliability in surface water supplies.

In particular, one Sustainability Indicator that must be addressed under SGMA is depletion of surface water bodies. Without the Sustainable Groundwater Management Act (SGMA), there is limited or no check on the amount that groundwater pumping can deplete the Salinas River. Developing these GSPs provides an opportunity for groundwater to be managed in a way the benefits surface water users and provides surface water reliability.

Groundwater management may be the most effective and primary method for managing future surface water reliability in the Valley. The two dams operated by the Monterey County Water Resources Agency (MCWRA are not operated for surface water reliability. The MCWRA website states that the operational pools of the Nacimiento and San Antonio Dams are for "groundwater recharge, fish passage, and operation of the Salinas valley Water Project." The dams are not necessarily operated to maintain flows in the Salinas River.

Based on our review of the integrated groundwater and surface water system in the Salinas Valley we conclude that users of surface water, including underflow, would receive clear benefits from groundwater sustainability because:

- The Salinas River has historically been viewed as primarily a source of groundwater recharge, not as an independent source of supply;
- The two dams operated by MCWRA are not operated to provide reliable surface water supplies;
- Managing groundwater levels can reduce surface water depletions, providing more reliable surface water supplies;
- Addressing surface water depletion and the resulting surface water flows is a required component of the GSPs;

The Salinas River operations, Salinas River flows, and ability to use water from the River will be clearly influenced by the decisions made during GSP development and implementation. Balanced groundwater management that maintains consistent groundwater levels will provide surface water reliability for the Valley's surface water users.

Finally, it is important to note that, for purposes of charging the Fee, the Salinas River has not yet been determined to include a "subterranean stream flowing through known and

MONTGOMERY
& ASSOCIATES

definite channels," thus the surface water/groundwater integration in the Basin makes it difficult to differentiate between the two where they interface. Thus, differentiating a fee based on whether surface water or groundwater is being pumped along that interface would be an extremely difficult, if not impossible, task.

Derrik Williams

Sincerely,
Derrik Williams
E.L. MONTGOMERY & ASSOCIATES

Derrik Williams, P.G., C.Hg., Principal Hydrogeologist/Director of California Business Development

Office: PASO ROBLES

Years Experience

Total: 30

Education

M.S., Hydrology, University of Arizona (1987)

B.S., Geology, University of California at Davis (1982)

Key Areas of Expertise

Groundwater basin management

3D groundwater flow and transport models

Groundwater recharge

Conjunctive water management

Aquifer test analysis

Interagency negotiation and coordination

Independent technical review

Derrik has more than 30 years of experience in applied geology and hydrogeology and excels at assisting clients with integrating technical analyses and institutional challenges to manage their water resources. His project experience includes managing, reviewing, and assisting on water supply, groundwater recharge, wastewater disposal, and hazardous waste remediation projects. Derrik is accomplished in analytical hydrogeology, with extensive interpretation and application of groundwater flow and transport models. He is an expert in aquifer test design and analysis and is experienced in all aspects of groundwater management.

Representative Projects

Water Resource Planning | Groundwater Management

SGMA Implementation • California Department of Water Resources •
Assisted DWR develop best management practices (BMP) for implementing SGMA and assist with developing Groundwater Sustainability Plans (GSPs). Met with DWR regularly to formulate statewide SGMA policy and draft policy documents. Helped develop DWR's guidance document for sustainable management criteria which was scheduled for release September 2017. [SACRAMENTO COUNTY, CA]

Basin Boundary Modification • Santa Margarita Groundwater Basin Boundary Modification • Scotts Valley Water District
Managed one of the most complex basin boundary modifications for SGMA's implementation. The basin boundary modification included both technical and jurisdictional modifications to promote sustainable groundwater management. Reviewed and interpreted relevant SGMA regulations for the client and hosted meetings with DWR and SWRCB to review and obtain agreement to the modification approach. Developed the technical justification to establish a new groundwater basin that encompasses all or parts of two existing groundwater basins, along with areas previously not considered groundwater basins. Assisted the client with required stakeholder outreach and water agency notification, and developed responses to concerns raised by neighboring water agencies. Presented the modification approach and technical work at numerous Boards of Directors meetings in Santa Cruz County. Directed the development of a 3D flow model to project groundwater inflow and dewatering requirements for a proposed gold mine [SANTA CRUZ COUNTY ,CA]

SGMA Support • SGMA Hydrology Tech Support • Santa Cruz Mid-County Groundwater Agency
Provides senior guidance for technical and policy support to the Groundwater Sustainability Agency (GSA) for the Santa Cruz Mid-County Basin regarding SGMA. This included the GSA formation process and an approved basin boundary modification that combined parts of four basins into a single basin

Professional Registrations

Registered Professional Geologist #6044, CA

Certified Professional Hydrogeologist #35, CA

Additional Training

Awards and Distinctions

and excluding areas that do not impact groundwater management. Led efforts with the newly formed GSA to finalize a schedule and scope for GSP development. The initial activities include presentations at stakeholder workshops to ensure all stakeholders understand the basin conditions and the requirements of SGMA. [SANTA CRUZ COUNTY, CA]

Groundwater Sustainability Agency Assessment • Butte County GSA Formation • Butte County Department of Water and Resource Conservation
Provided technical assistance regarding GSA development to Butte County as a subconsultant to Kearns and West Inc. Assisted Butte County assess the potential interest and concerns of various agencies and groups regarding GSA formation under SGMA. Helped develop the outreach materials to ensure that relevant information was collected to guide Butte County's GSA development. [BUTTE COUNTY, CA]

Groundwater Management • Seaside Basin Groundwater Management • Seaside Basin Watermaster
Helped develop both a Basin Management Action Plan and Seawater Intrusion Response Plan (SIRP) for the Watermaster in Monterey County. The Basin Management Action Plan identified specific data needs, water sources, and groundwater management actions and recommended an implementation strategy to the Watermaster. The SIRP was a companion document that included exhaustive statistical and graphical analyses of groundwater quality data to identify potential seawater intrusion. [MONTEREY COUNTY, CA]

Groundwater Management for the Soquel-Aptos Basin • General Hydrology • Soquel Creek Water District
Updated the groundwater management plan, investigated conjunctive use alternatives, provided well master plan EIR support, designed and installed monitoring wells, seawater intrusion monitoring, assisted with municipal well rehabilitation and restoration, and assisted with negotiating with neighboring agencies. [SANTA CRUZ COUNTY, CA]

Hydrologic Modeling | Groundwater Management

Managed Groundwater Model Update • Groundwater Model • Kings River Conservation District
Managed the groundwater model update for the Kings River Conservation District. The model is based on the State of California's Integrated Water Flow Model (IWFM). Important aspects of this model update include a reinterpretation of agricultural water demands throughout the region, and an update of the geologic structure that underpins the model. In particular, the client requested that the updated model parameters more accurately reflect our understanding of the basin's geologic structure. [FRESNO COUNTY, CA]

Lead Modeler • Seaside Basin Groundwater Model • Seaside Basin Watermaster
Served as project manager and lead modeler for the recently completed regional Seaside Basin groundwater model. The model was developed for the Seaside Groundwater Basin Watermaster. The model accurately simulates 22 years of historical water levels across a 76 square mile area near Monterey, California. An extensive update of the basin hydrostratigraphy was needed during the development phase of the model. The model is designed to compare benefits

for various potential groundwater management actions planned to be carried out in the basin. [MONTEREY COUNTY, CA]

Technical Analysis • Regional Groundwater Model • United Water Conservation District

Provided technical oversight for an update of United Water Conservation District's regional groundwater model. The model was providing unrealistic results, and was unable to predict future conditions adequately. Identified simulated water balance problems that, when changed, improved model performance dramatically. Provided technical assistance to staff on using the model to evaluate water management alternatives by implementing various hydrologic scenarios in model runs. [VENTURA COUNTY, CA]

Groundwater Model Support • Groundwater Basin Water Supply Plan and Groundwater Model • Squaw Valley Public Service District (SVPSD)

Provided groundwater support to the SVPSD continuously since 2000, beginning with development of a basin-wide groundwater model that could be used for management and planning. As SVPSD's needs have changed, adapted the initial model to help address new concerns. Under Derrik's direction, the project team has studied groundwater management alternatives as the main option in a plan to increase the water supply. They have used the groundwater flow model to support the water supply analyses. The model has also been used to develop pumping strategies that maximize long-term basin yield, and to identify locations of new wells that the SVPSD may use to increase their water supply. [PLACER COUNTY, CA]

Basin Analysis • Basin Management Plan Analysis • Pajaro Valley Water Management Agency

Led analysis of groundwater management alternatives for Pajaro Valley Water Management Agency's (PVWMA) Basin Management Plan. Directed simulation of alternatives using the Pajaro Valley Hydrologic Model developed by the U.S. Geological Survey that incorporated the Farm Process program, which allows detailed and realistic simulations of agricultural pumping and water transfers. Evaluated and presented model results for the BMP's selected alternative that showed that the alternative will eliminate overdraft in the most productive aquifers and reduce seawater intrusion by more than 90% in those aquifers. [SANTA CRUZ COUNTY, CA]

Developed Numerical Groundwater Model • Groundwater Model • Los Osos Community Services District

Developed a water and nitrate balance of the basin, accounting for all known water recharge and nitrate sources. Incorporated the water and nitrate balance into a numerical groundwater model, used to predict future groundwater conditions. The model showed that the proposed sewer system significantly lowers nitrate levels in the shallow aquifer. Nitrate was shown to be migrating towards municipal wells, however, and will continue to impact these wells for decades into the future. [SAN LUIS OBISPO COUNTY, CA]

Impact Analysis • Groundwater Impact Analysis • San Benito County Water Agency | City of Hollister

Investigated groundwater impacts from changing wastewater quality in San Benito County. Helped develop, calibrate, and use a groundwater model of San Benito County to estimate groundwater impacts and changing salt loads near the wastewater treatment ponds and at anticipated reclaimed water application sites. The modeling was used to develop alternative strategies to manage both salt loading and high groundwater levels. [SAN BENITO COUNTY, CA]

Developed Transport Model • Charnock Initial Regional Response Activities (CIRRA) Modeling • Environ Corporation
Helped develop and use a basin-wide flow and transport model for the Charnock Sub-Basin in Los Angeles County. Served as a senior consultant for this project, helped develop and guide the modeling program, calibrated the groundwater model, and provided quality assurance and quality control on the modeling process. [LOS ANGELES, CA]

Developed Groundwater Model • Regional Groundwater Flow Model • Santa Clara Valley Water District
Developed a groundwater flow model of the Northern Santa Clara Valley under a joint contract between the City of San Jose and the Santa Clara Valley Water District. The model is presently used by the SCVWD for future water planning. [SANTA CLARA COUNTY, CA]

Model Analysis • San Francisco Western Basin Groundwater Model • San Francisco Department of Public Works
Provided an independent review of the San Francisco Western Basin groundwater model. Produced a plan for field testing and expanding the groundwater model to include the influence of groundwater pumping in Daly City, Colma, and Burlingame on Lake Merced water levels. [SAN FRANCISCO COUNTY, CA]

Water Supply and Recharge | Groundwater Resource Development

Well Siting Study • SCWA Groundwater Assessment • Sonoma County Water Agency
Completed a well siting study for Sonoma County Water Agency's Reliability Assessment. Integrated hydrogeologic analyses of potential well sites with information on geologic hazards and existing and proposed water transmission facilities to identify optimum well locations. [SONOMA COUNTY, CA]

Designed Irrigation Wells • Golden Gate Park Replacement Wells • City of San Francisco
Managed the Golden Gate Park Replacement well project as part of a joint venture. Worked with the Department of Public Works and the Public Utility Commission to site and design two new irrigation wells. The irrigation wells were designed to meet DPW's goal of an assured water supply, while allowing PUC to use the wells as emergency potable supply. [SAN FRANCISCO COUNTY, CA]

Quantification of Interflow • Creek/Aquifer Interaction Study • Squaw Valley Public Service District (SVPSD)
Directed a unique study to establish and quantify the interflow between Squaw Creek and the adjoining shallow aquifers. The study used temperature monitoring techniques that directly estimate the flow rates between the Creek and the shallow aquifers. This project was funded by a California Department of Water Resources AB303 Local Groundwater Assistance Grant. [PLACER COUNTY, CA]

Water Supply and Recharge | Recharge & Recovery

Developed ASR System • Coastal Water Project Aquifer Storage and Recovery (ASR) • ASR Systems
Assisted with development of the ASR component of the Coastal Water Project (CWP) along the Monterey Peninsula. Helped design an ASR system that will provide peak flows to supplement supplies from the planned Moss Landing desalination plant and developed a groundwater model of the target injection zone, based on initial injection test results. [MONTEREY COUNTY, CA]

Feasibility program management • ASR Feasibility Study Management • Squaw Valley Public Service District (SVPSD)
Provided oversight of the field program that included a surface geophysical survey and installation of a monitoring well with a Sonic continuous coring rig. Reviewed the feasibility report that concluded that a suitable water storage interval for ASR in Squaw Valley is not present. [PLACER COUNTY, CA]

Developed Cost Estimates • ASR Well Costs • Sonoma County Water Agency
Developed well cost estimates for the groundwater banking program as part of a water supply EIR. Costs were developed for both new and retrofitted ASR wells. [SONOMA COUNTY, CA]

Technical Analysis • Water Supply Improvement Program • East Bay Municipal District
Coordinated the project, and performed technical analysis for the Water Supply Improvement Program. Assisted with siting and pre-design of injection and recovery facilities and served as the daily contact for EBMUD and the concerned water districts in California's Central Valley. [ALAMEDA COUNTY, CA]

Feasibility Study Implementation • Salinas Valley Reclaimed Water Injection and Recovery Program • Monterey Regional Water Pollution Control Agency
Implemented a feasibility study for reclaimed water injection/recovery (ASR) in the Salinas Valley. Developed a program for seasonally storing tertiary treated reclaimed water in the salt-water intruded portion of the Salinas Valley Aquifer. Coordinated meetings between local water agencies, city governments, the Water Pollution Control Agency, and regulatory agencies. [MONTEREY COUNTY, CA]

Geologic Assessment • Groundwater Assessment • Bear Valley | Fugro West
Conducted a geologic and hydrogeologic investigation showing that the existing wells were extracting groundwater in the most effective areas in the valley. A water budget was developed as part of the hydrogeologic investigation to estimate the amount of groundwater that could potentially be extracted from the valley. Additional wells were determined to be too expensive for the potential benefit. [ALPINE COUNTY, CA]

Hydrologic Modeling | Brackish Groundwater Development

Developed Flow Model • Saline Groundwater Intake and Disposal System Modeling and Design • City of Sand City
Developed a two-phase flow model of feedwater extraction and brine injection beneath the beach in Sand City for a planned desalination plant. The groundwater model was used to develop a unique arrangement of feedwater

wells and horizontal brine disposal wells that reduced environmental impacts on the National Marine Sanctuary. **[MONTEREY COUNTY, CA]**

Developed Flow and Transport Model • Desalination Brine Disposal Modeling • Marina Coast Water District
Developed a coupled density-dependent flow and transport model to help estimate and visualize the impacts from injecting brine from a small desalination plant beneath the sea floor. The model results suggested that the example brine discharge system created a subsurface brine mound that rose to the sea-floor surface, and entered the ocean at effectively full brine concentration. To obtain all the potential advantages of sea-floor injection, the injection system needed to inject brine over a larger area, at a lower injection rate. **[MONTEREY COUNTY, CA]**

Hydrologic Modeling | Recharge and Recovery

Developed Vadose Zone Model • Vadose Zone Modeling of Recharge with Reclaimed Water • Monterey County Regional Water Pollution Control Agency
Development of a vadose zone model for predicting travel times of water to the water table below a proposed recharge basin. The recharge basin was designed to infiltrate surplus reclaimed water from a regional wastewater treatment plant into a drinking water aquifer. The HYDRUS-2D model tested a series of likely hydraulic conductivity distributions based on field data to estimate a range of travel times. Model results showed that the testing program proposed for the recharge ponds would not result in the anticipated groundwater mounding. **[MONTEREY COUNTY, CA]**

Transport Model Development • Salinas Valley Reclaimed Water Injection and Recovery Program Modeling • Monterey Regional Water Pollution Control Agency
Employed a series of groundwater flow and contaminant transport models to study the effects of injecting reclaimed water into salt-water intruded aquifers beneath Salinas Valley. Used a local, variable density, contaminant transport model and a three-dimensional flow and transport model to demonstrate the impact of the injected reclaimed water on nearby water supply wells. **[MONTEREY COUNTY, CA]**

Hydrologic Modeling | Hydrologic Impact Study

Model Development • Avila Beach EIR Groundwater Model • Fugro West
Developed a flow and transport model of contamination beneath Avila Beach, California, where historical hydrocarbon contamination from leaking distribution pipes threatened the Pacific Ocean and the estuary of San Luis Creek. The groundwater model encompassed the entire town of Avila Beach, including the Pacific Ocean and San Luis Creek. Successfully demonstrated that significant impacts would result from proposed remediation. **[SAN LUIS OBISPO COUNTY, CA]**

Hydrologic Modeling | Contaminant Assessment & Remediation

Model Development • Groundwater TCE Plume Model • Scottsdale, Arizona
Retained as a neutral third party modeler for a TCE contaminated site with multiple potentially responsible parties. The model was used in negotiations with the USEPA to develop and implement remedial alternatives that ensure a

safe source of drinking water for the City, while preventing further degradation of the aquifers. [MARICOPA COUNTY, AZ]

Publications & Presentations

Presentations

Developing Groundwater Elevation Proxies for Surface Water Depletion Rates
Williams, D., 2017, Groundwater Resources Association Tools for SGMA Workshop, Modesto, CA, May 3

Using Cross-Sectional models to Develop Proxy Measurable Thresholds for Seawater Intrusion
Culkin, S., Tana., C., Williams, D., 2017, Groundwater Resources Association Tools for SGMA Workshop, Modesto, CA, May 4

Measuring Recharge from Ephemeral Streams
Williams, D., 2016, American Groundwater Act/American Ground Water Trust Annual Conference, Ontario, CA, Feb 17-18

First Steps in Inter-Basin Coordination for SGMA: Basin Boundary Modification Requests in Santa Cruz County
Tana, C., Culkin, S., Byler, N., Williams, D., 2016, Groundwater Resources Association of California Annual Conference, Concord, CA, September 28-29

Using Cross-Sectional Models to Develop Measurable Objectives for Seawater Intrusion
Culkin, S., Tana, C., Williams, D., 2016, California Water Environmental Modeling Forum Annual Meeting, Folsom, CA, April 11-13

Using Regional Models to Develop GSA Scale Models
Williams, D., Hundt, S., Bedakar, V., 2016, Groundwater Resources Association Role of Models and Data in Implementing SGMA, Davis, CA, February 8-9

ACWA's Groundwater Data Guidelines and SGMA
Williams, D., 2015, Association of California Water Agencies Legislative Summit, Davis, CA, June 1

Groundwater Analyses and Groundwater Models in the Sustainable Groundwater Management Act
Williams, D., 2015, American Groundwater Act/American Ground Water Trust Annual Conference, Ontario, CA, February 9-10

Eliminating Stream Depletion by Combining Time-Series Thermal Data with Aquifer Test Results
Hundt, S., King, G., Williams, D., 2014, California/Nevada American Water Works Association Whole Water Conference, Monterey, CA, June 24-26

Olympic Valley Creek/Aquifer Interaction Study
Williams, D., 2014, California/Nevada American Water Works Association Spring Conference, Anaheim, CA, March 25-28

Evaluating Water Quality with Data from Dynamic Tracer and Sampling Techniques Used in Production Wells
Tana, C., Byler, N., Quereshi, H., van Brocklin, D., Williams, D., 2014, California/Nevada American Water Works Association Spring Conference, Anaheim, CA, March 26

Beyond the Pavement: Groundwater Recharge Benefits from Urbanization
Williams, D., 2011, National Ground Water Association Cities, Suburbs, and Growth Areas Conference, Los Angeles, CA, August 8-9

Developing Drought Curtailment Criteria for a Groundwater Basin on a Model of Deep Recharge
Tana, C., King, G., Duncan, R., Williams, D., 2011, National Ground Water Association Cities, Suburbs, and Growth Areas Conference, Los Angeles, CA, August 8-9

Sustainability from the Ground Up: Groundwater Management in California, A Framework
Blacet, D., Parker, T., Aladjem, D., Williams, D. (reviewer), 2011, Association of California Water Agencies, April 2011

Managing Saltwater Intrusion with Protective Groundwater Elevation Constraints
Tana, C., King, G., Johnson, R., Lear, J., Williams, D., 2011, Proceedings from the 4th International Perspectives on Water Resources and Environment, Singapore

California Statewide Groundwater Elevation Monitoring(CASGEM) Workshop
Williams, D. (member of presenting team), 2010, California Department of Water Resources in conjunction with Association of California Water Agencies

Using PEST to Efficiently Implement Conceptual Model Changes in a Regional Groundwater Model
Tana, C., Williams, D., 2009, The PEST Conference, Potomac, MD, November 2-4

Using Uncertainty Analysis to Manage Seawater Intrusion
Tana, C., van Brocklin, D., Williams, D., 2009, The PEST Conference, Potomac, MD, November 2-4

Managing Seawater Intrusion without Knowing the Seawater Interface Location
Williams, D., van Brocklin, D., Tana, C., 2008, International Ground Water Modeling Center, Golden, CO, May 18-21

Successful and Unsuccessful Applications of Inverse Methods on a Regional Groundwater Model
Tana, C., Williams, D., 2007, Geological Society of America Annual Meeting, Denver, CO

Developing Sustainable Water Supplies from a Small Coastal Aquifer with both Onshore and Offshore Environmental Constraints
Williams, D., Feeney, M., 2003, The Second International Conference on Salt Water Intrusion and Coastal Aquifers in Monitoring, Modeling, and Management, Merida, Yucatan, Mexico, March 30-April 2

The Significance of Groundwater Gradient Magnitude on Flow Paths in Simulations of Heterogeneous Aquifers
Oliver, D., Williams, D., 2002, Bridging the Gap Between Measurement and Modeling in Heterogeneous Media, International Groundwater Symposium, Berkeley, CA, March 25-28

Publications

Conceptual Modeling of a Well Developed Alluvial Basin, in Subsurface Fluid Flow (Ground Water and Vadose Zone) Modeling
Williams, D., Johnson, N.M., Fowler, A.C., 1996, American Society of Testing and Materials, Philadephia, PA

EXHIBIT C

WATER RESOURCES AGENCY

MEMORANDUM

Monterey County

DATE: March 4, 2019

TO: Gary Petersen, General Manager, SVBGSA
Leslie J. Girard, SVBGSA General Counsel

FROM: Howard Franklin, P.G.

SUBJECT: Opinion on Groundwater and Surface Water Interdependence in the Salinas Valley Groundwater Basin

As you know, I am currently employed as a Senior Hydrologist with the Monterey County Water Resources Agency ("Agency") and am a licensed professional geologist with the State of California. I have been employed by the Agency for over 23 years; a copy of my C.V. is enclosed. I also currently serve on the SVBGSA Advisory Committee, and am assisting in the development of the Salinas Valley Integrated Hydrologic Model (SVIHM) by the United States Geological Survey. The SVIHM will be utilized, in part, by the SVBGSA in preparing GSPs for the Salinas Valley Groundwater Basin ("Basin"). During my time with the Agency I have become familiar with the hydrology and hydrogeology of the Basin, and the relationship and interaction between groundwater and surface water in the Basin.

Regarding, the Salinas River within the Basin, the river does not meet the definition of a "subterranean stream, which is defined as groundwater that is flowing through known and definite channels." Although not a subterranean stream, the river is operated by the Agency with a specific objective of providing recharge to the Basin. Of an estimated 504,000 acre-feet per year of inflow to the Basin, approximately 50 percent occurs as stream recharge, most of which can be attributed to flows within the Salinas River channel. Surface water within the Salinas River channel is therefore a primary source of recharge to the Basin.

In much of the Basin, groundwater extraction and/or surface water diversions occurs from wells that are in direct communication with the shallow alluvial of the Salinas River channel. In these areas, it is difficult to differentiate between the extraction of groundwater and the diversion of surface waters. Additionally, as was experienced and monitored throughout the Basin during the most recent drought period, lowering of the groundwater table has a significant impact on the Agency's ability to operate the reservoirs to a controlled range of flows at the Salinas River Diversion Facility. As such, overdraft of the groundwater basin, resulting in a reduction in groundwater levels significantly impacted surface water flows, depleting the availability of surface water to riparian water users.

Groundwater and surface water users alike will benefit when projects designed to recharge the groundwater basin and provide water for fish passage, spawning and rearing, maintain groundwater levels. For this reason, within the Basin, groundwater and surface water can be regarded as an interdependent system.

Based on this interdependence, it is my opinion that both surface water and groundwater users in the Basin will benefit from projects operated to achieve a sustainable groundwater basin. It is also my opinion that the benefit received from a sustainable groundwater basin cannot easily be differentiated between the two user groups.

HOWARD B. FRANKLIN

Phone: (831) 755-4860 | 9442 Saddler Drive
franklinh@co.monterey.ca.us | Gilroy, CA 95020

EDUCATION

MS University of Nevada, Reno, Hydrology/Hydrogeology — August 1993
Thesis: "Applications of GIS Technology in Water Resource Investigations"
Advisor: John Warrick, PHD

BA Southern Illinois University, Carbondale, Biological Sciences — May 1981
Minor: Geology
Minor: Geography (Cartography)
Minor: Microbiology

PROFESSIONAL QUALIFICATIONS

Manage and supervise professional geologist and engineers, scientist, technicians, general labor and administrative staff. Participate in strategic planning and budget development; Scope projects and develop budgets; Perform large scale and site specific scientific investigations; Oversee the development and implementation of complex basin wide integrated surface water groundwater models; Develop write and implement grant funded projects; Effectively planned and built heli-portable camps under extreme artic conditions.

Education, training and work experience in hydrology, hydrogeology, geology, geophysics, environmental science and water resource management. Licensed Professional Geologist in California (No. 8456).

Coordinated and implemented innovative projects in diverse environments; major metropolitan, agricultural, delta, desert, mountain and artic regions.

WORK EXPERIENCE

Monterey County Water Resources Agency, Salinas, California — 1995 to present

- Hydrologist / Program Manager / Senior Water Resources Hydrologist

Reporting directly to the General Manager, plan, organize and manage the Hydrology section of the Monterey County Water Resources Agency; manage the most complex, innovative and large scale hydrogeologic investigations, projects and programs; prepare conceptual designs and investigations, manage detail design of project phases by other staff and engineers; conduct and guide subordinate supervisors in performance appraisals and employee counseling; select candidates for employment; prepare and manage program, project and section budgets; participate in the development of Agency wide budgets; represent the Agency at Board of Directors and County Board of Supervisor meetings; prepare grant applications; negotiate and administer contracts with vendors, agencies, and consultants; collaborate and coordinate with regulatory agencies; negotiate, prepare, review and administer agreements with other departments or public agencies; analyze proposed and current legislation and government policies, rules and regulations and develop strategic recommendations.

Parsons Engineering Science, Alameda, CA 1993 to 1995

- Hydrologist / Hydrogeologist

Performed hydrogeologic modeling, analysis, and report preparation of surface and ground water contamination sites. Developed geospatial database and performed analysis of major projects involving multiple sampling media. Utilized remote sensing technologies to locate and evaluate potential disposal sites on military instillations involving unexploded ordnance. Performed water resource evaluations, watershed characterizations, and geostatistical analysis projects.

Washoe County Department of Comprehensive Planning, Natural Resources Division, Reno, Nevada 1991 to 1993

- Graduate Intern

Developed, installed, and monitored a data collection network of rain gages, weirs, and weather stations for water resource evaluations. Performed streamflow measurements and snow pack surveys. Responsible for GIS data development and mapping.

Western Geophysical Company, International Division, Houston, Texas 1981 to 1991

- Exploration Manager

Managed the operation of geophysical exploration crews in extreme environments. Led projects in artic, coastal, delta, swamp, desert, mountain, agricultural, and urban regions. Supervised the coordination of air, aquatic, and terrestrial operations.

Global Marine Drilling, Inc, Homer, Louisiana Summers: 1978 and 1979

- Roustabout / Roughneck

Worked aboard the deep-sea exploration ship the Glomar Grand Isle performing duties in support of all drilling activities. Offshore Gulf Coast and South America.

PROFESSIONAL LICENSE

State of California Board for Professional Engineers, Land Surveyors, and Geologist
Licensed Professional Geologist (No. 8456) 2008 to Present

State of California, Cal/OSHA
Licensed Geophysical Blaster (Explosive purchase and use license) 1982 to 1985

PUBLICATIONS/REPORTS

- "Special Report: Recommendations to Address the Expansion of Seawater Intrusion in the Salinas Valley Groundwater Basin", October 2017
- Salinas Valley Water Project Annual Flow Report: Water Years 2010 - 2018
- Groundwater Elevation Contours: 1995,1997, 1999, 2001, 2003, 2005, 2007, 2009, 2011, 2013, 2015, 2017
- Seawater Intrusion Maps: 2011, 2013, 2015, 2017
- Groundwater Extraction Reports: 2011, 2012, 2013, 2014, 2015, 2016
- Quarterly Salinas Valley Water Conditions Reports: Water Years 2003 – 2018
- Water Resources Data Report: Water Years 1994 – 1997
- "Special Report: A GIS Analysis of the Effects of land Use Constraints and Water Delivery on Water Demands in North Monterey County", December 1996

PRESENTATIONS

- UCC Irrigation and Nutrient Meeting, February 2018: Presenter - "Update on Seawater Intrusion in the Salinas Valley"
- California Groundwater Resources Association Annual Conference, October 2013: Presenter - "Groundwater level Trends and the Implementation of Water Supply Projects in the Salinas Valley, CA"
- American Association of Petroleum Geologists, 1999 Pacific Section Convention: Oral and Poster Presentations – "Monterey County Water Resources Agency's use of GIS Technology in the Salinas Valley" and "The Benefits of Proper Data Capture and Management Practices at Monterey County Water Resources Agency"

PROFESSIONAL TRAINING

Unexploded Ordinance (UXO) – Remote Sensing Seminar
Colorado School of Mines, Golden, Colorado, September 1993

Workshop and seminar on location and management of UXO detection and risk utilizing remote sensing technologies.

Groundwater-Surface Water Interaction: California's Legal and Scientific Disconnect - Symposium
Groundwater Resources Association of California, June 2011
Groundwater and surface-water are connected in the physical system, but not in the legal system, and the regulatory framework places pseudo boundaries to define under the influence. A debate has been heating up over the past few years as to whether the legal and regulatory system need to be changed to reflect physical reality and to protect the environment from further damage, whether local management initiatives and practice can effectively address the challenges, or some sort of hybrid needs to be developed for parts of the state. Our esteemed speakers and panelists will debate the pros and cons of the current system, and discuss their vision for California's future groundwater policy.

Principals of Groundwater and Flow Transport Modeling – Short Course
Groundwater Resources Association of California, September 2001
Principles and practical aspects of groundwater modeling.

PROFESSIONAL AFFILIATIONS

- Groundwater Resources Association of California
- Monterey Bay Geological Society

TECHNICAL ADVISORY

Salinas Valley Groundwater Basin Investigation, Technical Advisory Committee, Monterey County Water Resources Agency, Salinas, California, 2010 to present.
Manage and coordinate participation of qualified professionals in support of the development of a Salinas Valley Integrated Hydrologic Model (SVIHM) built on the USGS Integrated Hydrologic Model, One-Water Hydrologic Flow Model (MODFLOW-OWHM) in cooperation with the U.S. Geological Survey.

Technical Advisory Committee: Seaside Watermaster, 2004 to present
Provide technical assistance and guidance to Seaside Adjudicated Basin Watermaster

Technical Advisory Committee: Pajaro Valley Water Management Agency, 2010 to 2014
Development of USGS Integrated Hydrologic Model, One-Water Hydrologic Flow Model (MODFLOW-OWHM) of the Pajaro Valley, Santa Cruz and Monterey Counties, California

Technical Advisory Committee (Computer Model Update Subcommittee): Paso Robles Groundwater Basin, San Luis Obispo County, California, 2008 – 2014

Provide technical assistance and guidance in support of the Paso Robles Groundwater Basin Investigation.

COMMUNITY SERVICE

City of Gilroy, California
2010 General Plan Update Committee, 2008 - 2010

South Santa Clara County Planning Advisory Committer
City of Gilroy Representative, Santa Clare County, California, 2009 - 2012

LANGUAGES

English: Native Language

COMPUTER SKILLS

Programming: Python (limited) JavaScript (limited)

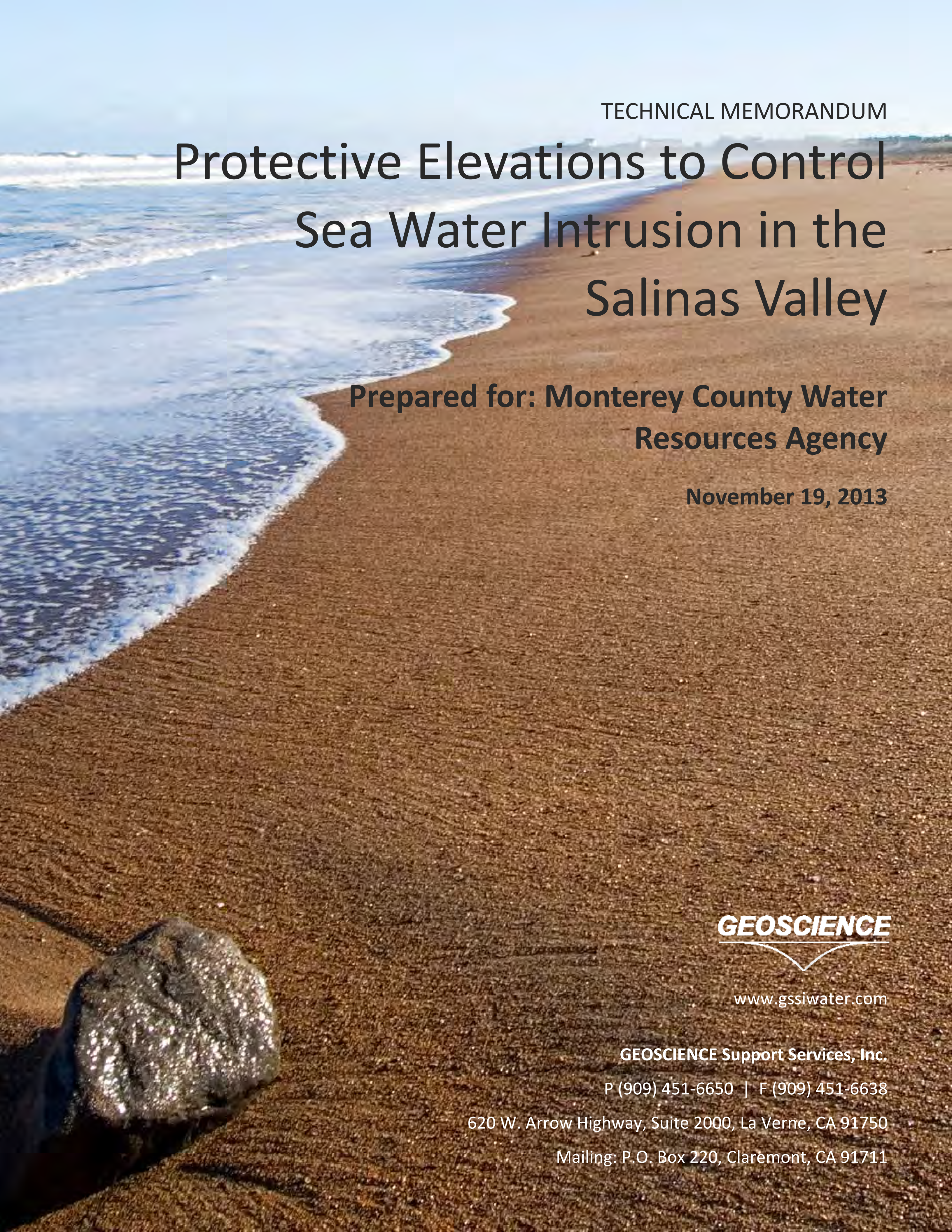
Applications: GIS, MS Office Suite (Proficiency in Word, Excel, PowerPoint, Access)

Platforms: MS Windows, iOS, Unix/Linux, Cloud, Social Media

OTHER

- LinkedIn: https://www.linkedin.com/pub/howard-b-franklin/b/3a6/b12
- PADI and NAUI Scuba Certified

EXHIBIT D



TECHNICAL MEMORANDUM

Protective Elevations to Control Sea Water Intrusion in the Salinas Valley

Prepared for: Monterey County Water Resources Agency

November 19, 2013

GEOSCIENCE

www.gssiwater.com

GEOSCIENCE Support Services, Inc.

P (909) 451-6650 | F (909) 451-6638

620 W. Arrow Highway, Suite 2000, La Verne, CA 91750

Mailing: P.O. Box 220, Claremont, CA 91711

PROTECTIVE ELEVATIONS TO CONTROL SEA WATER INTRUSION IN THE SALINAS VALLEY, CA

FIGURES

TABLES

APPENDIX

PROTECTIVE ELEVATIONS TO CONTROL SEA WATER INTRUSION IN THE SALINAS VALLEY, CA

1.0 BACKGROUND

This technical memorandum was prepared in support of preventing revocation of Permit 11043 (State of California Division of Water Rights Permit for Diversion and Use of Water - Amended Permit 11043 dated 11-Jul-49). Permit 11043 allows for appropriation of water from the Salinas River in Monterey County California, the quantity of which shall not exceed 400 cfs with an annual maximum diversion amount not to exceed 168,538 acre-ft/yr. Beneficial uses of the diverted water would add to and complement existing projects or implement new projects such as:

- Increase Ground Water Levels in the Pressure Area to Control Sea Water Intrusion
- Provide Additional Recharge to the Forebay And East Side Areas
- Provide More Water to the Salinas Valley Water Project
- Expansion of CSIP Deliveries
- Reduce Pumping in Pressure Area (in Lieu Recharge)

This report addresses one of the potential beneficial uses, that is, using the diverted water to help increase ground water levels in the Pressure and East Side Subareas to control seawater intrusion. The high quality diverted water would also result in improvement of ground water quality by blending with native ground water.

2.0 DESCRIPTION OF AQUIFER SYSTEMS

Water-bearing materials in the northern portion of the Salinas Valley, from oldest to youngest, consist of the Pliocene Marine Purisima Formation, Plio-Pleistocene Paso Robles Formation, Pleistocene Aromas Red Sands and the Holocene Valley Fill materials (Greene, 1970). In the Salinas Valley, according to Hanson et al. (2002), the upper portion of the aquifer system is present in the Holocene river and dune deposits, Valley Fill, Pleistocene Aromas Sands and the Paso Robles Formation. These water-bearing deposits consist of sand and gravel units which form aquifers in the upper 1,000 ft bgs[1] . Between 1,000 ft and 2,000 ft, the Pliocene Purisima Formation contains permeable sedimentary deposits which form a deeper aquifer system.

Aquifers in the Salinas Valley Ground Water Basin have been named for the average depth at which they occur. Beneath the center of the Salinas Valley within nine miles of the coast, the “180-Foot Aquifer” lies at an approximate depth of 50 to 250 ft, and has a thickness of 50 to 150 ft (Greene, 1970). The 180-Foot aquifer may correlate in part with the older valley-fill and upper Aromas Sands (Kennedy/Jenks Consultants, 2004; DWR, 1973; and Greene, 1970) and underlies a confining layer known as the Salinas Valley Aquitard (DWR, 2003; Hanson et al., 2002). The Salinas Valley Aquitard varies in thickness from 25 ft to more than 100 ft near Nashua Road, five miles west of Salinas (DWR, 1973; Montgomery Watson, 1994). Zones of discontinuous aquifers and aquitards approximately 10 to 200 ft thick underlie the 180-Foot aquifer (DWR, 1973). The “400-Foot Aquifer” lies at an approximate depth between 200 to 400 ft bgs, has a thickness of 230 to 350 ft, and may correlate with the lower Aromas Red Sands or Paso Robles Formation (Hanson et al., 2002; Greene, 1970). A deeper aquifer, also referred to as the “900-Foot Aquifer,” is separated from the overlying 400-Foot aquifer by a blue marine clay aquitard (DWR, 2003) and may be correlated with the Paso Robles Formations (Hanson et al., 2002). Figure 1 and Figure 2 depict the 180-Foot and 400-Foot aquifers. The 900-Foot aquifer is not shown on Figure 1 or Figure 2.

Existing published reports contain geohydrologic cross-sections of varying detail and applicability – such as those available in Greene (1970), DWR (1973), Harding ESE (2001), Hanson et al. (2002), and Kennedy/Jenks (2004). Cross-sections prepared by Kennedy/Jenks (2004) were used to help evaluate the extent of the base of the 180-Foot and 400-Foot aquifers and are discussed in a subsequent section of this memorandum (also see Appendix A).

[1] Below ground surface

3.0 PRESSURE AND EAST SIDE HYDROLOGIC SUBAREAS

Hydrologic subareas of the Salinas Valley have been delineated based on sources of ground water - recharge as well as stratigraphy. Historically, recharge to the Northern Salinas Valley comes primarily from two hydrologic subareas: underflow from the southern Forebay Subarea and underflow from the northeast East Side Subarea. The East Side Subarea is bounded by the Pressure Subarea on the west and Forebay Subarea on the south.

The East Side Subarea is recharged by streams draining the Gabilan Range to the northeast and from direct precipitation during wet years. The 180-Foot and 400-Foot aquifer zones in the Pressure Subarea are not found in the East Side Subarea. However, the East Side Shallow and Deep Aquifers can be time-stratigraphically correlated to equivalent zones in the Pressure Subarea (i.e. 180-Foot and 400-Foot aquifers). Therefore, the Pressure and East Side are in fact, hydrologically connected.

At one time (before excessive pumping), the East Side Subarea was one of the natural sources of recharge to the adjacent Pressure Subarea with ground water flowing from the northeast to the southwest. However, historical ground water level declines have resulted in a reversal of the gradient. That is, ground water now flows from the Pressure Subarea to the East Side Subarea (i.e. from the southwest to the northeast—see Figures 3 and 4).

4.0 HISTORICAL INTRUSION OF SEA WATER IN THE 180-FOOT AND 400-FOOT AQUIFERS

In general, ground water flows from areas of recharge to areas of discharge and the Salinas Valley is no exception. In the main Salinas Valley, ground water flows in a northwesterly direction from the inland recharge areas (Forebay Subarea) to the coast. Ground water also historically flowed from the East Side Subarea southwesterly into the Pressure Subarea. This natural flow of fresh ground water (towards the ocean) controlled inland migration of salt water into coastal aquifers. However, historical pumping has lowered ground water levels in both the 180-Foot and 400-Foot aquifer systems such that there is a landward hydraulic gradient which has caused extensive sea water intrusion (see Figures 3 and 4). It is believed that the primary mechanism of seawater intrusion is through the submarine outcrops of the 180-Foot and 400-Foot aquifers offshore of Monterey Bay. These outcrops are in direct hydraulic continuity with the Pressure Zone 180-Foot and 400-Foot aquifers. Graphical plots published by Monterey County Water Resources Agency (MCWRA, 2012) delineating historical extent of seawater intrusion, are shown on Figures 5 and 6 for the 180-Foot and 400-Foot aquifers respectfully. An analysis of these figures shows that the rate of seawater intrusion has progressively slowed due to implementation of the Salinas Valley Water Project and the Monterey County Recycling Projects. However, intrusion continues (albeit at a slower rate), migrating inland and salinating fresh-water aquifer systems. The following table summarizes the rate of seawater intrusion in the northern Salinas Valley as measured from the MCWRA plots (Figures 5 and 6).

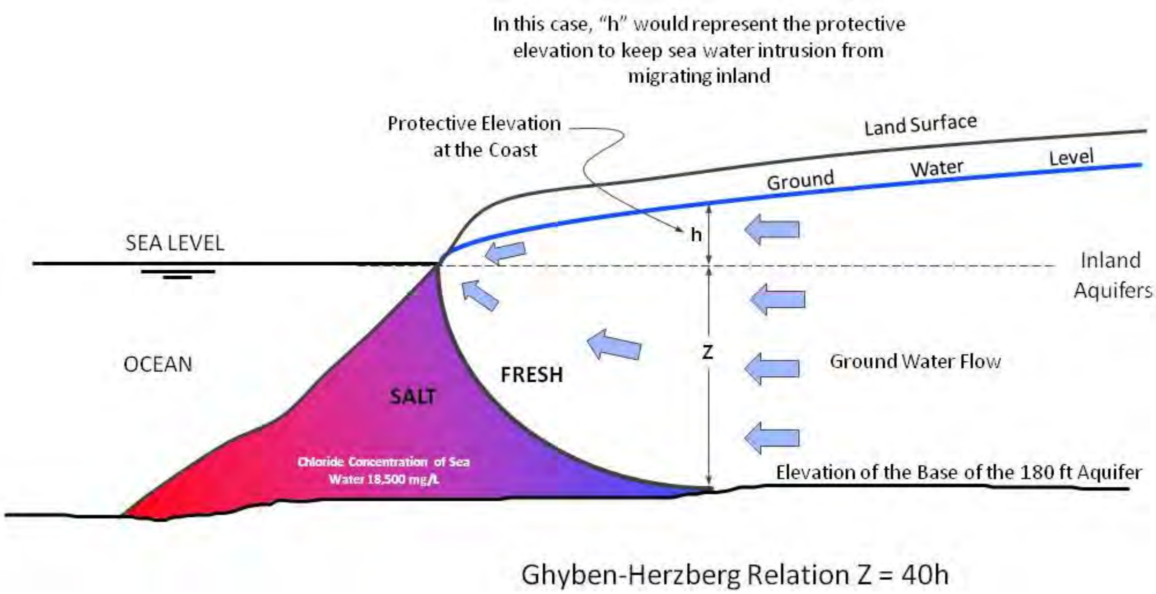
Table 1
Historical Rate of Sea Water Intrusion in the 180 and 400-Foot Aquifers, ft/yr

Time Interval	Aquifer	
	180-Foot	400-Foot
1944-1965	557	-
1959-1975	-	391
1965-1975	659	-
1975-1985	665	545
1985-1993	930	406
1993-1997	1028	1185
1997-1999	4086	1829
1999-2001	1418	1243
2001-2005	722	572
2005-2007	760	303
2007-2009	430	183
2009-2011	600	134

5.0 CONTROL OF SEA WATER INTRUSION – PROTECTIVE ELEVATIONS

Well over 100 years ago, two independent investigators Ghyben and Herzberg determined that salt water in aquifers was found at a depth below sea level of approximately 40 times the height of the fresh water above sea level (Todd, 1980). This distribution was due to the hydrostatic equilibrium between the densities of fresh water and seawater. The equation which explains this phenomenon is referred to as the Ghyben-Herzberg relation and assumes under hydrostatic conditions that the weight of a unit column of fresh water, extending from the ground water level to a point on the fresh/salt water interface, is balanced by a unit column of salt water extending from sea level to the same point on the interface. The figure below illustrates this principle.

Schematic Showing Protective Elevations and the Ghyben-Herzberg Relation



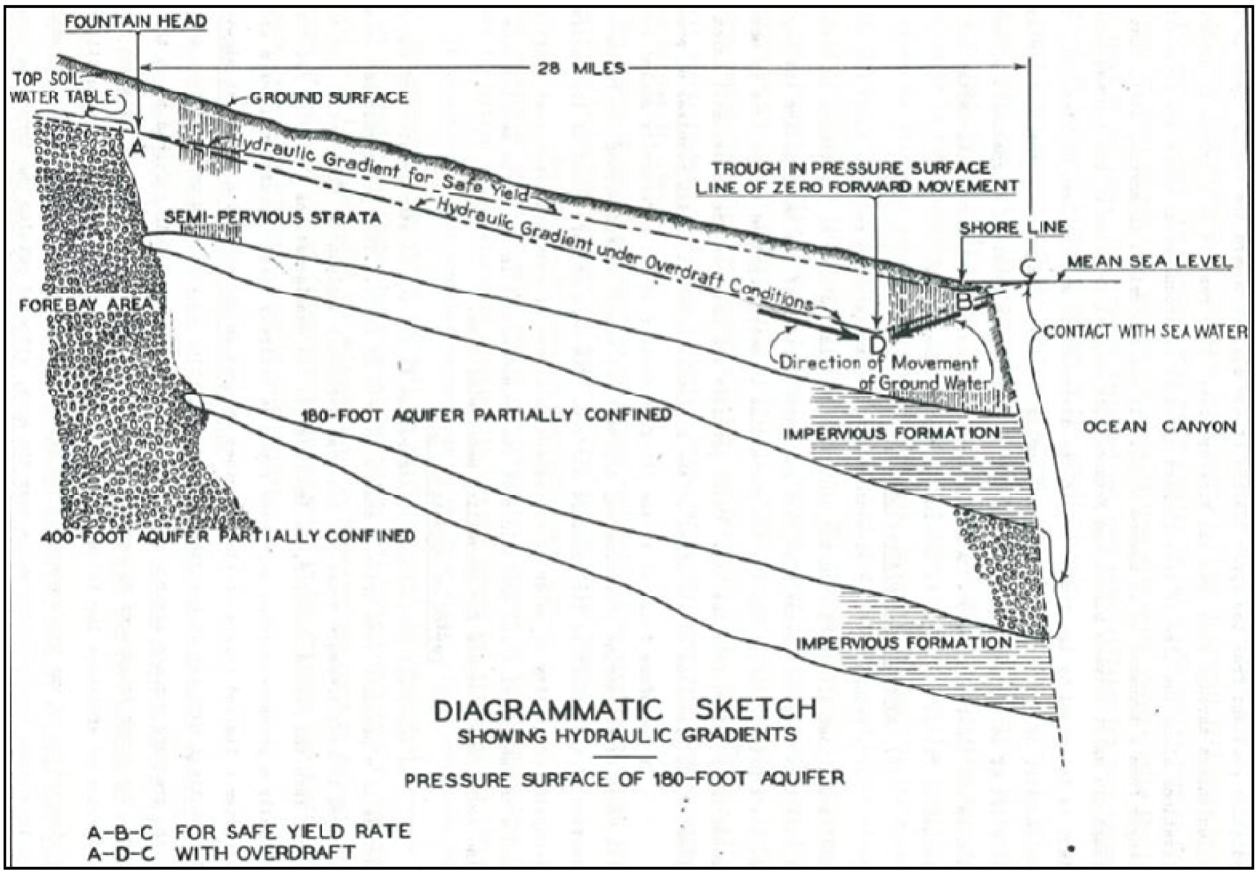
Protective elevations are defined as those ground water elevations which will keep the fresh/salt water interface from migrating inland. In the northern portion of Salinas Valley these elevations need to be above sea level and the flow of ground water towards the coast.

Ground water recharge (direct and in lieu), could be used to replenish storage and maintain a seaward hydraulic gradient. Additional recharge in the Forebay area would result in additional recharge to the northern pressure zone as underflow. Artificial recharge in the East Side Subarea would reduce subsurface inflow from the Pressure Subarea and eventually restore the historical northeast to southwest recharge. Both northwest underflow from the Forebay Subarea as well as southwest recharge from the East Side Subarea would help control seawater intrusion.

6.0 PROTECTIVE ELEVATIONS FOR THE 180-FOOT AND 400-FOOT AQUIFERS

One of the initial steps in the planning process for control of seawater intrusion is to quantify the protective elevations. As discussed above, in a simple hydrostatic case, protective elevations are defined as those ground water elevations (above sea level) which, due to density differences between fresh ground water and seawater, create a balance or equilibrium condition of the fresh water-salt water interface.

Schematic Showing Water Level Needed to Prevent Sea Water Intrusion (DWR, 1946)



The above sketch is from Plate 10 in DWR (1946) and shows the concept of establishing a seaward hydraulic gradient to prevent seawater intrusion. Near the coast it may be assumed that the chloride concentration is that of pure seawater (18,500 mg/L)[2] and the Ghyben-Herzberg 40:1 relation applies.

[2] http://shorestation.ucsd.edu/active/index_active.html

The extent of seawater intrusion varies in different aquifers due to a multitude of factors including aquifer depth, tidal influence, variation in hydrology and other water balance components. However, for planning purposes, the protective elevations as calculated in this technical memorandum are considered realistic for control of seawater intrusion. Protective elevations were calculated near the coast and merged with historical (1938) elevations obtained from Plates 8 and 9 (DWR, 1946).

Specifically, protective elevations for the 180-Foot and 400-Foot aquifers were calculated as follows:

1. The elevation of base of the 180-Foot and 400-Foot aquifers were obtained from recent geologic cross-sections and other publications (Figures 7, 8 and Appendix A).
2. The Ghyben-Herzberg relation of 40:1 was used to calculate the protective elevations at the Coast for each aquifer (see Figures 1 and 2).
3. Using the protective elevations at the coast and historical ground water flow directions as obtained from DWR Bulletin 52 (1946), the protective elevations were created assuming a seaward hydraulic gradient of 0.0002 (1 ft/mile) for both the 180-Foot and 400-Foot aquifers. This seaward hydraulic gradient is somewhat less than the historical gradient but as long as the coastal protective elevations are maintained by seaward flow, seawater intrusion can be controlled.

Figures 9 and 10 show the protective elevations and direction of ground water flow in the Northern Salinas Valley.

7.0 HISTORICAL DEPLETION OF STORAGE IN A PORTION OF THE 180-FOOT AND 400-FOOT AQUIFERS

The ground water storage depletion between the protective elevations (Figures 9 and 10) and current ground water elevations (Figures 3 and 4) was made for a portion of the 180-Foot and 400-Foot aquifers between the town of Salinas and the Coast. Historical ground water storage depletion was estimated by multiplying the historical change in hydraulic head by the area and aquifer storativity. For example, for the 180-Foot aquifer, the current ground water elevations (Figure 3) were subtracted from the protective elevations (Figure 9). This difference was then multiplied by the 180-Foot aquifer area and the storativity. Similarly, for the 400 Foot aquifer, the depletion in storage was calculated by subtracting current water levels (Figure 4) from protective elevations (Figure 10) and multiplying by the area and the 400-Foot aquifer storativity. Incremental areas and storativity values for each aquifer were obtained from the SVIGSM[3] model cells.

Keep in mind that since these aquifers are confined and semi-confined, the change in ground water storage is relatively small and is due to the compression of the aquifer and expansion of the water. This volume is several orders of magnitude lower than the water which would drain by gravity (from aquifer pore space) in an unconfined state. Table 2 summarizes historical change in ground water storage.

Table 2
Historical Depletion of Storage in a Portion of the 180-Foot and 400-Foot Aquifers Between the Town of Salinas and the Coast

Aquifer	Area Between the Coast and Salinas, acres	Average Decline of Water Level ft	Aquifer Storativity	Volume of Storage Depleted acre-ft
180-Foot	84,000	33	0.004	11,100
400-Foot	84,000	51	0.00009	400
			TOTAL	11,500

[3] Salinas Valley Integrated Ground Water-Surface Water Model

8.0 FLOW NEEDED TO MAINTAIN A SEAWARD HYDRAULIC GRADIENT

Table 2 (above) shows that a relatively small amount of water is necessary to replenish confined and semi-confined aquifer storage. More important in controlling seawater intrusion however, is the re-establishment of the coastal protective elevations and seaward hydraulic gradients. It is estimated that between 1970 and 1992 approximately 16,000 acre-ft/yr of intrusion occurred in the 180-Foot and 400-Foot aquifers (Montgomery Watson, 1994).

The amount, location and timing of ground water recharge (direct and in lieu), needed to maintain protective elevations and a seaward hydraulic gradient was determined using the SVIGSM. Based on model results, and assuming 2030 land use conditions, 12,000 acre-ft/yr will be required from the SVWP Phase I facilities and 48,000 acre-ft/yr will be required from the SVWP Phase II facilities. Given the hydrologic variability in the Salinas Valley area, in order to supply a total of 60,000 acre-ft/yr (on average), to the SVWP, it will be necessary to have the right to divert up to 135,000 acre-ft/yr from the Salinas River.

9.0 REFERENCES

California Department of Public Works, Water Resources Division (DWR), 1946. Salinas Basin Investigation, Bulletin 52.

California Department of Water Resources (DWR), 1973. Lower Salinas Valley Seawater Intrusion Investigation.

______, 1977. North Monterey Water Resources Investigation. Prepared pursuant to cooperative agreement between Department of Water Resources and Monterey County Flood Control and Water Conservation District. March 23, 1977.

______, 2003. California's Groundwater - Bulletin 118, Update 2003. October, 1, 2003.

Greene, Gary H., 1970. Geology of Southern Monterey Bay and its Relationship to Ground Water Basin and Sea Water Intrusion. U.S. Geologic Survey Open-File Report.

Hanson, R.T., R. Everett, M. Newhouse, S. Crawford, M.I. Pimental, and G. Smith, 2002. Geohydrology of a Deep-Aquifer Monitoring-Well Site at Marina, Monterey County, California. U.S.G.S. Water-Resources Investigations Report 02-4003. Prepared in cooperation with Monterey County Water Resources Agency.

Harding ESE, 2001. Hydrogeologic Investigation of the Salinas Valley Basin in the Vicinity of Fort Ord and Marina Salinas Valley, California. Prepared for Monterey County Water Resources Agency. April 28, 2001.

Johnson, M., 1983. Ground Water in North Monterey County, California, 1980. U.S.G.S. Water-Resources Investigations Report 83-4023. Prepared in cooperation with the Monterey County Flood Control and Water Conservation District. July 1983.

Kennedy/Jenks Consultants, 2004. Hydrostratigraphic Analysis of the Northern Salinas Valley.

Monterey County Water Resources Agency (MCWRA), 2012. Historic Seawater Intrusion Maps – 500 mg/L Chloride Areas. August 6, 2012. http://www.mcwra.co.monterey.ca.us/SVWP/01swi180.pdf; http://www.mcwra.co.monterey.ca.us/SVWP/01swi400.pdf Accessed 22-Jan-13

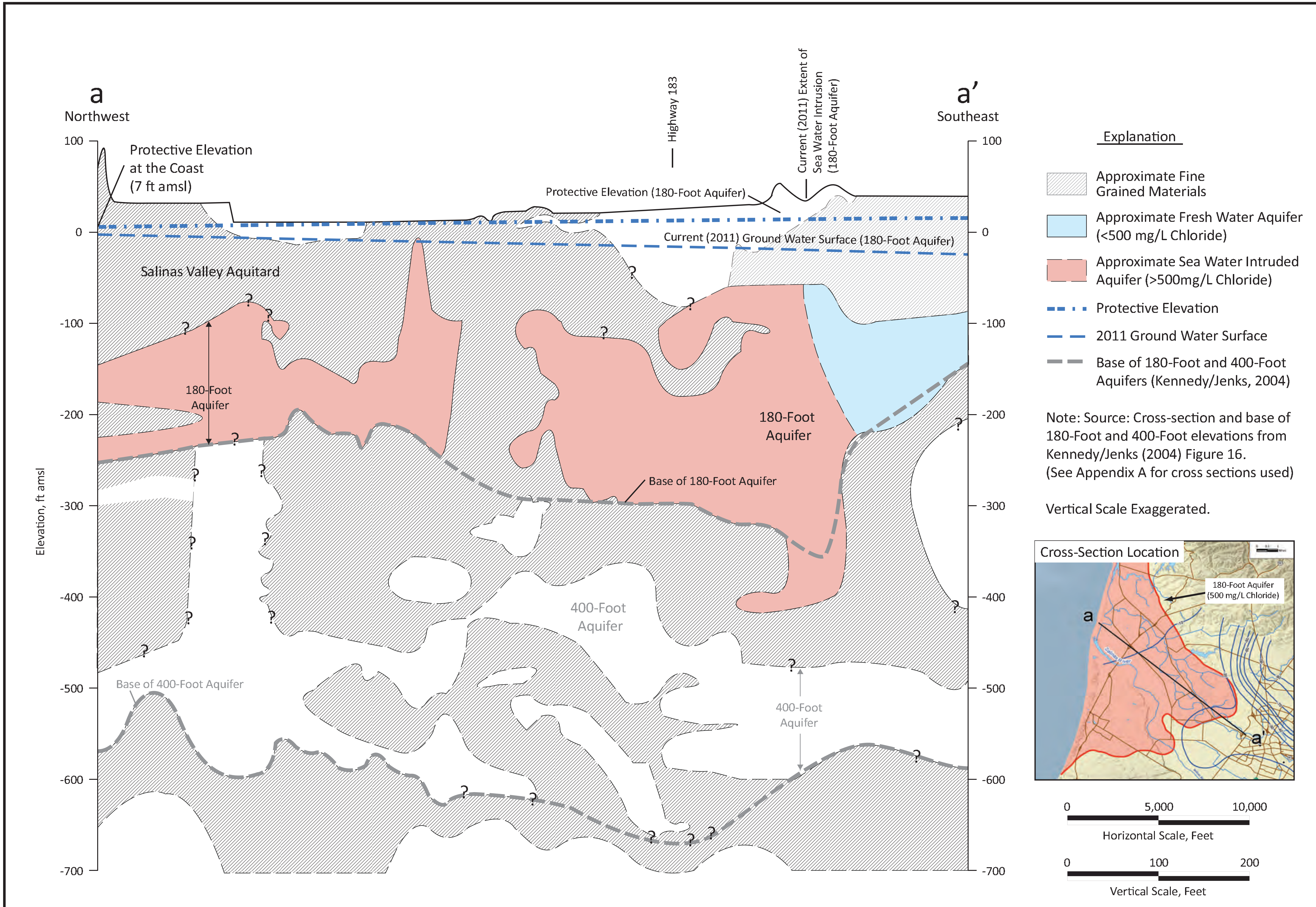
Montgomery Watson, 1994. Salinas River Basin Water Resources Management Plan Task 1.09 Salinas Valley Ground Water Flow and Quality Model Report. Prepared for Monterey County Water Resources Agency. February 1994.

Timothy J. Durbin, Inc., 2007. Groundwater Flow and Transport Model Seaside Groundwater Basin Monterey County, California. Prepared for RBF Consulting. October 26, 2007.

Todd, David K., 1980. Groundwater Hydrology, Second Edition. New York: John Wiley & Sons, 1980.

Yates, E.B., M.B. Feeney, and L.I. Rosenberg, 2005. Seaside Groundwater Basin: Update on Water Resource Conditions. Prepared for Monterey Peninsula Water Management District. April 14, 2005.

FIGURES



GEOSCIENCE

GEOSCIENCE Support Services, Incorporated
P.O. Box 220, Claremont, CA 91711
Tel: (909) 451-6650 Fax: (909) 451-6638
www.gssiwater.com

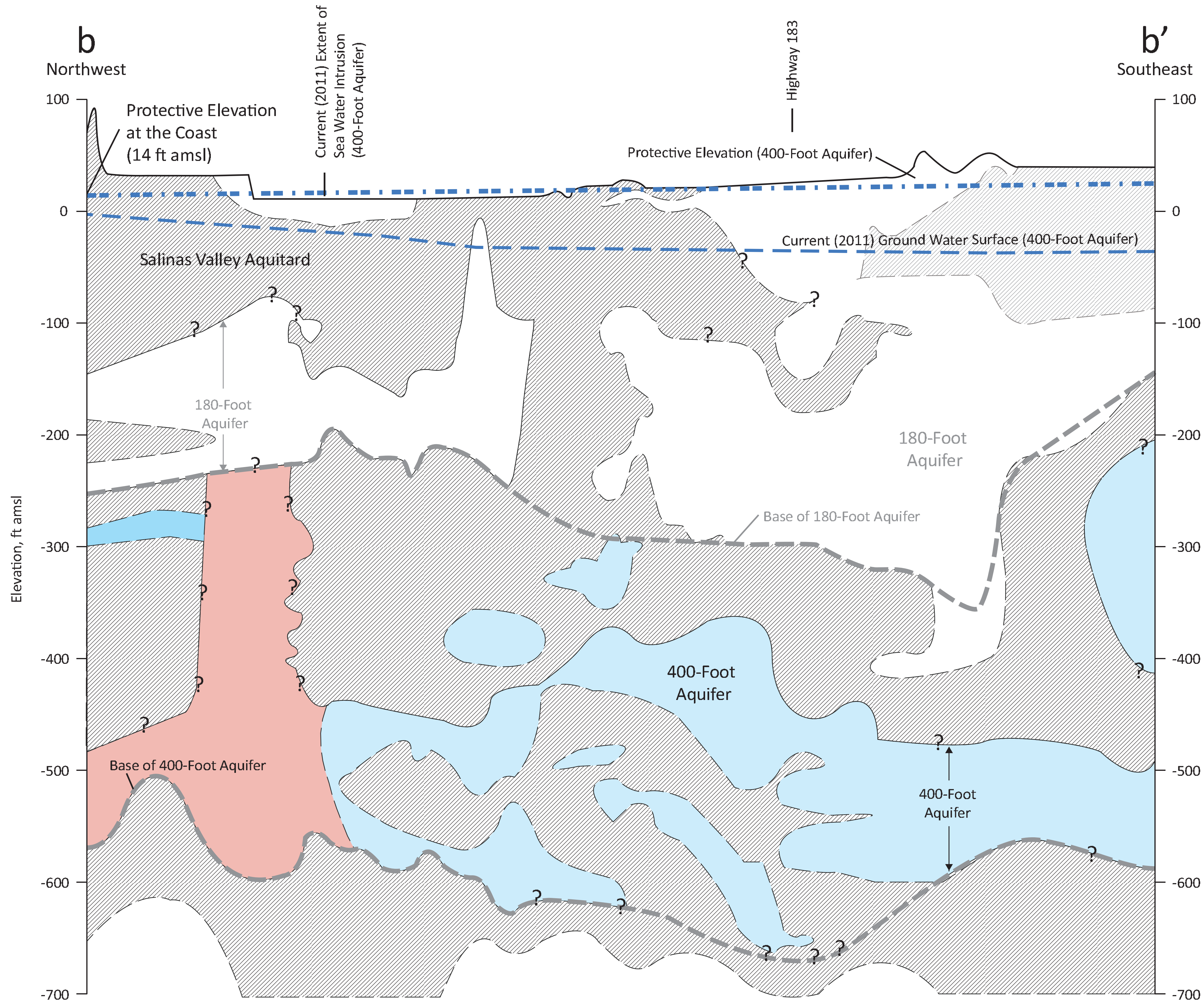
MONTEREY COUNTY WATER RESOURCES AGENCY

PROTECTIVE ELEVATIONS
180-FOOT AQUIFER

Drawn: LB
Checked: JK
Approved:
Date: 19-Nov-13

Figure 1

Projects\Downey-Brand\01) Salinas_Valley_Permit 11043\01) TM_Sea_Water_Intrusion\03) Revisions 19-Nov-13\01) TM figures\Fig_1_xsec_a-a_180_PE_11-13.ai



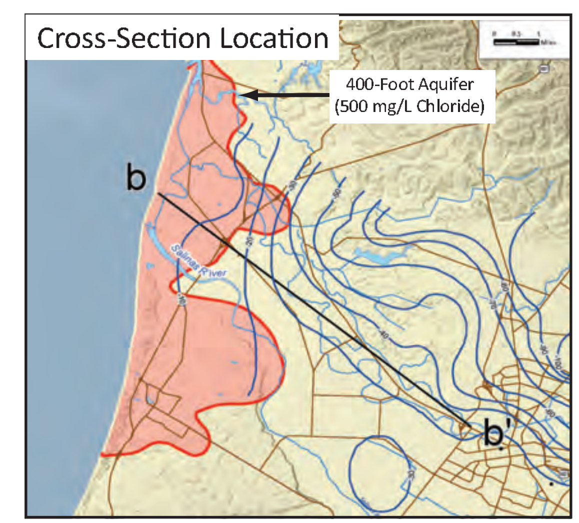
Explanation

- Approximate Fine Grained Materials
- Approximate Fresh Water Aquifer (<500 mg/L Chloride)
- Approximate Sea Water Intruded Aquifer (>500mg/L Chloride)
- Protective Elevation
- 2011 Ground Water Surface
- Base of 180-Foot and 400-Foot Aquifers (Kennedy/Jenks, 2004)

Note: Source: Cross-section and base of 180-Foot and 400-Foot elevations from Kennedy/Jenks (2004) Figure 16. (See Appendix A for cross sections used)

Vertical Scale Exaggerated.

Cross-Section Location



0 5,000 10,000
Horizontal Scale, Feet

0 100 200
Vertical Scale, Feet

GEOSCIENCE
GEOSCIENCE Support Services, Incorporated
P.O. Box 220, Claremont, CA 91711
Tel: (909) 451-6650 Fax: (909) 451-6638
www.gssiwater.com

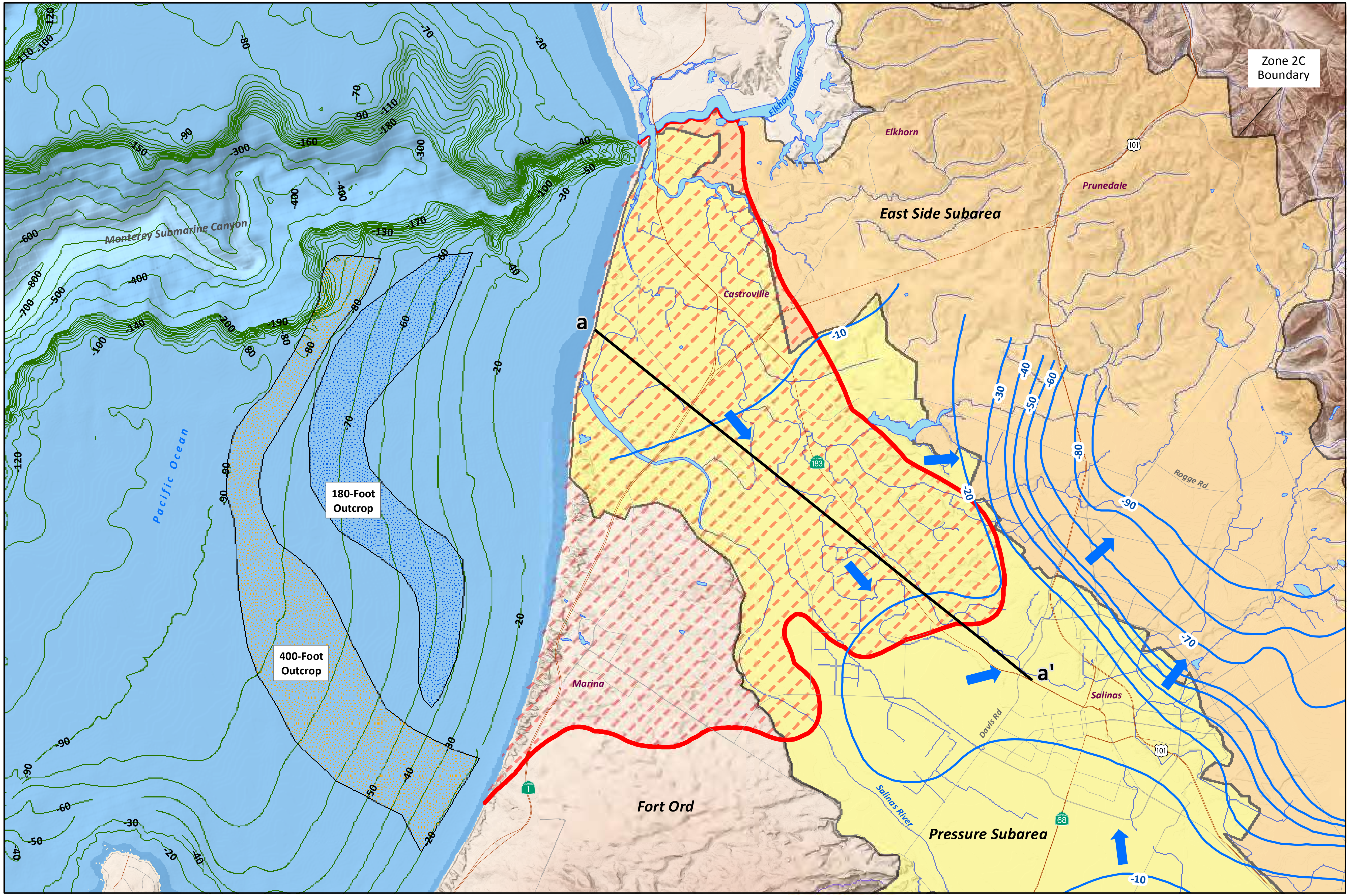
MONTEREY COUNTY WATER RESOURCES AGENCY

PROTECTIVE ELEVATIONS
400-FOOT AQUIFER

Drawn: LB
Checked: JK
Approved:
Date: 19-Nov-13

Figure 2

CURRENT GROUND WATER ELEVATIONS 180-FOOT AQUIFER



EXPLANATION

-50 Ground Water Elevation, ft amsl in the 180-Foot Aquifer August 2011 (MCWRA, 2012)

Ground Water Flow

a — a' Geohydrologic Cross-Section (See Figure 1)

Current Extent (2011) of Sea Water Intrusion in the 180-Foot Aquifer (>500 mg/L Chloride) (MCWRA, 2012)

Offshore Aquifer Outcrop (Green, 1970; DWR, 1973)

180-Foot Aquifer

400-Foot Aquifer

-10 Elevation of Sea Floor, meters (Wong, F.L. and Eittreim, S.L., 2001)

NORTH

0 2 4 Miles

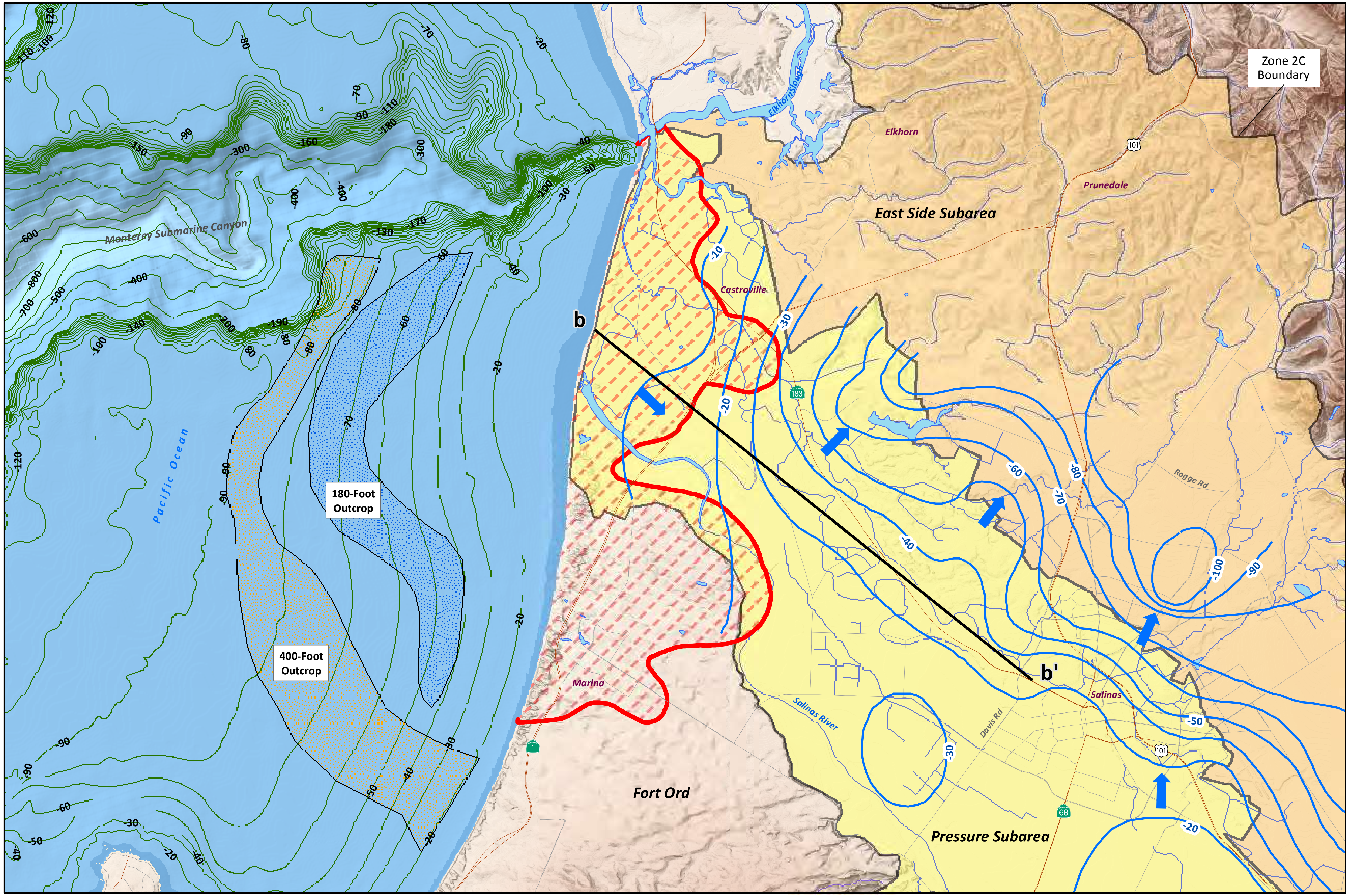
19-Nov-13

Prepared by: DWB. Map Projection: State Plane 1983, Zone IV.

GEOSCIENCE
GEOSCIENCE Support Services, Inc.
P.O. Box 220, Claremont, CA 91711
Tel: (909) 451-6650 Fax: (909) 451-6638
www.gssiwater.com

Figure 3

CURRENT GROUND WATER ELEVATIONS 400-FOOT AQUIFER



EXPLANATION

-50 Ground Water Elevation, ft amsl in the 180-Foot Aquifer August 2011 (MCWRA, 2012)

Ground Water Flow

b —— b' Geohydrologic Cross-Section (See Figure 1)

Current Extent (2011) of Sea Water Intrusion in the 180-Foot Aquifer (>500 mg/L Chloride) (MCWRA, 2012)

Offshore Aquifer Outcrop (Green, 1970; DWR, 1973)

180-Foot Aquifer

400-Foot Aquifer

-10 Elevation of Sea Floor, meters (Wong, F.L. and Eittreim, S.L., 2001)

19-Nov-13

Prepared by: DWB. Map Projection: State Plane 1983, Zone IV.

NORTH

0 2 4 Miles

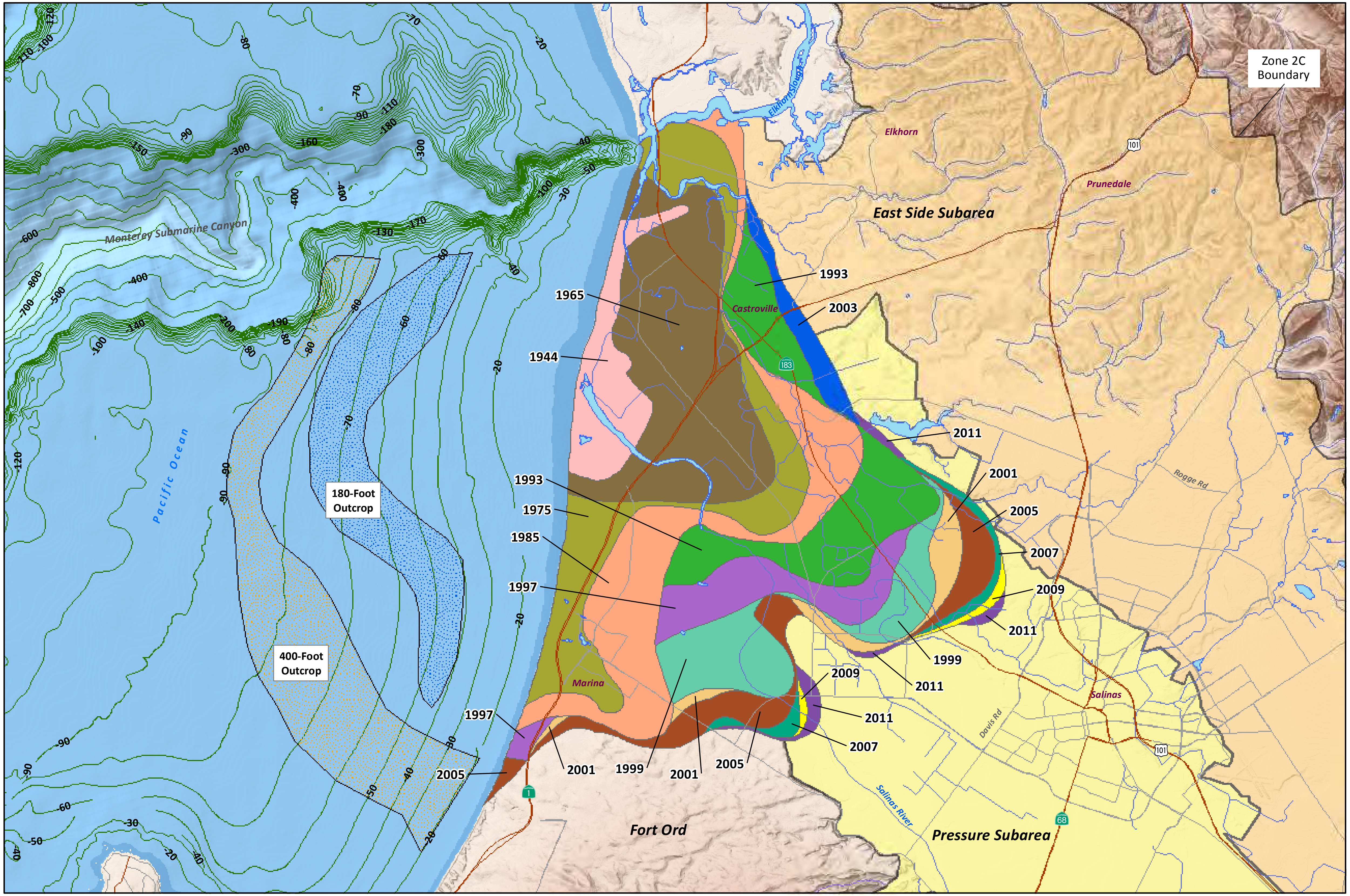
GEOSCIENCE

GEOSCIENCE Support Services, Inc.
P.O. Box 220, Claremont, CA 91711
Tel: (909) 451-6650 Fax: (909) 451-6638
www.gssiwater.com

Figure 4

GIS_proj/downey_brand_mont_water_rights_1-13/5_Fig_4_2011_GWE_400ft_11-13.mxd

HISTORICAL SEA WATER INTRUSION 180-FOOT AQUIFER



EXPLANATION

Historical Sea Water Intrusion (>500 mg/L Chloride) (MCRWA, 2012)

1944	2001
1965	2003
1975	2005
1985	2007
1993	2009
1997	2011
1999	

Offshore Aquifer Outcrop (Green, 1970; DWR, 1973)

180-Foot Aquifer

400-Foot Aquifer

-10 Elevation of Sea Floor, meters (Wong, F.L. and Eittreim, S.L., 2001)

19-Nov-13

Prepared by: DWB. Map Projection: State Plane 1983, Zone IV.

NORTH

0 2 4 Miles

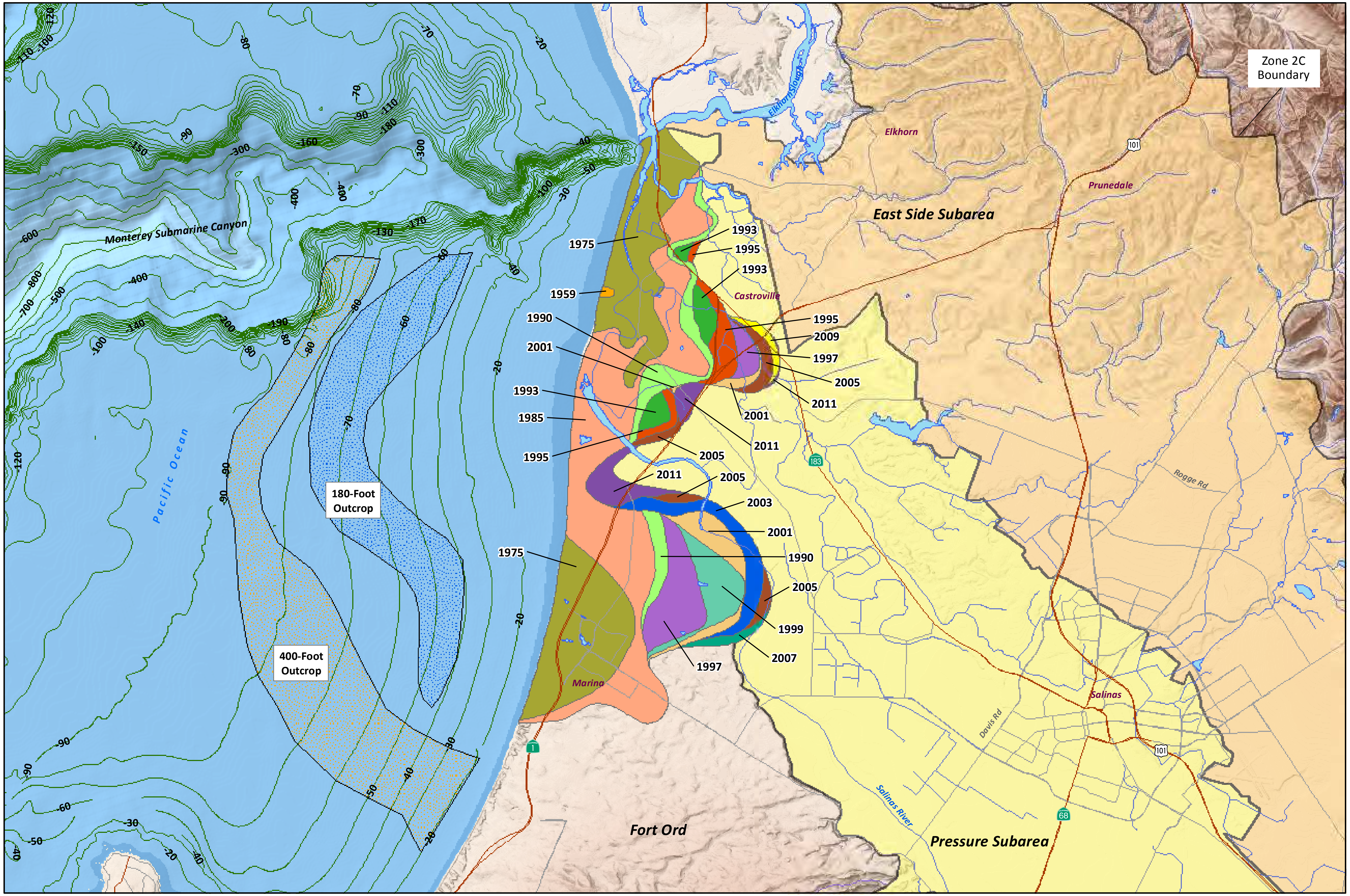
GEOSCIENCE

GEOSCIENCE Support Services, Inc.
P.O. Box 220, Claremont, CA 91711
Tel: (909) 451-6650 Fax: (909) 451-6638
www.gssiwater.com

Figure 5

GIS_proj/downey_brand_mont_water_rights_1-13/5_Fig_5_180ft_swi_11-13.mxd

HISTORICAL SEA WATER INTRUSION 400-FOOT AQUIFER



EXPLANATION

Historical Sea Water Intrusion (>500 mg/L Chloride) (MCRWA, 2012)

1959	1999
1975	2001
1985	2003
1990	2005
1993	2007
1995	2009
1997	2011

Offshore Aquifer Outcrop (Green, 1970; DWR, 1973)

180-Foot Aquifer

400-Foot Aquifer

-10 Elevation of Sea Floor, meters (Wong, F.L. and Eittreim, S.L., 2001)

19-Nov-13

Prepared by: DWB. Map Projection: State Plane 1983, Zone IV.

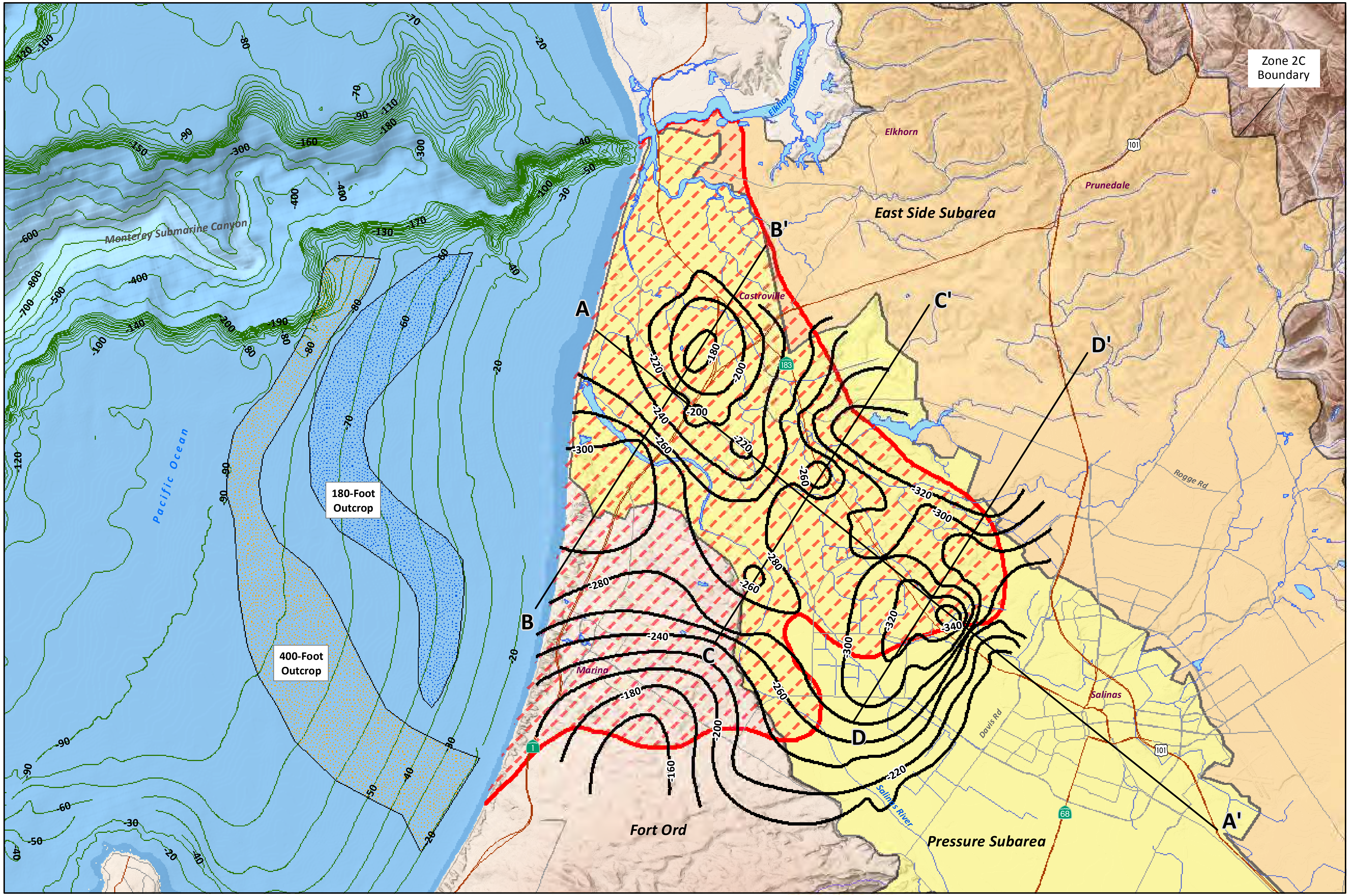
NORTH

0 2 4 Miles

GEOSCIENCE
GEOSCIENCE Support Services, Inc.
P.O. Box 220, Claremont, CA 91711
Tel: (909) 451-6650 Fax: (909) 451-6638
www.gssiwater.com

Figure 6

GIS_proj/downey_brand_mont_water_rights_1-13/5_Fig_6_400ft_swi_11-13.mxd



BASE OF THE 180-FOOT AQUIFER

EXPLANATION

-50 Base of 180-Foot Aquifer, ft amsl (Interpolated from geologic cross-section prepared by Kennedy/Jenks, 2004)

A ____ A' Geologic Cross-Section Location Used as Aquifer Base Elevation Control (Kennedy/Jenks, 2004. See Appendix A)

Current Extent (2011) of Sea Water Intrusion in the 180-Foot Aquifer (>500 mg/L Chloride) (MCWRA, 2012)

Offshore Aquifer Outcrop (Green, 1970; DWR, 1973)

180-Foot Aquifer

400-Foot Aquifer

-10 Elevation of Sea Floor, meters (Wong, F.L. and Eittreim, S.L., 2001)

19-Nov-13

Prepared by: DWB. Map Projection: State Plane 1983, Zone IV.

NORTH

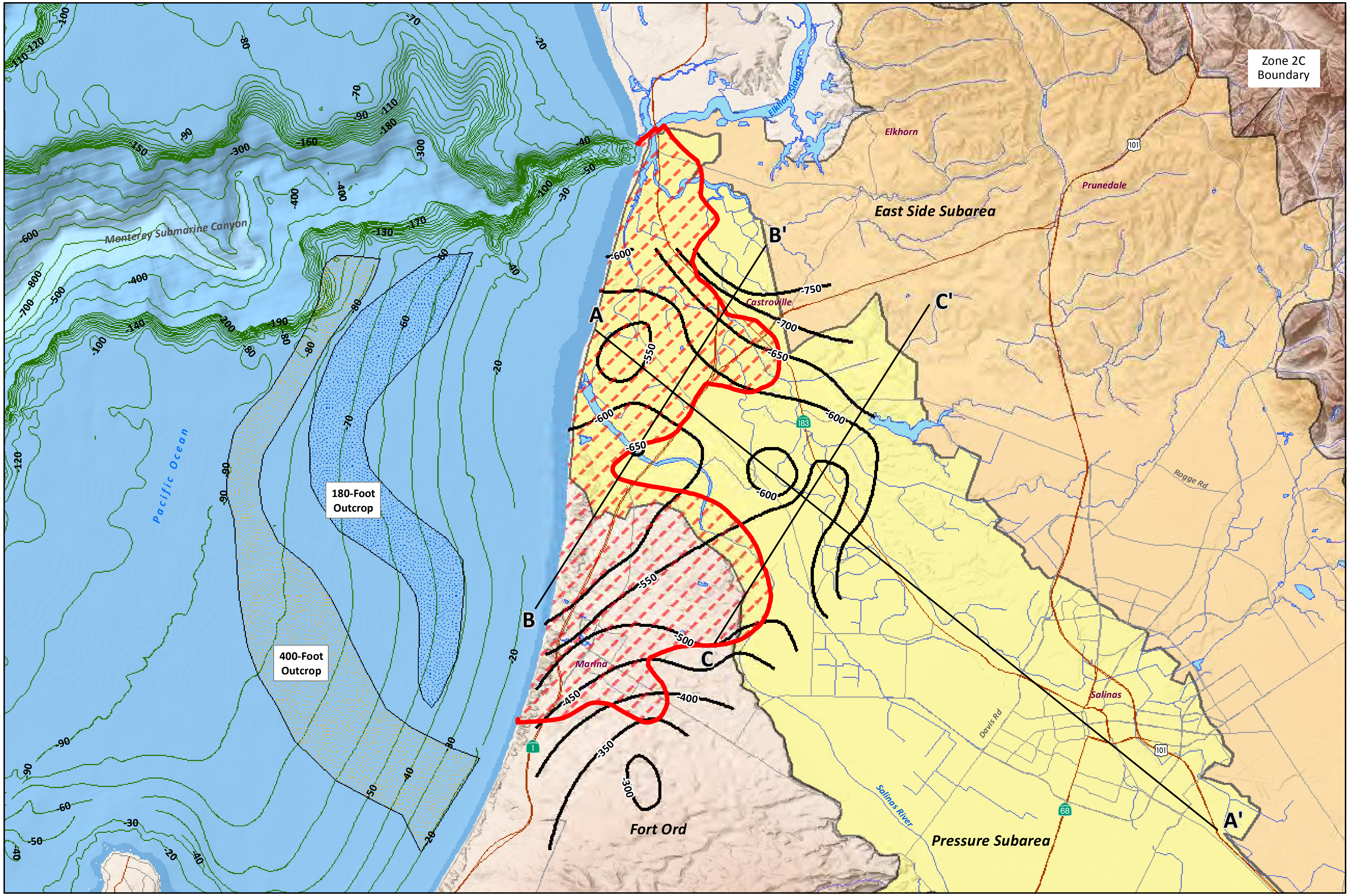
0 2 4 Miles

GEOSCIENCE
GEOSCIENCE Support Services, Inc.
P.O. Box 220, Claremont, CA 91711
Tel: (909) 451-6650 Fax: (909) 451-6638
www.gssiwater.com

Figure 7

MONTEREY COUNTY WATER RESOURCES AGENCY

PROTECTIVE ELEVATIONS TO CONTROL SEA WATER INTRUSION IN THE SALINAS VALLEY, CA



BASE OF THE 400-FOOT AQUIFER

EXPLANATION

-500 Base of 400-Foot Aquifer, ft amsl (Interpolated from geologic cross-section prepared by Kennedy/Jenks, 2004)

A ____ A' Geologic Cross-Section Location Used as Aquifer Base Elevation Control (Kennedy/Jenks, 2004. See Appendix A)

Current Extent (2011) of Sea Water Intrusion in the 180-Foot Aquifer (>500 mg/L Chloride) (MCWRA, 2012)

Offshore Aquifer Outcrop (Green, 1970; DWR, 1973)

180-Foot Aquifer

400-Foot Aquifer

-10 Elevation of Sea Floor, meters (Wong, F.L. and Eittreim, S.L., 2001)

19-Nov-13

Prepared by: DWB. Map Projection: State Plane 1983, Zone IV.

NORTH

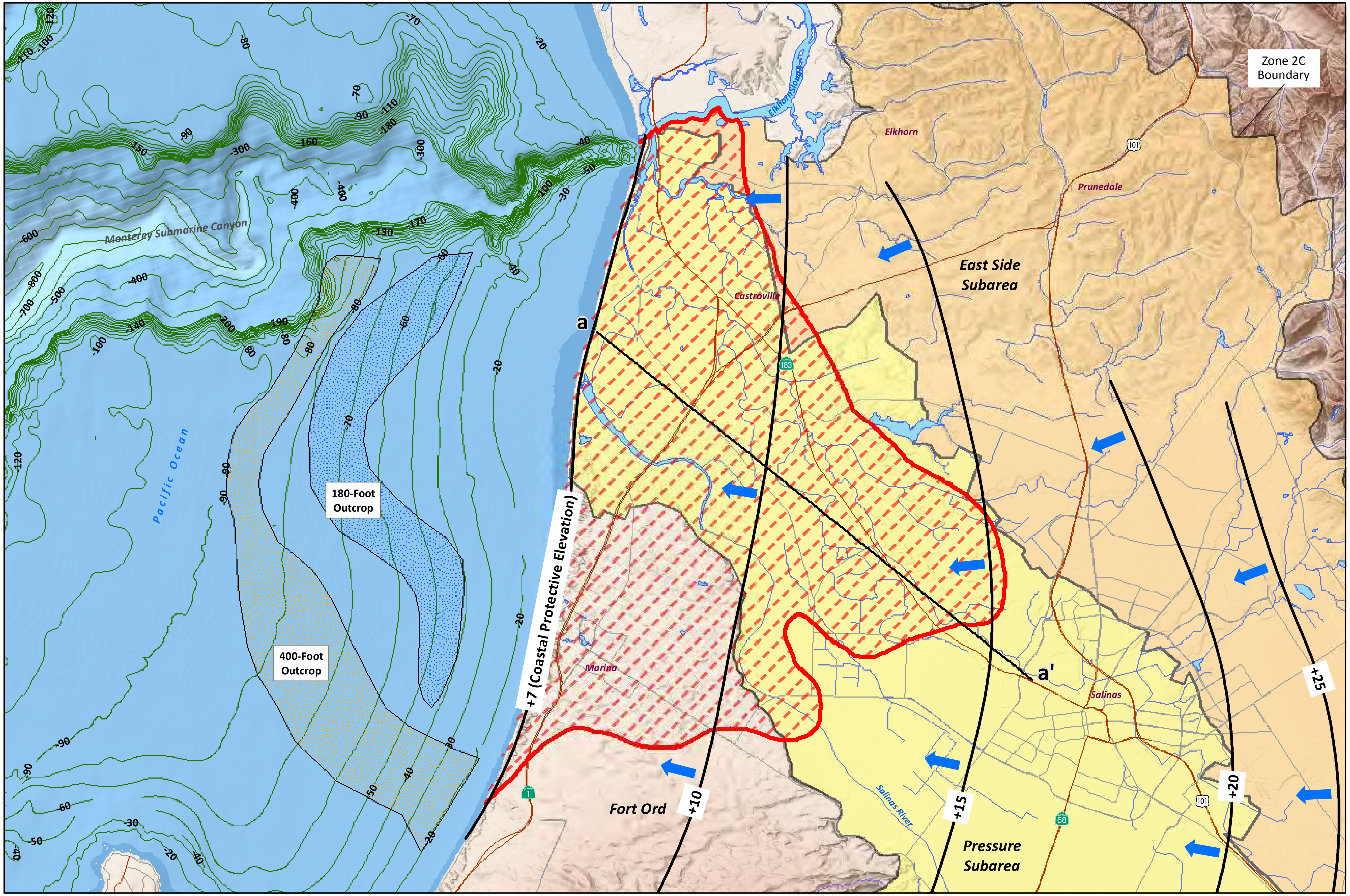
0 2 4 Miles

GEOSCIENCE
GEOSCIENCE Support Services, Inc.
P.O. Box 220, Claremont, CA 91711
Tel: (909) 451-6650 Fax: (909) 451-6638
www.gssiwater.com

Figure 8

GIS_proj/downey_brand_mont_water_rights_1-13/5_Fig_8_base_400ft_11-13.mxd

PROTECTIVE ELEVATIONS 180-FOOT AQUIFER



EXPLANATION

—10— Minimum Protective Elevations for the 180-Foot Aquifer, ft amsl Assumes 0.0002 (1 ft/mi) and 1938 ground water directions as per DWR (1946)

Ground Water Flow

a ____ a' Geohydrologic Cross-Section Used to Assess Protective Elevations (modified from Kennedy/Jenks, 2004)

Current Extent (2011) of Sea Water Intrusion in the 180-Foot Aquifer (>500 mg/L Chloride) (MCWRA, 2012)

Offshore Aquifer Outcrop (Green, 1970; DWR, 1973)

180-Foot Aquifer

400-Foot Aquifer

—-10— Elevation of Sea Floor, meters (Wong, F.L. and Eittreim, S.L., 2001)

19-Nov-13

Prepared by: DWB. Map Projection: State Plane 1983, Zone IV.

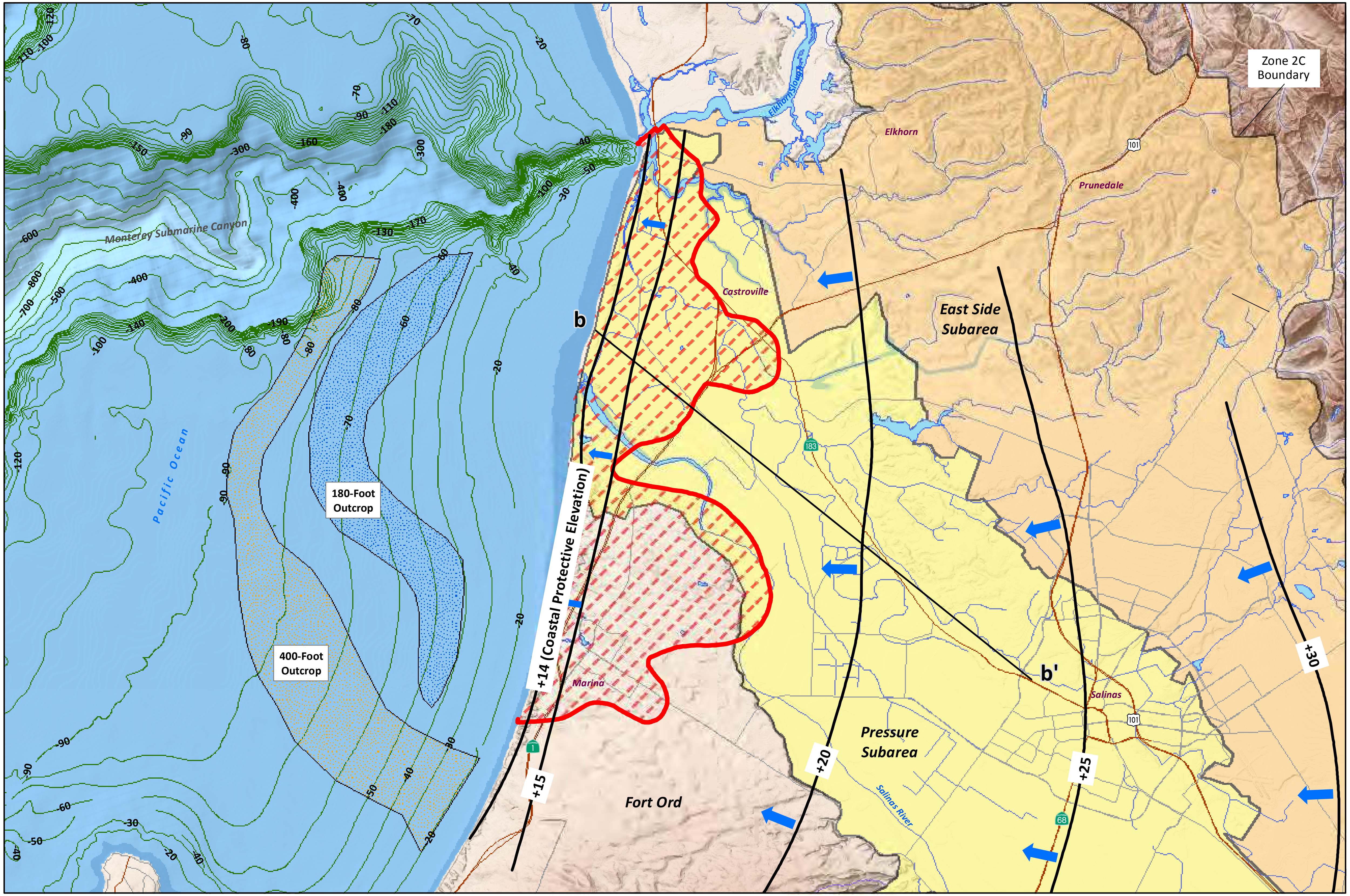
NORTH

0 2 4 Miles

GEOSCIENCE
GEOSCIENCE Support Services, Inc.
P.O. Box 220, Claremont, CA 91711
Tel: (909) 451-6650 Fax: (909) 451-6638
www.gssiwater.com

Figure 9

PROTECTIVE ELEVATIONS 400-FOOT AQUIFER



EXPLANATION

- 20 — Minimum Protective Elevations for the 400-Foot Aquifer, ft amsl. Assumes 0.0002 (1 ft/mi) and 1938 ground water directions as per DWR (1946)
- Ground Water Flow
- b ___ b' Geohydrologic Cross-Section Used to Assess Protective Elevations (modified from Kennedy/Jenks, 2004)
- Current Extent (2011) of Sea Water Intrusion in the 400-Foot Aquifer (>500 mg/L Chloride) (MCWRA, 2012)

Offshore Aquifer Outcrop (Green, 1970; DWR, 1973)

- 180-Foot Aquifer
- 400-Foot Aquifer
- -10 — Elevation of Sea Floor, meters (Wong, F.L. and Eittreim, S.L., 2001)

NORTH

0 2 4 Miles

19-Nov-13

Prepared by: DWB. Map Projection: State Plane 1983, Zone IV.

GEOSCIENCE
GEOSCIENCE Support Services, Inc.
P.O. Box 220, Claremont, CA 91711
Tel: (909) 451-6650 Fax: (909) 451-6638
www.gssiwater.com

Figure 10

GIS_proj/downey_brand_mont_water_rights_1-13/5_Fig_10_xsec_II-II_400ft_11-13.mxd

APPENDIX A

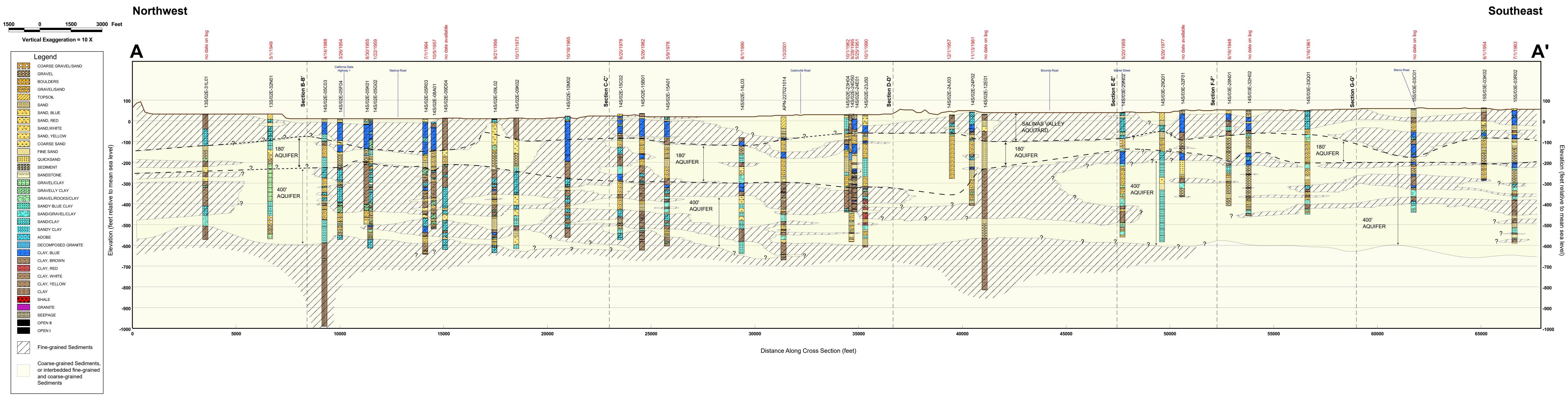
Cross-Sections Used to Delineate Base of 180-Foot and 400-Foot Aquifers

GEOSCIENCE

APPENDIX A

CROSS-SECTIONS USED TO DELINEATE BASE OF 180-FOOT AND 400-FOOT AQUIFERS

CONTENTS



H:\mcwra_swi\Report_200405\figure_03.pdf

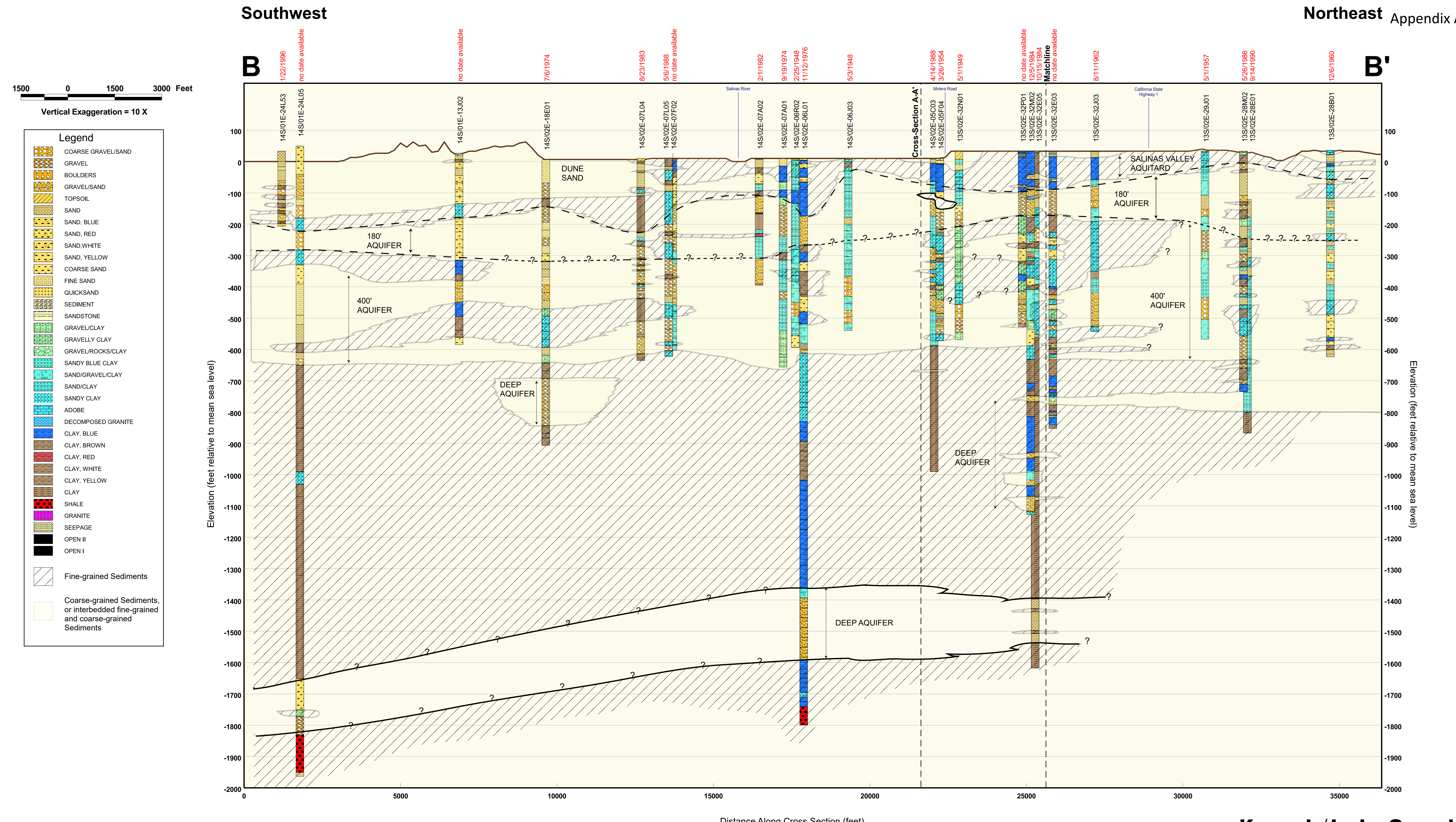
Kennedy/Jenks Consultants

Monterey County Water Resources Agency
Salinas, California

Cross-Section A-A'

K/J 035901.00
May 2004

Figure 3



Kennedy/Jenks Consultants

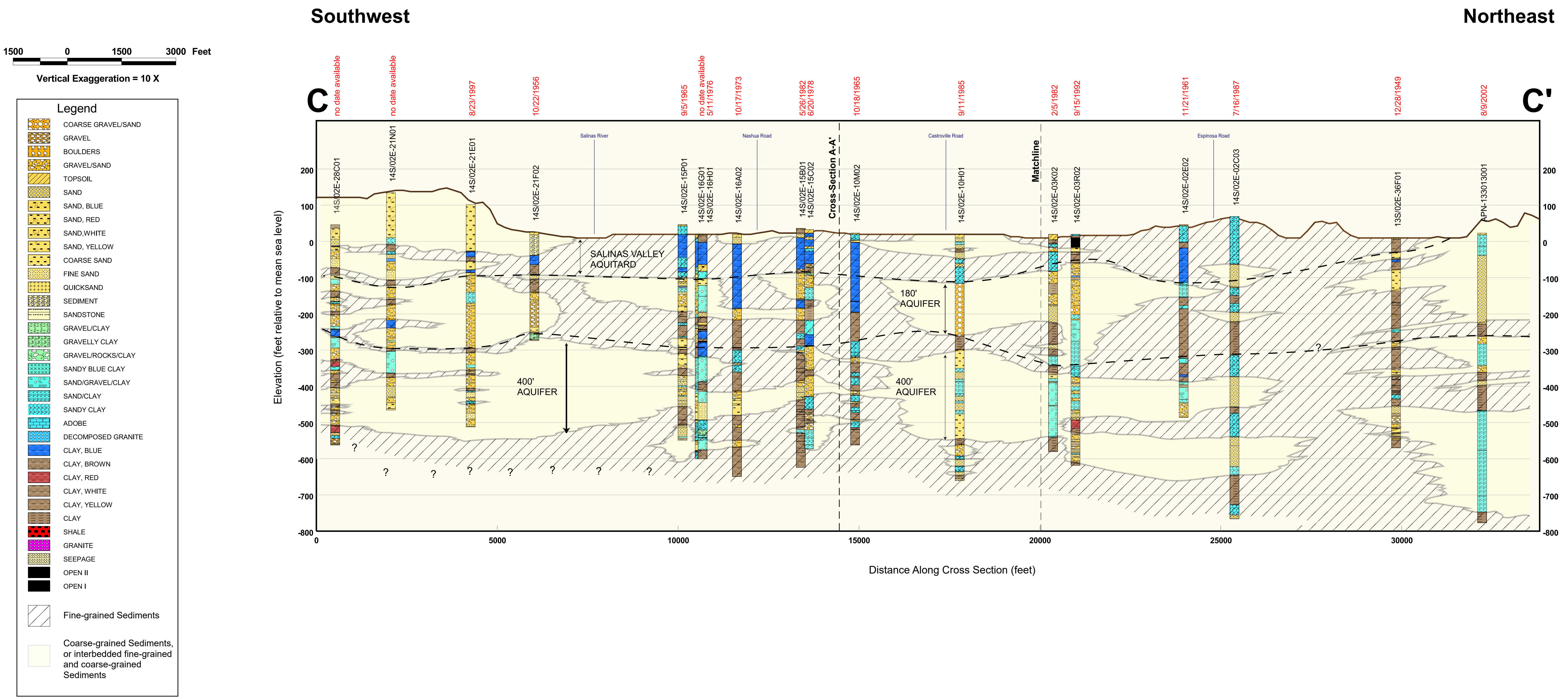
Monterey County Water Resources Agency
Salinas, California

Cross-Section B-B'

K/J 035901.00
May 2004

Figure 4

H:\mcwra_swi\Report_200405\figure_04.pdf



Kennedy/Jenks Consultants

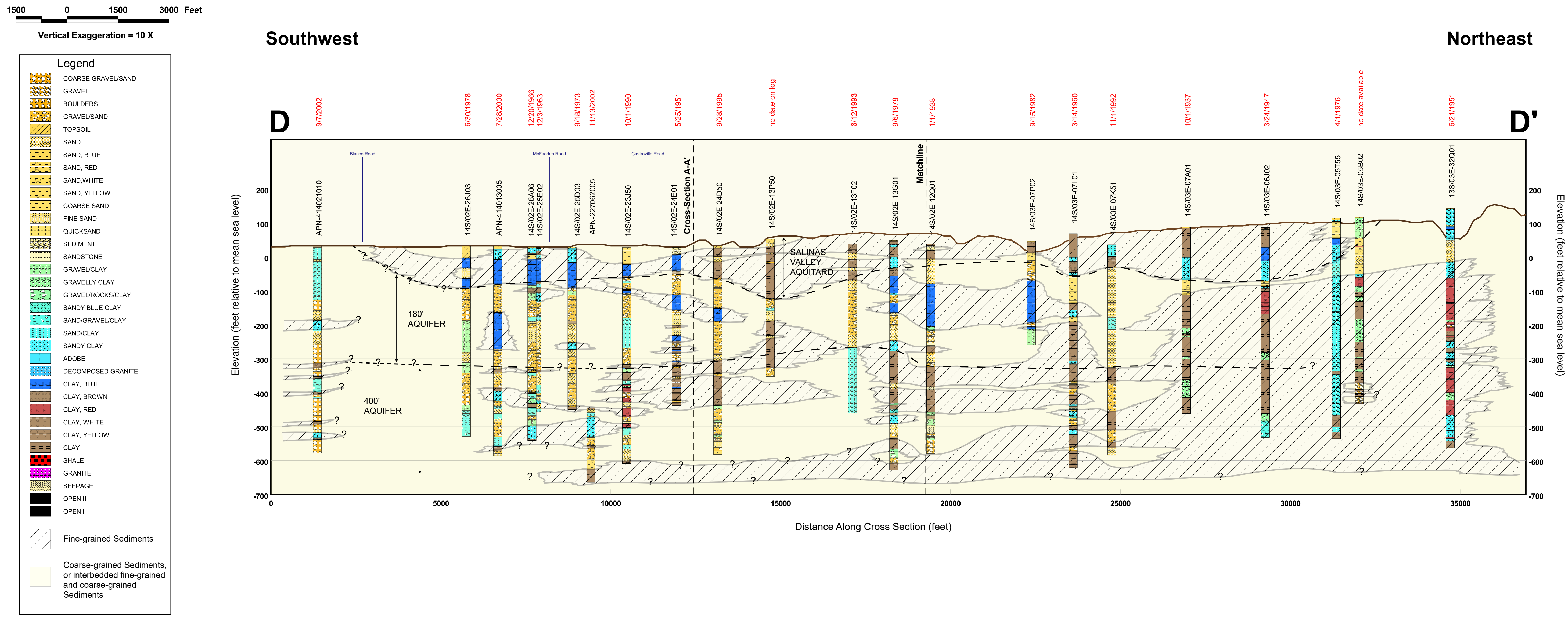
Monterey County Water Resources Agency
Salinas, California

Cross-Section C-C'

K/J 035901.00
May 2004

Figure 5

H:\mcwra_swi\Report_200405\figure_05.pdf



Kennedy/Jenks Consultants

Monterey County Water Resources Agency
Salinas, California

Cross-Section D-D'

K/J 035901.00
May 2004

Figure 6

H:\mcwra_swi\Report_200405\figure_06.pdf

GEOSCIENCE Support Services, Inc. | P (909) 451-6650 | F (909) 451-6638
620 W. Arrow Highway, Suite 2000, La Verne, CA 91750 | Mailing: P.O. Box 220, Claremont, CA 91711

EXHIBIT E

HYDROGEOLOGY AND WATER SUPPLY

OF SALINAS VALLEY

A White Paper prepared by

Salinas Valley Ground Water Basin
Hydrology Conference

For
Monterey County Water Resources Agency

June 1995

TABLE OF CONTENTS

CONCLUSIONS

- No member of this panel has any substantive disagreement with the conclusions of previous reports.
- The panel reached unanimous agreement on all major issues.
- Data that are available have been useful in determining regional and local surface water and ground water relationships and quality.
- Based on all the studies completed to date, there appears to be an adequate supply of water within Salinas Valley to meet all existing and projected future requirements.
- Despite this abundance, past and present water distribution and management practices have caused seawater intrusion, declining ground water levels in the East Side Area, and nitrate contamination.
- The solution for the seawater intrusion and declining ground water levels in Salinas Valley that was recommended in 1946 is so compelling we could not refrain from recommending it.
- Some form of extraction and conveyance system should be constructed.
- More recent studies conducted by Monterey County Water Resources Agency (MCWRA) since 1946 have reaffirmed and endorsed the original concepts.
- Residents of Salinas Valley are fortunate that an in-valley conjunctive use solution is available to them.

RECOMMENDATIONS

Monterey County Water Resources Agency should:

- Complete the extraction facilities and conveyance system, similar to those that were outlined in California Department of Water Resources Bulletin 52 in 1946, that are integral components of a total project.

- Continue studies to determine the relationships between fertilizer application, irrigation practices, plant growth, movement of water past the root zone, and ground water contamination under growing conditions prevalent in Salinas Valley.

- Use these studies to develop and demonstrate improved irrigation and fertilizer management methods that farmers can adopt with confidence.

- Continue to evaluate seawater intrusion monitoring data.

- MCWRA should continue their surface water and ground water monitoring program for quantity and quality. The data should be evaluated to ensure that the information is adequate for effective management of water resources.

INTRODUCTION

Purpose and Scope

The Monterey County Water Resources Agency (MCWRA) convened a panel of 10 geologists, hydrogeologists, and engineers familiar with Salinas Valley ground water basin to attempt to reach agreement on the basic physical characteristics of the basin, and the surface and ground water flow within the basin. Agreement on the completeness and accuracy of existing data and previous hydrogeological studies was seen as an important first step in identifying and implementing a technically sound solution acceptable to the public that would stop seawater intrusion that began some 60 years ago.

Mike Armstrong, General Manager of MCWRA, instructed the panel to review and, if possible, reach consensus on the hydrogeological characteristics of the basin, define clearly the water resources problems in the basin, and determine surface water and ground water flow within the basin. We were not requested to discuss specific local projects or political and institutional aspects of the problems.

The panel met in a closed-door session in Monterey on May 24 and 25, 1995. The session was closed to the public and the press to enable the panelists to discuss and explore ideas and opinions freely without worrying about statements, questions, and hypotheses being repeated out of context.

Members of the panel believe the process worked very well. This report presents our findings, conclusions, and recommendations. We were able to achieve more than our original scope of work. There was remarkable unanimity of opinion on our understanding of the physical characteristics of the basin, the hydrologic system, the interaction between surface water and ground water, and definition of the specific ground water problems in the basin.

In summary, the facts we agreed upon point so compellingly toward an already identified *regional* solution to the Valley's ground water resources problems that the panel has included a potential solution. We have included a strong recommendation in this White Paper for implementing that regional solution.

Panel Members

The panel consisted of 9 members and 1 facilitator/editor:

Mr. Carl Hauge, California Department of Water Resources, Sacramento, facilitator/editor.

Dr. Steven Bachman, Integrated Water Technologies, Santa Barbara.

Mr. Tim Durbin, HCI Hydrologic Consultants, Davis.

Mr. Martin Feeney, Fugro West, Monterey.

Mr. Joseph Scalmanini, Luhdorff and Scalmanini, Woodland.

Mr. Jim Schaaf, Schaaf & Wheeler, San Jose (attended May 25 only).

Dr. Dennis Williams, GEOSCIENCE, Claremont.

Mr. Gus Yates, Jones & Stokes Associates, Sacramento.

Dr. Young Yoon, Montgomery Watson, Sacramento.

Mr. Matt Zidar, Monterey County Water Resources Agency, Salinas.

Previous Reports

One of the first reports published on the hydrology of Salinas Valley was California Department of Water Resources Bulletin 52, *Salinas Basin Investigation*, released in 1946. Bulletin 52 recommended construction of a project consisting of dams to provide additional recharge and yield throughout the Valley, ground water extraction facilities, and a water conveyance facility to transport some of the additional yield to the area near the coast.

Other recent reports include:

Durbin, T.J. Kapple, G.W., and Freckleton, J.R., 1978, *Two-dimensional and three-dimensional digital flow models of the Salinas Valley ground water basin, California*; U.S. Geological Survey Water-Resources Investigation 78-113, 134 p.

Leedshill-Herkenhoff, Inc., 1985, *Salinas Valley Seawater Intrusion Study.*

Montgomery Watson, 1994, *Salinas River Basin Water Resources Management Plan, Task 1.09 SalinasValley Groundwater Flow and Quality Model Report.*

Todd, D.K., Consulting Engineers, Inc., 1989, *Sources of Saline Intrusion in the 400-Foot Aquifer, Castroville Area, California.*

Yates, E.B., 1988, *Simulated Effects of Ground-Water Management Alternatives for the Salinas Valley, California,* United States Geological Survey Water Resources Investigation Report 87-4066.

PROBLEM STATEMENT

The water resources problem in Salinas Valley is not a water supply problem. It is a water distribution problem. The basin has enough surface and ground water to meet existing and projected future average annual agricultural, and municipal and industrial (M & I) water demand through the year 2030. The problem lies in managing those supplies to meet water demands at all locations in the Valley at all times.

The overall water resources problem has three principal components:

- Seawater intrusion

  Seawater intrusion occurs near the coast principally because extraction of fresh ground water in the northern part of Salinas Valley exceeds recharge in the northern part of the Valley.

  In recent decades, the annual volume of intrusion has ranged from 2,000 to 30,000 acre feet per year (afy) and has averaged 17,000 acre feet per year.

  Seawater has advanced about 6 miles inland.

  About 20,000 acres of agricultural land near the coast are underlain by one or more aquifers that contain water too salty to use for irrigation.

- Declining ground water levels in the East Side Area

  Ground water levels continue to decline in the East Side Area.

  Lower ground water levels in the East Side Area induce additional recharge from the Pressure Area and the Forebay Area but also cause conditions for potential movement of additional seawater inland into the coastal area.

- Nitrate contamination

  Nitrate has contaminated ground water to varying concentrations throughout the Valley, but the level of contamination is especially high in the East Side, Forebay, and Upper Valley Areas.

  The maximum contaminant level (MCL) for drinking water is 45 mg/l as nitrate. In 50 percent of the wells sampled throughout the Valley, nitrate exceeds 45 mg/l; in some wells nitrate has reached several hundred mg/l.

High concentrations of nitrate limit beneficial use of the ground water for potable uses and for some agricultural uses.

An additional long-range problem is the build up of salts in the basin that is occurring because there is no subsurface outflow from the basin. Although the impacts of such a condition are manifested much more slowly than other problems, there is a long-term increase in salt concentration within the aquifer system. At some time in the future, such a build up will render the aquifer system unusable for certain beneficial uses.

These water resources problems result in economic and institutional consequences primarily because of water quality standards and the loss of supply associated with violation of those standards. The severity of the economic and institutional problems is not the same for all 3 of the problems and is dependent on the specific location and the use of the water.

The variability of precipitation and runoff is an important component of water supply planning and management. Water supply issues may appear to be non-existent when the *average* annual water supply is used for planning purposes. But in dry years, which are also a part of that average, those same supply issues become critical.

DESCRIPTION OF THE BASIN

Hydrogeology

The Salinas Valley ground water basin is one hydrologic unit. Four subareas based on differences in local hydrogeology and recharge have been identified: Upper Valley Area, Forebay Area, East Side Area and Pressure Area (which includes the area near the coast). All information collected to date indicates there are no barriers to the horizontal flow between these subareas, although aquifer characteristics decrease the rate of ground water flow in certain parts of the basin (for example, from the Pressure Area to the East Side Area, and especially from the Forebay Area to the Pressure Area). Ground water can move between the East Side and Pressure Areas, and between the Forebay and Pressure Areas, the Forebay and East Side Areas, and the Upper Valley and Forebay Areas. The "boundaries" between these areas have been identified as zones of transition between different depositional environments in past millennia.

While Salinas Valley ground water basin is one hydrologic unit, the impacts of ground water use are not distributed uniformly throughout the Valley. The impacts of ground water extraction occur mostly within the local area of the extraction. The impacts diminish rapidly with distance from the extraction, and the impacts tend to be very small at large distances from the extraction.

The alluvial fill in Salinas Ground Water Basin encompasses approximately 344,000 acres. The Upper Valley and Forebay Areas are unconfined and in direct hydraulic connection with Salinas River. The Upper Valley Area covers an area of approximately 92,000 acres near the south end of Salinas Valley from Greenfield to Bradley. Primary ground water recharge to the Upper Valley Area occurs from percolation in the channel of Salinas River.

The Forebay Area from Gonzales to Greenfield, consists of approximately 87,000 acres (including Arroyo Seco Cone) of unconsolidated alluvium. Principal recharge to the Forebay Area is from percolation of water from Salinas River and Arroyo Seco Cone, and ground water outflow from the Upper Valley.

Arroyo Seco Cone is located on the west side of southern Salinas Valley and is a part of the Forebay Area. Arroyo Seco Cone receives recharge from percolation in channels of Arroyo Seco and tributaries. The Cone covers approximately 26,000 acres of the Forebay Areas. The Arroyo Seco Cone may provide some opportunity for additional recharge.

The Pressure Area covers an area of approximately 91,000 acres between Gonzales and Monterey Bay. The Pressure Area is composed primarily of confined and semi-confined aquifers separated by clay layers (aquitards) that limit the amount of vertical recharge. Three primary water bearing strata have been identified in the Pressure Zone: the 180 Foot Aquifer, the 400 Foot Aquifer, and the Deep Zone. These aquifers are separated by aquitards, although some vertical recharge occurs locally where the aquitards are thin or missing. The uppermost aquitards allow some limited recharge from Salinas River directly to the 180-foot aquifer in the area near Spreckels. The areas of thin or missing aquitards also allow some interconnection between the shallow (180 foot) and deeper (400 foot) aquifers.

The exact nature of the connection between the Deep Zone and the ocean is unknown. Seawater intrusion has not been detected in Deep Zone wells, but there is no evidence indicating that the Deep Zone is not connected to the ocean. Lacking this evidence, it must be assumed that the deep zone, like the 180-foot and 400-foot aquifers above it, is connected to the ocean and vulnerable to seawater intrusion if ground water levels fall below sea level. Similarly, the aquitards between the 400-foot and the Deep Zone are subject to leakage of degraded water downward to the Deep Zone as the water level is lowered.

The Deep Zone is currently undefined both geologically and areally. In some locations, it is considered to be Purisima Formation, in others, lower Paso Robles Formation. Some recent evidence suggests that it may be Santa Margarita Formation. Water levels in Deep Zone wells have fallen approximately 60 feet since the late 1970s and are now substantially below sea level. Total extraction over this period of time has averaged less than 5,000 acre-feet per year. Water quality in the Deep Zone is unsuitable for agriculture because of extremely high sodium-adsorption ratios (SAR).

The East Side Area consists of 74,000 acres and contains unconfined and semiconfined aquifers in the northern portion of the Basin that historically received recharge from percolation from stream channels on the west slope of the Gabilan Range. As a result of extraction in excess of recharge, the decline in ground water level in the East Side Area has induced subsurface recharge from the Pressure Area, as well as from Salinas River and the Forebay Area. This inflow is now a larger source of recharge than the stream channels coming from the Gabilan Range.

Sources of Recharge

Ground water recharge in Salinas Valley is principally from infiltration from Salinas River, Arroyo Seco Cone, and, to a much lesser extent, from deep percolation of rainfall. Minor amounts are derived from infiltration from small streams and inflow from bedrock areas adjoining the basin. Deep percolation of applied irrigation water is the second largest component of the ground water budget, but because it represents recirculation of existing ground water rather than an inflow of "new" water, it is not considered a source of recharge for this discussion. Seawater intrusion is another source of inflow to the basin, but because it is not usable fresh water it is also excluded as a source of recharge for this discussion.

Infiltration from Salinas River and deep percolation of rainfall would occur under natural conditions, but both are increased by present water use patterns in the Valley. Ground water extraction increases the amount of infiltration from the river upstream of Salinas. Irrigation increases the amount of rainfall that percolates past the root zone by increasing antecedent soil moisture at the beginning of the rainy season. The low permeability of the Salinas Valley aquitard in the Pressure Area decreases but does not altogether eliminate deep percolation of rainfall and irrigation return flow directly to the 180-foot aquifer in the Pressure Area.

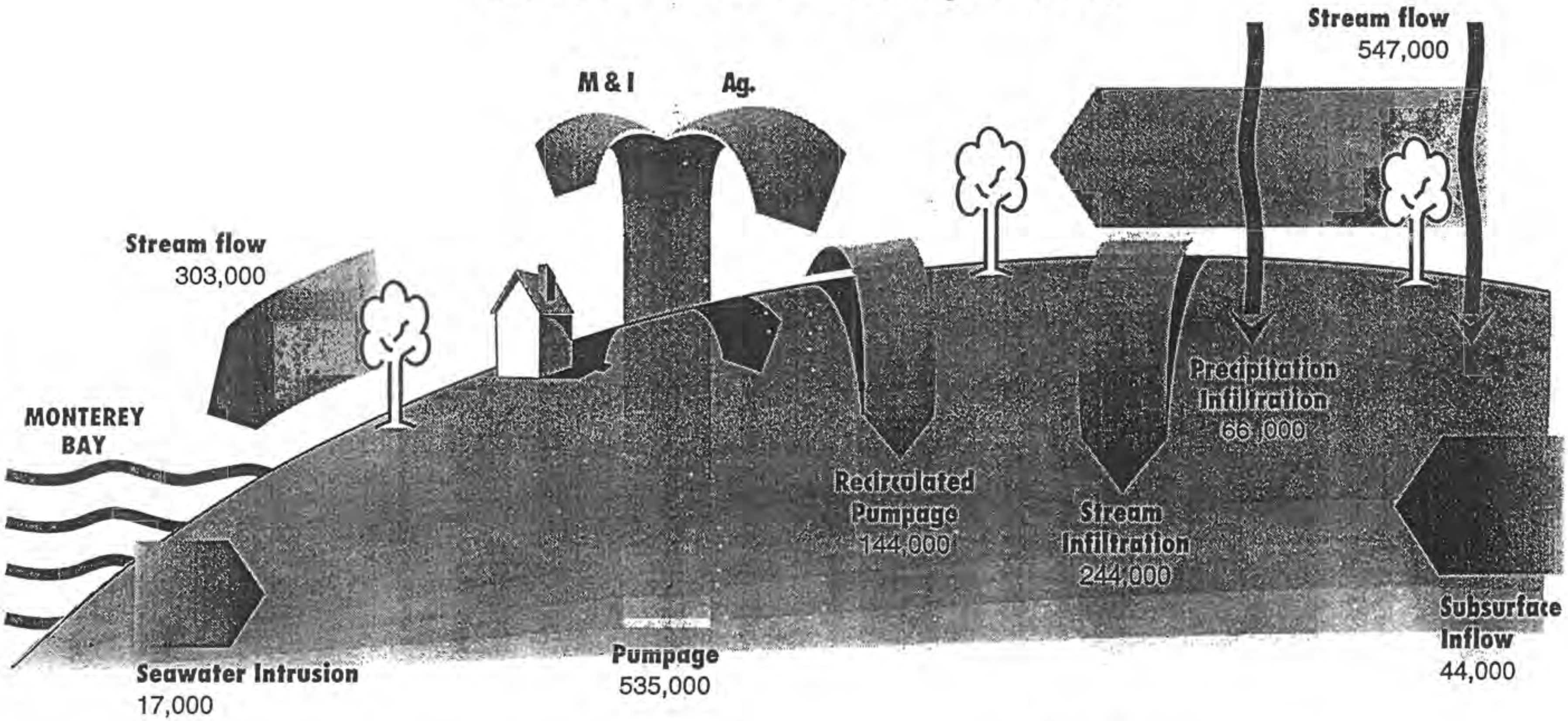
Figure 1 shows estimates of the average annual amounts of recharge derived from each source during 1970-1992 for the entire Valley. Average annual recharge, including irrigation return flow and seawater intrusion, totals 514,000 afy.

The estimates of items in the water budget are derived from a combination of direct measurement and extrapolation using three different and independently designed ground water models. It is important to recognize that the models include all available measured data and that all three of the modeling efforts completed to date have resulted in very similar estimates of the average annual basin-wide water budget. Our confidence in the general magnitude and proportion of flows in the budget is fairly high.

The water budget shown in Figure 1 is an average annual budget indicative of the long-term balance of components of the budget. It does not reveal the large amount of variation in annual flows in the water budget. These annual variations are an important factor in management of water resources and must be considered in any solution to water management in Salinas Valley.

The water budget indicates that ground water storage in the Valley has declined by 460,000 acre feet from 1970 to 1992, an average rate of 20,000 afy. However this decline was

Average Annual Basin-Wide Surface and Ground-Water Flows in Salinas Valley (AFY, 1970-1992 average flows)



Change in Ground Water Storage = -20,000 AFY

caused largely by the 1987 through 1992 drought.

Infiltration of water from Salinas River is relatively constant from year to year, partly because river flows are partially regulated by Nacimiento and San Antonio reservoirs and partly because ground water extraction--which induces a substantial amount of infiltration from the river--also remains fairly constant. In contrast, rainfall recharge is much more variable, with little, if any, recharge occurring in below-average rainfall years and large amounts occurring in wet years.

In the Upper Valley and Forebay Areas recharge from Salinas River is a rapid process, so that the effects of dry years on ground water levels are rapidly reversed in subsequent normal and wet years. After declining somewhat during the 1976-1977 and 1986-1992 droughts, water levels in the Upper Valley and Forebay Areas recovered fully within 1 to 2 years following the resumption of normal streamflow, including reservoir releases. This demonstrates the feasibility of conjunctively using ground water storage capacity in those areas to increase overall system yield.

BASIN MANAGEMENT

Seawater Intrusion

Analysis of water samples from wells in the Pressure Area has indicated that seawater has been intruding the aquifers for the last 60 or so years. The intrusion has moved progressively landward within the 180-foot and 400-foot aquifers during this time. To date, there has been no observed intrusion in the Deep Zone. The intrusion has moved as much as 6 miles inland in the 180-foot aquifer and 2 miles inland in the 400-foot aquifer, rendering wells in the intruded area unusable and decreasing usable basin storage. Between 1970 and 1992, the annual decrease in usable basin storage for ground water because of seawater intrusion has amounted to an average of 17,000 acre feet per year. While the average is 17,000 acre feet per year, it has varied from 2,000 acre feet per year to 30,000 acre feet per year. The cumulative total of seawater intrusion during the period 1970 to 1992 is about 374,000 acre feet.

Seawater intrudes coastal aquifers when ground water levels in the aquifers in contact with seawater decline below sea level. When this occurs, the normal gradient that produces ground water discharge into Monterey Bay is reversed. This reversal of ground water gradient in the Pressure Area resulted from extraction of ground water in excess of recharge in that Area. Seawater has intruded the aquifer in response to the reversed gradient that was caused by lowered ground water levels.

This saline water can move both horizontally within the aquifer or vertically through breaches in the various aquitards or through improperly constructed wells, wells that were abandoned but not destroyed, or through failed well casings. Most of the salinity is caused by intrusion of seawater through the offshore outcrops of the aquifers. An additional source of salinity may be the dewatering of salty marine clays within or between the aquifers in response to the lowered pressure levels in the aquifer system.

If the intrusion of seawater is left unchecked, seawater will continue to advance inland, eventually contaminating the East Side and Pressure Areas as far inland as Salinas. This will degrade the water supply of additional agricultural areas and will also degrade municipal drinking water supplies.

The only effective solution to controlling seawater intrusion in Salinas Basin is the re-establishment of higher ground water levels by relieving pumping stresses in the coastal portion of the aquifer. This can most efficiently be achieved by the cessation of pumping and the delivery of an alternative source of water to this area. This solution will allow recovery of water levels in the aquifer, thereby halting the advance of seawater intrusion and restoring normal aquifer pressures. The re-establishment of these conditions will also control the other possible sources of saline degradation such as the dewatering of marine clays and interaquifer leakage.

If a solution other than the delivery of water to the coastal area is to be considered, additional information regarding the components of the saline intrusion may be advisable.

Overdraft

In general, the term overdraft has been used to describe conditions where extraction from a ground water basin exceeds the perennial yield over a period of time, resulting in undesirable conditions. Undesirable conditions may include subsidence, seawater or other saline water intrusion, lower ground water level, and depletion of the supply. Perennial yield is sometimes called the safe yield or the sustained yield of the basin.

In Salinas Valley, the undesirable conditions lowered ground water levels and seawater intrusion. The conditions are the result of:

a) the physical characteristics of ground water occurrence in the Valley,

b) physical connection between the aquifers and seawater,

c) areal distribution of extraction from the aquifer system, and

d) water use practices.

These conditions require that management of ground water in different parts of the Valley recognize local hydrogeologic issues specific to each area.

There is a difference between total ground water in storage and usable ground water storage. The **total** storage of ground water in Salinas Valley is in the millions of acre feet. The **usable** storage is only a portion of the total volume in storage because all of the ground water is not available for extraction without causing some of the undesirable impacts that were listed above. Usable storage can be greatly influenced by the distribution of extraction and recharge facilities, water management practices, and physical facilities for storage and distribution of surface water and ground water.

Valley-wide, the ground water basin is only slightly out of balance because total inflow to the aquifer system is less than total outflow. Fresh water inflow consists of recharge from precipitation, streamflow, and recirculated irrigation water. Outflow consists of ground water extraction, which totals 20,000 afy more than total fresh water inflow.

Seawater is another source of inflow because of the lowering of ground water levels near the coast. The high chloride content, however, makes this water unusable. The average seawater intrusion totals about 17,000 afy. Thus, the Valley-wide water budget shows an average fresh water deficit of 37,000 afy.

In addition to the overdraft in the East Side Area and seawater intrusion in the Pressure Area, 2 other factors exacerbate the ground water supply problem in the Valley. First, nitrate concentrations in ground water are increasing in many areas of the Valley. Second, the basin is hydraulically closed to subsurface outflow, leading to long-term salt accumulation.

The undesirable conditions in the Valley include: seawater intrusion near the coast, decreasing ground water in storage in the East Side Area, nitrate increases in the Forebay and Upper Valley Area, and the salt build-up caused because the Valley is hydraulically closed. These conditions are occurring despite the fact that an essentially full aquifer system has existed under the major portion of the Valley.

The solution to these problems lies in focused relief of the pumping stresses. Such relief could include reduced local extraction in the areas where intrusion and declining water levels are occurring, development of a supplemental water supply to replace the reduced extraction, while maintaining current beneficial uses.

Nitrate

Nitrate contamination of ground water poses a significant threat to the beneficial use of ground water for drinking water and for some agricultural water uses. Nitrate concentrations exceed drinking water standards in many parts of the basin. The principal source of nitrates to ground water is almost certainly excess fertilizer that is leached by rainfall and applied irrigation water. Nitrates also originate from animal and human waste. The contribution of nitrate from various sources has been estimated at 90 percent from agriculture and 10 percent from urban sources. Contamination by nitrate has been observed in the unconfined aquifer and in some locations in the 180-foot aquifer of the Pressure Area.

Nitrate contamination can best be controlled by integrated on-farm fertilizer and water management practices. Such practices may require the voluntary implementation of improved water and fertilizer management by growers, possibly with incentives from MCWRA.

Water Conservation

There are probably some water supply benefits that can be achieved by implementing agricultural and urban water conservation measures. In agriculture, the potential savings would be achieved by decreasing direct evaporative losses during irrigation and by minimizing outflow of irrigation return flow from coastal areas to Monterey Bay. The potential for agricultural conservation of irrigation water is closely linked with interactions in the plant root zone, crop yield, and salt build-up. Any attempt to improve irrigation efficiency must evaluate each of these factors.

Water conservation by itself would not be sufficient to solve the problems of seawater intrusion near the coast and overdraft in the East Side Area.

PROBLEM SOLUTION

Seawater Intrusion and Overdraft

The only reasonable and effective solution for controlling seawater intrusion and overdraft in Salinas Valley is re-establishment of higher ground water levels by relieving pumping stresses in the aquifers in the Pressure and East Side Areas. The 2 alternatives for relieving pumping stresses are either 1) fallow land in the Pressure and East Side Areas, or 2) deliver an alternate supply of water to replace the reduced pumpage. If present agricultural and urban beneficial uses of water are to continue, the obvious solution is some sort of program to deliver water in lieu of ground water extraction. The Castroville Seawater Intrusion Project is a step in this direction, but it will not provide enough water to replace current extraction sufficiently to halt seawater intrusion.

Two approaches could be used to relieve overdraft in the East Side Area. One approach would be to allow water levels to continue declining. They would eventually stabilize near a level low enough to induce increased inflow from the Forebay and Pressure Areas at a rate sufficient to balance ground water extractions. This approach would result in high ground water extraction costs for the indefinite future and continued seawater intrusion in the Pressure Area.

An alternative approach would be to deliver in-lieu water to the East Side Area by means of a surface conveyance facility. This approach would decrease local ground water extraction costs and avoid the intrusion risk but would incur construction and pumping costs for the surface water facility.

The water-supply problem in Salinas Valley is the result of a water distribution problem. The water supply in Salinas Valley is the streamflow runoff from Salinas River watershed and the deep infiltration of precipitation on the Salinas Valley floor. However, a substantial part of this water supply is not captured at present and discharges to Monterey Bay from Salinas River. This discharge occurs mostly during storm periods, and the largest part of the discharge occurs during extreme flood events. The water-management solution to stop overdraft consists of facilities and management practices that use part of the discharge to Monterey Bay from Salinas River, while providing protection for instream uses in the River and in wetlands.

Valley-wide water management in Salinas Valley could best be accomplished by the conjunctive use of surface water and ground water storage. Storage could be used to retain some storm runoff from Salinas Valley watershed and the stored water could be made available for beneficial use within Salinas Valley. At present, runoff is stored in San Antonio and Nacimiento Reservoirs and within the ground water basin, but the current use of ground water storage is not adequate to resolve the problems of seawater intrusion into the Pressure Area and water-level declines within the East Side Area. More intensive management is required to address such conjunctive operation of surface water and ground water storage.

The need for conjunctive operation of surface water and ground water storage was recognized as early as 1946. In 1946, the California Department of Water Resources published a report on Salinas Valley that described the occurrence of seawater intrusion and declining ground water levels. The report recommended a project to eliminate these problems that included development of surface water and ground water storage. Surface water storage was to be accomplished by the construction of dams on tributaries to Salinas River, and ground water storage was to be accomplished by ground water transfers from the Forebay Area to the Pressure Area and East side Area. The Department recommended transfer facilities that included wells in the Forebay Area, conveyance facilities from the Forebay Area to the Pressure and East Side Areas, and distribution facilities within the Pressure and East Side Areas.

In such a conjunctive operation, the increased extraction in the Forebay Area and conveyance of water to the Pressure and East Side Areas would vacate ground water storage in the Forebay Area. This empty storage space would be refilled by additional infiltration from Salinas River. This mode of operation would effectively capture some of the water that presently flows to the ocean and would make it available for conveyance to the Pressure and East Side areas. The well-documented rapid recovery of ground water levels in the Forebay and Upper Valley Areas following recent drought years demonstrates the physical feasibility of this type of conjunctive use.

Part of the recommended facilities for surface water and ground water storage have been completed by the construction of the dams for SanAntonio and Nacimiento reservoirs, but the facilities for the effective use of ground water storage have not been completed. The operation of San Antonio and Nacimiento reservoirs has produced benefits to salinas Valley, but the ultimate benefits that would result from the construction and operation of transfer facilities have not been realized.

The panel concluded that the facilities recommended in 1946 by the California Department of Water Resources should be completed immediately. The Department recommended both dams and transfer facilities. Since that time, additional studies conducted by MCWRA have served to reaffirm and validate the original recommendations.

The dams that were recommended have been constructed, but the companion transfer facilities have not been constructed. The result of partially completing the project has been an uneven distribution of benefits throughout the Valley. The Forebay Area and Upper Valley Areas have enjoyed relatively large benefits from San Antonio and Nacimiento reservoirs that would have been shared equally with the Pressure and East Side Areas if the intended transfer facilities had been built. In the absence of the transfer facilities, seawater intrusion into the Pressure Area and water-level declines within the East Side Area have not been mitigated.

Instead, within the Forebay Area ground water levels are 20 to 30 feet higher than would have occurred without the dams. The Upper Valley Area has also benefited from somewhat higher ground water levels, and has used the yield of the 2 reservoirs to significantly increase the amount of irrigated land in this Area. Benefits have accrued also to the Pressure Area where seawater intrusion is 30 percent less than would have occurred. Benefits to the Pressure and East Side Areas have been relatively small

When Nacimiento and San Antonio dams were built, the effect of the additional water on seawater intrusion could not be predicted, and a "wait and see" attitude was adopted. Since the 2 dams have been operating, it has become clear that the Forebay Area has benefitted from essentially "full" ground water storage, but the ground water flow into the Pressure and East Side Areas has not been sufficient to stop the seawater intrusion and overdraft in these 2 areas. The remaining components of the solution proposed originally, an overland transfer of water directly to the intruded and overdrafted areas, are necessary to solve those problems.

The California Department of Water Resources recommended an effective plan for water-supply management within the Salinas Valley. That plan has been partly implemented. We recommend in the strongest terms that the transfer component be implemented immediately. Transfer of ground water from the Forebay Area to the Pressure and East Side Areas is the only feasible approach to eliminating seawater intrusion into the Pressure Area and water-level declines within the East Side Area. As recommended by the Department and others, transfers would be accomplished by extraction within the Forebay Area, conveyance of the extracted ground water to the Pressure Area, and distribution of water within the Pressure and East Side Areas.

The transfer facilities would produce minor water level declines within the Forebay Area. However, studies estimate that the solution can be accomplished by limiting the average decline to about 5 feet, and maximum localized decline to about 20 feet. The Forebay Area has enjoyed an average water-level rise of 25 feet due to operation of San Antonio and Nacimiento reservoirs. With transfer facilities, the average annual water-level rise, relative to pre-project conditions within the Forebay Area, would still be about 20 feet, seawater intrusion into the Pressure Area would be eliminated or severely curtailed, and water-level declines would be stopped within the East Side Area. With transfers, benefits would be distributed more uniformly throughout the Valley. Without transfers, the benefits would continue to be weighted toward the Forebay and Upper Valley Areas.

Nitrate

MCWRA knows enough about the nitrate problem to recommend initial steps to manage it. However, additional study is needed to understand the complex interrelationships of crop, irrigation, fertilizer, and soil management under conditions prevalent in Salinas Valley. Additional research into the plant-water-soil-nutrient relationships on specific soils in Salinas Valley will be required to maintain an acceptable salt balance and acceptable crop yields.

Critical information is not available to encourage growers to adopt best management practices for the mitigation of nitrate contamination of ground water. An intensive program must be undertaken by MCWRA to provide information on the effectiveness of practices for the management of soils for water conservation and the mitigation of nitrate contamination. Information is available to make initial steps toward developing best management practices, but additional information is critical to the long-term success of improved soils management.

Water Conservation

Some water supply benefits can probably be achieved by implementing agricultural and urban water conservation measures. In agriculture, the potential savings would be achieved by decreasing direct evaporative loss during irrigation and minimizing outflow of irrigation return flow from coastal areas to Monterey Bay, while maintaining a favorable salt balance.

On-farm management of irrigation needs to be done jointly with management of fertilizer application and salt leaching requirements. We recommend that MCWRA undertake studies to further understand these interrelated issues and develop best management practices tailored to growing conditions in Salinas Valley.

However, water conservation by itself would not be sufficient to solve the problems of seawater intrusion near the coast and overdraft in the East Side Area.

LAST WORD

The solution to the water resource problems within the Salinas Valley has been known since at least 1946. The solution that was proposed then by the California Department of Water Resources recognized that sufficient supplemental water could be developed within the basin. That proposal also recognized the need to transfer water from the Forebay Area to the Pressure and East Side Areas. The solution proposed in 1946 remains the best solution even today.

We urge the MCWRA to focus its attention on the completion of the original plan by the construction and operation of water transfer facilities. The MCWRA should avoid diverting its attention to suggested alternatives that are less viable economically or less effective technically. These less viable and less effective alternatives would not provide the same benefits as the original plan, would be more expensive, and the projected price of water would be significantly higher for all parties.

The panel believes strongly that Salinas Valley is fortunate that an in-Valley solution is available. We urge the Salinas Valley community to support the MCWRA in this effort to distribute the available water supplies for more efficient water management and lasting benefits for all residents of the Valley.

ATTACHMENT C
December 8, 2021
Brownstein Comment Letter

Brownstein

Brownstein Hyatt Farber Schreck, LLP
805.963.7000 main
1021 Anacapa Street, 2nd Floor
Santa Barbara, California 93101

December 8, 2021

Stephanie O. Hastings
Attorney at Law
805.882.1415 direct
shastings@bhfs.com

VIA E-MAIL – BOARD@SVBGSA.ORG; MEYERSD@SVBGSA.ORG; PRISO@MCWD.ORG; CITYCLERK@CI.GREENFIELD.CA.US

Board of Directors
Salinas Valley Basin Groundwater Sustainability Agency
c/o Donna Meyers
General Manager
P.O. Box 1350
Carmel Valley, CA 93924

Board of Directors
Marina Coast Water District Groundwater Sustainability Agency
c/o Paula Riso
Executive Assistant/Clerk to the Board
11 Reservation Road
Marina, CA 93933-2099

Governing Board
Arroyo Seco Groundwater Sustainability Agency
General Manager
c/o City Clerk
599 El Camino Real
Greenfield, CA 93927

RE: Groundwater Sustainability Plans for the Upper Valley, Forebay, Eastside, Langley, and Monterey Subbasins of the Salinas Valley Groundwater Basin

To the Boards of the Salinas Valley Basin Groundwater Sustainability Agencies:

On behalf of the Salinas Basin Water Alliance (*Alliance*),[1] this office submits these written comments on the Groundwater Sustainability Plans (GSP) for the Upper Valley, Forebay, Eastside, Langley, and

[1] The *Alliance* is a California nonprofit mutual benefit corporation formed to preserve the viability of agriculture and the agricultural community in the greater Salinas Valley. Alliance members include agricultural businesses and families that own and farm more than 80,000 acres within the Salinas Valley.

Monterey Subbasins of the Salinas Valley Groundwater Basin proposed for adoption by the Salinas Valley Basin Groundwater Sustainability Agency (SVBGSA), the Arroyo Seco Groundwater Sustainability Agency (ASGSA), and the Marina Coast Water District Groundwater Sustainability Agency (MCWDGSA) (collectively, the "GSAs").

Over the course of the GSPs' development, the *Alliance* has made numerous comments, including an October 15, 2021 letter (October 15 Letter) from this firm and an October 15, 2021 technical memorandum from aquilogic, Inc., detailing the GSPs' failure to comply with the Sustainable Groundwater Management Act (SGMA) and the *Alliance's* concerns with respect to the GSAs' approach to groundwater management in the Basin. The *Alliance* appreciates the SVBGSA's efforts to respond to the *Alliance*'*s* comments.[2] However, the *Alliance* hereby reiterates its prior comment that the SVBGSA should undertake additional modeling simulations to (a) analyze the impact of any projects or management actions on adjacent subbasins, *and* (b) understand how groundwater pumping impacts interbasin flows, prior to adoption of the GSPs. If the requested additional analysis cannot feasibly be accomplished prior to adoption of the GSPs and their submission to the Department of Water Resources, the Alliance implores the SVGBSA, at the time of and as a condition of adoption, to commit to undertaking the required analysis as soon as feasible. The Alliance is informed and believes that the SVGSA has the technical capacity to perform the requested simulations, that such simulations and analysis could be conducted in less than 30 days (potentially far less), and that the costs (e.g., consultant fees) would be nominal and easily incorporated into the SVGSA's budget for GSP preparation.

Until such time as this additional modeling is completed and the results are incorporated into the GSPs, the GSPs will continue to fail SGMA's requirements and will have the potential to inequitably distribute the burdens of groundwater management on pumpers within the Basin. As explained in detail in the October 15 Letter and below, these failures include, but are not limited to, the following:

1. <u>The GSPs Are Not Integrated</u>: SGMA requires the GSPs to be integrated in their planning, development, and implementation; integration ensures the objectives of SGMA are satisfied, the interests of all beneficial users throughout the Basin are considered, and the burden of sustainability is equitably allocated across the Basin. Integration is essential here as the surface water and groundwater resources within the Basin are generally interconnected. SVBGSA previously acknowledged this fact, proposing an integrated GSP to cover the entire Basin. However, the draft GSPs circulated for public comments were not integrated in any manner, containing numerous inconsistencies in their data, water budgets, and sustainable management criteria. Further, SVBGSA has now scrapped the integrated GSP in place of the development of a separate "Integrated Implementation Plan" without a guarantee that the "Implementation Plan" will address the numerous existing inconsistencies in the GSPs. In fact, the revisions to the GSPs made since submittal

[2] The SVBGSA has distributed a document reflecting responses to comments submitted on the draft GSPs. Please confirm that these responses will be included in the final GSPs and the submittal to the Department of Water Resources.

of the October 15 Letter confirm that the GSPs' inconsistencies will remain unaddressed through implementation, with the Upper Valley Subbasin GSP stating the Implementation Plan must be "consistent with" the GSPs, and deleting language suggesting projects and management actions will be considered on a Basin-wide level as opposed to a subbasin level. (See Upper Valley GSP, pp. 2-4, 9-2-3.) In other words, if the contents of the Implementation Plan are dictated by the confines of the GSPs, the Plan cannot address conflicts between the various GSPs and the GSPs will remain uncoordinated.

2. Additional Modeling Is Required: In prior comment letters,[3] the *Alliance* identified the need for additional modeling to support the GSPs. In particular, the *Alliance's* comments highlighted how the GSPs cannot adequately set sustainable management criteria and analyze impacts to adjacent subbasins without identifying the amount of Basin-wide groundwater discharge that is and has been captured by pumping. This information could be obtained by running additional model scenarios that do not include any pumping to analyze how interbasin flow responds accordingly. The *Alliance* requests the GSAs' future consideration of these analyses. However, the GSPs will remain insufficient until that time—the GSPs cannot adequately set sustainable management criteria and analyze impacts to adjacent basins and subbasins absent that information. This is especially significant as the GSPs for the Forebay and Upper Valley Subbasins fail to acknowledge that pumping in those subbasins impacts flows to the Eastside and 180/400-Foot Aquifer Subbasins in any manner.

3. The GSPs Do Not Analyze Impacts to Adjacent Subbasins: The GSPs define their water budgets and sustainable yields, and set their sustainable management criteria without consideration for impacts to adjacent subbasins. For example, in the Eastside and Langley Subbasin GSPs, the groundwater level minimum thresholds are set at or near historic lows and permit pumping depressions that reverse the natural flow of groundwater towards the 180/400-Foot Aquifer Subbasin to persist. Similarly, the Forebay and Upper Valley Subbasin GSPs erroneously conclude that the subbasins are presently sustainable,[4] and set their minimum thresholds near or, in the case of the Upper Valley GSP, below the historic lows.[5] However, the GSPs fail to include any analysis of how (a) pumping in these

---

[3] See October 15 Letter and August 12, 2021 letter re "Preliminary Comment on draft GSPs for the Eastside, Forebay, Langley, Monterey and Upper Valley Subbasins of the Salinas Valley Basin."

[4] The revisions to draft GSP reemphasize this point, claiming the GSP will be implemented to "maintain" sustainability in the subbasin as opposed to "achieve" sustainability.

[5] The SVBGSA attempts to rationalize the Upper Valley Subbasin's groundwater elevation minimum threshold in the revised GSP, claiming the threshold was set five feet below historic lows because it "would ensure a minimum 5-foot span between the minimum threshold and measurable objective to provide operational flexibility." (Upper Valley Subbasin GSP, p. 8-7.) This reasoning is flawed—the GSP is using water levels in five out of the 18 representative wells to justify an unreasonably low groundwater elevation minimum threshold especially considering Figure 8-2 shows a cumulative change of over 20 feet between the groundwater elevation measurable

subbasins impacts flows to adjacent subbasins, or (b) how implementing the sustainable management criteria, including the minimum thresholds, will impact adjacent subbasins. The October 15 Letter explains in detail how these failures create cascading faults in the GSPs.

4. The GSPs Must Be Revised to Address These Concerns: As a result of the GSPs' failures discussed above, the GSPs disproportionately allocate the burden of sustainability across the Basin and threaten to impair groundwater users' rights in and to the Basin. This approach violates SGMA and could result in projects and management actions being implemented in one subbasin as a result of groundwater management in another subbasin.

The *Alliance* appreciates the GSAs' collective efforts to implement SGMA and achieve sustainable groundwater management throughout the Basin.

Respectfully submitted,

Stephanie Osler Hastings
Christopher R. Guillen

cc: Emily Gardner, Senior Advisor / Deputy General Manager (gardnere@svbgsa.org)
Derrik Williams, Montgomery & Assoc. (dwilliams@elmontgomery.com)
Leslie Girard, Monterey County Counsel (GirardLJ@co.monterey.ca.us)

23459249.4

objective and the historic low experienced in groundwater elevations experienced in 2016. Moreover, the GSP utilizes the same standards for minimum thresholds and measurable objectives as for other sustainable management criteria (see groundwater quality).

ATTACHMENT D

December 8, 2021

aquilogic, inc. Memorandum

aquilogic, Inc.
environment ● water ● strategy

245 Fischer Avenue, Suite D-2
Costa Mesa, CA 92626
Tel. +1.714.770.8040
Web: www.aquilogic.com

December 8, 2021

MEMORANDUM

To: Board of Directors, Salinas Valley Basin Groundwater Sustainability Agency
Board of Directors, Marina Coast Water District Groundwater Sustainability Agency
Governing Board, Arroyo Seco Groundwater Sustainability Agency

From: Robert H. Abrams, PhD, PG, CHg, Principal Hydrogeologist, aquilogic, Inc.
Anthony Brown, CEO & Principal Hydrologist, aquilogic, Inc.

Subject: Comments on Groundwater Sustainability Plans for the Eastside Aquifer, Forebay Aquifer, Upper Valley Aquifer, Langley Area, and Monterey Subbasins of the Salinas Valley Groundwater Basin

Project No.: 018-09

Aquilogic, Inc. (**aquilogic**) is pleased to provide this memorandum on behalf of the Salinas Basin Water Alliance (Alliance). The curricula vitae for Mr. Brown and Dr. Abrams are provided in **Attachment A**. This memorandum transmits our comments on Salinas Valley Basin Groundwater Sustainability Agency's (SVBGSA) responses to **aquilogic**'s 10/15/2021 memorandum on the subject draft Groundwater Sustainability Plans (GSPs).

The 10/15/2021 **aquilogic** memorandum was included as an attachment to the 10/15/2021 letter from Brownstein Hyatt Farber and Schreck (Brownstein) to the SVBGSA and other parties. The SVBGSA's Comment Letter Responses table for each of the subbasins did not respond directly to the **aquilogic** memorandum. However, some of our comments were represented in the Brownstein letter, and the SVBGSA responded to several aspects of the Brownstein letter. We have yet to evaluate all of the responses from SVBGSA to the letter from Brownstein and the accompanying 10/15/21 **aquilogic** memorandum. However, at this time, we have identified the two responses below where we can provide follow-up comments in this memorandum.

Comments on SVBGSA Responses

In partial response to section II. A. of the Brownstein letter, the SVBGSA states,

> *"SVBGSA ran a no pumping scenario with the SVIHM to determine locations of surface water depletion due to pumping; however, it is a static model that does not shed light on how intersubbasin flow would have changed. It is a static dataset that reflects how reservoirs were actually operated, not how they would*

have been operated with no pumping. The Integrated Implementation Committee will consider the flow and relationship between subbasins early in 2022."

Aquilogic disagrees that the so-called "static" model cannot provide insight into the changes in inter-subbasin flows that occurred as groundwater extractions began and subsequently increased in the Salinas Valley Groundwater Basin (SVGB). The Alliance has requested an in-depth analysis of such flows (see 8/11/2021 **aquilogic** memorandum). The Alliance request is for concept development and hypothesis testing simulations, which can be accomplished with "what-if" model scenarios as proposed in the 8/11/2021 **aquilogic** memorandum (also included as Attachment C of the 10/15/2021 **aquilogic** memorandum. The request is not for a re-creation of past or hypothetical conditions. Historic reservoir releases are sufficient to conduct the simulation analyses. The questions being asked by such analyses are related to "order of magnitude" estimates of how much groundwater and surface water is captured by pumping, not a specific accounting of water budget components for a hypothetical scenario.

In partial response to section II. B. 1. a of the Brownstein letter, the SVBGSA states,

"*The boundary with the Eastside Subbasin generally represents the furthest extents of the alluvial fans, which are characterized by clays and other fine sediments. These sediments frequently act as an impediment to flow, if not fully a barrier in certain locations. Subsequently, the gradient relationship is not the only influence to groundwater flow between the 180/400-Foot and Eastside Subbasins, and needs to be considered along with all subsurface characteristics. While there is a relationship between the groundwater contours developed for the 180/400 and Eastside Subbasins, the contours themselves are not fully representative of flow between the subbasins*."

Aquilogic understands and agrees that the boundary between the Eastside Subbasin (Eastside) and the 180/400-Foot Aquifer Subbasin (180/400) represents a geological facies change from alluvial fans on the east to fluvial and marine deposits on the west. However, the draft Eastside GSP does not provide evidence, references, or analyses indicating impediments or full barriers to groundwater flow at this subbasin boundary. The SVBGSA is correct that the presence of a hydraulic gradient does not necessarily indicate groundwater flow. However, multiple previous publications state that the natural direction of groundwater flow has been reversed and groundwater from the 180/400 currently recharges the Eastside. In fact, this reversal in the natural direction of groundwater flow is acknowledged multiple times in the Eastside GSP (Eastside GSP, p. 4-35, 6-19 ["*Groundwater pumping near the city of Salinas has created a cone of depression . . . that draws in groundwater into the Eastside Subbasin from the 180/400-Foot Aquifer Subbasin, which is naturally slightly downgradient in the Salinas area*."]).

Groundwater elevation contour maps have been prepared and presented by the Monterey County Water Resources Agency (MCWRA) and the SVBGSA. Although they are regional in nature, these maps do not show perturbations in the contour lines that would be indicative of impediments or barriers to groundwater flow. Indeed, the contour lines generally show consistent magnitudes of hydraulic gradients (i.e., spacing between the contour lines) without abrupt shifts in direction. This observation is a first line of evidence. The nature of groundwater flow in the vicinity of this subbasin boundary is a data gap that should be identified as such in the Eastside GSP. In the absence of evidence, the SVBGSA should use the best available data, all of which suggest that groundwater currently flows from the 180/400 to the Eastside. Flow at and near the subbasin boundary may be at slower rates than flow in other parts of the 180/400, but no evidence or discussion one way or the other is provided in the draft Eastside GSP. Therefore, it is premature for the SVBGSA to dismiss the possibility that pumping in the Eastside may impact or exacerbate sustainability indicators in the 180/400.

Attachment A

185 San Leandro Way
San Francisco, CA 94127, USA
Mobile Tel. +1.949.939.7160
Web: www.aquilogic.com

CURRICULUM VITAE

September 2021

Anthony Brown

Principal Hydrologist

mobile: +1.949.939.7160
email: anthony.brown@aquilogic.com

Disciplines

Hydrology, Hydrogeology, Water Resources, Water Quality, Water Supply, Drinking Water Treatment, Contaminant Source Identification, Contaminant Fate and Transport, Soil and Groundwater Remediation, Environmental Liability Management, Legal and Regulatory Strategy.

Education

M.Sc. Engineering Hydrology, Imperial College London, 1989
D.I.C. Postgraduate diploma in Civil Engineering, Imperial College London, 1988
B.A. Geography, King's College London, 1985

Professional Experience

Anthony is a versatile and proficient professional with over 30 years of experience in hydrology, hydrogeology, water resources, water quality, fate and transport of contaminants, groundwater remediation, regulatory strategy, water resources evaluation, and water supply engineering.

Anthony has conducted and managed numerous groundwater resources projects, including:

- resource evaluation, development and management
- water balance, storage capacity and safe yield analysis
- water rights disputes and adjudication
- marginal groundwater development (e.g., brackish water)
- aquifer storage and recovery (ASR)
- indirect potable reuse (IPR).

He has also implemented hundreds of hazardous waste site investigations, including sites with multiple potentially responsible parties (PRPs), complex hydrogeology and fate and transport, fractured rock, multiple contaminants, and co-mingled plumes. This work has included detailed Remedial Investigation (RI) or Phase II characterization studies, groundwater flow and solute transport modeling, Preliminary Endangerment Assessments, Human Health Risk Assessments,

and remedial feasibility studies (FS), remedial system design and implementation. Anthony has been involved in the design, testing, and permitting of drinking water treatment systems for impaired (contaminated) water sources.

Anthony has provided expert services to many prominent water and environmental law firms, the Attorneys General of California, New Jersey, Pennsylvania, Maryland, Ohio, North Carolina, and Puerto Rico, several County District Attorneys, and numerous City Attorneys' Offices.

Through his work for water utilities impacted by gasoline constituents (e.g. MTBE), chlorinated solvents (e.g. PCE, TCE), solvent stabilizers (e.g. 1,4-dioxane), soil fumigants (e.g. 1,2,3-TCP), chlorofluorocarbons (e.g. Freon 11, 12 and 113), perfluorinated compounds (i.e., PFAS), the rocket propellants perchlorate and NDMA, and hexavalent chromium, arsenic and other metals, Anthony has become a recognized expert in the fate, transport, and remediation of these compounds, and the protection of source waters from contamination by such recalcitrant chemicals.

Amongst other technical areas of expertise, he has also provided expert advice related to:

- groundwater resource development
- groundwater basin management
- California Sustainable Groundwater Management Act (SGMA)
- water rights and the development of physical solutions
- groundwater discharges and the Clean Water Act
- compliance with the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) and National Contingency Plan (NCP)
- cleanup under the Resource Conservation and Recovery Act (RCRA)
- the environmental impact of oil field contaminants and their mitigation
- source identification and mitigation of bacteria and fecal contamination in coastal waters
- source identification and persistence of microplastics in coastal waters.

Through his extensive experience on "high-profile" projects, Anthony has developed an excellent working relationship with private and public sector clients, Federal, State, and local elected officials and government agency staff, the legal community, professional organizations, non-profit environmental organizations, and his colleagues in the environmental and water resources professions.

Anthony has also testified before the U.S. Senate and briefed White House staff, federal, State, and local elected officials and regulators, independent commissions, professional groups, academic institutions, and the news media (including CBS 60 Minutes, National Public Radio [NPR] and local newspapers) on groundwater issues.

Beyond his US experience, Anthony has worked on projects in the United Kingdom, Ireland, Canada, Mexico, Costa Rica, Columbia, Ecuador, Yemen, Egypt, and Nepal.

U.S. Senate Testimony and Briefings for Elected Officials

- Testimony before the U.S. Senate Committee on Environment and Public Works on "the Appropriate Role of States and the Federal Government in Protecting Groundwater", on April 18, 2018.
- Briefing for White House Officials and the Council on Environmental Quality on "the Impact of MTBE on Water Resources of the United States", in October 1997.
- Briefing for U.S. Senators Feinstein and Boxer on "MTBE Contamination of the City of Santa Monica Water Supply", in October 1997.
- Briefing for Assistant Administrators and other leadership at the US Environmental Protection Agency (EPA) on "the Impact of MTBE on Water Resources of the United States", in October 1997.
- Briefing of State Senator Sheila Kuehl, several Assembly members, leadership at the California Environmental Protection Agency (CalEPA) and State Water Resources Control Board (SWRCB) on "MTBE Contamination of the City of Santa Monica Water Supply", in 1997-1998

Anthony has also briefed the following on the impact of fuel oxygenates, chlorinated solvents, rocket propellants, metals, oil field activities, and bacteria on water quality:

- USEPA staff (Region IX)
- State Senators and Assembly Members
- State regulators
- Local officials (Mayors, council and board members, City attorneys, etc.)
- Independent Commissions
- Professional bodies (ABA, ACS, ACWA, AEHS, AGWA, NGWA, GRA, etc.)
- Academic institutions and many other organizations
- Media outlets (NPR, CBS 60 Minutes, local TV stations)

Expert Consulting and Witness Services

Anthony is a respected, credible, and highly effective expert witness. He has testified at trial on 11 occasions, including three times in Federal court. Anthony is currently scheduled to testify in another seven trials during the next 18 months. Overall, he has been retained as an expert in over 60 matters related to water rights, water resources management, and water pollution. Anthony has provided deposition testimony in 27 of these matters and these depositions have lasted from one to 32 days in length.

Active:

- Retained (but not disclosed) in numerous cases (>200) related to the impact on water supplies by a group of emerging contaminants (consolidated in multi-district litigation [MDL])
- Lanier Parkway Associates vs. Hercules Chemical (Ashland) (the impact of benzene and chlorobenzene contamination from a chemical facility on an adjacent commercial property) – Superior Court of Glynn County, Georgia (expert affidavit)
- Retained (but not disclosed) by a confidential investor-owned water utility client addressing the impact of Per and polyfluorinated substances (PFAS) on water supplies in two northeastern states
- College Park East vs. Midway City Sanitary District et al (groundwater contamination by chlorinated solvents at a former dry cleaner) - US District Court, Central District of California (discovery)
- TC Rich et al vs. Shaikh et al (chlorinated solvent contamination at a former small batch chemical distributor in Los Angeles) - US District Court, Central District of California (expert report)
- Mojave Pistachios et al vs. Indian Wells Valley Groundwater Authority (IWVGA) (challenge to the Groundwater Sustainability Plan [GSP] and associated pumping fees in a groundwater basin in eastern Kern County) – California Superior Court, Kern County (discovery)
- James J. Kim vs. L. Tarnol et al (chlorinated solvent contamination at a former dry cleaner in Glendale) – California Superior Court, Los Angeles County (discovery)
- City of Oxnard v. Fox Canyon Groundwater Management Agency (water rights dispute) – California Superior Court, Los Angeles County (discovery)
- City of Arcadia vs. Dow Chemical et al (1,2,3-TCP contamination of groundwater resources and water supply wells) – US District Court, Central District of California (expert report)
- Friends of Riverside Airport vs. Department of the Army et al (poly-chlorinated biphenyl [PCB] contamination of soil at a former wastewater treatment plant in Riverside, California) US District Court, Central District of California (expert report, deposition)
- Stoll vs. Ewing et al (chlorinated solvent contamination at a former dry cleaner in Pleasanton) - US District Court, Northern District of California (discovery)
- San Luis Obispo Coastkeeper et al vs. Santa Maria Valley Water Conservation District et al (dispute over surface water flows to enhance steelhead habitat in the Santa Maria River watershed, Santa Barbara County) – US District Court, Central District of California (discovery)
- Mojave Pistachios vs. Indian Wells Valley Water District (IWVWD) et al (water rights dispute in eastern Kern County between agricultural interests and public water purveyors) – California Superior Court, Kern County (discovery)
- Goleta Water District vs. Slippery Rock Ranch (water rights dispute in central California between an avocado ranch adjacent to an adjudicated groundwater basin) – California Superior Court, Santa Barbara (expert report, deposition, trial scheduled for May 2021)

- Santa Barbara Channel-keeper et al vs. City of San Buenaventura et al (adjudication of surface water and groundwater rights in the Ventura River watershed, Ventura County) – California Superior Court, Los Angeles (expert report)
- Las Posas Valley Water Rights Coalition et al vs. Fox Canyon Groundwater Management Agency et al (adjudication of groundwater rights in the Las Posas Groundwater Basin, Ventura County) – California Superior Court, Santa Barbara (expert report, deposition pending, trial scheduled for 2022)
- Black Warrior Riverkeeper et al vs. Drummond Coal (acid mine drainage from a former coal mine impacting a tributary of the Black Warrior River, Alabama) – US Federal Court, Middle District of Alabama, Birmingham (expert report, deposition, trial scheduled for October 2021)
- City of Riverside vs. Goodrich et al (perchlorate contamination of groundwater resources and water supply wells) - California Superior Court (expert declaration, deposition, further deposition pending)
- Commonwealth of Pennsylvania vs. ExxonMobil, et al (State-wide assessment of impact and damages associated with MTBE and TBA releases) – US Federal Court, Southern District of New York (expert reports)
- State of Maryland vs. ExxonMobil et al (State-wide assessment of impact and damages associated with MTBE and TBA releases in Maryland) – US Federal Court, Southern District of New York (discovery)
- Steinbeck Winery et al vs. City of Paso Robles et al (Quiet title action brought by a group of wineries against the public water agencies to adjudicate water rights) - California Superior Court, San Jose (deposition, Phase 2 and Phase 3 trial testimony, Phase 4 pending)
- Various individuals vs. San Luis Obispo County et al (Trichloroethene [TCE] contamination in groundwater and water supply wells in a community adjacent to a County-operated airport) – California Superior Court, San Luis Obispo (litigation stayed)
- Commonwealth of Puerto Rico vs. Shell Oil Co., et al (Island-wide assessment of impact and damages associated with MTBE and TBA releases in Puerto Rico) – US Federal Court, Southern District of New York (expert report, deposition, trial pending)
- City of Fresno vs. Shell Chemical et al (1,2,3-TCP contamination of groundwater resources and water supply wells) – California Superior Court (discovery)
- New Jersey Department of Environmental Protection (NJDEP) vs. Sunoco et al (State-wide assessment of impact and damages associated with MTBE and TBA releases in New Jersey) – US Federal Court, Southern District of New York (expert report, deposition, hearing testimony, trial pending)
- Orange County Water District (OCWD) vs. Sabic Innovative Plastics et al (Chlorinated solvent, 1,4-dioxane and perchlorate contamination of groundwater resources from various sites in Orange County, California) – California Superior Court, Orange County (expert report, deposition [32 days], trial testimony)

- City of Modesto vs. Vulcan Chemical et al (perchloroethylene [PCE] releases from numerous dry cleaners contaminating drinking water wells and groundwater resources) – California Superior Court, San Francisco (expert reports, deposition [25 days], trial testimony, returned by Appeals Court)

Past:

- City of Upland vs. Dow Chemical et al (1,2,3-TCP contamination of groundwater resources and water supply wells) – US District Court, Central District of California (expert report, settled)
- Borrego Water District (water rights dispute and physical solution) – California Superior Court, San Diego (stipulated adjudication)
- Charleston Waterkeeper and South Carolina Coastal Conservation League vs. Frontier Logistics (lawsuit over polyethylene nurdle pollution in and around Charleston Harbor) - US District Court, Charleston District of South Carolina (expert report, settled)
- San Miguel Electric Cooperative vs. Peeler Ranch (contamination of soil, surface water and groundwater beneath a ranch from a lignite mine and coal-fired power plant) – Texas Superior Court, 218th District (expert report, deposition, hearing testimony, settled)
- City of Hemet vs. Dow Chemical et al (1,2,3-TCP contamination of groundwater resources and water supply wells) – US Federal Court, Southern District of California (expert report, settled)
- Sierra Club et al vs. Dominion Energy (contamination of groundwater and surface water resources by coal combustion residuals [CCRs] from ash ponds) – US Federal Court, Eastern District of Virginia (deposition, trial testimony)
- Sunny Slope Water Company vs. Dow Chemical et al (1,2,3-TCP contamination of groundwater resources and water supply wells) – California Superior Court, Los Angeles County (settled)
- Greenfield et al vs. Ametek Aerospace et al (solvent contamination in groundwater beneath three mobile home parks) – US Federal Court, Southern District of California, San Diego (expert report, deposition, settled)
- Golden State Water Company vs. Dow Chemical et al (1,2,3-TCP contamination of groundwater resources and water supply wells in Nipomo and Claremont) – US Federal Court, Southern District of California (expert report, settled)
- National Association for the Advancement of Colored People (NAACP) vs. Duke Energy (coal ash contamination of groundwater, sediments, and surface waters at the Belews Creek coal-fired power plant) – US Federal Court, Middle District of North Carolina (expert report, settled)
- City of Atwater vs. Shell Chemical et al (1,2,3-TCP contamination of groundwater resources and water supply wells) – California Superior Court (expert report, deposition, trial testimony)
- State of Vermont vs. ExxonMobil et al (State-wide assessment of impact and damages associated with MTBE and TBA releases in Vermont) – US Federal Court, Southern District of New York (settled)

- Trujillo et al vs. Ametek Aerospace et al (solvent contamination in groundwater beneath an elementary school) – US Federal Court, Southern District of California, San Diego (expert report, deposition, settled)
- Roanoke River Basin Association vs. Duke Energy (coal ash contamination of groundwater, sediments, and surface waters at two coal-fired power plants: Mayo and Roxboro) – US Federal Court, Middle District of North Carolina (expert report, deposition, settled)
- OCWD vs. Unocal et al (MTBE and TBA contamination of groundwater resources from service station sites in Orange County, California) – US Federal Court, Southern District of New York (expert report, deposition, settled)
- State of North Carolina vs. Duke Energy (administrative hearing related to coal ash contamination at six power plants) – North Carolina Superior Court (settled)
- City of Clovis vs. Dow Chemical et al (1,2,3-TCP contamination of groundwater resources and water supply wells) – California Superior Court (expert report, deposition, trial testimony)
- San Juan Hills Golf Course vs. City of San Juan Capistrano et al (suit filed over groundwater pumping in the San Juan Basin) – California Superior Court, Orange County (settled)
- City of Tulare vs. Dow Chemical et al (1,2,3-TCP contamination of groundwater resources and water supply wells) – California Superior Court (settled)
- State of California vs. Columbia Casualty Company et al (perchlorate and solvent contamination at the Stringfellow Acid Waste disposal pits in Glen Avon) – California Superior Court (expert report, settled)
- City of Delano vs. Crop Production Services (CPS) et al (Nitrate contamination of water supply wells) - California Superior Court (settled)
- Laborers' International Union of North America Local Union No. 783 v. Santa Margarita Water District et al. (Review of the groundwater hydrology of the Cadiz project, San Bernardino County) - California Superior Court, Orange County (independent expert report, settled)
- Southern California Water Company vs. Aerojet General Corp. (TCE, perchlorate and NDMA contamination of drinking water supplies in Rancho Cordova, California) – California Superior Court, Sacramento District (expert report, deposition, settled)
- The City of Stockton Redevelopment Agency (RDA) vs. Conoco-Phillips et al (petroleum hydrocarbon contamination at former oil terminals) – California Superior Court (deposition, settled)
- PK Investments vs. Barry Avenue Plating (hexavalent chromium and solvent contamination of soil and groundwater) - California Superior Court, Los Angeles District (deposition, settled)
- City of Santa Monica, California vs. Shell et al (MTBE contamination of drinking water supplies) – California Superior Court, Orange County District (expert report, deposition, settled)
- State of California vs. Joint Underwriters (perchlorate and solvent contamination at the Stringfellow Acid Waste disposal pits in Glen Avon) – California Superior Court (expert report, deposition, settled)

- Community of Broad Creek, North Carolina vs. BP Amoco et al (MTBE, benzene and 1,2-DCA contamination of private water supply wells) – North Carolina Superior Court (deposition, settled)
- South Tahoe Public Utility District, California vs. ARCO et al (MTBE contamination of drinking water supplies) - California Superior Court, San Francisco (expert report, deposition, trial testimony)
- Private well owners in 18 reformulated gasoline (RFG) states vs. various oil companies (class action related to MTBE) - US Federal Court, New York District (deposition, class certification hearing)
- Individual plaintiffs vs. Lockheed Corporation (TCE and perchlorate contamination of drinking water supplies in Redlands, California) – California Superior Court, Los Angeles District (deposition, settled)
- City of Norwalk vs. Five Point U-Serve et al (1.2-DCA contamination of a municipal drinking water well) – California Superior Court (deposition, case dismissed)
- Forest City Corp. vs. Prudential Real Estate (PCE contamination of soil and groundwater) – California Superior Court, Los Angeles District (deposition, trial testimony)
- Huhtamaki vs. Ameripride (chlorinated solvent contamination at a commercial dry cleaner/ laundry facility) – California Superior Court, Sacramento District (expert report, deposition, settled)
- Consolidated Electrical Distributors (CED) vs. Hebdon Electronics et al (chlorinated solvent contamination in fractured granite) - California Superior Court, North San Diego District (expert report, deposition, trial testimony)
- Southern California Water Company vs. various parties (water rights petition and adjudication for the American River, Sacramento, California) – State Water Resources Control Board, Sacramento
- The City of Santa Monica, California vs. ExxonMobil Corporation (MTBE contamination of drinking water supplies) – California Superior Court (designated, settled, retained as consultant to both parties for remedy implementation)
- The town of Glenville, California vs. various parties (MTBE contamination of drinking water supplies in Kern County, California) - California Superior Court (designated, settled)
- Great Oaks Water Company vs. Chevron and Tosco (MTBE contamination of drinking water supplies in San Jose, California) - California Superior Court (designated, settled)
- Orange County District Attorney's Office vs. ARCO et al (Underground Storage Tank [UST] violations, and MTBE contamination of soil and groundwater) - California Superior Court (designated, settled)
- Cambria Community Services District (CCSD) vs. Chevron et al (MTBE impact to drinking water supplies) in San Luis Obispo County, California - California Superior Court (designated, settled)
- Los Osos Community Services District (CCSD) vs. Chevron et al (MTBE impact to drinking water supplies) in San Luis Obispo County, California - California Superior Court (designated, settled)

- The town of East Alton, Illinois vs. various parties (MTBE contamination of drinking water supplies) – Illinois Superior Court, Jefferson County (designated, settled)
- The City of Dinuba vs. Tosco et al (MTBE contamination of groundwater resources) - California Superior Court (expert report, settled during deposition)
- Stella Stephens vs. Bazz-Houston et al (chlorinated solvent contamination at an active metal finishing facility in Garden Grove, California) - California Superior Court (designated, settled)
- Communities for a Better Environment (CBE) vs. Chrome Crankshaft (hexavalent chromium and TCE contamination beneath a chrome plating facility and adjacent school) - California Superior Court (designated, settled)
- California Attorney General's Office vs. Unocal (Natural Resource Damage Assessment [NRDA] at a former oil field in the central coast of California) - California Superior Court (designated, settled)
- Phillips Petroleum Corporation vs. private property owner (contamination from a former oil well in Signal Hill, California) - California Superior Court (designated, settled)
- Mobil Oil Corporation vs. private property owner (contamination from a former bulk fuel plant in the Bay Delta area) – California Superior Court (designated, settled)
- Mobil Oil Corporation vs. terminal operator (contamination from a former bulk fuel plant in Monterey area) – California Superior Court (designated, settled)

General Project Experience

Anthony has acted as the Principal in Charge, Project Manager (PM), Quality Assurance (QA) Manager and/or Principal Review for the following ongoing or recently completed projects:

Current Water Resources Projects

- Review of the Effect of Releases from a Reservoir on Surface Water Flows Intended to Enhance California Steelhead Habitat, and the Potential Impact on Groundwater Recharge – City of Santa Maria, Golden State Water Company
- An Investigation of the Hydrology of Perennial Spring in the Mojave Desert, as it Relates to Potential Impact from a Groundwater Resource Development Project - Three Valleys Municipal Water District
- Consulting Support Related to the Implementation of SGMA in the Pleasant Valley and Oxnard Plain Groundwater Basins, Pleasant Valley County Water District, Guadalasca Mutual Water Company.
- Consulting Support for a Surface Water and Groundwater Rights Dispute in the Ventura River Watershed – Group of Confidential Landowners
- Support Related to a New Car Manufacturing Plant in Huntsville, Alabama, and potential impact on habitat for an endangered species of fish – Center for Biological Diversity
- Review of the Groundwater Monitoring, Management, and Mitigation Plan (GMMMP) for the Cadiz Water Conservation Project – Three Valleys Municipal Water District

- Groundwater Consulting Support to an Agricultural Business in southeast Kern County Located within a Partially Adjudicated Basin – SunSelect
- Strategic Groundwater Consulting Support to a Large Golf Resort Located in a Desert Groundwater Basin Subject to Critical Overdraft under SGMA – Rams Hill GC
- Assessment of Water Resources at Oil Fields Throughout California and the Development of Produced Waters as an Alternate Water Supply – California Resources Corporation (CRC)
- Support Related to SGMA, Possible Adjudication, and Overall Groundwater Management Strategy for a Municipality in Southern California – Confidential Municipal Client
- Consulting Support for a Groundwater Rights Adjudication in the Las Posas Groundwater Basin, Ventura County – Group of Large Landowners
- Support Related to SGMA, Salinity Management, Alternate Water Sources, and Overall Groundwater Management Strategy for a Grower in the Bay-Delta – Wonderful Orchards
- Evaluation of the Feasibility of Using Brackish Groundwater and Oilfield Produced Water as an Alternate Water Supply for a Basin in Critical Overdraft – Northwest Kern Brackish and Oilfield (BOF) Water Study Group
- Support Related to SGMA, Possible Adjudication, and Overall Groundwater Management Strategy for a Large Water District in the Central Valley – Confidential Water District Client
- Water Rights Dispute Between a Water District and an Avocado Ranch in Central California – Slippery Rock Ranch
- Evaluation of the Feasibility of Using Brackish Groundwater as an Alternate Water Supply for a Closed Desert Basin in Critical Overdraft – Indian Wells Valley Brackish Water Study Group
- Development of a Plan for an Adjudication of Water Rights in a Desert Basin and the Principles of a Groundwater Management Plan (i.e., Physical Solution) – Confidential Water District Client
- Support Related to SGMA for Water Districts on the West Side of Kern County, Including the Creation of Defined Groundwater Management Areas – Westside District Water Authority
- Support to Agricultural Interests in the "White Areas" in Madera County with Respect to the Implementation of the California Sustainable Groundwater Management ACT (SGMA) – Madera County Farm Bureau
- Evaluation of Water Supply Options, Including New Water Supply Wells, for a Major Oilfield in West Fresno County – CRC
- Development of a Water Budget for a Baseline Period, and Evaluation of Native Safe Yield, Annual Operating Safe Yield, Historical Pumping, and Conditions of Overdraft as Part of a Water Rights Dispute in the Central Coast of California – City of Paso Robles
- Design and Permitting of an Aquifer Storage and Recovery (ASR) Project for Indirect Potable Reuse (IPR) of Tertiary Treated Municipal and Industrial Wastewater – City of Fresno
- Assessment of Increased Pumping at a Data Center and the Impact on Nearby Municipal Water Supply Wells in Charleston, South Carolina – Southern Environmental Law Center (SELC)

- Litigation Support and Development of Groundwater Management Approaches as an Alternative to Compliance with the Sustainable Groundwater Management Act – Confidential Water District Client, Southern California
- Groundwater Management Support to a Very Large Agribusiness with Over 170,000 Acres of Almonds, Pistachios, Mandarins, Pomegranates, and Grapes in the San Joaquin Valley - Wonderful Orchards
- Evaluation of Groundwater Conditions and Quality, and The Degree of Hydraulic Connection Between Groundwater Basins, as Part of a Water Rights Dispute in the Central Coast of California – City of Paso Robles
- Development of a Water Supply Well Drilling Ordinance and Valuation of Water Rights for a Confidential Municipality in Southern California
- Support for a Major Agricultural Interest with Holdings in Four Separate Groundwater Basins in Relation to the Implementation of SGMA – RTS Agribusiness
- Development of a New Water Supply Well Field, Including Compliance with California Division of Drinking Water (DDW) Policy 97-005 (Impaired Source Policy), and Evaluation of Groundwater Contamination at a Nearby Aerospace Facility – City of Torrance
- Evaluation of Aquifer Characteristics and Groundwater Conditions Related to the Reinjection of Oil Field Produced Water and Development of a Strategy to Obtain an Aquifer Exemption – Confidential Oil Company
- Development of a recycled water program (including possible aquifer storage and recovery [ASR]/salt-water intrusion program) using advanced treatment of a blend of brackish groundwater and urban storm-water – City of Santa Monica
- Membership of the Technical Advisory Committee (TAC) of a Cooperative Groundwater Group that will Become a Groundwater Sustainability Agency (GSA) – Indian Wells Valley
- Evaluation of Basin Hydrogeology, Groundwater Conditions, Water Quality, and Well Production in a Riparian Coastal Basin in Southern California – City of San Juan Capistrano
- Investigation and Development of Alternate Groundwater Supplies for an Agricultural Interest with Land Holdings in an Arid California Valley – Mojave Pistachios
- Development of a 50,000 acre-foot per year (AFY) ASR Project in the Eastern Portion of a Large Agricultural Valley in Southeast California – Confidential Client
- Review of the Groundwater Hydrology of the Cadiz Project – an independent expert report prepared for Orange County Superior Court in re: Laborers' International Union of North America Local Union No. 783 v. Santa Margarita Water District et al.

Petroleum Hydrocarbons

- Assessment of the Impact of MTBE/TBA Contamination of Water Resources in the State of Vermont, Including Contamination at Release Sites, Public Water Supply Wells, and Private Domestic Wells – State of Vermont

- Evaluation of Produced Water Management Options for Two Active Oil Fields in Southern California, including Treatment and Beneficial Use - CRC
- Assessment of the Impact of MTBE/TBA Contamination of Groundwater Resources in the State of Maryland, and Development of Costs to Address the Contamination at Release Sites, Public Water Supply Wells, and Private Domestic Wells – State of Maryland
- Investigation of Petroleum Hydrocarbon Contamination Related to Releases at a Pipeline that Crosses a Large Ranch in the Central Coast of California – Twin Oaks Ranch
- Assessment of Petroleum Contamination from a Large Pipeline Release that is Discharging to Two Streams and a Wetland in Belton, South Carolina – Southern Environmental Law Center (SELC)
- Evaluation of Contamination by Petroleum Hydrocarbons from a Pipeline Release at a Large Ranch/Winery in the Central Coast of California, and Development of a Conceptual Remedial Program and Costs to Implement – Santa Margarita Ranch, California
- Assessment of the Impact of MTBE/TBA Contamination of Groundwater Resources in the State of Pennsylvania, and Development of Costs to Address the Contamination at Release Sites, Public Water Supply Wells, and Private Domestic Wells – Commonwealth of Pennsylvania
- Investigation and Remediation of MTBE/TBA and Petroleum Hydrocarbon Contamination (using surfactant enhanced product recovery) at a Maintenance Facility in Hawthorne, California – Golden State Water Company
- Assessment of the Effectiveness of Site Investigation and Remediation Activities, Investigation of Off-Site Groundwater Contamination by MTBE/TBA, and Development of Remedial Programs (and Costs) at "Bellwether" Trial Sites - Orange County Water District
- Evaluation of Contaminant Conditions and Prior Site Investigation and Remediation Activity, Implementation of Off-site Investigations, and Development of Remedial Programs and Associated Costs to Address MTBE/TBA Contamination at Trial Sites in Puerto Rico – Commonwealth of Puerto Rico
- Assessment of Site Investigation and Remediation Activities, Investigation of Off-Site Groundwater MTBE/TBA Contamination, and Development of Remedial Programs (and Costs) at Trial Sites – New Jersey Department of Environmental Protection (NJDEP)
- Environmental Impact Report (EIR) and Baseline Environmental Assessment at a Proposed Oil Field Redevelopment Project, Southern Iraq - Confidential Client
- Development of a Remediation Approach and Costs for Soil and Groundwater Contamination at Two Former Petroleum Terminals – Stockton Redevelopment Agency
- Assessment of the Nature of Contamination and the Costs to Address this Contamination at a Former Municipal Landfill in San Diego County – Confidential Client
- Evaluation of Contaminant Sources, and the Fate and Transport of MTBE, 1,2-DCA and Benzene to Numerous Private Water Supply Wells in the Community of Broad Creek, North Carolina

- Assessment of the Effectiveness of Site Investigation and Remediation Activities to Address MTBE/TBA/Benzene Contamination at ARCO and Thrifty Service Stations Throughout Orange County, California - Orange County District Attorney's Office
- Evaluation of Contaminant Sources, Fate, Transport, and Impact of MTBE and TBA to Public Water Supplies, and the Costs to Treat these Contaminants, in the town of East Alton, Illinois
- Court Appointed Consultant to Develop Site Investigation Programs for MTBE/TBA/Benzene Contamination at 35 Thrifty Service Stations in Orange County
- Impact and Mitigation of Oil Field Contaminants at the Belmont Learning Center – Los Angeles Unified School District (LAUSD) - Belmont Commission
- Investigation, PRP Identification, Remediation and Restoration of Municipal Well Fields Impacted by MTBE Contamination – City of Santa Monica (Charnock Well Field), South Lake Tahoe Public Utility District (STPUD), Santa Clara Valley Water District (SCVWD), Great Oaks Water Company
- Oversight of Oil Company Investigation and Remediation Programs in Honolulu Harbor, Hawaii – US Environmental Protection Agency (USEPA)
- Assessment of Oil Field Contaminants in Relation to High Incidences of Leukemia and non-Hodgkins Lymphoma at a High School in Southern California – Confidential Client
- Evaluation of Fuel Releases and Their Impact upon Groundwater Resources at Service Stations, Bulk Plants, Fuel Terminals and Refineries Throughout California – Confidential Client
- Complete Restoration of Municipal Water Supply Wells Contaminated with MTBE – City of Santa Monica (Arcadia Well Field) and ExxonMobil Corporation
- Preliminary Environmental Assessment (PEA) at the Hull Middle School - located on a former oil field and landfill - Torrance Unified School District (TUSD), California
- Oversight of Investigation and Remediation Activities for a MTBE Release at a Service Station and the Potential Impact on a City's Water Distribution System – City of Oxnard, California
- Investigation of MTBE Contamination of Water Supply Wells and Other Petroleum Hydrocarbon Contamination at a Marine Fueling Depot on Catalina Island – Southern California Edison
- Impact of MTBE Releases at Service Stations and a Bulk Fuel Terminal on Drinking Water Wells and Groundwater Resources - City of Dinuba, California
- Oversight of a Court-ordered MTBE/TBA Plume Delineation Program at Gasoline Service Stations in Orange County, California – OCDA, California
- Oversight and Investigation of Remediation of MTBE Contamination Impacting Drinking Water Supplies in the Towns of Cambria and Los Osos/Baywood Park, California – Cambria Community Services District (CCSD), Los Osos Community Services district (LOCSD), Cal-cities Water Company
- Assessment of the Impact of an MTBE Release on Water Supply Wells, Sewers, and a Wastewater Treatment Plant – City of Morro Bay, California

- Investigation and Remediation of an MTBE Release in the Immediate Vicinity of a Drinking Water Supply Well - City of Cerritos, California
- Assessment of the Impact of Petroleum Hydrocarbon Contamination from a Wolverine Pipeline Release in Jackson, Michigan – Private Property Owner
- Investigation of Fuel Oil LNAPL and Hexavalent Chromium Contamination at a Former Clay Products Manufacturing Facility in Fremont, California – Mission Clay Products
- Assessment of the Impact of MTBE Releases on Water Supply Wells, and Oversight of Responsible Party (RP) Investigation and Remediation Activities - Soquel Creek Water District, California
- MTBE Contamination of Private Drinking Water Supplies and Development of Water Supply Treatment and Replacement Alternatives – Glenville, California
- Assessment of the Impact of MTBE on Drinking Water Supply Wells in Santa Clara County, California – Great Oaks Water Company (GOWC)
- Assessment of Data Gaps and Research Needs Regarding MTBE Impact to Water Resources – UK Environment Agency
- Investigation and Mitigation of the Impact of Oil Field Contaminants on a Large Apartment Complex in Marina del Rey, Los Angeles, California – Confidential Client
- Investigation and Remediation of Methane and Hydrogen Sulfide as Part of the Redevelopment of a Former Oil Field in Carson, California - Dominguez Energy/Carson Companies
- Assessment of Methane and Petroleum Hydrocarbon Contamination at a Former Oil Field in Santa Fe Springs, California – General Petroleum
- Natural Resource Damage Assessment (NRDA) at the Guadalupe Oil Field, California - State of California (Department of Fish and Game [DFG], Oil Spill Prevention and Response [OSPR], Attorney General and Regional Water Quality Control Board [RWQCB])
- Assessment of the Impact of Oil Field Activities on Surface Water and Groundwater Resources in the Central Coast of California – State of California
- Groundwater Investigation and Remediation at Four Petroleum Terminals in Wilmington, Carson, and San Pedro, California - GATX
- Research into Technologies for Treatment of MTBE in Water - Association of California Water Agencies (ACWA) / Western States Petroleum Association (WSPA) / Oxygenated Fuels Association (OFA)
- Characterization and Remediation of a Hydrocarbon Release (including MTBE) from a Refined Product Pipeline in Fractured Bedrock in Illinois – Shell
- Investigation and Remediation of Petroleum Hydrocarbon Contamination Beneath a City Maintenance Yard and City Bus Yard – City of Santa Monica, California
- Investigation and Remediation of a Gasoline Release (including MTBE) in Fractured Bedrock Resulting from a Catastrophic Tank Failure – Intrawest Ski Resorts, California

- Assessment of LNAPL, Aromatic Hydrocarbon, and Chlorinated Solvent Contamination Beneath a Former Waste Disposal Facility in Santa Fe Springs, California – Confidential Client
- Investigation of Soil and Groundwater Contamination at a Fueling Facility at a Municipal Airport – City of Santa Monica, California
- Pipeline Leak Investigation and Remedial Design - Mobil Pipeline, Ft. Tejon, California
- Investigation of a Petroleum Release in Fractured Bedrock - Chevron, Julian, California
- Contribution of Multiple Sources to Groundwater Contamination – Mobil Oil Corporation, La Palma, California
- Forensic Assessment of a Gasoline Release – Mobil Oil Corporation, Santa Monica, California
- Investigation of a Diesel Fuel Release – General Petroleum, Point Hueneme, California
- Service Station Investigations and Remediation (> 60 sites) - Mobil Oil Corporation, World Oil, Los Angeles County Metropolitan Transportation Authority (LACMTA), and Others
- Assessment of a Crude Release from a Former Pipeline - Mobil Oil, Gorman, California
- Remediation of 2,000,000-gallon (7,560 m^3) LNAPL Spill - Gulf Strachan Gas Plant, Alberta

Chlorinated Solvents

- Evaluation of Groundwater Contamination at an Aerospace Facility in El Cajon, the Threat to Water Supply Wells, and Vapor Intrusion Concerns at Overlying Properties – Confidential Client
- Investigation of Groundwater Contamination and Potential Sources for TCE Contamination in Groundwater and Water Supply Wells in a Community Adjacent to a County-Operated Airport – Confidential Client
- Evaluation of Poly-Chlorinated Biphenyls (PCBs) in Storm Water and the Impact on Groundwater Resources and the Use of Treated Storm Water for Aquifer Recharge and Saline Intrusion Barriers – Confidential Municipal Clients
- Assessment of the Effectiveness of Site Investigation and Remediation Activities, Investigation of Off-Site Groundwater Contamination, and Development of Remedial Programs (and Costs) at Solvent "Source Sites" in the South Basin Groundwater Protection Project (SBGPP) - Orange County Water District
- Consulting Support to a Community Adjacent to the Santa Susana Field Laboratory (SSFL), a Facility Previously Used to Test Rockets – Bell Canyon Homeowners Association
- Investigation of Groundwater Contamination by Perfluorinated Compounds (e.g., PFOA, PFOS) and its Impact on Public Water Supplies in Southeastern North Carolina – Confidential Client
- Investigation of Chlorinated Solvent and Petroleum Hydrocarbon Contamination, and Implementation of an Extended Remediation Pilot Study, at a Small-Batch Chemical Distribution Facility in Santa Fe Springs, California – Angeles Chemical Corporation

- Evaluation of Contaminant Distribution and Fate, and Development of a Remedial Approach and Costs, for Chlorinated Solvent Contamination in Groundwater at a Light Industrial Facility in Northridge, California, – Confidential Client
- Project Management Consultant (PMC) for the Hazardous Substances Account Act (HSAA) Program (i.e., State-CERCLA) as part of the SBGPP – Orange County Water District
- Assessment of Conceptual Hydrogeology and the Sources of 1,2-DCA and PCE Contamination of a Large Public Water Supply Well – Confidential Client
- Investigation and Remediation of Chlorinated Solvent Contamination in Soil and Groundwater Beneath a Metal Finishing Facility in Inglewood, California – Bodycote Hinterliter and Joseph Collins Estate.
- Investigation and Remediation of Soil and Groundwater Contamination at a Former Wood Treating Facility – Port of Los Angeles
- Assessment of the Nature of PCE Releases from Dry Cleaning Facilities, the Impact Upon Groundwater Resources, and the Cost of Remediation – City of Modesto, California
- Investigation of Chlorinated Solvent Contamination in Soil, Groundwater and Drinking Water Supplies Beneath Various Facilities in Lodi, California – Confidential Client
- Investigation of TCE and Hexavalent Chromium Contamination at the Suva School in Montebello, California – Communities for a Better Environment
- Remediation of Chlorinated Solvents, Including Vinyl Chloride, in Soil and Groundwater Beneath a Former Aerospace Facility in West Los Angeles, California – Playa Vista Capital
- Assessment of Chlorinated Solvent and Hexavalent Chromium Contamination at an Active Metal Finishing Facility in the City of Garden Grove, California – Confidential Client
- Investigation and Remediation of Hexavalent Chromium and TCE Contamination at an Active Plating Facility in West Los Angeles – confidential client
- Contamination of Drinking Water Supplies by TCE and Perchlorate from an Aerospace Manufacturing Facility in Redlands, California – Individual Plaintiffs
- Investigation and Remediation of Hexavalent Chromium, TCE, and Gasoline LNAPL Contamination at an Active Plating Facility in Santa Fe Springs, California – Confidential Client
- Investigation and Remediation of Hexavalent Chrome and TCE Contamination at the Los Angeles Academy (formerly Jefferson) Middle School, Los Angeles, California – Jefferson Site PRP Group
- Evaluation of Groundwater and Contaminant Conditions at an Active Municipal Landfill in Los Angeles County, California – Browning Ferris Industries (BFI)
- Investigation of Chlorinated Solvent Contamination in Groundwater Beneath a Municipal Airport – City of Santa Monica, California
- Resource Conservation and Recovery Act (RCRA) Facility Assessment and Closure for a Large Aerospace Facility in Hawthorne, California – Northrop Grumman Corporation

- Characterization of Complex Hydrogeology and Contaminant Fate and Transport (with Poly-chlorinated Biphenyls [PCBs] and Chlorinated Solvents) in Karstic Bedrock at a Site on the National Priority List (NPL) in Missouri – MEW PRP Steering Committee
- Design of a Groundwater Remediation Program for Chlorinated Solvent, Perchlorate and Other Contaminants Utilizing Existing Drinking Water Wells – San Gabriel Valley Water Company (SGVWC)
- Investigation of a Chlorinated Solvent Release in Fractured Bedrock – Consolidated Electrical Distributors, San Diego, California
- Contamination of Drinking Water Supplies by TCE from an Aerospace Manufacturing Facility in Redlands, California – Individual Plaintiffs
- Investigation of a Chlorinated Solvent Release at an Active Chemical Terminal - GATX, San Pedro, California
- Technical and Regulatory Assistance, and RP Oversight and Review, Chlorinated Solvent Contamination Beneath a Former Aerospace Facility – City of Burbank, California
- Investigation and Remedial Design for a Chlorinated Solvent Release at an Active Machine Shop – Mighty USA, Los Angeles, California
- Remediation of Chlorinated Solvents in Groundwater as Part of a Rail Freight Transfer Terminal Development - Port of Los Angeles, California
- Remedial Evaluation of PCE Contamination at a Former Scientific Instruments Manufacturing Facility – Forest City, Irvine, California
- Evaluation of a Chlorinated Solvent Release at a Dry Cleaners - Los Angeles City Attorney, West Los Angeles, California
- Assessment of a Chlorinated Solvent Release from Former Dry Cleaners – DeLoretto Plaza, Santa Barbara, California
- Characterization and Remediation of LNAPL at an Active Chemical Refinery - ICI, Teeside, UK

Perchlorate

- Investigation of Regional Perchlorate Contamination of Groundwater Resources in the Central Basin of Los Angeles – Water Replenishment District of Southern California (WRD)
- Investigation of regional groundwater contamination by perchlorate in the Rialto-Colton, Bunker Hill, and North Riverside Basins, and impact to water supply wells – City of Riverside
- Assessment of the Effectiveness of Site Investigation and Remediation Activities, Investigation of Off-Site Groundwater Contamination, and Development of Remedial Programs (and Costs) at Perchlorate Release Sites in the South Basin Groundwater Protection Project (SBGPP) - Orange County Water District
- Hydrogeologic Investigation, Source Identification, Water Supply Well Impact Assessment, and Drinking Water Treatment for Perchlorate – City of Morgan Hill, California
- Evaluation of the Fate and Transport of Perchlorate and NDMA Contamination and its Impact on Water Supplies in Rancho Cordova, California – Southern California Water Company

- Hydrogeologic Investigation, Water Supply Well Impact Assessment, Regulatory Assistance, and Responsible Party (RP) Oversight for Perchlorate Contamination – City of Gilroy, California
- Regulatory and Technical Assistance, RP Oversight and Review, Water Resource Impact Assessment for Perchlorate Contamination – City of Santa Clarita, California
- Design of a Groundwater Remediation Program for Chlorinated Solvent, Perchlorate and Other Contaminants Utilizing Existing Drinking Water Wells – San Gabriel Valley Water Company (SGVWC), San Gabriel Valley Superfund Site, California
- Evaluation of the Off-site Migration of Perchlorate and TCE Contamination from a Rocket Testing Facility in Simi Hills, California – City of Calabasas, County of Los Angeles
- Investigation of Potential Perchlorate Source Sites, Source Contribution, Contaminant Pathway Assessment, and Drinking Water Treatment – Fontana Water Company, West Valley Water District, Fontana, California
- Evaluation of Previous Environmental Investigations, Contaminant Transport and Remediation Options for Perchlorate and Solvent Contamination at the Stringfellow Acid Waste Disposal Pits in Glen Avon, California – Joint Underwriters

Hexavalent Chromium

- Investigation and Remediation of Hexavalent Chrome and TCE Contamination at the Los Angeles Academy (formerly Jefferson) Middle School, Los Angeles – Jefferson Site PRP Group
- Investigation and Remediation of Hexavalent Chromium and TCE Contamination at an Active Plating Facility in West Los Angeles – Confidential Client
- Hydrogeologic Investigation of Hexavalent Chromium Contamination in the Northern Area of the Central Basin in Los Angeles County – Water Replenishment (WRD)
- Investigation of TCE and Hexavalent Chrome Contamination at the Suva School in Montebello, California – Communities for a Better Environment
- Investigation of Fuel Oil LNAPL and Hexavalent Chromium Contamination at a Former Clay Products Manufacturing Facility in Fremont, California – Mission Clay Products
- Investigation and Remediation of Hexavalent Chromium, TCE, and Gasoline LNAPL Contamination at an Active Plating Facility in Santa Fe Springs California – Confidential Client

Other Projects

- Investigation of the Source, Magnitude, Extent and Fate of Polyethylene Nurdle Pollution in and Around Charleston Harbor – Charleston Waterkeeper and South Carolina Coastal Conservation League
- Review and Critique of Proposed Coal Ash Pond Closure at the Tennessee Valley Authority (TVA) Gallatin Power Plant - SELC
- Evaluation of Surface Water and Groundwater Pollution by Boron and Other Metals and Salts Associated with Coal Ash at Georgia Power's Plant Scherer Generating Station - SELC

- Assessment of the Impact of 1,2,3-TCP Contamination from Soil Fumigant Applications on Municipal Water Supplies – City of Arcadia
- Investigation of PCB Contamination at a Former Wastewater Treatment Plant at a Former US Army Camp – City of Riverside
- Investigation of the Fate, Transport, and Persistence of 1,2,3-TCP Contamination of Groundwater and Municipal Water Supply Wells – City of Upland
- Assessment of Sediment, Surface Water, and Groundwater Contamination Associated with Coal Ash at the Belews Creek Coal-Fired Power Plants in North Carolina, and an Evaluation of Closure Options for Coal Ash Basins – NAACP
- Assessment of the Impact of 1,2,3-TCP Contamination from Soil Fumigant Applications on Municipal Water Supplies – Sunny Slope Water Company
- Investigation of Sources and Fate and Transport of 1,2,3-TCP Contamination in Groundwater and its Impact on Potable Water Supply Wells in and around the City of Claremont – Golden State Water Company
- Evaluation of disposal and/or treatment options for produced waters at three active oil fields in Kern County – California Resources Corporation
- Assessment of 1,2,3-TCP Contamination of Groundwater and Potable Water Supply Wells in the Nipomo Area of Central California – Golden State Water Company
- Evaluation of potential water resources impacts from a proposed coal ash landfill located within a flood plain near Laredo Texas – confidential ranch owner
- Investigation of the Fate, Transport, and Persistence of 1,2,3-TCP Contamination of Groundwater and Municipal Water Supply Wells – City of Hemet
- Investigation of elevated concentrations total dissolved solids (TDS) and dissolved metals in surface water and groundwater related to an active lignite mine and coal-fired power plant at a large ranch in southeast Texas – Peeler Ranch
- Assessment of soil, groundwater, and surface water contamination associated with a Former Manufactured Gas Plant (MGP) in South Carolina – Southern Environmental Law Center (SELC)
- Evaluation of Contaminated Groundwater and Surface Waters by 1,4-dioxane, Perfluorinated Compounds [PFCs], and Gen-X at a Chemical Manufacturing Facility in North Carolina – Cape Fear Riverkeeper
- Investigation of 1,2,3-TCP Contamination of Groundwater and Municipal Water Supply Wells – City of Fresno
- Evaluation of Surface Water, Sediment, and Groundwater Contamination and Assessment of Remedial Actions at a Former Manufactured Gas Plant in South Carolina – Confidential Client
- Evaluation of Flow Conditions and Water Quality in Surface Water and Groundwater at an Active Coal-Fired Power Plant in North Carolina, including Three-Dimensional Groundwater Flow and Solute Transport Modeling – Sierra Club

- Assessment of 1,2,3-TCP Contamination of Groundwater Resources and Water Supply Wells in Clovis, California, and Development of Well-head Treatment Programs and Associated Costs - City of Clovis
- Investigation of Surface Water and Groundwater Impacted by Acid Mine Drainage (AMD) from a Former Coal Mine in Alabama, Including Geophysical Mapping, Piezometer Installation, and Soil, Sediment, and Surface Water Sampling – Black Warrior Riverkeeper
- Evaluation of Groundwater and Surface Water Contamination by Coal Combustion Residuals (CCRs) from Ash Ponds at Power Generation Facilities in Eastern Virginia – Sierra Club
- Investigation of 1,2,3-TCP Contamination of Groundwater and Municipal Water Supply Wells – City of Atwater
- Evaluation of Contaminant Sources and Hydrogeologic Pathways for 1,2,3-TCP Contamination of Water Supply Wells - City of Tulare
- Identification of Potential Sources of Nitrate Contamination at a Municipal Water Supply Well – Water Replenishment District of Southern California (WRD)
- Assessment of Sediment, Surface Water, and Groundwater Contamination Associated with Coal Ash at Two Coal-Fired Power Plants in North Carolina, and an Evaluation of Closure Options for Coal Ash Basins – Roanoke River Basin Association
- Assessment of the Volume and Quality of Storm Water and Shallow Groundwater (from Dewatering) at a Large Condominium Complex, as part of a City's MS-4 Storm Water Permitting – Coronado
- Investigation of Nitrate Contamination of Groundwater Resources and Water Supply Wells in Delano, California, and Development of Well-head Treatment Programs and Associated Costs - City of Delano
- Evaluation of Contaminant Conditions and Closure Plans for Coal Ash Basins at Two Coal-Fired Power Plants in Virginia – Sierra Club
- Evaluation of Groundwater and Surface Water Contamination by CCRs from Ash Ponds at a Former Power Generation Facility in Central Virginia – Sierra Club and Potomac Riverkeeper
- Negotiation of Private Agreements Between Water Utilities and RPs – City of Santa Monica, STPUD, City of Morro Bay, SGVWC, GOWC, City of Oxnard, OCDA
- Evaluation of Power Plant Intake and Outfall Structures on Fecal Coliform Plume Dynamics and Resulting Beach Closures, Huntington Beach, California – California Energy Commission
- Investigation of Bacteria and Fecal Contamination in Groundwater Beneath the Downtown Area of Huntington Beach, California – City of Huntington Beach
- Investigation of the Source(s) and Transport of Enterococcus and Fecal Bacteria to the Near Shore Waters of Huntington Beach, California – City of Huntington Beach, County of Orange, Orange County Sanitation District (OCSD)
- Characterization and Remediation, Former Town Gas Sites - British Gas Properties, U.K.
- Aquifer Characterization, Contaminant Assessment, Slurry Wall Design and Installation, Soil Excavation and Water Treatment System Design - Port of Los Angeles, California

Professional History

aquilogic, Inc., CEO and Principal Hydrologist, 2011 to present.
exp, Executive Vice-President, Chief Business Development Officer, 2010 to 2011
WorleyParsons, Senior VP, Strategy & Development, 2006 to 2010.
Komex Environmental Ltd., Chief Executive Officer, Principal Shareholder, Director, 1999 to 2005.
Komex•H2O Science•Inc., President and Principal Hydrologist, 1992 to 1999.
Remedial Action Corporation, Project Manager and Geohydrologist, 1989 to 1992.
Lanco Engineering, Project Manager, 1985 to 1987, and 1988.
Royal Geographical Society, Kosi Hills Resource Conservation Project, Nepal: Project Director, 1983 to 1985

Teaching

Anthony has recently taught the following classes:

- Environmental Aspects of Soil Engineering and Geology - a ten-week course at the University of California, Irvine
- Site Characterization and Remediation of Environmental Pollutants - two lectures as part of the course at Imperial College London
- Methyl Tertiary Butyl Ether: Implications for European Groundwater - a one day seminar for the UK Environment Agency (UKEA)
- Successful Remediation Strategies – a two-day course for the NGWA
- Understanding Environmental Contamination in Real Estate, and one day class for the International Right-of-Way Association (IRWA)
- Project Development and the Environmental Process, a one-day class for the IRWA
- Environmental Awareness, a one-day class for the IRWA
- Regional Fuels Management Workshop, a two-day workshop for the USEPA.

Publications

In addition to his teaching experience, Anthony has prepared over 1000 written project reports, and has written, presented and published many articles regarding the following:

- The implementation of the SGMA in California
- Groundwater law in California
- The development of alternate water supplies, notably brackish groundwater
- Aquifer storage and recovery and other groundwater augmentation actions
- The Clean Water Act and groundwater contamination
- Contamination of groundwater and drinking water supplies by fuel oxygenates, chlorinated solvents, rocket propellants, PFCs, and metals
- Contaminant fate and transport in fractured or heterogeneous media
- The impact of oil field activities on the environment

- Source water assessment and protection
- Public health and toxicology
- Risk analysis and assessment
- Environmental economics
- General water resources and environmental issues

The following is a list of publications and presentations:

Brown, A., 2021. Science in the Court Room: Expert Witness Testimony in Contamination Cases. American Groundwater Trust California PFAS Webinar, March 2021.

Brown, A., 2021. Sources of 1,2,3-TCP and its Persistence in California Groundwater. American Groundwater Trust 1,2,3-TCP Webinar, February 2021.

Brown, A., 2020. Groundwater and the Clean Water Act. American Groundwater Trust California Groundwater Conference, Ontario, February 2020.

Brown, A., and T. Watson, 2020. Produced Water – A New California Resource. Produced Water Society Annual Seminar, Houston, February 2020.

Brown, A., 2019. Perspectives on the Future of the Water Business. Environmental Business International, Industry Summit, San Diego, March 2019.

Brown, A., 2019. Paso Robles – The First Jury Trial over Water Rights in California. American Groundwater Trust California Groundwater Conference, Ontario, February 2019.

Brown, A., 2018. Emerging Contaminants – Where Do They Come From? American Groundwater Trust Conference on Emerging Contaminants, Chino Basin, March 2018.

Brown, A., 2017. Contaminated Groundwater as a Resource. State Bar of California Environmental Law Conference, Yosemite, October 2017.

Stone A. and A. **Brown**, 2017 (organizers). Groundwater Law – An American Groundwater Trust Conference. UC Hastings Law School, San Francisco, May 18, 2017

Brown, A. 2016. The SGMA Cookbook – Implementing the Sustainable Groundwater Management Act. Association of California Water Agencies (ACWA), Spring Conference, Monterey, CA, April 2016.

Stone A. and A. **Brown**, 2016 (organizers). Groundwater Law – An American Groundwater Trust Conference. Loyola Law School, Los Angeles, April 26, 2016

Stone A. and A. **Brown**, 2015 (organizers). Groundwater Law – An American Groundwater Trust Conference. Doubletree San Francisco Airport, May 15, 2015

Brown, A., 2015. Challenges Implementing the California Sustainable Groundwater Management Act (SGMA). Bar Association of San Diego County, May 5, 2015.

Brown, A., 2015. Technical and Other Issues Implementing the California Sustainable Groundwater Management Act (SGMA). Ventura Association of Water Agencies, March 19, 2015.

Brown, A., 2015. Outlook for Environmental Services in the Global Energy and Resources Sectors. Environmental Business Journal, Environmental Industry Summit, San Diego, March 11-13, 2015.

Brown, A., 2015. The Effect of $50 Oil on the Environmental Services Sector. Environmental Business Journal Conference, San Diego, March 11-13, 2015.

Brown, A. 2014. Hydrology and the Law: The Role of Science in the Resolution of Legal Issues for Water Quality and Damages Issues. Law Seminars International, Santa Monica, CA. October 2014

Stone A. and A. **Brown**, 2014 (organizers). Groundwater Law – An American Groundwater Trust Conference. Marriott Marina del Rey, May 20-21, 2014

Brown, A. 2014. Environmental Issues with Hydraulic Fracturing. Los Angeles County Bar Association (LACBA), Spring Symposium, Los Angeles, CA. April 2014.

Brown, A. 2014. Environmental Services in the Global Energy & Resources Sectors. Environmental Business Journal, Environmental Industry Summit, San Diego, March 2014.

Brown, A. 2013. Dealing with Emerging Groundwater Contaminants. Association of California Water Agencies (ACWA), Fall Conference, Los Angeles, November 2013.

Brown, A., 2013. Outlook for Environmental Services in the Global Energy and Resources Sectors. Environmental Business Journal, Environmental Industry Summit, San Diego, March 2013.

Brown, A., Colopy, J, and Johnson, T, 2007. Groundwater Science in the Courtroom: Observations from the Expert Witness Chair. Groundwater Resource Association of California (GRAC), Groundwater Law Conference, San Francisco, June 2007.

Brown, A. 2005. Emerging Water Contaminants. California Special Districts Association (CSDA), Annual Conference, Palm Springs, May 2005.

Brown, A. 2005. The Interplay of Science and Policy at Contaminated Sites. Los Angeles County Bar Association (LACBA), Spring Symposium, Los Angeles, CA. April 2005.

Brown, A., M. Trudell, G. Steensma, and J. Dottridge, 2005. European Experiences with Artificial Aquifer Recharge. Groundwater Resource Association of California (GRAC), Aquifer Storage Conference, Sacramento, March 2005.

Brown, A. 2004. Viagra, Estrogen, Prozac, and Other Emerging Contaminants: have you checked your groundwater lately? American Groundwater Trust (AGWT), Legal Issues Conference, Los Angeles, November 2004.

Brown, A. 2004. The Use of Groundwater Models in Complex Litigation. American Groundwater Trust (AGWT), Groundwater Models in the Courtroom Symposium, May 2004.

Brown, A. 2004. Emerging Groundwater Contaminants: MTBE as a Case Study. Association of California Water Agencies (ACWA), Spring Conference, Los Angeles, May 2004.

Rohrer, J., A. **Brown**, S. Ross, 2004. MTBE and Perchlorate, Lessons Learned from Recent Groundwater Contaminants. California Special Districts Association (CSDA), Annual Conference, Palm Springs, May 2004.

Hagemann, M., A. **Brown**, and J. Klein, 2002. An Estimate of Costs to Address MTBE Releases from Underground Storage Tanks and to Treat Drinking Water Supplies Impacted by MTBE. NGWA, Conference on MTBE: Assessment, Remediation, and Public Policy, Orange, CA. June 2002

Hagemann, M., A. **Brown**, and J. Klein, 2002. From Tank to Tap: A Chronology of MTBE in Groundwater. NGWA, Conference on Litigation Ethics, and Public Awareness, Washington, D.C., August 2002

Major, W., A. **Brown**, S. Roberts, L. Paprocki, and A. Jones, 2001. The Effects of Leaking Sanitary Sewer Infrastructure on Groundwater and Near Shore Ocean Water Quality in Huntington Beach, California. California Shore and Beach Preservation Association and California Coastal Coalition – Restoring the Beach: Science, Policy and Funding Conference. San Diego, California, November 8-10, 2001.

Ross, S.D., A. Gray, and A. **Brown,** 2001. Remediation of Ether Oxygenates at Drinking Water Supplies and Release Sites. Can-Am 6th Annual Conference of National Groundwater Association Banff, Alberta, Canada. July 2001.

Gray, A.L. and A. **Brown**, 2000. The Fate, Transport, and Remediation of Tertiary-Butyl-Alcohol (TBA) in Ground Water. Proceedings of the NGWA/API 2000 Petroleum Hydrocarbons and Organic Chemicals in Groundwater: Prevention, Detection, and Remediation. Anaheim, November 14-17, 2000.

Hardisty, P.E., J. Dottridge and A. **Brown**, 2000. MTBE in Ground Water in the United Kingdom and Europe. Proceedings of the NGWA/API 2000 Petroleum Hydrocarbons and Organic Chemicals in Groundwater: Prevention, Detection, and Remediation. Anaheim, November 14-17, 2000.

Brown, A., B. Eisen, W. Major, and A. Zawadzki, 2000. Geophysical, Hydrogeological and Sediment Investigations of Bacterial Contamination in Huntington Beach, California. California Shore and Beach Preservation Association – Preserving Coastal Environments Conference. Monterey, California, November 2-4, 2000.

Hardisty, P.E., G.M. Hall, A. **Brown** and H.S. Wheater, 2000. Natural Attenuation of MTBE in Fractured Media. 2nd National Conference on Natural Attenuation in Contaminated Land and Groundwater. Sheffield, U.K., June 2000.

Brown, A., 2000. Treatment of Drinking Water Impacted with MTBE. Mealey's MTBE Conference. Marina del Rey, California. May 11-12, 2000.

Brown, A., 2000. Other Fuel Oxygenates in Groundwater. Mealey's MTBE Conference. Marina del Rey, California. May 11-12, 2000.

Brown, A., 2000. The Fate, Transport and Remediation of TBA in Groundwater. Mealey's MTBE Conference. Marina del Rey, California. May 11-12, 2000.

Brown, A., 2000. MTBE Contamination of the City of Santa Monica Water Supply: Recap. Mealey's MTBE Conference. Marina del Rey, California. May 11-12, 2000.

Mooder, R.B., M.D. Trudell, and A. **Brown**, 2000. A Theoretical Analysis of MTBE Leaching from Reformulated Gasoline in Contact with Groundwater. American Chemical Society, Div. of Environmental Chemistry, 219th ACS National Meeting. San Francisco, March 26-30, 2000.

Trudell, M.R., K.D. Mitchell, R.B. Mooder, and A. **Brown**, 2000. Modeling MTBE Transport for Evaluation of Migration Pathways in Groundwater. American Chemical Society, Div. of Environmental Chemistry, 219th ACS National Meeting. San Francisco, March 26-30, 2000.

Brown, A., 1999. How LUST Policy Led to the Current MTBE Problem. Submitted for the Government Conference on the Environment. Anaheim, CA. August 1999.

Trudell, M.R., K.D. Mitchell, R.B. Mooder and, A. **Brown**, 1999. Modeling MTBE transport for evaluation of migration pathway scenarios. In proceedings, 6th International Petroleum Environmental Conference, Houston TX, November 16-19, 1999. Integrated Petroleum Environmental Consortium, University of Tulsa, OK.

Gray, A.L., A. **Brown**, R.A. Rodriguez, 1999. Treatment of a Groundwater Impacted with MTBE By-Products**.** In proceedings, 6th International Petroleum Environmental Conference, Houston TX, November 16-19, 1999. Integrated Petroleum Environmental Consortium, University of Tulsa, OK.

Gray, A.L., A. **Brown**, M.M. Nainan, and R.A. Rodriguez, 1999. Restoring a Public Drinking Water Supply Contaminated with MTBE. In proceedings, 6th International Petroleum Environmental Conference, Houston TX, November 16-19, 1999. Integrated Petroleum Environmental Consortium, University of Tulsa, OK.

Ausburn M.P., A. **Brown**, D. A. Reid, and S.D. Ross, 1999. Environmental Aspects of Crude Oil Releases to the Subsurface. In proceedings, 6th International Petroleum Environmental Conference, Houston TX, November 16-19, 1999. Integrated Petroleum Environmental Consortium, University of Tulsa, OK.

Hardisty, P.E., A. **Brown**, and H. Wheater, 1999. Using Economic Analysis to Support Remedial Goal Setting and Remediation Technology Selection. In proceedings, 6th International Petroleum Environmental Conference, Houston TX, November 16-19, 1999. Integrated Petroleum Environmental Consortium, University of Tulsa, OK.

Brown, A., and J.J. Clark, 1999. MTBE: Air Today, Gone Tomorrow! California Environmental Law and Remediation Reporter. Argent Communications Group. Foresthill, CA. Volume 9 (2): pp 21 - 30.

Brown, A., P.E. Hardisty, and H. Wheater, 1999. The Impact of Fuel Oxygenates on Water Resources. A one-day course for the UK Environment Agency. London, UK. June 1999

Brown, A., K.D. Mitchell, C. Mendoza and M.R. Trudell, 1999. Modeling MTBE transport and remediation strategies for contaminated municipal wells. Battelle In-Situ and On-Site Bioremediation, Fifth International Symposium, San Diego, CA. April 19-22, 1999.

Brown, A., 1999. LUST Policy and Its Part in the MTBE Problem. USEPA National Underground Storage Tank Conference. Daytona Beach, FL. March 15-17, 1999.

Brown, A., T.E. Browne, and R.A. Rodriguez, 1999. Restoration Program for MTBE Contamination of the City of Santa Monica Arcadia Well Field. Ninth Annual Conference on Soil and Groundwater Contamination, Oxnard, CA. March 1999.

Brown, A., 1999. Moderator of a Panel Session - Judging Oil Spill Response Performance: The Challenge of Competing Perspectives. International Oil Spill Conference. Seattle, WA. March 8-11, 1999.

Brown, A., 1999. MTBE: Asleep at the Wheel! Editorial in the Newsletter of the Los Angeles County Bar Association, Environmental Section. February 1999.

Brown, A., J.S. Devinny, T.E. Browne and R.A. Rodriguez, 1998. Restoration of a Public Drinking Water Supply Impacted by Methyl *tertiary* Butyl Ether (MTBE) Contamination. Proceedings of the NGWA/API 1998 Petroleum Hydrocarbons and Organic Chemicals in Groundwater: Prevention, Detection, and Remediation, November 11-13, 1998, Houston, TX.

Brown, A., 1998. Petroleum and the Environment: A Consultants Perspective. USEPA Regional Fuels Management Workshop, November 3-4, 1998, Shell Beach, CA.

Brown, A., 1998. How Much Does Remediation Really Cost? Presented at the Southern California Chapter of the Appraisal Institute, Summer Seminar Spectacular: Damages, Diminution and Mitigation. Anaheim, California, August 13, 1998.

Brown, A., J.S. Devinny, A.L. Gray and R.A. Rodriguez, 1998. A Review of Potential Technologies for the Remediation of Methyl *tertiary* Butyl Ether (MTBE) In Groundwater. International Petroleum and the Environment Conference, Albuquerque, NM. October 1998.

Brown, A., A.L. Gray, and T.E. Browne, 1998. Remediation of MTBE at Leaking Underground Storage Tank (LUST) Sites. The UST Clean-up Fund Conference, Austin, TX. June 22, 1998.

Brown, A., J.R.C. Farrow, R.A. Rodriguez, and B.J. Johnson, 1998. Methyl *tertiary* Butyl Ether (MTBE) Contamination of the City of Santa Monica Drinking Water Supply: An Update. Proceedings of the National Ground Water Association (NGWA) Southwest Focused Conference: MTBE and Perchlorate, June 3-5, 1998, Anaheim, California.

Patterson, G, B. Groveman, J. Lawrence, and **A. Brown**, 1998. The Legal Implications, Claims, and Courses of Action for Water Purveyors Impacted by MTBE and Perchlorate. Proceedings of the NGWA Southwest Focused Ground Water Conference: Discussing the Issue of MTBE and Perchlorate in Ground Water. June 3-4, 1998, Anaheim, California.

Clark, J.J., **A. Brown**, and R.A. Rodriguez, 1998. The Public Health Implications of MTBE and Perchlorate in Water: Risk Management Decisions for Water Purveyors. Proceedings of the NGWA Southwest Focused Ground Water Conference: Discussing the Issue of MTBE and Perchlorate in Ground Water. June 3-4, 1998, Anaheim, California.

Brown, A., J.S. Devinny, M.K. Davis, T.E. Browne, and R.A. Rodriguez, 1997. A Review of Potential Technologies for the Treatment of Methyl *tertiary* Butyl Ether (MTBE) in Drinking Water. Proceedings of the NGWA/API 1997 Petroleum Hydrocarbons and Organic Chemicals in Groundwater: Prevention, Detection, and Remediation, November 12-14, 1997, Houston, TX.

Brown, A., J.R.C. Farrow, R.A. Rodriguez, B.J. Johnson and A.J. Bellomo, 1997. Methyl *tertiary* Butyl Ether (MTBE) Contamination of the City of Santa Monica Drinking Water Supply.

Proceedings of the National Groundwater (NGWA) and American Petroleum Institute (API) 1997 Petroleum Hydrocarbons and Organic Chemicals in Groundwater: Prevention, Detection, and Remediation, November 12-14, 1996, Houston, Texas.

Brown, A., J.S. Devinny, M.K. Davis, T.E. Browne, and R.A. Rodriguez, 1997. A Review of Treatment Technologies for Methyl *tertiary* Butyl Ether (MTBE) in Drinking Water. Proceedings of the American Chemical Society (ACS) Conference on Chemistry and Spectroscopy, October 1997, Irvine, California.

Brown, A., J.S. Devinny, T.E. Browne and D. Chitwood, 1997. A Review of Alternative Technologies for the Removal of MTBE from Drinking Water. Association of California Water Agencies (ACWA) Workshop on MTBE, March 13, 1997, Ontario Airport Hilton, California.

Brown, A., 1997. Methyl tertiary Butyl Ether (MTBE) in Groundwater and its Impact on the City of Santa Monica Drinking Water Supply. California Groundwater Resource Association (GRA), January 22, 1997, Wyndham Garden Hotel, Costa Mesa, California.

Gray, A.L., **A. Brown**, B.J. Moore, and T.E. Browne, 1996. Respiration Testing for Bioventing and Biosparging Remediation of Petroleum Contaminated Soil and Groundwater. NGWA Outdoor Action Conference, Las Vegas, NV, May 1996.

Brown, A., and P.E. Hardisty, 1996. Use of Technical and Economic Analyses for Optimizing Technology Selection and Remedial Design: Examples from Hydrocarbon Contaminated Sites. Sixth West Coast Conference on Contaminated Soils and Groundwater, AEHS, March 1996.

Farrow, J.R.C., **A. Brown**, W. Burgess, R.E. Payne, 1995. High Vacuum Soil Vapor Extraction as a Means of Enhancing Contaminant Mass Recovery from Groundwater Zones of Low Transmissivity. Accepted for Proceedings of the Petroleum Hydrocarbons and Organic Chemicals in Groundwater, API/NGWA Conference. Houston, TX. November 1995.

Ausburn, M.P., **A. Brown**, M. Brewster, and P. Caloz, 1995. Use of Borehole Terrain Conductivity Logging to Delineate Multiple Ground Water Bearing Zones and Map Alluvial Fan Facies. California Groundwater Resource Association (GRA), Annual Conference, November 1995, Costa Mesa, California.

Hardisty, P.E., S.D. Ross, F.B. Claridge and **A. Brown**, 1995. Technical and Economic Analysis of Remedial Techniques for LNAPL in Fractured Rock. International Association of Hydrogeologists (IAH), October 1995, Solutions 95 Conference, Calgary, Canada.

Croft, R.G., **A. Brown**, P. Johnson, and J. Armstrong, 1994. Tracer Gas Use in Soil Vapor Extraction and Air Sparge Pilot Tests: Case Studies. HMRCI Superfund XV Conf. Proceedings, Washington D.C, November 1994.

Bauman, P.B., M. Brewster and **A. Brown**, 1994. Borehole Logging as an Aid to Hydrogeologic Characterization of Leaking Underground Storage Tank (LUST) Sites. Proceedings from the National Groundwater Association (NGWA), 8th National Outdoor Action Conference and Exposition, Minneapolis, Minnesota. May 1994.

Bauman, P.B., **A. Brown,** M. Brewster, and M. Lockhart, 1994. The use of Borehole Geophysics in the Characterization of Both Vadose and Saturated Zone Lithologies at LUST Sites.

Proceedings from the USEPA Technology Transfer at LUST Sites Conference, Urbana, Illinois. May 1994.

Bauman, P.B., J. Sallomy, **A. Brown** and M. Brewster, 1994. Unconventional Applications of Terrain Conductivity Logging to Groundwater Investigations. Proceedings of the Symposium on the Application of Geophysics at Environmental and Engineering Projects (SAGEEP), Boston, Massachusetts, 1994.

Brown, A., R.E. Payne, and P. Perlwitz, 1993. Air Sparge Pilot Testing at a Site Contaminated with Gasoline. Proceedings of the Petroleum Hydrocarbons and Organic Chemicals in Groundwater: Prevention, Detection, and Restoration. API/NGWA Conference, Houston, Texas. November 1993.

Brown, A., 1991. Air Permeability Testing for Vapor Extraction. Conference Proceedings; Petroleum Hydrocarbon Contaminated Soil, San Diego, California. March 1991.

Wheater, H., B. Beck, **A. Brown,** and S. Langan, 1991. The Hydrological Response of the Allt a' Mharcaidh Catchment, Inferences from Experimental Plots. Journal of Hydrology, Vol. 123; pp 163-1990.

Brown, A., 1986. The Final Report of the Kosi Hills Resource Conservation Project, Nepal 1984. Royal Geographical Society Student Expedition.

aquilogic, Inc.
environment • water • strategy

245 Fischer Avenue, Suite D-2
Costa Mesa, CA 92626, USA
Tel. +1.714.770.8040
Web: www.aquilogic.com

CURRICULUM VITAE

October 2021

Robert H. Abrams, PhD, PG, CHg

Principal Hydrogeologist

mobile: +1.650.743.0594
email: bob.abrams@aquilogic.com

Disciplines

Hydrogeology, Water Resources, Geology, Geostatistics, Analytical and Numerical Modeling, Water Quality, Groundwater and Vadose Zone Fluid Flow, Contaminant Fate and Transport.

Education

Ph.D. Hydrogeology, Stanford University, 1999
M.S. Hydrogeology, Stanford University, 1996
B.S. Geology, San Francisco University, 1991

Professional Registrations

Professional Geologist, CA (No. 8703)
Certified Hydrogeologist, CA (No. 931)
Licensed Geologist, North Carolina (No. 2639)

Professional Experience

Bob has over 20 years of professional experience in groundwater resource development, groundwater sustainability, groundwater banking, groundwater quality, and model design and evaluation. He has worked for the California Geological Survey, the U.S. Geological Survey, Stanford University, San Francisco State University, consulting firms, and as an independent consultant for public and private clients. Recent projects have included vadose zone characterization and modeling, evaluation of subsidence investigations, developing and reviewing integrated groundwater/surface water hydrologic models that include simulation of current and future land-use-based water demand and the impact of climate change, and preparation of Groundwater Sustainability Plans.

Project Experience

Summary of California Central Coast Projects

- Currently serving on the Seawater Intrusion Working Group (SWIG) and SWIG Technical Advisory Committee (TAC). Theses groups are tasked with evaluating and recommending

approaches for mitigating seawater intrusion in the 180/400-Foot Aquifer Subbasin – *Salinas Basin Groundwater Sustainability Agency, Carmel Valley, California, representing the Salinas Basin Water Alliance*.

- Currently serving on a Drought Technical Advisory Committee (TAC) charged with developing standards and guiding principles for determining release schedules and operations of Nacimiento and San Antonio reservoirs during multiyear droughts. The TAC is also charged with developing the release schedules during such droughts – *Monterey County Water Resources Agency, Salinas, California, representing Grower-Shipper Association of Central California.*
- Invited to participate in the Deep Aquifer Roundtable, a formal meeting attended by Salinas Valley hydrogeology experts to discuss approaches to monitoring and protecting the deepest portions of the Salinas Valley aquifer system – *Monterey County Water Resources Agency, Salinas, California*.
- Served on the Technical Advisory Committee for the development of the Salinas Valley Integrated Hydrologic Model, a new MODFLOW model constructed by Monterey County and the U.S. Geological Survey – *Monterey County Water Resources Agency, Salinas, California representing Grower-Shipper Association of Central California*.
- Well efficiency test results for multiple years and multiple wells were evaluated for a Salinas Valley grower and food processor. Quantitative and statistical analyses were used to assess well performance and make recommendations for potential well maintenance and repair activities – *Nunes Vegetables, Salinas, California*.
- The factors influencing nitrate concentrations in well-water from approximately 60 wells on 40 ranches were determined and an enhanced groundwater monitoring program was developed. Diverse and complex data sets were analyzed statistically and qualitatively to understand the geologic, hydrologic, and anthropogenic factors that variably influence well-water concentrations over short- and long-term timeframes. Specific recommendations for wellhead protection were also developed – *Costa Farms, Analysis of Observed Nitrate Concentration Trends in Irrigation Wells, Soledad, California*.
- Published reports and data from international and national seawater intrusion mitigation efforts were reviewed and analyzed. The analysis was to assess the feasibility, level of effort required, volumes of water necessary, and costs of implementation in the Salinas Valley of a seawater intrusion injection barrier using recycled water. Ongoing injection barrier projects in Orange County and L.A. County were selected for in-depth review to evaluate the feasibility of a similar project in Monterey County – *Tanimura & Antle, Salinas, California*.
- Publicly available groundwater quality data from a set of regularly sampled water-supply wells were evaluated statistically to develop an alternative to installation of new monitoring wells for a land application area that received wastewater from a food processing plant. The effort was driven by a Central Coast Regional Water Quality Control Board order requiring client to participate in the General Waste Discharge Requirements (WDRs) for Fruit and Vegetable

Processors, which has stricter monitoring requirements than the previous individual WDRs – *Dole Fresh Vegetables, Salinas, California*.

- Evaluated (with SEAWAT) the degree to which irrigation wells were drawing seawater inland and if groundwater withdrawals contributed to anoxic conditions in certain reaches of a river hydraulically connected to the aquifer – *El Sur Ranch, Seawater Intrusion and Impact of Irrigation Wells, Monterey County, California*.
- Monte Carlo hydraulic gradient analysis and stochastic 1D and 2D solute transport simulations (analytical solutions) were conducted based on regional groundwater maps and 13 years of monthly groundwater levels from dozens of production wells to determine the most likely MTBE source areas. A customized GIS framework was developed to evaluate source-area probability. Accepted by the Central Coast Regional Water Quality Control Board – *Monterey County Water Resources Agency, Salinas MTBE Investigation, Salinas, California.*
- Conducted a technical evaluation and provided detailed comments regarding the hydrologic analysis undertaken for the draft environmental impact report/environmental impact statement for the proposed Monterey Peninsula Water Supply Project (MPWSP) - *Third-Party Evaluation of Hydrologic Analysis Conducted for Monterey Peninsula Water Supply Project, City of Marina, California*.

Summary of Selected Recent Projects

- Designed and wrote custom computer programs to construct and test a facsimile of the USGS Central Valley Hydrologic Model (CVHM) that runs in Groundwater Vistas (GV), a graphical user interface. The computer programs generated input data for the facsimile model from CVHM MODFLOW packages that are not supported by GV. The facsimile model produces results that are nearly identical to CVHM – *Confidential Client*.
- Combined vadose-zone flow and transport modeling, groundwater flow modeling, and particle-tracking simulations to estimate the persistence of dissolved 1,2,3-trichloropropane in the subsurface. Multiple application areas were characterized using lithologic logs and water flux out of the root zone taken from C2VSimFG Beta. Custom computer programs were written to determine arrival time at a declining water table. MODFLOW and MODPATH were used to estimate travel time from the water table to receptor water-supply wells. Four regions in California (one in Central Valley, three in Southern California) were successfully analyzed with this methodology (settlements and jury awards). For the Central Valley region, the CVHM facsimile model (described above) was used – *Confidential Clients*.
- Co-wrote the Chapter Groundwater Sustainability Plan for the Westside Water Authority in Kern County. Extremely sparse data and modeling results from C2VSimFG-Kern were used to estimate current and future water budgets and groundwater availability – *Westside Water Authority*.

- Conducted environmental impact assessment simulations using the CVHM facsimile model described above to evaluate drawdown and subsidence caused by a proposed brackish groundwater water treatment project in Kern County – *Westside Water Authority*.
- Critically evaluated subsidence estimates along the Tule Subbasin portion of the Friant-Kern Canal (FKC) by reviewing historical USGS reports, InSAR data, geomechanical modeling, and the Tule Subbasin Groundwater Flow Model. This evaluation indicated that responsibility for FKC subsidence should be shared across the subbasin and not focused primarily on the Eastern Tule Groundwater Sustainability Agency – *Confidential Client*.
- Critically evaluated groundwater flow and solute transport models for three coal ash disposal sites in North Carolina. Primary questions included if the models simulated flow and transport properly and sufficiently to allow the sites' owner to claim no offsite groundwater quality impacts above water quality standards – *Southern Environmental Law Center*.
- Developed a new IWFM groundwater-surface water model, based on the Central-Valley-wide C2VSim model, for Stanislaus County to assess impacts in terms of foreseeable land-use changes and installation of new wells – *Stanislaus County, Regional Groundwater-Surface Water Model for PEIR, Modesto, California.*
- Assist Stanislaus County with evaluation of new major well permit applications based on a then-recently passed groundwater ordinance requiring evaluation under CEQA for potential pumping-induced impacts to the groundwater basin, such as lowered water levels in existing wells, land subsidence, and significant groundwater or surface water depletion – *Stanislaus County, Well Permit CEQA Analysis, Modesto, California*.

Summary of Other Selected Water Supply Projects

- Two local-scale groundwater flow (MODFLOW) and solute transport models (MT3DMS) were developed for two sub-regions of the USGS regional Antelope Valley MODFLOW model to evaluate the performance of a new groundwater bank. Updated geologic characterization was based on recent investigations by the USGS and sparse well logs. Groundwater bank performance was evaluated with respect to water quantity and quality for various operational strategies, including well placement and infiltration schedules – *Antelope Valley-East Kern Water Agency (AVEK), Groundwater Banking and Blending Study, Palmdale, California.*
- Developed and calibrated three-dimensional, groundwater flow (MODFLOW) and solute transport models (MT3DMS) to assess water sources for a new 20 MGD water treatment plant. A detailed geologic model was developed for this project to assess the extent of the deep target aquifer, evaluate the risk from a heavy industrial area, well locations, long-term performance, define the wellhead protection area, and optimize wellfield performance – *City of Longview, Design and Construction of a New Groundwater Source and Treatment Facility, Longview, Washington.*
- Pilot study to evaluate the feasibility of compressed air energy storage of renewable energy. Developed and implemented three-dimensional groundwater flow models (MODFLOW) to

evaluate the impact on nearby wells of compressed air injection into a depleted natural-gas reservoir – *Pacific Gas and Electric (subcontractor to Jacobson James and Associates), Compressed Air Energy Storage Pilot Project, San Joaquin County, California.*

- Developed hydrostratigraphic model of the Mesquite Lake groundwater subbasin as interpreted from existing well logs and USGS studies that had been performed to the west and north. The hydrostratigraphic model was used as input to a three-dimensional, transient groundwater flow model (MODFLOW) that assessed the volume of water available for a new municipal water treatment plant – *Twentynine Palms Water District, Groundwater Study for the Mesquite Lake Subbasin, Twentynine Palms, California.*
- Developed a calibrated two-dimensional, steady-state analytical groundwater flow model for the Rialto-Colton Basin. The calibrated model was used to delineate source areas for two impacted production wells for a CDPH 97-005 permit application – *West Valley Water District, Wellhead Treatment Project, Rialto, California.*
- Analyzed the results of aquifer tests of multiple water supply wells completed in a fractured-rock aquifer – *Lake Don Pedro Community Services District, California (subcontractor to SGI The Source Group)*.
- Analyzed the results of a complex aquifer-test dataset to determine aquifer properties and assess groundwater availability. Characterized groundwater quality and assessed regional impact of developing a new water supply – *Silver Oak Cellars (subcontractor to Taber Consultants), Aquifer Test Analysis and Groundwater Availability Study, Sonoma County, California.*
- A well and a spring were evaluated in terms of water quality, influence of surface water, source area, and zone of influence for a license application to operate a new private water supply – *Buster's on the Mountain (subcontractor to Taber Consultants), Hydrogeology Report for New Private Water Supply, Napa County, California*.
- Groundwater flow modeling, aquifer test results, and qualitative hydrogeological analyses were reviewed and critiqued for accuracy and completeness to assess the feasibility of a gravel mining operation adjacent to the upper reaches of a major river in Los Angeles and Ventura counties. The assessment formed the basis for communications with the State Water Resources Control Board regarding appropriative water rights. In the second phase of the project, a new MODFLOW model was developed to assess groundwater-surface water interactions – *Confidential Client (subcontractor to Todd Engineers), Groundwater Pumping Impacts on Streamflow, Los Angeles County, California.*
- Developed complex geologic model in the fold-thrust terrane of the Las Posas Basin in eastern Ventura County. The geologic model formed the foundation for preliminary wellfield design and estimation of available groundwater for desalter operations in a strictly managed aquifer – *Calleguas Municipal Water District, Somis Desalter Feasibility Study, Las Posas Basin, Ventura County, California*.

- Evaluated geologic, hydrologic, and hydrogeologic data to assess the suitability for establishing a groundwater banking operation. Provided recommendations on further field-based and modeling studies deemed necessary to address data and knowledge gaps – *Los Angeles Department of Water and Power, Evaluation of Proposed Water Storage/Transfer Potential in Fremont Valley Basin, Fremont Valley, California.*
- Evaluated the groundwater component of an existing water-budget model. Implemented changes to include the effects on water levels from climate and distant municipal pumping in deeper parts of the aquifer. The improvements facilitated the development and simulation of future "what-if" scenarios used to design an engineered wetland that used stormwater runoff and groundwater pumping to maintain lake levels – *San Francisco Public Utilities Commission, Lake Merced Water-Budget Model, San Francisco, California.*

Summary of Other Selected Water Quality Projects

- Developed three-dimensional, variably saturated flow and reactive transport models (MODFLOW-SURFACT) to assess the groundwater impact from arsenic and boron in recharged partially treated oilfield produced water. Transport through the unsaturated and saturated zones related to groundwater banking operations were simulated. Regulatory approval was granted by the Central Valley Regional Water Quality Control Board – *Cawelo Water District, Groundwater Banking Waste Discharge Requirements Support, Central Valley, California*.
- A calibrated transient three-dimensional model (MODFLOW and MT3DMS) of groundwater flow and solute transport was developed, calibrated, evaluated, to compare estimated timeframes to achieve RAOs for three alternatives. Site data were used to characterize the subsurface and estimate land application rates and water quality of applied water. Regulatory approval was granted by the Central Valley Regional Water Quality Control Board – *Hilmar Cheese Company, Groundwater Modeling for Cleanup and Abatement Order, Central Valley, California.*
- The results of two modeling efforts were reviewed to reassess contributions from responsible parties. A new metric, the Responsibility Factor (RF), was developed and applied to existing input data. The RFs were used to estimate relative contributions to the MEW Superfund site regional plume from several responsible parties – *Confidential Client (subcontractor to Montclair Environmental Management), Reassessment of Contributions to the MEW Superfund Site Regional Plume, Santa Clara County, California.*
- Mass flux calculations for TCE and PCE were conducted on behalf of a multi-PRP group. Calculations of mass flux through time were compared upgradient and downgradient of several sites within the Omega Superfund site regional plume to estimate the contribution from each individual site. These calculations were used as part of the basis for cost allocation among PRPs – *Confidential Client, Mass Flux Calculations for Cost Allocation, Omega Superfund Site, Santa Fe Springs, California.*
- A three-dimensional model (MODLFOW-SURFACT) of unsaturated zone and saturated zone flow and solute transport was developed and calibrated based on sparse discharge records

and well observations to assess the fate of a legacy of contaminated soil water being mobilized by increased discharge to the subsurface. The modeling was an integral part of a report of waste discharge and request for waste discharge requirements from the Central Valley Regional Water Quality Control Board – *California Dairies, Incorporated, Report of Waste Discharge, Central Valley, California.*

- A transient groundwater flow model (MODFLOW) was conceptualized, implemented, and calibrated for a major oil refinery. Linear programming was used to quantitatively minimize groundwater pumping and qualitatively optimize well placement for containment of subsurface LNAPL and BTEX-contaminated groundwater. Multiple capture zones of various sizes were analyzed for control of LNAPL hotspots and site-wide containment scenarios – *Sun Oil Company, Pumping-Rate Optimization and Capture Zone Analysis, Tulsa County, Oklahoma.*
- A groundwater flow and reactive solute transport model (MODFLOW and RT3D) was developed to evaluate remediation efforts at a chemical production facility. The efficacy of a permeable reactive barrier was evaluated by simulating sequential decay and transport of TCE and its daughter products. The model was post-verified in the field by analyzing the concentration histories of several observation wells – *Mohawk Laboratories, Analysis of Permeable Reactive Barrier, Sunnyvale, California.*
- Determined regional-scale risk to groundwater from potentially contaminating activities (PCA) in the Santa Clara Valley, Coyote, and Llagas subbasins, as part of a multifaceted effort. A regional-scale PCA-risk map was developed and combined with intrinsic aquifer sensitivity to generate a groundwater vulnerability map, which formed the basis of a web-based GIS tool for evaluating development projects and land-use changes – *Santa Clara Valley Water District, Groundwater Vulnerability Study, Santa Clara, California.*
- A Remedial Investigation (RI) Summary report was prepared under CERCLA guidelines, which included development of a conceptual model that incorporated regional and local hydrostratigraphy, source-area history, details of previous remedial investigations, and characterization of the basin-wide perchlorate and TCE groundwater contamination – *West Valley Water District, NCP Compliance Documents, Rialto, California.*
- The volume of LNAPLs beneath a refinery was estimated by modifying the analytical solutions for LNAPL recovery presented within API Publications 4682 and 4729, utilizing the van Genuchten relations for porous media. Results of the modeling work were used to design a LNAPL recovery system – *Sun Oil Company, LNAPL Spatial Distribution, Tulsa County, Oklahoma.*
- DNAPL Assessment Techniques, Klickitat County, WA. Developed internal White Paper describing techniques and thresholds for assessing DNAPL mobility at a fueling facility – *BNSF, Remediation Design Support, Park County, Montana*.
- Report of waste discharge and request for waste discharge requirements for land application of onsite waste and storm water. For submission to the Los Angeles Regional Water Quality Control Board – *Confidential Client, Report of Waste Discharge, Los Angeles County, California.*

- Developed and implemented groundwater flow and particle tracking models to evaluate well placement designs and optimize pumping rates for an in-situ groundwater recirculation and treatment zone. The recirculation zone was used to chemically treat groundwater contaminated with VOCs – *BNSF, Remediation Design Support, Park County, Montana.*
- Analyzed slug test data for multiple tests using several techniques to assess parameter uncertainty for a bedrock aquifer, for submission to Montana Department of Environmental Quality – *BNSF, Site Characterization for Remedial Investigation, Park County, Montana.*
- A 1D unsaturated zone flow and transport model was developed to assess the impact to groundwater of VOCs and metals present in the soil at the Facility. A future 100-year scenario was developed based on climate data from the past 100 years. Mass transport process of volatilization, linear sorption, and advection and dispersion were considered for this investigation – *SMTEK, Former Chemical Facility, Orange County, California.*

Summary of Other Selected Litigation Support Projects

- Implemented detailed regional, three-dimensional conceptual model for a 35-year period (MODFLOW and MT3DMS). Geologic data, crop-based time-variant DBCP application rates, pumping, recharge basins, and flow and transport in the unsaturated and saturated zones were used to evaluate whether label-recommended use of DBCP caused contamination in municipal wells and to establish likely source areas for high-concentration hot spots – *Sedgwick, Detert, Moran, and Arnold, Regional-Scale Pesticide Contamination Litigation Support, Fresno, California.*
- Designed and implemented three-dimensional models (LEACHM, MODFLOW, and MT3DMS) of unsaturated and saturated fluid flow and solute transport for periods of up to 150-years using soils and geologic data, rainfall records, pumping, and plant operational history to assess whether off-site groundwater contamination was caused by unanticipated releases of coal tar at numerous sites in the Midwest – *Jones, Day, Reavis, and Pogue, Former Manufactured-Gas Plant Sites, Litigation Support, Los Angeles, California.*
- The impact of different rainfall data disaggregation techniques on the results of fluid flow and solute transport simulations in the unsaturated zone was evaluated. Various disaggregation strategies were applied to simulations of contaminant fate at three former manufactured-gas plants – *Northern Indiana Public Service Company, Impact of Rainfall Data Disaggregation Techniques, Merrillville, Indiana.*
- Evaluated expert reports and thoroughly evaluated and verified a detailed water budget model. Assisted in preparation of expert report related to the application of the model – *Confidential Client, Water Budget Model Litigation Support, Pinal County, Arizona*.
- Evaluated expert reports and critiqued a detailed MODFLOW groundwater flow model for litigation of damages and fatalities from a landslide. Assisted in preparation of expert report – *Confidential Client, Landslide Initiation Litigation Support, British Columbia.*

Professional History

aquilogic, Inc., Principal Hydrogeologist, October 2020 to present.
aquilogic, Inc., Senior Hydrogeologist, February 2018 to October 2020.
Jacobson James & Associates, Inc., Principal Hydrogeologist, October 2015 to December 2017.
Independent Consultant, December 2012 to September 2015.
Kennedy/Jenks Consultants, Associate Hydrogeologist, March 2009 to November 2012.
Independent Consultant, July 2005 to February 2009.
San Francisco State University, Lecturer/Adjunct Professor, September 2003 to February 2009.
SGI The Source Group, Inc., Senior Hydrogeologist, August 2002 to June 2005.
Stanford University, Research Associate, September 2000 to July 2002
Independent Consultant/Graduate Student, October 1995 to July 2000.
U.S. Geological Survey/Graduate Student, Hydrologist, June 1992 to September 1995.

Research

- A new protocol and computer code were designed and implemented to simulate the development of redox zones in contaminated aquifers. Transport of dissolved constituents coupled to complex interactions between organic and inorganic compounds were simulated with consideration of reaction energetics, reaction-rate limitations, and advection and dispersion – *Stanford University/United States Geological Survey, Development and Fate of Redox Zones in Contaminated Aquifers, Falmouth, Massachusetts*.
- Interactions between surface water, soil-water, and groundwater were evaluated with a three-dimensional model of coupled saturated-unsaturated subsurface and surface fluid flow. Detailed rainfall data were incorporated into the model to determine the relative importance of different stormflow generation mechanisms – *Stanford University, Stormflow Generation, Chickasha, Oklahoma*.
- Conducted basin-scale modeling analysis of subsurface fluid flow in the Illinois Basin to evaluate the role of paleogroundwater flow versus fluid density in long-range, deep-basin petroleum migration – *United States Geological Survey, Basin-scale Analysis of Subsurface Fluid Flow, Illinois Basin*.
- Developed reactive solute transport models to evaluate zinc transport in a geochemically complex aquifer in Falmouth, MA. Coupled solute transport/geochemical modeling, laboratory experiments, and a two-site surface complexation model were used to represent the pH-dependent adsorption of dissolved zinc on aquifer sediments – *United States Geological Survey, Zinc Transport in a Geochemically Complex Aquifer, Falmouth, Massachusetts*.

Peer-Reviewed Publications

Abrams, R.H. and K. Loague. 2000. A compartmentalized solute transport model for redox zones in contaminated aquifers, 2, Field-scale simulations. Water Resources Research 36, 2015-2029.

Abrams, R.H. and K. Loague. 2000. A compartmentalized solute transport model for redox zones in contaminated aquifers, 1, Theory and development. Water Resources Research 36, 2001-2013.

Abrams, R.H., K. Loague, and D.B. Kent. 1998. Development and testing of a compartmentalized reaction network model for redox zones in contaminated aquifers. Water Resources Research 34, 1531-1541.

Abrams, R.H. and K. Loague. 2000. Legacies from three former manufactured-gas plants: Impacts on groundwater quality. Hydrogeology Journal 8, 594-607.

Kent, D.B., R.H. Abrams, J.A. Davis, J.A. Coston, and D.R. LeBlanc. 2000. Modeling the influence of variable pH on the transport of zinc in a contaminated aquifer using semi-empirical surface complexation models. Water Resources Research 36, 3411-3425.

Kent, D.B., R.H. Abrams, J.A. Davis, and J.A. Coston. 1999. Modeling the influence of adsorption on the fate and transport of metals in shallow ground water--Zinc contamination in the sewage plume on Cape Cod, MA. Morganwalp, D.W., and Buxton, H.T., eds., USGS WRI Report 99-4018C, 361-370.

Loague, K., R.H. Abrams, S.N. Davis, A. Nguyen, and I.T. Stewart. 1998. A case study simulation of DBCP groundwater contamination in Fresno County, California: 2. Transport in the saturated subsurface. Journal of Contaminant Hydrology 29, 137-163.

Loague, K., D. Lloyd, A. Nguyen, S.N. Davis, and R.H. Abrams. 1998. A case study simulation of DBCP groundwater contamination in Fresno County, California: 1. Leaching through the unsaturated subsurface. Journal of Contaminant Hydrology 29, 109-136.

Loague, K. and R.H. Abrams. 1999. DBCP contaminated groundwater in Fresno County: Hot Spots and nonpoint sources. Journal of Environmental Quality 28, 429-445.

Coston, J. A., R. H. Abrams, and D. B. Kent. 1998. Selected inorganic solutes, in water quality data and methods of analysis for samples collected near a plume of sewage-contaminated ground water, Ashumet Valley, Cape Cod, Massachusetts, 1993-1994. USGS WRI Report 97-4269.

Loague, K., C.S. Heppner, R.H. Abrams, A.E. Carr, J.E. VanderKwaak, and B.A. Ebel. 2005. Further testing of the Integrated Hydrology Model (InHM): Event-based simulations for a small rangeland catchment located near Chickasha, Oklahoma. Hydrological Processes 19, 1373–1398.

Loague, K. and R.H. Abrams. 2001. Stochastic-conceptual analysis of near-surface hydrologic response. Hydrological Processes 15, 2715-2728.

Loague, K., G.A. Gander, J.E. VanderKwaak, R.H. Abrams, and P.C. Kyriakidis. 2000. Technical Addendum for "Simulating hydrologic response for the R-5 catchment: A never-ending story". Floodplain Management 2, 57-64.

Loague, K., G.A. Gander, J.E. VanderKwaak, R.H. Abrams, and P.C. Kyriakidis. 2000. Simulating hydrologic response for the R-5 catchment: A never-ending story. Floodplain Management 1, 57-83.

Grose, T. L. T. and R. H. Abrams, 1992. Geologic map of the Grasshopper Valley 15' quadrangle, Lassen County, California. California Department of Conservation, Division of Mines & Geology Open-File Report 93-07.

Grose, T. L. T. and R. H. Abrams. 1991. Geologic map of the Karlo 15' quadrangle, Lassen County, California. California Department of Conservation, Division of Mines & Geology Open-File Report 91-23.

ATTACHMENT E

Excerpts from Upper Valley Subbasin GSP Appendix 2-A.3 Comments on the Draft GSP: Comment Letters Responses

Salinas Valley Groundwater Basin
Upper Valley Aquifer Subbasin
Groundwater Sustainability Plan

Salinas Valley Basin
Groundwater Sustainability Agency

(Approved by Salinas Valley Basin Groundwater Sustainability Agency Board of Directors on January 13, 2022)

Prepared by:

MONTGOMERY
& ASSOCIATES
Water Resource Consultants

ACKNOWLEDGEMENTS

SVBGSA gratefully acknowledges the funding contribution from the California Department of Water Resources. Funding for this GSP has been provided in part from Proposition 1 (Round 2) and Proposition 68 (Round 3) grants from the Sustainable Groundwater Management Grant Program.

SVBGSA Member Agencies

County of Monterey
Monterey County Water Resources Agency
City of Salinas
City of Soledad
City of Gonzales
King City
Castroville Community Services District
Monterey One Water

SVBGSA Board Members

Steve Adams, *South County Cities Member*
Luis Alejo, *Other GSA Eligible Entities Member*
John Bramers, *Agriculture, Pressure Member*
Janet Brennan, *Environment Member*
Caroline Chapin, *Public Member*
Brenda Granillo, *CPUC Regulated Water Company Member*
Bill Lipe, *Agriculture, Upper Valley Member*
Steve McIntyre, *Agriculture, Forebay Member*
Colby Pereira, *Agriculture, Eastside/Langley Member and Chair*
Anthony Rocha, *City of Salinas Member*
Ron Stefani, *Disadvantaged Community or Public Water System Member*

Upper Valley Aquifer Subbasin Planning Committee

Andrea Bailey
Marc Bloom
Jeffrey Crank
Grant Cremers, Chair
Bill Lipe
Tom Merrifield
Roger Moitoso
Jason Smith

SVBGSA Staff

Donna Meyers, *General Manager*
Emily Gardner, *Deputy General Manager*
Gary Petersen, *Senior Advisor*
Les Girard, *General Counsel*
Merida Alvarez, *Administrative Assistant*
Ann Camel, *Administrative Support*
Harrison Tregenza, *Clerk of the Board*

Technical Consultants

Montgomery & Associates (M&A)
- Derrik Williams, P.G., C.Hg., *Principal Hydrogeologist*
- Abby Ostovar, Ph.D., *Water Policy Specialist*
- Tiffani Cañez, *Hydrogeologist*
- Joseph Oliver, *Senior Hydrogeologist*
- Staffan Schorr, *Principal Hydrogeologist*
- Greg Nelson, P.G., *Senior Hydrogeologist*
- Victoria Hermosilla, *Hydrogeologist*
- Michael Levengood, *GIS and Data Coordinator*
- Trevor Pontifex, *Hydrogeologist*
- Jon Reeves, *Hydrogeologist*

Wallace Group
- Kari Wagner, P.E., *Principal/Director of Water Resources*
- Greg Hulburd, P.E., *Senior Civil Engineer*

Wood Group
- Matt Baillie, P.G., C.Hg., *Senior Hydrogeologist*

Paris Kincaid Wasiewski
- Valerie Kincaid, *Principal*

Cite as: Salinas Valley Basin Groundwater Sustainability Agency. 2022. Upper Valley Aquifer Subbasin Groundwater Sustainability Plan. Prepared by Montgomery & Associates. Submitted to the California Department of Water Resources January 2022.

Salinas Valley: Upper Valley Aquifer Subbasin Groundwater Sustainability Plan

Prepared for:

Salinas Valley Basin Groundwater Sustainability Agency

Chapter 2
Appendix 2-A

Comments on the Draft GSP

1. Comment Table
2. Comment Letters
3. Comment Letters Responses

Number	Chapter	Date	Commenter	Comment	Response	Action
29	9	8/3/2021	Grant Cremers	See letter attached.	Received	Section 9.4.1, Paragraph 2: Language in 5th line changed to read "management actions or projects." Language in 9th line changed to read that SMC TAC will first report to Upper Valley Subbasin Committee as opposed to SVBGSA. Paragraph 4: “The SMC TAC will consider and recommend SVBGSA management actions and projects” changed to read “The SMC TAC will consider and make recommendations to the Upper Valley Subbasin Committee on management actions and projects.” Section 9.4.1.4: Language in second sentence changed to read "Upper Valley Subbasin Committee recommends." Order of Managemnet Actions and Projects: There is language that describes that components of this project are currently in place. The Subbasin Committee requested that projects be listed after management actions and that it be made clear that they are not entirely necessary at this point; however, nothing precludes the GSA from pursuing the projects sooner and the Road Map in Chapter 10 acknowledges that programs are existing and some stakeholders want to continue these efforts early in GSP implementation. Interlake Tunnel and Winter Releases with ASR: As with other projects, showing preliminary estimates of project benefits and costs are included to show the general scale of the project. The text has been revised to note that benefit numbers are from preliminary modeling. Different potential options for reservoir reoperation can be included in the broader reservoir reoperation management action.
Comments above were received prior to the full public release of the GSP. Several comments led to revisions in the chapters. Comments from here on are for the public review version of the GSP.						
30	Whole GSP	8/12/2021	Nancy Isakson, Salinas Valley Water Coalition Board	See letter attached.	Received	SVBGSA is currently working on reconvening the 180/400-Foot GSP Subbasin committee to discuss implementation. The content of the Integrated Implementation Plan is still under development, but is not currently anticipated to include management actions and projects. The SVIHM is the best available tool to determine water budgets at this time, and future results will be used to update the GSPs when available. The paragraph regarding the development of projects and management actions for the 180/400-Foot Aquifer Subbasin GSP has been deleted. The support for the 11043 permit and seawater intrusion barrier projects is noted.
31	Whole GSP	8/12/2021	Stephanie Hastings, Salinas Basin Water Alliance (SBWA)	See letter attached.	Received	For now, all additional simulations and analysis of intersubbasin flow (beyond what’s in the water budgets) will be considered by the integrated implementation committee after GSP submittal.

Number	Chapter	Date	Commenter	Comment	Response	Action
38	Whole GSP	10/15/2021	Stephanie Osler Hastings and Christopher R. Guillen on behalf of the Salinas Basin Water Alliance	See letter attached.	Received	I. SVBGSA replaced the Integrated Sustainability Plan for the the Integrated Implementation Plan. The Integrated Implementation Committee will outline the implementation of the 6 GSPs in the Salinas Valley Basin and address questions of groundwater relationship between the subbasins. This Committee will help ensure all subbasins get to sustainability. II. A. The SVIHM is the best avialable tool to compute water budgets for the subbasins in the Salinas Valley. The 180/400-Foot Aquifer Subbasin GSP will be updated using the SVIHM to be consistent with the rest of the subbains in the 2-Year Update currently underway. The SVIHM was used to develop water budgets for the Langley, Eastside, 180/400, Forebay, and Upper Valley using the same model simulations so that they would be consistent. The Monterey Subbasin used a different model due in part to poor calibration of the SVIHM in the Monterey Subbasin; however, it adopted boundary conditions from the SVIHM to increase compatibility and the Monterey Subbasin GSP includes an implementation action to integrate the Monterey Subbasin Model into the SVIHM when it is released. SVBGSA ran a no pumping scenario with the SVIHM to determine locations of surface water depletion due to pumping; however, it is a static model that does not shed light on how intersubbasin flow would have changed. It is a static dataset that reflects how reservoirs were actually operated, not how they would have been operated with no pumping. The Integrated Implementation Committee will consider the flow and relationship between subbasins early in 2022. II. B. 1. a & b. Sustainable yields were defined according to SGMA regulations. The water budgets measure inflows and outflows of the groundwater system, and both interbasin flow and groundwater extraction are accounted for. Minimum thresholds are meant to be prevented to avoid undesirable results. If each subbasin avoids their minimum thresholds, then neighboring subbasins will likely not be prevented from reaching or maintaining sustainability. The GSP does not dispute that its conditions affect adjacent subbasins; however, it does not prevent them from reaching sustainability. The sediment relationships between the 180/400-Foot Aquifer Subbasin, and the adjacent Langley/Eastside Subbasin demonstrate a dynamic environment where different sediments were deposited over time and subsequently, impact groundwater flow. The boundary with the Eastside Subbasin generally represents the furthest extents of the alluvial fans, which are characterized by clays and other fine sediments. These sediments frequently act as an impediment to flow, if not fully a barrier in certain locations. Subsequently, the gradient relationship is not the only influence to groundwater flow between the 180/400-Foot and Eastside Subbasins, and needs to be considered along with all subsurface characteristics. While there is a relationship between the groundwater contours developed for the 180/400 and Eastside Subbasins, the contours themselves are not fully representative of flow between the subbasins. As the model is further refined with additional and expanded data during Implementation, the SVBGSA and stakeholders will have a clearer view of the groundwater flow relationships, particularly as they relate to the recorded sediments in this area. The boundary with the Langley Subbasin was selected based on topographical changes, and the GSP fully acknowledges there is no hydrogeologic boundary that coincides with the administrative boundary. The key characteristic of the Langley Subbasin is the Aromas Sands, which are very permeable. Despite this connection and high permeability along with lowered groundwater elevations, the seawater intrusion front is not advancing in the direction of the Langley Subbasin. Subsequently, it would be premature to conclude that groundwater elevations in the Langley Subbasin are inducing or facilitating seawater intrusion in the 180/400-Foot Aquifer Subbasin. The groundwater flow relationship between the Langley and the Eastside Subbasins is largely uncharacterized as a result of a lack of data both about the sediment changes and the groundwater elevations in the area. This is a data gap that will be addressed during implementation. It is important to note that the 180/400-Foot Aquifer Subbasin GSP includes a plan in place to halt and reverse seawater intrusion and increase groundwater elevations, which will also serve to prevent adverse seawater intrusion impacts to the Eastside Subbasin. Both the Eastside Subbasin and the Langley Subbasin have developed projects and management actions to raise groundwater levels in their subbasins. The SMC were largely developed to be both achievable, as well as provide for operational flexibility during future droughts. Furthermore, these subbasins will be a part of the Integrated Implementation Plan, which will work to address seawater intrusion through a variety of strategies, which include increasing groundwater elevations. Additionally, the SWIG has been meeting regularly to learn and strategize projects to address seawater intrusion. The subbasins under the SVBGSA will be integrated during implementation, data acquisition, further data development, and coordinated stakeholder engagement. II. B. 1. c. Subbasin Planning Committees for each subbasin chose how they wanted to measure reduction in groundwater storage. The definition of storage for groundwater is expressly based on a change in pressure heads, or groundwater elevations, within an aquifer. Freeze and Cherry, in their seminal 1979 textbook Groundwater state, “The specific storage Ss of a saturated aquifer is defined as the volume of water that a unit volume of aquifer releases from storage under a unit decline in hydraulic head.” Hydraulic head is the sum of all pressures acting on water in the subsurface, which in unconfined aquifers, is generally summarized as elevation. Therefore, given the direct relationship between groundwater elevations and specific storage, groundwater elevations are appropriate as a proxy for storage. This is also explained in chapter 4.4.2 of the GSP, and a reference to that section has been added into Ch 8. Using the groundwater elevations as a proxy for storage is a reasonable alternative in Subbasins with less GEMS data available for estimating groundwater production. Additionally, the Langley, Eastside, Forebay, and Upper Valley Subbasins are characterized as having one principal aquifer, instead of multiple. This allows for the estimation of storage based on groundwater levels, since it is assumed that the groundwater is generally all connected in those Subbasins, and groundwater elevations are subsequently representative of groundwater conditions. II. B. 2. A description of how minimum thresholds will affect adjacent subbasins were provided per GSP Regulations. The Forebay and Upper Valley Subbaisn Planning Committees defined how the SMC for all sustainability indicators in their subbasins will be measured. The SMC in the Forebay and Upper Valley are set at similar levels to the other subbasins and will not prevent adjacent subbasins from reaching sustainability. Text was added to clarify how the minimum thresholds were developed based on the significant and unreasonable statement and why they are not in conflict. II. B. 3. SVBGSA has considered the interest of all beneficial users in the Salinas Valley. The GSA does not "allocate the burden of sustainability" nor undertake any actions that threaten or impinge on water rights.

						Action (cont.)
						III. Projects and managment actions were chosen by Subbasin Planning Committees, and are sufficient to maintain or achieve sustainability. the project mentioned was not brought up in any of the Subbasin Committee discussions on projects and management actions; however, the GSP does not preclude additional projects to be considered in the future. The Integrated Implementation Committee will determine which projects will be used to maintain or achieve sustainability in the Salinas Valley. Aquilogic Memo: The SVBGSA agrees that impacts on adjoining basins or subbasins must be addressed before implementing any management actions or projects. SVBGSA plans to conduct these analyses, which will include, among other things, updating the water budgets and sustainable management criteria in the 5-year updates if necessary, to account for inter-basin flows and impacts on adjoining basins or subbasins, when an appropriate tool becomes available. SVBGSA additionally agrees that the superposition approach included in the comment is a reasonable approach for addressing any action's or project's impact on inter-basin flows. This type of approach lessens the influence of model errors by addressing changes between simulations, and not absolute values in any simulation. SVBGSA will use this approach to address both intra and inter-basin impacts from any action or project. SVBGSA further agrees that the additional simulations proposed in the comment letter will facilitate a deeper understanding of the Salinas Valley Groundwater Basin, even though the additional simulations are not associated with specific actions or projects. To that end, SVBGSA staff will propose to the SVBGSA Board of Directors that the requested simulations would be informative, that these simulations be conducted before the next GSP assessment, and that the additional simulations will provide essential background understanding that will allow a thorough vetting of any potential management actions or projects. If and when approved by the SVBGSA Board of Directors, SVBGSA staff will work with all interested parties and stakeholders through the Integrated Implementation Committee to develop the assumptions and approaches for these simulations.

ATTACHMENT F
March 9, 2022
Brownstein Comment Letter

Brownstein

Brownstein Hyatt Farber Schreck, LLP
805.963.7000 main
1021 Anacapa Street, 2nd Floor
Santa Barbara, California 93101

March 9, 2022

Stephanie O. Hastings
Attorney at Law
805.882.1415 direct
shastings@bhfs.com

VIA E-MAIL – BOARD@SVBGSA.ORG; MEYERSD@SVBGSA.ORG

Board of Directors
Salinas Valley Basin Groundwater Sustainability Agency
c/o Donna Meyers
General Manager
P.O. Box 1350
Carmel Valley, CA 93924

RE: March 10, 2022 Board Meeting—Agenda Item 5.c—Draft Fiscal Year 2022 Staff Two Year Work Plan

To the Boards of the Salinas Valley Basin Groundwater Sustainability Agency:

This office represents the Salinas Basin Water Alliance (Alliance), a California nonprofit mutual benefit corporation formed to preserve the viability of agriculture and the agricultural community in the greater Salinas Valley. Alliance members include agricultural businesses and families that own and farm more than 80,000 acres within the Salinas Valley. The Alliance submits this comment letter to express its significant concern with the Salinas Valley Basin Groundwater Sustainability Agency's (GSA) draft Fiscal Year 2022 Staff Two Year Work Plan (Work Plan). As explained in further detail below, the Work Plan fails to include additional basin-wide modeling simulations, and the corresponding update to each of the Salinas Valley Subbasin Groundwater Sustainability Plans (GSPs),[1] the GSA committed to conducting before undertaking any projects or management actions. Absent this additional modeling, any projects or management actions undertaken by the GSA will violate the provisions of the Sustainable Groundwater Management Act (SGMA). To rectify this issue, the Alliance proposes the GSA adopt the revised Work Plan attached hereto as **Attachment A**.

I. THE GSA COMMITTED TO UNDERTAKING ADDITIONAL MODELING ANALYSES AND REVISING THE GSPS TO ADDRESS INADEQUACIES IN THE GSPS

As explained in the Alliance's comment letters dated October 15, 2021 and December 8, 2021, the GSPs are not integrated in any manner; they contain numerous inconsistencies in their data, water budgets,

[1] The "GSPs" refer to the Groundwater Sustainability Plans for the Upper Valley Subbasin, Forebay Subbasin, Eastside Subbasin, Langley Subbasin, 180/400-Foot Aquifer Subbasin, and the Monterey Subbasin.

and sustainable management criteria. These inconsistencies are concerning as the surface water and groundwater resources within the Salinas Valley are interconnected and, absent integration, the burdens of sustainable groundwater management may be inequitably apportioned throughout the Salinas Valley. The GSA previously acknowledged the need for integrated groundwater management and proposed an integrated Valley-wide GSP. However, the GSA subsequently scrapped that plan and developed the inconsistent, subbasin specific GSPs.

The GSA's failure to integrate the GSPs led to the adoption of GSPs that run afoul of SGMA. Most pressing is the failure to analyze how each of the GSPs will impact groundwater management in an adjacent subbasin (i.e., how implementation of the Forebay GSP will impact the 180/400-Foot Aquifer Subbasin). More specifically, the GSPs fail to include the required analysis of how (a) pumping in these subbasins impacts flows to adjacent subbasins, or (b) how implementing the sustainable management criteria, including the minimum thresholds, will impact adjacent subbasins.

After reviewing the Alliance's detailed comment letters, the GSA properly acknowledged the faults in the GSPs and committed to addressing the issues through additional modeling simulations and revisions to the GSPs. Specifically, each of the GSPs includes the following statement:

> The SVBGSA agrees that impacts on adjoining basins or subbasins must be addressed before implementing any management actions or projects. SVBGSA plans to conduct these analyses, which will include, among other things, updating the water budgets and sustainable management criteria in the 5-year updates if necessary, to account for inter-basin flows and impacts on adjoining basins or subbasins, when an appropriate tool becomes available.
>
> SVBGSA additionally agrees that the superposition approach included in the comment is a reasonable approach for addressing any action's or project's impact on inter-basin flows. This type of approach lessens the influence of model errors by addressing changes between simulations, and not absolute values in any simulation. SVBGSA will use this approach to address both intra and inter-basin impacts from any action or project.
>
> SVBGSA further agrees that the additional simulations proposed in the comment letter will facilitate a deeper understanding of the Salinas Valley Groundwater Basin, even though the additional simulations are not associated with specific actions or projects. To that end, SVBGSA staff will propose to the SVBGSA Board of Directors that the requested simulations would be informative, that these simulations be conducted before the next GSP assessment, and that the additional simulations will provide essential background understanding that will allow a thorough vetting of any potential management actions or projects. If and when approved by the

> SVBGSA Board of Directors, SVBGSA staff will work with all interested parties and stakeholders through the Integrated Implementation Committee to develop the assumptions and approaches for these simulations.

(See e.g., Forebay GSP, Response to Comment 36 (emphasis added).) In other words, the GSA agreed in its response to comment, which are incorporated into each of the GSPs, that (a) the GSPs do not analyze impacts to adjacent subbasins as required by SGMA, and (b) that additional modeling work must be conducted and the GSPs' water budgets and sustainability management criteria must be updated to address this issue.

II. THE WORK PLAN FAILS TO FULFILL THE GSA'S COMMITMENT TO ADDRESS THE INADEQUACIES IN THE GSPS

Despite the GSA's commitment to address the issues identified by the Alliance, the GSA now proposes the Work Plan that fails to fulfill this commitment and therefore is inconsistent with the GSPs themselves. Significantly, the Work Plan states the following:

> Planning work will continue during the two-year work plan on the Integrated Implementation Plan. The first phase of the plan will be completed early in the fiscal year and that will include basin wide (within SVBGSA jurisdiction) groundwater conditions and basin wide monitoring networks. This work will include analysis of inter-subbasin flow in existing model runs and in comparison to the current understanding of the hydrostratigraphy and subbasin connectivity as described in the GSPs.

(Emphasis added.) This is not what the GSA committed to in the GSPs—it limits the GSA's additional analysis to *existing model runs*, which the GSA already acknowledged fail to analyze impacts on inter-subbasin flow, like how pumping in each subbasin impacts flows to adjacent subbasins, and how implementing the sustainable management criteria, including the minimum thresholds, will impact adjacent subbasins. In other words, the GSA cannot rely on its past, inadequate work to fulfill its commitment in the GSPs.

Moreover, the failure to include the additional modeling simulations in the Work Plan taints the rest of the work proposed in the Work Plan. For one, the Work Plan states that work is "important especially within the subbasins that require actions and/or projects to reach sustainability, and identifies the 180/400-Foot Aquifer, Monterey, Eastside, and Langley Subbasins as "priority subbasins." However, the GSA cannot know which subbasins are "sustainable", in terms of how pumping affects adjacent and downgradient subbasins, without conducting the additional modeling the GSPs acknowledge is required. Similarly, the Work Plan proposes certain demand management proposals for some, but not all of the subbasins—the Corral de Tierra, Langley, Eastside and 180/400 Subbasins. This determination is premature, at best—e.g., the Work Plan incorrectly assumes that demand management actions will be required in only a subset of the subbasins before undertaking the required additional modeling of inter-subbasin impacts—and in conflict with the GSPs. The GSA cannot adequately assess what demand management is appropriate until it understands how groundwater pumping in the Forebay and Upper Valley Subbasins is impacting the Corral de Tierra, Langley, Eastside and 180/400 Subbasins.

III. CONCLUSION

For the reasons stated above, the Work Plan cannot be approved as presently proposed by GSA staff. The Alliance has proposed revisions to the Work Plan that reflect the GSA's commitment to conducting additional required analyses and the associated follow-on activities, including revisions of the GSPs as appropriate, especially before any consideration of demand management activities in any subbasin. (See Attachment A.)

The Alliance urges the Board to carefully consider these comments and to adopt a Work Plan that is consistent with the GSPs and their acknowledgement of the necessity to undertake inter-subbasin flow analyses. Given the importance of undertaking this work prior to implementation of any projects or management actions, this work should be prioritized.

Respectfully submitted,

Stephanie Osler Hastings
Christopher R. Guillen

cc: Emily Gardner, Senior Advisor / Deputy General Manager (gardnere@svbgsa.org)
Derrik Williams, Montgomery & Assoc. (dwilliams@elmontgomery.com)
Leslie Girard, Monterey County Counsel (GirardLJ@co.monterey.ca.us)

ATTACHMENT A

Salinas Valley Basin
Groundwater Sustainability Agency

Board of Directors
STAFF REPORT

MEETING DATE: March 10, 2022

AGENDA ITEM: 5.c

SUBJECT: Proposed Two-Year Work Plan for FY

2022 and FY 2023 **RECOMMENDATION:** Approve Two-Year

Work Plan for FY 2022 and FY 2023

BACKGROUND:
The JPA Agreement Section 10.3(b) states: "Beginning for Fiscal year 2019-20, no later than sixty (60) days prior to the end of each Fiscal Year, the Board shall adopt a budget for the Agency for the ensuing Fiscal Year." Staff have developed a two-year Work Plan for FY 2022/2022 and 2023/2024 to reflect the emerging duties of the Salinas Valley Basin Groundwater Sustainability Agency (Agency) as it transitions from planning related work to implementation of the 6 Groundwater Sustainability Plans (GSPs). Upon the adoption of the two-year work plan, staff will prepare the Agency budget for presentation to the Board by April 2022.

The guiding considerations in developing the two-year work include the following:

- The Sustainable Groundwater Management Act (SGMA) requires compliance and reporting annually for all basins that are medium, high, and critically overdrafted. It is important to remember that SGMA is a regulatory program and as such the Agency must plan and complete actions required to maintain or address basin sustainability.

- SGMA requires that data gaps and guiding scientific information be addressed in subsequent years after completing a GSP. Examples of this include conducting further aquifer properties tests, expanding monitoring networks, and completing modeling analysis including additional modeling required to examine the effects of groundwater pumping on adjacent and downgradient subbasins.

- The 6 GSPs completed in the past two years outline approximately $4,000,000 in necessary monitoring and further analysis for SVBGSA's adopted GSPs. This includes completing Annual Reports every year for all subbasins, and maintaining a Data Management System and web-based access to maps and data for public users.

3

- The 6 GSP identified four implementation actions that will be completed during the two-year Work Plan period. These include Groundwater Extraction Management System (GEMS) expansion and enhancement, establishing a Dry Well Notification System, convening the Water Quality Coordination Group, and creating the Land Use Jurisdiction Coordination Program.

- SVBGSA will receive a minimum of $7,600,000 from the SGMA Round 1 Implementation Grant by the start of the fiscal year. This funding will establish funding for data expansion, monitoring, and program development for the 180/400-Foot Aquifer Subbasin which Staff and consultants will manage and complete. The SGMA Round 1 Implementation Grant also will provide funding to conduct engineering feasibility studies on several projects proposed for the 180/400-Foot Aquifer Subbasin. This work requires project management by Agency staff.

DISCUSSION:
The attached two-year work plan outlines the activities to be completed in fiscal years 2022 and 2023. Staff brought this work plan to the Budget and Finance Committee on March 3, 2022 for initial review and for recommendations on completing a draft Agency budget to complete the work plan. Comments received included support for a two-year budget to encompass the identified needs of the work plan and a suggestion that a five-year financial plan makes sense for tracking implementation progress and outcomes for the GSPs. Staff will prepare a two-year Agency budget for review in April.

FISCAL IMPACT:
None.

ATTACHMENT(S):
Attachment A - Draft Two-Year Work Plan for FY 2022 and 2023

PREPARED BY:
Donna Meyers, General Manager

Salinas Basin Water Alliance
Proposed Revisions
March 9, 2022

Two-Year Work Plan for Fiscal Years 2022 and 2023

DRAFT

March 4, 2022

The Salinas Valley Basin Groundwater Sustainability Agency (Agency) has prepared a two-year work plan for fiscal years 2022 and 2023 for consideration by the SVBGSA Board of Directors. The Two-Year Work Plan presented focuses on the following work areas now that the groundwater sustainability plans (GSPs) have been completed.

SVBGSA Work Areas

COMPLIANCE REPORTING AND DATA MANAGEMENT AND EXPANSION

- The Agency begins fiscal year 2022 with immediate requirements for data reporting and compliance. The Agency must complete Annual Reports and update the Data Management System and Web Map hosting annually to meet compliance with SGMA. The Agency will complete six Annual Reports during each fiscal year during the 2-year work plan, two of which will be completed in coordination with other Groundwater Sustainability Agencies (GSAs), Marina Coast Water District GSA and the Arroyo Seco GSA.

Salinas Basin Water Alliance
Proposed Revisions
March 9, 2022

- Agency staff is recommending data collection expansion efforts in fiscal year 2022 and 2023 to addresses data gaps as required by SGMA. This effort will include additional bi-annual monitoring points, conducting aquifer properties tests in the basins and expanding the monitoring network with additional wells. Data gaps are required to be filled in all subbasins, ~~however, this work is important~~ especially ~~within the subbasins that require actions and/or projects to reach sustainability~~additional modeling required to evaluate how (a) how pumping in each subbasin impacts flows to adjacent subbasins, and (b) how implementing the sustainable management criteria, including the minimum thresholds, will impact adjacent subbasins.

~~1~~

1

Additional scientific information about the basins will lead to enhanced knowledge about the subbasins which will in turn assist with project development and management actions on the required timeline and in the appropriate places within the basins. Benefits and costs of project options will be available for stakeholder discussion early in the process.

- It will be also important during the two-year work plan period to work with Monterey Country Water Resources Agency (MCWRA) to develop data sharing agreements, begin expansion of the GEMS system, and coordinate on basin management efforts. Staff level coordination will continue, and an interagency MOU will be completed during the work plan period.
- Completion and publication of the USGS suite of models will be critical during the two-year work plan period. The goal will be to have the SVIHM and SVOM models publicly published in early 2023.
- Well registration will be a focus during the two-year work plan period. This work will begin in the 180/400-Foot Aquifer Subbasin and will involve close coordination with MCWRA and the Monterey County Environmental Health Bureau.
- The Water Quality Coordination Group will be convened annually during the work plan period.
- The Dry Well Notification System will be created during the work plan period.
- The Land Use Jurisdiction Coordination Program will be further refined with program actions approved by the Board of Directors.

PLANNING AND PROJECT INTEGRATION

- Planning work will continue during the two-year work plan on the Integrated Implementation Plan. The first phase of the plan will be completed early in the fiscal year and that will include basin wide (within SVBGSA jurisdiction) groundwater conditions and basin wide monitoring networks. This work will include analysis of inter-subbasin flow in existing model runs and in ~~comparison~~new model runs required to examine the effects of groundwater pumping on adjacent and downgradient subbasins. The new and existing model runs will be compared to the current understanding of the hydrostratigraphy and subbasin connectivity as described in the GSPs. The second phase will be initiated and will include updates based on feasibility analyses conducted at the subbasin level for projects ~~potentially benefiting multiple~~required to achieve sustainability in each of the subbasins. This phase will include additional modeling work using newly collected data (i.e. Deep Aquifers Study), newly developed models (i.e. Seawater Intrusion Model), and prioritized project concepts. These model simulations will examine project impacts, comparing recent conditions to conditions with a project where conditions include groundwater elevations, calculation of storage, inter-subbasin subsurface flow, interconnected surface water and others.

Salinas Basin Water Alliance Proposed Revisions March 9, 2022

- An examination of the legal basis and constraints for a Demand Management Program will be presented to the stakeholders and the Board. Stakeholder outreach on demand management strategies will be initiated in each of the ~~Corral de Tierra, Langley, Eastside and 180/400-Foot Subbasins~~subbasins. Core policy considerations will be identified, as the functional components of the program, relevant SGMA statutes, and the intended approach for the program. A report of facilitated stakeholder agreements on program type, guiding policy, and recommended type of demand-side management will be completed for ~~the 180/400-Foot Subbasin and initiated in the other three~~all subbasins.
- The Deep Aquifer Study will be completed during the work plan period. Agency partners and stakeholders will discuss and plan for the operationalization of management recommendations.

ENGINEERING AND PROJECT DEVELOPMENT

- The initial construction phases of the CSIP optimization project will be initiated during the work plan period. This work will be funded by the SGMA Round 1 Implementation Grant and will be done in partnership with Monterey One Water and MCWRA.
- Feasibility studies will be completed for the seawater extraction barrier, winter-release with aquifer storage and recovery in the 180/400-Foot Aquifer Subbasin, and seasonal storage in the southern portion of the 180/400-Foot Aquifer Subbasin.

FUNDING DEVELOPMENT AND LONG-TERM FINANCIAL PLAN

- Administer and complete projects in the SGMA Round 1 Implementation Grant for the 180/400-Foot Aquifer and apply for the SGMA Round 2 Implementation Grant for the high and medium priority basins.
- Present proposed fee structure for Board of Directors consideration through update of GSPs in 2027.

~~Priority Subbasins~~

Priorities

As the Agency begins implementation, the above work areas will be the organizing framework to move all 6 GSPs forward towards the goal of sustainability and compliance with SGMA requirements. ~~Due to the variability in the GSPs with regards to immediacy of actions needed to reach sustainability, staff is recommending that the following GSPs receive the bulk of staff efforts during the two-year work period. However, staff~~Staff is prioritizing the completion of the Integrated Implementation Plan early in the fiscal year and ~~that will include~~ additional modeling using newly collected data as described above to better understand inter-subbasin conditions.

Salinas Basin Water Alliance
Proposed Revisions
March 9, 2022

This

~~3~~

work will assist in understanding basinwide conditions and integration priorities in keeping with the current Board policy of maintaining an integrated basinwide approach for the Agency. ~~Management actions such as convening subbasin TACs or developing demand management frameworks for Forebay and Upper Valley subbasins could also be initiated during the annual work period depending on aquifer conditions and additional data analysis.~~

- ~~180/400-Foot Aquifer Subbasin~~
- ~~Monterey Subbasin~~
- ~~Eastside Subbasin~~
- ~~Langley Subbasin~~

Critical work that should be completed includes:

- Completing new modeling on intersubbasin flow and updating GSPs' water budgets and sustainability management criteria as required
- Project feasibility assessment including engineering analysis and refinement of cost and benefits estimates.
- Further stakeholder engagement through Subbasin Implementation Committees on project preferences and timelines.
- Prioritization of projects and actions.
- Conducting a funding analysis.

In addition to the compliance activities that are required to occur in all 6 subbasins, the ~~work in the~~ priority ~~subbasins~~work will be crucial to develop a predictable and well-informed pathway forward to reach subbasin sustainability by the SGMA deadlines.

Salinas Basin Water Alliance
Proposed Revisions
March 9, 2022

Detailed Work Plan for FY 2022 and FY 2023

Compliance Reporting and Data Management and Expansion	**Timeline**
Complete new modeling on intersubbasin flow	June 2022
Complete Annual Reports for all 6 subbasins	April 1, 2022 and April 1, 2023
Annual Update to Data Management System/Web Map	2022 and 2023
Initiate GEMS Expansion Annual Monitoring for specific constituents/identified needs Well Registration and Metering in ~~180/400-Foot Aquifer Subbasin~~all subbasins Dry Well Notification System GDE Field Verification Land Use Jurisdiction Coordination Program – define program actions **Planning and Project Integration** Complete Deep Aquifer Study and Operationalize Recommendations Complete Basin-wide Integrated Implementation Plan Complete Demand Management Recommendations ~~for 180/400, Corral de Tierra Management Area, Eastside and Langely~~ Stakeholder Engagement – Langley Outreach and Communication Plan Stakeholder Engagement – Implementation Committees Stakeholder Engagement – Water Quality Coordination Group Stakeholder Engagement – DACs and SDACS – Outreach and Communication Plan	Complete by June 2024 Annual activity Complete by June 2024 Complete by June 2023 Complete by June 2023 Complete by June 2023 Complete by June 2024 August 2022 Complete by June 2024 Initiate June 2022 Convene in April 2022 Annual Meeting December 2022 & 2023 Initiate August 2022
Engineering and Project Development	
Seawater Intrusion Pumping Barrier Feasibility Study with Cost/Benefit Assessment	Initiate June 2022
Winter Release with Aquifer Storage and Recovery Feasibility Analysis for 180/400	Initiate June 2022
CSIP Optimization – Distribution Systems and Water Scheduling	Complete June 2024
M1W Dry Chlorine Scrubber Installation	Complete June 2024
Funding Development and Long-Term Financial Plan	
Round 1 and Round 2 SGMA Implementation Grant implementation	May 2022 – June 2024
Present 5-year Fee Structure to the Board of Directors	May 2022

May 26th, 2022

Ms. Donna Meyers
General Manager
Salinas Valley Basin Groundwater Sustainability Agency
P.O. Box 1385
Carmel Valley, CA 93924

VIA: E-mail to gardnere@svbgsa.org

RE: Public Comments on Groundwater Sustainability Plan for 180/400 Sub-Basin of the Salinas Valley Groundwater Basin

To Whom It May Concern,

We would like to personally thank you and your team for the work you have done on the plan for the 180/400 Sub-Basin. It has taken a lot of collaboration, compromise and understanding to gain mutual support over a plan to manage our groundwater.

We are a small family farm in Gonzales that has been in business since the early 1900s. We have seen and been a part of many of the changes within our industry and community- water law being one of them. There are just a few notes we wanted to be considered in public comment.

Specifically in Gonzales, please consider the jurisdiction of the former Gonzales Irrigation Company- there are special preliminary water rights in this region from this case. These pre-1914 water rights could take precedent over other rights on other parcels in Monterey County. In drought instances if there is a shortage of water, holders of these rights may have first call on river water even if it is not taken directly from the river. (See letter to Clarence "Toots" Vosti and map enclosed on page 3).

Please also consider or make sure to be aware of the SVPOLA- Salinas Valley Property Owners for Lawful Assessments v. County of Monterey (Monterey County Superior Court Case No. M66890). From this court case there may need to be reconsideration of the responsibility for salt water intrusion for those represented land parcels whose owners won the ruling of this case. Most of these parcels are in the southern portion of the Pressure Area, which does not fall under the same category or jurisdiction of other parcels in the Pressure Area.

Supporting the invasive species issue in the Salinas River should not just stop at Arundo donax and Tamarisk- a more thorough examination and analysis of the species in the river should conclude other finds that with their removal can also gain additional water to help with replenishing our aquifer. Other ways to help penetration and replenishment would be additional clearing of our river channels.

Be aware of Ag Order 4.0 on its jurisdiction of groundwater. Part of the proposed regulations, specifically in Table 5, is crossing into SGMA territory by requiring *irrigated* riparian habitats/buffers. This was struck down in the final order however I would not be surprised if it is proposed again. Most of the irrigated water in the Salinas Valley is groundwater.

It is in the best interest of landowners, farmers and SVBGSA to monitor this cross over of regulatory agencies.

And speaking of cross overs, another one is by the State Department of Labor. The repressive California overtime laws for agricultural employees specifically now on irrigation workers, is causing farmers to have to waste more water because they have to start the sprinklers earlier in the afternoons for the night irrigation. The workers get sent home earlier than usual because growers are trying to mitigate higher costs from overtime with shorter days, but they have to set the irrigation time clocks for an extra hour of water each night to catch the calmer night conditions. In order to enforce the potential GSP to make farmers cut back on water, GSAs must encourage and collaborate with state lawmakers to cut out the overtime laws for irrigation workers as it used to be. Also more encouragement and work needs to be done by the GSA on tariffs or supply limitations from foreign competition. This must be pushed at the state and federal level by the GSA and incorporated into the GSP. Over supply from Mexico and other foreign countries destroys domestic markets and causes thousands of acres to be disked under due to poor demand and too much product. Much water is wasted on product that is never harvested because Salinas Valley farmers cannot compete with foreign farmers (many of which come from countries with no GSAs, no GSPs and no groundwater management act to work by). SGMA, GSAs and GSPs need to be supportive of domestic farmers and push at the state and federal level for limitations on imports and foreign suppliers that do not adhere to our same restrictions. This would help local farmers use not only water but all of our resources more efficiently.

Thank you for your time and consideration. We look forward to the final plan.

Sincerely,

Wayne Gularte
President
Rincon Farms, Inc.

WILLIAMS RANCHES

Chunn Ranch LLC **Williams Sisters Trust**

October 8, 1997

Dear Toots,

The enclosed map is a rough out line the Gonzales Irrigation Company Canal about 1901. The crosshatched area represents those acres that were irrigated by the canal. At that time the owners of the company filed for and were granted water rights for some 230,000 acre feet of water from the Salinas River. The company was dissolved in the early 30's but those who can trace a continuity of ownership to the canal have, theoretically, a right to the portion of that water that they have put to reasonable and practical use.

These pre-1914 water rights take precedence over the rights that the county currently holds to the water they are keeping behind the dams which theoretically means that in times of drought or other instances when there is a shortage of water, holders of these rights would have first call on river water before others, even if it is not taken directly from the river.

This is all based upon what several lawyers have told me and if you asked some lawyers on the other side I am sure you could get another opinion. It is interesting to note, however, that the county's legal staff has chosen to ignore the issue and move on to less controversial topics.

As you know the State Water Resources Board is going to start hearings early next year on the adjudication of water rights for the valley and it may be time for those of us with potential superior rights to prepare to defend our position.

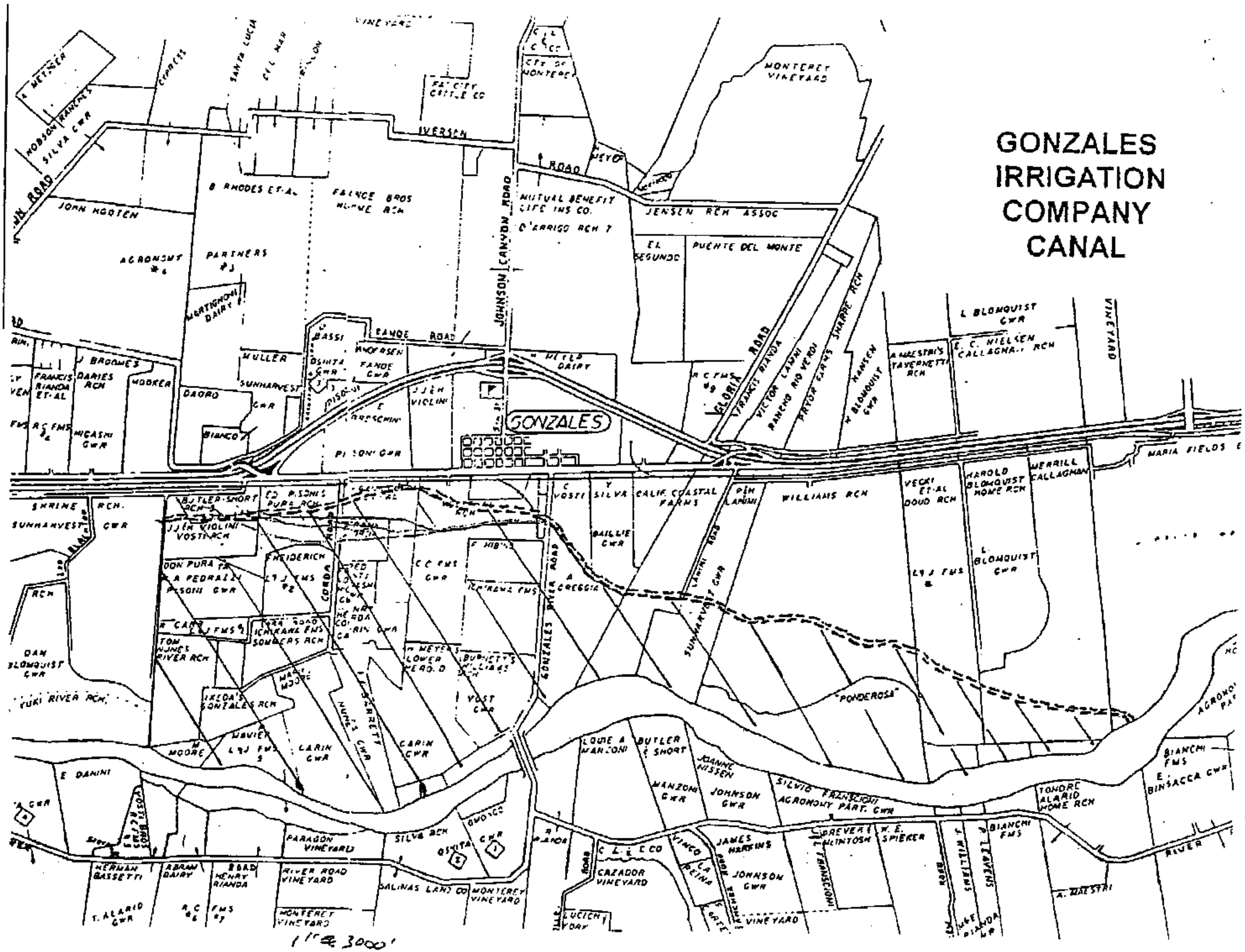
Please take a look at the attached map and let me know what you think about the whole situation.

Thanks,

Fred Sammis

77 Hazel Avenue, Larkspur, California 94939 - Box 883, Salinas, CA 93902
FAX (415) 927-9043

GONZALES IRRIGATION COMPANY CANAL



1" = 3000'

Number	Chapter	Date	Commenter	Comment	Response	Action
1	Whole GSP	12/21/2021	Wayne Gularte	See attached letter	Received	Noted. The CA Department of Water Resources designated the 180/400-Foot Aquifer Subbasin as a high priority subbasin because it is critically overdrafted. The purpose of the Salinas Valley GSA and the GSP is to manage the groundwater in the Salinas Valley for long-term sustainability.
2	8	12/30/2021	John Farrow, LandWatch	See attached letter	Received	A. SGMA does state that the storage SMC can be set using the metric of groundwater extractions; however, SGMA regulations allow groundwater levels to be used as a proxy for any other sustainability indicators (23 CCR §354.36(b)). Because of the complications with seawater intrusion in the 180/400-Foot Aquifer Subbasin, the SVBGSA has opted to develop a more complex proxy using both groundwater levels and extent of seawater intrusion. Since the origianl GSP was sumbitted, DWR has interpreted the regulations and approved GSPs with other approaches. Two GSPs that DWR has accepted as complete adopt a similar approach of using groundwater elevations and seawater intrusion control as a proxy for managing groundwater storage: the Oxnard Plain Subbasin GSP and the Pleasant Valley Subbasin GSP. These two approved GSPs, along with informal conversations with DWR staff, indicate that using groundwater levels and extent of seawater intrusion as proxies for storage is acceptable to DWR, which is the administrative agency that interprets and implements the SGMA regulations. SVBGSA, as the administrative agency, is charged with interpreting and implementing SGMA. The SVBGSA disagrees that the regulation's intent is to provide a basis for pumping allocations. The regulation's intent is to achieve groundwater sustainability. Pumping allocations are one tool that could be used to help achieve sustainability. Controlling pumping is not an objective of SGMA, it is a technique that can help reach some of the objectives of SGMA. Pumping within the sustainable yield is the objective, not dismissing the effectiveness of pumping reductions, but pumping reductions alone likely won't get the Subbasin to sustainability. However, if storage SMC is based on the sustainable yield it will change as projects get implemented, especially if a recharge project is implemented. The sustainable yield number is only a guide that will change over time, true sustainable yield is an absence of undesirable results which can also be achieved if another metric is chosen to measure storage SMC. The intent of the groundwater SMC is to demonstrate that there is no long-term, chronic loss of storage in the Subbasin. The SMC is not used to manage the Subbasin, it is used to demonstrate that management achieved sustainability. Calculating storage based on change in seawater intrusion and groundwater elevations will provide a direct calculation of groundwater storage and it will allow for operational flexibility between the minimum threshold and the measurable objective. B. The groundwater level minimum thresholds were set to a foot above 2015 groundwater elevations to avoid water levels reaching those drought conditions again. The seawater intrusion minimum threhsolds are set to the 2017 500 mg/L chloride isocontour, and despite many wells having water levels below sea level in recent years, the advancement of the seawater intrusion front in both the 180-Foot and 400-Foot Aquifers has been minimal since 2015 compared to historical rates. Sections 5.3.2 and 5.3.3 of the GSP Update discuss current seawater intrusion conditions, Section 5.3.3 shows bar graphs of the increase in seawater intruded acreage in the 180-Foot and 400-Foot Aquifers (Figure 5-28 and Figure 5-29, respectively). The increase in seawater intruded acreage from 2015 to 2017 in the 400-Foot Aquifer did increase more than that of the 180-Foot Aquifer, that change is not due to inland movement of the seawater intrusion front but the vertical migration of seawater from the 180-Foot to the 400-Foot Aquifer. This is an example of how seawater intrusion is not only dependent of groundwater elevations that are below sea level, but also a pathway that allows for seawater to move inland or vertically. Using groundwater extraction as the metric to measure the storage SMC will not capture the changes due to seawater intrusion and will provide little insight on how to best halt and reverse seawater intrusion. As described in Section 8.6.2.1, the change in storage is dominated by the changes in storage due to seawater intrusion, thus, changing the storage SMC will help capture the changes due to both seawater intrusion and groundwater elevation changes.

3	6	1/7/2022	Thomas Virsik	See attached letter	Received	The conceptual goal of a water budget descibed in your comment is correct. This water budget is derived from best available tools and data, meaning that not all components of the water budget are derived from the same source or with the same certainty, and, because of this, the water budget does not balance. The change in storage value calculated by the model, which makes the water budget equal zero, is reported in 6.3.2. text: "Averaged over the historical period, the preliminary SVIHM estimates that the 180/400-Foot Aquifer Subbasin is in overdraft by 14,800AF/yr." However, historical groundwater elevation data indicate that the model overestimates negative change in storage – see Section 6.3.2 of the GSP Update. Therefore, we adjust change in storage based on observed historical data, and apply that to the projected water budget because the projected SVOM model is developed based on historical data and therefore likely underestimates change in storage, similar to the SVIHM. The Table 6-13 change in storage of 800 AF/yr. comes from observed groundwater elevation changes. This was noted in the text in chapter 6 that says, "However, the storage loss estimate from Section 5.2.2 is likely underestimated because it does not account for conditions in the Deep Aquifers, due to lack of data. That estimate will be improved in the future after investigations of the Deep Aquifers." The pumping includes all pumping, including the Deep Aquifers. We know this is imperfect, but it is the best we could do with available data and tools. With regards to why -800 AF/yr is used as the change in storage in the future water budget, as the text explains: "As described for the historical water budget, data indicate that the Subbasin has historically been in overdraft (on the order of 800 AF/yr. decline), as described in Section 5.2.2. Even though the SVOM anticipates -10,500 and -11,300 AF/yr. change in storage due to groundwater levels for 2030 and 2070, respectively, the adjusted historical decline in storage is used with the adjusted pumping estimates to provide a likely more reasonable estimate for projected sustainable yield. The loss of groundwater storage is slightly less in the projected simulations than in the historical simulations, in part because there is no change in land use. This smaller decrease in groundwater storage is likely due to climate change, which is expected to be warmer and wetter according to DWR climate change factors. The model includes increased precipitation from climate change; however, it does not account for the frequency and magnitude of storm events. If storm events concentrate precipitation within short periods, more water may run off than infiltrate. More analysis needs to be done with regards to future recharge. Therefore, this projected water budget adopts the historical annual change in storage as the most reasonable estimate, assuming extraction continues. This is reflected in the adjusted average change in storage due to groundwater levels in Table 6 13, which is set to a decline of 800 AF/yr. However, as described above, this storage loss estimate is likely underestimated because it does not account for conditions in the Deep Aquifers, due to lack of data. The estimate will be improved in the future after additional hydrogeologic investigations of the Deep Aquifers."
4	6	1/20/2022	Grant Cremers	See attached letter	Received	With regard to why deep percolation was about 33% more than the historical average during the dry-normal water year 2016, it appears that this comment is referring to the "deep percolation of precipitation and applied irrigation" component of the groundwater budget. Comparing this component to the climate designation is problematic because deep percolation of irrigation water is not solely dependent on climate conditions. Other factors, such as crop water demand, water application rates, and land use, also influence deep percolation of excess applied irrigation water and do not vary solely based on climate. Thus, the historical average of this water budget component should not be expected to correlate perfectly with climate designation for any given year. With regard to whether the 9,000 acre feet of tile runoff is erroneously low, it is not. The 9,000 AF number being referred to represents the groundwater portion of tile drain runoff. That number belongs to the "discharge to drains" component of the groundwater budget. It represents the net amount of groundwater that seeps into the drains from the underlying aquifer. This component does not represent surface water runoff to the drains; instead, it is the groundwater portion of the tile drain runoff. The surface water budget includes a component representing runoff to streams (overland flow), which includes surface water runoff to drains. Estimated runoff to streams is about 21,400 AF/yr during the historical period. While it is understood that the commenter wants to know how much water is needed to 'solve our problems', there is no specific quantification because subbasins need to avoid undesirable results, which may not equate to a set volume of water, as there may be different ways to do so. For example, to stop seawater intrusion there are different kinds of projects to stop seawater intrusion, each associated with a different volume of water.

5	5 and 6	2/8/2022	John Farrow, LandWatch	See attached letter	Received	1.Historical water budgets: a.Adjusted pumping data – Pumping inputs to the SVIHM are based on reported data. Agricultural pumping is based on land use, while urban pumping is based on reported data and an estimation based on census data prior to GEMS. However, it is our understanding from the USGS that the data inputs contained errors during model development and calibration, which resulted in inaccuracies in the water budget estimates. The errors were discovered after the preliminary model was released by the USGS and, unfortunately, corrected model results were not available at the time of this GSP Update. We acknowledge the inconsistency between the pumping adjustment and the other water budget components that were estimated by the SVIHM. To account for the discrepancy between the erroneous model inputs and the actual reported values, we simply subtracted the difference in volume from groundwater storage. This approach assumes that all additional pumping is derived from storage and the volume of increased pumping is fully consumed by urban and agricultural consumptive use. This simplifying assumption is used to provide preliminary water budget estimates. These assumptions likely result in an overestimate of groundwater storage loss because some additional pumping may be compensated for by additional boundary flows, and some of the new applied water could have returned to the aquifer via deep percolation. However, that volume is likely relatively small so we did not attempt to adjust the deep percolation water budget numbers. Increasing the pumping in the model would result in changes to the overall water budget; however, given the complex interactions between water budget components, it is extremely difficult to estimate the magnitude of those potential changes without running a corrected version of the model. For example, agricultural pumping could be increased by adjusting the crops' consumptive uses, measured as evapotranspiration or ET. This ET is a specified model input. The increased agricultural pumping, and the associated increased irrigation, would potentially lead to several consequences including additional agricultural return flow, additional river recharge, or modified boundary flows. These effects, however, are likely small compared to the change in groundwater storage resulting from increased pumping. Therefore, the method used to adjust the water budget in Chapter 6 is the most reasonable and straightforward adjustment using existing tools. A recalibrated SVIHM with internally consistent water budgets is expected to be used for future GSP updates. Table 6-2 was updated to state that the source of pumping is from "Reported and adjusted data for historical municipal and agricultural pumping, and some small water systems. Agricultural pumping is based on reported land use and urban pumping is based on reported and estimated pumping.". b.Seawater Intrusion inconsistent – The seawater intrusion value presented in Table 6-8 was erroneously reported as the SVIHM simulated rate of 2,900 AF/yr, which is underestimated as described in Section 6.3.2. The GSP considers 12,600 AF/yr to be the annual rate of storage loss due to seawater intrusion. Table 6-8 was corrected accordingly. The SVIHM is not well calibrated for seawater intrusion, and it does not model the different densities of seawater and freshwater. SVBGSA and the County of Monterey are funding the development of a Seawater Intrusion Model to more accurately simulate seawater intrusion. c.Storage loss inconsistent –Total storage loss (or overdra.) is the sum of loss due to changes in groundwater levels and loss due to seawater intrusion. The SVIHM and SVOM treat these 2 components separately. The "net storage gain or loss" component in the water budget tables represents loss solely due to groundwater level changes. Table footnotes were updated to clarify that fact. Simulated storage loss due to groundwater level change from the preliminary SVIHM is overestimated. This is evident in that simulated groundwater levels are generally lower than measured groundwater levels in the Subbasin. Because of this discrepancy, estimates for storage loss (due to groundwater level changes) based on other analyses were used instead. We understand this approach is not internally consistent. However, the adjusted estimates provide more reasonable estimates for sustainable yield than the unadjusted model results. Other components of the water budget were not adjusted because they are not used in sustainable yield computation, and due to the complexities mentioned above in 1(a). The water budget error is mentioned in footnotes of the respective tables and it is described as being "unreasonably large and will be addressed and improved in future updates to the GSP." The water budgets in future GSP updates are expected to be internally consistent and based solely on model results, which are expected to be consistent with historical measurements. 2.Future water budgets: a.Storage loss inconsistent - as described for the historical water budget, the data inputs to the SVIHM contained errors during model development and calibration, which resulted in inaccurate water budget estimates. Because the SVOM builds off the SVIHM, the errors are also inherent in the preliminary SVOM model results. We acknowledge the inconsistency between the pumping and storage adjustments and the other water budget components that were estimated by the SVOM. This is a simplified approach used to provide preliminary future water budget estimates. Using the groundwater elevation data in the non-seawater intruded area of the Subbasin, there has been a historical loss in storage of 800 AF/yr which is used as the adjusted change in storage in the historical water budget. This is the best estimate available at the time of this GSP update. The future water budgets do not change land use or municipal pumping in the model and thus represent how groundwater conditions would change if pumping continued, in the absence of projects and management actions, but with anticipated climate change. Future pumping therefore is also adjusted by the same percentage difference between model results and reported extraction as the historical water budget. It is not exactly the same because land use varied in the past but is held constant in the SVOM. Although the SVOM anticipates a larger loss in storage for 2030 and 2070, the adjusted historical decline in storage is used with the adjusted pumping estimates to provide a likely more reasonable estimate for projected sustainable yield. Furthermore, the Chapter 6 text explains: "The loss of in groundwater storage [due to changes in groundwater levels] is slightly less in the projected simulations than in the historical simulations, even though there is no change in land use. This smaller decrease in groundwater storage is likely due to climate change, which is expected to be warmer and wetter according to DWR climate change factors.

						The model includes increased precipitation from climate change; however, it does not account for the frequency and magnitude of storm events. If storm events concentrate precipitation within short periods, more water may run off than infiltrate. More analysis needs to be done with regards to future recharge. Therefore, this projected water budget adopts the historical annual change in storage as the most reasonable estimate, assuming extraction continues. This is reflected in the adjusted average change in storage in Table 6-13, which is set to a decline of 800 AF/yr. However, as described above, this storage loss estimate is likely underestimated because it does not account for conditions in the Deep Aquifers, due to lack of data. The estimate will be improved in the future after additional hydrogeologic investigations of the Deep Aquifers." Improved versions of the SVIHM and SVOM, with internally consistent water budgets, are expected to be used for future GSP updates. 3.Sustainable yield: The comment letter correctly describes the components used for estimating sustainable yield. These components were adjusted during water budget development to address errors in the preliminary model results. Adjustments were not made to other components of the water budget because they are less important for estimating the sustainable yield value, and due to the complexities mentioned above in 1(a). The other water budget components will be of interest when evaluating benefits and impacts of projects and management actions, however the focus of this analysis was on sustainable yield. The sustainable yield derived from the model has been adjusted based on pumping reported through the GEMS program. This GSP uses the central tendency climate scenario recommended by DWR. Although DWR encourages evaluation of the other extreme climate scenarios, they are not required and would not likely change the management approach at this time, so they are not currently included. Climate change assumptions will be reevaluated as part of the 5-year update.4.Overdraft: We agree that overdraft was not well described in the previous draft GSP chapter and appreciate the opportunity to edit the text for clarity. Edits were made to the text to clarify that overdraft estimates for the Subbasin include both storage loss due to change in groundwater levels and seawater intrusion. Historical and projected future overdraft is estimated to be 13,400 AF/yr, which includes 800 AF/yr storage loss due to groundwater level changes and 12,600 AF/yr loss to seawater intrusion. 5.Intersubbasin flows: The Monterey Subbasin GSP used a different groundwater model in the 180/400 Subbasin GSP, due in part to poor calibration of the SVIHM in the Monterey Subbasin. However, the Monterey Subbasin Model adopted groundwater levels from the SVIHM; however, the Monterey Subbasin Model is more detailed in the Monterey Subbasin and does not include the full 180/400-Foot Aquifer Subbasin. The Monterey Subbasin GSP includes an implementation action to integrate the Monterey Subbasin Model into the SVIHM when the SVIHM is released to the public. For now, all additional simulations and analysis of intersubbasin flow (beyond what is described in the water budgets) will be considered by the Advisory Committee.
6	Whole GSP	2/22/2022	Nancy Isakson, SVWC	See attached letter	Received	1. Despite simulated extraction differing from reported extraction, the SVIHM is still the best available tool for developing water budgets. 2. The Chapter 6 text has been revised to more clearly identify where it states the overdraft. 3. See response to #1 and the response to the 2/8/2022 Landwatch letter 4. Section 4.5 describes "Surface Water Bodies" including descriptions of Nacimiento and San Antonio Reservoirs and their significance.

7	Whole GSP	4/12/2022	John Farrow, LandWatch	See attached letter	Received	1. Although SGMA does state that the storage SMC can be set using the metric of groundwater extractions, there is yet a good method to estimate sustainable yield in the 180/400-Foot Aquifer Subbasin. The estimate included in the original GSP was a preliminary estimate while the SVIHM was developed; however, the sustainable yield determined using the SVIHM does not seem accurate based on historical pumping data. The sustainable yield number is only a guide that will change over time, true sustainable yield is an absence of undesirable results which can also be achieved if another metric is chosen to measure storage SMC. Additonally, if the storage SMC is based on the sustainable yield it will change as projects get implemented, especially if a recharge project is implemented. As presented in Ch. 8 the correlation between cumulative change in storage and annual average change in groundwater elevation was 0.8334 from 1998 to 2016, which SVBGSA considers significant enough to establish groundwater elevations as a proxy for reduction of storage. The cumulative change in storage from the SVIHM was used because other ways of determining change in storage require using measured groundwater elevations leading to a perfect correlation between groundwater levels and storage. As previously mentioned in the repsonse to your December 30th letter, the SVBGSA has opted to develop a more complex proxy using both groundwater levels and extent of seawater intrusion due to complications with seawater intrusion in the Subbasin. DWR has accepted two GSPs that adopt a similar approach of using groundwater elevations and seawater intrusion control as a proxy for managing groundwater storage: the Oxnard Plain Subbasin GSP and the Pleasant Valley Subbasin GSP. Both of these GSPs, along with informal conversations with DWR staff, indicate that using groundwater levels and extent of seawater intrusion as proxies for storage is acceptable to DWR, which is the administrative agency that interprets and implements the SGMA regulations. SVBGSA, as the administrative agency, is charged with interpreting and implementing SGMA. The SVBGSA disagrees that the regulation's intent is to provide a basis for pumping allocations. The regulation's intent is to achieve groundwater sustainability and pumping allocations are only one tool that could be used to help achieve sustainability. Pumping within the sustainable yield is the objective, not dismissing pumping reductions, but pumping reductions alone likely will not help the Subbasin reach sustianability. The SMC are not used to manage the Subbasin, rather to demonstrate that management achieved sustainability. Calculating storage based on change in seawater intrusion and groundwater elevations will provide a direct calculation of groundwater storage and it will allow for more operational flexibility between the minimum threshold and the measurable objective. 2. The groundwater level minimum thresholds were set to a foot above 2015 groundwater elevations to avoid water levels reaching those drought conditions again. The sewater intrusion minimum threhsolds are set to the 2017 500 mg/L chloride isocontour, and despite many wells having water levels below sea level in recent years, the advancement of the seawater intrusion front in both the 180-Foot and 400-Foot Aquifers has been minimal since 2015 compared to historical rates. Sections 5.3.2 and 5.3.3 of the GSP Update discuss current seawater intrusion conditions, Section 5.3.3 shows bar graphs of the increase in seawater intruded acreage in the 180-Foot and 400-Foot Aquifers (Figure 5-28 and Figure 5-29, respectively). The increase in seawater intruded acreage from 2015 to 2017 in the 400-Foot Aquifer did increase more than that of the 180-Foot Aquifer, that change is not due to inland movement of the seawater intrusion front but the vertical migration of seawater from the 180-Foot to the 400-Foot Aquifer. This is an example of how seawater intrusion is not only dependent of groundwater elevations that are below sea level, but also a pathway that allows for seawater to move inland or vertically. Using groundwater extraction as the metric to measure the storage SMC will not capture the changes due to seawater intrusion and will provide little insight on how to best halt and reverse seawater instrusion. As described in Section 8.6.2.1, the change in storage is dominated by the changes in storage due to seawater intrusion, thus, changing the storage SMC will help capture the changes due to both seawater intrusion and groundwater elevation changes. 3 and 4. See Response to 2/8/2022 letter.

8	Whole GSP	3/14/2022	Seaside Basin Watermaster			Project timeline comment: Timelines for individual projects included in Ch 9. Project prioritization and selection will occur during GSP development. SGMA recognizes that it takes time to assess, compare, select, and implement projects by providing 20 years to reach sustainability. SVBGSA is committed to reaching sustainability and actively working toward that. Recycled water project comment: GSPs state that these are the bucket of realistic, potential projects, but not all projects will be implemented. Therefore, the amount of recycled water should not be summed between projects. SVBGSA is aware that there is not likely sufficient recycled water to do all projects. Extraction barrier comments: -Table 6-5 assumes that only the 180/400-Foot Aquifer Subbasin undertakes projects and management actions, and assumes that no actions will be taken on part of the Marina-Ord Area. The Marina-Ord Area is responsible for meeting its own SMC, which will likely include implementation of projects and management actions within the Monterey Subbasin. -Inter-subbasin subsurface flow is a natural occurrance that was often present prior to SGMA. SGMA does not assume no flow between basins/subbasins, but rather that flow is not altered substantially. Therefore, flow from Seaside to Monterey should be contextualized with the current inter-subbasin subsurface flow. -The 180/400-Foot Aquifer Subbasin Committee has not decided on the extraction barrier (nor any project). The estimation of the groundwater levels needed in the absence of an extraction barrier was determined by MCWDGSA without input from or evaluation by SVBGSA. SVBGSA will be assessing these and other projects and management actions to determine which to implement to meet all of the SMC. SVBGSA is aware of the difficult challenges in implementing projects and management actions, and it is committed to overcoming these to reach sustainability.
9	Whole GSP	4/25/2022	James Sang	See attached letter	Received	Thank you for your input and research. The subsoiling technique you recommend is more appropriate for rangeland for livestock grazing rather than crop land. This technique could be considered by growers to increase rainwater infiltration if they fallow their lands; however, the Salinas Valley Aquitard prevents recharge of the principal aquifers through manners like this across most of the 180/400-Foot Aquifer Subbasin.
10	Whole GSP	5/10/2022	Thomas Virsik	See attached letter	Received	Water Budget comments: Chapter 6 has been updated to clarify how extraction was input to into the Model and to describe the uncertainty in the Model. In addition, there was text added to describe that change in storage (overdraft) is the sum of change in storage due to groundwater levels and change in stroage due to seawater intrusion. Edit level comments and Updates missing in Update comments: Noted and thank you. Clarity comments: Demand management planning and its relationship to the sustainable yield is described in the management actions . The implementation schedule indicates the estimated timeline and the work that will begin within the demand management planning feasibility study.

11	Whole GSP	5/13/2022	Heather Lukacs, Community Water Center	See attached letter	Received	I. SVBGSA has taken a number of actions since GSP submittal, as described in the annual reports. For example, the Seawater Intrusion Working Group has been working to better understand seawater intrusion and the potential projects and management actions that could address it, a variable density seawater intrusion model is being developed to be able to assess those projects and actions, SVBGSA funded the Deep Aquifers Study, and SVBGSA has secured $7.6 million to implement projects, management actions, and feasibility studies in the 180/400-Foot Aquifer Subbasin. Among other actions, the funding will improve CSIP to reduce its groundwater extraction. SVBGSA is also working on implementing Governor Newsom's March 28th Executive Order. The GSP Update does not change the SMC; the revised results of the domestic well analysis are more accurate, but it is an estimate based on available data; since the SMC did not change, no additional wells will be impacted than with the original GSP. SVBGSA expanded the monitoring network from 21 to 91 wells in the Subbasin, which will better monitor groundwater conditions near underrepresented communities. Finally, SVBGSA has offered support to Castroville CSD and has been discussing short and long-term solutions for their drinking water supplies. They currently have sufficient supply, so a well mitigation program is not necessary; however, SVBGSA will continue to work with them to help ensure they have sufficient clean drinking water supplies in the future. II. The domestic well analysis included in the GSP Update uses wells with more accurate locations than those in the original GSP. The original GSP included all domestic wells in the OSWCR, even those located in the centorid of the PLSS sections, for which water elevations can not be estimated as accurately, leading to a misrepresentation of wells that will be impacted when water levels are at the minimum thresholds or measureable objectives. III. SVBGSA added text to the original GSP (now in Section 8.9.4.1 of the GSP Update), which sufficiently addresses DWR's comments on the water quality section in the original GSP. SVBGSA understands that groundwater extraction should not be managed merely to raise groundwater elevations; the statement in Section 8.9.4.1 saying that the groundwater level SMC is designed to protect groundwater quality is meant to reiterate that preventing decreases in groundwater elevations is intended to help prevent further degradation of water quality. Further the GSA is not denying that decreasing groundwater elevations may be linked to degradation of water quality; however, sufficient data do not exist to establish a statistically significant correlation among groundwater elevations and water quality constituents of concern in the Subbasin, although a visual correlation may exist for specific wells. The WY2021 Annual Report compared groundwater quality to the original GSP SMC; however, once the GSP Update is passed by the Board and submitted to DWR, annual reports will use the updated SMC that broadens what is included in the SMC to impacts from groundwater management. IV. Further, domestic wells were not omitted from consideration in the GSP. The letter cites DWR review of GSPs where the groundwater level minimum thresholds were set lower than 2015; however, the 180/400 GSP sets them above 2015 levels, in conjunction with no further advancement of seawater intrusion. For GSP monitoring, both the groundwater elevation and groundwater quality monitoring networks include domestic wells. The number of domestic wells included in the monitoring network are limited, however, to avoid contamination during sampling events. Additionally, the GSA is working to fill data gaps. To address the concern that domestic wells are too shallow to be covered by the monitoring network, we completed an additional depth analysis. Based on the PLSS Section data available through OSWCR, we identified sections where the minimum well depth was less than 100 feet. Wells below this depth are likely to be part of the 180-Foot Aquifer and covered by the monitoring wells. For sections with wells below 100 feet, those in the northern part of the Subbasin where the Salinas Valley Aquitard does not exist are likely covered by the monitoring network because the Salinas Valley Aquitard is not present in this area. For those in areas where the Aquitard is present, we reviewed well depths to identify the number of wells less than 100 feet where the Aquitard is present. Through these steps, we found that only 1.6% of the domestic wells in the Subbasin are potentially not covered by the monitoring network and 98.6% are likely covered by the monitoring network. V. SVBGSA adopted MCWRA's seawater intrusion monitoring network and maintains it is representative enough for monitoring purposes, based on the DWR Best Management Practices for monitoring networks, and exceeds these recommendations. Thus, domestic wells that are drilled in the principal aquifers should have sufficient coverage. If seawater intrusion advances, more wells may be added to the network, as needed. For other constituents of concern that are not related to seawater intrusion SVBGSA uses the DDW and ILRP monitoring networks which provide sufficient coverage of the Subbasin. VI. This GSP Update meets SGMA regulations and assesses the future water budget with the climate change scenarios recommended by DWR. We appreciate that CWC is interested in additional climate change scenarios and agree that projects and management actions should be considered with respect to multiple scenarios. SVBGSA will review climate change scenarios prior to doing the 2027 5-year assessments, and it will also take into account multiple potential climate futures when considering implementing projects and management actions.

Technical Review Appendix:
GW Conditions
-The SWIG TAC reviewed MCWRA's seawater intrusion monitoring network. The seawater intrusion monitoring network is sufficient for monitoring the chloride isocontour, other than in the Deep Aquifers which is a data gap identified in the GSP Update.
-Historical spatial exceedances of reg. limits are included in Appendix 5C. All this data is publicly available and putting all the data used in the GSP will be duplicative of SCWRB's GAMA efforts to publish data.

Water Budgets
-Chapter 6 has been edited to clarify throughout that both change in storage due to groundwater levels and change in storage due to seawater intrusion contribute to overdraft. The projected water budget can be improved when there is a fully calibrated model; however, at this point, the preliminary SVIHM/SVOM paired with observed and reported data provide the best available data.
-This GSP uses the central tendency climate scenario recommended by DWR. Although DWR encourages evaluation of the other extreme climate scenarios, they are not required and would not likely change the management approach at this time, so they are not currently included. Climate change assumptions will be reevaluated as part of the 5-year update.
- The projected sustainable yield is the long-term amount that can be extracted without causing undesirable results after sustainability has been met. It does not make any assumptions or decisions regarding what projects and management actions are implemented. Rather, it provides flexibility for how sustainability is met, and portrays the amount of extraction that can occur after that point without exceeding minimum thresholds.
SMCAs shown in the 2021 Annual Report, seawater intruded acreage in the 180-Foot Aquifer has not increased since 2020 although groundwater levels in the 180-Foot Aquifer were lower than sea level. For seawater to continue to intrude, persistently low groundwater elevations need to be paired with a pathway. The 180-Foot and 400-Foot Aquifers consists of many different sediments and often include clay lenses or layers of fine sediments that can impede or slow seawater intrusion.
-Measurable objectives are the conditions for which we are aiming. Minimum thresholds are meant to be avoided; however, they provide operational flexibility.
-The domestic well analysis was redone with updated 2020 data. The analysis completed is considered best available data for the reasons listed in the chapter. If the analysis was done including wells with inaccurate locations (located at the centroid of the section), G22in the 180-Foot Aquifer, 73% (141 out of 194) of domestic wells would have at least 25 feet of water if groundwater levels falling to their minimum thresholds. In the 400-Foot Aquifer, 95% (95 out of 100) of domestic wells would have at least 25 feet of water if groundwater levels falling to their minimum thresholds.
There is less groundwater level data from domestic wells than agricultural or municipal wells in part because MCWRA tends not to sample these wells due to cross-contamination. There are not errors in the contours, but rather some contours do not cover the whole subbasin due to lack of historical monitoring data. New constituents, such as hexavalent chromium, can be added when it's MCL is finalized. The intent of the SMC is to assess drinking water wells for Title 22 constituents.
-Appendix 7D clearly notes the wells included in the water quality monitoring network. The monitoring network only includes active wells and inactive wells that are still being sampled. All items requested in this comment bullet are already included. The SMC is established based on the most recent sample in each well and for each constituent prior to 2017, and the GSP Update compares this to current conditions, which are the most recent sample in each well and for each constituent prior to 2020.

Monitoring Network
-As stated in the 2021 Annual Report, the GSA is currently working on filling these data gaps and has secured funding to move forward on several of them. First, the GSA is looking for any existing wells and willing well owners, which would allow fill the data gap faster as opposed to drilling a new well. The GSA will drill a well if no wells are found in data gap areas.
-The GSP notes that a nested well that monitors multiple aquifers is ideal for this area in order to analyze vertical connectivity between the aquifers and hopefully add more coverage in this area.
-See GW conditions comment response.
-See SMC section comment responses.
-Domestic wells or small water systems are monitored by County Health. When the data becomes readily available, SVBGSA may incorporate them into the monitoring network. The state-led SAFER program is working to make this data more accessible.
-SVBGSA has secured $7.6 million SGMA Implementation Grant that includes funding for identifying well construction information of monitoring wells.
Projects and Management Actions
-SVBGSA has not yet selected which projects will be implemented nor identified specific funding mechanisms – those steps will occur during GSP implementation. Additional feasibility scoping is needed for that to occur, and SVBGSA has secured $7.6 million in funding, much of which will go towards that effort. The water budget does not need to include modeling of specific projects, but the Projects and Management Actions chapter shows that sufficient options exist. SVBGSA is committed to reaching sustainability.

12	Whole GSP	5/13/2022	Hastings. Brownstein Hyatt Farber Schreck on behalf of Salinas Basin Water Alliance (SBWA)	See attached letter	Received	Previous letters from the Alliance have been added to this adminstrative record and are included below. See comment responses to these letters below.
12.a	Letter submitted for 2022 GSPs	8/12/2021	Hastings. Brownstein Hyatt Farber Schreck on behalf of Salinas Basin Water Alliance (SBWA), including August 11, 2021 Aquilogic Memo attachment	See attached letter	Received	Additional simulations and analysis of intersubbasin flow (beyond what's in the water budgets, required by SGMA or in existing model runs) will be considered by the SVBGSA Board of Directors.

12.b	Letter submitted for 2022 GSPs	10/15/2021	Hastings and Guillen. Brownstein Hyatt Farber Schreck on behalf of Salinas Basin Water Alliance (SBWA), including October 15, 2021 Aquilogic Memo attachment	See attached letter	Received	I. SVBGSA updated the name of the Integrated Sustainability Plan to the the Integrated Implementation Plan to emphasize its focus on implementation. The Advisory Committee will outline the implementation of the 6 GSPs in the Salinas Valley Basin and address questions of groundwater relationship between the subbasins. This Committee will help ensure all subbasins get to sustainability. II. A. The SVIHM is the best available tool to compute water budgets for the subbasins in the Salinas Valley. The 180/400-Foot Aquifer Subbasin GSP has been updated using the SVIHM to be consistent with the rest of the subbasins in the 2-Year Update currently underway. The SVIHM was used to develop water budgets for the Langley, Eastside, 180/400, Forebay, and Upper Valley using the same model simulations so that they would be consistent. The Monterey Subbasin used a different model due in part to poor calibration of the SVIHM in the Monterey Subbasin; however, it adopted boundary conditions from the SVIHM to increase compatibility and the Monterey Subbasin GSP includes an implementation action to integrate the Monterey Subbasin Model into the SVIHM when it is released. SVBGSA ran a no pumping scenario with the SVIHM to determine locations of surface water depletion due to pumping; however, it is a static model that does not shed light on how intersubbasin flow would have changed. It is a static dataset that reflects how reservoirs were actually operated, not how they would have been operated with no pumping. II. B. 1. a & b. Sustainable yields were defined according to SGMA regulations. The water budgets measure inflows and outflows of the groundwater system, and both interbasin flow and groundwater extraction are accounted for. Minimum thresholds are meant to be prevented to avoid undesirable results. If each subbasin avoids their minimum thresholds, then neighboring subbasins will likely not be prevented from reaching or maintaining sustainability. The GSP does not dispute that its conditions affect adjacent subbasins; however, it does not prevent them from reaching sustainability. The sediment relationships between the 180/400-Foot Aquifer Subbasin, and the adjacent Langley/Eastside Subbasin demonstrate a dynamic environment where different sediments were deposited over time and subsequently, impact groundwater flow. The boundary with the Eastside Subbasin generally represents the furthest extents of the alluvial fans, which are characterized by clays and other fine sediments. These sediments frequently act as an impediment to flow, if not fully a barrier in certain locations. Subsequently, the gradient relationship is not the only influence to groundwater flow between the 180/400-Foot and Eastside Subbasins, and needs to be considered along with all subsurface characteristics. While there is a relationship between the groundwater contours developed for the 180/400 and Eastside Subbasins, the contours themselves are not fully representative of flow between the subbasins. As the model is further refined with additional and expanded data during Implementation, the SVBGSA and stakeholders will have a clearer view of the groundwater flow relationships, particularly as they relate to the recorded sediments in this area. The boundary with the Langley Subbasin was selected based on topographical changes, and the GSP fully acknowledges there is no hydrogeologic boundary that coincides with the administrative boundary. The key characteristic of the Langley Subbasin is the Aromas Sands, which are very permeable. Despite this connection and high permeability along with lowered groundwater elevations, the seawater intrusion front is not advancing in the direction of the Langley Subbasin. Subsequently, it would be premature to conclude that groundwater elevations in the Langley Subbasin are inducing or facilitating seawater intrusion in the 180/400-Foot Aquifer Subbasin. The groundwater flow relationship between the Langley and the Eastside Subbasins is largely uncharacterized as a result of a lack of data both about the sediment changes and the groundwater elevations in the area. This is a data gap that will be addressed during implementation. It is important to note that the 180/400-Foot Aquifer Subbasin GSP includes a plan in place to halt and reverse seawater intrusion and increase groundwater elevations, which will also serve to prevent adverse seawater intrusion impacts to the Eastside Subbasin. Both the Eastside Subbasin and the Langley Subbasin have developed projects and management actions to raise groundwater levels in their subbasins. The SMC were largely developed to be both achievable, as well as provide for operational flexibility during future droughts. Furthermore, these subbasins will be a part of the Integrated Implementation Plan, which will work to address seawater intrusion through a variety of strategies, which include increasing groundwater elevations. The subbasins under the SVBGSA will be integrated during implementation, data acquisition, further data development, and coordinated stakeholder engagement. II. B. 1. c. Subbasin Planning Committees for each subbasin chose how they wanted to measure reduction in groundwater storage. The definition of storage for groundwater is expressly based on a change in pressure heads, or groundwater elevations, within an aquifer. Freeze and Cherry, in their seminal 1979 textbook Groundwater state, “The specific storage Ss of a saturated aquifer is defined as the volume of water that a unit volume of aquifer releases from storage under a unit decline in hydraulic head.” Hydraulic head is the sum of all pressures acting on water in the subsurface, which in unconfined aquifers, is generally summarized as elevation. Therefore, given the direct relationship between groundwater elevations and specific storage, groundwater elevations are appropriate as a proxy for storage. This is also explained in chapter 4.4.2 of the GSP, and a reference to that section has been added into Ch 8.

						II. B. 2. A description of how minimum thresholds will affect adjacent subbasins were provided per GSP Regulations. The Forebay and Upper Valley Subbasin Planning Committees defined how the SMC for all sustainability indicators in their subbasins will be measured. The SMC in the Forebay and Upper Valley are set at similar levels to the other subbasins and will not prevent adjacent subbasins from reaching sustainability. Text was added to clarify how the minimum thresholds were developed based on the significant and unreasonable statement and why they are not in conflict. SGMA does not require an assessment on the conditions in adjacent subbasins, but rather requires that SMC are set at levels that do not prevent adjacent subbasins from avoiding their undesirable results. II. B. 3. SVBGSA has considered the interest of all beneficial users in the Salinas Valley. The GSA does not "allocate the burden of sustainability" nor undertake any actions that threaten or impinge on water rights. III. Projects and managment actions were chosen by Subbasin Planning Committees, and are sufficient to maintain or achieve sustainability. the project mentioned was not brought up in any of the Subbasin Committee discussions on projects and management actions; however, the GSP does not preclude additional projects to be considered in the future.
12.c	Letter submitted for 2022 GSPs	10/15/2021	Abrams and Brown. Aquilogic Memo, on behalf of Salinas Basin Water Alliance (SBWA)	See attached letter	Received	Original SVBGSA Response: "The SVBGSA agrees that impacts on adjoining basins or subbasins must be addressed before implementing any management actions or projects. SVBGSA plans to conduct these analyses as needed to make decisions regarding projects and management actions. In addition, as part of the 5-year updates, the water budgets will be updated and sustainable management criteria reviewed to account for inter-basin flows and impacts on adjoining basins or subbasins. SVBGSA additionally agrees that the superposition approach included in the comment is a reasonable approach for addressing any action's or project's impact on inter-basin flows. This type of approach lessens the influence of model errors by addressing changes between simulations, and not absolute values in any simulation. SVBGSA will use this approach to address both intra and inter-basin impacts from any action or project. SVBGSA further agrees that the additional simulations proposed in the comment letter will facilitate a deeper understanding of the Salinas Valley Groundwater Basin, even though the additional simulations are not associated with specific actions or projects. To that end, SVBGSA staff will propose to the SVBGSA Board of Directors that the requested simulations would be informative, that these simulations be conducted before the next GSP assessment, and that the additional simulations will provide essential background understanding that will allow a thorough vetting of any potential management actions or projects. If and when approved by the SVBGSA Board of Directors, SVBGSA staff will work with all interested parties and stakeholders through the ~~Integrated Implementation Committee~~ Advisory Committee to develop the assumptions and approaches for these simulations." Additional clarification and updates: The SVBGSA Advisory Committee has assumed the integrated implementation role originally planned for the "Integrated Implementation Committee". "Implement" in the first sentence of the response above was meant to refer to the final stages of management action or projects. Recent discussions with DWR indicate that "implementation" should be initiated immediately and SVBGSA's current phase of implementation is focused on feasibility studies. SVBGSA still intends to conduct these analysis as needed.
12.d	Letter submitted for 2022 GSPs	12/8/2021	Hastings and Guillen. Brownstein Hyatt Farber Schreck on behalf of Salinas Basin Water Alliance (SBWA), including October 15, 2021 Aquilogic Memo attachment	See attached letter	Received	See previous comment response from October 15, 2021 letter.

12.e	Letter submitted for 2022 GSPs	12/8/2021	Abrams and Brown. Aquilogic Memo, Salinas Basin Water Alliance (SBWA)	See attached letter	Received	‘Specified’ might be a more appropriate and understandable term than ‘static.’ The SVIHM is a transient model, meaning that it changes through time. Some model parameters are based on user-specified rates (i.e., the user controls the rates), while other parameters are “model-determined” rates (i.e., the model estimates the rates internally based on other inputs, such as pumping rates based on user-specified crop ET). The SVIHM simulates complex interactions in the basin’s hydrologic system while maintaining an internally consistent water budget. Reservoir operations in the SVIHM are based on a user-specified dataset that represents how reservoirs were actually operated in the past, not how they would have been operated with no pumping. The comment letter states “The Alliance request is for concept development and hypothesis testing simulations, which can be accomplished with “what-if” model scenarios” and “Historic reservoir releases are sufficient to conduct the simulation analyses. The questions being asked by such analyses are related to “order of magnitude” estimates of how much groundwater and surface water is captured by pumping, not a specific accounting of water budget components for a hypothetical scenario.” The level of insight that such an analysis can provide at this phase of GSP implementation is unclear. “What-if” scenarios are more useful when they are at least approximately realistic. Turning off pumping without adjusting land use or reservoir releases is an unrealistic historical “what-if” scenario, which could lead to additional questions and uncertainty about the water budgets. Reservoir releases would have been different if pumping was different historically. Further, given the errors and limited calibration of the preliminary SVIHM used for this GSP Update, any analysis of impacts from groundwater pumping on intersubbasin flows would be more appropriate after an improved, calibrated version of the model is available. The comment presented in the aquilogic follow up letter is an accurate description of groundwater contour lines as a first, and important line of evidence when assessing relationships and impacts. The contours do show consistency in magnitude and direction over time, and between the 180/400 and Eastside Subbasins. However, the groundwater contours lines also show a distinct change in elevations and magnitude of gradient near the Subbasins’ boundary. The groundwater elevation contour maps from different years shown in Chapter 5 demonstrate these relationships. The change in groundwater elevations within the 180/400 over the selected year are significantly greater than those across the boundary with the Eastside over the same time period. Whereas the groundwater elevations near the boundary with the Eastside shift only slightly. These slight shifts may also reflect not only a change in the groundwater elevations, but also the error in the interpolation between data points. The main conclusion from these observations is that the groundwater elevation contours cannot solely be relied upon to interpret the groundwater conditions and relationships across the boundary, which was explained in the comment response. Therefore, the response to Section II.B.1.a of the Brownstein letter stands as an affirmative response to the nuance and caution used to characterize this area. It is reflective of the best available data and published information in both report and map form. Best available references to substantiate the cautious explanation of the groundwater relationships with facies changes in this area include: •Kennedy/Jenks, 2004 •Brown & Caldwell, 2015 •Tinsley, 1975
12.f	Letter submitted for 2022 GSPs	3/9/2022	Hastings and Guillen. Brownstein Hyatt Farber Schreck on behalf of Salinas Basin Water Alliance (SBWA)	See attached letter	Received	This letter addresses SVBGSA's Two-Year Work Plan, not the GSP Update.

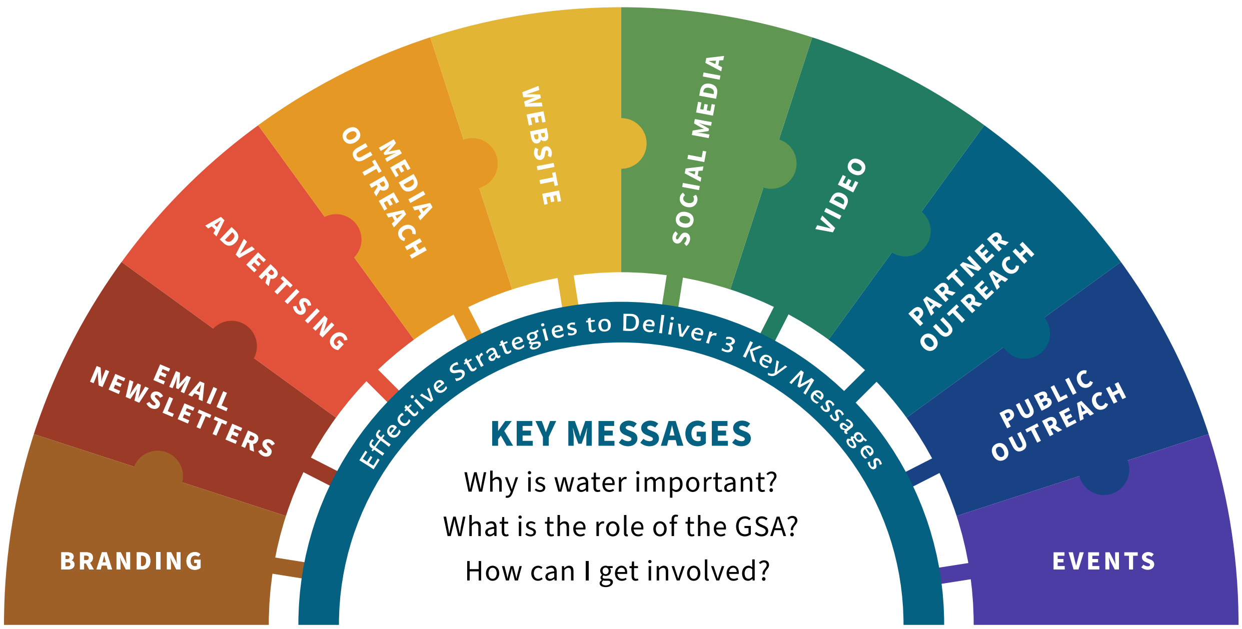
12.g	Letter submitted for 2022 GSPs	4/15/2022	Hastings and Guillen. Brownstein Hyatt Farber Schreck on behalf of Salinas Basin Water Alliance (SBWA)	See attached letter	Received	1.SGMA requires a GSP to be written for each Subbasin. SGMA does not require an assessment on the conditions in adjacent subbasins, but rather requires that SMC are set at levels that do not prevent adjacent subbasins from avoiding their undesirable results. In addition, the water budgets measure inflows and outflows of the groundwater system, and both interbasin flow and groundwater extraction are accounted for. Minimum thresholds are meant to be prevented to avoid undesirable results. If each subbasin avoids their minimum thresholds, then neighboring subbasins will likely not be prevented from reaching or maintaining sustainability. The first phase of the Integrated Implementation Plan (not required by SGMA) will include basin wide (within SVBGSA jurisdiction) groundwater conditions and basin wide monitoring networks. 2.The SVBGSA agrees that impacts on adjoining basins or subbasins must be addressed before the final implemention of management actions or projects. Feasibility sttudies are the being initiatied and SVBGSA plans to conduct these analyses as needed to make decisions regarding projects and management actions. In addition, as part of the 5-year updates, the water budgets will be updated and sustainable management criteria reviewed to account for inter-basin flows and impacts on adjoining basins or subbasins. The water budgets measure inflows and outflows of the groundwater system, and both interbasin flow and groundwater extraction are accounted for. 3.A description of how minimum thresholds will affect adjacent subbasins were provided per GSP Regulations. The Subbasin Planning Committees defined how the SMC for all sustainability indicators in their subbasins will be measured. The SMC are set at similar levels to the other subbasins and will not prevent adjacent subbasins from reaching sustainability. Text was added to clarify how the minimum thresholds were developed based on the significant and unreasonable statement and why they are not in conflict. 4.SVBGSA has considered the interest of all beneficial users in the Salinas Valley. The GSA does not "allocate the burden of sustainability" nor undertake any actions that threaten or impinge on water rights.
13	Whole GSP	5/19/2022	National Marine Fisheries Services	See attached letter	Received	Thank you for your comments. SVBGSA continues weekly meetings with MCWRA who is the entity responsible for operating the reservoirs. SVBGSA is also participating on the MCWRA Drought TAC for reservoir operations. The SVBGSA continues to assess groundwater conditions and publishes the data in Annual Reports. SVBGSA looks forward to continuing discussions with NMFS.
14	Whole GSP	5/26/2022	Wayne Gularte	See attached letter	Received	Thank you for your comments. - Please provide documentation of current, active pre-1914 rights as we do not see those described in your letter in the state's eWRIMS database. - The referenced Court Case relates to the MCWRA benefit assessments, and is not applicable to SVBGSA's fees. - The mulit-benefit stream channel improvements project includes invasive species eradication, native vegetation management, stream channel maintenance and floodplain restoration. - The SVBGSA intends to collaborate with other Agencies for coordination and to avoid duplicative efforts. There is a specific Implementation Action to coordinate with the Central Coast Regional Water Quality Control Board as well as other entities involved with water quality. - The Management Action for Conservation and Agricultural BMPs describes potential practices to support conservation and BMPs that growers and landowners are interested in. Labor laws and trade agreements are outside of the scope of the SVBGSA and SGMA.

Chapter 2
Appendix 2-**B**

Agency-Wide Marketing & Communications Plan

Appendix 2A. Agency-Wide Marketing & Communications Plan

Marketing & Communications Plan



Chapter 2
Appendix 2-C

Key Messages

Appendix 2B. Key Messages

Initially, our message points focus on: (1) **getting to know your GSA**; (2) **an overview of groundwater sustainability planning for our community**; and (3) **how we got here**. The key messages will be expanded as the work evolves.

Key Messages: Get to Know Your GSA

- The SVBGSA is on a mission to develop a Salinas Valley Integrated Groundwater Sustainability Plan by 2023 and achieve groundwater sustainability in the Salinas Valley by 2040.
- Our groundwater basin is comprised of 6 subbasins one of which is identified as "Critically Over-Drafted" – the 180/400-Foot Aquifer.
- The rate of the community's current water use is unsustainable. To meet our community's ongoing water supply needs now and into the future we must balance the basin.
- The State has put us on a tight timeline to fix the problem. We ambitiously accept the challenge.
- As of 2020, we have GSP for the 180/400-Foot Aquifer Subbasin and have scoped projects and programs to bring the subbasin back into balance.
- From 2020 through 2022 we will work on GSPs for the other five basins.
- We will start implementing our plans immediately and efficiently use our GSA sustainability fee to work towards sustainability.
- Developing a sustainability plan for groundwater impacts everyone. That's why the SVBGSA Board and our Advisory Committee are diverse and include stakeholders from every walk of life in the Salinas Valley.
- We have an unprecedented opportunity, and responsibility, to work together collaboratively and develop a science-based Groundwater Sustainability Plan.
- Join us! Visit our website, sign up for updates, attend the next meeting and follow us on Facebook.

Key Messages: Groundwater Sustainability Plan

The Upper Valley Subbasin Groundwater Sustainability Plan and Salinas Valley Integrated Sustainability Plan are our 20-year plans to ensure that the Salinas Valley Groundwater Basin (SVGB) will be managed sustainably for our current and future generations.

- Aquifer subbasin planning is not only critical to our future - it's mandatory. SGMA mandates that science-based GSPs be developed for the Basin by 2020 and 2022, and that the plan be implemented by 2040.
- The stakes are high. Should we choose not to act, or fail to meet the 2020, 2022, or 2040 milestones, the State can intervene with required (and hefty) pumping restrictions and extraction fees.
- To meet these milestones, we have been granted the authority to develop GSPs, monitor and measure the basin and individual wells within the basin, implement capital projects, and assess necessary fees for planning and implementation.
- Six "Sustainability Indicators" will be evaluated in the GSPs and used to gauge what we need to do to bring our groundwater supply and demand back into balance.
- Given the hydrologic and geographic diversity of the SVGB, the ISP will identify overlapping projects and programs which benefit the basins. Our planning process includes initiating planning committees for the subbasins and maintains our governance structure of the Board, advisory committee, and planning committee.
- Stakeholder engagement is a key component to the development and implementation of the GSP. We encourage and invite the community to get involved. Attend our monthly Board meetings, attend a Subbasin Planning Committee meeting, sign up for our newsletter.

Key Messages: Our History

- The Salinas Valley Basin GSA is firmly rooted in stakeholder engagement.
- From 2015-2017, local agencies and stakeholders worked with the Consensus Building Institute (CBI) to facilitate the formation of the GSA.
- In 2015, CBI began by conducting a Salinas Valley Groundwater Stakeholder Issue Assessment, which included interviews and surveys. This process resulted in recommendations for a transparent, inclusive process for the local implementation of SGMA and the formation of the GSA.
- Following the Issue Assessment, The Collaborative Work Group of stakeholders representing a broad range of interests met from March 2016 through April 2017 and developed recommendations on the governance structure, voting, and legal structure of the GSA.
- The Stakeholder Forum was simultaneously held throughout 2016 and served as a critical element for interested stakeholders and the public to learn about and provide input on the GSA.

- After nearly two years of community engagement led by the top consensus-building professionals in the nation, the Salinas Valley Basin Groundwater Sustainability Agency was formed in April 2017 with a broad and diverse foundation of support.

Chapter 2
Appendix 2-D

Media Policy

Appendix 2C. Media Policy

The press is an important partner for getting our message out to the community. To maximize our effectiveness in working with the media, a consistent protocol will be followed by staff, consultants, board members, and committee members.

Agency Spokesperson(s)

- The primary spokesperson for all media inquiries is the General Manager (GM). Media inquiries should first be directed to the GM to coordinate a response.
- Reporters may want to also interview board and community members. Some board members may enjoy media conversations, while others do not. The SVBGSA will maintain a standby list of a few board and community members, who will be prepared and can be called on for media inquiries.
- In preparation for the interview, the GM and Public Information Officer (PIO) will work closely with the spokespeople in preparation for media interviews. Factual and coordinated talking points will be provided in advance of the interview.

Responding Quickly

- Reporters work on tight deadlines. To ensure an opportunity is not missed, all media inquiries should receive an immediate response and referred to the GM at the earliest possible opportunity.

The Back-Up Plan

- If the GM is unavailable and cannot be reached for comment, media inquiries should be directed to the Board's back-up media representative. The Board's representative will contact the PIO to determine whether a response is necessary. If the response is not urgent, offer the media an appointment time for when the GM is available. If it is a time sensitive and urgent matter, a statement will be released from the Board representative in close coordination with the PIO.

News Monitoring and Tracking

- Following the interview or statement, if published, the GM or PIO will circulate the coverage to the Board and committee members.

Chapter 2
Appendix 2-**E**

Disadvantaged Communities (DACs)

APPENDIX 2D. DISADVANTAGED COMMUNITIES

Introduction and Purpose of Appendix

Many of the communities in the Salinas Valley Groundwater Basin are classified as Disadvantaged Communities (DACs) and Severely Disadvantaged Communities (SDACs), as well as Economically Distressed Areas (EDAs). The SVBGSA jurisdictional area has well documented DAC-designated areas including seven Census Designated Places (CDPs), 60 Block Groups, and 20 Tracts. Additionally, work conducted by the Greater Monterey County Integrated Regional Water Management (IRWM) Program identified 25 small disadvantaged, severely disadvantaged, and suspected disadvantaged communities in unincorporated areas of the IRWMP region (Greater Monterey County Regional Water Management Group, 2018), which includes the entire SVBGSA area. As many of these communities are dependent on groundwater for drinking water, they face challenges associated with drinking water quality.

The State of California has recognized challenges in providing clean, safe, and affordable drinking water to all of its citizens, especially low-income and minority communities. In 2012, California law AB 685, the Human Right to Water, declared that every person has a right to clean, safe, and affordable drinking water. In 2019, the State further made it a priority by passing SB 200, the Safe and Affordable Drinking Water Fund. In Fiscal Year 2019-2020 alone, it will dedicate $130 million for safe drinking water solutions in DACs that do not have access to safe drinking water.

The Salinas Valley Groundwater Basin is one of the most productive agricultural regions in the world. However, over several decades seawater intrusion and intensive fertilizer use resulting in nitrate contamination have compromised drinking water quality in parts of the Basin. Nitrate contamination in groundwater can pose serious health risks to pregnant women and infants if consumed at concentrations above the maximum contaminant level (MCL) of 10 milligrams per liter (mg/L) nitrate as nitrogen (NO_3-N). Nitrate contamination not only poses health risks, but also results in major costs for small rural communities. This is particularly challenging for the many economically disadvantaged communities in the Basin.

SGMA has limited requirements with regards to improving groundwater quality; the SGMA regulations are written in terms of avoiding degradation (CWC, §354.28 (c)(4)). However, the SVBGSA seeks to engage more constructively with disadvantaged communities moving forward in the subbasin planning processes. SVBGSA maintains excellent relationships with agencies monitoring and addressing water quality issues in the Basin. The purpose of this appendix is to provide background information on the relationship between DACs (including SDACs and EDAs) and groundwater, particularly with respect to the drinking water challenges in the Basin. Unless otherwise noted, the information in this appendix is based on and much is excerpted from the Integrated Regional Water Management (IRWM) Plan for the Greater Monterey County Region (Greater Monterey Regional Water Management Group, 2018).

Identifying DACs in the Salinas Valley

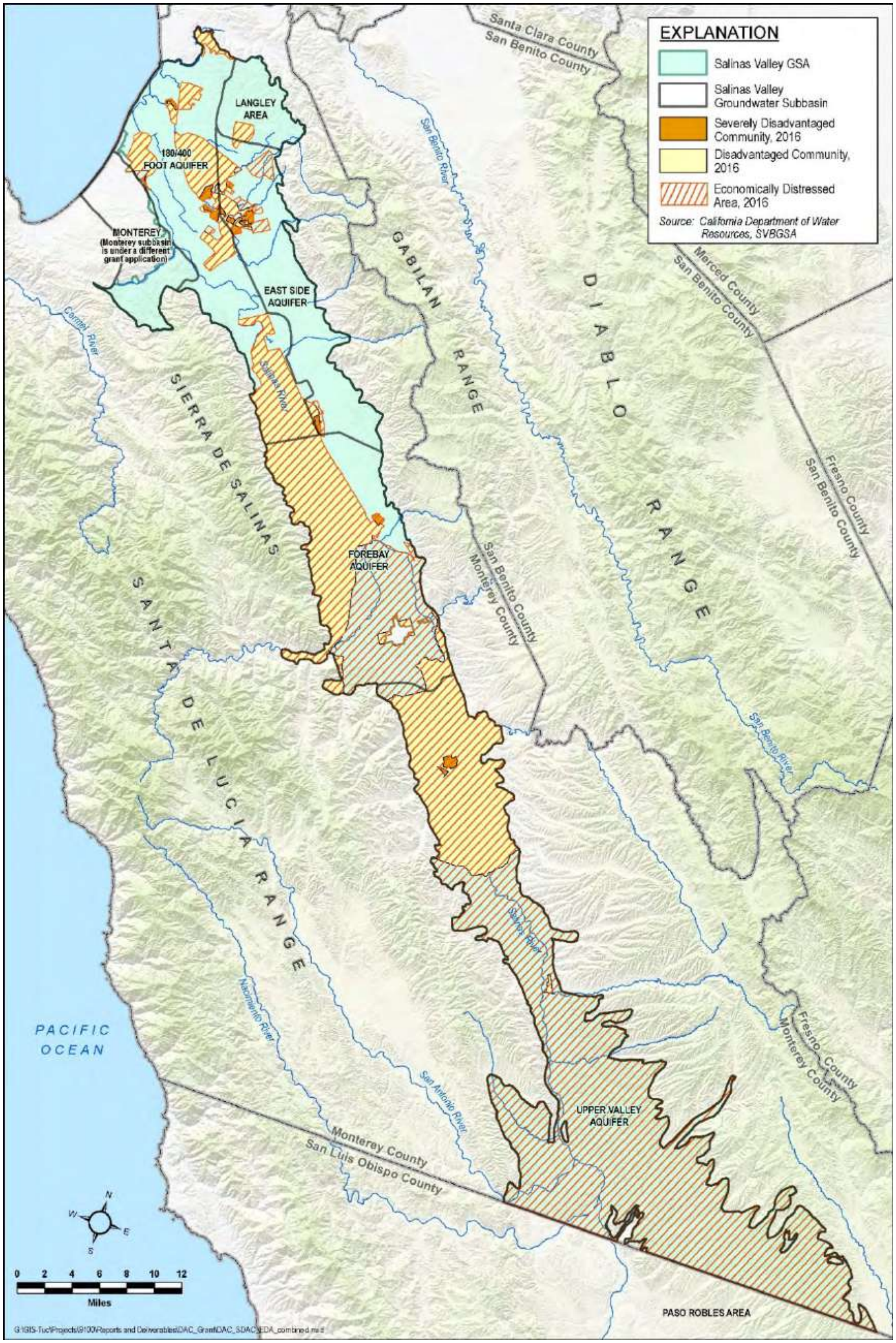
A Disadvantaged Community (DAC) is defined in the California Water Code (§79505.5(a)) as a community with an annual median household income that is less than 80% of the statewide annual median household income, based on five-year estimates. Further, a Severely Disadvantaged Community (SDAC) is defined as a community with an annual median household income that is less than 60% of the statewide annual median household income, based on five-year estimates. For information on how these designations are determined, see the Greater Monterey County Integrated Regional Water Management Plan (Greater Monterey County Regional Water Management Group, 2018). These designations are significant because in order for a community to be eligible for State grant funds specially allocated for disadvantaged communities, or to be eligible for reduced matching fund requirements, a community must meet one of these strict definitions.

At the same time, the California Department of Water Resources (DWR) also recognizes the existence of communities that are economically challenged but that are not designated as being disadvantaged according to U.S. Census data. These communities have been labeled Suspected Disadvantaged Communities until their status can be proven either way.

In addition to disadvantaged communities, DWR recognizes Economically Distressed Areas. An economically distressed area (EDA) is defined as:

> *…a municipality with a population of 20,000 persons or less, a rural county, or a reasonably isolated and divisible segment of a larger municipality where the segment of the population is 20,000 persons or less, with an annual median household income that is less than 85 percent of the statewide median household income, and with one or more of the following conditions as determined by the department: (1) financial hardship, (2) unemployment rate at least 2 percent higher than the statewide average, or (3) low population density (Water Code §79702(k)).*

Figure 1 shows the communities currently designated as DACs, SDACs, or EDAs in the Salinas Valley. This figure combines census tracts, blocks, and places to give a more complete representation of the communities within this area. Table 1 lists the DACs and SDACs in the Basin along with their 2016 populations. Currently, the statewide median household income is $63,783. Therefore, the calculated DAC and SDAC thresholds are $51,026 and $38,270, respectively (see https://water.ca.gov/Work-With-Us/Grants-And-Loans/Mapping-Tools). For example, Castroville has a median household income of $35,000 (Rural Community Assistance Corporation, 2017). Moss Landing is not currently designated as a DAC; however, according to a survey by the California Rural Water Association (2018), its median household income is $47,600.



EXPLANATION
Salinas Valley GSA
Salinas Valley Groundwater Subbasin
Severely Disadvantaged Community, 2016
Disadvantaged Community, 2016
Economically Distressed Area, 2016
Source: California Department of Water Resources, SVBGSA
Santa Clara County
San Benito County
LANGLEY AREA
180/400 FOOT AQUIFER
MONTEREY (Monterey subbasin is under a different grant application)
EAST SIDE AQUIFER
GABILAN RANGE
DIABLO RANGE
Merced County
San Benito County
SIERRA DE SALINAS
Fresno County
San Benito County
FOREBAY AQUIFER
San Benito County
Monterey County
SANTA DE LUCIA RANGE
PACIFIC OCEAN
Fresno County
Monterey County
UPPER VALLEY AQUIFER
Monterey County
San Luis Obispo County
PASO ROBLES AREA
0 2 4 6 8 10 12
Miles

Table 1. DAC/SDAC 2016 Population in the Salinas Valley Groundwater Basin

Tract Name	Block Group Number	DAC/SDAC (2016)	Population (2016)
010804	2	DAC	1,612
000900	1	DAC	952
014302	1	DAC	1,544
011101	2	DAC	1,317
011203	2	DAC	2,840
011204	2	DAC	2,718
011304	2	DAC	3,127
011304	3	DAC	2,777
000900	2	DAC	1,360
000600	1	DAC	1,764
010504	2	DAC	2,716
010607	2	DAC	2,298
000400	1	DAC	3,039
010505	2	DAC	3,801
000300	1	DAC	2,226
000800	2	DAC	1,665
010506	1	DAC	2,897
000502	2	DAC	1,659
000702	3	DAC	2,015
014500	1	DAC	1,195
011101	3	DAC	3,048
011101	1	DAC	906
000200	1	DAC	2,549
010506	2	DAC	1,830
000400	2	DAC	2,922
010608	2	DAC	1,011
010607	1	DAC	2,317
000400	3	DAC	1,565
010608	3	DAC	995
000702	1	DAC	1,994
000600	4	DAC	1,022
014700	4	DAC	3,169
010202	1	DAC	1,037
010501	4	DAC	1,156
010400	3	DAC	1,826
011202	2	DAC	3,077
000900	3	SDAC	3,055
010400	1	SDAC	1,685
011102	1	SDAC	3,925
011303	2	SDAC	1,122
000702	2	SDAC	2,160
000701	2	SDAC	2,325
000501	2	SDAC	2,286
001300	1	SDAC	2,786
000501	1	SDAC	2,113
010804	3	SDAC	2,670
000103	1	SDAC	1,633

Tract Name	Block Group Number	DAC/SDAC (2016)	Population (2016)
001801	1	SDAC	1,721
001700	2	SDAC	1,526
000600	3	SDAC	2,924
000800	3	SDAC	1,526
000600	2	SDAC	1,480
000701	3	SDAC	1,766
000701	1	SDAC	1,881
001802	2	SDAC	1,536
011302	1	SDAC	2,149
011302	2	SDAC	1,321
		Total DAC/SDAC	117,536
		Total SDAC	43,590

As highlighted in the IWRM Plan, small disadvantaged communities in unincorporated areas often have small public water systems that serve fewer than 200 connections. The smallest of these communities have State Small Water Systems (SSWS), which serve between five and 14 connections); Local Small Water Systems (LSWS), which serve between two and four connections; and/or households served by private domestic groundwater wells. There is a significant difference in capacity, water supply, and infrastructure needs between a DAC served by a large water system (e.g., a large disadvantaged community of several thousand people, or a small disadvantaged community served by a large water utility) and a small disadvantaged community served by a small water system or by private wells. The State Water Resources Control Board (SWRCB) summarized these differences in its 2015 report, Safe Drinking Water Plan for California (SWRCB, 2015):

- Small water systems have the greatest difficulty in providing safe drinking water because they are least able to address the threats to public health associated with water quality.
- Larger water systems are better equipped to deal with water quality issues because they have more customers to fund the necessary improvements, have economy of scale, more technical expertise, better management skills and knowledge, are able to solve operational problems internally, and have dedicated financial and business-related staff. They generally have more sophisticated treatment and distribution system operators who are able to react to incidents and changes in treatment conditions that may occur during operations.
- On the other hand, small systems, especially those in disadvantaged communities, have only a small number of customers, which provides them with limited fiscal assets and no economy of scale. They often lack technical expertise, the ability to address many of the issues pertinent to operating a water system, as well as qualified management and financial and business personnel. In many instances, especially for very small water systems, the system operator may be just a part-time position.

Following the Greater Monterey County IRWM Plan, this Appendix includes DACs, SDACs, and EDAs and places an emphasis on small disadvantaged communities for the reasons highlighted by the SWRCB.

Jurisdictional Responsibilities

A number of agencies and groups have existing jurisdictional responsibility over groundwater quality. The SVBGSA will collaborate with these agencies and groups so as to not duplicate efforts or overstep its institutional authority. The following agencies and groups have responsibility over various aspects of groundwater (Greater Monterey County Regional Water Management Group, 2018):

- **Greater Monterey County IRWM Regional Water Management Group** – AB1630 appropriated State grant funds to enable this Group to develop solutions for DACs to be integrated into the broader IRWM planning effort. IRWM is a voluntary, collaborative effort to identify and implement water management solutions on a regional scale to increase regional self-reliance, reduce conflict, and manage water resources. The IRWM planning process brings together water and natural resource managers along with other community stakeholders to collaboratively plan for and ensure the region's continued water supply reliability, improved water quality, flood management, and healthy functioning ecosystems. The Department of Water Resources manages grant programs specifically designated for adopted IRWM Plans including funding for water quality improvement projects.
- **State Water Resources Control Board (SWRCB)** – The SWRCB administers the state's Drinking Water Program as the federally-designated Primary Agency responsible for the administration and enforcement of the Safe Drinking Water Act requirements in California. Prior to July 1, 2014, the California Department of Public Health was designated as the Primary Agency. These requirements are defined in the California Health and Safety Code and Titles 17 and 22, California Code of Regulations. The CDPH continues to maintain the State's Drinking Water and Radiation Laboratory, which serves as the state's principal laboratory as required for primacy under the Safe Drinking Water Act. The SWRCB is responsible for the regulatory oversight of over 7,600 public water systems in California. It may delegate oversight responsibility of public water systems with less than 200 service connections to local county health departments, which it has done in Monterey County.
- **Monterey County Department of Environmental Health (MCDEH)** – Delegated oversight responsibility by the SWRCB, MCDEH is the Local Primary Agency and its Drinking Water Protection Services regulates domestic water systems in the County that serve between two and 199 connections. There are approximately 160 such systems in the County regulated under this program. MCDEH also regulates all well construction in Monterey County.
- **SWRCB and Central Coast Regional Water Quality Control Board** – State policy on water quality control falls under the SWRCB, which is the state water pollution control agency for all purposes under the Clean Water Act (CWC §13160), including drinking water sources from both surface water and groundwater. The SWRCB has nine regional boards, including the Central Coast Regional Water Quality Control Board (CCRWQCB), which is responsible for the day-to-day implementation of the federal Clean Water Act and California's Porter-Cologne Water Quality Control Act in the Central Coast. Together, the State Water Board and Regional Boards are responsible for the protection of the quality of ambient surface and groundwater up to the point where the water enters a drinking water well or surface water intake. The Regional Boards are

responsible for developing and enforcing water quality objectives and implementation plans to protect the beneficial uses of the State's waters. The Regional Boards enforce water quality regulations through the following means.

- **Basin Plan –** Each Regional Board is directed to formulate a water quality control plan, called a Basin Plan, that includes water quality standards under the Clean Water Act. The CCRWQCB implements the Basin Plan in the Central Coast Region, in part by issuing and enforcing waste discharge requirements to individuals, communities, or businesses whose waste discharges can affect water quality, including surface water, groundwater, or wetlands.
- **Waste Discharge Requirements (WDRs) –** WDRs, sometimes simply known as Orders, for discharges to waters of the United States also serve as National Pollutant Discharge Elimination System (NPDES) permits. The SWRCB and CCRWQCB regulate discharges from wastewater treatment and disposal systems under general WDRs. Small, domestic wastewater treatment systems having a maximum daily flow of 100,000 gallons per day (gpd) or less that discharge to land are covered under a statewide general WDR permit for small systems (Order WQ 2014-0153-DWQ). The State and Regional Boards are also responsible for plans and permits related to other uses, such as farming, septic tanks, and larger scale sewage treatment that can also impact the quality of surface and ground waters.
- **Irrigated Lands Regulatory Program (ILRP) –** The SWRCB initiated the ILRP in 2003 to control agricultural runoff's impairment of surface waters. In 2012, groundwater regulations were added to the program. Waste discharge requirements, which protect both surface water and groundwater, address agricultural discharges throughout the Central Coast. Anyone who irrigates land to produce crops or pasture commercially must seek ILRP permit coverage and maintain in good standing with their coalitions.

- **Department of Pesticide Regulation** – The California Department of Pesticide Regulation is responsible for ensure that pesticides do not contaminate the groundwater.
- **Office of Environmental Health Hazard Assessment** – The California Office of Environmental Health Hazard Assessment is responsible for providing the SWRCB with health-based risk assessments for contaminants. These assessments are used to develop primary drinking water standards.
- **California Public Utilities Commission (CPUC)** – The CPUC is responsible for ensuring that California's investor-owned water utilities deliver clean, safe, and reliable water to their customers at reasonable rates. The Water Division regulates over 100 investor-owned water and sewer utilities under the CPUC's jurisdiction; providing water service to about 16 percent of California's residents.

- **Local Agency Formation Commissions (LAFCOs)** – These commissions oversee the expansion of service areas of public agencies, including cities that own or operate public water systems. They can review public agencies to determine if the agency is providing municipal services in a satisfactory manner, including the delivery of safe drinking water.
- **Central Coast Groundwater Coalition (CCGC)** – The CCGC is a non-profit 501(c)5 mutual benefit organization that represents landowners and growers who operate in Monterey, San Benito, Santa Clara, Santa Cruz, San Luis Obispo, and Santa Barbara counties, as well as the northern portion of Ventura County in the Central Coast Region. The CCGC is not a governmental organization like the other jurisdictional agencies, and therefore does not have legal jurisdictional authority. However, the CCGC is the primary organization tasked with fulfilling the groundwater quality regulatory requirements in the Irrigated Lands Regulatory Program (ILRP) of the Central Coast Regional Water Quality Control Board. The organization combines the resources of its members to achieve economies of scale to comply with the regulatory requirements of the CCRWQCB. Between 2013 and 2015, the CCGC characterized the rural drinking water supply and shallow groundwater aquifer in the CCGC region which includes the previously noted six counties. In addition to using data from member wells, CCGC gathered publicly available data generated by the counties and data submitted by landowners and growers who perform individual monitoring as part of the current ILRP. Information collected on tested wells included depth to groundwater and well perforation levels where available. For many wells, quality parameters were collected, such as nitrates and total dissolved solids (TDS). In the groundwater characterization report, the information from the six counties was compiled and analyzed to produce maps showing areas where groundwater quality exceeds drinking water limits for nitrates. This information enabled CCGC to develop an accurate groundwater characterization in 2015 which provides growers, regulators and the public with a better understanding of local aquifers and geology in the six-county region.

DAC Drinking Water Challenges

Drinking water systems are categorized according to the number of service connections:

- Public water systems, which are referred to as municipal public water systems in this GSP for clarity, are water systems that provide drinking water to at least 15 service connections or serve an average of at least 25 people for at least 60 days a year,
- State small water systems are water systems that provide piped drinking water to between five and 14 service connections, and do not regularly serve drinking water to more than an average of 25 individuals daily for more than 60 days out of the year,
- Local small water systems are water systems that provide drinking water to between two and four service connections, and

- Private domestic wells usually provide water to only one or two connections.

Since state small water systems, local small water systems, and private domestic wells face more severe drinking water challenges than public water systems, they are the focus for the following discussion.

Private domestic wells are not regulated by the State. MCDEH requires one-time nitrate testing of newly installed private domestic wells, but there are no additional requirements. The SWRCB's Groundwater Ambient Monitoring and Assessment (GAMA) Domestic Well Project was developed in order to address the lack of domestic well water quality data. The GAMA Groundwater Information System includes numerous datasets that can be downloaded by users. The CCRWQCB also collects domestic well data per Irrigated Lands Regulatory Program (ILRP) groundwater monitoring requirements.

Between October 2013 and August 2014, the CCGC compiled water quality data from 229 samples from domestic and irrigation wells in the Salinas Valley. Data were collected from the GeoTracker GAMA database that includes data from the California Department of Public Health, GAMA-SWRCB data collection efforts and Regulated Sites. Additional data were collected from the USGS National Water Information System data, and data were extracted from the GAMA special study carried out by Lawrence Livermore National Laboratory. In its 2015 *Groundwater Characterization Report* (CCGC, 2015), CCGC made the following conclusions regarding nitrate in the Salinas Valley:

- 41% of wells with nitrate concentrations (or 309 of 758 total wells sampled) had maximum concentrations over the MCL.
- 34% of the land area within the Salinas Valley has nitrate concentrations over the MCL.
- 55% of domestic wells or 121 of 221 total sampled on CCGC-member properties had concentrations exceeding the MCL.

Domestic wells and wells associated with local small and state small water systems are generally more susceptible to nitrate contamination since they are typically shallow and are more likely to be located in rural areas within or adjacent to agricultural areas. They are also more susceptible to potential nitrate contamination from nearby septic systems. Public water systems, on the other hand, tend to access deeper groundwater and are more likely to be located in areas that are less susceptible nitrate contamination. Public water system operators implement regular water quality testing and treatment as necessary, and wells are usually taken out of service once they become contaminated. Funding programs are often available for public water systems, and costs are spread out over a large number of ratepayers over time. When contamination is detected in private domestic wells, treatment options are limited and the individual homeowner will typically have to bear the full cost of addressing the problem (CCGC, 2015).

According to the IRWM Plan, only a very small percentage of domestic wells in Monterey County have been tested through the Central Coast Regional Water Quality Board's groundwater monitoring programs. MCDEH has recently adopted a policy to begin requiring well testing when an application for repair or replacement of a septic system is proposed, which will provide new additional data.

MCDEH Drinking Water Protection Services regulates state small and local small water systems through their Small Water System Program. There are currently 694 local small and 276 state small water systems in Monterey County, which serve about 4,232 connections (Greater Monterey County Regional Water Management Group, 2018).

DACs in the Basin rely primarily on groundwater for their drinking water supply, except for those who rely on bottled water due to unsafe or poor water quality conditions. The primary drinking water problems experienced by small DACs in Monterey County are related to nitrate contamination, seawater intrusion, or other contaminants of concern. Numerous studies over the decades have documented these challenges.

Insufficient water quantity is generally less of a problem in the Salinas Groundwater Basin than poor or unsafe water quality; although poor water quality effectively results in insufficient water supply. During the recent prolonged drought, while Monterey County was classified as experiencing "exceptional" drought, very few water users in the Greater Monterey County IRWM region actually suffered from a lack of water availability. While the drought had immediate impacts on surface water supplies throughout the State, it tended to have a more gradual impact on groundwater supplies. Groundwater quality, rather than quantity, is of primary concern for drinking water supplies in the Salinas Valley Groundwater Basin, particularly nitrate contamination and seawater intrusion.

Nitrate Contamination

Nitrate contamination is particularly problematic in the Salinas Valley Groundwater Basin, where agriculture dominates the landscape. Nitrate is currently extensively monitored and evaluated by the CCGC and is documented in a report submitted to the CCRWQCB (CCGC, 2015). Nitrate contamination in the Salinas Valley was first documented in a report published by the Association of Monterey Bay Area Governments (AMBAG) in 1978. In 1988, a report by the State Water Board documented that nitrate levels in the Salinas Valley groundwater had impaired its beneficial use as a drinking water supply. In a July 1995 staff report, the SWRCB ranked the Salinas Valley as their number one water quality concern due to the severity of nitrate contamination. All of the Salinas Valley cities have had to replace domestic water wells due to high nitrate levels that exceed the drinking water MCL. Maps prepared by the MCWRA indicate that elevated nitrate concentrations in groundwater were locally present through the 1960s, but significantly increased in the 1970s and 1980s.

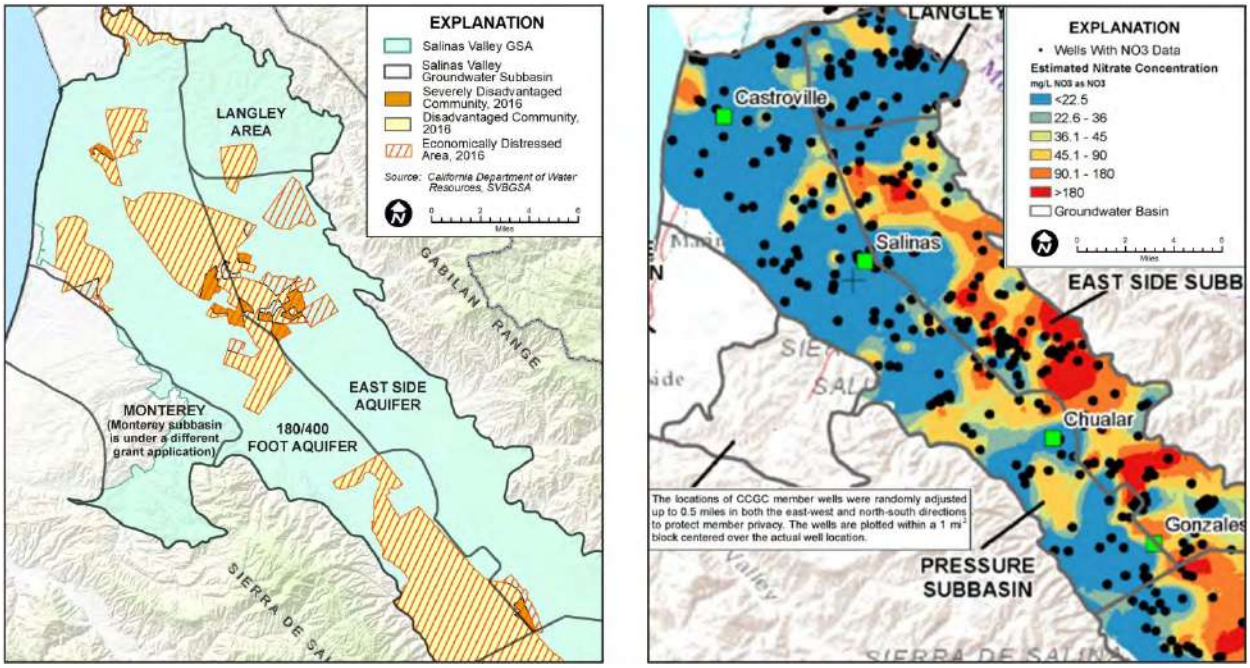


Figure 2. DACs, SDACs, and EDAs in the 180/400-Foot Aquifer Subbasin and Nitrate Concentration Map developed by CCGC (2015)

Seawater Intrusion

Seawater Intrusion is another major water quality concern for DACs and SDACs, primarily impacting coastal communities in the northern part of the Salinas Valley Groundwater Basin. Seawater intrusion has been observed in the 180-Foot and 400-Foot Aquifer Subbasin for over 70 years, and was documented in DWR Bulletin 52 in 1946. By the 1940s, many agricultural wells in the Castroville area had become so salty that they had to be abandoned (Greater Monterey County Regional Water Management Group, 2018). Seawater is high in chlorides. EPA defines the 500 mg/L threshold as an Upper Limit Secondary Maximum Contaminant Level (SMCL). Seawater intrusion is the primary threat to drinking water supplies for many DACs located in the northern coastal portion of the Basin.

Seawater has intruded inland in the 180-Foot and 400-Foot Aquifers, as shown on Figure 3 and Figure 4. Seawater intrusion in the 180-Foot Aquifer covered approximately 20,000 acres in 1995 and had expanded to approximately 28,000 acres by 2010. Since then, the rate of expansion has decreased, with an overlying area of 28,300 acres in 2017. The area overlying intrusion into the 400-Foot Aquifer is not as extensive, with an overlying area of approximately 12,000 acres in 2010. However, between 2013 and 2015, the 400-Foot Aquifer experienced a significant increase in the area of seawater intrusion, from approximately 12,500 acres to approximately 18,000 acres, likely resulting from localized downward migration between aquifers.

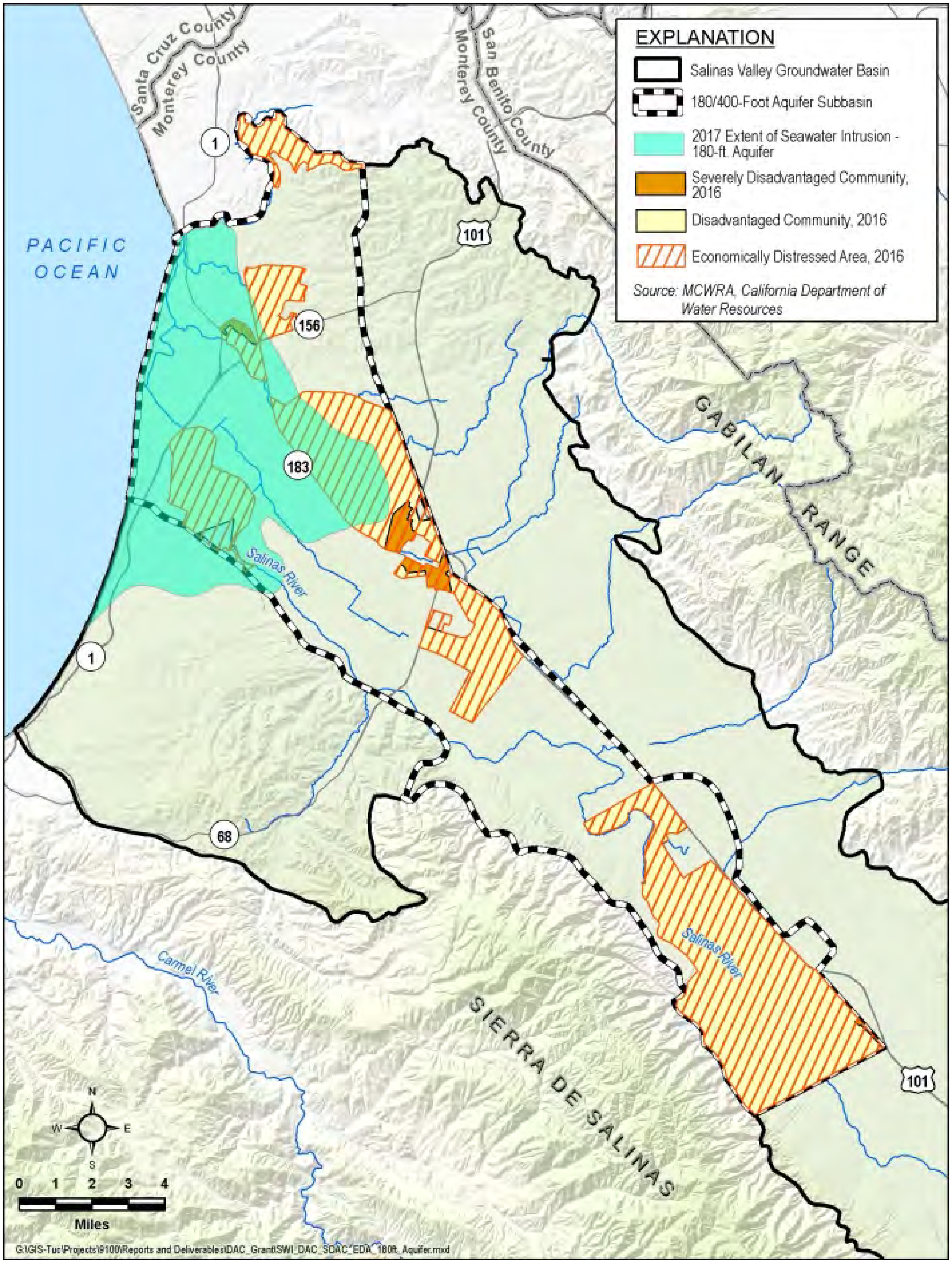


Figure 3. 2017 Extent of Seawater Intrusion in the 180-Foot Aquifer

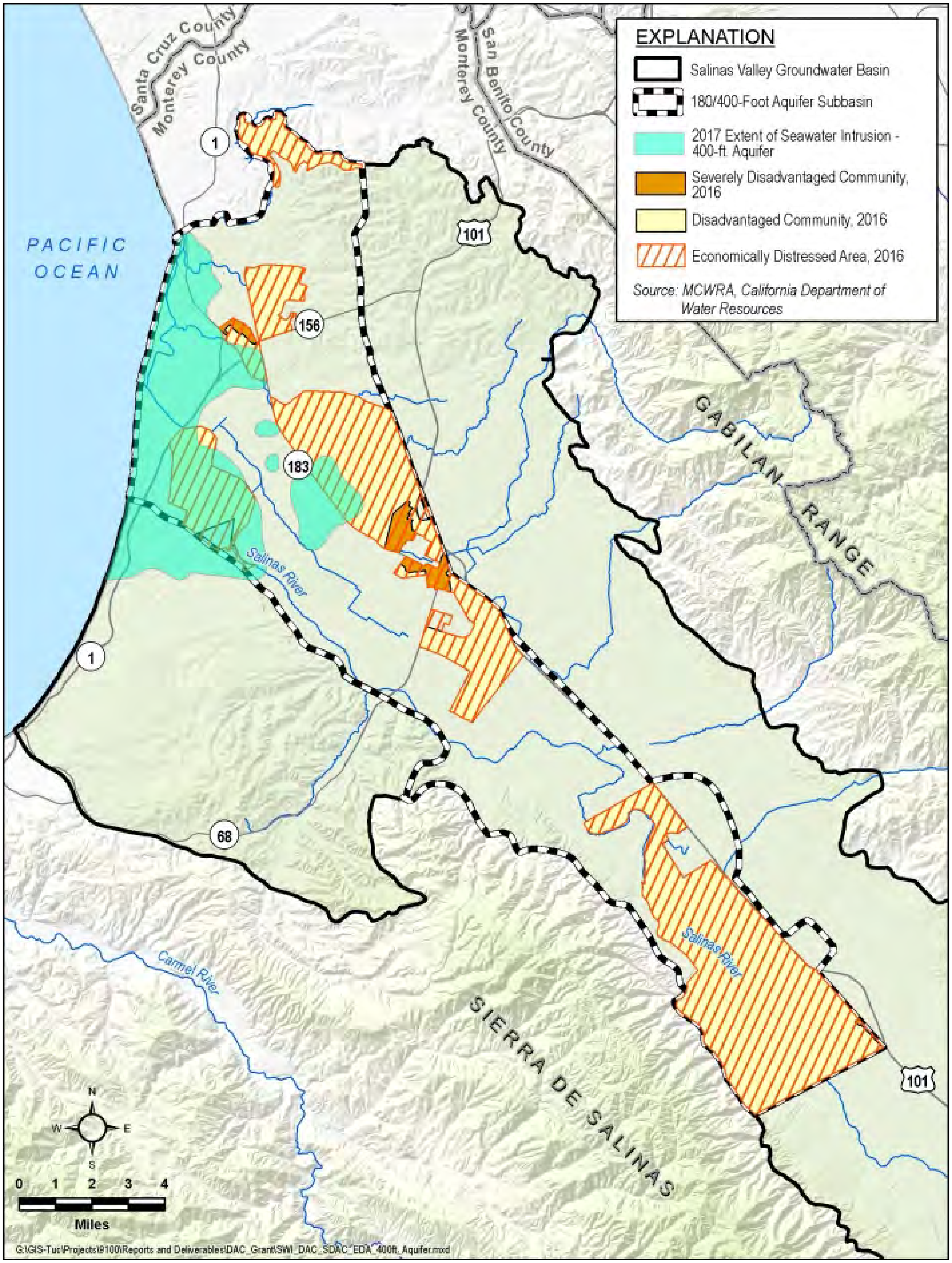


Figure 4. 2017 Extent of Seawater Intrusion in the 400-Foot Aquifer

Other Contaminants of Concern

In addition to nitrates and seawater intrusion, there are a few other contaminants of concern. With the recent passage of Assembly Bill (AB) 1249 (Salas, Chapter 717, Statutes of 2014), the State has recognized the prevalence, and urgency to address, the contamination of drinking water supplies in California by not only nitrate, but specifically by arsenic, perchlorate, and hexavalent chromium. The Greater Monterey County IRWM Regional Water Management Group is currently working with a Technical Advisory Committee, which includes MCDEH and the Central Coast Regional Water Quality Control Board, to identify the extent of nitrate, arsenic, perchlorate, and hexavalent chromium contamination in communities throughout the region. This group will develop a plan to address the contamination from these additional contaminants of concern.

Conclusion

The State of California has recognized the severity of drinking water challenges for DACs with the passage of the 2012 Human Right to Water Act (AB 685), which declared that every person has a right to clean, safe, and affordable drinking water. Further, it emphasized this state-wide focus with the Safe and Affordable Drinking Water Fund in 2019, which provides funding specifically for safe drinking water solutions in DACs that do not have access to safe drinking water.

This appendix highlights the relationship between DACs and groundwater in the Salinas Valley Groundwater Basin, particularly with respect to drinking water. It provides a base for the SVBGSA to engage DACs in a strategic dialogue and support state and local efforts related to drinking water.

References

California Rural Water Association. 2018. "Moss Landing County Sanitation District Median Household Income (MHI) Survey Final Report." December 2018.

CCGC (Central Coast Groundwater Coalition). 2015. *Northern Counties Groundwater Characterization: Salinas Valley, Pajaro Valley and Gilroy-Hollister Valley*. Submitted to the Central Coast Regional Water Quality Control Board on June 1, 2015. Salinas, CA Prepared by Luhdorff & Scalmanini Consulting Engineers. 454 p.

Greater Monterey County Regional Water Management Group. 2018. "Integrated Regional Water Management Plan for the Greater Monterey County Region." Accessed December 20, 2019. http://www.greatermontereyirwmp.org/documents/plan/.

Rural Community Assistance Corporation. 2017. "Castroville Community Services District Median Household Income Survey Results Prop 1 Agreement No. D1612801/TA Work Plan No. 5077-A." March 30, 2017.

SWRCB (State Water Resources Control Board). 2015. Safe Drinking Water Plan for California. Report to the Legislature in Compliance with Health & Safety Code Section 116365. Dated June 2015. Available at: https://www.waterboards.ca.gov/publications_forms/publications/legislative/docs/2015/sdwp.pdf.

Chapter 3
Appendix 3-A

Water Systems

Table 1. Small Water Systems (2-14 connections)

Water System Name	ID	Connections	Population Served	Subbasin
ABBOTT ST WS #01	2702711	N/A	N/A	180/400 FOOT AQUIFER
AMARAL RD WS #01	2700909	N/A	N/A	180/400 FOOT AQUIFER
AMARAL RD WS #02	2702441	N/A	N/A	180/400 FOOT AQUIFER
ARCHER RD WS #02	2701414	N/A	N/A	180/400 FOOT AQUIFER
ARCHER RD WS #04	2701415	N/A	N/A	180/400 FOOT AQUIFER
ARCHER RD WS #05	2701547	N/A	N/A	180/400 FOOT AQUIFER
ARMSTRONG RD WS #01	2701813	N/A	N/A	180/400 FOOT AQUIFER
AVERY LN WS #01	2701620	N/A	N/A	180/400 FOOT AQUIFER
AVERY LN WS #03	2702159	N/A	N/A	180/400 FOOT AQUIFER
BAUMANN RD WS #02	2702261	N/A	N/A	180/400 FOOT AQUIFER
BAYVIEW RD WS #01	2700505	N/A	N/A	180/400 FOOT AQUIFER
BAYVIEW RD WS #02	2702240	N/A	N/A	180/400 FOOT AQUIFER
BAYVIEW RD WS #04	2700841	N/A	N/A	180/400 FOOT AQUIFER
BAYVIEW RD WS #06	2701609	N/A	N/A	180/400 FOOT AQUIFER
BAYVIEW RD WS #07	2702212	N/A	N/A	180/400 FOOT AQUIFER
BAYVIEW RD WS #08	2700506	N/A	N/A	180/400 FOOT AQUIFER
BLANCO RD WS #04	2702205	N/A	N/A	180/400 FOOT AQUIFER
BLANCO RD WS #06	2701949	N/A	N/A	180/400 FOOT AQUIFER
BLUEROCK VIEW APARTMENTS WS	2701229	N/A	N/A	180/400 FOOT AQUIFER
BORONDA RD WS #05	2701773	N/A	N/A	180/400 FOOT AQUIFER
CABIN OWNERS ASSN WS	2701824	N/A	N/A	180/400 FOOT AQUIFER
CARR RD WS #01	2702130	N/A	N/A	180/400 FOOT AQUIFER
CASTROVILLE BLVD WS #02	2700525	N/A	N/A	180/400 FOOT AQUIFER
CASTROVILLE BLVD WS #04	2700527	N/A	N/A	180/400 FOOT AQUIFER
CASTROVILLE BLVD WS #09	2702385	N/A	N/A	180/400 FOOT AQUIFER
CASTROVILLE BLVD WS #11	2702463	N/A	N/A	180/400 FOOT AQUIFER
CASTROVILLE BLVD WS #12	2702593	N/A	N/A	180/400 FOOT AQUIFER
CASTROVILLE BLVD WS #14	2702632	N/A	N/A	180/400 FOOT AQUIFER
CHUALAR RIVER RD WS #03	2701003	N/A	N/A	180/400 FOOT AQUIFER
CHUALAR RIVER RD WS #04	2702437	N/A	N/A	180/400 FOOT AQUIFER
DEL MONTE FARMS RD WS #01	2700539	N/A	N/A	180/400 FOOT AQUIFER
DEL MONTE FARMS RD WS #02	2700540	N/A	N/A	180/400 FOOT AQUIFER
DEL MONTE FARMS RD WS #05	2700543	N/A	N/A	180/400 FOOT AQUIFER
DEL MONTE FARMS RD WS #06	2700544	N/A	N/A	180/400 FOOT AQUIFER
DEL MONTE FARMS RD WS #08	2701712	N/A	N/A	180/400 FOOT AQUIFER
DEL MONTE FARMS RD WS #09	2702054	N/A	N/A	180/400 FOOT AQUIFER
DEL MONTE FARMS RD WS #10	2702311	N/A	N/A	180/400 FOOT AQUIFER
DEL MONTE FARMS RD WS #11	2701421	N/A	N/A	180/400 FOOT AQUIFER
DEL MONTE FARMS RD WS #12	2701909	N/A	N/A	180/400 FOOT AQUIFER

Water System Name	ID	Connections	Population Served	Subbasin
DEL MONTE FARMS RD WS #13	2702524	N/A	N/A	180/400 FOOT AQUIFER
DESMOND RD WS #09	2702117	N/A	N/A	180/400 FOOT AQUIFER
DESMOND RD WS #11	2702536	N/A	N/A	180/400 FOOT AQUIFER
EDEN LN WS #01	2701650	N/A	N/A	180/400 FOOT AQUIFER
EL CAMINO REAL WS #45	2702058	N/A	N/A	180/400 FOOT AQUIFER
ELKHORN ESTATES WS	2702488	N/A	N/A	180/400 FOOT AQUIFER
ELKHORN RD WS #06	2701430	N/A	N/A	180/400 FOOT AQUIFER
ELKHORN RD WS #09	2701618	N/A	N/A	180/400 FOOT AQUIFER
ELKHORN RD WS #10	2701628	N/A	N/A	180/400 FOOT AQUIFER
ELKHORN RD WS #14	2701873	N/A	N/A	180/400 FOOT AQUIFER
ELKHORN RD WS #15	2701507	N/A	N/A	180/400 FOOT AQUIFER
ELKHORN RD WS #17	2701907	N/A	N/A	180/400 FOOT AQUIFER
ELKHORN RD WS #18	2702231	N/A	N/A	180/400 FOOT AQUIFER
ELKHORN RD WS #19	2702303	N/A	N/A	180/400 FOOT AQUIFER
ELKHORN RD WS #21	2702427	N/A	N/A	180/400 FOOT AQUIFER
ELKHORN RD WS #22	2702451	N/A	N/A	180/400 FOOT AQUIFER
ELKHORN RD WS #24	2701481	N/A	N/A	180/400 FOOT AQUIFER
ESPINOSA RD WS #01	2701685	N/A	N/A	180/400 FOOT AQUIFER
ESPINOSA RD WS #02	2701770	N/A	N/A	180/400 FOOT AQUIFER
ESPINOSA RD WS #04	2701862	N/A	N/A	180/400 FOOT AQUIFER
ESPINOSA RD WS #05	2701692	N/A	N/A	180/400 FOOT AQUIFER
ESPINOSA RD WS #07	2700568	N/A	N/A	180/400 FOOT AQUIFER
FOOTHILL RD WS #02	2702605	N/A	N/A	180/400 FOOT AQUIFER
FOSTER RD WS #02	2701793	N/A	N/A	180/400 FOOT AQUIFER
GONZALES RIVER RD WS	2701928	N/A	N/A	180/400 FOOT AQUIFER
GOULD RD WS #01	2701064	N/A	N/A	180/400 FOOT AQUIFER
HARKINS RD WS #01	2701848	N/A	N/A	180/400 FOOT AQUIFER
HECTOR GRACIA WS	2701015	N/A	N/A	180/400 FOOT AQUIFER
HIDDEN VALLEY RD WS #01	2700593	N/A	N/A	180/400 FOOT AQUIFER
HIDDEN VALLEY RD WS #05	2700596	N/A	N/A	180/400 FOOT AQUIFER
HIDDEN VALLEY RD WS #06	2701497	N/A	N/A	180/400 FOOT AQUIFER
HIDDEN VALLEY RD WS #08	2701518	N/A	N/A	180/400 FOOT AQUIFER
HIDDEN VALLEY RD WS #10	2701812	N/A	N/A	180/400 FOOT AQUIFER
HIDDEN VALLEY RD WS #13	2701534	N/A	N/A	180/400 FOOT AQUIFER
HIDDEN VALLEY RD WS #14	2701684	N/A	N/A	180/400 FOOT AQUIFER
HIDDEN VALLEY RD WS #15	2701704	N/A	N/A	180/400 FOOT AQUIFER
HIDDEN VALLEY RD WS #16	2702810	N/A	N/A	180/400 FOOT AQUIFER
HILLCREST RD WS #05	2702413	N/A	N/A	180/400 FOOT AQUIFER
HUNTER LN WS #01	2701899	N/A	N/A	180/400 FOOT AQUIFER
HWY 1 WS #06	2701118	N/A	N/A	180/400 FOOT AQUIFER
HWY 101 WS #05	2702436	N/A	N/A	180/400 FOOT AQUIFER

Water System Name	ID	Connections	Population Served	Subbasin
HWY 183 WS #01	2701863	N/A	N/A	180/400 FOOT AQUIFER
KARNER RD WS #01	2700609	N/A	N/A	180/400 FOOT AQUIFER
KARNER RD WS #02	2701984	N/A	N/A	180/400 FOOT AQUIFER
KARNER RD WS #03	2702516	N/A	N/A	180/400 FOOT AQUIFER
LEAFWOOD RD WS #02	2702138	N/A	N/A	180/400 FOOT AQUIFER
LONG VALLEY RD WS #01	2701443	N/A	N/A	180/400 FOOT AQUIFER
LONG VALLEY RD WS #02	2702815	N/A	N/A	180/400 FOOT AQUIFER
MERIDIAN RD WS #01	2700645	N/A	N/A	180/400 FOOT AQUIFER
MERIDIAN RD WS #05	2701393	N/A	N/A	180/400 FOOT AQUIFER
MERIDIAN RD WS #15	2702596	N/A	N/A	180/400 FOOT AQUIFER
MERIDIAN RD WS #16	2702597	N/A	N/A	180/400 FOOT AQUIFER
NASHUA RD WS	2702458	N/A	N/A	180/400 FOOT AQUIFER
OLD STAGE RD WS #16	2702310	N/A	N/A	180/400 FOOT AQUIFER
ORMART RD WS #01	2702217	N/A	N/A	180/400 FOOT AQUIFER
PARADISE RD WS #02	2700675	N/A	N/A	180/400 FOOT AQUIFER
PARADISE RD WS #03	2700676	N/A	N/A	180/400 FOOT AQUIFER
PARADISE RD WS #04	2700677	N/A	N/A	180/400 FOOT AQUIFER
PARADISE RD WS #13	2701461	N/A	N/A	180/400 FOOT AQUIFER
PARADISE RD WS #15	2701606	N/A	N/A	180/400 FOOT AQUIFER
PARADISE RD WS #16	2701621	N/A	N/A	180/400 FOOT AQUIFER
PARADISE RD WS #17	2701622	N/A	N/A	180/400 FOOT AQUIFER
PARADISE RD WS #18	2701625	N/A	N/A	180/400 FOOT AQUIFER
PARADISE RD WS #19	2701629	N/A	N/A	180/400 FOOT AQUIFER
PARADISE RD WS #20	2701631	N/A	N/A	180/400 FOOT AQUIFER
PARADISE RD WS #25	2701690	N/A	N/A	180/400 FOOT AQUIFER
PARADISE RD WS #29	2701696	N/A	N/A	180/400 FOOT AQUIFER
PARADISE RD WS #34	2702473	N/A	N/A	180/400 FOOT AQUIFER
PARSONS RD WS #01	2701766	N/A	N/A	180/400 FOOT AQUIFER
PESANTE RD WS #18	2701983	N/A	N/A	180/400 FOOT AQUIFER
PLAZA SERENA WS	2701636	N/A	N/A	180/400 FOOT AQUIFER
PRUNETUCKY WS	2701639	N/A	N/A	180/400 FOOT AQUIFER
RIVER RD WS #01	2701689	N/A	N/A	180/400 FOOT AQUIFER
RIVER RD WS #02	2701698	N/A	N/A	180/400 FOOT AQUIFER
RIVER RD WS #07	2701744	N/A	N/A	180/400 FOOT AQUIFER
RIVER RD WS #08	2701745	N/A	N/A	180/400 FOOT AQUIFER
RIVER RD WS #09	2701750	N/A	N/A	180/400 FOOT AQUIFER
RIVER RD WS #14	2702248	N/A	N/A	180/400 FOOT AQUIFER
RIVER RD WS #19	2702150	N/A	N/A	180/400 FOOT AQUIFER
RIVER RD WS #20	2701743	N/A	N/A	180/400 FOOT AQUIFER
RIVER RD WS #21	2702193	N/A	N/A	180/400 FOOT AQUIFER
RIVER RD WS #23	2702286	N/A	N/A	180/400 FOOT AQUIFER

Water System Name	ID	Connections	Population Served	Subbasin
RIVER RD WS #24	2702334	N/A	N/A	180/400 FOOT AQUIFER
RIVER RD WS #26	2702334	N/A	N/A	180/400 FOOT AQUIFER
RIVER RD WS #27	2702419	N/A	N/A	180/400 FOOT AQUIFER
RIVER RD WS #29	2702492	N/A	N/A	180/400 FOOT AQUIFER
RIVER RD WS #30	2702622	N/A	N/A	180/400 FOOT AQUIFER
RIVER RD WS #33	2702754	N/A	N/A	180/400 FOOT AQUIFER
RODGERS RD WS #02	2701968	N/A	N/A	180/400 FOOT AQUIFER
RUSSO RD WS #01	2700714	N/A	N/A	180/400 FOOT AQUIFER
RUSSO RD WS #03	2701560	N/A	N/A	180/400 FOOT AQUIFER
RUSSO RD WS #04	2701665	N/A	N/A	180/400 FOOT AQUIFER
SAN JON RD WS #01	2701877	N/A	N/A	180/400 FOOT AQUIFER
SAN JON RD WS #02	2701878	N/A	N/A	180/400 FOOT AQUIFER
SAN JON RD WS #03	2701521	N/A	N/A	180/400 FOOT AQUIFER
SHAFFI LN WS #01	2701786	N/A	N/A	180/400 FOOT AQUIFER
SIMONVILLE WC	2700660	N/A	N/A	180/400 FOOT AQUIFER
SOMAVIA RD WS #02	2700960	N/A	N/A	180/400 FOOT AQUIFER
SPRECKELS LN WS #02	2701679	N/A	N/A	180/400 FOOT AQUIFER
SPRECKELS PLAZA WS	2702375	N/A	N/A	180/400 FOOT AQUIFER
SPRING POINT WS #01	2700758	N/A	N/A	180/400 FOOT AQUIFER
SPRING POINT WS #02	2700759	N/A	N/A	180/400 FOOT AQUIFER
SPRING POINT WS #03	2700760	N/A	N/A	180/400 FOOT AQUIFER
SPRING POINT WS #05	2701479	N/A	N/A	180/400 FOOT AQUIFER
SPRING POINT WS #06	2701602	N/A	N/A	180/400 FOOT AQUIFER
SPRING POINT WS #07	2702502	N/A	N/A	180/400 FOOT AQUIFER
STRAWBERRY RD WS #03	2700763	N/A	N/A	180/400 FOOT AQUIFER
STRAWBERRY RD WS #04	2700764	N/A	N/A	180/400 FOOT AQUIFER
STRAWBERRY RD WS #07	2702238	N/A	N/A	180/400 FOOT AQUIFER
STRAWBERRY RD WS #09	2700769	N/A	N/A	180/400 FOOT AQUIFER
STRAWBERRY RD WS #12	2701121	N/A	N/A	180/400 FOOT AQUIFER
STRAWBERRY RD WS #13	2701854	N/A	N/A	180/400 FOOT AQUIFER
STRAWBERRY RD WS #14	2701482	N/A	N/A	180/400 FOOT AQUIFER
STRAWBERRY RD WS #15	2701527	N/A	N/A	180/400 FOOT AQUIFER
STRAWBERRY RD WS #17	2701600	N/A	N/A	180/400 FOOT AQUIFER
STRAWBERRY RD WS #25	2702781	N/A	N/A	180/400 FOOT AQUIFER
TUCKER RD WS #01	2701554	N/A	N/A	180/400 FOOT AQUIFER
TUCKER RD WS #02	2701661	N/A	N/A	180/400 FOOT AQUIFER
TUCKER RD WS #03	2701902	N/A	N/A	180/400 FOOT AQUIFER
TUCKER RD WS #05	2702216	N/A	N/A	180/400 FOOT AQUIFER
TUCKER RD WS #06	2702239	N/A	N/A	180/400 FOOT AQUIFER
TUMBLEWEED LN WS #01	2702442	N/A	N/A	180/400 FOOT AQUIFER
TUMBLEWEED LN WS #02	2702676	N/A	N/A	180/400 FOOT AQUIFER

Water System Name	ID	Connections	Population Served	Subbasin
VALLEY RD WS #01	2701120	N/A	N/A	180/400 FOOT AQUIFER
VALLEY RD WS #02	2702164	N/A	N/A	180/400 FOOT AQUIFER
WALKER VALLEY WS #02	2700801	N/A	N/A	180/400 FOOT AQUIFER
WALKER VALLEY WS #03	2700802	N/A	N/A	180/400 FOOT AQUIFER
WALKER VALLEY WS #04	2701373	N/A	N/A	180/400 FOOT AQUIFER
WALKER VALLEY WS #06	2701663	N/A	N/A	180/400 FOOT AQUIFER
WALKER VALLEY WS #07	2702387	N/A	N/A	180/400 FOOT AQUIFER
WALKER VALLEY WS #09	2702434	N/A	N/A	180/400 FOOT AQUIFER
WALKER VALLEY WS #10	2702454	N/A	N/A	180/400 FOOT AQUIFER
WALKER VALLEY WS #11	2702498	N/A	N/A	180/400 FOOT AQUIFER
WILLOW RD WS #01	2702501	N/A	N/A	180/400 FOOT AQUIFER

Table 2. Public Water Systems (15 < connections or serving more than 25 people for at least 60 days out of the year)

Water System Name	PWSID	Connections	Population Served	Subbasin	State Water System Classification
ALCO WATER SERVICE	CA2710001	9,272	29,179	180/400 FOOT AQUIFER	C
ASSOCIATED TAGLINE WS	CA2701109	5	70	180/400 FOOT AQUIFER	NTNC
BAUMANN RD WS #01	CA2700842	17	40	180/400 FOOT AQUIFER	C
BERRY DR WS #02	CA2701897	19	30	180/400 FOOT AQUIFER	C
BUD ANTLE MARINA WS	CA2700998	4	150	180/400 FOOT AQUIFER	NTNC
CAL AM WATER COMPANY - CHUALAR	CA2701202	192	736	180/400 FOOT AQUIFER	C
CASTROVILLE CSD	CA2710005	1,952	7,100	180/400 FOOT AQUIFER	C
COLOR SPOT NURSERY WS #01	CA2700853	4	200	180/400 FOOT AQUIFER	NTNC
COLOR SPOT NURSERY WS #02	CA2702482	1	25	180/400 FOOT AQUIFER	NTNC
CONUNDRUM WINERY WS	CA2702641	1	25	180/400 FOOT AQUIFER	NC
CORDA RD WS	CA2701820	19	60	180/400 FOOT AQUIFER	C
CWSC OAK HILLS	CA2710019	894	3,904	180/400 FOOT AQUIFER	C
CWSC SALINAS	CA2710010	24,036	106,858	180/400 FOOT AQUIFER	C
CWSC SALINAS HILLS	CA2710012	2,386	8,213	180/400 FOOT AQUIFER	C
DEL MONTE FARMS RD WS #03	CA2700541	16	55	180/400 FOOT AQUIFER	C
DESMOND RD WS #03	CA2700547	17	55	180/400 FOOT AQUIFER	C
DOLAN RD MWC	CA2700548	40	120	180/400 FOOT AQUIFER	C
DOLAN RD WATER SYSTEM #2	CA2702652	4	50	180/400 FOOT AQUIFER	NTNC

Water System Name	PWSID	Connections	Population Served	Subbasin	State Water System Classification
EL CAMINO MACHINE & WELDING WS	CA2702452	3	28	180/400 FOOT AQUIFER	NTNC
EL CAMINO WC INC	CA2702409	21	90	180/400 FOOT AQUIFER	C
ELKHORN RD WS #04	CA2700579	20	60	180/400 FOOT AQUIFER	C
ELKHORN SCHOOL WS	CA2700577	2	545	180/400 FOOT AQUIFER	NTNC
ESPERANZA RD WS	CA2702615	1	160	180/400 FOOT AQUIFER	NTNC
FIRESTONE BUSINESS PARK WS	CA2701214	1	154	180/400 FOOT AQUIFER	NTNC
FLORICULTURA PACIFIC WS	CA2701152	3	125	180/400 FOOT AQUIFER	NTNC
FOOTHILL WA	CA2702135	18	28	180/400 FOOT AQUIFER	C
GONZALES GAS STATION WS	CA2701542	2	200	180/400 FOOT AQUIFER	NC
GONZALES, CITY OF	CA2710007	1,930	8,383	180/400 FOOT AQUIFER	C
GRAVES SCHOOL WS	CA2702180	2	56	180/400 FOOT AQUIFER	NTNC
GREEN ACRES WA	CA2701647	20	50	180/400 FOOT AQUIFER	C
GROWERS SERVICE ASSN WS (ICE)	CA2702484	40	500	180/400 FOOT AQUIFER	NTNC
GROWERS TRANSPLANTING WS	CA2701153	1	50	180/400 FOOT AQUIFER	NTNC
HARBOR VIEW WA	CA2701498	28	75	180/400 FOOT AQUIFER	C
HARRIS RD WS #10	CA2702704	4	284	180/400 FOOT AQUIFER	NTNC
HIDDEN VALLEY WA	CA2700594	31	51	180/400 FOOT AQUIFER	C
HITCHCOCK RD WS #01	CA2702320	1	175	180/400 FOOT AQUIFER	C
HITCHCOCK RD WS #02	CA2702584	4	25	180/400 FOOT AQUIFER	NTNC
LEAFWOOD COMMUNITY WA	CA2700624	23	66	180/400 FOOT AQUIFER	C
MARINA LANDFILL WS	CA2702453	1	55	180/400 FOOT AQUIFER	NTNC
MERIDIAN RD WS #09	CA2701837	2	35	180/400 FOOT AQUIFER	NTNC
MISIONERO VEGETABLES WS	CA2701946	3	60	180/400 FOOT AQUIFER	NTNC
MONTEREY DUNES MWA	CA2701452	137	280	180/400 FOOT AQUIFER	C
MONTEREY ONE WATER (FORMERLY MRWPCA)	CA2702456	5	73	180/400 FOOT AQUIFER	NTNC
MOSS LANDING HARBOR WS	CA2701515	152	402	180/400 FOOT AQUIFER	C
MOSS LANDING MWC	CA2701683	3	260	180/400 FOOT AQUIFER	NTNC
PAJARO/SUNNY MESA COMMUNITY SERVICES DISTRICT	CA2710020	460	6,500	180/400 FOOT AQUIFER	C
PARADISE LAKE MUTUAL WATER CO.	CA2700674	90	180	180/400 FOOT AQUIFER	C
PARADISE RD WS #21	CA2701633	16	48	180/400 FOOT AQUIFER	C
PEDRAZZI MWC	CA2701364	96	273	180/400 FOOT AQUIFER	C

Water System Name	PWSID	Connections	Population Served	Subbasin	State Water System Classification
RIVER RD WS #25	CA2701063	19	65	180/400 FOOT AQUIFER	C
RIVER RD WS #26	CA2702396	3	45	180/400 FOOT AQUIFER	NC
RIVER RD WS #28	CA2702444	13	25	180/400 FOOT AQUIFER	NC
RIVER RD WS #34	CA2702799	3	53	180/400 FOOT AQUIFER	NC
SPRECKELS LN WS #03	CA2701912	5	50	180/400 FOOT AQUIFER	NTNC
STRAWBERRY RD WS #06	CA2700766	27	78	180/400 FOOT AQUIFER	C
TASCO SPRECKELS WATER COMPANY	CA2710023	327	1,079	180/400 FOOT AQUIFER	C

Chapter 4
Appendix 4-A

ISW Seasonality Analysis

Appendix 4a. ISW Seasonality Analysis

Surface water and groundwater can be hydrologically connected along a stream reach during some months of the year and not others. These temporal variations of interconnected surface water (ISW) during a given year are the result of variations in recharge, precipitation, groundwater pumping, and riparian evapotranspiration. Along the Salinas River, monthly changes in reservoir operations also influence ISW reaches. Hydrologic connectivity in the Salinas Valley is estimated using results from the provisional SVIHM. Along the Salinas River, the timing of reservoir releases is used to determine the months that the ISW sustainable management criteria applies since releases during the peak conservation period (June through September) are intended for groundwater recharge. The ISW delineated along the Salinas River in section 4.4.5.1 of the GSP represent reaches that are connected during a majority (greater than 50%) of months during the non-peak conservation release period (October through May) over the full SVIHM simulation period from 1967 to 2017. However, model results indicate that the ISW length along the Salinas River is virtually the same throughout the year, connected the vast majority of time.

For tributaries or streams away from the Salinas River, reservoir releases have less impact on ISW, if any, than for the Salinas River. To estimate the seasonal variability of ISW for stream reaches away from the Salinas River, a monthly analysis. These locations are the best estimates of where persistent hydrologic connections occur along streams in the Salinas Valley. However, the lateral extents (lengths) of these reaches vary from month to month during the year, as well as from year to year.

To understand whether surface water is connected to groundwater only during certain months, a monthly analysis was undertaken. The monthly analysis produces 2 pieces of information for each month of the year: (1) the average percent of years simulated by the SVIHM that a stream has hydrologic connection, based on the average monthly connectivity of every model grid cell identified as ISW along the stream, and (2) the average extent of where hydrologic connection occurs. Figure 1 shows the average percent of time when connectivity occurs at any location along a given stream in Salinas Valley. These data show the average temporal connectivity along the entire length of a stream; however, some reaches of the stream have much lower or higher connectivity then indicated by the average values. The results on Figure 1 are most useful for identifying the seasonal trends of connectivity for streams. Tributaries to the river and streams away from the river show seasonal variation in connectivity, with higher average connectivity in the Winter and Spring months and lower average connectivity in the Summer months.

Consistent with the seasonal variations in average time of connectivity, the lengths of ISW along the streams away from the Salinas River are generally longest during the late Winter and Spring months and shortest during the late Summer months. The average ISW length varies during the year in the Langley Area Subbasin and along Arroyo Seco in Forebay Subbasin, with the locations of ISW in 4.4.5.1 representing the stream reaches with more consistent connection. The lengths of average ISW away from Salinas River in Upper Valley vary very little, if at all, during the year. The average monthly variations and extents are based on results from the provisional SVIHM and are subject to change in future updates to the GSP as additional data increases the understanding regarding ISW extents.

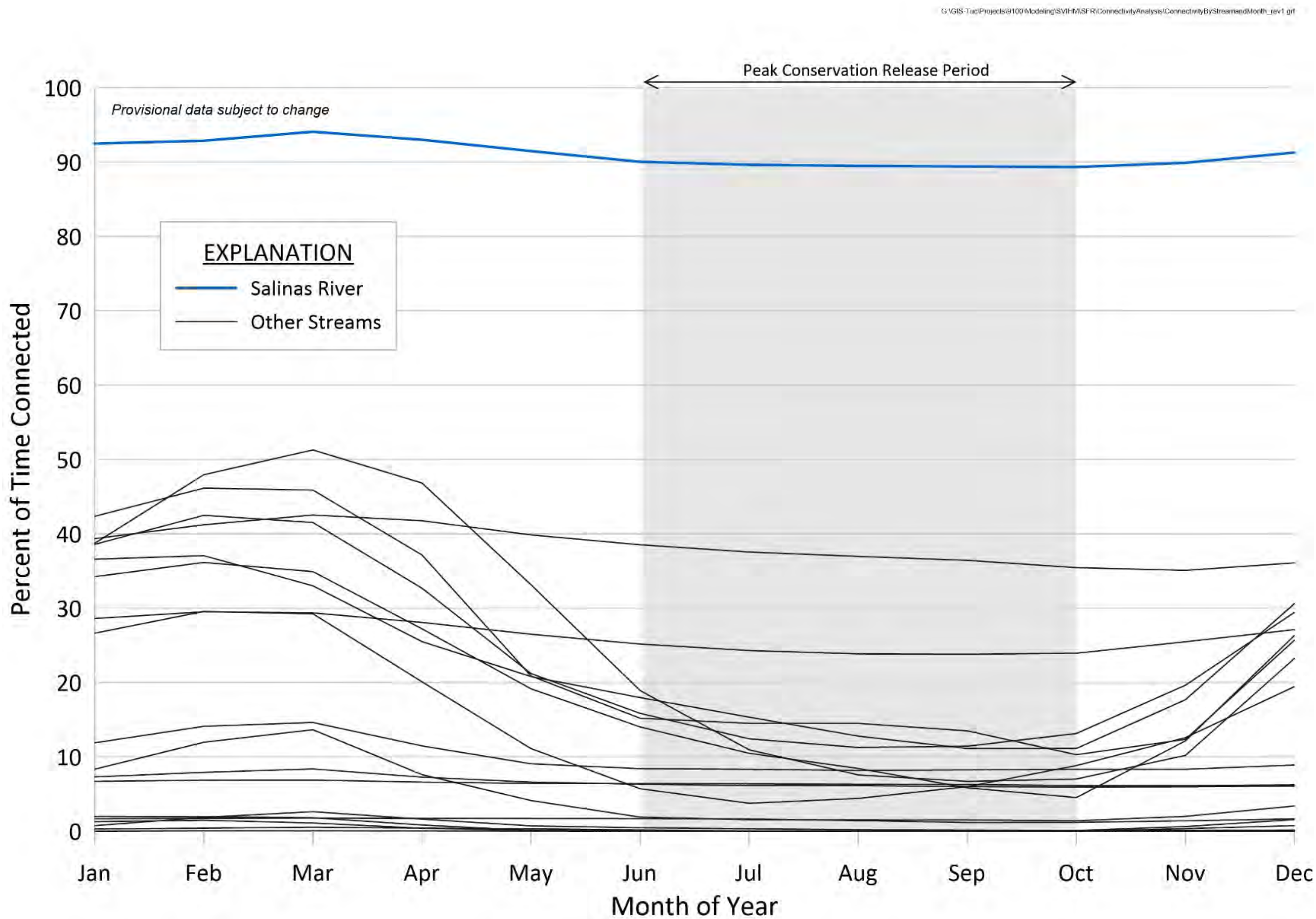


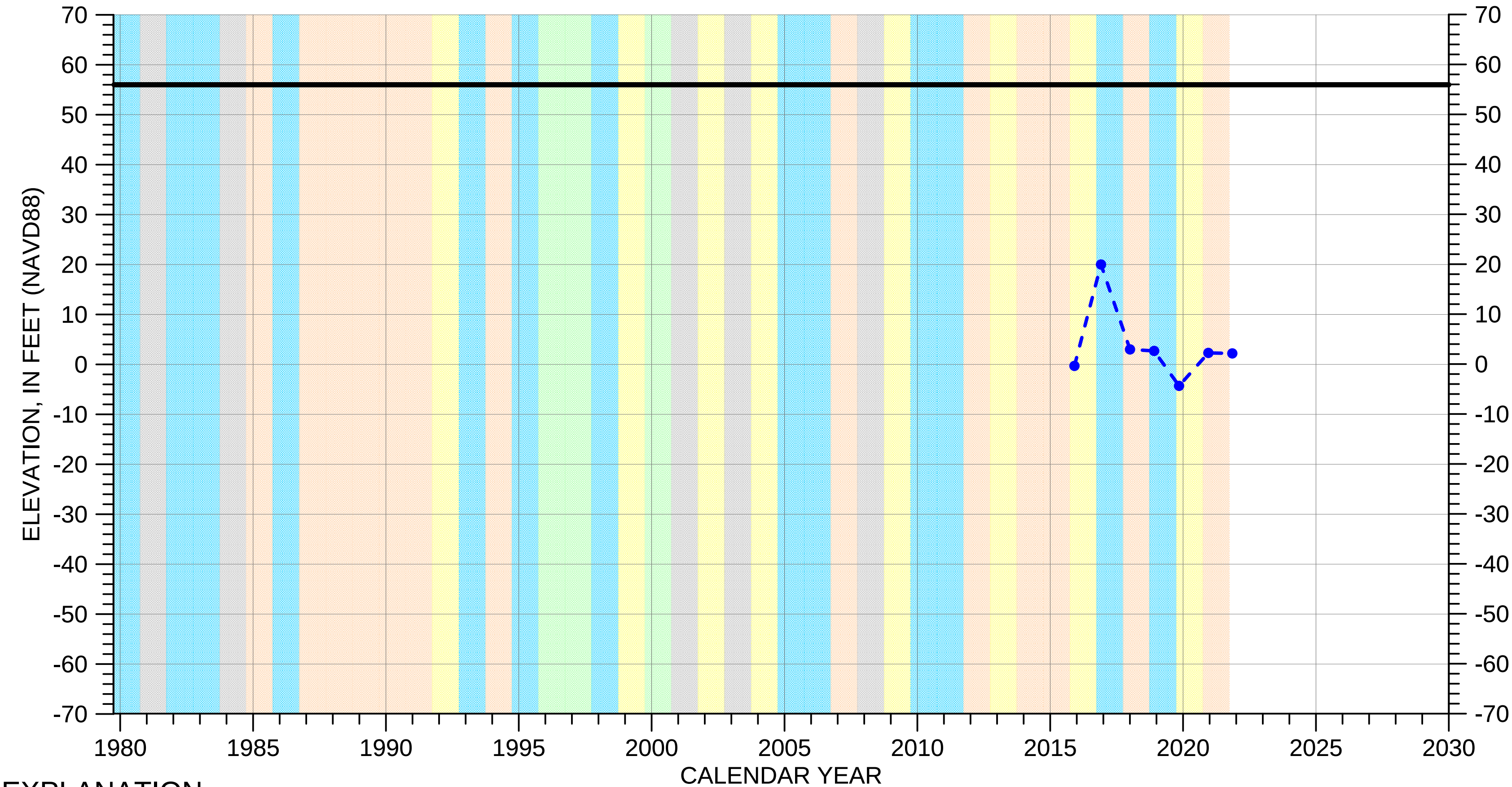
Figure 1. Average Monthly Connectivity Along Streams in Salinas Valley

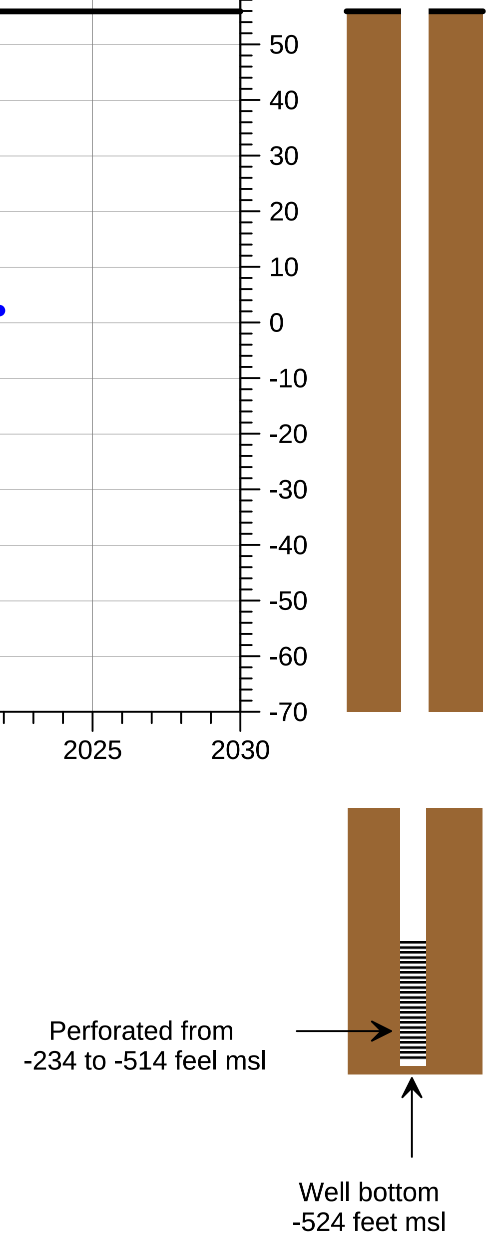
Chapter 5
Appendix 5-A

Hydrographs

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 12S/02E-33H02

180/400-Foot Aquifer Subbasin





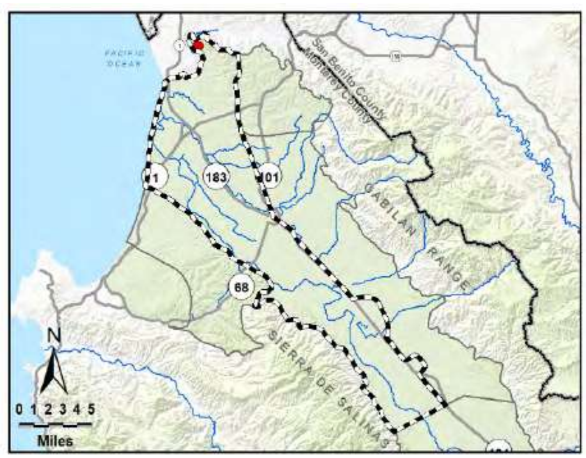
\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEW\GRFs_Ch5\12S_02E-33H02.grf

EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface

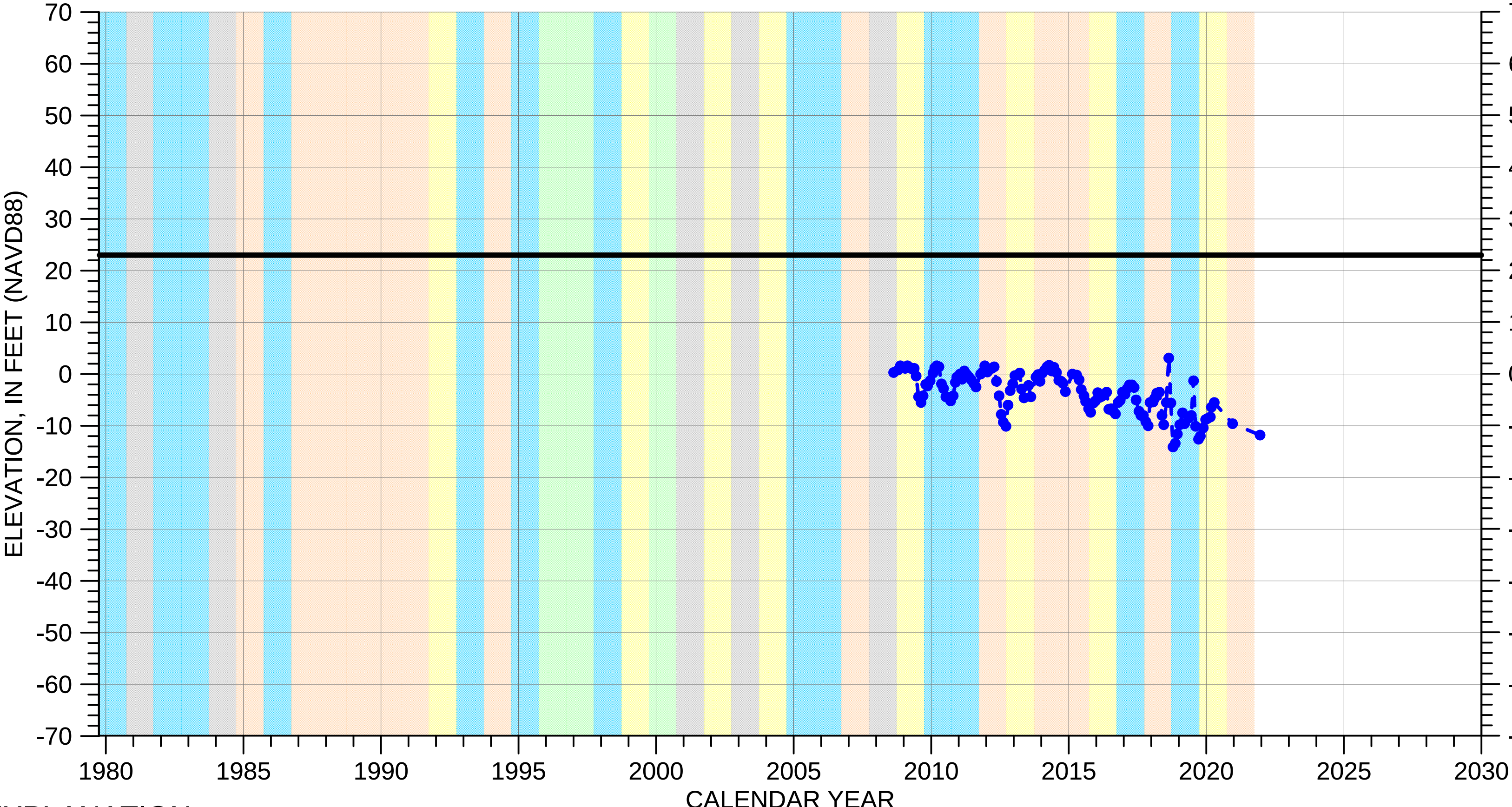
WATER YEAR TYPE DESIGNATION

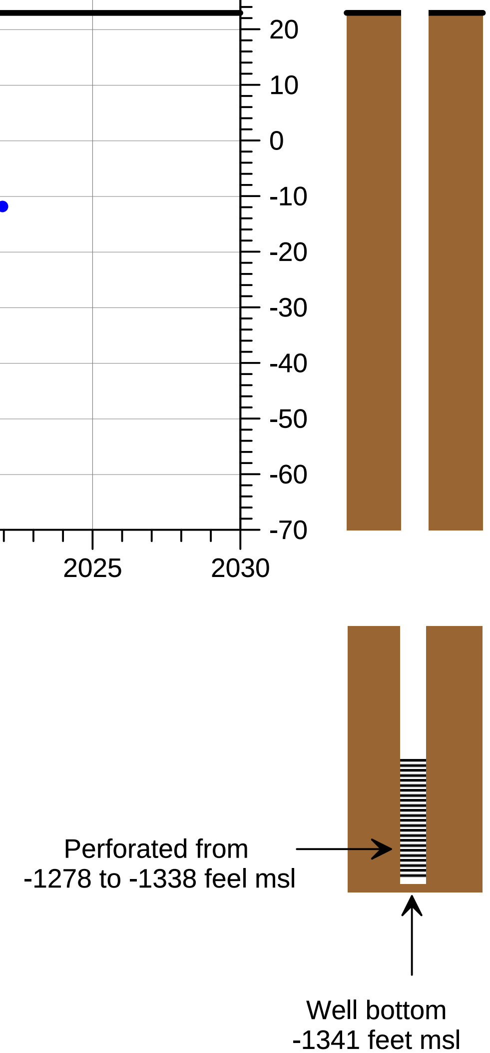
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET



HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 13S/01E-36J02

180/400-Foot Aquifer Subbasin





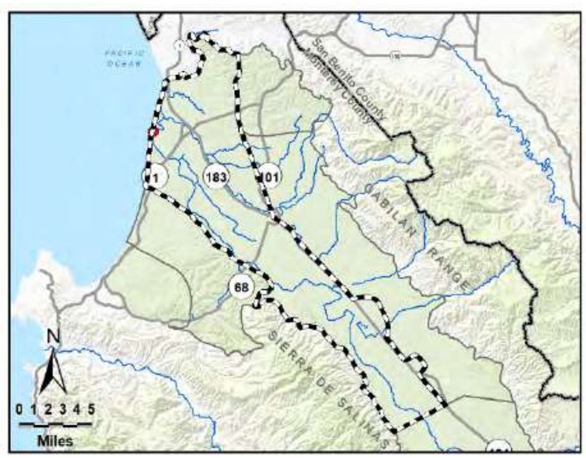
\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch5\13S_01E-36J02.grf

EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface

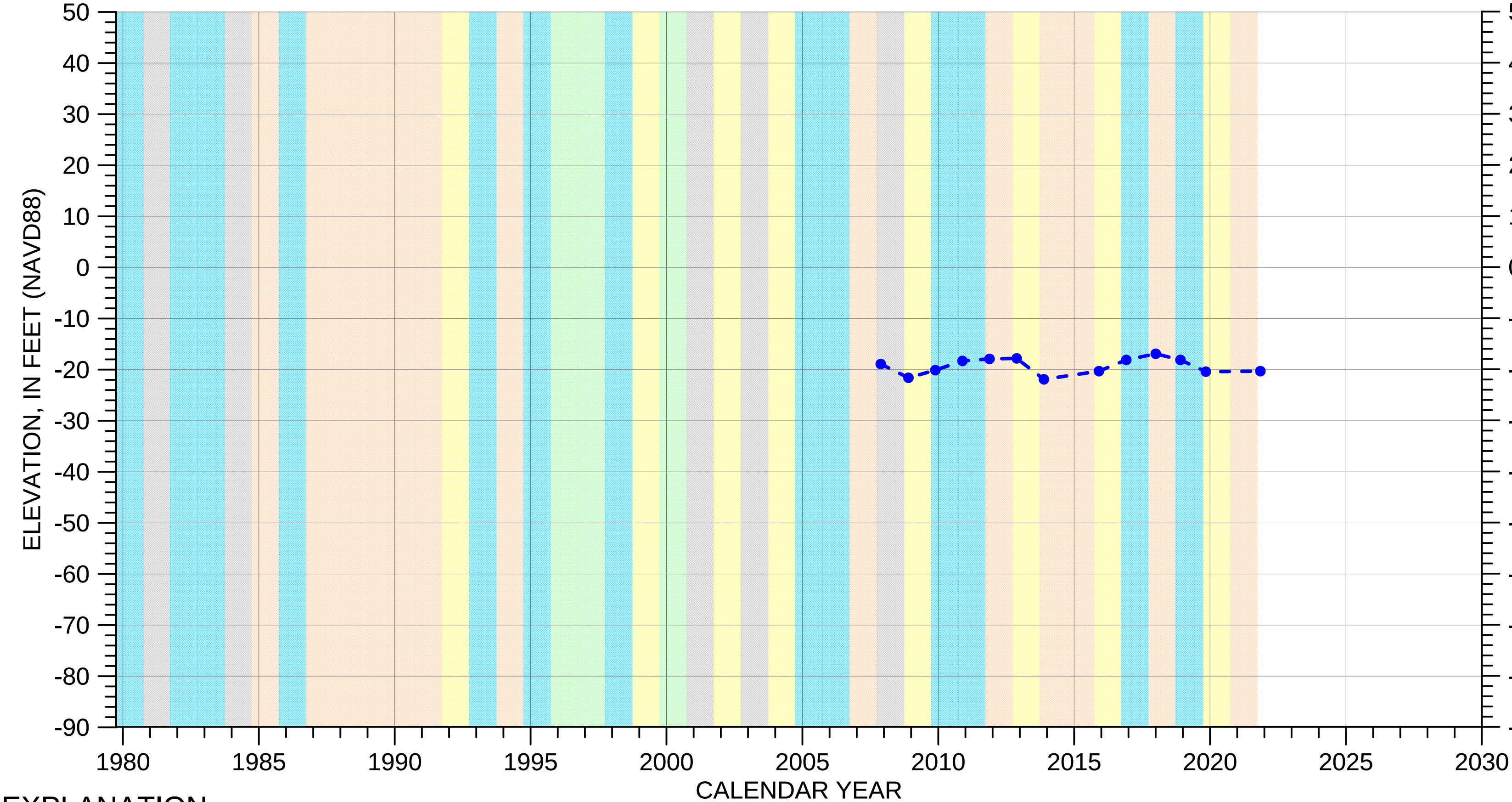
WATER YEAR TYPE DESIGNATION

- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET



HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 13S/02E-10K01

180/400-Foot Aquifer Subbasin



EXPLANATION

Groundwater Elevation

Suspect Measurement

Land Surface (100 FT MSL)

WATER YEAR TYPE DESIGNATION

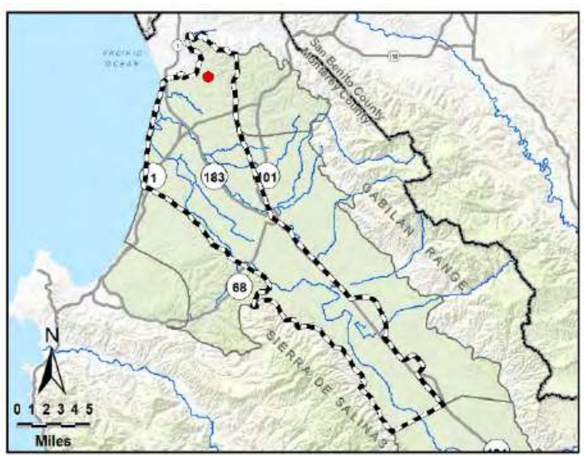
DRY

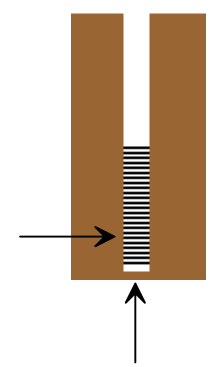
DRY - NORMAL

NORMAL

WET - NORMAL

WET

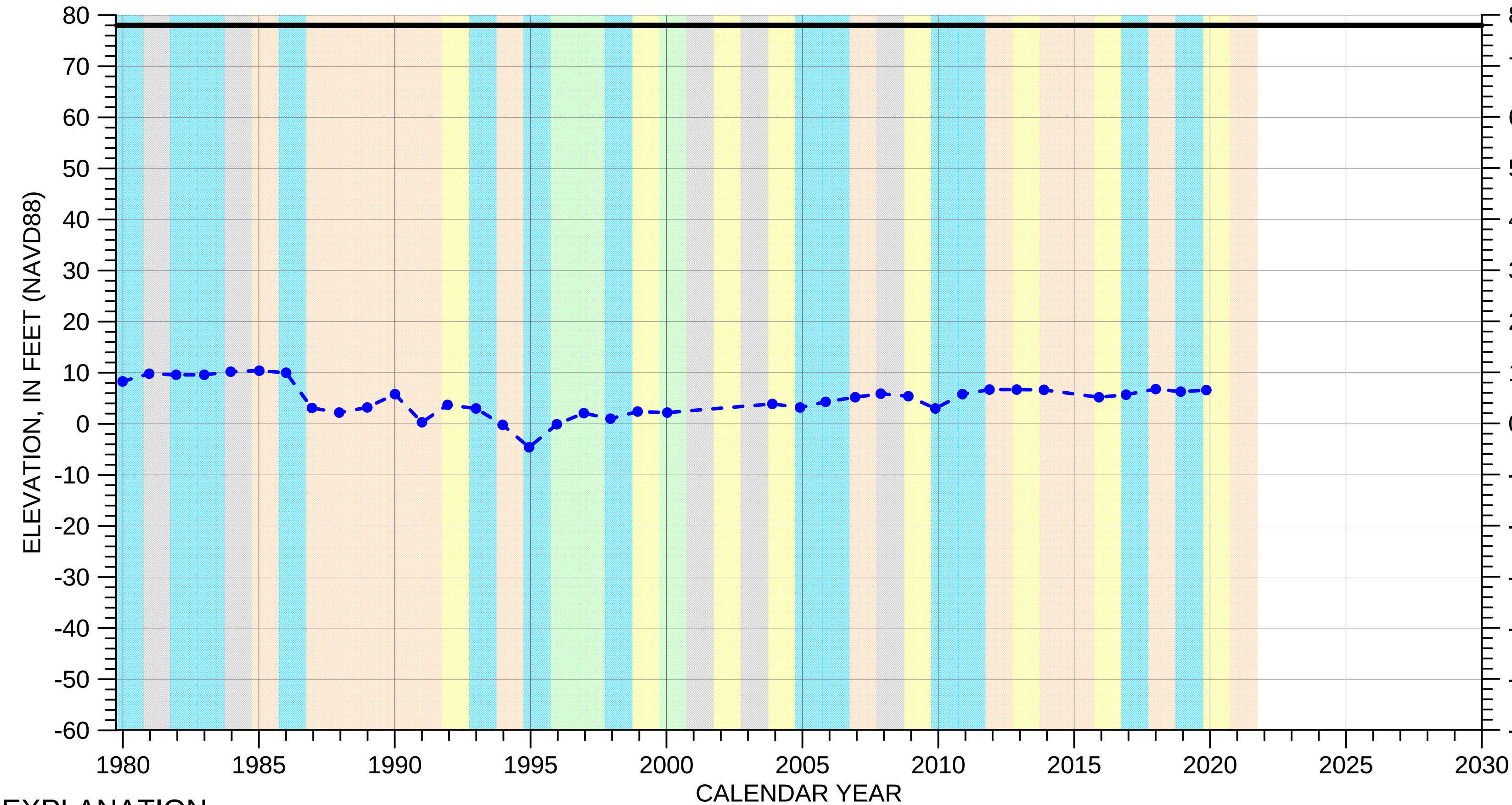


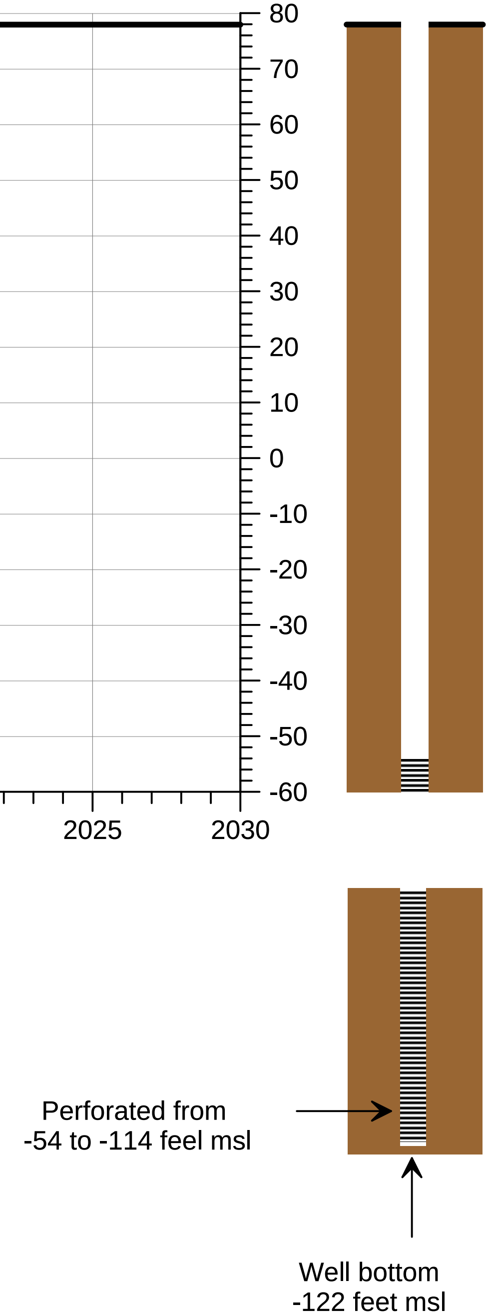


\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch513S_02E-10K01.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 13S/02E-13N01

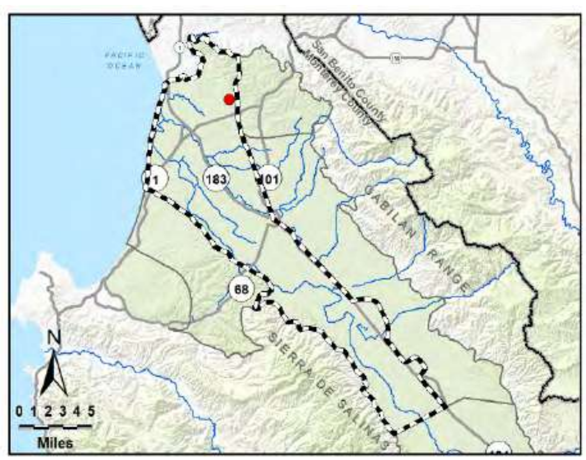
180/400-Foot Aquifer Subbasin





EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface



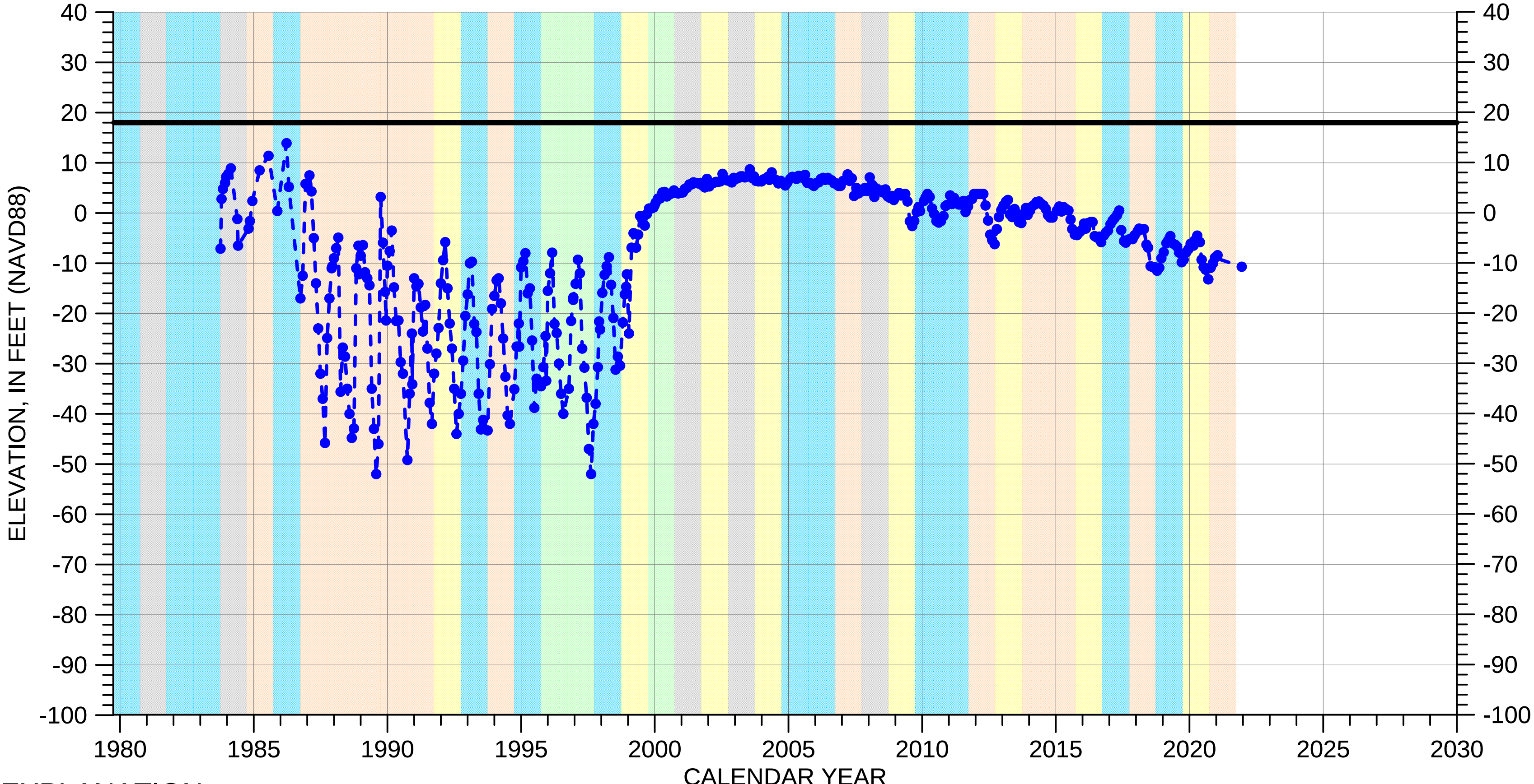
WATER YEAR TYPE DESIGNATION

- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch5\13S_02E-13N01.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 13S/02E-19Q03

180/400-Foot Aquifer Subbasin



Perforated from
-1202 to -1532 feet msl

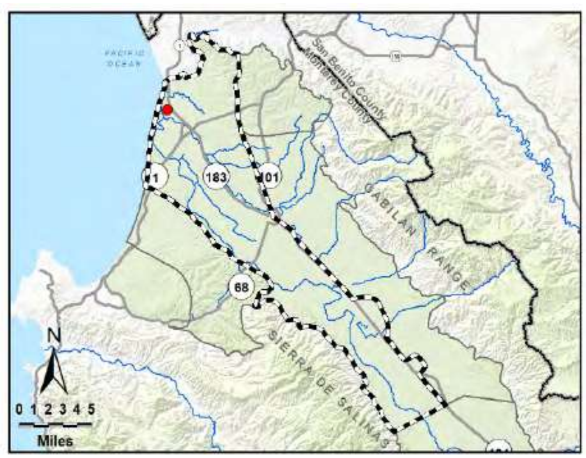
Well bottom
-1544 feet msl

EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface

WATER YEAR TYPE DESIGNATION

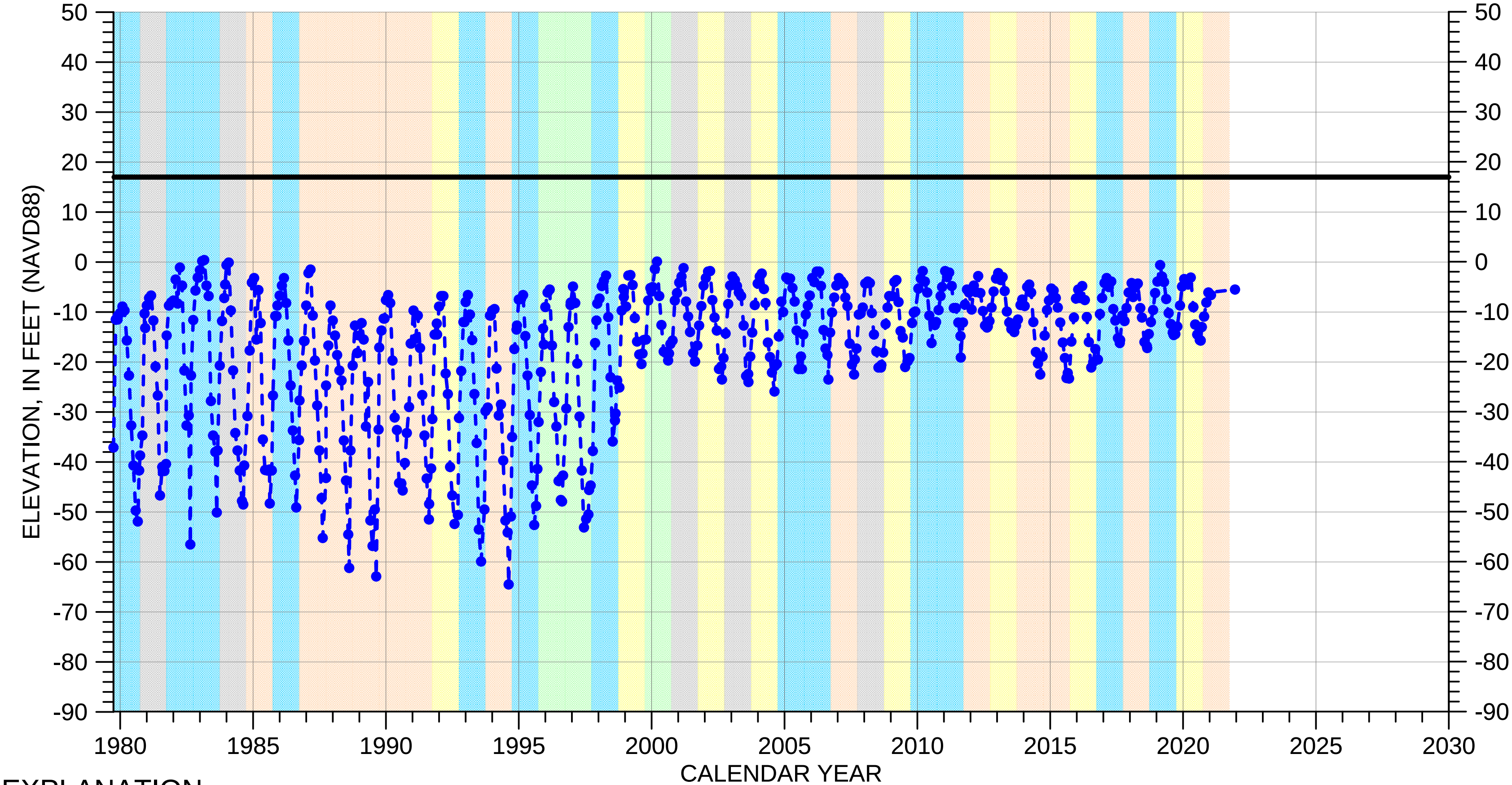
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET



\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch5\13S_02E-19Q03.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 13S/02E-21N01

180/400-Foot Aquifer Subbasin



EXPLANATION

Groundwater Elevation

Suspect Measurement

Land Surface

WATER YEAR TYPE DESIGNATION

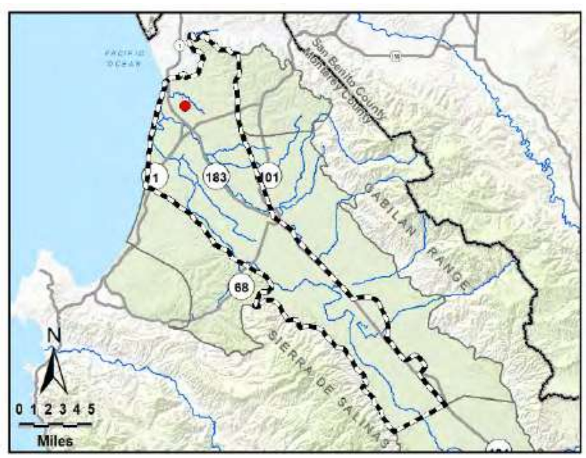
DRY

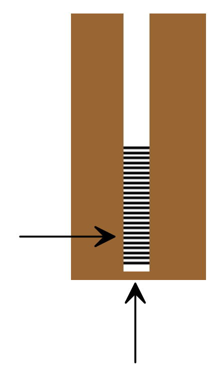
DRY - NORMAL

NORMAL

WET - NORMAL

WET





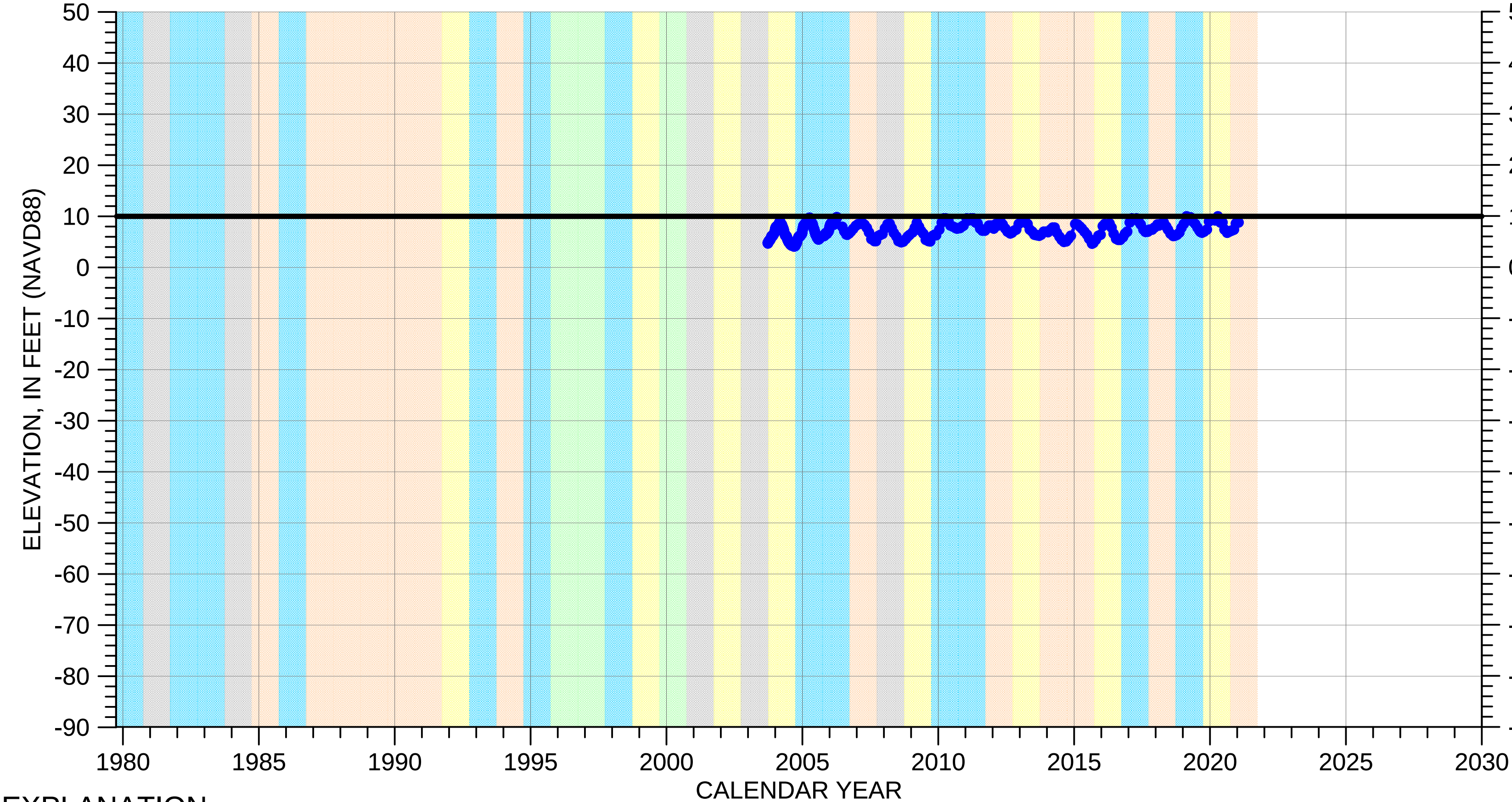
Perforated from
-352 to -533 feet msl

Well bottom
-533 feet msl

\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch5\13S_02E-21N01.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 13S/02E-21Q01

180/400-Foot Aquifer Subbasin

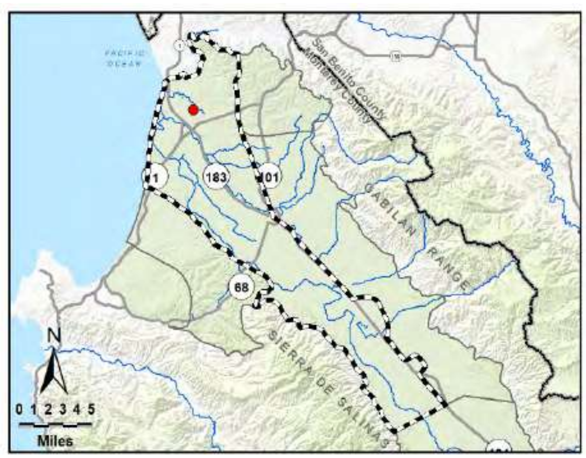


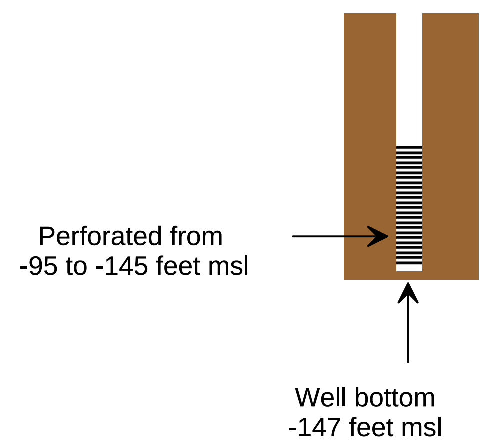
EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface

WATER YEAR TYPE DESIGNATION

- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

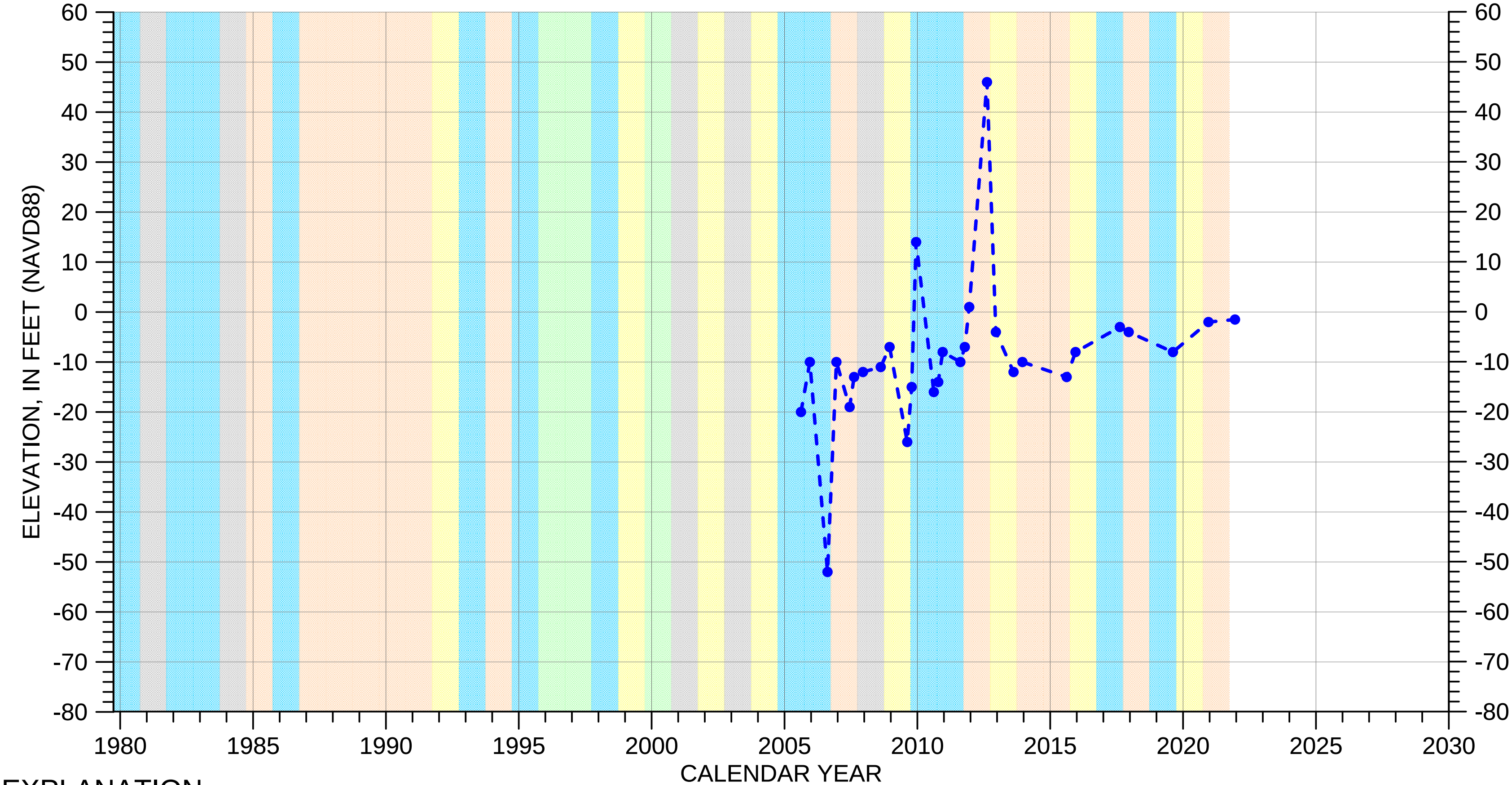




\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRA\NEWGRFs_Ch5\13S_02E-21Q01.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 13S/02E-24N01

180/400-Foot Aquifer Subbasin



EXPLANATION

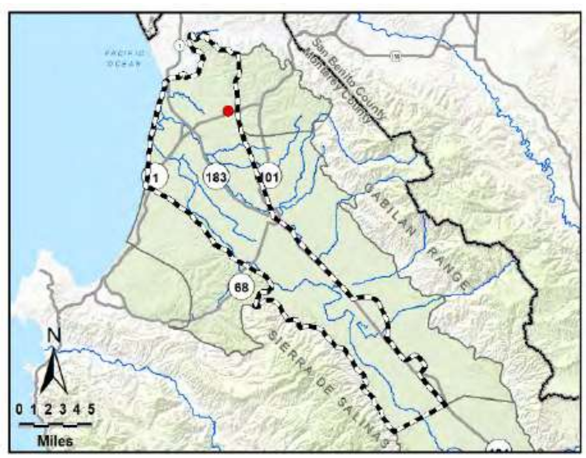
Groundwater Elevation

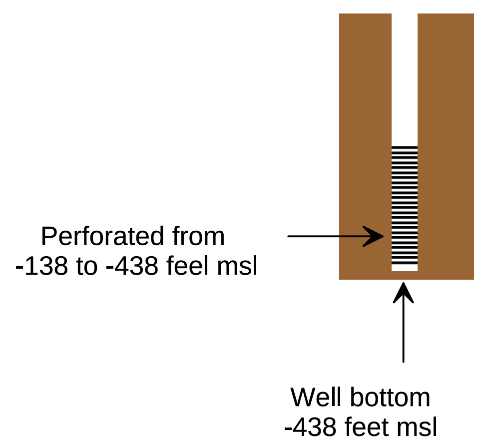
Suspect Measurement

Land Surface (162 FT MSL)

WATER YEAR TYPE DESIGNATION

DRY
DRY - NORMAL
NORMAL
WET - NORMAL
WET

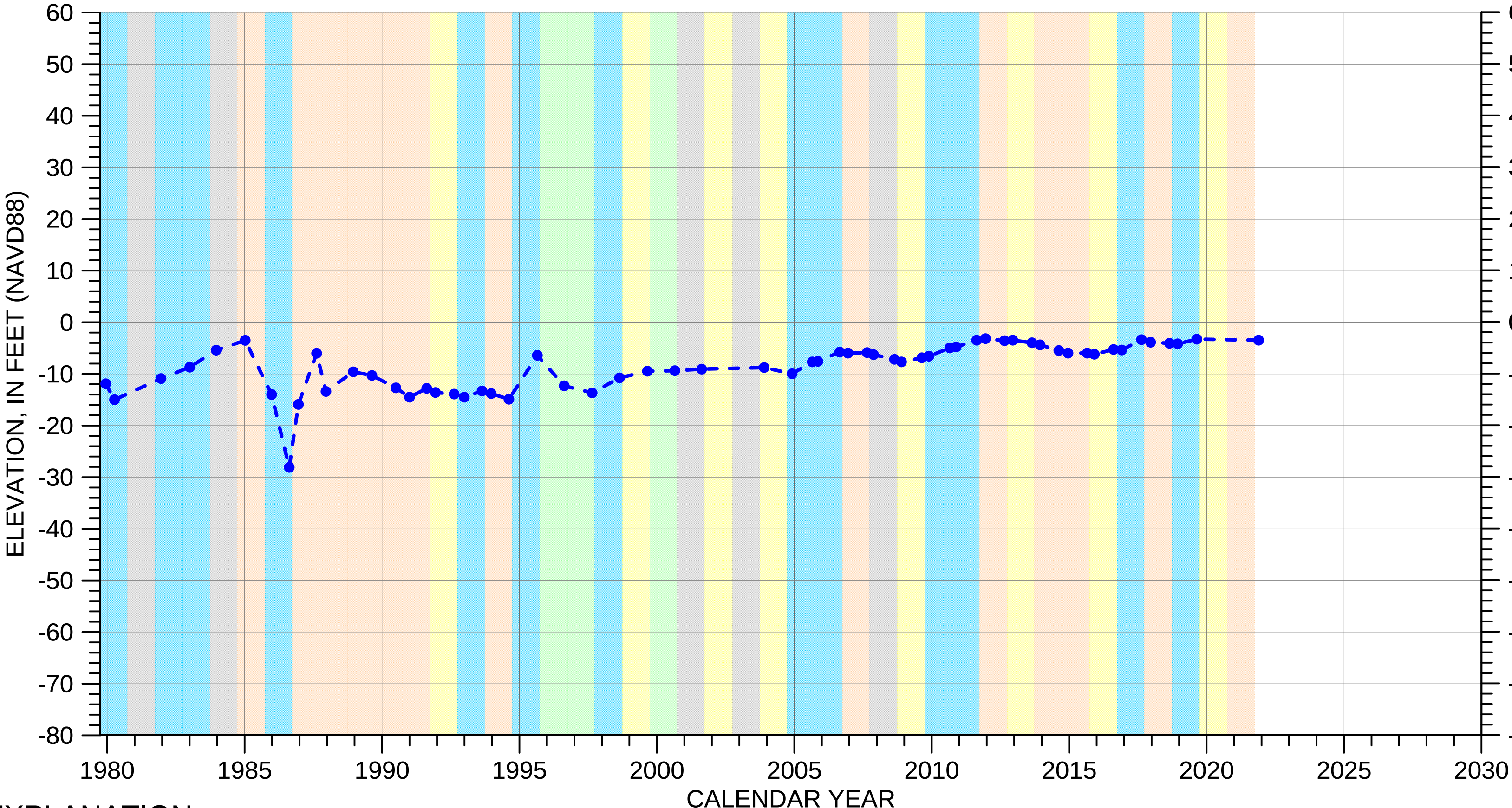


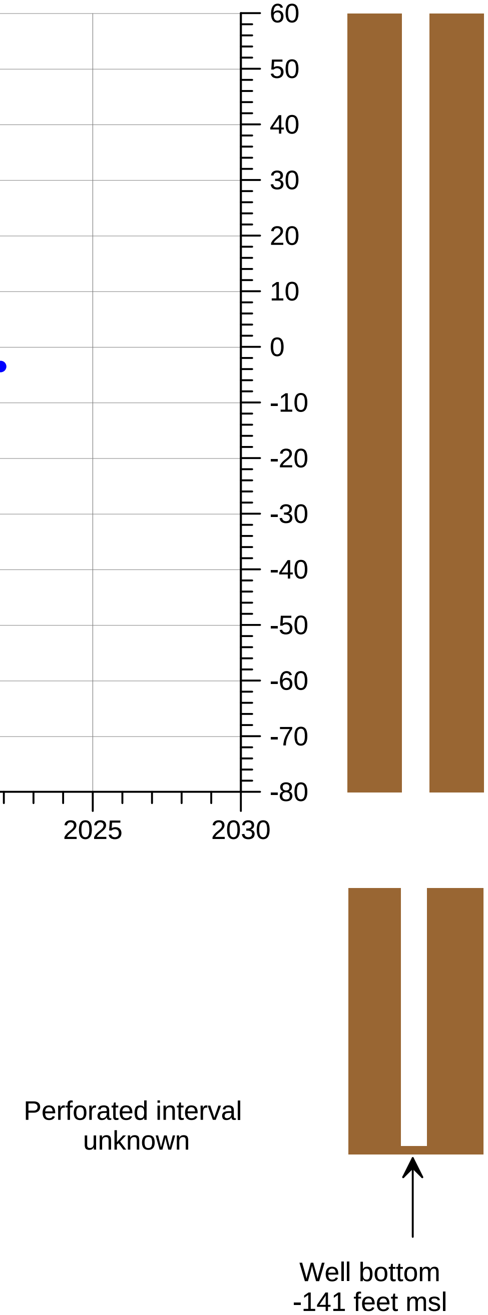


\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRA\NEWGRFs_Ch5\13S_02E-24N01.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 13S/02E-26L01

180/400-Foot Aquifer Subbasin



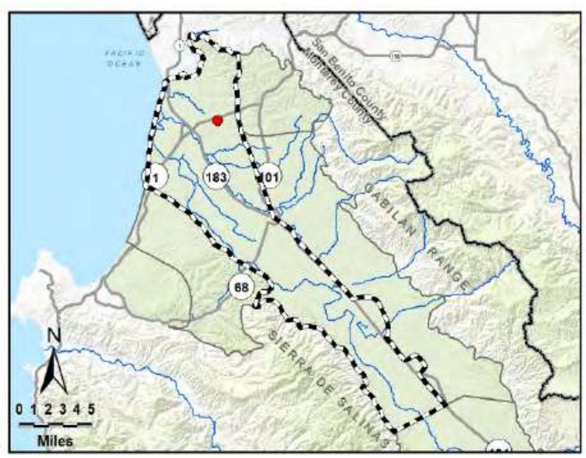


EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface (109 FT MSL)

WATER YEAR TYPE DESIGNATION

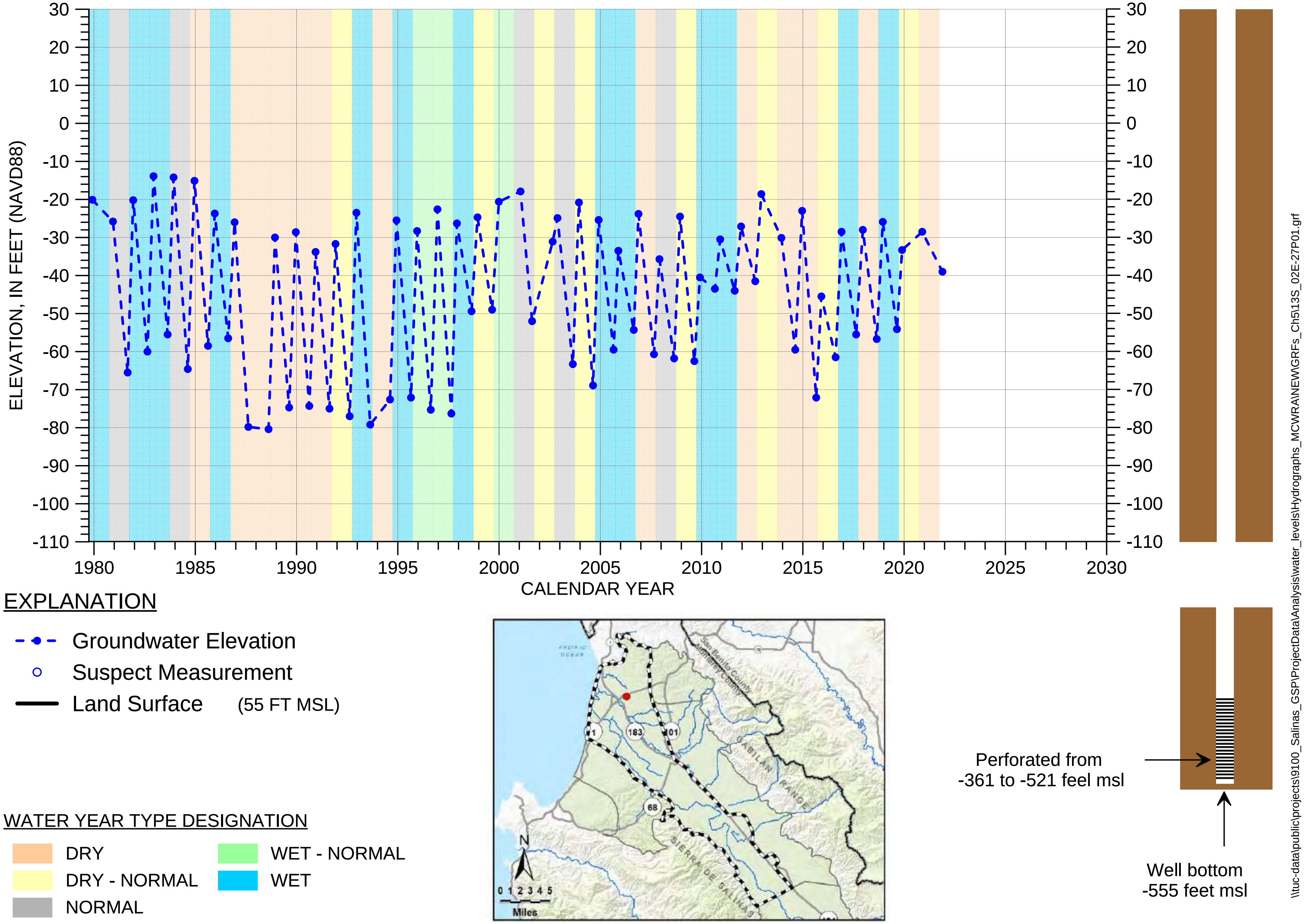
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET



\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch5\13S_02E-26L01.grf

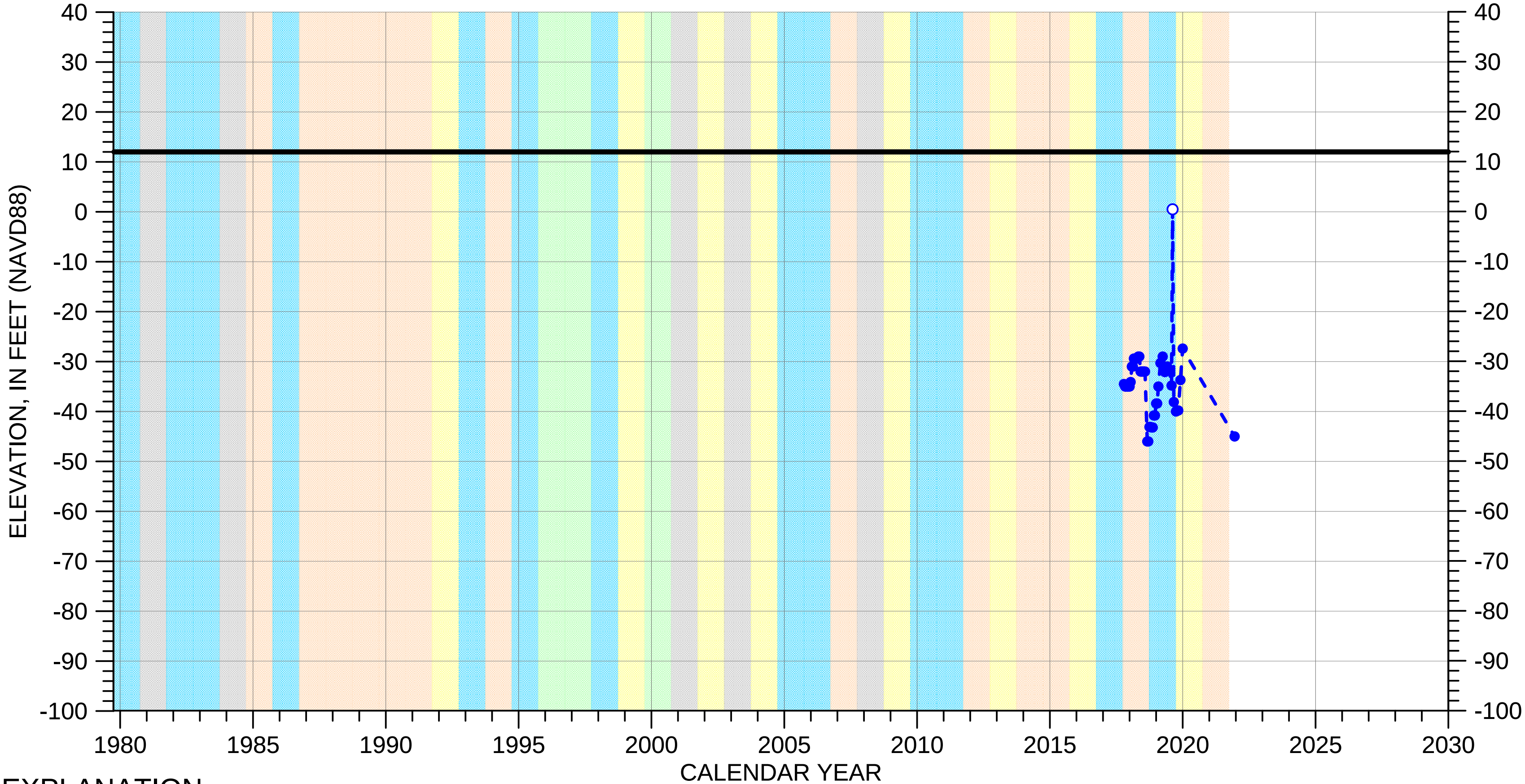
HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 13S/02E-27P01

180/400-Foot Aquifer Subbasin



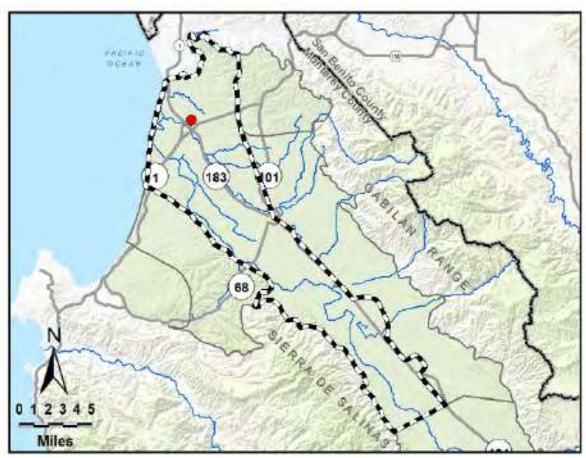
HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 13S/02E-28L03

180/400-Foot Aquifer Subbasin



EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface



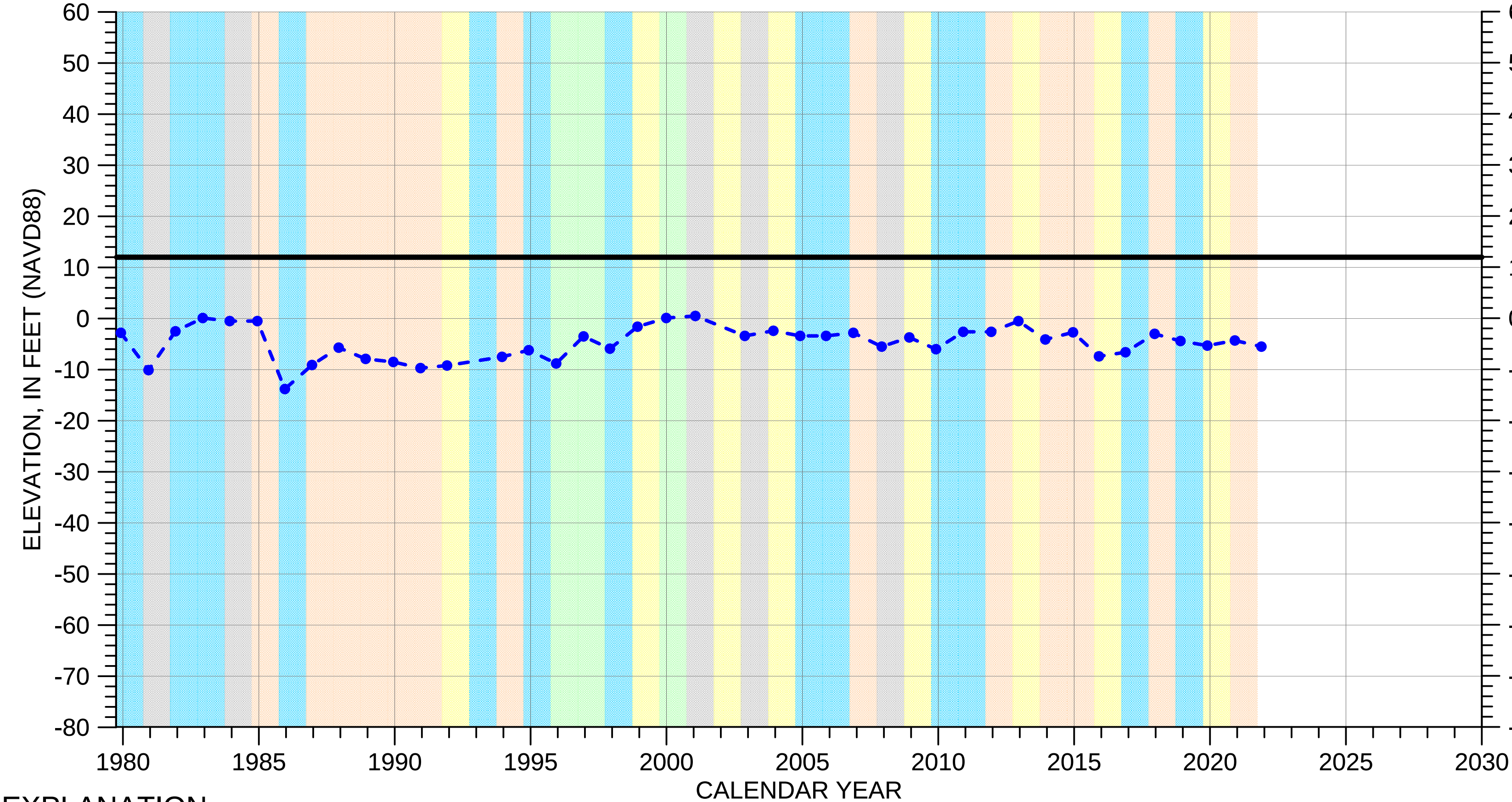
WATER YEAR TYPE DESIGNATION

- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch5\13S_02E-28L03.grf

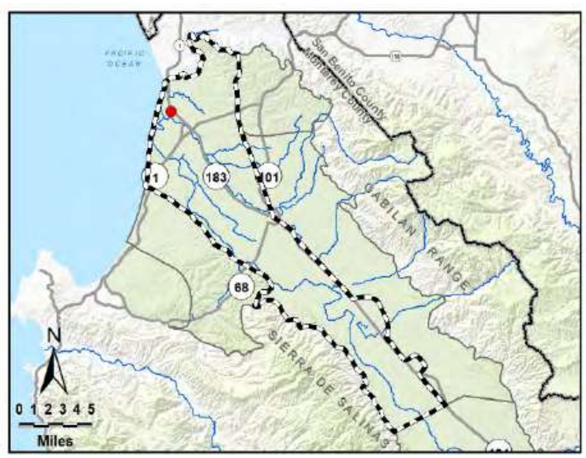
HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 13S/02E-29D03

180/400-Foot Aquifer Subbasin



EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface



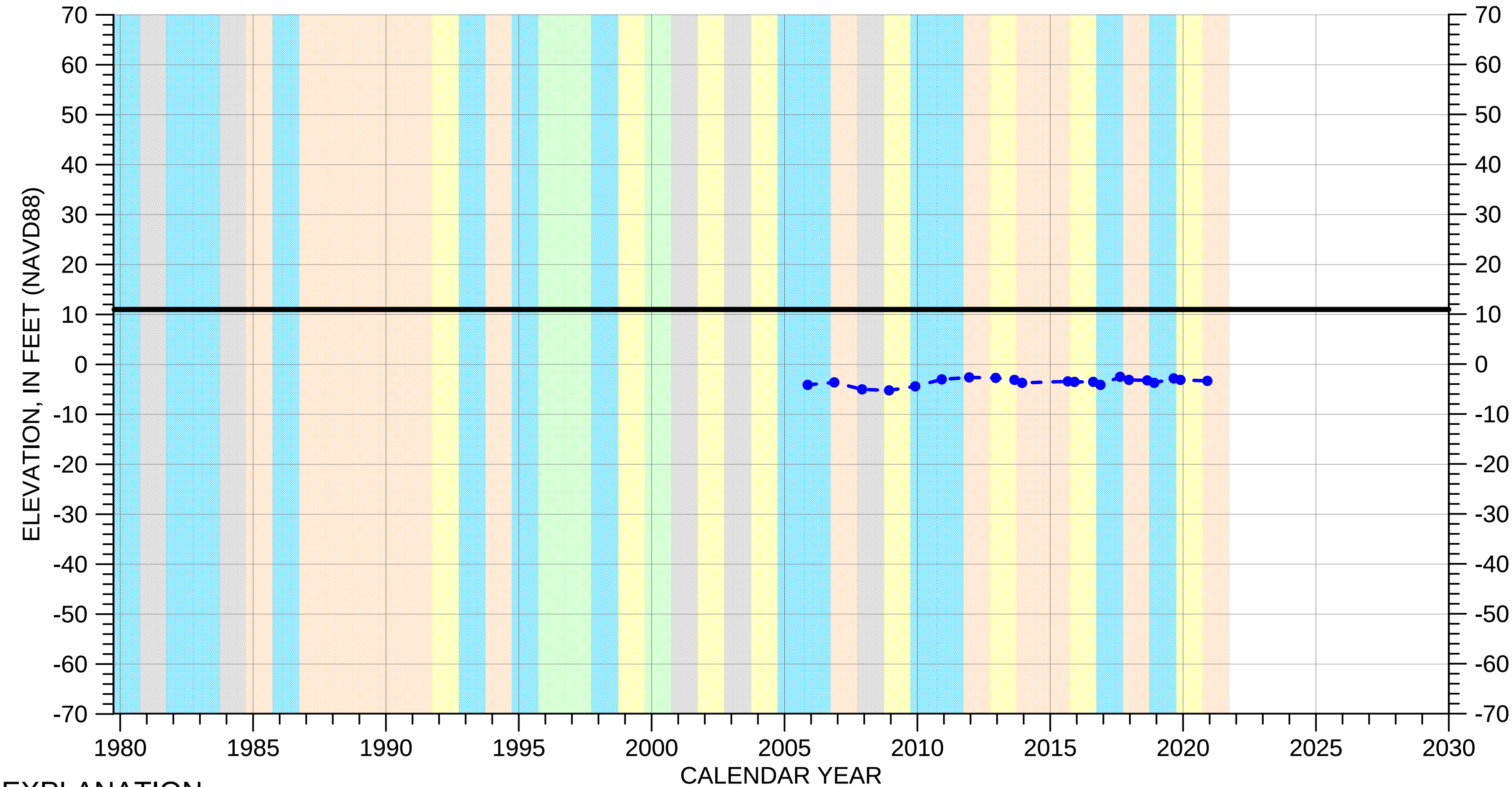
WATER YEAR TYPE DESIGNATION

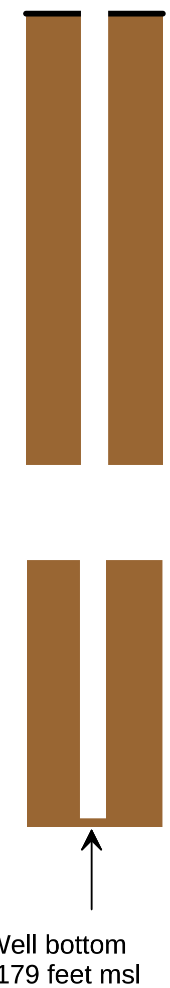
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch5\13S_02E-29D03.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 13S/02E-29D04

180/400-Foot Aquifer Subbasin



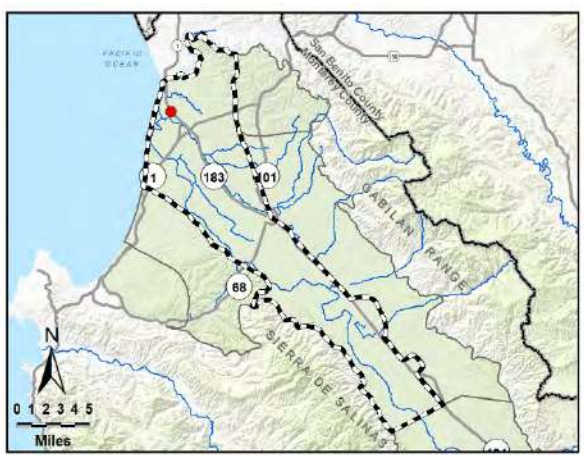


EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface

WATER YEAR TYPE DESIGNATION

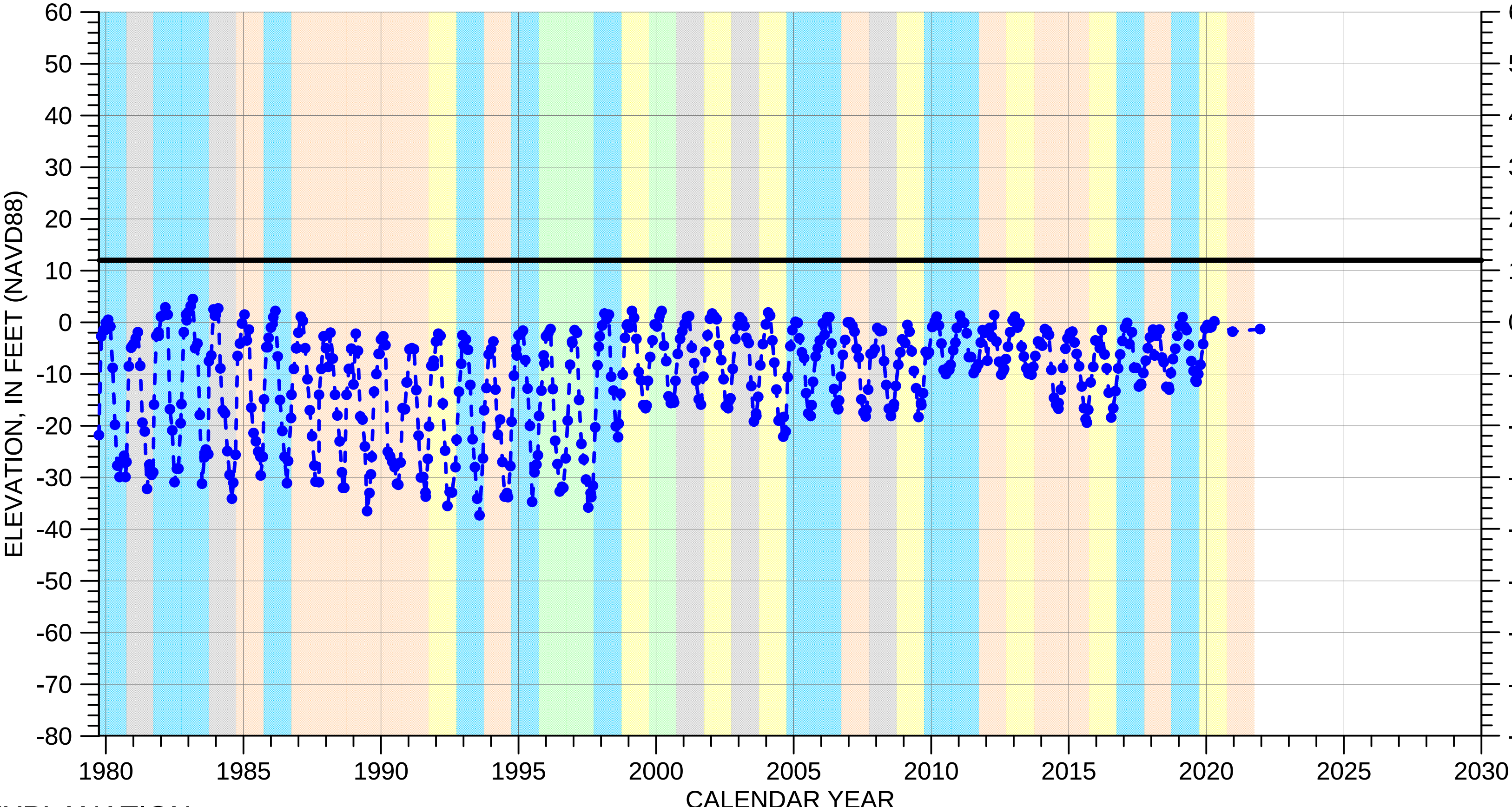
DRY
DRY - NORMAL
NORMAL
WET - NORMAL
WET



\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRA\NEWGRFs_Ch5\13S_02E-29D04.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 13S/02E-31N02

180/400-Foot Aquifer Subbasin



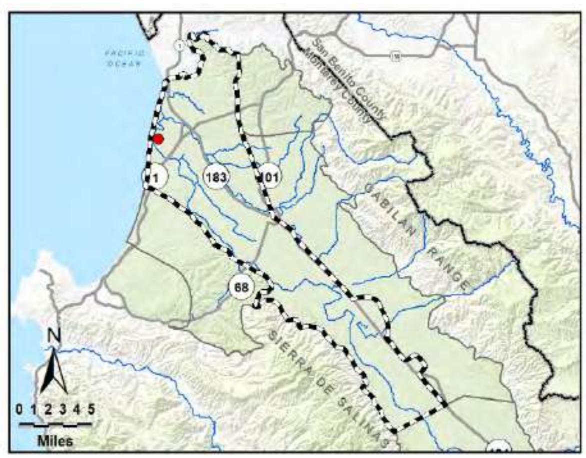
Perforated from
-314 to -518 feel msl

Well bottom
-566 feet msl

\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch5\13S_02E-31N02.grf

EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface

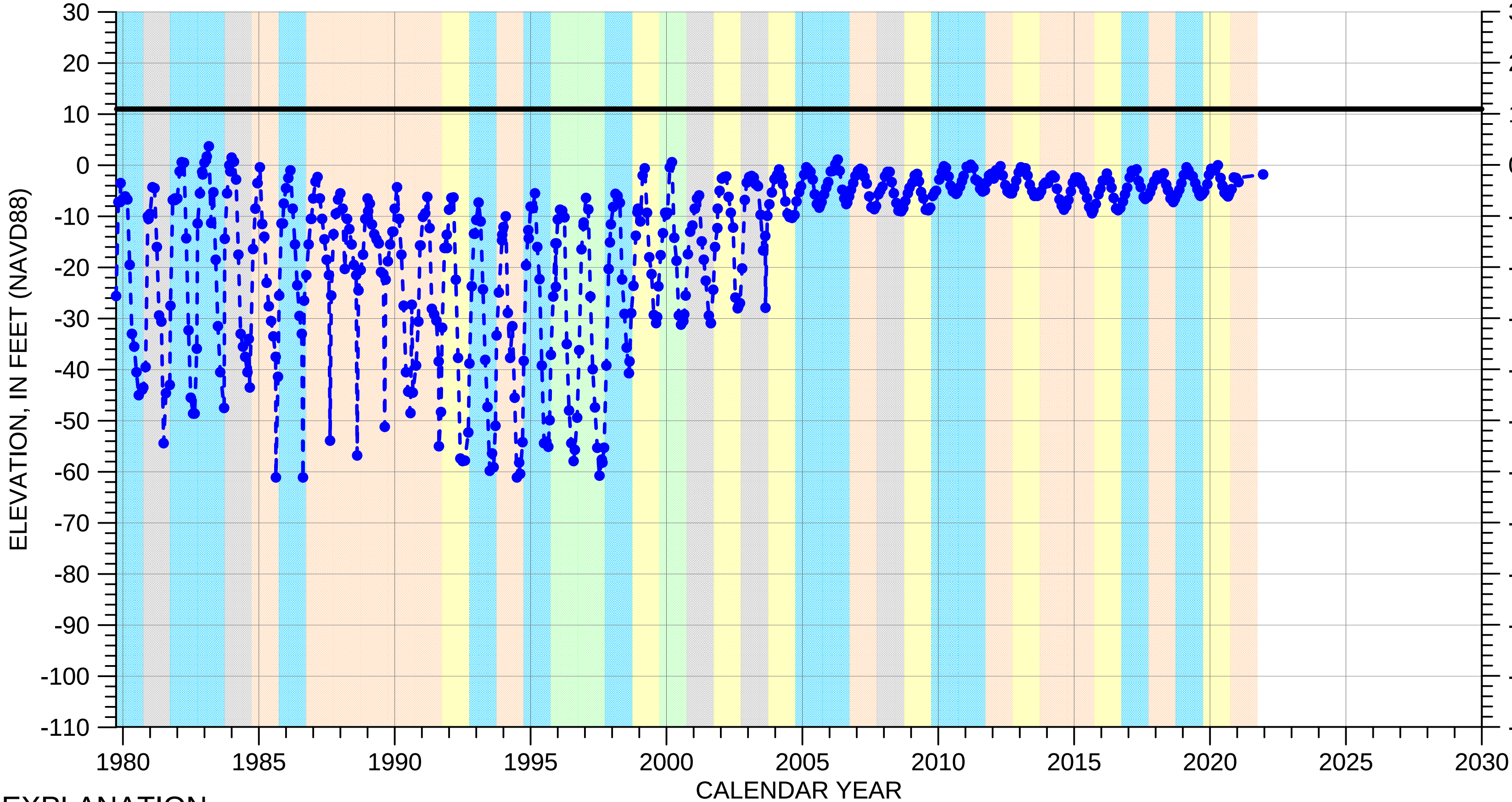


WATER YEAR TYPE DESIGNATION

- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 13S/02E-32A02

180/400-Foot Aquifer Subbasin

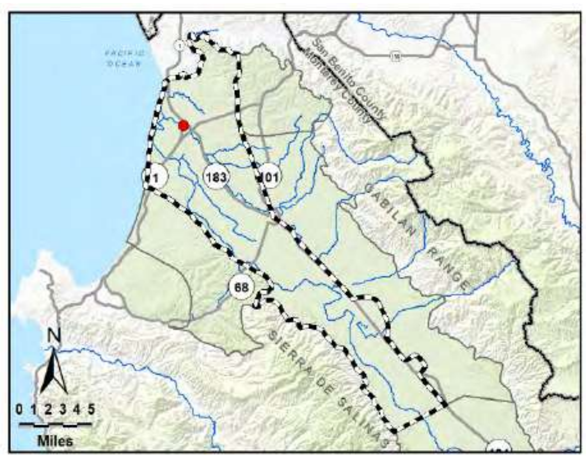


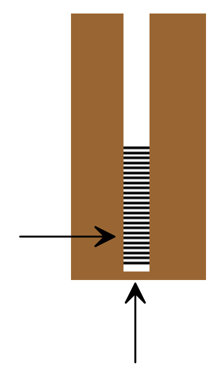
EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface

WATER YEAR TYPE DESIGNATION

- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

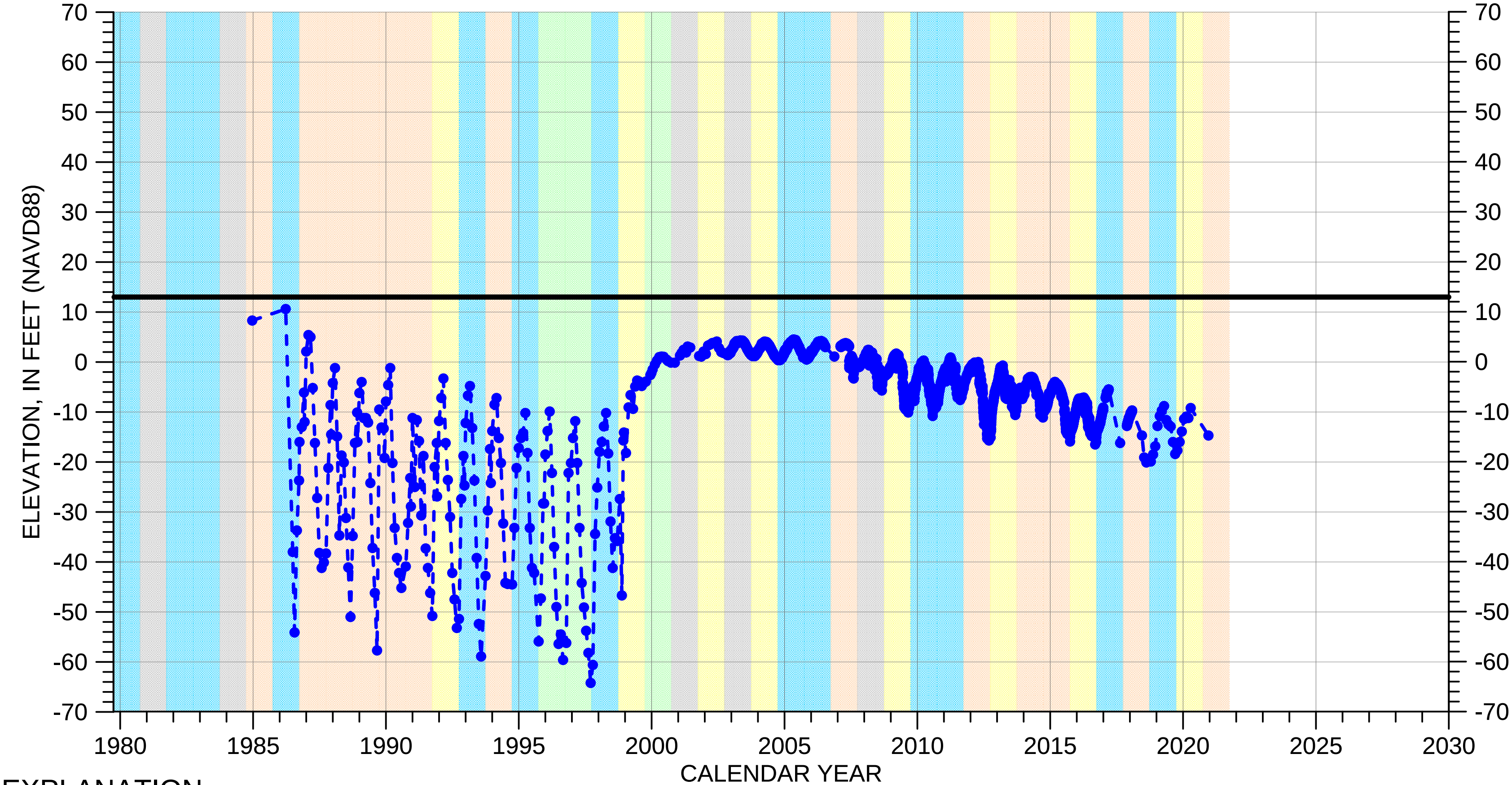




\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch5\13S_02E-32A02.grf

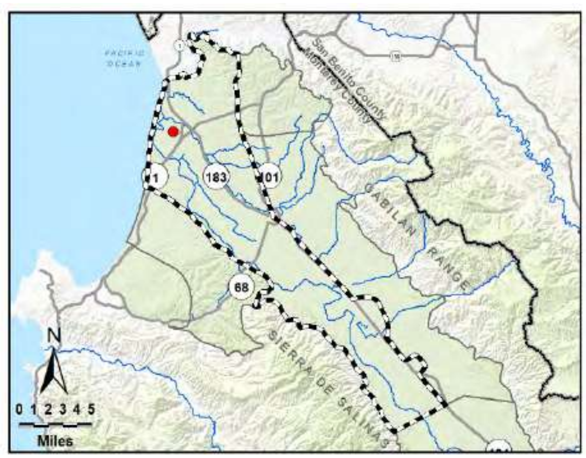
HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 13S/02E-32E05

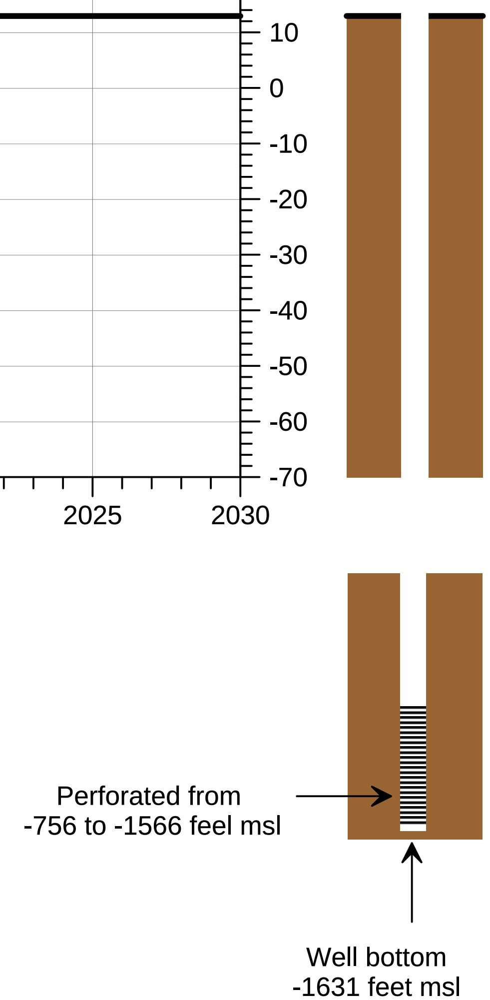
180/400-Foot Aquifer Subbasin



EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface



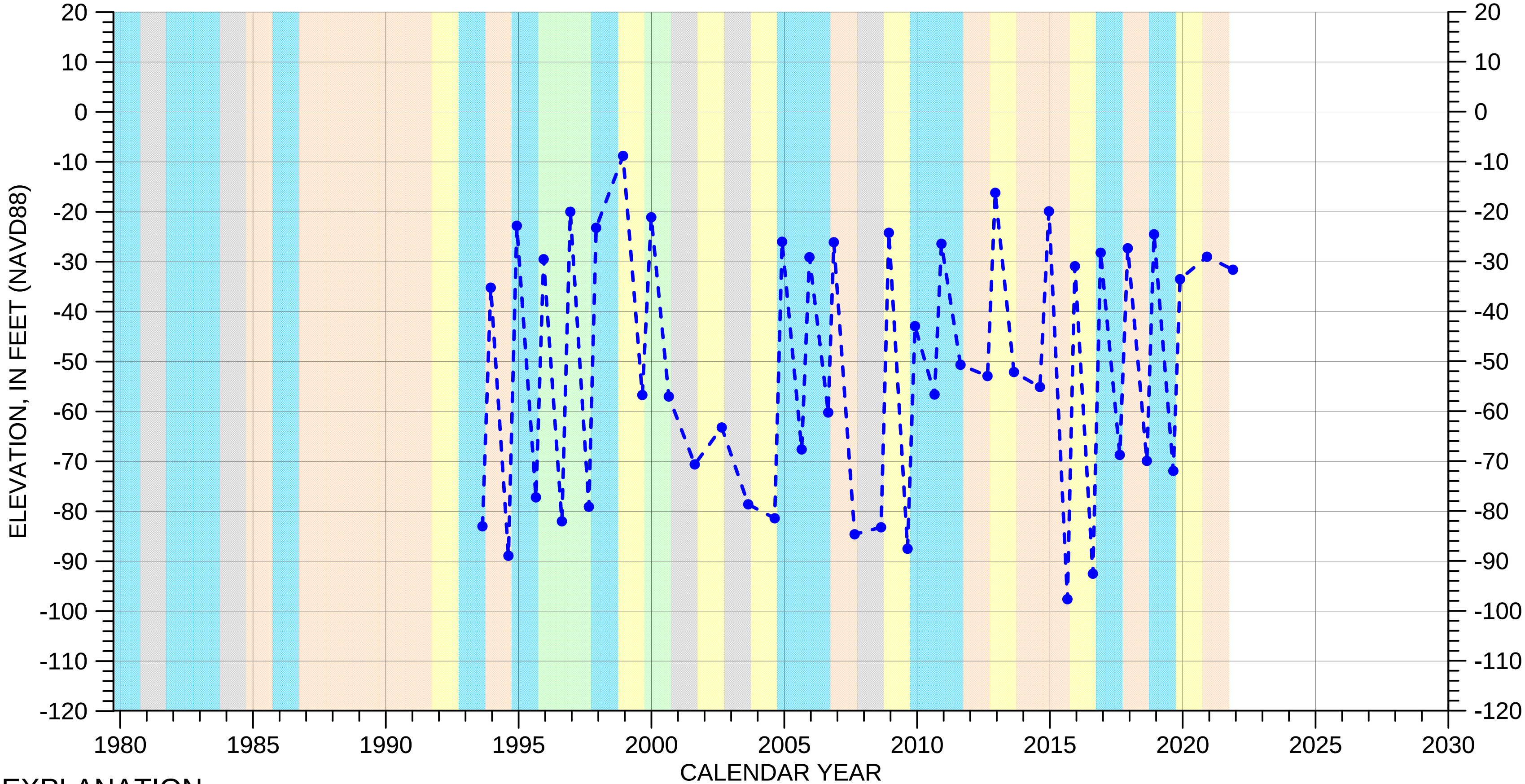


WATER YEAR TYPE DESIGNATION

DRY	WET - NORMAL
DRY - NORMAL	WET
NORMAL	

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-02C03

180/400-Foot Aquifer Subbasin



EXPLANATION

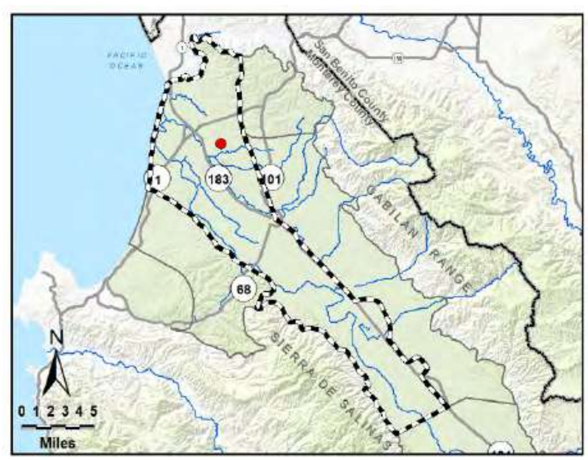
Groundwater Elevation

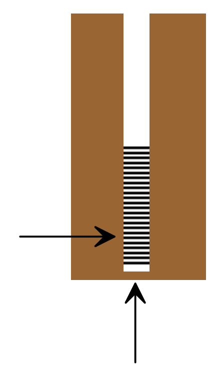
Suspect Measurement

Land Surface (66 FT MSL)

WATER YEAR TYPE DESIGNATION

DRY
DRY - NORMAL
NORMAL
WET - NORMAL
WET

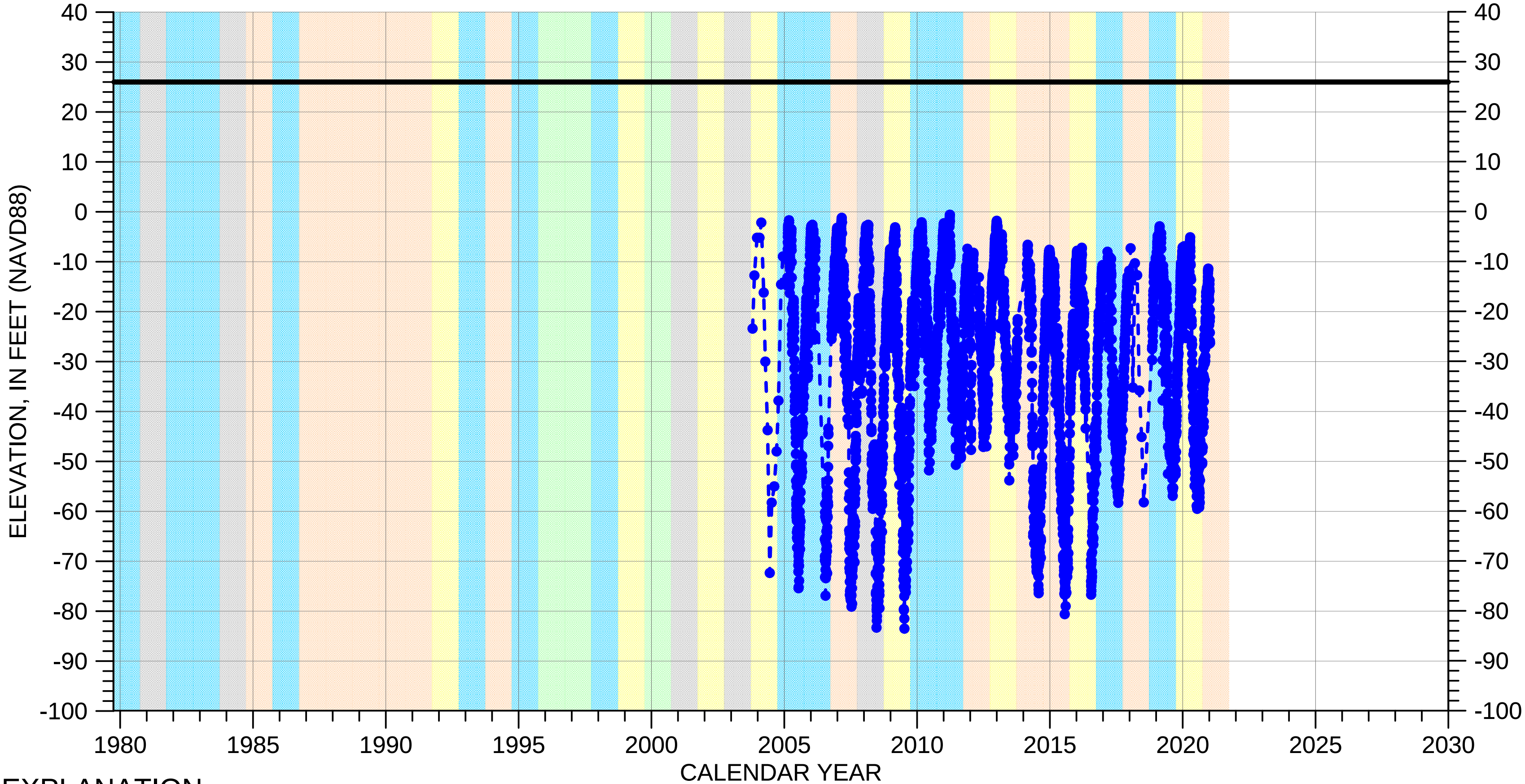




\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch5\14S_02E-02C03.grf

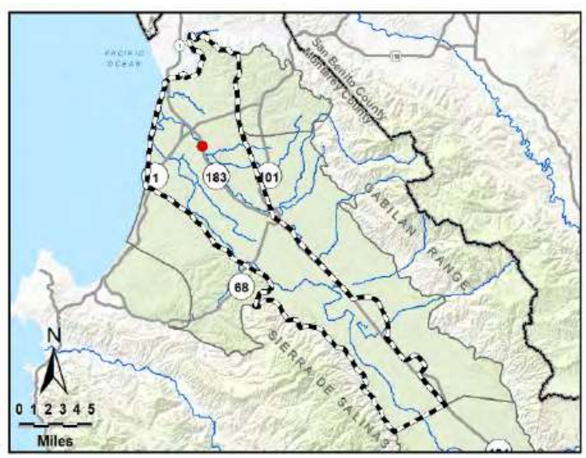
HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-03F03

180/400-Foot Aquifer Subbasin



EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface



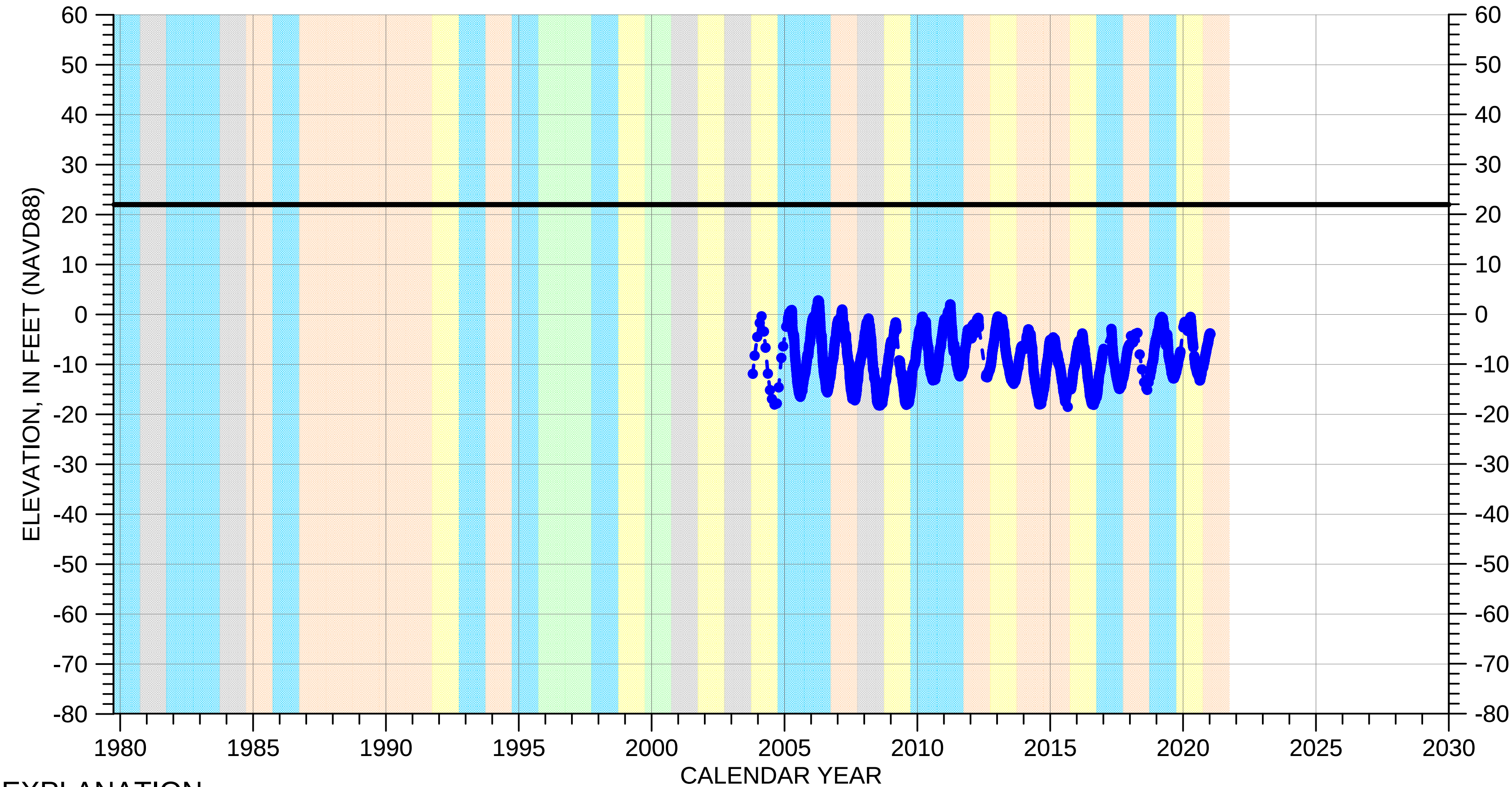
WATER YEAR TYPE DESIGNATION

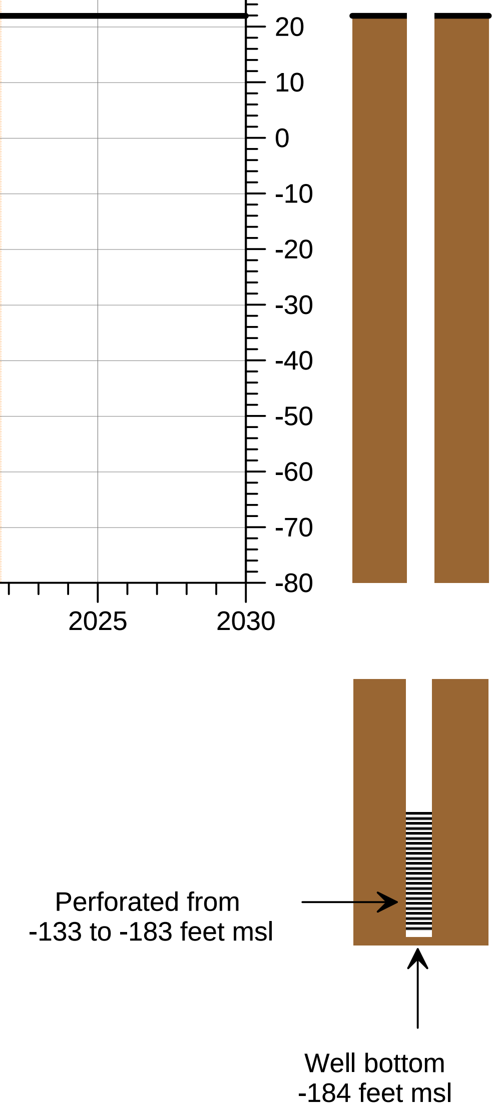
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch5\14S_02E-03F03.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-03F04

180/400-Foot Aquifer Subbasin



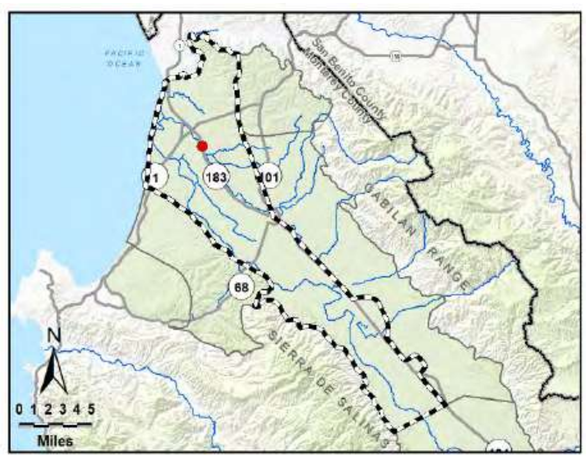


EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface

WATER YEAR TYPE DESIGNATION

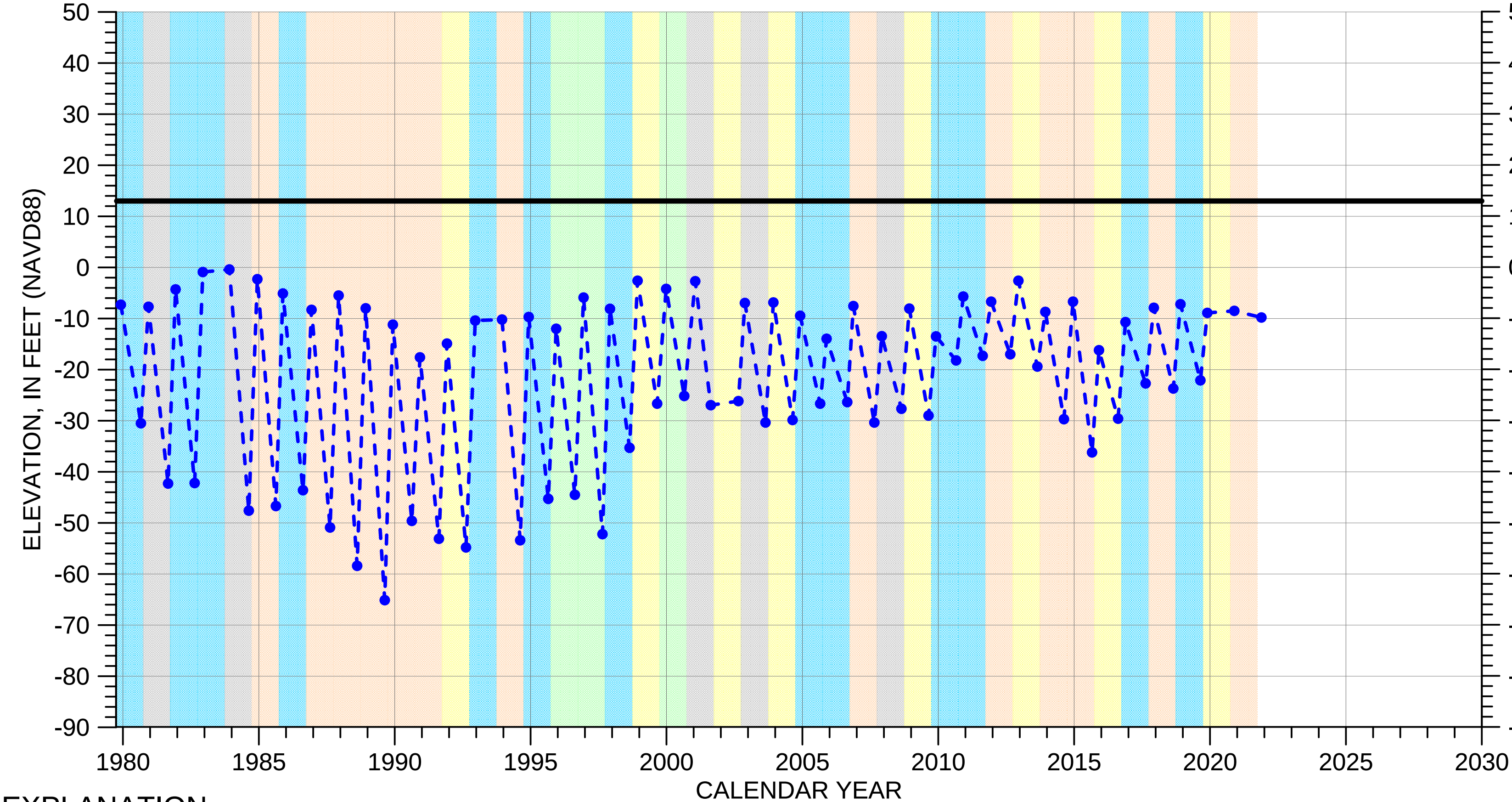
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET



\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRA\NEWGRFs_Ch5\14S_02E-03F04.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-05F04

180/400-Foot Aquifer Subbasin

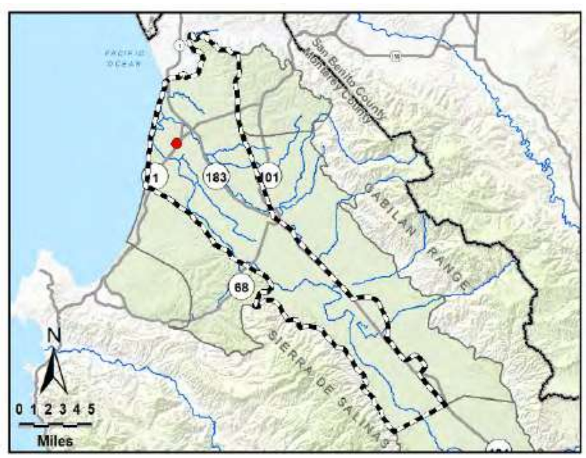


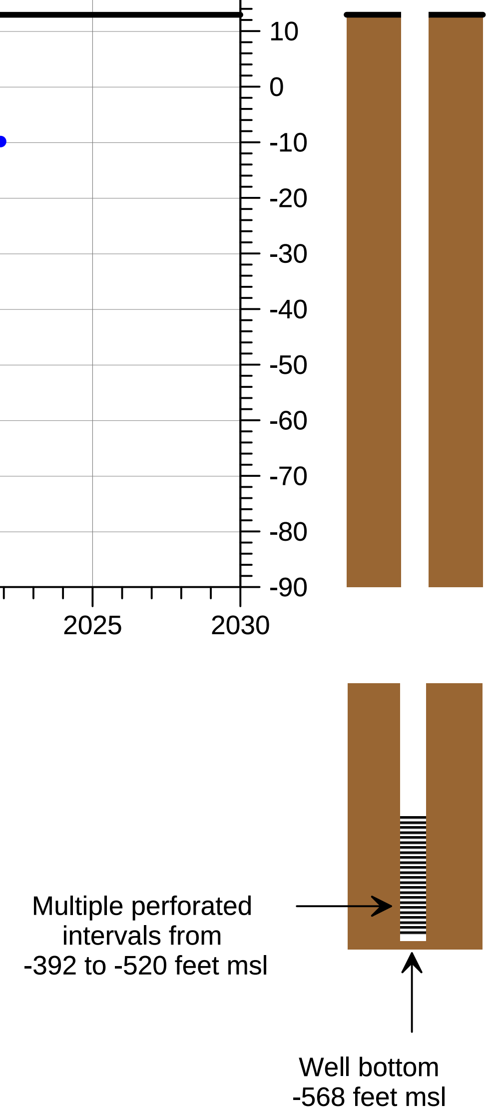
EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface

WATER YEAR TYPE DESIGNATION

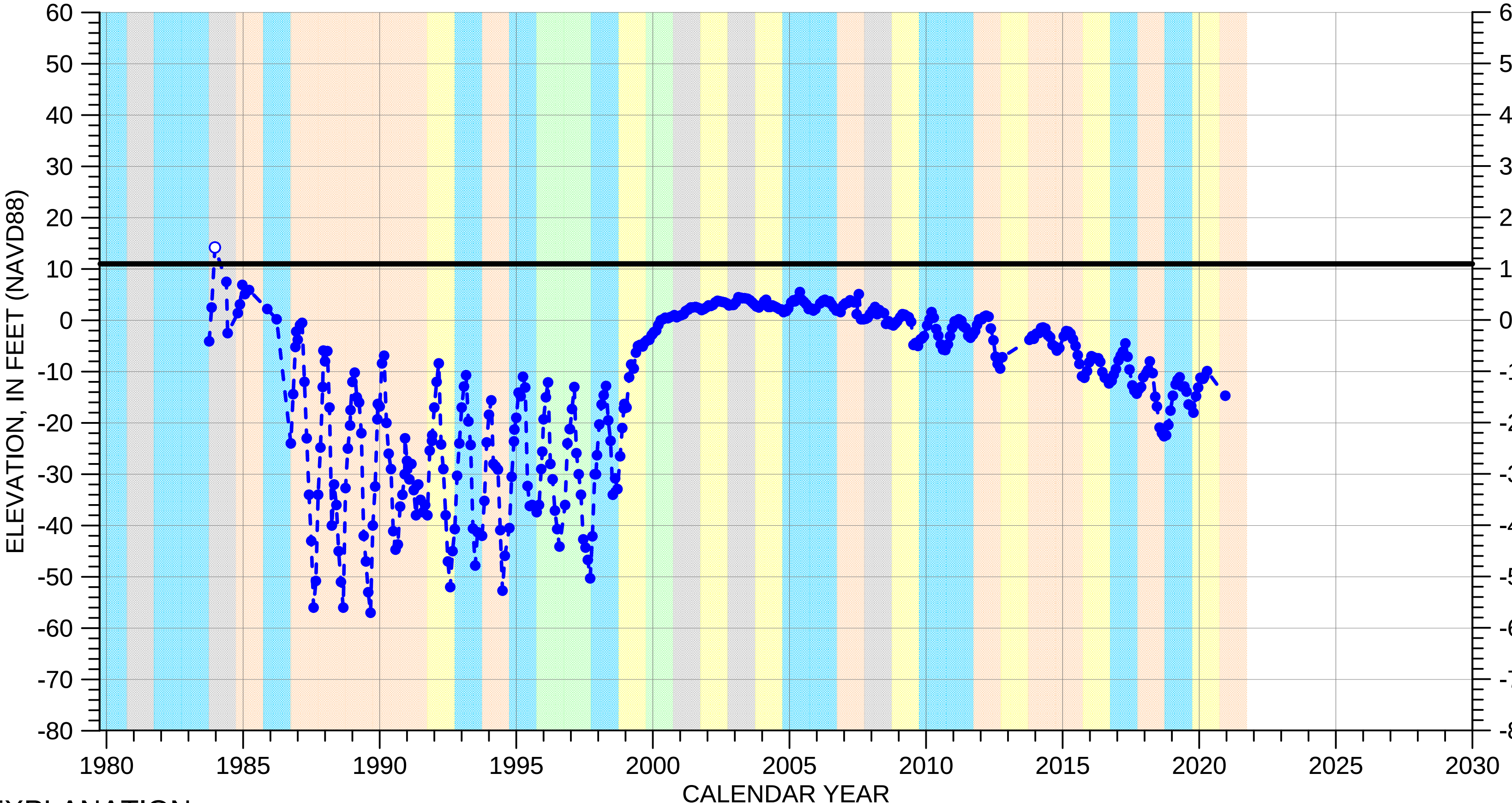
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

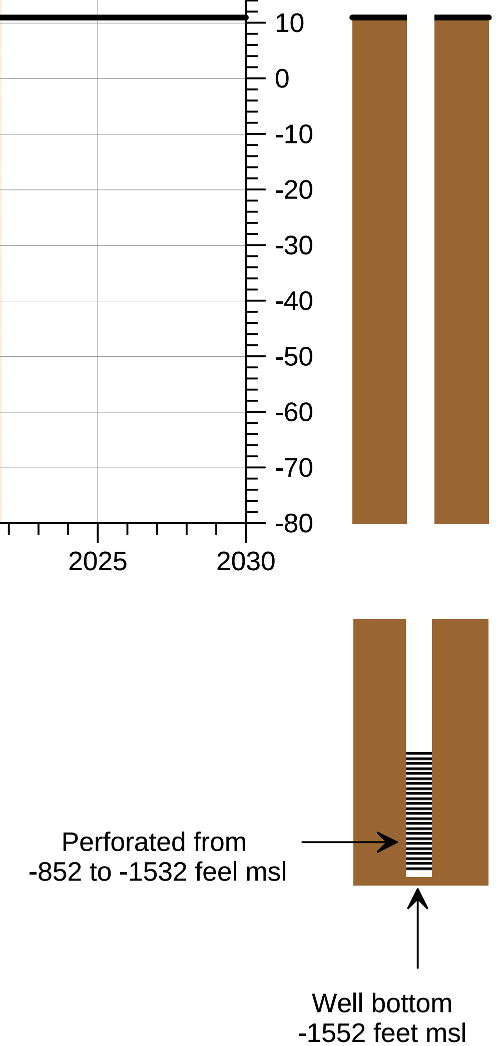




\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch5\14S_02E-05F04.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-06L01 180/400-Foot Aquifer Subbasin

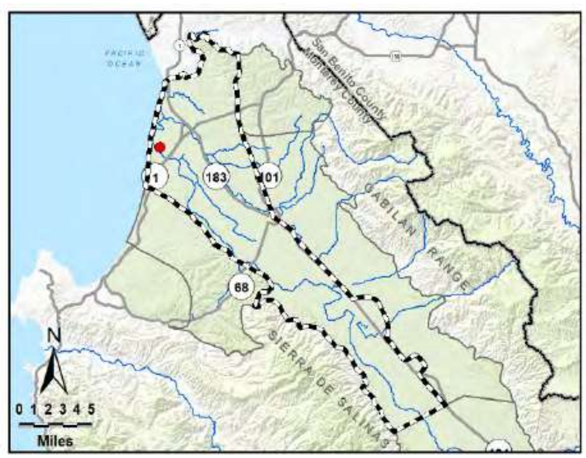




\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch5\14S_02E-06L01.grf

EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface

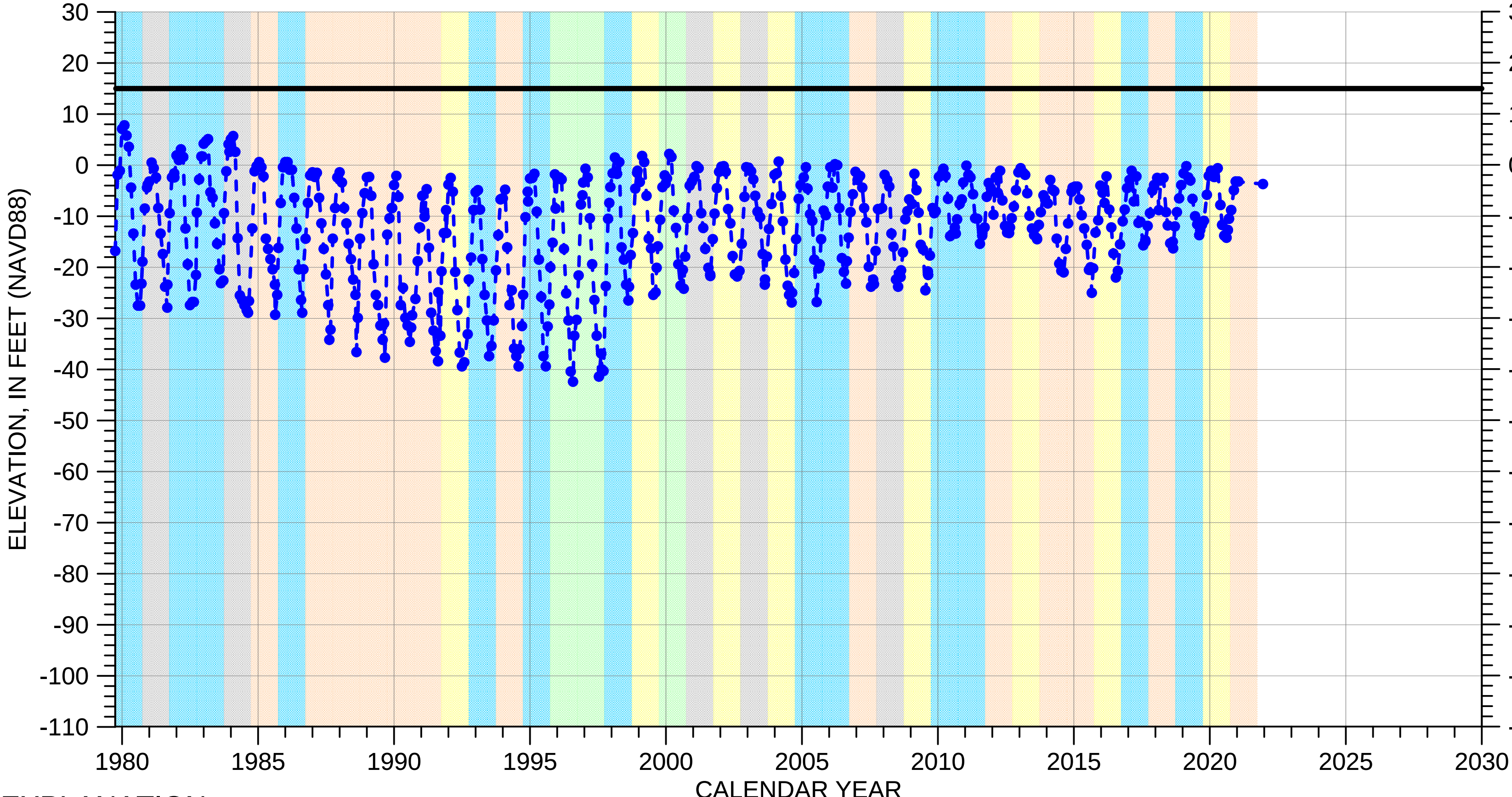


WATER YEAR TYPE DESIGNATION

- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-08M02

180/400-Foot Aquifer Subbasin

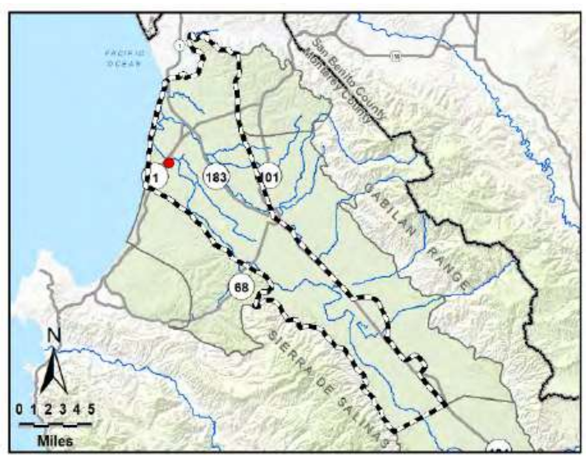


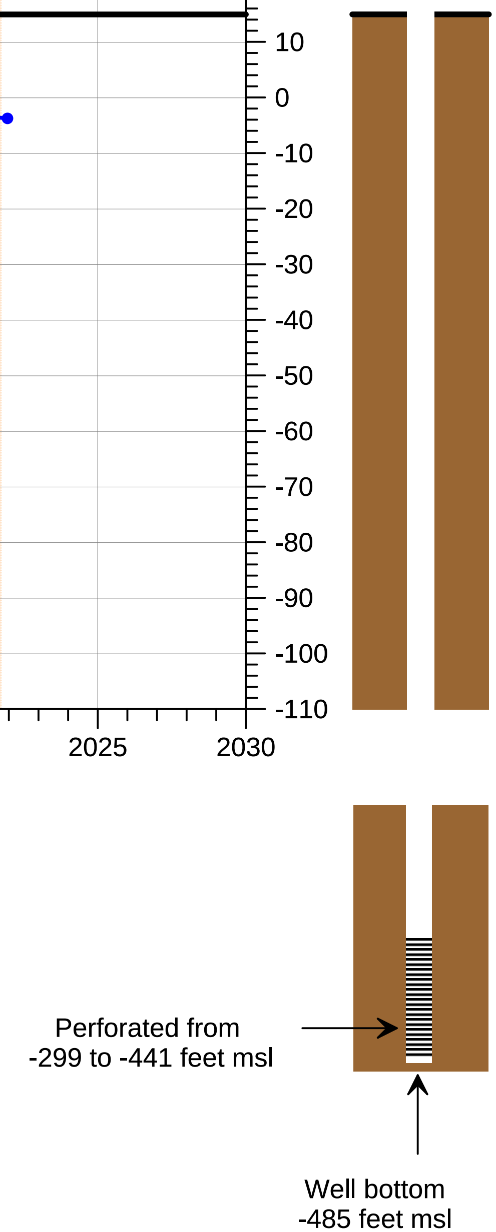
EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface

WATER YEAR TYPE DESIGNATION

- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

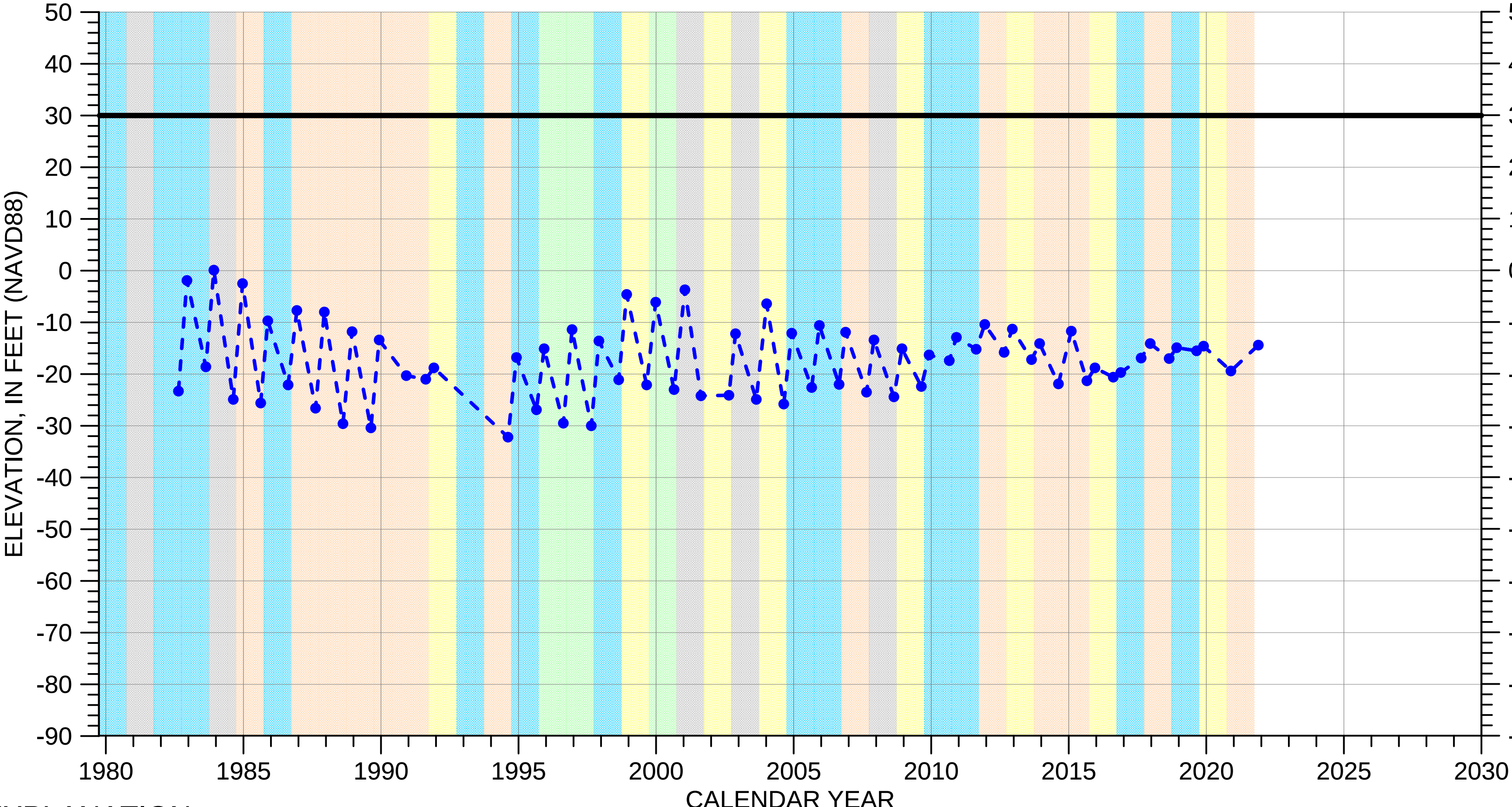




\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch5\14S_02E-08M02.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-10P01

180/400-Foot Aquifer Subbasin



EXPLANATION

Groundwater Elevation

Suspect Measurement

Land Surface

WATER YEAR TYPE DESIGNATION

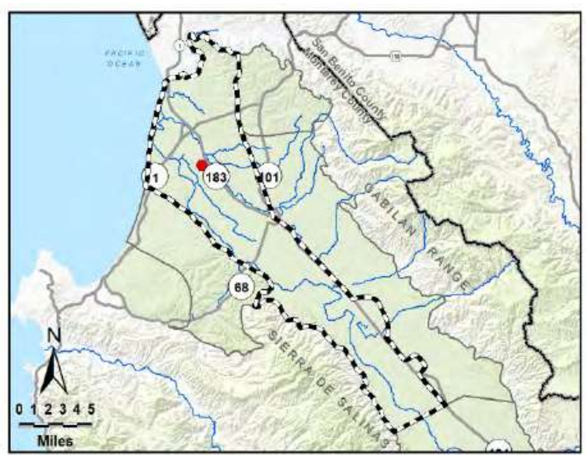
DRY

DRY - NORMAL

NORMAL

WET - NORMAL

WET



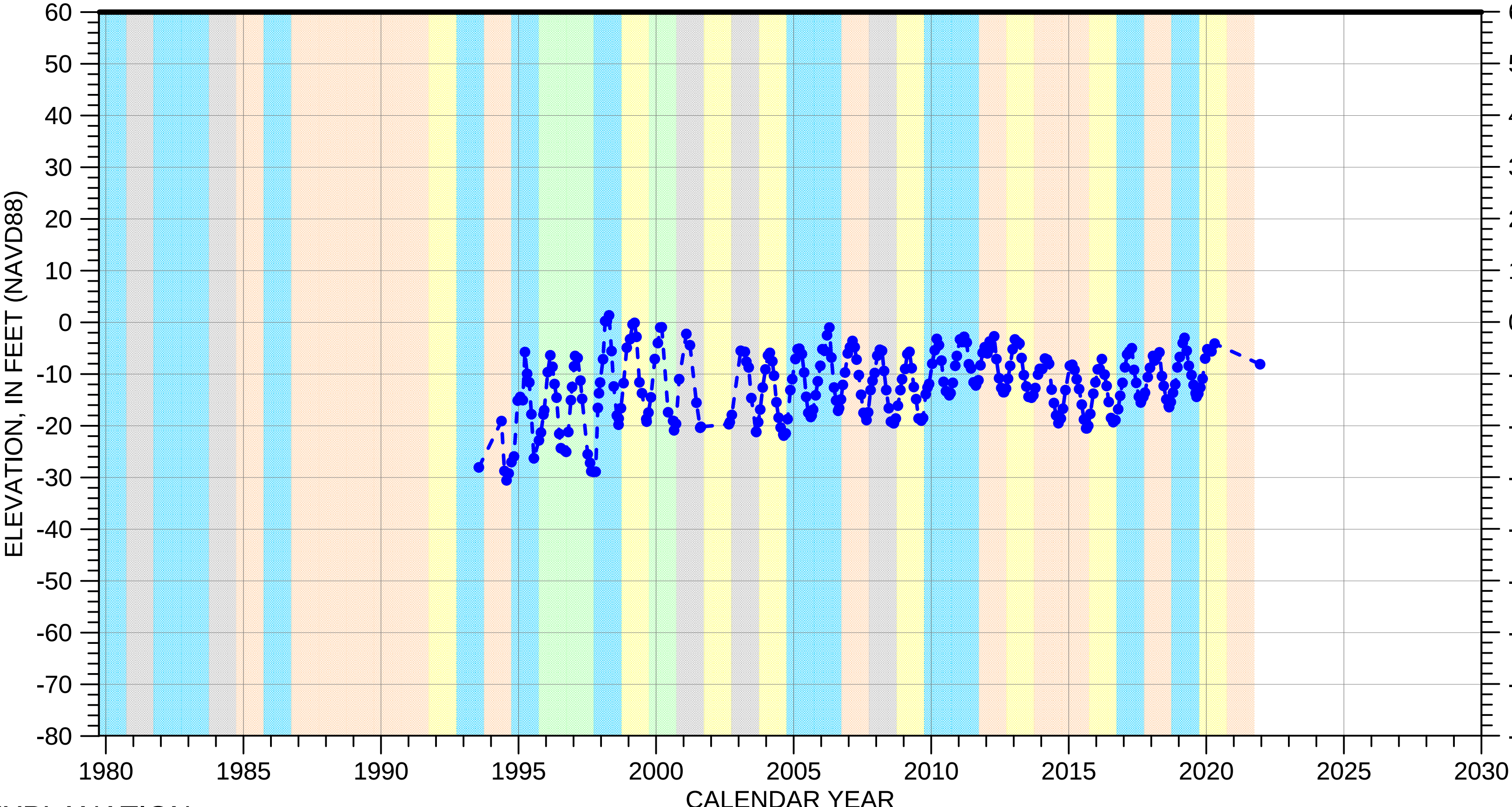
Perforated interval unknown

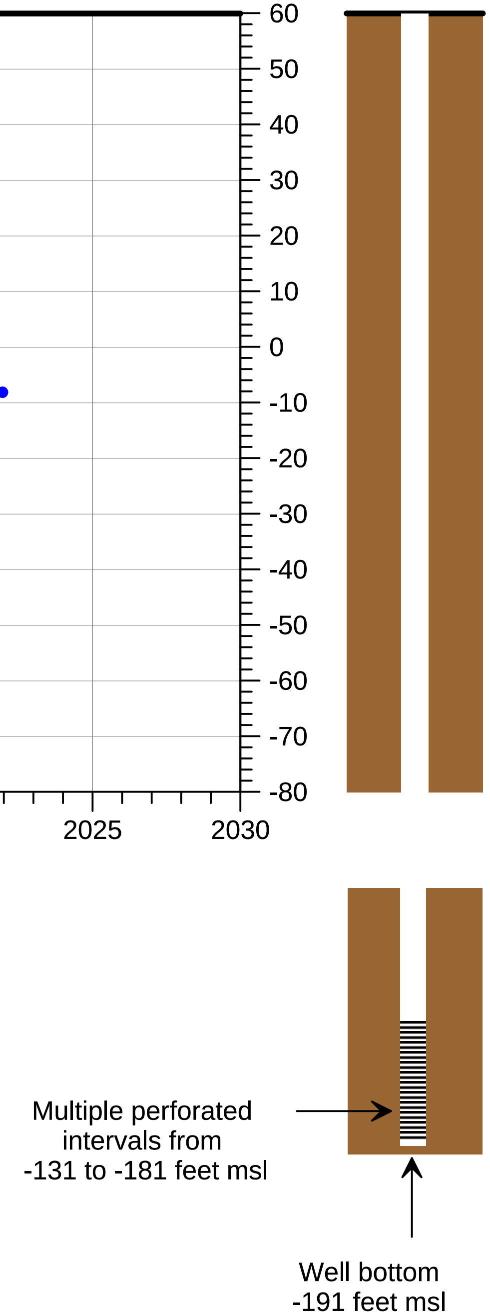
Well bottom
-167 feet msl

\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch5\14S_02E-10P01.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-11A02

180/400-Foot Aquifer Subbasin



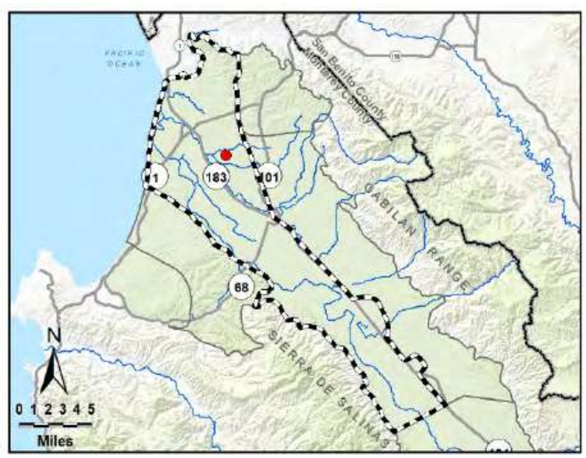


EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface

WATER YEAR TYPE DESIGNATION

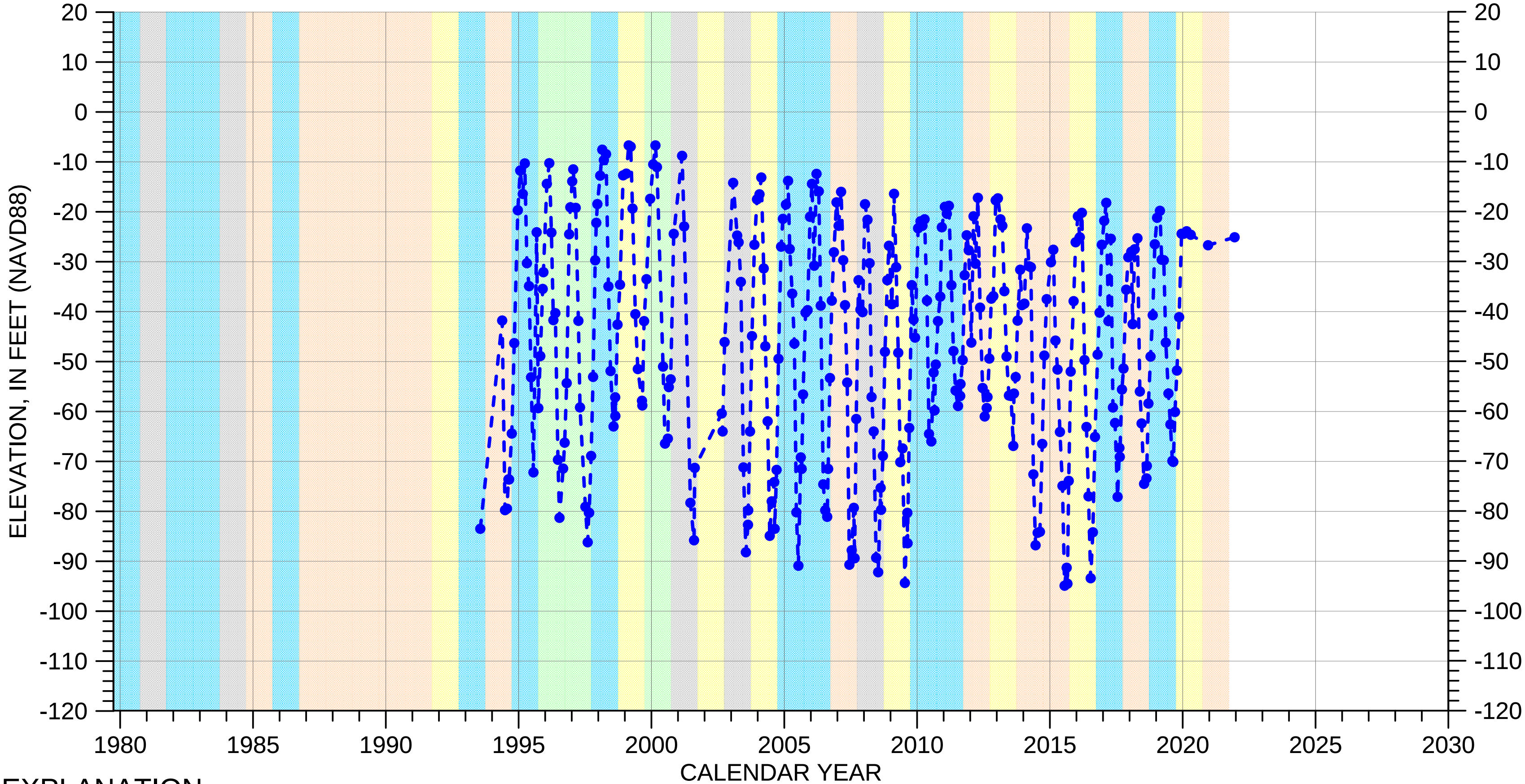
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET



\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRA\NEWGRFs_Ch5\14S_02E-11A02.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-11A04

180/400-Foot Aquifer Subbasin

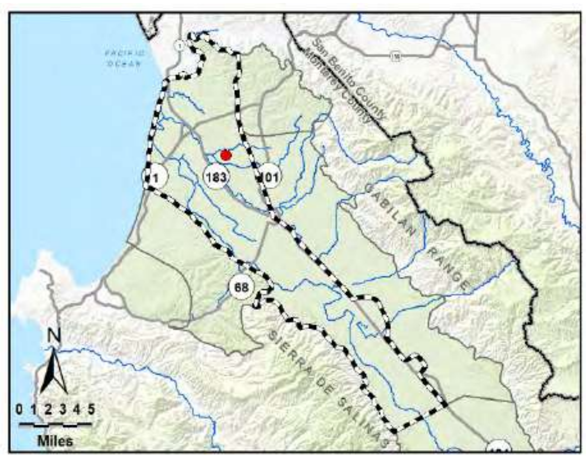


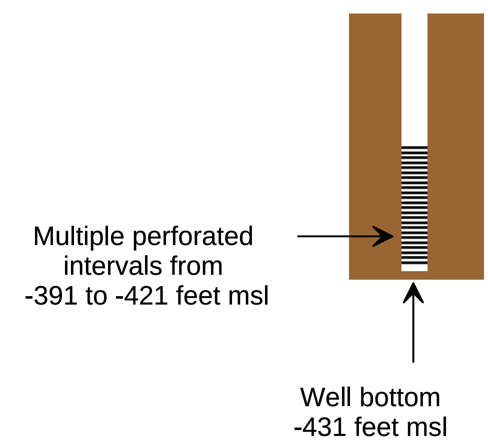
EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface (59 FT MSL)

WATER YEAR TYPE DESIGNATION

- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

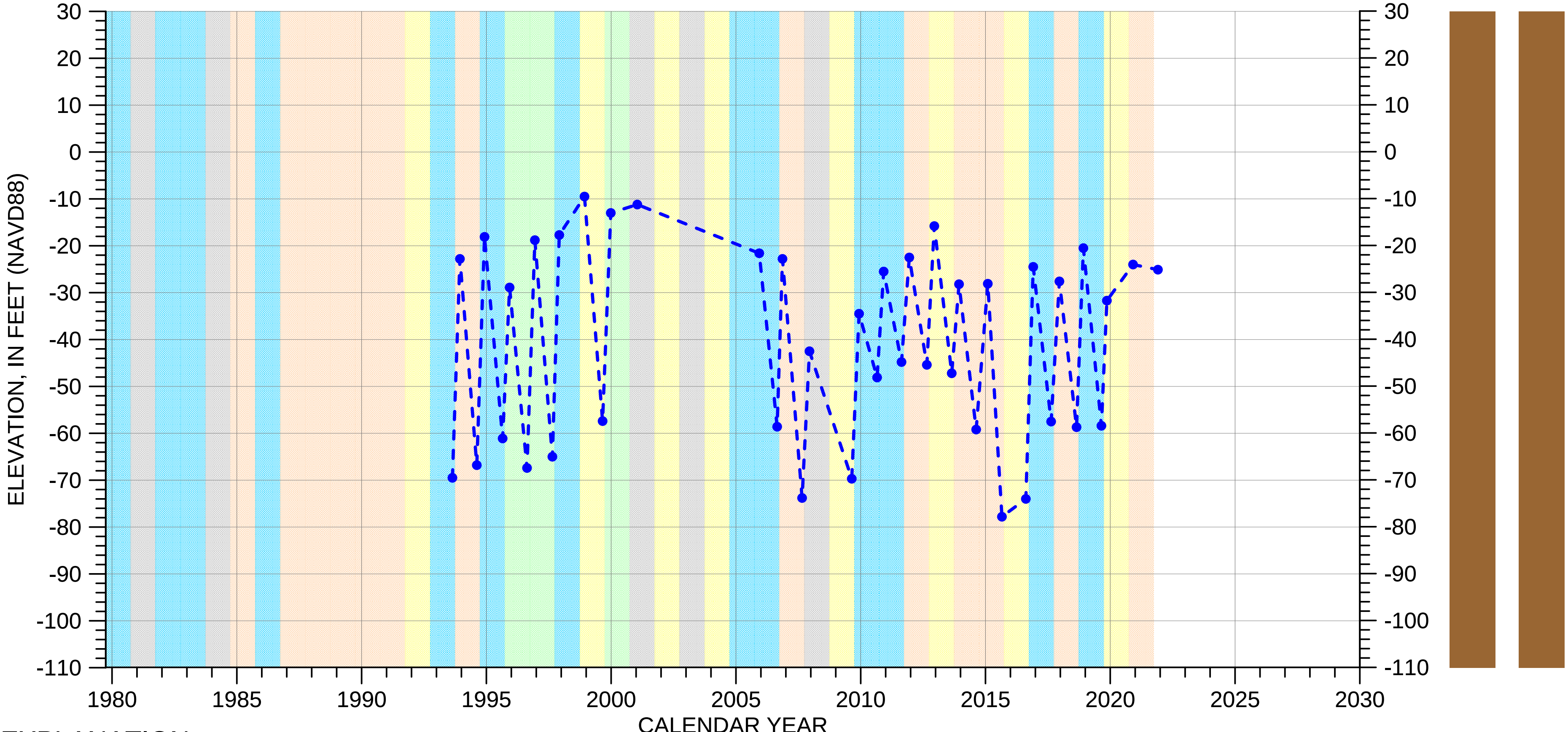




\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch5\14S_02E-11A04.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-11M03

180/400-Foot Aquifer Subbasin

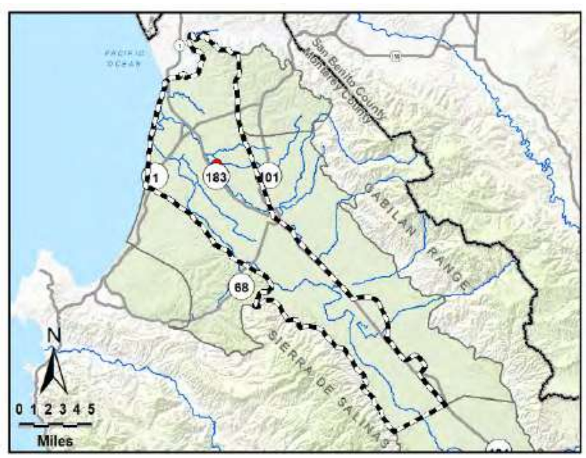


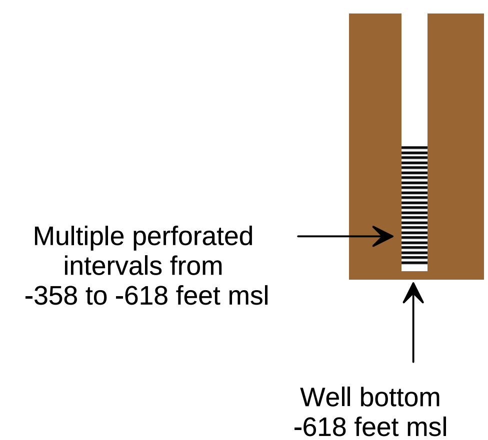
EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface (38 FT MSL)

WATER YEAR TYPE DESIGNATION

- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

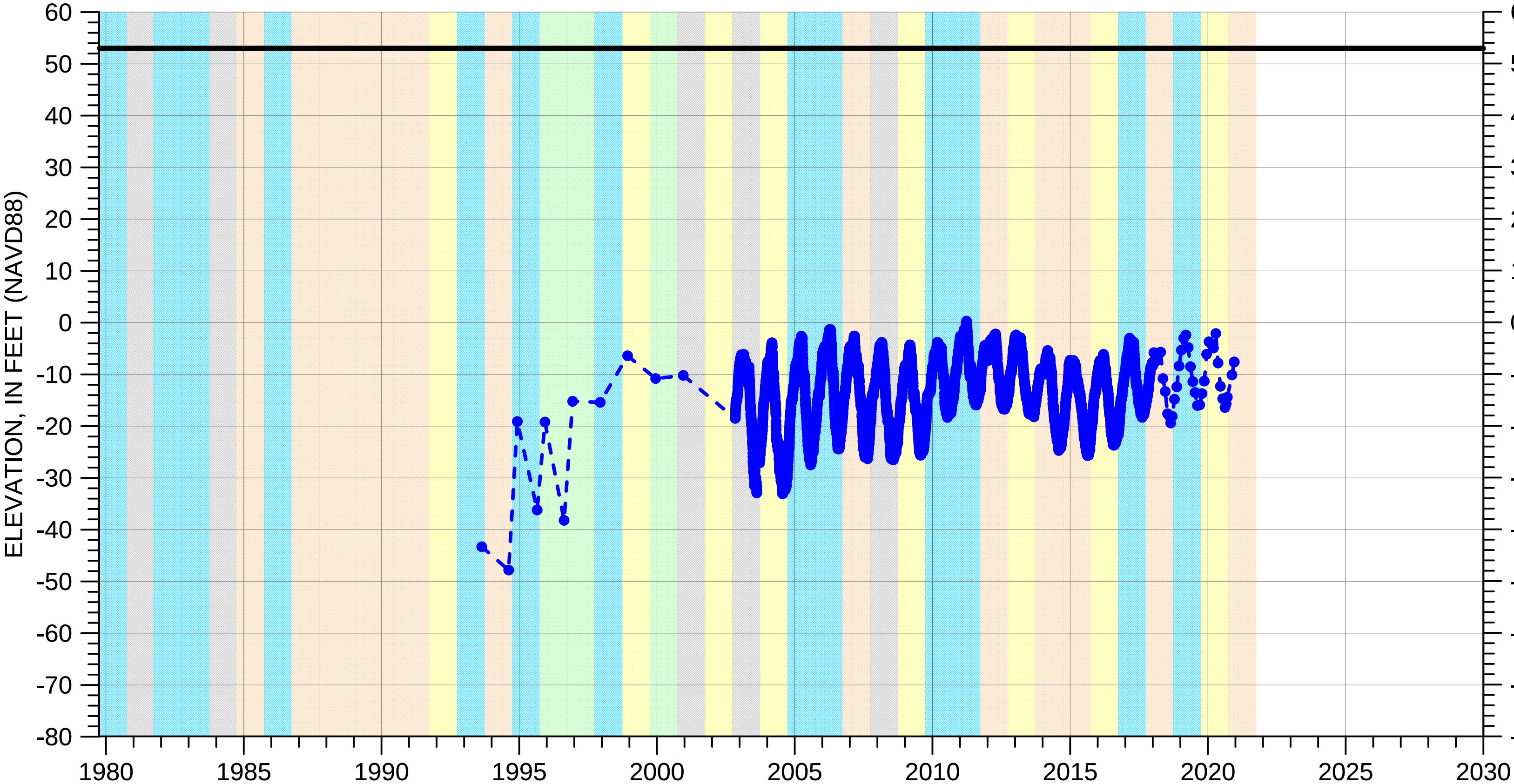




\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch5\14S_02E-11M03.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-12B02

180/400-Foot Aquifer Subbasin



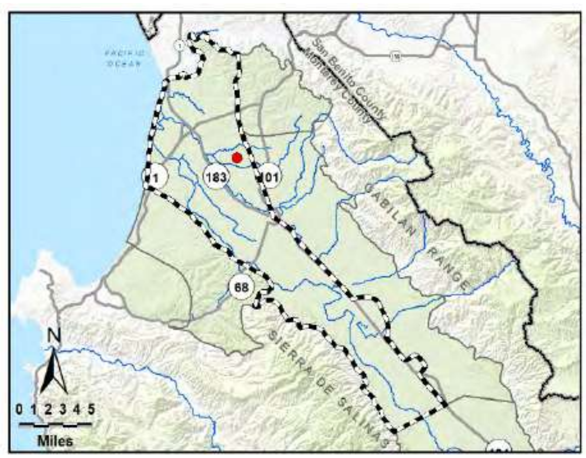
Perforated from
-157 to -207 feet msl

Well bottom
-212 feet msl

\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRA\NEWGRFs_Ch5\14S_02E-12B02.grf

EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface

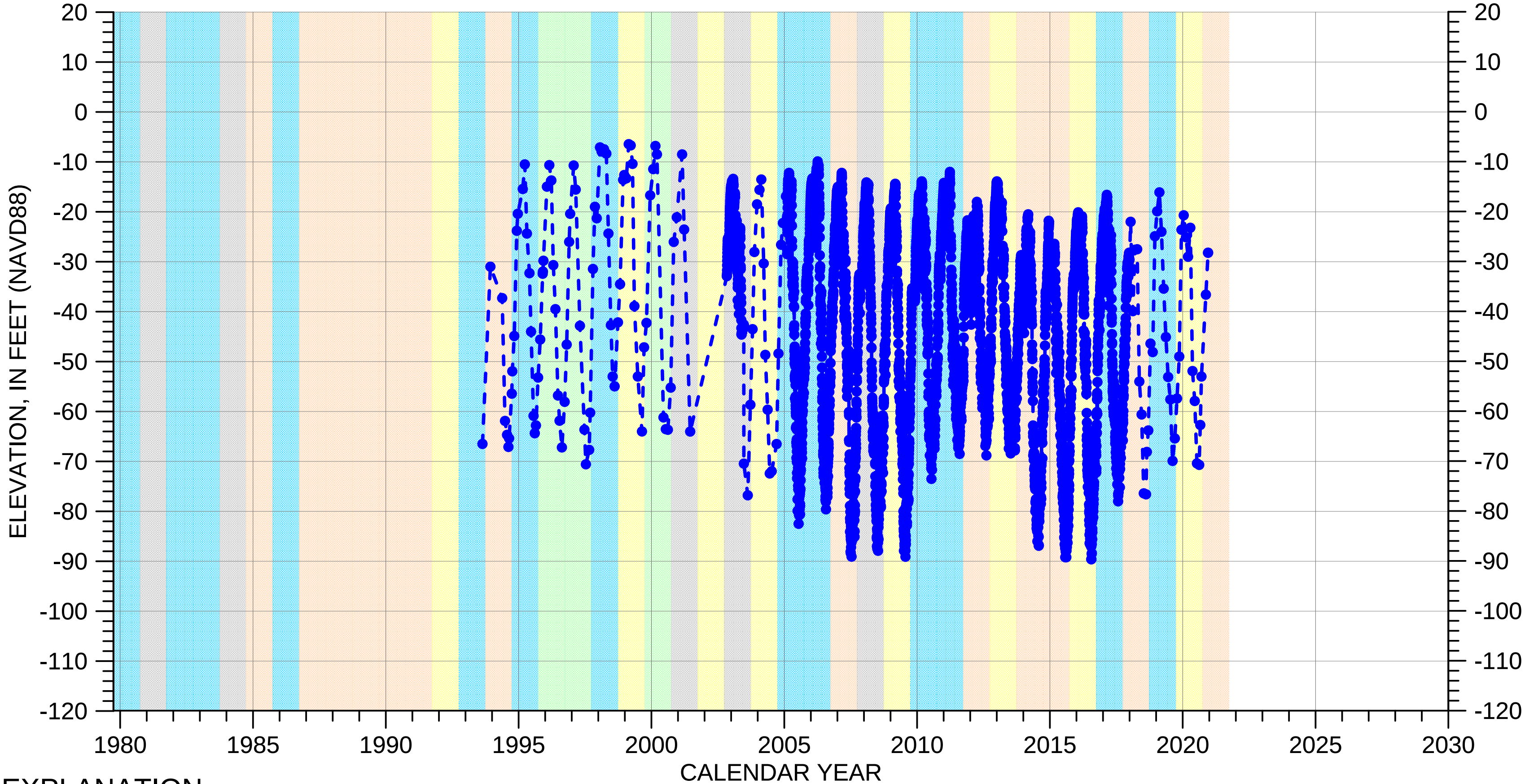


WATER YEAR TYPE DESIGNATION

DRY	WET - NORMAL
DRY - NORMAL	WET
NORMAL	

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-12B03

180/400-Foot Aquifer Subbasin

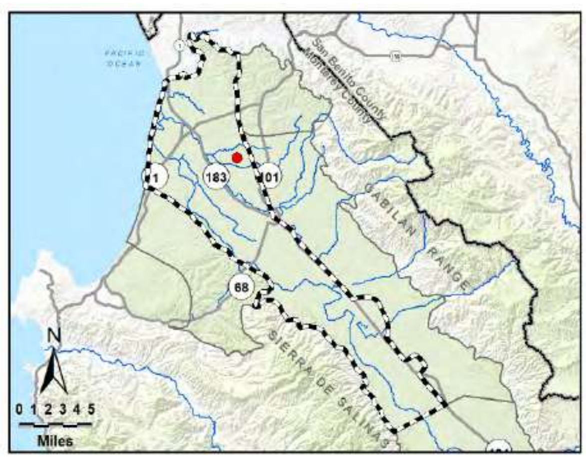


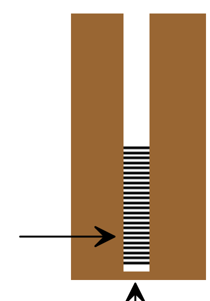
EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface (53 FT MSL)

WATER YEAR TYPE DESIGNATION

- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

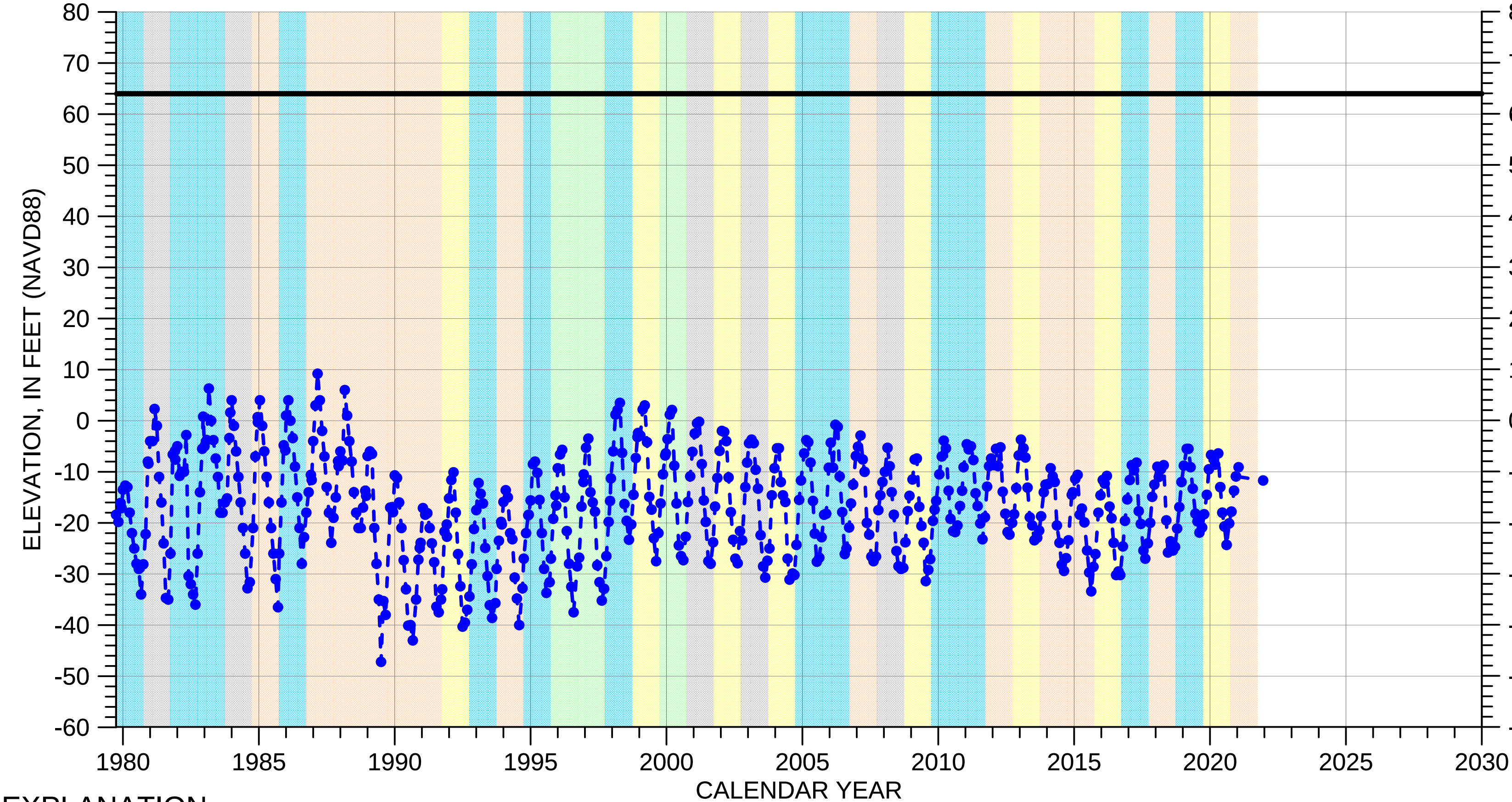




\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch5\14S_02E-12B03.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-12Q01

180/400-Foot Aquifer Subbasin



EXPLANATION

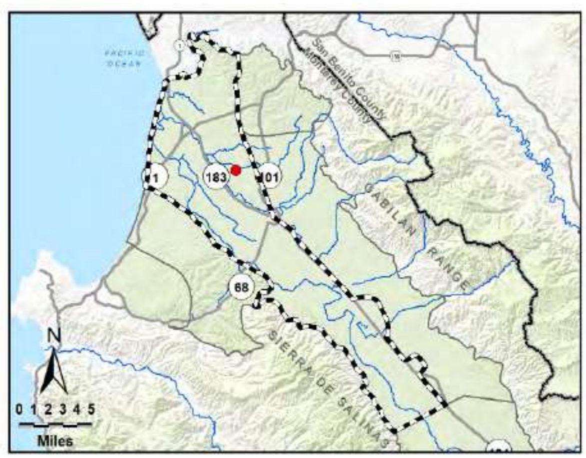
Groundwater Elevation

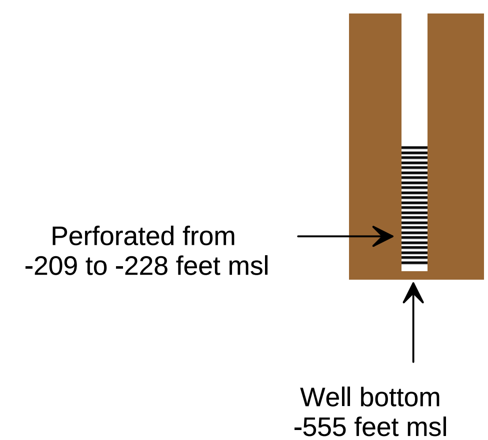
Suspect Measurement

Land Surface

WATER YEAR TYPE DESIGNATION

DRY | WET - NORMAL | DRY - NORMAL | WET | NORMAL

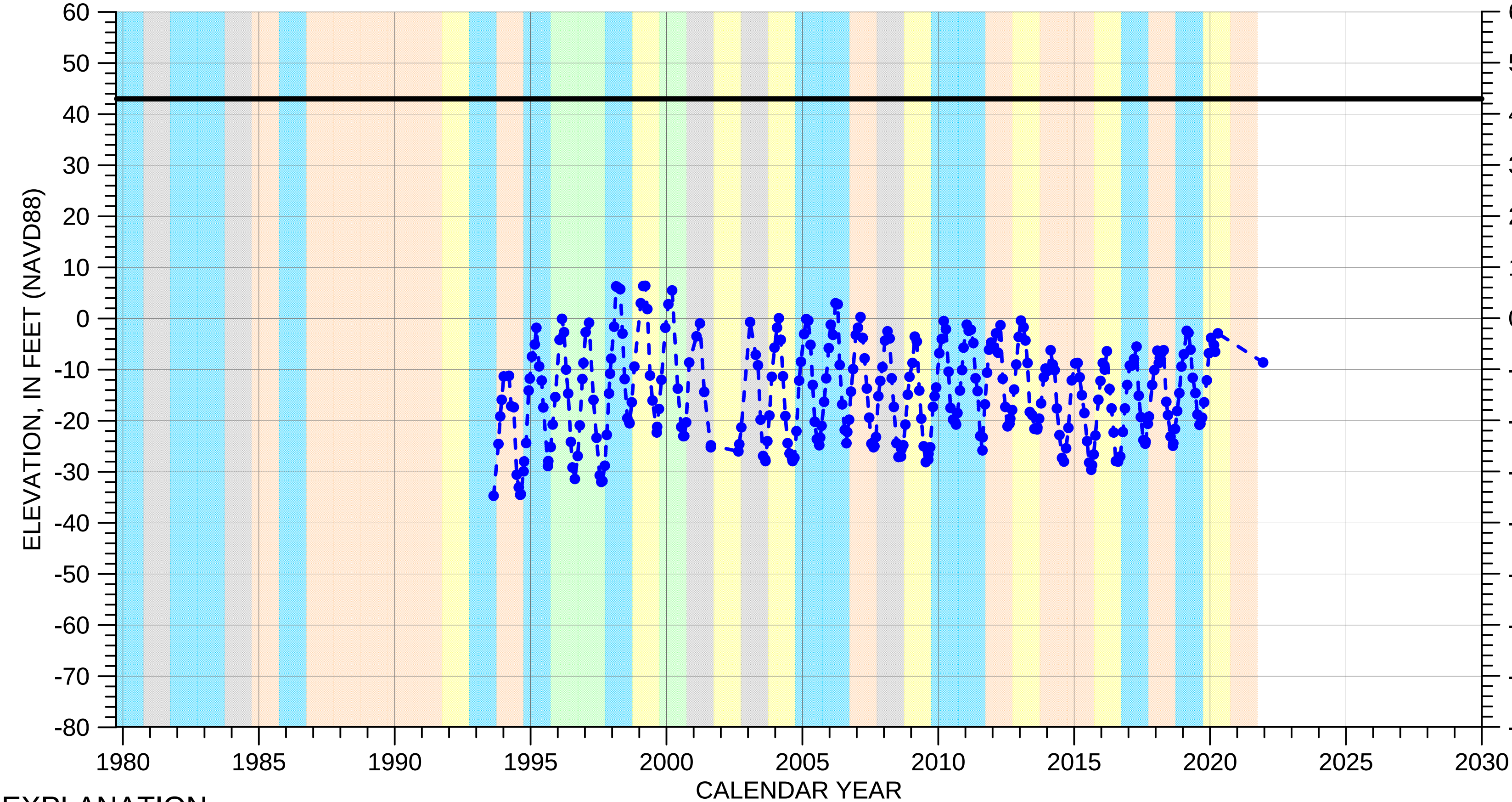




\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch5\14S_02E-12Q01.grf

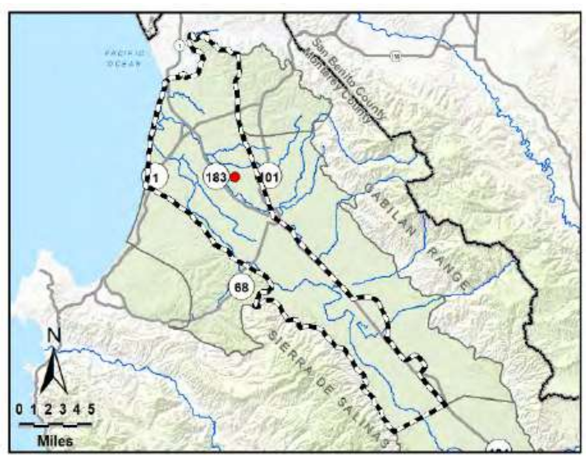
HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-13F03

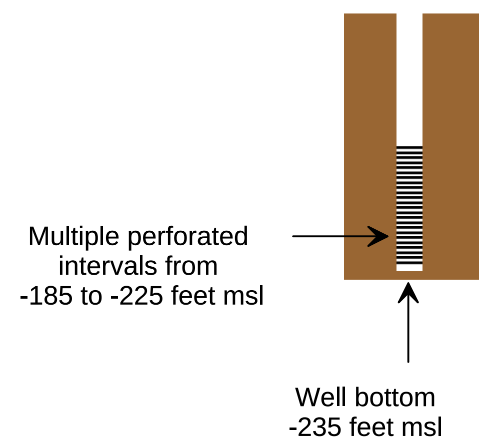
180/400-Foot Aquifer Subbasin



EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface





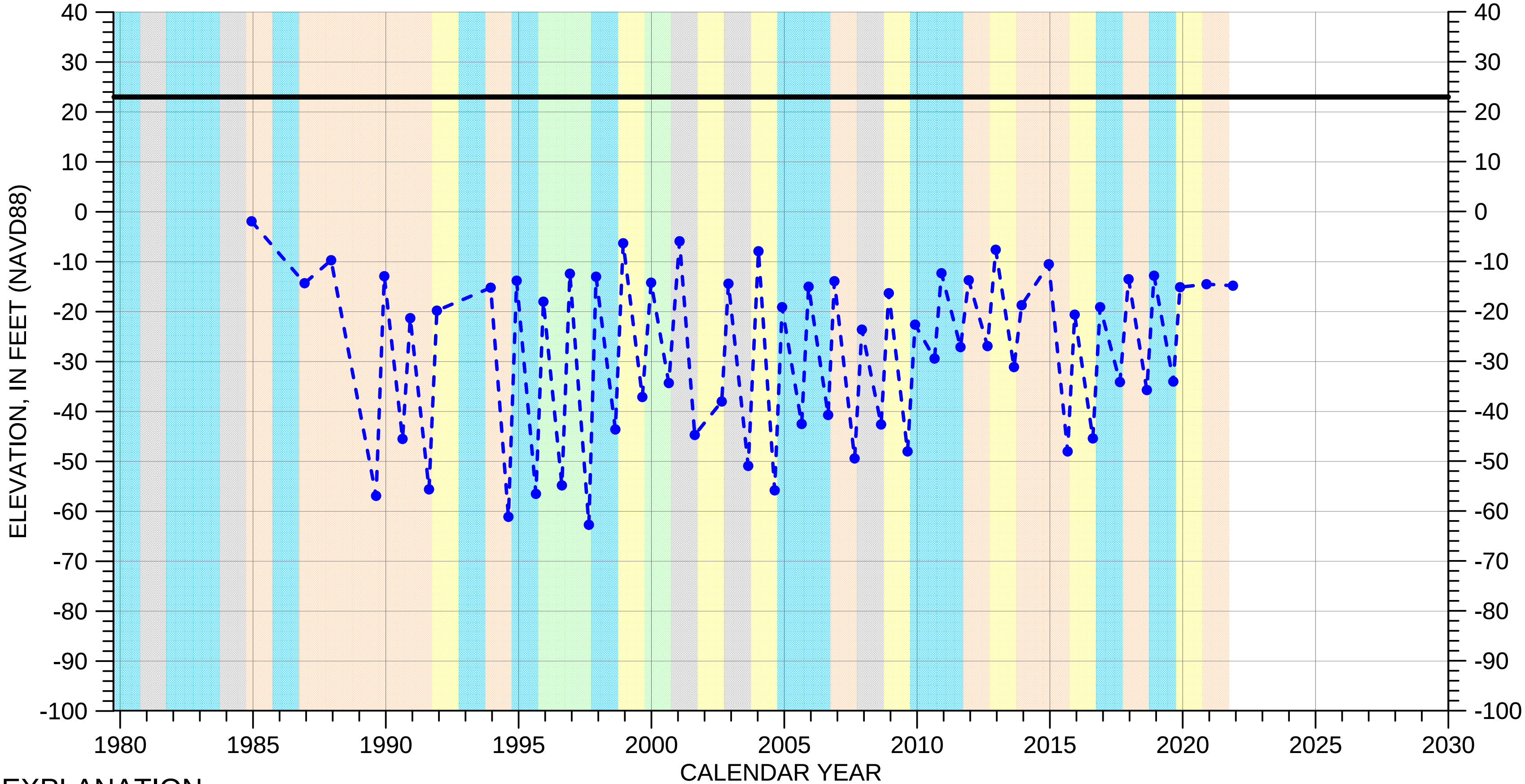
WATER YEAR TYPE DESIGNATION

- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch5\14S_02E-13F03.grf

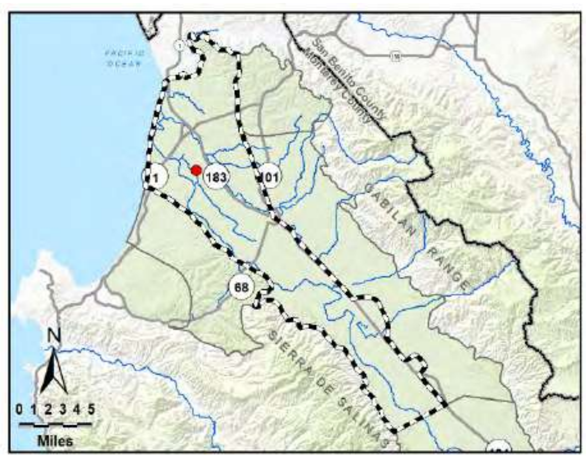
HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-16A02

180/400-Foot Aquifer Subbasin



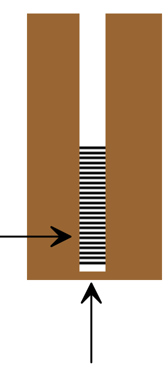
EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface



WATER YEAR TYPE DESIGNATION

- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET



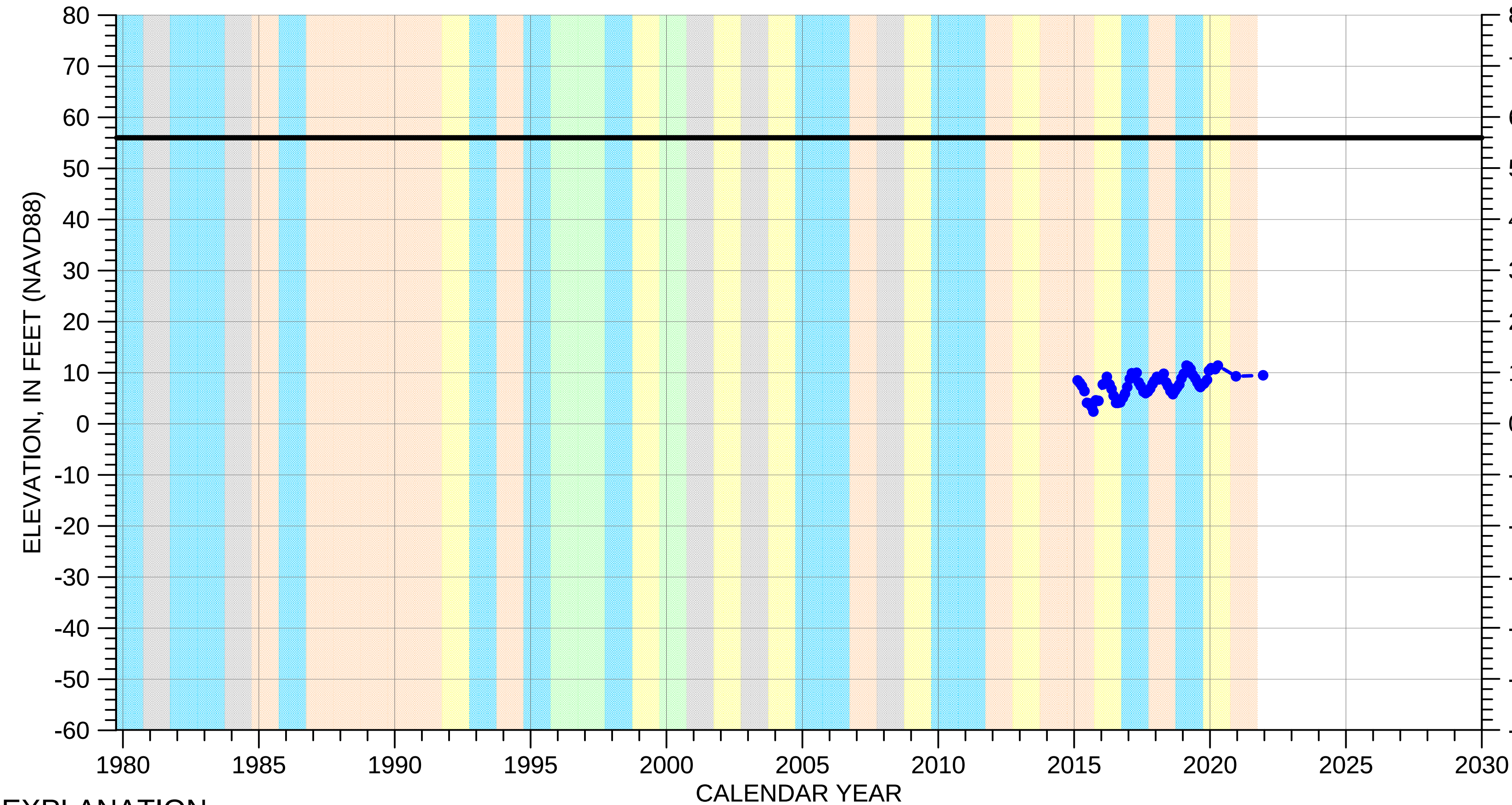
Multiple perforated intervals from -409 to -597 feet msl

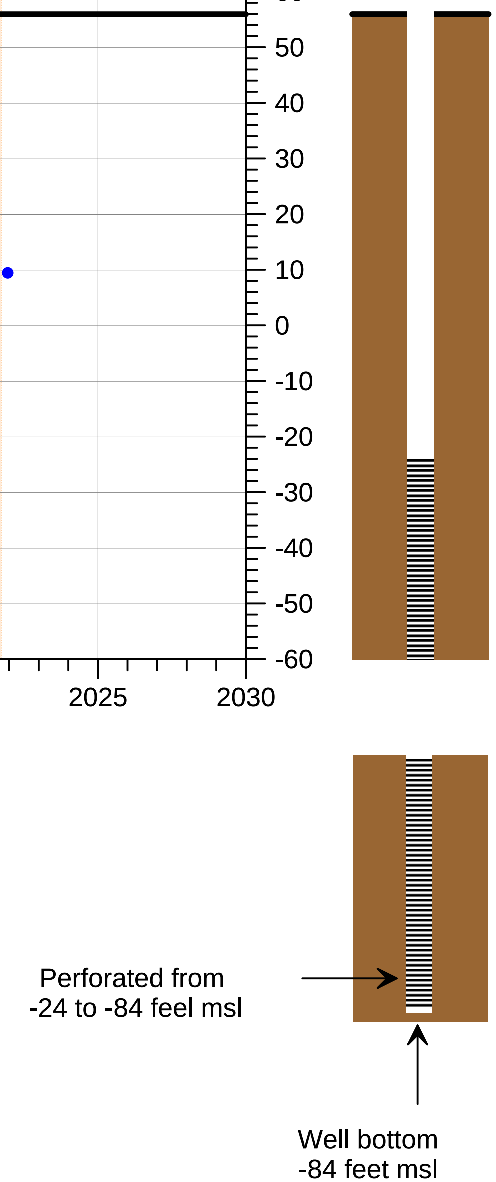
Well bottom -648 feet msl

\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch5\14S_02E-16A02.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-17C02

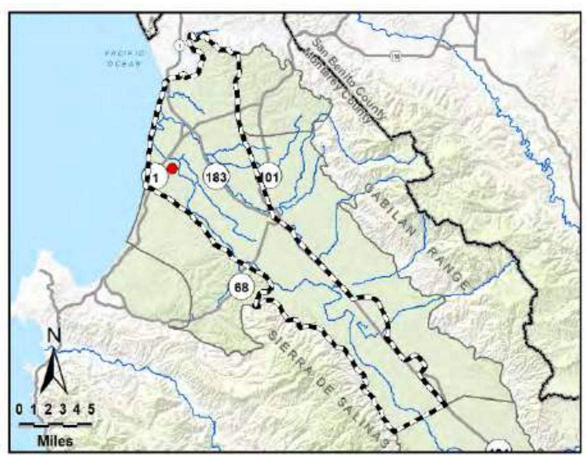
180/400-Foot Aquifer Subbasin





EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface



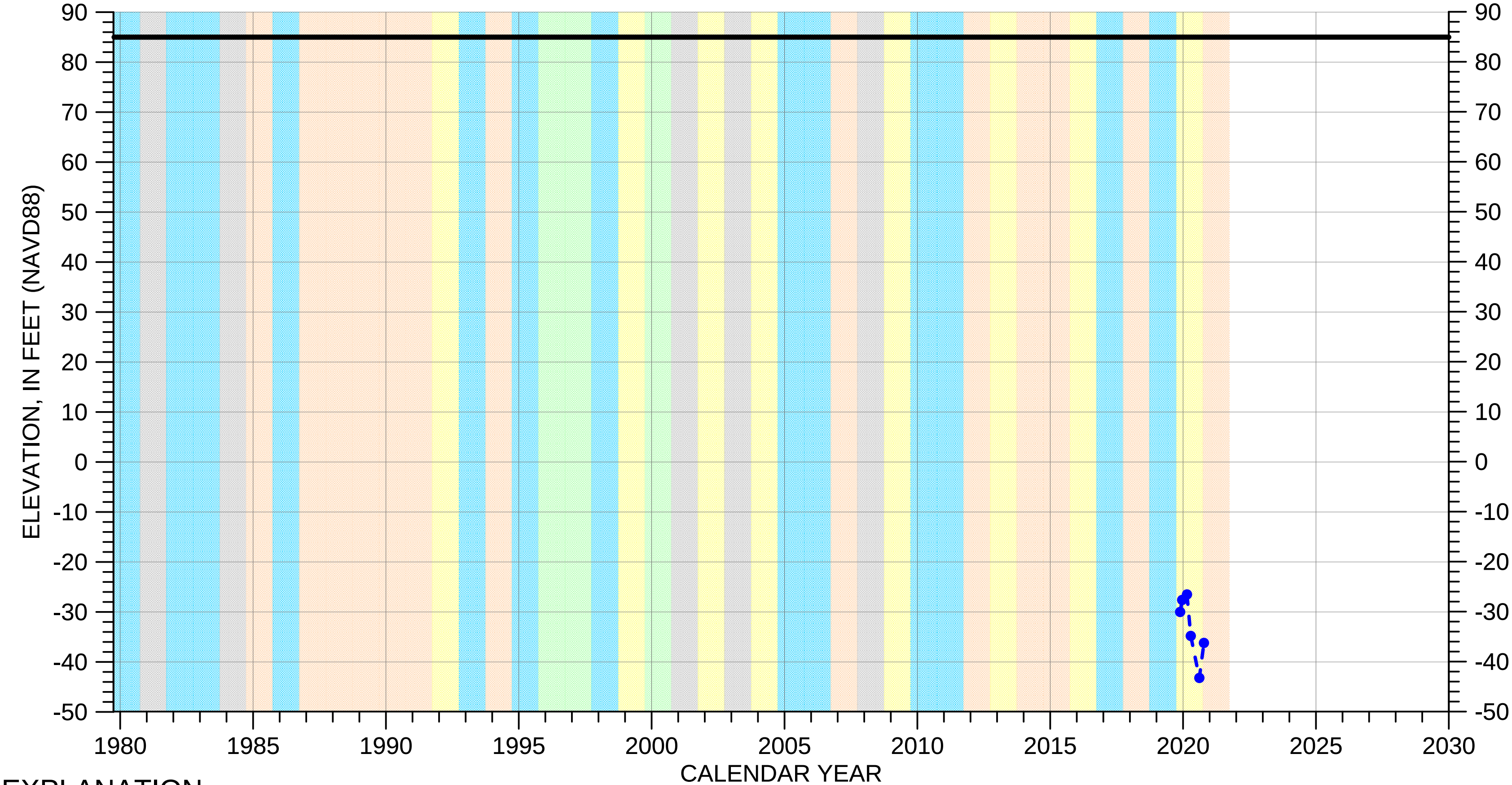
WATER YEAR TYPE DESIGNATION

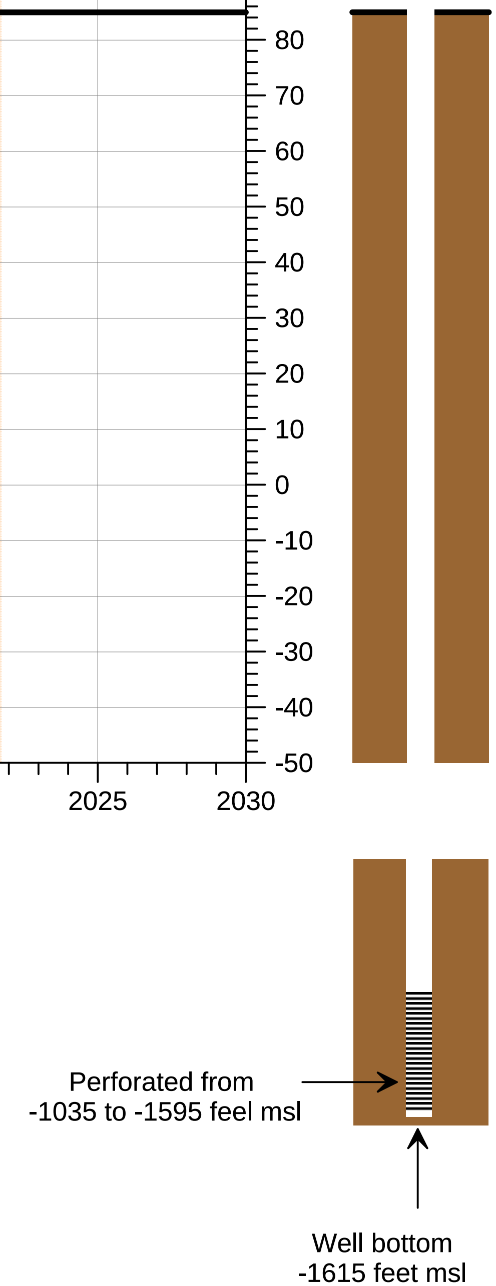
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEW\GRFs_Ch5\14S_02E-17C02.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-18B01

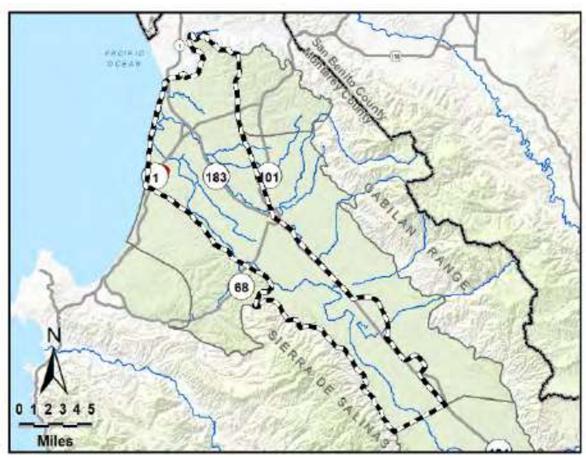
180/400-Foot Aquifer Subbasin





EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface



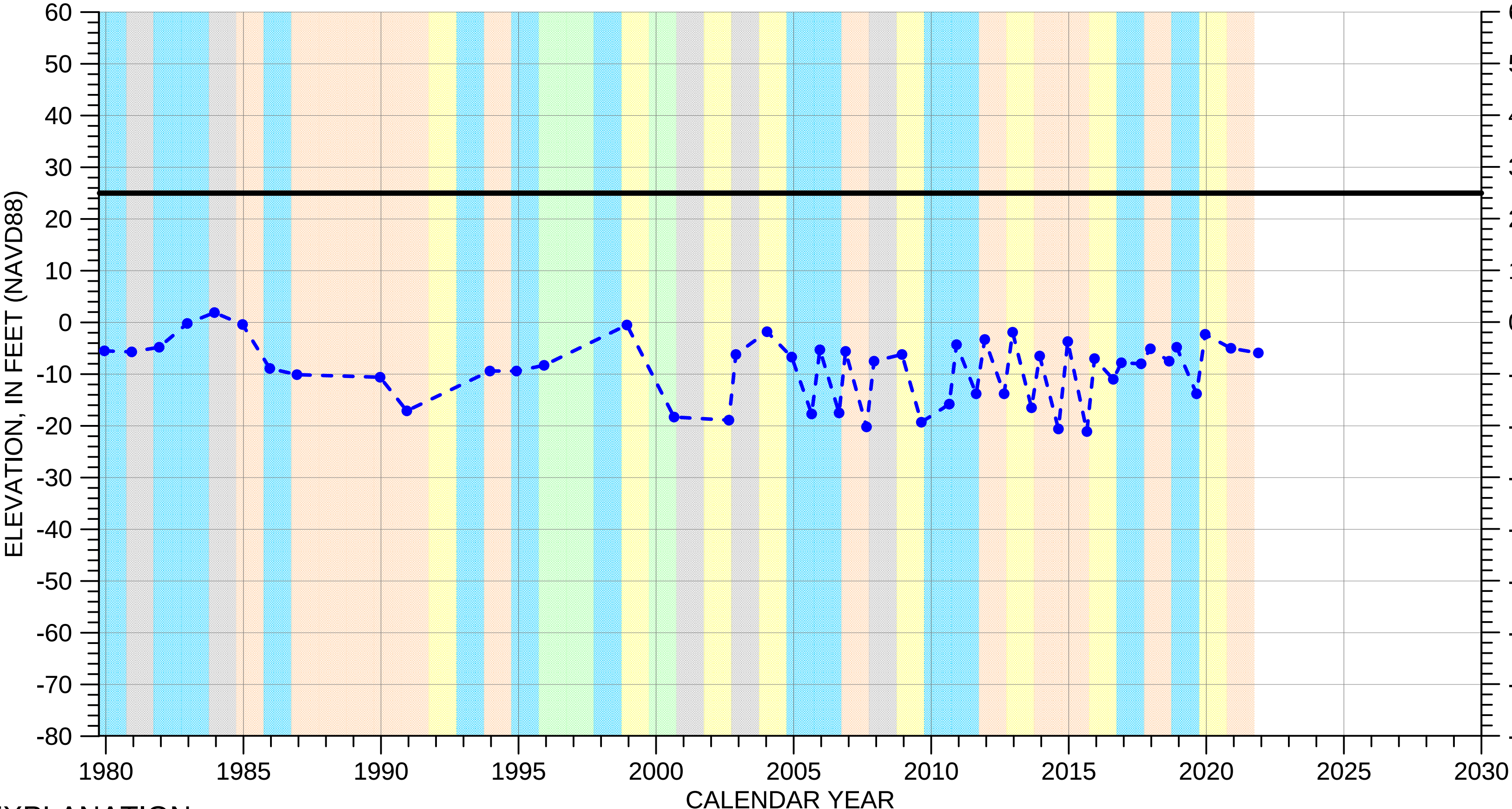
WATER YEAR TYPE DESIGNATION

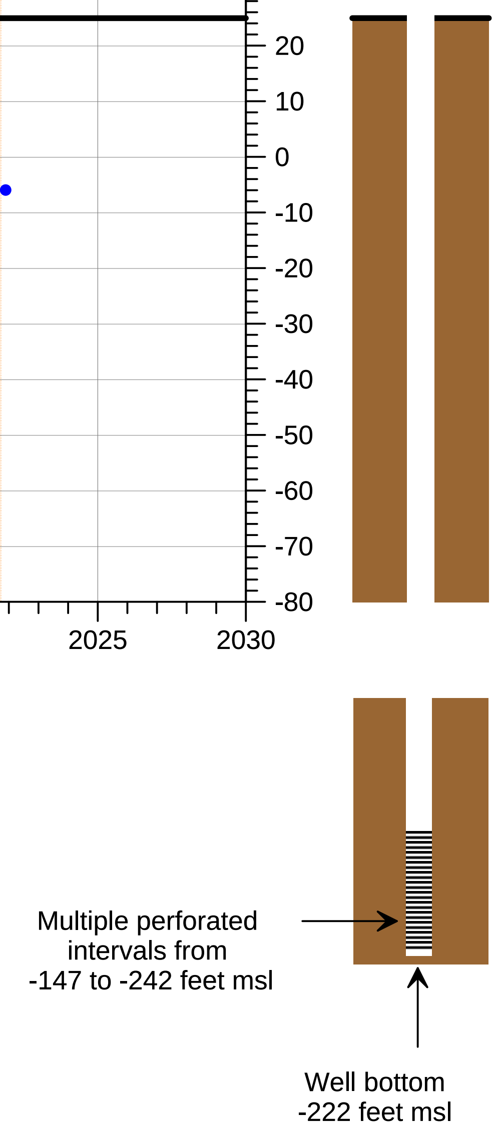
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch5\14S_02E-18B01.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-21L01

180/400-Foot Aquifer Subbasin

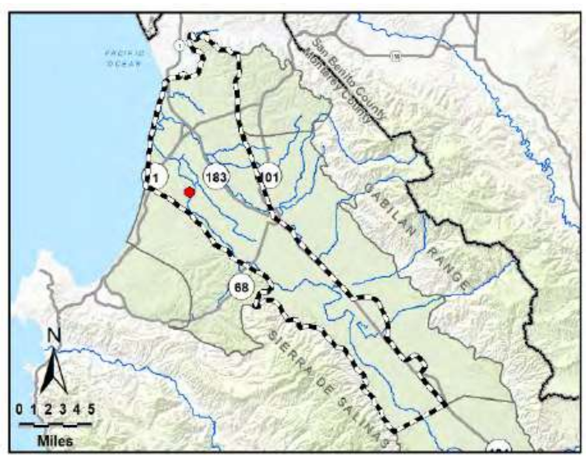




\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch5\14S_02E-21L01.grf

EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface

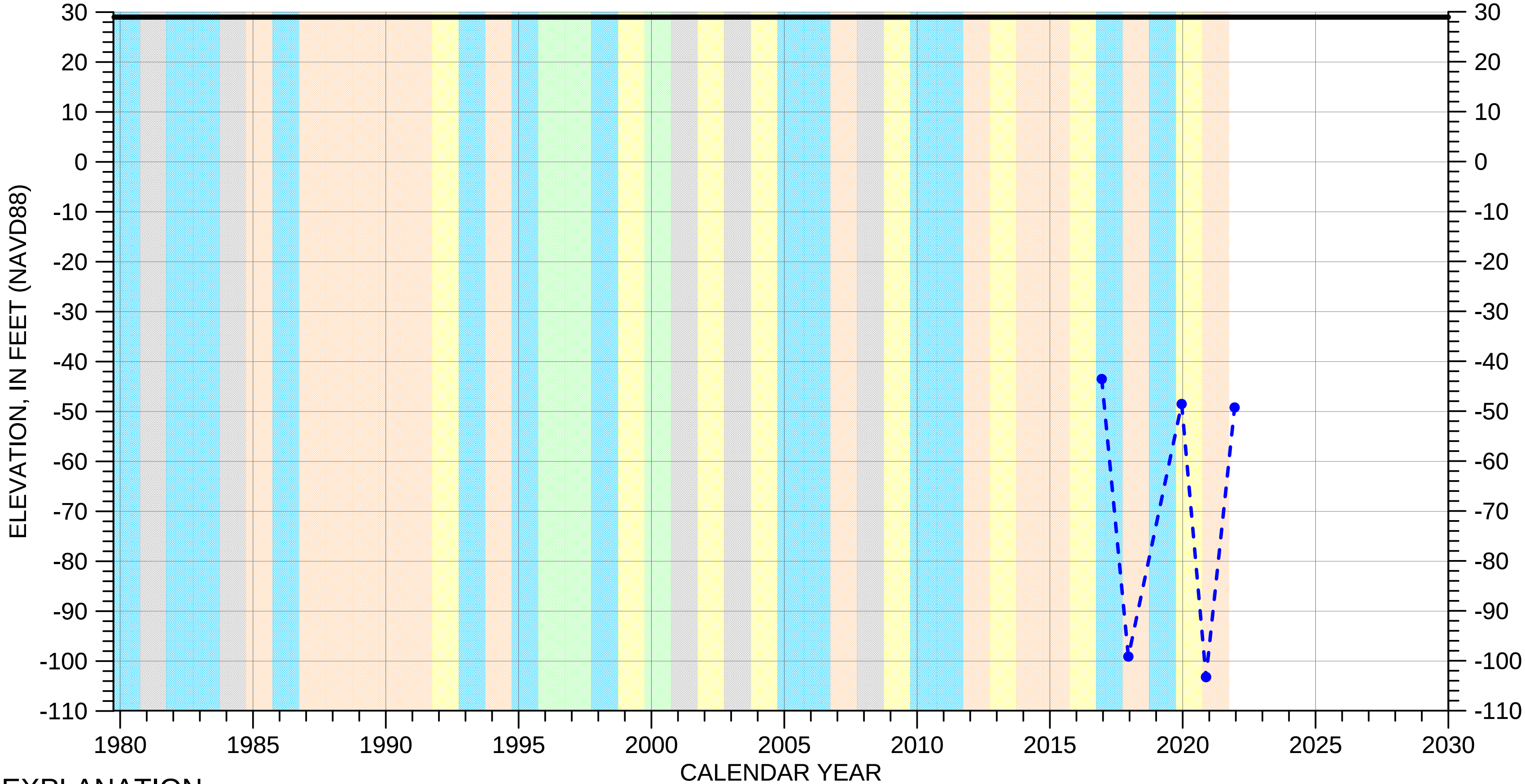


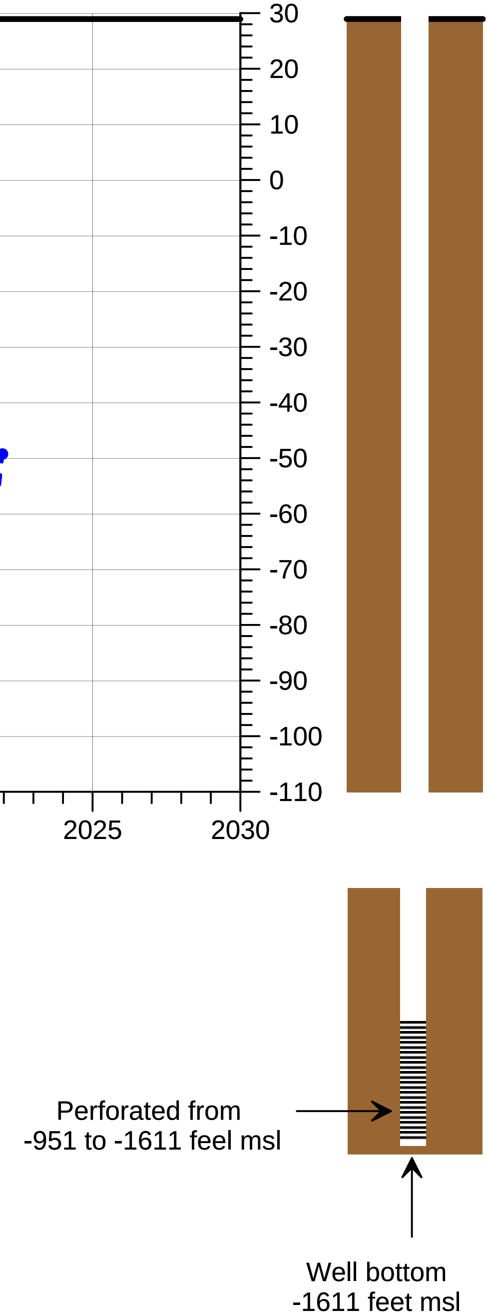
WATER YEAR TYPE DESIGNATION

- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-22A03

180/400-Foot Aquifer Subbasin



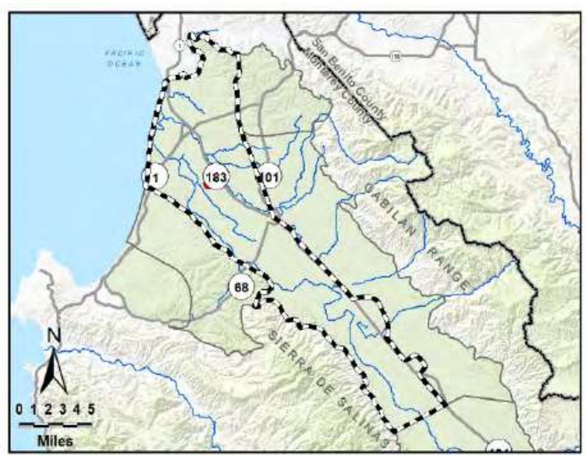


EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface

WATER YEAR TYPE DESIGNATION

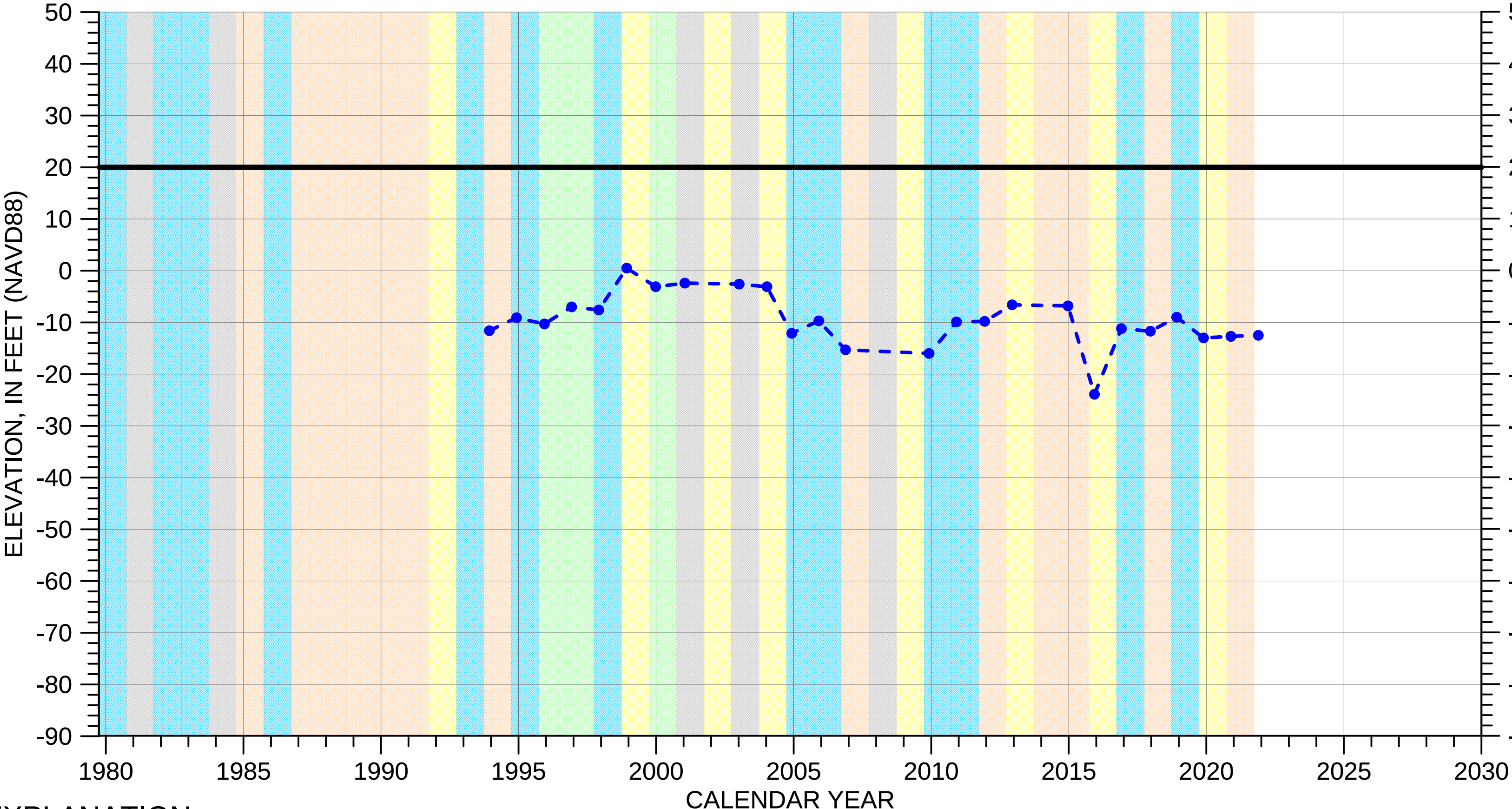
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

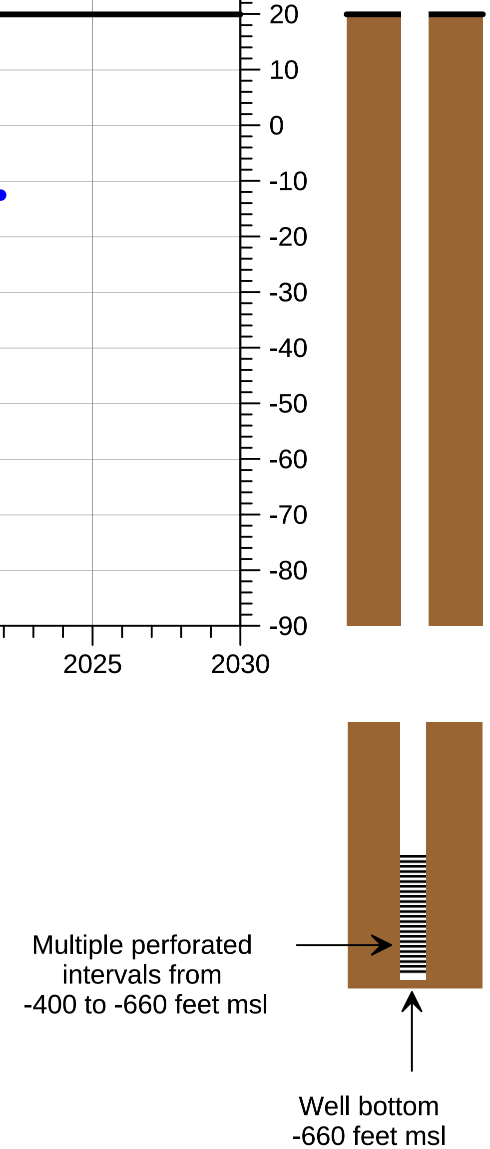


\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch5\14S_02E-22A03.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-22L01

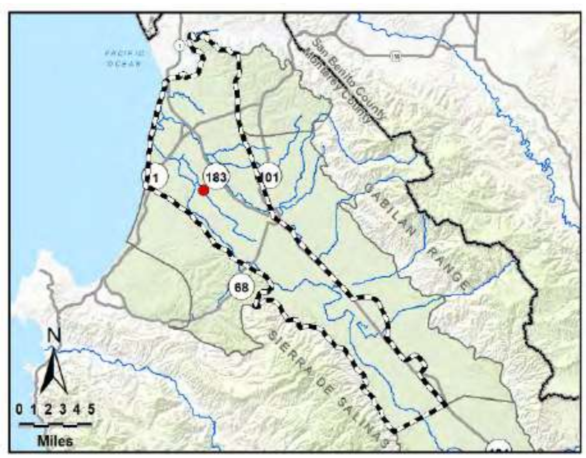
180/400-Foot Aquifer Subbasin





EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface



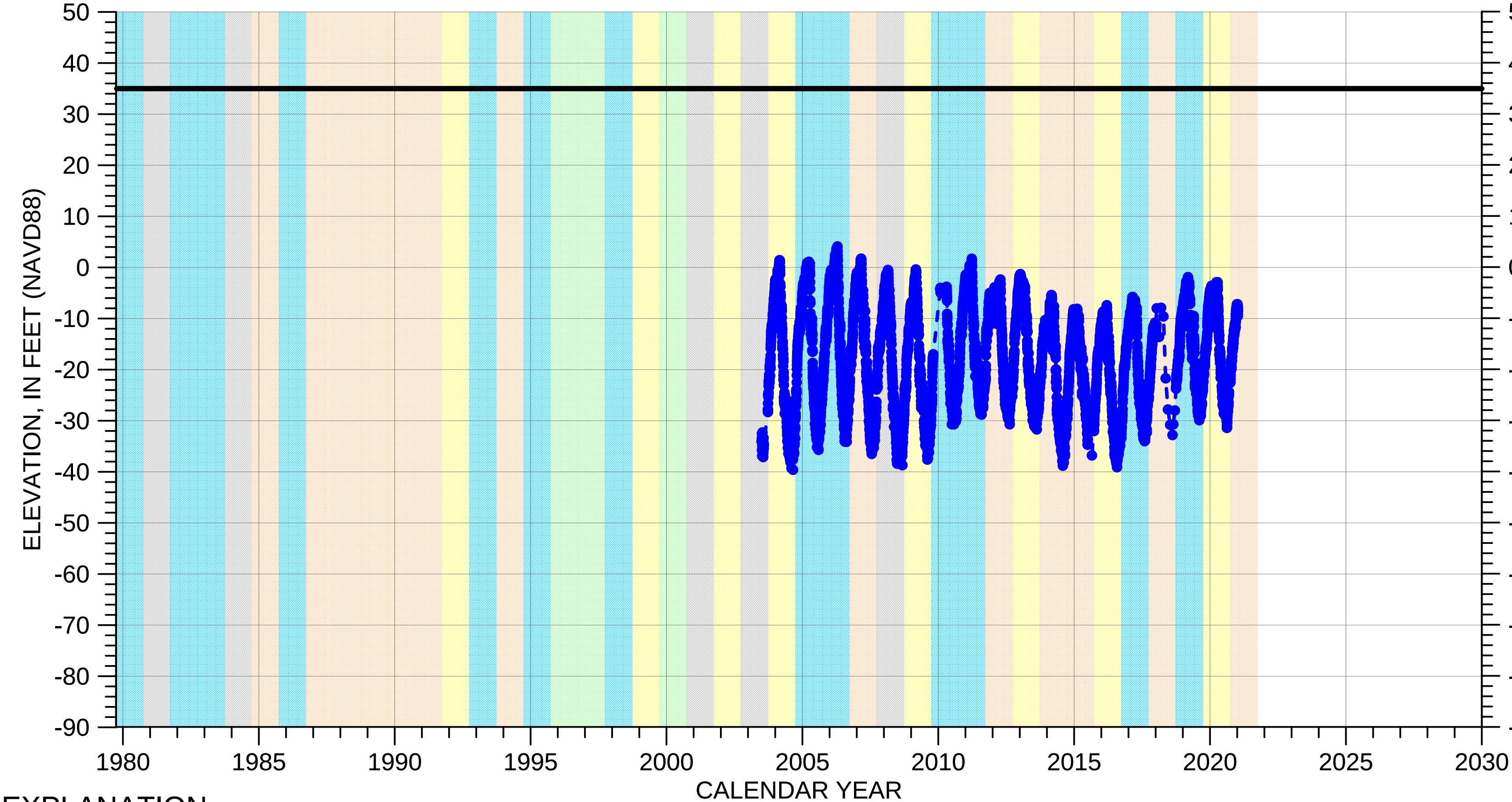
WATER YEAR TYPE DESIGNATION

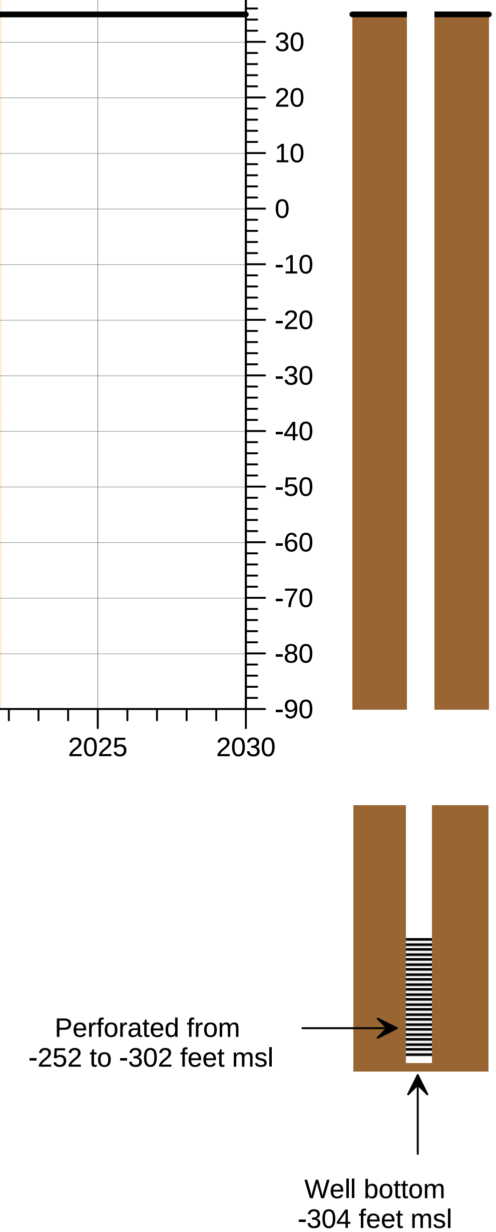
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRA\NEWGRFs_Ch5\14S_02E-22L01.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-26H01

180/400-Foot Aquifer Subbasin





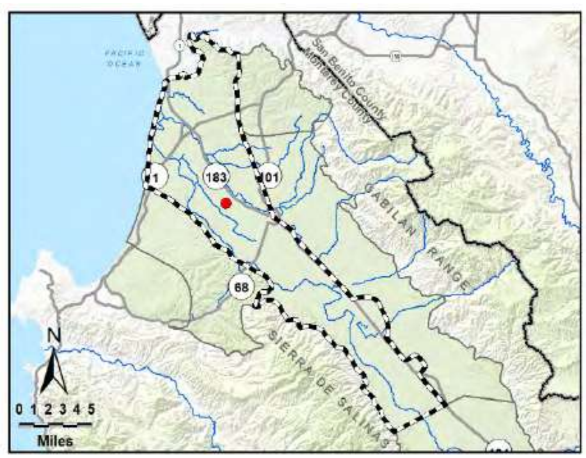
\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEW\GRFs_Ch5\14S_02E-26H01.grf

EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface

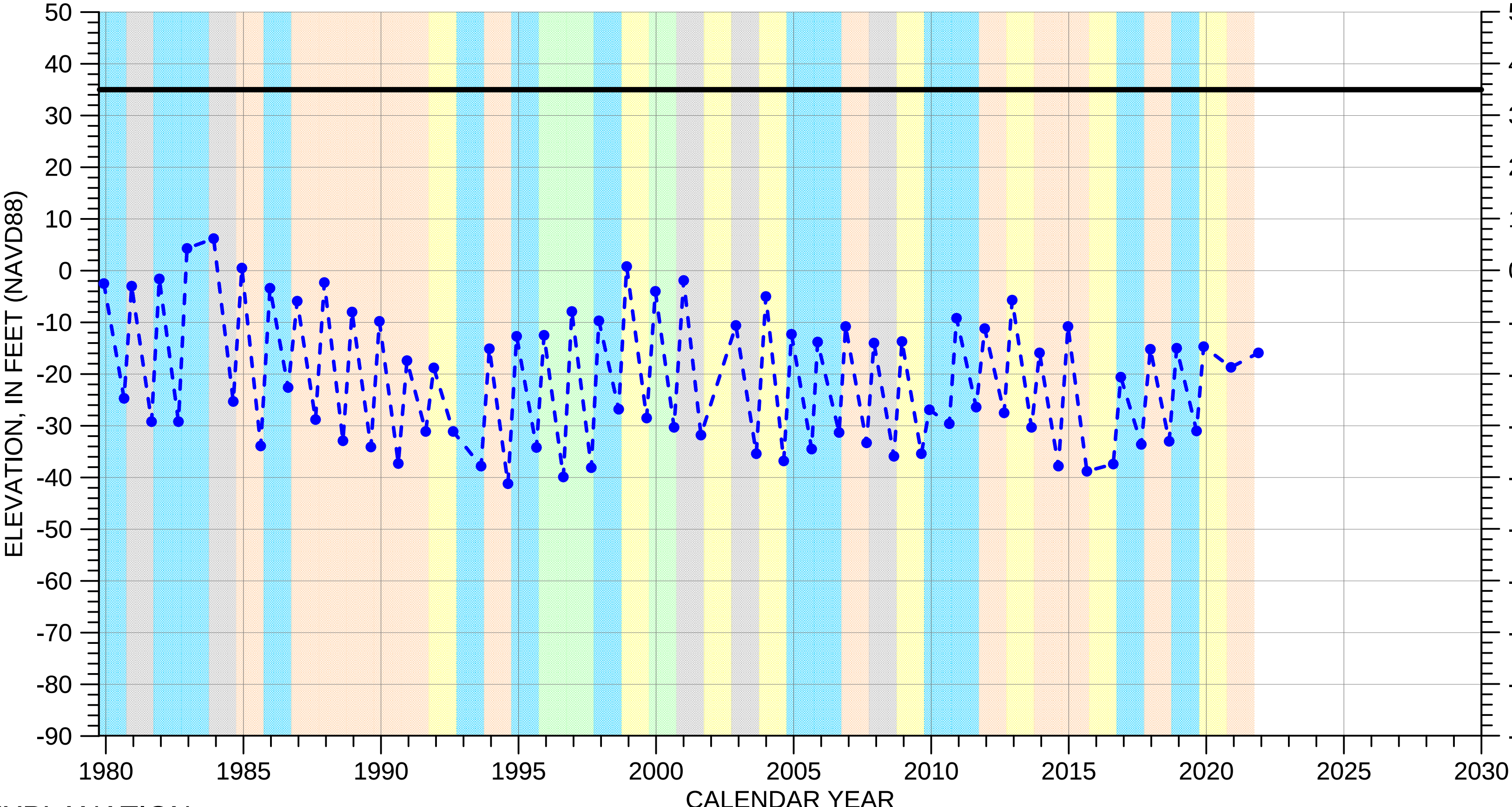
WATER YEAR TYPE DESIGNATION

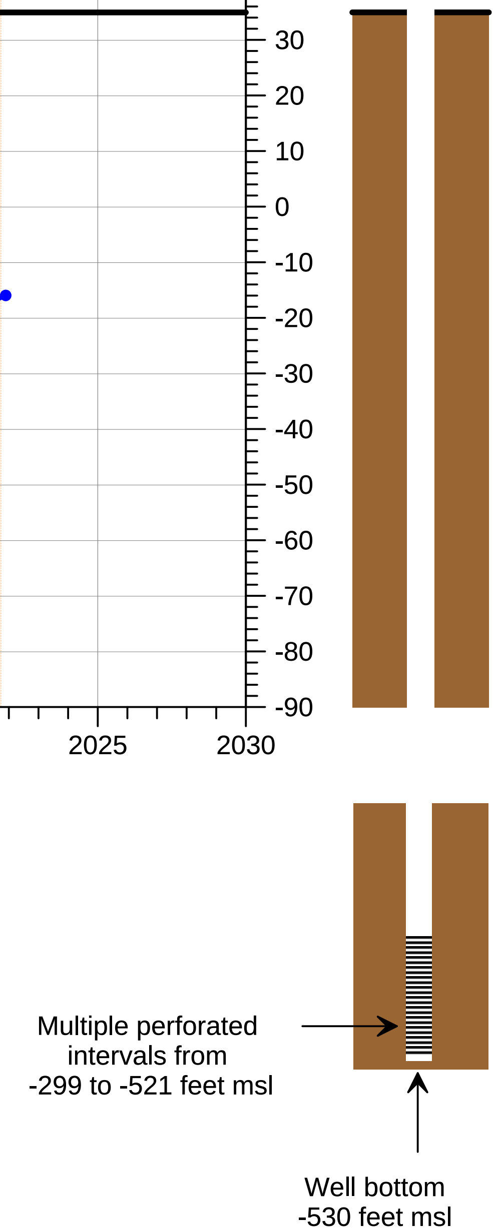
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET



HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-26J03

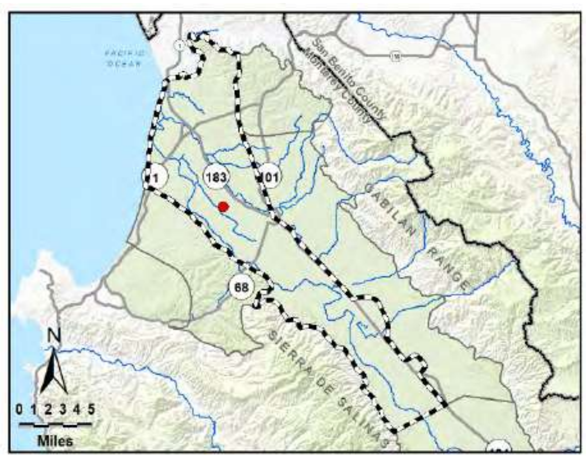
180/400-Foot Aquifer Subbasin





EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface



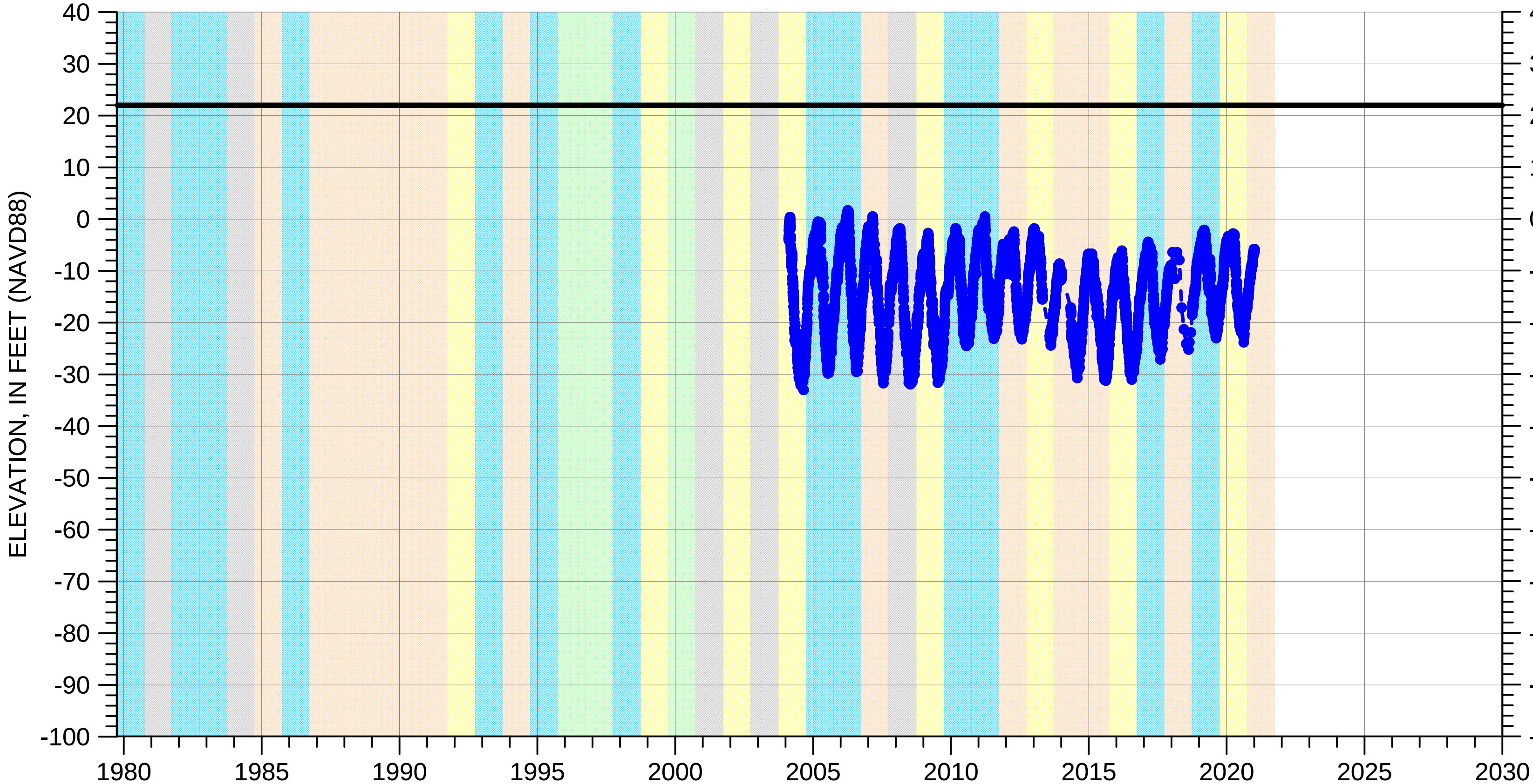
WATER YEAR TYPE DESIGNATION

- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch5\14S_02E-26J03.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-27A01

180/400-Foot Aquifer Subbasin



Perforated from -218 to -268 feet msl

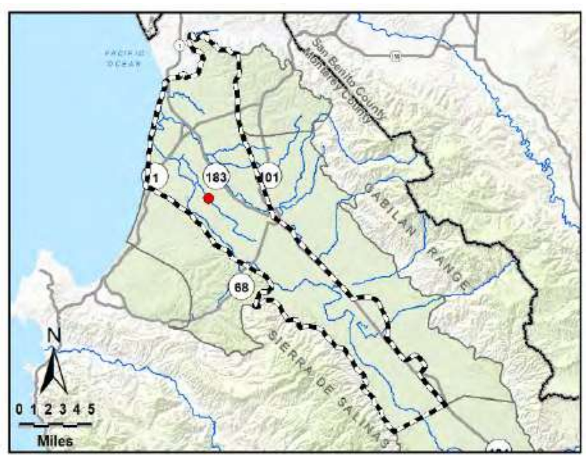
Well bottom -271 feet msl

EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface

WATER YEAR TYPE DESIGNATION

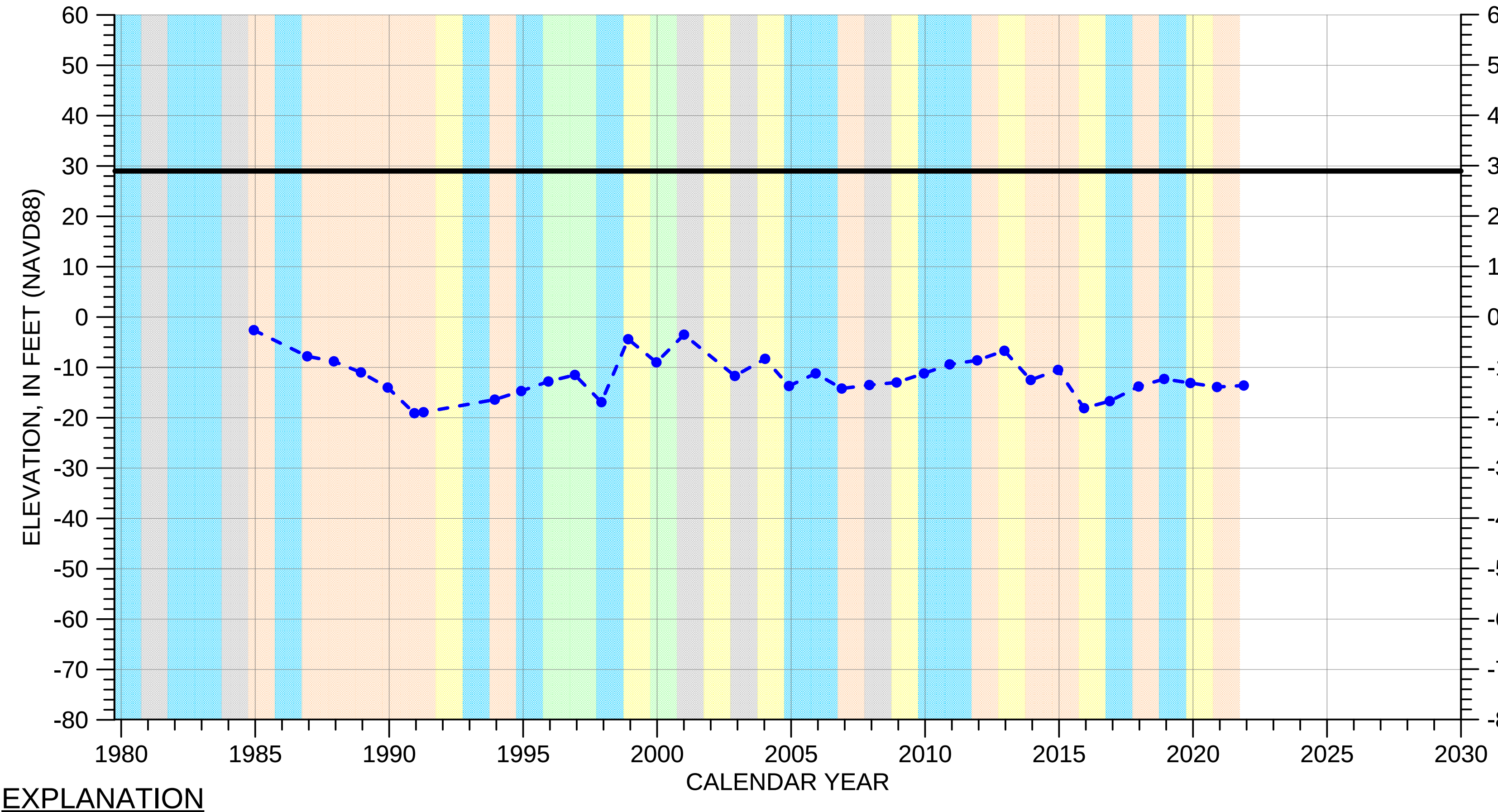
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

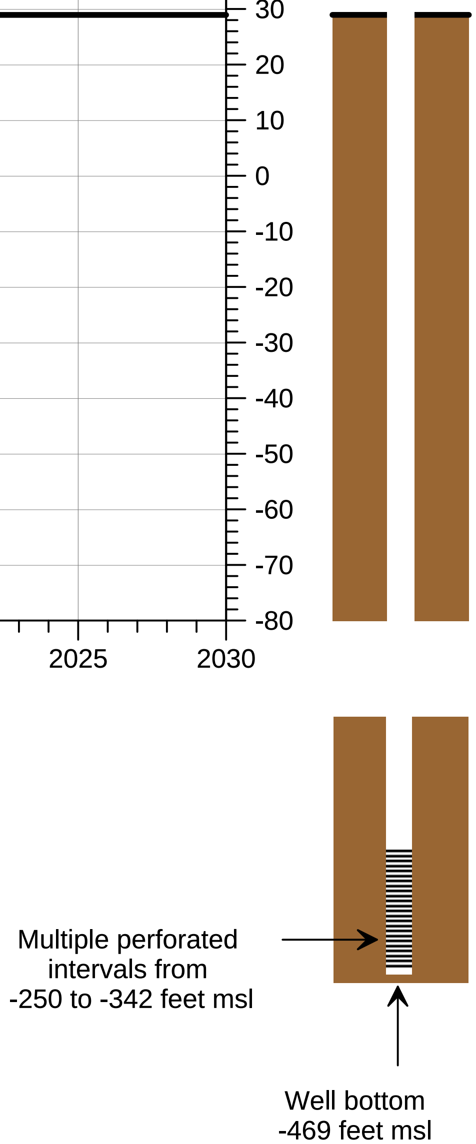


\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch5\14S_02E-27A01.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-27G03

180/400-Foot Aquifer Subbasin

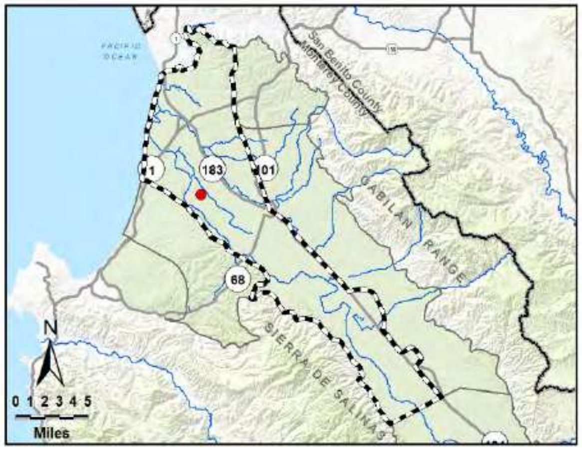




\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch5\14S_02E-27G03.grf

EXPLANATION

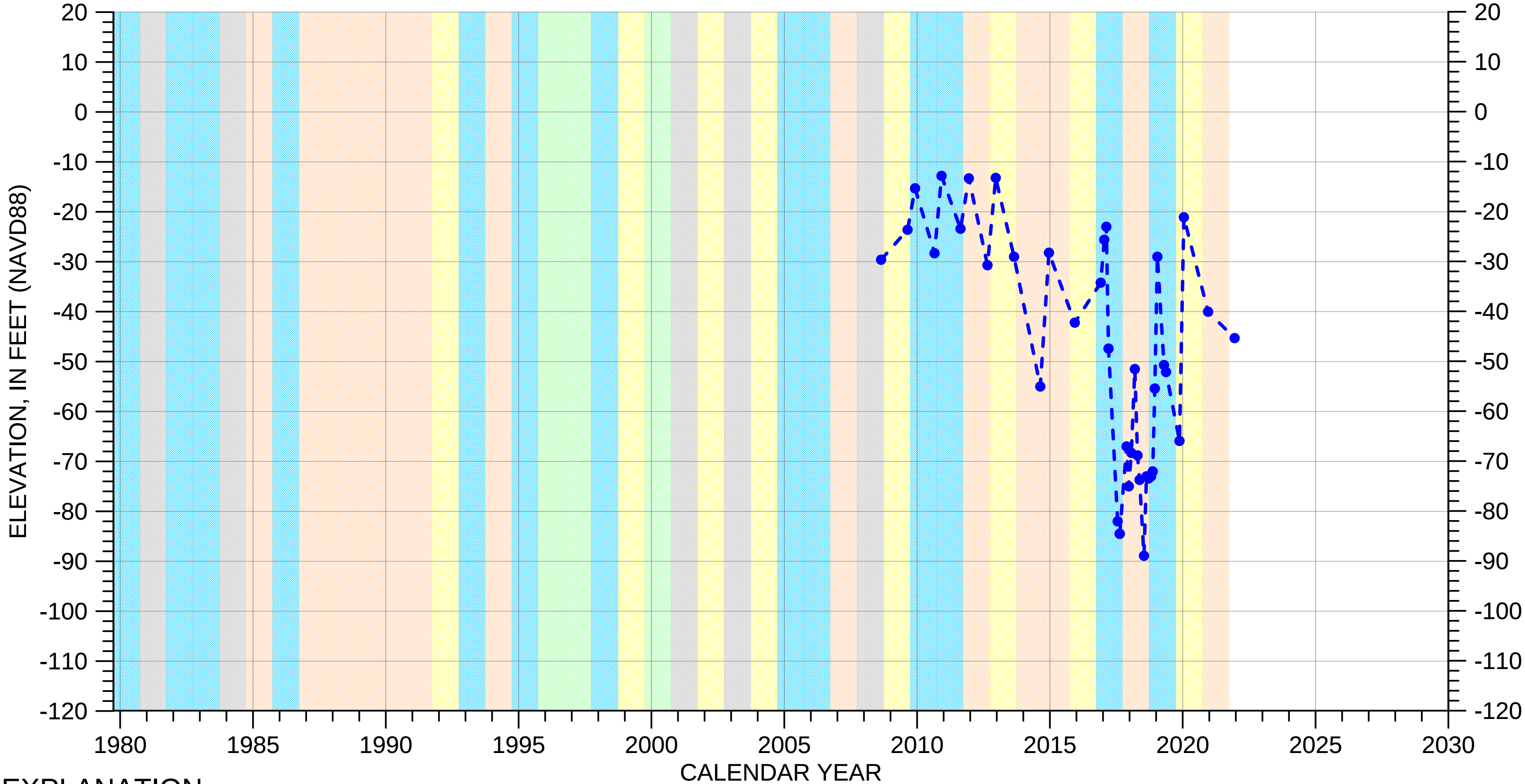
Groundwater Elevation
Suspect Measurement
Land Surface



WATER YEAR TYPE DESIGNATION

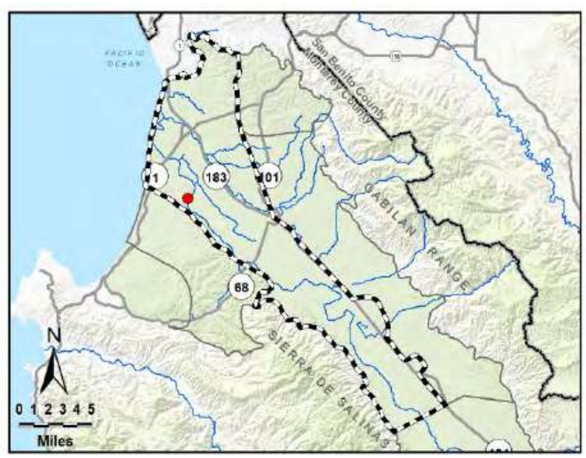
DRY
DRY - NORMAL
NORMAL
WET - NORMAL
WET

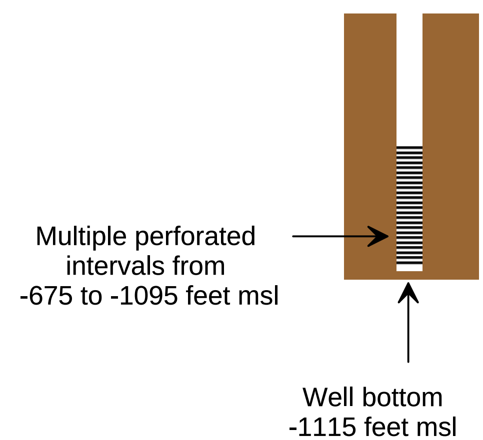
HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-28C02 180/400-Foot Aquifer Subbasin



EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface (45 FT MSL)





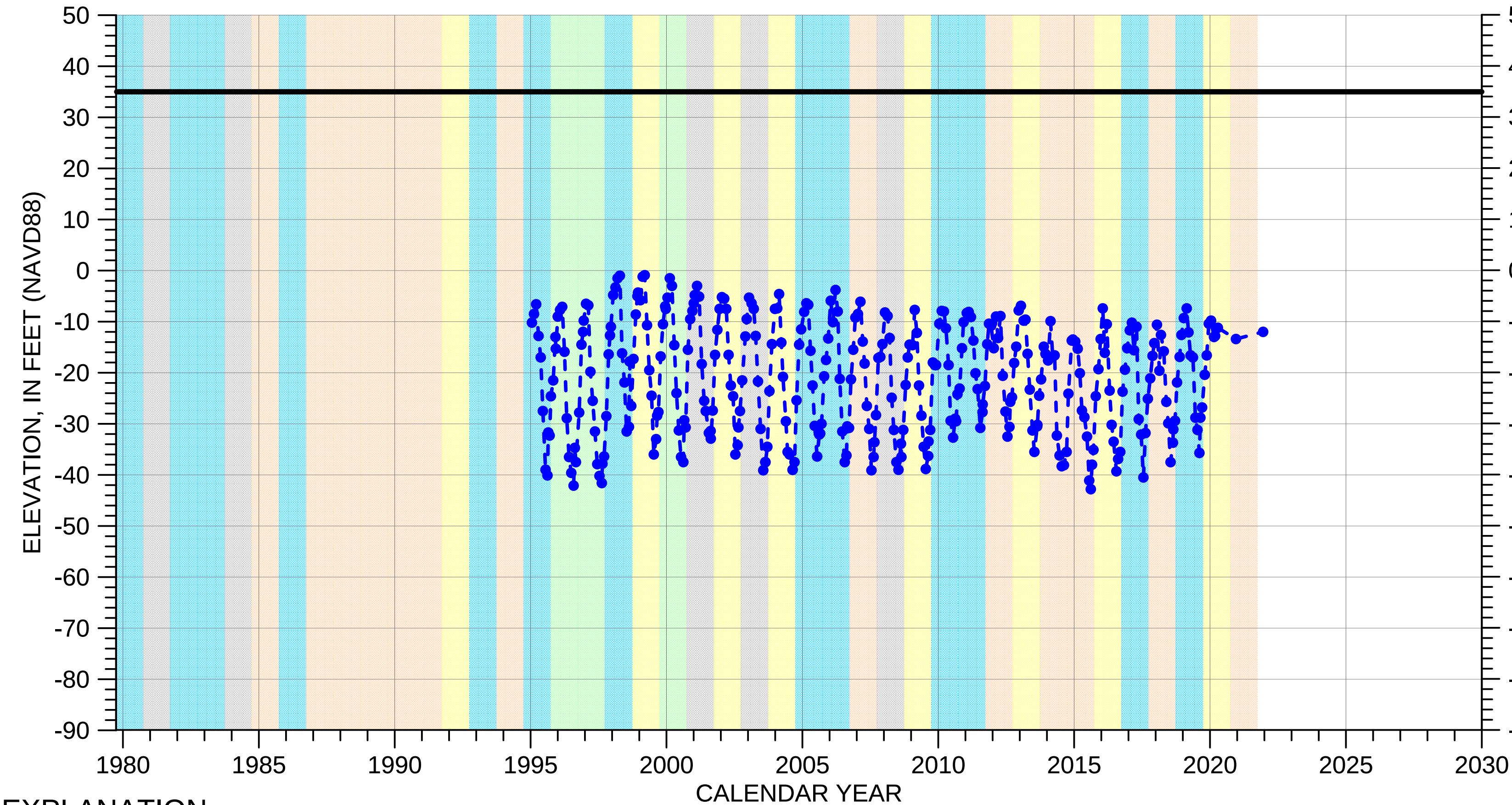
WATER YEAR TYPE DESIGNATION

- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRA\NEW\GRFs_Ch5\14S_02E-28C02.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-34A03

180/400-Foot Aquifer Subbasin



Multiple perforated intervals from -457 to -587 feet msl

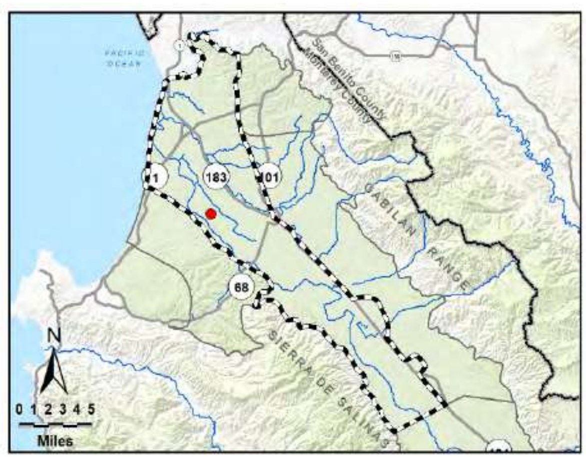
Well bottom -637 feet msl

EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface

WATER YEAR TYPE DESIGNATION

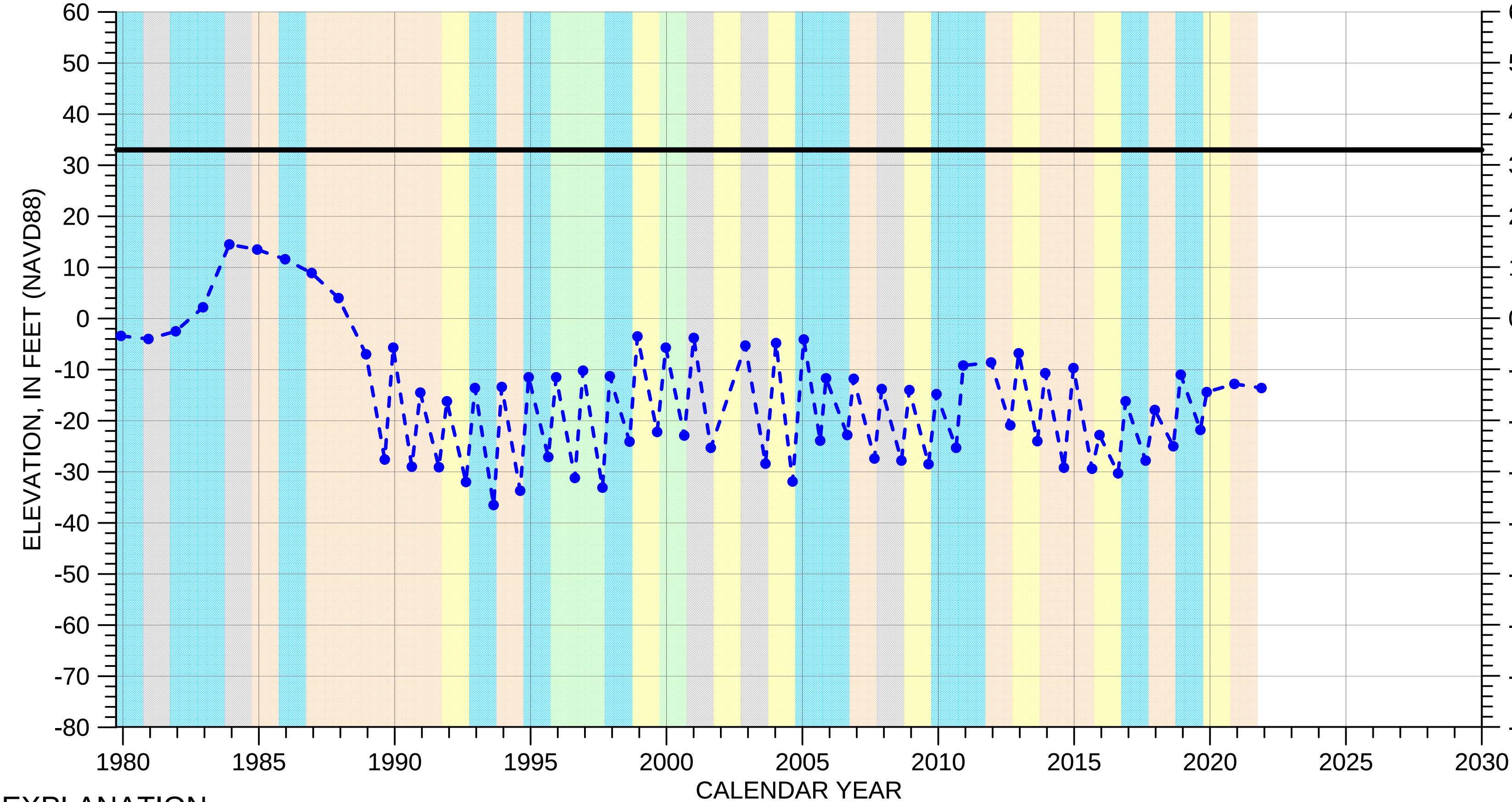
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET



\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch5\14S_02E-34A03.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-34B03

180/400-Foot Aquifer Subbasin



EXPLANATION

Groundwater Elevation

Suspect Measurement

Land Surface

WATER YEAR TYPE DESIGNATION

DRY

DRY - NORMAL

NORMAL

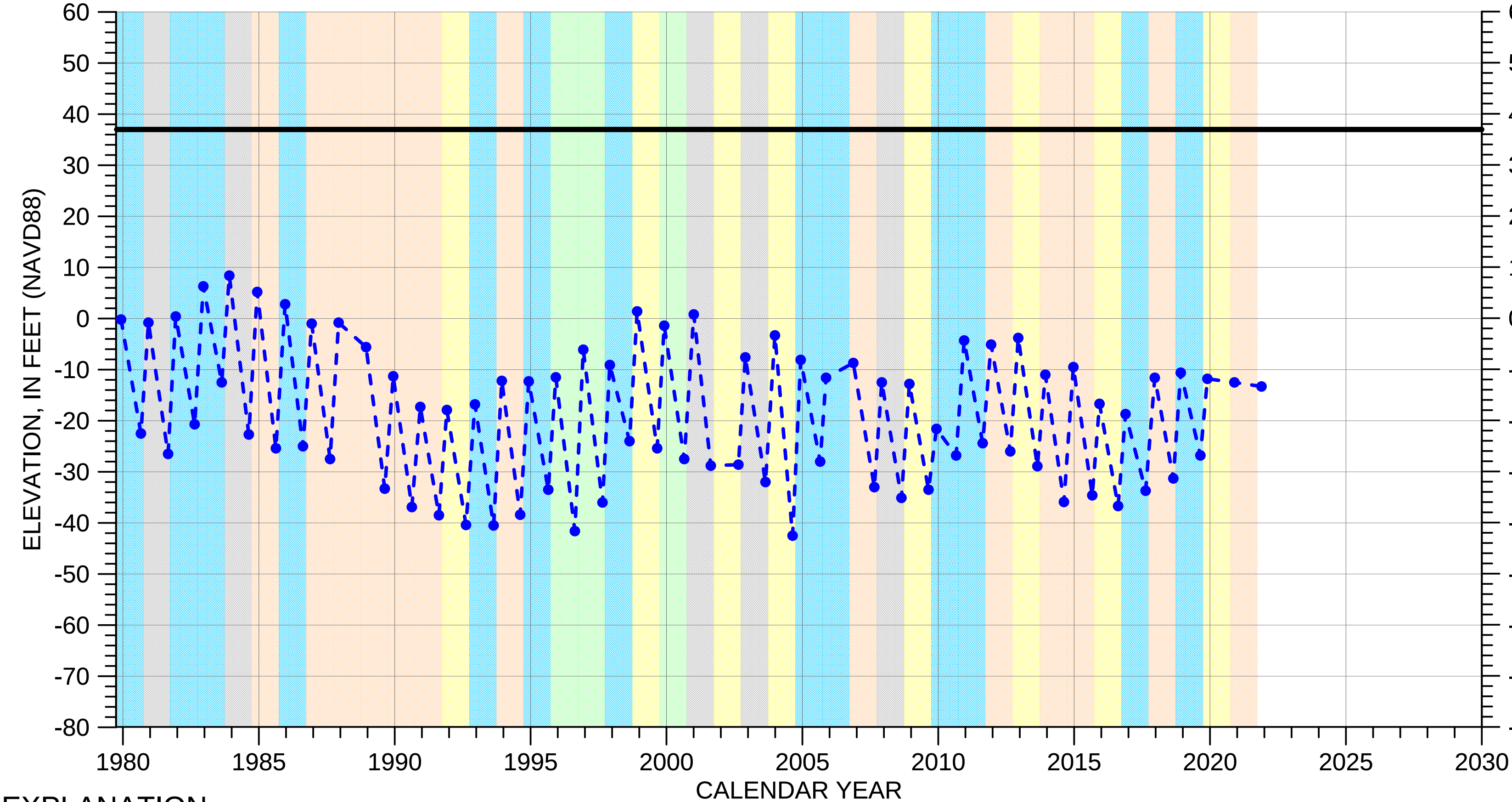
WET - NORMAL

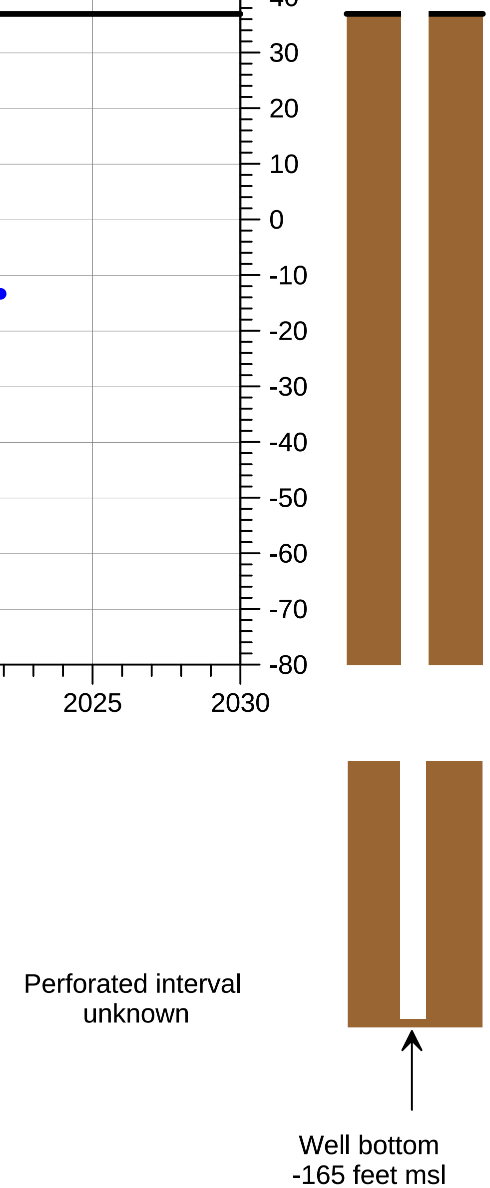
WET

\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch5\14S_02E-34B03.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-36E01

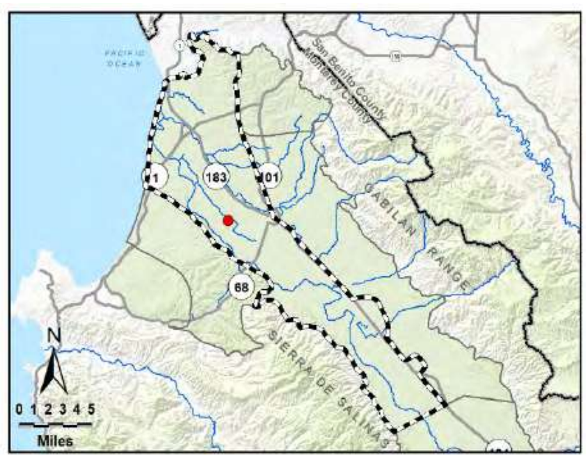
180/400-Foot Aquifer Subbasin





EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface



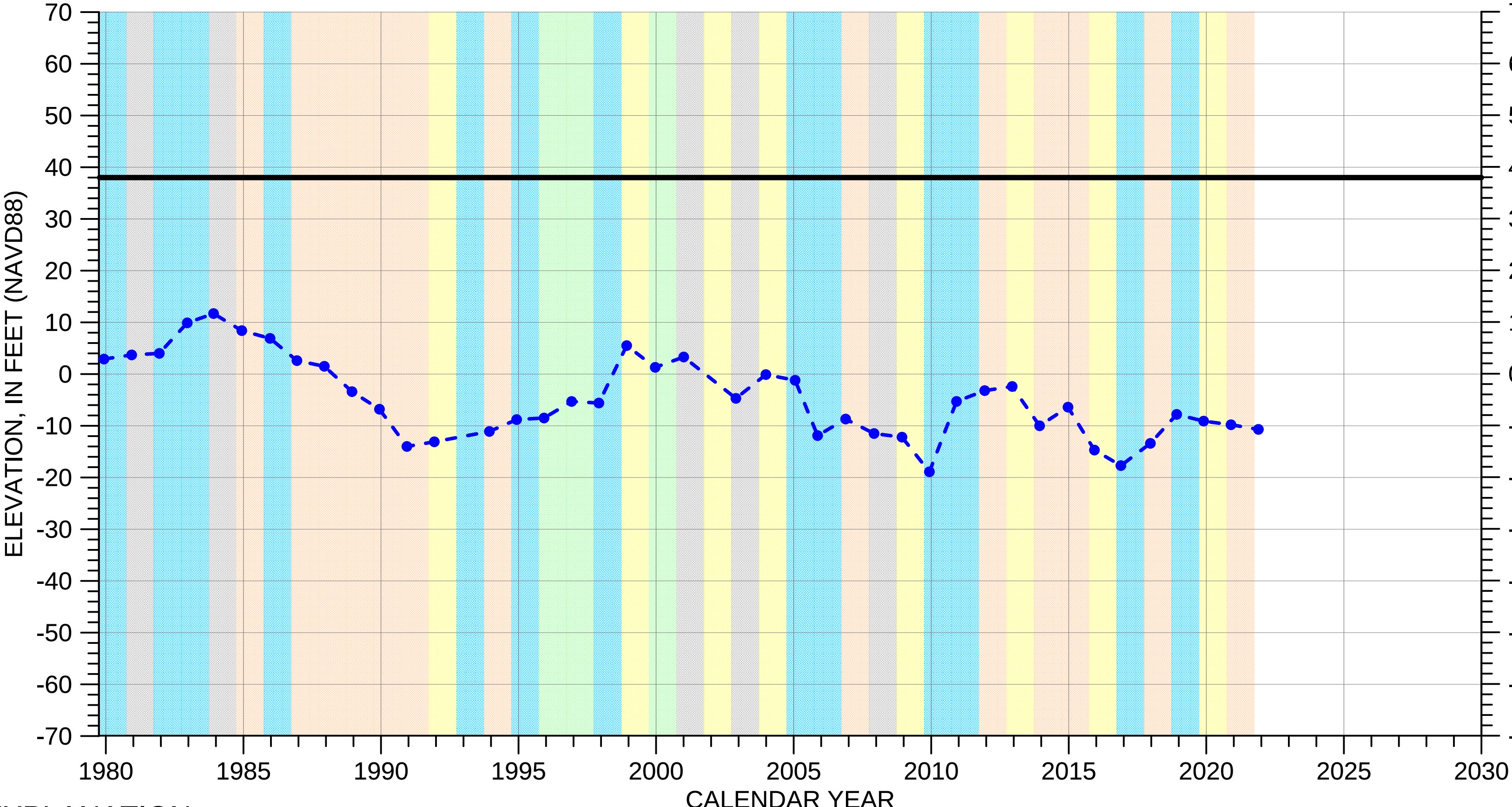
WATER YEAR TYPE DESIGNATION

- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch5\14S_02E-36E01.grf

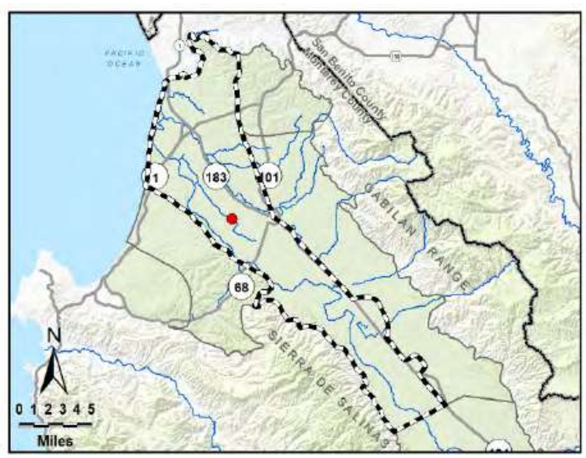
HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-36G01

180/400-Foot Aquifer Subbasin



EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface



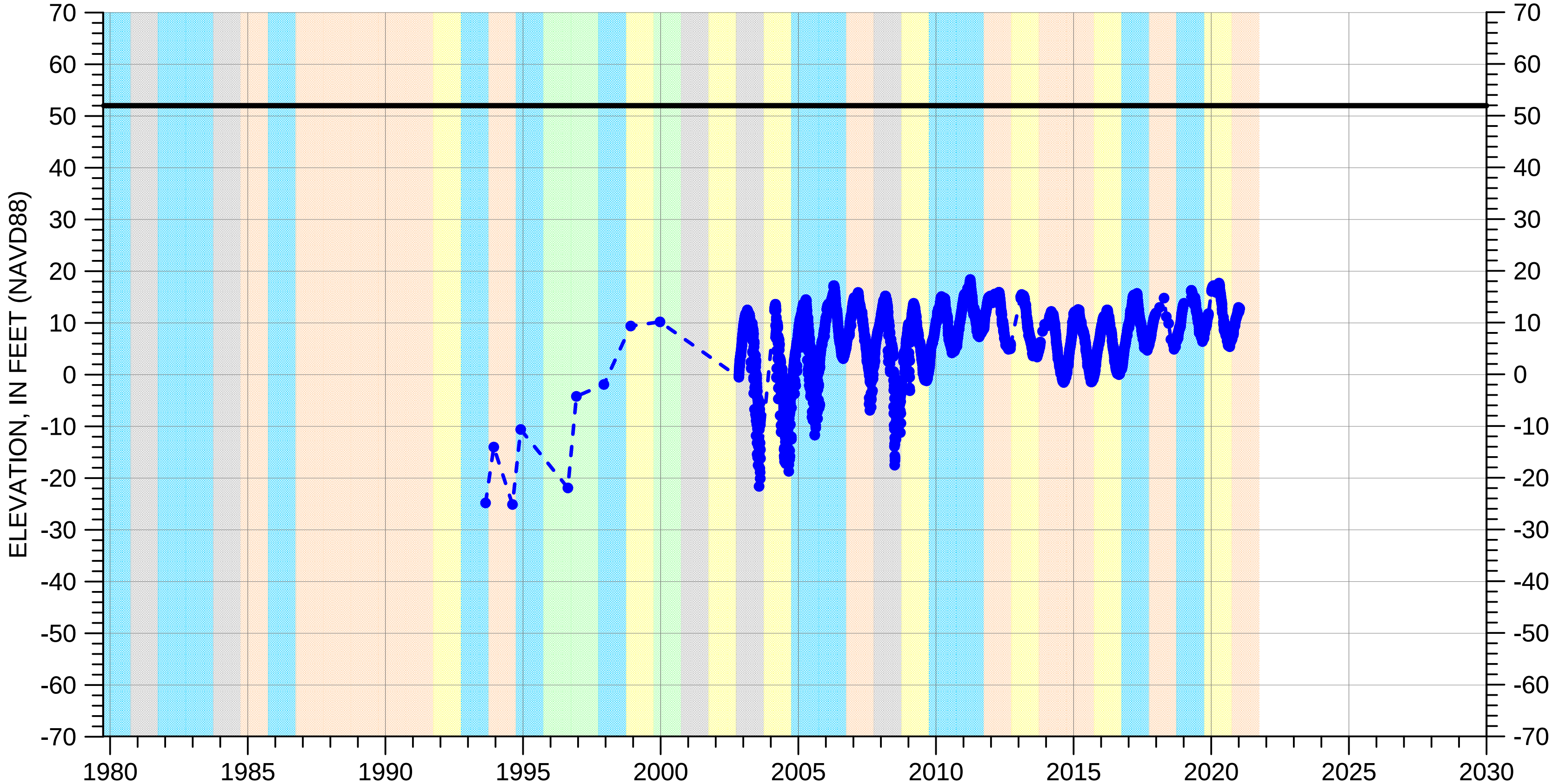
WATER YEAR TYPE DESIGNATION

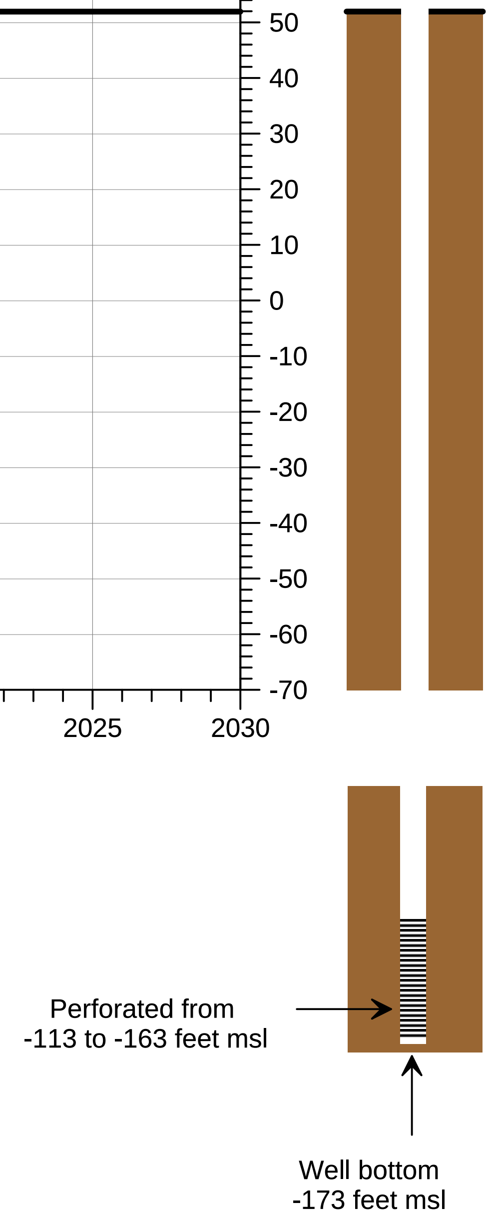
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch5\14S_02E-36G01.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/03E-18C01

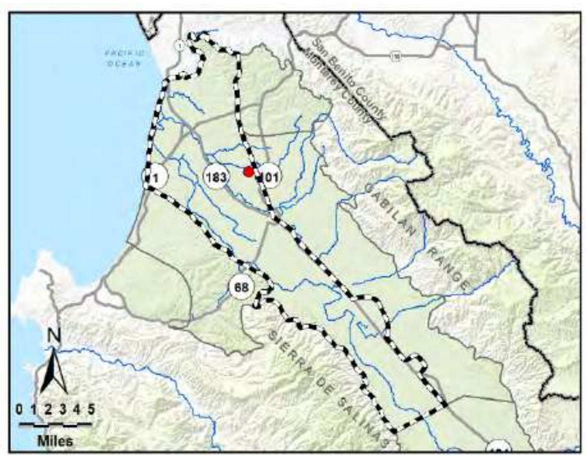
180/400-Foot Aquifer Subbasin





EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface



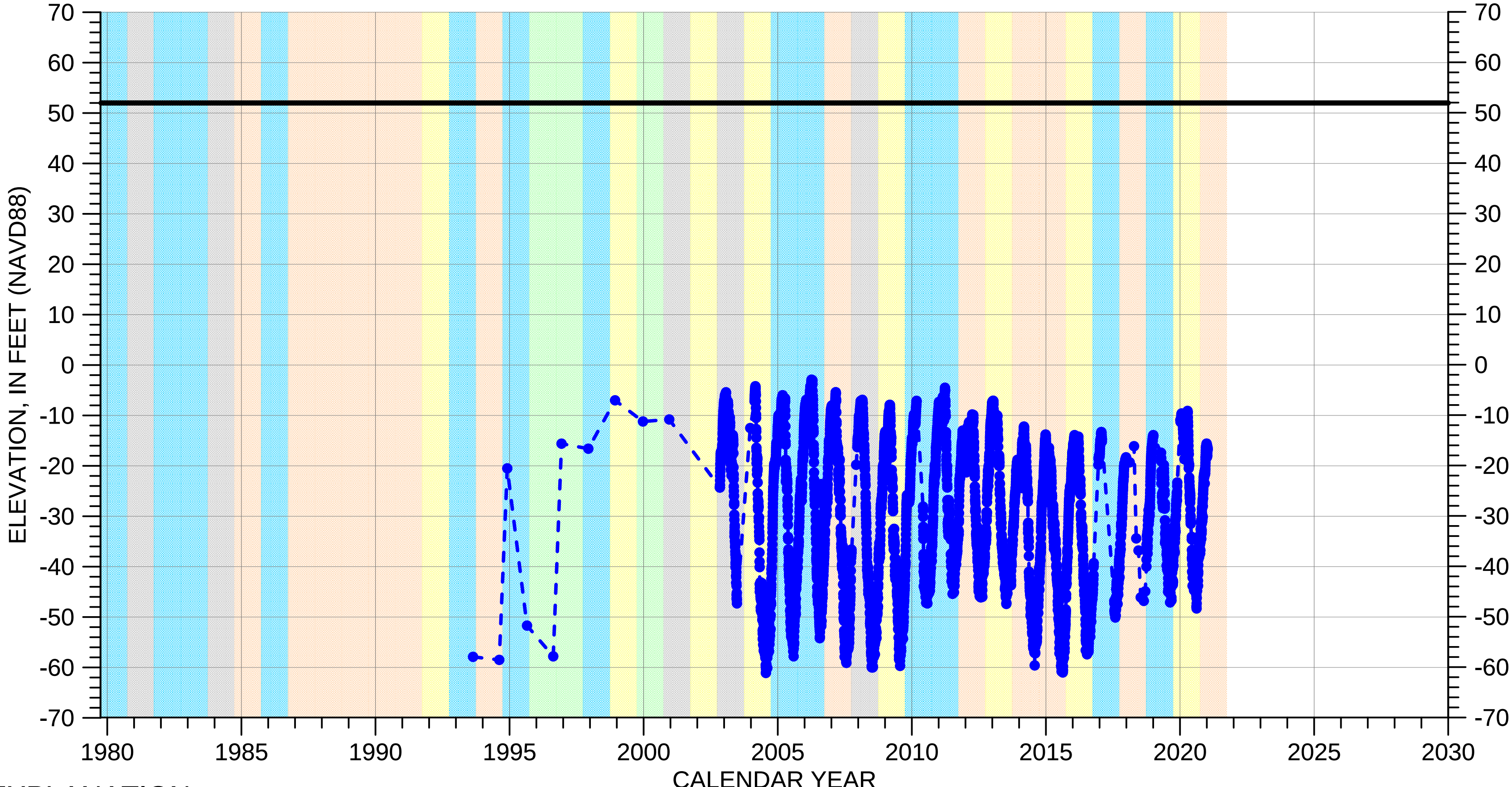
WATER YEAR TYPE DESIGNATION

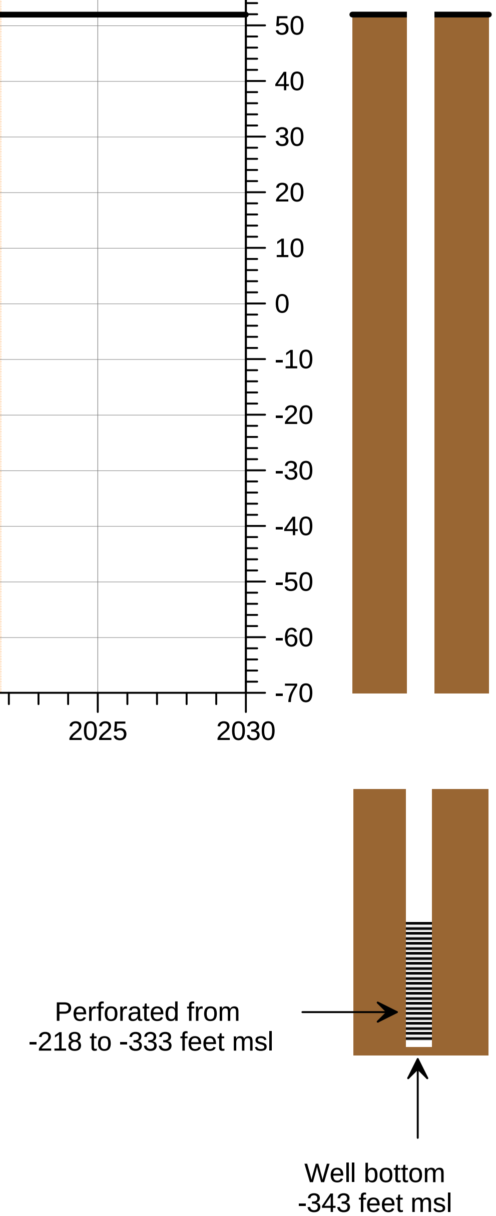
DRY
DRY - NORMAL
NORMAL
WET - NORMAL
WET

\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch5\14S_03E-18C01.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/03E-18C02

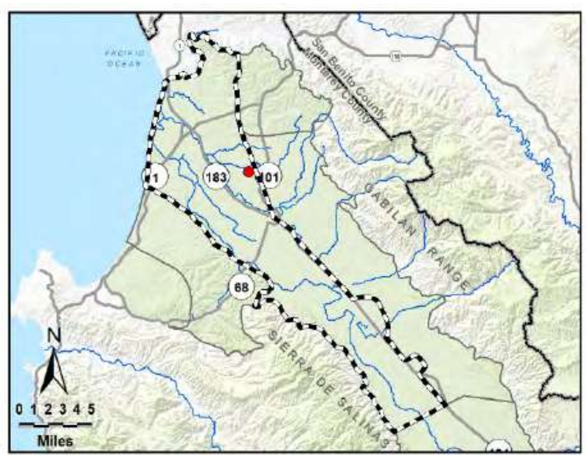
180/400-Foot Aquifer Subbasin





EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface



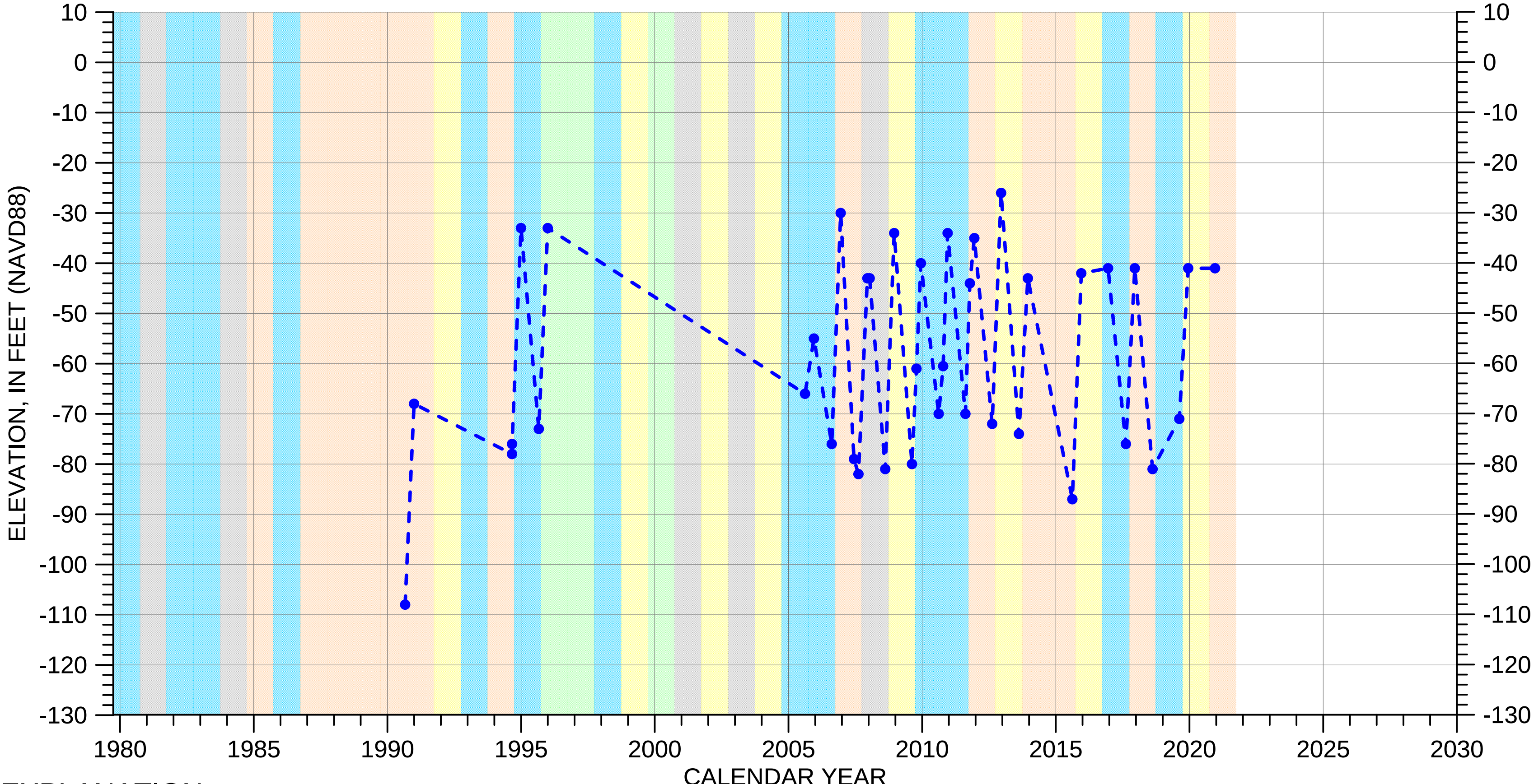
WATER YEAR TYPE DESIGNATION

- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch5\14S_03E-18C02.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/03E-20C01

180/400-Foot Aquifer Subbasin

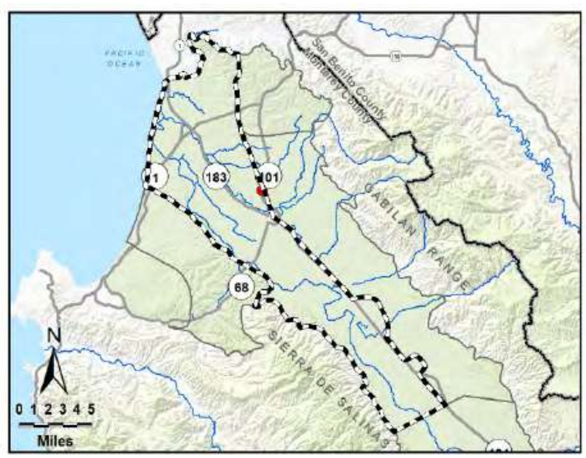


EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface (63 FT MSL)

WATER YEAR TYPE DESIGNATION

- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET



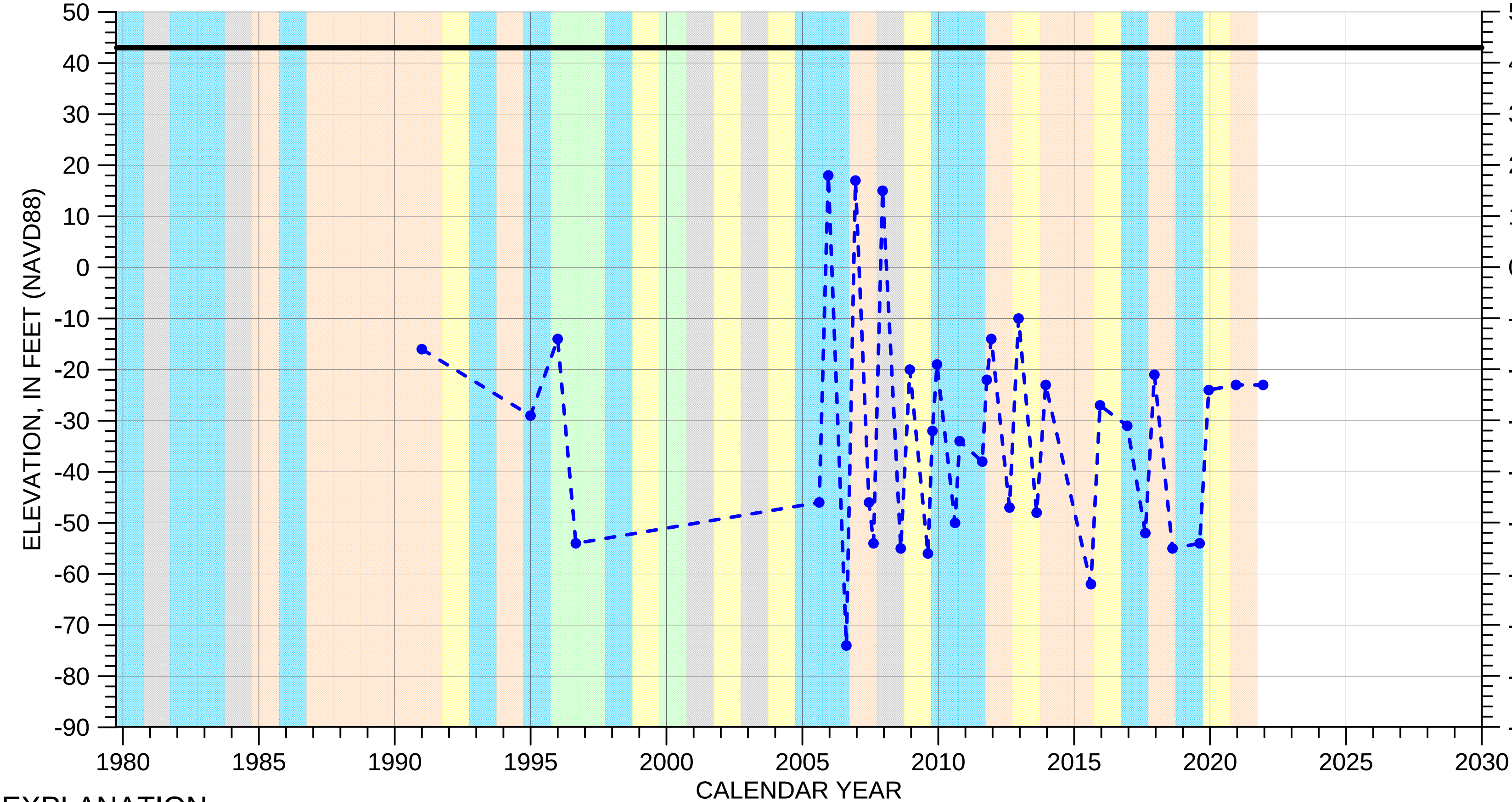
Multiple perforated intervals from -400 to -548 feet msl

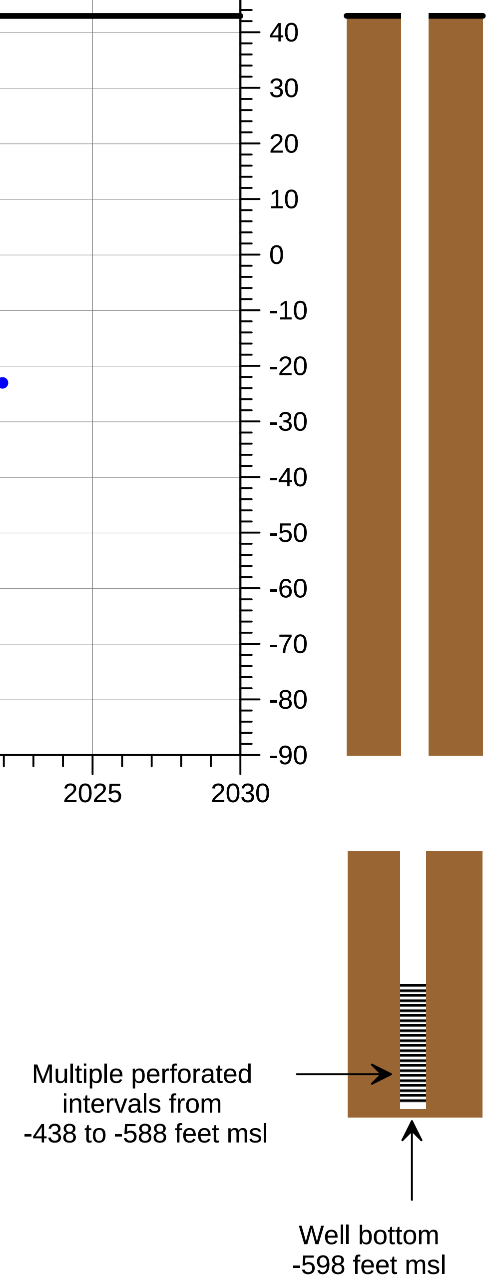
Well bottom -639 feet msl

\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch5\14S_03E-20C01.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/03E-29F03

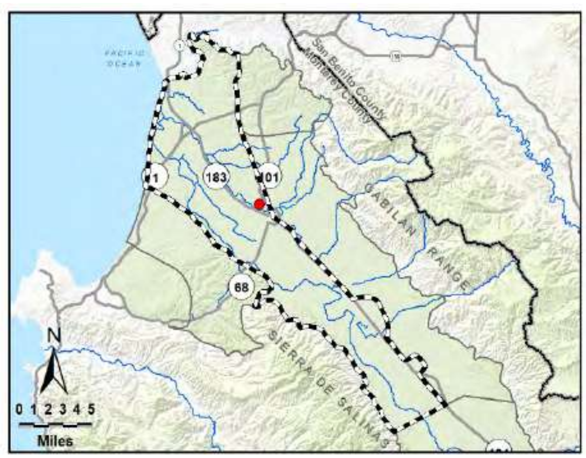
180/400-Foot Aquifer Subbasin





EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface



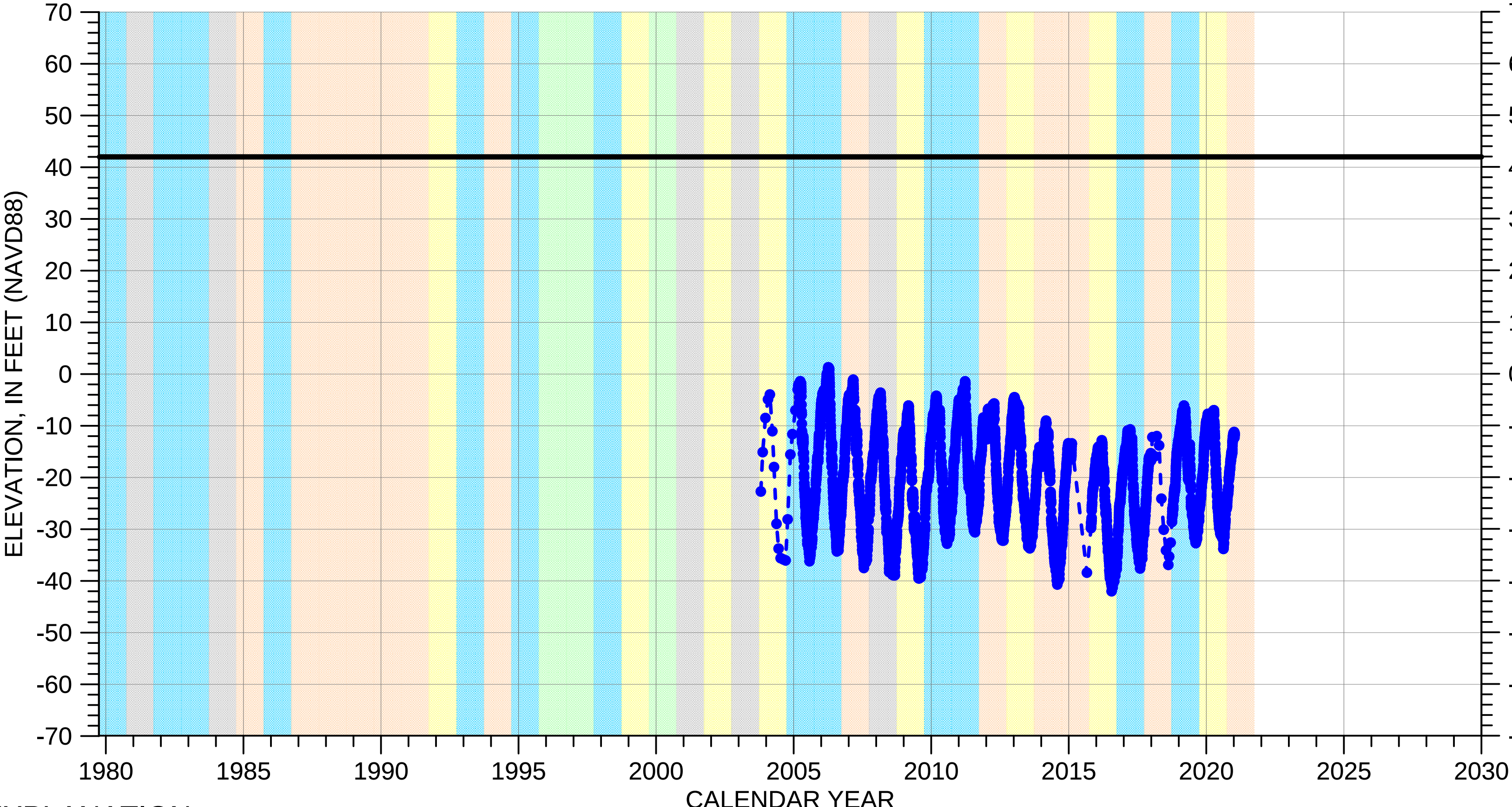
WATER YEAR TYPE DESIGNATION

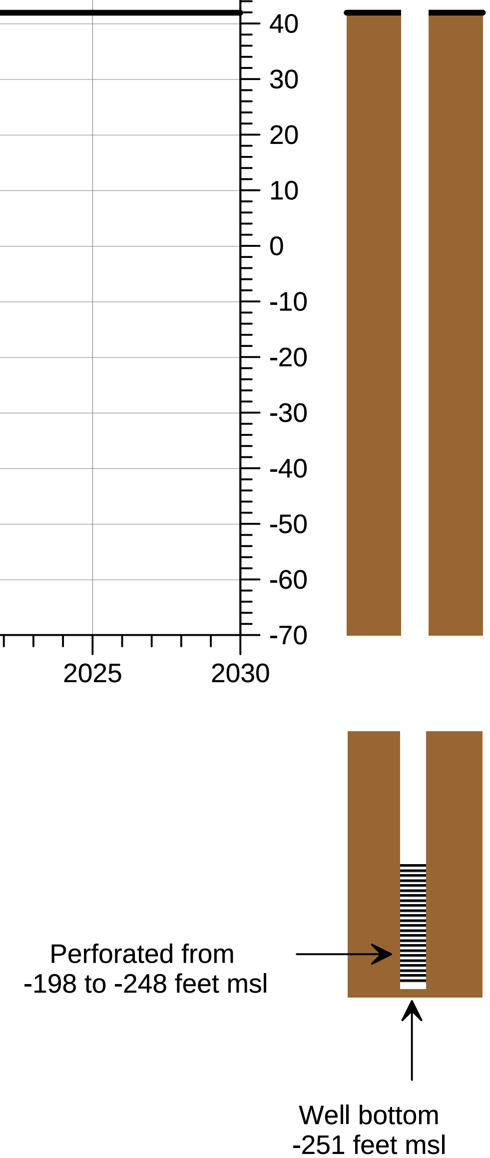
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch5\14S_03E-29F03.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/03E-30G08

180/400-Foot Aquifer Subbasin



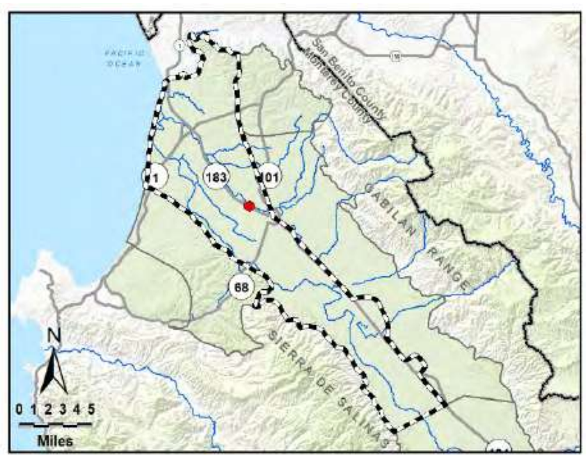


EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface

WATER YEAR TYPE DESIGNATION

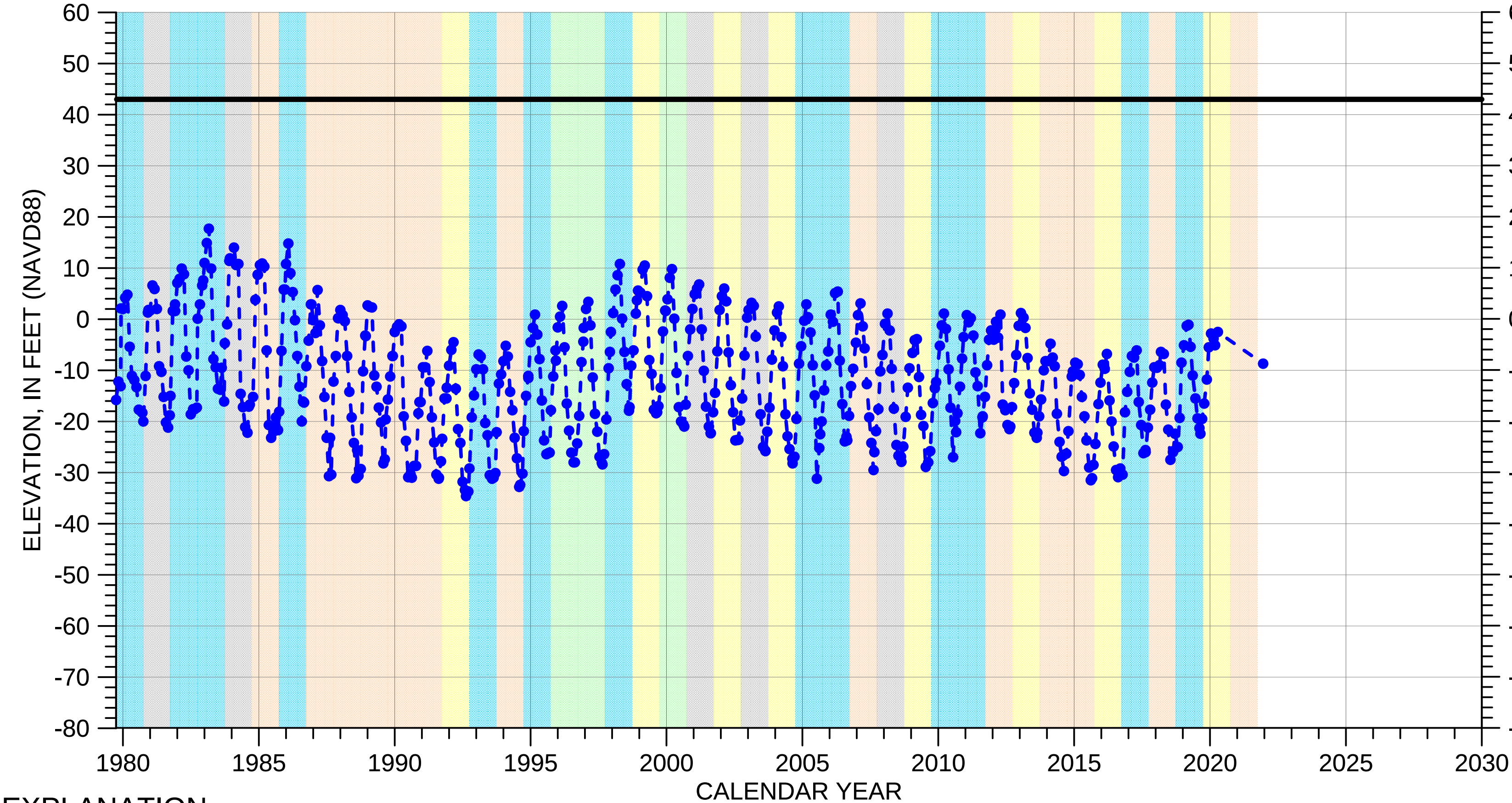
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

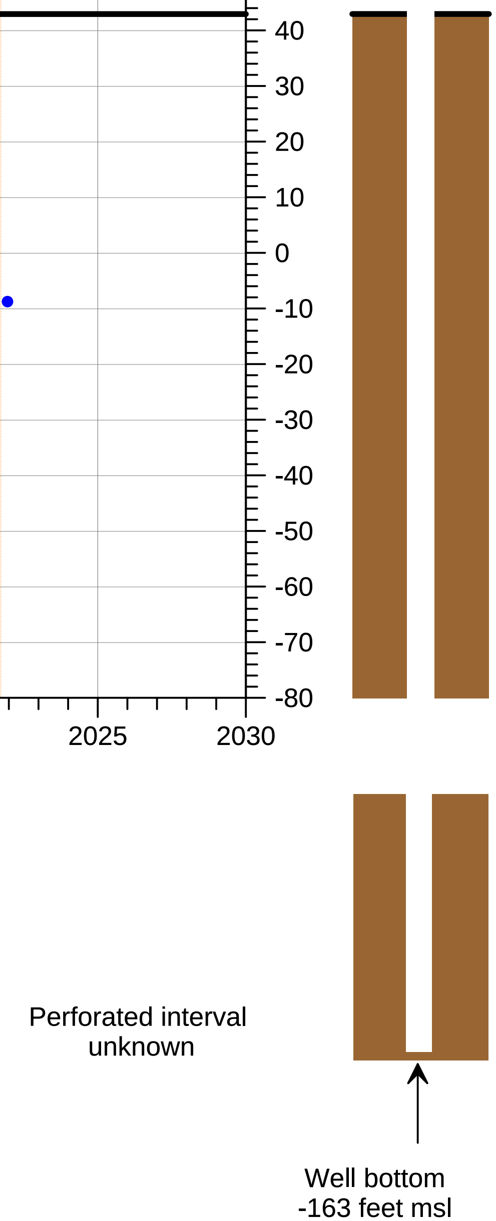


\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch5\14S_03E-30G08.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/03E-31F01

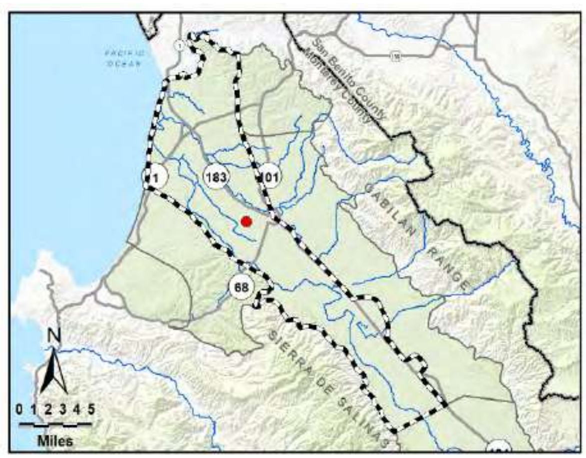
180/400-Foot Aquifer Subbasin





EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface



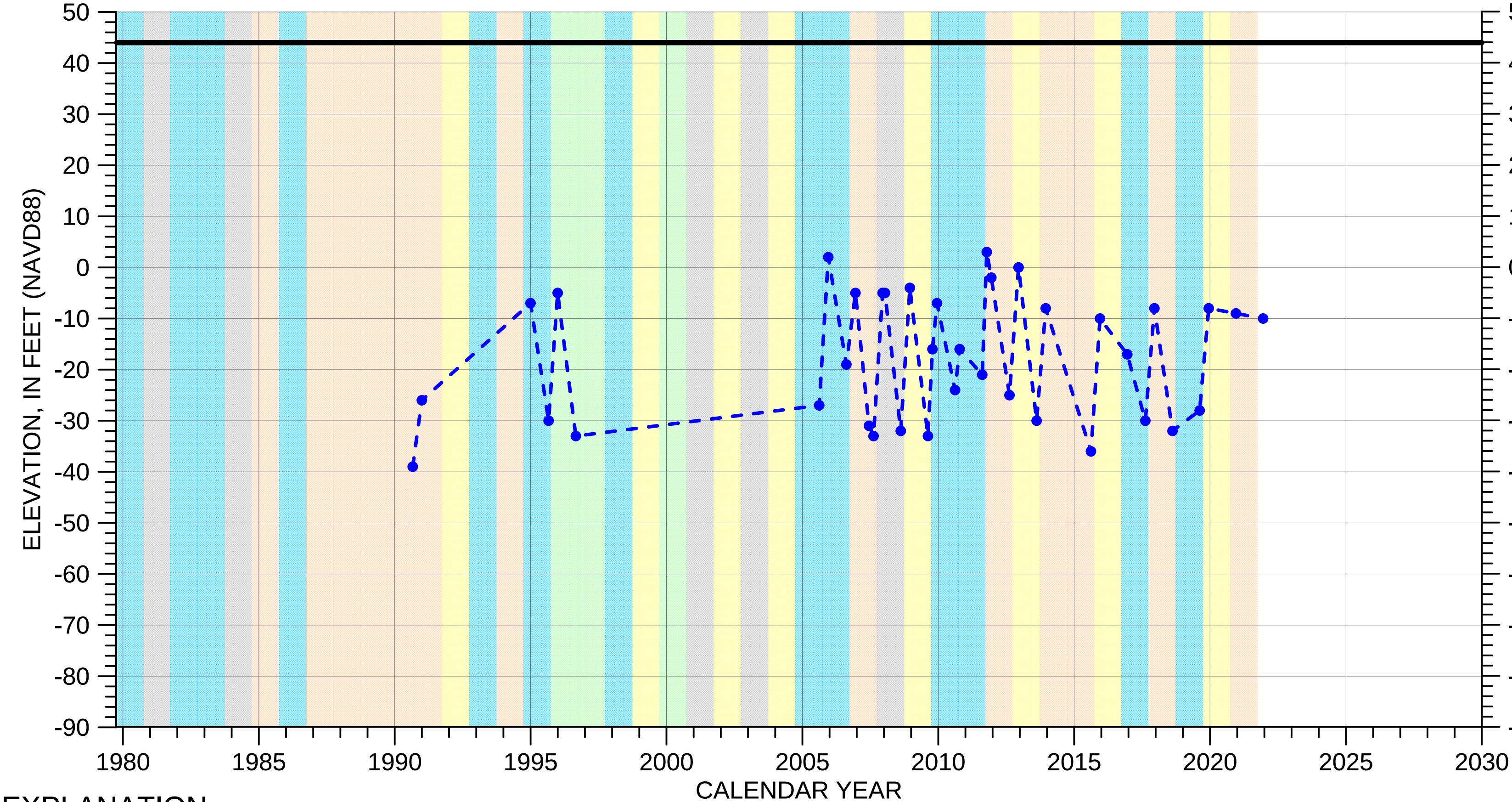
WATER YEAR TYPE DESIGNATION

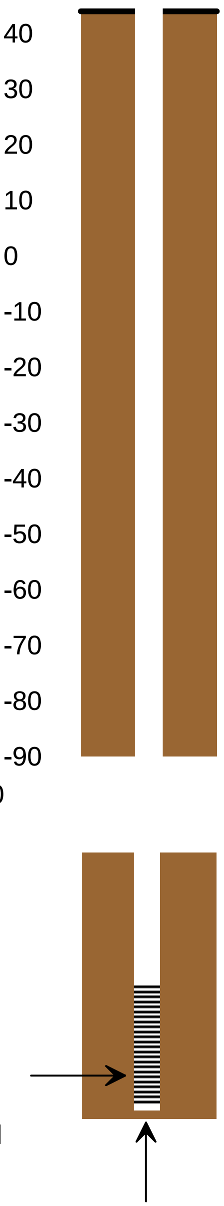
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch5\14S_03E-31F01.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/03E-31L01

180/400-Foot Aquifer Subbasin

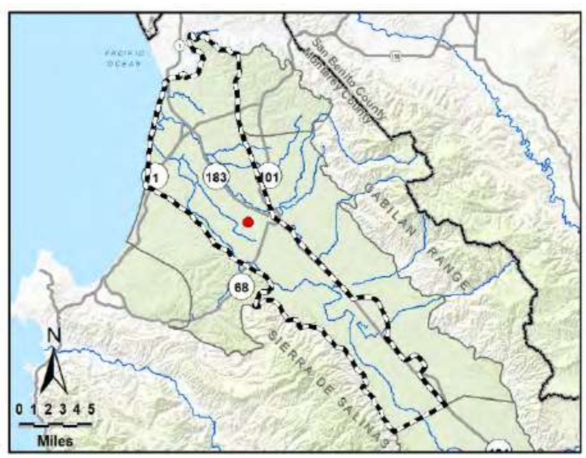




\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch5\14S_03E-31L01.grf

EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface

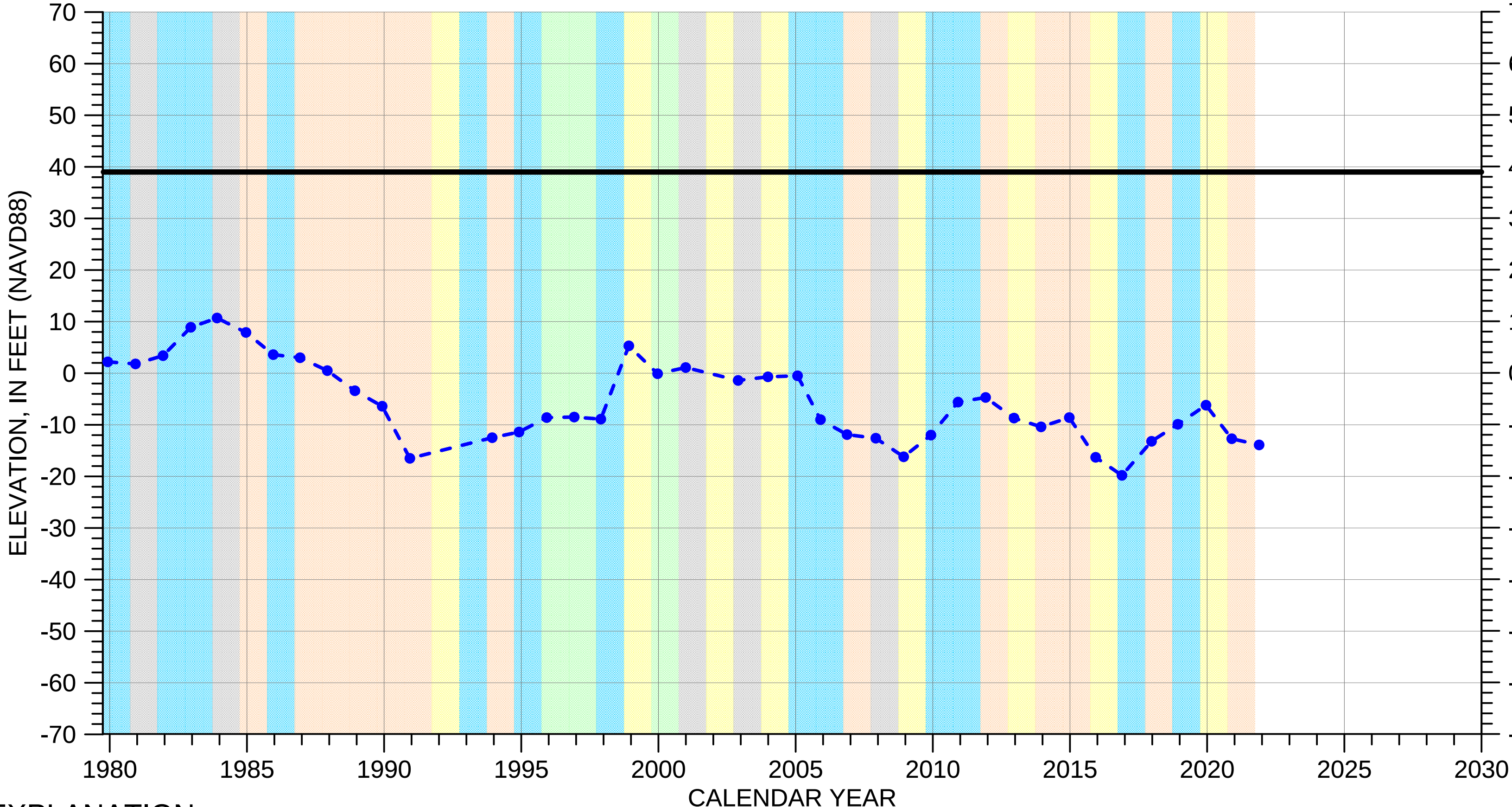


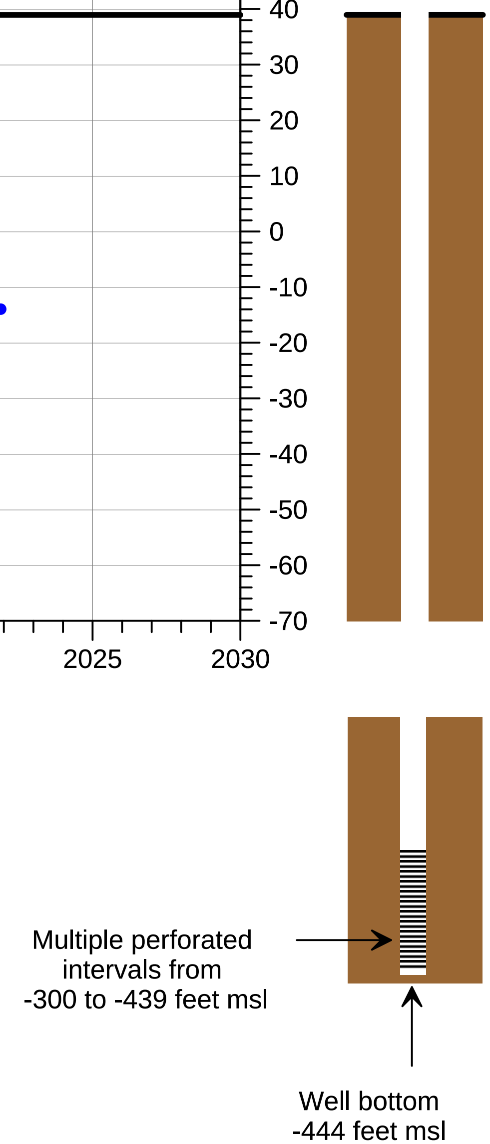
WATER YEAR TYPE DESIGNATION

- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 15S/02E-01A03

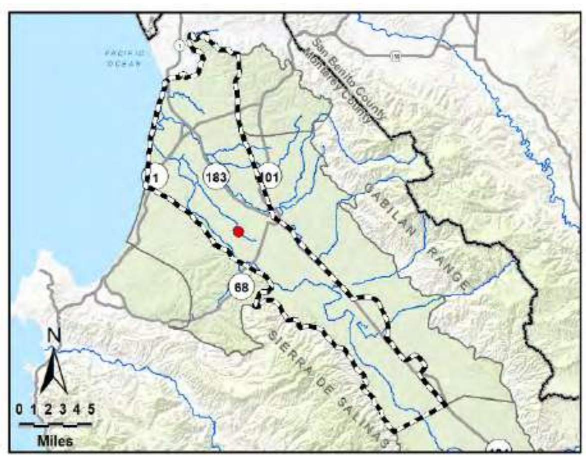
180/400-Foot Aquifer Subbasin





EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface



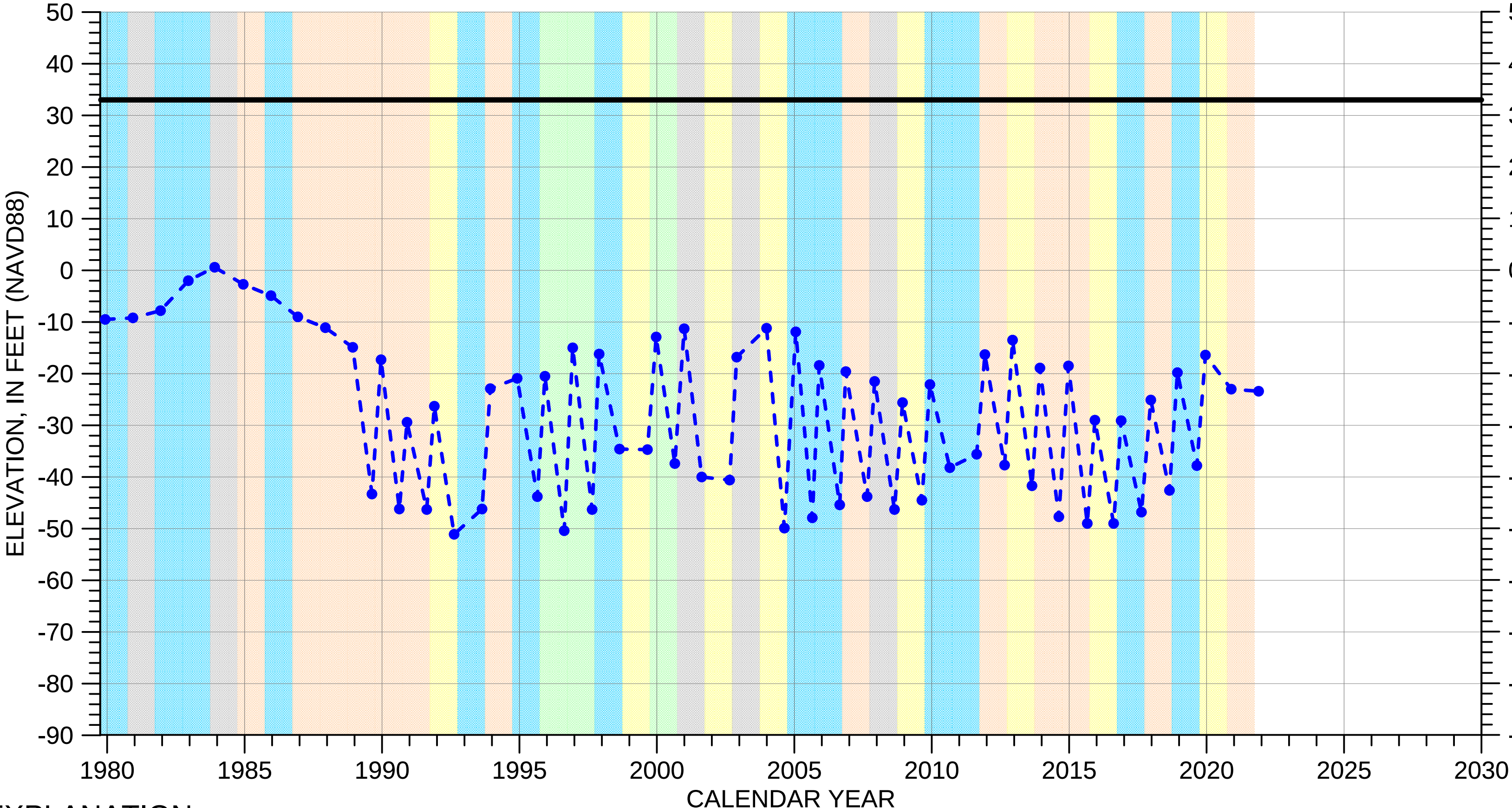
WATER YEAR TYPE DESIGNATION

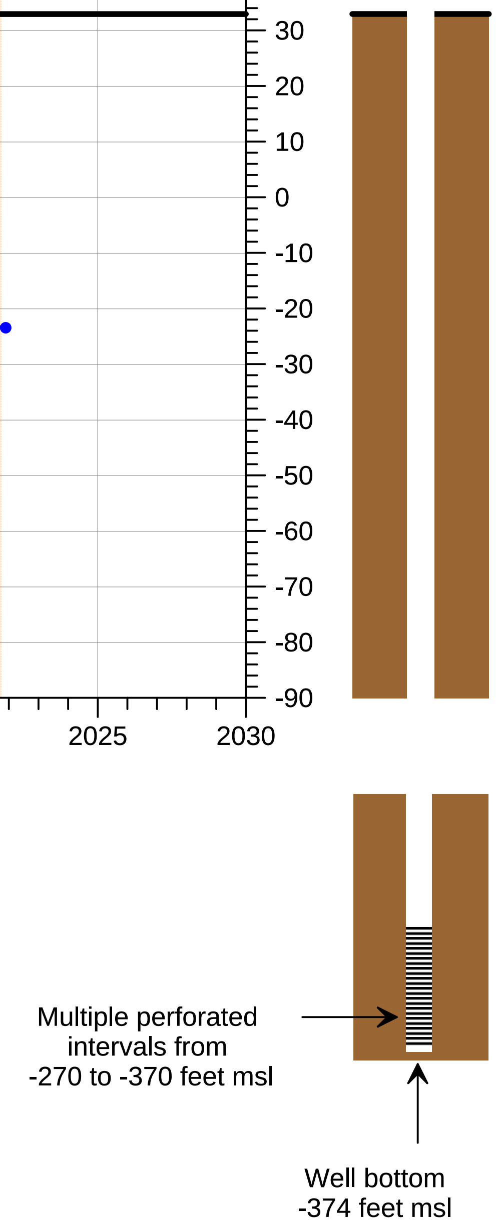
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRA\NEWGRFs_Ch5\15S_02E-01A03.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 15S/02E-02G01

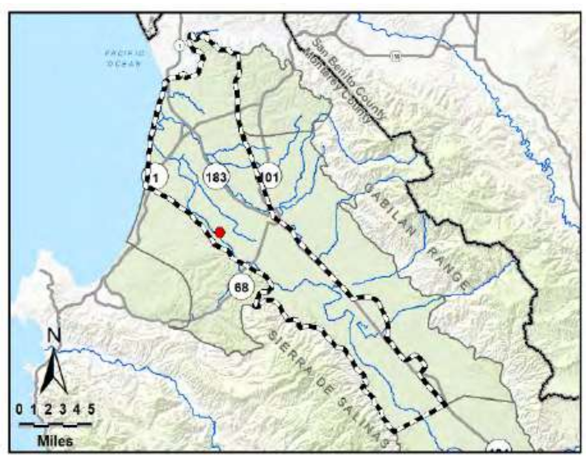
180/400-Foot Aquifer Subbasin





EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface



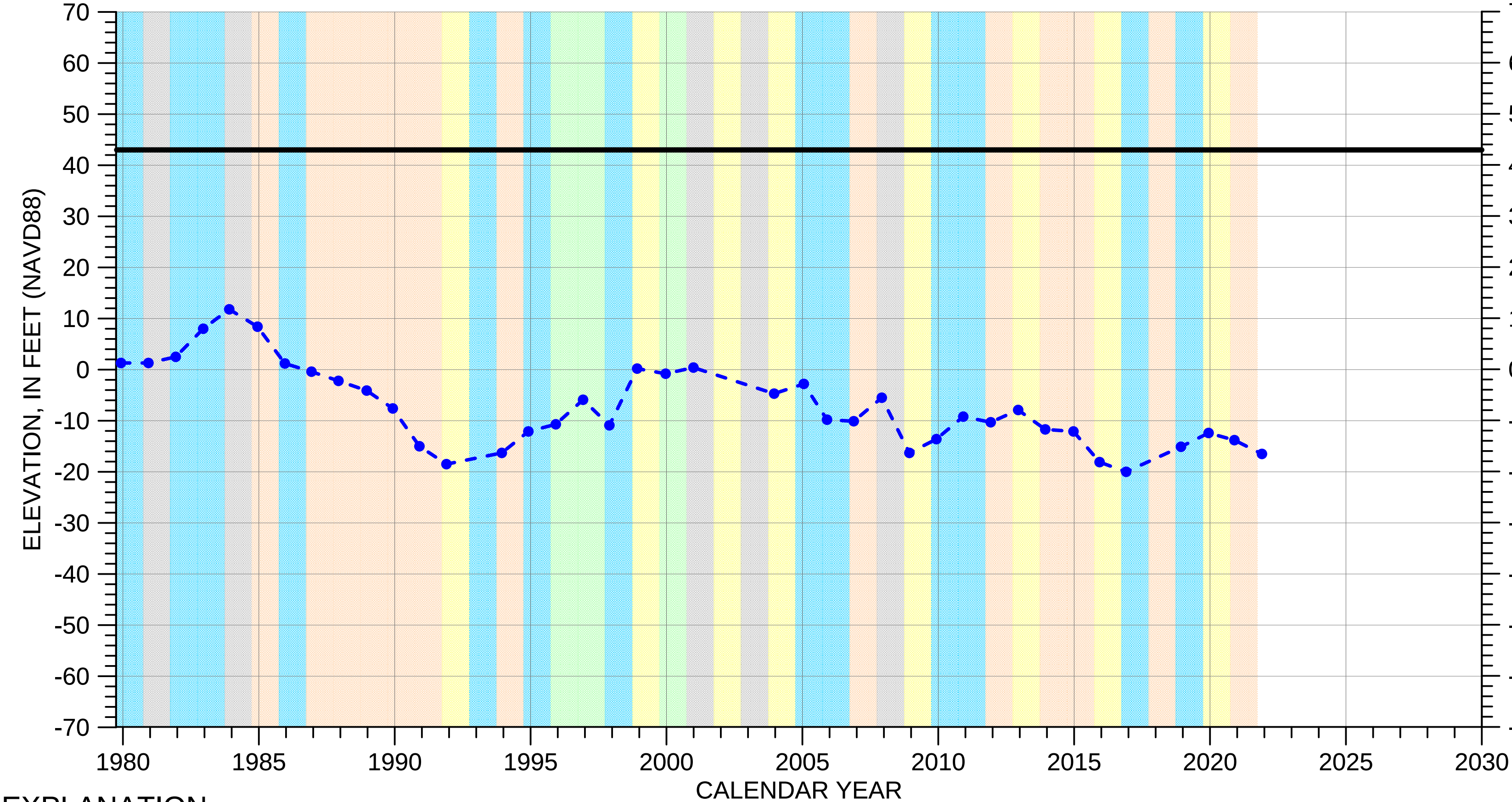
WATER YEAR TYPE DESIGNATION

- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRA\NEWGRFs_Ch5\15S_02E-02G01.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 15S/02E-12A01

180/400-Foot Aquifer Subbasin

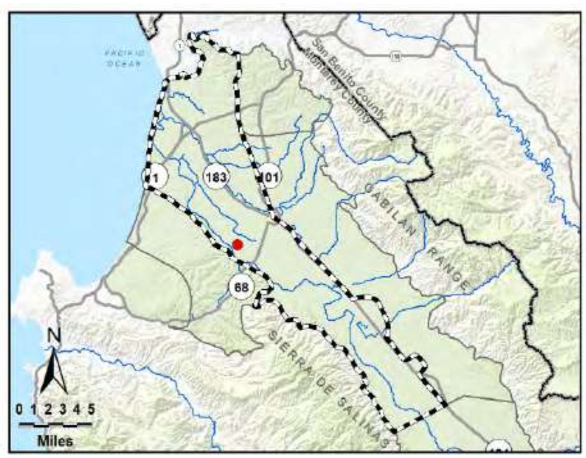


Multiple perforated intervals from -383 to -464 feet msl

Well bottom -506 feet msl

EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface



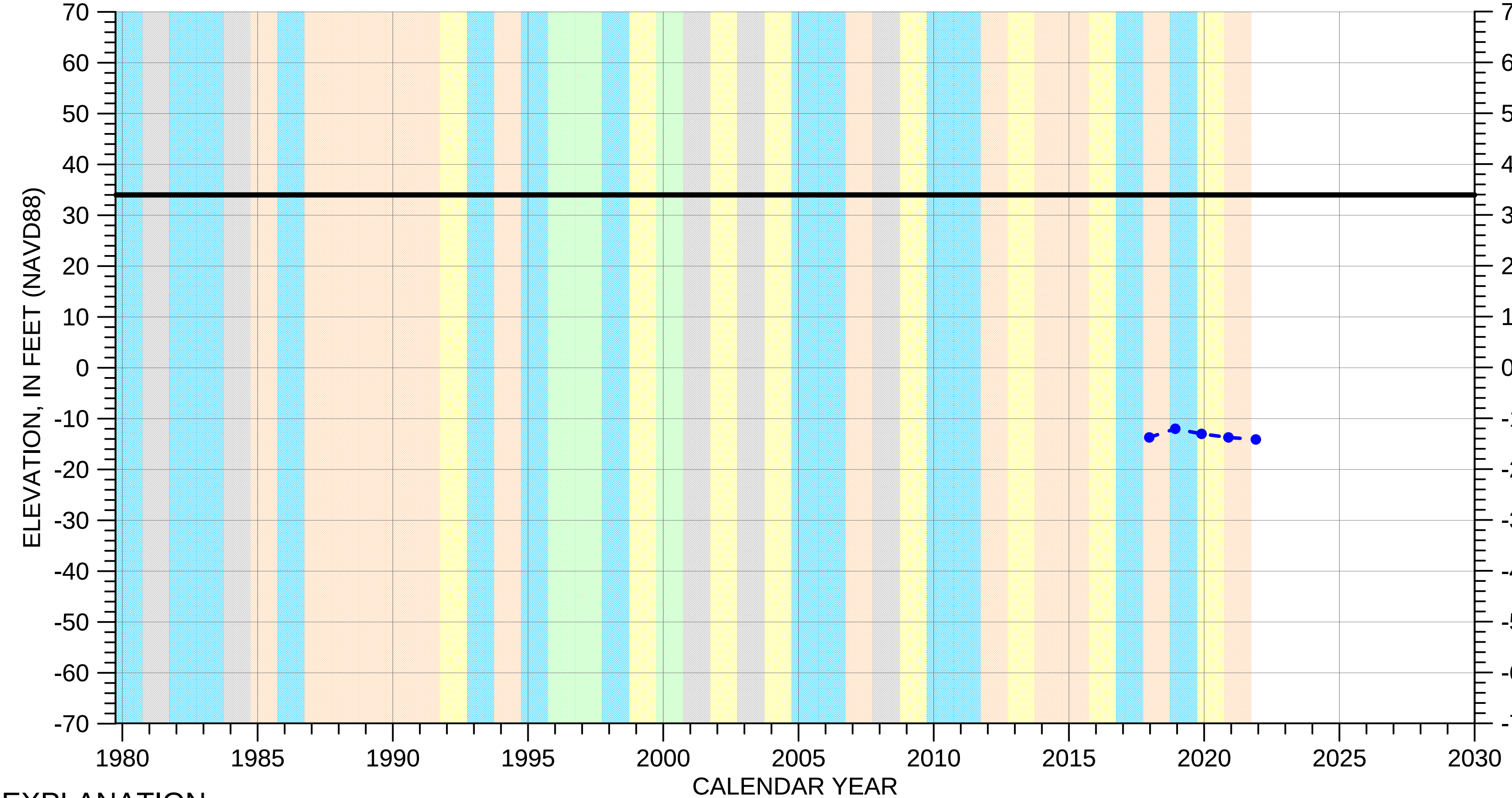
WATER YEAR TYPE DESIGNATION

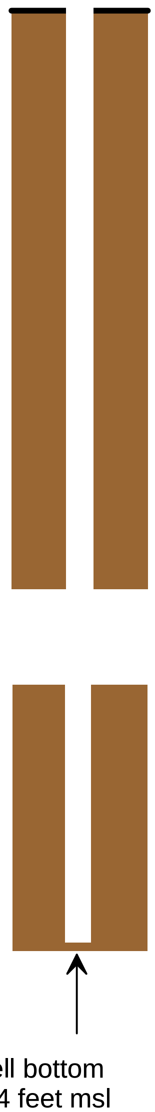
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch5\15S_02E-12A01.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 15S/02E-12C01

180/400-Foot Aquifer Subbasin



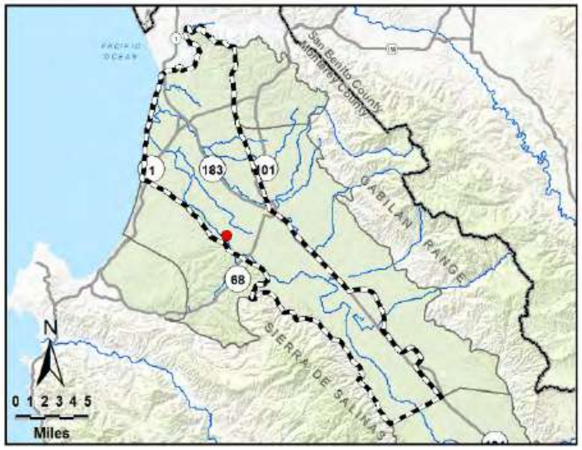


EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface

WATER YEAR TYPE DESIGNATION

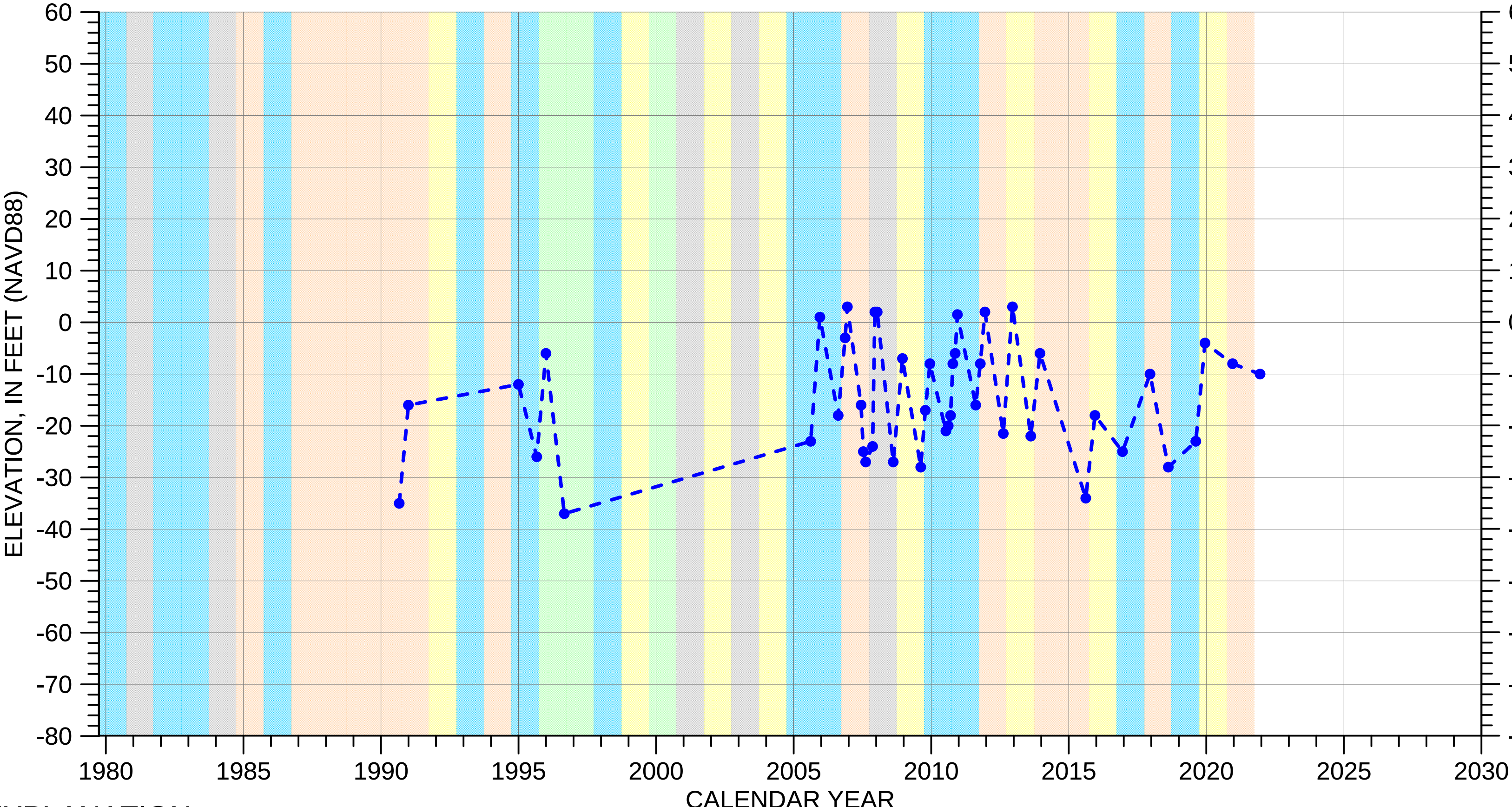
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET



\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRA\NEWGRFs_Ch5\15S_02E-12C01.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 15S/03E-03R02

180/400-Foot Aquifer Subbasin

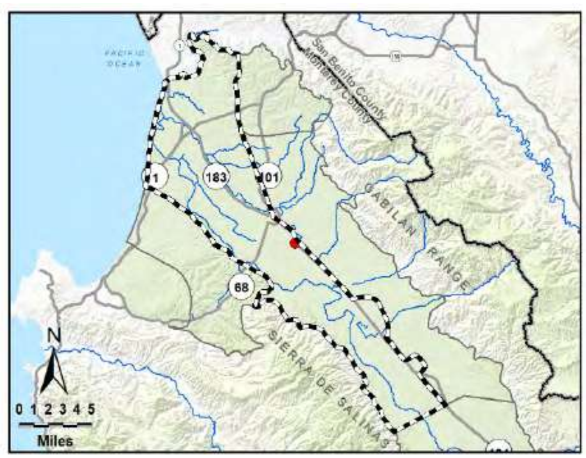


EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface (63 FT MSL)

WATER YEAR TYPE DESIGNATION

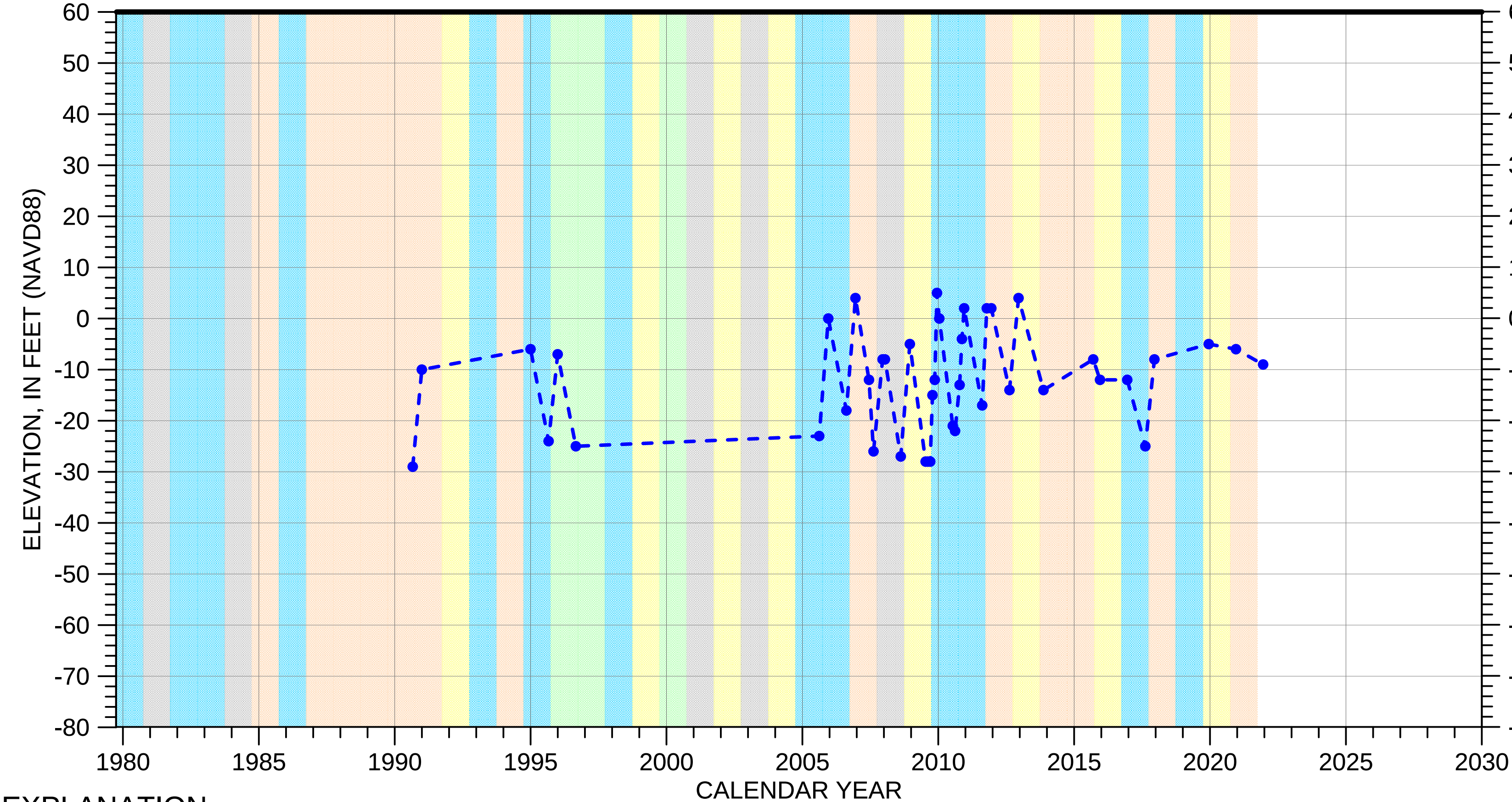
DRY
DRY - NORMAL
NORMAL
WET - NORMAL
WET



\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch5\15S_03E-03R02.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 15S/03E-04Q01

180/400-Foot Aquifer Subbasin

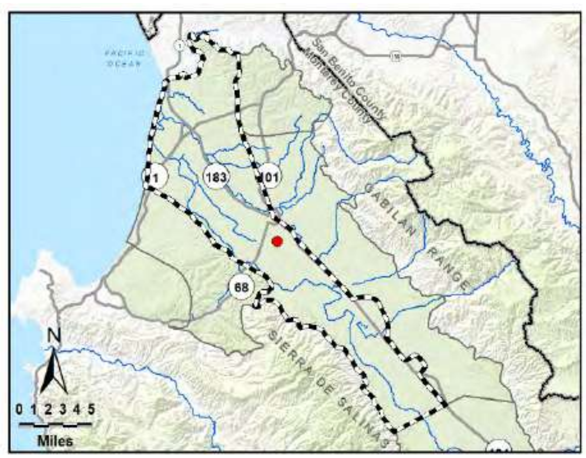


EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface

WATER YEAR TYPE DESIGNATION

- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET



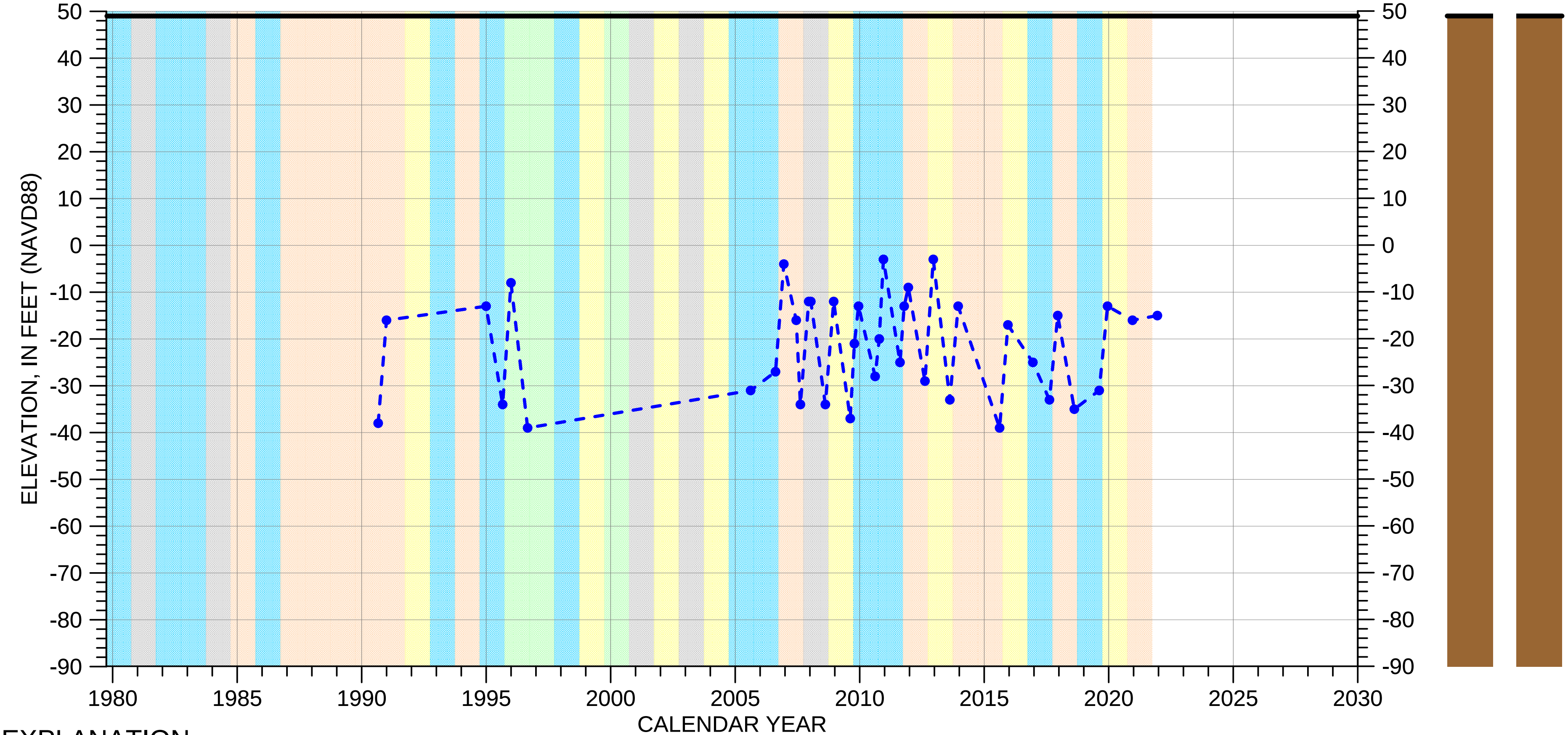
Multiple perforated intervals from -248 to -458 feet msl

Well bottom -478 feet msl

\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch5\15S_03E-04Q01.grf

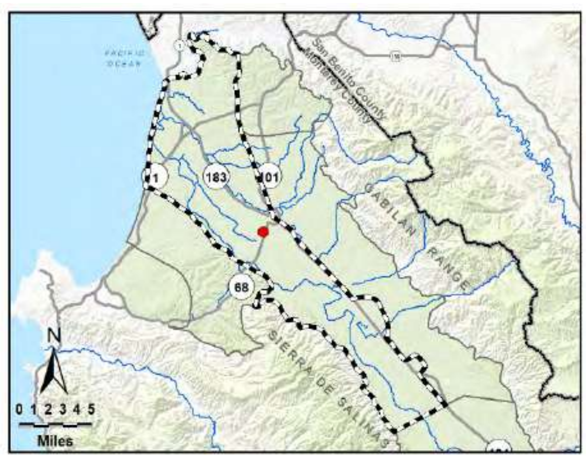
HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 15S/03E-05C02

180/400-Foot Aquifer Subbasin



EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface



Multiple perforated intervals from -312 to -392 feet msl

Well bottom -569 feet msl

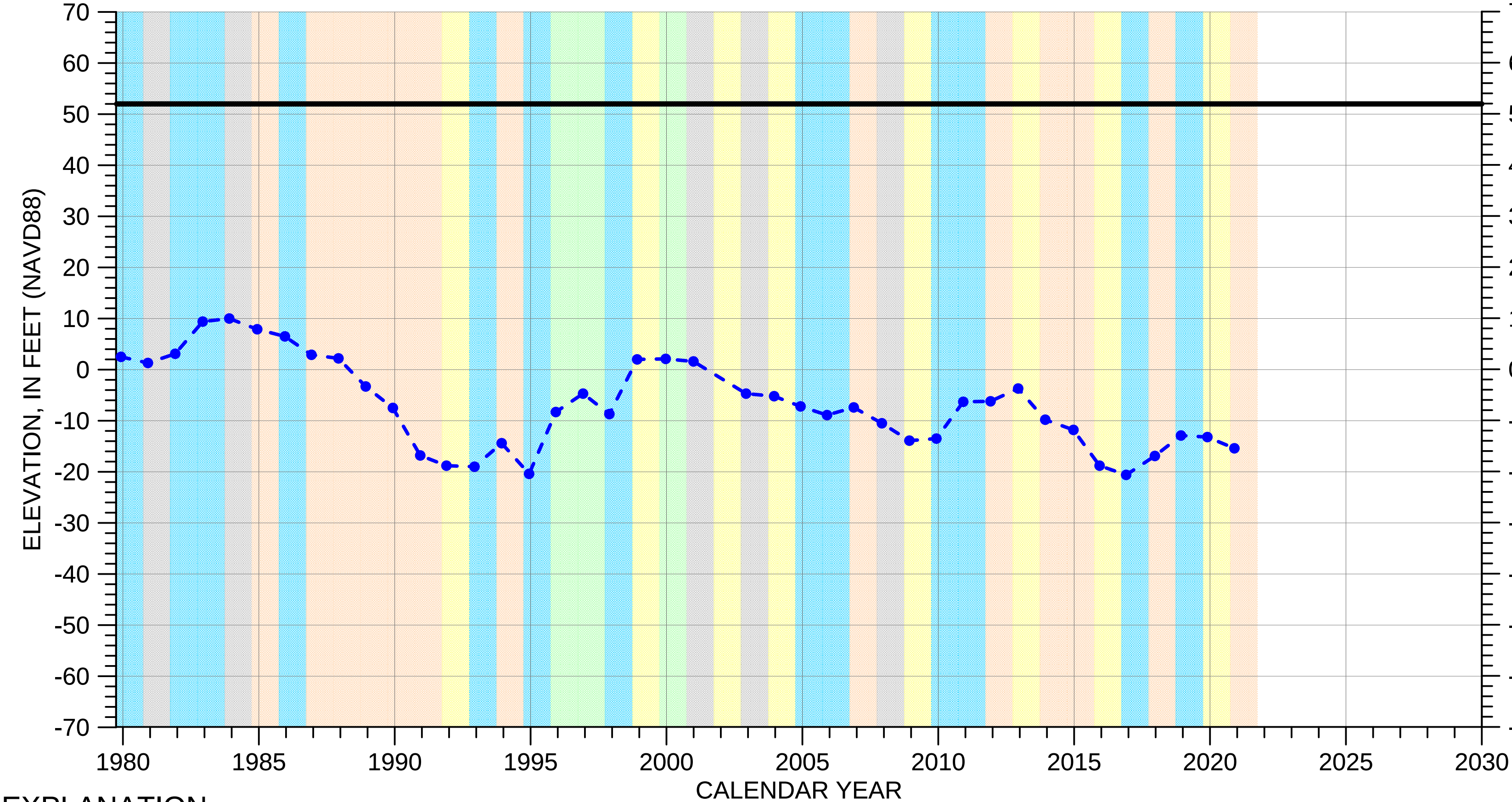
WATER YEAR TYPE DESIGNATION

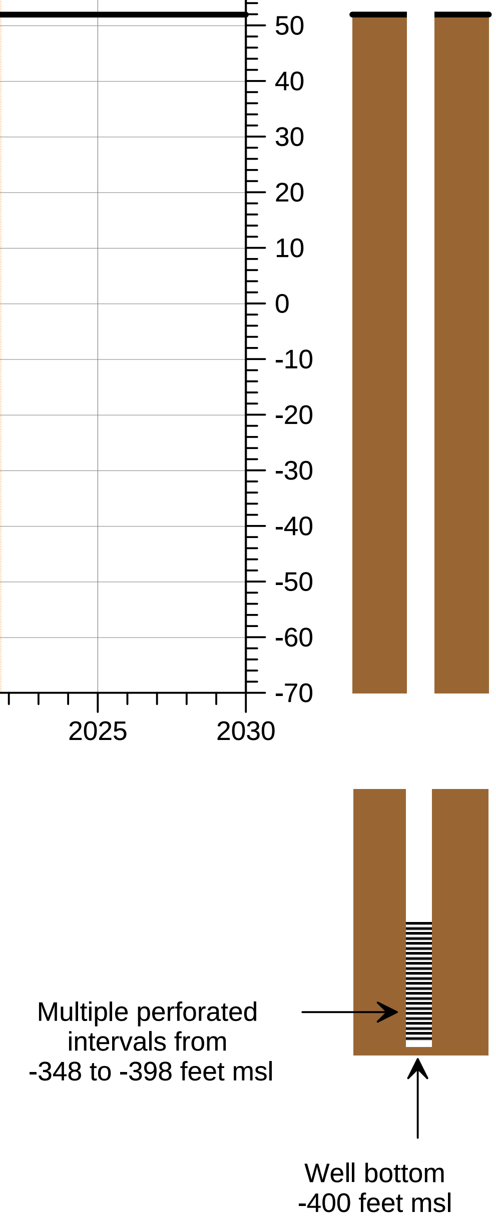
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRA\NEWGRFs_Ch5\15S_03E-05C02.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 15S/03E-08F01

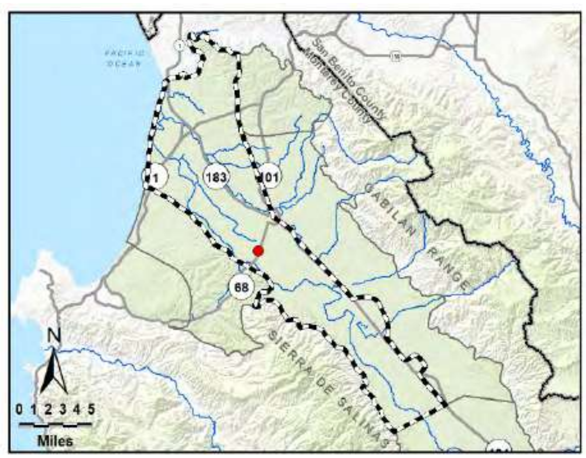
180/400-Foot Aquifer Subbasin





EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface



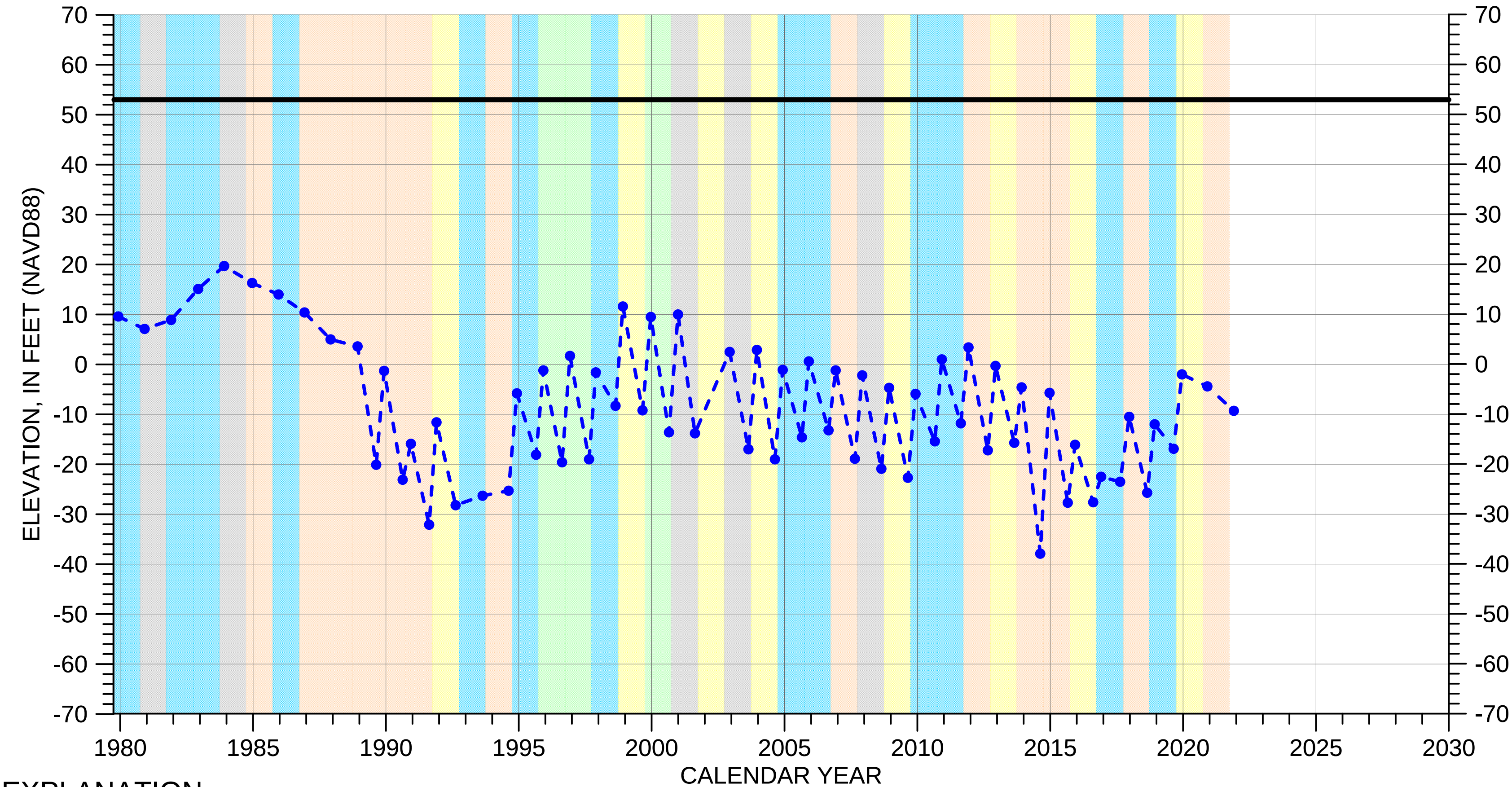
WATER YEAR TYPE DESIGNATION

- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch5\15S_03E-08F01.grf

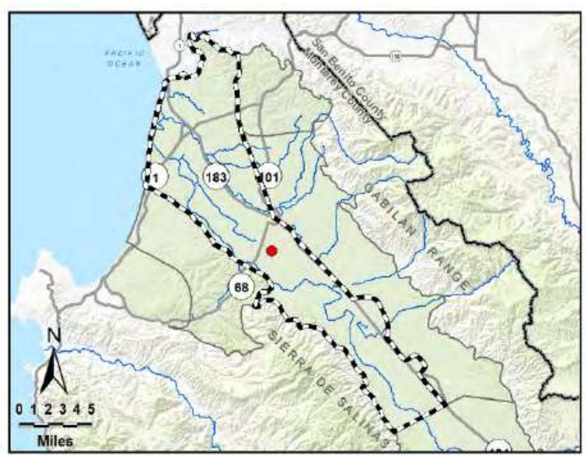
HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 15S/03E-09E03

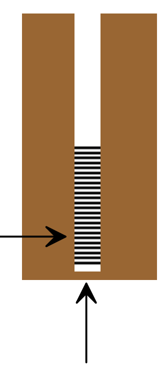
180/400-Foot Aquifer Subbasin



EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface





Multiple perforated intervals from -131 to -192 feet msl

Well bottom -195 feet msl

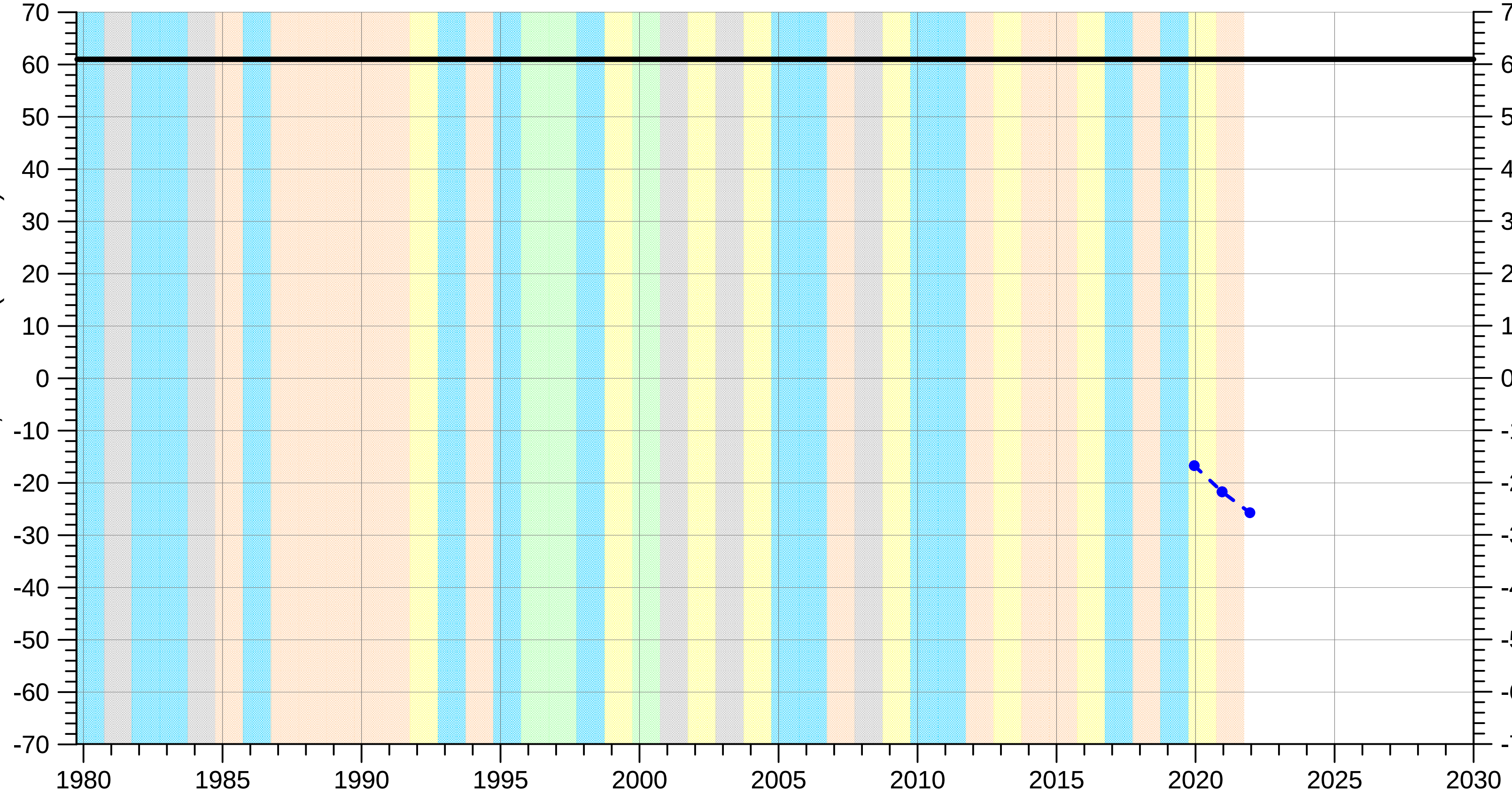
WATER YEAR TYPE DESIGNATION

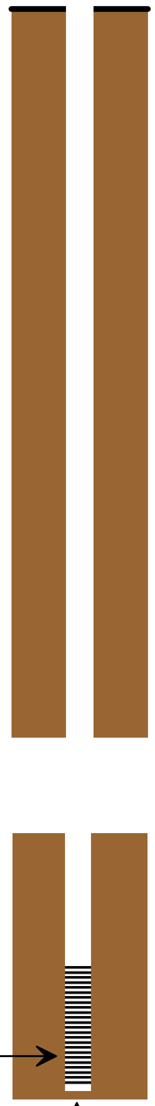
DRY	WET - NORMAL
DRY - NORMAL	WET
NORMAL	

\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRA\NEWGRFs_Ch5\15S_03E-09E03.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 15S/03E-10D04

180/400-Foot Aquifer Subbasin

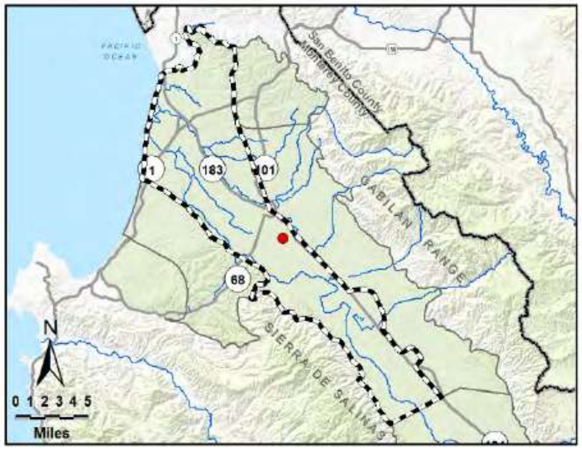




\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEW\GRFs_Ch5\15S_03E-10D04.grf

EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface

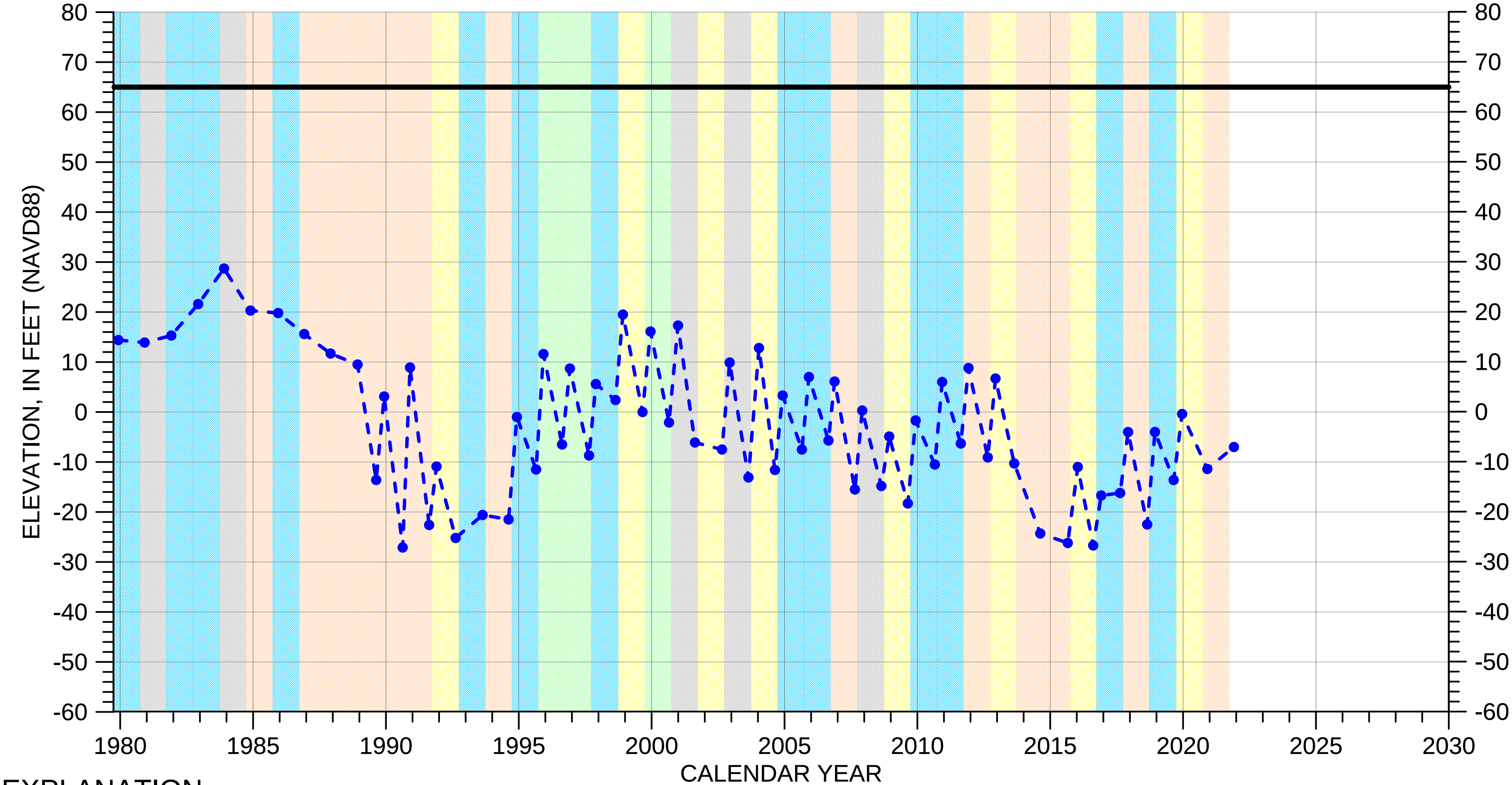


WATER YEAR TYPE DESIGNATION

- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 15S/03E-13N01

180/400-Foot Aquifer Subbasin

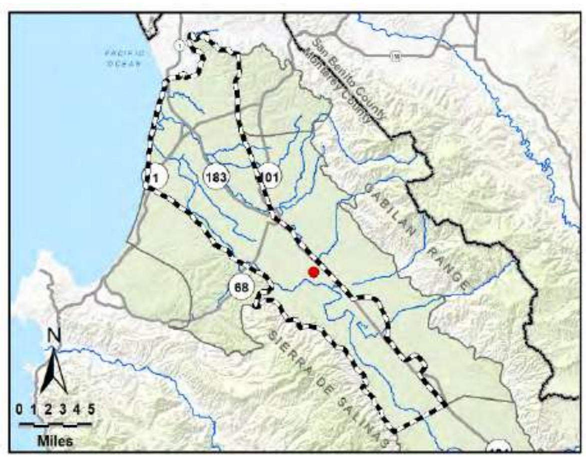


EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface

WATER YEAR TYPE DESIGNATION

- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET



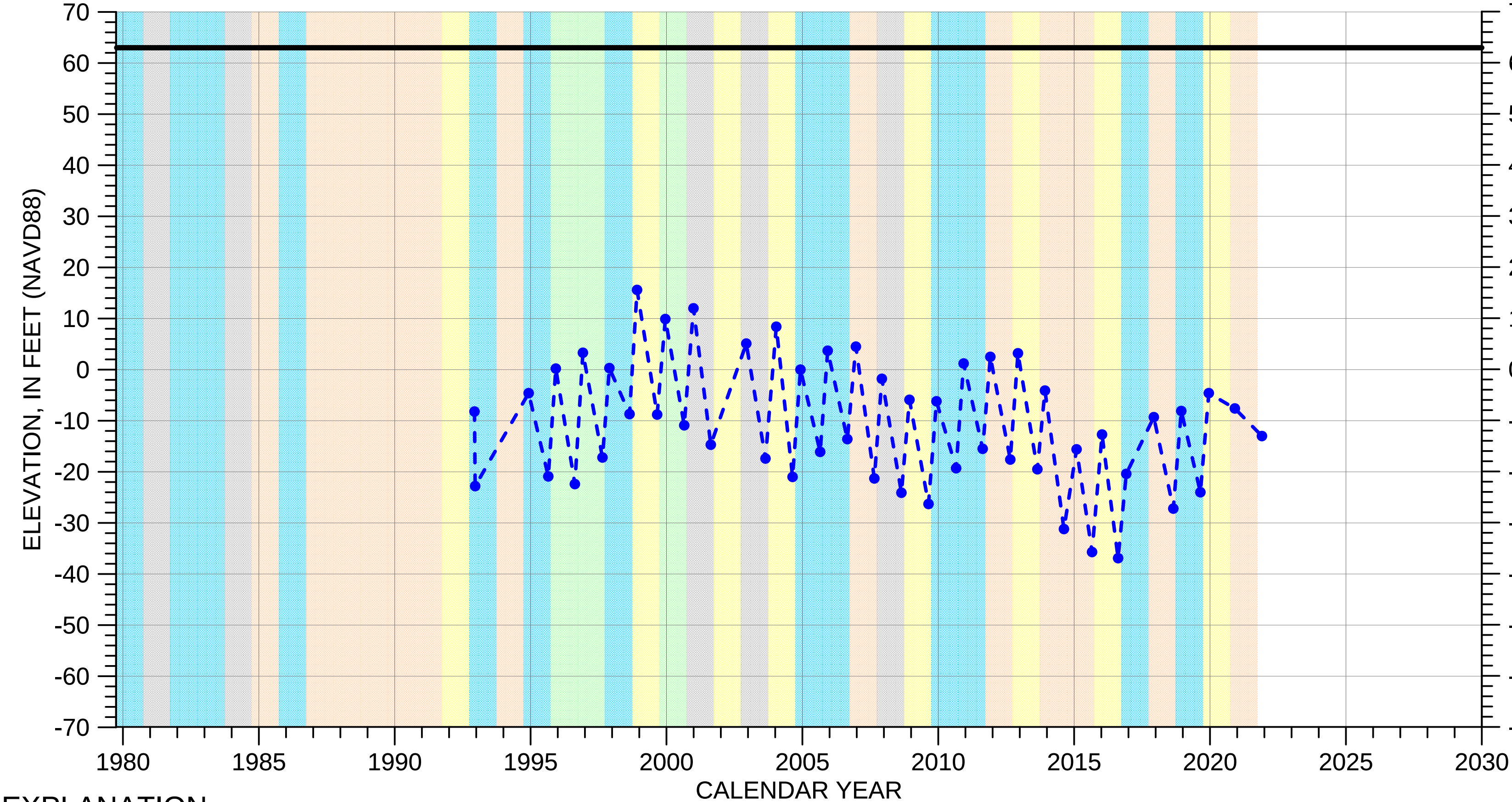
Multiple perforated intervals from -149 to -205 feet msl

Well bottom -208 feet msl

\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch5\15S_03E-13N01.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 15S/03E-14P02

180/400-Foot Aquifer Subbasin



EXPLANATION

Groundwater Elevation

Suspect Measurement

Land Surface

WATER YEAR TYPE DESIGNATION

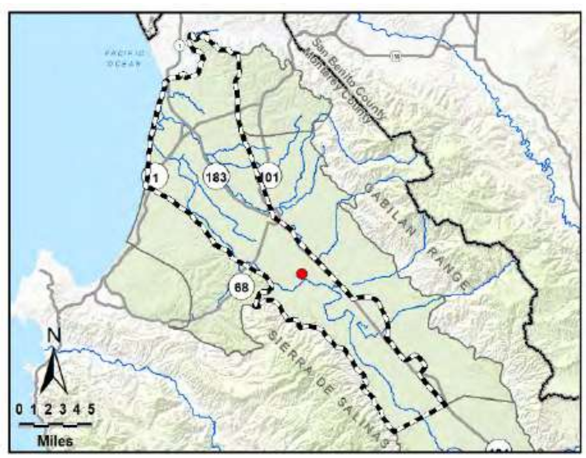
DRY

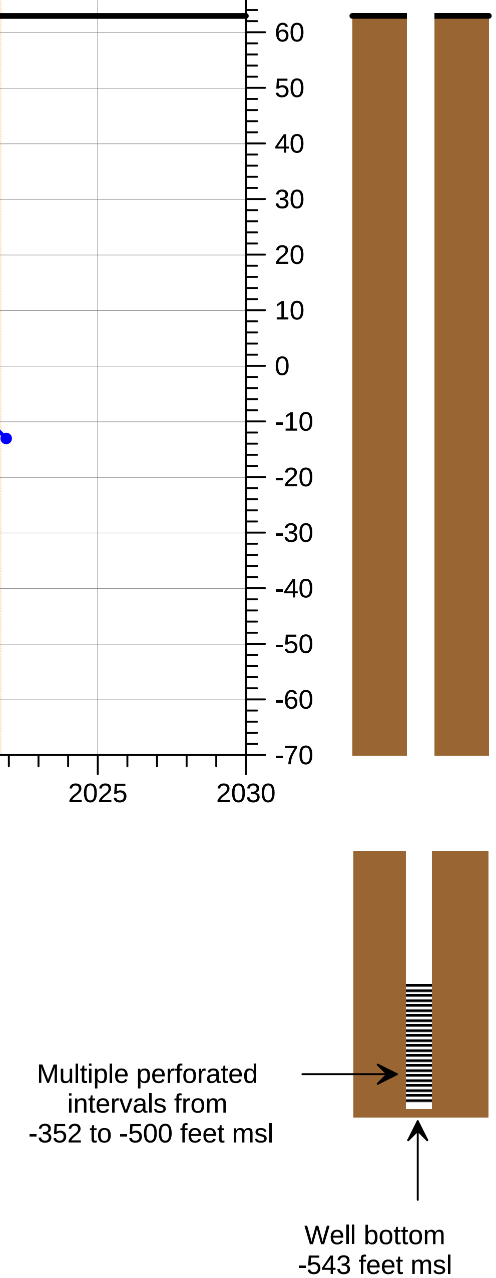
DRY - NORMAL

NORMAL

WET - NORMAL

WET

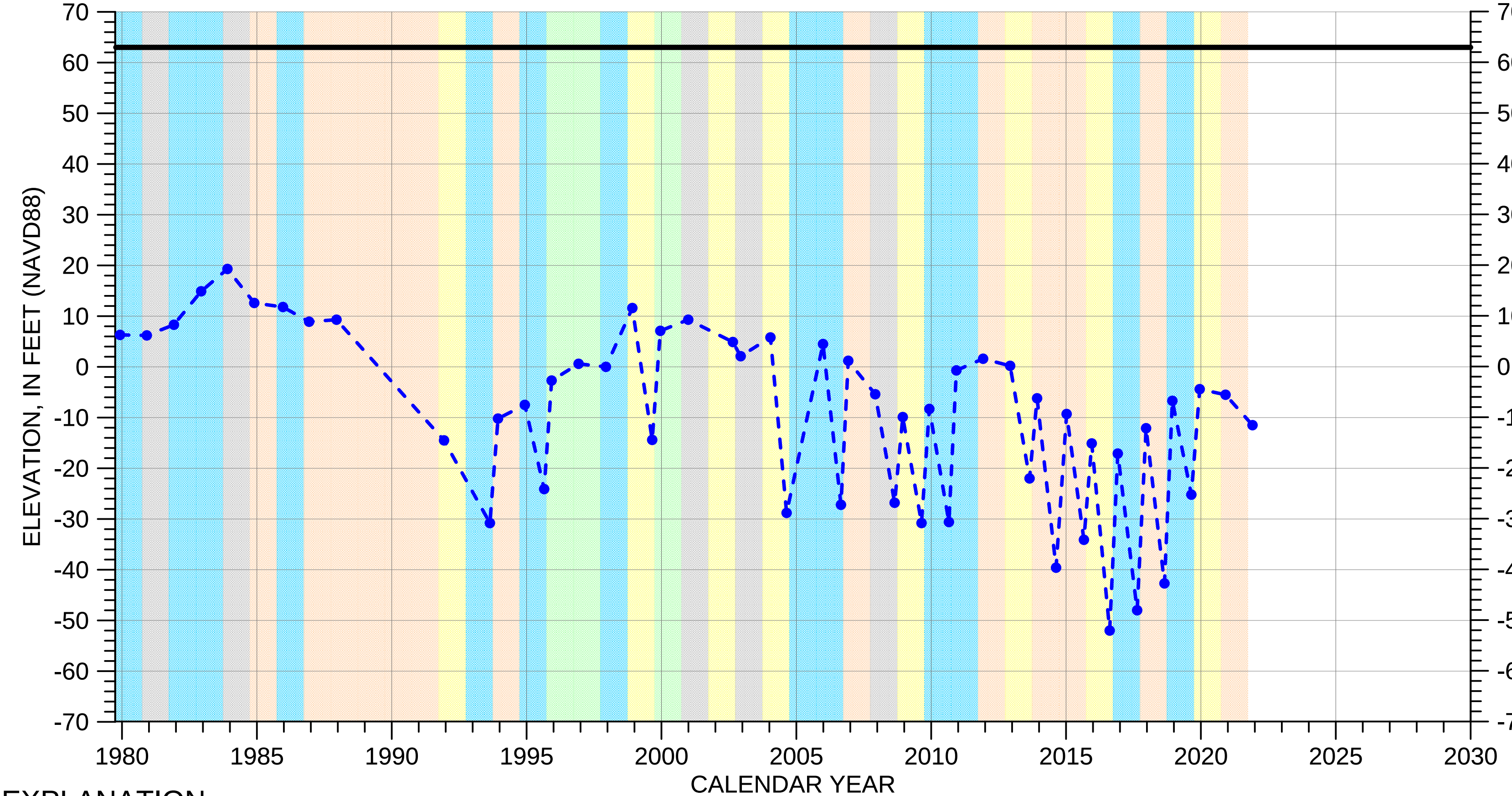


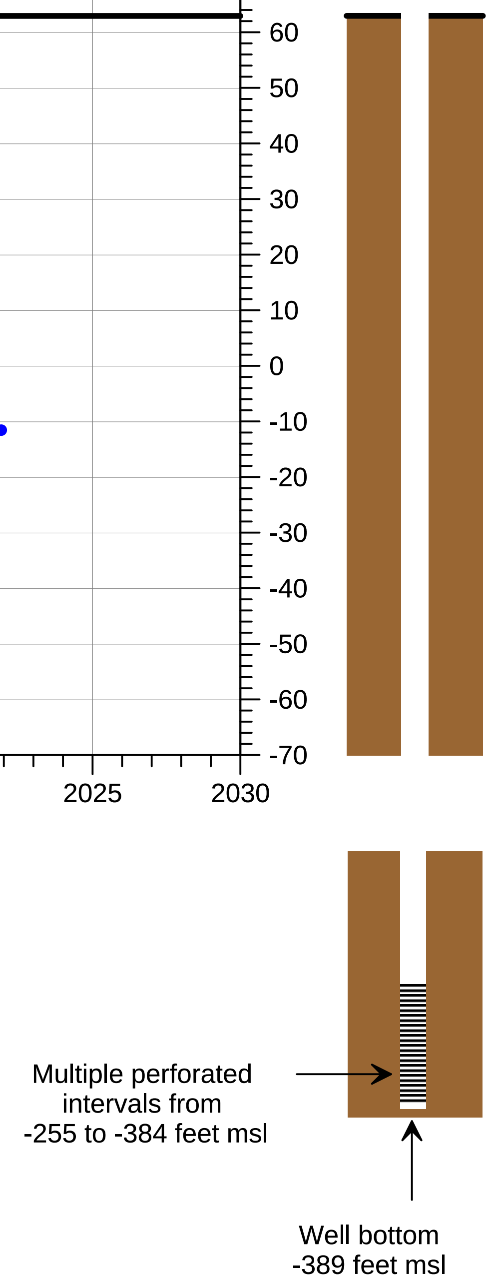


\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch5\15S_03E-14P02.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 15S/03E-15B01

180/400-Foot Aquifer Subbasin



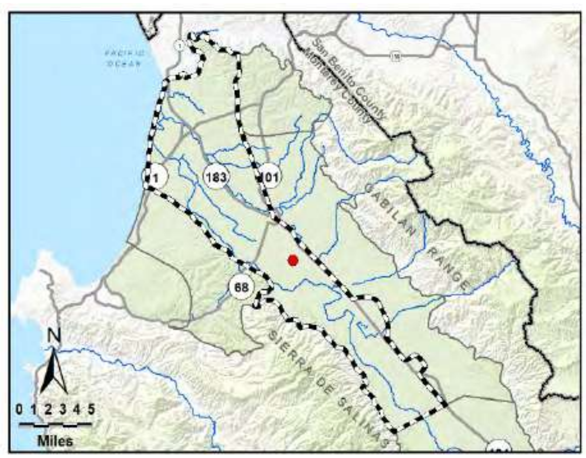


EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface

WATER YEAR TYPE DESIGNATION

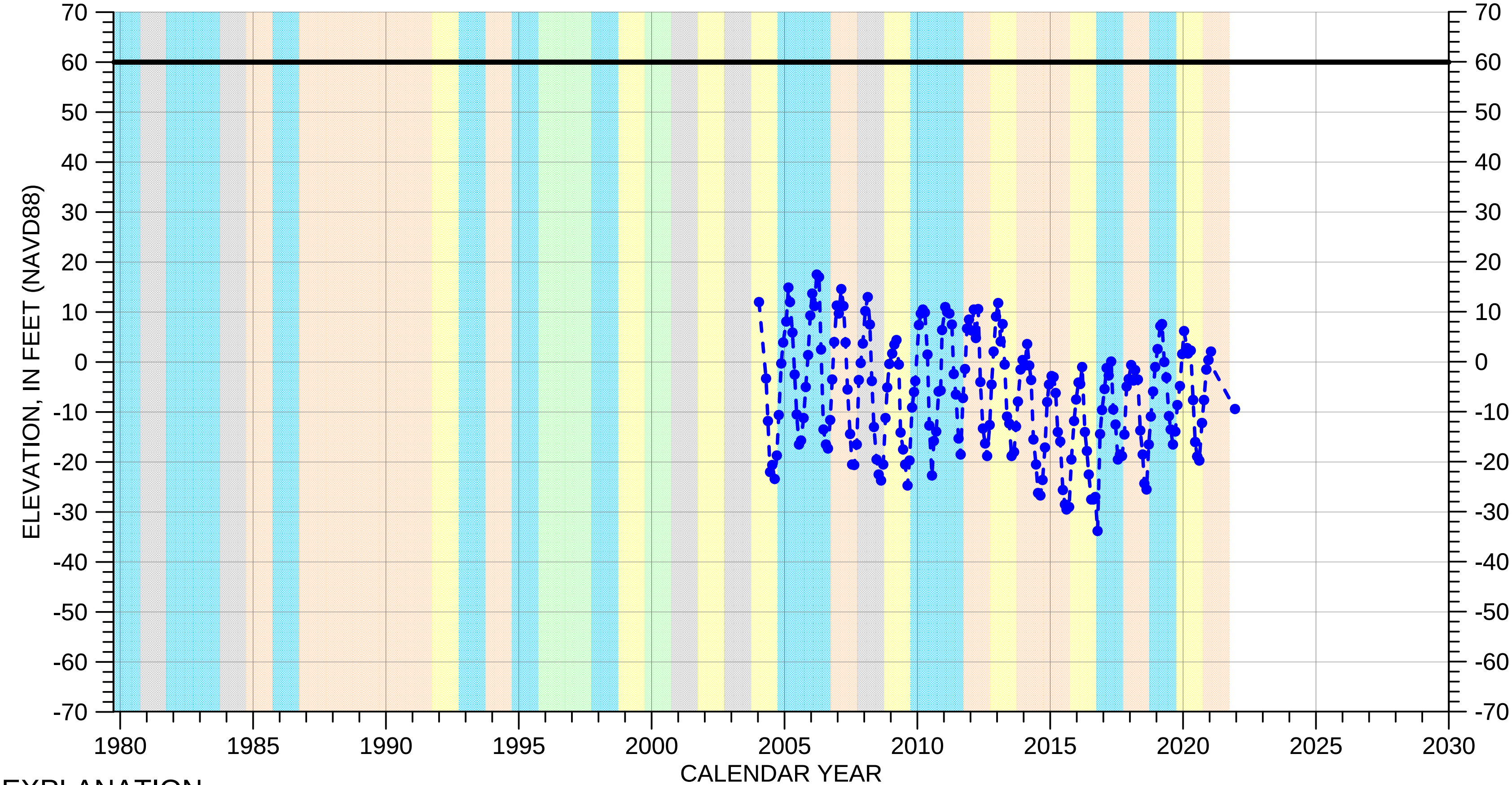
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

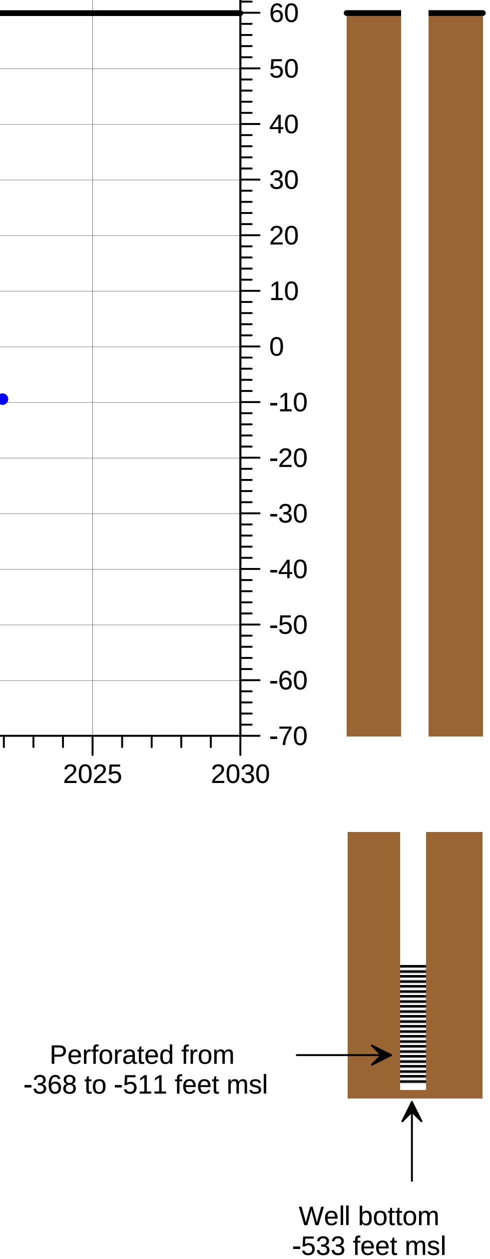


\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch5\15S_03E-15B01.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 15S/03E-16F02

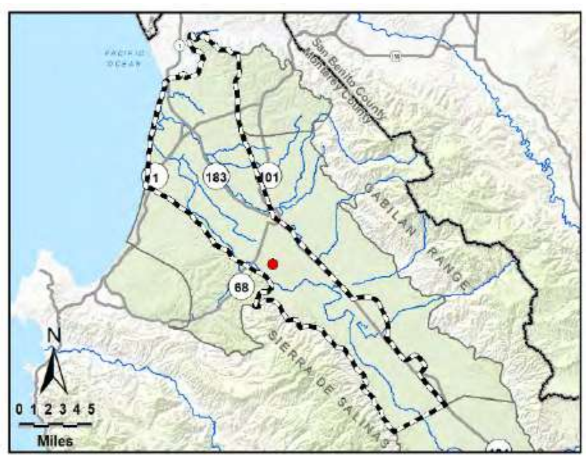
180/400-Foot Aquifer Subbasin





EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface



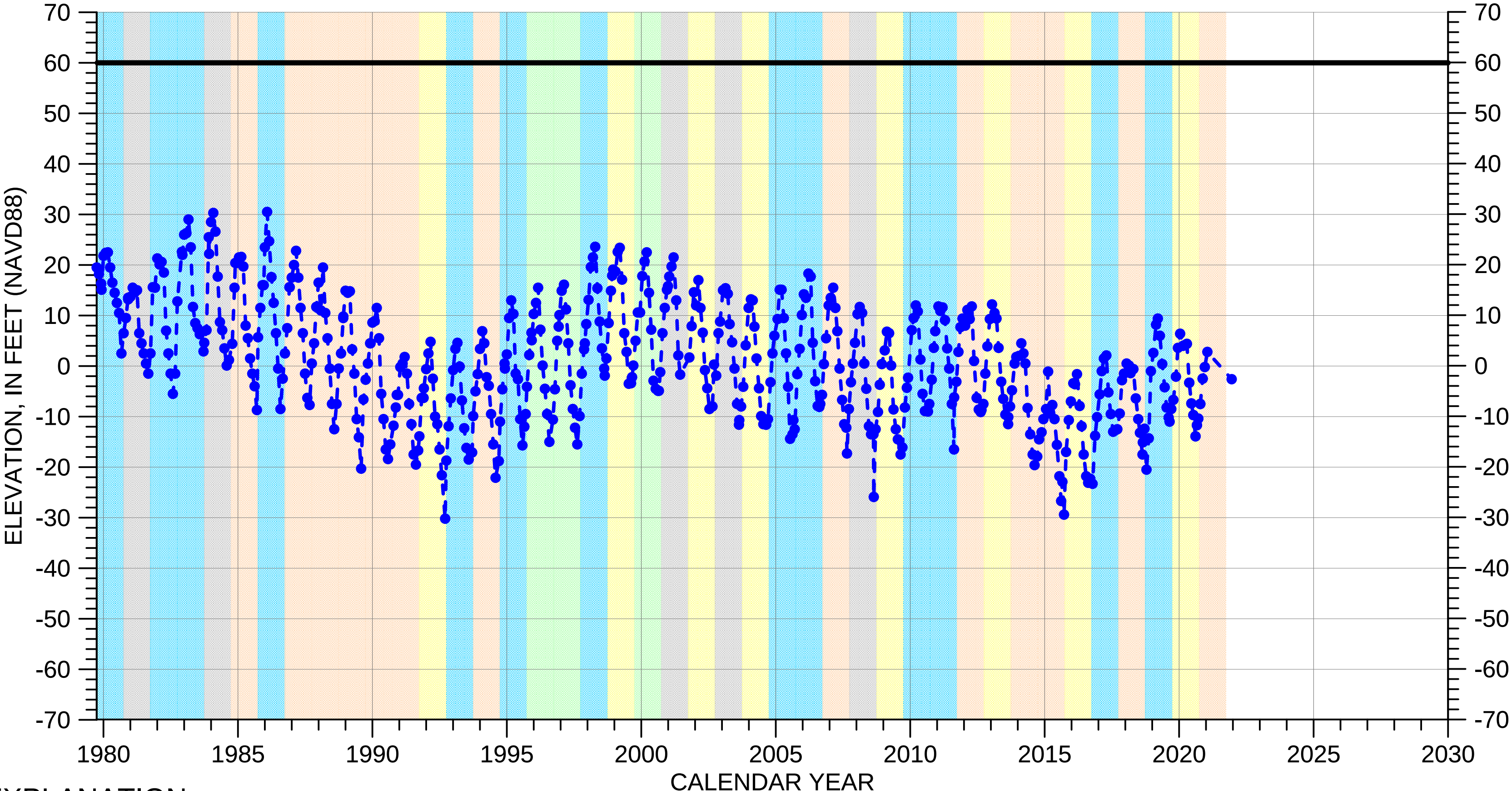
WATER YEAR TYPE DESIGNATION

- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch515S_03E-16F02.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 15S/03E-16M01

180/400-Foot Aquifer Subbasin



EXPLANATION

Groundwater Elevation

Suspect Measurement

Land Surface

WATER YEAR TYPE DESIGNATION

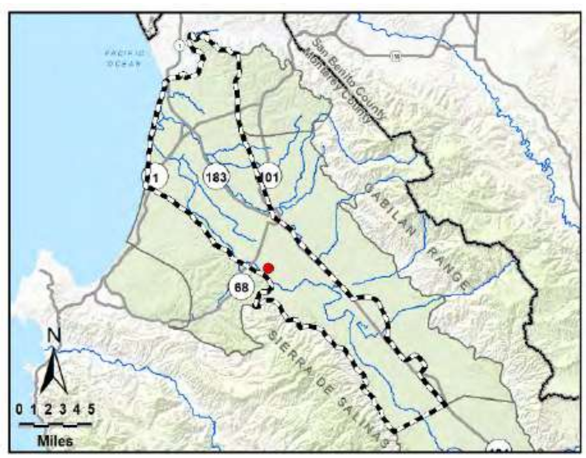
DRY

DRY - NORMAL

NORMAL

WET - NORMAL

WET



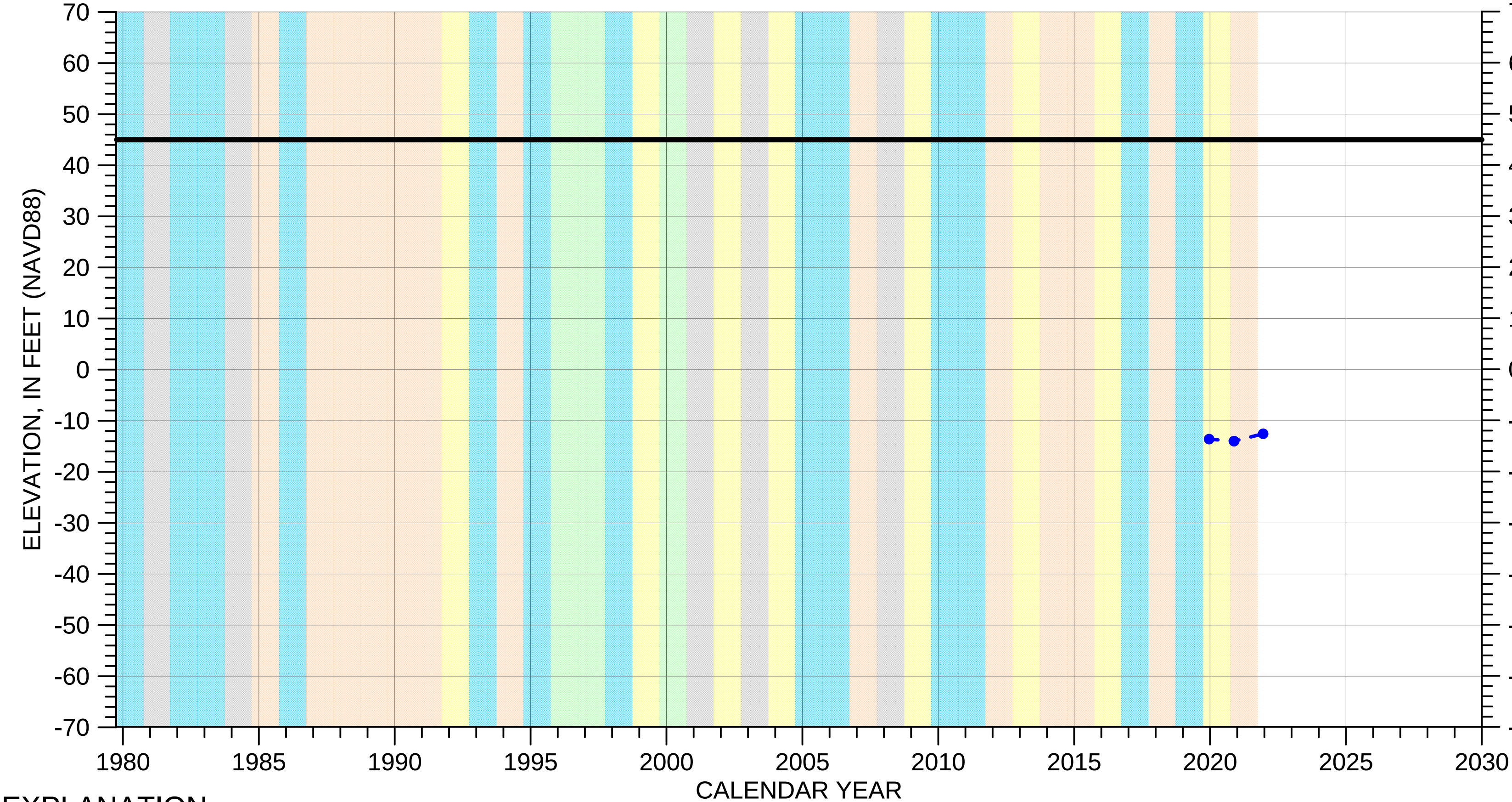
Perforated interval unknown

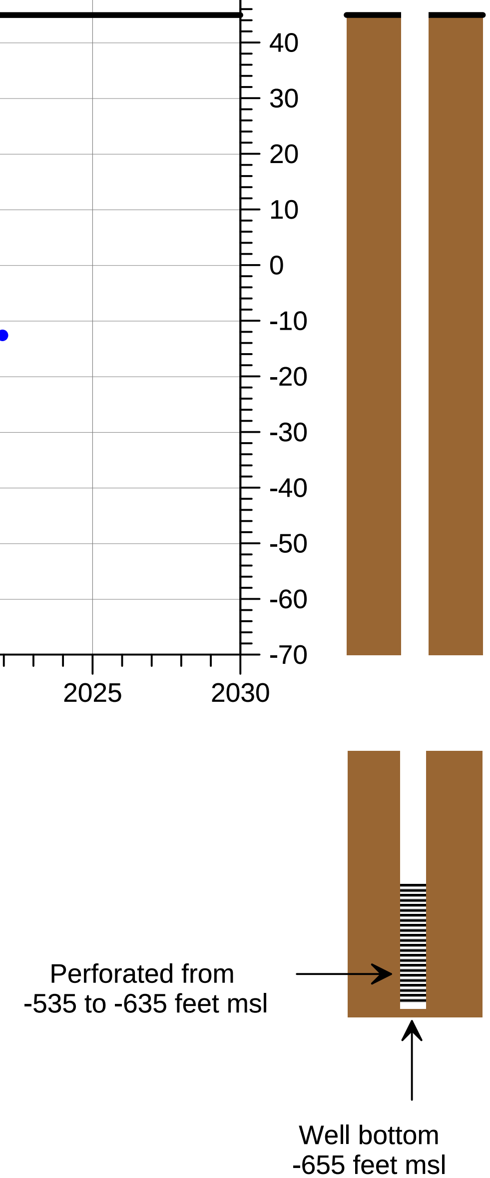
Well bottom elevation unknown

\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEW\GRFs_Ch5\15S_03E-16M01.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 15S/03E-17E02

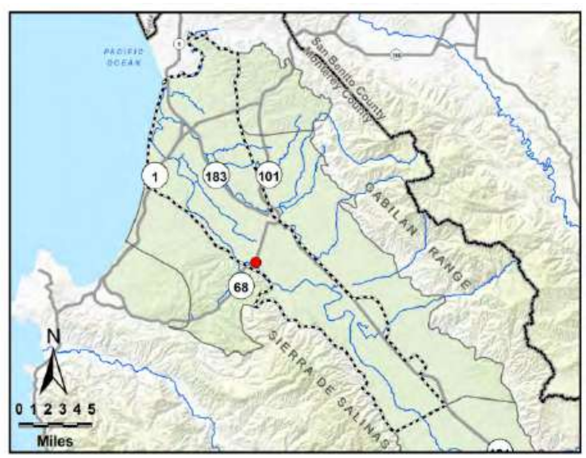
180/400-Foot Aquifer Subbasin





EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface



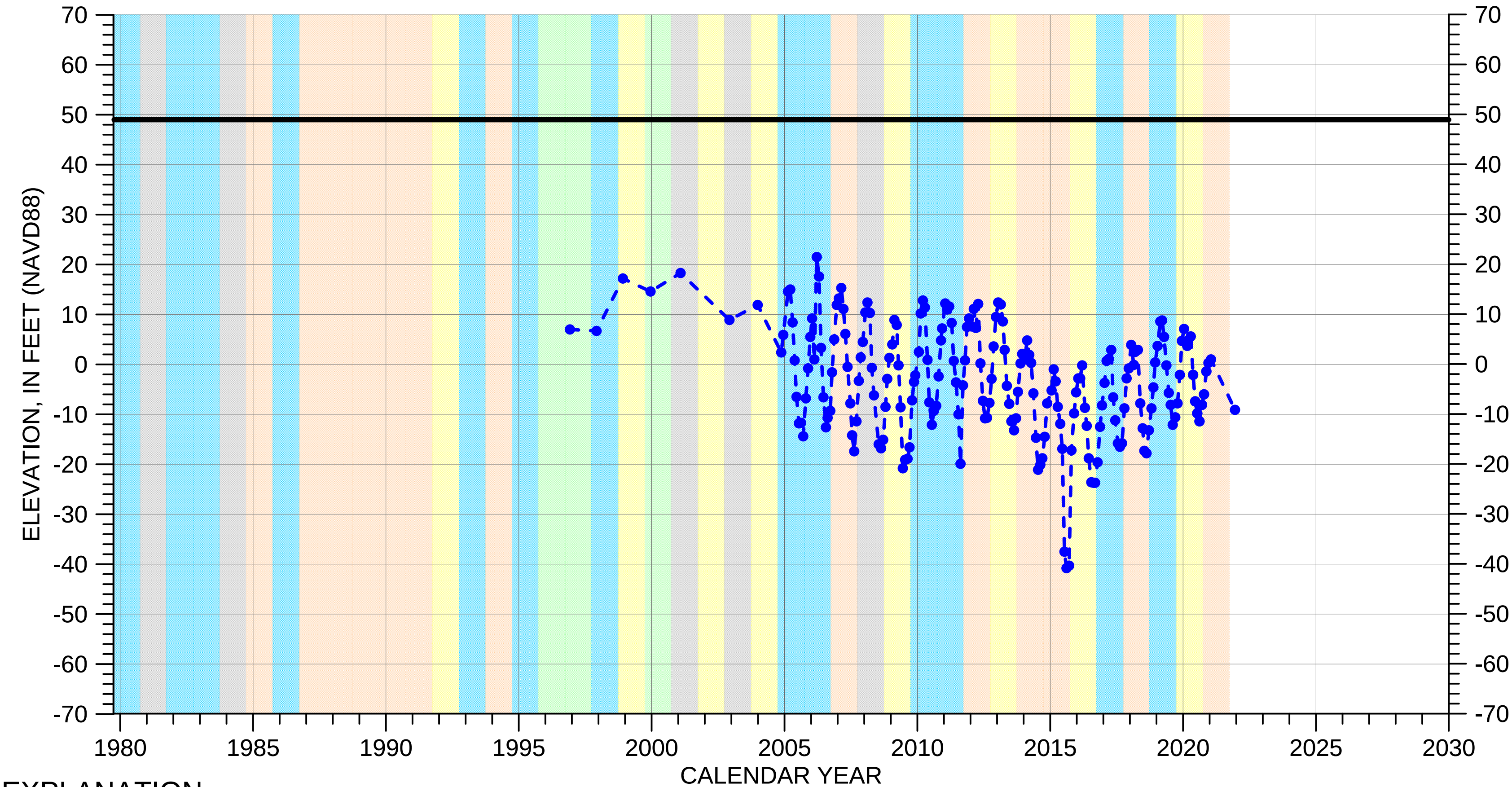
WATER YEAR TYPE DESIGNATION

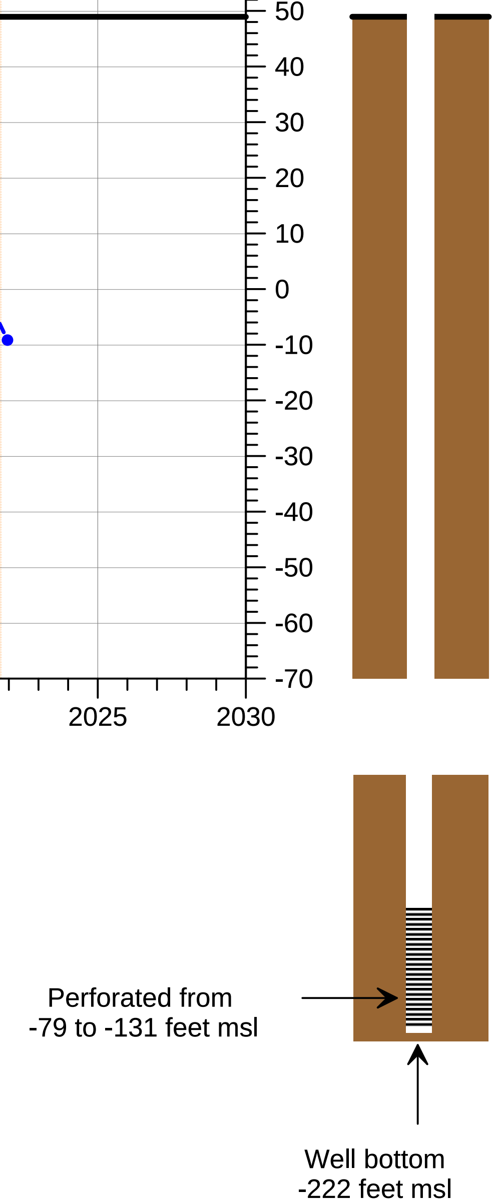
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEW\GRFs_Ch5\15S_03E-17E02.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 15S/03E-17M01

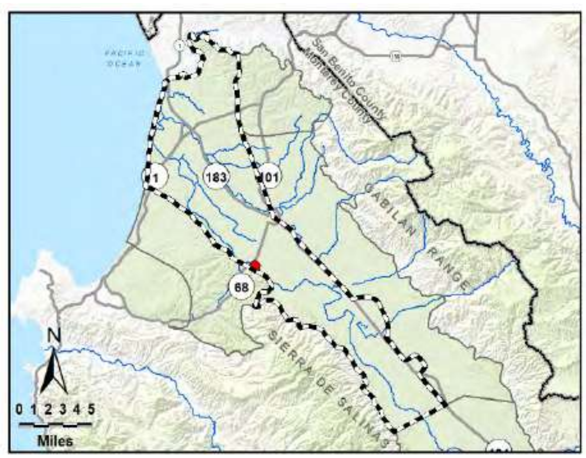
180/400-Foot Aquifer Subbasin





EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface



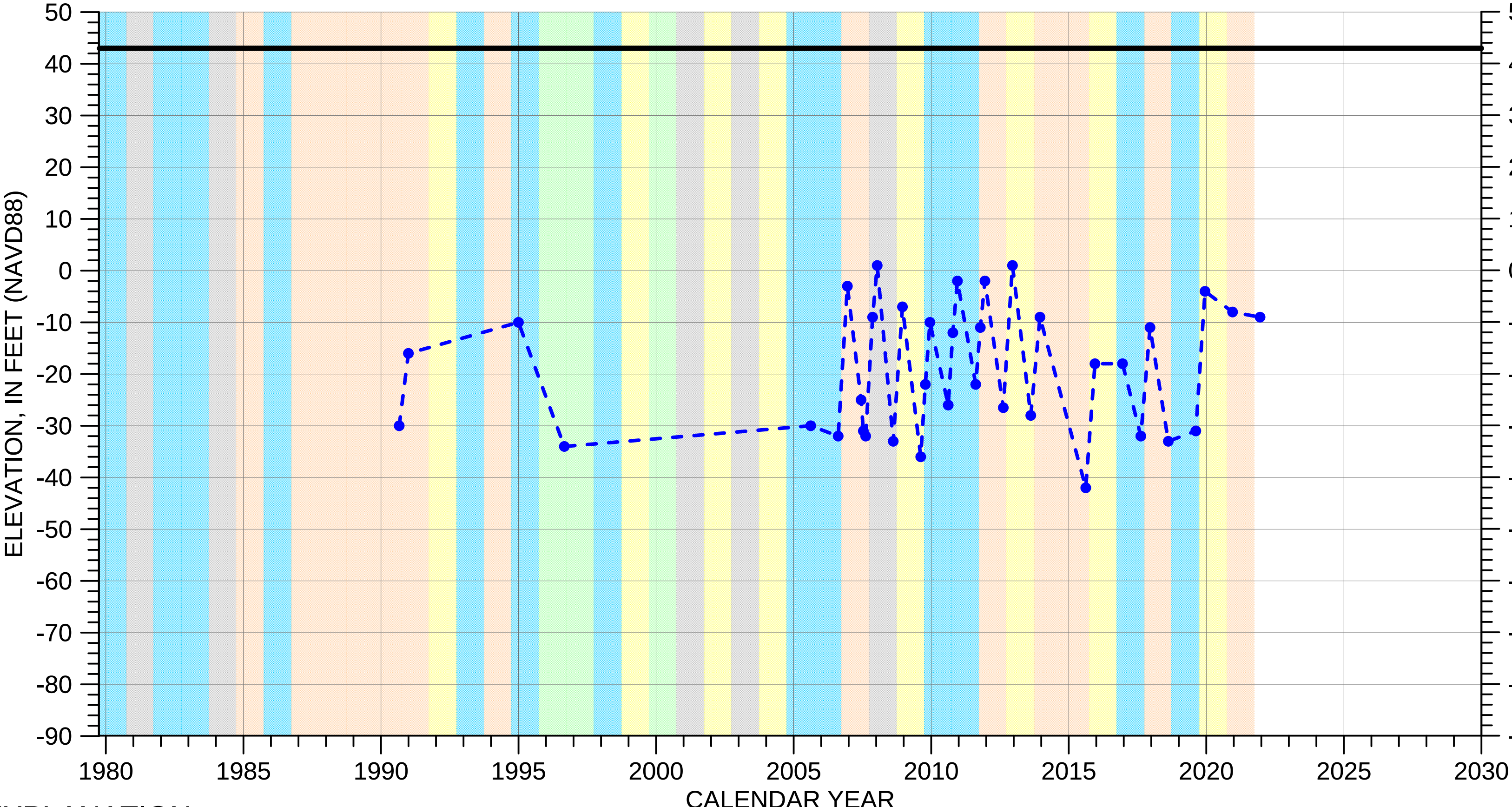
WATER YEAR TYPE DESIGNATION

- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch5\15S_03E-17M01.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 15S/03E-17P02

180/400-Foot Aquifer Subbasin



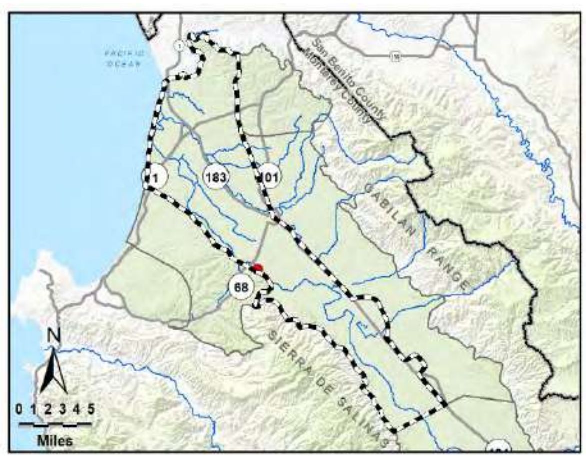
\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRA\NEWGRFs_Ch5\15S_03E-17P02.grf

EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface

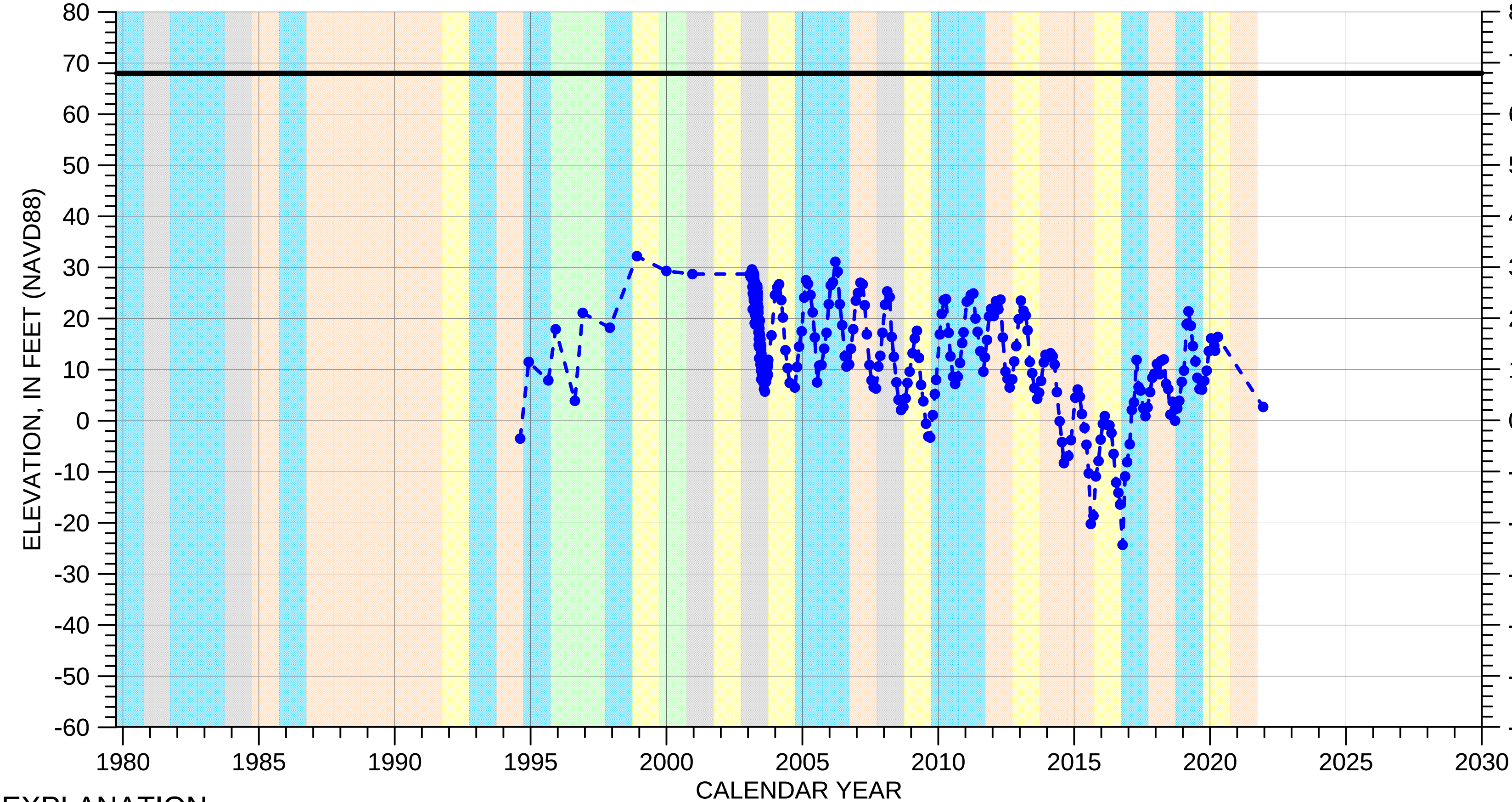
WATER YEAR TYPE DESIGNATION

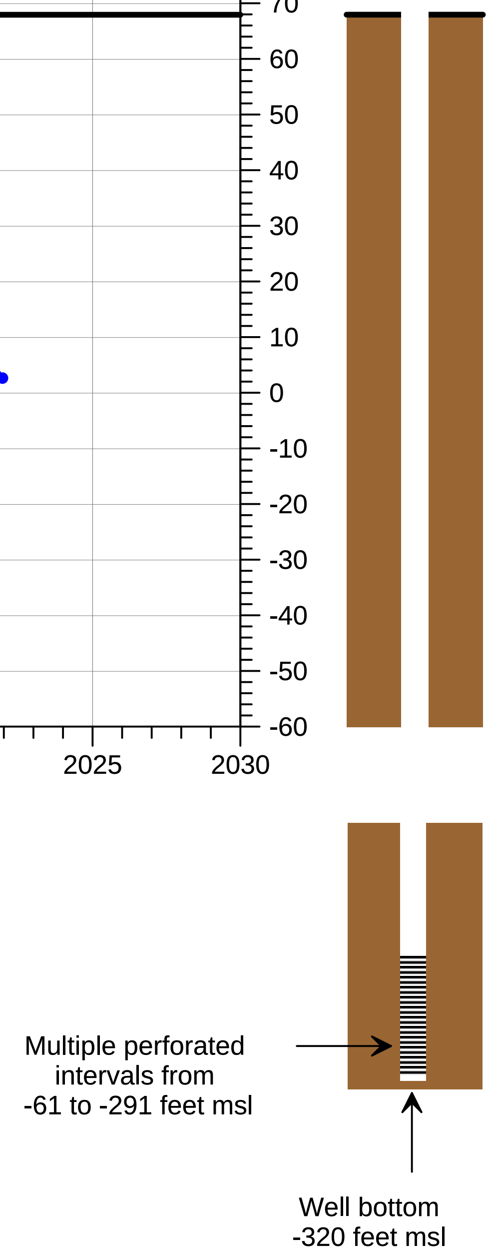
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET



HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 15S/03E-25L01

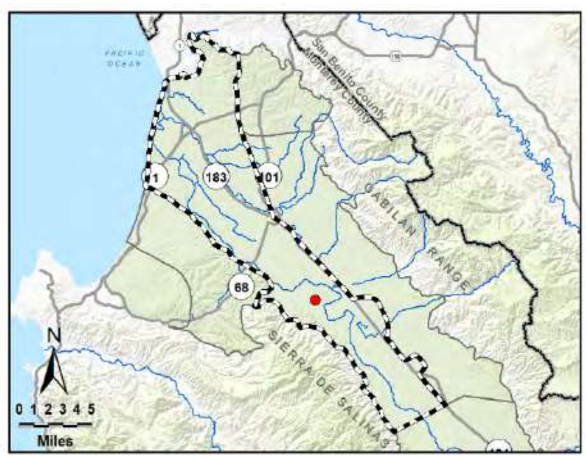
180/400-Foot Aquifer Subbasin





EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface



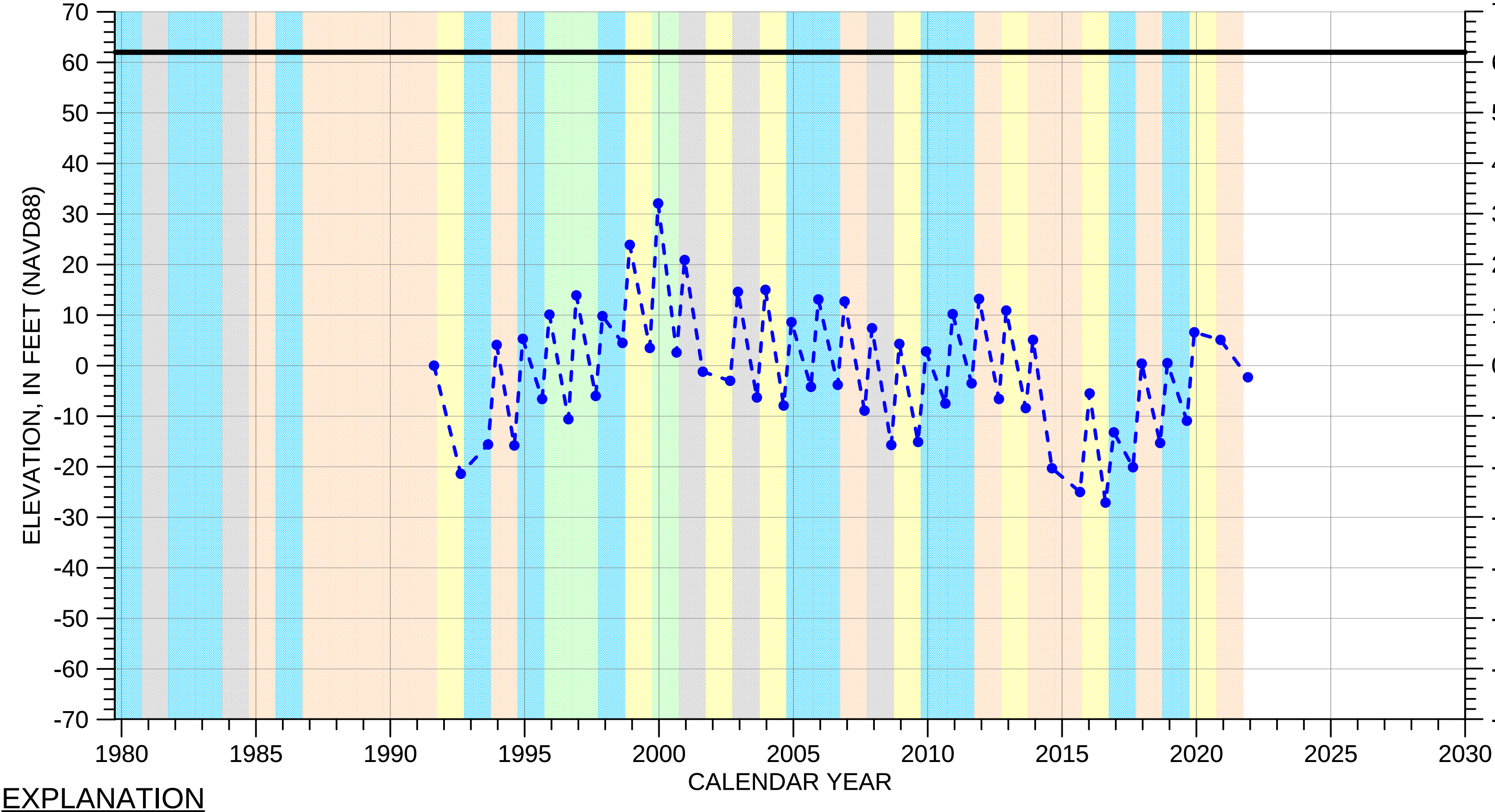
WATER YEAR TYPE DESIGNATION

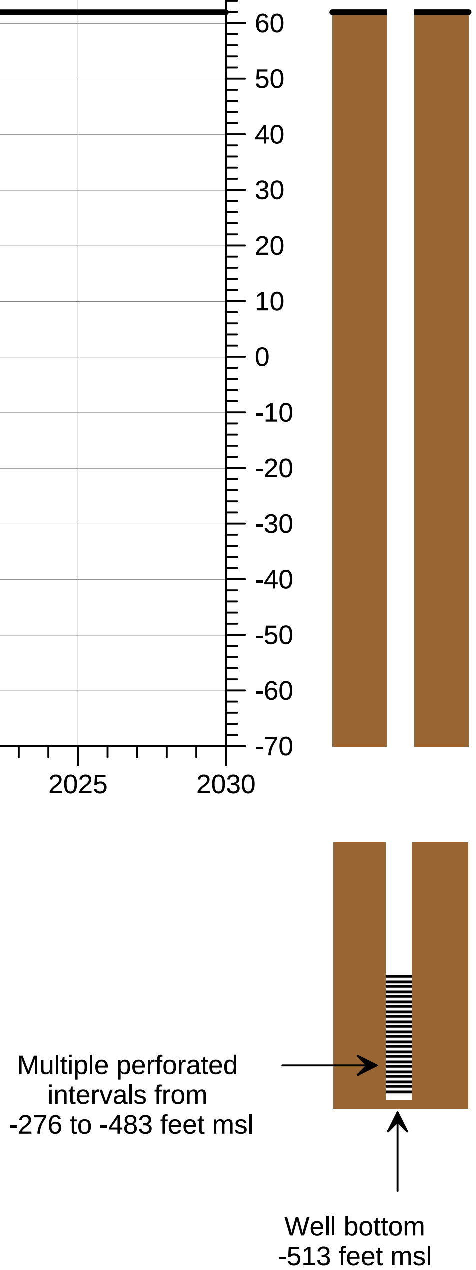
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRA\NEWGRFs_Ch5\15S_03E-25L01.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 15S/03E-26A01

180/400-Foot Aquifer Subbasin





EXPLANATION

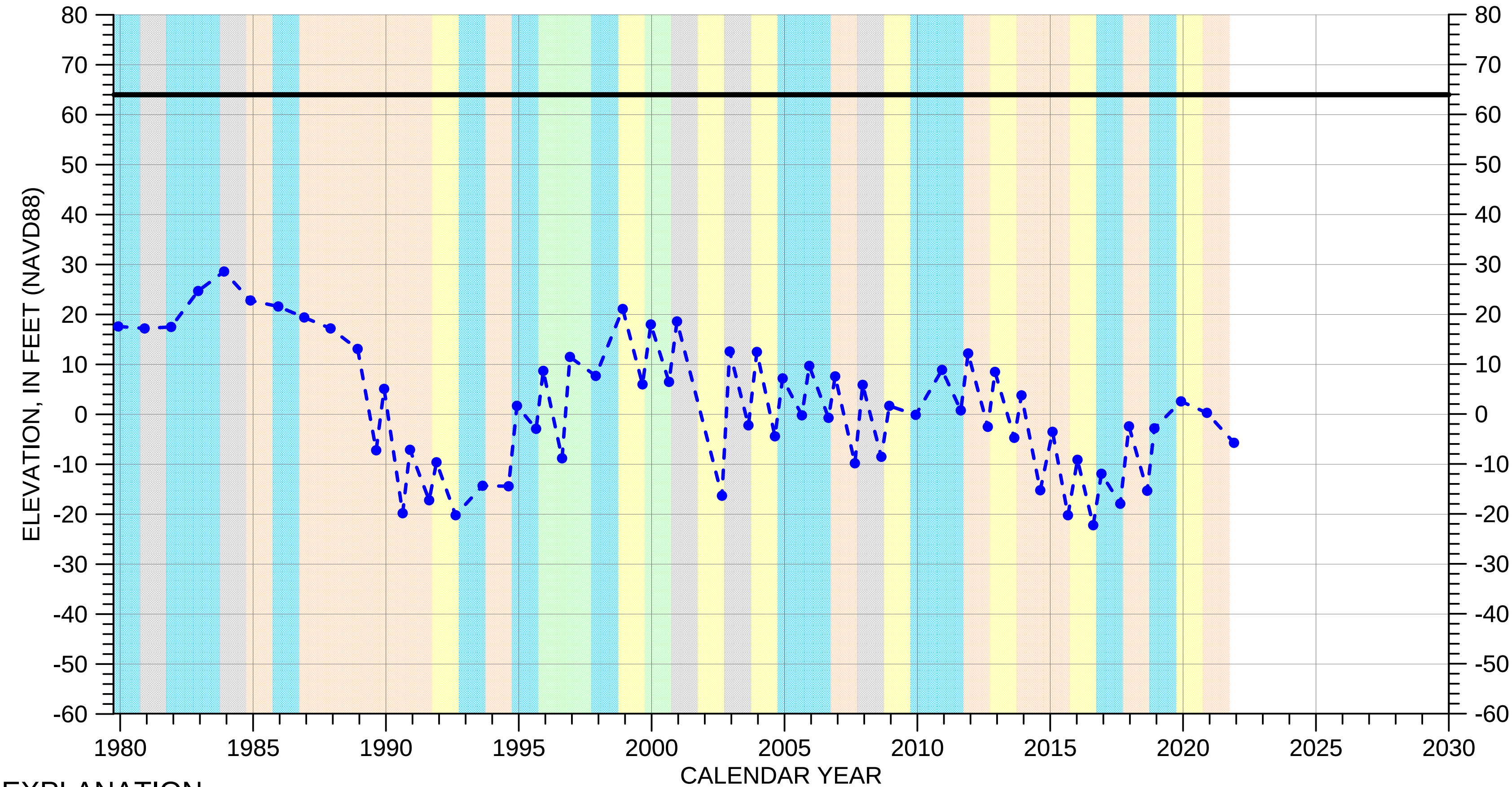
- Groundwater Elevation
- Suspect Measurement
- Land Surface

WATER YEAR TYPE DESIGNATION

- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 15S/03E-26F01

180/400-Foot Aquifer Subbasin



Multiple perforated intervals from -178 to -232 feet msl

Well bottom -254 feet msl

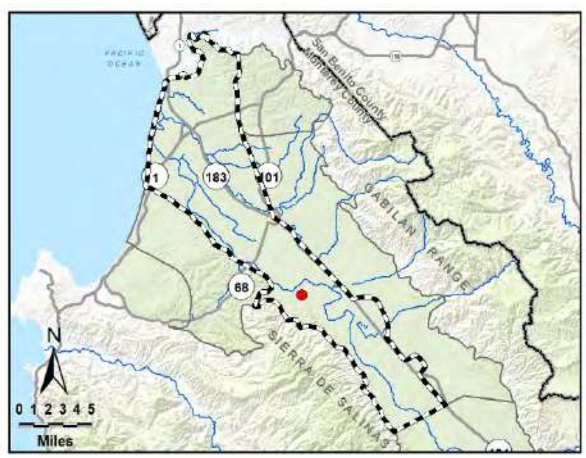
\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch5\15S_03E-26F01.grf

EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface

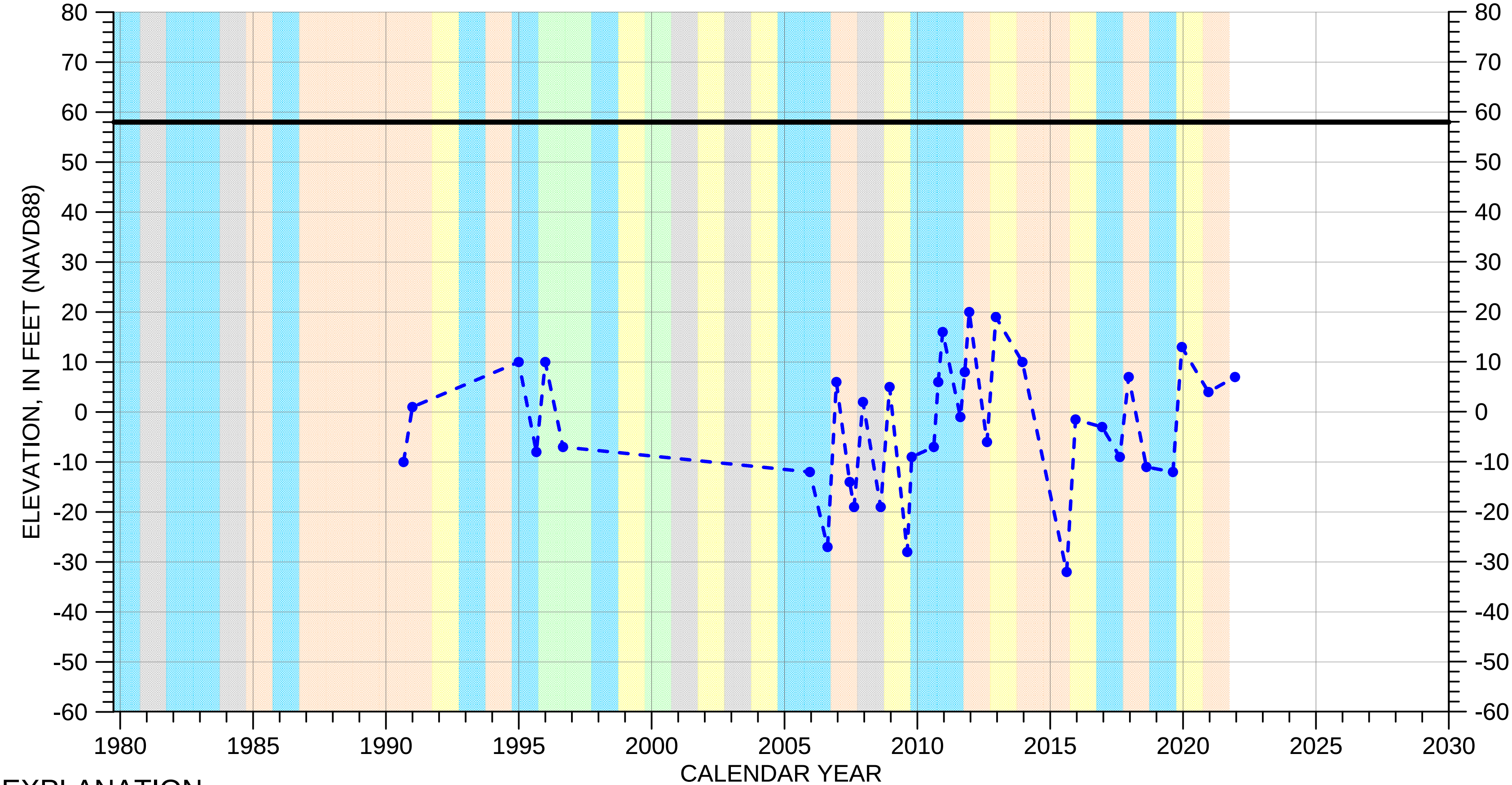
WATER YEAR TYPE DESIGNATION

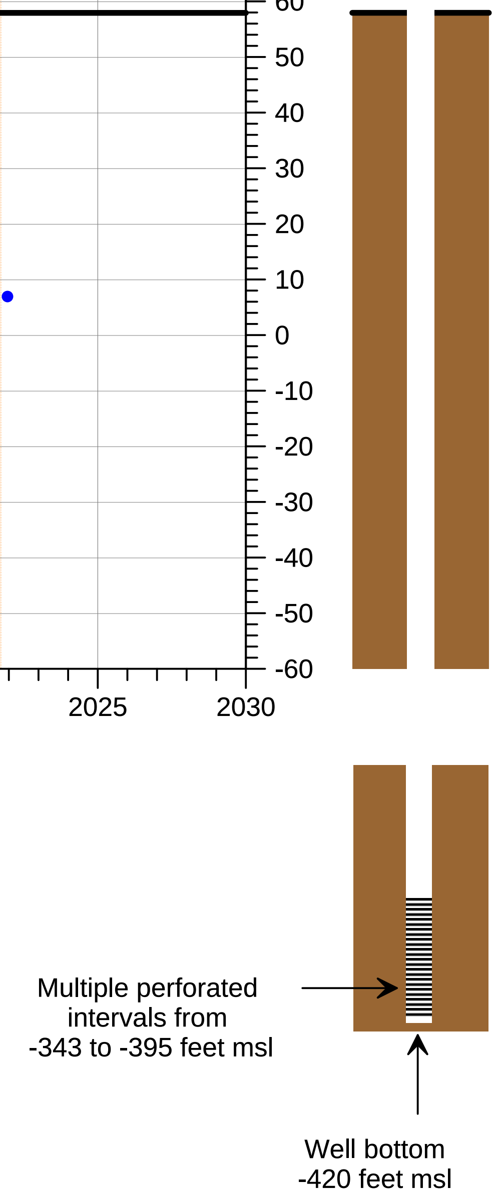
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET



HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 15S/03E-28B02

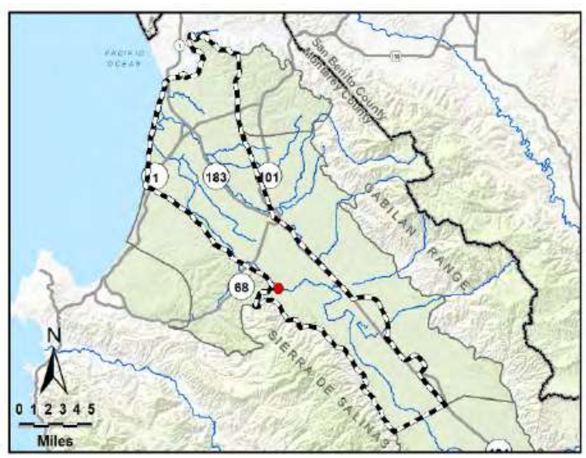
180/400-Foot Aquifer Subbasin





EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface

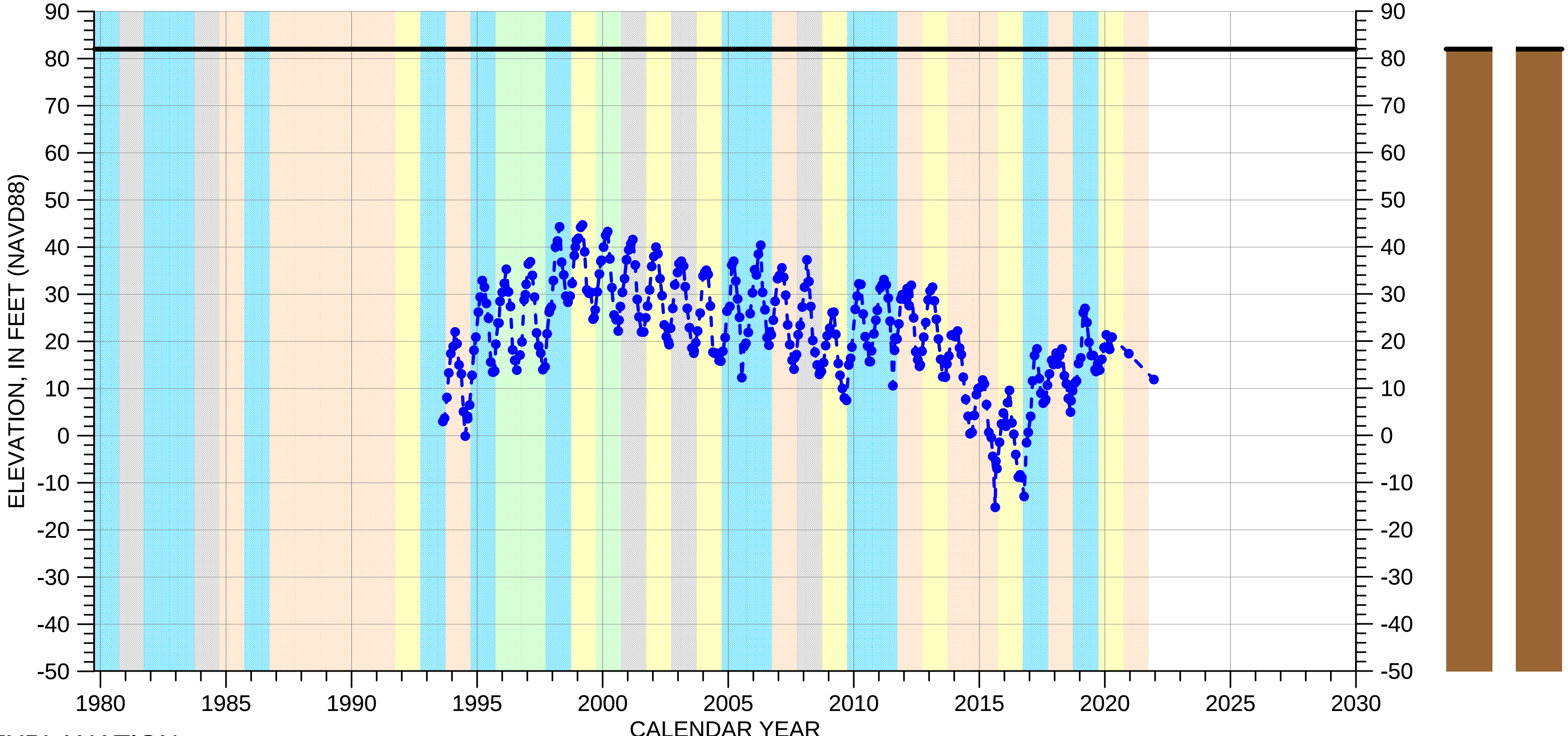


WATER YEAR TYPE DESIGNATION

- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRA\NEWGRFs_Ch5\15S_03E-28B02.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 15S/04E-29Q02 180/400-Foot Aquifer Subbasin

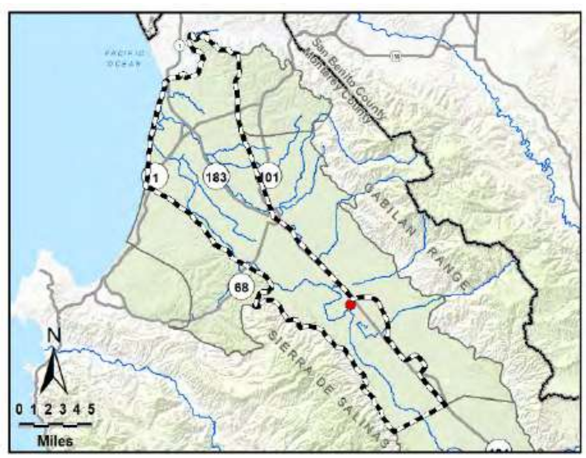


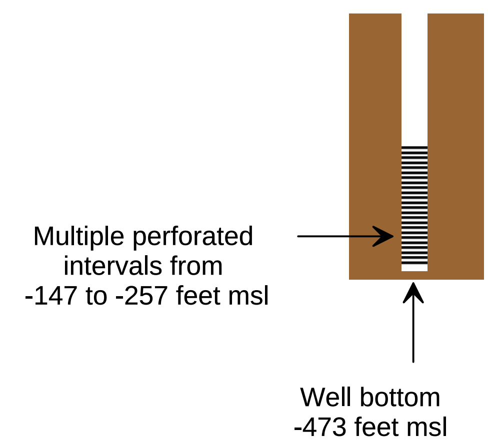
EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface

WATER YEAR TYPE DESIGNATION

DRY	WET - NORMAL
DRY - NORMAL	WET
NORMAL	

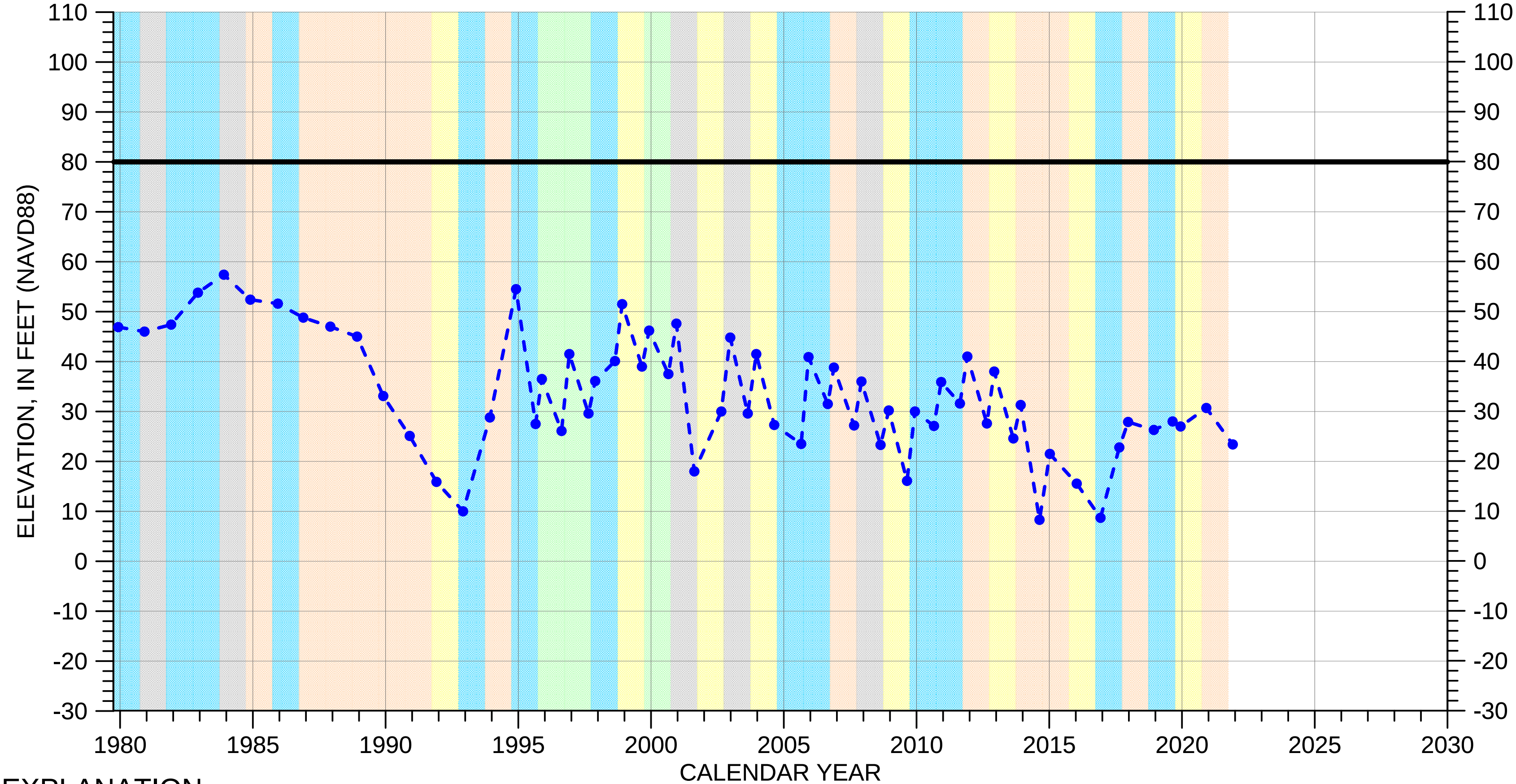




\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch515S_04E-29Q02.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 15S/04E-31A02

180/400-Foot Aquifer Subbasin



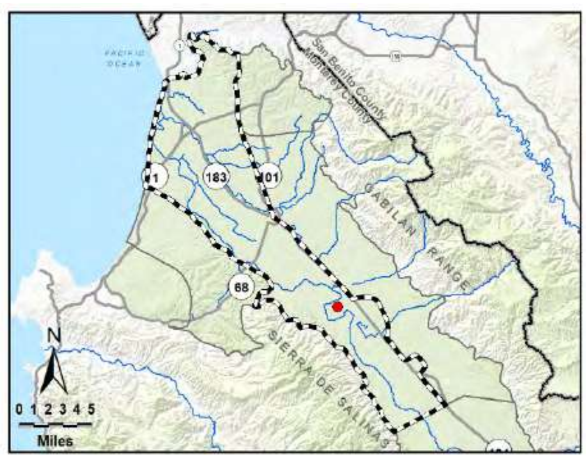
\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRA\NEWGRFs_Ch5\15S_04E-31A02.grf

EXPLANATION

Groundwater Elevation
Suspect Measurement
Land Surface

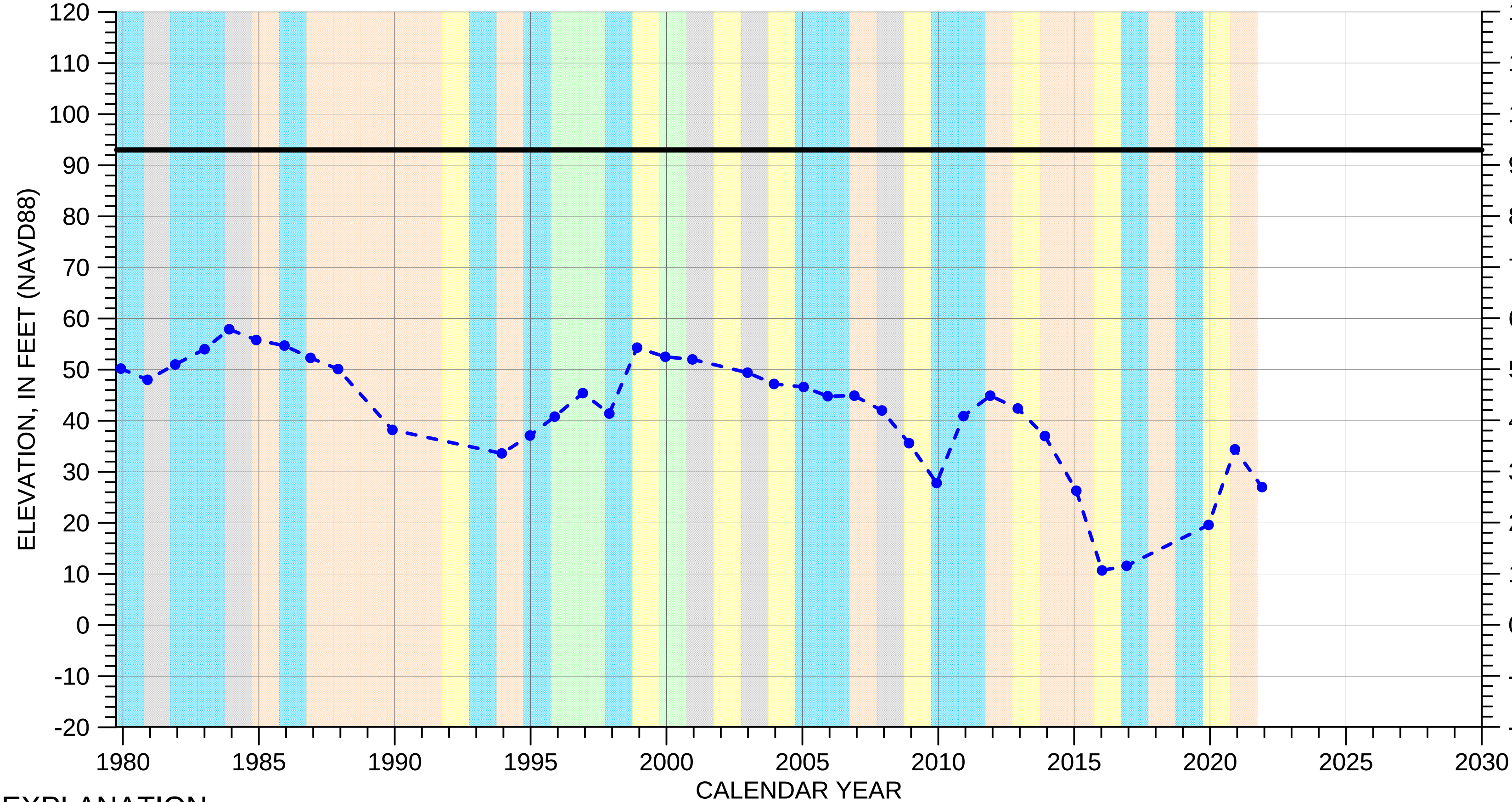
WATER YEAR TYPE DESIGNATION

DRY
DRY - NORMAL
NORMAL
WET - NORMAL
WET



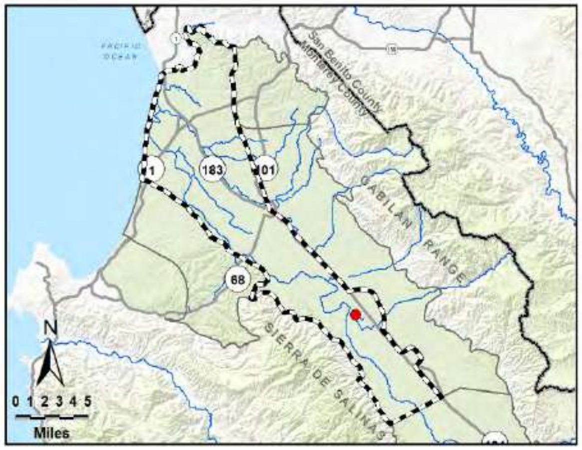
HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 16S/04E-04C01

180/400-Foot Aquifer Subbasin



EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface



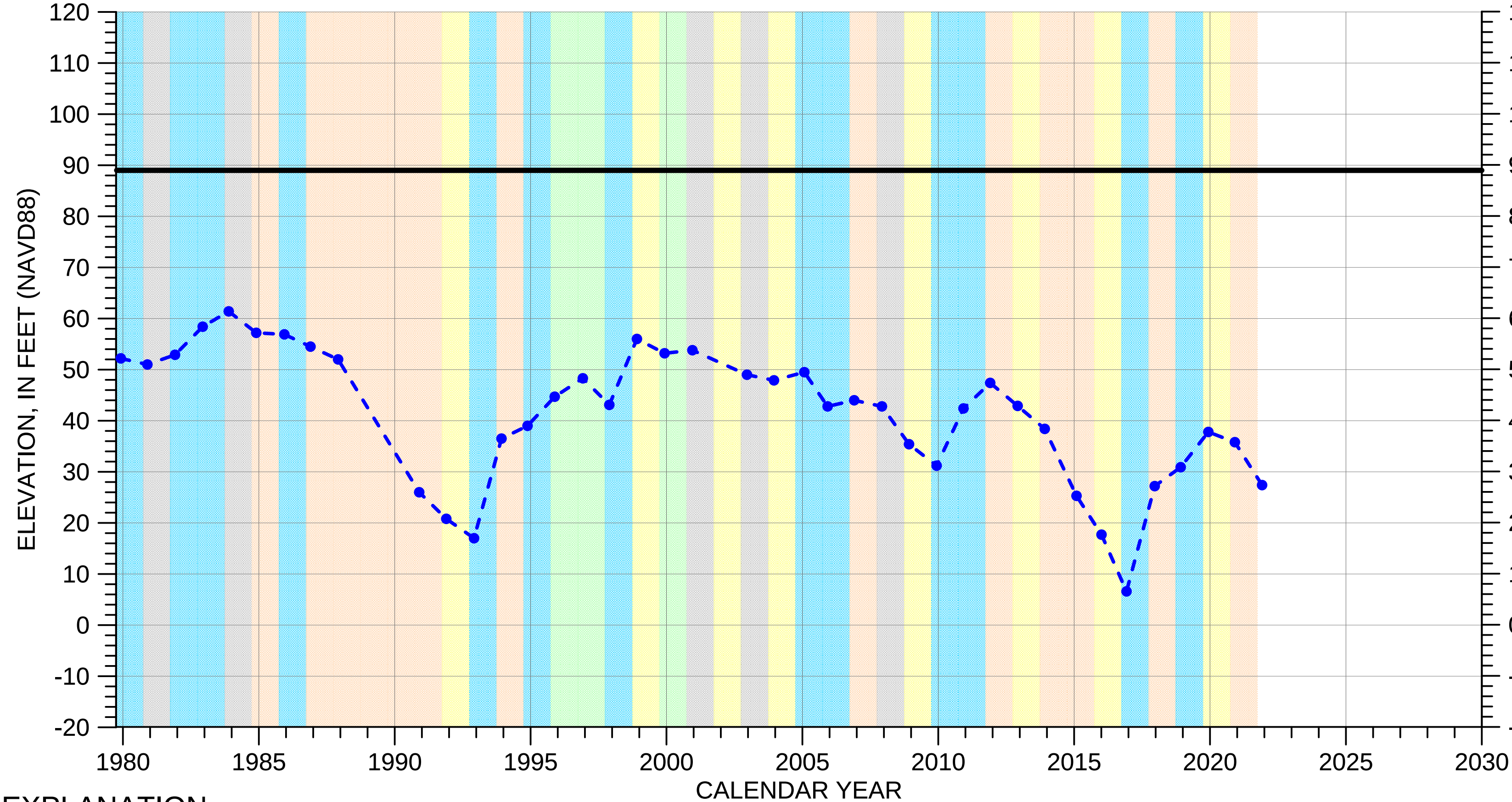
WATER YEAR TYPE DESIGNATION

- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch5\16S_04E-04C01.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 16S/04E-05M02

180/400-Foot Aquifer Subbasin



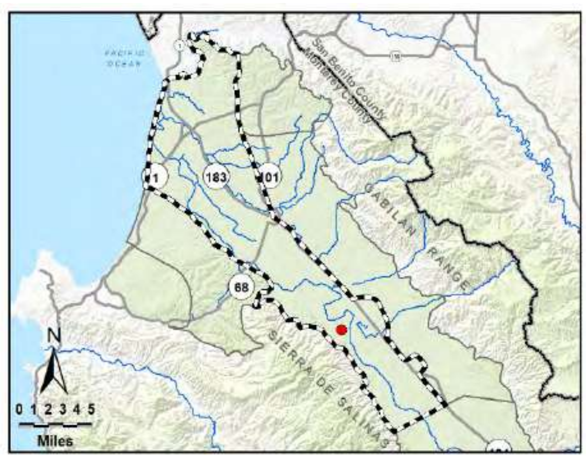
Perforated interval unknown

Well bottom -178 feet msl

\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEW\GRFs_Ch5\16S_04E-05M02.grf

EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface

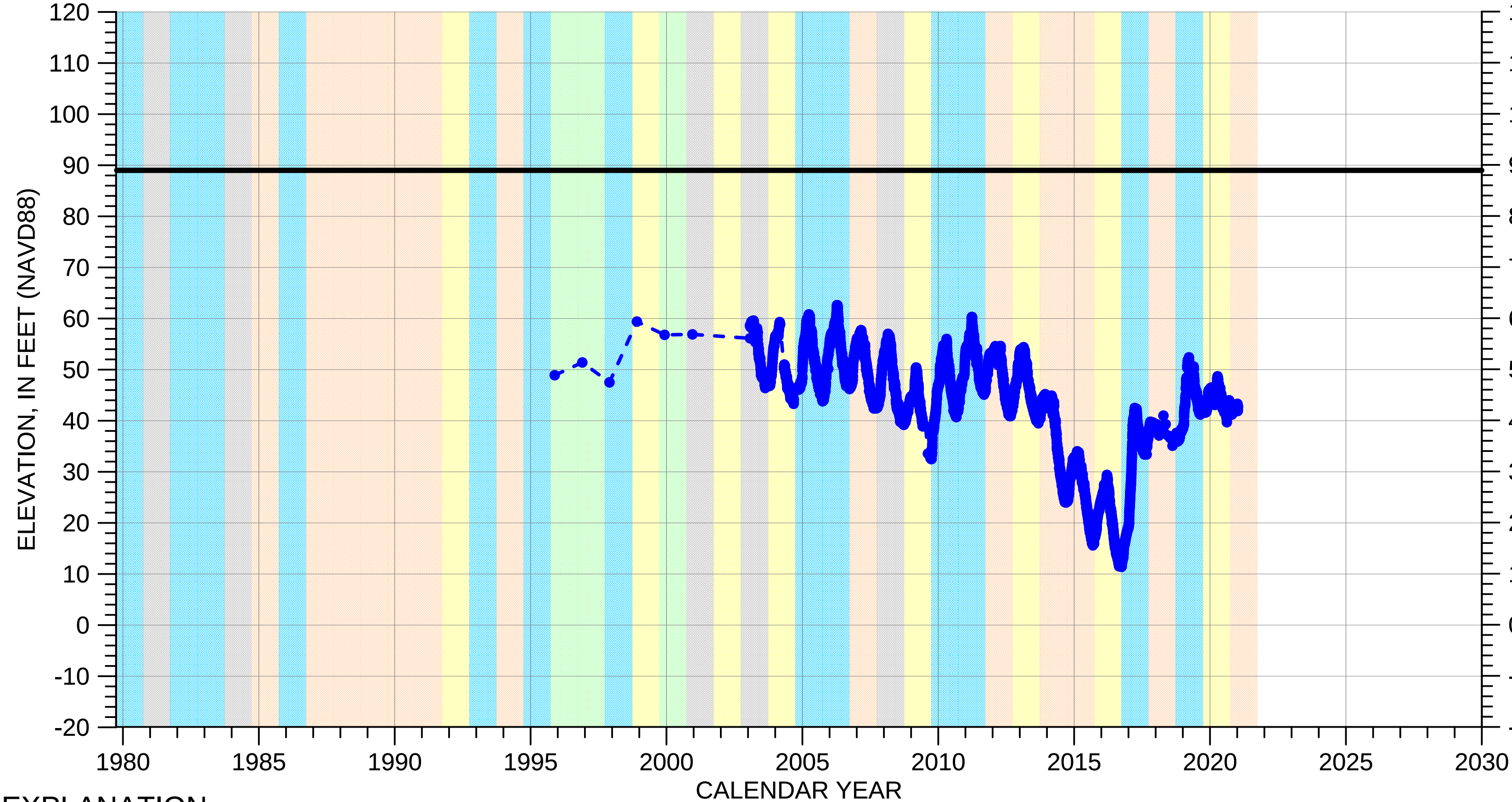


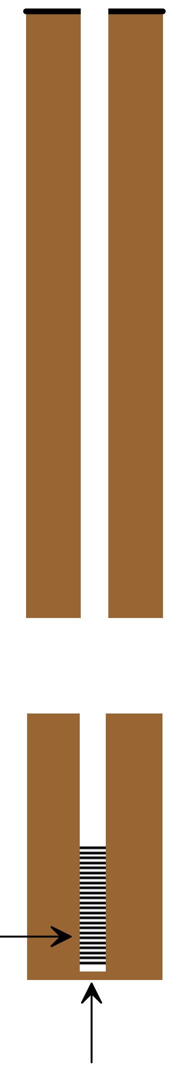
WATER YEAR TYPE DESIGNATION

- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 16S/04E-08H03

180/400-Foot Aquifer Subbasin





EXPLANATION

Groundwater Elevation

Suspect Measurement

Land Surface

WATER YEAR TYPE DESIGNATION

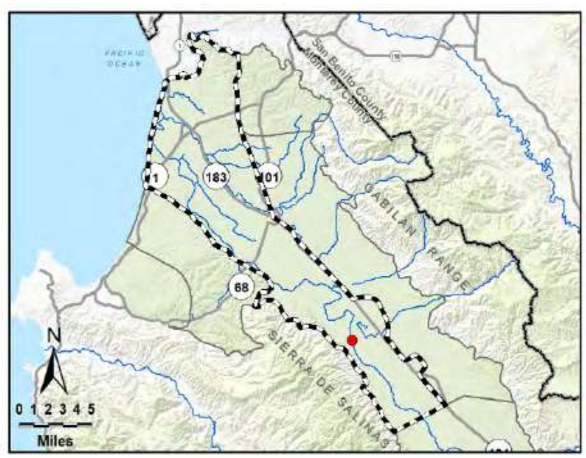
DRY

DRY - NORMAL

NORMAL

WET - NORMAL

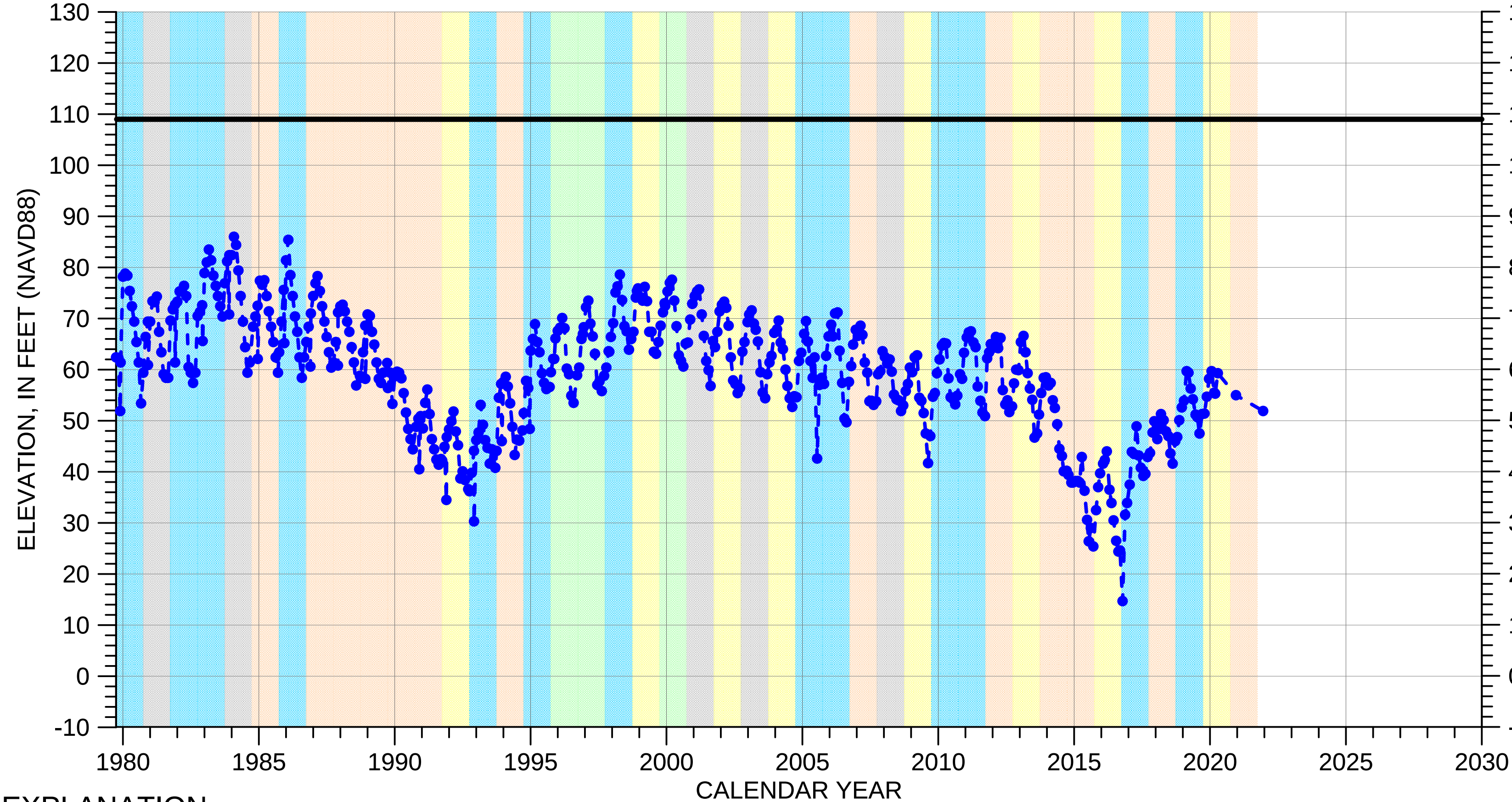
WET

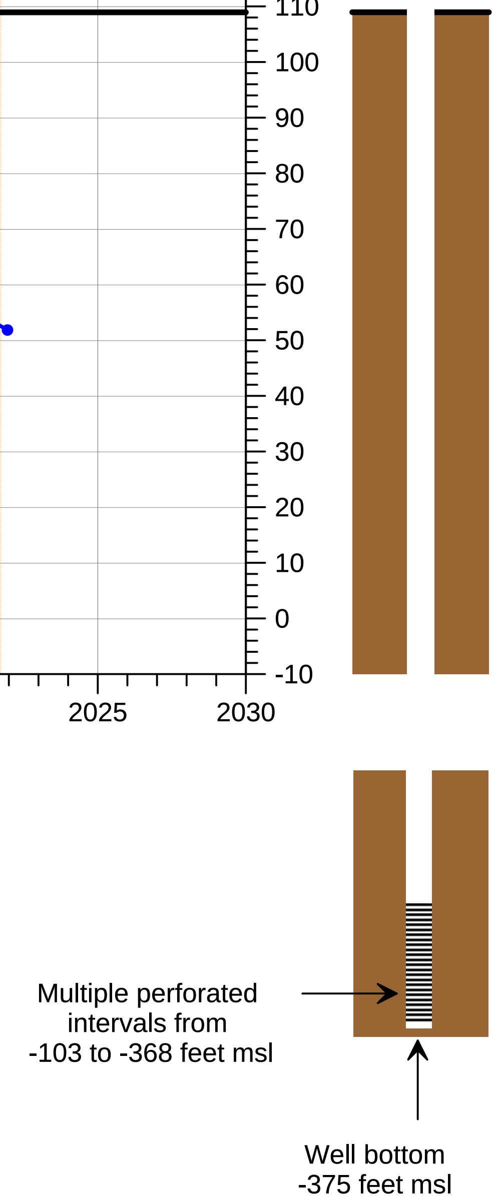


\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch5\16S_04E-08H03.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 16S/04E-10R02

180/400-Foot Aquifer Subbasin



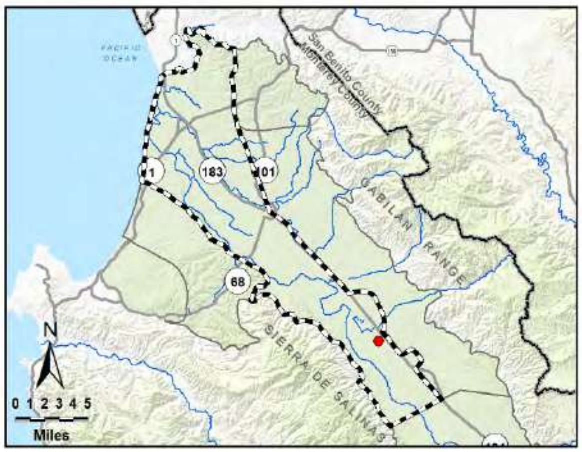


EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface

WATER YEAR TYPE DESIGNATION

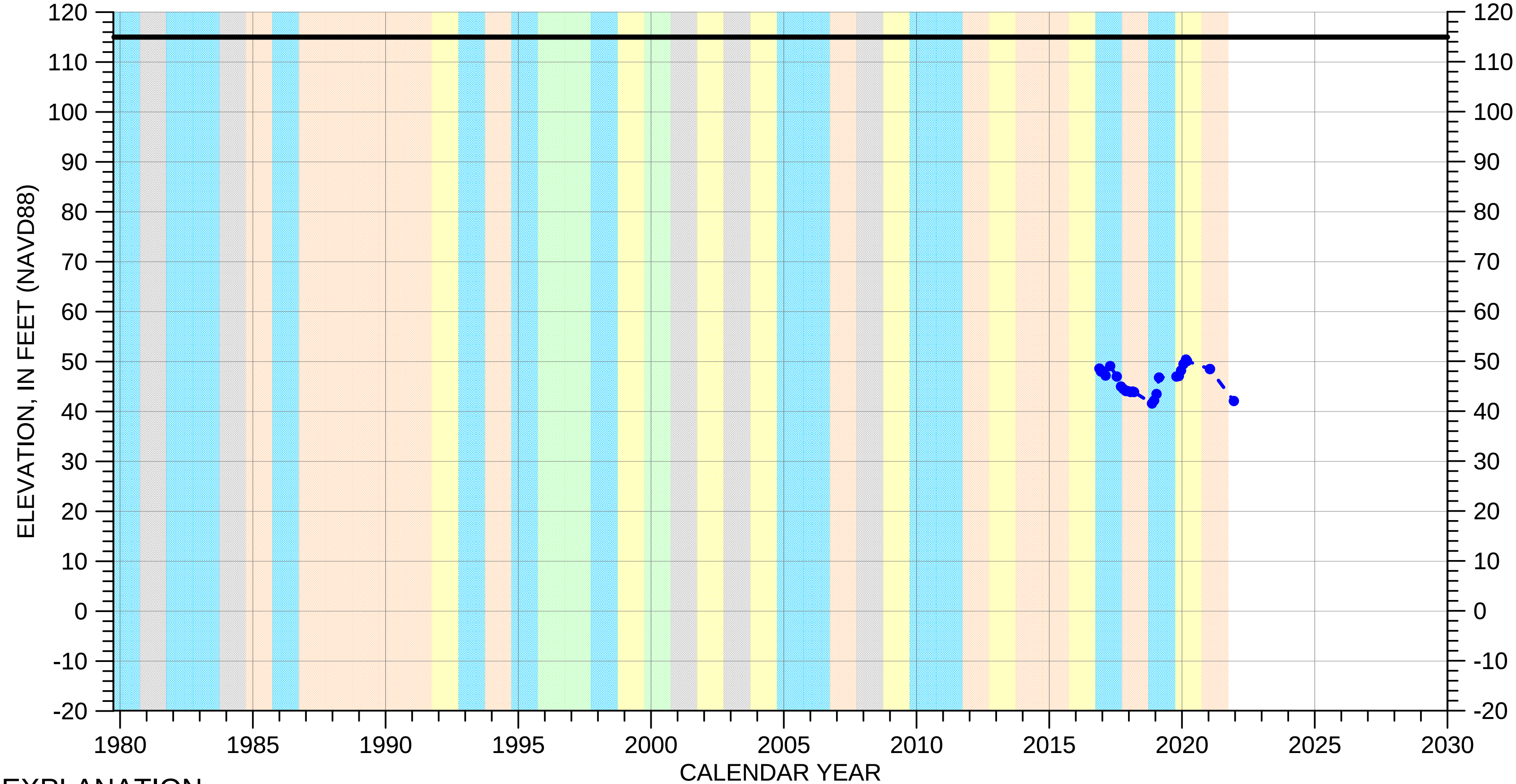
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET



\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch5\16S_04E-10R02.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 16S/04E-11D51

180/400-Foot Aquifer Subbasin

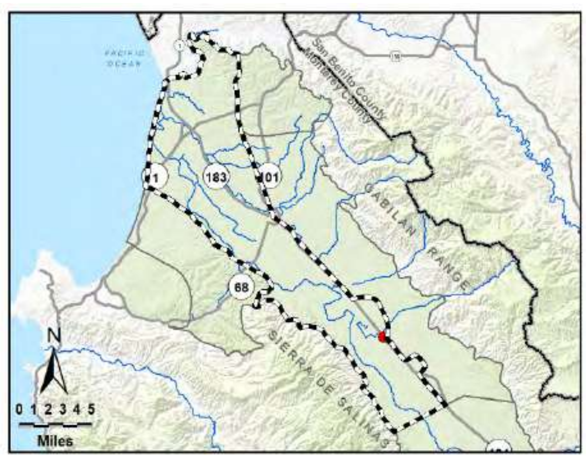


Perforated from
-425 to -875 feel msl

Well bottom
-885 feet msl

EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface



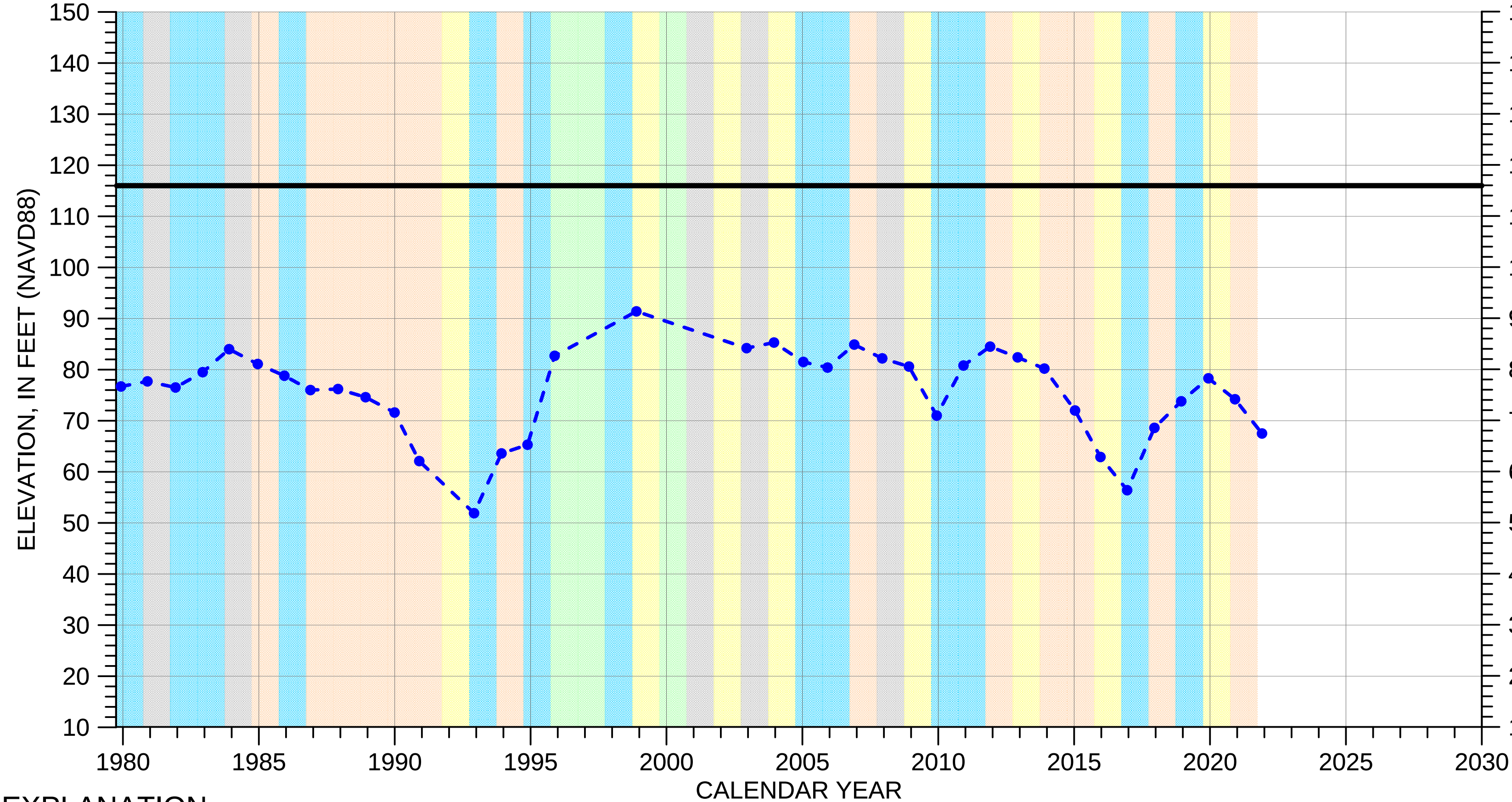
WATER YEAR TYPE DESIGNATION

- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch5\16S_04E-11D51.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 16S/04E-13R02

180/400-Foot Aquifer Subbasin



EXPLANATION

Groundwater Elevation

Suspect Measurement

Land Surface

WATER YEAR TYPE DESIGNATION

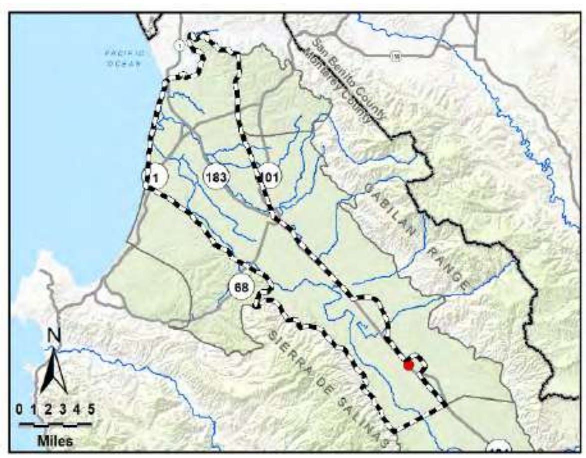
DRY

DRY - NORMAL

NORMAL

WET - NORMAL

WET



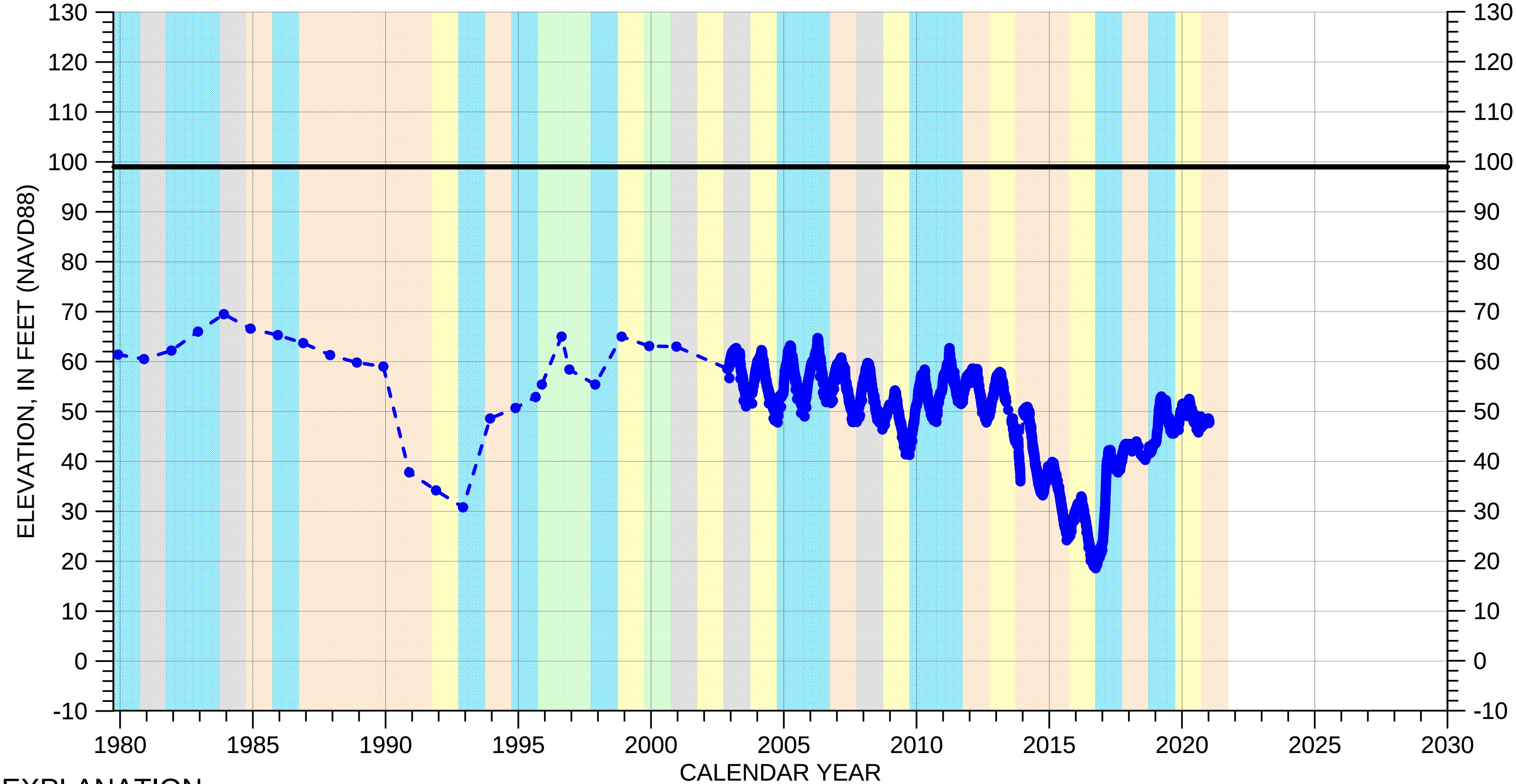
Multiple perforated intervals from -17 to -160 feet msl

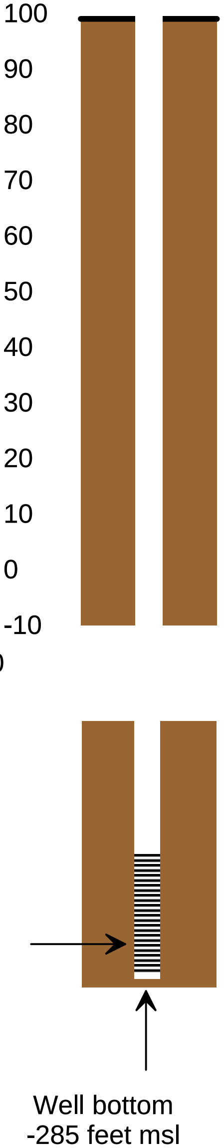
Well bottom -161 feet msl

\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRA\NEWGRFs_Ch5\16S_04E-13R02.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 16S/04E-15D01

180/400-Foot Aquifer Subbasin



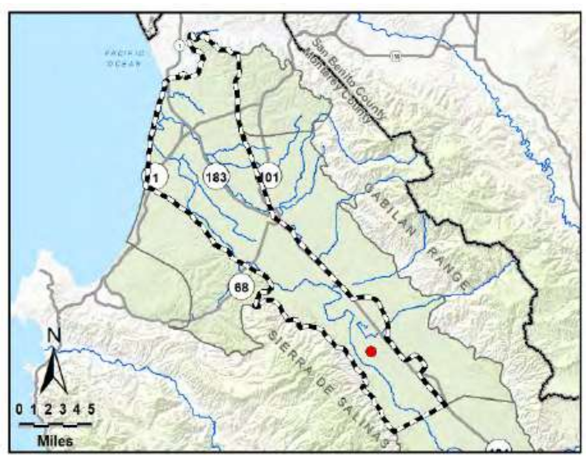


EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface

WATER YEAR TYPE DESIGNATION

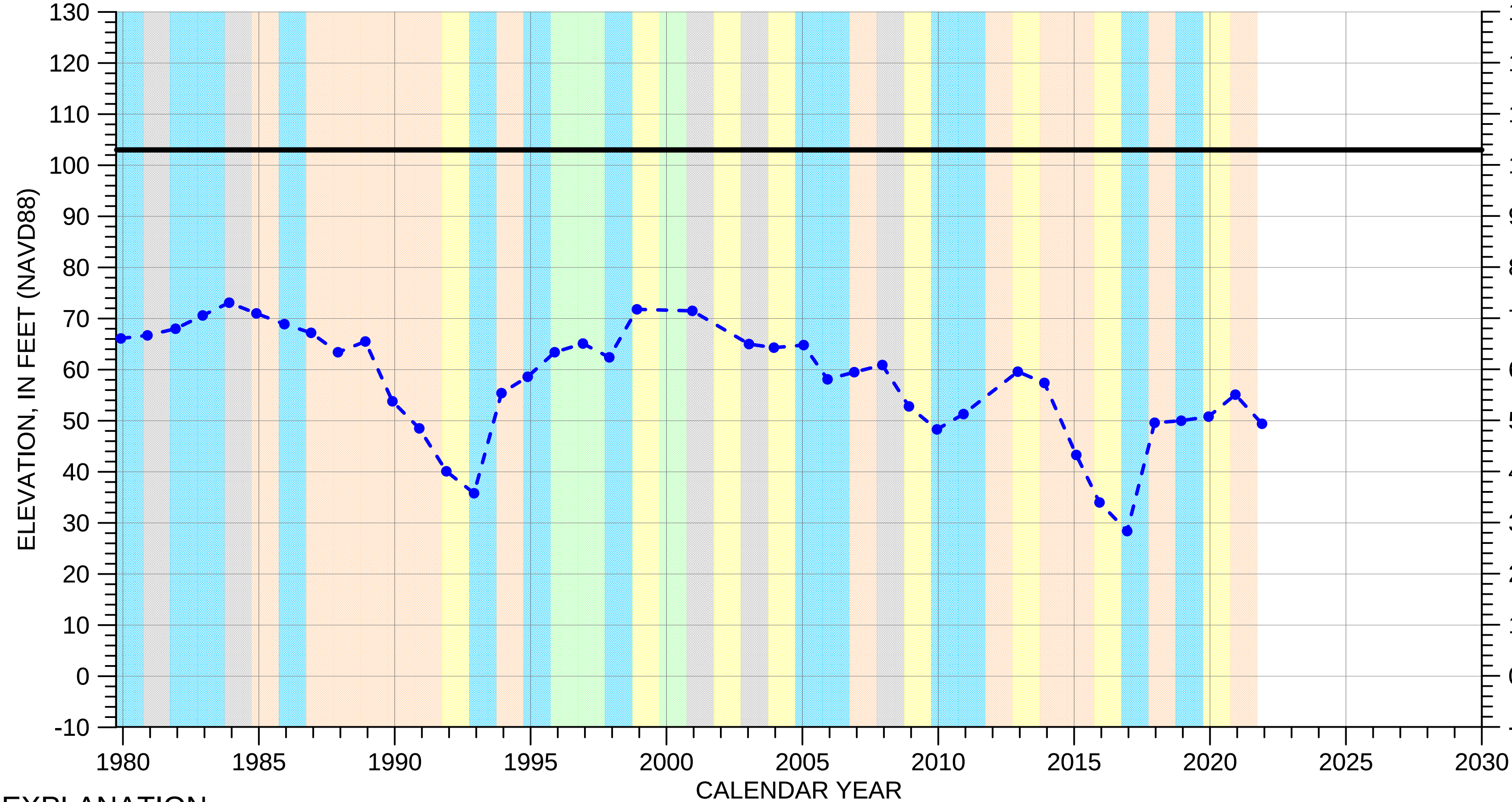
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

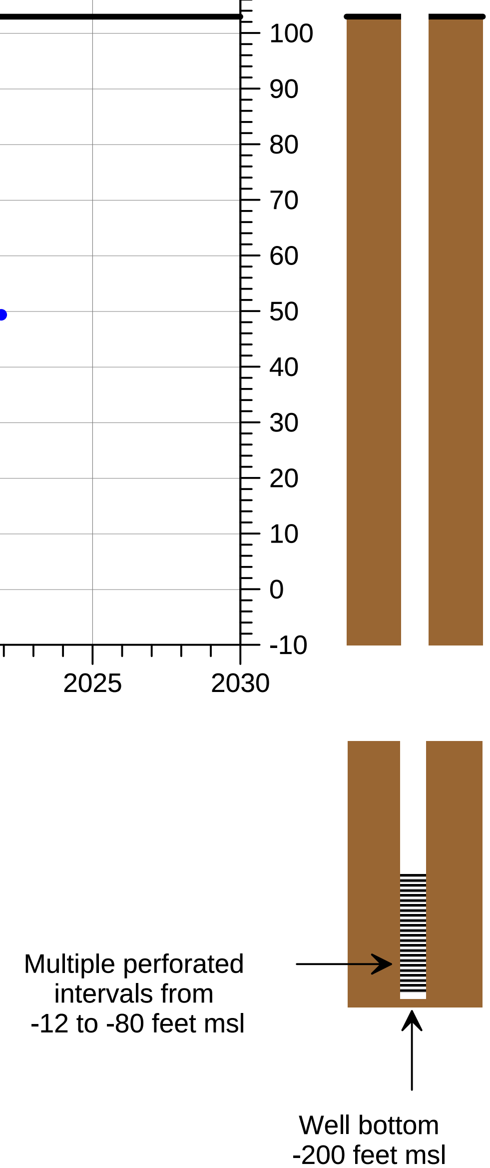


\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch5\16S_04E-15D01.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 16S/04E-15R02

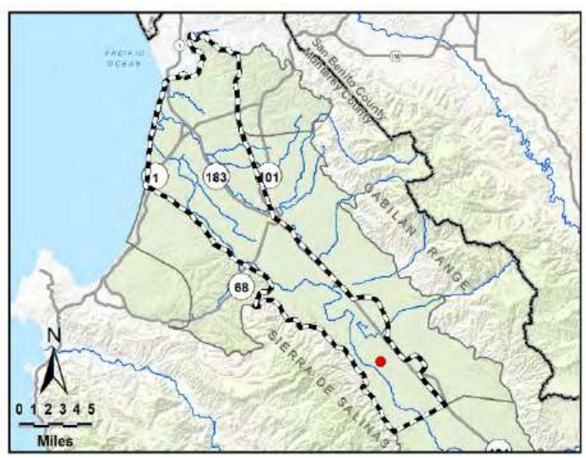
180/400-Foot Aquifer Subbasin





EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface



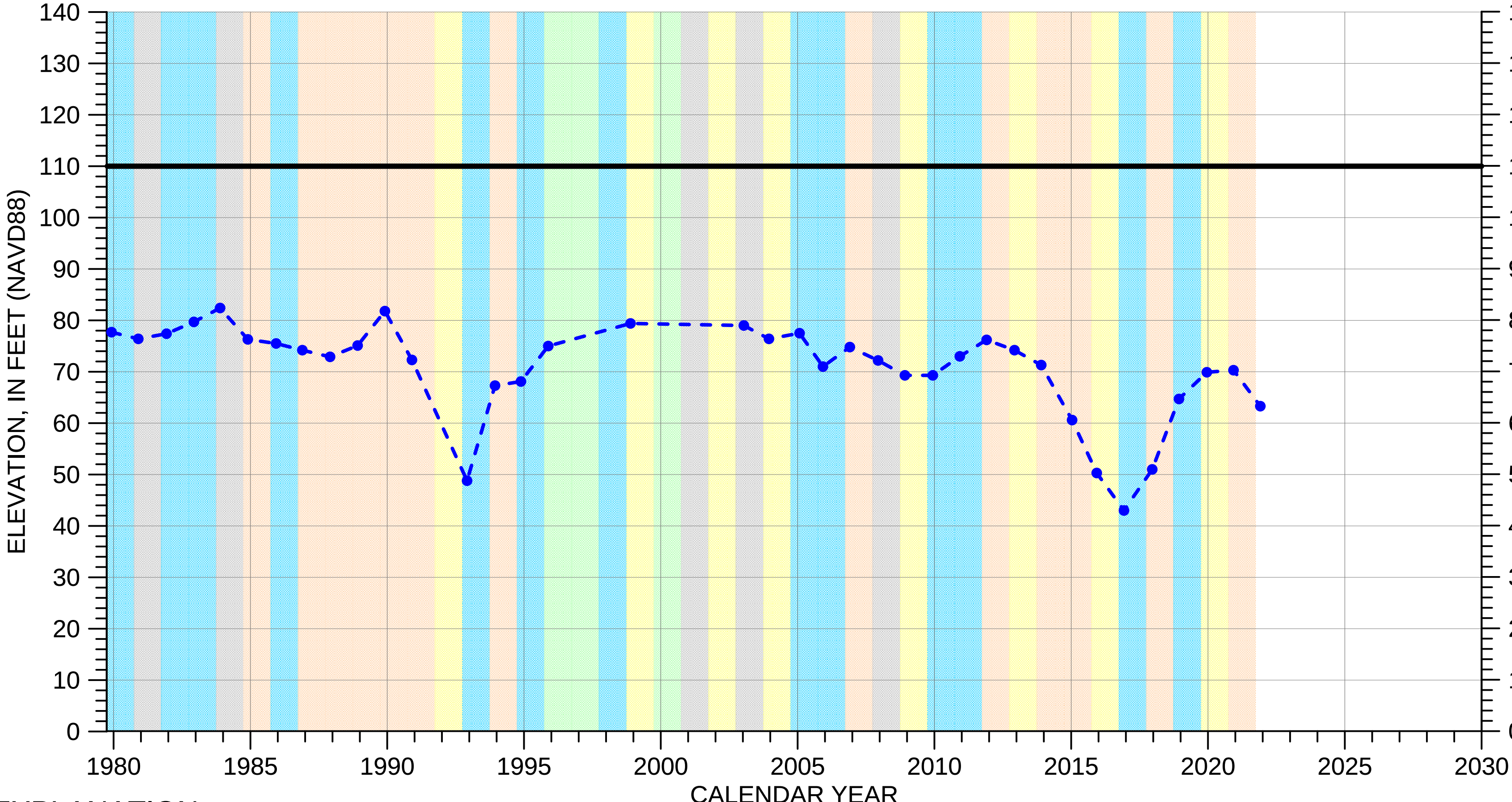
WATER YEAR TYPE DESIGNATION

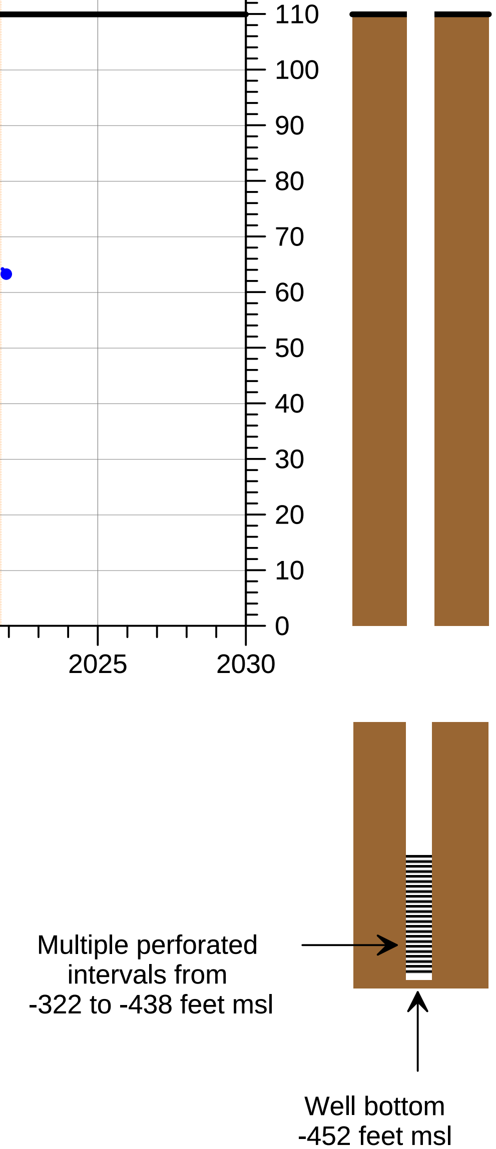
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch5\16S_04E-15R02.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 16S/04E-25G01

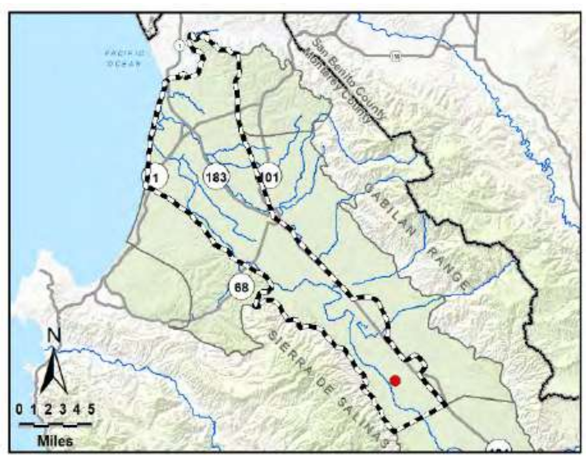
180/400-Foot Aquifer Subbasin





EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface



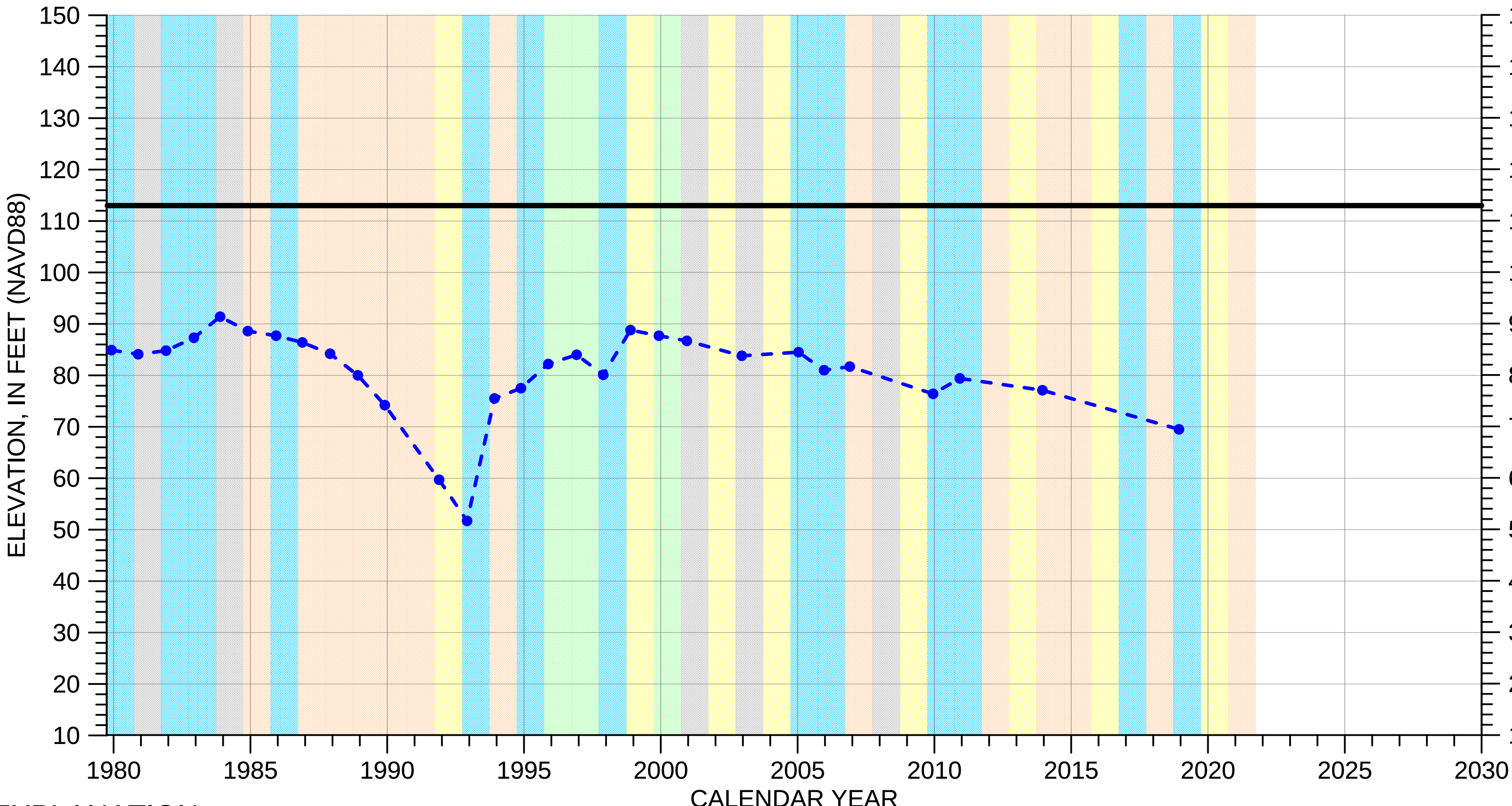
WATER YEAR TYPE DESIGNATION

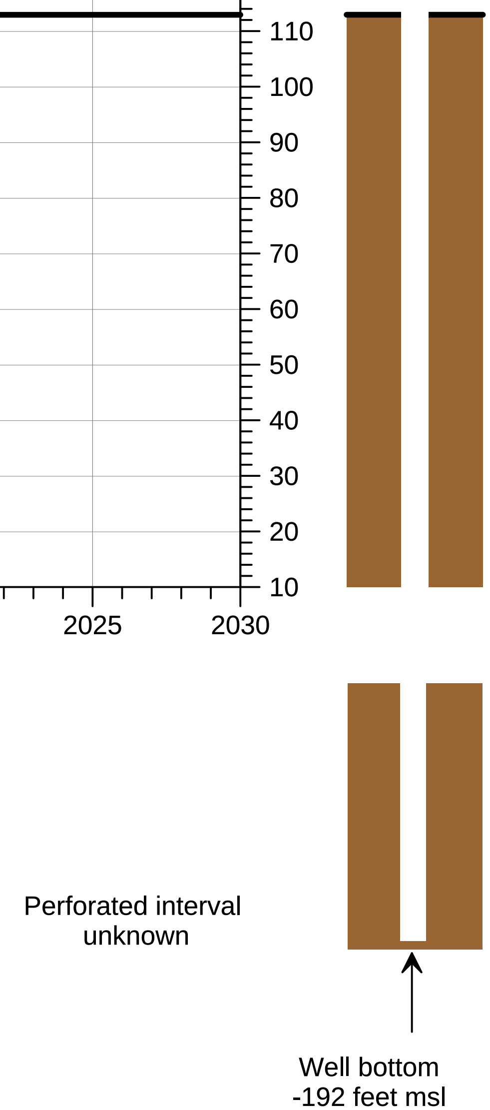
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch5\16S_04E-25G01.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 16S/04E-27B02

180/400-Foot Aquifer Subbasin



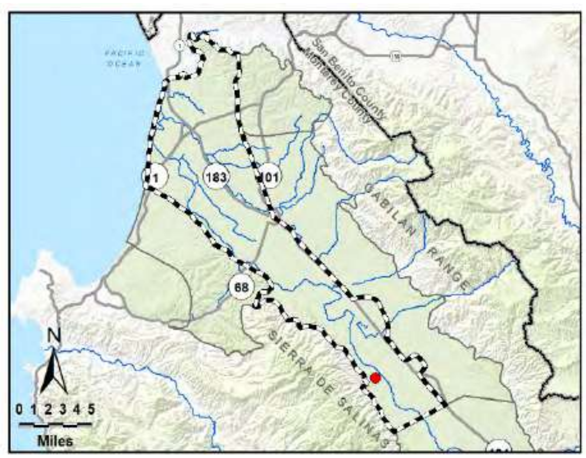


EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface

WATER YEAR TYPE DESIGNATION

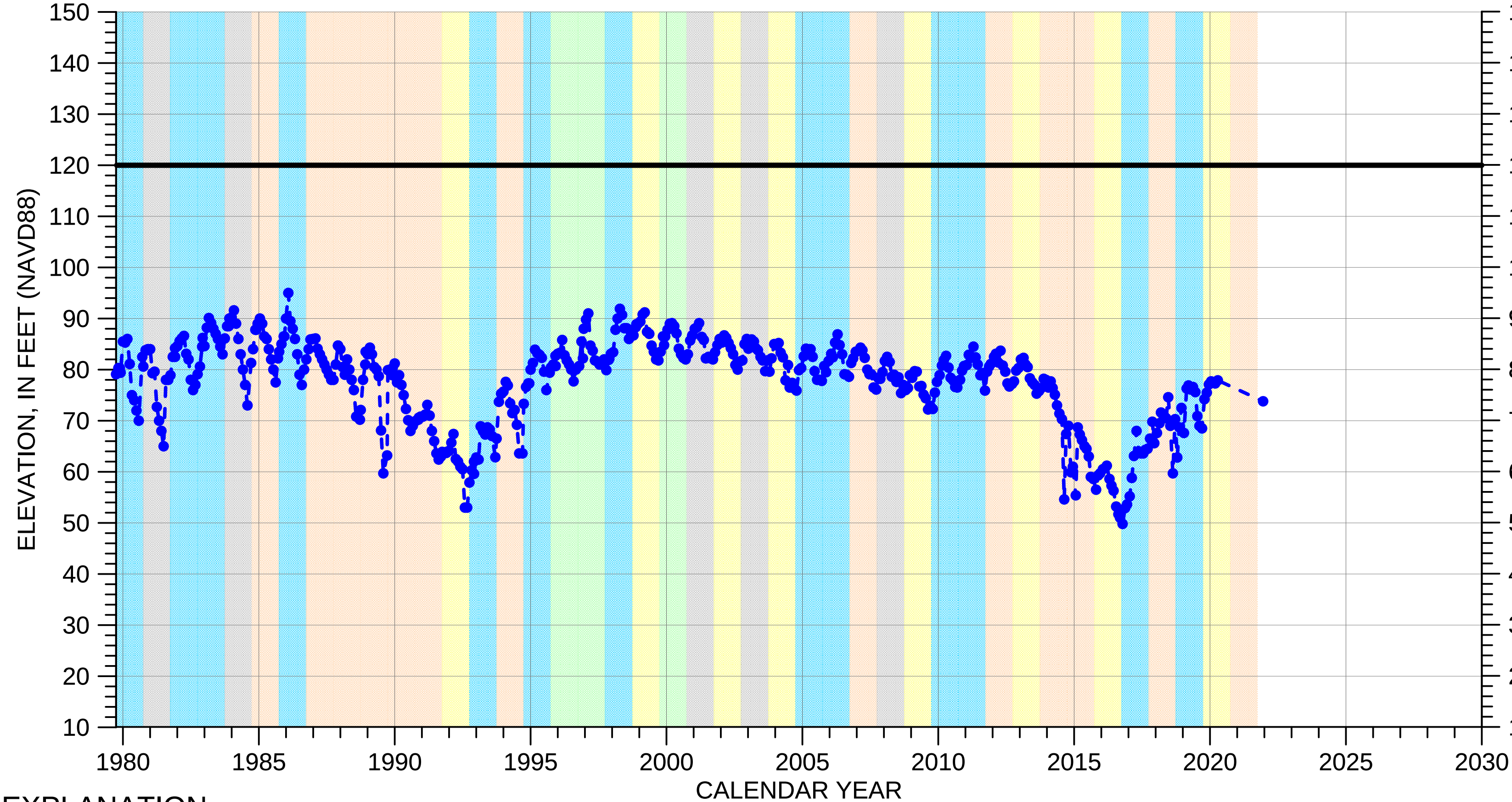
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

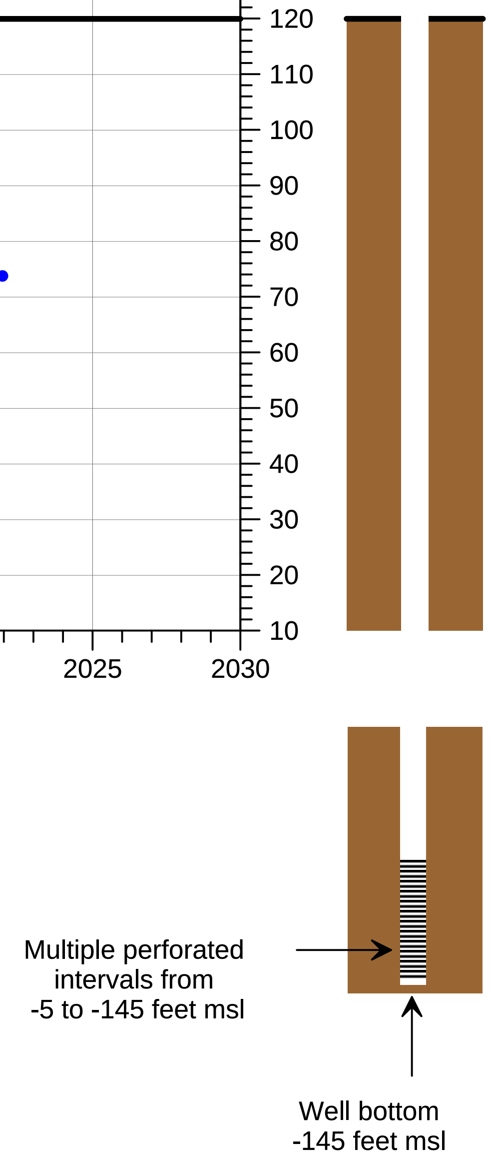


\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRA\NEW\GRFs_Ch5\16S_04E-27B02.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 16S/05E-30E01

180/400-Foot Aquifer Subbasin



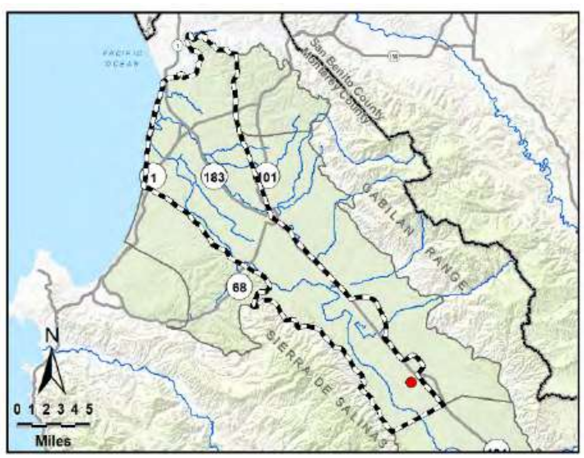


EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface

WATER YEAR TYPE DESIGNATION

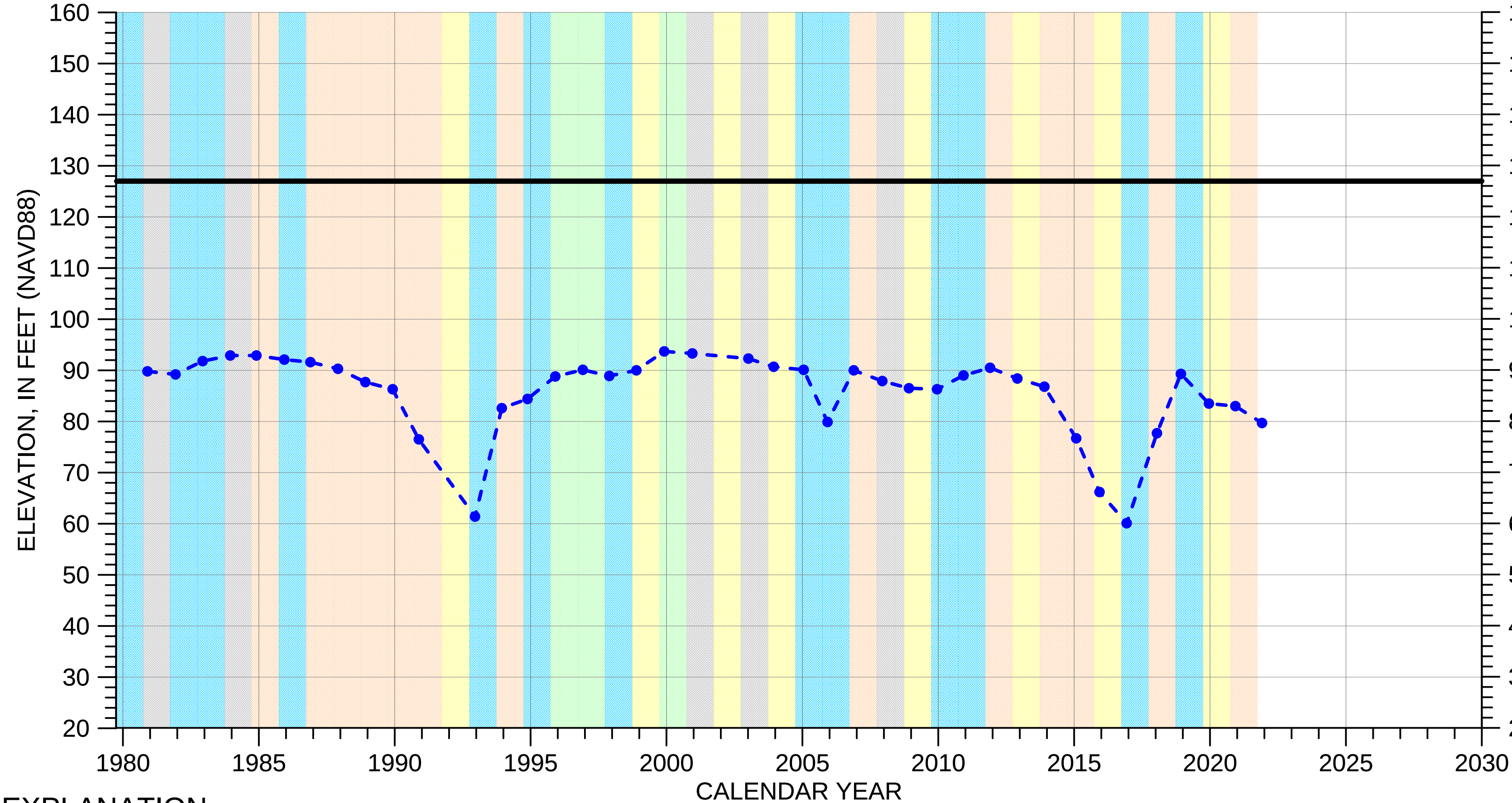
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

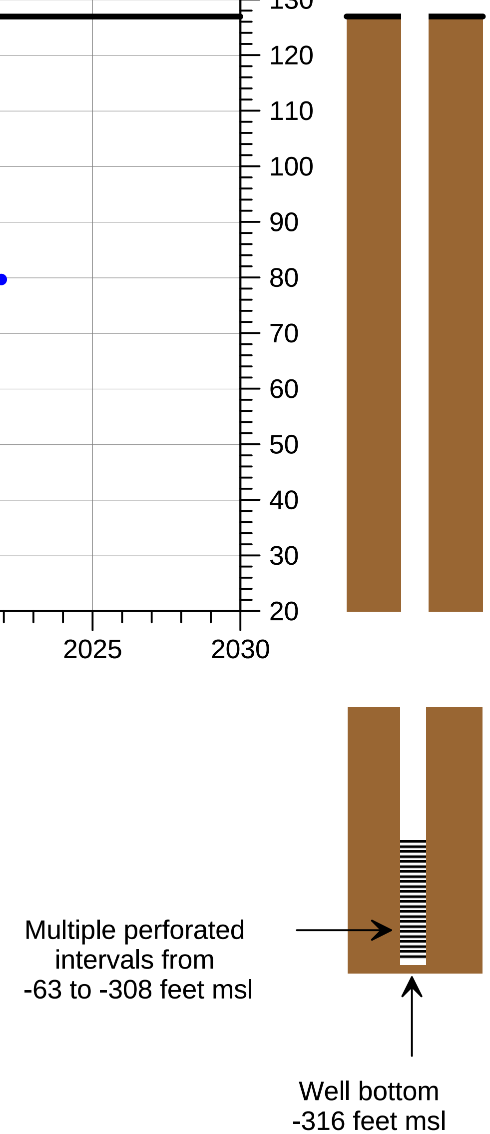


\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch5\16S_05E-30E01.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 16S/05E-30J02

180/400-Foot Aquifer Subbasin





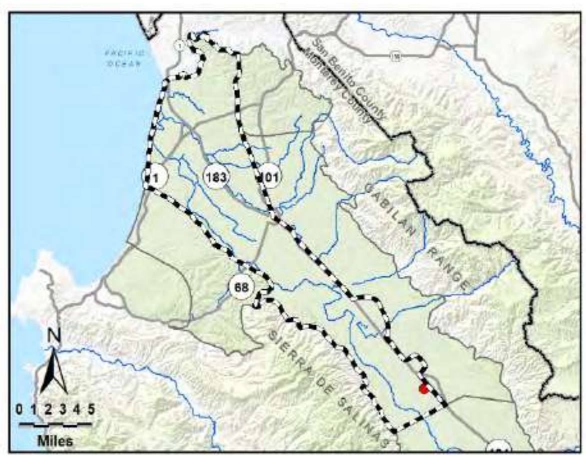
\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch5\16S_05E-30J02.grf

EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface

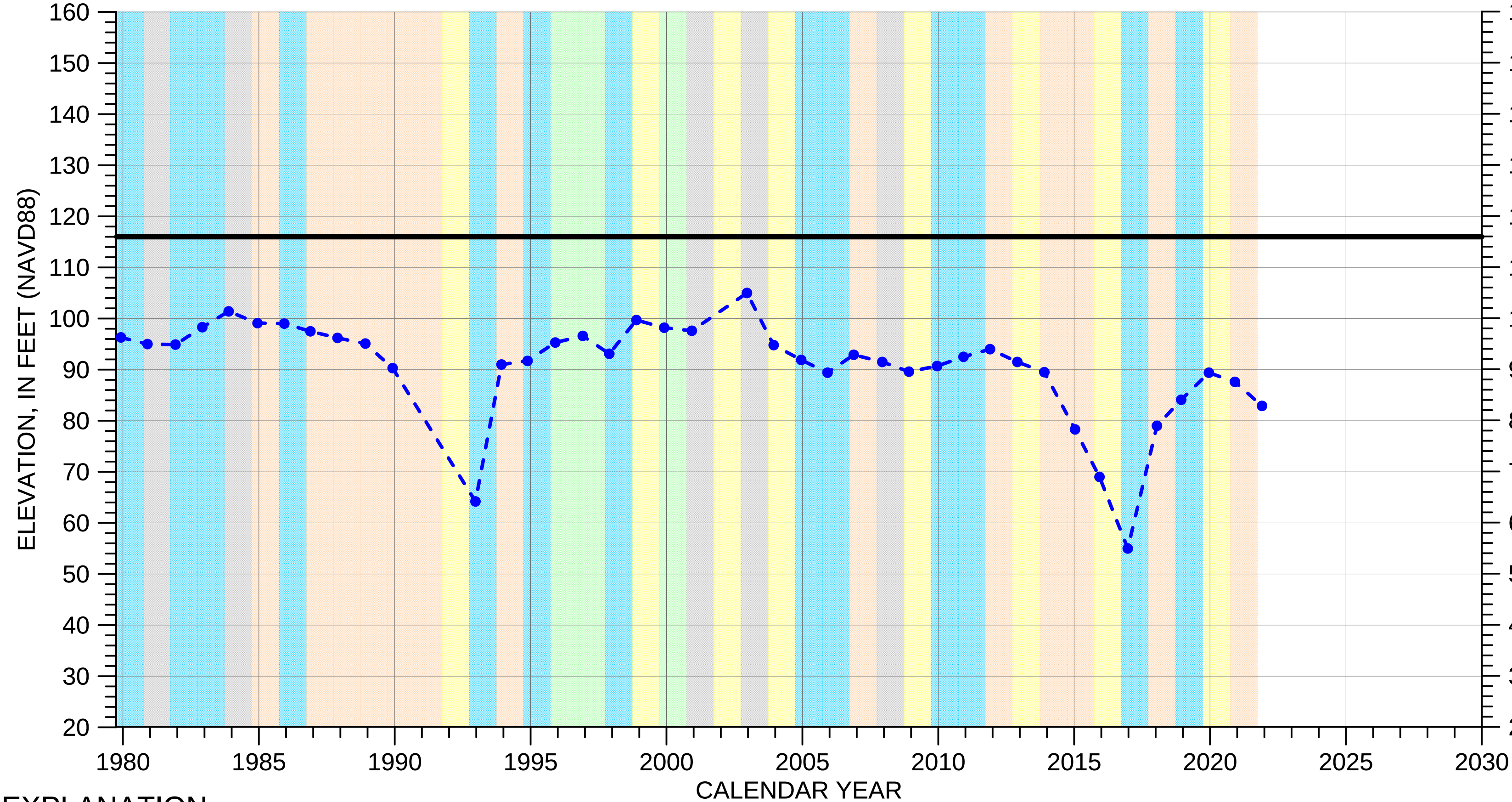
WATER YEAR TYPE DESIGNATION

- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET



HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 16S/05E-31M01

180/400-Foot Aquifer Subbasin

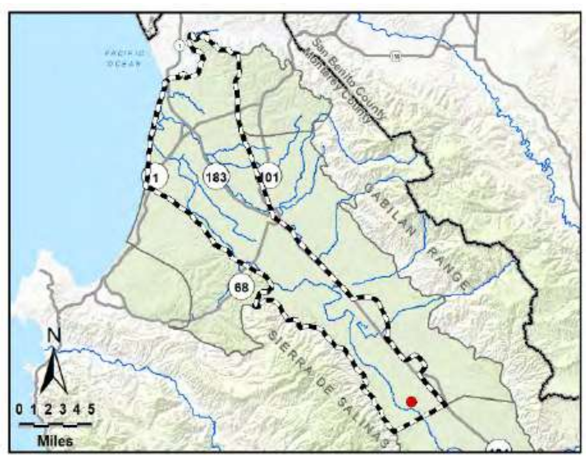


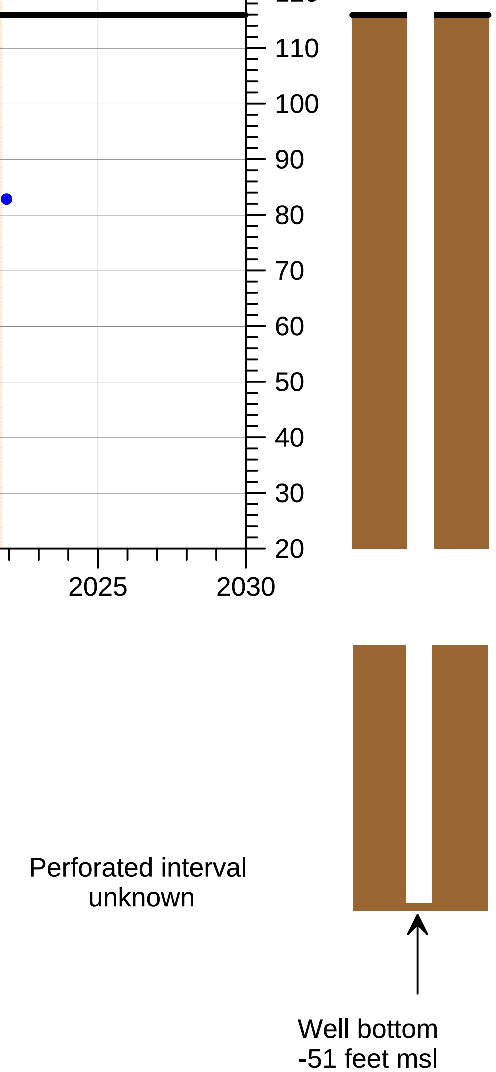
EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface

WATER YEAR TYPE DESIGNATION

- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

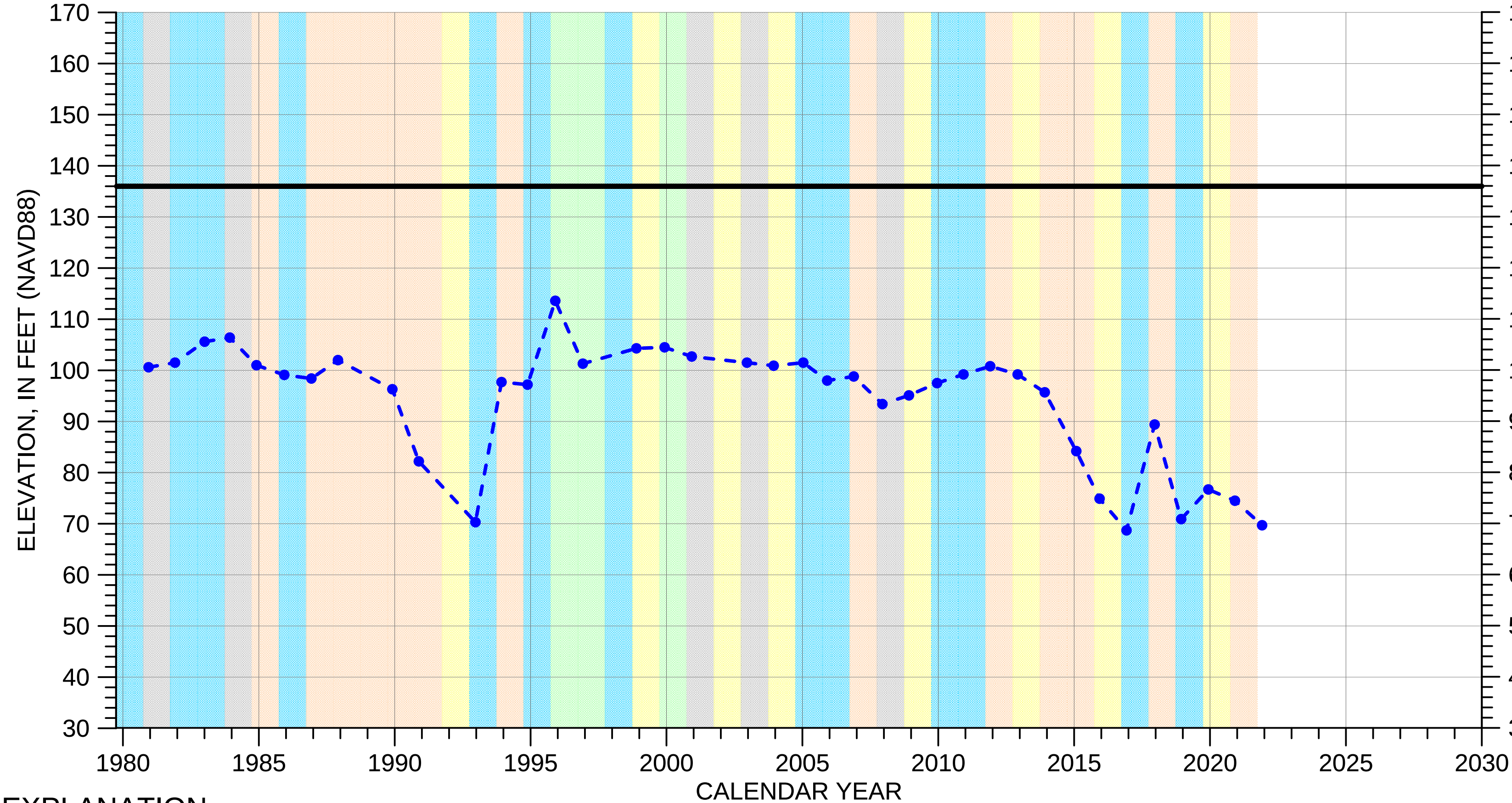




\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch5\16S_05E-31M01.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 17S/04E-01D01

180/400-Foot Aquifer Subbasin

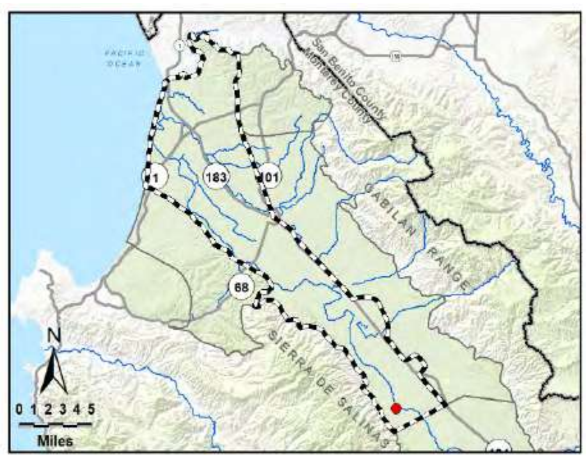


EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface

WATER YEAR TYPE DESIGNATION

- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET



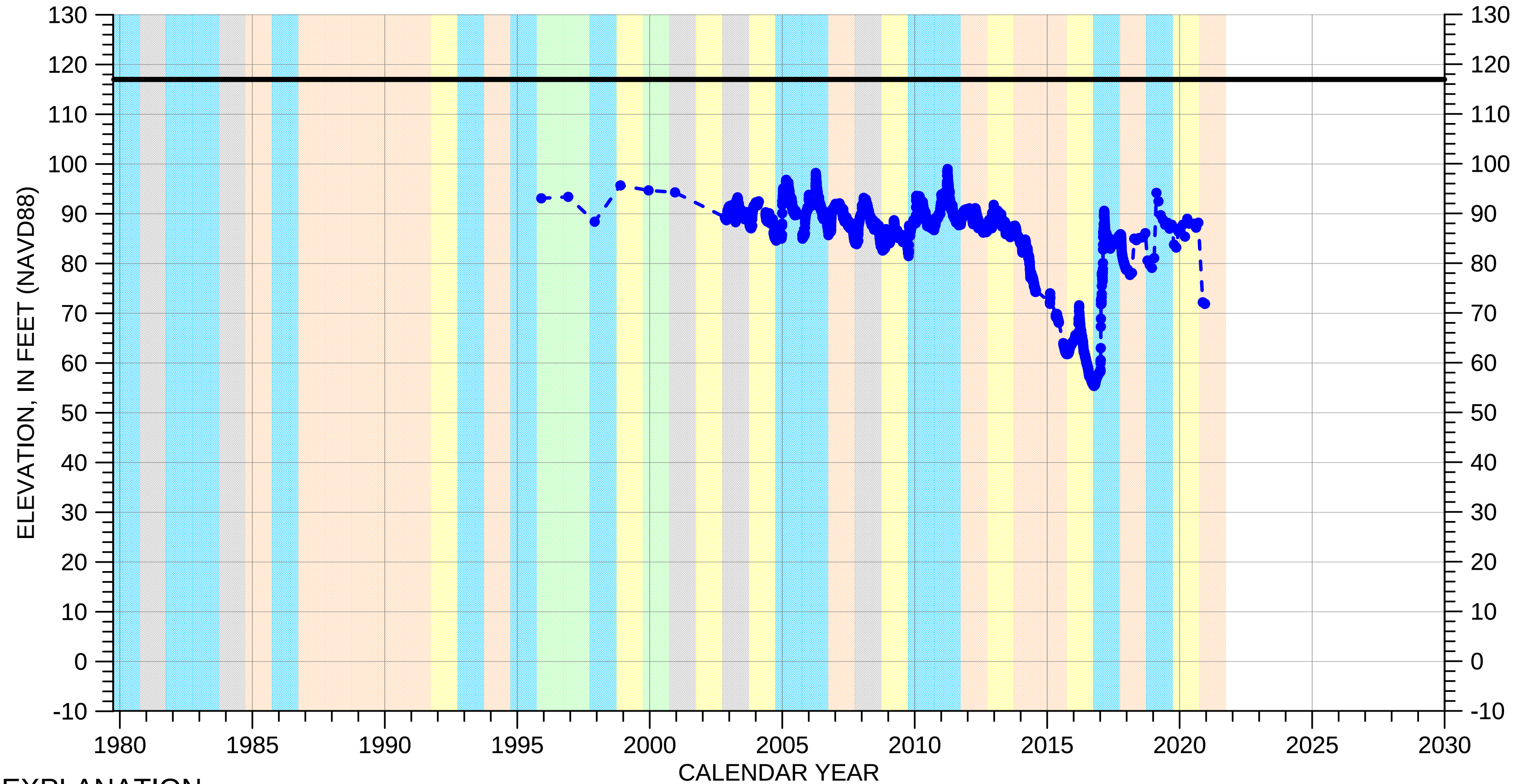
Perforated interval unknown

Well bottom
-175 feet msl

\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch5\17S_04E-01D01.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 17S/05E-06C02

180/400-Foot Aquifer Subbasin



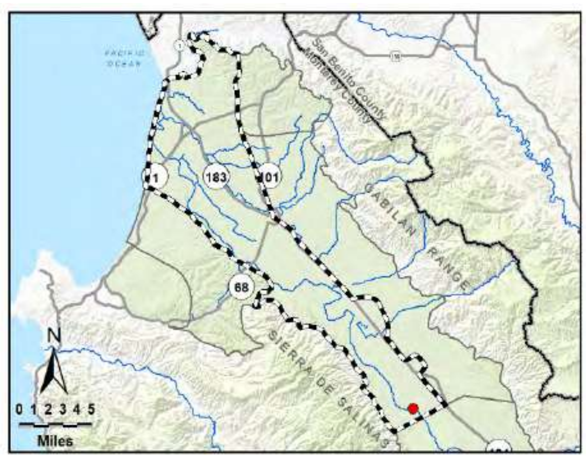
\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRA\NEWGRFs_Ch5\17S_05E-06C02.grf

EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface

WATER YEAR TYPE DESIGNATION

- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET



Chapter 5
Appendix 5-B

Storage Coefficient Description

AQUIFER STORAGE COEFFICIENTS USED IN GROUNDWATER STORAGE CHANGE CALCULATIONS FOR 180/400-FOOT AQUIFER SUBBASIN GSP UPDATE

The change in storage due to groundwater elevations in the non-seawater intruded part of the 180/400-Foot Aquifer Subbasin is based on the change in groundwater elevations. The observed groundwater elevation changes provide a measure of the amount of groundwater that has moved into and out of storage during a given time period. Aquifer properties that characterize the relationship between groundwater elevations and the amount of water stored in an aquifer are specific yield and specific storage. Specific yield is the ratio of the volume of water which a saturated porous medium will yield by gravity drainage to the volume of the porous medium (dimensionless units) (Lohman, 1972). Specific yield is generally applied to unconfined or "water table" aquifers. Specific storage is the volume of water released from or taken into storage per unit volume of a confined aquifer per unit change in head (units of 1/length) (Lohman, 1972).

Change in storage due to change in groundwater elevations is equal to the change in groundwater elevation multiplied by the non-intruded subbasin area multiplied by a storage coefficient. For confined aquifers, the storage coefficient, or storativity, is equal to the specific storage multiplied by the aquifer saturated thickness. For unconfined aquifers, the storage coefficient is specific yield. Storage coefficients are commonly estimated through long-term pumping tests, laboratory tests, or groundwater modeling. Very few estimates of storage coefficients are available for the 180/400-Foot Aquifer Subbasin. To calculate aquifer-specific and Subbasin-wide storage changes due to changes in groundwater elevations, the GSP Update uses 3 different storage coefficients: one for the whole Subbasin, one for the 180-Foot Aquifer, and one for the 400-Foot Aquifer.

Subbasin-Wide Storage Coefficient

Previous estimates of groundwater storage were developed in the *State of the Basin Report* (Brown and Caldwell, 2015) and the *Salinas Valley Historical Benefits Analysis* (Montgomery Watson, 1998). Both these reports developed change in storage estimates for the Pressure Subarea which overlaps with most of the 180/400-Foot Aquifer Subbasin. Both these reports use one average storage coefficient for the Subarea, not distinguishing between aquifers. However, these estimates are likely greater than the groundwater storage changes in the Subbasin because the Pressure Subarea covers a larger area than the Subbasin (Figure 5-14). Furthermore, the model used for the *Salinas Valley Historical Benefits Analysis* did not explicitly simulate the surficial sediments, and therefore the top model layer shows greater water level fluctuations than might be expected in a water table aquifer.

These previous reports cover different time periods, but both include data between 1980 and 1994. The *State of the Basin* report estimates that groundwater storage in the Pressure Subarea declined by approximately 2,200 AF/yr. from 1980 to 1994 due to changes in groundwater elevations. The *Salinas Valley Historical Benefits Analysis* estimates that groundwater storage in the Pressure Subarea declined by approximately 15,600 AF/yr. from 1980 to 1994 due to changes in groundwater elevations. Neither report estimates groundwater storage changes due to the advancing seawater intrusion front.

The previous reports provide starkly different estimates of the historical change in storage, and therefore provide minimal guidance for establishing a reliable change in storage methodology. There are no tools currently available to reliably estimate groundwater storage changes due to both groundwater elevations and seawater intrusion in the Subbasin, although the final SVIHM is anticipated to provide reliable estimates of change in storage due to groundwater elevations when it is released. Therefore, the method used in Chapter 5 that calculates change in groundwater storage as the sum of the change in storage due to groundwater elevations outside of the seawater intruded area and change in storage due to seawater intrusion within the seawater intruded area provides the best available method.

The Subbasin-wide storage coefficient is used to compare current groundwater conditions to SMC and to estimate change in storage for the water budget. When developing the reduction in storage SMC described in Chapter 8, two previous storage coefficients were considered. A storage coefficient of 0.036, inclusive of the 180-Foot, 400-Foot, and Deep Aquifers, was used in the *State of the Basin* report that MCWRA has used to calculate cumulative change in storage based on groundwater elevation changes. This number is the average of 3 previous estimates: 0.018, 0.015, and 0.075 for the northern, southern, and central parts of the Subbasin, respectively, based on Bulletin 118 for the 180/400-Foot Aquifer Subbasin (DWR, 2004). Although most of the aquifers in the Subbasin are considered to be confined or partially confined, changes in storage due to groundwater elevations in the unconfined parts of the Subbasin likely drive the Subbasin-wide total change in storage due to groundwater elevation changes because groundwater is more easily drained from an unconfined aquifer than a confined aquifer. Changes in groundwater elevation in an unconfined aquifer represents a larger change in storage than the same change in groundwater elevation in a confined aquifer. Therefore, a storage coefficient of 0.12, which is the initial estimate of specific yield in the Salinas Valley Integrated Hydrologic Model (SVIHM) and ongoing seawater intrusion modeling of the Subbasin, is investigated for this analysis in addition to the 0.036 storage coefficient mentioned above. The groundwater storage change due to changes in groundwater elevations is calculated based on an average groundwater elevation difference between 0.036 and 0.12, multiplied by the area of the Subbasin that is not seawater intruded and a storage coefficient. The groundwater in storage between minimum threshold and measurable objectives groundwater elevations, using the storage coefficient of 0.036, yields a groundwater level-based change in groundwater storage of 41,000 AF, similar to the 33,000 AF of groundwater storage that was lost in the 15 years reported in the *State of the Basin* report. While the storage coefficient of 0.12 yields a groundwater level-based change in groundwater storage of 138,000 AF. Both these estimates are based on an area of 84,200 acres, which is the non-seawater intruded area in the Subbasin at the measurable objective.

Change in storage due to seawater intrusion is estimated as the volume of water in both the 180-Foot and 400-Foot Aquifers that would transition from saline to fresh based on the location of the minimum threshold and measurable objective 500-mg/L chloride isocontour locations. This volume is calculated using the mapped seawater intruded acreage produced annually by MCWRA, multiplied by the approximate aquifer thickness of 150 feet for the 180-Foot Aquifer and 200 feet for the 400-Foot Aquifer. The volumes for the individual aquifers are added and then multiplied by an effective porosity of 0.12 from the SVIHM to calculate the total volume of seawater intruded groundwater in the Subbasin. Effective porosity represents the portions of the aquifer that are able to transmit water and it is used in this case because seawater is coming into the aquifers not being drained from them. If the 500-mg/L isocontour is moved to the measurable objective location from the minimum threshold location in each respective aquifer, the total increase in usable stored water due to reduced seawater intrusion would be 536,000 AF (334,000 AF in the 180-Foot Aquifer and 202,000 AF in the 400-Foot Aquifer).

Total change in groundwater storage is the sum of the storage change due to groundwater elevations and the storage change due to seawater intrusion. The total water in storage between minimum threshold and measurable objective groundwater conditions is 577,000 using the storage coefficient of 0.036 and 674,000 AF using the storage coefficient of 0.12. Although the smaller storage coefficient is more representative of confined aquifers, changes in groundwater elevation in an unconfined aquifer have greater influence in the overall change in storage than the same elevation change in a confined aquifer, so the average of 0.036 and 0.12 (0.078) is used to set the SMC for reduction of storage to be more representative of the conditions that occur in the Subbasin. Using the average storage coefficient of 0.078, the total volume of groundwater in storage between minimum threshold and measurable objective groundwater conditions is 626,000 AF. Reduction in seawater intrusion accounts for about 86% of the total average storage change between minimum thresholds and measurable objective conditions so the choice of storage coefficient only has a small influence on the SMC.

Aquifer-Specific Storage Coefficients

The aquifer-specific storage coefficients for this analysis were derived from the aquifer properties used in the SVIHM. Aquifer-specific storage coefficients are necessary to comply with GSP Regulations that require annual reports to calculate annual change in groundwater storage by aquifer. These aquifer-specific storage coefficients are used to calculate storage change caused by changes in groundwater elevations in the non-seawater intruded areas of the Subbasin. Specific storage values specified in the SVIHM are 8.2×10^{-5} ft^{-1} and 2.7×10^{-5} ft^{-1} for the 180-Foot and 400-Foot Aquifers, respectively. These numbers are consistent with the specific storage estimates for the 180-Foot and 400-Foot Aquifers in the North Marina Groundwater Model (NMGWM), as presented in *North Marina Groundwater Model Review, Revision, and Implementation for Slant Well Pumping Scenarios* (HydroForcus, 2016). The NMGWM estimates that the 180-Foot Aquifer specific storage ranges from 2.0×10^{-5} to 8.2×10^{-3} ft^{-1} (layer 4), and specific storage in the 400-Foot Aquifer ranges from 1.0×10^{-5} to 8.2×10^{-3} ft^{-1} (layer 6). The lower specific storage estimates in the NMGWM are typically specified for onshore areas, and are comparable to the SVIHM onshore specific storage values. Given the similarities between the NMGWM and SVIHM specific storage estimates, this GSP Update adopts the SVIHM estimates to calculate change in groundwater storage due to changes in groundwater elevations.

As previously described, a storage coefficient is equal to the specific storage multiplied by the aquifer saturated thickness. Specific storage estimates from the SVIHM multiplied by the approximate thicknesses of 150 feet for the 180-Foot Aquifer and 200 feet for the 400-Foot Aquifer. This yields storage coefficients of 0.012 and 0.005 for the 180-Foot and 400-Foot Aquifers, respectively. The specific storage estimates will likely change when the SVIHM is finalized; however, these values are reasonable and are the best available data. When the final SVIHM is released the specific storage estimates will be updated for the aquifer-specific storage change calculations due to changes in groundwater elevations.

REFERENCES

Brown and Caldwell. 2015. State of the Salinas River Groundwater Basin - Hydrology Report. Monterey County Water Resources Agency Water Reports. http://digitalcommons.csumb.edu/hornbeck_cgb_6_a/21.

Department of Water Resources. 2004. Bulletin 118 Interim Update 2004; *Salinas Valley Groundwater Basin, 180/400 Foot Aquifer Subbasin*. https://water.ca.gov/-/media/DWR-Website/WebPages/Programs/Groundwater-Management/Bulletin-118/Files/2003-BasinDescriptions/3_004_01_180-400FootAquiferSubbasin.pdf.

HydroFocus. 2016. North Marina Groundwater Model Review, Revision, and Implementation for Slant Well Pumping Scenarios. https://ia.cpuc.ca.gov/Environment/info/esa/mpwsp/deir-eis/Appendix%20E2.pdf.

Lohman, S.W., 1972, Groundwater hydraulics: U.S. Geological Survey Professional Paper 708.

Montgomery Watson. 1998. Salinas Valley Historical Benefits Analysis (HBA). Accessed January 27, 2022. https://www.co.monterey.ca.us/government/government-links/water-resources-agency/documents/historic-benefits-analysis.

Chapter 5
Appendix 5-C

COC Exceedance Maps

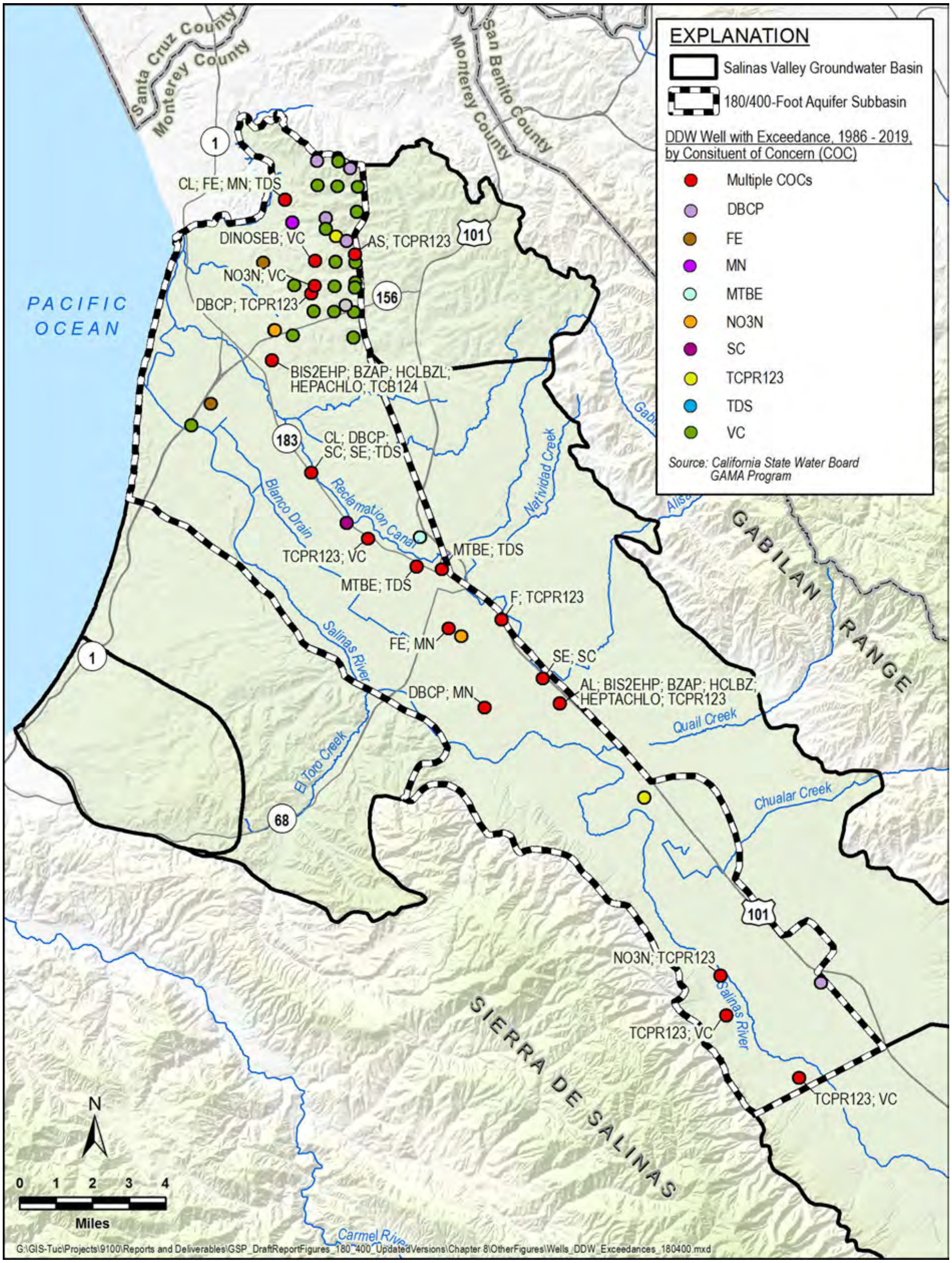


Figure 1. Water Quality Exceedances for DDW Wells

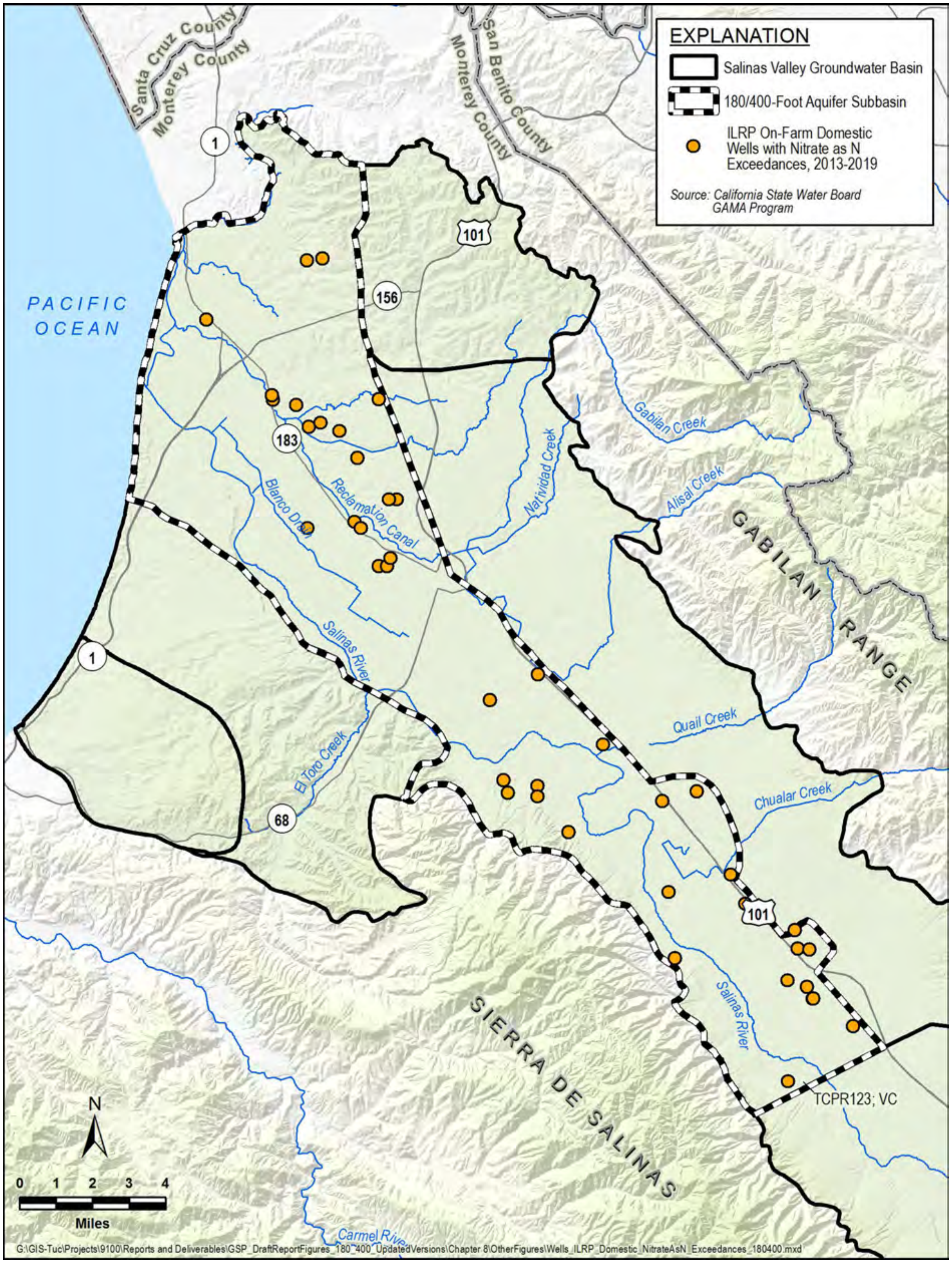


Figure 2. Nitrate Exceedances for ILRP On-Farm Domestic Wells

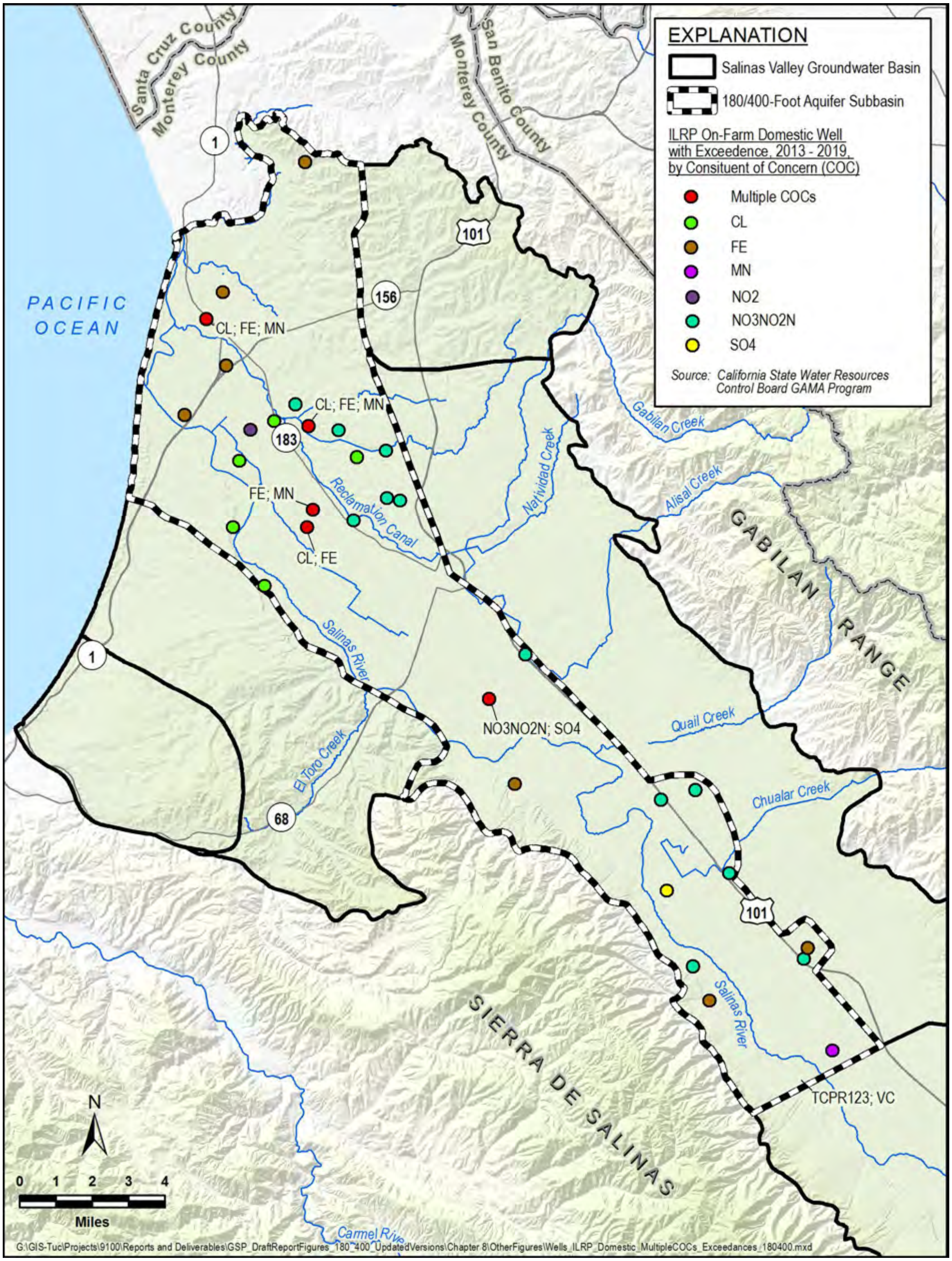


Figure 3. Exceedances for other Constituents of Concern for ILRP On-Farm Domestic Wells

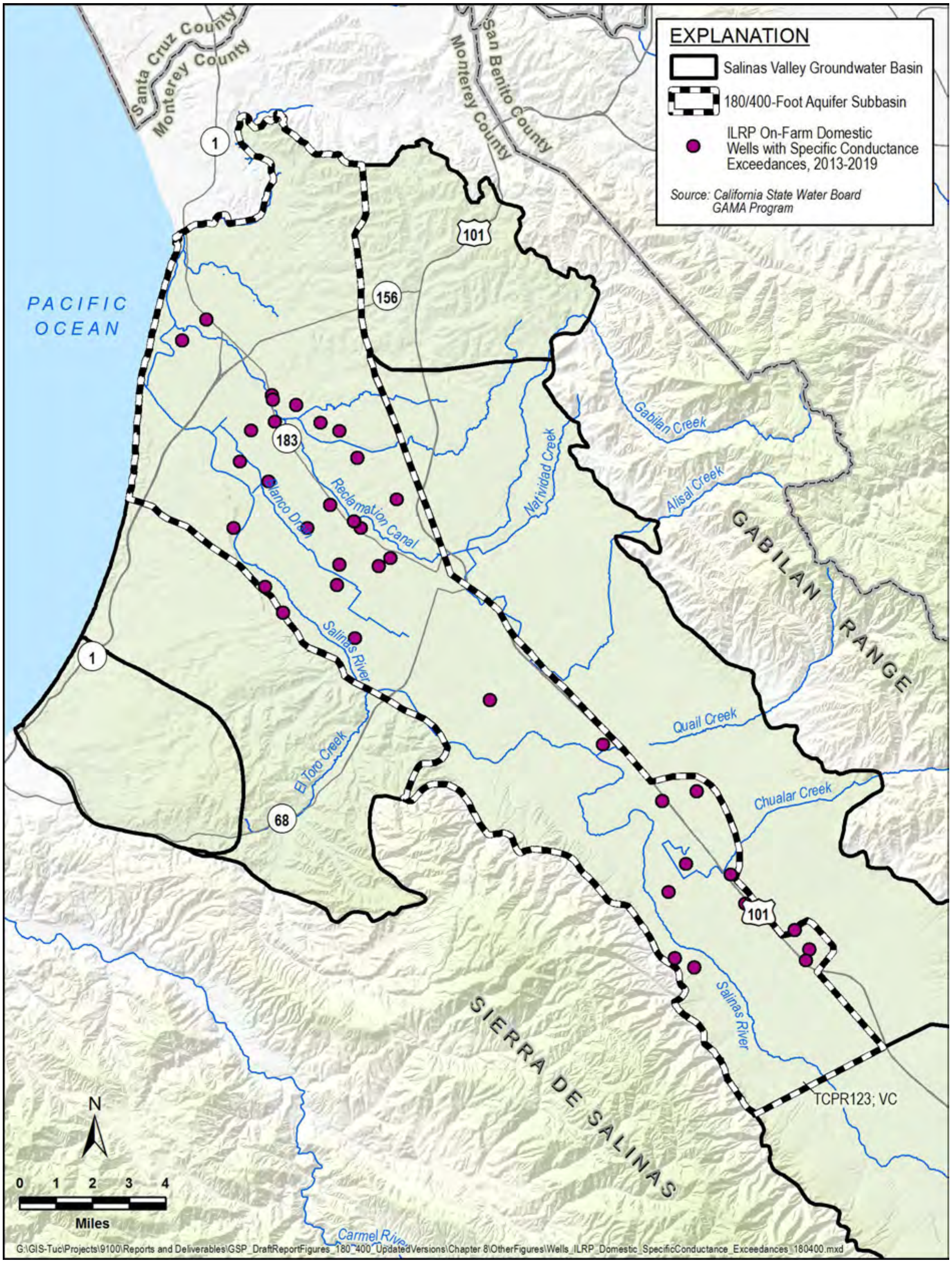


Figure 4. Exceedances for Specific Conductance for ILRP On-Farm Domestic Wells

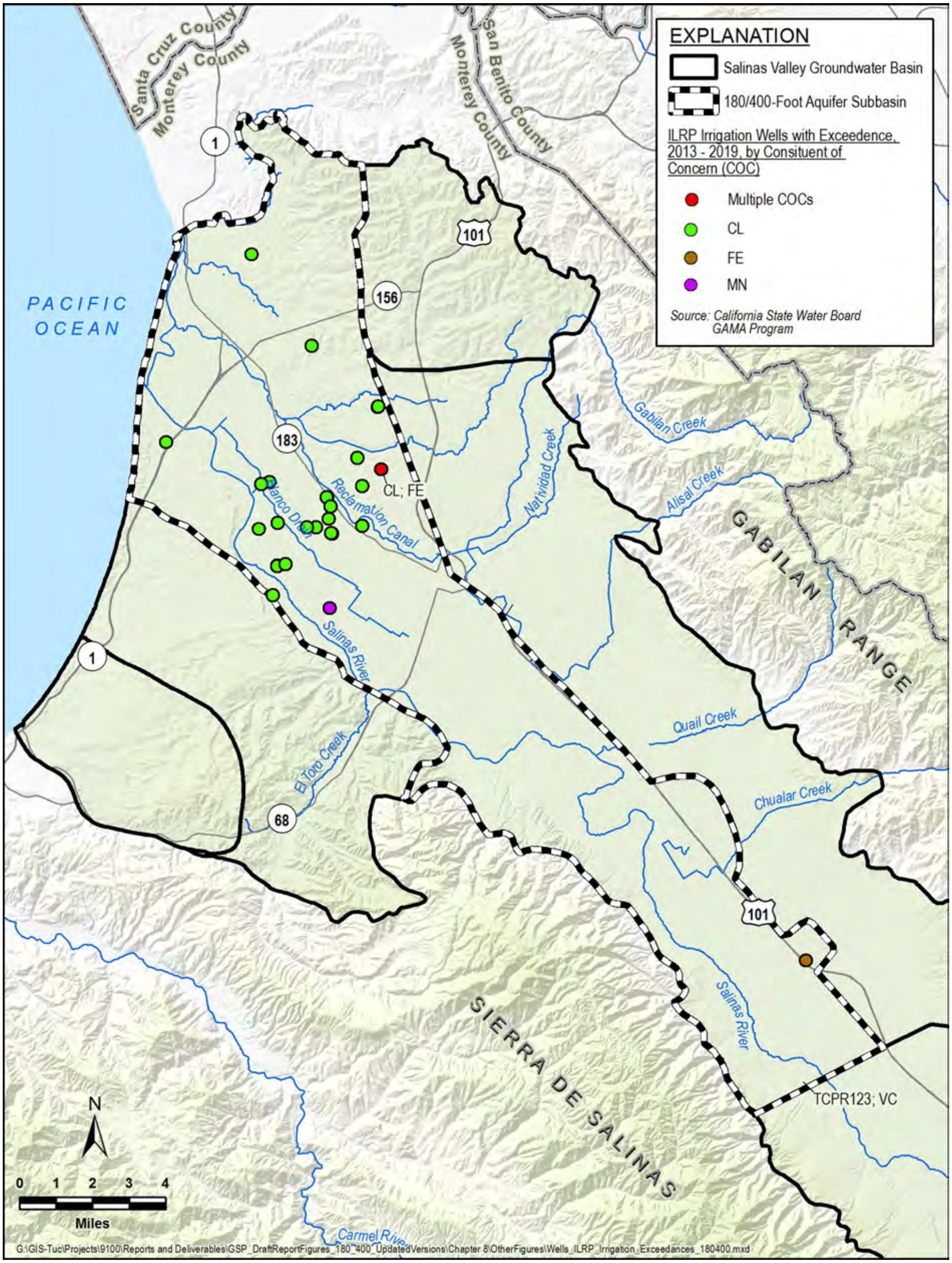


Figure 5. Water Quality Exceedances for ILRP Irrigation Wells

Chapter 6
Appendix 6-A

Salinas Valley Models Project Progress Report

United States Department of the Interior

U. S. GEOLOGICAL SURVEY
California Water Science Center
6000 J Street. Placer Hall
California State University
Sacramento, California 95819-6129
Phone: (916) 278-3000 **Fax: (916)** 278-3231
http:\water.usgs.gov

Project Progress Report

November 2, 2021

Wesley Henson, PhD., Project Chief, US Geological Survey California Water Science Center

In cooperation with Monterey County, Monterey County Water Resources Agency, and the Salinas Valley Basin GSA.

Overview of Salinas Valley Models

Introduction

In January 2016, the U.S. Geological Survey California Water Science Center (USGS CAWSC) began collaborating with Monterey County and the Monterey County Water Resources Agency (MCWRA) to create a suite of geologic and hydrologic models. The primary purpose of these models is to inform the County's five-year (2014 – 2018) hydrologic study of the water supply and groundwater quality in the MCWRA's Zone 2C, within the Salinas Valley Aquifers as part of a settlement agreement (Monterey County 2010). The suite of models include: (1) a geologic model to estimate aquifer properties and aquifer and aquitard extents; (2) a watershed model to simulate surface processes and inflows to the groundwater basin from adjacent catchments; (3) an integrated hydrologic model of the Salinas Valley Groundwater Basin; and (4) an operational reservoir model. The Salinas Valley models will contribute to several other regional modeling efforts: for MCWRA's Interlake Tunnel Project, the development of Groundwater Sustainability Plans under the State's Sustainable Groundwater Management Act (SGMA; CADWR, 2014), and a future water supply risk assessment for the Salinas and Carmel River Basins Study (SCRBS) by the U.S. Bureau of Reclamation (2015) in cooperation with local partners.

Salinas Valley model development and use in these studies are keystones of regional drought planning tools for managing conjunctive use of groundwater and surface water. These models provide vital information for evaluating strategies to achieve groundwater sustainability. These decision tools provide estimates of groundwater storage, surface and subsurface storage and flows, groundwater-surface water (GW-SW) interactions, and hydrologic and agricultural budgets. In addition, the cooperative research partnership between the Monterey County Water Resources Agency and the USGS has resulted in development of model update utilities, cutting-edge reservoir simulation and land use methods, and SGMA reporting utilities that will benefit multiple California modeling efforts.

The purposes of this project update are to (1) describe the model development (2) describe how model results are used to understand seawater intrusion, water levels (hydraulic heads), and land use, (3) provide an overview of the model review process and anticipated completion timeline, and (4) discuss how modeling results and future model updates can be used in ongoing and future hydrologic investigations in the basin.

Model development and Updates

Model development has been a collaborative process with regular guidance and input from Monterey County, MCWRA, and their consultants. Additional guidance and review were provided by an independent Technical Advisory Committee with regional stakeholders, consultants, agricultural commissioners, and the Salinas Valley Basin Groundwater Sustainability Agency.

The models were constructed using published open-source modeling software. The Salinas Valley integrated hydrologic model (SVIHM) and Salinas Valley Operational Model (SVOM) are built using the latest version of MODFLOW-OWHM (Boyce and others, 2020) with the MODFLOW Farm Process (Schmid and others (2006), Schmid and Hanson (2009)). The software can be downloaded in its entirety here, https://code.usgs.gov/modflow/mf-owhm. You can also find helpful information on this webpage https://www.usgs.gov/software/modflow-one-water-hydrologic-flow-model-conjunctive-use-simulation-software-mf-owhm. The SVIHM has been developed using two sub-models, a 3-D geologic framework and texture model (Salinas Valley Geologic Model; SVGM; Sweetkind and others, In Prep), and a Hydrologic Simulation Program – Fortran watershed model (HSPF; Bicknell and others, 1997) for the entire Salinas Valley Watershed (Salinas Valley Watershed Model, SVWM).

Geologic Framework and Texture Model

The geologic framework model was used to define the spatial extent, depth, and distribution of geologic material textures for the offshore region, five major aquifers of the Salinas Valley, aquitards between each aquifer, and the depth to bedrock. The aquifers are defined consistent with previous studies and include the surficial aquifer, 180-ft aquifer, 400-ft aquifer, Purisima aquifer, and Paso Robles aquifer.

Each of the aquifers was explicitly defined using well borehole data, and local geologic investigations (Tinsley, 1975; Feeney and Rosenberg, 2003; Kennedy/Jenks, 2004; Hanson and others, 2002; Colgan and others, 2012; Langenheim and others 2012, Hanson and Sweetkind, 2014; Taylor and Sweetkind, 2014; Hanson and others, 2014a; Baillie and others, 2015;). The distribution of texture in each aquifer was developed for each borehole location and kriged to create a continuous surface. These depth-discrete spatial layers for each aquifer were used to define a geologic texture for each model cell as a percentage of coarse material (K_{coarse}). This method has been widely used in hydrologic models (Faunt and others, 2009a; Faunt and others, 2009b; Faunt and others, 2010) to relate geologic texture to hydraulic properties. This approach defines aquifer properties using a coarse-grained (K_{coarse}) and fine-grained (K_{fine}) end member defined as:

$K_{fine}=1.0-K_{coarse}$

Hydraulic conductivity ranges for each aquifer were defined using data from previous models (Hanson and others, 1990; Hanson and Benedict, 1993; Hanson and others, 2003, 2004, 2014 a,c,d,e; Sweetkind and others, 2013; Phillips and others, 2007; Faunt and others, 2009a,b; Ludington and others, 2007; MCWRA monitoring well database), aquifer tests, and estimated ranges for geologic materials.

The hydraulic conductivity value at the upper extent of the range is assigned to cells in areas where the percentage of coarse material is 100% (K_{coarse} =1.0). Similarly, the hydraulic conductivity value at the lower extent of the range is assigned to cells in areas where the percentage of coarse material is 0% (K_{fine} = 1.0). For all other model cells, a composite hydraulic conductivity was generated using a power law relationship between the values for the K_{coarse} and K_{fine} end members.

Data from previous offshore studies (Johnson and others, 2016) were used to define the structure, distribution, and properties of the offshore region. The offshore region was parameterized similarly to the onshore region of the model domain providing continuity between the offshore and onshore regions of each aquifer that facilitates a robust estimation of fluxes between the offshore and onshore areas of each aquifer.

Climate data

Climate data for the SVWM and SVIHM include minimum and maximum air temperature, precipitation, and potential evapotranspiration. Climate data for both models were developed using the Basin Characteristics Model (BCM) tools (Flint and others, 2004; Flint and Flint, 2007 a,b,c) from national climate data stations (for example, Daly and others, 2004) and data from the California Irrigation Management System stations (CIMIS, 2005). The BCM tools were used to develop daily spatially distributed 270-m resolution climate datasets for the future climate scenarios. Climate input datasets are precipitation, maximum and minimum air temperature, and solar radiation; the latter two are used to compute evapotranspiration.

Climate input were developed as spatially distributed grids. Gridded data were interpolated onto the model grid using an area-weighted approach. For the SVWM, the 270-m climate data were interpolated onto the hydrologic response units (HRUs). For the SVIHM, the 270-m climate grids were interpolated onto the model grid.

Salinas Valley Watershed Model

The (SVWM) simulates watershed processes for the entire Salinas River watershed (figure 1). The model simulates the historical period between 10/1/1948 - 9/30/2018. Each sub-catchment in the domain was defined as a hydrologic response unit (HRU). Hydrologic processes simulated for each HRU include evapotranspiration, runoff, interflow and baseflow. Each HRU is connected to stream segments and tributaries that represent a drainage network to route surface waterthrough the SVWM from upland areas to the Pacific Ocean. Streamflow in each stream segment is simulated using the kinematic wave method. The simulation includes the discharge volume, stream velocity, stage, and water volume for the segment, as well as stream losses from evaporation and streamchannel infiltration.

The SVWM combines the BCM tools and HSPF models to simulate the climate and hydrology for the upland areas and tributaries draining into the alluvial valleys simulated by the SVIHM. The SVWM domain consists of an upper Salinas Valley subarea and lower Salinas Valley subarea simulated as sub-catchments connected at the location of USGS streamgage 11150500 (SALINAS R NR BRADLEY CA, https://waterdata.usgs.gov/nwis/uv?site_no=11150500), with all surface water outflows from the upper SVWM entering the lower SVWM as Salinas River streamflow at the location of the streamgage. The upper SVWM includes five sub-watershed areas that contain most of the Paso Robles area of the Upper Salinas

River Valley in San Luis Obispo County area, while the lower SVWM contains most of the SVIHM area within its five sub-watershed areas.

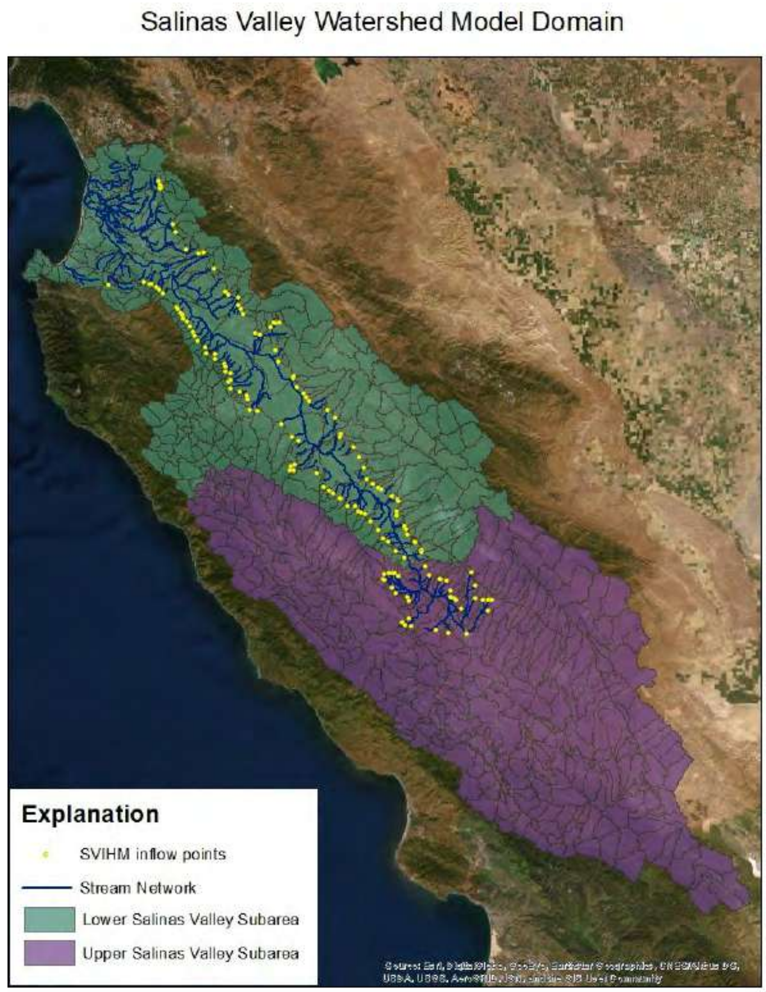


Figure 1: Salinas Valley Watershed Model (SVWM) domain showing Upper and Lower Salinas Valley Subareas, stream network, and inflow points where watershed flows are routed into the Salinas Valley Integrated Hydrologic Model (SVIHM).

Spatial discretization of the SVWM was based on topographically defined watersheds that were subdivided into smaller sub-drainage areas using a combination of surface flow-routing defined by a 10-meter digital elevation model (DEM) and pre-defined sub-drainages (CalWater version 2.2.1, Department of Forestry and Fire Protection, http://frap.fire.ca.gov/data/frapgisdata-sw-calwaterdownload). The smaller sub-drainages were used to (1) represent spatially varying climate and topography in the upland areas of the SVWM model domain, and (2) define pour points to route estimated ungaged flows from the SVWM to the SVIHMstream networks. The SVWM spatial discretization resulted in HSPF segments varying in area from 65 acres to about 25,000 acres and a total of 148 pour-point connections for inflows from upstream drainagesalong the Salinas Valley.

The HSPF model is run as a continuous simulation using an hourly time step; however, in the current

SVWM version, the daily climate inputs are uniformly distributed to hourly values. Therefore, only daily results are used for calibration and for developing SVIHM inflows.

SVWM model parameters were developed using geographic information system (GIS) data sets that included: DEM-derived elevation, slope and aspect, estimated soil water storage capacity (State Soil Survey Geographic ((SSURGO), Web Soil Survey, available online at https://websoilsurvey.nrcs.usda.gov/), percent forest canopy and impervious land cover (National Land Cover Data, NLCD; U.S. Geological Survey, 2007, 2011, 2014). For discrete data such as land cover type, GISanalysis was used to calculate the weighted average values for each HSPF parameter based on the fractional area of a given discrete data value within each HSPF segment. The fractional areas for discretedata are calculated in GIS, and the weighted averages are calculated in spreadsheets, resulting in a uniqueset of HSPF parameters for each model segment. This method provided a better representation of the physical watershed characteristics for each segment as compared to simply using the dominant discrete data within each segment. Continuous data such as slope and percent canopy cover were mapped directly to HSPF segments as area-average values using GIS.

The SVWM was used to estimate inflows into the Salinas Valley from adjoining ungaged watersheds. These inflows are provided as a monthly inflow time series to the SVIHM. Although the model is only used to estimate ungaged watershed inflows to the SVIHM, the SVWM is calibrated for the entire basin, providing many opportunities for future evaluations where surface water and sediment and nutrient transport are of greater concern than groundwater storage. These potential applications will be discussed in the section on Future model updates, applications, and developments.

Salinas Valley Integrated Hydrologic Model

The Salinas Valley Integrated Hydrologic Model (SVIHM) is an integrated water resources management tool that simulates the conjunctive use of groundwater and surface-water in the Salinas Valley (Figure 2). The Salinas Valley model simulates the period between 10/1/1967 to 9/30/2018 and has been calibrated for the period from 10/1/1967 to 12/31/14. The SVIHM includes explicit representation of climate, groundwater and surface water, recharge, runoff, inflows from ungaged watersheds, reservoir releases, Salinas River diversions, municipal and industrial water supply pumping, and a rigorous simulation of the substantial Salinas Valley agricultural industry.

The SVIHM is built using the latest version of MODFLOW-OWHM (Boyce and others, 2020) with the MODFLOW farm process. OWHM simulates water supply and demand for natural, urban, and cultivated lands. OWHM uses an embedded land use and crop model based on the widely used FAO56 method (Allen and others, 2005) to estimate water demands for a set of user-specified land uses. If precipitation and direct groundwater root uptake are insufficient to meet simulated land use water demands, then additional supplies can be provided to meet the deficit (groundwater pumping, surface water diversions, wastewater reclamation, and reservoirs). Additionally, for cultivated lands, water demand efficiencies can be specified for land-use type, irrigation type, climate regime (wet or dry), and region. This well-developed model framework facilitates evaluation of water demand by region, crop, and climate regime and allows for scenario testing to evaluate the effects of potential changes in agricultural practices, increases in efficiency, and optimization of agricultural development within the basin. This tool is well suited for the analyses that will be needed throughout the next century to manage sustainability of the Salinas Valley aquifer system.

Salinas Valley Integrated Hydrologic Model Domain

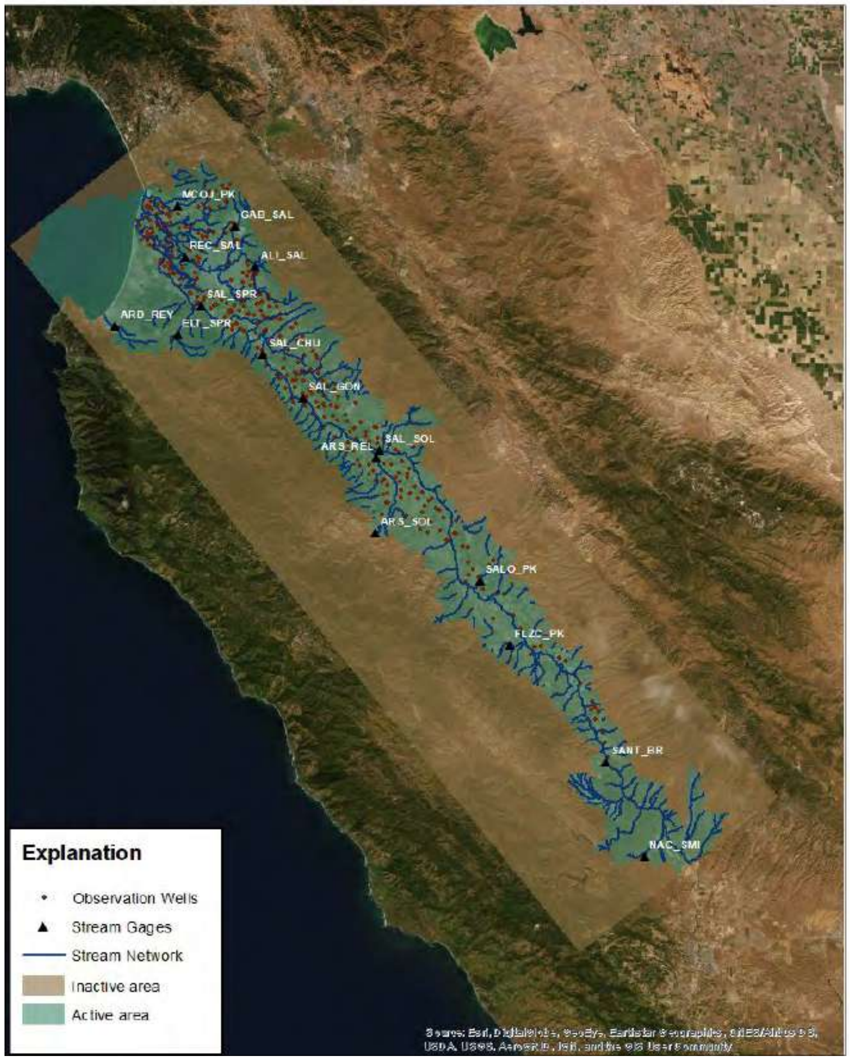


Figure 2: Salinas Valley Integrated Hydrologic Model (SVIHM) showing domain extent with inactive and active areas, stream network, stream gages, and observation wells.

The total active modeled area in the SVIHM is 10,266 mi^2. The model grid is uniform, where each grid cell is approximately 6.42 acres (529-by-529 ft). There are 976 rows, 567 columns, and 9 layers having a varying number of active cells in each layer, for a total of 265,382 active model cells. To assess changes in aquifer storage due to seawater intrusion, the model includes approximately 84,000 active cells onshore and 11,000 active cells offshore. The SVIHM includes nine model layers that correspond to locally defined hydrostratigraphic units such as the defined aquifers (180-Foot and 400-Foot aquifers), confining units, and geologic units (e.g., basement bedrock). The top of SVIHM is represented by the altitude of the land surface, but because hydrostratigraphic units are discontinuous across the study area, the uppermost active layer is a composite of model layers 1, 3, 5, 7, and 9.

The SVIHM is partitioned into 31 water balance subregions (WBS; Figure 3 and Table 1). Each WBS has simulatedwater demands for each land use and a unique set of available water supplies that can be used by the model to meet the demands. The model includes WBS representing the Zone 2C jurisdictional area and associated subareas, the Castroville Seawater Intrusion Project (CSIP) area, Seaside Basin, and areas outside the Zone 2C boundary but within the SVIHM model domain.

Table 1. Summary of water-balance subregions within the Salinas Valley Integrated Hydrologic Model, Monterey and San Luis Obispo Counties, California. (SW= Surface water, GW = Groundwater, None = No Deliveries).

Water Balance Subregion	Region Name	Region Description	Irrigation Water Supply
1	Riparian Corridor	Monterey and SLO Counties	None
2	CSIP Area	Castroville Seawater Intrusion Project Region	GW/SW/recycled water
3	Coastal Urban areas	Salinas, Castroville, Marina, Seaside, Sand City, Monterey, Del Rey Oaks	None
4	Inland Urban areas	Chualar, Gonzales, Soledad, Greenfield, King City, & San Ardo	None
5	Highlands South	North of Eastside outside of Zone 2C	GW
6	Granite Ridge	North of Eastside outside of Zone 2C	GW
7	Corral De Tierra	South of Pressure part within Zone 2C	GW
8	Blanco Drain Area	Drain subarea within Pressure subarea of Zone2C	GW
9	East Side	Remainder of Eastside subarea in Zone2C	GW
10	Pressure Northeast	Pressure subarea NE of Salinas River in Zone 2C	GW
11	Pressure Southwest	Pressure subarea SW of Salinas River in Zone 2C	GW
12	Forebay Northeast	Forebay subarea NE of Salinas River in Zone 2C	GW
13	Forebay Southwest	Forebay subarea SW of Salinas River in Zone 2C	GW
14	Arroyo Seco	Subarea SW of Salinas River outside of Zone 2C	GW
15	Clark Colony	Subarea SW of Salinas River partly outside of Zone 2C	SW/GW
16	Upper Valley Northeast	Upper Valley subarea NE of Salinas River and northeast of King City in Zone 2C	GW
17	Upper Valley Northwest	Upper Valley subarea NW of Salinas River and west of King City in Zone 2C	GW
18	Upper Valley Southeast	Upper Valley subarea SE of Salinas River and east of King City in Zone 2C	GW
19	Upper Valley Southwest	Upper Valley subarea SW of Salinas River and west of King City in Zone 2C	GW
20	Below Dam	Subregion below Nacimiento Dam and within Zone 2C	GW

21	Westside Region	Westside Regions of SVIHM outside of Zone 2C boundary in Monterey County Inland Southwest of Arroyo Seco and Clark Colony subregion	GW
22	Hames Valley	Outside Zone 2C but in Monterey County	GW
23	NE Quarries	Outside Zone 2C but in Monterey County	GW
24	Northeast Region	Northeast Regions of SVIHM outside of Zone 2C on the Northeast side of the Eastside, Granite Ridge, and Highlands South subregions	GW
25	Southwest Region	Southwest regions of SVIHM outside of Coastal Pressure subregion Zone 2C boundary in Monterey County	GW
26	Northeast Region	Northeast Region of SVIHM outside of Zone 2C Forebay subregion in Monterey County	GW
27	Southwest Region	Southwest regions of SVIHM outside of the Upper Valley and Forebay regions subregions of Zone 2C in Monterey County plus outside of Arroyo Seco, Hames Valley, and SLO active subregions	GW
28	Southeast Region	Southeast Region of SVIHM outside of Below Dam and Upper Valley subregions of Zone 2C boundary in Monterey County	GW
29	Paso Robles Region	Remainder of Paso Robles Basin in active model grid in San Luis Obispo County	GW
30	Seaside Basin	Seaside Adjudicated Basin (landward only)	GW
31	Offshore	Offshore (groundwater analysis only)	None

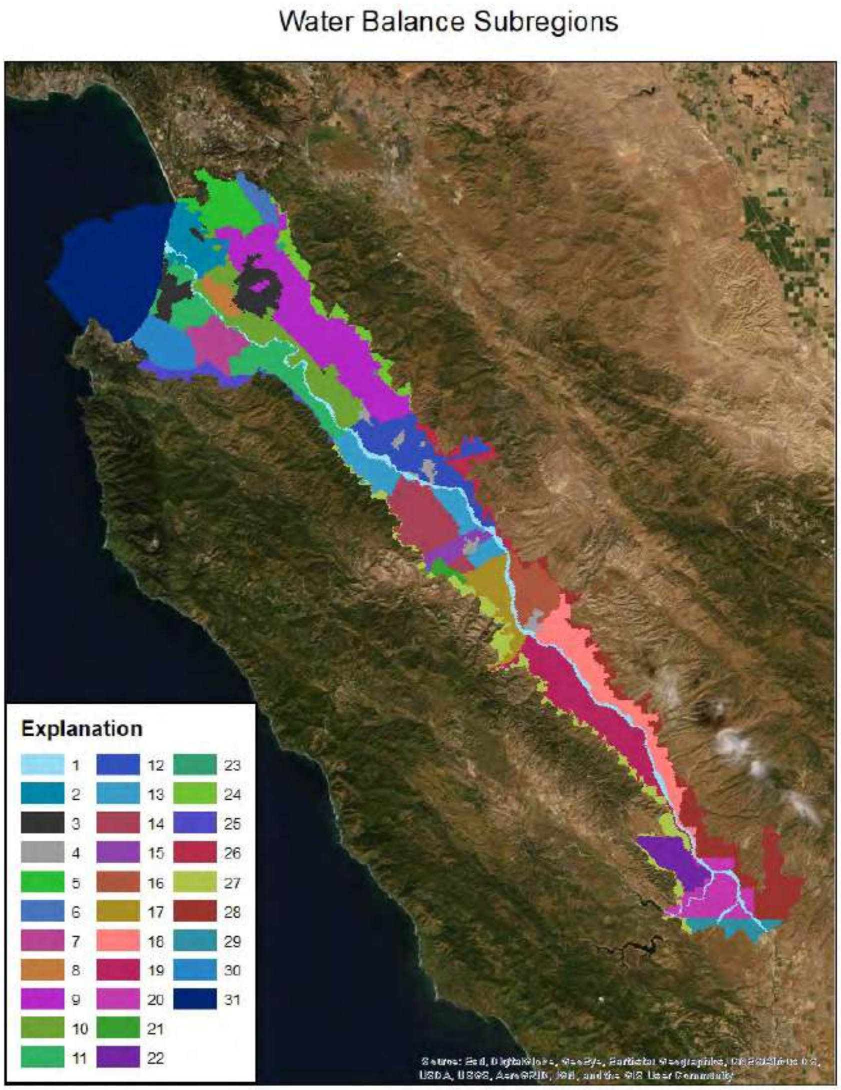


Figure 3: Salinas Valley Integrated Hydrologic Model Water Balance Subregions.

The SVIHM has 56 specified land use types (Table 2), each with defined water sources, irrigation type and efficiency (if applicable), and crop water demand properties (crop coefficients, area, crop development timeline). For each model year, two six-month land use maps were generated using a composite of available land use data from California Department of Water Resources, Monterey County, and the National Land Cover Database (NLCD, U.S. Geological Survey, 2014) and a newly developed method that leverages the California Pesticide Use Reporting (CalPUR) database.

The new CalPUR method is used to provide greater detail about the distribution of crops within areas with vague land use types such as “truck and vegetable crops” (Henson and others, in Prep). This approach captures complex cultivation methods including multi-cropping and crop rotations, providing a rich dataset for estimating agricultural water demands.

Table 2: Salinas Valley Integrated Hydrologic Model (SVIHM) Land Use Types

Land Use Type		Land Use Type		Land Use Type	
1	Celery – coastal	20	Root vegetables – inland	39	Outdoor nurseries – coastal
2	Celery – inland	21	Tomato/pepper – coastal	40	Outdoor nurseries – inland
3	Cucumber/melon/squash – coastal	22	Tomato/pepper – inland	41	Indoor nurseries
4	Cucumber/melon/squash – inland	23	Strawberries – coastal	42	Artichokes
5	Legumes – coastal	24	Strawberries – inland	43	Pasture
6	Legumes – inland	25	Corn – coastal	44	Non-irrigated
7	Lettuce – coastal	26	Corn – inland	45	Semi-agricultural
8	Lettuce – inland	27	Field crops – coastal	46	Idle/fallow
9	Rotational 30-day – coastal	28	Field crops – inland	47	Ag-trees
10	Rotational 30-day – inland	29	Grain crops – coastal	48	Golf course turf/parks
11	Crucifers/cabbages – coastal	30	Grain crops – inland	49	Urban
12	Crucifers/cabbages – inland	31	Cane/bush berries – coastal	50	Quarries
13	Unspecified irrigated row crops – coastal	32	Cane/bush berries – inland	51	Water
14	Unspecified irrigated row crops – inland	33	Deciduous fruits and nuts – coastal	52	Riparian
15	Carrots – coastal	34	Deciduous fruits and nuts – inland	53	Upland grasslands/shrub lands
16	Carrots – inland	35	Citrus/subtropical – coastal	54	Woodlands
17	Onions/garlic – coastal	36	Citrus/subtropical – inland	55	Beach/dunes
18	Onions/garlic – inland	37	Vineyards – coastal	56	Barren/burned
19	Root vegetables – coastal	38	Vineyards – inland		

The SVIHM was calibrated using over 63,098 monthly observations including: 1,738 measurements from the MCWRA observation well network (Figure 2); 6,448 streamflow measurements of at 17 streamgages (Figure 2 and Table 3); 127,683 monthly reported groundwater extraction values; and 162 reported monthly diversions. In addition, calibration included second-order observations of streamflow differences between gages and vertical hydraulic head differences between aquifers with multiple nested observation wells.

Table 3: Stream gage information showing Gage ID, U.S. Geological Survey National Water Information System (NWIS) gage number and gage name.

Gage ID	NWIS Gage Number	Gage Name
ARS_SOL	11152000	ARROYO SECO NR SOLEDAD CA
ARS_REL	11152050	ARROYO SECO BL RELIZ C NR SOLEDAD CA
SAL_SOL	11151700	SALINAS R A SOLEDAD CA
ELT_SPR	11152540	EL TORO C NR SPRECKELS CA
SAL_CHU	11152300	SALINAS R NR CHUALAR CA
ALI_SAL	11152570	ALISAL C NR SALINAS CA
SANT_BR	11150500	SALINAS R NR BRADLEY CA
SAL_SPR	11152500	SALINAS R NR SPRECKELS CA
SALO_PK	11151500	SAN LORENZO C A KING CITY CA
NAC_SMI	11149500	NACIMIENTO R BL NACIMIENTO DAM NR BRADLEY CA
REC_SAL	11152650	RECLAMATION DITCH NR SALINAS CA
GAB_SAL	11152600	GABILAN C NR SALINAS CA
ARD_REY	11143300	ARROYO DEL REY A DEL REY OAKS CA
FLZC_PK	11150700	FELIZ CYN TRIB NR SAN LUCAS CA
MCOJ_PK	11152700	MORO COJO SLOUGH TRIB NR CASTROVILLE CA
SAL_GON	11152200	SALINAS R NR GONZALES CA

In collaboration with MCWRA and the Pajaro Valley Water Management Agency, self-updating model tools have been developed which allow temporal datasets of MODFLOW-OWHM models to be updated using spreadsheets with updated temporal data. This approach is an improvement that allows models to continue to be updated and useful for the wide range of resource questions and scenarios that arise. These self-updating model tools can be used to update or correct input data describing climate data, ungaged inflow data, land use properties, observed hydraulic heads, groundwater extraction, wastewater reclamation, surface water diversions, reservoir releases, and agricultural pumping, irrigation types and efficiencies. All these updates can be completed without rebuilding the entire model. Model updates are described in the section "Future model updates, applications, and developments".

Salinas Valley Operational Model

The Salinas Valley operational model (SVOM) uses the Surface Water Operations Module of MODFLOW-OWHM. This implementation of reservoir operations is based on a wealth of prior publications (Ferguson and others 2015; Ferguson and others, 2016; Hevesi and others, 2019; Hanson and others, 2020; Boyce and others, 2020). The SVOM is a baseline model that is used to evaluate water supply projects such as the reservoir modification and changes to operations to aide with groundwater sustainability efforts. The SVOM is similar to the SVIHM for simulation of hydrologic processes, surface and subsurface properties, and simulation of agricultural operations. In this model, the land use is fixed to 2014, the time step is shorter, about five to six days, and the reservoir operations are explicitly simulated. The reservoir operations rules are human readable text files that formulate the logic for the current mandated operational rules for conservation, water supply, flood mitigation, and water rights. These operations include fish passage rules that support the life cycle of threatened steelhead fish populations. These input data just translate existing flow charts and figures from the approved operations into text that the model can read in. These data are available from MCWRA upon request, both in the form used in the model and in public documents.

Model Representation of Seawater Intrusion, Groundwater Levels and Land Use

The following descriptions of methods are provided to illustrate how the model will inform future evaluations of Seawater Intrusion, groundwater sustainability evaluations and scenarios, and responses to changes in land use and climate.

Seawater Intrusion

Interactions with onshore freshwater aquifers and near-shore saltwater aquifers are driven by contrast in aquifer hydraulic heads and pore water densities between freshwater and seawater and the distribution of aquifer permeability along the coast. Seawater Intrusion (SWI) is estimated in the SVIHM as flux across the coastal boundary. The monthly elevation of the 9413450 NOAA Station buoy in Monterey Bay is used as a proxy for the sea water elevation (H_{sw}). In the model, the sea level is simulated as an equivalent freshwater head (h_{fw}) using the following relation from Motz (2005):

$$h_{fw} = \frac{\rho_{sw}}{\rho_{fw}} h_{sw} - \left(\frac{\rho_{sw} - \rho_{fw}}{\rho_{fw}} \right) Z$$

where

- h_{fw} is the seawater's equivalent freshwater hydraulic head at elevation Z (L),
- ρ_{sw} is the seawater density (M/L^3),
- ρ_{fw} is the freshwater density (M/L^3), and
- Z is the elevation point where the equivalent freshwater head is calculated (L).

Similar to other models in the region (Hanson, 2003a,b), the freshwater-seawater interface is simulated as general head boundary (GHB), that is, a boundary that depends on the aquifer hydraulic heads along the coast. To specify an ocean boundary condition with the GHB, the sea level is converted to an equivalent freshwater head at the model cell's center. The density of seawater is assumed to have an average value of 1,025 kg/m^3, and the density of freshwater is assumed to be 1,000 kg/m^3 (Motz, 2005). When hydraulic head in an aquifer is greater than h_{fw} along the coast, hydrologic flows are seaward. Conversely, when hydraulic head in an aquifer is less than h_{fw} along the coast, seawater intrusion into the aquifer occurs. The net annual flux values along the coastline for each aquifer are simulated by the SVIHM to inform interpretation of chloride monitoring by MCWRA.

Although these estimates do not provide information about the onshore spatial extent of SWI, the model is well-poised to be used to provide this information in future model updates and applications. These more explicit methods will be described in the Future model updates, applications, and developments section.

Groundwater Elevations

The SVIHM and SVOM estimate groundwater elevations using well-developed methods of the MODFLOW framework. MODFLOW uses the method of finite differences to solve the groundwater flow equation for each model cell. This approach assumes Darcian flow that is based upon hydraulic gradients within and among aquifers and the spatial distribution of hydraulic conductivity. Additional boundary conditions or processes that can increase or decrease hydraulic heads in the model are simulated such as barriers to flow (for example, faults), groundwater extraction (for example, municipal and agricultural pumping), stream-aquiferinteractions, sea water intrusion, and recharge.

After successful calculation of the hydraulic head in each aquifer, well depth-weighted composite heads are developed for wells screened in multiple aquifers. Composite- and single-well aquifer values for the simulated and observed hydraulic heads are compared. If the comparison between simulated and observed hydraulic heads is reasonable, the spatial distribution of simulated aquifer hydraulic heads provides another source for evaluating groundwater elevations and complements independently developed groundwater contour maps by MCWRA.

Land Use

Land use will be updated in future updates of the SVIHM using available spatial datasets and the CalPUR method to attribute vague land use categories. As new spatial data become available, they can be prioritized in the composite land use map and replace co-located data. The process for developing land use input data has four steps: develop a composite map, enhance map with CalPUR data, interpolate onto model grid, and generate the input files. In the future, new land use properties may need to be developed for new crop types not already represented in the current version of the historical model. An example of the 2017 land use map is provided to illustrate the representation of land use for every year in the model (Figure 4).

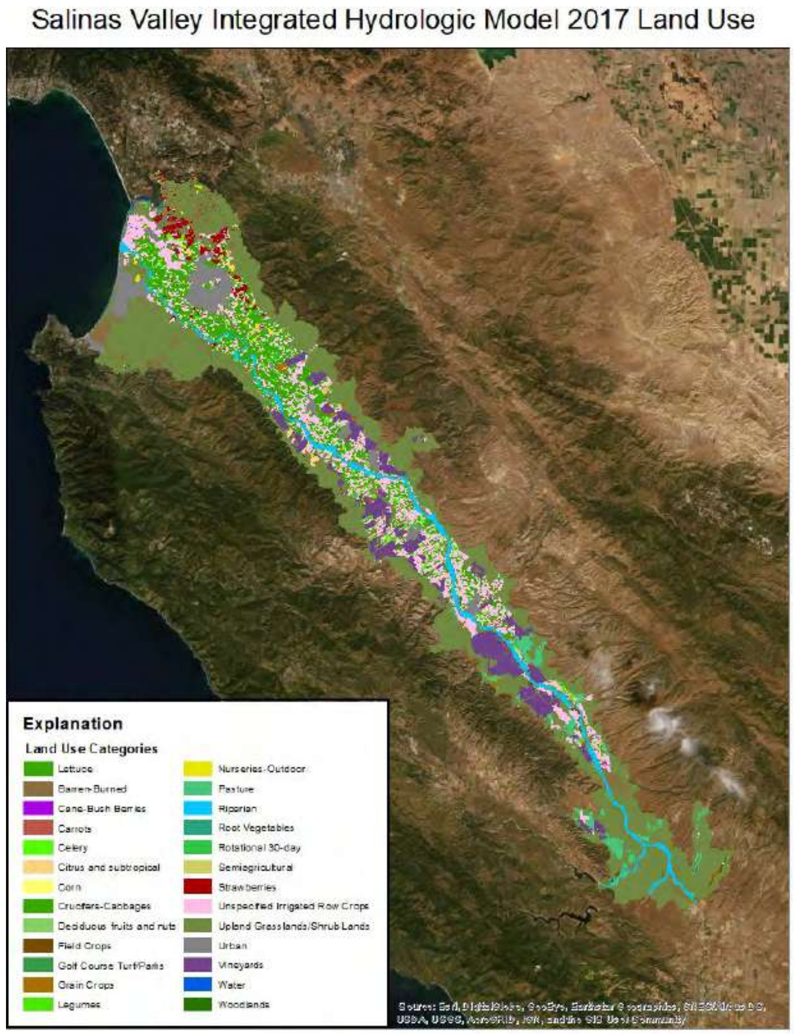


Figure 4: Salinas Valley Integrated Hydrologic Model (SVIHM) 2017 land use.

Model Review and Public Release

The model public release will consist of three elements: (1) a report about geologic and development and calibration of hydrologic models, (2) a data release with SVGM model input files and metadata, and (3) a data release with SVWM, SVIHM, and SVOM model input files and metadata in a public repository. The SVWM and SVIHM reports will document how the historical models were constructed. The SVOM report will include a description of the adaptations to the SVIHM to generate a baseline reservoir operations model, describe reservoir model implementation, and document implementation of rules. The report and data releases will be publicly available after completion of fundamental science review by the USGS. The USGS fundamental science review has multiple levels of scientific and technical review. These include technical, scientific, editorial, and regional review. This review ensures complete and accurate documentation of model development and results before data are potentially used for decision-making. The model is undergoing final calibration and has been updated through water year 2018. Final calibration is occurring simultaneously with report development.

The Salinas Valley models have been developed to address additional applications for ongoing regulatory and management efforts. A comprehensive 51-year climate, surface and groundwater, agricultural and reservoir operations model of the entire Salinas Valley is a substantial effort that warrants and benefits greatly from a sufficient technical review. This review provides a rigorous basis for further tool development and refinement and scenario testing. The technical review has been enhanced by use and further development of the Salinas Valley Suite in two regional projects, (1) the WaterSMART water supply vulnerability study cooperatively funded in partnership with the U.S. Bureau of Reclamation and (2) the Interlake Tunnel project. The WaterSMART Study includes forecast and analysis framework to evaluate conditions to 2100 for multiple possible climates, socio-economic growth scenarios, projects, and conservation strategies in the Salinas Valley and region. The Interlake Tunnel benefit analysis facilitated the operational model development which will benefit future project evaluations for years to come. These applications of the model allowed for more rigorous review of model input data, better implementation of important processes, and improved representation of land use.

Every effort is being made to publish the models within the estimated timeframe. However, it is important to note that the initial model scope was to address specific concerns about historical conditions for the Monterey County Basin Investigation. Since the start of project, the models have been refined with better representation wells and updated with four additional years of critical climate, land use, water supply, and reservoir storage, that represent drought recovery between 2014 and 2018. These data allow for (1) better representation of stakeholder conservation efforts that are essential for evaluation of water budgets and potential sustainability projects, (2) a longer duration for evaluation of operations, and (3) many updates to model input data sets to better represent the groundwater well network.

The Salinas Valley hydrologic model suite development has leveraged a unique opportunity to benefit multiple projects for stakeholders throughout the entire Salinas Valley. Although the technical review and model development has taken longer than anticipated, the value-added information and consistent analysis framework for these concurrent studies benefits both stakeholders and the models. As presented at the Model Workshop, the SVIHM is expected to be submitted for USGS Specialist Review in winter 2021-2022

Future model updates, developments, and applications

The SVWM and SVIHM will need annual updates to keep the models relevant for evaluating and reporting sustainability efforts for Sustainable Groundwater Management Act (SGMA) compliance or for use with other future projects. Updates to the SVIHM conceptual model, aquifer parameters, and input data facilitate timely SVOM updates, so that reservoir operations can continue to be refined to meet stakeholder needs. The SVWM and SVIHM will require periodic calibration to maintain model accuracy with potential changes in hydrology, climate, and land use. The model can also be improved with additional stakeholder support and refined to keep the model relevant to decision-making.

MCWRA and USGS continue to develop workflows and train staff to use model update tools. These self-updating model tools can convert MCWRA hydrologic data into model input. However, climate, land use, observation, extraction, diversion, and reservoir release datasets require some development. Data describing observed hydraulic heads, municipal and industrial groundwater extraction, wastewater reclamation, reported diversions, reservoir releases, and reported agricultural pumping are readily available in various MCWRA and Monterey County databases and require monthly aggregation and conversion to model units. These tools facilitate a model framework that can be readily updated with minimal lag time with support from the USGS.

PRISM climate data and climate station data are used to generate spatially distributed temperature, precipitation and potential evapotranspiration estimates using the BCM tools. There is a six-month lag time for some of these climate datasets. Climate data are used in the SVWM to develop ungaged watersheds inflows to the valley.

Land use will be updated in future updates of the SVIHM using available spatial datasets and the CalPUR method to attribute vague land use categories. As new spatial data become available, they can be prioritized in the composite land-use map and replace co-located data. The process for developing land-use input data will be to develop a composite map, enhance with CalPUR data, map onto model grid, and generate the input files. Additionally, new land use properties may need to be developed for new crop types not already represented in the current version of the historical model. As remote sensing technologies, such as satellite multi -spectral data analysis, are developed and refined alternate approaches to assigning time series crop water demand will be evaluated for future model updates.

The SVWM can be extended to look at nutrient and sediment loading and transport in the Salinas River watershed. This could be a powerful tool for soil conservation, nutrient evaluations, and water quality assessments. The SVWM can also be used to examine changes in runoff and recharge in response to land surface change. This can be a useful tool for initial assessments of potential surface storage sites, habitat restoration and flood flows.

The SVGM provides a basis for evaluating aquifer structure, evaluation of faults and other structures that may influence subsurface flow paths and facilitate interpretation of geophysics such as airborne electromagnetic (AEM) surveys.

The SVIHM can be extended to provide insights into several county initiatives: (1) assessment of Sea Water Intrusion (SWI) and contaminant transport, (2) evaluation of conceptual models of potential interactions between 180-ft and 400-ft aquifers (3) evaluation of optimal monitoring network expansion, (4) uncertainty estimates for important hydrologic predictions (SWI, GW-SW interactions, recharge).

The SVIHM could be extended to evaluate Sea Water Intrusion (SWI) more completely. Currently the model examines net volumes of landward flow from the ocean. In order of increasing effort, other options for SWI evaluation include particle tracking, the sharp water interface Modflow package (SWI2, Bakker and others 2013)), and coupled simulation of sea- and fresh water such as SEAWAT (Guo and Langevin, 2002; Langevin, 2001). The SVIHM geologic texture model, aquifer parameters, and model structure provide a backbone for any of these options for evaluating SWI.

SWI monitoring and analysis by the MCWRA has identified the occurrence of vertical migration of seawater from the overlying intruded Pressure 180-foot aquifer to the Pressure 400-foot aquifer (MCWRA, 2017). More information is needed to understand these interactions among aquifers and aquifer responses to stress. As monitoring and data collection efforts are refined and expanded, along with continued refinement of hydrostratigraphic information, the SVIHM can be used to evaluate new conceptual models of the aquifers and evaluate the aquifer's response under various management scenarios.

Summary

A suite of geologic and hydrologic models has been developed to estimate water supply and availability in the Salinas Valley. These models will be documented and released to the public after completion of review and approval according to USGS fundamental science practices. After publication these models will continue to be updated to support future water management objectives.

Disclaimer

Any use of trade, firm, or product names is for descriptive purposes only and does not imply endorsement by the U.S. Government.

References Cited

Allen, R. G., Pereira, L. S., Smith, M., Raes, D., & Wright, J. L. (2005). FAO-56 dual crop coefficient method for estimating evaporation from soil and application extensions. Journal of irrigation and drainage engineering, 131(1), 2-13.

Baillie, M., Chau, L., and Turner, J., 2015, State of the Salinas River Groundwater Basin, Consultants report prepared for Monterey County Resources Management Agency, 240p.

Bakker, M., Schaars, F., Hughes, J.D., Langevin, C.D., and Dausman, A.M., 2013, The seawater intrusion (SWI2) package for modeling vertically-integrated variable-density groundwater flow in regional aquifers using the U.S. Geological Survey Modular Groundwater Flow Model (MODFLOW-2005): U.S. Geological Survey Techniques in Water Resources Investigations, Book 6, Chapter A46, 47 p.

Bicknell, B.R., Imhoff, J.C., Kittle, J.L., Jr., Donigian, A.S., Jr., and Johanson, R.C., 1997, Hydrological Simulation Program--Fortran, User's manual for version 11: U.S. Environmental Protection Agency, National Exposure Research Laboratory, Athens, Ga., EPA/600/R-97/080, 755 p.

Boyce, S.E., Hanson, R.T., Ferguson, I., Schmid, W., Henson, W., Mehl, Reimann, T., S.M., and Earll, M.M., 2020, One-Water Hydrologic Flow Model: A MODFLOW Based Conjunctive-Use Simulation Software: U.S. Geological Survey Techniques and Methods 6, https://doi.org/10.3133/tm6a60

California Department of Water Resources (CADWR), 2014, California Sustainable Groundwater Management Act (SGMA): http://www.water.ca.gov/groundwater/sgm/ , (last accessed 12/7/2015).

California Irrigation Management Information System (CIMIS), 2005, Meteorological data: California Department of Water Resources and University of California at Davis. (Available at http://www.cimis.water.ca.gov/.)

Casagrande, J. and Watson, F., 2006, Carr Lake Watershed / Reclamation Ditch Subwatershed Assessment and Management Plan, Consultants report prepared by The Watershed Institute for Monterey County Water Resources Agency, 355p.

Colgan, J. P., McPhee, D. K., McDougall, K., and Hourigan, J. K., 2012, Superimposed extension and shortening in the southern Salinas Basin and La Panza Range, California: A guide to Neogene deformation in the Salinian block of the central California Coast Ranges: Lithosphere, v. 4 no. 5 p. 411-429, DOI: 10.1130/L208.1

Daly, C., Gibson, W.P., Doggett, M., Smith, J., and Taylor, G., 2004, Up-to-date monthly climate maps for the conterminous United States: Procedures of the 14th American Meteorological Society Conference on Applied Climatology, 84th American Meteorological Society Annual Meeting Combined Preprints, American Meteorological Society, Seattle, Washington, January 13–16, 2004, Paper P5.1, CD-ROM.

Dausman, A. M., Doherty, J., Langevin, C. D., & Sukop, M. C. (2010). Quantifying data worth toward reducing predictive uncertainty. *Groundwater*, *48*(5), 729-740.

Faunt, C. C., Belitz, K., & Hanson, R. T. (2010). Development of a three-dimensional model of sedimentary texture in valley-fill deposits of Central Valley, California, USA. *Hydrogeology Journal*, *18*(3), 625-649.

Feeney, M. and Rosenberg, L., 2003, Deep Aquifer Investigation – Hydrogeologic Data Inventory, Review, Interpretation and Implications,

Ferguson, I.A., and Llewellyn, D., 2015, Simulation of Rio Grande Project Operations in the Rincon and Mesilla Basins: Summary of Model Configuration and Results, U.S. Bureau of Reclamation Technical Memorandum No. 86-68210–2015-05, 56p.'

Ferguson, I.A., Llewellyn, D., R.T. Hanson, and S.E. Boyce, 2016. User Guide to the Surface Water Operations Process: Simulation of Large-Scale Surface Water Management in MODFLOW-Based Hydrologic Models, U.S. Bureauof Reclamation Technical Memorandum No. 86-68210–2015-XX, 79p.

Faunt, C.C., Hanson, R.T., Belitz, K., 2009a, Ground-Water Availability of California's Central Valley: U.S. Geological Survey Professional Paper 1766, Ground-Water Availability of California's Central Valley, Claudia Faunt ed., 212 p.

Faunt, C.C., Hanson, R.T., Belitz, Kenneth, and Rogers, Laurel, 2009b, California's Central Valley Groundwater Study: A Powerful New Tool to Assess Water Resources in California's Central Valley: U.S. Geological Survey Fact Sheet 2009-3057, 4 p. (http://pubs.usgs.gov/fs/2009/3057/)

Flint, A.L., Flint, L.E., Hevesi, J.A., and Blainey, J.M., 2004, Fundamental concepts of recharge in the Desert Southwest: a regional modeling perspective, in Hogan, J.F., Phillips, F.M., and Scanlon, B.R., eds., Groundwater Recharge in a

Desert Environment: The Southwestern United States, Washington D.C., Water Science and Applications Series, Vol. 9, American Geophysical Union, pp. 159 – 184.

Flint, A.L., and Flint, L.E., 2007a, Application of the basin characterization model to estimate in-place recharge and runoff potential in the Basin and Range carbonate-rock aquifer system, White Pine County, Nevada, and adjacent areas in Nevada and Utah: U.S. Geological Survey Scientific Investigations Report 2007-5099, 20p.

Flint, L.E. and Flint, A.L., 2007b, Estimation of hourly stream temperatures in unmeasured tributaries to the lower Klamath River, California: J. of Environmental Quality, 37:57-68.

Flint, L.E., and Flint, A.L., 2007c, Regional analysis of ground-water recharge, in Stonestrom, D.A., Constantz, J., Ferré, T.P.A., and Leake, S.A., eds., Ground-water recharge in the arid and semiarid southwestern United States: U.S. Geological Survey Professional Paper 1703, p. 29-59.

Guo, W. and Langevin, C.D. (2002). User's guide to SEAWAT: A computer program for simulation of three-dimensional variable-density ground-water flow. Open-File Report 01-434, U.S. Geological Survey, Tallahassee, Florida, 77 pp.

Langevin, C.D. (2001). Simulation of ground-water discharge to Biscayne Bay, southeastern Florida. Water Resources Investigations Report 00-4251, U.S. Geological Survey, Tallahassee, Florida, 127 pp.

Hanson, R.T., Anderson, S.R., and Pool, D.R., 1990, Simulation of ground-water flow and potential land subsidence, Avra Valley, Arizona: U.S. Geological Survey Water-Resources Investigation Report 90-4178, 41 p. (http://pubs.er.usgs.gov/usgspubs/wri/wri904178)

Hanson, R.T., and Benedict J.F., 1993, Simulation of ground-water flow and potential land subsidence, upper Santa Cruz River Basin, Arizona: U.S. Geological Survey Water- Resources Investigation Report 93-4196, 47 p. (http://pubs.er.usgs.gov/usgspubs/wri/wri934196)

Hanson, R.T., Everett, R.R., Newhouse, M.W., Crawford, S.M., Pimentel, M.I., and Smith, G.A., 2002, Geohydrology of a deep-aquifer system monitoring-well site at Marina, Monterey County, California: Geological Survey Water-Resources Investigation Report 02-4003, 73 p.

Hanson, R.T., Martin, P., Koczot, K M., 2003, Simulation of ground-water/surface-water flow in the Santa Clara - Calleguas basin, California: U.S. Geological Survey Water-Resources Investigation Report 02-4136, 214 p. (ONLINE ONLY -- http://water.usgs.gov/pubs/wri/wri024136/text.html)

Hanson, R.T., 2003a, Geohydrologic framework of recharge and seawater intrusion in the Pajaro Valley, Santa Cruz and Monterey Counties, California: U.S. Geological Survey Water-Resources Investigation Report 2003–4096, 88 p., http://pubs.er.usgs.gov/publication/wri034096.

Hanson, R.T., 2003b, Geohydrology of recharge and seawater intrusion in the Pajaro Valley, Santa Cruz and Monterey Counties, California: U.S. Geological Survey Fact Sheet 044–03, 4 p. http://pubs.er.usgs.gov/publication/fs04403.

Hanson, R.T., Li, Z., and Faunt C., 2004, Documentation of the Santa Clara Valley regional ground-water/surface-water flow model, Santa Clara County, California: Scientific Investigations Report SIR2004-5231 , 75 p. (ONLINE ONLY -- http://pubs.usgs.gov/sir/2004/5231/)

Hanson, R.T., Schmid, Wolfgang, Faunt, C. C., Lear, J., and Lockwood, B., 2014, Integrated Hydrologic Model of Pajaro Valley, Santa Cruz and Monterey Counties, California: U.S. Geological Survey Scientific Investigations Report SIR 2014-5111, 166 p.

Hanson, R.T., Boyce, S.E., Schmid, Wolfgang, Hughes, J.D., Mehl, S.M., Leake, S.A., Maddock, Thomas, III, and Niswonger, R.G., 2014, MODFLOW-One-Water Hydrologic Flow Model (MF-OWHM): U.S. Geological Survey Techniques and Methods 6-A51, 122 p.

Hanson, R.T., Lockwood, B., and Schmid, Wolfgang, 2014, Analysis of Projected Water Availability with Current Basin Management Plan, Pajaro Valley, California, Journal of Hydrology, Vol. 519, Part A, pp. 131-147.

Hanson, R.T., Flint, L.E., Faunt, C.C., Gibbs, D.R., and Schmid, W., 2014b, Hydrologic models and analysis of water availability in Cuyama Valley, California: U.S Geological Survey Scientific Investigations Report 2014–5150, 150 p., http://dx.doi.org/10.3133/sir20145150.

Hanson, R.T., and Sweetkind,D.S., 2014, Water Availability in Cuyama Valley, California: U.S. Geological Survey Fact Sheet FS2014-3075 4p.

Hanson, R.T., Ritchie, A.B., Boyce, S.E., Galanter, A.E., Ferguson, I.A., Flint, L.E., Flint, A., and Henson, W.R., 2020, Rio Grande transboundary integrated hydrologic model and water-availability analysis, New Mexico and Texas, United States, and northern Chihuahua, Mexico: U.S. Geological Survey Scientific Investigations Report 2019–5120, 186 p., https://doi.org/10.3133/sir20195120. (see pages 7-9)

Harbaugh, A.W., 2005. MODFLOW-2005, the U.S. Geological Survey modular ground-water model-the Ground-Water Flow Process: U.S. Geological Survey Techniques and Methods 6-A16, variously paginated.

Henson, W.R., In Prep, Estimating Multi-Cropped Land Use Using a Pesticide Database. Journal of Hydrology.

Hevesi, J.A., Boyce, S.E., Henson, W., Hanson, R.T., 2019, Integrated hydrologic modeling of the Salinas River, California, for sustainable water management, in SEDHYD 2019 Conference, Reno, NV, Jun. 24-28, 2019, Federal Interagency Subcommittee on Sedimentation (SOS).

Homer, C., Dewitz, J., Fry, J., Coan, M., Hossain, N., Larson, C., ... & Wickham, J. (2007). Completion of the 2001 national land cover database for the conterminous United States. Photogrammetric engineering and remote sensing, 73(4), 337.

Hydrometrics, 2009, Seaside Groundwater Basin Modeling and Protective Groundwater Elevations: Consultants Report prepared for the Seaside Basin Watermaster by Hydrometrics LLC, November 2009, 210p.

Johnson, S.Y., Dartnell, P., Hartwell, S.R., Cochrane, G.R., Golden, N.E., Watt, J.T., Davenport, C.W., Kvitek, R.G., Erdey, M.D., Krigsman, L.M., Sliter, R.W., and Maier, K.L. (S.Y. Johnson and S.A. Cochran, eds.), 2016, California State Waters Map Series—Offshore of Monterey, California: U.S. Geological Survey Open-File Report 2016–1110, pamphlet 44 p., 10 sheets, scale 1:24,000, http://dx.doi.org/10.3133/ofr20161110.

Kennedy/Jenks, 2004, Hydrostratigraphic Analysis of the Northern Salinas Valley, Consultants report prepared for Monterey County Water Resources Agency, 14 May 2004, 98p.

Langenheim, V.E., Jachens, R.C., Graymer, R.W., Colgan, J.P. Wentworth, C.M., and Stanley, R.G., 2012, Fault geometry and cumulative offsets in the central Coast Ranges, California: Evidence for northward increasing slip along the San Gregorio–San Simeon–Hosgri fault: Lithosphere, v. 5 no. 1 p. 29-48 doi: 10.1130/L233.1

Motz, L. H. (2005). Representing the saltwater-freshwater interface in regional groundwater flow models. Groundwater and saline intrusion, (15), 33.

Monterey County (MC), 2010, Settlement Agreement in Salinas Valley Water Coalition and others v. County of Monterey:Monterey County Case No. M109451, Attachment H and Exhibit B, 16p.

Monterey County Water Resources Agency (MCWRA), 2017, Recommendations to Address the Expansion of Seawater Intrusion in the Salinas Valley Groundwater Basin, Special Reports Series 17-01.

Phillips, S.P., Green, C.T., Burow, K.R., Shelton, J.L., and Rewis, D.L., 2007, Simulation of Multiscale Ground-Water Flow in Part of the Northeastern San Joaquin Valley, California: US Geological Survey Scientific Investigations Report 2007-5009, 43p.

Schmid, Wolfgang, and Hanson R.T., 2009, The farm process version 2 (FMP2) for MODFLOW-2005—Modifications and upgrades to FMP1: U.S. Geological Survey Techniques in Water Resources Investigations, book 6, chap. A32, 102 p.

Schmid, W., Hanson, R.T., Maddock III, T.M., and Leake, S.A., 2006, User's guide for the Farm Package (FMP1) for the U.S. Geological Survey's modular three-dimensional finite-difference ground-water flow model, MODFLOW-2000: U.S. Geological Survey Techniques and Scientific Methods Report Book 6, Chapter A17, 127p. (http://pubs.usgs.gov/tm/2006/tm6A17/)

Sweetkind, D.S., Faunt, C.C., and Hanson, R.T., 2013, Construction of 3-D geologic framework and textural models for Cuyama Valley groundwater basin, California: U.S. Geological Survey Scientific Investigations Report 2013–5127, 46 p.

Sweetkind, D.S., Henson, W.R., In Prep, Construction of 3-D geologic framework and textural models for Salinas Valley groundwater basin, California: U.S. Geological Survey Scientific Investigations Report

Taylor, E.M., and Sweetkind, D.S., 2014, Quaternary geologic map of the north-central part of the Salinas River Valley and Arroyo Seco, Monterey County, California: U.S. Geological Survey Scientific Investigations Map 3260, 13 p., 2 sheets, scales 1:24,000 and 1:50,000, http://dx.doi.org/10.3133/sim3260.

Tinsley, J.C., Quaternary Geology of Northern Salinas Valley, Monterey County, California, Stanford University Dissertation, August 1975, 211p.

U.S. Geological Survey (2014). NLCD 2011 Land Cover (2011 Edition, amended 2014) - National Geospatial Data Asset (NGDA) Land Use Land Cover.

USBR, 2015, Salinas and Carmel River Basins Study proposal: U.S. Bureau of Reclamation (USBR), April, 2015, 38p.

Chapter 7

Appendix 7-A

Monitoring Procedures from MCWRA CASGEM Monitoring Plan

4.0 Monitoring Procedures

This section addresses the various procedures and protocols involved in collecting, processing, and reporting data from wells in the CASGEM network.

4.1 Monitoring Frequency and Timing

Nineteen (19) of the CASGEM wells are currently, and will continue to be, measured on a monthly basis. The three (3) voluntary wells are also measured monthly. MCWRA will use the monthly measurements from August and either January, February, or March to satisfy the biannual CASGEM reporting criteria.

To determine the monthly distribution of seasonal high and low groundwater elevations, MCWRA analyzed measurements from approximately 50 wells throughout the Salinas Valley Groundwater Basin. This included wells in the 180/400 Foot Aquifer, East Side Aquifer, Forebay Aquifer, and Upper Valley Aquifer. The measurements were collected during eight (8) different Water Years (WY): WY 1985, representative of near normal conditions; WY 1991, representative of dry conditions; and the six most recent Water Years, WY 2009 through WY 2014. MCWRA reports this data on a quarterly basis; a sample report is included in Appendix B.

Based on this analysis of historical data, August is typically representative of seasonal low conditions (Figure 10). A relaxation of groundwater levels, or seasonal high conditions, is evident during the period from January to March (Figure 11). Data from these three months will be evaluated and the highest groundwater elevation from that series will be submitted to the CASGEM online submittal system. The month chosen to be representative of the seasonal high groundwater conditions will be consistent across all data groups.

Nineteen (19) of the CASGEM wells are equipped with pressure transducers which collect depth to water data on an hourly basis. This data will be synthesized so that biannual measurements representing seasonal high and low conditions are available for CASGEM reporting. The groundwater level measurement collected at noon on the fifteenth day of the month will be selected and compared to other monthly data to ensure that it is a representative value. Data from the month of August will be used to represent the seasonal low and a fall/winter measurement from either January, February, or March will be used to represent the seasonal high; the same month will be used as was selected based on monthly well measurements, as discussed above.

Four (4) of the wells in the CASGEM network are currently measured once per year, during the period from November to January. Based on the recent analysis of seasonal groundwater highs, this period will be shifted to cover the months from January through March. An additional measurement event will be added during the month of August for these wells in order to also capture the seasonal groundwater low.

Appendix C contains a summary of the frequency and timing of measurement of wells in the CASGEM network. Any new wells that are brought into the CASGEM program will be monitored on a biannual basis, with data collection occurring on the same schedule as the other wells that are measured twice a year.

4.2 Well Locations

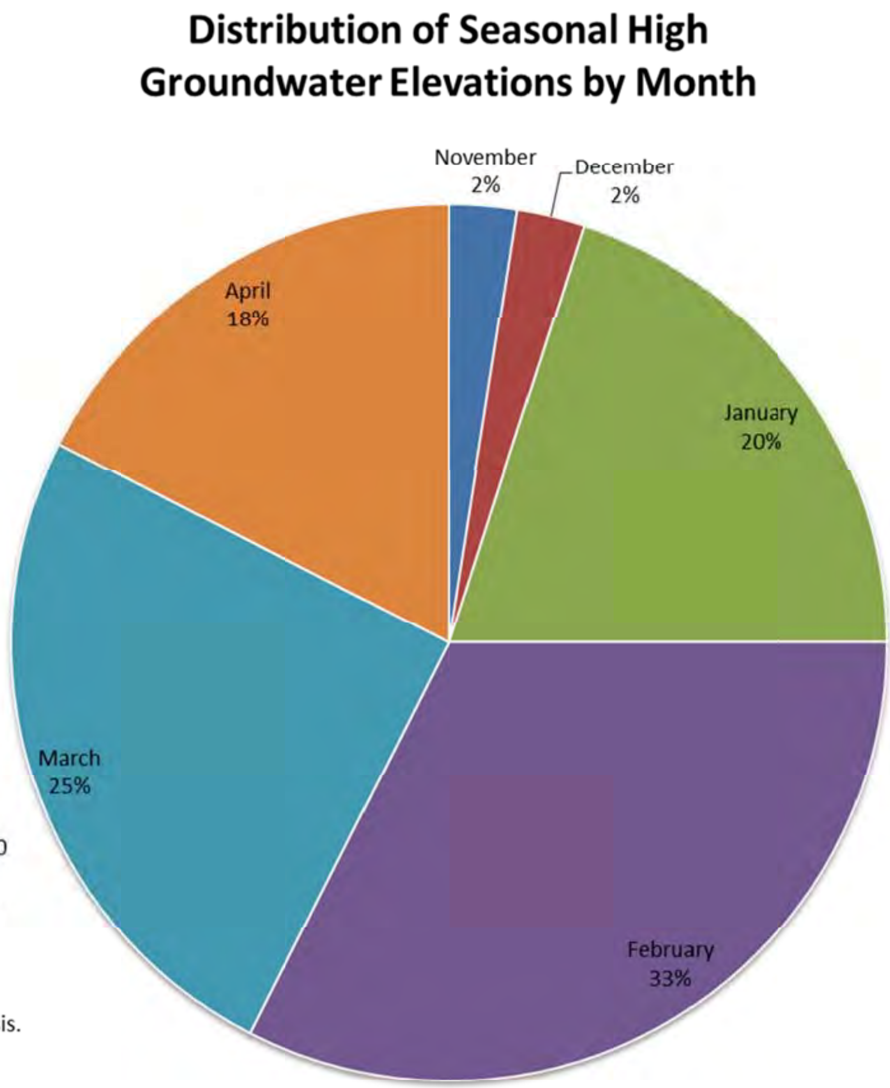
The latitude and longitude of each well was collected using a handheld GPS unit, which has accuracy to within one (1) meter. Coordinates for wells in the CASGEM network are shown in Appendix A. Any wells incorporated into the CASGEM network in the future will be geographically located using a similar method.

4.3 Reference Points

All of the wells that comprise the CASGEM network described herein are currently part of a groundwater level monitoring program conducted by MCWRA. As part of the existing monitoring programs, reference points (RP) have been established for all of the wells. To ensure consistency in measuring depth to water, a description of each well's RP is recorded in a field data collection notebook. In many cases, photographs have also been taken of the RP. Reference point elevations have been determined for all wells that are currently in a monitoring program; this data is listed in Appendix A.

A reference point will be determined for any new wells that are brought into the CASGEM network. Reference point elevations are determined using a digital elevation model from the United States Geological Survey (USGS) with a cell size of 32 feet by 32 feet.

Figure 10 – Distribution of Seasonal High Groundwater Elevations by Month

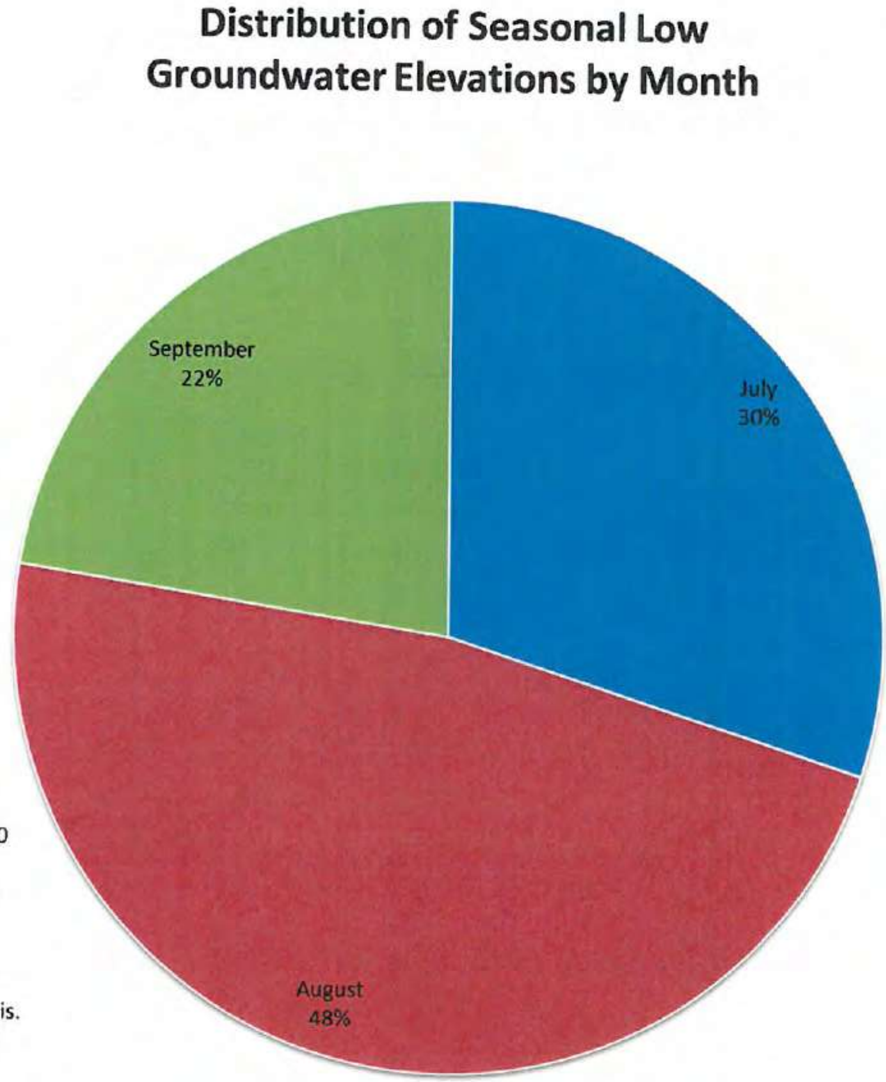


Notes

(1) Chart reflects data from the following subbasins of the Salinas Valley Groundwater Basin: 180/400 Foot Aquifer, East Side Aquifer, Forebay Aquifer, and Upper Valley Aquifer.

(2) Water Years 1985, 1991, and 2009-2014 were used in this analysis. These years represent near normal conditions (WY85), dry conditions (WY91), and the six most recent water years.

Figure 11 – Distribution of Seasonal Low Groundwater Elevations by Month



Notes

(1) Chart reflects data from the following subbasins of the Salinas Valley Groundwater Basin: 180/400 Foot Aquifer, East Side Aquifer, Forebay Aquifer, and Upper Valley Aquifer.

(2) Water Years 1985, 1991, and 2009-2014 were used in this analysis. These years represent near normal conditions (WY85), dry conditions (WY91), and the six most recent water years.

4.4 Field Methods

Groundwater elevation data collected from wells in the CASGEM network is intended to reflect static conditions. Best efforts will be made to ensure that wells have not recently been pumped prior to collecting a data point. Depth to water measurements will be made using one or more of the methods discussed in the following sections. Measurement methods described in the following sections are based on the Department of Water Resources document *Groundwater Elevation Monitoring Guidelines* (December 2010) with some alterations specific to wells in the monitored basins/subbasins described in this Monitoring Plan.

4.4.1 Graduated steel tape

Prior to measurement:

- Ensure that the reference point on the well can be clearly determined. Check notes in the field data collection notebook.
- Review the notes and comments for previous measurements in the field data collection notebook to determine if there are any unique circumstances at this well.
- Take note of whether oil has previously been present at this well; this will be recorded in the comments section of the data form.

Making a measurement:

- Use the previous depth to water measurement to estimate a length of tape that will be needed.
- Lower the tape into the well, feeling for a change in the weight of the tape, which typically indicates that either (a) the tape has reached the water surface or (b) the tape is sticking to the side of the well casing.
- Continue lowering the tape into the well until the next whole foot mark is at the reference point. This value on the tape should be recorded in the field data collection notebook.
- Bring the tape to the surface and record the number of the wetted interval to the nearest foot.
- If an oil layer is present, read the tape at the top of the oil mark to the nearest foot. Note in the comments section of the data form that oil was present.
- Repeat this procedure a second time and note any differences in measurement in the field data collection notebook.

4.4.2 Electric water level meter

This method of measurement employs a battery-powered water level meter and a small probe attached to a ruled length of cable. Depth to water measurements collected using this equipment are recorded to the nearest tenth of an inch. This instrument is sometimes referred to as a “sounder”.

Prior to measurement:

- Review the field data sheet for the well and note whether oil has been present at this well in the past. The electric water level meter should not be used in wells where oil is present.
- Ensure that the reference point on the well can be clearly determined. Check notes in the field data collection notebook.
- Confirm that the water level meter is functioning and is turned on so that the beeping indicator will operate properly.

Making a measurement:

- Review previous depth to water measurements for the well to estimate the length of tape that will be needed.
- Lower the electrode into the well until the indicator sounds, showing the probe is in contact with the water surface.
- Place the tape against the reference point and read the depth to water to the nearest 0.1 foot. Record this value on the field data sheet.
- Make a second measurement and note any differences in measurement in the field data collection notebook.

4.4.3 Sonic water level meter

This meter uses sound waves to measure the depth to water in a well. The meter must be adjusted to the air temperature outside the well; there is a card with reference temperatures in the case with the sonic meter.

Making a measurement:

- Insert the meter probe into the access port and push the power-on switch. Record the depth from the readout.
- Record the depth to water measurement in the field data collection notebook.

4.4.4 Pressure transducer

Automated water-level measurements are made with a pressure transducer attached to a data logger. Pressure transducers are lowered to a depth below the water level in the well and fastened to the well head at a reference point. Data points are logged on an hourly basis. MCWRA uses factory-calibrated, vented pressure transducers (Appendix D). MCWRA staff collects the pressure transducer data once per quarter. During the data collection process, data loggers are stopped, and the data is downloaded onto a laptop, and then the data logger is reactivated and scheduled to begin collecting data again on the next hour. Upon return from the field, data is processed and reviewed for errors.

4.5 Data Collection, Processing, and Reporting

Following completion of all fieldwork, data is transcribed from field data sheets and checked for errors before being loaded into MCWRA's Oracle platform database. All data will be stored in the MCWRA database before being uploaded to the CASGEM website. Submittal of data to the CASGEM website will occur at a minimum of twice per year, no later than January 1 and July 1, per DWR CASGEM program guidelines.

Bi-annual submittal of data to the CASGEM website will include the following for each well in the CASGEM network, as described in the DWR document *CASGEM Procedures for Monitoring Entity Reporting*:

- Well identification number
- Measurement date
- Reference point and land surface elevation, in feet, using NAVD88 vertical datum
- Depth to water, in feet
- Method of measuring water depth
- Measurement quality codes
- Measuring agency identification
- Comments about measurement, if applicable

The following information will also be submitted to the CASGEM online system, as it is required by DWR unless otherwise noted:

- Monitoring Entity name, address, telephone number, contact person name and email address, and any other relevant contact information
- Groundwater basins being monitored (both entire and partial basins)
- State Well Identification number (recommended)
- Decimal latitude/longitude coordinates of well (NAD83)
- Groundwater basin or subbasin
- Reference point elevation of the well, in feet, using NAVD88 vertical datum
- Elevation of land surface datum at the well, in fee, using NAVD88 vertical datum
- Use of well
- Well completion type (e.g. single well, nested well, or multi-completion well)
- Depth of screened interval(s) and total depth of well, in feet, if available
- Well Completion Report number (DWR Form 188), if available

Chapter 7
Appendix 7-B

MCWRA's Quality Assurance Project Plan (QAPP) for SWI Monitoring

Quality Assurance Project Plan (QAPP)
For
Water Quality Monitoring
Associated with the Salinas Valley Integrated Water Management Plan (SVIWMP)

EPA R9#03-238
X-97994701-0

Monterey County Water Resources Agency
P.O. Box 930
Salinas, CA 93902
Telephone: (831) 755-4860
Fax: (831) 424-7935
Website: http://www.mcwra.co.monterey.ca.us

WATR0584QV4 (COPY 2)

1.0 PROJECT MANAGEMENT

1.1 TITLE AND APPROVAL PAGE

Quality Assurance Project Plan
For
Water Quality Monitoring Associated with
The Salinas Valley Integrated Water Management Plan (SVIWMP)
EPA R9#03-238
X-97994701-0

Prepared by:
Monterey County Water Resources Agency (MCWRA)
P.O. Box 930
Salinas, CA 93902

Prepared for:
US EPA Region 9
75 Hawthorne Street
San Francisco, CA 94105-3901

Approval Signatures

[signature]	8/12/07
Elizabeth Krafft Agency Project Manager:	Date:
[signature]	8/17/07
Kathleen Thomasberg Agency Project QA/Task Manager:	Date:
[signature]	10/22/07
Eugenia McNaughton, Ph.D. USEPA Region 9 QA Program Manager:	Date:
[signature]	12/3/07
Carolyn Yale USEPA Region 9 Project Officer:	Date:
[signature]	22 Oct 2007
Mark Kutnink USEPA Region 9 Chemist:	Date:

1.2 TABLE OF CONTENTS

FIGURES

TABLES

APPENDICES

1.3 DISTRIBUTION LIST

The following is a list of organizations and persons who will receive copies of the approved QA Project Plan and any subsequent revisions:

Monterey County Water Resources Agency (Agency)
P.O. Box 930
Salinas, CA 93902

Elizabeth Krafft
Project Manager
(831) 755-4860
krafftea@co.monterey.ca.us

Kathleen Thomasberg
Project QA/Task Manager
(831) 755-4860
thomasbergk@co.monterey.ca.us

Manuel Saavedra
Hydrologist/ Team Lead
(831) 755-4860
saavedram@co.monterey.ca.us

Carla James
Water Resources Technician/ Field Sampler
(831) 755-4860
JamesCR@co.monterey.ca.us

Tamara Voss
Water Resources Technician/ Field Sampler
(831) 755-4860
vosstl@co.monterey.ca.us

U.S. Environmental Protection Agency, Region 9
75 Hawthorne Street
San Francisco, CA 94105-3901

Eugenia McNaughton, Ph.D.
QA Program Manager
(415) 972-1111

Carolyn Yale
Project Officer
(415) 972-3482

Mark Kutnink
Chemist
(415) 972-3801

Monterey County Consolidated Chemistry Laboratory (CCL)
1270 Natividad Road, Room A15
Salinas, CA 93906

Germain Guibert
Laboratory Director
(831) 755-4516

1.4 PROJECT/TASK ORGANIZATION

The organization responsible for overseeing this ground water monitoring program is the Monterey County Water Resources Agency (Agency). This project is funded through a grant from the Environmental Protection Agency (EPA), under the authority of Section §104 (b)(3) of the Clean Water Act. This project falls under the Monitoring and Assessment funding category. The Monterey County Health Department's Consolidated Chemistry Laboratory is a California state certified laboratory that will perform the chemical analyses for this ground water monitoring program. The laboratory will use standard analytical methods.

The roles and responsibilities of those involved in the implementation of the ground water monitoring program are described below. An organizational chart for the program is shown below.

Project Manager is the responsible official who will oversee the preparation of grants and the fiscal management of the project.

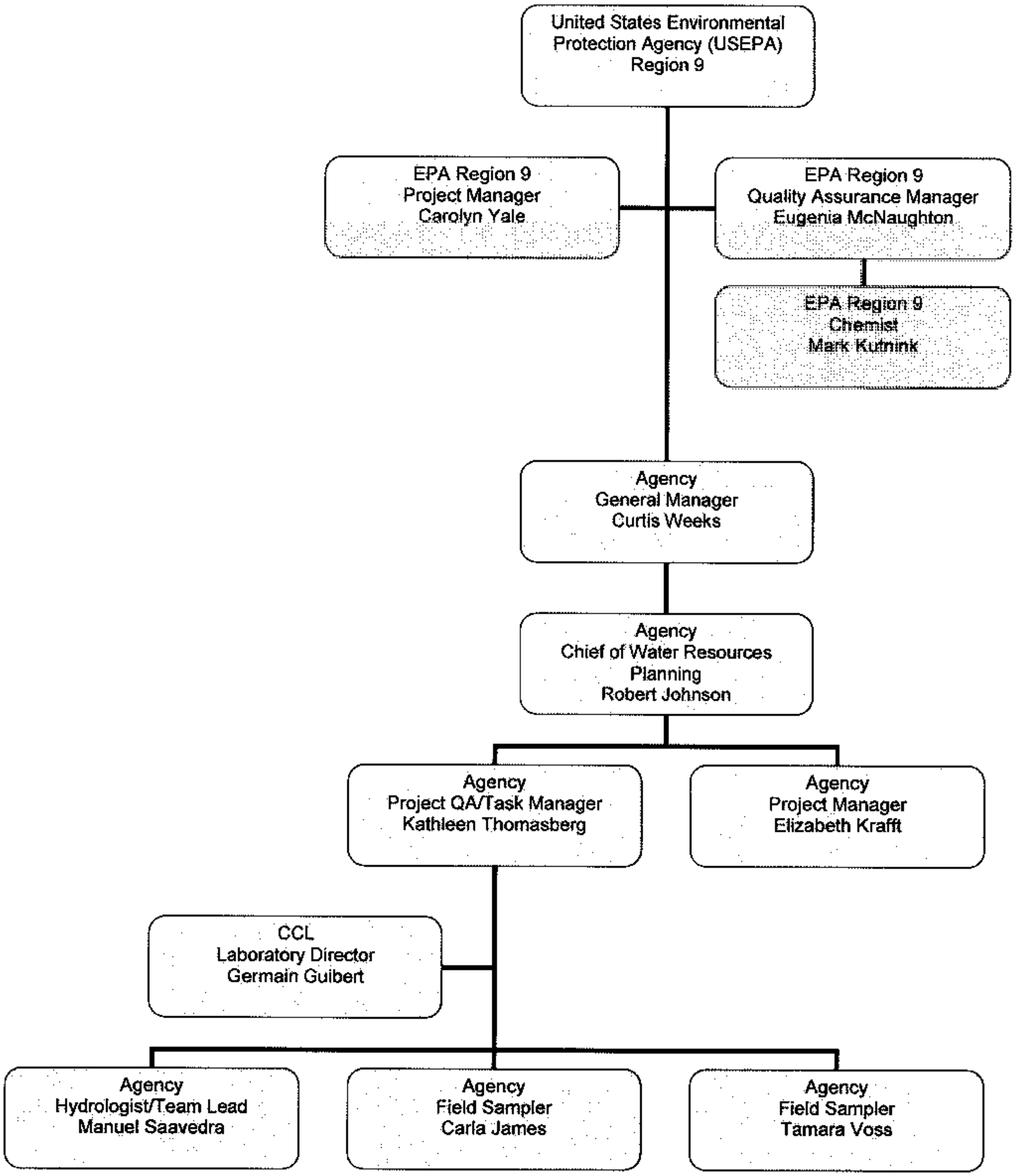
Project QA Manager is in charge of establishing the QA/QC protocols found in the QAPP as part of the sampling and analysis procedures. The QA Manager will also review and assess all analytical data from the contract laboratory and will be the liaison regarding data quality issues and concerns. She may stop all actions, including those conducted by the contract laboratory and will be responsible for ensuring that any amended versions of the QAPP are distributed to the organizations and individuals listed in Section 1.3.

Project Task Manager will oversee the ground water monitoring program. She will ensure that all QAPP protocols are followed and will oversee the writing and revisions of the QAPP. Since the Agency's Water Quality Department is not large, the Project Task Manager will function in the dual role of Task Manager and QA Manager.

Hydrologist/Team Lead will be responsible for coordinating with the Water Resources Technicians/ Field Samplers to review field and analytical requirements, documentation, and sampling schedules.

Water Resources Technicians/Field Samplers will be responsible for sample collection and communication with the contract laboratory regarding the sampling shipment schedule. They are also responsible for writing the QAPP.

ORGANIZATIONAL CHART



1.5 PROBLEM DEFINITION/BACKGROUND

1.5.1 Background

The Monterey County Water Resources Agency's (Agency) mission is to manage, protect, and enhance the quantity and quality of water for present and future generations of Monterey County (County). Monterey County, located along the California Central Coast, covers 3,322 square miles (8604 km^2) and has a resident population of 424,842 (Fact Finder, 2007). The County supports a $3.4 billion agricultural industry (Ag Commission, 2006) and a $1.75 billion tourism industry (EPA Grant R9#03-238). The primary land use within the Salinas Valley is agricultural. Since the 1940's, irrigated acreage within the valley has increased substantially. Coastal regions of California are subject to rapid urbanization, and the milder coastal climate supports year-round intensive cultivation of many high-value crops (Hunt et al, 2003). As agricultural and urban areas have expanded, so have the water needs of the County (EPA Grant R9#03-238).

The Agency uses a network of wells to monitor ground water conditions in the Salinas Valley Ground Water Basin (Basin) (Geomatrix, 2001). The Basin is situated entirely within the County (EPA Grant R9#03-238). The Salinas Valley is surrounded by the Gabilan and Diablo Ranges on the east, by the Sierra de Salinas and Santa Lucia Range on the west, and is drained by the Salinas River, which empties into Monterey Bay in the north (DWR 1946a) (Fig 1). Four subareas based on differences in local hydrogeology and recharge have been identified (White Paper, 1995; DWR, 2003). These are known as the Pressure, East Side, Forebay, and Upper Valley subareas (Fig 2). These subareas are hydrologically and hydraulically connected (EPA Grant R9#03-238); all information collected to date indicates there are no barriers to the horizontal flow (of ground water) between these subareas (White Paper, 1995). The "boundaries" between these subareas have been identified as zones of transition between different depositional environments in past millennia (White Paper, 1995).

The primary surface water features overlying and influencing the Basin's hydrology are the Salinas River and its tributaries, the Nacimiento and San Antonio reservoirs, and the Monterey Bay (EPA Grant R9#03-238). The Salinas River extends approximately 120 miles from the river's headwaters in San Luis Obispo County, near Santa Margarita, and flows north/northwest and discharges into the Monterey Bay National Marine Sanctuary near Moss Landing in Monterey County (EPA Grant R9#03-238). The Nacimiento and San Antonio reservoirs, located in the upper watershed, serve as storage and flood control for the Basin.

Ground water recharge in Salinas Valley is principally from infiltration from the Salinas River, Arroyo Seco Cone, and to a much lesser extent, from deep percolation of rainfall (White Paper, 1995). Deep percolation of applied irrigation water is the second largest component of the ground water budget, but because it represents recirculation of existing ground water rather than an inflow of "new" water, it is not considered a source of recharge (White Paper, 1995). Nitrate contamination of ground water poses a significant threat to the beneficial use of ground water for drinking water and for some agricultural water uses (White Paper, 1995). Nitrate concentrations exceed drinking water standards in some parts of the Basin (MCWRA, 1997). The principal source of nitrates to ground water is almost certainly excess fertilizer that is leached by rainfall and applied irrigation water (White Paper, 1995).

Seawater intrusion is another source of inflow to the Basin, but because it is not usable freshwater it is also excluded as a source of recharge (White Paper, 1995). Historically, ground water flowed from subareas to the south and east through the (Pressure) and seaward to discharge zones in the walls of the submarine canyon in Monterey Bay (Durbin et al 1978; Greene 1970). Within the Pressure subarea, due to the impermeable nature of the clay aquitard above the 180-Foot Aquifer, recharge from precipitation, agricultural return flows, or river flow is nil (DWR, 2003). Instead, recharge is from underflow originating in Upper Valley areas such as the Arroyo Seco Cone and Salinas River bed or the East Side subarea, and more recently, from seawater intrusion (DWR, 2003). Heavy pumping of the Pressure-180 Foot and Pressure-400 Foot aquifers has caused significant seawater intrusion into both of these aquifers, which was first documented in the1930's (DWR 1946a). Ground water flow in the northernmost area of the Pressure subarea has been directed from the Monterey Bay inland since this time (DWR, 2003). With increased pumping in the East Side subarea since the 1970's, ground water flow is dominantly northeast in the Pressure's central and southern locations (DWR, 2003).

Declining ground water levels in the Pressure and East Side subareas, Basin overdraft, ground water contamination, including nitrate and seawater intrusion are serious concerns for the Agency. (EPA Grant R9#03-238)

1.5.2 Program Objectives

The Agency is charged with management of the Basin's ground water resources. Much of the Agency's investigative work pertaining to the occurrence and use of ground water is to identify the quality, quantity, and temporal trends of ground water resources within the County. A network of monitoring wells provides the information needed to manage and protect ground water resources and sustain beneficial uses. In order for the Agency to develop projects to mitigate problems, such as seawater intrusion, local ground water overdraft, and high nitrate concentrations, the Agency must first implement an effective and accurate monitoring program to identify the extent of the potential problem.

The Ground Water Quality Monitoring Objectives are:
-continued monitoring of the ambient ground water quality, including general minerals
-continued monitoring of coastal aquifers (including Pressure Deep Aquifer) for detection of advancing seawater intrusion
-continued monitoring to determine distribution of conductivity in ground water
-continued monitoring to determine distribution of nitrate in ground water and identification of problem areas

Ambient ground water quality will be used to establish a cohesive and succinct Water Quality Management Plan in accordance to the work begun under EPA-I and continued under EPA-II. For the purposes of this QAPP, the EPA-I grant has funded the Agency to develop this QAPP. The EPA-II grant is funding the Agency to implement the sampling described in the QAPP.

1.5.3 Program Goals

The ground water monitoring objectives in the Salinas Valley will be met by the goal of sampling all 344 wells located throughout the four subareas within the Salinas Valley Ground Water Basin, during the 2007 summer field season.

The ground water monitoring objectives along the coast, specifically located within the Pressure subarea will be met by the goal of sampling all 85 monitoring wells, during the 2007 summer field season.

The Agency's overarching goal for this program is the continued monitoring of the Basin's ambient ground water for use in the management of this important resource, and *not* for the purpose of regulatory control.

1.6 PROJECT/TASK DESCRIPTION

1.6.1 Work Statement and Produced Products

The Salinas Valley Ground Water monitoring will sample 344 wells located throughout the Salinas Valley Ground Water Basin for ten constituents (Table 1). Each well will be sampled once. Samples will be collected during the 2007 summer agricultural growing season and analyzed for a complete mineral panel. The Coastal Ground Water monitoring will sample 85 wells located within the area of historic seawater intrusion. Each well in the Coastal Program will be sampled once a month during the agricultural growing season. The first month's sample will be analyzed for complete mineral panel and the two remaining sampling events will by analyzed for partial mineral panel (three constituents) (Table 1). All water monitoring samples will be delivered the same day as collected to the contract laboratory for analysis.

All ground water sampling locations are accessible using a 4-wheel drive vehicle. All samples will be collected as a grab sample. All sampling locations will be recorded using global positioning system (GPS) equipment, and digital pictures will be taken at each site.

After laboratory analysis and data validation is completed, a technical memorandum (EPA II, XP-96995301 Task 2 Water Quality Assessment) will be written and submitted to US EPA. The technical memorandum, EPA II, XP-96995301 Task 2 Water Quality Assessment, will include result tables for chloride, nitrate, and specific conductivity, and maps of chloride, nitrate, and specific conductivity gradient contours.

1.6.2 Constituents to be monitored and measurement techniques

Samples will be sent to an off-site laboratory for analysis. Ground water samples will be analyzed for either complete or partial mineral panels. A complete mineral panel includes calcium, cation-anion balance, chloride, conductivity, magnesium, nitrate, pH, potassium, sodium, sulfate, and total alkalinity. A partial mineral panel consists of chloride, conductivity, and nitrate.

Sample analysis will be preformed at the Monterey County Consolidated Chemistry Laboratory (CCL), which is part of the Environmental Health Department. Listed below is the laboratory's contact information and ELAP Certification number.

Laboratory Name	***Contact Information***	***Abbreviation***
Monterey County Consolidated Chemistry Laboratory ELAP Certification No 1395	1270 Natividad Road Salinas, CA 93906 Phone: 831-755-4516 Fax: 831-755-4652 http://www.co.monterey.ca.us/health	CCL

1.6.3 Project Schedule

The proposed project schedule is summarized below.

Prior to Sample Collection	
January 2006 - January 2007	: Develop project strategy
15 January, 2007	: Submit Draft QA Project Plan
22 March, 2007	: Receive review comments on QA Project Plan from US EPA
6 July, 2007	: Submit Draft Final QA Project Plan
13 July, 2007	: Obtain QA Project Plan approval (to begin fieldwork)
20 July, 2007	: Submit Final QA Project Plan (signatory copy) EPA R9#03-238; X-97994701-0
Sample Collection	
August 2007 - September 2007	: Coastal Ground Water (each well 3x, once per month)
August 2007 - September 2007	: Salinas Valley Ground Water (each well 1x)
Post Sample Collection	
November 2007	: Compile all remaining laboratory analyses reports
1 - 15 December, 2007	: Evaluate laboratory data for QA/QC requirements
15 December, 2007	: Copy of analytical results sent to well owner/operators
16 - 31 December, 2007	: Summarize and tabulate data
January 2008	: Write Technical Memorandum (EPA II, XP-96995301 Task 2 Water Quality Assessment)
March 2008	: Submit Technical Memorandum (EPA II, XP-96995301 Task 2 Water Quality Assessment) to US EPA

1.6.4 Geographical Setting

The Salinas Ground Water Basin encompasses approximately 537.5 square miles (1,392 km^2). The regional ground water flow is to the northwest. Seawater intrusion is a result of coastal pumping (Figure 3). Ground water pumping can dramatically impact localized coastal ground water flow.

1.6.5 Constraints

Ground water samples must be taken from the well while the pump is operating to ensure that the sample is representative of the aquifer and not standing water within the well casing. The Agency wants to measure the water quality when the aquifers are stressed due to pumping. For this reason the 2007 field sampling season will coincide with the agricultural irrigation season.

1.7 DATA QUALITY OBJECTIVES FOR MEASUREMENT DATA

This section describes the data objectives of the project and defines the measurement performance criteria deemed necessary to meet those objectives.

1.7.1 Objectives and Project Decisions

In Monterey County the Salinas Valley and Coastal Ground Water ambient monitoring programs are designed to characterize the ground water quality conditions of the Basin. All data generated from the sampling program in this project are tabulated as they have been over the many years of the program. Data generated from these monitoring activities allows the Agency to track changes in ground water quality over time and to assess potential impacts to ground water in the Basin. Water resource management and policy decisions may follow based on maps and tabulated data generated as a part of this project (program).

For the coastal ground water sampling program, the general mineral data are evaluated to determine if seawater intrusion is progressing landward as indicated by increasing well chloride values. The chloride values for all wells are evaluated, and then the 500mg/L chloride isochlor contours are mapped for the two coastal aquifers. When the maps are published, the information generated by MCWRA staff and approved by the MCWRA Board of Directors, is posted and passed on to Monterey County departments, regional government regulatory agencies, and public / private entities via the MCWRA web page, presentations, public meetings, and networking.

Monterey County departments such as the Planning Department and Health Department utilize the advancement of seawater as it relates to potable water and public health, while the agricultural community becomes aware of the proximity of their wells to the intrusion advancement, and the possible need for funds to drill new, deeper, wells and destroy the older high nitrate wells. Actions by regulators, depending on the entity, are related to prioritization of Regional Watershed and Water Quality Action Plans, and the associated success of MCWRA capital projects to halt seawater intrusion as governed by the State Water Resources Control Board adjudication process.

Actions by the MCWRA after the landward advancement of seawater have been ongoing for many years. Actions include consideration of more stringent Monterey County well drilling ordinances for assuring the continued prevention of cross-aquifer contamination in the coastal Salinas Valley, *"Zone 6 Drilling Standards", April 19, 1988;* the development and implementation of the Monterey County Recycling Projects, a tertiary treatment plant and treated water distribution system, to help further reduce agricultural pumping in the coastal Salinas Valley for halting seawater intrusion; and future use of these data will be utilized by the newly established Seaside Watermaster for comparison to and the development of the Monterey Peninsula seawater intrusion front.

For the Salinas Valley general mineral ground water sampling program, nitrate data tabulation and map representation has been the focus of the MCWRA for many years. All results over the laboratory's practical quantitative limit generated from this program are tabulated to evaluate the minimum, maximum, median, and mean value of nitrate as NO_3 in mg/L for each of the Salinas Valley Hydrogeologic Subareas.

For the Salinas Valley monitoring program, the Agency sends the general mineral testing results, including nitrate, to the well owners/growers who operate the wells sampled. Also, in this transmittal, the well operators are also provided with a conversion sheet of the nitrate concentration *from mg/L nitrate as NO_3 to pounds of nitrate per acre inch of water*, agricultural terms. If a nitrate value in ground source water is elevated, then that growers can incorporate this available nitrate into their fertilizer crop scheduling. This is a method for growers to reduce applied nitrate to crops, while maintaining maximum crop productivity.

And, as with the Coastal monitoring program, the tabulated and mapped Salinas Valley nitrate data are posted and passed on to Monterey County departments, regional government regulatory agencies, and public / private entities via the MCWRA web page.

The MCWRA uses the well nitrate data during the technical well application review process. Monterey County Health Department (Heatlh Department) issues well permits after the Agency provides a technical review of well applications for new, abandoned, or repaired wells. The well application proposal is evaluated with other well construction and water quality within a one miles radius of the new well and represented on a map. Agency staff makes qualitative recommendations to the Health Department on the new well's sanitary seal based on other well seals, the perforated intervals, and the nitrate values of wells in the area. The final decision for the well construction is made by the Health Department after the well drilling progresses.

Actions taken by the MCWRA are conditional. If extreme nitrate values are observed in agricultural production wells, then re-sampling of the wells may take place to confirm the elevated concentrations and may lead to increased sampling points for wells in the same vicinity and with the same well design. Continued increases in Salinas Valley ground water nitrate values could lead to special nitrate investigations on movement of nitrate in ground water and also outreach to the public on the reduction of nitrate to the environment.

1.7.2 Action Limits/Levels

Since the overarching goal for this project is the continued monitoring of ambient ground water, the Agency has set no specific water quality standards. As a result, the laboratory's practical quantitation limits (PQL) will serve as the Project Action Levels (PALs). Table 1 provides a listing of the parameter to be sampled and a summary of the laboratory's method detection limit, those minimum concentrations that can be detected above the instrumental background/baseline signal noise. Table 1 also provides the PQL, lowest calibration standard and PALs required by the Agency for the QAPP. The quality limits listed are deemed acceptable by the Agency to meet the project objectives.

1.7.3 Measurement Performance Criteria

The objective of data collection for this Monitoring Project is to produce data that represent the *in situ* conditions of the ground water. This objective will be achieved by using accepted standard methods for water collection and analysis and defining data quality indicators (DQIs) for each analytical parameter. The DQIs include accuracy, precision, comparability, sensitivity, completeness, and representativeness and are defined below and presented in Table 2. Some DQIs will be assessed quantitatively, while others will be qualitatively assessed. Example calculations have been provided for quantitative assessments and appropriate quality control (QC) samples have been identified. Laboratory Data Quality Objectives are given in Table 3.

Accuracy, or bias, is a measure of how close a result is to the expected value of the target analyte in a sample. Accuracy will be determined by the analysis of certified reference materials and matrix spikes, where the results can be compared with an expected value and expressed as %recovery. This is an assessment of laboratory analytical methods. For Laboratory Control Samples (LCS), it will be expressed as %recovery by the following equation:

$$\%Recovery = \frac{X}{T} \times 100$$

where,

X = Measured concentration
T = True spiked concentration

or, for Matrix Spike (MS) samples, by the following equation:

$$\%Recovery = \frac{(B - A)}{T} \times 100$$

where,

B = Measured concentration of spiked sample
A = Measured concentration of unspiked sample
T = True spiked concentration

The frequency of the LCS and MS samples associated with the analytical parameters will be 5%. MS and MSD samples will be spiked at 3-10 times the native sample concentration.

Accuracy/bias as related to contamination involves both field and laboratory components. Field blanks will be collected at a frequency of 5%. Laboratory blanks will be prepared and analyzed at a one per batch or 5% frequency.

Precision is concerned with the ability to quantitatively repeat results. To demonstrate the precision of a method or instrument, field duplicates will be collected, analyzed, and their results compared. Precision is expressed as relative percent difference (RPD) by the following equation:

$$RPD (\%) = \frac{|X_1 - X_2|}{(X_1 + X_2)/2} \times 100$$

where,

X_1 = Original sample concentration
X_2 = Duplicate sample concentration
$|X_1 - X_2|$ = Absolute value of $X_1 - X_2$

Field duplicates will be collected at a frequency of 10% for the first two sampling events. If the criterion of <25% RPD is met, then the remaining field duplicates will be collected at a 5% frequency. Laboratory duplicates will be prepared and analyzed at a one per batch or 5% frequency.

Comparability of the data can be defined as the similarity of data generated by different monitoring programs. Comparability helps to measure the scientific coherence and validity of a project. This objective is addressed primarily by using standard sampling and analytical procedures. Additionally, comparability of analytical data is addressed by result comparison of certified reference materials.

Sensitivity of the analytical instrument or method is the ability to detect and quantify an analytical parameter at the concentration level of interest. Sensitivity can be evaluated by method or instrument detection limit studies (MDL and IDL) or calculated practical quantitative limits (PQL) and method report limits (MRL).

Completeness is a measure of the amount of successfully collected and validated data relative to the amount of data planned to be collected for the project. Project completeness is typically based on the percentage of the data needed for the program or study to reach statistically valid conclusions. Because the SVIWMP is a monitoring program, data that are not successfully collected for a specific sample event or site can typically be recollected at a later sampling event. For this reason, most of the data planned for collection can not be considered statistically critical, and it is difficult to set a meaningful objective for data completeness. However, some reasonable objectives for the data are desirable, if only to measure the effectiveness of the Monitoring Program. %Completeness will be expressed by the following equation:

$$\%\text{Completeness} = \frac{N}{T} \times 100$$

where,

N = Number of usable results
T = Total number of samples planned to be collected

A completeness goal of 90% has been set for the ground water monitoring program.

Representativeness can be defined as the degree to which the environmental data generated by the monitoring program accurately and precisely represent actual environmental conditions. This objective is addressed by the overall design of the monitoring program. Specifically, assuring the representativeness of the data is addressed primarily by selecting appropriate locations, methods, times, and frequencies of sampling for each environmental parameter, and by maintaining the integrity of the sample after collection. Representativeness judges how well a single sample can describe the conditions of an entire sample population. Accurate, artifact-free sampling procedures and appropriate sample homogenization achieve representativeness.

1.8 TRAINING REQUIREMENTS/CERTIFICATION

1.8.1 Training of Field Personnel

A specialized training requirement for this project is for the use of Global Positioning Systems (GPS) Technology. Training in the use of handheld GPS units and software will be performed on an individual basis between the trainer and the trainee. Training will be provided by staff experienced in the use of GPS and Geographic Information Systems (GIS).

Field personnel will also be given initial instructions prior to the beginning of sample collection activities. These initial instructions will help familiarize the field personnel with sample collection containers, sample handling techniques, chain-of-custody forms, and sample transport. New field personnel will be accompanied by a trainer in the field as part of the initial instructions. All field samplers have completed a four-hour training session in the field. Training included confirmation of the well ID electrical meter tag number and MCWRA tag number, recognizing the appropriate sampling port, sample collection technique, proper handling of the sample during transportation to the lab, and accurate completion of the chain-of-custody forms. The completion of field training session has been documented in the Agency's personnel files.

All field personnel will follow sample collection procedures from accepted methods for the collection of ground water. Sample collection will follow protocols in accordance with recommended guidelines established by the U.S. Geological Survey (USGS) for ground water collection as described in the

National Field Manual for the Collection of Water-Quality Data, U.S. Geological Survey, Techniques of Water-Resources Investigations, Book 9, Chapters A1-A9. Field personnel will be familiar with the above-mentioned document.

Field personnel will also read and be familiar with this Quality Assurance Project Plan (QAPP) prior to beginning any sample collection activities.

1.8.2 Training of Laboratory Personnel

No specialized training of laboratory personnel is required for this project. The ground water constituents to be analyzed by the laboratory are routine and do not require additional expertise. In addition, the laboratory's QA plan notes that analysts 'must conduct sufficient preliminary tests using the methodology and typical samples to demonstrate competence in the use of the measurement procedure'.

1.8.3 GPS Training Documentation

Documentation of field personnel training for GPS includes: the name of the staff member being trained, the training date, the name of the trainer (instructor), and a checklist of satisfactory completion of each step. These training records are stored inside a monitoring binder and filed in the Agency's Water Quality Section. A sample GPS training record is attached in Appendix A.

Training documentation of laboratory personnel for routine methods is kept on file at the Consolidated Chemistry Laboratory (CCL). The CCL has written a policy regarding laboratory personnel training in their lab QA plan.

1.9 DOCUMENTATION AND RECORDS

1.9.1 QA Project Plan Distribution

The MCWRA Hydrologist/ Team Lead will safeguard the original QAPP and any subsequent revisions (both hard and electronic), plus keep a record of the distribution list in order to send out amendments to the QAPP and retrieve any obsolete versions (from the individuals listed earlier in section 1.3).

1.9.2 Field Documentation and Records

All field documentation generated by the sampling program will be kept on file in the Water Quality Section of the Agency. Field documentation includes field sheets, chain of custody (COC) forms, photographs, and labels (see Appendix B for examples of each).

1.9.2.1 Field Sheets

Field sheets are used to aid in the identification of each ground water source (well). The field sheets list the name of each well (as assigned by the well owner) and the State Well Number. The field sheets also contain a section that describes who the sampler should contact in order to have a well turned on, where to find the sample port, etc. The sampler is responsible for recording the sample date and time on the field sheet. Site observations should be written in the comments section of the field sheet, and initialed by the sampler. Site observations may include information such as detailed directions to the well location, changes to the electrical meter tag number, and the owner contact name and phone number. Field sheets also contain PG&E electrical meter numbers, which can be either verified or updated while the sampler is in the field.

Field sheets are double-checked by the sampler for completeness and accuracy while still in the field. The sampler should look for: incomplete and/or missing data/omissions, incorrect or invalid information, and clarity problems. Any discrepancies should be cleared up before the sampler leaves the field. Data that has been entered by one field sampler will be reviewed by a different field sampler to verify that no transcription errors have occurred. These data entry reviews will take place at least weekly.

Original field sheets are categorized (according to Coastal wells or Salinas Valley wells) inside binders which are kept in the Water Quality Section at the Agency for a period of 10 years. After such time, the copies are transferred to the Monterey County Record Retention Center and archived for a period of 5 years.

Data collected on field sheets will also be recorded electronically and stored in an Access database inside a shared network drive that is backed-up on a daily basis. These electronic records will be retained permanently.

1.9.2.2 Chain Of Custody (COC) Forms

Chain-of-custody (COC) forms will be provided by the Consolidated Chemistry Laboratory and filled out while the sampler is in the field. The COC will accompany the samples at all times in order to insure the custodial integrity of the samples. A sample is considered to be in custody if it is: in someone's physical possession, in someone's view, locked up, or secured in an area that is restricted to authorized personnel.

Care should be taken to protect the COC from physical damage (i.e., water, wind, etc). The COC will have the following information:

- Client Code
- Client Name
- Client Address
- Client Phone Number
- Client Fax Number
- Report Attention
- Sampler Name
- Collection Date
- Collection Time
- Sample Site (identified by state well identification number) or QC sample (if appropriate)
- Sample Type (all of the samples in this project will be **grab** samples)
- Matrix (all of the samples in this project will be **ground water** samples)
- Analyses Requested

Upon relinquishing the sample(s) to the Consolidated Chemistry Laboratory, the sampler will sign and date the COC form. Lab personnel will then receive the sample(s), mark the date and time received, assign unique lab identification numbers (lab IDs) to each sample, and sign the COC form. The signed COC form is then photocopied; the lab keeps the original, and a copy is given to the sampler.

Hard copies of COC forms are categorized (Coastal wells or Salinas Valley wells) inside binders which are kept in the Water Quality Section at the Agency for a period of 10 years. After such time, the copies are transferred to the Monterey County Record Retention Center and archived for a period of 5 years.

Electronic COC information is also stored in an Access database inside a shared network drive that is backed-up on a daily basis. These electronic records will be retained permanently.

1.9.2.3 Photographs

The Agency maintains a photo catalog which contains photographs of the Coastal well site locations. The photo catalog is carried into the field to assist with the identification of each well. If there are significant changes to the appearance of the well site, then staff will take a new digital photo. The old photo in the catalog will then be replaced with a copy of the new photo. Photographs will be taken of the Salinas Valley wells after confirming the correct well location of each.

Two photographs of each well location will be taken using a high resolution digital camera. One photograph will be from a distance of 100 ft. or more to aid in the identification of the correct site location. The second photograph will be a close up of the well and pump head, which will be used to verify location of the correct sampling port. Printed hard copies of these two photographs for each well will be kept in the photo log book and labeled with the state well identification number as listed on the field sheets.

Photographs will serve to help verify information entered into the field sheets. Photographs are stored in an electronic database and labeled according to site number and date last photographed. Previous photos will be archived electronically for retrieval purposes if the need arises.

1.9.2.4 Labels

Labels for each sample site are pre-printed on Avery (size 5163) sheets (10 labels per sheet). Indelible ink will be used on the labels and clear packing tape will be applied over the label to prevent it from coming off if it gets wet. Each label will have the following information:

- Sample Site (pre-printed)
- Collection Date (to be filled out in the field)
- Collection Time (to be filled out in the field)
- Analyses Requested (complete or partial mineral panel)
- Sampler Name (to be filled out in the field)
- Comments (if any)

The sample site name (state well identification number) will serve as the unique identifier for each sample (e.g. 14S/02E-08M02). When the samplers arrive at the CCL a unique in-house lab number is assigned to each sample.

1.9.2.5 Field Quality Control Sample Records

Quality Control samples from the field will be identified using the state well identification number plus either -1 or -2 (e.g. 14S/02E-08M02-1, for a field blank).

- -1 = Field Blank
- -2 = Field Duplicate

1.9.3 Laboratory Documentation and Records

The Consolidated Chemistry Laboratory will keep a sample receiving log containing the completed COC forms submitted with the samples collected for this project. The CCL will keep records of all analyses performed as well as associated QC information, including: laboratory blanks, laboratory duplicates, matrix spikes, matrix spike duplicates and laboratory control samples. Hard copy data of analytical results will be maintained for three years by the CCL. The CCL maintains a Laboratory Information Management System (LIMS) which will be used to store electronic data.

The data generated by the CCL for each sampling event will be compiled into individual data reports. The individual data reports will include the following information:

- Sample results and associated Quantitative Limits (QLs)
- Cation-Anion Balance Sheet
- QC check sample records and acceptance criteria for the following:
    - Laboratory Control Sample(s)
    - Matrix Spike(s)
    - Matrix Spike Duplicate(s)
    - Analytical Duplicate(s)
    - Method Blank(s)
- Project narrative including a discussion of problems or unusual events (including, but not limited to, topics such as: receipt of samples in incorrect, broken, or leaky containers, with improperly or incompletely filled out COC forms; receipt and/or analysis of samples after the holding times have expired; summary of QC results exceeding acceptance criteria; etc.)

The above information is logged into the LIMS database at CCL.

The Public Health Chemist of the Consolidated Chemistry Laboratory will be responsible for reviewing, validating, and/or qualifying results on the data reports. Any deviations from sample preparation, analysis, and/or QA/QC procedures will be documented. Departure from QC acceptance limits will be highlighted. Once the data reports are finalized, the hard copy will be sent to the Project QA Manager at the Agency.

At the end of the sampling season, all data for both programs (Coastal and Salinas Valley) will be electronically transferred to the Agency. After data verification, the Agency Hydrologist/ Team Lead will upload the data to the Agency's Water Resources Agency Information Management System (WRAIMS) relational database.

1.9.4 Technical Reviews and Evaluations

Technical reviews and evaluations are limited to Field Activities and Laboratory Data Review Checklists.

1.9.4.1 Field Activities Review Checklist

Field personnel will be required to fill out a Field Activities Review Checklist as part of the double-check process upon returning from the field after each sampling event (see Appendix C).

1.9.4.2 Laboratory Data Review Checklist

Laboratory data reports from the CCL will be routed to the Project QA Manager at the Agency, who will do a preliminary assessment of the data. The data reports will then be given to the Agency

Hydrologist/ Team Lead who will be responsible for completing a Laboratory Data Review Checklist (see Appendix C).

1.9.5 Technical Memorandum

The Agency Project QA Manager is responsible for the preparation of the technical memorandum. The technical memorandum will be written in the "post sample collection" phase (see section 1.6.3). The technical memorandum will be submitted to USEPA for review by the EPA Region 9 Project Manager.

The technical memorandum will contain the following elements:

- Table of results for Chloride
- Table of results for Nitrate
- Table of results for Specific Conductance
- Map of Chloride contours for 500 mg/L values
- Map of Nitrates showing those sites which have values above and below the Drinking Water Standard Limit of 45 mg/L (nitrate as NO3)
- Map of Conductivity contours

2.0 DATA GENERATION AND ACQUISITION

2.1 SAMPLING DESIGN

In the Salinas Valley, there are four hydrogeologic subareas: Pressure, East Side, Forebay, and Upper Valley. All four subareas were selected using a directed sampling design approach. These subareas were selected deliberately based on knowledge from previous monitoring work to contain analytes of interest, specifically nitrate and conductivity in the Salinas Valley Program, and chloride and conductivity in the Coastal Program. Actual sampling sites/wells within the Salinas Valley Basin Monitoring Program were chosen using a non-deliberate sampling approach. The wells included are acquired opportunistically. Site accessibility is a key issue for sampling. Permission of property owners must be secured before accessing private wells.

There are just over 1700 active wells in the Salinas Valley. Of this total number of wells, 344 wells make up the Salinas Valley Ground Water program and 85 wells make up the Coastal Ground Water program. The wells that make up these two programs have all been sampled in the past; some have data sets as far back as the 1950's, when this was a State of CA Department of Public Works (now the Department of Water Resources) program. The Agency wants to keep as complete and continuous a data set for each of these wells as possible.

Due to the time constraints the Agency is facing during this shortened 2007 field season, June - September, staff will prioritize which wells within the Salinas Valley portion of this project will be sampled. Wells to be sampled first will be located within approximately one mile radius of municipalities and industries (such as vegetable packing plants). We refer to these areas as high beneficial use areas. Ground water wells will be identified by State Well Numbers (Township, Range, Section, and Subsection).

All wells are high production agricultural wells. All wells are sampled in the same way, if the pump is in operation then a sample will be collected. If the pump if not operating then the field sampler will note it on the field sheets and come back to the well at a later date when the well is in operation. The pump must be operating for a sample to be collected. The age of well does not alter sampling protocols. If a well is found to have been abandoned since the Agency last sampled the well, a notation will be made on the field sheets and the well will be removed from future sampling efforts.

2.1.1 Salinas Valley Ground Water

While it is known that high levels of nitrates exist in some aquifers of the Salinas Valley Ground Water Basin, a significant sampling effort to determine the extent in the ground water has not been conducted by the Agency for several years. There are a total of 344 sample locations within the Salinas Valley monitoring program. Sample locations are operational ground water wells, the majority of which are used for agricultural irrigation. The Pressure subarea has 158 wells, the East Side subarea has 66 wells, the Forebay has 84 wells, and the Upper Valley has 35 wells (Figures 4-7). Each of these wells will be sampled once during the 2007 summer field season (July-September). The primary criterion currently used to determine if a well will be included in the Salinas Valley monitoring program has been its status as previously sampled. This program is an ongoing ambient ground water monitoring program and continuity in sampling the same wells each field year is of prime importance, especially for water quality trend analysis. Other factors that are important in deciding if a well should be included in the monitoring program are; copy of the well completion report (commonly referred to as the driller's log), location of the perforation interval along the well casing to determine which aquifer is sampled, age of the well, and construction method used to drill the well. Additionally it is useful to know the proximity of the well to other water use (industrial, municipal, or domestic) areas. A list of Salinas Valley well names and locations are given in Table 4. All wells on this program are planned to be part of the monitoring design for subsequent years. Until these monitoring wells are abandoned or destroyed, they will remain part of this program.

2.1.2 Coastal Ground Water

The Agency currently conducts a seawater intrusion monitoring and mapping program (EPA II). This program will continue to evaluate the extent and status of seawater intrusion in the coastal areas of the Salinas Valley Basin (EPA II). The Coastal portion of the ground water program contains 85 wells, most of which are located in the Pressure subarea (Figure 8). Each well will be sampled three times, once each month of the summer 2007 field season (July-September). The first sample collection at each well will be analyzed for a complete mineral panel (Table 1), and following two collections will be analyzed for a partial mineral panel (Table 1). There are 21 wells located in the Pressure 180-Foot Aquifer, 52 wells within the Pressure 400-Foot Aquifer, two wells with perforations within both the Pressure180-Foot and 400-Foot Aquifers, four wells are located within the Pressure Deep Zone Aquifer, three in the East Side Deep Aquifer, one in the East Side Shallow Aquifer, and one in the Prunedale Aquifer. The principal criterion for inclusion in the Coastal monitoring program is historical sampling and well availability. Additional criteria for selecting a well for inclusion into the Coastal monitoring program are: a well completion report, location of the perforation interval along the well casing to determine which aquifer is sampled (180, 400, or deep zone AQ), well age, and well construction type. A list of Coastal sites and their representative aquifers are listed in Table 5.

It can not be stressed enough how important the continued monitoring of these ground water wells are for the Agency to meet its mission of monitoring the quality of the County's ground water resources. Some of these well have been sampled since the 1950's and the loss of such a long term water quality record within the County of Monterey would irreplaceable.

2.2 SAMPLING METHODS

The objectives of the sampling procedure are to minimize changes in ground water chemistry during sample collection and transport to the laboratory, and to maximize the probability of obtaining a representative, reproducible ground water sample. This well-volume purging procedure provides a reproducible sampling technique with the goal that the samples obtained will represent water quality over the entire screen interval of the well.

Standing water in the well casing can be of a different chemical composition than that contained in the aquifer to be sampled. Solutes may be adsorbed on to, or desorbed from the well casing material, oxidation may occur, and biological activity is possible. Therefore, the stagnant water within the well must be purged so that the sample is representative of the aquifer. As a result, a well may be sampled only after the pump has been in operation for at least 15-20 minutes.

All the wells included in this project, from both the Salinas Valley area and the Coastal monitoring area are high production agricultural wells that contain deep turbine pumps operating at 500-1200 gallons per minute (gpm). Over the years of managing the ambient monitoring program, the Agency has determined that operating a deep turbine pump for 15-20 minutes before taking a sample is sufficient time to clear the entire well casing of three well volumes for ensuring a representative well sample. For referencing well casing volume, the Agency uses the well casing size provided in the well completion reports (driller's log) for each of the wells included in this monitoring program (National Field Manual for the Collection of Water-Quality Data, Chapter A2).

Sample bottles and caps are rinsed three times with ambient ground water prior to collection. The sample container is then filled, tightly capped, and labeled. No field sample filtration is required. Samples are put into a cooler with ice immediately and maintained at 4°C and delivered to the laboratory daily. See Table 6 for sample collection requirements. Extra sample containers, caps and field supplies will be carried in the truck as back-up should any problem arise in the field. Additionally, the Field Sampler will carry and maintain an updated hardcopy of the QAPP in the field to be used as a reference.

The following precautions will be followed in order to limit sampling error at the wellhead:

- Operate the pump long enough to produce water that is representative of the aquifer and not stagnant water from the casing.
- Take samples at the wellhead or near the wellhead and away from fertilizer injection ports.

Sample collection will follow protocols in accordance with recommended guidelines established by the U. S. Geological Survey (USGS) for ground water collection as described in the National Field Manual for the Collection of Water-Quality Data.

The National Field Manual for the Collection of Water-Quality Data, U.S. Geological Survey, Techniques of Water-Resources Investigations, Book 9, Chapters A1-A9 is maintained as a web-based document and is located at http://pubs.water.usgs.gov/twri9A. Updates and revisions for the National Field Manual can be found using this web-based approach.

2.3 SAMPLE HANDLING AND CUSTODY

This section describes how all samples will be treated after collection, during transport, and upon arrival at the CCL. It also includes information on proper sample disposal after laboratory analysis.

2.3.1 Sample Containers and Preservatives

Sample containers to be used in this project are high density polyethylene (HDPE), one pint (~0.5 L) and 0.5 gallon (~2 liter) sizes, for partial mineral or complete mineral analyses, respectively. The Agency has used these same sample container types during previous years of this ongoing ambient monitoring program and has never had any problems with container contamination issues. Field blanks will be closely monitored and, should a problem arise, corrective actions will be taken. Only one container (pint *or* half gallon) is needed per sampling site to provide the necessary volume to run the required lab analyses (see Table 6). Sample containers and caps are purchased in bulk from a plastic container manufacturer (Consolidated Container Company). The caps for the containers are packaged separately. The containers and caps are clean upon receipt, as long as they arrive with the outer cardboard packaging intact. The containers will be kept in a closed, dry environment away from the outside elements. Sterility is not of importance because this sampling project does not include microbiological testing. As previously mentioned, all containers and caps will be rinsed three times with ambient sample water prior to sample collection.

Sample containers are labeled with pre-printed labels, which lists which panel of analytes is requested, either complete mineral or partial mineral. The collection date, collection time, and sampler name are recorded in the field with an indelible marker. After being filled out, labels will be covered with clear plastic tape (packaging type) to protect the labels from destruction during transport.

No chemical *field preservation* of the samples is required. All samples will be kept at 4±2°C.

Preservation of samples, if required prior to analysis, will be the responsibility of the contract lab (CCL). Part of the CC lab sample receiving protocols includes lab personnel verifying, at the time of sample receipt, if any samples require lab preservation. Refer to Table 6 for listings of preservatives for specific analytes.

2.3.2 Sample Packaging and Transport

All samples will be handled, prepared, transported and stored in a manner so as to minimize contamination and spills. After collection, sample caps will be checked for tightness, and the samples will be put in ice chests immediately. During travel between sites, ice chest lids will be kept tightly closed in order to keep the samples at the correct temperature and protect them from sunlight. Ice used for maintaining sample temperature will be double-bagged inside durable plastic bags (Ziploc type) and be of sufficient quantity so that all samples will stored at 4±2°C. Maximum holding times for specific analytes are listed in Table 6.

2.3.3 Sample Custody

Chain of custody (COC) procedures require that possession of samples be traceable from the time the samples are collected until completion and submittal of the analytical results. A completed chain of custody form is to accompany the samples to the contract laboratory (CCL). Requirements for COC paperwork can be found in Section 1.9.2.2 of this document.

All samples collected for this project will be transported from the field to the CCL via an Agency vehicle. The field sampler will deliver the samples directly to the CCL daily; there will be no intermediary transfers. Samples need to arrive at the CCL no later than 15:00, to ensure log-in and laboratory preservation. Personnel at the CCL will examine the samples for correct documentation and holding times. The CCL will follow sample custody procedures as outlined in their QA plan (see Appendix D).

2.3.4 Sample Disposal

All samples remaining after successful completion of analyses will be disposed of properly. It is the responsibility of the personnel at the CCL to ensure that all applicable regulations are followed in the disposal of samples or related chemicals. Sample disposal procedures used by the CCL are discussed in their QA plan (see Appendix D).

2.4 ANALYTICAL METHODS

All samples will be analyzed at the County Consolidated Chemistry Laboratory (CCL). Analyses will be performed following either EPA approved methods or methods from *Standard Method for the Examination of Water and Wastewater, 18th Edition,* see Table 1 (CCL's QA Manual cites *18th Edition,* see Appendix D). Standard operating procedures (SOPs) from CCL have been included in Appendix D for each of the analyses. Should there be any deviation from these SOPs the Laboratory Director must contact the Project QA Manager.

The CCL will submit a data report and associated QC results after analyses are complete to the Project QA Manager. This data report is described in Section 1.9.3. After a preliminary assessment the Project QA Manager will pass the data on to the Team Lead, who will review the data report and QC results and evaluate its quality and usability in addressing the Project objectives.

2.5 QUALITY CONTROL

2.5.1 Field Sampling Quality Control

The assessment of field measurements will be determined from the collection and analysis of field blanks and field duplicates. For this monitoring program the field blanks will be collected at one every 20 samples or a frequency of 5%. Field duplicates will be collected at a frequency of 10% for the first two sampling events. If the criterion of <25% RPD is met, then the remaining field duplicates will be collected at a 5% frequency. Analytical acceptance criteria and corrective actions for field QC are listed in Table 2.

Deionized (DI) water will be acquired from the CCL and kept at 4±2°C, while transported into the field. Field blank samples will be obtained by pouring DI water into a pint (~500 mL) HDPE sample container that has been triple-rinsed with DI water at the sampling location. The container will be tightly capped, placed in the cooler and delivered to the contract laboratory. Field blanks are labeled with the sampling location (State Well Number) followed by "-1".

Field blanks will be used to evaluate the collection process (from field sampling through sample analysis) for contamination from exposure to ambient conditions, from sample containers or from improper sampling and handling technique. If target analytes are found in field blanks, sampling and handling procedures will be reevaluated and corrective actions taken. Corrective actions may consist of, but are not limited to, re-training of field personnel, discussions with the contract laboratory, invalidation or qualifying of results.

Field duplicates will be collected for every analytical parameter. The duplicate sample will be collected immediately after collection of the native, following the same sampling protocols. Field duplicates are labeled with the sampling location (State Well Number) followed by "-2".

Field duplicates will be used to evaluate the precision of the sample collection through analysis. The combined variability from sampling and analysis technique, in addition to sample heterogeneity, will be assessed using field duplicates. If acceptance criteria are exceeded, field sampling and handling protocols will be reviewed and problems corrected. These may consist of, but are not limited to, additional training, revised sampling techniques and reevaluation of sampling location.

2.5.2 Laboratory Analyses Quality Control (Contract Laboratory)

The Monterey County Consolidated Chemistry Laboratory's (CCL) personnel are responsible for analytical Quality Control. Standard laboratory quality control elements include method blanks, laboratory control samples, analytical duplicates, matrix spikes and calibration procedures. Laboratory data quality objectives include QC acceptance criteria, frequency of analysis, and corrective actions. These data quality objectives and quality control elements for CCL are described in its QA Manual (Appendix D) and SOPs (Appendix D) and are listed in Table 3. After examination of these documents, the Agency believes that the laboratory will be able to meet the project data quality needs. Any deviation from these written procedures must be documented by the laboratory and reported to the Project QA Manager.

2.6 INSTRUMENT/EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE REQUIREMENTS

Testing, inspection, and maintenance of laboratory equipment are the responsibility of the Monterey County Consolidated Chemistry Laboratory and are detailed in its QA manual in Appendix D.

2.7 INSTRUMENT CALIBRATION AND FREQUENCY

Instrument calibrations are the responsibility of the Monterey County Consolidated Chemistry Laboratory and acceptance criteria for calibrations are detailed in its QA manual in Appendix D.

2.8 INSPECTION/ACCEPTANCE REQUIREMENTS FOR SUPPLIES

2.8.1 Initial Inspection of Supplies

As mentioned previously in Section 2.3.1, sample containers are purchased in bulk from an outside vendor who specializes in supplying plastics to the beverage industry. An initial inspection will be conducted upon receipt of each shipment. Each shipment will be considered acceptable for use if *all* of the following are true:

- The shipment arrives with the outer cardboard packaging intact.
- The containers are the correct type (HDPE) and size (0.5 gal/~2L *or* 1 pint/~0.5L).
- The insides of the containers are dry.
- The insides of the containers are free of dirt or any particulate matter.

2.8.2 Field Inspection of Supplies

Immediately prior to sample collection, field samplers will visually inspect each sample container for the following:

- Dirt or any particulate matter
- Cracks of any size
- Improper fit of the cap on the container

If the field sampler observes any of the above, then the container will be discarded and an acceptable container will be used instead.

2.8.3 Laboratory Inspection of Supplies

CCL will be responsible for establishing inspection and acceptance criteria for supplies that adhere to their internal QA/QC policies.

2.9 DATA ACQUISITION REQUIREMENTS (NON-DIRECT MEASUREMENTS)

Non-direct measurement data will not be used during this monitoring program. Should at some time in the future the Agency decide to use data from an external source, QA/QC requirements will be established. Should this occur, an addendum to this QAPP will be submitted to USEPA.

2.10 DATA MANAGEMENT

Data, as related to documentation and records, will be managed as outlined earlier in Section 1.9 of this QAPP.

In addition, the CCL will group QA/QC data under a separate client code so that QA/QC data can be filtered from regular sample data before being uploaded into the Agency's Data Management System (WRAIMS). This allows the Agency a greater flexibility both in quickly and easily accessing the data that included QA/QC samples for initial review, and increased flexibility in uploading and moving large data sets.

3.0 ASSESSMENT AND RESPONSE ACTIONS

This section lists review procedures that will be taken to ensure all the protocols outlined in the QAPP are consistently followed.

3.1 REVIEWS

3.1.1 Readiness Reviews

Water Resources Technicians/ Field Samplers will be trained by the Hydrologist/Team Lead before any field sampling begins. Training will cover proper sample collection and handling and the completion of all paperwork (COCs, field logbooks, etc). The Team Lead will ensure that Field Samplers have properly prepared all collection containers, paperwork and other supplies needed to complete a successful sampling event. Any problems discovered during the readiness review will be corrected before the Samplers begin work.

3.1.2 Field Reviews

The Team Lead will be responsible for overseeing that all field activities are incompliance with Agency protocols. The Team Lead will be available via phone should any questions arise while the Samplers are in the field. The Team Lead will also review all field paperwork such as COCs and field logbooks for completion. Additionally the field QC samples (field blanks and duplicates) will be used to evaluate the individual Sampler's technique. If problems are exposed they will be corrected straight away so that all further samples are valid. A stop-work order may be issued by the Project QA Manager at any time if a discrepancy or error is found that could negatively affect the data being collected.

3.1.3 Post Sampling Reviews

Post sampling reviews will be conducted following each sampling event in order to ensure all information is complete. Reviews will be conducted by the Field Sampler due to the small size of the staff. They will include evaluation of sampling activities and field documentation and will take place in the office, not in the field. Findings will be passed on to the Team Lead and the Project QA Manager to be incorporated into the next field event.

3.1.4 Laboratory Data Reviews

The Team Lead will be responsible for reviewing the laboratory's data for completeness and accuracy. The data will also be checked to determine that all specified methods were used and all related QC data was provided with the sample analytical results. These reviews will take place immediately upon receipt of data reports from the laboratory. This will ensure that any method deviations are corrected or explained, and any missing or incomplete data are provided. The Project QA Manager has the authority to request re-testing of laboratory data if it is invalid or would otherwise compromise the quality of the resulting project conclusions.

3.2 REPORTS

The Project QA Manager will be responsible for the technical memorandum (EPA R9# 03-238 Task 3.3) which will be provided in March 2008 to US EPA. The technical memorandum (EPA R9# 03-238 Task 3.3) will include result tables for chloride, nitrate, and specific conductivity, and maps of chloride, nitrate, and specific conductivity gradients. The technical memorandum will include a summary of any significant QA/QC issues and how they were resolved. It is currently understood that this project is of short enough duration that only a final technical memorandum to the EPA is necessary.

4.0 DATA VALIDATION AND USABILITY

4.1 DATA VERIFICATION AND VALIDATION

Data review is the in-house examination to ensure that the data have been recorded, transmitted, and processed correctly. The Team Lead is responsible for the data review. This examination will check for data entry errors, calculation errors, and data omission errors. If possible these errors will be corrected.

4.1.1 Field Data

Field data include logbooks, photographs, and COCs. The Field Sampler is responsible for reviewing the field data at the end of the sampling event. This includes determining that all information is complete and any deviations from the sampling methodologies are documented using the Field Activities Review Checklist (Appendix C).

4.1.2 Laboratory Data

Initial evaluation of the laboratory data are carried out by the CCL in agreement with protocols listed in their SOPs and QA manual. The Team Lead will also conduct an independent review of the data and QC parameters as described in sections 3.1.4 and using the Laboratory Data Review Checklist as detailed in section 1.9.4.4 and Appendix C.

4.2 RECONCILIATION WITH USER REQUIREMENTS

The purpose of the continued ambient monitoring of the Salinas Valley Basin Ground Water is to assess the water quality to manage and protect ground water resources. For data to be useful in developing the overreaching Salinas Valley Integrated Water Management Plan, it must first meet the requirement of this QA project Plan. The Project QA Manager will be responsible for making the final evaluation of the data's usability in meeting the Project objectives. All data passing this final evaluation will then be used to establish a cohesive and succinct Water Quality Management Plan in accordance to the work begun under EPA-I and continued under EPA-II. Additionally, the Agency will integrate these ground water quality data with previously collected data for use in trend analysis.

5.0 REFERENCES

Department of Public Works, Division of Water Resources (DWR). 1946. *Bulletin 52: Salinas Basin Investigation.*

Durbin, TJ, GW Kapple, JR Freckleton. 1978. *Two-Dimensional and Three-Dimensional Digital Flow Models of the Salinas Valley Ground-Water Basin, California.* US Geological Survey. Water Resources Investigations Report 78-113. Prepared in cooperation with the US Army Corps of Engineers.

Geomatrix Consultants. 2001. *Evaluation of the Salinas Valley Groundwater Monitoring Network and Proposed Redesign.* Prepared for The Monterey County Water Resources Agency.

Greene, HG. 1970. *Geology of Southern Monterey Bay and its Relationship to the Ground-Water Basin and Seawater Intrusion.* US Geological Survey Open File Report.

Hunt, JW, BS Anderson, BM Phillips, PA Nicely, RS Tjeerdema, HM Puckett, M Stephenson, K Worcester, V deVlaming. 2003. *Ambient toxicity due to chlorpyrifos and diazinon in a Central California Watershed.* Environ. Monit. Assess. 82: 83-112.

Monterey County Agricultural Commissioner's Office (Ag Commission). 2006. *Monterey County Crop Report.*

Monterey County. 2007. *Fact Finder.* Prepared by Monterey County Administrative Office.

Monterey County Water Resources Agency (MCWRA). 1997. *Water Resources Data Report, Water Year 1994-1995.*

Quality Assurance Project Plan for Monitoring of Surface Water Eagle Valley Reservation. 2005. Prepared by Eagle Valley Environmental Program Eagle Valley Band of Indians Eagle Valley Reservation. Prepared for US EPA Region 9.

Salinas Valley Ground Water Basin Hydrology Conference (White Paper). 1995. *Hydrogeology and Water Supply of Salinas Valley.* Prepared for The Monterey County Water Resources Agency.

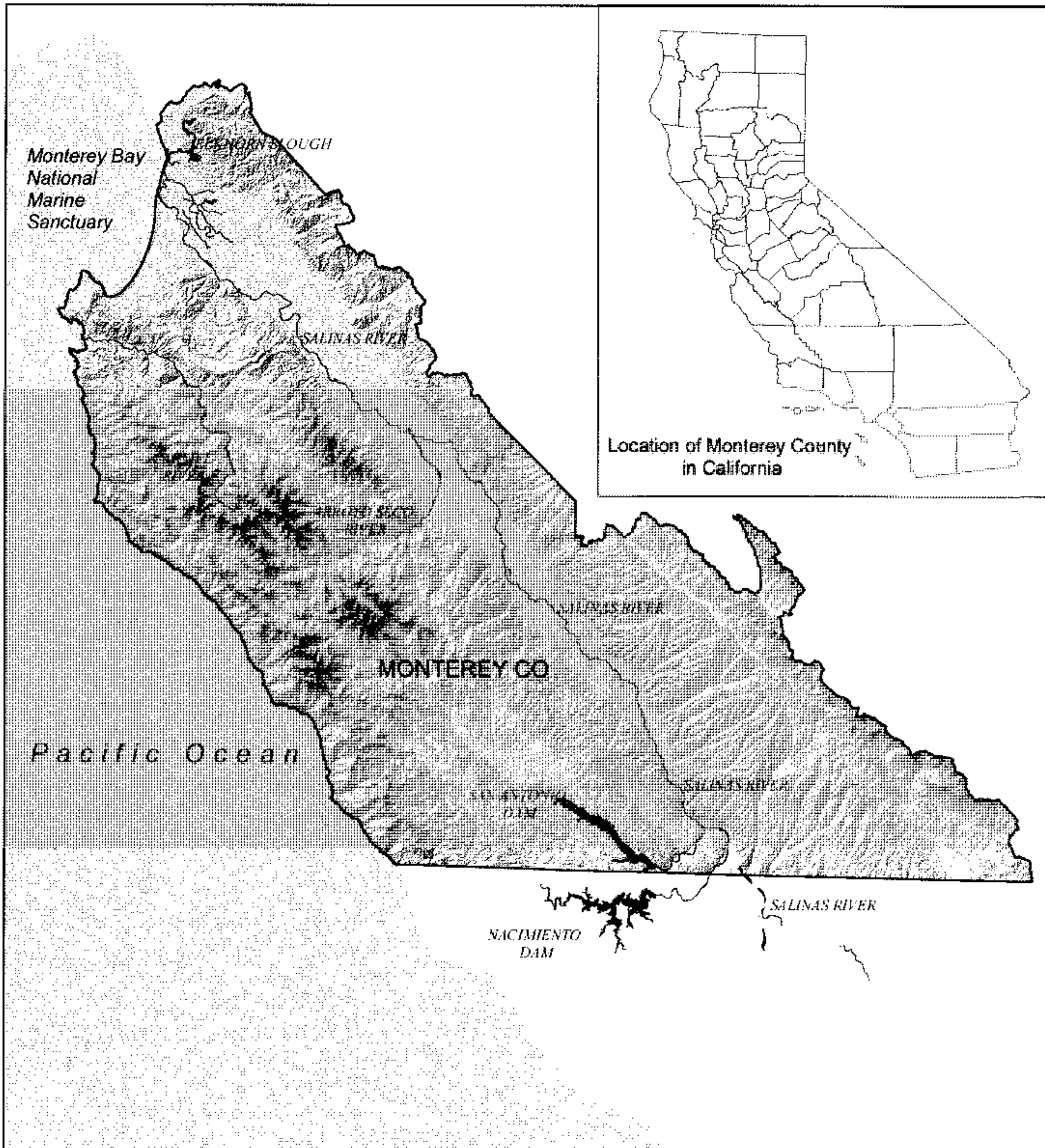
State of California, Department of Water Resources (DWR). 2003. *Bulletin 118 Update: California's Groundwater.*

Sycamore Creek Quality Assurance Management Plan. 2006. Prepared by Instant Reference Sources, Inc. Prepared for California State Water Resources Control Board.

US EPA. 2002. *Guidance for Quality Assurance Project Plans.*

US EPA Grant R9# 03-238. 2003. *Salinas Valley Integrated Water Management Plan.* Prepared by The Monterey County Water Resources Agency. Prepared for US EPA Region 9. Grants Management Office.

FIGURES



Legend

Water Bodies/ Channels

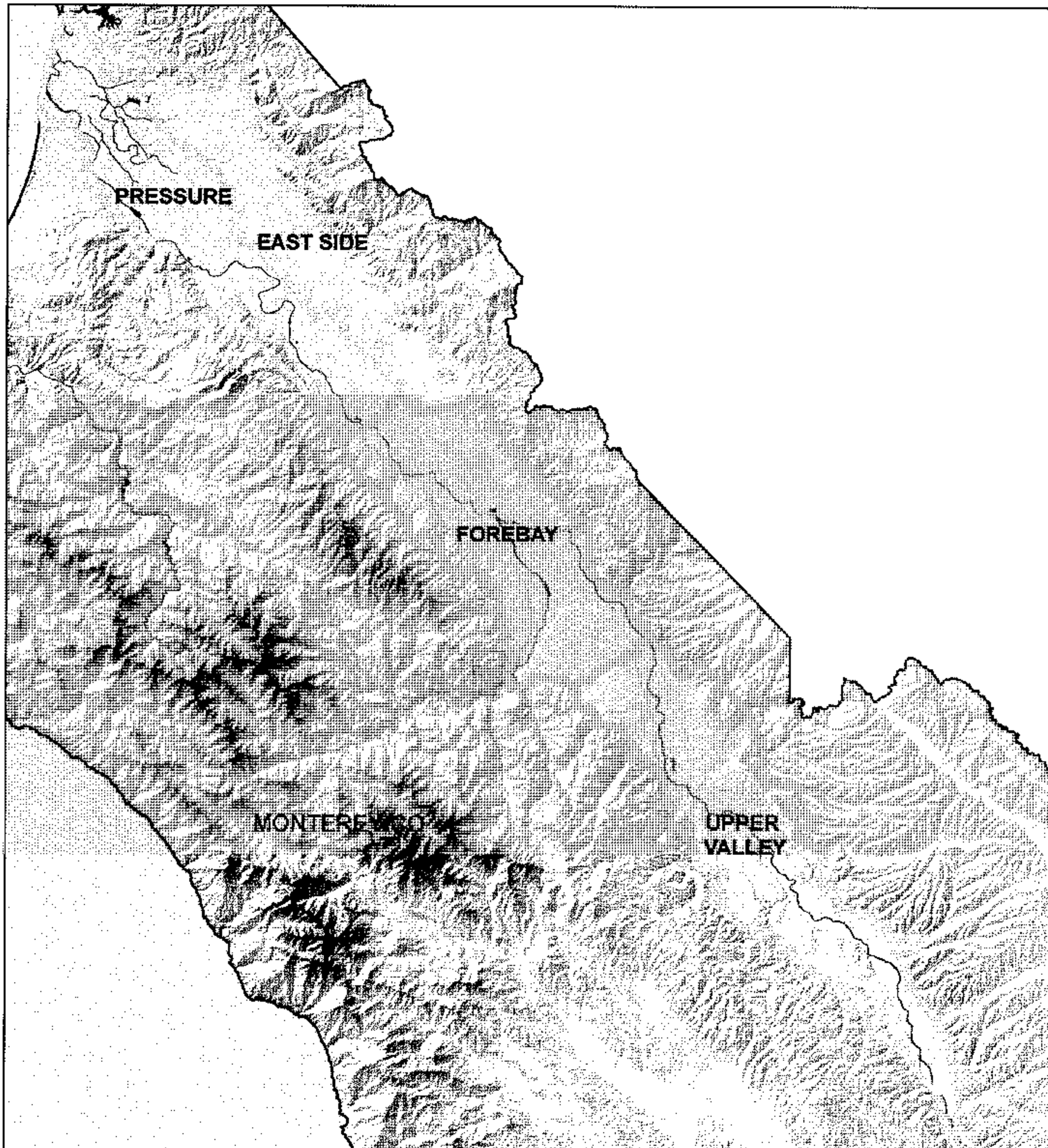
Monterey County, California

Figure 1

0 4 8 12 16 Miles

Note: The scale and configuration of all information shown hereon are approximate and are not intended as a guide for survey or design work

Map Date: July 5, 2007



Legend
Water Bodies/ Channels

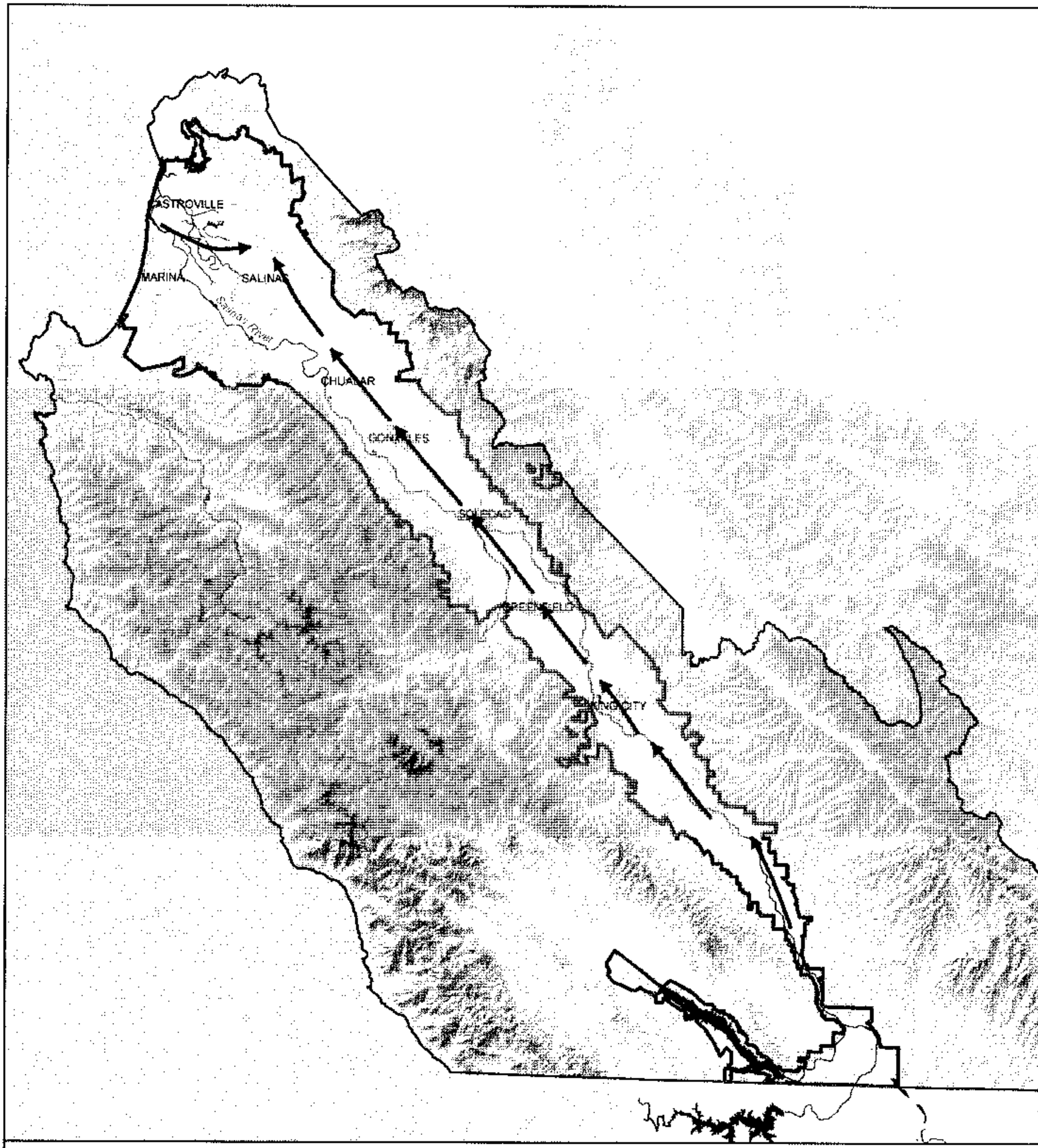
Salinas Valley Aquifers

Figure 2

0 2 4 6 8 Miles

Note: The scale and configuration of all information shown hereon are approximate and are not intended as a guide for survey or design work.

Map Date: July 5, 2007



Ground Water Flow Direction in the Salinas Valley

Figure 3

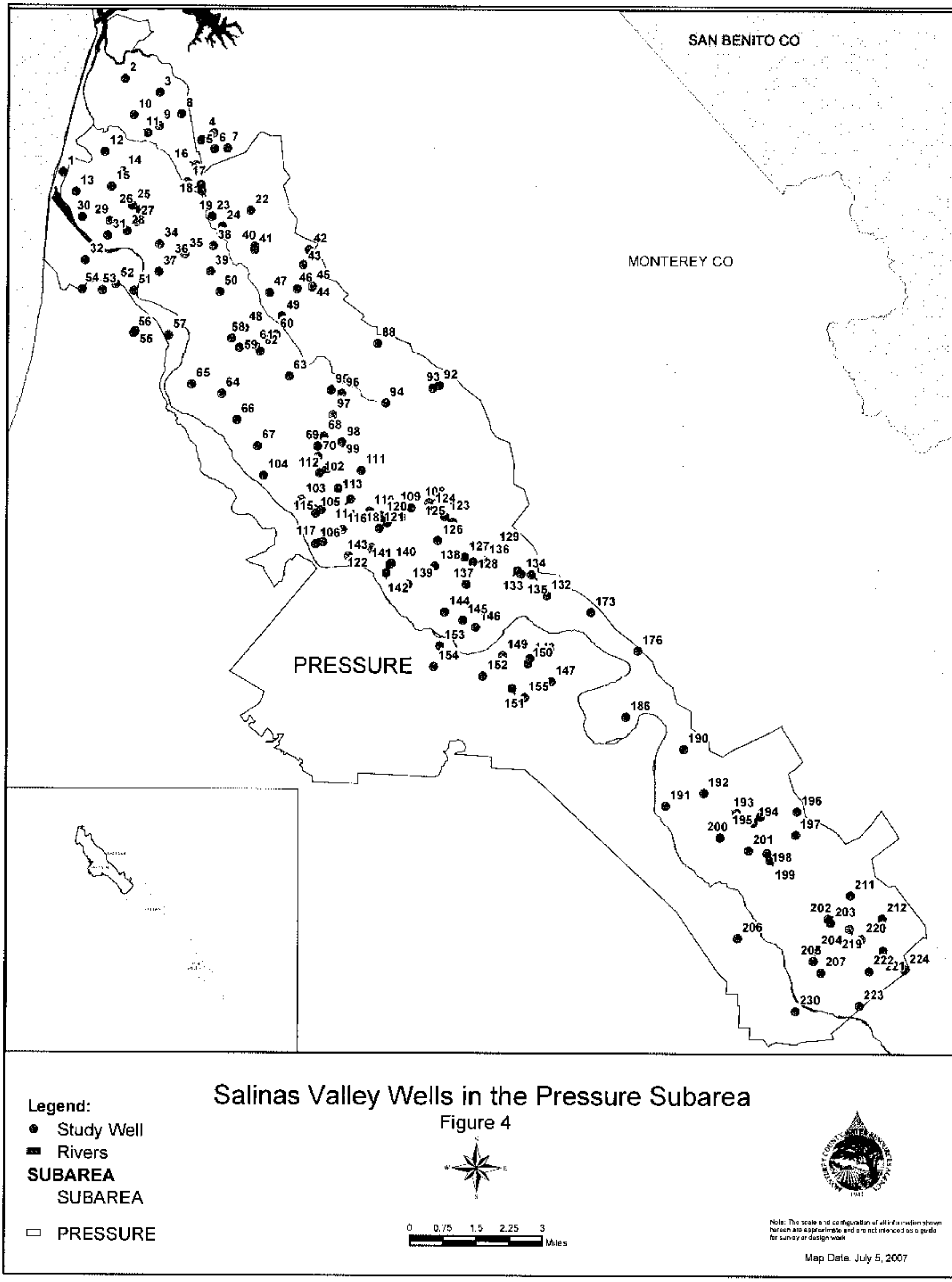
Legend

- Ground Water Flow Direction
- Assessment Zone 2C
- Monterey County
- Rivers and Other Bodies of Water

0 10 20 Miles

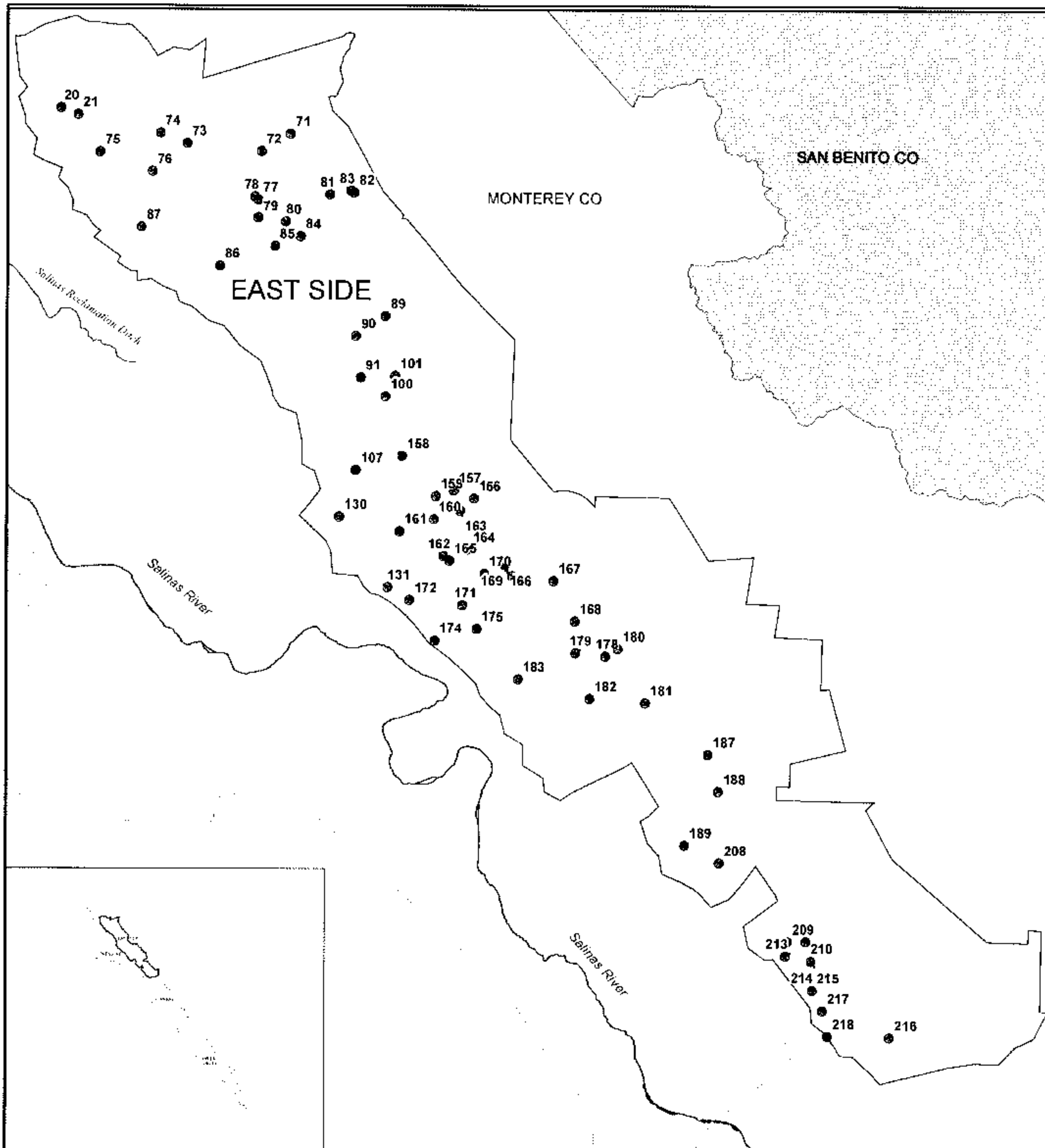
Note: The scale and configuration of all information shown hereon are approximate and are not intended as a guide for survey or design work.

Map Date: July 6, 2007



Salinas Valley Wells in the Pressure Subarea

Figure 4



Legend:
- Study Well
- Rivers

SUBAREA

SUBAREA

EAST SIDE

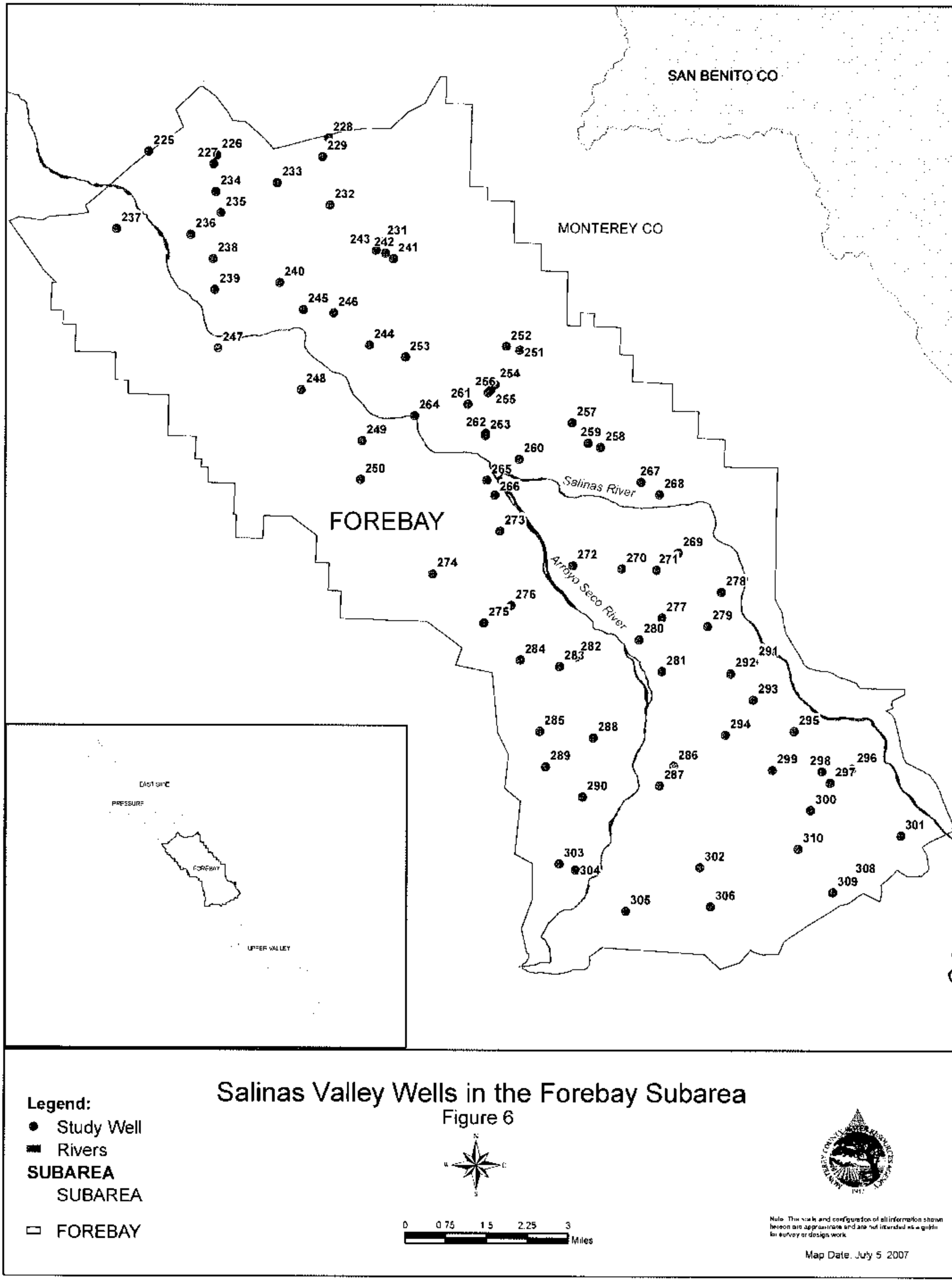
Salinas Valley Wells in the East Side Subarea

Figure 5

0 0.75 1.5 2.25 3 Miles

Note: The scale and configuration of all information shown hereon are approximate and are not intended as a guide for survey or design work.

Map Date: July 5, 2007

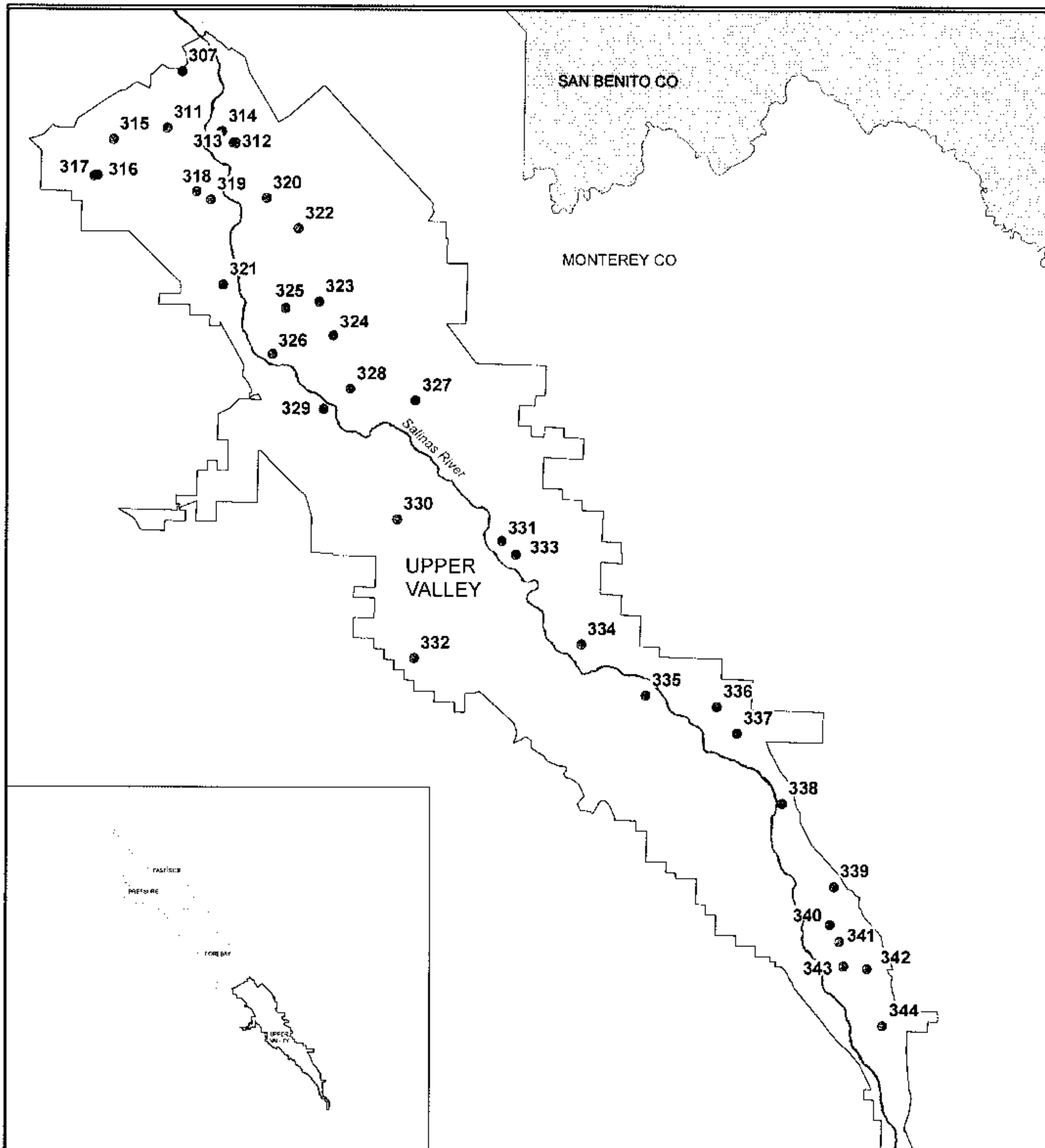


Salinas Valley Wells in the Forebay Subarea

Figure 6

Note: The scale and configuration of all information shown hereon are approximate and are not intended as a guide for survey or design work.

Map Date: July 5 2007



Salinas Valley Wells in the Upper Valley Subarea
Figure 7

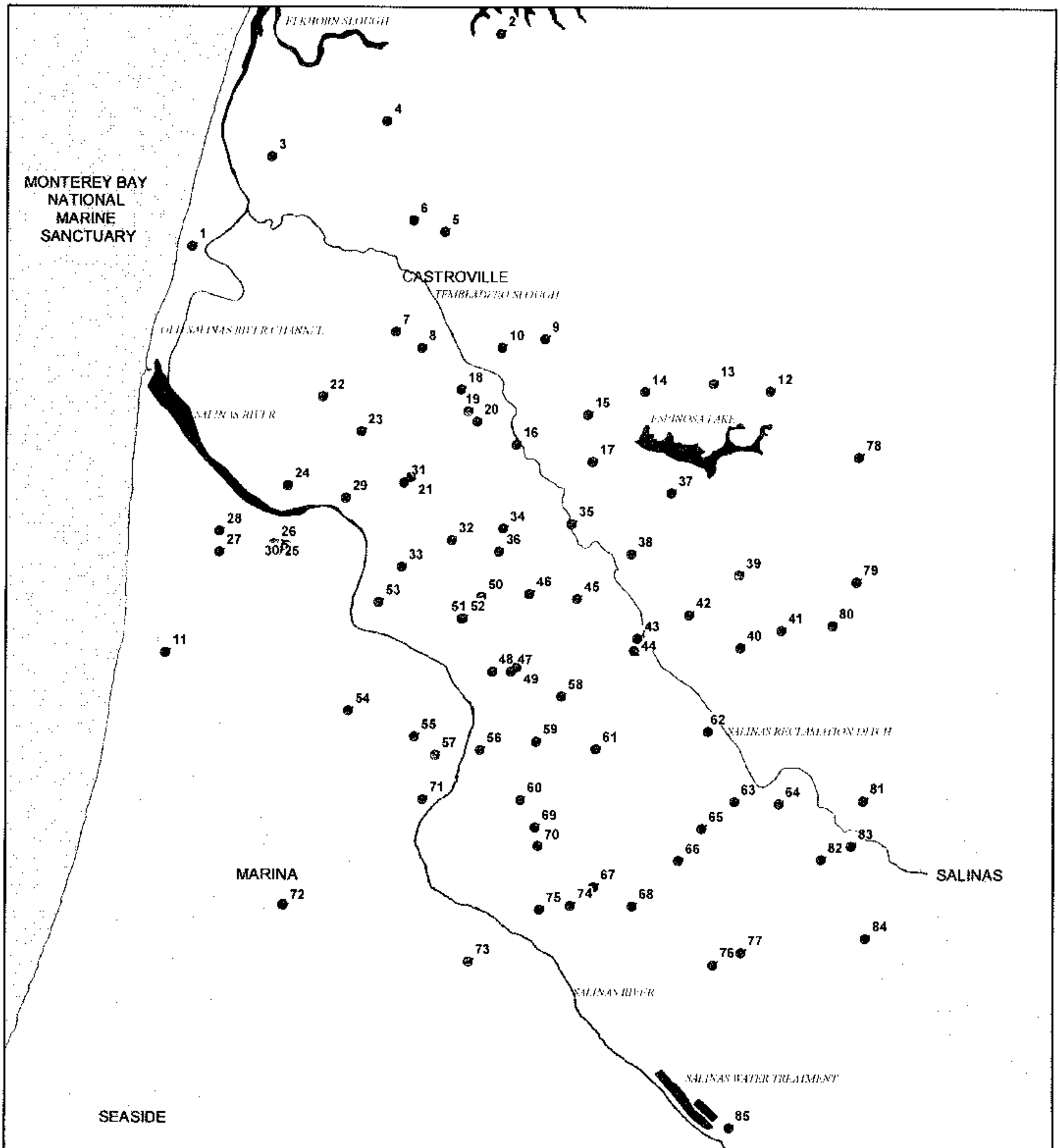
Legend:
- Study Well
- Rivers

SUBAREA
- SUBAREA
- UPPER VALLEY

0 0.75 1.5 2.25 3 Miles

Note: The scale and configuration of all information shown hereon are approximate and are not intended as a guide for survey or design work.

Map Date: July 5, 2007



Coastal Ground Water Monitoring Program Wells

Figure 8

Legend:

- Study Well
- Cities
- Water Bodies/ Channels

0 0.5 1 1.5 2 Miles

Note: The scale and configuration of all information shown hereon are approximate and are not intended as a guide for survey or design work.

Map Date: July 02, 2007

TABLES

Table 1 COMPLETE MINERAL PANEL ANALYTES

ANALYTE	*METHOD*	*LABORATORY MDL***	*LABORATORY PQL*	*LOWEST CALIB. STD.*	*PAL*
Calcium (Ca)	SM 3111 B[1]	0.02 mg/L	1.0 mg/L	1.0 mg/L	1.0 mg/L
CATION ANION BALANCE	Calculated	--	--	--	--
*Chloride (Cl)	EPA 300.0[2]	0.01 mg/L	1.0 mg/L	0.1 mg/L	1.0 mg/L
*Conductivity (SEC)	SM 2510 B	1 umho/cm @ 25 C	1 umho/cm @ 25 C	N/A	1 umho/cm @ 25 C
Magnesium (Mg)	SM 3111 B	0.005 mg/L[1]	1.0 mg/L	0.1 mg/L	1.0 mg/L
*Nitrate (NO3)	EPA 300.0	0.002 mg/L[2]	1.0 mg/L	0.1 mg/L	1.0 mg/L
pH (Laboratory)	SM 4500-H B	pH Units (2 sig figs)	pH Units (2 sig figs)	N/A	pH Units (2 sig figs)
Potassium (K)	SM 3111 B	0.025 mg/L[1]	0.1 mg/L	0.1 mg/L	0.1 mg/L
Sodium (Na)	SM 3111 B	0.03 mg/L[1]	1.0 mg/L	0.1 mg/L	1.0 mg/L
Sulfate (SO4)	EPA 300.0	0.03 mg/L[2]	1.0 mg/L	0.1 mg/L	1.0 mg/L
Total Alkalinity (as CaCO3)	SM 2320 B	1.0 mg/L	1.0 mg/L	N/A	1.0 mg/L

[1] = MDL study completed February 2007
[2] = MDL study completed May 2007
* = Partial Mineral Panel analytes
** = These are the laboratory's latest MDLs and supersede the MDLs listed in Appendix D-1.
MDL = method detection limit; PQL = practical quantitative limit; PAL = project action level
All laboratory results are bracketed by calibration standards. No "estimated" results (below the lowest calib std and above the MDL) are given to the Agency.

Table 2 QUALITY CONTROL REQUIREMENTS FOR LABORATORY ANALYSES

QA PROCEDURE	QA PARAMETER	FREQUENCY	CRITERION	CORRECTIVE ACTION
Field Blank	Field Contamination	1/20 field samples; 5% frequency	<MDL	Recollect sampling event or flag data if unable recollect
Field Duplicate	Field Precision	1/10 field samples for first two events; if criterion is met, then 1/20 field samples	RPD < 25%	Recollect sampling event or flag data if unable recollect
Method Blank	Analytical Contamination	3 per analytical batch	< RL	Reanalyze analytical batch
LCS (CRM)	Accuracy	1 per analytical batch	80-120% REC	Reanalyze analytical batch
Analytical Duplicate	Analytical Precision	1 per analytical batch	RPD < 25%	Reanalyze analytical batch
Matrix Spike	Matrix Interference and Accuracy	1 per analytical batch; at 3-10x the native conc.	75-125% REC	Reanalyze analytical batch
Matrix Spike Duplicate	Precision and Accuracy	1 per analytical batch; at 3-10x the native conc.	RPD <25%	Reanalyze analytical batch
Continuing Calibration	Analytical Control	1 per 10 sample runs	80-120% of initial slope	Reanalyze analytical batch
Assess percent of data successfully collected	Data Completeness	N/A	90%	N/A

MDL=Method Detection Limit; RPD=Relative Percent Difference; RL=Report Limit;
REC=Recovery; LCS=Laboratory Control Sample; CRM=Certified Reference Material
An analytical batch is defined as 20 or fewer samples.

Table 3 LABORATORY DATA QUAILITY OBJECTIVES (DQOs)

ANALYTE	*METHOD BLANK*	*LCS (CRM)*	*ANALYTICAL DUPLICATE*	*MATRIX SPIKE*	*MATRIX SPIKE DUPLICATE*	*CONTINUING CALIBRATION*
Calcium (Ca)	yes	yes	yes	yes	yes	yes
Chloride (Cl)	yes	yes	yes	yes	yes	yes
Conductivity (SEC)	yes	yes	yes	no	no	yes
Magnesium (Mg)	yes	yes	yes	yes	yes	yes
Nitrate (NO3)	yes	yes	yes	yes	yes	yes
pH (Laboratory)	no	yes	yes	no	no	yes
Potassium (K)	yes	yes	yes	yes	yes	yes
Sodium (Na)	yes	yes	yes	yes	yes	yes
Sulfate (SO4)	yes	yes	yes	yes	yes	yes
Total Alkalinity (as CaCO3)	yes	yes	yes	no	no	yes

Table 4 SALINAS VALLEY WELLS AND LOCATIONS

STATE WELL NUMBER	AQUIFER	MAP ID	FALSE EASTING[1]	FALSE NORTHING[1]
13S/01E-36J01	PRESSURE 900	1	5741483.0	2170847.00002
13S/02E-20M02	PRESSURE 400	2	5748878.5	2182094.25003
13S/02E-21N01	PRESSURE 400	3	5753018.5	2180456.75002
13S/02E-27L01	PRESSURE 180	4	5759500.0	2175572.50002
13S/02E-27M01	PRESSURE 400	5	5758010.0	2174784.50002
13S/02E-27P01	PRESSURE 400	6	5759593.5	2173660.50002
13S/02E-27Q02	PRESSURE 400	7	5761129.5	2173768.75002
13S/02E-28B01	PRESSURE 400	8	5755624.0	2177900.75002
13S/02E-28E01	PRESSURE 400	9	5752984.0	2176434.75002
13S/02E-29F02	PRESSURE 400	10	5749961.0	2177732.25002
13S/02E-29J01	PRESSURE 400	11	5751657.5	2175604.25002
13S/02E-31A02	PRESSURE 900	12	5746516.5	2173308.00002
13S/02E-31N02	PRESSURE 400	13	5743060.5	2168496.25002
13S/02E-32M02	PRESSURE 900	14	5748673.0	2170965.00002
13S/02E-32N01	PRESSURE 400	15	5747285.0	2169132.75003
13S/02E-33H03	PRESSURE 180	16	5757325.5	2171726.00002
13S/02E-33R01	PRESSURE 180	17	5756359.5	2169699.75003
13S/02E-34M02	PRESSURE 180	18	5757952.0	2169365.25003
13S/02E-34N01	PRESSURE 180	19	5758043.5	2168657.25003
13S/02E-36J01	EAST SIDE BOTH	20	5772057.0	2168257.00002
14S/02E-01A01	EAST SIDE	21	5773736.0	2167596.00002
14S/02E-02E02	PRESSURE 400	22	5763989.0	2166284.00003
14S/02E-03F02	PRESSURE 180	23	5759284.0	2165549.00003
14S/02E-03K02	PRESSURE 400	24	5760546.0	2164390.00002
14S/02E-05F04	PRESSURE 400	25	5749784.5	2166850.50002
14S/02E-05G03	PRESSURE 400	26	5750701.5	2166258.50002
14S/02E-05K01	PRESSURE 400	27	5750303.5	2164892.00002
14S/02E-05P02	PRESSURE 400	28	5749120.0	2163754.25002
14S/02E-06J03	PRESSURE 400	29	5747119.5	2164986.75002
14S/02E-06L01	PRESSURE 900	30	5743826.5	2165438.75002
14S/02E-06R02	PRESSURE 400	31	5746852.5	2163229.50003
14S/02E-07K01	PRESSURE 400	32	5744199.0	2160286.75002
14S/02E-08A01	PRESSURE 400	33	5751818.0	2162226.75002
14S/02E-09D03	PRESSURE 400	34	5753098.5	2162246.50002
14S/02E-09H03	PRESSURE 400	35	5756070.0	2161048.75002

STATE WELL NUMBER	AQUIFER	MAP ID	FALSE EASTING[1]	FALSE NORTHING[1]
14S/02E-09L02	PRESSURE 400	36	5754291.5	2160250.25002
14S/02E-09N01	PRESSURE 400	37	5752950.5	2158867.00003
14S/02E-10C01	PRESSURE 400	38	5759437.0	2162015.75002
14S/02E-10P02	PRESSURE 400	39	5759125.0	2158942.75002
14S/02E-11C01	PRESSURE 180	40	5764471.5	2161959.50002
14S/02E-11D01	PRESSURE 180	41	5764508.5	2161568.25002
14S/02E-12B01	PRESSURE 400	42	5771184.5	2161614.00002
14S/02E-12L02	PRESSURE 400	43	5770434.5	2159815.50002
14S/02E-12Q01	PRESSURE 400	44	5771537.0	2157088.75002
14S/02E-13B02	PRESSURE 180	45	5771526.0	2157219.75003
14S/02E-13D01	PRESSURE 180	46	5769699.5	2156883.75002
14S/02E-14B01	PRESSURE 180	47	5766275.0	2156434.00002
14S/02E-14N03	PRESSURE 400	48	5763230.0	2152205.50003
14S/02E-14R01	PRESSURE 180	49	5767842.5	2153580.50002
14S/02E-15B01	PRESSURE 400	50	5760275.5	2156533.25002
14S/02E-17B02	PRESSURE 400	51	5749990.5	2156598.25002
14S/02E-17C01	PRESSURE 180	52	5747844.0	2157381.75003
14S/02E-18A01	PRESSURE 400	53	5746233.0	2156686.25002
14S/02E-18C01	PRESSURE 400	54	5743827.5	2156787.25002
14S/02E-20B01	PRESSURE 180	55	5750165.5	2151711.75003
14S/02E-20B02	PRESSURE 180	56	5750001.0	2151554.75003
14S/02E-21F02	PRESSURE 180	57	5754169.5	2151251.50002
14S/02E-22H01	PRESSURE 400	58	5761690.5	2150902.75002
14S/02E-22H02	PRESSURE 180	59	5762674.0	2149777.00002
14S/02E-23A01	PRESSURE 180	60	5767130.0	2151399.50002
14S/02E-23F01	PRESSURE 180	61	5764570.5	2149971.00002
14S/02E-23L03	PRESSURE 400	62	5765164.5	2149382.00002
14S/02E-25D03	PRESSURE 400	63	5768753.5	2146325.50002
14S/02E-27K01	PRESSURE 180	64	5760536.0	2144212.25002
14S/02E-28H02	PRESSURE 180	65	5756940.5	2145354.75002
14S/02E-34A03	PRESSURE 400	66	5762394.5	2141097.75002
14S/02E-35L02	PRESSURE 400	67	5764879.0	2137944.25002
14S/02E-36H01	PRESSURE 180	68	5773015.5	2139158.50003
14S/02E-36J02	PRESSURE 400	69	5772268.5	2137939.00002
14S/02E-36R02	PRESSURE 400	70	5772326.5	2136698.50002
14S/03E-02E03	EAST SIDE BOTH	71	5794727.5	2165742.50002
14S/03E-03K01	EAST SIDE BOTH	72	5791884.0	2164011.25002

STATE WELL NUMBER	AQUIFER	MAP ID	FALSE EASTING[1]	FALSE NORTHING[1]
14S/03E-04E01	EAST SIDE BOTH	73	5784479.5	2164809.75002
14S/03E-05B02	EAST SIDE BOTH	74	5781839.5	2165837.25002
14S/03E-06L01	EAST SIDE SHALLOW	75	5775895.0	2163924.50003
14S/03E-08C01	EAST SIDE BOTH	76	5781050.5	2162072.25002
14S/03E-10F02	EAST SIDE	77	5791569.0	2159330.50002
14S/03E-10F03	EAST SIDE BOTH	78	5791236.5	2159578.00002
14S/03E-10P01	EAST SIDE	79	5791544.0	2157558.25002
14S/03E-10R02	EAST SIDE BOTH	80	5794251.5	2157151.00002
14S/03E-11H01	EAST SIDE SHALLOW	81	5798504.0	2159823.00002
14S/03E-12E01	EAST SIDE SHALLOW	82	5800865.5	2160009.25003
14S/03E-12E02	EAST SIDE	83	5800608.5	2160173.25003
14S/03E-14D01	EAST SIDE SHALLOW	84	5795697.5	2155748.25003
14S/03E-15H03	EAST SIDE BOTH	85	5793222.5	2154777.00002
14S/03E-16K03	EAST SIDE	86	5787748.0	2152845.50003
14S/03E-17D01	EAST SIDE	87	5779979.0	2156594.00002
14S/03E-20D01	PRESSURE 400	88	5779540.0	2150357.75002
14S/03E-24H01	EAST SIDE SHALLOW	89	5803951.0	2147934.50002
14S/03E-24N01	EAST SIDE	90	5801060.0	2146002.50002
14S/03E-25L02	EAST SIDE BOTH	91	5801508.5	2141975.75002
14S/03E-28B02	PRESSURE 400	92	5786919.0	2145249.50002
14S/03E-28F02	PRESSURE 400	93	5786200.6	2144963.98574
14S/03E-29L04	PRESSURE 180	94	5780547.4	2143125.21920
14S/03E-30E01	PRESSURE 180	95	5773899.5	2144670.25003
14S/03E-30F02	PRESSURE 180	96	5775180.5	2144268.50002
14S/03E-30N01	PRESSURE 180	97	5774083.5	2141696.50002
14S/03E-31F01	PRESSURE 180	98	5775271.5	2138346.50003
14S/03E-31F02	PRESSURE 400	99	5775228.5	2138492.00002
14S/03E-36A01	EAST SIDE SHALLOW	100	5803921.0	2140085.50002
14S/04E-30N01	EAST SIDE BOTH	101	5804847.5	2142132.00001
15S/02E-01A03	PRESSURE 400	102	5772482.0	2134724.00002
15S/02E-01K01	PRESSURE 180	103	5770291.5	2131514.75002
15S/02E-02G01	PRESSURE 400	104	5765615.0	2134401.50002
15S/02E-12A01	PRESSURE 400	105	5772051.5	2129878.50002
15S/02E-12R01	PRESSURE 400	106	5772057.5	2126203.25003
15S/03E-01L01	EAST SIDE	107	5801038.5	2132896.75002
15S/03E-04K03	PRESSURE 400	108	5785732.5	2131172.00002
15S/03E-04N03	PRESSURE 400	109	5783621.0	2130577.75002

STATE WELL NUMBER	AQUIFER	MAP ID	FALSE EASTING[1]	FALSE NORTHING[1]
15S/03E-05N01	PRESSURE 180	110	5778619.0	2130164.00003
15S/03E-06A03	PRESSURE 180	111	5777613.0	2135010.00002
15S/03E-06D02	PRESSURE 400	112	5773392.0	2135175.75002
15S/03E-06F02	PRESSURE 400	113	5774781.5	2132857.75002
15S/03E-06K01	PRESSURE 400	114	5776302.5	2131605.50002
15S/03E-07D02	PRESSURE 400	115	5772729.0	2130304.25002
15S/03E-07G01	PRESSURE 400	116	5775356.0	2127909.75002
15S/03E-07N01	PRESSURE 180	117	5772911.5	2126430.50002
15S/03E-08B04	PRESSURE 400	118	5780790.5	2128738.25002
15S/03E-08C06	PRESSURE 180	119	5780025.5	2129640.75003
15S/03E-08C07	PRESSURE 400	120	5780124.5	2129385.50002
15S/03E-08F07	PRESSURE 400	121	5779786.0	2128096.50002
15S/03E-08N03	PRESSURE 400	122	5778859.5	2125760.50002
15S/03E-09B01	PRESSURE 180	123	5787613.5	2129526.50003
15S/03E-09C01	PRESSURE 180	124	5785912.0	2130387.75002
15S/03E-09H02	PRESSURE 180	125	5788543.5	2128841.50003
15S/03E-09K04	PRESSURE 400	126	5786815.0	2126625.50003
15S/03E-10P01	PRESSURE 180	127	5789973.0	2124641.25002
15S/03E-10P03	PRESSURE 180	128	5790992.5	2124075.25002
15S/03E-10R02	PRESSURE 180	129	5793537.5	2125764.25002
15S/03E-12E02	EAST SIDE BOTH	130	5799472.0	2128349.25000
15S/03E-13J02	EAST SIDE	131	5804170.5	2121482.50002
15S/03E-13N01	PRESSURE 180	132	5799834.5	2120075.00003
15S/03E-14C01	PRESSURE 180	133	5796323.5	2123063.75002
15S/03E-14G01	PRESSURE 180	134	5796738.0	2122656.50003
15S/03E-14H01	PRESSURE 180	135	5797941.0	2122606.00002
15S/03E-15B01	PRESSURE 400	136	5792336.0	2124219.00002
15S/03E-15L02	PRESSURE 180	137	5790177.0	2121393.00002
15S/03E-16B03	PRESSURE 400	138	5786481.0	2123545.50002
15S/03E-16M01	PRESSURE 180	139	5783233.5	2121388.25002
15S/03E-17B01	PRESSURE 180	140	5781259.5	2123911.75003
15S/03E-17B02	PRESSURE 180	141	5781099.5	2123757.50002
15S/03E-17G01	PRESSURE 180	142	5780630.0	2122750.25002
15S/03E-18B01	PRESSURE 180	143	5776074.5	2124737.50002
15S/03E-21A01	PRESSURE 180	144	5787617.0	2118056.00002
15S/03E-22F02	PRESSURE 180	145	5789756.5	2117099.00002
15S/03E-22G01	PRESSURE 180	146	5791343.0	2116241.25002

STATE WELL NUMBER	AQUIFER	MAP ID	FALSE EASTING[1]	FALSE NORTHING[1]
15S/03E-25L01	PRESSURE 180	147	5800408.5	2109728.50003
15S/03E-26A01	PRESSURE 400	148	5797857.5	2112518.00002
15S/03E-26D01	PRESSURE 180	149	5794548.5	2112893.75003
15S/03E-26H02	PRESSURE 180	150	5797573.5	2111904.75002
15S/03E-26P01	PRESSURE 400	151	5795686.5	2108925.25002
15S/03E-27J01	PRESSURE 400	152	5792207.5	2110413.00002
15S/03E-28B02	PRESSURE 400	153	5787075.5	2113993.25002
15S/03E-28G01	PRESSURE 180	154	5786358.0	2111546.50003
15S/03E-35B05	PRESSURE 180	155	5797153.0	2107813.50003
15S/04E-05K01	EAST SIDE	156	5812585.0	2130171.00001
15S/04E-05M01	EAST SIDE BOTH	157	5810608.5	2130920.50001
15S/04E-06D04	EAST SIDE BOTH	158	5805535.0	2134296.75001
15S/04E-06R01	EAST SIDE BOTH	159	5808832.0	2130397.50001
15S/04E-07A01	EAST SIDE BOTH	160	5808667.0	2128112.25001
15S/04E-07E02	EAST SIDE	161	5805290.0	2126918.25001
15S/04E-07R01	EAST SIDE SHALLOW	162	5809617.5	2124497.75001
15S/04E-08C01	EAST SIDE SHALLOW	163	5811226.0	2128961.75001
15S/04E-08L01	EAST SIDE BOTH	164	5812038.0	2125163.50001
15S/04E-08N01	EAST SIDE BOTH	165	5810237.5	2124086.00001
15S/04E-09N01	EAST SIDE	166	5815679.0	2123673.25001
15S/04E-15D02	EAST SIDE SHALLOW	167	5820525.5	2122131.50001
15S/04E-15P02	EAST SIDE BOTH	168	5822591.0	2118164.75001
15S/04E-16D01	EAST SIDE BOTH	169	5816370.5	2122604.00001
15S/04E-17B01	EAST SIDE	170	5813674.5	2122802.00001
15S/04E-17P02	EAST SIDE SHALLOW	171	5811444.0	2119748.75001
15S/04E-18L01	EAST SIDE	172	5806258.0	2120249.25001
15S/04E-19D02	PRESSURE 400	173	5805231.0	2118084.25001
15S/04E-19H03	EAST SIDE	174	5808765.0	2116311.75003
15S/04E-20B02	EAST SIDE SHALLOW	175	5812893.0	2117437.00001
15S/04E-20N01	PRESSURE 400	176	5810999.0	2113437.25001
15S/04E-20Q01	EAST SIDE	177	5813019.5	2113916.75003
15S/04E-22J01	EAST SIDE	178	5825620.5	2114797.50001
15S/04E-22L02	EAST SIDE BOTH	179	5822626.0	2115130.25001
15S/04E-23M01	EAST SIDE	180	5826800.0	2115510.00001
15S/04E-26G01	EAST SIDE	181	5829452.0	2110273.75001
15S/04E-27G01	EAST SIDE BOTH	182	5824082.0	2110658.00001
15S/04E-28C01	EAST SIDE	183	5817013.0	2112539.50001

STATE WELL NUMBER	AQUIFER	MAP ID	FALSE EASTING[1]	FALSE NORTHING[1]
15S/04E-28C01	EAST SIDE	184*	*	*
15S/04E-29K03	EAST SIDE	185*	*	*
15S/04E-32E01	PRESSURE 180	186	5809573.0	2105524.75003
15S/04E-36H01	EAST SIDE BOTH	187	5835591.5	2105235.00001
15S/04E-36R02	EAST SIDE BOTH	188	5836592.5	2101652.75001
16S/04E-01L02	EAST SIDE	189	5833261.5	2096387.25003
16S/04E-04C01	PRESSURE 400	190	5816563.5	2101653.00001
16S/04E-08J01	PRESSURE 180	191	5814399.5	2094772.87501
16S/04E-09A01	PRESSURE 180	192	5818962.5	2096385.75001
16S/04E-10K01	PRESSURE 400	193	5822871.5	2093933.87501
16S/04E-10R02	PRESSURE 400	194	5824891.5	2092808.00001
16S/04E-11E02	PRESSURE 400	195	5825734.0	2093587.12501
16S/04E-12M01	PRESSURE 400	196	5830110.0	2094179.62501
16S/04E-13D01	PRESSURE 400	197	5829977.5	2091400.75001
16S/04E-14M01	PRESSURE 400	198	5826507.0	2089158.00001
16S/04E-14M02	PRESSURE 400	199	5826934.0	2088314.12501
16S/04E-15D01	PRESSURE 180	200	5820915.5	2091029.00003
16S/04E-15H02	PRESSURE 400	201	5824314.0	2089470.00001
16S/04E-24R01	PRESSURE 400	202	5833826.5	2081330.00003
16S/04E-25A01	PRESSURE 400	203	5834115.0	2080854.00001
16S/04E-25K01	PRESSURE 180	204	5832503.0	2077482.12501
16S/04E-25Q01	PRESSURE 400	205	5832125.5	2076199.75001
16S/04E-27G01	PRESSURE 180	206	5823057.0	2078926.75001
16S/04E-36B01	PRESSURE 180	207	5833029.5	2074811.87501
16S/05E-07G01	EAST SIDE BOTH	208	5836648.0	2094674.00003
16S/05E-17P01	EAST SIDE BOTH	209	5843361.0	2086999.12503
16S/05E-17R01	EAST SIDE SHALLOW	210	5845212.0	2087024.25003
16S/05E-19F01	PRESSURE 180	211	5836477.0	2084158.37503
16S/05E-19R01	PRESSURE 180	212	5840423.0	2081360.37503
16S/05E-20C01	EAST SIDE	213	5843125.0	2085585.12503
16S/05E-20H01	EAST SIDE	214	5845691.0	2085074.25003
16S/05E-20R01	EAST SIDE BOTH	215	5845834.0	2082220.00003
16S/05E-27G01	EAST SIDE	216	5853466.8	2077678.05320
16S/05E-28D01	EAST SIDE BOTH	217	5846865.0	2080272.25003
16S/05E-28P01	EAST SIDE BOTH	218	5847355.5	2077784.37503
16S/05E-30C01	PRESSURE 180	219	5836401.5	2080129.50003
16S/05E-30G01	PRESSURE 180	220	5837912.0	2078876.87503

STATE WELL NUMBER	AQUIFER	MAP ID	FALSE EASTING[1]	FALSE NORTHING[1]
16S/05E-30J02	PRESSURE 400	221	5840526.5	2077512.50003
16S/05E-31A01	PRESSURE 180	222	5838804.0	2075067.12503
16S/05E-31Q01	PRESSURE 180	223	5837656.0	2070857.75003
16S/05E-32C01	PRESSURE 180	224	5843159.0	2075228.62503
16S/05E-32M01	FOREBAY	225	5840439.0	2072879.00003
16S/05E-33F01	FOREBAY	226	5847064.0	2072544.75003
16S/05E-33Q01	FOREBAY	227	5846731.0	2071679.00003
16S/05E-35C01	FOREBAY	228	5857923.0	2074215.75003
16S/05E-35L01	FOREBAY	229	5857341.0	2072381.25003
17S/04E-01D01	PRESSURE 180	230	5829970.4	2070190.88233
17S/05E-01R01	FOREBAY	231	5863270.5	2064114.75003
17S/05E-02G01	FOREBAY	232	5858061.5	2067655.75001
17S/05E-03B01	FOREBAY	233	5852910.5	2069821.37503
17S/05E-04C01	FOREBAY	234	5846947.5	2068985.25003
17S/05E-04K01	FOREBAY	235	5847433.5	2066928.37503
17S/05E-04N01	FOREBAY	236	5844523.0	2064819.50003
17S/05E-06Q01	FOREBAY	237	5837274.0	2065350.12503
17S/05E-09G01	FOREBAY	238	5846689.0	2062431.75003
17S/05E-09Q01	FOREBAY	239	5846868.5	2059437.25003
17S/05E-10Q01	FOREBAY	240	5853142.5	2060133.00003
17S/05E-12B01	FOREBAY	241	5864362.0	2062470.37503
17S/05E-12B02	FOREBAY	242	5863570.5	2063023.50003
17S/05E-12B03	FOREBAY	243	5862636.0	2063300.00003
17S/05E-13L02	FOREBAY	244	5861995.0	2054065.12503
17S/05E-14D01	FOREBAY	245	5855476.7	2057512.98904
17S/05E-14G01	FOREBAY	246	5858431.5	2057156.87503
17S/05E-21A01	FOREBAY	247	5847203.9	2053734.78530
17S/05E-23L01	FOREBAY	248	5855276.5	2049667.00003
17S/05E-25L01	FOREBAY	249	5861282.5	2044709.87503
17S/05E-36F02	FOREBAY	250	5861156.5	2040988.13679
17S/06E-16N01	FOREBAY	251	5876658.0	2053579.37503
17S/06E-17R01	FOREBAY	252	5875370.0	2053960.00003
17S/06E-19D01	FOREBAY	253	5865512.0	2052870.75003
17S/06E-20K01	FOREBAY	254	5874270.5	2050202.50003
17S/06E-20Q02	FOREBAY	255	5873861.0	2049734.12503
17S/06E-20Q03	FOREBAY	256	5873624.0	2049413.37503
17S/06E-27E03	FOREBAY	257	5881725.5	2046512.12503

STATE WELL NUMBER	AQUIFER	MAP ID	FALSE EASTING[1]	FALSE NORTHING[1]
17S/06E-27K01	FOREBAY	258	5884526.5	2044144.50003
17S/06E-27L01	FOREBAY	259	5883319.0	2044534.62503
17S/06E-28N01	FOREBAY	260	5876603.5	2042971.37503
17S/06E-29C01	FOREBAY	261	5871659.0	2048323.00003
17S/06E-29K01	FOREBAY	262	5873377.5	2045490.50003
17S/06E-29Q01	FOREBAY	263	5873361.0	2045274.25003
17S/06E-30F01	FOREBAY	264	5866434.0	2047190.00003
17S/06E-32G01	FOREBAY	265	5873481.5	2040947.12503
17S/06E-32J02	FOREBAY	266	5874264.0	2039466.50003
17S/06E-35F01	FOREBAY	267	5888535.0	2040776.00003
17S/06E-35J01	FOREBAY	268	5890370.5	2039573.75003
18S/06E-01E01	FOREBAY	269	5892201.0	2033873.12503
18S/06E-02N01	FOREBAY	270	5886656.0	2032336.12503
18S/06E-02R01	FOREBAY	271	5890070.0	2032210.75003
18S/06E-03P01	FOREBAY	272	5881836.0	2032629.37503
18S/06E-05H01	FOREBAY	273	5874765.0	2035980.12503
18S/06E-07A01	FOREBAY	274	5868250.5	2031805.25003
18S/06E-08R01	FOREBAY	275	5873246.0	2027074.87503
18S/06E-09M02	FOREBAY	276	5875856.5	2028751.00003
18S/06E-11J01	FOREBAY	277	5890622.5	2027590.87503
18S/06E-12A01	FOREBAY	278	5896424.0	2030093.87503
18S/06E-12R02	FOREBAY	279	5895096.5	2026768.25003
18S/06E-14B01	FOREBAY	280	5888379.5	2025469.87503
18S/06E-14R01	FOREBAY	281	5890625.0	2022391.37503
18S/06E-15F01	FOREBAY	282	5882187.0	2023781.12503
18S/06E-15M01	FOREBAY	283	5880584.0	2022838.50003
18S/06E-16L01	FOREBAY	284	5876773.5	2023478.50003
18S/06E-21Q01	FOREBAY	285	5878665.0	2016542.37503
18S/06E-25F01	FOREBAY	286	5891762.0	2013188.12503
18S/06E-26R01	FOREBAY	287	5890408.5	2011271.25003
18S/06E-27A01	FOREBAY	288	5883864.0	2015914.75003
18S/06E-28J01	FOREBAY	289	5879251.0	2013091.87503
18S/06E-34B01	FOREBAY	290	5882838.0	2010128.37503
18S/07E-18K01	FOREBAY	291	5899619.5	2023322.62503
18S/07E-18P01	FOREBAY	292	5897367.5	2022162.75003
18S/07E-19G02	FOREBAY	293	5899561.5	2019657.12503
18S/07E-19N01	FOREBAY	294	5896875.0	2016213.75002

STATE WELL NUMBER	AQUIFER	MAP ID	FALSE EASTING[1]	FALSE NORTHING[1]
18S/07E-20K01	FOREBAY	295	5903526.5	2016596.50003
18S/07E-28K01	FOREBAY	296	5909064.5	2012996.12503
18S/07E-28N02	FOREBAY	297	5906995.5	2011573.25003
18S/07E-29J01	FOREBAY	298	5906172.5	2012704.50003
18S/07E-29M01	FOREBAY	299	5901432.0	2012790.87503
18S/07E-32G02	FOREBAY	300	5905129.0	2008896.37503
18S/07E-34P02	FOREBAY	301	5913853.5	2006429.50003
19S/06E-01H01	FOREBAY	302	5894418.0	2003322.50003
19S/06E-03E02	FOREBAY	303	5880577.0	2003637.62503
19S/06E-03K01	FOREBAY	304	5882172.5	2003068.00003
19S/06E-11C01	FOREBAY	305	5887118.5	1999053.25003
19S/06E-12A01	FOREBAY	306	5895441.5	1999532.50003
19S/07E-03H02	UPPER VALLEY	307	5916058.0	2002263.25003
19S/07E-04G01	FOREBAY	308	5908976.0	2002192.50003
19S/07E-04Q01	FOREBAY	309	5907241.5	2000938.12503
19S/07E-05B02	FOREBAY	310	5903922.5	2005128.00003
19S/07E-10P02	UPPER VALLEY	311	5914112.0	1994937.37503
19S/07E-13D01	UPPER VALLEY	312	5923060.5	1993005.87503
19S/07E-13D02	UPPER VALLEY	313	5922703.0	1993016.87503
19S/07E-13D03	UPPER VALLEY	314	5921177.5	1994464.25003
19S/07E-16D01	UPPER VALLEY	315	5907215.0	1993447.25003
19S/07E-20A01	UPPER VALLEY	316	5904728.0	1988737.75003
19S/07E-20A02	UPPER VALLEY	317	5905140.0	1988780.50003
19S/07E-23F01	UPPER VALLEY	318	5917918.5	1986682.87503
19S/07E-23G01	UPPER VALLEY	319	5919819.5	1985678.50003
19S/07E-24H02	UPPER VALLEY	320	5927076.5	1985899.12503
19S/07E-36N01	UPPER VALLEY	321	5921376.0	1974705.75003
19S/08E-30A01	UPPER VALLEY	322	5931268.5	1981945.62503
20S/08E-05C02	UPPER VALLEY	323	5933968.0	1972500.37503
20S/08E-05R03	UPPER VALLEY	324	5935855.5	1968133.00003
20S/08E-06B01	UPPER VALLEY	325	5929631.0	1971657.50003
20S/08E-07E01	UPPER VALLEY	326	5927847.5	1965744.25003
20S/08E-15H03	UPPER VALLEY	327	5946414.0	1959720.37503
20S/08E-16C01	UPPER VALLEY	328	5938055.0	1961243.37501
20S/08E-17K03	UPPER VALLEY	329	5934573.0	1958618.62503
20S/08E-34G01	UPPER VALLEY	330	5944061.5	1944379.50003
20S/08E-36R01	UPPER VALLEY	331	5957517.0	1941628.62503

STATE WELL NUMBER	AQUIFER	MAP ID	FALSE EASTING[1]	FALSE NORTHING[1]
21S/08E-15J01	UPPER VALLEY	332	5946267.0	1926489.62503
21S/09E-06C01	UPPER VALLEY	333	5959365.5	1939884.62503
21S/09E-16E02	UPPER VALLEY	334	5967913.5	1928310.37503
21S/09E-22J01	UPPER VALLEY	335	5976378.5	1921774.75003
21S/09E-24Q01	UPPER VALLEY	336	5985537.5	1920320.00003
21S/10E-30E02	UPPER VALLEY	337	5988110.5	1916891.25003
21S/10E-32N01	UPPER VALLEY	338	5993930.5	1907839.00003
22S/10E-09P01	UPPER VALLEY	339	6000619.0	1897117.87503
22S/10E-16P01	UPPER VALLEY	340	6000072.0	1892154.87503
22S/10E-21C01	UPPER VALLEY	341	6001268.5	1890089.75003
22S/10E-22N01	UPPER VALLEY	342	6004921.0	1886561.87503
22S/10E-28B01	UPPER VALLEY	343	6001816.0	1886849.25003
22S/10E-34G01	UPPER VALLEY	344	6007012.0	1879185.87503

[1] State Plane Coordinate System, California Zone IV, Feet, North American Datum 1983

*Coordinates to be collected

Table 5 COASTAL WELLS AND LOCATIONS

STATE WELL NUMBER	AQUIFER	MAP ID	FALSE EASTING[1]	FALSE NORTHING[1]
13S/01E-25R01	PRESSURE 900	1	5742345.5	2174687.00002
13S/02E-15M01	PRUNEDALE	2	5757881.5	2185405.50002
13S/02E-19Q03	PRESSURE 900	3	5746313.5	2179184.50002
13S/02E-20J01	PRESSURE 400	4	5752096.0	2180981.25002
13S/02E-28L02	PRESSURE BOTH	5	5755055.5	2175441.75002
13S/02E-28M02	PRESSURE 400	6	5753447.0	2175997.50002
13S/02E-32J03	PRESSURE 400	7	5752560.0	2170401.75002
13S/02E-33N04	PRESSURE 400	8	5753898.0	2169605.00002
13S/02E-34G01	PRESSURE 400	9	5760129.5	2170052.25002
13S/02E-34M01	PRESSURE 400	10	5757997.5	2169621.75002
14S/01E-13J02	PRESSURE 400	11	5741048.0	2154289.50002
14S/02E-01C01	EASTSIDE DEEP	12	5771477.5	2167454.25002
14S/02E-02A02	EASTSIDE DEEP	13	5768561.0	2167823.50002
14S/02E-02C03	PRESSURE 400	14	5765109.0	2167416.00002
14S/02E-03H01	PRESSURE 400	15	5762283.0	2166255.50002
14S/02E-03M02	PRESSURE 400	16	5758710.5	2164740.50002
14S/02E-03R02	PRESSURE 400	17	5762517.0	2163892.75002
14S/02E-04B01	PRESSURE 400	18	5755909.0	2167499.00002
14S/02E-04G02	PRESSURE 400	19	5756262.0	2166403.75002
14S/02E-04H01	PRESSURE 400	20	5756715.0	2165886.25002
14S/02E-04N03	PRESSURE 400	21	5753365.0	2163112.75002
14S/02E-05C03	PRESSURE 400	22	5748893.5	2167132.50002
14S/02E-05K02	PRESSURE 400	23	5750829.0	2165370.75002
14S/02E-07A01	PRESSURE 400	24	5747142.5	2162655.25002
14S/02E-07J02	PRESSURE 400	25	5746655.0	2159408.25002
14S/02E-07J03	PRESSURE DEEP ZONE	26	5746476.9	2159735.06998
14S/02E-07L04	PRESSURE 400	27	5743780.0	2159328.00002
14S/02E-07L05	PRESSURE 400	28	5743784.5	2160380.50002
14S/02E-08C03	PRESSURE 400	29	5750055.0	2162036.75002
14S/02E-08M02	PRESSURE 400	30	5747103.0	2159672.50002
14S/02E-09D04	PRESSURE 400	31	5753016.5	2162818.75002
14S/02E-09K02	PRESSURE 400	32	5755450.0	2159946.25002
14S/02E-09N02	PRESSURE 400	33	5752897.5	2158609.50002
14S/02E-10E02	PRESSURE 400	34	5758062.0	2160525.75002
14S/02E-10H01	PRESSURE 400	35	5761492.0	2160761.75002

STATE WELL NUMBER	AQUIFER	MAP ID	FALSE EASTING[1]	FALSE NORTHING[1]
14S/02E-10M02	PRESSURE 400	36	5757853.5	2159387.75002
14S/02E-11B01	PRESSURE 400	37	5766446.0	2162325.25002
14S/02E-11M03	PRESSURE 400	38	5764448.5	2159266.75002
14S/02E-12N02	PRESSURE 180	39	5769893.5	2158219.50002
14S/02E-13F01	PRESSURE 180	40	5769952.5	2154587.75002
14S/02E-13G01	PRESSURE 400	41	5772057.5	2155470.50002
14S/02E-14A01	PRESSURE 400	42	5767367.0	2156210.25002
14S/02E-14L02	PRESSURE 180	43	5764775.5	2155024.75003
14S/02E-14L03	PRESSURE 400	44	5764610.5	2154419.75002
14S/02E-15A01	PRESSURE 400	45	5761774.5	2157015.50002
14S/02E-15C02	PRESSURE 400	46	5759385.5	2157259.00002
14S/02E-15L02	PRESSURE 180	47	5758452.0	2153366.00003
14S/02E-15N01	PRESSURE 400	48	5757522.5	2153353.25002
14S/02E-15P01	PRESSURE 400	49	5758767.5	2153584.50002
14S/02E-16A02	PRESSURE 400	50	5756957.5	2157123.50002
14S/02E-16G01	PRESSURE 400	51	5755957.0	2155999.50002
14S/02E-16H01	PRESSURE 400	52	5756041.0	2156035.25002
14S/02E-17A02	PRESSURE 400	53	5751744.5	2156837.50002
14S/02E-20B03	PRESSURE 900	54	5750210.5	2151407.25003
14S/02E-21E01	PRESSURE 400	55	5753561.0	2150101.50003
14S/02E-21J01	PRESSURE 180	56	5756896.0	2149447.75002
14S/02E-21L01	PRESSURE 180	57	5754605.0	2149175.75002
14S/02E-22B01	PRESSURE 400	58	5760986.0	2152124.75002
14S/02E-22L01	PRESSURE 400	59	5759725.0	2149855.00002
14S/02E-22P02	PRESSURE 180	60	5758952.5	2146937.25002
14S/02E-23M01	PRESSURE 180	61	5762708.0	2149478.75002
14S/02E-24E01	PRESSURE 180	62	5768326.5	2150393.25002
14S/02E-24P02	PRESSURE 400	63	5769670.0	2146858.75002
14S/02E-24Q01	PRESSURE 180	64	5771942.5	2146772.50003
14S/02E-25D04	PRESSURE 180	65	5768019.0	2145519.50003
14S/02E-26J03	PRESSURE 400	66	5766847.5	2143883.00002
14S/02E-26N03	PRESSURE 180	67	5762617.0	2142567.75002
14S/02E-26P01	PRESSURE 180	68	5764519.0	2141615.00003
14S/02E-27C02	PRESSURE 400	69	5759686.0	2145562.00002
14S/02E-27F02	PRESSURE 180	70	5759825.0	2144647.75002
14S/02E-28C01	PRESSURE 400	71	5753983.5	2146953.50002
14S/02E-32D06	PRESSURE 180	72	5746981.0	2141653.75003

STATE WELL NUMBER	AQUIFER	MAP ID	FALSE EASTING[1]	FALSE NORTHING[1]
14S/02E-33P01	PRESSURE BOTH	73	5756348.0	2138806.75003
14S/02E-34A04	PRESSURE 180	74	5761465.0	2141623.00002
14S/02E-34B03	PRESSURE 180	75	5759909.5	2141431.00002
14S/02E-36E01	PRESSURE 180	76	5768600.0	2138685.00002
14S/02E-36G01	PRESSURE 400	77	5770039.0	2139297.50002
14S/03E-06L02	EASTSIDE DEEP	78	5775957.0	2164155.50002
14S/03E-07P02	EASTSIDE SHALLOW	79	5775832.0	2157899.00003
14S/03E-18E02	PRESSURE 400	80	5774633.5	2155704.50003
14S/03E-19Q02	PRESSURE 180	81	5776192.0	2146948.50002
14S/03E-30E03	PRESSURE 400	82	5774081.0	2143975.75002
14S/03E-30F01	PRESSURE 180	83	5775609.5	2144673.00002
14S/03E-31B01	PRESSURE 180	84	5776312.0	2140030.50002
15S/02E-12C01	PRESSURE 180	85	5769441.0	2130513.75002

[1] State Plane Coordinate System, California Zone IV, Feet, North American Datum 1983

Table 6 REQUIREMENTS FOR SAMPLE COLLECTION[1]

ANALYTE	CONTAINER TYPE	SAMPLE VOLUME	PRESERVATIVE	HOLDING TIME
Calcium (Ca)	polyethylene (HDPE[2])	200 mL[3]	HNO_3 pH<2	3 days w/o pres. 6 months w/ pres.
CATION ANION BALANCE[4]	N/A Calculation	N/A Calculation	N/A Calculation	N/A Calculation
Chloride (Cl)[5]	polyethylene (HDPE[1])	100 mL[2]	4±2°C	28 days
Conductivity (SEC)[5]	polyethylene (HDPE[1])	100 mL[2]	4±2°C	28 days
Magnesium (Mg)	polyethylene (HDPE[1])	200 mL[2]	HNO_3 pH<2	3 days w/o pres. 6 months w/ pres.
Nitrate (NO3)[5]	polyethylene (HDPE[1])	100 mL[2]	none HSO_4; pH<2	48 hours at 4° C 28 days
pH (Laboratory)	polyethylene (HDPE[1])	30 mL[2]	none	48 hours at 4° C
Potassium (K)	polyethylene (HDPE[1])	200 mL[2]	HNO_3 pH<2	3 days w/o pres. 6 months w/ pres.
Sodium (Na)	polyethylene (HDPE[1])	200 mL[2]	HNO_3 pH<2	3 days w/o pres. 6 months w/ pres.
Sulfate (SO4)	polyethylene (HDPE[1])	100 mL[2]	4±2°C	28 days
Total Alkalinity (as CaCO3)	polyethylene (HDPE[1])	100 mL[2]	4±2°C	14 days

[1] = CCL QA Manual and SOPs

[2] = High Density Polyethylene

[3] = only one 0.5 gal (~2L) container is needed for all analyses

[4] = Cation anion balance is a calculation

[5] = Analytes in partial mineral panel, one pint (~500 mL) container is need for analyses

APPENDICES

APPENDIX A

GLOBAL POSITIONING SYSTEM (GPS) TRAINING

Appendix A-1: GPS Training Record

Appendix A-2: TSC1 Asset Surveyor Manual

Appendix A-3: Pro XR/XRS Receiver Manual

Geographic Positioning System (GPS) Training Record

Name of Trainee

Name of Trainer

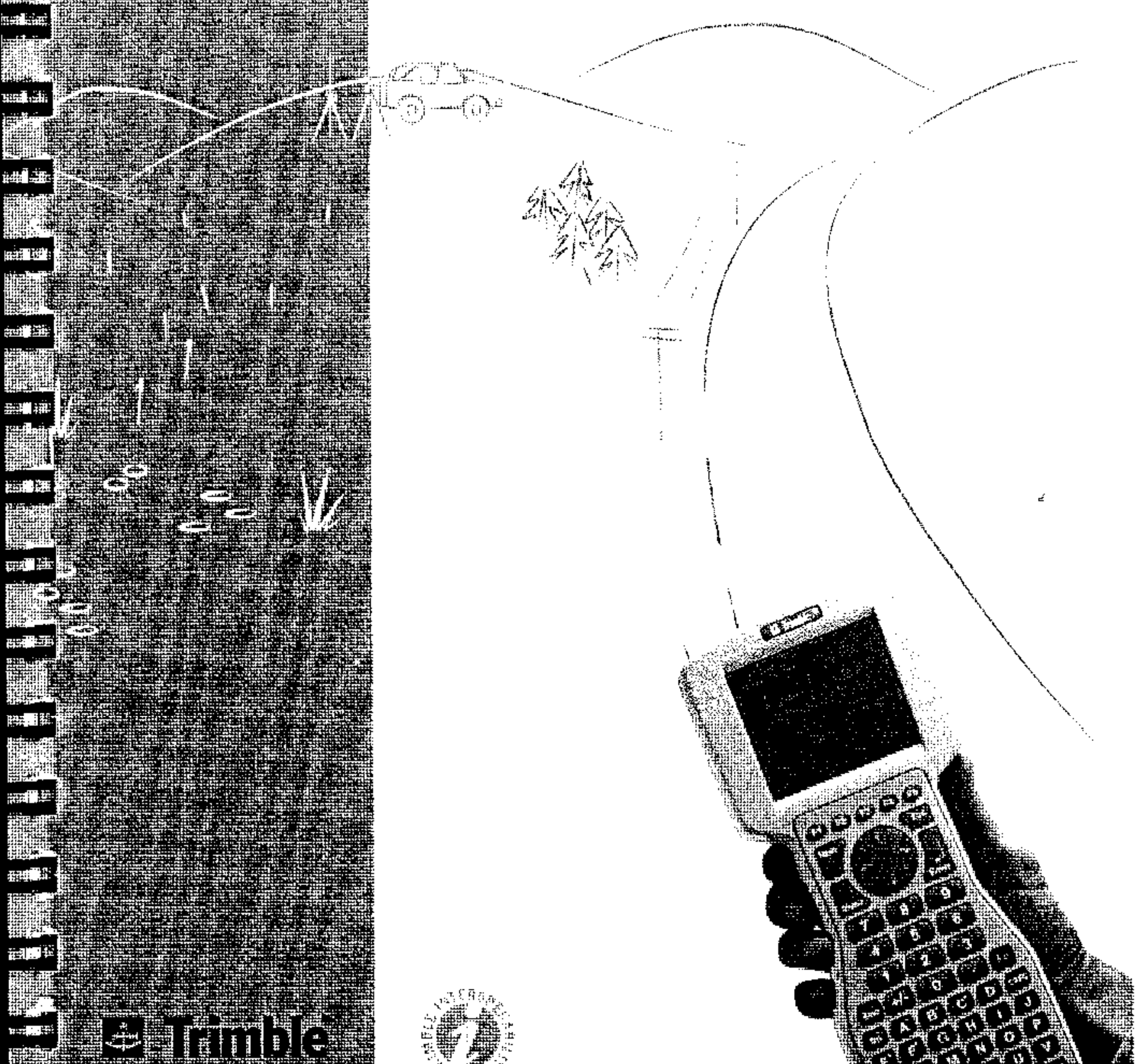
Date of Training

	Satisfactory Completion / Understanding
Verification of access to Pathfinder Office software	
Preparation of data dictionary	
Set-up of equipment	
Trimble® TSC1 Asset Surveyor[1]	
Trimble® Pro XR Receiver[1]	
Connector cables	
Batteries (Asset Surveyor and Receiver)	
Confirmation of communication between Asset Surveyor and Receiver	
Acquiring satellites	
Setting up and checking critical settings	
-logging intervals	
-PDOP mask[2]	
Proper packing and unpacking of equipment	
Transferring data files from Asset Surveyor to the computer	

[1] The Agency uses Trimble® products, the GPS industry standard.
[2] PDOP = Position Dilution Of Precision

TSC1 Asset Surveyor

Operation Manual



TSC1 Asset Surveyor

Operation Manual

Part Number 34182-05-ENG

Version 5.00

October 1999

Revision A

Trimble Navigation Limited
Mapping & GIS Systems
645 North Mary Avenue
P.O. Box 3642
Sunnyvale, CA 94088-3642
U.S.A.

1-800-827-8000 in North America
+1-408-481-8000 International
Fax: +1-408-481-7744
www.trimble.com

1 Quick Setup

The instructions in this chapter are a simplified version of the various steps found in Chapters 4, 5, and 6 of this manual. The purpose of the simplified version is to provide quick setup guides with reasonable default values that can be distributed to field crews to ensure proper setup of rover or base station receivers.

Data is logged to the TSC1 with the Asset Surveyor software. For full details on configuration and data collection, refer to the *TSC1 Asset Surveyor Software User Guide*.

Note – The steps outlined in this chapter do not include steps required to collect data using carrier phase information. For instructions on how to collect high accuracy features, see Chapter 7, Carrier Phase Data Collection.

1.1 Before Leaving the Office

1. Install the Pathfinder Office software on your office computer (refer to the *Pathfinder Office Getting Started Guide*).
2. Using the Pathfinder Office software, prepare any data files or data dictionaries you require, and transfer them to the TSC1. If you want to update GPS or attribute information on features stored in a GIS, import the data files and data dictionary into Pathfinder Office and then transfer them to the TSC1. You may also want to transfer any waypoint and coordinate system files to the datalogger.

3. Check that you have all the required equipment, and that it is operational. Set up and connect your GPS system (the appendix for your GPS receiver lists the equipment and shows you how to connect it).
4. If the GPS receiver has an On/Off switch, turn it on (the Series 4000, GPS Total Station 4700, GPS Total Station 4800, Site Surveyor 4400 and 4600LS receivers have an On/Off switch).

   Start the Asset Surveyor software to check that it and the GPS receiver are communicating correctly. If communication is established, the GPS status line appears. If communication fails, an error message pops up on the screen.
5. Check all critical settings in the Asset Surveyor software.

   You should also check non-critical and display settings, especially if the system has been used by someone else recently. For details of how to configure Asset Surveyor, refer to the *TSC1 Asset Surveyor Software User Guide*.
6. Turn everything off and pack it into carrying cases if you have to travel a significant distance to the survey site. Pack spare sets of batteries if you expect to operate the receiver for any length of time.

1.2 In the Field

1. Travel to the survey site, remembering to carry all the required equipment with you.
2. Reassemble the system.
3. If the GPS receiver has an On/Off switch, turn it on. Then start the Asset Surveyor software, if it is not already on.

   Wait until the GPS receiver acquires enough satellites to start computing GPS positions, before beginning to work. The number of satellites being tracked displays on the status line.

You should now change some of the configuration settings as follows:

Main menu

1.	*Configuration*	Highlight *Configuration* then press the [Enter] key

Configuration menu

2.	*GPS rover options*	Press [Enter]
3.	*Logging options*	Press [Enter]

Logging options screen

4.	*Point feature*	Synchronized with the base station
5.	*Line/area*	Synchronized with the base station
6.	*Not in feature*	Synchronized with the base station
7.	*Minimum positions*	3
8.	*Allow GPS update*	'Warn first'
9.	*Warning distance*	'Any'
10.	To accept	Press [Enter]

Position filters screen

11.	*Position mode*	'Manual 3D' or 'Overdet. 3D' depending on canopy density
12.	*PDOP mask*	4 or 6 (depending on receiver)
13.	To accept	Press [Enter]

4. Create a new data file, associating the correct data dictionary with it. Alternatively, re-open an existing data file.
5. Begin collecting data. Collect, review and update all the features necessary.
6. Close the data file.
7. Disconnect and repack the components of the system. Remember to turn off the GPS receiver, if it has an On/Off switch. Return to your office.

1.3 Back in the Office

1. Transfer the data files from the TSC1 to the PC using the Pathfinder Office software.
2. Use the Pathfinder Office software for differential correction, plotting, and exporting the data file(s) to a GIS.
3. Recharge the TSC1 datalogger and GPS receiver batteries.

1.4 Rover Configuration

Use the following procedure to set up your system in a rover configuration.

From the *Utilities* menu, select *Factory defaults*. This resets the Asset Surveyor software to its default configuration and then restarts the datalogger.

Antenna options screen

14. *Height*	Height to antenna's phase center
15. *Measure*	'Vertical'
16. *Type*	For a list of antenna types, see the *TSC1 Asset Surveyor Software User Guide*
17. *Confirm*	Select 'Per feature', 'Per file', or 'Never'
18. To accept	Press Enter

GPS rover options menu

19. To return to the *Configuration* menu	Press Esc

Configuration menu

20. *Communication options*	Press Enter
21. *Real-time input options*	Press Enter

Real-time input options screen

22. RTCM age limit	5 or 10 (depending on your radio)
23. To accept	Press Enter
24. To return to the *Configuration* menu	Press Esc

Configuration menu

25. To exit the *Configuration* menu	Press Esc

1.4.1 Data Collection

Use the following procedure to set up your system for rover data collection.

Main menu

1. Select *Data collection* and press [Enter]

Data collection menu

2.	Create a data file -or- Open an existing data file	Select *Create new file*: Press [Enter] and then press [Enter] -or- Select *Open existing file*. Press [Enter] Select an existing file to append to or update, and press [Enter]
3.	To exit *Data collection*	Press [Esc] and press [Yes] to confirm exit

1.5 Base Station Configuration

Use the following procedure to set up your system in a base station configuration.

Main menu

1.	*Configuration*	Highlight *Configuration* then press the [Enter] key

Configuration menu

2.	*GPS base station options*	Press [Enter]
3.	*Logging options*	Press [Enter]

Logging options screen

4.	*Measurements*	One to five seconds (depending on rover interval and free space)
5.	To accept	Press [Enter]
6.	To return to the *Configuration* menu	Press [Esc]

Configuration menu

7.	To exit the *Configuration* menu	Press [Esc]

1.5.1 Base Station Data Collection

Use the following procedure to set up your system for base station data collection.

Main menu

1.	*Data collection*	Press Enter

Data collection menu

2.	*Create base file*	Press Enter

Create File screen

3.	Create file	Press Enter

Antenna options screen

4.	*Height*	Height to antenna's phase center
5.	*Measure*	'Vertical'
6.	*Type*	For a list of antenna types, see the *TSC1 Asset Surveyor Software User Guide*
7.	To accept	Press Enter

Reference Position screen

8.	Enter reference position	Type lat/lon (or north/east) and altitude, and press [Enter]
	-or-	-or-
	Use an existing waypoint	Press [WayPt], select the waypoint and press [Enter]
	-or-	-or-
	Use an approximate position	Press [Here] and press [Enter]
	-or-	-or-
	Leave as is and set in the Pathfinder Office software	Press [Enter]

Base Station screen

9.	To exit *Base station*	Press [Enter] and press [Yes] to confirm exit.

Key Symbols

The Asset Surveyor software uses both *hard* (that is, physical) keys on a keypad and *soft* (that is, visual) keys on the datalogger's screen.

Hard (physical) keys on the TSC1 keypad are indicated as follows:

Enter, ◄, F1, and so on.

Softkeys on the TSC1 screen are indicated as follows:

Create, Del, Edit, and so on.

A softkey is activated by pressing the corresponding function key (F1...F5) on the TSC1 keypad.

Warnings, Cautions, Notes, and Tips

Warnings, cautions, notes, and tips draw attention to important information, and indicate its nature and purpose.

Warning – Warnings alert you to situations that could cause personal injury or unrecoverable data loss.

Caution – Cautions alert you to situations that could cause hardware damage or software error.

Note – Notes give additional significant information about the subject to increase your knowledge, or guide your actions.

Tip – Tips indicate a shortcut or other time- or labor-saving hint that can help you make better use of the product.

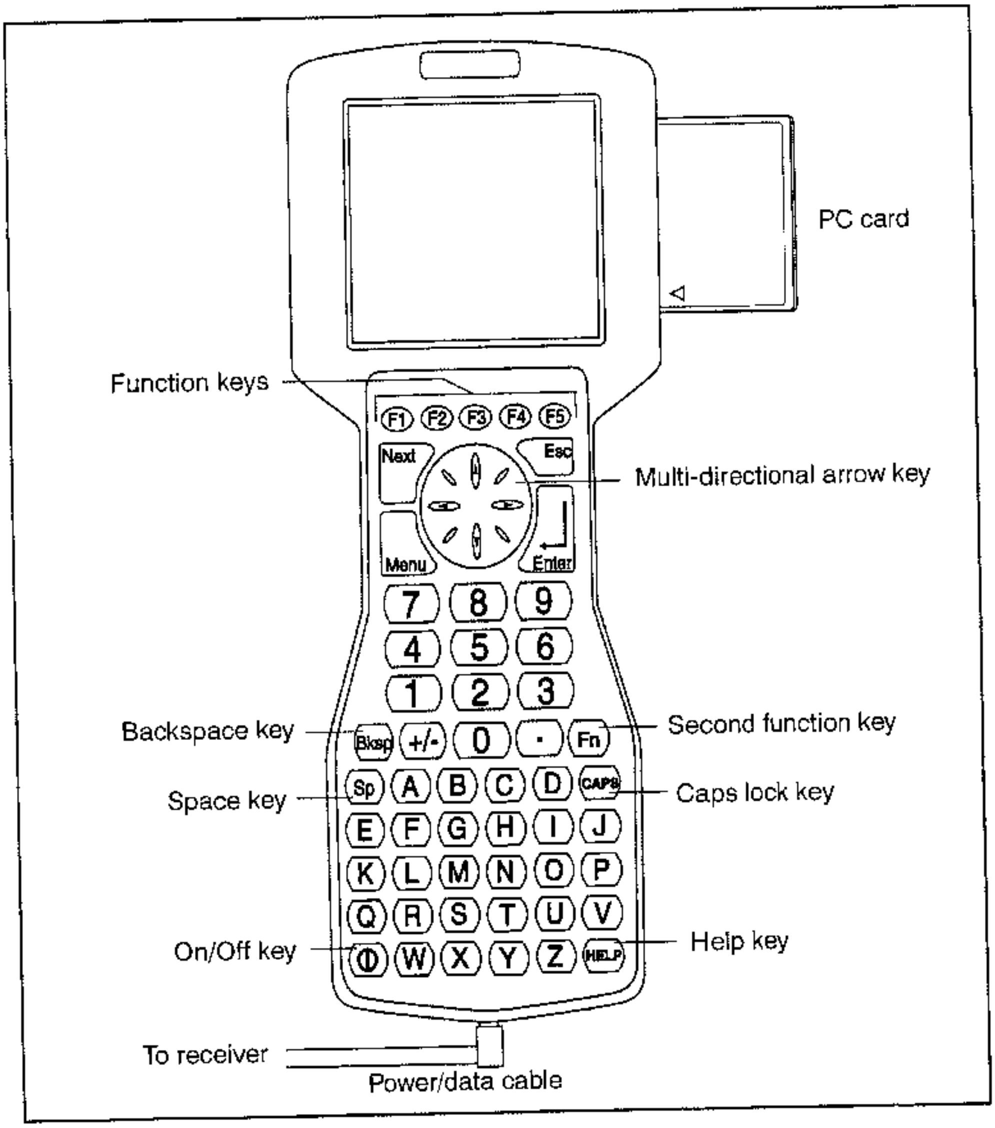


Figure 3-1 Front View of the TSC1 Datalogger

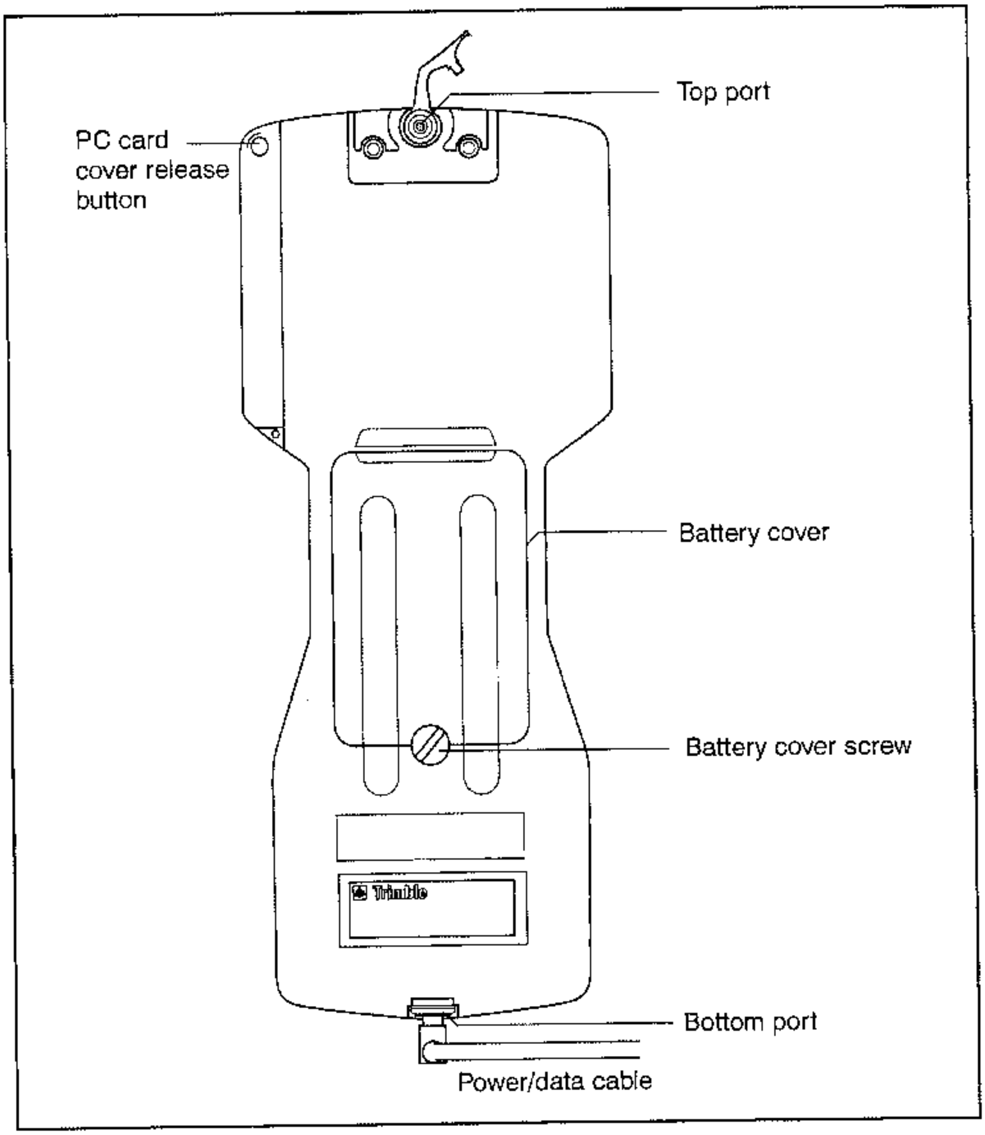


Figure 3-2 Back View of the TSC1 Datalogger

3.2 Turning the TSC1 Datalogger On and Off

To turn on the TSC1 datalogger, make sure that power is supplied (see Power Sources, page 3-11). Then press the green on/off key marked [⏻].

To turn off the TSC1, hold down [⏻] for one second.

Tip – For the location of the [⏻] key and other keys on the TSC1 datalogger's keypad, refer to Figure 3-1.

3.2.1 Hard Keys

Hard keys are the physical keys on the TSC1 keypad, such as [1], [A], [Enter], [◄►], [▲▼], and [Esc]. Use these keys to enter data and to access different screens.

3.2.2 Alternate Keys

Alternate keys give some hard keys a second function. Some of the second functions are displayed on the hard keys in small yellow lettering. To use a second function, press the [Fn] hard key and then press the alternate hard key.

Table 3-1 shows some of the functions that you can access using alternate keys.

Table 3-1 Useful Second Functions

Keys	Function
[Fn] [▼]	Page down
[Fn] [▲]	Page up
[Fn] [◄]	Home
[Fn] [►]	End
[Fn] [Next]	Previous screen
[Fn] [E]	Contrast up
[Fn] [F]	Contrast down

3.2.3 Softkeys

Softkeys are displayed on the bottom line of the TSC1 screen. A softkey corresponds to the adjacent hard key: F1, F2, F3, F4, F5. Press the hard key to activate the softkey on the screen. To activate the Pause softkey, for example, press F1. See Figure 3-3.

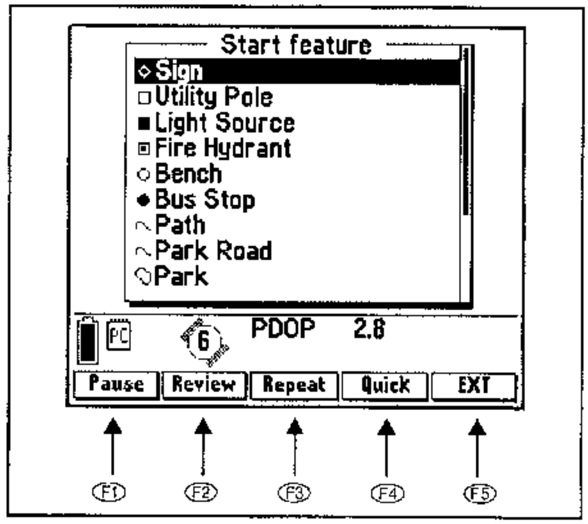


Figure 3-3 How Function Keys Correspond to Softkeys

Softkeys relate to particular forms or fields and only appear when these forms or fields are accessed. For example, the Seg softkey only appears when a line feature is opened for data collection, as this functionality applies to line features only.

3.2.4 Menu Key

To return to the *Main menu* at any time, press the Menu hard key. Use this key in conjunction with the Next key to move around the Asset Surveyor screens quickly.

3.2.5 Next Key

To simplify the task of moving around menus, the [Next] hard key offers quick access to open screens (windows).

3.2.6 Help Key

Press the [HELP] hard key at any time to obtain further information about a topic. When you press it, the *Help* menu appears. To exit *Help*, press [Esc] from the *Help* menu.

3.3 Screen

The TSC1 has an LCD screen. This screen responds to heat, and prolonged exposure to full sunlight can cause it to darken. If the screen does darken, turn it away from direct sunlight until it returns to normal.

Caution – Repeated exposure to direct sunlight can cause the screen to degrade.

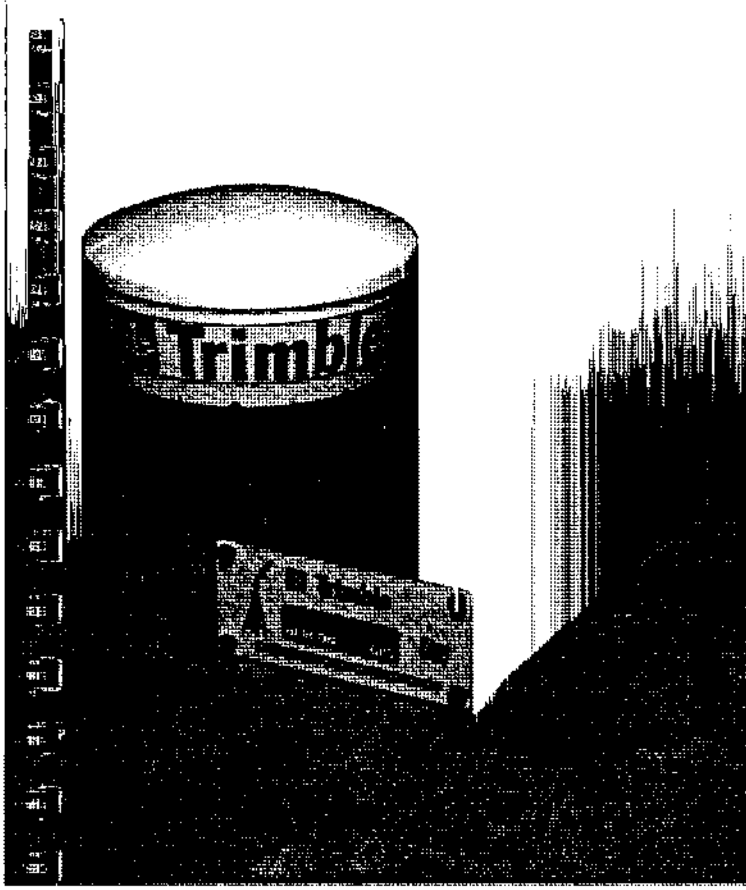
3.3.1 Contrast

To increase the screen contrast, press [Fn] [E].

To decrease the screen contrast, press [Fn] [F].

3.3.2 Backlight

To toggle the screen backlight on and off, press [Fn] [L].



Pro XR/XRS
Receiver Manual

Trimble

Pro XR/XRS

Receiver Manual

Part Number 31172-20-ENG

Revision A

May 1998

Trimble Navigation Limited
Mapping and GIS Systems Division
645 North Mary Avenue
P.O. Box 3642
Sunnyvale, CA 94088-3642
U.S.A.

1-800-827-8000 in North America
+1-408-481-8000 International
Fax: +1-408-481-7744
www.trimble.com

4 Pro XR/XRS System Equipment

This chapter provides details of the equipment associated with the Pro XR and Pro XRS receivers and shows how to assemble the equipment.

4.1 Pro XR Receiver Front Panel

The Pro XR receiver, shown in Figure 4-1, is mounted in a weatherproof housing.

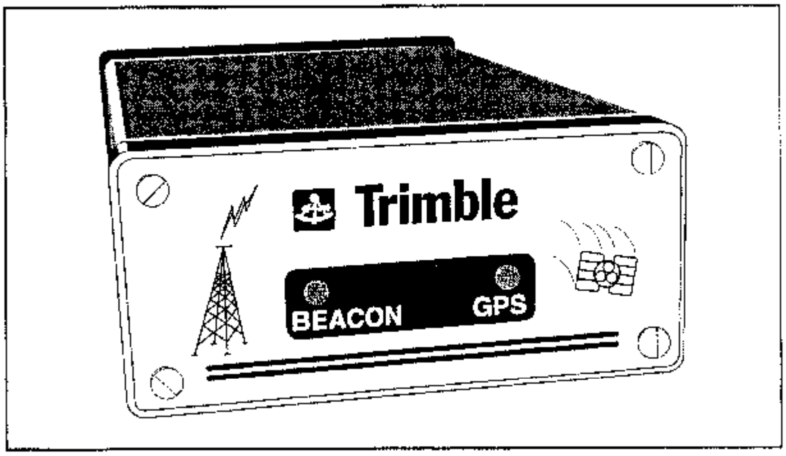


Figure 4-1 Pro XR Receiver Front Panel

4.2.1 Pro XR Status Lights

The two status lights on the front panel of the Pro XR receiver provide the status information listed in Table 4-1.

Table 4-1 Pro XR Status Lights

	GPS	Beacon
OFF	Unit not powered up	Unit not powered up or beacon function is disabled
FAST FLASH	Searching for satellites	Searching for MSK signals
SLOW FLASH	Found one or more satellites. Not enough for a position fix.	Found MSK signal. RTCM data has not been sent to GPS receiver.
ON	Performing position fixes	Good RTCM data is being provided to the GPS receiver

4.3 Back Panel

The Pro XR and Pro XRS receivers have two serial communications ports (RS232) and an antenna cable port. The serial communications ports, shown in Figure 4-3, are 12-pin(m) bulkhead connectors located on the back panel of the Pro XR and Pro XRS receivers.

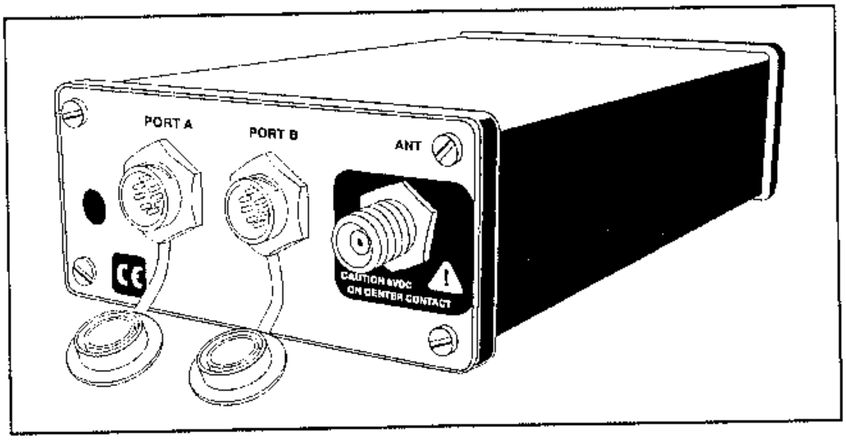


Figure 4-3 Pro XR/XRS Receiver Back Panel

4.3.1 Port A

Port A offers RS232 communication standards. It is designed for NMEA-0183 output and RTCM input.

4.3.2 Port B

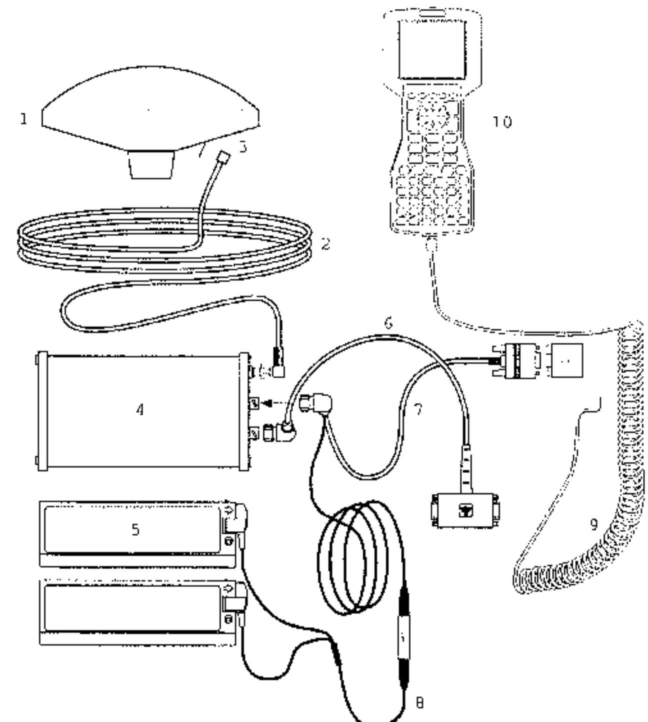
Port B also offers RS232 communication standards. It is designed for two-way data flow, external sensor input and power.

4.3.3 Antenna Port

The antenna connector is a TNC(f) connector located on the far right on the back panel of the Pro XR or Pro XRS receiver.

4.4 GPS Pro XR Cabling

To use the TSC1 handheld with a GPS Pro XR receiver, connect the system as shown in Figure 4-4.



1	P/N 16741-00	Compact Dome Antenna
2	P/N 22628	Antenna Cable
3	P/N 31180	Antenna Cable Adapter
4	P/N 29654-11	12-channel Pro XR receiver
5	P/N 17466	Camcorder Batteries
6	P/N 30232-00	NMEA/RTCM Cable
7	P/N 30231-00	Data/Power Cable
8	P/N 24333	Dual Battery Cable
9	P/N 32287-00	TSC1 Data/ESP Cable
10	P/N 29673-50	TSC1 Handheld

Figure 4-4 GPS Pro XR / TSC1 Connection Diagram

4.7 Pro XR/XRS System Hip Pack

The Pro XR and Pro XRS systems come equipped with an ergonomic hip pack carrying system, see Figure 4-18. The receiver, batteries and antenna are carried in the field using this hip pack/strapping system.

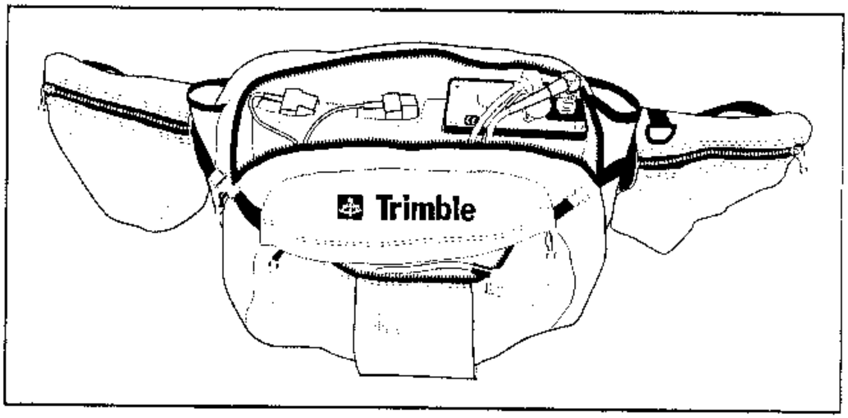


Figure 4-18 Pro XR/XRS System Hip Pack

4.7.1 Pro XR/XRS Hip Pack Contents

The Pro XR and Pro XRS systems are packed so that they are almost ready for use. The items not included in the hip pack are three 1-foot antenna poles, one 6-inch antenna pole and the data collector cable (P/N 30233-00 for TDC1, P/N 30234 for TDC2, or P/N 30236 for Field Computer/MC-V). These are located inside the shipping case.

The large interior of the hip pack contains: the Pro XR or Pro XRS receiver, two camcorder batteries, the power/data cable, and the camcorder power cable. All of these are set up inside the pack and ready for use. The exterior pocket of the hip pack contains a 3-meter antenna cable attached to the receiver and routed through a passage between the large interior pocket and exterior pocket. Both the data collector cable and antenna are routed out of the exterior pocket through the double zipper.

To route the data collector cable:

1. Locate the data collector cable and connect it to the data power cable, DE-9 connector labeled TO RECEIVER.
2. Once connected, feed the coiled cable through the passage and into the exterior pocket.

4.7.2 Wearing and Adjusting the Hip Pack

The Pro XR/XRS hip pack, once adjusted to suit, is comfortable and easy to use. See Figure 4-19.

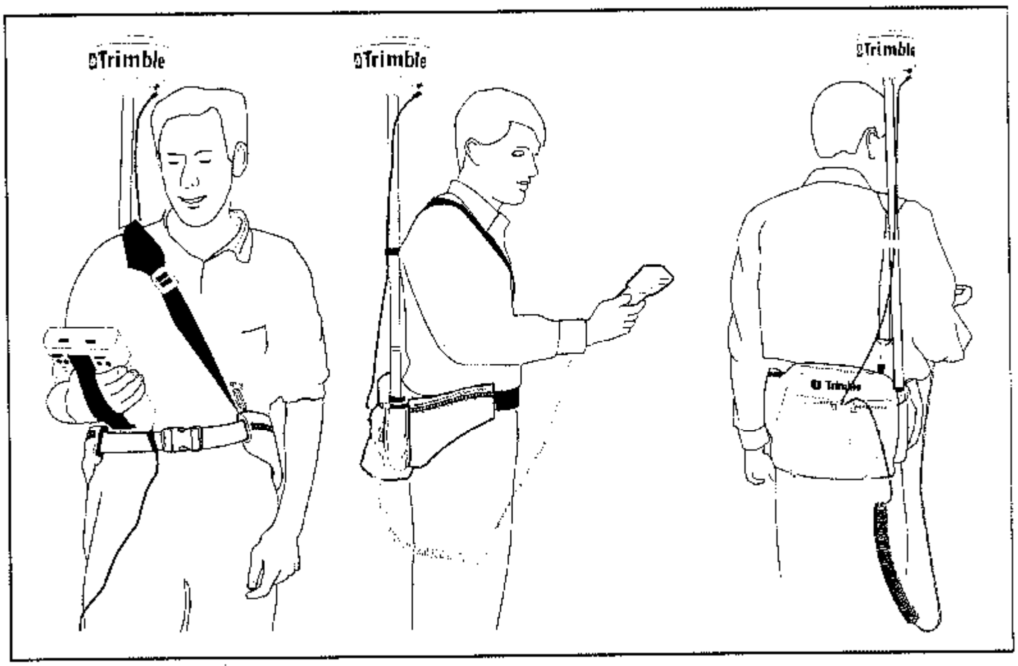


Figure 4-19 View of Hip Pack Setup

Antenna

When wearing the hip pack, the antenna height should be 3-4 inches above your head. The number of antenna pole sections required varies depending on your height. For example, if you are 5'5" tall, you may need two 1-foot and one 6-inch pole sections. If you are 6'2" tall, you may need three 1-foot poles. Try out different pole heights.

To set up the antenna with the hip pack:

1. Attach the pole sections together and connect the antenna onto the top of the pole sections.
2. Attach the pole/antenna to the hip pack.
3. Choose the side of your body that you prefer the antenna to be on and slide the pole sections into the small sleeve on that side of the hip pack.

Hip Pack and Strap

To adjust the hip pack and strap:

1. Connect the strap to the rear D-ring on the side of the pack on which the antenna is located.
2. Connect the other end of the strap to the D-ring on the belt on the opposite of the bag.
3. Slide the antenna pole through the velcro connection on the strap.
4. Put the strap over your head and across your opposite shoulder.

   At this point, the shoulder strap should lead naturally from the antenna pole across your chest to the belt.
5. Buckle the hip pack around your waist/hip area so that the belt buckle is centered in the middle of your body.

   The pack should adjust to fit close to the small of your back.

6. Adjust the front and back straps so the shoulder strap is situated squarely on your shoulder.
7. Put the pack on by slipping the strap over your head and across your body and then buckling the belt of the hip pack.

   The hip pack includes side compression straps that can be pulled towards you to hold the pack firmly and comfortably against your back.

Remove the hip pack/strap by unbuckling the belt and slipping the strap over your head.

The hip pack and strap can also double as a shoulder bag. Tuck the belt portion of the pack into the webbing material on the back of the pack and hook the strap on the large D-rings of the pack. The unit can now be carried on your shoulder instead of around your waist.

The pack has extra room in the interior and exterior pockets for additional items you may need in the field. The hip pack also includes straps on the bottom of the pack to secure an extra sweater or coat while in the field.

4.8 Optional Range Poles and Tripods

Range poles and tripods are very useful when collecting carrier phase data. The height of the antenna can be accurately measured, and the antenna can be held still easily, compared to an antenna mounted from the hip pack.

APPENDIX B

FIELD DOCUMENTATION

MONTEREY COUNTY WATER RESOURCES AGENCY - COASTAL GROUND WATER MONITORING PROGRAM **June 2007**

F CODE	SWID	STATUS	AQUIFER	USE	WELL NAME	METER No	PLANT No	SMPLE PT	VISIT DATE	APPT. DATE	SMPLE DATE	SMPLE TIME	SMPLER	REMARKS
886	14S/02E-24E01	ACTIVE	P400	AG	R5P1	4571R8	92205	DL						D'Arrigo Bros. R5P1. Tag #1164 Well is at corner of San Jon Rd an Hwy 183. Go twice then call Ed Mora 206-9164 or Jesse Aragon 90 9073. See photo
331	14S/02E-36E01	ACTIVE	P180	AG	BARDIN 12	0R1749	92428	faucet on booster						T & A Bardin #12. Tag #1037 Well on Hitchcock Rd. off Blanco office Go twice, then call Dennis See photo
673	14S/02E-13F01	ACTIVE	P180	AG	SAN JON B	R39873	95522	DL						Sea Mist San Jon well B Tag #1186. Call Chris Three day notice S photo
975	14S/02E-12N02	CSIP-SBI	P180	AG		92593R	91785	DL						Schneider Domestic well Tag #2960 Run for 30 min. to stabilize conductivity, EC = 2920 (Jul '04) Call Tim Schneider 449-0874. Tw week notice. Take EC meter, a bucket and last years results See pho
1055	14S/02E-15A01	CSIP-SUPP	P400	AG	15A01	R69587	94951	DL			6/12/2007	9:05:00 AM		CSIP-SUPP Well 15A1 PCA site #17 Go twice, then call Bill or Je See photo
1324	14S/02E-15C02	CSIP-SUPP	P400	AG	15C02	42542R		DL			6/12/2007	8:55:00 AM		CSIP-SUPP. Well 15C2 Tag #2838. PCA site #19 Go twice, then c Bill or Jesse See photo
861	14S/02E-15P01	CSIP-SBA	P400	AG	MORO COJO#1 (YARD)	31535R	95209	DL						Higashi Farms Moro Cojo #1 By house and shed Call Peter, 2 day notice See photo
279	14S/02E-16H01	CSIP-SBA	P400	AG	CONLEY	91R418		DL						Higashi Farms Connely Ranch well Tag #2856. Call Peter Odello 5 7926 or Charlie 578-7416. See photo INACTIVE
2779	14S/02E-21E01	ABAN	P400	AG	MARINA-ARMSTRONG WELL	02384R		DL						Armstrong Marina-Amstrong well Tag #2962 SW of MRWPCA, sample from ball valve on pressure/flow control valve Jack Armstro 455-1901 See photo. INACTIVE
766	14S/02E-22P02	ACTIVE	P180	AG	VIERRA#1	1843T	95485	truck fill valve						Crown Packing Vierra #1 Tag #1095 Call Bill or Jose Two day notice See photo
859	14S/02E-15N01	CSIP-SBA	P400	AG	MORO COJO#2	3538R4	95637	DL						Higashi Farms Moro Cojo #2. Big yellow truck-fill Call Peter 2 da notice. See photo
1282	14S/02E-24P02	ACTIVE	P400	AG	BORONDA SCHOOLHOUSE#1	93258T		DL						Crown Packing Boronda Schoolhouse well. Tag #1099 Call Bill Sullivan 214-4650 or Jose Luis Lepe 970-6889 Well next to house/metal shed on McFadden Road, close to elem school Two day
22929	14S/02E-28H04	ACTIVE	PDEEP	AG	JACKS YARD									New Deep aquifer well located .54 mi W of Cooper Rd & .27 mi S of McFadden Rd on the Nissen Rch

ENVIRONMENTAL ANA' YSIS REQUEST FORM

MONTEREY COUNTY CONSOLID... ED CHEMISTRY LABORATORY
1270 NATIVIDAD ROAD, SALINAS, CALIFORNIA 93906 Phone (831) 755-4516

Shaded areas for laboratory use only

Chain of Custody:

Collected by (Print & sign):	Received by:	Date & Time:
Relinquished by:	Received for Laboratory:	Date & Time:

Client Name:	Report Attention:	
Address:	Copy to:	
City, State, Zip:	Phone:	Fax:

Laboratory Number	Sample ID or System #	Sample Site or Description	Collection Date & Time	Matrix[1] 1-Routine 2-Repeat 3-Replacement	No. of Containers	Coliform	MMO... Quanti... Low-D...	Nitrate					

ANALYSES REQUESTED (columns from No. of Containers onward)

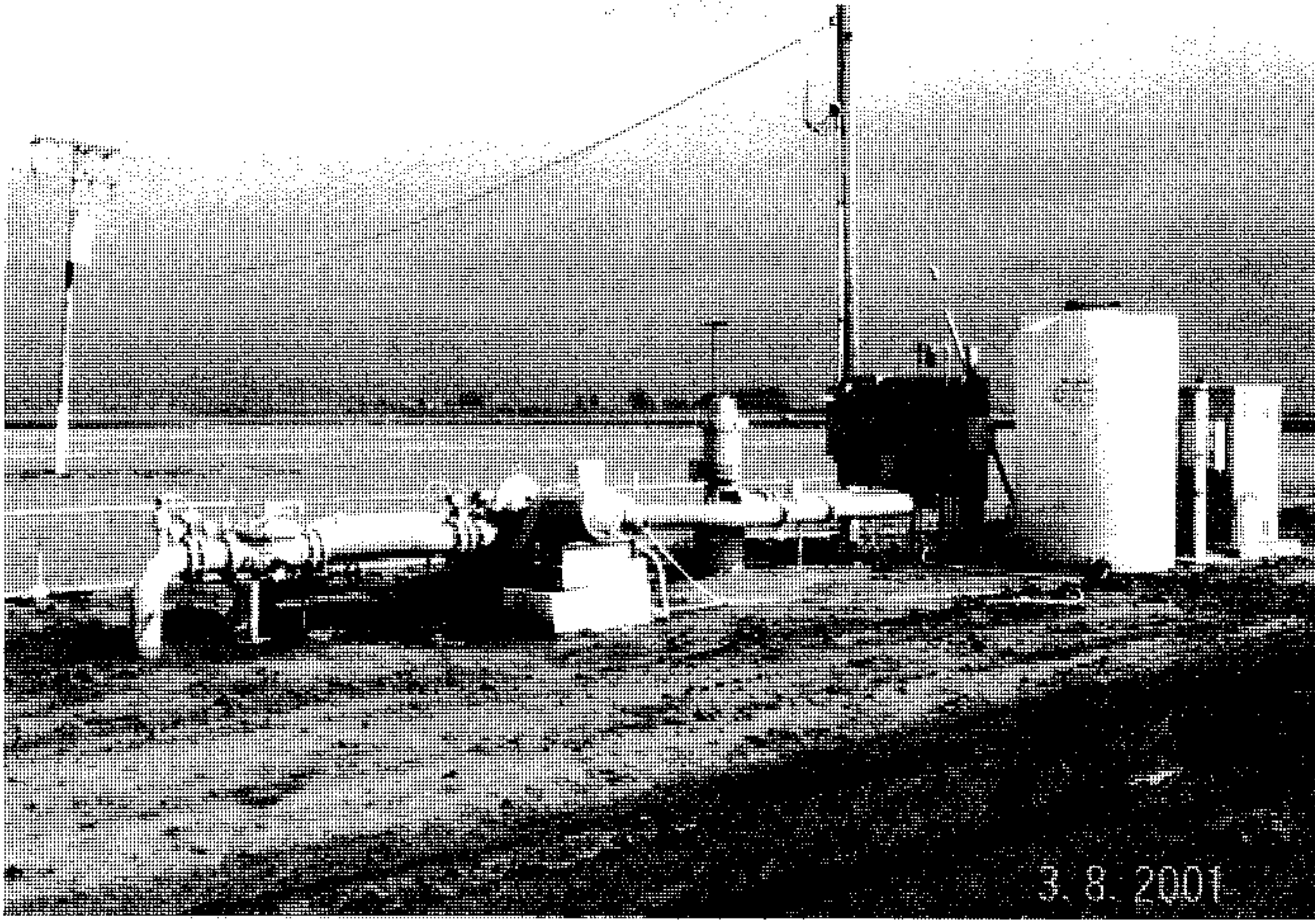
[1] **D**=Drinking Water (Specify as routine, repeat or replacement) **W**=Wastewater (Specify as grab or composite) **O**=Other (identify)

[ ] Payment received with delivery Amount: ______

Check: ______ Initials: ______

Receipt #: ______ Date: ______

Sample comments (irregularities/preservation, billing information if different than reporting):


3. 8. 2001

15S/04E-07A01

Sampling Date: Sampler:

Sampling Time:

Comments:
Complete General Mineral Analyses

15S/04E-08M04

Sampling Date: Sampler:

Sampling Time:

Comments:
Complete General Mineral Analyses

15S/04E-15D02

Sampling Date: Sampler:

Sampling Time:

Comments:
Complete General Mineral Analyses

15S/04E-17P02

Sampling Date: Sampler:

Sampling Time:

Comments:
Complete General Mineral Analyses

15S/04E-19H03

Sampling Date: Sampler:

Sampling Time:

Comments:
Complete General Mineral Analyses

15S/04E-20B02

Sampling Date: Sampler:

Sampling Time:

Comments:
Complete General Mineral Analyses

15S/04E-26G01

Sampling Date: Sampler:

Sampling Time:

Comments:
Complete General Mineral Analyses

15S/04E-36H01

Sampling Date: Sampler:

Sampling Time:

Comments:
Complete General Mineral Analyses

APPENDIX C

REVIEW CHECKLISTS

Appendix C-1: Field Activities Review Checklist

Appendix C-2: Laboratory Data Review Checklist

Field Activities Review Checklist

Sampling Location(s): ______

Sampling Date: ______

Item	Yes	No	NA	Comment
All required information was entered into field sheets in ink, and sheets were signed and dated by the field sampler.				
Deviations from SOPs, along with any pertinent verbal approval authorizations and dates, were documented on the field sheets.				
Samples were collected at the correct sites.				
The correct number of samples for each type of analysis and the correct volume was collected (0.5 gal/ ~2L for complete mineral panel OR one pint/ ~0.5L for partial mineral panel).				
Acceptable sample containers, appropriate for the intended analysis, were used.				
Field blanks were collected, and at the correct frequency (one every 25 samples).				
Field duplicates were collected, and at the correct frequency (one every 25 samples).				
Samples were packed with double-bagged ice and transported at the proper temperature ($4\pm2°C$).				
Chain of custody (COC) documents were completed properly.				
Sample holding times were not exceeded during field operations. See Table 6 (QAPP).				

Reviewer's Name (print): ______

Reviewer's Signature: ______

Reviewer's Title: ______

Date of Review: ______

Laboratory Data Review Checklist

Sampling Location(s): ______________________

Sampling Date: ______________________

Item	Yes	No	NA	Comment
Samples arrived at the laboratory at the proper temperature (4±2ºC).				
All requested analyses were performed and were documented in the analytical report.				
Analyses were performed according to the methods specified in the approved QA Project Plan.				
Holding times for extraction and analysis were not exceeded. See Table 6 (QAPP).				
Field Blanks results were below MDLs and were analyzed at a frequency of one every 25 samples.				
Field Duplicate results were ≤ 25% RPD and were analyzed at a frequency of one every 25 samples.				
Method detection limits were included in the report.				
A narrative summarizing the analyses and describing any analysis problems was included in the data report.				
Data qualifiers and flags were explained in the data report.				
Initial calibration data were within laboratory SOP defined acceptance criteria ($r^2 \geq 0.995$) for all analyses.				
Method blanks were performed at 3 per analytical batch, and were below MDL.				
Laboratory Control Sample (LCS) data were included for all analyses for every analytical batch.				
Laboratory Control Sample Results were within 80-120% recovery.				

Item	Yes	No	NA	Comment
Analytical Duplicate data were included for all analyses for every analytical batch.				
Analytical Duplicate results were < 25% RPD.				
Matrix spike data were included for all pertinent analyses for every analytical batch, and recoveries were within 75-125%.				
Matrix spike additions were at 3-10x the native.				
Matrix spike duplicates were ≤ 25% RPD.				
Continuing calibration data were within QAPP defined acceptance criteria (80-120% of initial slope) for all analyses.				

Reviewer's Name (print): ______________________________

Reviewer's Signature: ______________________________

Reviewer's Title: ______________________________

Date of Review: ______________________________

APPENDIX D

MONTEREY COUNTY CONSOLIDATED CHEMISTRY LABORATORY

QA MANUAL AND STANDARD OPERATING PROCEDURES

Appendix D-1: QA Manual

Appendix D-2: Specific Conductance, based on SM 2510 B

Appendix D-3: pH, based on SM 4500-H B

Appendix D-4: Total Alkalinity, based on SM 2320 B

Appendix D-5: Metals, based on SM 3111 B

Appendix D-6: Anions, based on EPA 300.0

TABLE OF CONTENTS

ORGANIZATION AND RESPONSIBILITY

On October 11, 1988, the Monterey County Board of Supervisors, in Resolution No. 88-508, authorized the Director of the County Health Department and the General Manager of Monterey County Flood Control and Water Conservation District (MCFC&WCD) to consolidate laboratory services for their respective programs into one facility. A Laboratory Steering Committee, comprised of representatives from both agencies, was established for the purpose of providing the planning, operation, and future development of the Consolidated Environmental Laboratory.

Each year the Steering Committee develops a Memorandum of Agreement (MOA) that describes and confirms the services to be provided by the Health Department to the Water Resources Agency (formerly the Flood Control and Water Conservation District) and defines the responsibilities of each party. In addition to providing laboratory support for the Health Department and the Water Resources Agency, the Consolidated Chemistry Laboratory provides analytical services to the Monterey Regional Water Pollution Control District, the County Department of Public Works and numerous water supply systems and wastewater treatment facilities.

The Consolidated Environmental Laboratory is accredited by the State Department of to perform tests in the following fields: 1) microbiology of drinking water and waste water; 2) inorganic chemistry and physical properties of drinking water; 3) analysis of toxic chemical elements in drinking water; 4) wastewater inorganic chemistry, nutrients and demand; and 5) toxic chemical elements in wastewater. A list of analyses and methods used in the laboratory is included in Appendix A.

The following is a brief description of the staff support for the Consolidated Chemistry Laboratory:

1. Director - Plans, organizes and controls laboratory operations. Coordinates laboratory interactions with other programs in the Health Department. Administers laboratory budget, billing and purchasing. Develops laboratory policy and procedures and supervises staff.

2. Public Health Chemist – Principal analyst. Performs complex organic and inorganic chemical analysis, evaluates and implements laboratory methods, develops and maintains quality assurance, reports results and maintains records, purchases equipment and supplies, provides technical consultation to Environmental Health and Water Resources Agency. Trains analysts and documents competency

3. Water Quality Specialist- Performs broad range of professional scientific work related to water quality and environmental issues; is proficient in

performing water quality analyses and managing the laboratory water quality database. Interpret and explain regulatory guidelines to clients.

4. Public Health Microbiologists - Assist Public Health Chemist in performing microbiological analyses and performing quality control.

5. Laboratory Assistant - Prepares culture media and reagents, assists in the processing of specimens, performs low to moderately complex environmental analyses and clinical analyses where interpretation or medical judgement is not required.

5. Laboratory Helper - Washes and sterilizes glassware and supplies. Prepares and labels mailing containers and specimen collection kits. Accession laboratory specimens. Sterilizes and disposes infectious waste. Maintains stockroom.

6. Typist-Clerk II - Enters clients and laboratory results into computer. Prints reports/forms. Prepares billing statements; receives and accounts for payments. Distributes laboratory results, and maintains laboratory files.

QUALITY ASSURANCE OJECTIVES FOR MEASUREMENT OF DATA

Quality Assurance (QA) includes all aspects of laboratory operation that affect the accuracy and reliability of sample test results. In addition to quality control of the analytical test process, quality assurance practices include: 1) proper sample collection, receiving and holding, 2) proper maintenance of equipment, 3) accurate data reduction, validation and reporting; and, 4) periodic performance and systems audits.

CUSTODY, HOLDING AND DISPOSAL OF SAMPLES

Quality assurance includes proper labeling of samples, proper completion of the chain of custody/analysis request form, proper collection, preservation and storage of samples, proper accessioning of samples, and proper disposal of the sample.

1) Sample Collection/Labeling. Sample collection is a coordinated effort between the client and the laboratory. The laboratory will provide clients with appropriate sample containers and sample collection/preservation instructions. The laboratory will also request duplicates and blanks according to client's sample plan requirements. All samples submitted for testing should be appropriately labeled. Sample containers provided by our laboratory have a suitable label which should be filled out at the time of sampling by the sample collector. The following information must be provided with all samples:

    a) Sample identification - submitters identification of sample (e.g. well number)

    b) Location - an address or brief description of the place the sample was taken.

    c) Time and date taken.

    d) Name of sample collector.

    e) Any preservatives

2) Chain of Custody/Analysis Request Form. A Chain of Custody/Analysis Request form should accompany all samples (see Appendix B). The Chain of Custody/Analysis Request form must include the following information: submitter name and address; sample identification; location of sample collection; date & time of collection; sample type; analysis to be performed; signatures of persons involved in the collection and chain of possession; and inclusive dates of possession.

3) Sample Receiving. Laboratory personnel receiving samples should assure that samples are properly collected, labeled, and the Custody/Analysis Request form has been completed:

    a) The laboratory assistant receiving the specimen must sign and date the Custody/Analysis Request form. Make sure that any special requests made by the client are recorded under the comments section of the form

    b) Assign each sample a unique laboratory identification number. Place preprinted lab number on analysis request form and sample container. When a sample is collected in multiple containers for different analyses, each container should receive the same laboratory number. (Exception: sample containers for analytes requiring a rapid turnaround time (e.g. coliforms) may receive separate number to expedite reporting).

c) Check that the samples meet the criteria described in Table 1006:I Summary of Special Sampling or Handling Requirements in 18th ed. of *Standard Methods for the Examination of Water and Wastewater* (Appendix C)

   i) Samples should be collected in a suitable container; samples collected in bottles of unknown origin or questionable cleanliness should be brought to the attention of the Water Quality Specialist or the Public Health Chemist.

   ii) Samples should be adequately labeled

   iii) Samples should be checked for proper preservative, holding time, and holding temperature.

   iv) Samples should be adequately sealed. Notify public health chemist if there is evidence of leakage. Verify that adequate sample volume exists to perform requested analysis.

d) NOTE: Samples that are not properly identified or are otherwise unsuitable for testing (e.g. improperly preserved or exceeding holding/ transport time) are recorded on the "Sample Invalidation Log" and the Water Quality Specialist or Public Health Chemist notifies the client. Samples not meeting collection/preservation criteria may be tested only if resampling is impossible; results from such samples must be qualified on the laboratory report by comments describing sample deficiency.

4) When the sample meets criteria for acceptance by the laboratory, required preservatives are added immediately and the sample is stored under conditions specified by the analytical method to be used. For samples requiring thermal preservation, a laboratory refrigerator and freezer is available. The temperature is maintained at 4 degrees and below -10°C respectively. Temperatures are monitored each day.

5) Chain of Custody/Analysis Request forms are given to the clerk to enter into a password protected computer laboratory information management system. Refer to "Water Sample Entry" in Clerical Manual for instructions on sample log-in.

6) Disposal of samples: Upon completion of all analyses, any remaining

sample will be stored for at least one month prior to disposal. Chain-of-Custody form, worksheets and lab reports are retained for three years. NOTE: Longer retention of samples or data may be required when legal action is probable. The samples and any associated extracts or digests are disposed of following recommendations found in the book, *Prudent Practices for Disposal of Chemicals from Laboratories*, National Academy Press, Washington, D.C. 1983.

CALIBRATION PROCEDURES AND FREQUENCY

Calibration is the process for determining the correctness of the assigned values of the physical standards used or the scales of the measuring instruments. Calibration accuracy is critically dependent on the reliability of the standards used for the required comparisons. Only the highest quality chemicals are used to provide necessary standard solutions, and due care is exercised in their preparation. The concentrations of the calibration standards bracket the expected concentration of the analyte in the samples. No data is reported beyond the range of calibration of the methodology. The calibration data, when plotted graphically, is referred to as a calibration curve. The calibration must be done under the same instrumental and chemical conditions as those that will exist during the measurement process. The frequency of calibration depends on the accuracy requirements of the investigation and the stability of the instrument used for the measurements:

At a minimum, three different dilutions of the standard will be measured when an analysis is initiated. Correlation coefficient must be > 0.995. Reportable analytical results are those within the range of the standard dilutions used. Do not report values above the highest standard. The lowest reportable value is the Method Detection Limit (MDL), providing that the lowest calibration standard is less than 10 times the MDL.

1) Atomic Absorption Spectrophotometers - Two approaches are used to calibrate atomic absorption spectrophotometers. These methods are direct comparison and standard additions.

   a) Direct comparison is the simple approach, and can be used with many instruments to give a direct readout of the concentration of an element in an unknown sample. To obtain good precision (e.g., 1-2% coefficient of variation), the absorbance levels measured must be about 0.1 to 0.6 units. Standard and sample solutions should be similar in bulk matrix constituents, particularly acid and salt content. Interference suppressants are used in all solutions when required. A number of standards (usually three to five in increasing concentration) as well as a blank, are prepared to cover the concentration range. A volume of type II reagent water with the same amounts of acids as the samples and standards) will be used for calibration blank. These solutions are run in absorbance to check linearity of the calibration curve.

   b) The method of standard additions is used when samples contains severe matrix interference. In this case it is possible to add small amounts of conventional standard solutions, in increasing amounts, to aliquots of each sample. A calibration graph can then be constructed. This method will often be used in work with the graphite furnace.

2) UV-VIS Spectrophotometer - The calibration procedure for the UV-VIS spectrophotometer is similar to that for the A.A. spectrophotometers. An integration interval is not required as the signal is very stable. It is important to use blanks and allow at least 1/2 hour warm up time.

3) PH Meters - The proper calibration of pH meters requires the use of two buffer solutions and a thermometer. The two buffer solutions must cover the expected range of samples to be tested. A third buffer is used to confirm calibration. The pH meter should be calibrated each day. The temperature of the buffers must be entered into the meter.

4) Conductivity Meter - The conductivity meter does not require frequent calibration but should be checked against a known standard each day of use. Recalibrate when there is significant deviation with the value of the standard.

5) Ion Chromatograph- Calibration of the Ion Chromatograph is performed at least once each year and whenever: 1) Controls are out of range; or, 2) the column, suppressor or detector is changed.

6) Inductively Coupled Plasma/Mass Spectrometer – Calibration of the ICP-MS is performed every day of analysis and whenever controls are out of range. See the SOP for more information.

ANALYTICAL PROCEDURES

The laboratory employs only methods approved by Environmental Laboratory Accreditation Program. Analysts must conduct sufficient preliminary tests using the methodology and typical samples to demonstrate competence in the use of the measurement procedure.

Each time an analytical procedure is performed controls are included and duplicate samples and known additions are tested to insure accuracy and precision. Results are not reported unless all controls are within acceptance limits referenced in Standard Methods 18th Edition, 1992.

To monitor reliability of analytical measurements, data is periodically obtained on detection limits, accuracy, precision and recovery.

ACQUISITION, REDUCTION, VALIDATION OF REPORTING DATA

The analytical chemist is responsible for describing and reporting the data in an appropriate manner. In order to insure the accurate transcription, calculation and reporting of analytical data, the chemist will adhere to the following quality assurance procedures.

1) Use documented procedures and record all significant experimental details in such a way that the measurements could be reproduced by a competent analyst at a later date.

2) All measurements are made so that results are representative of the matrix (soil, water, etc.) and conditions being measured.

3) Report data only to the number of significant figures consistent with their limits of uncertainty.

4) Report data with the proper units of concentration. Units should be chosen which clearly indicate whether the concentration is in terms of weight by weight, weight by volume or volume by volume. Unless otherwise specified, all data are calculated and reported in standard units to allow comparison with data reported by other laboratories.

5) The analytical methodology used will be cited. The raw data for each sample, along with reagent blanks, control, and spiked samples will be suitably identified if included in the report. If average values are reported, an expression of the precision, including the number of measurements, must be included.

6) The report should include date and place of sampling, sampling point, the name of the sample collector, identification as to type of sample, date and time of submittal to the lab, date of analysis, name of the analyst, and the result. Any conditions which may effect the interpretation of the data should be noted in the report.. All results will be reviewed by a Water Quality Specialist or Public Health Chemist before a final report is released.

7) Laboratory records will be retained in a permanent file for three years.

8) Retain samples for one month after issuing final report and retain data and documentary evidence for three years.

INTERNAL QUALITY CONTROL

Quality Control (QC) may be defined as those measures undertaken in the laboratory to maintain the analytical testing process within acceptable limits of accuracy and precision.
The Quality Control Program consists of the following elements: documentation of operator competence, recovery of known additions, analysis of externally supplied standards, analysis of method blanks, and testing of replicate samples:

1) Operator competence The principal analyst is responsible for: 1) developing a standardized training syllabus for the methods employed in the laboratory; 2) assuring that test personnel are adequately trained; 3) assessing the competency of test personnel, and 4) maintaining documentation of training and competency of all test personnel.

   a) Before test personnel are permitted to do reportable work , competency in performing the analysis is to be demonstrated. Commonly, the analyst performs replicate analysis under the supervision of the principal analyst. General limits for acceptable work are found in Standard Methods 18th Edition, 1992 in Table 1020 :I.

   b) After initial demonstration of competency, the principal analyst will assure test personnel maintain competency through testing internal or external proficiency test samples at least once each year.

2) With each batch of samples tested, controls will be tested to verify the accuracy of results as described below. Controls used with each method are outlined in Appendix D.

   a) Recovery of known additions as part of all regular analytical protocols except titrimetric and gravimetric methods. Use known additions to verify the absence of matrix effects. Spiked samples shall be analyzed with a minimum frequency of ten percent of the samples per matrix per batch of samples. Spike recovery must be between 80-120% for potable water (75-125% for waste water). When a spike sample fails to meet this criteria, retest all samples following the last acceptable spike sample. Spike recovery calculated as % of the known addition recovered.

   b) Analyze control standards with a minimum frequency of ten percent of the samples per matrix, per batch of samples. If there are less than 10 samples in a batch, at least one per matrix per batch must be analyzed. The concentration of the sample shall be within the working range of the method. Sources of these samples include but are not limited to: performance evaluation samples from the EPA, commercially available standards, or standards prepared in-house but from sources different from calibration standard. Control standards must be within the published acceptance range (for external controls). If the control standard does not have a published acceptance range, recovery of the control should be within 10% of the known value. When a control standard fails to meet this criteria, retest all samples following the last acceptable control.

c) Method blanks will be analyzed with each batch of samples. The use of method blanks provides a measurement of laboratory contamination. Blanks cannot exceed the minimum detection level. See Appendix A.

d) Replicate samples will be analyzed with a minimum frequency of ten percent of samples per matrix, per batch of samples for drinking water. For wastewater the requirement is 5%. If there are less than ten samples per batch, at least one sample per matrix per batch must be analyzed. If the analyte is not detected, replicate matrix spike samples will be analyzed. The percent difference between replicate samples must be within 20% for potable water (25% for wastewater). When a replicate sample fails to meet this criteria, retest all samples following the last acceptable replicates. Duplicate % difference calculated as the difference as a percent of the mean. [100(X1-X2)/avg].

e) In addition to the control standards tested with each run, an external reference standard for each analyte will be tested at least once each quarter.

All of the quality assurance control procedures will be followed in the laboratory. All documentation for these checks should be available for inspection by laboratory management.

PREVENTIVE MAINTENANCE

As part of the QA plan, the laboratory has a comprehensive preventive maintenance program. Balances, spectrophotometers, and other instruments undergo routine maintenance and accuracy checks by a manufacturer's representative or by laboratory personnel as described below. All preventive maintenance performed in-house is documented on preventive maintenance forms. Instrument s which undergo routine professional maintenance have labels affixed to indicate date of last servicing. Manufacturer's instructions and service manuals are readily accessible.

Adequate spare parts are kept on hand to perform routine maintenance and minimize downtime. The spectrophotometers have maintenance contracts that provide for immediate servicing in the event of malfunction. Equipment records documenting preventive maintenance and emergency servicing/repairs are kept for a minimum of three years.

1) Thermometer/temperature-reading instruments: Accuracy of thermometers or recording instruments are checked annually against a certified National Bureau of Standards (NBS) thermometer or one traceable to NBS and conforming to NBS specifications. All thermometers a relabeled with date calibrated and correction factor.

2) Balance: Balance accuracy is verified each week using ASTM type 1 reference weights. Accuracy checks are documented on preventive maintenance chart. Balances are serviced and certified annually through a maintenance contract. Type 1 weights are re-certified at least every five years.

3) pH meter: pH meters are standardized with at least two NIST traceable standard buffers (pH 4.0, 7.0, or 10.0) and compensated for temperature before each series of tests. A third buffer is used to confirm calibration. Date buffer solutions when opened and discard buffer after expiration date on bottle. Buffers prepared from powders are replaced after four weeks.

4) Water deionization unit: Conductivity of the RO and Nanopure water is checked each month. A heterotrophic plate count on Nanopure water is also performed monthly. Filters are changed as indicated by conductivity readings and heterotrophic plate count. Records are maintained on preventive maintenance chart. Water is tested annually for bacteriologic quality and heavy metals.

5) Autoclave: Autoclave charts are used to document date, time, temperature and contents of each load. Chem-di indicators and heat sensitive tape are used with each load to identify materials that have been autoclaved; results are recorded on autoclave chart. Autoclave performance is

checked each month with biological indicator (e.g. spore suspension). Autoclaves are serviced quarterly under maintenance contract. The accuracy of autoclave recording thermometer is checked annually. The autoclave operating temperature is monitored on a weekly basis.

6) Refrigerator: Temperatures are recorded daily and units defrosted and cleaned as needed. All media and reagents stored in the refrigerator are labeled.

7) Freezer: Temperatures are recorded daily. Identify and date materials stored. Defrost and clean semiannually; discard outdated materials.

8) Ultraviolet sterilization lamps: Unit is cleaned monthly by wiping lamps with a soft cloth moistened with ethanol. Test lamps quarterly with UV light meter and replace if they emit less than 70 % of initial output or if agar spread plates containing 200 to 250 microorganisms, exposed to the light for 2 minutes, do not show a count reduction of 99%.

9) Water bath: Fecal coliform water bath is checked twice daily. All other water baths are checked each day of use.

10) Incubator: Check and record temperature twice daily (morning and afternoon) on the shelf areas in use. Locate incubator where room temperature is in the range of 16 to 27O C.

11) Fume hoods/Biological Safety Cabinets: Fume hoods are checked once each month using a velometer; readings are recorded on preventive maintenance chart. Hoods and safety cabinets are certified annually through service contract.

PERFORMANCE AND SYSTEMS AUDITS

Corrective action is required when data is outside of predetermined limits for acceptability. The corrective actions can be triggered by the following quality assessment activities: Control Chart analysis; proficiency evaluation testing; and QA audits.

1) CONTROL CHART ANALYSIS:
The laboratory's quality assessment techniques will be used to maintain the precision and accuracy of all laboratory analyses within a state of statistical control. Precision and accuracy measurements are the best way to assess analytical performance. Precision is the degree of reproducibility of a particular analytical procedure. Accuracy is a measure of the agreement between an experimental determination and the true value.

a) PRECISION - Assess precision by replicate analysis, by repeated analysis of a stable standard, or by analysis of known additions to samples. Precision is specified by the standard deviation of the results. The formula for determining standard deviation (SD) is:

$$SD = \sqrt{\Sigma}\ (X1-X)^2/(N-1)$$

X1 is the value of the individual measurements; X is the mean of all measurements for a given sample and N is the number of measurements.

The purpose of determining precision is to establish the typical variance of the method in the absence of any matrix influence. In the course of determining precision, there are two cases that indicate there is a problem with the precision data:

i) The measured values show wide variation from one to another for a given day.

ii) The measured values show little variance from one to another for a given day, but the mean and standard deviation show wide variation from one day to another.

If either of the above occurs, factors such as sample homogeneity, instrument calibration, or analyst error should be checked, documented, and corrected. The precision measurements should then be repeated.

b) ACCURACY - The best method to determine accuracy is to spike an alequot of reagent water with a known amount of the constituent being measured and analyze the sample. The amount spiked should be at least five to ten times greater than the analytical detection limit.

To evaluate the data accuracy, the percent recovery of the spike must be determined. The formula for determining percent recovery is:

$$\% \text{ recovery} = [100(S - S1) \div S2]$$

Where S is the concentration of the spiked sample; S1 is the concentration of the unspiked sample; S2 is the concentration of the spike added to the sample.

If the percent recovery deviates significantly from 100% and the method has not demonstrated significant bias, the problem must be detected and corrected prior to continuing the analysis. Sources of this problem include incorrect standard or spike solution concentration or a problem in the procedural detection system.

Precision, accuracy, and detection limits for all methods used in the laboratory is comparable to values referenced in Standard Methods 18th Edition, 1992 and EPA Methods for Chemical Analysis of Water and Wastes, March 1983.

2) PERFORMANCE EVALUATION SAMPLES: The laboratory director is responsible for enrolling the laboratory in ELAP approved proficiency testing program(s) and assuring that proficiency testing is performed for all regulated tests. The principal analyst (Public Health Chemist) will conduct and document internal proficiency testing at least once a year for tests where proficiency testing is not available. Proficiency test samples are treated in the same manner as routine samples (ie. tested the same number of times, tested using personnel who routinely perform testing, tested using routine methods and tested during patient testing).

3) QUALITY ASSURANCE AUDIT: The quality assurance program will be audited quarterly and any deviations from the program will signal corrective action to be taken. Quality assurance audit will be documented in a written report. The audit will include the following aspect:

   a) Competency of test personnel must be evaluated annually and be documented

   b) Evidence of the systematic use of control samples, replicate measurements and reference materials all in conjunction with control charts.

   c) Proper labeling of reagents and samples.

   d) Use of approved methods.

e) Results on blind samples.

f) Acceptable safety equipment and procedures.

g) Quality assurance reports generated on a regular basis.

h) Documentation on equipment performance and maintenance.

i) Training records.

j) All relevant files accessible and organized.

k) Laboratory personnel following good laboratory practices.

l) Laboratory personnel following good measurement practices

The Public Health Chemist will be responsible for initiating and documenting any corrective action necessary. Corrective action will be documented on the appropriate control chart, performance evaluation report, or QA audit report. No data shall be reported until the cause of the problem is located and corrected or the laboratory demonstrates the cause was a random event and no longer affects data. Although the elimination of events requiring corrective action may not be achieved, a reduction in the repetition of these events is the objective of this program.

REFERENCES FOR QUALITY ASSURANCE DOCUMENT

1) Standard Method for the Examination of Water and Wastewater, 18th edition, 1992.

2) Handbook for Analytical Quality Control in Water and Wastewater Laboratories. EPA-600/4-79-019, March 1979, USEPA.

3) Manuals for the Certification of Laboratories Analyzing Drinking Water Criteria and Procedures/Quality Assurance. EPA QAMS-005/80, Interim Guidelines, EPA-570/9-82-009, USEPA.

4) Methods for Chemical Analysis for Water and Waste. EPA-600/4-79-020, March 1983.

Written by: Gerry Guibert & David Holland

Date: May 1993

Revised: January 1999
Revised: September 21, 2004

Approved by: ________________________________

(Laboratory Director's Signature)

Appendix A

Monterey County
Consolidated Chemistry Laboratory

ANALYTICAL METHODS FOR WATER ANALYSIS

PARAMETER	HOLD TIMES	METHOD REFERENCE	MDL	UNITS
Free Chlorine	.25 h; ASAP	SM 4500-Cl G	0.02	mg/L
Total Chlorine	.25 h; ASAP	SM 4500-Cl G	0.05	mg/L
Enterococcus	8 h	IDEXX	1/100 ml	
Heterotrophic Plate Count	8 h	SM 9215 B	1	CFU
E. coli – MPN	6 h waste 8 h source 30 h potable	SM 9221 B	2/100 ml	
Fecal Coliform – MPN	6 h waste 8 h source 30 h potable	SM 9221 B	1/100 ml	
Total Coliform – MPN	6 h waste 8 h source 30 h potable	SM 9221 B	2/100 ml	
Total Coliform – Quantitray	6 h waste 8 h source 30 h potable	SM 9223	1/100 ml	
E. coli – Presence/Absence	30 h potable	SM 9223	1/100 ml	
Total Coliform – P/A	30 h potable	SM 9223	1/100 ml	
pH	.25 h; ASAP	SM4500H B		pH units
Bicarbonate	ASAP (with pH)	SM 2320 B	10	mg/L
Calcium Carbonate	ASAP (with pH)	SM 2320 B	1	mg/L
Carbonate	ASAP (with pH)	SM 2320 B	1	mg/L
Solids	24 h	SM 2540 F	0.1	mL/L
Color Determination	48 h	SM 2120 B	2	CU
Odor	NS; 48 h (rec 6h)	SM 2150 B	1	TON
Turbidity	48 h	SM 2130 B	0.05	NTU
Nitrate	48 h	EPA 300.0	1	mg/L
Nitrite as (N)	48 h	SM 4500 NO2-B	10	ug/L
Total Dissolved Solids	7 d	SM 2540 C	5	mg/L
Total Suspended Solids	7 d	SM 2540 D	5	mg/L
Alkalinity	14 d	SM 2320 B	1.0	mg/L, CaCO3
Bromide	28 d	EPA 300.0	1	mg/L
Chloride	28 d	EPA 300.0	1	mg/L
Fluoride	28 d	EPA 300.0	0.02	mg/L
Sulfate	28 d	EPA 300.0	1	mg/L
Conductivity	28 d	SM 2510 B	1	umhos at 25C
Ammonia (N)	28 d	SM 4500 NH3 F	0.05	mg/L
Orthophosphate	NS; 28 d	SM 4500 P E	0.03	mg/L
Total Phosphorus	28 d	SM 4500 P E	0.03	mg/L

Monterey County
Consolidated Chemistry Laboratory

PARAMETER	HOLD TIMES	METHOD REFERENCE	MDL	UNITS
Aluminum	6 months	EPA 200.8	5	ug/L
Antimony	6 months	EPA 200.8	0.5	ug/L
Arsenic	6 months	EPA 200.8	1	ug/L
Barium	6 months	EPA 200.8	0.5	ug/L
Beryllium	6 months	EPA 200.8	0.5	ug/L
Cadmium	6 months	EPA 200.8	0.5	ug/L
Chromium	6 months	EPA 200.8	5	ug/L
Copper	6 months	EPA 200.8	0.5	ug/L
Iron	6 months	SM 3111B	100	ug/L
Lead	6 months	EPA 200.8	0.5	ug/L
Manganese	6 months	EPA 200.8	0.5	ug/L
Mercury	6 months	EPA 200.8	0.25	ug/L
Nickel	6 months	EPA 200.8	0.5	ug/L
Selenium	6 months	EPA 200.8	5	ug/L
Silver	6 months	EPA 200.8	5	ug/L
Thallium	6 months	EPA 200.8	0.5	ug/L
Zinc	6 months	EPA 200.8	5	ug/L
Calcium	6 months	SM 3111B	1.0	mg/L
Magnesium	6 months	SM 3111B	0.1	mg/L
Potassium	6 months	SM 3111B	0.1	mg/L
Sodium	6 months	SM 3111B	0.1	mg/L
Hardness as CaCO3	6 months	SM 2340 B	1.0	mg/L
Boron	6 months	SM 4500 B B	0.1	mg/L

Appen... B

ENVIRONMENTAL ANA' YSIS REQUEST FORM

MONTEREY COUNTY CONSOLII D CHEMISTRY LABORATORY
1270 NATIVIDAD ROAD, SALINAS, CA..FORNIA 93906 Phone (831) 755-4516

Shaded areas for laboratory use only

Chain of Custody:

Collected by (Print & sign):	Received by:	Date & Time:
Relinquished by:	Received for Laboratory:	Date & Time:

Client Name:	Report Attention:	
Address:	Copy to:	
City, State, Zip:	Phone:	Fax:

Laboratory Number	Sample ID or System #	Sample Site or Description	Collection Date & Time	Matrix(1) 1-Routine 2-Repeat 3-Replacement	ANALYSES REQUESTED: No. of Containers	Coliform	MMO... Quanti... Low-D...	Nitrate					

(1) **D**=Drinking Water (Specify as routine, repeat or replacement) **W**=Wastewater (Specify as grab or composite) **O**=Other (identify)

[ ] Payment received with delivery Amount: ____

Check: ____ Initials: ____

Receipt #: ____ Date: ____

Sample comments (irregularities/preservation, billing information if different than reporting):

SPECIFIC CONDUCTANCE
EPA 120.1/SM 2510 B
umhos at 25°C

Scope and Application:
This method is applicable to drinking, surface and saline waters, domestic and industrial wastes and acid rain.

Summary of Method:
The specific conductance of a sample is measured by use of a self-contained conductivity meter, the YSI Model 32. The conductivity meter is used in the temperature compensated mode.

Sample Criteria & Acceptability:
A minimum of 100 ml sample should be submitted in a clean container provided by the laboratory. Samples can be stored for up to 28 days at 4oC. The samples must be brought to room temperature before testing. If the sample does not meet the above criteria, document it on the worksheet but perform the test.

Reagents:
0.02 Molar Standard Potassium Chloride Solution:

1. Dry 0.85 g of Reagent Grade Potassium Chloride (KCl) for 4 hours at 105°C. Use immediately or store in a desiccator until use.
2. Dissolve 0.7456g of pre-dried potassium chloride in a 1 liter Class A volumetric flask using deionized water.
3. Label the flask with Potassium Standard Solution, 0.7456 g KCl/L, date made, outdate of 3 months, and initial.
4. Alternately, order two 500 ml containers of the Traceable Conductivity Calibration Standard near the 1414 micromho/cm range; from Fisher Scientific, Cat No. 09-328-11.

Control

1. Check deionized water. It should read less than 1 umho. If the reading is higher, clean cell and repeat reading of deionized water. If reading is still high, notify the Chemist.
2. Use current Quality Control sample with each run. The control must be in range before proceeding with specimens. The 0.01 M KCl can be used as control.

Conductance Meter Maintenance:

1. Store cell in deionized water. If the cell has been stored dry, soak in deionized water for 24 hours.
2. Check the platinum black coating on the electrode. If the coating appears thin or if it is flaking off the electrode, the cell should be cleaned and the electrodes replatinized. See "Instruction Manual YSI Model 32 Conductance Meter" pages 11 and 12 for instructions.
3. The electrode should be cleaned and replatinized every four months. Record the preventative maintenance on the "PM Worksheet".

Conductance Meter Calibration Check:

Instrument must be standardized with KCl solution before daily use.

1. Pour 50 ml of the standard potassium chloride solution into a 250 ml beaker. Alternately, immerse the conductivity cell and thermometer in the Rinse Bottle, then transfer to the Read Bottle for actual reading
2. Immerse conductivity cell in sample. The electrodes must be submerged and the electrode chamber must be free of trapped air. Tap the cell to remove any bubbles, and dip it two or three times to assure proper wetting.
3. Rotate the Range Switch to the lowest range position that gives a reading (within range) on the display. An over-range value is indicated by a "1" followed by blanks. An under-range value is indicated by a reading followed by a small letter "u". Readings may be in error when operating in the under range conditions. On the 0.1 – 2 micromho range; allow extra time to stabilize.
4. The conductance value of the solution is displayed on the meter. The units in which it is to be read are determined by the Range Switch, either in mU or in uU (or milli and micro siemens).

   2 uU, 20 uU, 200 uU reading = final result

   2 mU, 20 mU, 200 mU readings x 1000 = final result

5. Use the table below to check accuracy of cell constant:

	Conductivity of 0.01 M KCl
Temperature in Centigrade	Micro-omhos/cm
21	1305
22	1332
23	1359
24	1386
25	1413
26	1441
27	1468
28	1496

6. If the standard is within range, rinse the cell three times with deionized water, and start testing unknowns as described in steps 2-4.

Reporting:

Report results to three significant figures. Report in units of micromhos per centimeter at 25 ^{o}C

References:

1. Instruction Manual YSI Model 32 Conductance Meter", Item 060818, PN A32018 R, October 88 EP
2. Methods for Chemical Analysis of Water and Wastes", EPA- 600: 4-79-020, March 1983, pages 120.1-1 to 120.1-3.
3. "Standard Methods for the Examination of Water and Wastewater", 18th Edition, 1992.

Written by: David Perez, Date: February 1993
Revised: January 12, 2007

Approved by:______________________________
Chemist

pH
SM 4500-H B
Electrometric

Scope and Application
Application to drinking, surface, ground and saline waters as well as acid rain, and wastewater (domestic and industrial.

Principle of Operation
pH is defined as the negative logarithm of the hydrogen ion concentration in moles per liter. The pH scale goes from zero to fourteen with a value of seven units to be considered neutral. Values below seven are acid; values above seven are basic. It is important to note that a one-unit change in pH represents a ten-fold change in the concentration of the hydrogen ion.

pH has a great impact on almost all biological and chemical processes used for water and wastewater treatment, and proper measurement of this value is critical. pH is measured using a pH meter consisting of a potentiometer, glass pH electrode, reference electrode and temperature compensating device. When calibrating the instrument, use two buffers that bracket the expected pH value for greatest accuracy.

Specimen collection and Handling
Collect sample in plastic or glass container. Test sample immediately upon receiving and/or within two hours after collection.

Instrument Calibration:
Two buffer calibration:

1. Fill a 50 ml beaker with up to 30 ml of pH 7 buffer. Add a stir bar and set the knob on the magnetic stirrer to the second line on the dial (slow spin). Place the electrode in the pH 7 buffer; make sure that the reference electrode is filled with KCl and is open. Allow the electrode to equilibrate for 5 minutes.

2. Release Standby button and press the pH button. Measure the temperature of the buffer solution and set the temperature control. Turn the large slope knob to 100 and the inner know fully clockwise.

3. Adjust the calibration control until the readout displays 7.00. Press the mv button and record the mv reading on the worksheet. Remove electrodes from the buffer and rinse with deionized water.

4. Fill a 50 ml beaker with up to 30 ml of pH 4 buffer. Add a stir bar and set the knob n the magnetic stirrer to the second line on the dial (slow spin). Place the electrode in the pH 4 buffer and allow the electrode to equilibrate for 5 minutes. Press the pH button.

5. Adjust the slope knob until the readout displays 4.00. Press the mv button and record the mv reading on the worksheet. Remove electrodes from the buffer and rinse with deionized water.

6. Fill a 50 ml beaker with up to 30 ml of pH 6.86 buffer. Add a stir bar and set the knob n the magnetic stirrer to the second line on the dial (slow spin). Place the electrode in the pH 6.86 buffer and allow the electrode to equilibrate for 5 minutes. Press the pH button and record the result on the worksheet and quality control graph. PH should be 6.86 ± 0.1; notify chemist if out of range.

7. Rinse the electrodes with deionized water.

8. Record mv readings of calibration buffers. Calculate change in millivolts and divide by 3. The result should be 58 ± 2 mv.

9. If the slope is within limits, begin testing unknowns. If the slope is out of range, re-calibrate the pH meter. If the second calibration slope is out of range, notify the chemist.

Controls

1. Run every tenth specimen in duplicate. The duplicates should be within 20% of each other.

2. Check the 6.86 control buffer after every tenth specimen. Record the results on the worksheet and quality control chart.

Procedure

Once the pH meter has been calibrated, the unknown samples can be tested.

1. Pour 30 ml of unknown (or 50 ml of unknown if also testing for alkalinity) into a 150 ml beaker containing a small stir bar. Start the stirrer. Keep the automatic stirrer at a constant moderate rate (The speed is marked on the dial by a pen marking).
2. Allow the display to stabilize, and record the results on the worksheet.
3. Rinse the electrode with deionized water between specimens. Blot dry with a 'kimwipe'. Do not rub the electrode; the static electricity can alter readings.

Reporting

Report the result to the nearest tenth (0.1).

References:

1. "Method for Chemical analysis of Water and Wastes", EPA 600/4-79-020, Revised March 1983.
2. Standard Methods for the Examination of Water and Wastewater 18th edition 1992

Written by: David Perez
Date: December 1994

Approved by: ____________________________
Chemist

Total Alkalinity
SM 2320 B
Titration

Principle
Total alkalinity is defined as the acid-neutralizing capability of water. It is reported as due to bicarbonate (HCO3), carbonate (CO3), and hydroxide (OH). Unaltered sample is titrated potentiometrically to pH 8.3 endpoint for "carbonate" alkalinity and 4.5 endpoint for "bicarbonate" alkalinity.
Note: Samples with a pH less than 8.3 (i.e. most drinking water samples) are reported as having non-detectable hydroxide and carbonate alkalinity; for these samples total alkalinity is due entirely to the bicarbonate content of the water. Bicarbonate alkalinity (as HCO3) can be calculated from total alkalinity (as CaCO3) by multiplying by a factor of 1.22.
Applicable to drinking and surface waters, domestic and industrial wastes, and saline waters.

Sample Criteria & Acceptability
Samples should be submitted in clean containers provided by the laboratory. A minimum of 100ml of sample should be submitted for testing. Samples, which cannot be tested within 24 hours of collection, should be stored at $4^{o}C$ and tested within 14 days. If any sample does not meet the above criteria, document it on the worksheet but perform the test.

Equipment
1. pH meter that can read to 0.05 pH units.
2. Two 1,000 ml Class A volumetric flasks.
3. Magnetic stirrer and magnetic stir bars.
4. Two 100 mL beakers.
5. One 250 mL flask
6. One 50 mL graduated cylinder

Reagents
The day before preparing standardize sulfuric acid, dry 0.1 g of Tris Buffer for at least 3 hours at 103 C (overnight is acceptable). After drying, immediately weigh out the Tris buffer. If that is not possible, store the reagent in the desiccators until used.

1. Standardized 0.02 N H_2SO_4 (sulfuric acid) + 0.004 units:

   The concentrated H_2SO_4 and stock 1.0 N H2SO4 may be found in acid cabinet below hood.

   a. Prepare a 1.0 N H H_2SO_4 Stock Solution: Fill a 1,000 ml Class A volumetric flask three quarters full with deionized water. Carefully add 28.0 mL of concentrated H_2SO_4 using a 25 mL and 3 mL Class A volumetric pipette. Fill to the mark with deionized water and mix. Transfer to plastic bottle and label as 1.0 N H_2SO_4 Stock Solution, date made, outdate of 1 year, and initial. Cap tightly.

   b. Prepare a standardized 0.02 N H_2SO_4.
      1. Fill a 1,000 mL Class A volumetric flask three quarters full with deionized water. Carefully add 20.0 mL of the Stock H_2SO_4 using a 20 mL Class A pipette. Fill to mark and mix thoroughly.
      2. Weigh out between 0.0700 to 0.0800 g of Tris buffer using the analytical balance. Record the weight of the Tris Buffer to four places in the "Standard & Reagent Preparation" notebook. Add the buffer to 250 mL flask containing 25 mL of deionized water and stir bar; mix.

3. Add 3 drops of Hach Brom Cresol Green-Methyl Red indicator solution (Hach cat. number 451) to the Tris buffer solution.
4. Fill the titrating buret with the 0.02 N H_2SO_4 solution. Titrate the solution until a stable pink color is reached. Record the volume of reagent used.
5. Calculations:
   Normality of H_2SO_4 = Wt of Tris Buffer (g) ÷ (0.121137 g/meq Tris X mL of 0.02 N H_2SO_4 used)
   Example:
   0.0879 g Tris Buffer ÷ (0.121137 g/meq Tris X 35.7 ml H_2SO_4) = 0.0203 N H H_2SO_4
6. Transfer the 0.02 N H_2SO_4 to a one liter plastic bottle. Record the normality on the bottle, date made, outdate of 3 months, and initial. Store at room temperature.

2. Alternatively, order 0.02 N H_2SO_4 , already prepared and standardized from a vendor such as Fisher Scientific. Record lot on QC worksheet.

Controls

1. Run deionized water as blank. Value of blank should be less than 2 mg/L of calcium carbonate (approximately 0.1 mL of H_2SO_4).

2. Use one quality control standard. This is a solution of sodium bicarbonate (100 mg/l). Run once with each set of samples and record results on control chart. Consult chemist if out of control situation exists.

3. Run every 10^{th} specimen in duplicate. Calculate the relative standard deviation (RSD) of the replicates using the following formula: RSD=SD ÷ mean x 100. The RSD should be less than 10% If the replicates are outside of this range, repeat the specimen a third time. Check with the chemist for instructions.

4. Each quarter an external reference sample is to be analyzed. In the case of results exceeding acceptance values, document corrective action. Place any corrective action records in proficiency file

Procedure:

If applicable, standardize the pH meter each day of use (see supplemental procedure). Record slope with offset on worksheet.

Run the blank and control first. If the control is within range (range found in the "QC Inorganic True Value" binder), run the samples. Repeat the control if it is out of range. Notify the chemist if the control is out of range a second time.

1. Add 50 mL of control or sample to a 100 ml beaker containing a magnetic stir bar. Set magnetic stirrer at low speed.

2. Carefully lower pH probe into the solution. **If the pH is above 8.3 consult principal analyst!**

3. Fill the titrating buret to the zero mark with the standardized H2SO4. Carefully add the H2SO4 to the sample until a pH of 4.5 ± 0.05 is reached.

4. Record the volume of H_2SO_4 added to the sample, to the nearest tenth, on the chemistry worksheet.

5. Rinse the pH electrode with deionized water. Measure out the next sample, refill the buret, and titrate the next specimen.

Calculations:

Use the following formula to calculate the alkalinity as mg/L of calcium carbonate.
Exception: For alkalinity below 20 mg/L use low alkalinity calculation procedure (refer to SM2320B part 5)

mg/L = (mL of H_2SO_4 – 0.1) X normality of H_2SO_4 X (50,000 ÷ ml of sample)
Example (for 50 ml sample):
(28.6 mL – 0.1) X 0.02 X (50,000÷50ml) = 570 mg/L of Calcium Carbonate
or
(28.6 ml – 0.1 ml) X (20) = 570 mg/L of Calcium Carbonate

Reporting

Report in **whole** numbers; round off to 3 significant figures. Examples:
2,902.5 = 2,900; 1,125.9 = 1,130; 23.65 = 24

References

Standard Methods for the Examination of Water and Wastewater 18th edition 1992

Written by: David Perez
Date: January 1993
Revised by: G. R. Guibert
Date: August, 1998

Approved by:______________________________
Principal Analyst

Varian Flame AA Procedure
SM 3111B
For Ca, Mg, Na, K and Fe

Principle:
In flame atomic absorption spectrometry, a sample is aspirated into a flame and atomized. A light beam is directed through the flame, into a monochrometer and into a detector that measures the amount of light absorbed. Because each metal has its own characteristic absorption wavelength, a source lamp composed of that element is used. The amount of energy absorbed in the flame is proportional to the concentration of the element in the sample.

Sample Collection/Handling:
Use metal free collection bottle to collect sample. Collect one liter of sample. Smaller volumes (not less than 200 ml) can be used if necessary. On collection, acidify samples to pH <2 with 1:1 nitric acid, usually 3ml per liter. If samples are not acidified at time of collection, add acid upon receipt in lab and hold for minimum of 16 hours before analysis.[40 CFR 141.23(K)].

Sample Preparation:
Samples containing particulate or organic material require pretreatment before analysis. Samples with a turbidity <1 NTU, no odor and single phase may be analyzed directly. Digest all other samples before determining total metals.

Digestion Procedure for total metals:
Drinking water samples with turbidity >1 NTU can be analyzed following digestion with nitric acid. See procedure SM 3030E (Nitric Acid Digestion). Wastewater samples are better digested using method SM 3030F part b (Nitric Acid-Hydrochloric Acid Digestion). Report as total recoverable metal.

Sample criteria:
Except as noted, specimens that do not meet the criteria below should be immediately reported as "no test" with an explanatory note:

1. Samples submitted in improper collection container.
2. Sample inadequately identified. (Sample has no identification, or cannot be matched to a laboratory request form).
3. Sample quantity insufficient
4. Sample container broken or leaked in transit.

Special Instructions:
All glassware and pipettes used in this procedure must be cleaned using glassware-cleaning procedure. See document in kitchen.

Reagents:

1. Nitric Acid (HNO3). Use high purity nitric acid 1+1.
2. Lanthanum solution (1.11%): Dissolve 58.65 g lanthanum oxide in 250 ml of conc HCL. Add slowly with stirring until dissolved and dilute to about 900 ml. Allow to cool for a few hours then dilute to final 1000 ml volume. Used for Ca, Mg, Na, and K analysis.
3. Calcium solution: Dissolve 630 mg calcium carbonate, CACO3, in 50 ml of 1+5 HCL. If necessary, boil gently to obtain complete solution. Cool and dilute to 1000 mL with water. Used for Fe analysis.
4. Standard Metal solutions: Standard metal solutions are prepared from 1000 mg/l AA or ICP-MS standards purchased from Ricca Chemical company, Spex Certiprep, LabChem, Fisher Scientific or VWR. A standard from EM scientific (ICP Multi-element Standard) is very convenient for calibration standards.
5. Deionized Water from Millipore system – metal free water.

Instrument Set-up:
Use the Varian Spectra 300AA operating in the flame mode with Air Acetylene burner.

1. Turn on exhaust hood. Switch is located in the corner by the Chemistry room refrigerator. Note: Turn switch until it clicks on. If you continue turning the switch after it clicks, the airflow will be reduced.

2. Turn on "Acetylene" gas cylinder located outside in the "Safety Storage" shed. The correct door housing the tank is labeled "Acetylene". Pressure should be set at 8-9 PSI.
   Note: The cylinder valve is opened by turning the handle only 1/4 turn counterclockwise. Replace cylinder when pressure in tank drops below 100 psi. This prevents acetone from entering instrument.

3. Check the Varian Spectra AA 300A unit to see if the burner is installed.

4. Check to see if the cathode lamp required is in the correct socket position, and it is lined up in the "Operating Lamp"
   Note: Lamps are stored in the top drawer located directly across from the GTA 96 Graphite Tube Atomizer (next to hood).

5. Turn on the equipment in the following order (allow a 20 minute warm-up period):
   Note: If the computer is already on, turn it off.
   a. Spectra AA 300A: switch located on lower right front of instrument.
   b. IBM PC and Printer: Turn surge suppressor on (power supply); hit reset button.

Once the unit has been set-up, program the machine for testing by:

1. Start at the "C:" prompt. Press "M" and "Enter".

2. Press "Spectra Flame"

3. Press "Index" (F10). Enter number 10, "Sequence Selection", press "Enter" key.

4. Select element to be tested

5. Press "Sequence Control" (F6). Enter number of samples to be tested.

6. Press "Index" (F10), enter number 6, "Optimization", press "Enter" key.

7. The Screen will display two signal bar graphs. Check the previous week worksheet for the "Photomultiplier voltage" reading.

8. Maximize the lamp signal of the Cathode tube using the two thumbscrews located on the back of the lamp socket (see figure 5.8).
   a. Watch the bar graph as you turn one thumbscrew. Once the value reaches .9 or greater press "Rescale" (F1).
   b. Check the Photomutiplier Voltage display on the screen, after rescaling. If the voltage is higher than the preceding week, continue adjusting and rescaling until the proper voltage is reached. If you are unable to reach the proper voltage, try adjusting the second screw.
   c. Note: Normally the voltage stays the same from week to week, but as the lamp nears the end of its usefulness, the voltage reading will go up. If a new lamp is installed, the starting voltage may be different than the previous lamp. Record millivolt reading on worksheet.

9. After adjusting for maximum signal, hit "Rescale" (F1). The photomultiplier voltage will be displayed. If the reading matches the previous week, record the voltage on the new worksheet. If it is out of range, readjust lamps. If voltage is still out of range, notify Chemist.

10. Press "Index" (F10) key and select "Standards" (number 7). Verify that the values of the standards are correct (see previous worksheet for standard values). To select a value to change, use the up and down arrows. Enter the correct value with the keyboard.

11. Check to see that drain hose, located below the Spectra 300A, is inserted into the drain bottle. (empty after each use).

12. Press "Index" key, enter number 18 (Signal Graphics), and press "Enter".

13. Press "Shift" and "Instrument Zero" (F10).

14. Light burner by pressing ignite button. Aspirate DI water for about 10 minutes. This will allow burner temperature to stabilize.

Standard and Sample Preparation:
Required sample preparation depends on the metal form being measured.

Procedure for Ca, Mg, Na, and K
1. Label the 10 ml beakers with the standard value; label the sample beakers with the last three numbers of the tiny tab number. Using the adjustable pipette, pipette 1.0 ml of sample or standard into each disposable beakers.

2. Add 9.0 ml of 1.11% lanthanum to each sample or standard using the adjustable pipette.

3. Repeat the process once again by diluting 1 ml of the diluted sample to 10 ml with the 1.11% Lanthanum. The samples have now been diluted 1:10 and 1:100. Alternatively use proportionally smaller volumes (i.e. .5 ml sample and 4.5 ml of 1.11% lanthanum).

4. The standards are prepared from stock solutions that when diluted 1:10 will give the necessary concentrations for calibration. The stock solutions are prepared from 1000 ppm standard metal solutions purchased from Ricca Chemical Co. Record dates of preparation and expiration (3 months) in sample prep manual.

5. The final concentration of calibration standards will be,

    1. Ca: 1.00, 3.00, 5.00 and 10.00 mg/l
    2. Mg 0.10, 0.50, 1.00 and 1.50 mg/l
    3. Na 0.10, 0.50, 1.00, 1.50 and 2.50 mg/l
    4. K 0.10, 0.50, 1.00, 1.50 and 2.50 mg/l

6. Set report format: Go back to index by pressing the "Index" (F10) key, then select the "Report Format" (number 13). Here you can enter the name of the operator, batch name, and date. No other changes are usually necessary.

7. Start program: Press the "Start" (F11). The screen will show the message "Select Lamp 3"; press "Start" (F11). The program will now run to completion.

8. Calibration of other Metals besides Fe/Mn: The other metals tested by flame AA does not require an ionization suppressor and can be directly aspirated. See specific method on computer for required calibration standards.

Standard and Sample Preparation: Procedure for Fe:

1. Label the sample beakers with the last three numbers of the tiny tab number. Using the adjustable pipette, pipette 1.0 ml of Ca solution into each disposable beakers.

2. Add 4.0 ml of sample to each beaker using the adjustable pipette.

3. The standards are prepared from 1000 ppm standard metal solutions purchased from LabChem or Spex Certiprep. Add 20 ml Ca solution and 1 ml conc HNO3 to each 100 ml of standard prepared. Record dates of preparation and expiration (3 months) in sample prep manual.

4. The final concentration of Fe calibration standards will be: 0.3, 0.5, 1.0, and 3.00 mg/l

5. Set report format: Go back to index by pressing the "Index" (F10) key, then select the "Report Format" (number 13). Here you can enter the name of the operator, batch name, and date. No other changes are usually necessary.

6. Start program: Press the "Start" (F11). The screen will show the message "Select Lamp 3"; press "Start" (F11). The program will now run to completion.

Quality Control:

1. Analyze a Blank after every 10 samples to verify baseline stability. Rezero when necessary.
2. Duplicate Spikes - replicate spikes are to be performed on 10% of samples. Recovery of spike in drinking water should be between 80% and 120% with a precision of 20%. Recovery of spike in wastewater should be between 75-125% with a precision of 25%. Spike level should not exceed MCL for analyte. Spiking solutions are available from Cresent Chemical Co.or SPEX.
3. External Reference Sample - Analyze a known reference sample after initial calibration and after every ten samples to confirm the test is in control.
4. See Table 3111:III in Standard Methods for recommended concentrations of standards to be run, limits of acceptability, and reported single operator precision data.
5. Analyze External Reference Sample on quarterly basis. Solutions available from APG, ERA or SPEX.

CRITERIA FOR ACCEPTABILITY OF RUN

1. Recoveries of spikes and controls are within acceptable range.
2. Blank values below detection levels.
3. Acceptable levels of precision.

NOTE: If any of the acceptance criteria are not met, the analyst must stop the run, correct the problem and and retest the samples.

OUT OF CONTROL PLAN

No sample should be reported until the all acceptance criteria have met. Or the out-of-control condition has been corrected and any problems or departure from protocol identified.

Trouble Shooting:

1. PROBLEM - poor precision,
   Check alignment of hollow cathode lamp. Check that capillary hose is not clogged. Make sure burner is clean and flame appears smooth and even. Replace pinched or crimped capillary tubing.

2. PROBLEM - error message
   Refer to instrument service manual

3. PROBLEM - Contamination
Check supplies associated with sample collection for contamination. Check rinse water, sample diluent, pipettes, sample cups. Make sure work area is free from dust.

Shutdown Procedure:
Turn off acetylene, IBM PC,and AA300, and exhaust hood, in that order.

Calculations:
The results will be printed and should be recorded on a worksheet. The dilution factor must be shown and considered in the calculations.

Reporting:

1. The data from the printout should be transferred to the worksheet. Verify that controls were within acceptable range and that duplicates are within range.

2. The lab clerk enters the results into the computer. Results are reported in units and number of significant figures consistent with MDL of method.

References:

1. "Analytical Methods for Flame Atomic Absorption Spectrometry" Varian Techtron Pty, Limited, 1989.

2."Standard Methods for the Examination of Water and Wastewater"
18th Edition 1992 by APHA, AWWA, and the WEF.

Written by: David Holland
Date: January 1999

Approved by:________________________
Laboratory Director

DETERMINATION OF INORGANIC ANIONS
BY ION CHROMATOGRAPHY (EPA METHOD 300.0)
USING THE DIONEX DX-80 ION ANALYZER

PRINCIPLE
This method determines the following inorganic anions: fluoride, chloride, nitrite, bromide, nitrate, phosphate and sulfate.

A small volume of sample (approx. 1 ml) is loaded into the ion chromatograph. The injection valve injects 10 ul of the sample into the flow of eluent. The eluent (a NaHCO3 - Na2CO3 solution) flows continuously through the IC and serves as a carrier for the 10 ul of sample and facilitates in the separation process.

The anions of interest are separated using suppressed conductivity detection, and are identified and quantified by comparing data to those obtain from a standard solution. The major parts of the system are the liquid eluent, high pressure pump, sample injector, guard column, the separator column, the chemical suppressor and the conductivity detector. The guard column protects the separator column, which separates the anions based on their size and charge. The function of the suppressor is to chemically reduce the background conductivity of the electrolytes in the eluent, and to convert the sample anions into a more conductive form. The detector then detects the conductivity of the solution, which varies depending on the concentrations of the anions (higher conductivity indicates a greater concentration of the anion).

SAMPLE CRITERIA
The holding times for drinking water samples are as follows:

Fl^-	28 days
Cl^-	28 days
NO_2^-	48 hours
NO_3^-	48 hours
SO_4^-	28 days
Br^-	28 days

Samples submitted for IC testing routinely should be run within 48 hours of collection, especially for nitrite and nitrate. If testing needs to be delayed, the sample can be preserved with sulfuric acid; preserved samples can be held for up to 28 days and the nitrate results reported as combined Nitrate/Nitrite. Any samples not tested within specified holding times should be identified on the worksheet.

Samples bottles dedicated for IC testing only are placed on the IC bench. As soon as a sample is setup, place it on the white tray for easier storage. After 6 weeks the containers should be emptied and discarded. Nondedicated samples (i.e. those also submitted for additional testing) should be returned to the designated cart after IC testing.

QUALITY ASSURANCE

Operator competency - Ion chromatography may be performed only by analysts who have been trained and who have demonstrated competency with the procedure. One check consists of preparing the calibration standards and calibrating the I.C. An r-value of 0.995 or higher (correlation coefficient of 99.95%) in the linear fit type must be attained for each analyte of interest. Another way to demonstrate competence is to run a minimum of four replicate analyses of an independently prepared sample. Each analyte of interest in the sample should have a known concentration between 5 and 50 times the MDL.

Blank - A blank consisting of nanopure water should be included at the beginning of each run. The results for the blank must be below the MDL for each analyte.

Control standard(s) - Controls representing two concentration levels for each analyte (ICMIX HIGH & ICMIX LOW) must be analyzed as described below. The source of the analytes used to prepare these controls must be different from the source used to prepare the calibration standards. An ICMIX HIGH stock solution of the 7 anions with the following final concentrations:

Anion	*Final Conc*	*Preparation in 500 ml volumetric flask*
Fl^-	20 ppm	10 ml of 1000 ppm Fl std
Cl^-	100 ppm	50 ml of 1000 ppm Cl std
NO2	65.5 ppm	10 ml of 1000 ppm NO2-N std
Br^-	20 ppm	10 ml of 1000 ppm Br std
NO3	100 ppm	50 ml of 1000 ppm NO3 std
PO4	100 ppm	50 ml of 1000 ppm PO4 std
SO4	100 ppm	50 ml of 1000 ppm SO4 std

should be kept on hand. Use this undiluted at the beginning of the run and after every tenth sample. Each week, prepare an ICMIX LOW solution from the ICMIX HIGH solution as follows: Using a 100 ml volumetric flask add 1 ml if ICMIX HIGH using the 1 ml volumetric pipet and fill to mark with nanopure water. Record date made in the IC logbook under Quality Control. Run the IC LOW at the beginning of the days run and after every 10^{th} sample after the IC HIGH. The percent recovery for each anion should be between 90 and 110%.

Duplicate spikes – Duplicate spikes should be run after every tenth sample. The spike should not be less than four times the MDL, and it should increase each anion concentration by more than 25% of the background value. A suitable spike can be prepared by adding one part ICMIX HIGH to three parts sample. The average percent recovery for each anion should be between 80 and 120%. The duplicate spikes should be within 10% of each other. Record average percent recovery of spikes and duplicate percent difference on worksheets. Note: if the concentration of the spike is less than 25% of the background concentration, the spike recovery should not be calculated.

If any of the above control criteria are not met, do not report sample results until the problem has been resolved.

External controls & chart analysis - In addition to the control standards tested with each batch of samples, an external reference standard (i.e. SPEX IC standard or WS proficiency sample) should be tested on a quarterly basis; however we like to run one at the end of each run.

CALIBRATION FOR GOUNDWATER (DRINKING WATER AND MONITORING WELLS):

Calibration for groundwater samples is described below. Calibration should be performed whenever: 1) controls are out of range; 2) a new batch/lot of eluent/regenerant is made or 3) when a column, suppressor or detector is changed.

1. Prepare 1/10, 1/100, 1/1000 dilutions of the calibration standard ordered from Dionex, which contains 20 mg/l fluoride, 100mg/l chloride, 100 mg/L nitrite, 100 mg/L bromide, 100 mg/l nitrate, 200 mg/L phosphate and 100 mg/l sulfate.

2. Run calibration standards beginning with the highest dilution (1/1000) first.

3. Create calibration sequence: File – New – Sequence – Standards – Next. Skip section on Choosing Timebase – name the sequence *calibMMDDYEAR* and initials – Next – Done.

4. Add sequence to batch file before starting

5. After all four calibration standards have been ran, check the calibration curve.

   a) Double click on any of the calibration standards (Cal Std 1). You will get a chromatograph

   b) Click on Calibration Plot icon, upper right corner or click on VIEW – Calibration Plot. You will see a graph of the first analyte along with the correlation coefficient percentage for each analyte. Only anaytes with percentage of 99.5 or greater are acceptable. Generally try for a 99.98% for an average of all seven analytes to pass quality control checks. See the principle analyst if the result is a lesser value.

   c) The mean retention times and detection range are automatic on the DX-80 Ion Analyzer and can not be changed or edited.

PREPARE MDL STUDY

The Method Detection Limit is the lowest concentration of a substance that can be identified with accuracy and confidence by a certain method or analysis.

1) Prepare a Cal Std 1 level each analyte separately using the secondary standards (not Dionex mix)
2) Make seven replicates of this dilution and run through the Ion Analyzer under the Unknown Method.
3) Collect data and calculate the standard deviation for the seven replicates. Multiply the standard deviation values by 3.143. This number will be the Method Detection Limit.

GENERATE BACKLOG REPORT:

1) On a network computer – not the Instrument computer. Double click on LABWORKS icon. Enter password. Click on OK. Click on backlog. Click on analysis code. Click on OK. Type in #ICANION. Click on OK. Click on display report. Click on print. Click on exit until you are out.

2) Check the clipboard to see if a worksheet has been initiated listing samples that need repeat testing; if so, append worksheet with samples on backlog report.
   a) Account for all specimens on backlog report
      i) Samples may have been tested in a previous run but not recorded. Record these results and give to the clerk.
      ii) If a sample appears on the backlog but needs to be tested by a different method (i.e. wastewater), inform the clerk so that the analysis ordered can be modified.
   b) Include any "new" samples on the I.C. bench that have not yet been entered into the computer.

SAMPLE PREPARATION

Groundwater (drinking water and monitoring wells) should be filtered through 0.45 um membrane filters before injection:

1) Rinse the syringe once with the sample water. Then fill syringe with about 10 ml of sample water.
2) Filter a minimum of 2 ml of sample through the 0.45 membrane into a labeled autosampler vial discarding the first few drops.
3) Place autosampler cap on vial and press down using the provided tool. Make sure the cap goes in straight and remove any air bubbles seen in the vial (invert or knock gently).
4) Place sample in autosampler rack. The order in the rack must match that on the schedule. Note: If you suspect the result of a sample to be above that of the calibration standard for an analyte, make an appropriate dilution. Check by measuring conductivity – anything greater than 700 uS will need to be diluted.
5) Include duplicate spikes for every 10th sample. Add 1 part ICMIX high to 3 parts filtered sample. Then IC HIGH, LRB, IC LOW. The laboratory reagent blank (LRB) is necessary to minimize carry over as the IC low is 100 times less than the High. Double check any samples where analyte concentrations are low after a high sample to verify analyte is even detected.

Samples which may contain high concentrations of chloride or organic contaminants (Carmel Area Wastewater District and ESF), are run on the DX-100 and require additional filtering through Dionex OnGuard P, Dionex OnGuard Ag, and Dionex OnGuard H filters before injection. See supplemental procedures.

SYSTEM START-UP:

1) Ensure the **eluent** bottle is at least ¼ full. If it is less, depending on size of run, prepare new eluent (and regenerant):
   a) Prepare 2 liters of a final eluent concentration of 8.0 mM Sodium Carbonate and 1.0 mM Sodium Bicarbonate by diluting one Dionex AS 14A Eluent Concentrate bottle (P/N 057060) into two 1L-volumetric flasks. Bring each to volume (1000 ml) with nanopure water. Makes 2 liters.
   b) Use the designated filter/vacuum flask, a filter funnel, a clean 0.45um membrane filter, and a large magnetic stir bar to degas the eluent. Pour the eluent into the filter funnel and turn on the vacuum. Set the magnetic sticker at medium to high speed. Once all the eluent has been filtered, keep the vacuum and magnetic stirrer on for 15-20 minutes, allowing the eluent to degas.
   c) Turn off the magnetic stirrer and the vacuum. Remove the filter funnel. Carefully decant the degassed eluent into the eluent bottle, without aerating. Make sure the cap is on tightly, and the tubes are securely attached.

2) Whenever new eluent is prepared, new **regenerant** must also be made.
   a) Prepare 2 liters of a final anion regenerant concentration of 72 mN Sulfuric Acid by adding one Dionex Anion Regenerant Concentrate bottle (P/N 057559) to two liters of nanopure water.
   b) Mix in the regenerant in the designated filter flask using the stir bar and degas for 15-20 minutes.
   c) Turn off the magnetic stirrer and the vacuum. Remove the filter funnel. Carefully decant the degassed regenerant into the REGEN bottle, without aerating. Make sure the cap is on tightly, and the tubes are securely attached.

DX-80 OPERATION

1) Turn on nitrogen gas cylinder (main knob only), autosampler (rear right hand corner), ion analyzer (rear panel right hand side) and computer.

2) Double click on Peaknet to open computer program. **File – Panels\Dionex DX-80 System** for the Control Panel.

3) Under the DX-80 Status click on **CONNECT** to connect analyzer to computer

4) Turn on the pump by clicking the **ON** button on the DX-80 Control Panel. **Prime** the pump by turning the pump head waste valve knob counter clockwise and leaving it open for about 5 seconds. Close the pump valve knob by turning clockwise until secure. After changing to new eluent, it is a good idea to leave pump valve open until all air bubbles have been purged – look for the air bubbles coming out the eluent bottle until it reaches the waste line at the pump. This will allow any air bubbles to be pumped to waste instead of through the columns.
5) Allow the system to **equilibrate** for 30 minutes minimum, generally one hour if new eluent is used. Once ready, the **operating pressure** should be 2000+- 300 psi (usu 2100

psi); and the operating **total conductivity** background should be < 30 uS (usually 25.00uS). You can offset the background and zero the reading by clicking the Autozero button on the Control Panel.

6) To begin a run, create a sequence worksheet by clicking on **File – New – Sequence**. (May have to do this twice if worksheet is not already open.)
   a. It will then prompt you to choose Standard or Unknowns. Choose **Unknowns - Next**
   b. Skip **next** screen where it prompts you to specify timebase,
   c. **Estimate** number of unknowns (you can always add or delete samples from sequence when done.
   d. Fill out file name you wish to save the file We save under ***MMDDYEAR*** and **initials**: *(05052002tl)* and press **enter**.
   e. Press **Done** when prompted to exit wizard.
   f. A worksheet will appear where sample identifications can be added after the calibration data (line #5). Follow printed worksheet – first include a *blank, ic low, ic high, lrb*, then the samples. Note for the first set, the lrb is listed as a sample. *Duplicate spikes* are required for every 10^{th} sample or a minimum of 10% of samples. Finish off sequence with a known quality control standard, usually a proficiency standard such as *WS 60* or Ultra QC and another blank (LRB).
   g. Change *dilution factor* if sample was diluted; default is one. Save by pressing the SAVE icon (floppy disk).

7) To start the run – click on **Batch – Edit – Add –** double click on the newly created sequence, or the one you want run – then **Start** to begin.

8) Make sure autosampler vials are in order and the green light is on 'Run' not 'Hold'.

9) Record date, total conductivity and pressure in the log notebook at which the run has started.

10) During or after the run, verify that the blank and QCs (IC HIGH, IC LOW, IC CHECK) are within range. If not stop the run by clicking on **Batch – Stop - after current sample**, and notify principal analyst to investigate and solve the problem before resuming the run.

REPORTING RESULTS

1) When run is complete the analyst performing the run is responsible for recording and reporting results. Review each chromatogram to verify that the peaks were properly identified. Retention times may shift if there was a sudden change in pressure. Changes to the peak name can be made by a right click on the peak and choosing the correct analyte then save.

2) The results are found on the worksheet next to the sample ID and can be exported to an excel file for accuracy calculation:
   a) Click on any sample cell – i.e. ic low, cell will be outlined.

b) Click on **File – Batch Report – Export** (unclick the Printout option- computer is not connected to any printer) – **Excel file format**

c) For sheets to be exported, choose only " **Summary – INJ vs. Area, Ht, Amt**." Unclick the Integration, Calibration, Peak analysis, Summary-INJ vs. Anion, and Audit Trail options as they are extra and rarely needed for our purpose.

d) Click on **Finish** then **OK** on batch menu. Status will appear and when transfer is complete, press **OK** to exit.

3) To copy exported file onto a floppy, right click on Start icon on lower left screen and choose EXPLORE for Windows Explorer. Under **C:\Chromel\Export** folders are the files just exported. Highlight the correct sequence and drag to **A:** drive to copy file. (Make sure you have a floppy disk inserted).

4) Open exported file under an EXCEL program – the instrument computer does not have one so use a network computer. You will see three types of charts: first- Sample vs. Area, second - Sample vs. Height, and third - Sample vs. Amount. Copy all of the **Sample vs. Amount** table to an old/previous excel file.

5) The Excel Results worksheet is permanently saved under **G:\Laboratory\Data\Water\IC Data\2002** under the correct month. It is also saved in Tess' computer under **C:\My Documents\IC Data** and correct year and month. Easiest way to create the worksheet is to open a previously saved file (of the same year and month) and then cut and paste the data. There are two worksheets in each file, one for the complete results, the other for the raw data (the Sample vs Amount table exported from peaknet).

a) Before any changes are made, save the file under a new name: MMDDYY and initials

b) On RAW worksheet, delete old table and replace with recently ran sequence data. Add a column between Sample ID and Fluoride Amount for the dilution factor.

c) Change Date Analyzed and Analyst if applicable. Calibrations are generally done once a month with the most recent noted under Date of Calibration – change if necessary.

d) **Copy** and paste data results from raw worksheet onto Results worksheet under correct sample name. Use the **Paste Special option – Values** - to retain similar fonts on results worksheet. **% Recoveries** will be automatically calculated as will **% Differences**, and **Averages** for the duplicate spikes but references to certain cells may need to be changed for the correct result.

e) Verify that all QC are accurate before entering into labworks.

6) For drinking water, results should be recorded as ND – Not Detected for levels below DLR (Detection Limit for Reporting) as follows:

a) Fluoride 0.1 mg/L

b) Nitrate 2.0 mg/L

c) Sulfate 0.5 mg/L

d) Bromide 0.1 mg/L

e) Chloride, Nitrite, Phosphate 1.0 mg/L

f) Any samples with readings above the calibration range (20 mg/L fluoride, 100 mg/l chloride, nitrite, bromide, nitrate, sulfate, and 200 mg/l phosphate) needs to be diluted and repeated in the next run. List these samples on a new worksheet with the appropriate dilution and place the worksheet on the clipboard.

7) Do not report results if control/spike values do not fall within limits (refer to section on quality control). If controls, spikes, etc. are out of range, notify the principal analyst. If controls are within limits, date and initial the worksheet and give the worksheet to the clerk for data entry. When the worksheet and backlog are returned place them in the binder.

SHUT DOWN

After the run is complete the Ion Analyzer can be shut down. The IC should be shut down on weekends if the system is not in operation on Friday night so as not to damage the suppressor unit:

1) On the Control Panel screen of Peaknet - turn **OFF** pump and **DISCONNECT** DX-80
2) Close Peaknet.
3) Turn off DX-80, autosampler and close nitrogen cylinder valve.

PREVENTIVE MAINTENANCE:

1) Each quarter, replace the bed supports on guard column
2) Maintain the following spare parts. These items are considered consumables:
   a) Anion Refill Kit (Part No. 057069) contains 4 bottles each of AS14A eluent and anion regenerant concentrate.
   b) AS14A anion separator column, 3 mm (Part No. 056901)
   c) AS14G anion guard column (Part No. 056899)
   d) AMMS III suppressor (Part No. 056751)
   e) DS5 Detection Stabilizer (Part No. 057290T)

DOS AND DON'TS

* Try to make additions, changes, and deletions to the sequence during the middle of a run and then save immediately. If the changes are not saved immediately, the program may get confused on which sequence to use and will freeze. If this happens, wait until the current sample is completed, turn off all equipment and wait for about 15 minutes before restarting.

* Be gentle when loading samples onto the autosampler, especially the first rack. If racks are installed too roughly, conveyor belt may get stuck and samples will not be injected in the proper sequence.

REFERENCES:

1) DX-80 Ion Chromatograph with SRS Control Operator's Manual, Dionex Corporation, 2002.
2) Methods for the Determination of Inorganic Substances in Environmental Samples, Method Number 300.0, Determination of Inorganic Anions by Ion Chromatography, John D. Pfaff, U.S. Environmental Protection Agency, 1993.
3) Standard Methods, 18th Edition, 1992. Part 4110.

Originally written by: Johanna Rosen for DX-100
Date: 12-96
Updated by: Theresa Lam for DX-80 Ion Analyzer
Date: 05-02

Approved by: ____________________________
(Lab Director's signature)

Chapter 7
Appendix 7-C

MCWRA's Chloride Data Contouring Protocols

WATER RESOURCES AGENCY

M E M O R A N D U M

Monterey County

DATE: April 17, 2018

FROM: Sean Noble

TO: Water Quality

SUBJECT: How to Contour SWI in ArcGIS

Background

The purpose of this memo is to describe the process of creating the initial seawater intrusion contours using ArcGIS. This is an attempt to standardize the process. Contours are based on chloride (Cl) data sampled from coastal wells in the Pressure 400-Foot and Pressure 180-Foot Aquifers. This data for comes from three primary sources. First, coastal wells are sampled twice each summer by Agency staff. Second, monitoring wells are sampled once each summer, using a portable pump. Finally, data from outside sources are pulled in to supplement the data and create better geospatial coverage. Historically contours are generated on every odd year, using even year data to fill any data gaps. Data is used to create contours that are then added to the historical seawater intrusion maps. The maps are as follows:

P180 Sea Water Intrusion Map

P400 Sea Water Intrusion Map

(In the future the deep aquifer may be added to the process)

After reviewing all the data and uploading it to the WRAIMS database, we are ready to move on to ArcGIS.

**** The 2017 year Pressure 400 will be used as an example ****

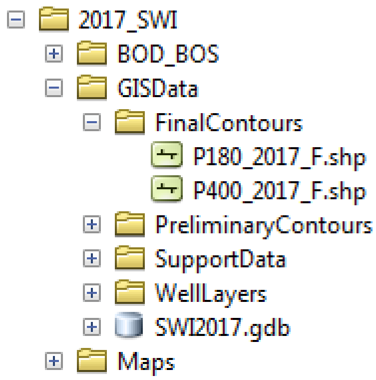
ArcCatalog

Open ArcCatalog and navigate to R:\Workspace\Common\WaterQuality\SWI. Notice that the folders are labeled by year with the exception of the CommonDirectories. This folder stores GIS data that can be used for any year that is contoured. It contains commonly used boundaries, databases, and layers.

In ArcCatalog copy/paste folder of the last year contoured (2015_SWI) and rename current year (2017_SWI).

This will be the naming convention for naming files:

Aquifer_Year _Version(if applicable), examples:



Within each year there are two main folders:

GISData

FinalContours, storage of approved shapefiles

PreliminaryContours – primary exported contour shapefiles

SupportData – secondary export shapefiles, database tables, and imagery

Maps

Stores final project maps and products

ArcMap

Step 1 – Project Formatting

Rename the ArcMap contour projects stored in the Maps folder:

R:\Workspace\Common\WaterQuality\SWI\2017_SWI\Maps**P400_2015.mxd** ->
R:\Workspace\Common\WaterQuality\SWI\2017_SWI\Maps**P400_2017.mxd**

By using the previous project, all of the background shapefiles can stay and be reused for the new project.

Step 2 – Database Formatting

Navigate to:
R:\Workspace\Common\WaterQuality\SWI\CommonDirectories\Databases
And open the **SWIContours (Current).mdb** database
First, make sure that all relevant data has been reviewed and loaded to WRAIMS. Open the **_Contouring_Start_** table and edit the year to the year being contoured.

Run the macro: **SWI_ContourTables**

The macro SWI_ContourTables runs four make table queries to produce these tables:

SWI180_ALL
SWI400_ALL
SWI_180_CONTOUR_WELLS

SWI_400_CONTOUR_WELLS

The '…_ALL' tables include all wells that are in the Monthly Water Quality program and in the appropriate aquifers. Some wells have the aquifer designation PRESSURE BOTH. These well are included in both '…_ALL' tables, but are not included in the contouring. The '…_CONTOUR_WELLS' tables are a subsection of the '…_ALL' tables and only include wells to be used in contouring for the respective aquifers.

If certain wells need to be excluded, modify the **tblExcludedWells** table. Wells are excluded based on facility code and aquifer (180 or 400), so make sure both of those fields are filled out correctly. This table is used dictate which wells are excluded and to document which wells have been excluded and why. It should be kept updated as changes to the dataset are made. After adding new wells to tblExcludedWells, rerun the macros to update the tables.

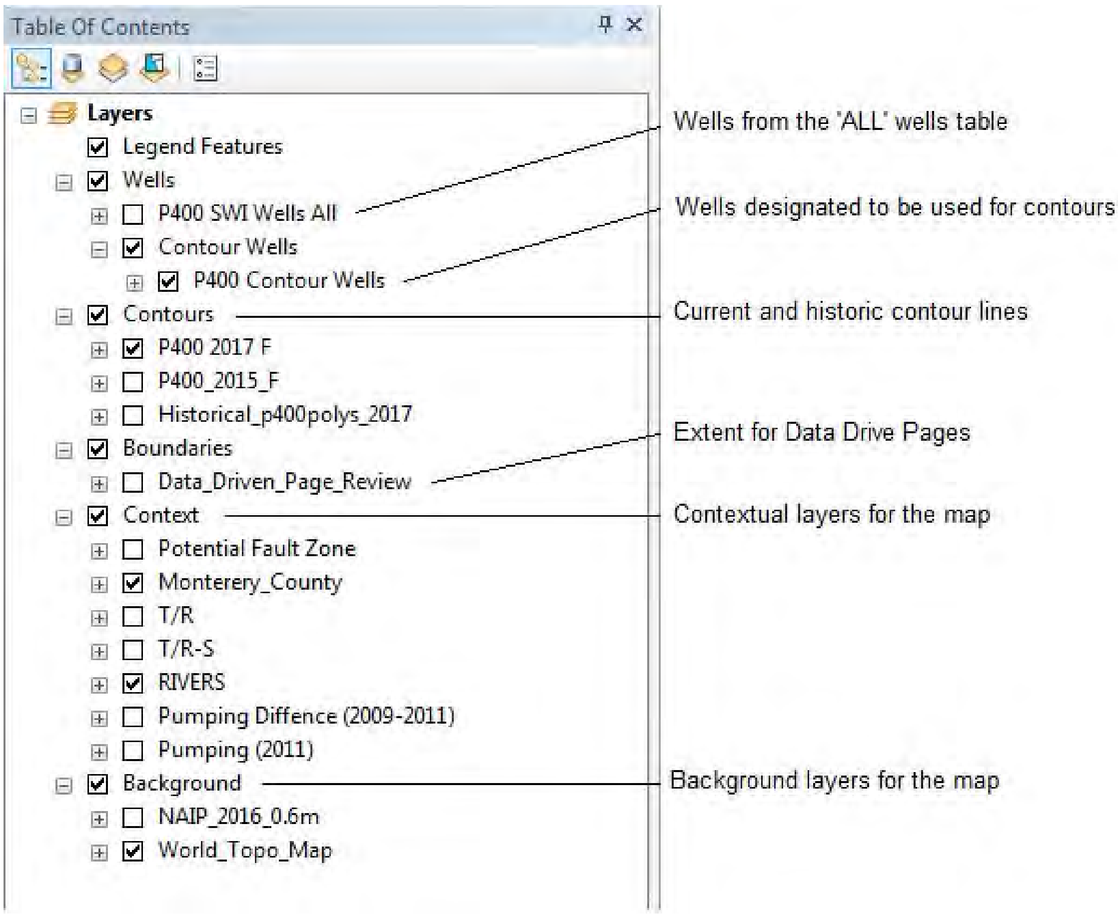
The **ExternalData** table can be used to add data that is not stored in WRAIMS but has been approved to be used for contouring. In the 2017 example, the data from the Monterey Peninsula Water Supply Project monitoring wells was added this way. Only wells with a FACILITY_CODE and in the WellsAll GIS layer can be utilized in this manner (R:\Workspace\Common\MapElements\WellsAll.lyr).

The tables include both present and past measurements and automatically include data from the previous year if the current year is missing data.

Field Name	Description
FACILITY_CODE	Facility Code of the well
FACILITY_NAME	State Well ID based on township and range
BASIN_NAME	Aquifer designation
ContourValue	Value used to contour as a year average of all samples taken during the most recent year
ContourValYr	Year that the value used to contour was sampled
ConYrCl	Contour year average of Cl data
ConYrStDev	Contour year standard deviation of Cl data
1yrBackCl	Previous year average of Cl data (2016)
1YrStDev	Previous year standard deviation of Cl data (2016)
2yrBackCl	Two years prior average of Cl data (2015)
2YrStDev	Two years prior standard deviation of Cl data (2015)
3yrBackCl	Three years prior average of Cl data (2014)
3YrStDev	Three years prior standard deviation of Cl data (2014)
PERF_START	Start of recorded perforation in well casing
PERF_END	End of recorded perforation in well casing
Use	Abbreviation of the wells primary uses
WATER_USE_DESCRIPTION	Description of the wells primary uses
FACILITY_STATUS_NAME	The status of the well

Step 3 – Data Labeling & Symbology

In ArcGIS:
All of the well layers in the ArcMap projects should automatically update to the 'Current' database values. The projects should be laid out in similar formats as demonstrated below. Compare the values and dates of various wells with recorded values in WRAIMS to ensure the correct data is being used.



Step 4 – Draft 1

To generate profiles run the tool
ArcToolbox -> SWIContouringTools -> SWI_Spline_Coastal_Contouring

And fill out the fields

Contour Wells:	Wells\Contour Wells\P180 Contour Wells
Z value field:	SWI_400_CONTOUR_WELLS.ContourValue
Spline type:	TENSION
Number of points:	4
Weight:	0.01

Contour Output:

R:\Workspace\Common\WaterQuality\SWI\2017_SWI\GISData\PreliminaryContours\p400_2017_v1.shp

In Layout view change any labels and titles to match the current year and draft, and make any appropriate changes to the legends.

Export to PDF, R:\Workspace\Common\WaterQuality\SWI\2017_SWI\GISData\PreliminaryContours\p400_2017_V1.pdf. From PDF, print to 11x17 and review. If all the data is there and the labels and symbology are correct then Print to Plotter, 30x30.

Steps Summary

Version 1 is the computers attempt to contour the data based on all the data that has been collected and reviewed for the appropriate aquifer. The next set of versions are created through careful examination of the data to establish what wells will be excluded from the contouring. Use past exclusion to help with wells with ambiguous aquifer designations and refer to well logs, well measurement histories, piper diagrams, and sample notes for wells that don't seem to fit the general trend. Once the list of wells to exclude is agreed upon, run the tool again. This process is iterated until **tblExcludedWells** is agreed to be final by the project supervisor. The next step is to generate the last set of computer generated lines (AT_2017_F) and edit them to match previous contours and represent the general trend of seawater intrusion.

Editing Contour Lines

The computer generated AT_2017_F needs to stay intact incase it has to be referenced at some point. The first thing to do is copy/paste AT_2017_F into the R:\Workspace\Common\WaterQuality\SWI\2017_SWI\GISData\FinalContours folder (this will be the version you edit). In ArcGIS:

Right click on the layer you wish to edit
Go to **Edit Features**
Click **Start Editing**

It sometimes makes editing easier to make the edited layer the only selectable layer.

Right click on layer
Go to **Selection**
Click on **Make This The Only Selectable Layer**

Double-click on the contour line you wish to modify. Many vertices will appear on the line as boxes. These are the points to drag in order to modify the line. When adding lines remember to edit the attribute table to add the appropriate contour value. Due to the limited data the contours will have to be heavily edited to achieve a general representation of sea water intrusion into the aquifers. As a general rule, lines will not recede approved by the project lead. Unless otherwise directed, lines that are seaward of past contours will default to the furthest inland historical extent (use the historical contour lines). Judgement will have to be used to decide how to alter lines to represent general seawater intrusion: work with the project lead on hand kriging and editing.

<u>Final Clean Up</u>

Once the list of excluded wells has been finalized copy the “Current” database and rename it with the contour year. This creates a backup and documents which wells were used and what values. Similarly, ensure that all shape files are in the correct places and properly labeled, especially the final contours.

Chapter 7
Appendix 7-D

DDW and ILRP Wells in the Water Quality Monitoring Network

180/400-Foot Aquifer Subbasin DDW Wells								
Well ID	Water System Name	Well Screen Info			Coordinates		Monitoring Date Range	
		Top of Screen Depth (ft bgs)	Bottom of Screen Depth (ft bgs)	Screen Length (ft)	Latitude (NAD83)	Longitude (NAD83)	First Year	Last Year
2700518-002	WATSONVILLE PRODUCE INC		0	0	36.78700	-121.72139	4/6/2004	11/12/2010
2700547-001	DESMOND RD WS #03		248	40	36.80299	-121.70051	4/8/1987	12/21/2020
2700548-001	DOLAN RD MWC		246	75	36.79594	-121.73707	3/30/1987	9/21/2020
2700577-001	ELKHORN SCHOOL WS		0	0	36.79711	-121.71809	4/8/1987	10/12/2020
2700579-001	ELKHORN RD WS #04		140	10	36.84000	-121.72056	5/14/1987	11/3/2020
2700594-001	HIDDEN VALLEY WA		404	40	36.83722	-121.70411	3/25/1987	9/22/2020
2700624-001	LEAFWOOD COMMUNITY WA		240	56	36.80840	-121.70459	5/14/1987	12/21/2020
2700674-002	PARADISE LAKE MUTUAL WATER CO.		398	40	36.81644	-121.70550	1/26/2004	4/13/2020
2700674-003	PARADISE LAKE MUTUAL WATER CO.		340	60	36.81644	-121.70550	1/26/2004	8/20/2020
2700802-001	WALKER VALLEY WS #03				36.81292	-121.71514	5/14/1987	8/27/2013
2700842-002	BAUMANN RD WS #01		290	20	36.78700	-121.72139	12/30/2003	11/9/2020
2700850-001	ALTMAN PLANTS WS #03 - ESPINOSA 303		225	355	36.74652	-121.69451	12/18/2003	6/16/2020
2700992-001	MILLER'S LODGE WS		14	10	36.62422	-121.62999	8/22/1986	12/3/2019
2700998-004	BUD ANTLE MARINA WS				36.72764	-121.78220	1/26/2011	3/30/2020
2701057-001	N/A		325	53	36.57131	-121.52222	1/30/2004	1/11/2016
2701109-001	ASSOCIATED TAGLINE WS		0	0	36.71564	-121.71908	5/27/1987	6/2/2020
2701152-001	FLORICULTURA PACIFIC WS		508	72	36.59308	-121.53903	10/14/2003	9/2/2020
2701153-001	GROWERS TRANSPLANTING WS		410	75	36.73547	-121.68475	10/15/2001	9/14/2020
2701171-001	CHEVRON OIL FIELD WS		88	40	36.59308	-121.53903	7/19/2012	7/19/2012
2701202-002	CAL AM WATER COMPANY - CHUALAR		750	150	36.57035	-121.51500	7/7/1998	3/20/2020
2701202-004	CAL AM WATER COMPANY - CHUALAR		760	140	36.56959	-121.51371	11/19/2002	3/20/2020
2701214-001	FIRESTONE BUSINESS PARK WS		524	24	36.62672	-121.59290	4/8/1987	2/18/2016
2701214-002	FIRESTONE BUSINESS PARK WS		517	28	36.62673	-121.59299	12/9/2003	12/22/2020
2701229-001	BLUEROCK VIEW APARTMENTS WS				36.69000	-121.69000	4/6/1987	12/29/2020
2701232-001	OLD NATIVIDAD RD WS #01		390	100	36.65907	-121.62292	8/14/1986	12/21/2020
2701325-001	SAN CLEMENTE RANCHO WS				36.50417	-121.50667	4/30/2002	9/5/2018
2701364-001	PEDRAZZI MWC		474	34	36.60000	-121.63000	8/28/1986	8/12/2020
2701414-001	ARCHER RD WS #02				36.79194	-121.69972	3/16/1987	3/16/1987
2701452-002	MONTEREY DUNES MWA		1323	60	36.76944	-121.79528	12/11/2002	7/23/2019
2701452-004	MONTEREY DUNES MWA				36.75820	-121.80102	1/8/2007	12/11/2019
2701498-001	HARBOR VIEW WA		220	10	36.81727	-121.71527	3/25/1987	11/22/2020
2701515-001	MOSS LANDING HARBOR WS		400	350	36.79877	-121.74571	8/1/1986	8/17/2020
2701515-005	MOSS LANDING HARBOR WS				36.62620	-121.64660	8/15/2013	8/17/2020

2701575-002	N/A				36.59028	-121.60639	5/25/2018	12/11/2018
2701633-001	PARADISE RD WS #21		150	10	36.81387	-121.70236	3/4/2002	1/27/2011
2701647-001	GREEN ACRES WA		220	40	36.79628	-121.73238	4/21/1987	8/6/2020
2701683-001	MOSS LANDING MWC		309	245	36.79975	-121.74275	4/15/2008	7/6/2020
2701698-001	RIVER RD WS #02				36.50417	-121.50667	3/17/1987	1/9/2002
2701721-001	N/A				36.77000	-121.73000	5/27/1987	12/19/2000
2701768-001	N/A				36.73319	-121.77889	3/17/1987	8/4/2003
2701813-001	ARMSTRONG RD WS #01				36.69000	-121.70000	7/26/2003	1/17/2009
2701820-001	CORDA RD WS		520	40	36.51808	-121.46044	7/14/2003	12/15/2020
2701825-001	GLEN OAKS WS #01				36.51808	-121.46044	5/27/2003	8/10/2015
2701894-001	N/A				36.59000	-121.55000	9/17/1986	9/17/1986
2701897-001	BERRY DR WS #02		408	192	36.60000	-121.63173	8/21/1986	8/12/2020
2701912-002	SPRECKELS LN WS #03				36.63043	-121.66826	3/3/2016	7/14/2020
2701926-001	MORO RD WS #09		445	40	36.80299	-121.70051	3/16/1987	4/5/2016
2702121-001	ROSEHART INDUSTRIAL PARK WS		520	52	36.69611	-121.70072	4/24/2002	6/2/2020
2702135-001	FOOTHILL WA				36.56056	-121.56278	8/7/1986	11/3/2020
2702150-001	RIVER RD WS #19				36.48000	-121.47000	3/17/1987	3/21/2003
2702180-001	GRAVES SCHOOL WS		370	60	36.69611	-121.70072	4/6/1987	4/2/2020
2702226-002	CDFW ELKHORN SLOUGH ECOLOGICAL RESERVE		350	140	36.82403	-121.73577	6/26/1990	12/21/2020
2702226-003	CDFW ELKHORN SLOUGH ECOLOGICAL RESERVE		380	280	36.81519	-121.73198	6/4/2004	12/21/2020
2702259-003	LHOIST NORTH AMERICA WS				36.80333	-121.78278	4/8/2014	4/28/2014
2702320-001	HITCHCOCK RD WS #01		560	80	36.66430	-121.70081	7/26/2003	12/9/2020
2702440-001	N/A		0	0	36.51905	-121.52949	4/26/2004	10/13/2004
2702444-001	RIVER RD WS #28		430	0	36.59670	-121.62416	6/3/2004	9/17/2020
2702452-001	EL CAMINO MACHINE & WELDING WS		0	0	36.63669	-121.60194	4/21/2004	8/11/2020
2702452-002	EL CAMINO MACHINE & WELDING WS		0	0	36.63646	-121.60175	6/12/2013	11/24/2020
2702453-001	MARINA LANDFILL WS		40	210	36.71272	-121.76911	12/4/2002	8/3/2020
2702456-001	MONTEREY ONE WATER (FORMERLY MRWPCA)				36.70541	-121.76922	9/27/2017	10/5/2020
2702456-002	MONTEREY ONE WATER (FORMERLY MRWPCA)		670	80	36.63646	-121.60175	5/5/2004	8/1/2017
2702482-001	ALTMAN PLANTS WS #05 -ESP 325 (PREV CS2)		300	100	36.74564	-121.68665	1/14/2002	5/28/2020
2702484-003	GROWERS SERVICE ASSN WS (ICE)		604	28	36.65113	-121.63218	12/10/2003	5/14/2020
2702584-003	HITCHCOCK RD WS #02				36.66147	-121.68343	3/30/2011	9/14/2020
2702704-001	HARRIS RD WS #10				36.62422	-121.62999	3/9/2009	4/8/2020
2702964-001	PEZZINI FARMS WS				36.74189	-121.76960	6/7/2017	9/30/2019
2710005-003	CASTROVILLE COMMUNITY SERVICES DISTRICT		0	300	36.77122	-121.75435	4/8/1985	2/3/2020
2710005-004	CASTROVILLE COMMUNITY SERVICES DISTRICT		0	160	36.75543	-121.74379	4/8/1985	12/21/2020

2710005-005	CASTROVILLE COMMUNITY SERVICES DISTRICT		0	85	36.75679	-121.73658	4/8/1985	1/13/2020
2710005-009	CASTROVILLE COMMUNITY SERVICES DISTRICT				36.77133	-121.75403	3/13/2007	12/7/2020
2710007-004	GONZALES, CITY OF		400	260	36.49903	-121.43588	10/19/1987	8/4/2020
2710007-006	GONZALES, CITY OF		440	220	36.50561	-121.44638	6/24/1998	11/3/2020
2710010-002	CWSC SALINAS		249	210	36.67849	-121.65299	4/6/1982	4/1/2003
2710010-009	CWSC SALINAS		357	80	36.66113	-121.66068	3/9/1983	11/30/2020
2710010-015	CWSC SALINAS		330	63	36.65076	-121.62008	4/6/1982	5/27/2020
2710010-017	CWSC SALINAS		451	66	36.66456	-121.67020	9/29/1983	5/13/2020
2710010-019	CWSC SALINAS		360	144	36.65045	-121.63070	7/19/1982	12/9/2020
2710010-020	CWSC SALINAS		462	61	36.70258	-121.66350	11/14/1983	12/16/2020
2710010-023	CWSC SALINAS		330	135	36.67021	-121.67952	6/21/1983	7/29/2020
2710010-026	CWSC SALINAS		420	160	36.69746	-121.66701	5/12/1983	12/16/2020
2710010-027	CWSC SALINAS		350	190	36.66545	-121.68064	2/8/1984	8/11/2020
2710010-030	CWSC SALINAS		490	150	36.68826	-121.66590	4/30/1986	12/16/2020
2710010-077	CWSC SALINAS		385	220	36.65510	-121.64883	7/16/2002	4/23/2020
2710010-102	CWSC SALINAS		565	120	36.66466	-121.65405	12/12/2007	11/17/2020
2710010-131	CWSC SALINAS				36.64804	-121.63070	10/11/2011	12/15/2020
2710012-002	CWSC SALINAS HILLS		413	52	36.60495	-121.63936	4/4/1984	8/6/2020
2710012-003	CWSC SALINAS HILLS		410	320	36.60228	-121.63861	10/4/1983	6/18/2020
2710012-009	CWSC SALINAS HILLS		360	380	36.62377	-121.66588	4/1/1991	8/6/2020
2710012-016	CWSC SALINAS HILLS		453	36	36.60023	-121.63169	3/27/2002	9/17/2020
2710012-017	CWSC SALINAS HILLS				36.60117	-121.63341	8/28/1986	12/17/2020
2710012-018	CWSC SALINAS HILLS		540	120	36.60619	-121.64275	2/28/2006	11/12/2020
2710012-024	CWSC SALINAS HILLS				36.59869	-121.62869	10/8/2002	8/26/2020
2710019-001	CWSC OAK HILLS		300	300	36.78127	-121.70807	9/3/1982	3/26/2020
2710019-003	CWSC OAK HILLS		200	420	36.77544	-121.72213	10/31/1985	12/9/2020
2710019-008	CWSC OAK HILLS				36.77361	-121.72929	1/31/2012	12/15/2020
2710023-002	TASCO SPRECKELS WATER COMPANY		390	62	36.62326	-121.65063	8/16/1995	12/9/2020
2710023-005	TASCO SPRECKELS WATER COMPANY				36.62211	-121.65092	9/25/2006	12/9/2020
2710023-009	TASCO SPRECKELS WATER COMPANY				36.62726	-121.64650	12/7/2015	12/9/2020

180/400-Foot Aquifer Subbasin ILRP Wells

Well ID	Well Type	Well Screen Info			Coordinates		Monitoring Date Range	
		Top of Screen Depth (ft bgs)	Bottom of Screen Depth (ft bgs)	Screen Length (ft)	Latitude (NAD83)	Longitude (NAD83)	First Year	Last Year
AGC100000001-CCGC_0001	ON-FARM DOMESTIC				36.50544	-121.50916	10/24/2013	10/24/2013
AGC100000001-CCGC_0010	ON-FARM DOMESTIC				36.62735	-121.62755	10/21/2013	10/21/2013
AGC100000001-CCGC_0012	ON-FARM DOMESTIC				36.67890	-121.71400	10/21/2013	10/21/2013
AGC100000001-CCGC_0023	ON-FARM DOMESTIC				36.59305	-121.53632	10/21/2013	10/21/2013
AGC100000001-CCGC_0031	ON-FARM DOMESTIC				36.67660	-121.69975	10/22/2013	10/22/2013
AGC100000001-CCGC_0032	ON-FARM DOMESTIC				36.53880	-121.47402	10/25/2013	10/25/2013
AGC100000001-CCGC_0035	ON-FARM DOMESTIC				36.54883	-121.49877	10/21/2013	10/21/2013
AGC100000001-CCGC_0036	ON-FARM DOMESTIC				36.72103	-121.74617	10/22/2013	10/22/2013
AGC100000001-CCGC_0037	ON-FARM DOMESTIC				36.71922	-121.75455	10/22/2013	10/22/2013

AGC100000001-CCGC_0038	ON-FARM DOMESTIC				36.72735	-121.74327	10/22/2013	10/22/2013
AGC100000001-CCGC_0039	ON-FARM DOMESTIC				36.51170	-121.46920	10/25/2013	10/25/2013
AGC100000001-CCGC_0045	ON-FARM DOMESTIC	570			36.51385	-121.48253	10/23/2013	10/23/2013
AGC100000001-CCGC_0046	ON-FARM DOMESTIC				36.50980	-121.48500	10/23/2013	10/23/2013
AGC100000001-CCGC_0047	ON-FARM DOMESTIC	580			36.50900	-121.47560	10/23/2013	10/23/2013
AGC100000001-CCGC_0048	ON-FARM DOMESTIC	670			36.51480	-121.46920	10/23/2013	10/23/2013
AGC100000001-CCGC_0054	ON-FARM DOMESTIC				36.55264	-121.53686	10/21/2013	10/21/2013
AGC100000001-CCGC_0056	ON-FARM DOMESTIC				36.51877	-121.47708	10/23/2013	6/24/2015
AGC100000001-CCGC_0057	ON-FARM DOMESTIC				36.51647	-121.46733	10/23/2013	10/23/2013
AGC100000001-CCGC_0059	ON-FARM DOMESTIC				36.51169	-121.46427	10/23/2013	8/28/2014
AGC100000001-CCGC_0060	ON-FARM DOMESTIC				36.55367	-121.54482	10/21/2013	10/21/2013
AGC100000001-CCGC_0068	ON-FARM DOMESTIC				36.67130	-121.70465	10/22/2013	10/22/2013
AGC100000001-CCGC_0069	ON-FARM DOMESTIC				36.64648	-121.67895	10/21/2013	10/21/2013
AGC100000001-CCGC_0070	ON-FARM DOMESTIC				36.68600	-121.73445	10/21/2013	10/21/2013
AGC100000001-CCGC_0071	ON-FARM DOMESTIC				36.74208	-121.74092	10/25/2013	10/25/2013
AGC100000001-CCGC_0109	ON-FARM DOMESTIC				36.64108	-121.70229	3/10/2014	3/10/2014
AGC100000001-CCGC_0110	ON-FARM DOMESTIC				36.65014	-121.69505	3/10/2014	3/10/2014
AGC100000001-CCGC_0111	ON-FARM DOMESTIC				36.63401	-121.62740	3/10/2014	3/10/2014
AGC100000001-CCGC_0112	ON-FARM DOMESTIC				36.64411	-121.63367	3/10/2014	3/10/2014
AGC100000001-CCGC_0114	ON-FARM DOMESTIC				36.64123	-121.68018	3/11/2014	3/11/2014
AGC100000001-CCGC_0117	ON-FARM DOMESTIC				36.69293	-121.75523	3/11/2014	3/11/2014
AGC100000001-CCGC_0118	ON-FARM DOMESTIC				36.69187	-121.70799	3/11/2014	3/11/2014
AGC100000001-CCGC_0120	ON-FARM DOMESTIC				36.69397	-121.70140	3/11/2014	3/11/2014
AGC100000001-CCGC_0122	ON-FARM DOMESTIC				36.58895	-121.54105	3/12/2014	3/12/2014
AGC100000001-CCGC_0123	ON-FARM DOMESTIC				36.61069	-121.57110	3/12/2014	3/12/2014
AGC100000001-CCGC_0126	ON-FARM DOMESTIC				36.77033	-121.71179	3/12/2014	3/12/2014
AGC100000001-CCGC_0127	ON-FARM DOMESTIC				36.75918	-121.70183	3/12/2014	3/12/2014
AGC100000001-CCGC_0128	ON-FARM DOMESTIC				36.76853	-121.70036	3/12/2014	3/12/2014
AGC100000001-CCGC_0131	ON-FARM DOMESTIC				36.68254	-121.67858	3/13/2014	3/13/2014
AGC100000001-CCGC_0133	ON-FARM DOMESTIC				36.60090	-121.60335	3/13/2014	3/13/2014
AGC100000001-CCGC_0134	ON-FARM DOMESTIC				36.59864	-121.60401	3/13/2014	3/13/2014
AGC100000001-CCGC_0135	ON-FARM DOMESTIC				36.60361	-121.60947	3/13/2014	3/13/2014
AGC100000001-CCGC_0136	ON-FARM DOMESTIC				36.49762	-121.50223	3/14/2014	3/14/2014
AGC100000001-CCGC_0137	ON-FARM DOMESTIC				36.54449	-121.55027	3/14/2014	3/14/2014
AGC100000001-CCGC_0145	ON-FARM DOMESTIC				36.48009	-121.47879	3/10/2014	3/10/2014
AGC100000001-CCGC_0146	ON-FARM DOMESTIC				36.64520	-121.61012	3/10/2014	3/10/2014
AGC100000001-CCGC_0159	ON-FARM DOMESTIC				36.55890	-121.55553	3/12/2014	3/12/2014
AGC100000001-CCGC_0182	ON-FARM DOMESTIC				36.66213	-121.68796	3/13/2014	3/13/2014
AGC100000001-CCGC_0183	ON-FARM DOMESTIC				36.67133	-121.68198	3/13/2014	3/13/2014
AGC100000001-CCGC_0184	ON-FARM DOMESTIC				36.60604	-121.60017	3/13/2014	3/13/2014
AGC100000001-CCGC_0185	ON-FARM DOMESTIC				36.59610	-121.60171	3/13/2014	3/13/2014
AGC100000001-CCGC_0193	ON-FARM DOMESTIC				36.53132	-121.46655	3/19/2014	3/19/2014
AGC100000001-CCGC_0378	ON-FARM DOMESTIC				36.80149	-121.72186	5/1/2014	5/1/2014
AGC100000001-CCGC_0398	ON-FARM DOMESTIC				36.58935	-121.60287	8/7/2014	8/7/2014
AGC100000001-CCGC_0399	ON-FARM DOMESTIC				36.59607	-121.59765	8/7/2014	8/7/2014
AGC100000001-CCGC_0404	ON-FARM DOMESTIC				36.70589	-121.68010	8/7/2014	8/7/2014
AGC100000001-CCGC_0405	ON-FARM DOMESTIC				36.70905	-121.70044	8/7/2014	8/7/2014
AGC100000001-CCGC_0406	ON-FARM DOMESTIC				36.55190	-121.50496	8/7/2014	8/7/2014

AGC100000001-CCGC_0441	ON-FARM DOMESTIC				36.64205	-121.66720	8/14/2014	8/14/2014
AGC100000001-CCGC_0442	ON-FARM DOMESTIC				36.65451	-121.68216	8/14/2014	8/14/2014
AGC100000001-CCGC_0443	ON-FARM DOMESTIC				36.66439	-121.68044	8/14/2014	8/14/2014
AGC100000001-CCGC_0444	ON-FARM DOMESTIC				36.65747	-121.68575	8/14/2014	8/14/2014
AGC100000001-CCGC_0475	ON-FARM DOMESTIC				36.68114	-121.72552	8/28/2014	8/28/2014
AGC100000001-CCGC_0533	ON-FARM DOMESTIC				36.67841	-121.73455	4/6/2015	4/6/2015
AGC100000001-CCGC_0537	ON-FARM DOMESTIC				36.69415	-121.69383	4/6/2015	4/6/2015
AGC100000001-CCGC_0543	ON-FARM DOMESTIC				36.67895	-121.72928	4/6/2015	4/6/2015
AGC100000001-CCGC_0544	ON-FARM DOMESTIC				36.73244	-121.70570	4/6/2015	4/6/2015
AGC100000001-CCGC_0546	ON-FARM DOMESTIC				36.64743	-121.69202	4/7/2015	4/7/2015
AGC100000001-CCGC_0547	ON-FARM DOMESTIC				36.67162	-121.69472	4/7/2015	4/7/2015
AGC100000001-CCGC_0548	ON-FARM DOMESTIC				36.67837	-121.72296	4/7/2015	4/7/2015
AGC100000001-CCGC_0549	ON-FARM DOMESTIC				36.69322	-121.73548	4/7/2015	5/3/2016
AGC100000001-CCGC_0550	ON-FARM DOMESTIC				36.64276	-121.64684	4/7/2015	4/7/2015
AGC100000001-CCGC_0559	ON-FARM DOMESTIC				36.47854	-121.47536	6/24/2015	6/24/2015
AGC100000001-CCGC_0562	ON-FARM DOMESTIC				36.53164	-121.47224	6/24/2015	6/24/2015
AGC100000001-CCGC_0583	ON-FARM DOMESTIC				36.65292	-121.67973	6/24/2015	6/24/2015
AGC100000001-CCGC_0584	ON-FARM DOMESTIC				36.72249	-121.69755	6/24/2015	6/24/2015
AGC100000001-CCGC_0585	ON-FARM DOMESTIC				36.69660	-121.69693	6/24/2015	6/24/2015
AGC100000001-CCGC_0596	ON-FARM DOMESTIC				36.72757	-121.67544	6/30/2015	6/30/2015
AGC100000001-CCGC_0598	ON-FARM DOMESTIC				36.71118	-121.67595	6/30/2015	4/28/2016
AGC100000001-CCGC_0616	ON-FARM DOMESTIC				36.66958	-121.74030	8/25/2015	8/25/2015
AGC100000001-CCGC_0617	ON-FARM DOMESTIC				36.66651	-121.73640	8/25/2015	8/25/2015
AGC100000001-CCGC_0618	ON-FARM DOMESTIC				36.73176	-121.74947	8/25/2015	8/25/2015
AGC100000001-CCGC_0632	ON-FARM DOMESTIC				36.70597	-121.67630	8/27/2015	8/27/2015
AGC100000001-CCGC_0642	ON-FARM DOMESTIC				36.58581	-121.60444	4/28/2016	4/28/2016
AGC100000001-CCGC_0649	ON-FARM DOMESTIC				36.73546	-121.73783	5/3/2016	5/3/2016
AGC100000001-CCGC_0650	ON-FARM DOMESTIC				36.74254	-121.72749	5/3/2016	5/3/2016
AGC100000001-CCGC_0651	ON-FARM DOMESTIC				36.74130	-121.73444	5/3/2016	5/3/2016
AGC100000001-CCGC_0652	ON-FARM DOMESTIC				36.74438	-121.73898	5/3/2016	5/3/2016
AGL020000702-CCGC_0057	ON-FARM DOMESTIC				36.51600	-121.46780	5/2/2017	4/15/2019
AGL020000705-CCGC_0056	ON-FARM DOMESTIC				36.51900	-121.47680	5/2/2017	4/15/2019
AGL020000721-WELL #1	ON-FARM DOMESTIC				36.50999	-121.51623	11/14/2012	9/22/2017
AGL020000967-CCGC_0038	ON-FARM DOMESTIC		540	18	36.72735	-121.74327	6/2/2017	6/2/2017
AGL020000967-SPIEGL DOM	ON-FARM DOMESTIC				36.72740	-121.74343	4/27/2018	4/8/2019
AGL020000969-CCGC_0039	ON-FARM DOMESTIC		210	60	36.51170	-121.46920	6/2/2017	6/2/2017
AGL020000969-VOSTI DOM	ON-FARM DOMESTIC				36.51165	-121.46935	4/27/2018	4/8/2019
AGL020000972-BROOMEDOM	ON-FARM DOMESTIC				36.53880	-121.47407	4/27/2018	4/8/2019
AGL020000972-CCGC_0032	ON-FARM DOMESTIC				36.53880	-121.47402	6/2/2017	6/2/2017
AGL020000974-CCGC_0031	ON-FARM DOMESTIC				36.67660	-121.69975	6/2/2017	6/2/2017
AGL020000975-DOM	ON-FARM DOMESTIC				36.72107	-121.74625	6/5/2018	4/8/2019
AGL020000977-DOM	ON-FARM DOMESTIC				36.71923	-121.75468	6/5/2018	4/8/2019
AGL020001154-HOUSE LOT 7	ON-FARM DOMESTIC				36.63971	-121.64213	12/12/2013	3/13/2014
AGL020001154-HUNTER1_DU	ON-FARM DOMESTIC				36.63960	-121.64158	6/7/2017	12/18/2017
AGL020001162-BRUN_DOM	ON-FARM DOMESTIC				36.63053	-121.60002	12/20/2017	9/12/2019
AGL020001166-ABRAMS_DOM	ON-FARM DOMESTIC				36.59563	-121.53960	6/13/2017	12/14/2017

AGL020001183-HOUSE LOT 12	ON-FARM DOMESTIC				36.58783	-121.52991	12/12/2013	3/14/2014
AGL020001183-HOUSE LOT 17	ON-FARM DOMESTIC				36.59319	-121.52415	12/12/2013	3/14/2014
AGL020001183-JENSEN12_D	ON-FARM DOMESTIC				36.58783	-121.52988	6/7/2017	6/7/2017
AGL020001183-JENSEN17_D	ON-FARM DOMESTIC				36.59318	-121.52415	6/8/2017	12/14/2017
AGL020001221-BRAMERS_D	ON-FARM DOMESTIC				36.64127	-121.64568	6/8/2017	12/18/2017
AGL020001221-BRAMERSHSELOT 1	ON-FARM DOMESTIC				36.64113	-121.64562	12/13/2013	3/13/2014
AGL020001225-#2HRDEN DUAL	ON-FARM DOMESTIC				36.70604	-121.67622	12/12/2017	5/18/2018
AGL020001225-HARDEN DOM	ON-FARM DOMESTIC				36.70518	-121.67431	12/12/2017	5/18/2018
AGL020001239-DW	ON-FARM DOMESTIC				36.65951	-121.73098	1/27/2014	8/27/2018
AGL020001246-MASSA DOM	ON-FARM DOMESTIC				36.72500	-121.68204	12/12/2017	5/18/2018
AGL020001278-BIANCO_DOM	ON-FARM DOMESTIC				36.52675	-121.46822	6/13/2017	12/18/2017
AGL020001285-DAORO_DUAL	ON-FARM DOMESTIC				36.53127	-121.46660	6/7/2017	12/18/2017
AGL020001593-DOM_WELL4	ON-FARM DOMESTIC				36.76998	-121.70315	12/17/2012	4/21/2014
AGL020001593-DOM_WELL5	ON-FARM DOMESTIC				36.77056	-121.71147	12/17/2012	4/21/2014
AGL020001617-WELL 21	ON-FARM DOMESTIC				36.58931	-121.60279	11/27/2018	6/18/2019
AGL020002102-DOM_BERTEL	ON-FARM DOMESTIC				36.77542	-121.77302	12/11/2013	9/29/2017
AGL020002708-DOMESTIC	ON-FARM DOMESTIC				36.74189	-121.76965	6/19/2015	9/8/2020
AGL020002802-CCGC_0048	ON-FARM DOMESTIC		370	300	36.51480	-121.46920	8/29/2017	11/12/2020
AGL020002820-CCGC_0045	ON-FARM DOMESTIC		360	210	36.51385	-121.48253	8/29/2017	11/12/2020
AGL020002823-CCGC_0047	ON-FARM DOMESTIC				36.50900	-121.47560	8/29/2017	11/25/2020
AGL020002825-CCGC_0046	ON-FARM DOMESTIC				36.50980	-121.48500	8/29/2017	11/25/2020
AGL020002876-R4N W3D	ON-FARM DOMESTIC				36.49070	-121.45296	10/16/2013	4/26/2018
AGL020002878-R6_YARD	ON-FARM DOMESTIC				36.50918	-121.51452	6/19/2015	4/26/2018
AGL020002878-R6_YARD2	ON-FARM DOMESTIC				36.51225	-121.50974	4/11/2017	4/26/2018
AGL020002886-R12_W13	ON-FARM DOMESTIC				36.67936	-121.70371	4/23/2015	5/4/2018
AGL020002893-R17_MYARD	ON-FARM DOMESTIC				36.63806	-121.60426	7/14/2015	4/30/2018
AGL020002897-R19 WD	ON-FARM DOMESTIC				36.76693	-121.78466	10/10/2013	6/11/2018
AGL020002899-R21_YARD1	ON-FARM DOMESTIC				36.59357	-121.61357	4/11/2017	5/1/2018
AGL020002899-R21_YARD2	ON-FARM DOMESTIC				36.59367	-121.60297	4/14/2017	5/1/2018
AGL020003051-AF01-01DOM	ON-FARM DOMESTIC				36.53822	-121.51284	10/31/2012	12/8/2020
AGL020003652-DOM_BOGGIA	ON-FARM DOMESTIC				36.74130	-121.73443	12/18/2013	10/1/2014
AGL020003699-CCGC_0133	ON-FARM DOMESTIC		437	15	36.60090	-121.60335	10/31/2017	9/25/2019
AGL020003699-CCGC_0184	ON-FARM DOMESTIC				36.60604	-121.60017	10/31/2017	9/25/2019
AGL020003699-CCGC_0185	ON-FARM DOMESTIC				36.59610	-121.60171	10/31/2017	9/25/2019
AGL020003705-DOM_MOLERA	ON-FARM DOMESTIC				36.74693	-121.77450	12/18/2013	10/1/2014
AGL020003706-CCGC_0135	ON-FARM DOMESTIC				36.60361	-121.60947	10/31/2017	9/25/2019
AGL020003810-CCGC_0109	ON-FARM DOMESTIC		360	40	36.64108	-121.70229	6/1/2017	5/1/2019
AGL020003818-CCGC_0111	ON-FARM DOMESTIC				36.63401	-121.62740	6/1/2017	5/1/2019
AGL020003867-CCGC_0145	ON-FARM DOMESTIC				36.48009	-121.47879	6/1/2017	5/2/2019
AGL020003916-CCGC_0146	ON-FARM DOMESTIC				36.64520	-121.61012	6/1/2017	5/2/2019
AGL020003934-CCGC_0110	ON-FARM DOMESTIC				36.65014	-121.69505	6/1/2017	5/1/2019
AGL020004048-CCGC_0010	ON-FARM DOMESTIC				36.62735	-121.62755	5/30/2017	7/9/2019
AGL020004052-CCGC_0012	ON-FARM DOMESTIC				36.67890	-121.71400	6/26/2019	6/26/2019

AGL020004156-CCGC_0122	ON-FARM DOMESTIC				36.58895	-121.54105	10/24/2017	7/30/2019
AGL020004180-CCGC_0001	ON-FARM DOMESTIC				36.50544	-121.50916	8/24/2018	8/27/2019
AGL020004191-DOM_OCBAR8	ON-FARM DOMESTIC				36.67231	-121.71359	9/5/2013	6/7/2019
AGL020004282-CCGC_0123	ON-FARM DOMESTIC				36.61069	-121.57110	10/24/2017	7/30/2019
AGL020004301-VIOLINI_WELL_1	ON-FARM DOMESTIC				36.62167	-121.66381	7/25/2017	10/2/2019
AGL020004355-CCGC_0114	ON-FARM DOMESTIC				36.64123	-121.68018	6/7/2017	11/4/2019
AGL020004363-BOBHOUSE_D	ON-FARM DOMESTIC				36.53158	-121.53266	6/7/2017	11/4/2019
AGL020004375-CCGC_0054	ON-FARM DOMESTIC				36.55264	-121.53686	5/25/2017	10/24/2017
AGL020004435-WELL	ON-FARM DOMESTIC				36.74567	-121.68661	8/6/2012	9/10/2014
AGL020004461-LEON_RIVER	ON-FARM DOMESTIC				36.73695	-121.78233	12/18/2018	6/25/2019
AGL020004578-CCGC_0068	ON-FARM DOMESTIC		260	123	36.67130	-121.70465	6/29/2017	7/16/2019
AGL020004612-CCGC_0069	ON-FARM DOMESTIC		400	40	36.64648	-121.67895	6/28/2017	7/16/2019
AGL020004618-CCGC_0070	ON-FARM DOMESTIC				36.68600	-121.73445	6/29/2017	7/16/2019
AGL020004624-CCGC_0071	ON-FARM DOMESTIC		418	6	36.74208	-121.74092	6/29/2017	7/16/2019
AGL020004640-CCGC_0546	ON-FARM DOMESTIC				36.64743	-121.69202	6/28/2017	6/28/2017
AGL020004641-CCGC_0548	ON-FARM DOMESTIC				36.67837	-121.72296	6/29/2017	6/29/2017
AGL020004703-RODGERS_D	ON-FARM DOMESTIC				36.73615	-121.70490	5/31/2018	5/31/2018
AGL020004704-CCGC_0544	ON-FARM DOMESTIC				36.73244	-121.70570	11/16/2017	11/5/2019
AGL020004829-DM WELL 3	ON-FARM DOMESTIC				36.67929	-121.68028	12/27/2013	11/15/2018
AGL020004847-DOM WELL	ON-FARM DOMESTIC				36.68121	-121.72553	12/11/2012	7/17/2018
AGL020004986-DOM WELL	ON-FARM DOMESTIC				36.67917	-121.68444	6/8/2015	11/15/2018
AGL020005087-DOM WELL	ON-FARM DOMESTIC				36.54470	-121.49340	2/19/2019	8/13/2019
AGL020005192-DOM_WELL_S	ON-FARM DOMESTIC				36.80178	-121.72162	4/15/2013	4/15/2013
AGL020005198-2150_ELKHO	ON-FARM DOMESTIC				36.80015	-121.72425	8/26/2015	11/15/2017
AGL020005403-CCGC_0023	ON-FARM DOMESTIC				36.59305	-121.53632	6/27/2017	1/30/2019
AGL020005801-WELL	ON-FARM DOMESTIC				36.80050	-121.70720	7/21/2015	11/1/2017
AGL020007215-DM WELL	ON-FARM DOMESTIC				36.52639	-121.53278	2/26/2018	2/26/2018
AGL020007485-JARDINI	ON-FARM DOMESTIC				36.55855	-121.55793	6/22/2017	6/22/2017
AGL020007547-B24 HOUSE	ON-FARM DOMESTIC				36.69668	-121.69707	6/29/2017	12/27/2017
AGL020007547-OFF BOR QVF	ON-FARM DOMESTIC				36.70600	-121.68070	6/29/2017	12/27/2017
AGL020007548-SAN JON DOM	ON-FARM DOMESTIC				36.70910	-121.70050	6/29/2017	6/29/2017
AGL020007551-GL QVF	ON-FARM DOMESTIC				36.76290	-121.71850	6/29/2017	12/27/2017
AGL020007552-SCH HOUSE	ON-FARM DOMESTIC				36.72527	-121.70223	6/29/2017	1/24/2018
AGL020007557-MR QVF 1	ON-FARM DOMESTIC				36.55199	-121.50480	6/29/2017	12/27/2017
AGL020008224-CCGC_0583	ON-FARM DOMESTIC				36.65292	-121.67973	10/31/2017	10/31/2017
AGL020008433-17-DOM	ON-FARM DOMESTIC				36.56417	-121.52897	6/14/2017	10/12/2017
AGL020008433-R 7 DW	ON-FARM DOMESTIC				36.56400	-121.52860	5/22/2014	5/22/2014
AGL020008554-WELL 20	ON-FARM DOMESTIC				36.59610	-121.59770	11/27/2018	6/18/2019
AGL020011542-DOM_GT	ON-FARM DOMESTIC				36.74747	-121.72363	12/11/2013	12/11/2013
AGL020011542-NIEL_SOUTH	ON-FARM DOMESTIC				36.74747	-121.72362	12/21/2017	5/4/2018
AGL020011562-DOM_NIELSE	ON-FARM DOMESTIC				36.74610	-121.73958	12/11/2013	9/29/2017
AGL020011567-DOM_QB	ON-FARM DOMESTIC				36.73567	-121.71510	12/11/2013	12/11/2013
AGL020011569-DOM_SANJON	ON-FARM DOMESTIC				36.72213	-121.69638	12/11/2013	9/29/2017
AGL020011573-DOM_M_HILL	ON-FARM DOMESTIC				36.75118	-121.79465	12/11/2013	9/29/2017

AGL020011575-DOM_M_HILL	ON-FARM DOMESTIC				36.75118	-121.79465	6/7/2017	9/29/2017
AGL020011582-DOM_PRESTO	ON-FARM DOMESTIC				36.75718	-121.76243	12/11/2013	11/1/2017
AGL020011584-DOM_DESAN	ON-FARM DOMESTIC				36.78622	-121.76505	12/11/2013	9/29/2017
AGL020011790-WELL DOM	ON-FARM DOMESTIC				36.56118	-121.55280	6/23/2017	9/20/2017
AGL020012422-R1-YARD 2E	ON-FARM DOMESTIC				36.62443	-121.62705	5/3/2017	4/30/2018
AGL020012424-VOSTI4YARD	ON-FARM DOMESTIC				36.50124	-121.44404	8/10/2015	4/26/2018
AGL020012462-FONTES_12	ON-FARM DOMESTIC				36.70046	-121.71741	4/5/2017	5/4/2018
AGL020012462-FONTES_12Y	ON-FARM DOMESTIC				36.69352	-121.72010	5/3/2017	5/3/2017
AGL020013402-WELL_DOM	ON-FARM DOMESTIC				36.58935	-121.62153	6/25/2017	9/17/2019
AGL020013402-WELL_DOMRENTAL	ON-FARM DOMESTIC				36.59560	-121.61978	9/17/2019	9/17/2019
AGL020013410-WELL_OLDDOM	ON-FARM DOMESTIC				36.51180	-121.46410	6/25/2017	6/25/2017
AGL020013485-DW	ON-FARM DOMESTIC				36.70306	-121.70917	1/27/2014	8/27/2018
AGL020013486-DW	ON-FARM DOMESTIC				36.71167	-121.74000	1/27/2014	8/27/2018
AGL020014783-TURRI D	ON-FARM DOMESTIC				36.56034	-121.50633	2/10/2014	11/1/2017
AGL020015622-DELMONTE_JEF	ON-FARM DOMESTIC				36.72732	-121.77997	6/1/2017	6/1/2017
AGL020015807-CCGC_0547	ON-FARM DOMESTIC				36.67162	-121.69472	6/29/2017	6/29/2017
AGL020015945-CCGC_0120	ON-FARM DOMESTIC				36.69397	-121.70140	7/25/2017	7/25/2017
AGL020016624-MSJ QVFD	ON-FARM DOMESTIC				36.70910	-121.70050	12/27/2017	12/27/2017
AGL020017226-DOM WELL	ON-FARM DOMESTIC				36.64412	-121.63385	12/27/2017	4/13/2018
AGL020017228-DOM WELL	ON-FARM DOMESTIC				36.64943	-121.67294	12/27/2017	4/13/2018
AGL020017663-CCGC_0118	ON-FARM DOMESTIC				36.69187	-121.70799	7/25/2017	7/25/2017
AGL020019642-CCGC_0117	ON-FARM DOMESTIC				36.69293	-121.75523	6/7/2017	12/9/2019
AGL020019642-MARV-TER_D	ON-FARM DOMESTIC				36.69270	-121.75666	6/7/2017	11/4/2019
AGL020022744-CCGC_0584	ON-FARM DOMESTIC				36.72249	-121.69755	11/16/2017	11/16/2017
AGL020023022-TARP_WEST_DOM	ON-FARM DOMESTIC				36.59055	-121.61733	6/21/2017	10/31/2019
AGL020024082-#3 CH QVF	ON-FARM DOMESTIC				36.75900	-121.70100	6/29/2017	12/27/2017
AGL020026783-HILLTOP_D	ON-FARM DOMESTIC				36.73384	-121.72079	11/16/2017	11/5/2019
AGL020026802-DM WELL	ON-FARM DOMESTIC				36.80180	-121.72085	1/24/2018	1/24/2018
AGL020027408-CCGC_0550	ON-FARM DOMESTIC				36.64276	-121.64684	10/24/2017	7/30/2019
AGL020027508-CCGC_0650	ON-FARM DOMESTIC				36.74254	-121.72749	11/16/2017	11/5/2019
AGL020027508-CCGC_0651	ON-FARM DOMESTIC				36.74130	-121.73444	11/16/2017	11/5/2019
AGL020027692-DOM_KS01	ON-FARM DOMESTIC				36.83927	-121.72614	4/26/2017	12/12/2017
AGL020027805-PEDRAZZI_DOM	ON-FARM DOMESTIC				36.58872	-121.60439	6/21/2017	10/30/2017
AGL020027813-CCGC_0549	ON-FARM DOMESTIC				36.69322	-121.73548	6/29/2017	6/29/2017
AGL020027837-WELL D	ON-FARM DOMESTIC				36.53273	-121.47845	3/30/2017	11/1/2017
AGL020027896-#5 CW QVF	ON-FARM DOMESTIC				36.77040	-121.71160	6/29/2017	12/27/2017
AGL020028095-HOME DOM	ON-FARM DOMESTIC				36.64227	-121.66571	12/12/2017	5/18/2018
AGL020028097-MACHADO DOM	ON-FARM DOMESTIC				36.66471	-121.68073	12/12/2017	5/18/2018
AGL020028099-ABE DUAL	ON-FARM DOMESTIC				36.65735	-121.68576	12/12/2017	5/18/2018
AGL020028101-LANINI DUAL	ON-FARM DOMESTIC				36.65448	-121.68219	12/12/2017	5/18/2018
AGL020028136-BARDIN_DUAL	ON-FARM DOMESTIC				36.57554	-121.58697	6/21/2017	10/10/2017
AGL020028328-RIV WELL	ON-FARM DOMESTIC				36.49249	-121.49281	5/9/2017	5/18/2020
AGL020028368-DOLE	ON-FARM DOMESTIC				36.59736	-121.52433	12/29/2017	4/13/2018
AGL020028432-DOM WELL	ON-FARM DOMESTIC				36.59863	-121.60402	12/20/2017	4/12/2018

AGL020028446-NAKAGA_IRR	ON-FARM DOMESTIC				36.80110	-121.71639	12/21/2017	5/7/2018
AGL020035697-BIANCO DOM	ON-FARM DOMESTIC				36.52681	-121.46823	3/14/2019	3/14/2019
AGL020035698-HEESS DOM	ON-FARM DOMESTIC				36.52287	-121.52301	3/14/2019	3/14/2019
AGL020035700-MFADMIR2_D	ON-FARM DOMESTIC				36.64744	-121.69202	5/1/2019	5/1/2019
AGC100000001-CCGC_0020	IRRIGATION SUPPLY				36.63792	-121.60444	10/21/2013	10/21/2013
AGL020000702-PU AGWELL 1	IRRIGATION SUPPLY				36.52400	-121.46940	5/2/2017	5/2/2017
AGL020000705-PE AGWELL 1	IRRIGATION SUPPLY				36.51900	-121.47720	5/2/2017	5/2/2017
AGL020000721-ABRAMS	IRRIGATION SUPPLY				36.50078	-121.50423	11/14/2012	9/22/2017
AGL020000721-CAYMUS	IRRIGATION SUPPLY				36.50494	-121.50819	11/14/2012	9/22/2017
AGL020000721-RIVER 1	IRRIGATION SUPPLY				36.52013	-121.51810	11/14/2012	9/22/2017
AGL020000876-IRRIG	IRRIGATION SUPPLY				36.82013	-121.70670	12/21/2017	12/21/2017
AGL020000967-LOT 2	IRRIGATION SUPPLY				36.72740	-121.74388	4/27/2018	4/27/2018
AGL020000969-VOSTI 1	IRRIGATION SUPPLY				36.51165	-121.46923	4/27/2018	4/27/2018
AGL020000974-BLANCO1AG	IRRIGATION SUPPLY				36.67656	-121.69990	9/3/2019	9/3/2019
AGL020001154-HUNTER WELL 1	IRRIGATION SUPPLY				36.63944	-121.64152	12/12/2013	3/13/2014
AGL020001162-BRUN_AG	IRRIGATION SUPPLY				36.62942	-121.60320	6/7/2017	6/7/2017
AGL020001166-ABRAMS1_AG	IRRIGATION SUPPLY				36.59590	-121.54518	6/7/2017	12/18/2017
AGL020001183-JENSEN WELL 3	IRRIGATION SUPPLY				36.58641	-121.53062	12/12/2013	3/14/2014
AGL020001183-JENSEN3_AG	IRRIGATION SUPPLY				36.58642	-121.53065	6/7/2017	12/14/2017
AGL020001206-REEVES PRIMARY	IRRIGATION SUPPLY				36.71818	-121.67804	4/11/2016	12/12/2017
AGL020001221-BRAMERS WELL	IRRIGATION SUPPLY				36.63806	-121.64674	12/13/2013	3/13/2014
AGL020001221-BRAMERS_AG	IRRIGATION SUPPLY				36.63822	-121.64673	6/13/2017	12/18/2017
AGL020001229-AW 1	IRRIGATION SUPPLY				36.62623	-121.65955	9/15/2014	10/31/2017
AGL020001229-AW 2	IRRIGATION SUPPLY				36.62377	-121.65152	9/15/2014	10/31/2017
AGL020001239-AW 1	IRRIGATION SUPPLY				36.65465	-121.71687	9/18/2014	9/19/2019
AGL020001239-AW 2	IRRIGATION SUPPLY				36.66137	-121.73066	9/15/2014	9/19/2019
AGL020001239-AW 3	IRRIGATION SUPPLY				36.66204	-121.72984	9/18/2014	9/19/2019
AGL020001246-#1MASSA IRR	IRRIGATION SUPPLY				36.72324	-121.67986	12/12/2017	12/12/2017
AGL020001258-AW 1	IRRIGATION SUPPLY				36.64667	-121.66444	1/27/2014	9/19/2019
AGL020001258-AW 2	IRRIGATION SUPPLY				36.64750	-121.66472	1/27/2014	9/19/2019
AGL020001258-AW 3	IRRIGATION SUPPLY				36.65167	-121.66250	1/27/2014	9/19/2019
AGL020001269-AW 1	IRRIGATION SUPPLY				36.63995	-121.61683	9/18/2014	9/19/2019
AGL020001269-AW 2	IRRIGATION SUPPLY				36.64205	-121.62276	9/15/2014	9/19/2019
AGL020001278-BIANCO_AG	IRRIGATION SUPPLY				36.52675	-121.46813	6/13/2017	12/18/2017
AGL020001283-MANN WELL 3	IRRIGATION SUPPLY				36.59847	-121.53182	12/12/2013	3/14/2014
AGL020001283-MANN3_AG	IRRIGATION SUPPLY				36.59847	-121.53185	6/7/2017	12/14/2017
AGL020001542-AG_CUCUNA	IRRIGATION SUPPLY				36.81306	-121.71500	6/19/2014	6/8/2018
AGL020001593-AG_WELL1	IRRIGATION SUPPLY				36.75929	-121.70916	12/17/2012	4/21/2014
AGL020001593-AG_WELL2	IRRIGATION SUPPLY				36.75798	-121.69291	12/17/2012	4/21/2014
AGL020001593-AG_WELL3	IRRIGATION SUPPLY				36.75917	-121.70175	11/29/2012	4/21/2014
AGL020001593-AG_WELL4	IRRIGATION SUPPLY				36.77016	-121.69902	11/29/2012	10/11/2013
AGL020001593-AG_WELL5	IRRIGATION SUPPLY				36.77056	-121.71147	11/29/2012	10/11/2013

AGL020001617-WELL 1	IRRIGATION SUPPLY				36.59504	-121.60057	11/20/2017	4/23/2019
AGL020001971-WELL	IRRIGATION SUPPLY				36.54472	-121.53173	7/12/2016	11/6/2017
AGL020002105-AG_HAYMORE	IRRIGATION SUPPLY				36.73215	-121.69043	12/11/2013	9/29/2017
AGL020002604-AG_WELL95A	IRRIGATION SUPPLY				36.73732	-121.75895	9/21/2012	3/13/2013
AGL020002605-AG_WELL55B	IRRIGATION SUPPLY				36.74322	-121.76788	9/21/2012	3/13/2013
AGL020002669-71906	IRRIGATION SUPPLY				36.53814	-121.48701	5/24/2017	5/24/2017
AGL020002669-71907	IRRIGATION SUPPLY				36.49135	-121.49135	5/24/2017	5/24/2017
AGL020002669-71908	IRRIGATION SUPPLY				36.52968	-121.47457	5/24/2017	5/24/2017
AGL020002804-R4 P1 WELL	IRRIGATION SUPPLY				36.52192	-121.46937	7/16/2019	11/25/2020
AGL020002870-R1 W3	IRRIGATION SUPPLY				36.62383	-121.63712	10/14/2013	4/30/2018
AGL020002876-R4N W5	IRRIGATION SUPPLY				36.48733	-121.44440	10/16/2013	4/26/2018
AGL020002877-R5 W2	IRRIGATION SUPPLY				36.70815	-121.70366	10/14/2013	5/4/2018
AGL020002878-R6 W1	IRRIGATION SUPPLY				36.51786	-121.51550	10/16/2013	4/26/2018
AGL020002886-R12 W1	IRRIGATION SUPPLY				36.68604	-121.71151	10/14/2013	5/4/2018
AGL020002892-AG_MARTIN2	IRRIGATION SUPPLY				36.57520	-121.55543	12/3/2013	8/7/2019
AGL020002893-R17 W1	IRRIGATION SUPPLY				36.62943	-121.60721	10/14/2013	4/30/2018
AGL020002894-AG_MORISO1	IRRIGATION SUPPLY				36.52818	-121.46307	12/3/2013	10/9/2019
AGL020002898-R20-W1CSIP	IRRIGATION SUPPLY				36.77753	-121.78132	10/10/2013	10/10/2013
AGL020002899-R21 W2	IRRIGATION SUPPLY				36.59702	-121.60528	10/15/2013	5/1/2018
AGL020002966-AG_PETERS4	IRRIGATION SUPPLY				36.62170	-121.57858	12/3/2013	12/3/2013
AGL020002970-AG_DIAC1	IRRIGATION SUPPLY				36.61300	-121.57305	12/3/2013	12/22/2017
AGL020002975-AG_NMART_1	IRRIGATION SUPPLY				36.57755	-121.56878	12/3/2013	9/24/2019
AGL020003051-AF01-05WELL	IRRIGATION SUPPLY				36.53669	-121.50811	10/31/2012	12/8/2020
AGL020003053-AF03-09WELL	IRRIGATION SUPPLY				36.55180	-121.50585	4/4/2013	12/8/2020
AGL020003487-AG_LYONS1	IRRIGATION SUPPLY				36.75659	-121.72900	6/16/2017	11/7/2017
AGL020003487-WELL #2	IRRIGATION SUPPLY				36.75660	-121.72908	5/2/2014	5/2/2014
AGL020003524-WELL	IRRIGATION SUPPLY				36.69276	-121.75525	4/22/2014	4/22/2014
AGL020003637-AG_WELL1	IRRIGATION SUPPLY				36.71348	-121.66877	12/18/2013	8/9/2019
AGL020003644-AG_BLANCO	IRRIGATION SUPPLY				36.67380	-121.69423	12/18/2013	8/7/2019
AGL020003654-AG_BORAND5	IRRIGATION SUPPLY				36.69652	-121.67958	12/18/2013	9/24/2019
AGL020003658-SHULTZ_AG	IRRIGATION SUPPLY				36.73342	-121.74575	6/9/2017	6/9/2017
AGL020003659-AG_FERRAS1	IRRIGATION SUPPLY				36.64905	-121.66107	12/18/2013	8/9/2019
AGL020003661-AG_HUNT_18	IRRIGATION SUPPLY				36.64650	-121.63665	12/18/2013	8/7/2019
AGL020003691-AG_JACOB	IRRIGATION SUPPLY				36.64893	-121.70103	12/18/2013	8/7/2019
AGL020003694-AG_DOLAN	IRRIGATION SUPPLY				36.66440	-121.68753	12/18/2013	8/7/2019
AGL020003699-BLUE_IRR	IRRIGATION SUPPLY				36.60955	-121.60985	10/31/2017	10/31/2017
AGL020003706-GRYWELL_I	IRRIGATION SUPPLY				36.60352	-121.60892	10/31/2017	10/31/2017
AGL020003778-WELL	IRRIGATION SUPPLY				36.64199	-121.67942	12/12/2017	12/12/2017
AGL020003778-WELL 1	IRRIGATION SUPPLY				36.64450	-121.68548	12/12/2017	12/12/2017
AGL020003780-WELL	IRRIGATION SUPPLY				36.66216	-121.68813	12/12/2017	8/5/2019
AGL020003793-WELL	IRRIGATION SUPPLY				36.66361	-121.73249	12/12/2017	8/5/2019
AGL020003810-JACKS_IRR	IRRIGATION SUPPLY				36.65049	-121.71629	6/1/2017	6/1/2017
AGL020003812-WELL	IRRIGATION SUPPLY				36.67303	-121.68141	12/12/2017	8/5/2019

AGL020003816-TORO_IRR1	IRRIGATION SUPPLY				36.62899	-121.67969	6/1/2017	6/1/2017
AGL020003818-SPRECKLES_5	IRRIGATION SUPPLY				36.63766	-121.63368	6/1/2017	6/1/2017
AGL020003834-WELL	IRRIGATION SUPPLY				36.77861	-121.70028	12/26/2017	5/21/2018
AGL020003867-OMO_IRR1	IRRIGATION SUPPLY				36.48087	-121.48059	6/1/2017	6/1/2017
AGL020003880-MFMOLE2_I	IRRIGATION SUPPLY				36.73488	-121.75981	5/1/2019	5/1/2019
AGL020003903-WELL 1	IRRIGATION SUPPLY				36.65185	-121.69842	12/12/2017	8/5/2019
AGL020003903-WELL 2	IRRIGATION SUPPLY				36.65867	-121.70742	12/12/2017	8/5/2019
AGL020003916-AIRPUMP2_I	IRRIGATION SUPPLY				36.64650	-121.61051	6/1/2017	6/1/2017
AGL020003917-WELL	IRRIGATION SUPPLY				36.67741	-121.72601	12/12/2017	12/12/2017
AGL020004048-HARRIS_PAS	IRRIGATION SUPPLY				36.62053	-121.61093	5/30/2017	5/30/2017
AGL020004052-HARRIS_SCHWEEN	IRRIGATION SUPPLY				36.68545	-121.71116	5/30/2017	5/30/2017
AGL020004056-HARRIS_WHALE	IRRIGATION SUPPLY				36.69723	-121.74097	5/30/2017	5/30/2017
AGL020004069-HARRIS_YUKI	IRRIGATION SUPPLY				36.53215	-121.49567	5/30/2017	5/30/2017
AGL020004072-VIOLOT3_I	IRRIGATION SUPPLY				36.60178	-121.61538	10/24/2017	10/24/2017
AGL020004072-VIOLOT8_I	IRRIGATION SUPPLY				36.60251	-121.61375	10/24/2017	10/24/2017
AGL020004124-WELL 1	IRRIGATION SUPPLY				36.78713	-121.73167	12/13/2012	10/12/2017
AGL020004124-WELL 2	IRRIGATION SUPPLY				36.78552	-121.73587	12/13/2012	10/12/2017
AGL020004130-WELL 1	IRRIGATION SUPPLY				36.76614	-121.72057	12/13/2012	10/12/2017
AGL020004136-WELL 1	IRRIGATION SUPPLY				36.75835	-121.72414	12/13/2012	10/12/2017
AGL020004156-JUANL10_I	IRRIGATION SUPPLY				36.58358	-121.54065	10/24/2017	10/24/2017
AGL020004156-JUANLOT4_I	IRRIGATION SUPPLY				36.58342	-121.54610	10/24/2017	10/24/2017
AGL020004156-JUANLOT9_I	IRRIGATION SUPPLY				36.58511	-121.54402	10/24/2017	10/24/2017
AGL020004169-WELL 2	IRRIGATION SUPPLY				36.61172	-121.61971	6/13/2017	9/18/2018
AGL020004169-WELL 4	IRRIGATION SUPPLY				36.61183	-121.62469	6/13/2017	9/18/2018
AGL020004172-WELL 1	IRRIGATION SUPPLY				36.62208	-121.66362	6/12/2017	9/21/2018
AGL020004178-WELL 1	IRRIGATION SUPPLY				36.67891	-121.72931	6/12/2017	9/21/2018
AGL020004178-WELL 2	IRRIGATION SUPPLY				36.67894	-121.73038	6/13/2017	9/21/2018
AGL020004178-WELL 4	IRRIGATION SUPPLY				36.67817	-121.73455	6/13/2017	9/21/2018
AGL020004178-WELL 5	IRRIGATION SUPPLY				36.67825	-121.73446	6/13/2017	9/21/2018
AGL020004179-AG_GARIN4	IRRIGATION SUPPLY				36.69174	-121.70795	9/5/2013	11/3/2017
AGL020004180-BASSETT_I	IRRIGATION SUPPLY				36.50759	-121.50795	8/24/2018	8/27/2019
AGL020004183-BLANCO WELL	IRRIGATION SUPPLY				36.69385	-121.72028	6/13/2017	6/13/2017
AGL020004193-AG_MCDOUG3	IRRIGATION SUPPLY				36.66192	-121.70795	9/5/2013	6/7/2019
AGL020004202-WELL 1	IRRIGATION SUPPLY				36.76472	-121.78328	6/13/2017	9/12/2018
AGL020004208-WELL 1	IRRIGATION SUPPLY				36.72612	-121.79113	6/13/2017	9/25/2018
AGL020004208-WELL 2	IRRIGATION SUPPLY				36.72897	-121.79132	6/13/2017	12/6/2017
AGL020004214-AZEVEDO	IRRIGATION SUPPLY				36.84562	-121.74852	6/12/2014	9/25/2014
AGL020004215-VASQUEZ	IRRIGATION SUPPLY				36.84376	-121.74163	6/12/2014	9/17/2018
AGL020004282-MUSANL29_I	IRRIGATION SUPPLY				36.61164	-121.56940	10/24/2017	10/24/2017
AGL020004289-STRUBYL5_I	IRRIGATION SUPPLY				36.71650	-121.68624	10/24/2017	10/24/2017
AGL020004296-FIRESTONE_1	IRRIGATION SUPPLY				36.61729	-121.58325	7/17/2017	11/8/2017
AGL020004298-HILLTOWN_WELL_1	IRRIGATION SUPPLY				36.62667	-121.66992	7/25/2017	11/8/2017
AGL020004303-FELIPE_1	IRRIGATION SUPPLY				36.60015	-121.62849	7/17/2017	11/8/2017
AGL020004345-WELL 1	IRRIGATION SUPPLY				36.73701	-121.67860	11/20/2017	4/24/2019

AGL020004355-DAVIS2_I	IRRIGATION SUPPLY				36.64223	-121.68048	6/7/2017	6/7/2017
AGL020004355-DAVIS4_1	IRRIGATION SUPPLY				36.63729	-121.69165	6/7/2017	6/7/2017
AGL020004363-TJERILD1_I	IRRIGATION SUPPLY				36.52387	-121.52076	6/7/2017	6/7/2017
AGL020004366-HOMEPUMP2_I	IRRIGATION SUPPLY				36.56667	-121.55565	5/25/2017	5/25/2017
AGL020004370-VIOPUMP3_I	IRRIGATION SUPPLY				36.56336	-121.55299	5/25/2017	5/25/2017
AGL020004377-R3PUMP5_I	IRRIGATION SUPPLY				36.54164	-121.53046	5/25/2017	5/25/2017
AGL020004436-STONEWALL	IRRIGATION SUPPLY				36.48183	-121.48872	11/30/2012	10/24/2017
AGL020004578-BARDN1W2_I	IRRIGATION SUPPLY				36.67444	-121.70289	6/28/2017	6/28/2017
AGL020004610-TABLACK_I	IRRIGATION SUPPLY				36.68955	-121.73574	6/29/2017	6/29/2017
AGL020004616-TADAVEMC_I	IRRIGATION SUPPLY				36.68227	-121.73524	6/29/2017	6/29/2017
AGL020004617-TAFOSTER_I	IRRIGATION SUPPLY				36.64872	-121.68974	6/28/2017	6/28/2017
AGL020004618-TAFRANK2_I	IRRIGATION SUPPLY				36.68602	-121.73473	6/29/2017	6/29/2017
AGL020004621-TAJENSEN_I	IRRIGATION SUPPLY				36.66956	-121.69214	6/28/2017	6/28/2017
AGL020004626-TAMATHEW_I	IRRIGATION SUPPLY				36.65585	-121.68304	6/29/2017	6/29/2017
AGL020004629-TAPORBOT_I	IRRIGATION SUPPLY				36.66757	-121.72414	6/29/2017	6/29/2017
AGL020004630-TAPORTER_I	IRRIGATION SUPPLY				36.67241	-121.71719	6/29/2017	6/29/2017
AGL020004633-TASTIRW1_I	IRRIGATION SUPPLY				36.64317	-121.66556	6/28/2017	6/28/2017
AGL020004635-RHARRIS2_I	IRRIGATION SUPPLY				36.61780	-121.63647	6/28/2017	6/28/2017
AGL020004636-HUNTER1_I	IRRIGATION SUPPLY				36.64489	-121.66216	6/28/2017	6/28/2017
AGL020004638-ROSILOT8_I	IRRIGATION SUPPLY				36.62914	-121.64745	6/28/2017	6/28/2017
AGL020004639-STORM1_I	IRRIGATION SUPPLY				36.65192	-121.64561	6/28/2017	6/28/2017
AGL020004641-BARDIN1_I	IRRIGATION SUPPLY				36.67026	-121.71993	6/28/2017	6/28/2017
AGL020004654-SULPOMW1_I	IRRIGATION SUPPLY				36.66901	-121.71727	6/29/2017	6/29/2017
AGL020004704-HMHAMBEY_I	IRRIGATION SUPPLY				36.72949	-121.70043	5/31/2018	5/31/2018
AGL020004833-AG WELL 1	IRRIGATION SUPPLY				36.62877	-121.61395	1/6/2014	12/11/2018
AGL020004847-AG WELL	IRRIGATION SUPPLY				36.68158	-121.72547	7/17/2018	7/17/2018
AGL020004886-LEONARDI	IRRIGATION SUPPLY				36.59776	-121.62634	6/16/2017	6/16/2017
AGL020004906-AG WELL 1	IRRIGATION SUPPLY				36.67908	-121.71905	1/8/2014	11/16/2018
AGL020004931-AG WELL 2	IRRIGATION SUPPLY				36.55532	-121.52207	12/26/2013	5/23/2014
AGL020004964-AG WELL 6	IRRIGATION SUPPLY				36.58194	-121.57417	7/10/2017	7/10/2017
AGL020004968-AG WELL 2	IRRIGATION SUPPLY				36.58394	-121.57552	1/8/2014	12/28/2018
AGL020004986-AG WELL 2	IRRIGATION SUPPLY				36.67303	-121.68951	12/26/2013	11/15/2018
AGL020005012-AG WELL 1	IRRIGATION SUPPLY				36.68640	-121.68646	1/8/2014	11/15/2018
AGL020005030-AG WELL 1	IRRIGATION SUPPLY				36.58914	-121.56049	12/26/2013	12/11/2018
AGL020005049-AG WELL 1	IRRIGATION SUPPLY				36.58338	-121.59173	1/8/2014	5/23/2014
AGL020005051-WELL_AG	IRRIGATION SUPPLY				36.58991	-121.60625	6/25/2017	6/25/2017
AGL020005087-AG WELL	IRRIGATION SUPPLY				36.54260	-121.49130	2/19/2019	2/19/2019
AGL020005167-PANZIERA	IRRIGATION SUPPLY				36.66644	-121.73632	6/19/2017	12/19/2017
AGL020005192-AG_WELL_SU	IRRIGATION SUPPLY				36.80187	-121.72088	4/15/2013	4/15/2013
AGL020005401-SALINAS2	IRRIGATION SUPPLY				36.74767	-121.70765	2/5/2016	2/5/2016
AGL020005842-RUBIO-9071	IRRIGATION SUPPLY				36.78564	-121.71987	4/21/2017	4/21/2017
AGL020006080-AG WELL	IRRIGATION SUPPLY				36.74688	-121.71538	4/24/2018	9/18/2018
AGL020006623-ESCOLLE	IRRIGATION SUPPLY				36.47858	-121.47529	3/11/2013	3/11/2013
AGL020007123-VIERRAWELL	IRRIGATION SUPPLY				36.71187	-121.71046	10/26/2017	10/26/2017
AGL020007181-WELL #2	IRRIGATION SUPPLY				36.60827	-121.57119	12/19/2017	4/24/2018

AGL020007215-AG WELL	IRRIGATION SUPPLY				36.52667	-121.53306	2/26/2018	2/26/2018
AGL020007441-ESP-1	IRRIGATION SUPPLY				36.73554	-121.68477	10/2/2013	5/4/2018
AGL020007457-RUSSELL-1	IRRIGATION SUPPLY				36.74269	-121.68697	8/31/2015	5/4/2017
AGL020007457-RUSSELL-2	IRRIGATION SUPPLY				36.74275	-121.68724	8/31/2015	12/20/2017
AGL020007527-IRRIGATION	IRRIGATION SUPPLY				36.48883	-121.47693	12/28/2017	12/28/2017
AGL020007534-GH19-01	IRRIGATION SUPPLY				36.50810	-121.48087	4/3/2013	12/16/2020
AGL020007535-GH17-02	IRRIGATION SUPPLY				36.55127	-121.49800	4/10/2013	12/15/2020
AGL020007536-GH16-15	IRRIGATION SUPPLY				36.52914	-121.48515	10/31/2012	12/15/2020
AGL020007541-GH21-215	IRRIGATION SUPPLY				36.56622	-121.53185	10/31/2012	12/7/2020
AGL020007547-BOR QVF 6	IRRIGATION SUPPLY				36.70550	-121.68342	6/29/2017	12/27/2017
AGL020007548-SAN JON 1	IRRIGATION SUPPLY				36.71100	-121.69370	6/29/2017	12/27/2017
AGL020007549-HET QVF 1	IRRIGATION SUPPLY				36.72287	-121.68682	6/29/2017	12/27/2017
AGL020007553-MARTIN MAIN	IRRIGATION SUPPLY				36.75850	-121.72410	12/27/2017	5/26/2018
AGL020008223-NISSEN_IRR	IRRIGATION SUPPLY				36.68874	-121.74491	10/31/2017	10/31/2017
AGL020008223-NISSEN1_I	IRRIGATION SUPPLY				36.69259	-121.74408	10/31/2017	10/31/2017
AGL020008234-SCHOOL_IRR	IRRIGATION SUPPLY				36.69378	-121.70184	10/31/2017	10/31/2017
AGL020008235-BALESTRA_I	IRRIGATION SUPPLY				36.69187	-121.70835	10/31/2017	10/31/2017
AGL020008332-WELL 1	IRRIGATION SUPPLY				36.69503	-121.69316	6/12/2017	12/6/2017
AGL020008403-TASIMON2_I	IRRIGATION SUPPLY				36.65929	-121.71438	6/29/2017	6/29/2017
AGL020008405-ROSMASSA_I	IRRIGATION SUPPLY				36.57535	-121.51371	6/28/2017	6/28/2017
AGL020008426-R19-4	IRRIGATION SUPPLY				36.56328	-121.52033	6/14/2017	10/12/2017
AGL020008433-17-20	IRRIGATION SUPPLY				36.57325	-121.53786	6/19/2017	10/12/2017
AGL020008433-17-21	IRRIGATION SUPPLY				36.57711	-121.53172	6/19/2017	10/12/2017
AGL020008433-R17-28	IRRIGATION SUPPLY				36.56633	-121.52478	6/14/2017	10/12/2017
AGL020008433-R17-29	IRRIGATION SUPPLY				36.55894	-121.52922	6/14/2017	11/1/2017
AGL020008433-R17-32	IRRIGATION SUPPLY				36.56772	-121.52983	6/14/2017	10/12/2017
AGL020008433-R17-33	IRRIGATION SUPPLY				36.57047	-121.53444	6/14/2017	10/12/2017
AGL020008438-R16-19	IRRIGATION SUPPLY				36.56542	-121.51300	6/14/2017	10/25/2017
AGL020008438-R16-5	IRRIGATION SUPPLY				36.57406	-121.50753	6/14/2017	10/25/2017
AGL020008528-WDAVIS4_I	IRRIGATION SUPPLY				36.63733	-121.69170	7/24/2018	7/24/2018
AGL020008543-BORONDA_I	IRRIGATION SUPPLY				36.69242	-121.70490	7/25/2017	7/25/2017
AGL020008550-WELL	IRRIGATION SUPPLY				36.63664	-121.66856	6/9/2015	7/25/2017
AGL020008554-WELL 5	IRRIGATION SUPPLY				36.59932	-121.58587	11/20/2017	4/22/2019
AGL020008603-#2 ODELLO IRR	IRRIGATION SUPPLY				36.71504	-121.67794	12/12/2017	12/12/2017
AGL020008762-AG_PORTO6	IRRIGATION SUPPLY				36.49054	-121.44456	9/6/2013	6/7/2019
AGL020009002-DOLAN_WELL	IRRIGATION SUPPLY				36.80180	-121.75153	5/28/2014	12/12/2017
AGL020009042-BAJO	IRRIGATION SUPPLY				36.57296	-121.57626	8/19/2014	8/19/2014
AGL020009043-POZZI	IRRIGATION SUPPLY				36.60765	-121.64377	8/19/2014	8/19/2014
AGL020009044-PALMAS	IRRIGATION SUPPLY				36.59334	-121.60400	8/19/2014	8/19/2014
AGL020010462-CRAN AG	IRRIGATION SUPPLY				36.71042	-121.70704	10/26/2017	11/19/2019
AGL020010482-HOME WELL	IRRIGATION SUPPLY				36.68248	-121.67879	8/2/2017	10/26/2017
AGL020010483-PUMP 1	IRRIGATION SUPPLY				36.69392	-121.71593	8/2/2017	10/26/2017
AGL020010483-PUMP 2	IRRIGATION SUPPLY				36.69748	-121.70960	8/2/2017	10/26/2017
AGL020011568-R14_BLK19	IRRIGATION SUPPLY				36.71772	-121.68445	6/7/2017	9/29/2017
AGL020011571-AG_JON_G	IRRIGATION SUPPLY				36.72218	-121.69633	12/11/2013	6/7/2017

AGL020011571-AG_SJON_MA	IRRIGATION SUPPLY				36.71650	-121.69932	6/7/2017	9/29/2017
AGL020011571-R14_BLK19	IRRIGATION SUPPLY				36.71772	-121.68445	6/3/2016	6/3/2016
AGL020011790-WELL AG	IRRIGATION SUPPLY				36.56126	-121.55281	6/23/2017	9/20/2017
AGL020011791-WELL AG	IRRIGATION SUPPLY				36.53668	-121.54198	6/23/2017	9/20/2017
AGL020012422-R1 W12	IRRIGATION SUPPLY				36.61288	-121.63564	10/14/2013	4/30/2018
AGL020012423-R4S W4	IRRIGATION SUPPLY				36.48798	-121.46063	10/16/2013	4/26/2018
AGL020012424-VOSTI 4 W2	IRRIGATION SUPPLY				36.49297	-121.44898	10/16/2013	6/8/2018
AGL020012463-R12 W20	IRRIGATION SUPPLY				36.69029	-121.70712	10/14/2013	6/11/2018
AGL020012664-AG_WELL_C	IRRIGATION SUPPLY				36.77334	-121.76025	10/8/2012	4/26/2018
AGL020012823-AG WELL	IRRIGATION SUPPLY				36.77455	-121.71360	2/15/2013	6/17/2013
AGL020013342-AG_VAUGHN3	IRRIGATION SUPPLY				36.68937	-121.69827	9/5/2013	11/3/2017
AGL020013402-WELL_AG	IRRIGATION SUPPLY				36.59551	-121.62159	6/25/2017	6/25/2017
AGL020013403-WELL_AG	IRRIGATION SUPPLY				36.59143	-121.55957	6/25/2017	6/25/2017
AGL020013405-WELL_AG_3	IRRIGATION SUPPLY				36.55423	-121.54453	6/25/2017	6/25/2017
AGL020013410-WELL_AG_2	IRRIGATION SUPPLY				36.51028	-121.45904	6/25/2017	6/25/2017
AGL020013410-WELL_AG_HM	IRRIGATION SUPPLY				36.51225	-121.46555	6/25/2017	6/25/2017
AGL020013482-AW	IRRIGATION SUPPLY				36.70611	-121.71083	4/30/2014	4/30/2014
AGL020013482-AW 1	IRRIGATION SUPPLY				36.70614	-121.71104	9/18/2014	9/18/2014
AGL020013483-AW 1	IRRIGATION SUPPLY				36.63500	-121.67667	1/27/2014	9/19/2019
AGL020013483-AW 2	IRRIGATION SUPPLY				36.63694	-121.66861	1/27/2014	9/19/2019
AGL020013485-AW 1	IRRIGATION SUPPLY				36.70252	-121.70902	9/18/2014	10/10/2018
AGL020013485-AW_NEW_WELL	IRRIGATION SUPPLY				36.70216	-121.71201	10/31/2017	9/19/2019
AGL020013486-AW 1	IRRIGATION SUPPLY				36.71139	-121.73944	1/27/2014	9/19/2019
AGL020013486-AW 2	IRRIGATION SUPPLY				36.71056	-121.74361	1/27/2014	9/19/2019
AGL020013668-WELL	IRRIGATION SUPPLY				36.73090	-121.68784	7/27/2017	7/27/2017
AGL020013670-WELL 2	IRRIGATION SUPPLY				36.69528	-121.73482	6/13/2017	9/18/2018
AGL020014363-SOM	IRRIGATION SUPPLY				36.59678	-121.55299	5/11/2017	9/26/2017
AGL020014763-QUATRIN1_I	IRRIGATION SUPPLY				36.69139	-121.67579	6/7/2017	6/7/2017
AGL020014781-WELL #2	IRRIGATION SUPPLY				36.50179	-121.47464	12/19/2012	11/14/2017
AGL020014783-WELL #1	IRRIGATION SUPPLY				36.55947	-121.50735	12/17/2012	11/1/2017
AGL020014787-WELL #2	IRRIGATION SUPPLY				36.59898	-121.59242	12/17/2012	5/14/2014
AGL020014842-AG_AZEVEDO	IRRIGATION SUPPLY				36.84725	-121.75018	12/14/2012	10/10/2018
AGL020014842-AZEVEDO_1	IRRIGATION SUPPLY				36.84681	-121.74972	12/21/2017	12/21/2017
AGL020014842-AZEVEDO_2	IRRIGATION SUPPLY				36.84563	-121.74853	4/12/2019	10/10/2019
AGL020014885-AG_MERDIAN	IRRIGATION SUPPLY				36.78837	-121.70530	12/14/2012	10/10/2019
AGL020014885-MERIDIAN_2	IRRIGATION SUPPLY				36.78566	-121.71301	9/26/2016	10/10/2019
AGL020014885-MERIDIAN_3	IRRIGATION SUPPLY				36.78531	-121.70241	9/26/2016	10/10/2019
AGL020014954-GH22-03	IRRIGATION SUPPLY				36.58812	-121.56517	10/31/2012	12/8/2020
AGL020015807-TANUTALL_I	IRRIGATION SUPPLY				36.66470	-121.70017	6/28/2017	6/28/2017
AGL020015811-LOT24-33_I	IRRIGATION SUPPLY				36.63956	-121.66394	6/28/2017	6/28/2017
AGL020015944-WELL	IRRIGATION SUPPLY				36.68636	-121.67711	6/10/2015	7/25/2017
AGL020015966-SIP 1	IRRIGATION SUPPLY				36.61962	-121.65389	12/12/2012	3/7/2013
AGL020016122-WELL 2	IRRIGATION SUPPLY				36.63995	-121.64058	6/12/2017	6/12/2017
AGL020016363-WELL	IRRIGATION SUPPLY				36.68832	-121.68126	3/25/2013	6/13/2013
AGL020016624-MSJ QVFI	IRRIGATION SUPPLY				36.70860	-121.69950	12/27/2017	12/27/2017

AGL020016642-#2 CN QVF	IRRIGATION SUPPLY				36.75840	-121.69240	6/29/2017	12/27/2017
AGL020016762-MAIN IRR	IRRIGATION SUPPLY				36.85032	-121.73830	4/23/2015	12/29/2017
AGL020016782-RSSLLBGWL	IRRIGATION SUPPLY				36.74276	-121.68689	12/20/2012	5/17/2013
AGL020016782-RSSLLSMWL	IRRIGATION SUPPLY				36.74276	-121.68689	12/20/2012	12/20/2012
AGL020017225-WELL 3	IRRIGATION SUPPLY				36.70778	-121.73046	12/27/2017	4/13/2018
AGL020017226-WELL 2	IRRIGATION SUPPLY				36.63904	-121.62690	12/27/2017	4/13/2018
AGL020017227-WELL 1	IRRIGATION SUPPLY				36.64866	-121.66965	12/27/2017	4/13/2018
AGL020017228-WELL 1	IRRIGATION SUPPLY				36.64841	-121.67118	12/27/2017	4/13/2018
AGL020017642-RIANDA_PUMP_1	IRRIGATION SUPPLY				36.48107	-121.47047	10/10/2017	10/3/2018
AGL020017663-BALESTRA_I	IRRIGATION SUPPLY				36.69186	-121.70841	7/25/2017	7/25/2017
AGL020017742-AG WELL 3	IRRIGATION SUPPLY				36.58861	-121.55389	7/10/2017	7/10/2017
AGL020019644-SANDHIL1_I	IRRIGATION SUPPLY				36.69284	-121.77155	6/7/2017	6/7/2017
AGL020019983-LOT1-8W2_I	IRRIGATION SUPPLY				36.68872	-121.74495	6/29/2017	6/29/2017
AGL020019984-TAWYNNE1_I	IRRIGATION SUPPLY				36.68712	-121.73519	6/29/2017	6/29/2017
AGL020020063-R28W1ACSIP	IRRIGATION SUPPLY				36.71990	-121.71420	10/14/2013	10/14/2013
AGL020020702-AG_BRYGGMA	IRRIGATION SUPPLY				36.72947	-121.67612	6/5/2017	10/20/2017
AGL020020802-SIMON1_I	IRRIGATION SUPPLY				36.66423	-121.70263	7/25/2017	7/25/2017
AGL020021343-71898	IRRIGATION SUPPLY				36.61431	-121.57790	5/24/2017	5/24/2017
AGL020021343-71899	IRRIGATION SUPPLY				36.61732	-121.58327	5/24/2017	5/24/2017
AGL020021343-71900	IRRIGATION SUPPLY				36.61436	-121.58418	5/24/2017	5/24/2017
AGL020021343-71901	IRRIGATION SUPPLY				36.61678	-121.59341	5/24/2017	5/24/2017
AGL020021382-71903	IRRIGATION SUPPLY				36.62253	-121.60219	5/24/2017	5/24/2017
AGL020021422-AG WELL	IRRIGATION SUPPLY				36.59243	-121.61684	2/20/2018	7/10/2018
AGL020021965-FAJIO	IRRIGATION SUPPLY				36.57011	-121.57087	6/16/2017	6/16/2017
AGL020021971-SIMON1_IRR	IRRIGATION SUPPLY				36.66423	-121.70258	10/31/2017	10/31/2017
AGL020021982-HICKS_AG	IRRIGATION SUPPLY				36.58962	-121.60575	9/25/2017	9/25/2017
AGL020022262-SELVA_PUMP	IRRIGATION SUPPLY				36.48266	-121.48282	10/10/2017	10/3/2018
AGL020022302-WELL	IRRIGATION SUPPLY				36.78888	-121.71768	4/28/2016	7/27/2017
AGL020023022-TARP_W_AG	IRRIGATION SUPPLY				36.59055	-121.61733	6/16/2017	6/16/2017
AGL020023022-TARP_WEST_AG_1	IRRIGATION SUPPLY				36.59055	-121.61731	10/31/2019	10/31/2019
AGL020024042-STRAW_CYN	IRRIGATION SUPPLY				36.83000	-121.70389	6/19/2014	6/19/2014
AGL020026802-AG WELL	IRRIGATION SUPPLY				36.80180	-121.72090	1/24/2018	1/24/2018
AGL020027408-TARPLOT3_I	IRRIGATION SUPPLY				36.64252	-121.64655	10/24/2017	10/24/2017
AGL020027420-R23HOOT P1	IRRIGATION SUPPLY				36.54164	-121.46566	5/20/2016	4/26/2018
AGL020027513-AG_ELKHORN	IRRIGATION SUPPLY				36.81750	-121.72107	3/5/2015	1/17/2018
AGL020027551-AG_MORIMOT	IRRIGATION SUPPLY				36.74204	-121.68398	6/16/2016	8/28/2017
AGL020027805-PEDRAZZ_AG	IRRIGATION SUPPLY				36.58870	-121.60445	6/16/2017	6/16/2017
AGL020027813-SULVIERA_I	IRRIGATION SUPPLY				36.69323	-121.73839	6/29/2017	6/29/2017
AGL020027837-AG WELL	IRRIGATION SUPPLY				36.53174	-121.46044	3/30/2017	11/1/2017
AGL020027895-#4 CE QVF	IRRIGATION SUPPLY				36.77000	-121.69900	6/29/2017	12/27/2017
AGL020027906-R6PUMP1_I	IRRIGATION SUPPLY				36.59244	-121.58901	5/25/2017	5/25/2017
AGL020027938-AG_HOOKER1	IRRIGATION SUPPLY				36.53176	-121.47249	5/23/2017	6/7/2019
AGL020027970-CHULAR W1	IRRIGATION SUPPLY				36.54642	-121.54954	6/14/2017	12/6/2017
AGL020027974-BAILLIE_1	IRRIGATION SUPPLY				36.60143	-121.58755	5/8/2017	9/13/2017

AGL020027974-BAILLIE_2	IRRIGATION SUPPLY				36.60333	-121.58352	5/8/2017	9/8/2017
AGL020027974-BAILLIE_3	IRRIGATION SUPPLY				36.60597	-121.58122	5/8/2017	9/8/2017
AGL020027974-BAILLIE_4	IRRIGATION SUPPLY				36.60645	-121.57882	5/4/2017	9/13/2017
AGL020027975-R16_P1	IRRIGATION SUPPLY				36.60298	-121.58367	5/5/2016	5/1/2018
AGL020028005-BUENVIS1_I	IRRIGATION SUPPLY				36.59267	-121.61210	7/25/2017	7/25/2017
AGL020028005-BUENVIS2_I	IRRIGATION SUPPLY				36.59376	-121.61485	7/25/2017	7/25/2017
AGL020028005-BUENVIS3_I	IRRIGATION SUPPLY				36.59167	-121.60953	7/25/2017	7/25/2017
AGL020028095-HOME IRR	IRRIGATION SUPPLY				36.64206	-121.66729	12/12/2017	12/12/2017
AGL020028097-MACHADO IRR	IRRIGATION SUPPLY				36.66434	-121.68110	12/12/2017	12/12/2017
AGL020028103-TERAJI IRR	IRRIGATION SUPPLY				36.65049	-121.65755	12/12/2017	12/12/2017
AGL020028122-AG_PEDRAZ1	IRRIGATION SUPPLY				36.58635	-121.59843	9/29/2016	4/12/2019
AGL020028122-AG_PEDRAZ2	IRRIGATION SUPPLY				36.58623	-121.58996	8/15/2016	4/12/2019
AGL020028122-AG_PEDRAZ3	IRRIGATION SUPPLY				36.58340	-121.59168	8/11/2016	10/10/2019
AGL020028138-TARP_EAST	IRRIGATION SUPPLY				36.59054	-121.60734	6/16/2017	6/16/2017
AGL020028194-MFBAILL1_I	IRRIGATION SUPPLY				36.72483	-121.76015	5/1/2019	5/1/2019
AGL020028215-R31_LEO_W1	IRRIGATION SUPPLY				36.59767	-121.62651	4/7/2017	4/7/2017
AGL020028216-R32_PED_W1	IRRIGATION SUPPLY				36.58808	-121.60393	4/7/2017	4/7/2017
AGL020028217-R33_TARPW1	IRRIGATION SUPPLY				36.59064	-121.60760	4/7/2017	4/7/2017
AGL020028315-#2BAILIE IRR	IRRIGATION SUPPLY				36.60325	-121.58360	12/12/2017	12/12/2017
AGL020028399-NORTH WELL	IRRIGATION SUPPLY				36.49759	-121.50224	5/25/2017	10/9/2017
AGL020028432-AG WELL	IRRIGATION SUPPLY				36.59998	-121.60394	2/20/2018	7/10/2018
AGL020028446-NAKAGA_DOM	IRRIGATION SUPPLY				36.80154	-121.72120	12/21/2017	5/7/2018
AGL020030108-FLEW_W1	IRRIGATION SUPPLY				36.59995	-121.60345	12/5/2017	5/1/2018
AGL020030231-CHUALAR_1	IRRIGATION SUPPLY				36.55580	-121.51590	6/7/2019	6/7/2019
AGL020030333-IRR WELL	IRRIGATION SUPPLY				36.48923	-121.48198	4/26/2018	4/26/2018
AGL020032745-HICKS_AG	IRRIGATION SUPPLY				36.58963	-121.60579	10/31/2019	10/31/2019
AGL020035698-HEESS IRR	IRRIGATION SUPPLY				36.52623	-121.53288	4/4/2019	4/4/2019
AGL020035701-BUENVIS2_I	IRRIGATION SUPPLY				36.60337	-121.58365	5/1/2019	5/1/2019
AGL020035760-SALMINA1_I	IRRIGATION SUPPLY				36.69502	-121.69310	7/16/2019	7/16/2019
AGL020036211-ROMIE_1	IRRIGATION SUPPLY				36.56320	-121.52040	6/7/2019	6/7/2019
AGL020036835-STEINBECK_IW	IRRIGATION SUPPLY				36.59853	-121.57471	5/21/2020	5/21/2020

Chapter 7
Appendix 7-E

Central Coast Ag Order 3.0 **and Ag Order 4.0**
Monitoring and Reporting Program

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL COAST REGION

MONITORING AND REPORTING PROGRAM
ORDER NO. R3-2017-0002-01

TIER 1

DISCHARGERS ENROLLED UNDER
CONDITIONAL WAIVER OF WASTE DISCHARGE REQUIREMENTS FOR
DISCHARGES FROM IRRIGATED LANDS

This Monitoring and Reporting Program Order No. R3-2017-0002-01 (MRP) is issued pursuant to California Water Code (Water Code) sections 13267 and 13269, which authorize the California Regional Water Quality Control Board, Central Coast Region (hereafter Central Coast Water Board) to require preparation and submittal of technical and monitoring reports. Water Code section 13269 requires a waiver of waste discharge requirements to include as a condition the performance of monitoring and the public availability of monitoring results. *Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands*, Order No. R3-2017-0002 (Order) includes criteria and requirements for three tiers. This MRP sets forth monitoring and reporting requirements for **Tier 1 Dischargers** enrolled under the Order. A summary of the requirements is shown below.

SUMMARY OF MONITORING AND REPORTING REQUIREMENTS FOR TIER 1:

Part 1: Surface Receiving Water Monitoring and Reporting *(cooperative or individual)*
Part 2: Groundwater Monitoring and Reporting *(cooperative or individual)*

Pursuant to Water Code section 13269(a)(2), monitoring requirements must be designed to support the development and implementation of the waiver program, including, but not limited to, verifying the adequacy and effectiveness of the waiver's conditions. The monitoring and reports required by this MRP are to evaluate effects of discharges of waste from irrigated agricultural operations and individual farms/ranches on waters of the state and to determine compliance with the Order.

MONITORING AND REPORTING BASED ON TIERS

The Order and MRP include criteria and requirements for three tiers, based upon those characteristics of individual farms/ranches at the operation that present the highest level of waste discharge or greatest risk to water quality. Dischargers must meet conditions of the Order and MRP for the appropriate tier that applies to their land and/or the individual farm/ranch. Within a tier, Dischargers comply with requirements based on the specific level of discharge and threat to water quality from individual farms/ranches. The lowest tier, Tier 1, applies to dischargers who discharge the lowest level of waste (amount or concentration) or pose the lowest potential to cause or contribute to an exceedance of water quality standards in waters of the State or of the United States. The highest tier, Tier 3, applies to dischargers who discharge the highest level of waste or pose the greatest potential to cause or contribute to an exceedance of water quality standards in waters of the State or of the United States. Tier 2 applies to dischargers whose discharge has a moderate threat to water quality. Water quality is defined in terms of regional, state, or federal numeric or narrative water quality standards. Per the Order, Dischargers may submit a request to the Executive Officer to approve transfer to a lower tier. If the Executive Officer approves a transfer to a lower tier, any interested person may request that the Central Coast Water Board conduct a review of the Executive Officer's determination.

PART 1. SURFACE RECEIVING WATER MONITORING AND REPORTING REQUIREMENTS

The surface receiving water monitoring and reporting requirements described herein are generally a continuation of the surface receiving water monitoring and reporting requirements of Monitoring and Reporting Program Order No. 2012-0011-01, as revised August 22, 2016, with the intent of uninterrupted regular monitoring and reporting during the transition from Order No. R3-2012-0011-01 to Order No. R3-2017-0002-01.

Monitoring and reporting requirements for surface receiving water identified in Part 1.A. and Part 1.B. apply to Tier 1 Dischargers. Surface receiving water refers to water flowing in creeks and other surface waters of the State. Surface receiving water monitoring may be conducted through a cooperative monitoring program on behalf of Dischargers, or Dischargers may choose to conduct surface receiving water monitoring and reporting individually. Key monitoring and reporting requirements for surface receiving water are shown in Tables 1 and 2.

A. Surface Receiving Water Quality Monitoring

1. Dischargers must elect a surface receiving water monitoring option (cooperative monitoring program or individual receiving water monitoring) to comply with surface receiving water quality monitoring requirements, and identify the option selected on the Notice of Intent (NOI).

2. Dischargers are encouraged to choose participation in a cooperative monitoring program (e.g., the existing Cooperative Monitoring Program or a similar program) to comply with receiving water quality monitoring requirements. Dischargers not participating in a cooperative monitoring program must conduct surface receiving water quality monitoring individually that achieves the same purpose.

3. Dischargers (individually or as part of a cooperative monitoring program) must conduct surface receiving water quality monitoring to a) assess the impacts of their waste discharges from irrigated lands to receiving water, b) assess the status of receiving water quality and beneficial use protection in impaired waterbodies dominated by irrigated agricultural activity, c) evaluate status, short term patterns and long term trends (five to ten years or more) in receiving water quality, d) evaluate water quality impacts resulting from agricultural discharges (including but not limited to tile drain discharges), e) evaluate stormwater quality, f) evaluate condition of existing perennial, intermittent, or ephemeral streams or riparian or wetland area habitat, including degradation resulting from erosion or agricultural discharges of waste, and g) assist in the identification of specific sources of water quality problems.

Surface Receiving Water Quality Sampling and Analysis Plan

4. **By March 1, 2018, or as directed by the Executive Officer**, Dischargers (individually or as part of a cooperative monitoring program) must submit a surface receiving water quality Sampling and Analysis Plan (SAAP) and Quality Assurance Project Plan (QAPP); this requirement is satisfied if an approved SAAP and QAPP addressing all surface receiving water quality monitoring requirements described in this Order has been submitted pursuant to Order No. R3-2012-0011 and associated Monitoring and Reporting Programs. Dischargers (or a third party cooperative monitoring program) must develop the Sampling and Analysis Plan to describe how the proposed monitoring will achieve the objectives of the MRP and evaluate compliance with the Order. The Sampling and Analysis Plan may propose alternative monitoring site locations, adjusted monitoring parameters, and other changes as necessary to assess the impacts of waste discharges from irrigated lands to receiving water. The Executive Officer must approve the Sampling and Analysis Plan and QAPP.

5. The Sampling and Analysis Plan must include the following minimum required components:
    a. Monitoring strategy to achieve objectives of the Order and MRP;
    b. Map of monitoring sites with GIS coordinates;
    c. Identification of known water quality impairments and impaired waterbodies per the 2010 Clean Water Act 303(d) List of Impaired Waterbodies (List of Impaired Waterbodies);
    d. Identification of beneficial uses and applicable water quality standards;
    e. Identification of applicable Total Maximum Daily Loads;
    f. Monitoring parameters;
    g. Monitoring schedule, including description and frequencies of monitoring events;

h. Description of data analysis methods;

6. The QAPP must include receiving water and site-specific information, project organization and responsibilities, and quality assurance components of the MRP. The QAPP must also include the laboratory and field requirements to be used for analyses and data evaluation. The QAPP must contain adequate detail for project and Water Board staff to identify and assess the technical and quality objectives, measurement and data acquisition methods, and limitations of the data generated under the surface receiving water quality monitoring. All sampling and laboratory methodologies and QAPP content must be consistent with U.S. EPA methods, State Water Board's Surface Water Ambient Monitoring Program (SWAMP) protocols and the Central Coast Water Board's Central Coast Ambient Monitoring Program (CCAMP). Following U.S. EPA guidelines[1] and SWAMP templates[2], the receiving water quality monitoring QAPP must include the following minimum required components:
    a. Project Management. This component addresses basic project management, including the project history and objectives, roles and responsibilities of the participants, and other aspects.
    b. Data Generation and Acquisition. This component addresses all aspects of project design and implementation. Implementation of these elements ensures that appropriate methods for sampling, measurement and analysis, data collection or generation, data handling, and quality control activities are employed and are properly documented. Quality control requirements are applicable to all the constituents sampled as part of the MRP, as described in the appropriate method.
    c. Assessment and Oversight. This component addresses the activities for assessing the effectiveness of the implementation of the project and associated QA and QC activities. The purpose of the assessment is to provide project oversight that will ensure that the QA Project Plan is implemented as prescribed.
    d. Data Validation and Usability. This component addresses the quality assurance activities that occur after the data collection, laboratory analysis and data generation phase of the project is completed. Implementation of these elements ensures that the data conform to the specified criteria, thus achieving the MRP objectives.

---

[1] USEPA. 2001 (2006) USEPA Requirements for Quality Assurance Project Plans (QA/R-5) Office of Environmental Information, Washington, D.C. USEPA QA/R-5

[2] http://waterboards.ca.gov/water_issues/programs/swamp/tools.shtml#qa

7. The Central Coast Water Board may conduct an audit of contracted laboratories at any time in order to evaluate compliance with the QAPP.

8. The Sampling and Analysis Plan and QAPP, and any proposed revisions are subject to approval by the Executive Officer. The Executive Officer may also revise the Sampling and Analysis Plan, including adding, removing, or changing monitoring site locations, changing monitoring parameters, and other changes as necessary to assess the impacts of waste discharges from irrigated lands to receiving water.

Surface Receiving Water Quality Monitoring Sites

9. The Sampling and Analysis Plan must, at a minimum, include monitoring sites to evaluate waterbodies identified in Table 1, unless otherwise approved by the Executive Officer. The Sampling and Analysis Plan must include sites to evaluate receiving water quality impacts most directly resulting from areas of agricultural discharge (including areas receiving tile drain discharges). Site selection must take into consideration the existence of any long term monitoring sites included in related monitoring programs (e.g. CCAMP and the existing CMP). Sites may be added or modified, subject to prior approval by the Executive Officer, to better assess the pollutant loading from individual sources or the impacts to receiving waters caused by individual discharges. Any modifications must consider sampling consistency for purposes of trend evaluation.

Surface Receiving Water Quality Monitoring Parameters

10. The Sampling and Analysis Plan must, at a minimum, include the following types of monitoring and evaluation parameters listed below and identified in Table 2:

    a. Flow Monitoring;
    b. Water Quality (physical parameters, metals, nutrients, pesticides);
    c. Toxicity (water and sediment);
    d. Assessment of Benthic Invertebrates.

11. All analyses must be conducted at a laboratory certified for such analyses by the State Department of Public Health (CDPH) or at laboratories approved by the Executive Officer. Unless otherwise noted, all sampling, sample preservation, and analyses must be performed in accordance with the latest edition of *Test Methods for Evaluating Solid Waste*, SW-846, U.S. EPA, and analyzed as specified herein by the above analytical methods and reporting limits indicated. Certified laboratories can be found at the web link: http://www.cdph.ca.gov/certlic/labs/Documents/ELAPLablist.xls

12. Water quality and flow monitoring is used to assess the sources, concentrations, and loads of waste discharges from individual farms/ranches and groups of Dischargers to surface waters, to evaluate impacts to water quality and beneficial uses, and to evaluate the short term patterns and long term trends in receiving water quality. Monitoring data must be compared to existing numeric and narrative water quality objectives.

13. Toxicity testing is to evaluate water quality relative to the narrative toxicity objective. Water column toxicity analyses must be conducted on 100% (undiluted) sample. At sites where persistent unresolved toxicity is found, the Executive Officer may require concurrent toxicity and chemical analyses and a Toxicity Identification Evaluation (TIE) to identify the individual discharges causing the toxicity.

Surface Receiving Water Quality Monitoring Frequency and Schedule

14. The Sampling and Analysis Plan must include a schedule for sampling. Timing, duration, and frequency of monitoring must be based on the land use, complexity, hydrology, and size of the waterbody. Table 2 includes minimum monitoring frequency and parameter lists. Agricultural parameters that are less common may be monitored less frequently. Modifications to the receiving water quality monitoring parameters, frequency, and schedule may be submitted for Executive Officer consideration and approval. At a minimum, the Sampling and Analysis Plan schedule must consist of monthly monitoring of common agricultural parameters in major agricultural areas, including two major storm events during the wet season (October 1 – April 30).

15. Storm event monitoring must be conducted within 18 hours of storm events, preferably including the first flush run-off event that results in significant increase in stream flow. For purposes of this MRP, a storm event is defined as precipitation producing onsite runoff (surface water flow) capable of creating significant ponding, erosion or other water quality problem. A significant storm event will generally result in greater than 1-inch of rain within a 24-hour period.

16. Dischargers (individually or as part of a cooperative monitoring program) must perform receiving water quality monitoring per the Sampling and Analysis Plan and QAPP approved by the Executive Officer.

B. Surface Receiving Water Quality Reporting

Surface Receiving Water Quality Data Submittal

1. Dischargers (individually or as part of a cooperative monitoring program) must submit water quality monitoring data to the Central Coast Water Board electronically, in a format specified by the Executive Officer and compatible with SWAMP/CCAMP electronic submittal guidelines, each January 1, April 1, July 1, and October 1.

<u>Surface Receiving Water Quality Monitoring Annual Report</u>

2. **By July 1, 2017,** and every July 1 annually thereafter, Dischargers (individually or as part of a cooperative monitoring program) must submit an Annual Report, electronically, in a format specified by the Executive Officer including the following minimum elements:

a. Signed Transmittal Letter;
b. Title Page;
c. Table of Contents;
d. Executive Summary;
e. Summary of Exceedance Reports submitted during the reporting period;
f. Monitoring objectives and design;
g. Monitoring site descriptions and rainfall records for the time period covered;
h. Location of monitoring sites and map(s);
i. Tabulated results of all analyses arranged in tabular form so that the required information is readily discernible;
j. Summary of water quality data for any sites monitored as part of related monitoring programs, and used to evaluate receiving water as described in the Sampling and Analysis Plan.
k. Discussion of data to clearly illustrate compliance with the Order and water quality standards;
l. Discussion of short term patterns and long term trends in receiving water quality and beneficial use protection;
m. Evaluation of pesticide and toxicity analyses results, and recommendation of candidate sites for Toxicity Identification Evaluations (TIEs);
n. Identification of the location of any agricultural discharges observed discharging directly to surface receiving water;
o. Laboratory data submitted electronically in a SWAMP/CCAMP comparable format;
p. Sampling and analytical methods used;
q. Copy of chain-of-custody forms;
r. Field data sheets, signed laboratory reports, laboratory raw data;
s. Associated laboratory and field quality control samples results;
t. Summary of Quality Assurance Evaluation results;

u. Specify the method used to obtain flow at each monitoring site during each monitoring event;
v. Electronic or hard copies of photos obtained from all monitoring sites, clearly labeled with site ID and date;
w. Conclusions.

PART 2. GROUNDWATER MONITORING AND REPORTING REQUIREMENTS

Groundwater monitoring may be conducted through a cooperative monitoring and reporting program on behalf of growers, or Dischargers may choose to conduct groundwater monitoring and reporting individually. Qualifying cooperative groundwater monitoring and reporting programs must implement the groundwater monitoring and reporting requirements described in this Order, unless otherwise approved by the Executive Officer. An interested person may seek review by the Central Coast Water Board of the Executive Officer's approval or denial of a cooperative groundwater monitoring and reporting program.

Key monitoring and reporting requirements for groundwater are shown in Table 3.

A. Groundwater Monitoring

1. Dischargers must sample private domestic wells and the primary irrigation well on their farm/ranch to evaluate groundwater conditions in agricultural areas, identify areas at greatest risk for nitrogen loading and exceedance of drinking water standards, and identify priority areas for follow up actions.

2. Dischargers must sample at least one groundwater well for each farm/ranch on their operation, including groundwater wells that are located within the property boundary of the enrolled county assessor parcel numbers (APNs). For farms/ranches with multiple groundwater wells, Dischargers must sample all domestic wells and the primary irrigation well. For the purposes of this MRP, a "domestic well" is any well that is used or may be used for domestic use purposes, including any groundwater well that is connected to a residence, workshop, or place of business that may be used for human consumption, cooking, or sanitary purposes. Groundwater monitoring parameters must include well screen interval depths (if available), general chemical parameters, and general cations and anions listed in Table 3.

3. Dischargers must conduct two rounds of monitoring of required groundwater wells during calendar year 2017; one sample collected during spring (**March - June)** and one sample collected during fall **(September - December)**.

4. Groundwater samples must be collected by a qualified third party (e.g., consultant, technician, person conducting cooperative monitoring) using proper sampling methods, chain-of-custody, and quality assurance/quality

control protocols. Groundwater samples must be collected at or near the well head before the pressure tank and prior to any well head treatment. In cases where this is not possible, the water sample must be collected from a sampling point as close to the pressure tank as possible, or from a cold-water spigot located before any filters or water treatment systems.

5. Laboratory analyses for groundwater samples must be conducted by a State certified laboratory according to U.S. EPA approved methods; unless otherwise noted, all monitoring, sample preservation, and analyses must be performed in accordance with the latest edition of *Test Methods for Evaluating Solid Waste*, SW-846, United States Environmental Protection Agency, and analyzed as specified herein by the above analytical methods and reporting limits indicated. Certified laboratories can be found at the web link below: http://www.waterboards.ca.gov/centralcoast/water_issues/programs/ag_waivers/docs/resources4growers/2016_04_11_labs.pdf

6. If a discharger determines that water in any domestic well exceeds 10 mg/L of nitrate as N, the discharger or third party must provide notice to the Central Coast Water Board within 24 hours of learning of the exceedance. For domestic wells on a Discharger's farm/ranch that exceed 10 mg/L nitrate as N, the Discharger must provide written notification to the users within 10 days of learning of the exceedance and provide written confirmation of the notification to the Central Coast Water Board.

   The drinking water notification must include the statement that the water poses a human health risk due to elevated nitrate concentration, and include a warning against the use of the water for drinking or cooking. In addition, Dischargers must also provide prompt written notification to any new well users (e.g. tenants and employees with access to the affected well), whenever there is a change in occupancy.

   For all other domestic wells not on a Discharger's farm/ranch but that may be impacted by nitrate, the Central Coast Water Board will notify the users promptly.

   The drinking water notification and confirmation letters required by this Order are available to the public.

B. Groundwater Reporting

1. **Within 60 days of sample collection,** Dischargers must coordinate with the laboratory to submit the following groundwater monitoring results and information, electronically, using the Water Board's GeoTracker electronic deliverable format (EDF):
   a. GeoTracker Ranch Global Identification Number

b. Field point name (Well Name)
c. Field Point Class (Well Type)
d. Latitude
e. Longitude
f. Sample collection date
g. Analytical results
h. Well construction information (e.g., total depth, screened intervals, depth to water), as available

2. Dischargers must submit groundwater well information required in the electronic Notice of Intent (eNOI) for each farm/ranch and update the eNOI to reflect changes in the farm/ranch information within 30 days of the change. Groundwater well information reported on the eNOI includes, but is not limited to:

a. Number of groundwater wells present at each farm/ranch
b. Identification of any groundwater wells abandoned or destroyed (including method destroyed) in compliance with the Order
c. Use for fertigation or chemigation
d. Presence of back flow prevention devices
e. Number of groundwater wells used for agricultural purposes
f. Number of groundwater wells used for or may be used for domestic use purposes (domestic wells).

PART 3. GENERAL MONITORING AND REPORTING REQUIREMENTS

A. Submittal of Technical Reports

1. Dischargers must submit reports in a format specified by the Executive Officer. A transmittal letter must accompany each report, containing the following penalty of perjury statement signed by the Discharger or the Discharger's authorized agent:

   "In compliance with Water Code §13267, I certify under penalty of perjury that this document and all attachments were prepared by me, or under my direction or supervision following a system designed to assure that qualified personnel properly gather and evaluate the information submitted. To the best of my knowledge and belief, this document and all attachments are true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment".

2. If the Discharger asserts that all or a portion of a report submitted pursuant to this Order is subject to an exemption from public disclosure (e.g. trade secrets or secret processes), the Discharger must provide an explanation of how those portions of the reports are exempt from public disclosure. The

Discharger must clearly indicate on the cover of the report (typically an electronic submittal) that the Discharger asserts that all or a portion of the report is exempt from public disclosure, submit a complete report with those portions that are asserted to be exempt in redacted form, submit separately (in a separate electronic file) unredacted pages (to be maintained separately by staff). The Central Coast Water Board staff will determine whether any such report or portion of a report qualifies for an exemption from public disclosure. If the Central Coast Water Board staff disagrees with the asserted exemption from public disclosure, the Central Coast Water Board staff will notify the Discharger prior to making such report or portions of such report available for public inspection.

B. Central Coast Water Board Authority

1. Monitoring reports are required pursuant to section 13267 of the California Water Code. Pursuant to section 13268 of the Water Code, a violation of a request made pursuant to section 13267 may subject you to civil liability of up to $1000 per day.

2. The Water Board needs the required information to determine compliance with Order No.R3-2017-0002. The evidence supporting these requirements is included in the findings of Order No.R3-2017-0002.

John M. Robertson
Executive Officer

March 8, 2017
Date

Table 1. Major Waterbodies in Agricultural Areas[1]

Hydrologic SubArea	Waterbody Name	Hydrologic SubArea	Waterbody Name
30510	Pajaro River	30920	Quail Creek
30510	Salsipuedes Creek	30920	Salinas Reclamation Canal
30510	Watsonville Slough	31022	Chorro Creek
30510	Watsonville Creek[2]	31023	Los Osos Creek
30510	Beach Road Ditch[2]	31023	Warden Creek
30530	Carnadero Creek	31024	San Luis Obispo Creek
30530	Furlong Creek[2]	31024	Prefumo Creek
30530	Llagas Creek	31031	Arroyo Grande Creek
30530	Miller's Canal	31031	Los Berros Creek
30530	San Juan Creek	31210	Bradley Canyon Creek
30530	Tesquisquita Slough	31210	Bradley Channel
30600	Moro Cojo Slough	31210	Green Valley Creek
30910	Alisal Slough	31210	Main Street Canal
30910	Blanco Drain	31210	Orcutt Solomon Creek
30910	Old Salinas River	31210	Oso Flaco Creek
30910	Salinas River (below Gonzales Rd.)	31210	Little Oso Flaco Creek
30920	Salinas River (above Gonzales Rd. and below Nacimiento R.)	31210	Santa Maria River
30910	Santa Rita Creek[2]	31310	San Antonio Creek[2]
30910	Tembladero Slough	31410	Santa Ynez River
30920	Alisal Creek	31531	Bell Creek
30920	Chualar Creek	31531	Glenn Annie Creek
30920	Espinosa Slough	31531	Los Carneros Creek[2]
30920	Gabilan Creek	31534	Arroyo Paredon Creek
30920	Natividad Creek	31534	Franklin Creek

[1] At a minimum, monitoring sites must be included for these waterbodies in agricultural areas, unless otherwise approved by the Executive Officer. Monitoring sites may be proposed for addition or modification to better assess the impacts of waste discharges from irrigated lands to surface water. Dischargers choosing to comply with surface receiving water quality monitoring, individually (not part of a cooperative monitoring program) must only monitor sites for waterbodies receiving the discharge.

[2] These creeks are included because they are newly listed waterbodies on the 2010 303(d) list of Impaired Waters that are associated with areas of agricultural discharge.

Table 2. Surface Receiving Water Quality Monitoring Parameters

Parameters and Tests	RL[3]	Monitoring Frequency[1]
Photo Monitoring		
Upstream and downstream photographs at monitoring location		With every monitoring event
WATER COLUMN SAMPLING **Physical Parameters and General Chemistry**		
Flow (field measure) (CFS) following SWAMP field SOP[9]	.25	Monthly, including 2 stormwater events
pH (field measure)	0.1	”
Electrical Conductivity (field measure) (µS/cm)	2.5	”
Dissolved Oxygen (field measure) (mg/L)	0.1	”
Temperature (field measure) (^{o}C)	0.1	”
Turbidity (NTU)	0.5	”
Total Dissolved Solids (mg/L)	10	”
Total Suspended Solids (mg/L)	0.5	”
Nutrients		
Total Nitrogen (mg/L)	0.5	Monthly, including 2 stormwater events
Nitrate + Nitrite (as N) (mg/L)	0.1	”
Total Ammonia (mg/L)	0.1	”
Unionized Ammonia (calculated value, mg/L))		”
Total Phosphorus (as P) (mg/L)	0.02	
Soluble Orthophosphate (mg/L)	0.01	”
Water column chlorophyll a (µg/L)	1.0	“
Algae cover, Floating Mats, % coverage	-	“
Algae cover, Attached, % coverage	-	“
Water Column Toxicity Test		
Algae - *Selenastrum capricornutum (*96-hour chronic; Method1003.0 in EPA/821/R-02/013)	-	4 times each year, twice in dry season, twice in wet season
Water Flea – *Ceriodaphnia dubia* (7-day chronic; Method 1002.0 in EPA/821/R-02/013)	-	”
Midge - *Chironomus spp.* (96-hour acute; Alternate test species in EPA 821-R-02-012)	-	“

Parameters and Tests	RL[3]	Monitoring Frequency[1]
Toxicity Identification Evaluation (TIE)	-	As directed by Executive Officer
Pesticides[2] /Herbicides (µg/L)		
Organophosphate Pesticides		
Azinphos-methyl	0.02	2 times in both 2017 and 2018, once in dry season and once in wet season of each year, concurrent with water toxicity monitoring
Chlorpyrifos	0.005	”
Diazinon	0.005	”
Dichlorvos	0.01	”
Dimethoate	0.01	”
Dimeton-s	0.005	”
Disulfoton (Disyton)	0.005	”
Malathion	0.005	”
Methamidophos	0.02	”
Methidathion	0.02	“
Parathion-methyl	0.02	“
Phorate	0.01	“
Phosmet	0.02	“
Neonicotinoids		
Thiamethoxam	.002	“
Imidacloprid	.002	“
Thiacloprid	.002	“
Dinotefuran	.006	“
Acetamiprid	.01	“
Clothianidin	.02	“
Herbicides		
Atrazine	0.05	“
Cyanazine	0.20	“
Diuron	0.05	“
Glyphosate	2.0	“
Linuron	0.1	“
Paraquat	0.20	“
Simazine	0.05	“
Trifluralin	0.05	“
Metals (µg/L)		
Arsenic (total) [5,7]	0.3	2 times in both 2017 and 2018, once in dry season and once in wet season of each year, concurrent with water toxicity monitoring
Boron (total) [6,7]	10	“
Cadmium (total & dissolved) [4.5,7]	0.01	“

Parameters and Tests	RL[3]	Monitoring Frequency[1]
Copper (total and dissolved) [4,7]	0.01	“
Lead (total and dissolved) [4,7]	0.01	“
Nickel (total and dissolved) [4,7]	0.02	“
Molybdenum (total) [7]	1	“
Selenium (total)[7]	0.30	“
Zinc (total and dissolved) [4.5,7]	0.10	“
Other (µg/L)		
Total Phenolic Compounds[8]	5	2 times in 2017, once in spring (April-May) and once in fall (August-September)
Hardness (mg/L as CaCO3)	1	“
Total Organic Carbon (ug/L)	0.6	“
SEDIMENT SAMPLING		
Sediment Toxicity - *Hyalella azteca* 10-day static renewal (EPA, 2000)		2 times each year, once in spring (April-May) and once in fall (August-September)
Pyrethroid Pesticides in Sediment (µg/kg)		
Gamma-cyhalothrin	2	2 times in both 2017 and 2018, once in spring (April-May) and once in fall (August-September) of each year, concurrent with sediment toxicity sampling
Lambda-cyhalothrin	2	“
Bifenthrin	2	“
Beta-cyfluthrin	2	“
Cyfluthrin	2	“
Esfenvalerate	2	“
Permethrin	2	“
Cypermethrin	2	“
Danitol	2	“
Fenvalerate	2	“
Fluvalinate	2	“
Other Monitoring in Sediment		
Chlorpyrifos (µg/kg)	2	“
Total Organic Carbon	0.01%	“
		“
Sediment Grain Size Analysis	1%	“

[1]Monitoring frequency may be used as a guide for developing alternative Sampling and Analysis Plans implemented by individual growers.
[2]Pesticide list may be modified based on specific pesticide use in Central Coast Region. Analytes on this list must be reported, at a minimum.
[3] Reporting Limit, taken from SWAMP where applicable.
[4] Holmgren, Meyer, Cheney and Daniels. 1993. Cadmium, Lead, Zinc, Copper and Nickel in Agricultural Soils of the United States. J. of Environ. Quality 22:335-348.

[5]Sax and Lewis, ed. 1987. Hawley's Condensed Chemical Dictionary. 11th ed. New York: Van Nostrand Reinhold Co., 1987. Zinc arsenate is an insecticide.
[6]Http://www.coastalagro.com/products/labels/9%25BORON.pdf; Boron is applied directly or as a component of fertilizers as a plant nutrient.
[7]Madramootoo, Johnston, Willardson, eds. 1997. Management of Agricultural Drainage Water Quality. International Commission on Irrigation and Drainage. U.N. FAO. SBN 92-6-104058.3.
[8]http://cat.inist.fr/?aModele=afficheN&cpsidt=14074525; Phenols are breakdown products of herbicides and pesticides. Phenols can be directly toxic and cause endocrine disruption.
[9]See SWAMP field measures SOP, p. 17
mg/L – milligrams per liter; ug/L – micrograms per liter; ug/kg – micrograms per kilogram;
NTU – Nephelometric Turbidity Units; CFS – cubic feet per second.

Table 3. Groundwater Sampling Parameters

Parameter	RL	Analytical Method[3]	Units
pH	0.1	Field or Laboratory Measurement EPA General Methods	pH Units
Specific Conductance	2.5		µS/cm
Total Dissolved Solids	10		mg/L
Total Alkalinity as $CaCO_3$		EPA Method 310.1 or 310.2	
Calcium	0.05	General Cations[1] EPA 200.7, 200.8, 200.9	
Magnesium	0.02		
Sodium	0.1		
Potassium	0.1		
Sulfate (SO4)	1.0	General Anions EPA Method 300 or EPA Method 353.2	
Chloride	0.1		
Nitrate + Nitrite (as N)[2] or Nitrate as N	0.1		

[1]General chemistry parameters (major cations and anions) represent geochemistry of water bearing zone and assist in evaluating quality assurance/quality control of groundwater monitoring and laboratory analysis.
[2]The MRP allows analysis of "nitrate plus nitrite" to represent nitrate concentrations (as N). The "nitrate plus nitrite" analysis allows for extended laboratory holding times and relieves the Discharger of meeting the short holding time required for nitrate.
[3]Dischargers may use alternative analytical methods approved by EPA.
RL – Reporting Limit; µS/cm – micro siemens per centimeter

Table 4. Tier 1 - Time Schedule for Key Monitoring and Reporting Requirements (MRPs)

REQUIREMENT	TIME SCHEDULE[1]
Submit Sampling And Analysis Plan and Quality Assurance Project Plan (SAAP/QAPP) for Surface Receiving Water Quality Monitoring *(individually or through cooperative monitoring program)*	By March 1, 2018, or as directed by the Executive Officer; satisfied if an approved SAAP/QAPP has been submitted pursuant to Order No. R3-2012-0011 and associated MRPs
Initiate surface receiving water quality monitoring *(individually or through cooperative monitoring program)*	Per an approved SAAP and QAPP
Submit surface receiving water quality monitoring data *(individually or through cooperative monitoring program)*	Each January 1, April 1, July 1, and October 1

Submit surface receiving water quality Annual Monitoring Report *(individually or through cooperative monitoring program)*	By July 1 2017; annually thereafter by July 1
Initiate monitoring of groundwater wells	First sample from March-June 2017, second sample from September-December 2017
Submit groundwater monitoring results	Within 60 days of the sample collection

[1] Dates are relative to adoption of this Order, unless otherwise specified.

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL COAST REGION

MONITORING AND REPORTING PROGRAM
ORDER NO. R3-2017-0002-02

TIER 2

DISCHARGERS ENROLLED UNDER
THE CONDITIONAL WAIVER OF WASTE DISCHARGE REQUIREMENTS FOR
DISCHARGES FROM IRRIGATED LANDS

This Monitoring and Reporting Program Order No. R3-2017-0002-02 (MRP) is issued pursuant to California Water Code (Water Code) sections 13267 and 13269, which authorize the California Regional Water Quality Control Board, Central Coast Region (hereafter Central Coast Water Board) to require preparation and submittal of technical and monitoring reports. Water Code section 13269 requires a waiver of waste discharge requirements to include as a condition the performance of monitoring and the public availability of monitoring results. *Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands*, Order No. R3-2017-0002 (Order) includes criteria and requirements for three tiers. This MRP sets forth monitoring and reporting requirements for **Tier 2 Dischargers** enrolled under the Order. A summary of the requirements is shown below.

SUMMARY OF MONITORING AND REPORTING REQUIREMENTS FOR TIER 2:

Part 1: Surface Receiving Water Monitoring and Reporting *(cooperative or individual)*
Part 2: Groundwater Monitoring and Reporting *(cooperative or individual)*
Total Nitrogen Applied Reporting *(required for subset of Tier 2 Dischargers if farm/ranch growing any crop with high nitrate loading risk to groundwater);*
Part 3: Annual Compliance Form

Pursuant to Water Code section 13269(a)(2), monitoring requirements must be designed to support the development and implementation of the waiver program, including, but not limited to, verifying the adequacy and effectiveness of the waiver's conditions. The monitoring and reports required by this MRP are to evaluate effects of discharges of waste from irrigated agricultural operations and individual farms/ranches on waters of the state and to determine compliance with the Order.

MONITORING AND REPORTING BASED ON TIERS

The Order and MRP include criteria and requirements for three tiers, based upon those characteristics of the individual farms/ranches at the operation that present the highest level of waste discharge or greatest risk to water quality. Dischargers must meet conditions of the Order and MRP for the appropriate tier that applies to their land and/or the individual farm/ranch. Within a tier, Dischargers comply with requirements based on the specific level of discharge and threat to water quality from individual farms/ranches. The lowest tier, Tier 1, applies to dischargers who discharge the lowest level of waste (amount or concentration) or pose the lowest potential to cause or contribute to an exceedance of water quality standards in waters of the State or of the United States. The highest tier, Tier 3, applies to dischargers who discharge the highest level of waste or pose the greatest potential to cause or contribute to an exceedance of water quality standards in waters of the State or of the United States. Tier 2 applies to dischargers whose discharge has a moderate threat to water quality. Water quality is defined in terms of regional, state, or federal numeric or narrative water quality standards. Per the Order, Dischargers may submit a request to the Executive Officer to approve transfer to a lower tier. If the Executive Officer approves a transfer to a lower tier, any interested person may request that the Central Coast Water Board conduct a review of the Executive Officer's determination.

PART 1. SURFACE RECEIVING WATER MONITORING AND REPORTING REQUIREMENTS

The surface receiving water monitoring and reporting requirements described herein are generally a continuation of the surface receiving water monitoring and reporting requirements of Monitoring and Reporting Program Order No. 2012-0011-02, as revised August 22, 2016, with the intent of uninterrupted regular monitoring and reporting during the transition from Order No. R3-2012-0011-02 to Order No. R3-2017-0002-02.

Monitoring and reporting requirements for surface receiving water identified in Part 1.A. and Part 1.B. apply to Tier 2 Dischargers. Surface receiving water refers to water flowing in creeks and other surface waters of the State. Surface receiving water monitoring may be conducted through a cooperative monitoring program on behalf of Dischargers, or Dischargers may choose to conduct surface receiving water monitoring and reporting individually. Key monitoring and reporting requirements for surface receiving water are shown in Tables 1 and 2. Time schedules are shown in Table4.

A. Surface Receiving Water Quality Monitoring

1. Dischargers must elect a surface receiving water monitoring option (cooperative monitoring program or individual receiving water monitoring) to comply with surface receiving water quality monitoring requirements, and identify the option selected on the Notice of Intent (NOI).

2. Dischargers are encouraged to choose participation in a cooperative monitoring program (e.g., the existing Cooperative Monitoring Program or a similar program) to comply with receiving water quality monitoring requirements. Dischargers not participating in a cooperative monitoring program must conduct surface receiving water quality monitoring individually that achieves the same purpose.

3. Dischargers (individually or as part of a cooperative monitoring program) must conduct surface receiving water quality monitoring to a) assess the impacts of their waste discharges from irrigated lands to receiving water, b) assess the status of receiving water quality and beneficial use protection in impaired waterbodies dominated by irrigated agricultural activity, c) evaluate status, short term patterns and long term trends (five to ten years or more) in receiving water quality, d) evaluate water quality impacts resulting from agricultural discharges (including but not limited to tile drain discharges), e) evaluate stormwater quality, f) evaluate condition of existing perennial, intermittent, or ephemeral streams or riparian or wetland area habitat, including degradation resulting from erosion or agricultural discharges of waste, and g) assist in the identification of specific sources of water quality problems.

Surface Receiving Water Quality Sampling and Analysis Plan

4. **By March 1, 2018, or as directed by the Executive Officer**, Dischargers (individually or as part of a cooperative monitoring program) must submit a surface receiving water quality Sampling and Analysis Plan (SAAP) and Quality Assurance Project Plan (QAPP); this requirement is satisfied if an approved SAAP and QAPP addressing all surface receiving water quality monitoring requirements described in this Order has been submitted pursuant to Order No.R3-2012-0011 and associated Monitoring and Reporting Programs. Dischargers (or a third party cooperative monitoring program) must develop the Sampling and Analysis Plan to describe how the proposed monitoring will achieve the objectives of the MRP and evaluate compliance with the Order. The Sampling and Analysis Plan may propose alternative monitoring site locations, adjusted monitoring parameters, and other changes as necessary to assess the impacts of waste discharges from irrigated lands to receiving water. The Executive Officer must approve the Sampling and Analysis Plan and QAPP.

5. The Sampling and Analysis Plan must include the following minimum required components:
    a. Monitoring strategy to achieve objectives of the Order and MRP;
    b. Map of monitoring sites with GIS coordinates;

c. Identification of known water quality impairments and impaired waterbodies per the 2010 Clean Water Act 303(d) List of Impaired Waterbodies (List of Impaired Waterbodies);
d. Identification of beneficial uses and applicable water quality standards;
e. Identification of applicable Total Maximum Daily Loads;
f. Monitoring parameters;
g. Monitoring schedule, including description and frequencies of monitoring events;
h. Description of data analysis methods;

6. The QAPP must include receiving water and site-specific information, project organization and responsibilities, and quality assurance components of the MRP. The QAPP must also include the laboratory and field requirements to be used for analyses and data evaluation. The QAPP must contain adequate detail for project and Water Board staff to identify and assess the technical and quality objectives, measurement and data acquisition methods, and limitations of the data generated under the surface receiving water quality monitoring. All sampling and laboratory methodologies and QAPP content must be consistent with U.S. EPA methods, State Water Board's Surface Water Ambient Monitoring Program (SWAMP) protocols and the Central Coast Water Board's Central Coast Ambient Monitoring Program (CCAMP). Following U.S. EPA guidelines[1] and SWAMP templates[2], the receiving water quality monitoring QAPP must include the following minimum required components:
   a. Project Management. This component addresses basic project management, including the project history and objectives, roles and responsibilities of the participants, and other aspects.
   b. Data Generation and Acquisition. This component addresses all aspects of project design and implementation. Implementation of these elements ensures that appropriate methods for sampling, measurement and analysis, data collection or generation, data handling, and quality control activities are employed and are properly documented. Quality control requirements are applicable to all the constituents sampled as part of the MRP, as described in the appropriate method.
   c. Assessment and Oversight. This component addresses the activities for assessing the effectiveness of the implementation of the project and associated QA and QC activities. The purpose of the assessment is to provide project oversight that

[1] USEPA 2001 (2006) USEPA requirements for Quality Assurance Project Plans (QA/R-5) Office of Environmental Information, Washington, D.C. USEPA QA/R-5
[2] http://waterboards.ca.gov/water_issues/programs/swamp/tools.shtml#qa

will ensure that the QA Project Plan is implemented as prescribed.

d. Data Validation and Usability. This component addresses the quality assurance activities that occur after the data collection, laboratory analysis and data generation phase of the project is completed. Implementation of these elements ensures that the data conform to the specified criteria, thus achieving the MRP objectives.

7. The Central Coast Water Board may conduct an audit of contracted laboratories at any time in order to evaluate compliance with the QAPP.

8. The Sampling and Analysis Plan and QAPP, and any proposed revisions are subject to approval by the Executive Officer. The Executive Officer may also revise the Sampling and Analysis Plan, including adding, removing, or changing monitoring site locations, changing monitoring parameters, and other changes as necessary to assess the impacts of waste discharges from irrigated lands to receiving water.

Surface Receiving Water Quality Monitoring Sites

9. The Sampling and Analysis Plan must, at a minimum, include monitoring sites to evaluate waterbodies identified in Table 1, unless otherwise approved by the Executive Officer. The Sampling and Analysis Plan must include sites to evaluate receiving water quality impacts most directly resulting from areas of agricultural discharge (including areas receiving tile drain discharges). Site selection must take into consideration the existence of any long term monitoring sites included in related monitoring programs (e.g. CCAMP and the existing CMP). Sites may be added or modified, subject to prior approval by the Executive Officer, to better assess the pollutant loading from individual sources or the impacts to receiving waters caused by individual discharges. Any modifications must consider sampling consistency for purposes of trend evaluation.

Surface Receiving Water Quality Monitoring Parameters

10. The Sampling and Analysis Plan must, at a minimum, include the following types of monitoring and evaluation parameters listed below and identified in Table 2:

    a. Flow Monitoring;
    b. Water Quality (physical parameters, metals, nutrients, pesticides);
    c. Toxicity (water and sediment);
    d. Assessment of Benthic Invertebrates.

11. All analyses must be conducted at a laboratory certified for such analyses by the State Department of Public Health (CDPH) or at laboratories approved by the Executive Officer. Unless otherwise noted, all sampling, sample preservation, and analyses must be performed in accordance with the latest edition of *Test Methods for Evaluating Solid Waste*, SW-846, U.S. EPA, and analyzed as specified herein by the above analytical methods and reporting limits indicated. Certified laboratories can be found at the web link: http://www.cdph.ca.gov/certlic/labs/Documents/ELAPLablist.xls

12. Water quality and flow monitoring is used to assess the sources, concentrations, and loads of waste discharges from individual farms/ranches and groups of Dischargers to surface waters, to evaluate impacts to water quality and beneficial uses, and to evaluate the short term patterns and long term trends in receiving water quality. Monitoring data must be compared to existing numeric and narrative water quality objectives.

13. Toxicity testing is to evaluate water quality relative to the narrative toxicity objective. Water column toxicity analyses must be conducted on 100% (undiluted) sample. At sites where persistent unresolved toxicity is found, the Executive Officer may require concurrent toxicity and chemical analyses and a Toxicity Identification Evaluation (TIE) to identify the individual discharges causing the toxicity.

Surface Receiving Water Quality Monitoring Frequency and Schedule

14. The Sampling and Analysis Plan must include a schedule for sampling. Timing, duration, and frequency of monitoring must be based on the land use, complexity, hydrology, and size of the waterbody. Table 2 includes minimum monitoring frequency and parameter lists. Agricultural parameters that are less common may be monitored less frequently. Modifications to the receiving water quality monitoring parameters, frequency, and schedule may be submitted for Executive Officer consideration and approval. At a minimum, the Sampling and Analysis Plan schedule must consist of monthly monitoring of common agricultural parameters in major agricultural areas, including two major storm events during the wet season (October 1 – April 30).

15. Storm event monitoring must be conducted within 18 hours of storm events, preferably including the first flush run-off event that results in significant increase in stream flow. For purposes of this MRP, a storm event is defined as precipitation producing onsite runoff (surface water flow) capable of creating significant ponding, erosion or other water quality problem. A

significant storm event will generally result in greater than 1-inch of rain within a 24-hour period.

16. Dischargers (individually or as part of a cooperative monitoring program) must perform receiving water quality monitoring per the Sampling and Analysis Plan and QAPP approved by the Executive Officer.

B. Surface Receiving Water Quality Reporting

Surface Receiving Water Quality Data Submittal

1. Dischargers (individually or as part of a cooperative monitoring program) must submit water quality monitoring data to the Central Coast Water Board electronically, in a format specified by the Executive Officer and compatible with SWAMP/CCAMP electronic submittal guidelines, each January 1, April 1, July 1, and October 1.

Surface Receiving Water Quality Monitoring Annual Report

2. **By July 1, 2017,** and every July 1 annually thereafter, Dischargers (individually or as part of a cooperative monitoring program) must submit an Annual Report, electronically, in a format specified by the Executive Officer including the following minimum elements:
   a. Signed Transmittal Letter;
   b. Title Page;
   c. Table of Contents;
   d. Executive Summary;
   e. Summary of Exceedance Reports submitted during the reporting period;
   f. Monitoring objectives and design;
   g. Monitoring site descriptions and rainfall records for the time period covered;
   h. Location of monitoring sites and map(s);
   i. Tabulated results of all analyses arranged in tabular form so that the required information is readily discernible;
   j. Summary of water quality data for any sites monitored as part of related monitoring programs, and used to evaluate receiving water as described in the Sampling and Analysis Plan.
   k. Discussion of data to clearly illustrate compliance with the Order and water quality standards;
   l. Discussion of short term patterns and long term trends in receiving water quality and beneficial use protection;
   m. Evaluation of pesticide and toxicity analyses results, and recommendation of candidate sites for Toxicity Identification Evaluations (TIEs);

n. Identification of the location of any agricultural discharges observed discharging directly to surface receiving water;
o. Laboratory data submitted electronically in a SWAMP/CCAMP comparable format;
p. Sampling and analytical methods used;
q. Copy of chain-of-custody forms;
r. Field data sheets, signed laboratory reports, laboratory raw data;
s. Associated laboratory and field quality control samples results;
t. Summary of Quality Assurance Evaluation results;
u. Specify the method used to obtain flow at each monitoring site during each monitoring event;
v. Electronic or hard copies of photos obtained from all monitoring sites, clearly labeled with site ID and date;
w. Conclusions.

PART 2. GROUNDWATER MONITORING AND REPORTING REQUIREMENTS

Groundwater monitoring may be conducted through a cooperative monitoring and reporting program on behalf of growers, or Dischargers may choose to conduct groundwater monitoring and reporting individually. Qualifying cooperative groundwater monitoring and reporting programs must implement the groundwater monitoring and reporting requirements described in this Order, unless otherwise approved by the Executive Officer. An interested person may seek review by the Central Coast Water Board of the Executive Officer's approval or denial of a cooperative groundwater monitoring and reporting program.

Key monitoring and reporting requirements for groundwater are shown in Table 3.

A. Groundwater Monitoring

1. Dischargers must sample private domestic wells and the primary irrigation well on their farm/ranch to evaluate groundwater conditions in agricultural areas, identify areas at greatest risk for nitrogen loading and exceedance of drinking water standards, and identify priority areas for follow up actions.

2. Dischargers must sample at least one groundwater well for each farm/ranch on their operation, including groundwater wells that are located within the property boundary of the enrolled county assessor parcel numbers (APNs). For farms/ranches with multiple groundwater wells, Dischargers must sample all domestic wells and the primary irrigation well. For the purposes of this MRP, a "domestic well" is any well that is used or may be used for domestic use purposes, including any groundwater well that is connected to a residence, workshop, or place of business that may be used for human consumption, cooking, or sanitary purposes. Groundwater monitoring

parameters must include well screen interval depths (if available), general chemical parameters, and general cations and anions listed in Table 3.

3. Dischargers must conduct two rounds of monitoring of required groundwater wells during calendar year 2017; one sample collected during spring (**March - June)** and one sample collected during fall **(September - December)**.

4. Groundwater samples must be collected by a qualified third party (e.g., consultant, technician, person conducting cooperative monitoring) using proper sampling methods, chain-of-custody, and quality assurance/quality control protocols. Groundwater samples must be collected at or near the well head before the pressure tank and prior to any well head treatment. In cases where this is not possible, the water sample must be collected from a sampling point as close to the pressure tank as possible, or from a cold-water spigot located before any filters or water treatment systems.

5. Laboratory analyses for groundwater samples must be conducted by a State certified laboratory according to U.S. EPA approved methods; unless otherwise noted, all monitoring, sample preservation, and analyses must be performed in accordance with the latest edition of *Test Methods for Evaluating Solid Waste*, SW-846, United States Environmental Protection Agency, and analyzed as specified herein by the above analytical methods and reporting limits indicated. Certified laboratories can be found at the web link below: http://www.waterboards.ca.gov/centralcoast/water_issues/programs/ag_waivers/docs/resources4growers/2016_04_11_labs.pdf

6. If a discharger determines that water in any domestic well exceeds 10 mg/L of nitrate as N, the discharger or third party must provide notice to the Central Coast Water Board within 24 hours of learning of the exceedance. For domestic wells on a Discharger's farm/ranch, that exceed 10 mg/L of nitrate as N, the Discharger must provide written notification to the users within 10 days of learning of the exceedance and provide written confirmation of the notification to the Central Coast Water Board.

   The drinking water notification must include the statement that the water poses a human health risk due to elevated nitrate concentration, and include a warning against the use of the water for drinking or cooking. In addition, Dischargers must also provide prompt written notification to any new well users (e.g. tenants and employees with access to the affected well), whenever there is a change in occupancy.

   For all other domestic wells not on a Discharger's farm/ranch but that may be impacted by nitrate, the Central Coast Water Board will notify the users promptly.

The drinking water notification and confirmation letters required by this Order are available to the public.

B. Groundwater Reporting

1. **Within 60 days of sample collection,** Dischargers must coordinate with the laboratory to submit the following groundwater monitoring results and information, electronically, using the Water Board's GeoTracker electronic deliverable format (EDF):
    a. GeoTracker Ranch Global Identification Number
    b. Field point name (Well Name)
    c. Field Point Class (Well Type)
    d. Latitude
    e. Longitude
    f. Sample collection date
    g. Analytical results
    h. Well construction information (e.g., total depth, screened intervals, depth to water), as available

2. Dischargers must submit groundwater well information required in the electronic Notice of Intent (eNOI) for each farm/ranch and update the eNOI to reflect changes in the farm/ranch information within 30 days of the change. Groundwater well information reported on the eNOI includes, but is not limited to:
    a. Number of groundwater wells present at each farm/ranch
    b. Identification of any groundwater wells abandoned or destroyed (including method destroyed) in compliance with the Order
    c. Use for fertigation or chemigation
    d. Presence of back flow prevention devices
    e. Number of groundwater wells used for agricultural purposes
    f. Number of groundwater wells used for or may be used for domestic use purposes (domestic wells).

C. Total Nitrogen Applied Reporting

1. By March 1, 2018, and by March 1 annually thereafter, Tier 2 Dischargers growing any crop with a high potential to discharge nitrogen to groundwater must record and report total nitrogen applied for each specific crop that was irrigated and grown for commercial purposes on that farm/ranch during the preceding calendar year (January through December).

    Crops with a high potential to discharge nitrogen to groundwater are: beet, broccoli, cabbage, cauliflower, celery, Chinese cabbage (napa), collard, endive, kale, leek, lettuce (leaf and head), mustard, onion (dry and green), spinach, strawberry, pepper (fruiting), and parsley.

Total nitrogen applied must be reported on the Total Nitrogen Applied Report form as described in the Total Nitrogen Applied Report form instructions.

Total nitrogen applied includes any product containing any form or concentration of nitrogen including, but not limited to, organic and inorganic fertilizers, slow release products, compost, compost teas, manure, and extracts.

2. The Total Nitrogen Applied Report form includes the following information:
    a. General ranch information such as GeoTracker file numbers, name, location, acres.
    b. Nitrogen concentration of irrigation water
    c. Nitrogen applied in pounds per acre with irrigation water
    d. Nitrogen present in the soil
    e. Nitrogen applied with compost and amendments
    f. Specific crops grown
    g. Nitrogen applied in pounds per acre with fertilizers and other materials to each specific crop grown
    h. Crop acres of each specific crop grown
    i. Whether each specific crop was grown organically or conventionally
    j. Basis for the nitrogen applied
    k. Explanation and comments section
    l. Certification statement with penalty of perjury declaration
    m. Additional information regarding whether each specific crop was grown in a nursery, greenhouse, hydroponically, in containers, and similar variables.

PART 3. ANNUAL COMPLIANCE FORM

Tier 2 Dischargers must submit annual compliance information, electronically, on the Annual Compliance Form. The purpose of the electronic Annual Compliance Form is to provide information to the Central Coast Water Board to assist in the evaluation of threat to water quality from individual agricultural discharges of waste and measure progress towards water quality improvement and verify compliance with the Order and MRP. Time schedules are shown in Table 4.

A. Annual Compliance Form

1. **By March 1, 2018, and updated annually thereafter by March 1**, Tier 2 Dischargers must submit an Annual Compliance Form electronically, in a

format specified by the Executive Officer. The electronic Annual Compliance Form includes, but is not limited to the following minimum requirements[1]:

a. Question regarding consistency between the Annual Compliance Form and the electronic Notice of Intent (eNOI);
b. Information regarding type and characteristics of discharge (e.g., number of discharge points, estimated flow/volume, number of tailwater days);
c. Identification of any direct agricultural discharges to a stream, lake, estuary, bay, or ocean;
d. Identification of specific farm water quality management practices completed, in progress, and planned to address water quality impacts caused by discharges of waste including irrigation management, pesticide management, nutrient management, salinity management, stormwater management, and sediment and erosion control to achieve compliance with this Order; and identification of specific methods used, and described in the Farm Plan consistent with Order Provision 44.g., for the purposes of assessing the effectiveness of management practices implemented and the outcomes of such assessments;
e. Proprietary information question and justification;
f. Authorization and certification statement and declaration of penalty of perjury.

PART 5. GENERAL MONITORING AND REPORTING REQUIREMENTS

A. Submittal of Technical Reports

1. Dischargers must submit reports in a format specified by the Executive Officer. A transmittal letter must accompany each report, containing the following penalty of perjury statement signed by the Discharger or the Discharger's authorized agent:

   "In compliance with Water Code §13267, I certify under penalty of perjury that this document and all attachments were prepared by me, or under my direction or supervision following a system designed to assure that qualified personnel properly gather and evaluate the information submitted. To the best of my knowledge and belief, this document and all attachments are true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment".

[1] Items reported in the Annual Compliance Form are due by March 1, 2018, and annually thereafter, unless otherwise specified.

2. If the Discharger asserts that all or a portion of a report submitted pursuant to this Order is subject to an exemption from public disclosure (e.g. trade secrets or secret processes), the Discharger must provide an explanation of how those portions of the reports are exempt from public disclosure. The Discharger must clearly indicate on the cover of the report (typically an electronic submittal) that the Discharger asserts that all or a portion of the report is exempt from public disclosure, submit a complete report with those portions that are asserted to be exempt in redacted form, submit separately (in a separate electronic file) unredacted pages (to be maintained separately by staff). The Central Coast Water Board staff will determine whether any such report or portion of a report qualifies for an exemption from public disclosure. If the Central Coast Water Board staff disagrees with the asserted exemption from public disclosure, the Central Coast Water Board staff will notify the Discharger prior to making such report or portions of such report available for public inspection.

B. Central Coast Water Board Authority

1. Monitoring reports are required pursuant to section 13267 of the California Water Code. Pursuant to section 13268 of the Water Code, a violation of a request made pursuant to section 13267 may subject you to civil liability of up to $1000 per day.

2. The Water Board needs the required information to determine compliance with Order No. R3-2017-0002. The evidence supporting these requirements is included in the findings of Order No. R3-2017-0002.

John M. Robertson
Executive Officer

March 8, 2017
Date

Table 1. Major Waterbodies in Agricultural Areas[1]

Hydrologic SubArea	Waterbody Name	Hydrologic SubArea	Waterbody Name
30510	Pajaro River	30920	Quail Creek
30510	Salsipuedes Creek	30920	Salinas Reclamation Canal
30510	Watsonville Slough	31022	Chorro Creek
30510	Watsonville Creek[2]	31023	Los Osos Creek
30510	Beach Road Ditch[2]	31023	Warden Creek
30530	Carnadero Creek	31024	San Luis Obispo Creek
30530	Furlong Creek[2]	31024	Prefumo Creek
30530	Llagas Creek	31031	Arroyo Grande Creek
30530	Miller's Canal	31031	Los Berros Creek
30530	San Juan Creek	31210	Bradley Canyon Creek
30530	Tesquisquita Slough	31210	Bradley Channel
30600	Moro Cojo Slough	31210	Green Valley Creek
30910	Alisal Slough	31210	Main Street Canal
30910	Blanco Drain	31210	Orcutt Solomon Creek
30910	Old Salinas River	31210	Oso Flaco Creek
30910	Salinas River (below Gonzales Rd.)	31210	Little Oso Flaco Creek
30920	Salinas River above Gonzales Rd. and below Nacimiento R.)	31210	Santa Maria River
30910	Santa Rita Creek[2]	31310	San Antonio Creek[2]
30910	Tembladero Slough	31410	Santa Ynez River
30920	Alisal Creek	31531	Bell Creek
30920	Chualar Creek	31531	Glenn Annie Creek
30920	Espinosa Slough	31531	Los Carneros Creek[2]
30920	Gabilan Creek	31534	Arroyo Paredon Creek
30920	Natividad Creek	31534	Franklin Creek

[1] At a minimum, monitoring sites must be included for these waterbodies in agricultural areas, unless otherwise approved by the Executive Officer. Monitoring sites may be proposed for addition or modification to better assess the impacts of waste discharges from irrigated lands to surface water. Dischargers choosing to comply with surface receiving water quality monitoring, individually (not part of a cooperative monitoring program) must only monitor sites for waterbodies receiving the discharge.

[2] These creeks are included because they are newly listed waterbodies on the 2010 303(d) list of Impaired Waters that are associated with areas of agricultural discharge.

Table 2. Surface Receiving Water Quality Monitoring Parameters

Parameters and Tests	RL[3]	Monitoring Frequency[1]
Photo Monitoring		
Upstream and downstream photographs at monitoring location		With every monitoring event
WATER COLUMN SAMPLING		
Physical Parameters and General Chemistry		
Flow (field measure) (CFS) following SWAMP field SOP[9]	.25	Monthly, including 2 stormwater events
pH (field measure)	0.1	”
Electrical Conductivity (field measure) (µS/cm)	2.5	”
Dissolved Oxygen (field measure) (mg/L)	0.1	”
Temperature (field measure) (°C)	0.1	”
Turbidity (NTU)	0.5	”
Total Dissolved Solids (mg/L)	10	”
Total Suspended Solids (mg/L)	0.5	”
Nutrients		
Total Nitrogen (mg/L)	0.5	Monthly, including 2 stormwater events
Nitrate + Nitrite (as N) (mg/L)	0.1	”
Total Ammonia (mg/L)	0.1	”
Unionized Ammonia (calculated value, mg/L))		”
Total Phosphorus (as P) (mg/L)	0.02	
Soluble Orthophosphate (mg/L)	0.01	”
Water column chlorophyll a (µg/L)	1.0	“
Algae cover, Floating Mats, % coverage	-	“
Algae cover, Attached, % coverage	-	“
Water Column Toxicity Test		
Algae - *Selenastrum capricornutum (*96-hour chronic; Method1003.0 in EPA/821/R-02/013)	-	4 times each year, twice in dry season, twice in wet season
Water Flea – *Ceriodaphnia dubia* (7-day chronic; Method 1002.0 in EPA/821/R-02/013)	-	”
Midge - *Chironomus spp.* (96-hour acute; Alternate test species in EPA 821-R-02-012)	-	“

Parameters and Tests	RL[3]	Monitoring Frequency[1]
Toxicity Identification Evaluation (TIE)	-	As directed by Executive Officer
Pesticides[2] /Herbicides (µg/L)		
Organophosphate Pesticides		
Azinphos-methyl	0.02	2 times in both 2017 and 2018, once in dry season and once in wet season of each year, concurrent with water toxicity monitoring
Chlorpyrifos	0.005	”
Diazinon	0.005	”
Dichlorvos	0.01	”
Dimethoate	0.01	”
Dimeton-s	0.005	”
Disulfoton (Disyton)	0.005	”
Malathion	0.005	”
Methamidophos	0.02	”
Methidathion	0.02	“
Parathion-methyl	0.02	“
Phorate	0.01	“
Phosmet	0.02	“
Neonicotinoids		
Thiamethoxam	.002	“
Imidacloprid	.002	“
Thiacloprid	.002	“
Dinotefuran	.006	“
Acetamiprid	.01	“
Clothianidin	.02	
Herbicides		
Atrazine	0.05	“
Cyanazine	0.20	“
Diuron	0.05	“
Glyphosate	2.0	“
Linuron	0.1	“
Paraquat	0.20	“
Simazine	0.05	“
Trifluralin	0.05	“
Metals (µg/L)		
Arsenic (total) [5,7]	0.3	2 times in both 2017 and 2018, once in dry season and once in wet season of each year, concurrent with water toxicity monitoring
Boron (total) [6,7]	10	“

Parameters and Tests	RL[3]	Monitoring Frequency[1]
Cadmium (total & dissolved) [4,5,7]	0.01	"
Copper (total and dissolved) [4,7]	0.01	"
Lead (total and dissolved) [4,7]	0.01	"
Nickel (total and dissolved) [4,7]	0.02	"
Molybdenum (total) [7]	1	"
Selenium (total)[7]	0.30	"
Zinc (total and dissolved) [4,5,7]	0.10	"
Other (µg/L)		
Total Phenolic Compounds[8]	5	2 times in 2017, once in spring (April-May) and once in fall (August-September)
Hardness (mg/L as CaCO3)	1	"
Total Organic Carbon (ug/L)	0.6	"
SEDIMENT SAMPLING		
Sediment Toxicity - *Hyalella azteca* 10-day static renewal (EPA, 2000)		2 times each year, once in spring (April-May) and once in fall (August-September)
Pyrethroid Pesticides in Sediment (µg/kg)		
Gamma-cyhalothrin	2	2 times in both 2017 and 2018, once in spring (April-May) and once in fall (August-September) of each year, concurrent with sediment toxicity sampling
Lambda-cyhalothrin	2	"
Bifenthrin	2	"
Beta-cyfluthrin	2	"
Cyfluthrin	2	"
Esfenvalerate	2	"
Permethrin	2	"
Cypermethrin	2	"
Danitol	2	"
Fenvalerate	2	"
Fluvalinate	2	"
Other Monitoring in Sediment		
Chlorpyrifos (µg/kg)	2	"
Total Organic Carbon	0.01%	"
		"
Sediment Grain Size Analysis	1%	"

[1]Monitoring is ongoing through all five years of the Order, unless otherwise specified. Monitoring frequency may be used as a guide for developing alternative Sampling and Analysis Plan.
[2]Pesticide list may be modified based on specific pesticide use in Central Coast Region. Analytes on this list must be reported, at a minimum.

[3] Reporting Limit, taken from SWAMP where applicable.
[4] Holmgren, Meyer, Cheney and Daniels. 1993. Cadmium, Lead, Zinc, Copper and Nickel in Agricultural Soils of the United States. J. of Environ. Quality 22:335-348.
[5]Sax and Lewis, ed. 1987. Hawley's Condensed Chemical Dictionary. 11th ed. New York: Van Nostrand Reinhold Co., 1987. Zinc arsenate is an insecticide.
[6]Http://www.coastalagro.com/products/labels/9%25BORON.pdf; Boron is applied directly or as a component of fertilizers as a plant nutrient.
[7]Madramootoo, Johnston, Willardson, eds. 1997. Management of Agricultural Drainage Water Quality. International Commission on Irrigation and Drainage. U.N. FAO. SBN 92-6-104058.3.
[8]http://cat.inist.fr/?aModele=afficheN&cpsidt=14074525; Phenols are breakdown products of herbicides and pesticides. Phenols can be directly toxic and cause endocrine disruption.
[9]See SWAMP field measures SOP, p. 17
mg/L – milligrams per liter; ug/L – micrograms per liter; ug/kg – micrograms per kilogram;
NTU – Nephelometric Turbidity Units; CFS – cubic feet per second;

Table 3. Groundwater Monitoring Parameters

Parameter	RL	Analytical Method[3]	Units
pH	0.1	Field or Laboratory Measurement EPA General Methods	pH Units
Specific Conductance	2.5		µS/cm
Total Dissolved Solids	10		mg/L
Total Alkalinity as CaCO3	1	EPA Method 310.1 or 310.2	
Calcium	0.05	General Cations[1] EPA 200.7, 200.8, 200.9	
Magnesium	0.02		
Sodium	0.1		
Potassium	0.1		
Sulfate (SO4)	1.0	General Anions EPA Method 300 or EPA Method 353.2	
Chloride	0.1		
Nitrate + Nitrite (as N)[2] or Nitrate as N	0.1		

[1]General chemistry parameters (major cations and anions) represent geochemistry of water bearing zone and assist in evaluating quality assurance/quality control of groundwater sampling and laboratory analysis.
[2]The MRP allows analysis of "nitrate plus nitrite" to represent nitrate concentrations (as N). The "nitrate plus nitrite" analysis allows for extended laboratory holding times and relieves the Discharger of meeting the short holding time required for nitrate.
[3]Dischargers may use alternative analytical methods approved by EPA.
RL – Reporting Limit; µS/cm – micro siemens per centimeter

Table4. Tier 2 - Time Schedule for Key Monitoring and Reporting Requirements (MRPs)

REQUIREMENT	TIME SCHEDULE[1]
Submit Sampling And Analysis Plan and Quality Assurance Project Plan (SAAP/QAPP) for Surface Receiving Water Quality Monitoring (*individually or through cooperative monitoring program*)	By March 1, 2018, or as directed by the Executive Officer; satisfied if an approved SAAP/QAPP has been submitted pursuant to Order No. R3-2012-0011 and associated MRPs
Initiate surface receiving water quality monitoring (*individually or through cooperative monitoring program*)	Per an approved SAAP and QAPP
Submit surface receiving water quality monitoring data (*individually or through cooperative monitoring program*)	Each January 1, April 1, July 1, and October 1
Submit surface receiving water quality Annual Monitoring Report *(individually or through cooperative monitoring program*)	By July 12017: annually thereafter by July 1
Initiate monitoring of groundwater wells	First sample from March-June 2017, second sample from September-December 2017
Submit electronic Annual Compliance Form	March 1, 2018 and every March 1 annually thereafter
Submit groundwater monitoring results	Within 60 days of the sample collection
Tier 2 Dischargers with farms/ranches growing high risk crops: Report total nitrogen applied on the Total Nitrogen Applied form	March 1, 2018 and every March 1annually thereafter

[1] Dates are relative to adoption of this Order or enrollment date for Dischargers enrolled after the adoption of this Order, unless otherwise specified.

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL COAST REGION

MONITORING AND REPORTING PROGRAM
ORDER NO. R3-2017-0002-03

TIER 3

DISCHARGERS ENROLLED UNDER
CONDITIONAL WAIVER OF WASTE DISCHARGE REQUIREMENTS FOR DISCHARGES FROM IRRIGATED LANDS

This Monitoring and Reporting Program Order No. R3-2017-0002-03 (MRP) is issued pursuant to California Water Code (Water Code) sections 13267 and 13269, which authorize the California Regional Water Quality Control Board, Central Coast Region (hereafter Central Coast Water Board) to require preparation and submittal of technical and monitoring reports. Water Code section 13269 requires a waiver of waste discharge requirements to include as a condition, the performance of monitoring and the public availability of monitoring results. *Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands,* Order No. R3-2017-0002 (Order), includes criteria and requirements for three tiers. This MRP sets forth monitoring and reporting requirements for **Tier 3 Dischargers** enrolled under the Order. A summary of the requirements is shown below.

SUMMARY OF MONITORING AND REPORTING REQUIREMENTS FOR TIER 3:

Part 1: Surface Receiving Water Monitoring and Reporting *(cooperative or individual)*
Part 2: Groundwater Monitoring and Reporting *(cooperative or individual)*
Total Nitrogen Applied Reporting *(required for subset of Tier 3 Dischargers if farm/ranch growing any crop with high nitrate loading risk to groundwater);*
Part 3: Annual Compliance Form
Part 5: Individual Surface Water Discharge Monitoring and Reporting
Part 6: Irrigation and Nutrient Management Plan *(required for subset of Tier 3 Dischargers if farm/ranch has High Nitrate Loading Risk)*
Part 7: Water Quality Buffer Plan *(required for subset of Tier 3 Dischargers if farm/ranch contains or is adjacent to a waterbody impaired for temperature, turbidity or sediment)*

Pursuant to Water Code section 13269(a)(2), monitoring requirements must be designed to support the development and implementation of the waiver program, including, but not limited to, verifying the adequacy and effectiveness of the waiver's conditions. The monitoring and reports required by this MRP are to evaluate effects of discharges of waste from irrigated agricultural operations and individual farms/ranches on waters of the state and to determine compliance with the Order.

MONITORING AND REPORTING BASED ON TIERS

The Order and MRP includes criteria and requirements for three tiers, based upon those characteristics of the individual farms/ranches at the operation that present the highest level of waste discharge or greatest risk to water quality. Dischargers must meet conditions of the Order and MRP for the appropriate tier that applies to their land and/or the individual farm/ranch. Within a tier, Dischargers comply with requirements based on the specific level of discharge and threat to water quality from individual farms/ranches. The lowest tier, Tier 1, applies to dischargers who discharge the lowest level of waste (amount or concentration) or pose the lowest potential to cause or contribute to an exceedance of water quality standards in waters of the State or of the United States. The highest tier, Tier 3, applies to dischargers who discharge the highest level of waste or pose the greatest potential to cause or contribute to an exceedance of water quality standards in waters of the State or of the United States. Tier 2 applies to dischargers whose discharge has a moderate threat to water quality. Water quality is defined in terms of regional, state, or federal numeric or narrative water quality standards. Per the Order, Dischargers may submit a request to the Executive Officer to approve transfer to a lower tier. If the Executive Officer approves a transfer to a lower tier, any interested person may request that the Central Coast Water Board conduct a review of the Executive Officer's determination.

PART 1. SURFACE RECEIVING WATER MONITORING AND REPORTING REQUIREMENTS

The surface receiving water monitoring and reporting requirements described herein are generally a continuation of the surface receiving water monitoring and reporting requirements of Monitoring and Reporting Program Order No. 2012-0011-03, as revised August 22, 2016, with the intent of uninterrupted regular monitoring and reporting during the transition from Order No. R3-2012-0011-03 to Order No. R3-2017-0002-03.

Monitoring and reporting requirements for surface receiving water identified in Part 1.A. and Part 1.B. apply to Tier 3 Dischargers. Surface receiving water refers to water flowing in creeks and other surface waters of the State. Surface receiving water monitoring may be conducted through a cooperative monitoring program on behalf of Dischargers, or Dischargers may choose to conduct surface receiving water monitoring and reporting individually. Key monitoring and reporting requirements for surface receiving water are shown in Tables 1 and 2. Time schedules are shown in Table 5.

A. Surface Receiving Water Quality Monitoring

1. Dischargers must elect a surface receiving water monitoring option (cooperative monitoring program or individual receiving water monitoring) to comply with surface receiving water quality monitoring requirements, and identify the option selected on the Notice of Intent (NOI).

2. Dischargers are encouraged to choose participation in a cooperative monitoring program (e.g., the existing Cooperative Monitoring Program or a similar program) to comply with receiving water quality monitoring requirements. Dischargers not participating in a cooperative monitoring program must conduct surface receiving water quality monitoring individually that achieves the same purpose.

3. Dischargers (individually or as part of a cooperative monitoring program) must conduct surface receiving water quality monitoring to a) assess the impacts of their waste discharges from irrigated lands to receiving water, b) assess the status of receiving water quality and beneficial use protection in impaired waterbodies dominated by irrigated agricultural activity, c) evaluate status, short term patterns and long term trends (five to ten years or more) in receiving water quality, d) evaluate water quality impacts resulting from agricultural discharges (including but not limited to tile drain discharges), e) evaluate stormwater quality, f) evaluate condition of existing perennial, intermittent, or ephemeral streams or riparian or wetland area habitat, including degradation resulting from erosion or agricultural discharges of waste, and g) assist in the identification of specific sources of water quality problems.

Surface Receiving Water Quality Sampling and Analysis Plan

4. **By March 1, 2018, or as directed by the Executive Officer**, Dischargers (individually or as part of a cooperative monitoring program) must submit a surface receiving water quality Sampling and Analysis Plan (SAAP) and Quality Assurance Project Plan (QAPP); this requirement is satisfied if an approved SAAP and QAPP addressing all surface receiving water quality monitoring requirements described in this Order has been submitted pursuant to Order No.R3-2012-0011 and associated Monitoring and Reporting Programs. Dischargers (or a third party cooperative monitoring program) must develop the Sampling and Analysis Plan to describe how the proposed monitoring will achieve the objectives of the MRP and evaluate compliance with the Order. The Sampling and Analysis Plan may propose alternative monitoring site locations, adjusted monitoring parameters, and other changes as necessary to assess the impacts of waste discharges from irrigated lands to receiving water. The Executive Officer must approve the Sampling and Analysis Plan and QAPP.

5. The Sampling and Analysis Plan must include the following minimum required components:
   a. Monitoring strategy to achieve objectives of the Order and MRP;
   b. Map of monitoring sites with GIS coordinates;

c. Identification of known water quality impairments and impaired waterbodies per the 2010 Clean Water Act 303(d) List of Impaired Waterbodies (List of Impaired Waterbodies);
d. Identification of beneficial uses and applicable water quality standards;
e. Identification of applicable Total Maximum Daily Loads;
f. Monitoring parameters;
g. Monitoring schedule, including description and frequencies of monitoring events;
h. Description of data analysis methods;

6. The QAPP must include receiving water and site-specific information, project organization and responsibilities, and quality assurance components of the MRP. The QAPP must also include the laboratory and field requirements to be used for analyses and data evaluation. The QAPP must contain adequate detail for project and Water Board staff to identify and assess the technical and quality objectives, measurement and data acquisition methods, and limitations of the data generated under the surface receiving water quality monitoring. All sampling and laboratory methodologies and QAPP content must be consistent with U.S. EPA methods, State Water Board's Surface Water Ambient Monitoring Program (SWAMP) protocols and the Central Coast Water Board's Central Coast Ambient Monitoring Program (CCAMP). Following U.S. EPA guidelines[1] and SWAMP templates[2], the receiving water quality monitoring QAPP must include the following minimum required components:
    a. Project Management. This component addresses basic project management, including the project history and objectives, roles and responsibilities of the participants, and other aspects.
    b. Data Generation and Acquisition. This component addresses all aspects of project design and implementation. Implementation of these elements ensures that appropriate methods for sampling, measurement and analysis, data collection or generation, data handling, and quality control activities are employed and are properly documented. Quality control requirements are applicable to all the constituents sampled as part of the MRP, as described in the appropriate method.
    c. Assessment and Oversight. This component addresses the activities for assessing the effectiveness of the implementation of the project and associated QA and QC activities. The purpose of the assessment is to provide project oversight that

---

[1] USEPA. 2001 (2006) USEPA Requirements for Quality Assurance Project Plans (QA/R-5) Office of Environmental Information, Washington, D.C. USEPA QA/R-5
[2] http://waterboards.ca.gov/water_issues/programs/swamp/tools.shtml#qa

will ensure that the QA Project Plan is implemented as prescribed.

d. Data Validation and Usability. This component addresses the quality assurance activities that occur after the data collection, laboratory analysis and data generation phase of the project is completed. Implementation of these elements ensures that the data conform to the specified criteria, thus achieving the MRP objectives.

7. The Central Coast Water Board may conduct an audit of contracted laboratories at any time in order to evaluate compliance with the QAPP.

8. The Sampling and Analysis Plan and QAPP, and any proposed revisions are subject to approval by the Executive Officer. The Executive Officer may also revise the Sampling and Analysis Plan, including adding, removing, or changing monitoring site locations, changing monitoring parameters, and other changes as necessary to assess the impacts of waste discharges from irrigated lands to receiving water.

Surface Receiving Water Quality Monitoring Sites

9. The Sampling and Analysis Plan must, at a minimum, include monitoring sites to evaluate waterbodies identified in Table 1, unless otherwise approved by the Executive Officer. The Sampling and Analysis Plan must include sites to evaluate receiving water quality impacts most directly resulting from areas of agricultural discharge (including areas receiving tile drain discharges). Site selection must take into consideration the existence of any long term monitoring sites included in related monitoring programs (e.g. CCAMP and the existing CMP). Sites may be added or modified, subject to prior approval by the Executive Officer, to better assess the pollutant loading from individual sources or the impacts to receiving waters caused by individual discharges. Any modifications must consider sampling consistency for purposes of trend evaluation.

Surface Receiving Water Quality Monitoring Parameters

10. The Sampling and Analysis Plan must, at a minimum, include the following types of monitoring and evaluation parameters listed below and identified in Table 2:

   a. Flow Monitoring;
   b. Water Quality (physical parameters, metals, nutrients, pesticides);
   c. Toxicity (water and sediment);
   d. Assessment of Benthic Invertebrates.

11. All analyses must be conducted at a laboratory certified for such analyses by the State Department of Public Health (CDPH) or at laboratories approved by the Executive Officer. Unless otherwise noted, all sampling, sample preservation, and analyses must be performed in accordance with the latest edition of *Test Methods for Evaluating Solid Waste*, SW-846, U.S. EPA, and analyzed as specified herein by the above analytical methods and reporting limits indicated. Certified laboratories can be found at the web link: http://www.cdph.ca.gov/certlic/labs/Documents/ELAPLablist.xls

12. Water quality and flow monitoring is used to assess the sources, concentrations, and loads of waste discharges from individual farms/ranches and groups of Dischargers to surface waters, to evaluate impacts to water quality and beneficial uses, and to evaluate the short term patterns and long term trends in receiving water quality. Monitoring data must be compared to existing numeric and narrative water quality objectives.

13. Toxicity testing is to evaluate water quality relative to the narrative toxicity objective. Water column toxicity analyses must be conducted on 100% (undiluted) sample. At sites where persistent unresolved toxicity is found, the Executive Officer may require concurrent toxicity and chemical analyses and a Toxicity Identification Evaluation (TIE) to identify the individual discharges causing the toxicity.

Surface Receiving Water Quality Monitoring Frequency and Schedule

14. The Sampling and Analysis Plan must include a schedule for sampling. Timing, duration, and frequency of monitoring must be based on the land use, complexity, hydrology, and size of the waterbody. Table 2 includes minimum monitoring frequency and parameter lists. Agricultural parameters that are less common may be monitored less frequently. Modifications to the receiving water quality monitoring parameters, frequency, and schedule may be submitted for Executive Officer consideration and approval. At a minimum, the Sampling and Analysis Plan schedule must consist of monthly monitoring of common agricultural parameters in major agricultural areas, including two major storm events during the wet season (October 1 – April 30).

15. Storm event monitoring must be conducted within 18 hours of storm events, preferably including the first flush run-off event that results in significant increase in stream flow. For purposes of this MRP, a storm event is defined as precipitation producing onsite runoff (surface water flow) capable of creating significant ponding, erosion or other water quality problem. A

significant storm event will generally result in greater than 1-inch of rain within a 24-hour period.

16. Dischargers (individually or as part of a cooperative monitoring program) must perform receiving water quality monitoring per the Sampling and Analysis Plan and QAPP approved by the Executive Officer.

B. Surface Receiving Water Quality Reporting

Surface Receiving Water Quality Data Submittal

1. Dischargers (individually or as part of a cooperative monitoring program) must submit water quality monitoring data to the Central Coast Water Board electronically, in a format specified by the Executive Officer and compatible with SWAMP/CCAMP electronic submittal guidelines, each January 1, April 1, July 1, and October 1.

Surface Receiving Water Quality Monitoring Annual Report

2. **By July 1, 2017,** and every July 1 annually thereafter, Dischargers (individually or as part of a cooperative monitoring program) must submit an Annual Report, electronically, in a format specified by the Executive Officer including the following minimum elements:
   a. Signed Transmittal Letter;
   b. Title Page;
   c. Table of Contents;
   d. Executive Summary;
   e. Summary of Exceedance Reports submitted during the reporting period;
   f. Monitoring objectives and design;
   g. Monitoring site descriptions and rainfall records for the time period covered;
   h. Location of monitoring sites and map(s);
   i. Tabulated results of all analyses arranged in tabular form so that the required information is readily discernible;
   j. Summary of water quality data for any sites monitored as part of related monitoring programs, and used to evaluate receiving water as described in the Sampling and Analysis Plan.
   k. Discussion of data to clearly illustrate compliance with the Order and water quality standards;
   l. Discussion of short term patterns and long term trends in receiving water quality and beneficial use protection;

m. Evaluation of pesticide and toxicity analyses results, and recommendation of candidate sites for Toxicity Identification Evaluations (TIEs);
n. Identification of the location of any agricultural discharges observed discharging directly to surface receiving water;
o. Laboratory data submitted electronically in a SWAMP/CCAMP comparable format;
p. Sampling and analytical methods used;
q. Copy of chain-of-custody forms;
r. Field data sheets, signed laboratory reports, laboratory raw data;
s. Associated laboratory and field quality control samples results;
t. Summary of Quality Assurance Evaluation results;
u. Specify the method used to obtain flow at each monitoring site during each monitoring event;
v. Electronic or hard copies of photos obtained from all monitoring sites, clearly labeled with site ID and date;
w. Conclusions.

PART 2. GROUNDWATER MONITORING AND REPORTING REQUIREMENTS

Groundwater monitoring may be conducted through a cooperative monitoring and reporting program on behalf of growers, or Dischargers may choose to conduct groundwater monitoring and reporting individually. Qualifying cooperative groundwater monitoring and reporting programs must implement the groundwater monitoring and reporting requirements described in this Order, unless otherwise approved by the Executive Officer. An interested person may seek review by the Central Coast Water Board of the Executive Officer’s approval or denial of a cooperative groundwater monitoring and reporting program.

Key monitoring and reporting requirements for groundwater are shown in Table 3.

A. Groundwater Monitoring

1. Dischargers must sample private domestic wells and the primary irrigation well on their farm/ranch to evaluate groundwater conditions in agricultural areas, identify areas at greatest risk for nitrogen loading and exceedance of drinking water standards, and identify priority areas for follow up actions.

2. Dischargers must sample at least one groundwater well for each farm/ranch on their operation, including groundwater wells that are located within the property boundary of the enrolled county assessor parcel numbers (APNs). For farms/ranches with multiple groundwater wells, Dischargers must sample all domestic wells and the primary irrigation well. For the purposes of this MRP, a “domestic well” is any well that is used or may be used for domestic

use purposes, including any groundwater well that is connected to a residence, workshop, or place of business that may be used for human consumption, cooking, or sanitary purposes. Groundwater monitoring parameters must include well screen interval depths (if available), general chemical parameters, and general cations and anions listed in Table 3.

3. Dischargers must conduct two rounds of monitoring of required groundwater wells during calendar year 2017; one sample collected during spring (**March - June)** and one sample collected during fall **(September - December)**.

4. Groundwater samples must be collected by a qualified third party (e.g., consultant, technician, person conducting cooperative monitoring) using proper sampling methods, chain-of-custody, and quality assurance/quality control protocols. Groundwater samples must be collected at or near the well head before the pressure tank and prior to any well head treatment. In cases where this is not possible, the water sample must be collected from a sampling point as close to the pressure tank as possible, or from a cold-water spigot located before any filters or water treatment systems.

5. Laboratory analyses for groundwater samples must be conducted by a State certified laboratory according to U.S. EPA approved methods; unless otherwise noted, all monitoring, sample preservation, and analyses must be performed in accordance with the latest edition of *Test Methods for Evaluating Solid Waste*, SW-846, United States Environmental Protection Agency, and analyzed as specified herein by the above analytical methods and reporting limits indicated. Certified laboratories can be found at the web link below: http://www.waterboards.ca.gov/centralcoast/water_issues/programs/ag_waivers/docs/resources4growers/2016_04_11_labs.pdf

6. If a discharger determines that water in any domestic well exceeds 10 mg/L of nitrate as N, the discharger or third party must provide notice to the Central Coast Water Board within 24 hours of learning of the exceedance. For domestic wells on a Discharger's farm/ranch that exceed 10 mg/L nitrate as N, the Discharger must provide written notification to the users within 10 days of learning of the exceedance and provide written confirmation of the notification to the Central Coast Water Board.

   The drinking water notification must include the statement that the water poses a human health risk due to elevated nitrate concentration, and include a warning against the use of the water for drinking or cooking. In addition, Dischargers must also provide prompt written notification to any new well users (e.g. tenants and employees with access to the affected well), whenever there is a change in occupancy.

For all other domestic wells not on a Discharger's property, the Central Coast Water Board will notify the users promptly.

The drinking water notification and confirmation letters required by this Order are available to the public.

B. Groundwater Reporting

1. **Within 60 days of sample collection,** Dischargers must coordinate with the laboratory to submit the following groundwater monitoring results and information, electronically, using the Water Board's GeoTracker electronic deliverable format (EDF):
    a. GeoTracker Ranch Global Identification Number
    b. Field point name (Well Name)
    c. Field Point Class (Well Type)
    d. Latitude
    e. Longitude
    f. Sample collection date
    g. Analytical results
    h. Well construction information (e.g., total depth, screened intervals, depth to water), as available

2. Dischargers must submit groundwater well information required in the electronic Notice of Intent (eNOI) for each farm/ranch and update the eNOI to reflect changes in the farm/ranch information within 30 days of the change. Groundwater well information reported on the eNOI includes, but is not limited to:
    a. Number of groundwater wells present at each farm/ranch
    b. Identification of any groundwater wells abandoned or destroyed (including method destroyed) in compliance with the Order
    c. Use for fertigation or chemigation
    d. Presence of back flow prevention devices
    e. Number of groundwater wells used for agricultural purposes
    f. Number of groundwater wells used for or may be used for domestic use purposes (domestic wells)

C. Total Nitrogen Applied Reporting

1. By March 1, 2018, and by March 1 annually thereafter, Tier 3 Dischargers growing any crop with a high potential to discharge nitrogen to groundwater must record and report total nitrogen applied for each specific crop that was irrigated and grown for commercial purposes on that farm/ranch during the preceding calendar year (January through December).

   Crops with a high potential to discharge nitrogen to groundwater are: beet, broccoli, cabbage, cauliflower, celery, Chinese cabbage (napa), collard, endive, kale, leek, lettuce (leaf and head), mustard, onion (dry and green), spinach, strawberry, pepper (fruiting), and parsley.

Total nitrogen applied must be reported on the Total Nitrogen Applied Report form as described in the Total Nitrogen Applied Report form instructions.

Total nitrogen applied includes any product containing any form or concentration of nitrogen including, but not limited to, organic and inorganic fertilizers, slow release products, compost, compost teas, manure, and extracts.

2. The Total Nitrogen Applied Report form includes the following information:
    a. General ranch information such as GeoTracker file numbers, name, location, acres.
    b. Nitrogen concentration of irrigation water
    c. Nitrogen applied in pounds per acre with irrigation water
    d. Nitrogen present in the soil
    e. Nitrogen applied with compost and amendments
    f. Specific crops grown
    g. Nitrogen applied in pounds per acre with fertilizers and other materials to each specific crop grown
    h. Crop acres of each specific crop grown
    i. Whether each specific crop was grown organically or conventionally
    j. Basis for the nitrogen applied
    k. Explanation and comments section
    l. Certification statement with penalty of perjury declaration
    m. Additional information regarding whether each specific crop was grown in a nursery, greenhouse, hydroponically, in containers, and similar variables.

PART 3. ANNUAL COMPLIANCE FORM

Tier 3 Dischargers must submit annual compliance information, electronically, on the Annual Compliance Form. The purpose of the electronic Annual Compliance Form is to provide information to the Central Coast Water Board to assist in the evaluation of threat to water quality from individual agricultural discharges of waste and measure progress towards water quality improvement and verify compliance with the Order and MRP. Time schedules are shown in Table 5.

A. Annual Compliance Form

1. **By March 1, 2018, and updated annually thereafter by March 1**, Tier 3 Dischargers must submit an Annual Compliance Form electronically, in a format specified by the Executive Officer. The electronic Annual Compliance Form includes, but is not limited to the following minimum requirements[1]:
    a. Question regarding consistency between the Annual Compliance Form and the electronic Notice of Intent (eNOI);
    b. Information regarding type and characteristics of discharge (e.g., number of discharge points, estimated flow/volume, number of tailwater days);
    c. Identification of any direct agricultural discharges to a stream, lake, estuary, bay, or ocean;
    d. Identification of specific farm water quality management practices completed, in progress, and planned to address water quality impacts caused by discharges of waste including irrigation management, pesticide management, nutrient management, salinity management, stormwater management, and sediment and erosion control to achieve compliance with this Order; and identification of specific methods used, and described in the Farm Plan consistent with Order Provision 44.g., for the purposes of assessing the effectiveness of management practices implemented and the outcomes of such assessments:
    e. Proprietary information question and justification;
    f. Authorization and certification statement and declaration of penalty of perjury.

PART 5. INDIVIDUAL SURFACE WATER DISCHARGE MONITORING AND REPORTING REQUIREMENTS

Monitoring and reporting requirements for individual surface water discharge identified in Part 5.A. and Part 5.B. apply to Tier 3 Dischargers with irrigation water or stormwater discharges to surface water from an outfall. Outfalls are locations where irrigation water and stormwater exit a farm/ranch, or otherwise leave the control of the discharger, after being conveyed by pipes, ditches, constructed swales, tile drains, containment structures, or other discrete structures or features that transport the water. Discharges that have commingled with discharges from another farm/ranch are considered to have left the control of the discharger. Key monitoring and reporting requirements for individual surface water discharge are shown in Tables 4A and 4B. Time schedules are shown in Table 5.

[1] Items reported in the Annual Compliance Form are due by March 1 2018, and annually thereafter, unless otherwise specified.

A. Individual Surface Water Discharge Monitoring

1. Tier 3 Dischargers must conduct individual surface water discharge monitoring to a) evaluate the quality of individual waste discharges, including concentration and load of waste (in kilograms per day) for appropriate parameters, b) evaluate effects of waste discharge on water quality and beneficial uses, and c) evaluate progress towards compliance with water quality improvement milestones in the Order.

Individual Sampling and Analysis Plan

2. **By March 1, 2018, or as directed by the Executive Officer**, Tier 3 Dischargers must submit an individual surface water discharge Sampling and Analysis Plan (SAAP) and QAPP to monitor individual discharges of irrigation water and stormwater that leaves their farm/ranch from an outfall. The Sampling and Analysis Plan and QAPP must be submitted to the Executive Officer; this requirement is satisfied if an approved SAAP and QAPP addressing all individual surface water discharge monitoring requirements described in this Order has been submitted pursuant to Order No.R3-2012-0011 and associated Monitoring and Reporting Programs.

3. The Sampling and Analysis Plan must include the following minimum required components to monitor irrigation water and stormwater discharges:
   a. Number and location of outfalls (identified with latitude and longitude or on a scaled map);
   b. Number and location of monitoring points;
   c. Description of typical irrigation runoff patterns;
   d. Map of discharge and monitoring points;
   e. Sample collection methods;
   f. Monitoring parameters;
   g. Monitoring schedule and frequency of monitoring events;

4. The QAPP must include appropriate methods for sampling, measurement and analysis, data collection or generation, data handling, quality control activities, and documentation.

5. The Sampling and Analysis Plan and QAPP, and any proposed revisions are subject to approval by the Executive Officer. The Executive Officer may require modifications to the Sampling and Analysis Plan or Tier 3 Dischargers may propose Sampling and Analysis Plan modifications for Executive Officer approval, when modifications are justified to accomplish the objectives of the MRP.

Individual Surface Water Discharge Monitoring Points

6. Tier 3 Dischargers must select monitoring points to characterize at least 80% of the estimated maximum irrigation run-off discharge volume from each farm/ranch based on that farm's/ranch's typical discharge patterns[1], including tailwater discharges and discharges from tile drains. Sample must be taken when irrigation activity is causing maximal run-off. Load estimates will be generated by multiplying flow volume of discharge by concentration of contaminants. Tier 3 Dischargers must include at least one monitoring point from each farm/ranch which drains areas where chlorpyrifos or diazinon are applied, and monitoring of runoff or tailwater must be conducted within one week of chemical application. If discharge is not routinely present, Discharger may characterize typical run-off patterns in the Annual Report. See Table 4A for additional details.

7. Tier 3 Dischargers must also monitor storage ponds and other terminal surface water containment structures that collect irrigation and stormwater runoff, unless the structure is (1) part of a tail-water return system where a major portion of the water in such structure is reapplied as irrigation water, or (2) the structure is primarily a sedimentation pond by design with a short hydraulic residence time (96 hours or less) and a discharge to surface water when functioning. If multiple ponds are present, sampling must cover at least those structures that would account for 80% of the maximum storage volume of the containment features. See Table 4B for additional details. Where water is reapplied as irrigation water. Dischargers shall document reuse in the Farm Plan.

Individual Surface Water Discharge Monitoring Parameters, Frequency, and Schedule

8. Tier 3 Dischargers must conduct monitoring for parameters, laboratory analytical methods, frequency and schedule described in Tables 4A and 4B. Dischargers may utilize in-field water testing instruments/equipment as a substitute for laboratory analytical methods if the method is approved by U.S. EPA, meets reporting limits (RL) and practical quantitation limits (PQL) specifications in the MRP, and appropriate sampling methodology and quality assurance checks can be applied to ensure that QAPP standards are met to ensure accuracy of the test.

[1] The requirement to select monitoring points to characterize at least 80% of the estimated maximum irrigation run-off based on typical discharge patterns is for the purposes of attempting to collect samples that represent a majority of the volume of irrigation run-off discharged; however the Board recognizes that predetermining these locations is not always possible and that sampling results may vary. The MRP does not specify the number or location of monitoring points to provide maximum flexibility for growers to determine how many sites necessary and exact locations are given the anticipated site-specific conditions.

9. Tier 3 Dischargers must initiate individual surface water discharge monitoring per an approved Sampling and Analysis Plan and QAPP, unless otherwise directed by the Executive Officer.

B. Individual Surface Water Discharge Reporting

Individual Surface Water Discharge Monitoring Data Submittal

By March 1, 2018, and annually thereafter by March 1, Tier 3 Dischargers must submit individual surface water discharge monitoring data and information to the Central Coast Water Board electronically, in a pdf format, containing at least the following items, or as otherwise approved by the Executive Officer:

a. Electronic laboratory data
- All reports of results must contain Ranch name and Global ID, site name(s), project contact, and date.
- Electronic laboratory data reports of chemical results shall include analytical results, as well as associated quality assurance data including method detection limits, reporting limits, matrix spikes, matrix spike duplicates, laboratory blanks, and other quality assurance results required by the analysis method.
- Electronic laboratory data reports of toxicity results shall include summary results comparable to those required in a CEDEN file delivery, including test and control results. For each test result, the mean, associated control performance, calculated percent of control, statistical test results and determination of toxicity, must be included. Test results must specify the control ID used to calculate statistical outcomes.
- Field data results, including temperature, pH, conductivity, turbidity and flow measurements, any field duplicates or blanks, and field observations.
- Calculations of un-ionized ammonia concentrations
- Calculations of total flow and pollutant loading (for nitrate, pesticides if sampled, total ammonia, and turbidity) (include formulas);

b. Narrative description of typical irrigation runoff patterns;
c. Location of sampling sites and map(s);
d. Sampling and analytical methods used;
e. Specify the method used to obtain flow at each monitoring site during each monitoring event;
f. Photos obtained from all monitoring sites, clearly labeled with location and date;
g. Sample chain-of-custody forms do not need to be submitted but must be made available to Central Coast Water Board staff, upon request.

PART 6. IRRIGATION AND NUTRIENT MANAGEMENT PLAN

Monitoring and reporting requirements related to the Irrigation and Nutrient Management Plan (INMP) identified in Part 6.A., and 6.B, apply to Tier 3 Dischargers identified by the Executive Officer that are newly enrolled in Order No. R3-2017-0002, and Tier 3 Dischargers that were subject to Irrigation and Nutrient Management Plan Requirements in Order R3-2012-0011 per MRP Order No. R3-2012-0011-03 Time schedules are shown in Table 5.

A. Irrigation and Nutrient Management Plan Monitoring

1. Tier 3 Dischargers required in Order No. R3-2012-0011 to develop and initiate implementation of an Irrigation and Nutrient Management Plan (INMP) certified by a Professional Soil Scientist, Professional Agronomist, or Crop Advisor certified by the American Society of Agronomy, or similarly qualified professional, are required to update (as necessary) and implement their INMP throughout the term of this Order.

2. The Executive Officer will assess whether an INMP is required for new Tier 3 Dischargers that enroll in Order No. R3-2017-0002 during the term of the Order. The Executive Officer will use the criteria established in Order No. R3-2012-0011 to make this assessment. If a Tier 3 Discharger is required to develop an INMP, the Tier 3 discharger must develop and initiate implementation of an Irrigation and Nutrient Management Plan (INMP) certified by a Professional Soil Scientist, Professional Agronomist, or Crop Advisor certified by the American Society of Agronomy, or similarly qualified professional, **within 18 months** of the Executive Officer's assessment of the INMP requirement.
3. The purpose of the INMP is to budget and manage the nutrients applied to each farm/ranch considering all sources of nutrients, crop requirements, soil types, climate, and local conditions in order to minimize nitrate loading to surface water and groundwater in compliance with this Order. The professional certification of the INMP must indicate that the relevant expert has reviewed all necessary documentation and testing results, evaluated total nitrogen applied relative to typical crop nitrogen uptake and nitrogen removed at harvest, with consideration to potential nitrate loading to groundwater, and conducted field verification to ensure accuracy of reporting.
4. Tier 3 Dischargers required to develop and initiate implementation an (INMP) must include the following elements in the INMP. The INMP is not submitted to the Central Coast Water Board, with the exception of the INMP Effectiveness Report:
    a. Proof of INMP certification;
    b. Map locating each farm/ranch;
    c. Identification of crop nitrogen uptake values for use in nutrient balance calculations;

d. Record keeping annually by either Method 1 or Method 2:

e. To meet the requirement to record total nitrogen in the soil,dischargers may take a nitrogen soil sample (e.g. laboratory analysis or nitrate quick test) or use an alternative method to evaluate nitrogen content in soil, prior to planting or seeding the field or prior to the time of pre-sidedressing, or at an alternative time when it is most effective to determine nitrogen present in the soil that is available for the next crop and to minimize nitrate leaching to groundwater. The amount of nitrogen remaining in the soil must be accounted for as a source of nitrogen when budgeting, and the soil sample or alternative method results must be maintained in the INMP.

f. Identification of irrigation and nutrient management practices in progress (identify start date), completed (identify completion date), and planned (identify anticipated start date) to reduce nitrate loading to groundwater to achieve compliance with this Order.

g. Description of methods Discharger will use to verify overall effectiveness of the INMP.

5. Tier 3 Dischargers must evaluate the effectiveness of the INMP. Irrigation and Nutrient Management Plan effectiveness monitoring must evaluate reduction in new nitrogen[1] loading potential based on minimized fertilizer use and improved irrigation and nutrient management practices in order to minimize new nitrogen loading to surface water and groundwater. Evaluation methods used may include, but are not limited to analysis of groundwater well monitoring data or soil sample data, or analysis of trends in new nitrogen application data.

B. Irrigation and Nutrient Management Plan Reporting

1. **By March 1, 2019**, Tier 3 Dischargers required to develop and initiate implementation of an INMP must submit an INMP Effectiveness Report to evaluate reductions in nitrate loading to surface water and groundwater based on the implementation of irrigation and nutrient management practices in a format specified by the Executive Officer. Dischargers in the same groundwater basin or subbasin may choose to comply with this requirement as a group by submitting a single report that evaluates the overall effectiveness of the broad scale implementation of irrigation and nutrient management practices identified in individual INMPs to protect groundwater. Group efforts must use data from each farm/ranch (e.g., data from individual groundwater wells, soil samples, or nitrogen application). The INMP

[1] New nitrogen is nitrogen from fertilizers, amendments, and other nitrogen sources applied other than nitrogen present in groundwater.

Effectiveness Report must include a description of the methodology used to evaluate and verify effectiveness of the INMP.

PART 7. WATER QUALITY BUFFER PLAN

Monitoring and reporting requirements related to the Water Quality Buffer Plan identified in Part 7.A. and Part 7.B. apply to <u>Tier 3 Dischargers that have farms/ranches *that contain or are adjacent to waterbody identified on the List of Impaired Waterbodies as impaired for temperature, turbidity, or sediment).*</u> Time schedules are shown in Table 5.

A. **Water Quality Buffer Plan**

1. **By 18 months following enrollment in Order No. R3-2017-0002 of a Tier 3 farm/ranch**, Tier 3 Dischargers adjacent to or containing a waterbody identified on the List of Impaired Waterbodies as impaired for temperature, turbidity or sediment must submit a Water Quality Buffer Plan (WQBP) to the Executive Officer that protects the listed waterbody and its associated perennial and intermittent tributaries. The purpose of the Water Quality Buffer Plan is to prevent waste discharge, comply with water quality standards (e.g., temperature, turbidity, sediment), and protect beneficial uses in compliance with this Order and the following Basin Plan requirement:

   Basin Plan (Chapter 5, p. V-13, Section V.G.4 – Erosion and Sedimentation, *"A filter strip of appropriate width, and consisting of undisturbed soil and riparian vegetation or its equivalent, must be maintained, wherever possible, between significant land disturbance activities and watercourses, lakes, bays, estuaries, marshes, and other water bodies. For construction activities, minimum width of the filter strip must be thirty feet, wherever possible…."*

2. The Water Quality Buffer Plan must include the following or the functional equivalent, to address discharges of waste and associated water quality impairments:

   a. A minimum 30 foot buffer (as measured horizontally from the top of bank on either side of the waterway, or from the high water mark of a lake and mean high tide of an estuary);
   b. Any necessary increases in buffer width to adequately prevent the discharge of waste that may cause or contribute to any excursion above or outside the acceptable range for any Regional, State, or Federal numeric or narrative water quality standard (e.g., temperature, turbidity);

c. Any buffer less than 30 feet must provide equivalent water quality protection and be justified based on an analysis of site-specific conditions and be approved by the Executive Officer;
d. Identification of any alternatives implemented to comply with this requirement, that are functionally equivalent to described buffer;
e. Schedule for implementation;
f. Maintenance provisions to ensure water quality protection;
g. Annual photo monitoring;

2. The WQPB must be submitted using the Water Quality Buffer Plan form, or, if an alternative to the WQBP is submitted, in a format approved by the Executive Officer.

3. **By March 1, 2019**, Tier 3 Dischargers that submitted a WQBP pursuant to Order No. R3-2012-0011 or Order No. R3-2017-0002, are required to update (as necessary) and implement their WQBP, and annually submit a WQBP Status Report of their WQBP implementation using the Water Quality Buffer Plan form, or, if an alternative to the WQBP was submitted, an Alternative to WQBP Status Report, electronically, in a format approved by the Executive Officer.

PART 8. GENERAL MONITORING AND REPORTING REQUIREMENTS

A. Submittal of Technical Reports

1. Dischargers must submit reports in a format specified by the Executive Officer (reports will be submitted electronically, unless otherwise specified by the Executive Officer). A transmittal letter must accompany each report, containing the following penalty of perjury statement signed by the Discharger or the Discharger’s authorized agent:

   “In compliance with Water Code §13267, I certify under penalty of perjury that this document and all attachments were prepared by me, or under my direction or supervision following a system designed to assure that qualified personnel properly gather and evaluate the information submitted. To the best of my knowledge and belief, this document and all attachments are true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment”.

2. If the Discharger asserts that all or a portion of a report submitted pursuant to this Order is subject to an exemption from public disclosure (e.g. trade secrets or secret processes), the Discharger must provide an explanation of how those portions of the reports are exempt from public disclosure. The

Discharger must clearly indicate on the cover of the report (typically an electronic submittal) that the Discharger asserts that all or a portion of the report is exempt from public disclosure, submit a complete report with those portions that are asserted to be exempt in redacted form, submit separately (in a separate electronic file) unredacted pages (to be maintained separately by staff). The Central Coast Water Board staff will determine whether any such report or portion of a report qualifies for an exemption from public disclosure. If the Central Coast Water Board staff disagrees with the asserted exemption from public disclosure, the Central Coast Water Board staff will notify the Discharger prior to making such report or portions of such report available for public inspection.

B. Central Coast Water Board Authority

1. Monitoring reports are required pursuant to section 13267 of the California Water Code. Pursuant to section 13268 of the Water Code, a violation of a request made pursuant to section 13267 may subject you to civil liability of up to $1000 per day.

2. The Water Board needs the required information to determine compliance with Order No.R3-2017-0002. The evidence supporting these requirements is included in the findings of Order No.R3-2017-0002.

____
John M. Robertson
Executive Officer

____
Date

Table 1. Major Waterbodies in Agricultural Areas[1]

Hydrologic SubArea	Waterbody Name	Hydrologic SubArea	Waterbody Name
30510	Pajaro River	30920	Quail Creek
30510	Salsipuedes Creek	30920	Salinas Reclamation Canal
30510	Watsonville Slough	31022	Chorro Creek
30510	Watsonville Creek[2]	31023	Los Osos Creek
30510	Beach Road Ditch[2]	31023	Warden Creek
30530	Carnadero Creek	31024	San Luis Obispo Creek
30530	Furlong Creek[2]	31024	Prefumo Creek
30530	Llagas Creek	31031	Arroyo Grande Creek
30530	Miller's Canal	31031	Los Berros Creek
30530	San Juan Creek	31210	Bradley Canyon Creek
30530	Tesquisquita Slough	31210	Bradley Channel
30600	Moro Cojo Slough	31210	Green Valley Creek
30910	Alisal Slough	31210	Main Street Canal
30910	Blanco Drain	31210	Orcutt Solomon Creek
30910	Old Salinas River	31210	Oso Flaco Creek
30910	Salinas River (below Gonzales Rd.)	31210	Little Oso Flaco Creek
30920	Salinas River (above Gonzales Rd. and below Nacimiento R.)	31210	Santa Maria River
30910	Santa Rita Creek[2]	31310	San Antonio Creek[2]
30910	Tembladero Slough	31410	Santa Ynez River
30920	Alisal Creek	31531	Bell Creek
30920	Chualar Creek	31531	Glenn Annie Creek
30920	Espinosa Slough	31531	Los Carneros Creek[2]
30920	Gabilan Creek	31534	Arroyo Paredon Creek
30920	Natividad Creek	31534	Franklin Creek

[1] At a minimum, monitoring sites must be included for these waterbodies in agricultural areas, unless otherwise approved by the Executive Officer. Monitoring sites may be proposed for addition or modification to better assess the impacts of waste discharges from irrigated lands to surface water. Dischargers choosing to comply with surface receiving water quality monitoring, individually (not part of a cooperative monitoring program) must only monitor sites for waterbodies receiving the discharge.

[2] These creeks are included because they are newly listed waterbodies on the 2010 303(d) list of Impaired Waters that are associated with areas of agricultural discharge.

Table 2. Surface Receiving Water Quality Monitoring Parameters

Parameters and Tests	RL[3]	Monitoring Frequency[1]
Photo Monitoring		
Upstream and downstream photographs at monitoring location		With every monitoring event
WATER COLUMN SAMPLING		
Physical Parameters and General Chemistry		
Flow (field measure) (CFS) following SWAMP field SOP[9]	.25	Monthly, including 2 stormwater events
pH (field measure)	0.1	”
Electrical Conductivity (field measure) (µS/cm)	2.5	”
Dissolved Oxygen (field measure) (mg/L)	0.1	”
Temperature (field measure) (°C)	0.1	”
Turbidity (NTU)	0.5	”
Total Dissolved Solids (mg/L)	10	”
Total Suspended Solids (mg/L)	0.5	”
Nutrients		
Total Nitrogen (mg/L)	0.5	Monthly, including 2 stormwater events
Nitrate + Nitrite (as N) (mg/L)	0.1	”
Total Ammonia (mg/L)	0.1	”
Unionized Ammonia (calculated value, mg/L))		”
Total Phosphorus (as P) (mg/L)	0.02	
Soluble Orthophosphate (mg/L)	0.01	”
Water column chlorophyll a (µg/L)	1.0	“
Algae cover, Floating Mats, % coverage	-	“
Algae cover, Attached, % coverage	-	“
Water Column Toxicity Test		
Algae - *Selenastrum capricornutum (*96-hour chronic; Method1003.0 in EPA/821/R-02/013)	-	4 times each year, twice in dry season, twice in wet season
Water Flea – *Ceriodaphnia dubia* (7-day chronic; Method 1002.0 in EPA/821/R-02/013)	-	”
Midge - *Chironomus spp.* (96-hour acute; Alternate test species in EPA 821-R-02-012)	-	“

Parameters and Tests	RL[3]	Monitoring Frequency[1]
Toxicity Identification Evaluation (TIE)	-	As directed by Executive Officer
Pesticides[2] /Herbicides (µg/L)		
Organophosphate Pesticides		
Azinphos-methyl	0.02	2 times in both 2017 and 2018, once in dry season and once in wet season of each year, concurrent with water toxicity monitoring
Chlorpyrifos	0.005	”
Diazinon	0.005	”
Dichlorvos	0.01	”
Dimethoate	0.01	”
Dimeton-s	0.005	”
Disulfoton (Disyton)	0.005	”
Malathion	0.005	”
Methamidophos	0.02	”
Methidathion	0.02	“
Parathion-methyl	0.02	“
Phorate	0.01	“
Phosmet	0.02	“
Neonicotinoids		
Thiamethoxam	.002	“
Imidacloprid	.002	“
Thiacloprid	.002	“
Dinotefuran	.006	“
Acetamiprid	.01	“
Clothianidin	.02	
Herbicides		
Atrazine	0.05	“
Cyanazine	0.20	“
Diuron	0.05	“
Glyphosate	2.0	“
Linuron	0.1	“
Paraquat	0.20	“
Simazine	0.05	“
Trifluralin	0.05	“
Metals (µg/L)		
Arsenic (total)[5,7]	0.3	2 times in both 2017 and 2018, once in dry season and once in wet season of each year, concurrent with water toxicity monitoring
Boron (total)[6,7]	10	“
Cadmium (total & dissolved)[4.5,7]	0.01	“

Parameters and Tests	RL[3]	Monitoring Frequency[1]
Copper (total and dissolved) [4,7]	0.01	"
Lead (total and dissolved) [4,7]	0.01	"
Nickel (total and dissolved) [4,7]	0.02	"
Molybdenum (total) [7]	1	"
Selenium (total)[7]	0.30	"
Zinc (total and dissolved) [4.5,7]	0.10	"
Other (µg/L)		
Total Phenolic Compounds[8]	5	2 times in 2017, once in spring (April-May) and once in fall (August-September)
Hardness (mg/L as CaCO3)	1	"
Total Organic Carbon (ug/L)	0.6	"
SEDIMENT SAMPLING		
Sediment Toxicity - *Hyalella azteca* 10-day static renewal (EPA, 2000)		2 times each year, once in spring (April-May) and once in fall (August-September)
Pyrethroid Pesticides in Sediment (µg/kg)		
Gamma-cyhalothrin	2	2 times in both 2017 and 2018, once in spring (April-May) and once in fall (August-September) of each year, concurrent with sediment toxicity sampling
Lambda-cyhalothrin	2	"
Bifenthrin	2	"
Beta-cyfluthrin	2	"
Cyfluthrin	2	"
Esfenvalerate	2	"
Permethrin	2	"
Cypermethrin	2	"
Danitol	2	"
Fenvalerate	2	"
Fluvalinate	2	"
Other Monitoring in Sediment		
Chlorpyrifos (µg/kg)	2	"
Total Organic Carbon	0.01%	"
		"
Sediment Grain Size Analysis	1%	"

[1]Monitoring is ongoing through all five years of the Order, unless otherwise specified. Monitoring frequency may be used as a guide for developing alternative Sampling and Analysis Plan.
[2]Pesticide list may be modified based on specific pesticide use in Central Coast Region. Analytes on this list must be reported, at a minimum.
[3] Reporting Limit, taken from SWAMP where applicable.

[4] Holmgren, Meyer, Cheney and Daniels. 1993. Cadmium, Lead, Zinc, Copper and Nickel in Agricultural Soils of the United States. J. of Environ. Quality 22:335-348.
[5]Sax and Lewis, ed. 1987. Hawley's Condensed Chemical Dictionary. 11th ed. New York: Van Nostrand Reinhold Co., 1987. Zinc arsenate is an insecticide.
[6]Http://www.coastalagro.com/products/labels/9%25BORON.pdf; Boron is applied directly or as a component of fertilizers as a plant nutrient.
[7]Madramootoo, Johnston, Willardson, eds. 1997. Management of Agricultural Drainage Water Quality. International Commission on Irrigation and Drainage. U.N. FAO. SBN 92-6-104058.3.
[8]http://cat.inist.fr/?aModele=afficheN&cpsidt=14074525; Phenols are breakdown products of herbicides and pesticides. Phenols can be directly toxic and cause endocrine disruption.
[9]See SWAMP field measures SOP, p. 17
mg/L – milligrams per liter; ug/L – micrograms per liter; ug/kg – micrograms per kilogram;
NTU – Nephelometric Turbidity Units; CFS – cubic feet per second;

Table 3. Groundwater Monitoring Parameters

Parameter	RL	Analytical Method[3]	Units
pH	0.1	Field or Laboratory Measurement EPA General Methods	pH Units
Specific Conductance	2.5		μS/cm
Total Dissolved Solids	10		mg/L
Total Alkalinity as $CaCO_3$	1	EPA Method 310.1 or 310.2	
Calcium	0.05	General Cations[1] EPA 200.7, 200.8, 200.9	
Magnesium	0.02		
Sodium	0.1		
Potassium	0.1		
Sulfate (SO_4)	1.0	General Anions EPA Method 300 or EPA Method 353.2	
Chloride	0.1		
Nitrate + Nitrite (as N)[2] *or* Nitrate as N	0.1		

[1]General chemistry parameters (major cations and anions) represent geochemistry of water bearing zone and assist in evaluating quality assurance/quality control of groundwater monitoring and laboratory analysis.
[2]The MRP allows analysis of "nitrate plus nitrite" to represent nitrate concentrations (as N). The "nitrate plus nitrite" analysis allows for extended laboratory holding times and relieves the Discharger of meeting the short holding time required for nitrate.
[3]Dischargers may use alternative analytical methods approved by EPA.
RL – Reporting Limit; μS/cm – micro siemens per centimeter

Table 4A. Individual Discharge Monitoring for Tailwater, Tile drain, and Stormwater Discharges

Parameter	Analytical Method[1]	Maximum PQL	Units	Min Monitoring Frequency
Discharge Flow or Volume	Field Measure	---	CFS	(a) (d)
Approximate Duration of Flow	Calculation	---	hours/month	
Temperature (water)	Field Measure	0.1	°Celsius	
pH	Field Measure	0.1	pH units	

Electrical Conductivity	Field Measure	100	µS/cm	
Turbidity	SM 2130B, EPA 180.1	1	NTUs	
Nitrate + Nitrite (as N)	EPA 300.1, EPA 353.2	0.1	mg/L	
Ammonia	SM 4500 NH3, EPA 350.3	0.1	mg/L	
Chlorpyrifos[2]	EPA 8141A, EPA 614	0.02	ug/L	(b) (c) (d)
Diazinon[2]				
Ceriodaphnia Toxicity (96-hr acute)	EPA-821-R-02-012	NA	% Survival	
Hyalella Toxicity in Water (96-hr acute)	EPA-821-R-02-012	NA	% Survival	

[1] In-field water testing instruments/equipment as a substitute for laboratory analysis if the method is approved by EPA, meets RL/PQL specifications in the MRP, and appropriate sampling methodology and quality assurance checks can be applied to ensure that QAPP standards are met to ensure accuracy of the test.
[2]If chlorpyrifos or diazinon is used at the farm/ranch, otherwise does not apply. The Executive Officer may require monitoring of other pesticides based on results of downstream receiving water monitoring.
(a) Two times per year during primary irrigation season for farms/ranches less than or equal to 500 acres, and four times per year during primary irrigation season for farms/ranches greater than 500 acres. Executive Officer may reduce sampling frequency based on water quality improvements.
(b) Once per year during primary irrigation season for farms/ranches less than or equal to 500 acres, and two times per year during primary irrigation season for farms/ranches greater than 500 acres.
(c) Sample must be collected within one week of chemical application, if chemical is applied on farm/ranch;
(d) Once per year during wet season (October – March) for farms/ranches less than or equal to 500 acres, and two times per year during wet season for farms/ranches greater than 500 acres, within 18 hours of major storm events;
CFS – Cubic feet per second; NTU – Nephelometric turbidity unit; PQL – Practical Quantitation Limit;
NA – Not applicable

Table 4B. Individual Discharge Monitoring for Tailwater Ponds and other Surface Containment Features

Parameter	Analytical Method[1]	Maximum PQL	Units	Minimum Monitoring Frequency
Volume of Pond	Field Measure	1	Gallons	(a) (d)
Nitrate + Nitrite (as N)	EPA 300.1, EPA 353.2	50	mg/L	

[1] In-field water testing instruments/equipment as a substitute for laboratory analysis if the method is approved by EPA, meets RL/PQL specifications in the MRP, and appropriate sampling methodology and quality assurance checks can be applied to ensure that QAPP standards are met to ensure accuracy of the test.
(a) Four times per year during primary irrigation season; Executive Officer may reduce monitoring frequency based on water quality improvements.
(d) Two times per year during wet season (October – March, within 18 hours of major storm events)

Table 5. Tier 3 - Time Schedule for Key Monitoring and Reporting Requirements (MRPs)

REQUIREMENT	TIME SCHEDULE[1]
Submit Sampling And Analysis Plan and Quality Assurance Project Plan (SAAP/QAPP) for Surface Receiving Water Quality Monitoring (*individually or*	By March 1, 2018, or as directed by the Executive Officer; satisfied if an approved SAAP/QAPP has been submitted pursuant

through cooperative monitoring program)	to Order No. R3-2012-0011 and associated MRPs
Initiate surface receiving water quality monitoring (*individually or through cooperative monitoring program*)	Per an approved SAAP and QAPP
Submit surface receiving water quality monitoring data (*individually or through cooperative monitoring program*)	Each January 1, April 1, July 1, and October 1
Submit surface receiving water quality Annual Monitoring Report (*individually or through cooperative monitoring program*)	By July 1 2017; annually thereafter by July 1
Initiate monitoring of groundwater wells	First sample from March-June 2017, second sample from September-December 2017
Submit individual surface water discharge SAAP and QAPP	By March 1, 2018 or as directed by the Executive Officer; waived if an approved SAAP and QAPP has been submitted and being implemented pursuant to Order No. R3-2012-0011.
Initiate individual surface water discharge monitoring	As described in an approved SAAP and QAPP
Submit individual surface water discharge monitoring data	March 1, 2018, and every March 1 annually thereafter
Submit electronic Annual Compliance Form	March 1, 2018 and every March 1 annually thereafter
Submit groundwater monitoring results	Within 60 days of the sample collection
Submit Water Quality Buffer Plan or alternative	Within 18 months of enrolling new Tier 3 farm/ranch in Order
Submit Status Report on Water Quality Buffer Plan or alternative	March 1, 2019
Tier 3 Dischargers with farms/ranches growing high risk crops:	
Report total nitrogen applied on the Total Nitrogen Applied form	March 1, 2018 and every March 1 annually thereafter
Submit INMP Effectiveness Report	March 1, 2019

[1] Dates are relative to adoption of this Order, unless otherwise specified.

STATE OF CALIFORNIA
CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL COAST REGION

PROPOSED GENERAL WASTE DISCHARGE REQUIREMENTS FOR DISCHARGES FROM IRRIGATED LANDS

ORDER NO. R3-2021-0040

April XX, 2021

ORDER

Table of Contents

Attachments

THE CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD, CENTRAL COAST REGION FINDS:

Part 1, Section A. Findings

Background and Purpose

1. As described in the Water Quality Control Plan for the Central Coastal Basin (Basin Plan), the central coast region of California represents approximately 7.2 million acres of land. There are approximately 540,000 acres of irrigated land and approximately 3,000 agricultural operations that may be generating wastewater that falls into the category of discharges of waste from irrigated lands.

2. The central coast region has more than 17,000 miles of surface waters (linear streams/rivers) and approximately 4,000 square miles of groundwater basins that are, or may be, affected by discharges of waste from irrigated lands. Of the nine hydrologic regions in the state, the central coast region is the most groundwater dependent region with approximately 86% of its water supply being derived from groundwater.

3. The State Water Resources Control Board (State Water Board) and Regional Water Quality Control Boards (Regional Water Boards) are the principal state agencies with primary responsibility for the coordination and control of water quality for the health, safety and welfare of the people of the state pursuant to the Porter-Cologne Water Quality Control Act (Porter-Cologne Act, codified in Water Code Division 7). The legislature, in the Porter-Cologne Act, directed the state, through the Water Boards, to exercise its full power and jurisdiction to protect the quality of the waters in the state from degradation and to attain the highest water quality which is reasonable, considering all demands being made and to be made on those waters and the total values involved, beneficial and detrimental, economic and social, tangible and intangible, and considering precipitation, topography, population, recreation, agriculture, industry, and economic development (Water Code section 13000).

4. Since the issuance of the first Agricultural Order in 2004 and subsequent Agricultural Orders in 2012 and 2017, the California Regional Water Quality Control Board, Central Coast Region (Central Coast Water Board) has compiled additional and substantial empirical data demonstrating that water quality conditions in agricultural areas of the region continue to be severely impaired or polluted by waste discharges from irrigated agricultural operations and activities that impair beneficial uses. The main impacts from irrigated agriculture in the central coast region are nitrate discharges to groundwater and associated drinking water impacts, nutrient discharges to surface water, pesticide discharges

and associated toxicity, sediment discharges, and degradation of riparian and wetland areas and the associated impairment or loss of beneficial uses.

5. The objectives of this Order are:

   a. Protect and restore beneficial uses and achieve water quality objectives specified in the Basin Plan for commercial irrigated agricultural areas in the central coast region by:
      i. Minimizing nitrate discharges to groundwater,
      ii. Minimizing nutrient discharges to surface water,
      iii. Minimizing toxicity in surface water from pesticide[1] discharges,
      iv. Protecting riparian and wetland habitat, and
      v. Minimizing sediment discharges to surface water.
   b. Effectively track and quantify achievement of 5.a.i through 5.a.v over a specific, defined time schedule.
   c. Comply with the State's Policy for Implementation and Enforcement of the Nonpoint Source Pollution Control Program (NPS Policy), the State Antidegradation Policy, relevant court decisions such as those pertaining to Coastkeeper *et al* lawsuits, the precedential language in the Eastern San Joaquin Watershed Agricultural Order, and other relevant statutes and water quality plans and policies, including total maximum daily loads in the central coast region.

6. This Order regulates discharges of waste from irrigated lands by requiring individuals subject to this Order to comply with the terms and conditions set forth herein to ensure that such discharges do not cause or contribute to the exceedance of any regional, state, or federal numeric or narrative water quality objectives or impair any beneficial uses in waters of the state and of the United States.

7. Water Code section 13260(a) requires that any person discharging waste or proposing to discharge waste that could affect the quality of the waters of the state, other than into a community sewer system, must file with the appropriate Regional Board a report of waste discharge (ROWD) containing such information and data as may be required by the Central Coast Water Board, unless the Central Coast Water Board waives such requirement.

8. Water Code section 13263(a) requires the Central Coast Water Board to prescribe waste discharge requirements (WDRs), or waive WDRs, for the discharge. The requirements must implement the Basin Plan and must take into

[1] A pesticide is any substance intended to control, destroy, repel, or otherwise mitigate a pest. The term pesticide is inclusive of all pest and disease management products, including insecticides, herbicides, fungicides, nematicides, rodenticides, algicides, etc.

consideration the beneficial uses to be protected and the water quality objectives reasonably required for that purpose, other waste discharges, the need to prevent nuisance, and the provisions of Water Code section 13241.

9. Water Code section 13263(b) states that, in prescribing requirements, the Central Coast Water Board need not authorize the utilization of the full waste assimilation capacities of the receiving waters.

10. This Order does not create a vested right to discharge; all discharges are a privilege, not a right, as described in Water Code section 13263(g).

11. Water Code section 13263(i) authorizes the Central Coast Water Board to prescribe general WDRs for a category of discharges if the Central Coast Water Board finds or determines that all the criteria listed below apply to the discharges in that category. Discharges associated with irrigated agricultural operations that will be regulated under this Order are consistent with these criteria and therefore a general order is appropriate.

    a. The discharges are produced by the same or similar operations.
    b. The discharges involve the same or similar type of waste.
    c. The discharges require the same or similar treatment standards.
    d. The discharges are more appropriately regulated under general WDRs than individual WDRs.

12. Water Code section 13243 authorizes the Central Coast Water Board, in WDRs, to specify certain conditions or areas where the discharge of waste, or certain types of waste, will not be permitted.

13. Water Code section 13267(a) authorizes the Central Coast Water Board to, in establishing or reviewing waste discharge requirements, or in connection with any action to any plan or requirement authorized by the Porter-Cologne Act, investigate the quality of any waters of the state within the region. The monitoring and reporting requirements as set forth in Attachment B are established under Water Code section 13267(b).

14. Water Code section 13267(c) authorizes the Central Coast Water Board or its authorized representatives to, in conducting an investigation of the quality of waters of the state within the region, inspect the facilities of the Discharger upon consent, issuance of a warrant, or in an emergency affecting public health or safety, to ascertain compliance with this Order and to ascertain whether the purpose of the Porter-Cologne Act are being met. Inspections under Water Code section 13267(c) include sampling and monitoring.

15. Water Code section 13304 authorizes the Central Coast Water Board to, upon making the requisite findings, issue a cleanup and abatement order (CAO) that

requires Dischargers to provide emergency and long-term alternative water supplies or replacement water service, including wellhead treatment, to each affected public water supplier or private well owners. A CAO is a separate action from this Order; this Order does not require Dischargers to provide alternative water supplies or replacement water.

Public Participation Process

16. In August 2017, Central Coast Water Board staff held a series of listening sessions throughout the central coast region to solicit stakeholder input on potential improvements to the previous agricultural order. The Central Coast Water Board discussed the input received from stakeholders during the September 2017 board meeting.

17. In February 2018, the Central Coast Water Board published an initial study to begin soliciting input related to environmental review for the California Environmental Quality Act (CEQA), in preparation for developing a draft Environmental Impact Report (EIR). A 73-day public comment period was held for the initial study. In March 2018, Central Coast Water Board staff held a series of public CEQA scoping meetings throughout the region. Input received during the public comment period and public scoping meetings has been considered in the development of the draft EIR.

18. In March and May 2018, Central Coast Water Board meetings included informational items dedicated to a review of water quality conditions associated with agricultural activities and discharges. The March 2018 informational item focused on surface water quality conditions and agricultural discharges and the May 2018 informational item focused on groundwater quality conditions and nitrate impacts to groundwater. Both informational items incorporated presentations from several outside speakers.

19. In September 2018, the Central Coast Water Board's public meeting was dedicated to a workshop for agricultural order stakeholders. Panels of agricultural, environmental, and environmental justice representatives gave presentations to the board in response to a series of questions staff proposed:

    a. What can growers and the regional board do to demonstrate quantifiable progress to minimize nitrate discharge to groundwater to achieve water quality objectives?
    b. What can growers and the regional board do to demonstrate quantifiable progress to minimize nutrient discharge to surface waters to achieve water quality objectives?
    c. What can growers and the regional board do to demonstrate quantifiable progress to minimize toxicity in surface waters from pesticide discharges to achieve water quality objectives?

d. What can growers and the regional board do to ensure that riparian and wetland habitat is protected due to agricultural activities and discharges?
e. What can growers and the regional board do to demonstrate quantifiable progress to minimize sediment discharge to achieve water quality objectives?
f. How can the regional board use discharge permit requirements to ensure current and future affordable, safe, and clean water for drinking and environmental uses?

20. In November 2018, the Central Coast Water Board published a set of five conceptual options tables that serve as the Central Coast Water Board's framework to address the questions posed in the September 2018 meeting. The Central Coast Water Board reviewed and discussed the options tables during its public meeting in November, and a 64-day written public comment period was subsequently held to solicit detailed stakeholder input. Central Coast Water Board staff held a series of outreach meetings throughout the region during the comment period.

21. In March 2019, after the 64-day public comment period, the Central Coast Water Board published updated versions of the five conceptual options tables. During the public meetings in March and May 2019, the Central Coast Water Board discussed the updated tables and received additional stakeholder comment.

22. In September 2019, during its public meeting, the Central Coast Water Board held a workshop focused on co-managing food safety and environmental protection, the role of riparian vegetation in water quality and beneficial use protection, and Discharger experiences with food safety challenges.

23. On February 21, 2020, the Central Coast Water Board published the draft Order and draft EIR and began a 45-day public comment period. The comment period was extended twice and closed on June 22, 2020.

24. In June 2020, Central Coast Water Board staff conducted three outreach meetings, which included presentations of the draft Order and draft EIR, and a question and answer session for attendees. These outreach meetings were conducted virtually via the Zoom platform, due to the COVID-19 pandemic.

25. Beginning on September 10, 2020 and continuing to January 8, 2021, the Central Coast Water Board held 10 days of Board meetings to receive oral comments from the public and to discuss the draft Order. During these meetings, three of which were devoted entirely to receiving public comment and Board engagement with stakeholders, the Board deliberated on the draft Order using a consensus-based approach through which they directed staff on the development of a revised Order.

26. On January 26, 2021, the Central Coast Water Board circulated a revised draft Order for a 30-day public comment period that closed on February 25, 2021. Central Coast Water Board staff subsequently considered the public comments and developed a proposed Order for Board consideration during an April 14-16, 2021, public hearing.

27. The Central Coast Water Board, in a public hearing held on April 14-16, 2021, has heard and considered all comments pertaining to the discharge and proposed Order.

28. After considering all comments pertaining to this General Permit during a public hearing on April 14-16, 2021, this Order was found consistent with the findings in this Part 1 and Attachment A.

29. Any person aggrieved by this action of the Central Coast Water Board may petition the State Water Board to review the action in accordance with California Water Code section 13320 and title 23 California Code of Regulations sections 2050 and following. The State Water Board must receive the petition by 5:00 p.m., within 30 calendar days of the date of adoption of this Order at the following address, except that if the thirtieth day following the date of adoption falls on a Saturday, Sunday, or state holiday, the petition must be received by the State Water Board by 5:00 p.m. on the next business day:

    State Water Resources Control Board
    Office of Chief Counsel
    P.O. Box 100, 1001 I Street
    Sacramento, CA 95812-0100

    Or by email at **waterqualitypetitions@waterboards.ca.gov**

    For instructions on how to file a petition for review, see **http://www.waterboards.ca.gov/public_notices/petitions/water_quality/wqpetition_instr.shtml**.

Scope of Order

Irrigated Lands and Agricultural Discharges Regulated Under this Order

30. This Order regulates (1) discharges of waste from commercial irrigated lands, including, but not limited to, land planted to row, vineyard, field and tree crops where water is applied for producing commercial crops; (2) discharges of waste from commercial nurseries, nursery stock production, and greenhouse operations with soil floors that do not have point source-type discharges and are not currently operating under individual WDRs; and (3) discharges of waste from

lands that are planted to commercial crops that are not yet marketable, such as vineyards and tree crops.

31. Discharges from irrigated lands regulated by this Order include discharges to surface water and groundwater, through mechanisms such as irrigation return flows, percolation, tailwater, tile drain water, stormwater runoff flowing from irrigated lands, stormwater runoff conveyed in channels or canals resulting from the discharge from irrigated lands, and runoff resulting from frost control or operational spills. These discharges can contain wastes that could affect the quality of waters of the state and impair beneficial uses.

32. This Order also regulates agricultural activities such as the removal or degradation of riparian vegetation resulting in the loss or degradation of instream beneficial uses.

Dischargers Regulated Under this Order

33. This Order regulates both landowners and operators of commercial irrigated lands on or from which there are discharges of waste or activities that could affect the quality of any surface water or groundwater or result in the impairment of beneficial uses (Dischargers). Dischargers are responsible for complying with the conditions of this Order. Both the landowner and the operator of the irrigated agricultural land are Dischargers under this Order. The Central Coast Water Board will hold both the landowner and the operator liable for noncompliance with this Order, regardless of whether the landowner or the operator is the party to enroll under this Order.

34. For the purposes of this Order, irrigated lands producing commercial crops are those operations that have one or more of the following characteristics:

    a. The landowner or operator has obtained a pesticide use permit from a local County Agricultural Commissioner;
    b. The crop is sold, including but not limited to 1) an industry cooperative, 2) a harvest crew/company, or 3) a direct marketing location, such as certified Farmers Markets;
    c. The federal Department of Treasury Internal Revenue Service for 1040 Schedule F Profit or Loss from Farming is used to file federal taxes.

35. The electronic Notice of Intent (eNOI) serves as a report of waste discharge (ROWD) for the purposes of this Order.

36. The Central Coast Water Board recognizes that certain limited resource growers[2] (as defined by the U.S. Department of Agriculture) may have difficulty achieving

[2] The term “Limited Resource Farmer or Rancher” means a participant:

compliance with this Order. The Central Coast Water Board will prioritize assistance for these growers, including but not limited to technical assistance, grant opportunities, and necessary flexibility to achieve compliance with this Order (e.g., adjusted monitoring, reporting, or time schedules).

Agricultural Dischargers Not Covered Under this Order and Who Must Apply for Individual Waste Discharge Requirements

37. This Order does not cover point source-type discharges from commercial nurseries, nursery stock production, greenhouses, or other operations. This Order does not cover discharges of waste from fully contained greenhouse operations (i.e., those that have no groundwater discharge due to impermeable floors but may have other discharges associated with the operation). These operations must either eliminate all such discharges of waste or submit a ROWD to apply for individual WDRs as set forth in Water Code section 13260.

Enforcement for Noncompliance

38. The State Water Board's Water Quality Enforcement Policy (Enforcement Policy) describes progressive enforcement action for violations of WDRs when appropriate. However, the Enforcement Policy recommends formal enforcement as a first response to more significant violations. Progressive enforcement is an escalating series of actions that allows for the efficient and effective use of enforcement resources to 1) assist cooperative Dischargers in achieving compliance; 2) compel compliance for repeat violations and recalcitrant violators; and 3) provide a disincentive for noncompliance. Progressive enforcement actions may begin with informal enforcement actions such as a verbal, written, or electronic communication between the Central Coast Water Board and a Discharger. The purpose of an informal enforcement action is to quickly bring the violation to the Discharger's attention and to give the Discharger an opportunity to return to compliance as soon as possible. The highest level of informal enforcement is a Notice of Violation.

39. The Enforcement Policy recommends formal enforcement actions for the highest priority violations, chronic violations, and/or threatened violations. Violations of this Order that will be considered a priority include, but are not limited to:

    a. Failure to obtain required regulatory coverage;

- With direct or indirect gross farm sales not more than the current indexed value in each of the previous two years, and
- Who has a total household income at or below the national poverty level for a family of four, or less than 50 percent of county median household income in each of the previous two years.

A Self-Determination Tool is available to the public and may be completed on-line or printed and completed hardcopy at the **USDA website**:
https://lrftool.sc.egov.usda.gov/DeterminationTool.aspx?fyYear=2020

b. Failure to achieve numeric limits;
c. Falsifying information or intentionally withholding information required by applicable laws, regulations, or an enforcement order;
d. Failure to monitor or provide complete and accurate information as required;
e. Failure to pay annual fees, penalties, or liabilities; and
f. Failure to submit required reports on time.

40. Water Code section 13350 provides that any person who violates WDRs may be 1) subject to administrative civil liability imposed by the Central Coast Water Board or State Water Board in an amount of up to $5,000 per day of violation, or up to $10 per gallon of waste discharged; or 2) subject to civil liability imposed by a court in an amount of up to $15,000 per day of violation, or up to $20 per gallon of waste discharged. The actual calculation and determination of administrative civil penalties must be consistent with the Enforcement Policy and the Porter-Cologne Act.

Order Effectiveness Evaluation

41. Water Code section 13263(e) states that for WDRs, "Upon application by any affected person, or on its own motion, the regional board may review and revise requirements. All requirements shall be reviewed periodically." It is the expressed intent of the Central Coast Water Board that its staff and, as appropriate, third-party groups or programs provide annual updates to the board during public meetings regarding the implementation of this Order. The purpose of the updates is to evaluate and report out on individual discharger and third-party group compliance; identify successes, challenges, and emerging science and management practices; consider potential Order modifications as may be appropriate at five-year intervals; and generally inform the Board and public regarding the Order's effectiveness towards achieving the stated objectives.

Additional Findings and Regulatory Considerations

42. Attachment A to this Order, incorporated herein, includes additional findings that further describe the Water Board's legal and regulatory authority; compliance with CEQA requirements; applicable plans and policies adopted by the State Water Board and the Central Coast Water Board that contain regulatory conditions that apply to the discharge of waste from irrigated lands; and the rationale for this Order, including descriptions of the environmental and agricultural resources in the central coast region and impacts to water quality and beneficial uses from agricultural discharges.

43. The Central Coast Water Board encourages Dischargers to participate in third-party groups or programs (e.g., certification program, watershed group, water quality coalition, monitoring coalition, or other third-party effort) to facilitate and document compliance with this Order. Third-party programs can be used to

implement outreach and education, monitoring and reporting, management practice and/or water quality improvement projects. Regionally scaled third-party programs addressing multiple Order requirements are preferred to provide economies of scale to reduce Discharger costs, maximize effectiveness, and streamline Water Board oversight; however, watershed- or basin-scale third-party programs of limited scope may be appropriate under certain circumstances and should be coordinated to the extent practicable for consistency and effectiveness. Commodity group certification programs may also be effective in facilitating compliance with this Order. Dischargers participating in an Executive Officer approved third-party program may be subject to permit fee reductions or alternative compliance pathways that substantively comply with this Order.

44. The Central Coast Water Board acknowledges that it will take time to develop meaningful and effective third-party programs that facilitate compliance with this Order. The Order considers this by allowing an initial grace period for the phasing in of various requirements. The phasing in of various requirements is also intended to allow Water Board staff time to develop online reporting tools and templates and to conduct outreach and education to help Dischargers and service providers come up to speed on the new requirements.

45. Third-party programs are discussed in **Part 2, Section A**. The Central Coast Water Board will provide more detailed third-party expectation documents and/or third-party program requests for proposals (RFPs) to inform and solicit third-party program proposals for Executive Officer consideration.

46. The Executive Officer may make non-substantive changes to the Order to correct typographical errors or to maintain consistency within the Order or between the Order and its Attachments, e.g., to conform changes made during the Order development process that were inadvertently not carried through the entire Order. [The Board will provide public notice of the non-substantive changes.]

IT IS HEREBY ORDERED that Order No. R3-2017-0002 is terminated as of the effective date of this Order except for the purposes of enforcement, and that pursuant to Water Code sections 13260, 13263, and 13267, Dischargers enrolled in this Order, their agents, successors, and assigns, must comply with the following terms and conditions to meet the provisions contained in Water Code Division 7 and regulations, plans, and policies adopted thereunder.

Part 2, Section A. Enrollment, Fees, Termination, General Provisions, and Third-Party Programs

1. This Order is effective upon adoption by the Central Coast Water Board.

2. Except where stated otherwise, all requirements of this Order apply to all Dischargers.

Enrollment

3. Enrollment in this Order requires the submittal of the electronic Notice of Intent (eNOI) pursuant to Water Code section 13260. Submittal of all other technical reports pursuant to this Order is required pursuant to Water Code section 13267. Failure to submit technical reports or the attachments in accordance with the time schedules established by this Order or Monitoring and Reporting Program (MRP), or failure to submit a complete technical report (i.e., of sufficient technical quality to be acceptable to the Executive Officer), may subject the Discharger to enforcement action pursuant to Water Code sections 13261, 13268, or 13350. Dischargers must submit technical reports in the format specified by the Executive Officer.

4. Dischargers who are not currently enrolled in the existing agricultural order must submit to the Central Coast Water Board a complete eNOI prior to discharging. Upon submittal of a complete and accurate eNOI, the Discharger is enrolled under this Order, unless otherwise informed by the Executive Officer.

5. Dischargers who were enrolled in Order R3-2017-0002 as of the effective date of this Order are automatically enrolled in this Order.

6. In the case where an operator may be operating for a period of less than 12 months, the landowner must submit the eNOI. In all other cases, either the landowner or the operator must submit the eNOI. Both the landowner and the operator are Dischargers and considered a responsible party for compliance with the requirements of this Order.

7. **Prior to any discharge or commencement of activities that may cause a discharge**, including land preparation prior to crop production, any Discharger proposing to control or own a new operation or ranch that has the potential to

discharge waste that could directly or indirectly reach waters of the state and/or affect the quality of any surface water and/or groundwater must submit an eNOI.

8. **Within 60 days** of any change in operation or ranch information, the Discharger must update the eNOI.

9. **Within 60 days** of any change in control or ownership of an operation, ranch, or land presently owned or controlled by the Discharger, the Discharger must notify the succeeding owner and operator of the existence of this Order.

10. **Within 60 days** of acquiring control or ownership of an existing operation or ranch, the succeeding Discharger must submit an eNOI.

11. Dischargers must submit all the information required in the eNOI form, including but not limited to the following information for the operation and individual ranch:

    a. Assessor parcel numbers (APNs) covered by enrollment,
    b. Landowner(s),
    c. Operator(s),
    d. Contact information,
    e. Third-party program membership,
    f. Location of operation, including specific ranch(es),
    g. Map with discharge locations and groundwater wells identified,
    h. Type and number of groundwater wells located on ranch parcels,
    i. Total and irrigated acreage,
    j. Crop types grown,
    k. Irrigation system type,
    l. Discharge type,
    m. Chemical use,
    n. Slope,
    o. Impermeable surfaces,
    p. Presence and location of any waterbodies on or adjacent to the ranch.
    q. Status of drinking water notification to well users

12. Dischargers or groups of Dischargers seeking regulatory requirements tailored to their specific operation, ranch, geographic area, or commodity may submit an ROWD to obtain an individual order or MRP, or request the development of a general order for a specific type of discharge (e.g., commodity-specific general order). This Order remains applicable to those Dischargers until the Central Coast Water Board adopts such an individual order, MRP, or general order, and, if applicable, the Dischargers are enrolled in the general order.

13. Dischargers seeking enrollment in this Order must submit a statement of understanding of the conditions of this Order and MRP signed by the Discharger (landowner or operator) with the eNOI. If the operator signs and submits the

electronic NOI, the operator must provide a copy of the complete NOI form to the landowner(s).

14. Coverage under this Order is not transferable to any person except after the succeeding Discharger's submittal to the Central Coast Water Board of an updated eNOI and approval by the Executive Officer.

Fees

15. Dischargers must pay a fee to the State Water Resources Control Board in compliance with the fee schedule contained in Title 23 California Code of Regulations.

16. Dischargers must pay any relevant third-party program fees (e.g., Surface Water Third-Party Monitoring Program (aka Cooperative Monitoring Program or CMP) necessary to comply with monitoring and reporting conditions of this Order or they must comply with monitoring and reporting requirements individually.

17. For Dischargers who choose to participate in a third-party program, failure to pay third-party program fees voids a selection or notification of the option to participate in the third-party program and hence requires Dischargers to immediately comply with individual groundwater protection and/or surface water protection requirements.

Termination

18. **Immediately**, if a Discharger wishes to terminate coverage under this Order for the operation or an individual ranch, the Discharger must submit a complete Notice of Termination (NOT), in a format specified by the Executive Officer. Termination from coverage is the date the termination request is approved, unless specified otherwise. All discharges must cease before the date of termination, and any discharges on or after the date of termination are violations of this Order, unless covered by other WDRs or waivers of WDRs. All required monitoring and reporting are due **within 60 days of the termination or March 1 following the termination date**, whichever is sooner, unless otherwise directed by the Executive Officer.

General Provisions

19. The unauthorized discharge of any waste not specifically regulated by this Order, is prohibited.

20. The discharge of waste at a location or in a manner different from that described in the eNOI is prohibited.

21. Dischargers must comply with the Monitoring and Reporting Program (MRP), incorporated herein as Attachment B.

22. All forms, reports, documents, and laboratory data must be submitted to the Central Coast Water Board electronically through the State Water Board's database systems (e.g., GeoTracker, CEDEN,[3] etc.).

23. Dischargers are defined in this Order as both the landowner and the operator of irrigated agricultural land on or from which there are discharges of waste from irrigated agricultural activities that could affect the quality of any surface water or groundwater. The Central Coast Water Board will hold both the landowner and the operator liable for noncompliance with this Order.

24. The Executive Officer may propose, and the Central Coast Water Board may adopt, individual WDRs for any Discharger at any time.

25. The Central Coast Water Board or the Executive Officer may, at any time, terminate applicability of this Order with respect to an individual Discharger upon written notice to the Discharger.

26. Noncompliance with requirements in this Order is grounds for enforcement action and/or termination of coverage for waste discharges under this Order, subjecting the Discharger to enforcement under the Water Code for further discharges of waste to surface water or groundwater.

27. The fact that it would have been necessary to halt or reduce the permitted discharge activity to maintain compliance with this Order is not a defense for the Discharger's violations of this Order.

28. Provisions of this Order are severable. If any provision of this Order is found invalid, the remainder of this Order will not be affected.

29. Upon the Central Coast Water Board's or Executive Officer's request and within a reasonable timeframe, Dischargers must submit any information required to determine compliance with this Order or to determine whether there is cause for modifying or terminating this Order.

30. Under authority of Water Code section 13267(c), the Discharger must allow the Central Coast Water Board, or an authorized representative, upon consent or other documents as may be required by law, to do the following:

    a. Enter upon the Discharger's premises where a regulated facility or activity is located or conducted or where records must be kept under the conditions of this Order,

[3] CEDEN is the California Environmental Data Exchange Network.

b. Have access to and copy, at reasonable times, any records that must be kept under the conditions of this Order,
c. Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this Order, and
d. Collect samples from and monitor waters of the state within or bordering property subject to this Order, at reasonable times for the purposes of assuring compliance with this Order or as otherwise authorized by the Water Code. The sampling and monitoring may include and is not limited to domestic and irrigation wells, surface receiving waters, and edge of field discharges to surface waters.

31. This Order may be reopened to address changes in statutes, regulations, plans, policies, or case law that govern water quality requirements for the discharges regulated herein.

Third-Party Programs

32. Dischargers may comply with portions of this Order by participating in third-party groups or programs (e.g., certification program, watershed group, water quality coalition, monitoring coalition, or other third-party effort) approved by the Executive Officer. In this case, the third-party will assist individual Dischargers in achieving compliance with this Order, including implementing water quality improvement projects and required monitoring and reporting as described in the MRP. Compliance with the requirements of this Order is still required for all members of the third-party program; however, the third-party may propose modified monitoring and reporting for approval by the Executive Officer. Third-party program proposals will be evaluated on a case-by-case basis relative to their ability to document compliance with this Order as part of a request for proposal process and as further informed by a forthcoming third-party expectations document.

33. This Order includes specific provisions and an alternative compliance pathway for third-party programs that will also be subject to a third-party request for proposal process and Executive Officer review and approval. Dischargers participating in a third-party administered alternative compliance pathway program, and that remain in good standing as defined in this Order and/or Executive Officer approved third-party work plan, are subject to the third-party program requirements in lieu of individual requirements as specified. The third-party alternative compliance pathway program's assessment and evaluation for groundwater protection and the regional groundwater quality trend monitoring program described in **Part 2, Section C.1** must be closely aligned and coordinated such that they are effectively measuring the objectives the programs are trying to achieve.

34. Third-party program proposals must include and identify specific membership eligibility requirements, for approval by the Executive Officer, to evaluate whether third-party program members are in good standing. Members that are not in good standing with the membership eligibility requirements lose their membership and must immediately comply with individual groundwater protection and/or surface water protection requirements. At a minimum, third-party program proposals must include membership eligibility requirements and follow-up consequences that are triggered, including revocation of membership eligibility, to address the following scenarios where members are no longer in good standing:

    a. Non-payment of fees
    b. Non-submittal of information
    c. Non-participation in education/outreach or site visits
    d. Failure to implement / adapt management practices

35. Consistent with the Water Board’s Policy for Implementation and Enforcement of the Nonpoint Source Pollution Control Program (NPS Policy), the ineffectiveness of a third-party program through which a Discharger participates in nonpoint source control efforts cannot be used as a justification for lack of individual discharger compliance. Dischargers continue to be responsible for complying with this Order individually.

36. Dischargers who elect to join a third-party program to facilitate compliance with this Order must retain their membership with the third-party in good standing. If the Discharger does not meet the requirements of membership in the third-party program, then the Discharger is responsible for complying with all requirements in this Order individually unless the approved third-party administered alternative compliance pathway or approved third-party work plan allows for specific deviations from the individual requirements.

37. Dischargers who elect to join an approved third-party program must notify the approved third-party program administrator of their election to participate in the third-party program within 60 days of: 1) approval of the third-party program, and/or 2) the Discharger’s enrollment in this Order, whichever is later.

38. The third-party program administrator must notify the Central Coast Water Board of Dischargers electing to participate within 90 days of the third-party program approval, and then provide member participation updates on a quarterly basis thereafter. At a minimum, participating Discharger information provided to the Central Coast Water Board must include operation enrollment information (e.g., AW numbers and operation names) and ranch enrollment information (e.g., GeoTracker AGL numbers and ranch names) in a format specified by the Executive Officer.

39. Third-party programs must meet the following minimum criteria:

a. Effectiveness of scale and scope – The program must be of sufficient scale and scope relative to its intended purpose to maximize Discharger participation, implementation effectiveness and Order compliance. Although regionally scaled programs are preferred, watershed- or basin-scale programs will be considered as needed to address localized water quality issues.
b. Clearly stated goals and objectives – The program must have meaningful and clearly stated goals, objectives, and associated performance metrics relevant to the Order requirements that are the focus of the program.
c. Management and administration – The program must have a well-defined and robust governance and administrative structure with clearly defined roles and responsibilities.
d. Capacity and expertise – The program must demonstrate sufficient technical, managerial, and financial capacity to successfully achieve its goals and objectives.
e. Physical presence – The program should have a physical presence in the central coast region, including staff and a headquarters, that can assist its members on a continual and as-needed basis. If the third-party program administrator does not have or plan to have a physical presence in the region, they must demonstrate they can effectively establish, maintain, and engage with core membership without a headquarters in the central coast region.
f. Transparency and accountability – The program must provide regular assessments of its performance relative to its stated goals and objective based on meaningful performance metrics. This includes reporting of water quality data and farm-level data as needed to document compliance with this Order.
g. Membership and fee accounting – The program must track and provide ongoing accounting of its Discharger membership and fees to document Discharger compliance.
h. Data management – The program must upload data as required by this Order to the Water Boards' various data management systems (e.g., CEDEN, GeoTracker, etc.).
i. Member requirements – The program must have clearly stated and enforced Discharger membership eligibility requirements and report out on them as needed to document compliance.
j. Coordination – The program must consider and coordinate with other third-party programs/groups or local entities as may be appropriate to create consistency; leverage the efforts, infrastructure and expertise of others; and streamline the program to maximize effectiveness (e.g., coordination with Groundwater Sustainability Agencies [GSAs], flood control management agencies, watershed restoration and management entities, etc.).
k. Continuing education – The program must include continuing education opportunities as appropriate either directly through the program or through

coordination with other third-party programs/groups or local entities to ensure its members obtain technical skills and assistance necessary to achieve compliance with the limits established in this Order. In the instance of third-party monitoring programs, membership outreach and education should be implemented to inform members about the monitoring results relative to meeting specific water quality objectives, numeric targets, numeric interim quantifiable milestones, or numeric limits.

l. Specific project plan documents – The program must have a detailed work plan including a Quality Assurance Project Plan (QAPP) and Sampling and Analysis Plan (SAP) as may be appropriate based on the program goals and objectives and associated Order requirements.

40. The Central Coast Water Board's review of third-party program proposals will consider the criteria outlined above relative to overall program effectiveness, with an emphasis on approving programs that can effectively assist their members in complying with the requirements of this Order.

Part 2, Section B. Planning, Education, Management Practices, and CEQA

Farm Water Quality Management Plan (Farm Plan)

1. Dischargers must develop, implement, and update as necessary a Farm Water Quality Management Plan (Farm Plan) for each ranch. A current copy of the Farm Plan must be maintained by the Discharger and must be submitted to the Central Coast Water Board upon request. At a minimum, the Farm Plan must include the discrete sections listed below. Additional details regarding each section are included in subsequent sections of this Order. Certain elements included in the Farm Plan must be reported on; however, in general, the Farm Plan is a planning and recordkeeping tool used by Dischargers to manage various aspects of their agricultural operation.

    a. Irrigation and Nutrient Management Plan (INMP)
    b. Pesticide Management Plan (PMP)
    c. Sediment and Erosion Management Plan (SEMP)
    d. Water Quality Education
    e. CEQA Mitigation Measure Implementation

2. The INMP, PMP, and SEMP sections of the Farm Plan must include information on management practice implementation and assessment. Elements of the INMP are reported on in the Total Nitrogen Applied report or INMP Summary report. Elements of all the sections listed above are reported on in the Annual Compliance Form (ACF). Additional information on the monitoring and reporting requirements related to each of these sections is included in the MRP.

3. Where required by the Executive Officer based on groundwater quality or surface water quality conditions or exceedances of the numeric targets, numeric interim quantifiable milestones, or numeric limits established in this Order, the Farm Plan must incorporate ranch-level groundwater or surface water discharge monitoring information described in the MRP. The ranch-level groundwater and surface water discharge monitoring must be designed and implemented to inform improved management practices to protect groundwater and surface water quality.

4. Dischargers must maintain all records related to compliance with this Order for a minimum of ten years. Records include, but are not limited to, monitoring information, calculations, management practice implementation and assessment, education records, and all required reporting and information used to submit complete and accurate reports. Third parties that have been approved by the Executive Officer to assist Dischargers with complying with this Order, for example in the form of water quality monitoring, must also maintain all records for a minimum of ten years. Records must be submitted to the Central Coast Water Board upon request or as required by this Order or an approved work plan.

Continuing Education

5. Dischargers must attend outreach and education events annually to obtain technical skills and assistance necessary to achieve compliance with the numeric targets, numeric interim quantifiable milestones, and numeric limits established by this Order. Outreach and education events should focus on meeting water quality objectives and protecting beneficial uses by identifying water quality problems, implementing pollution prevention strategies, and implementing management practices and assessment designed to protect water quality and beneficial uses and resolve water quality problems to achieve compliance with this Order. Records of participation in continuing education must be maintained in the Farm Plan and submitted to the Central Coast Water Board upon request.

6. Dischargers who exceed the fertilizer nitrogen application targets or limits, nitrogen discharge targets or limits, numeric interim quantifiable milestones, or surface receiving water limits must complete additional relevant water quality education sufficient to fully inform the implementation of additional or improved management practices and assessment to avoid future exceedances.

7. A copy of this Order and MRP must be kept at the ranch for reference by operating personnel. Key operating and site management personnel must be familiar with the content of both documents.

Management Practice Implementation and Assessment

8. Dischargers must implement management practices and assessment, as necessary, to improve and protect water quality, protect beneficial uses, achieve compliance with applicable water quality objectives, achieve the numeric targets, numeric interim quantifiable milestones, and numeric limits established in this Order. Management practices implementation and assessment must be documented in the appropriate section of the Farm Plan (e.g., irrigation and nutrient management practices and assessment must be documented in the INMP section of the Farm Plan). Dischargers must report on management practice implementation and assessment in the ACF, as described in the MRP.

CEQA Mitigation Measure Implementation, Monitoring, and Reporting

9. Impacts and mitigation measures identified in CEQA Mitigation Monitoring and Reporting Program are set forth in the Final Environmental Impact Report (FEIR) at Appendix D, which is incorporated by reference. Mitigation measures identified in the FEIR for this Order and required to be implemented as described in Appendix D, will substantially reduce environmental effects of the project. The mitigation measures included in this Order have eliminated or substantially lessened all significant effects on the environment, where feasible. Where noted, some of the mitigation measures are within the responsibility and jurisdiction of other public agencies. Such mitigation measures can and should be adopted, as applicable, by those other agencies.

10. Dischargers must report on mitigation measure implementation electronically in the Annual Compliance Form (ACF), as described in the MRP. Draft mitigation monitoring and reporting is available for review in the FEIR.

Part 2, Section C.1. Groundwater Protection

1. Dischargers may not be subject to all provisions of **Part 2, Section C.1** if they are members in good standing with the third-party alternative compliance pathway program included within **Part 2, Section C.2**.

Phasing

2. Ranches are assigned the Groundwater Phase Area of the groundwater basin where the ranch is located based on the relative level of water quality and beneficial use impairment and risk to water quality. All ranches are assigned a Groundwater Phase Area of 1, 2, or 3. Groundwater Phase 1 areas represent greater water quality impairment and higher risk to water quality relative to Groundwater Phase 2 and 3 areas.

3. The requirements and implementation schedules for groundwater protection are based on the groundwater phase areas, listed in **Table C.1-1** and shown on the maps in **Figure C.1-1**.

4. In the event that a ranch spans multiple Groundwater Phase areas, the ranch will be assigned the earlier phase. For example, a ranch that spans both Groundwater Phase 1 and Groundwater Phase 2 areas will be assigned to Groundwater Phase 1.

5. The Groundwater Phase Area assigned to each ranch will be displayed on the ranch eNOI in GeoTracker.

Irrigation and Nutrient Management Plan

6. Dischargers must develop and implement an Irrigation and Nutrient Management Plan (INMP) that addresses both groundwater and surface water. This section applies to the groundwater related INMP requirements and the surface water related INMP requirements are contained within **Part 2, Section C.3** of this Order. The INMP is a section of the Farm Plan and must be maintained in the Farm Plan and submitted to the Central Coast Water Board upon request. Summary information from the INMP must be submitted in the INMP Summary report. At a minimum, the elements of the INMP related to groundwater protection must include:

    a. Monitoring and recordkeeping necessary to submit complete and accurate reports, including the ACF, Total Nitrogen Applied (TNA) report, and INMP Summary report.
    b. Planning and management practice implementation and assessment that results in compliance with the fertilizer nitrogen application limits in **Table C.1-2** and the nitrogen discharge targets and limits in **Table C.1-3**.
    c. Descriptions of all irrigation, nutrient, and salinity management practices implemented and assessed on the ranch.
    d. When INMP certification is required, e.g., as a follow-up action or as a consequence for not meeting the quantifiable milestones and time schedules below, the INMP certification shall include the following:

       The person signing this Irrigation and Nitrogen Management Plan (INMP) certifies, under penalty of law, that the INMP was prepared under his/her direction and supervision, that the information and data reported is to the best of his/her knowledge and belief, true, accurate, and complete, and that he/she is aware that there are penalties for knowingly submitting false information. The qualified professional signing the INMP may rely on the information and data provided by the Discharger and is not required to independently verify the information and data.

The qualified professional signing the INMP below further certifies that he/she used sound irrigation and nitrogen management planning practices to develop irrigation and nitrogen application recommendations and that the recommendations are informed by applicable training to minimize nitrogen loss to surface water and groundwater. The qualified professional signing the INMP is not responsible for any damages, loss, or liability arising from subsequent implementation of the INMP by the Discharger in a manner that is inconsistent with the INMP's recommendations for nitrogen application. This certification does not create any liability or claims for environmental violations.

Qualified professional certification:
"I, ____________________, certify this INMP in accordance with the statement above."

___________________________ (Signature)

The discharger additionally agrees as follows:

"I, ____________________, Discharger, have provided information and data to the certifier above that is, to the best of my knowledge and belief, true, accurate, and complete, that I understand that the certifier may rely on the information and data provided by me and is not required to independently verify the information and data, and that I further understand that the certifier is not responsible for any damages, loss, or liability arising from subsequent implementation of the INMP by me in a manner that is inconsistent with the INMP's recommendations for nitrogen application. I further understand that the certification does not create any liability for claims for environmental violations."

Quantifiable Milestones and Time Schedules

7. As shown in **Table C.1-2**, the fertilizer nitrogen application limits go into effect during the second year of the this Order (December 31, 2023).

8. As shown in **Table C.1-3**, the nitrogen discharge targets go in to effect during the second year of this Order (December 31, 2023) and nitrogen discharge limits go in to effect during the fifth year of this Order (December 31, 2027).

Fertilizer Nitrogen Application Limits

9. Dischargers must not apply fertilizer nitrogen ($\mathbf{A_{FER}}$) at rates greater than the limits in **Table C.1-2.** Compliance with fertilizer nitrogen application limits is assessed for each specific crop reported in the TNA report or INMP Summary report.

Nitrogen Discharge Targets and Limits

10. This Order requires Dischargers to submit information on nitrogen applied (**A**) and nitrogen removed (**R**). This Order also establishes nitrogen discharge targets and limits based on the calculation of nitrogen applied minus nitrogen removed (**A-R**) using the formulas below. Nitrogen must not be discharged at rates greater than the targets and limits in **Table C.1-3**. Compliance with nitrogen discharge targets and limits is assessed annually for the entire ranch in the INMP Summary report through one of the **three compliance pathways** shown below. Compliance with all pathways is not required.

    Compliance Pathway 1:

    $$A_{FER} + (C \times A_{COMP}) + (O \times A_{ORG}) + A_{IRR} - R = \text{Nitrogen Discharge}$$

    OR

    Compliance Pathway 2:

    $$A_{FER} + (C \times A_{COMP}) + (O \times A_{ORG}) = R$$

    OR

    Compliance Pathway 3:

    $$A_{FER} + (C \times A_{COMP}) + (O \times A_{ORG}) - R = \text{Nitrogen Discharge}$$

    In all formulas, $R = R_{HARV} + R_{SEQ} + R_{SCAVENGE} + R_{TREAT} + R_{OTHER}$

    a. $\mathbf{A_{FER}}$ is the amount of fertilizer nitrogen applied in pounds per acre.
    b. **C** is the compost discount factor used to represent the amount of compost nitrogen mineralized during the year that the compost was applied.
    c. $\mathbf{A_{COMP}}$ is the total amount of compost nitrogen applied in pounds per acre.
    d. **O** is the organic fertilizer discount factor used to represent the amount of nitrogen mineralized during the first 12 weeks in the year it was applied.
    e. $\mathbf{A_{ORG}}$ is the total amount of organic fertilizer or amendment nitrogen applied in pounds per acre.

f. $\mathbf{A_{IRR}}$ is the amount of nitrogen applied in the irrigation water estimated from the volume required for crop evapotranspiration (ET) in pounds per acre.
g. **R** is the amount of nitrogen removed from the field through harvest, sequestration, or other removal methods, in pounds per acre.
h. $\mathbf{R_{HARV}}$ is the amount of nitrogen removed from the field through harvest or other removal of crop material.
i. $\mathbf{R_{SEQ}}$ is the amount of nitrogen removed from the field through sequestration in woody materials of permanent or semi-permanent crops.
j. $\mathbf{R_{SCAVENGE}}$ is the amount of nitrogen removed from the field through nitrogen scavenging cover crops and/or nitrogen scavenging high carbon amendments during the wet/rainy season.
k. $\mathbf{R_{TREAT}}$ is the amount of nitrogen removed from the ranch through a quantifiable treatment method (e.g., bioreactor).
l. $\mathbf{R_{OTHER}}$ is the amount of nitrogen removed from the ranch through other methods not previously quantified.

11. The Central Coast Water Board encourages the use of irrigation water nitrogen as a method of reducing the amount of fertilizer nitrogen applied to crops. The use of irrigation water nitrogen is typically referred to as “pump and fertilize” and is incentivized through compliance pathway 2 and 3 in **Table C.1-3**. The amount of irrigation water nitrogen is not used in the compliance calculation in these compliance pathways. The amount of irrigation water nitrogen must be reported regardless of the compliance pathway.

12. The Central Coast Water Board encourages the use of compost to improve soil health, nutrient and carbon sequestration, and water holding capacity consistent with the state’s Healthy Soils Initiative. All compost nitrogen ($\mathbf{A_{COMP}}$) applied to the ranch must be reported in the TNA report or INMP Summary report; however, the use of compost is incentivized through the option for Dischargers to use a compost “discount” factor (**C**). Dischargers may use the compost discount factor provided by the Central Coast Water Board in the MRP or may determine their own discount factor. The discounted compost nitrogen must, at a minimum, represent the amount of compost mineralized during the year the compost was applied to the ranch. If the Discharger uses their own compost discount factor, they must maintain records of the method used to determine the compost discount factor in the Farm Plan, and these records must be submitted to the Central Coast Water Board upon request.

13. The Central Coast Water Board encourages the use of organic fertilizers and amendments to improve soil health, nutrient and carbon sequestration, and water holding capacity consistent with the state’s Healthy Soils Initiative. All organic fertilizer and amendment nitrogen ($\mathbf{A_{ORG}}$) applied to the ranch must be reported in the TNA report or INMP Summary report; however, the use of organic fertilizers and amendments is incentivized through the option for Dischargers to

use an organic fertilizer “discount” factor (**O**). Dischargers may use the organic fertilizer discount factor associated with the products C:N ratio, provided by the Central Coast Water Board in the MRP. The discounted organic fertilizer nitrogen must, at a minimum, represent the amount of organic fertilizer mineralized during the first 12 weeks the organic fertilizer was applied to the ranch. The Discharger must maintain records of the organic products used and their associated C:N ratios in the Farm Plan, and these records must be submitted to the Central Coast Water Board upon request. The following products are not eligible to receive an organic fertilizer discount: a) products with no organic compounds (long chain carbon) molecules, such as conventional fertilizer, slow release fertilizers, b) products that do not depend on microbial mineralization to release nitrogen to mineral form to make it available for crop uptake, c) products without C:N ratio information available, and d) organic liquid fertilizers that are in the liquid and/or emulsified form.

14. The amount of **crop material** removed through harvest or other methods ($\mathbf{R_{HARV}}$) must be calculated using the formula described below. Dischargers must either use the crop-specific conversion coefficient values found in the MRP or develop their own conversion coefficient values following the approved method in the MRP. If Dischargers develop their own conversion coefficient, they must maintain information on the method used in the Farm Plan, and these records must be submitted to the Central Coast Water Board upon request.

    $\mathbf{R_{HARV}}$ **= Conversion Coefficient x Material Removed**

    a. The **Conversion Coefficient** is a crop-specific coefficient used to convert from units of material removed per acre to units of nitrogen removed per acre.
    b. **Material Removed** is the amount of nitrogen-containing material removed from the field, in units of pounds per acre.

15. The amount of nitrogen removed through **sequestration** in woody material of permanent or semi-permanent crops ($\mathbf{R_{SEQ}}$) must be estimated by the Discharger. Dischargers must maintain records detailing how they estimated the amount of nitrogen sequestered in their permanent crops. These records must be maintained in the Farm Plan and submitted to the Central Coast Water Board upon request.

16. The Central Coast Water Board encourages Dischargers to implement best management practices that reduce nitrogen leaching in the wet/rainy season. Dischargers may claim a nitrogen scavenging credit ($\mathbf{R_{SCAVENGE}}$) provided by the Central Coast Water Board in the MRP, one time per year for each ranch acre where nitrogen scavenging cover crops or nitrogen scavenging high carbon amendments are utilized during the wet/rainy season. The total acres receiving

the nitrogen scavenging credit may not exceed the ranch acres. Dischargers electing to claim the nitrogen scavenging credit must ensure that their cover crop and/or high carbon amendment best management practice meets the definitions of a nitrogen scavenging cover crop and/or nitrogen scavenging high carbon amendment, as noted in the MRP and Definitions. Substantiating records for this credit must be maintained in the Farm Plan and submitted to the Central Coast Water Board upon request.

17. The Central Coast Water Board encourages Dischargers to develop and implement innovative methods for removing nitrogen from the environment to improve water quality. Dischargers may use treatment methods (e.g., bioreactors) to remove nitrogen from groundwater or surface water and may count this towards their nitrogen removal (**R**) value if they are able to quantify the amount of nitrogen removed from ranch discharge to groundwater or surface water. This quantified removal through treatment or other innovative methods must be reported as $\mathbf{R_{TREAT}}$. Dischargers electing to account for this nitrogen removal must monitor the volume and concentration of water entering and exiting their treatment system and calculate the amount of nitrogen removed. These records must be maintained in the Farm Plan and submitted to the Central Coast Water Board upon request.

18. If Dischargers remove additional nitrogen through means other than removing crop material ($\mathbf{R_{HARV}}$), sequestration ($\mathbf{R_{SEQ}}$), scavenging credit ($\mathbf{R_{SCAVENGE}}$), or treatment methods ($\mathbf{R_{TREAT}}$), they must quantify and report this additional removal as $\mathbf{R_{OTHER}}$. Dischargers must maintain records detailing how they calculated $\mathbf{R_{OTHER}}$. These records must be maintained in the Farm Plan and submitted to the Central Coast Water Board upon request.

19. The discharge of nitrogen in excess of the nitrogen discharge **targets** in **Table C.1-3** may result in additional requirements, including obtaining additional education, INMP certification by a qualified professional, implementing additional or improved management practices, and increased monitoring and/or reporting.

20. The discharge of nitrogen in excess of the nitrogen discharge **limits** in **Table C.1-3** may result in additional requirements, including obtaining additional education, INMP certification by a qualified professional, implementing additional or improved management practices, increased monitoring and reporting, and/or progressive enforcement actions.

21. Dischargers who apply more fertilizer nitrogen ($\mathbf{A_{FER}}$) than the fertilizer nitrogen application limits in **Table C.1-2** to any specific crop **and** who are able to demonstrate compliance with the **final** nitrogen discharge limits, as shown in **Table C.1-3**, are exempt from the fertilizer nitrogen application limit.

22. Dischargers who can quantifiably demonstrate that their ranches pose no threat to surface water quality or groundwater quality may submit a technical report to the Executive Officer for review. If approved, the Discharger is not required to conduct the nitrogen application (**A**) or removal (**R**) monitoring and reporting or to submit the INMP Summary report, regardless of what Groundwater Phase area the ranch is in. The technical report must demonstrate that nitrogen applied at the ranch does not percolate below the root zone in an amount that could degrade groundwater and does not migrate to surface water through discharges, including drainage, runoff, or sediment erosion. Dischargers must provide the Executive Officer with annual updates to confirm that the exemption is still applicable. Failure to provide sufficient annual updates confirming that the exemption is still applicable will result in an immediate reinstatement of the requirement to submit the INMP Summary report for applicable Dischargers. Dischargers electing to use this approach are still eligible to participate in the third-party alternative compliance pathway for groundwater protection.

23. Dischargers who can quantifiably demonstrate that their ranch is achieving the **final** nitrogen discharge limits , as shown in **Table C.1-3,** are not required to submit the nitrogen removal (**R**) reporting in the INMP Summary report, regardless of what Groundwater Phase area the ranch is in. Example situations where this may apply include participation in an approved third-party program that certifies that the Discharger is meeting the final discharge limit and will continue to do so for the duration of the Discharger's participation in the approved third-party program, or by submitting a technical report, subject to Executive Officer review, that quantifies the amount of nitrogen discharge based on the volume and nitrogen concentration of all discharges from the ranch. In these situations, confirmation of membership in the approved third-party program or Executive Officer approval of a submitted technical report constitute compliance with the nitrogen removed (**R**) reporting requirement in the INMP Summary report. This exemption only applies to removal (**R**) in the INMP Summary report; all other requirements, including the TNA report, still apply as described in this Order. Dischargers must provide the Executive Officer with annual updates to confirm that the exemption is still applicable. Failure to provide sufficient annual updates confirming that the exemption is still applicable will result in an immediate reinstatement of the requirement to submit the nitrogen removal (R) reporting information in the INMP Summary report for applicable Dischargers. Dischargers electing to use this approach are still eligible to participate in the third-party alternative compliance pathway for groundwater protection.

24. Dischargers, groups of dischargers or commodity groups who can quantify the amount of nitrogen discharged from their ranch or for specific crops or via specific management practices by directly monitoring it at the points of discharge can propose an alternative monitoring methodology to comply with the nitrogen

discharge targets and limits, in lieu of using the A-R compliance formulas. Example situations where this may apply includes greenhouse, nursery, container production or intensive crop production where irrigation and drain water is captured and allows for direct monitoring of discharges. For these types of situations, it may be easier to monitor nitrogen discharge than to calculate the amount of nitrogen removed at harvest for each one of the many different crops and plants being grown. Dischargers must submit a request to the Executive Officer with a technical report of the methodology proposed to quantify nitrogen discharges. The methodology must include enough information to quantify the amount of nitrogen discharged and confirm compliance with the nitrogen discharge targets and limits, as shown in **Table C.1-3 or Table C.2-2** (for Dischargers participating in the Third-Party Alternative Compliance Pathway Program for Groundwater Protection described in **Part 2, Section C.2)**. Acceptable methodologies must include direct measurements of the volume and nitrogen concentration of the water discharged from each ranch per acre and year. Executive Officer approval of the method(s) must be granted before the discharger begins reporting nitrogen discharge based on the proposed methodology. Dischargers who obtain Executive Officer approval to directly monitor their nitrogen discharge from their ranches will not be required to submit nitrogen removal (R) reporting in the INMP Summary report. Dischargers electing to use this approach are still eligible to participate in the third-party alternative compliance pathway program for groundwater protection.

25. The initial 2027 nitrogen discharge limits, as shown in **Table C.1-3** will be re-evaluated based on Discharger reported nitrogen applied and removed data, new science, and management practice implementation and assessment before becoming effective.

Monitoring and Reporting

26. Dischargers must report on management practice implementation and assessment electronically in the **ACF**, as described in the MRP.

27. Dischargers must record and report total nitrogen applied to all crops grown on the ranch, electronically in the TNA report form, as described in the MRP.

28. Dischargers must track and record the following elements of the INMP Summary report that are not included in the TNA report: total nitrogen removed from the ranch and information on irrigation water application and discharge volumes. Dischargers must submit this information electronically in the INMP Summary report form as described in the MRP.

29. The INMP Summary report contains the same nitrogen application information as the TNA report, plus additional information related to nitrogen removed and irrigation management. **Therefore, the INMP Summary report satisfies the**

TNA report requirement and an additional TNA report is not required to be submitted when the INMP Summary report is submitted to the Central Coast Water Board.

30. Dischargers must conduct **irrigation well monitoring and reporting prior to the start of groundwater quality trend monitoring and reporting**, either individually or as part of a third-party effort, as described in the MRP.

31. Dischargers must conduct **on-farm domestic well monitoring and reporting**, either individually or as part of a third-party effort, as described in the MRP.

32. Dischargers must conduct **groundwater quality trend monitoring and reporting**, either individually or as part of a third-party effort, as described in the MRP. This requirement applies to all Dischargers enrolled in this Order, regardless of how many wells are currently present on their ranch.

    a. Dischargers who elect to perform groundwater quality trend monitoring and reporting as part of a **third-party** effort must form or join a third-party. The third-party must submit a work plan for Executive Officer review by the dates and covering the areas specified in the MRP unless it is associated with the Third-Party Alternative Compliance Pathway for Groundwater Protection described in **Part 2, Section C.2**. The work plan must be approved by the Executive Officer prior to implementation. Once approved by the Executive Officer, the work plan must be implemented.
    b. Dischargers who elect to perform groundwater quality trend monitoring and reporting individually must submit a work plan for Executive Officer review, by the date specified in the MRP, based on their ranch location. The work plan must be approved by the Executive Office prior to implementation. The work plan must describe how the ranch-level groundwater quality trend monitoring program will evaluate groundwater quality trends over time and assess the impacts of agricultural discharges on groundwater quality. Once approved by the Executive Officer, the work plan must be implemented. Dischargers without a well on their property may comply with individual ranch-level groundwater quality trend monitoring and reporting requirements by implementing one of the options specified in the MRP.

33. When required by the Executive Officer based on groundwater quality data or significant and repeated exceedance of the nitrogen discharge targets or limits, Dischargers must complete **ranch-level groundwater discharge monitoring and reporting**, either individually or as part of a third-party effort as described in the MRP. Water Board staff will coordinate with Dischargers prior to the Executive Officer invoking this requirement to determine if non-compliance is the result of unforeseen or uncontrollable circumstances and to provide the Discharger with 90-day advanced notice of the forthcoming requirement. When ranch-level groundwater discharge monitoring and reporting is required, a work

plan, including a SAP and QAPP, must be submitted for Executive Officer review prior to implementation. Once approved by the Executive Officer, the work plan must be implemented. Ranch-level groundwater discharge monitoring may be discontinued with the approval of the Executive Officer when the Discharger comes into compliance with the nitrogen discharge targets or limits, or the discharge has otherwise ceased.

Part 2, Section C.2. Third-Party Alternative Compliance Pathway for Groundwater Protection

1. Dischargers that are members in good standing in the third-party alternative compliance pathway program are subject to the provisions of this **Part 2, Section C.2**, unless otherwise stated. For purposes of this section, such Dischargers are referred to as “participating Dischargers.”

   Participating dischargers:

   a. Are not subject to fertilizer nitrogen application limits in **Table C.1-2**, which are enforceable by the Central Coast Water Board.
   b. Are not subject to nitrogen discharge limits in **Table C.1-3**, which are enforceable by the Central Coast Water Board.
   c. Are subject to targets, which if exceeded result in consequences outlined in this **Part 2, Section C.2**.
   d. Are not subject to ranch-level groundwater discharge monitoring and reporting.
   e. Are generally provided more time to achieve fertilizer nitrogen application targets and nitrogen discharge targets, relative to non-participating dischargers.

2. Prior to the initiation of the work plan process outlined below and in the MRP for this third-party alternative compliance pathway program, entities wishing to implement the third-party alternative compliance pathway program described in this **Part 2, Section C.2** must submit a third-party alternative compliance pathway program proposal consistent with the third-party program requirements outlined in **Part 2, Section A** of this Order, as well as the request for proposal process and associated third-party program expectations document forthcoming after Order adoption. For purposes of this section, the entity approved to implement the third-party alternative compliance pathway is referred to as the approved third-party alternative compliance pathway program administrator.

3. Participating Dischargers must develop and implement an Irrigation and Nutrient Management Plan (INMP) that addresses groundwater. The INMP is a section of the Farm Plan and must be maintained in the Farm Plan and submitted to the Central Coast Water Board upon request. Summary information from the INMP must be submitted in the INMP Summary report. At a minimum, the elements of

the INMP related to groundwater and surface water protection for participating Dischargers in a third-party program must include:

a. Monitoring and recordkeeping necessary to submit complete and accurate reports, including the Annual Compliance form (ACF), Total Nitrogen Applied (TNA) report, and INMP Summary report.
b. Planning and management practice implementation and assessment that results in compliance with the fertilizer nitrogen application targets in **Table C.2-1,** the nitrogen discharge targets in **Table C.2-2**, and groundwater protection area targets to be determined and approved by the Executive Officer.
c. Descriptions of all irrigation, nutrient, and salinity management practices implemented and assessed on the ranch.

Quantifiable Milestones and Time Schedules

4. As shown in **Table C.2-1**, the fertilizer nitrogen application targets go in to effect during the third year of the this Order (December 31, 2024) for participating Dischargers in the third-party alternative compliance pathway.

5. As shown in **Table C.2-2**, the nitrogen discharge targets go in to effect during the third year of this Order (December 31, 2024) for participating Dischargers in the third-party alternative compliance pathway.

Fertilizer Nitrogen Application Targets

6. Participating Dischargers must not apply fertilizer nitrogen ($\mathbf{A_{FER}}$) at rates greater than the **targets** in **Table C.2-1.** Compliance with fertilizer nitrogen application targets is assessed annually for each specific crop reported in the TNA report or INMP Summary report.

7. Participating Dischargers that apply fertilizer nitrogen ($\mathbf{A_{FER}}$) at rates greater than the **targets** in **Table C.2-1** one year after the compliance date are subject to follow-up by the approved third-party program administrator, which could include additional education and/or implementation of additional or improved management practices.

8. Participating Dischargers that apply fertilizer nitrogen ($\mathbf{A_{FER}}$) at rates greater than the **targets** in **Table C.2-1** for a two-year running average after the compliance date, are no longer eligible to participate in the third-party alternative compliance pathway program and must comply with the individual groundwater protection requirements in **Part 2, Section C.1**. Water Board staff will coordinate with participating Dischargers prior to the Executive Officer invoking this requirement to determine if non-compliance is the result of unforeseen or uncontrollable

circumstances and to provide the Discharger with 90-day advanced notice of the forthcoming individual groundwater protection requirements.

Nitrogen Discharge Targets

9. Participating Dischargers must not discharge nitrogen at rates greater than the **targets** in **Table C.2-2**. Compliance with nitrogen discharge targets is assessed annually for the entire ranch using INMP Summary report information. Participating Dischargers must comply with at least one of the nitrogen discharge compliance pathways described in **Part 2, Section C.1** by the compliance date.

10. The final year 2028 nitrogen discharge **targets**, as shown in **Table C.2-2** will be re-evaluated based on discharger reported nitrogen applied and removed data, new science, management practice effectiveness assessment and evaluation, and groundwater protection area collective numeric interim and final targets before becoming effective.

11. Participating Dischargers that discharge nitrogen in excess of the nitrogen discharge **targets** in **Table C.2-2** one year after the compliance date are subject to follow-up by the approved third-party alternative compliance pathway program administrator, which could include additional education and/or implementation of additional or improved management practices.

12. Participating Dischargers that discharge nitrogen in excess of the nitrogen discharge **targets** in **Table C.2-2** for a two-year running average, must obtain annual INMP certification by a qualified professional until nitrogen discharge targets are achieved for a two-year running average. The INMP certification must include the certification language outlined in **Part 2, Section C.1**.

13. Participating Dischargers that discharge nitrogen in excess of the final nitrogen discharge target in **Table C.2-2** for a three-year running average after the compliance date, are no longer eligible to participate in the third-party alternative compliance pathway program and must comply with individual groundwater protection requirements in **Part 2, Section C.1**. Water Board staff will coordinate with participating Dischargers prior to the Executive Officer invoking this requirement to determine if non-compliance is the result of unforeseen or uncontrollable circumstances and to provide the Discharger with 90-day advanced notice of the forthcoming individual groundwater protection requirements.

Groundwater Protection Areas, Formulas, Values, and Targets

14. The approved third-party alternative compliance pathway program administrator, on behalf of its participating Dischargers, must develop and submit incremental 35%, 70%, and 100% work plans for Executive Officer approval, as described in

the MRP. The 35% and 70% work plans will be subject to Executive Officer approval following a 30-day written public period and a public meeting to receive public comments and board input.

15. The incremental draft and final work plans must include the following:

    a. Clearly defined objectives and scientific justification for all proposed groundwater protection (GWP) areas, formulas, values, and collective numeric interim and final targets.

    b. Scientific justification in support of the proposed GWP areas with respect to, but not limited to, geology, hydrogeology, groundwater basin and subbasin areas, recharge areas, land uses, cropping patterns, and potential membership coverage by acreage and number of members. The proposed GWP areas, formula, values, and collective interim and final targets must be tied together and scaled in a way that will allow for the effective evaluation of water quality and beneficial use protection and compliance with GWP interim and final targets on both a collective and individual basis.

    c. A program to assess and evaluate the performance and effectiveness of the third-party alternative compliance pathway program's collective numeric interim and final targets in achieving tangible groundwater quality improvements over time at the individual GWP area scale. The assessment and evaluation program must be scaled – spatially and temporally – in coordination with the regional groundwater quality trend monitoring program described in **Part 2, Section C.1** of the third-party program over time.

    d. Criteria and associated follow-up actions or consequences that the third-party alternative compliance pathway program administrator will implement if participating Dischargers do not meet collective numeric interim and final targets, and third-party program membership eligibility requirements including membership probation and revocation to address recalcitrant participating Dischargers.

16. The final work plans must be approved by the Executive Officer prior to implementation. Once approved by the Executive Officer, the work plans must be implemented.

17. Compliance with the collective numeric interim and final targets for a GWP area shall be determined by aggregating data from participating Dischargers within a GWP area to determine if the combined nitrogen discharge is achieving collective compliance with the GWP Area numeric interim and final targets.

18. Although compliance with GWP collective numeric interim and final targets is assessed using the combined nitrogen discharge of participating Dischargers in a GWP area, GWP collective numeric interim and final targets must be designed such that there is a clear and quantifiable means of assessing individual ranch level contribution to the success or failure of complying with the GWP area collective numeric interim and final targets.

19. Participating Dischargers in a GWP area that exceed the GWP collective numeric interim and final targets by 20% or more, as evaluated individually and on an annual basis, are subject to follow-up by the approved third-party alternative compliance pathway program administrator, which could include additional education or implementation of additional or improved management practices.

20. All participating Dischargers in a GWP area that exceeds the collective numeric interim and final GWP targets by 20% or more for a 3-year running average after the compliance date, are no longer eligible to participate in the third-party alternative compliance pathway program and must comply with the individual groundwater protection requirements in **Part 2, Section C.1**.

Monitoring and Reporting

21. Participating Dischargers must submit ACF, TNA, and INMP Summary information according to requirements outlined in **Part 2, Section C.1**, and as described in the MRP.

22. Participating Dischargers must submit ACF, TNA, and INMP Summary information accordingto the groundwater phase assigned to each ranch. Groundwater phases are outlined in **Part 2, Section C.1**.

23. Participating Dischargers must submit groundwater monitoring and reporting information according to requirements outlined in **Part 2, Section C.1** and as described in the MRP, either individually or as part of a third-party program.

Part 2, Section C.3. Surface Water Protection

Priority Areas (Individual)

1. Ranches are assigned the Surface Water Priority area of the HUC-8 watershed where the ranch is located based on the relative level of water quality, beneficial use impairment and risk to water quality. All ranches are assigned a Surface Water Priority of 1, 2, 3, or 4. Surface Water Priority Area 1 areas represent greater water quality impairment and higher risk to water quality relative to Surface Water Priority Areas 2, 3, and 4.

2. The follow-up surface receiving water implementation requirements for surface water protection are based on the surface water priority areas, listed in **Table C.3-1** and shown on the map in **Figure C.3-1**.

3. In the event that a ranch spans multiple Surface Water Priority areas, the ranch will either be assigned the earlier priority or will be assigned the priority of the watershed or drainage unit that the ranch drains or discharges to, if specific discharge information is provided to the Central Coast Water Board.

4. The Surface Water Priority assigned to each ranch will be displayed in the ranch eNOI in GeoTracker.

Priority Areas (Third-Party Program)

5. Ranches that are enrolled as part of an approved third-party follow-up surface receiving water implementation program are assigned the third-party program Surface Water Priority of high priority, medium priority, or low priority where the ranch is located, as shown in **Table C.3-1.3P** and the map shown in **Figure C-3.1. 3P**.

6. In the event that a ranch spans multiple third-party program Surface Water Priority areas, the ranch will either be assigned the earlier priority or will be assigned the priority of the watershed or drainage unit that the ranch drains or discharges to, if specific discharge information is provided to the Central Coast Water Board.

7. The third-party program Surface Water Priority assigned to each ranch will be displayed in the ranch eNOI in GeoTracker.

Irrigation and Nutrient Management

8. Dischargers must develop and implement an Irrigation and Nutrient Management Plan (INMP) that addresses both groundwater and surface water. This section applies to the surface water related INMP requirements and the groundwater related INMP requirements are contained within **Part 2, Section C.1** of this Order. The INMP is a section of the Farm Plan, must be maintained in the Farm Plan (see **Part 2, Section B** and Farm Plan paragraph 14 below), and submitted to the Central Coast Water Board upon request. Summary information from the INMP must be submitted in the ACF, as described in the MRP.

Pesticide Management

9. Dischargers must develop and implement a Pesticide Management Plan (PMP). The PMP is a section of the Farm Plan, must be maintained in the Farm Plan (see **Part 2, Section B** and Farm Plan paragraph 14 below), and submitted to

the Central Coast Water Board upon request. Summary information from the PMP must be submitted in the ACF, as described in the MRP.

Sediment and Erosion Management

10. Dischargers must develop and implement a Sediment and Erosion Management Plan (SEMP). The SEMP is a section of the Farm Plan, must be maintained in the Farm Plan (see **Part 2, Section B** and Farm Plan paragraph 14 below), and submitted to the Central Coast Water Board upon request. Summary information from the SEMP must be submitted in the ACF, as described in the MRP.

Impermeable Surfaces

11. Ranches with either 50 to 100 percent of fields covered by impermeable surfaces (defined in Attachment C of this Order), or with greater than or equal to 22,500 square feet (0.5 acre) of impermeable surfaces must manage stormwater discharge duration, rate, and volume as described below.

    a. Stormwater discharge intensity from fields with impermeable surfaces must not exceed the stormwater discharge intensity from equivalent permeable field area for any storm event up to and including the 10-year storm event. The *Santa Barbara Urban Hydrograph Method* [4] and the *Rational Method* [5] are two methods for determining the stormwater discharge intensity match, however other similar methods to determine stormwater discharge intensity may be used.

    b. Stormwater discharge volume from fields with impermeable surfaces must not exceed the stormwater discharge volume from equivalent permeable field area for any storm event up to and including the 95th percentile, 24-hour storm event. The *Curve Number Method* [6] is a method for determining the stormwater discharge volume match, however other similar methods to determined stormwater discharge volume may be used.

    c. Description and time schedules of management practices, treatment, and/or control measures implemented to meet design storm requirements and mitigate for increased stormwater runoff from impermeable surfaces must be kept in the Farm Plan. Methods for assessing the effectiveness of each management practice, treatment, and/or control measure include calculation of peak and runoff volumes, visual inspection, photo documentation, and local precipitation event data, however other storm event measurement

---

[4] The Santa Barbara Urban Hydrograph Method is based on the curve number approach and is useful for sheet flow over a plane surface, called overland flow.

[5] The Rational Method is used to determine peak discharge from runoff in a given area.

[6] The Curve Number Method was developed by the Soil Conservation Service to estimate runoff from rainfall on agricultural fields and provides runoff depth that can be used to calculate runoff volume.

types and recordkeeping that determine the effectiveness of management practices may be used.

Farm Plan

12. At a minimum, the elements of the Farm Plan related to surface water protection must include:

    a. Monitoring and recordkeeping necessary to submit complete and accurate reports, including the ACF.

    b. Planning and management practice implementation and assessment that results in compliance with the surface water limits in **Table C.3-2** (TMDL areas) and **Table C.3-3** (non-TMDL areas) for nutrients, **Table C.3-4** (TMDL areas) and **Table C-3.5** (non-TMDL areas) for pesticides and toxicity, and **Table C.3-6** (TMDL areas) for sediment and **Table C.3-7** (non-TMDL areas) for turbidity that apply to a ranch based on the ranch location.

    c. Descriptions of all management practices implemented on the ranch, as follows:

        i. All irrigation, nutrient, and salinity management practices (i.e., INMP).
        ii. All pesticide management practices (i.e., PMP), including pesticide application characteristics (e.g., timing, formulations, wind, and rainfall monitoring, etc.) and any integrated pest management (IPM) practices implemented (e.g., scouting, beneficial insects, etc.).
        iii. All sediment, erosion, irrigation, stormwater, road, agricultural drainage pump, and impermeable surface management practices (i.e., SEMP).

Quantifiable Milestones and Time Schedules

13. Dischargers in an area **with an established TMDL** (**Figure C.3-2** for Nutrient TMDL areas, **Figure C.3-3** for Pesticide and Toxicity TMDL areas, and **Figure C.3-4** for Sediment TMDL areas) for a pollutant must not cause or contribute to an exceedance of the pollutant's surface receiving water limit in **Table C.3-2** for nutrients, **Table C.3-4** for pesticides and toxicity, and **Table C.3-6** for sediment in accordance with the compliance dates specified in the applicable table.

14. Dischargers in an area **without an established TMDL** for a pollutant must not cause or contribute to an exceedance of the pollutant's surface receiving water limit in **Table C.3-3** for nutrients, **Table C-3.5** for pesticides and toxicity, and **Table C.3-7** for turbidity in accordance with the compliance dates specified in the applicable table.

15. The surface receiving water limits in **Table C.3-3** for nutrients, **Table C-3.5** for pesticides and toxicity, and **Table C.3-7** for turbidity, apply to all Dischargers unless a specific surface receiving water limit based on a TMDL in **Table C.3-2** for nutrients, **Table C.3-4** for pesticides and toxicity, and **Table C.3-6** for sediment applies to a Discharger.

16. Dischargers in areas where the water quality for a pollutant is better (i.e., of higher quality) than the applicable limit in **Table C.3-2** (TMDL areas) and **Table C.3-3** (non-TMDL areas) for nutrients, **Table C.3-4** (TMDL areas) and **Table C-3.5** (non-TMDL areas) for pesticides and toxicity, and **Table C.3-6** (TMDL areas) for sediment and **Table C.3-7** (non-TMDL areas) for turbidity must not cause or contribute to an increase of that pollutant in receiving waters, except as consistent with the antidegradation findings of this Order.

17. The discharge of pollutants from a ranch that cause or contribute to an exceedance of the applicable limits after the compliance date in **Table C.3-2** (TMDL areas) and **Table C.3-3** (non-TMDL areas) for nutrients, **Table C.3-4** (TMDL areas) and **Table C-3.5** (non-TMDL areas) for pesticides and toxicity, and **Table C.3-6** (TMDL areas) for sediment and **Table C.3-7** (non-TMDL areas) for turbidity may result in additional requirements, including obtaining additional education, implementing additional or improved management practices, follow-up monitoring and reporting, ranch-level surface discharge monitoring and reporting, and progressive enforcement actions.

Monitoring and Reporting

18. Dischargers must complete **surface receiving water monitoring and reporting** as described in the MRP, either individually or through a third-party monitoring program approved by the Executive Officer. Dischargers, either individually or through a third-party monitoring program, must submit a work plan, including a SAP and QAPP as described the MRP, for Executive Officer review prior to implementation. Once approved by the Executive Officer, the work plan must be implemented. The work plan must include applicable monitoring for the pollutants in **Table C.3-2** (TMDL areas) and **Table C.3-3** (non-TMDL areas) for nutrients, **Table C.3-4** (TMDL areas) and **Table C-3.5** (non-TMDL areas) for pesticides and toxicity, and **Table C.3-6** (TMDL areas) for sediment and **Table C.3-7** (non-TMDL areas) for turbidity and must describe the actions that will be taken to achieve the limits in the tables.

19. Dischargers must develop a **follow-up surface receiving water implementation work plan**, either individually or through a third-party program. The work plans per the MRP requirements are subject to Executive Officer approval following a 30-day period to receive written public comments. The work plan due date is based on the Surface Water Priority of the ranch.

a. Individual Dischargers that are not part of a third-party program approved to develop and implement follow-up surface receiving water implementation work plan(s) must submit an individual work plan by the dates specified below, based on the ranch's Surface Water Priority Area defined in **Table C.3-1** of the Order:
   i. March 1, 2023 for Surface Water Priority 1 areas
   ii. March 1, 2024 for Surface Water Priority 2 areas
   iii. March 1, 2025 for Surface Water Priority 3 areas
   iv. March 1, 2026 for Surface Water Priority 4 areas

b. Third-party program(s) approved to develop and implement follow-up surface receiving water implementation work plan(s) on behalf of participating Dischargers must submit work plan(s) by the dates specified below, based on the third-party program surface water priority area. Third-party program surface water priority areas are defined in **Table C.3-1.3P** of the Order:
   i. March 1, 2024 for High Priority areas
   ii. March 1, 2026 for Medium Priority areas
   iii. March 1, 2028 for Low Priority and All Other areas

c. The work plan must include numeric interim quantifiable milestones and follow-up actions, such as outreach, education, and management practice implementation and assessment, and, where applicable for pollutant source identification and abatement, additional surface receiving water monitoring locations. The work plan must include a SAP and QAPP. The work plan must describe the implementation measures that will be taken to reduce the discharge of relevant pollutants and achieve the applicable surface water numeric limits by the compliance dates in **Table C.3-2** (TMDL areas) and **Table C.3-3** (non-TMDL areas) for nutrients, **Table C.3-4** (TMDL areas) and **Table C-3.5** (non-TMDL areas) for pesticides and toxicity, and **Table C.3-6** (TMDL areas) for sediment and **Table C.3-7** (non-TMDL areas) for turbidity. The work plan must be submitted for Executive Officer review prior to implementation. Once approved, the work plan must be implemented.

d. Prior to the applicable compliance dates in **Table C.3-2** (TMDL areas) and **Table C.3-3** (non-TMDL areas) for nutrients, **Table C.3-4** (TMDL areas) and **Table C-3.5** (non-TMDL areas) for pesticides and toxicity, and **Table C.3-6** (TMDL areas) for sediment and **Table C.3-7** (non-TMDL areas) for turbidity, Dischargers who elect to participate in a third-party program to develop and implement their work plan will not be subject to ranch-level surface discharge monitoring and reporting.

e. Work plans must take into consideration the level of water quality impairment identified through surface receiving water monitoring. Work plans for areas with persistent exceedances of the surface water limits in **Table C.3-2**

(TMDL areas) and **Table C.3-3** (non-TMDL areas) for nutrients, **Table C.3-4** (TMDL areas) and **Table C-3.5** (non-TMDL areas) for pesticides and toxicity, and **Table C.3-6** (TMDL areas) for sediment and **Table C.3-7** (non-TMDL areas) for turbidity must identify follow-up actions to restore degraded areas and meet surface receiving water limits (e.g., numeric interim quantifiable milestones, outreach, education, management practice implementation and assessment) and additional surface receiving water monitoring locations for pollutant source identification and abatement. Work plans for areas that are already achieving the surface water limits in **Table C.3-2** (TMDL areas) and **Table C.3-3** (non-TMDL areas) for nutrients, **Table C.3-4** (TMDL areas) and **Table C-3.5** (non-TMDL areas) for pesticides and toxicity, and **Table C.3-6** (TMDL areas) for sediment and **Table C.3-7** (non-TMDL areas) for turbidity must identify actions to be taken to protect the high-quality areas (e.g., numeric interim quantifiable milestones, outreach and education).

f. Dischargers who elect to develop their work plan individually and whose ranches are located in areas where surface receiving water monitoring shows an exceedance of an applicable surface water limit in **Table C.3-2** (TMDL areas) and **Table C.3-3** (non-TMDL areas) for nutrients, **Table C.3-4** (TMDL areas) and **Table C-3.5** (non-TMDL areas) for pesticides and toxicity, and **Table C.3-6** (TMDL areas) for sediment and **Table C.3-7** (non-TMDL areas) for turbidity after the applicable compliance deadline may be subject to ranch-level surface discharge monitoring and reporting.

20. When required by the Executive Officer, based on surface receiving water quality data or significant and repeated exceedance of the surface water quality limits in **Table C.3-2** (TMDL areas) and **Table C.3-3** (non-TMDL areas) for nutrients, **Table C.3-4** (TMDL areas) and **Table C-3.5** (non-TMDL areas) for pesticides and toxicity, and **Table C.3-6** (TMDL areas) for sediment and **Table C.3-7** (non-TMDL areas) for turbidity, Dischargers must complete **ranch-level surface discharge monitoring and reporting** as described in the MRP. Dischargers can complete this requirement either individually or as part of a third-party program effort. Water Board staff will coordinate with Dischargers prior to the Executive Officer invoking this requirement to determine if non-compliance is the result of unforeseen or uncontrollable circumstances and to provide the Discharger with 90-day advanced notice of the forthcoming requirement. When ranch-level surface discharge monitoring and reporting is required, a work plan, including a SAP and QAPP, must be submitted for Executive Officer review prior to implementation. Once approved by the Executive Officer, the work plan must be implemented. Ranch-level surface discharge monitoring may be discontinued with the approval of the Executive Officer when the Discharger comes into compliance with the surface receiving water limits, or the discharge has otherwise ceased.

21. Dischargers must report on nutrient, pesticide, and sediment and erosion control management practice implementation and assessment electronically in the ACF, as described in the MRP.

22. Dischargers whose ranches have impermeable surfaces must report on stormwater management practice implementation and assessment electronically in the ACF, as described in the MRP.

23. Dischargers with waterbodies within or bordering their ranch must measure and report the current riparian area (average width and length, in feet) in the ACF, as described in the MRP.

Part 2, Section D. Additional Requirements and Prohibitions

Waste Discharge Control and Prohibitions

1. Except in compliance with this Order, Dischargers must not cause or contribute to exceedances of applicable water quality objectives, as defined in Attachment A, must protect all beneficial uses for inland surface waters, enclosed bays, and estuaries, and for groundwater, as outlined in sections 3.3.2 and 3.3.4 of the Basin Plan, and must prevent nuisance as defined in Water Code section 13050.

2. Dischargers must achieve applicable Total Maximum Daily Load (TMDL) Load Allocations (LAs) by achieving the surface water receiving limits established in this Order. Dischargers must incorporate planning elements from applicable TMDLs into the appropriate section of their Farm Plan and, as appropriate, into their follow-up surface receiving water implementation work plan(s).

3. Dischargers that anticipate exceeding a limit or condition of the Order after the final compliance date has passed may request a time schedule order pursuant to Water Code section 13300 for the Central Coast Water Board's consideration. A time schedule order must be requested 18 months in advance of a Discharger or a group of Dischargers anticipating that they will not be able to achieve the receiving water limit by the compliance date. At a minimum, the request for a time schedule order must include information outlined in Attachment A (Additional Findings). Dischargers may either individually request a time schedule order or may jointly request a time schedule order with other Dischargers subject to the same groundwater or surface receiving water limit.

4. The discharge of rubbish, refuse, trash, irrigation tubing or tape, or other solid wastes into surface waters is prohibited. The placement of such materials where they discharge or have the potential to discharge to surface waters is prohibited.

5. The discharge of chemicals such as fertilizers, fumigants, pesticides, herbicides, or rodenticides down a groundwater well casing is prohibited.

6. The discharge of chemicals, including those used to control wildlife (such as bait traps or poison), directly into surface waters or groundwater is prohibited. The placement of chemicals in a location where they may be discharged to surface waters or groundwater is prohibited.

7. Dischargers who apply fertilizers, fumigants, pesticides, herbicides, rodenticides, or other chemicals through an irrigation system must have functional and properly maintained backflow prevention devices installed at the well or pump to prevent pollution of groundwater and surface water that comply with any applicable DPR requirements or local ordinances. Backflow prevention devices used to protect water quality must be those approved by the United States Environmental Protection Agency (USEPA), DPR, California Department of Public Health (CDPH), or the local public health or water agency.

8. Dischargers must properly destroy all abandoned groundwater wells, exploration holes or test holes, as defined by Department of Water Resources (DWR) Bulletin 74-81 and revised in 1988, in such a manner that they will not produce water or act as a conduit for mixing or otherwise transfer groundwater or waste pollutants between permeable zones or aquifers. Well destruction must be performed in compliance with any applicable DWR requirements or local ordinances (including local well destruction permitting requirements).

9. This Order does not authorize the discharge of pollutants from point sources to waters of the United States, including wetlands. Where required, Dischargers must obtain authorization for such discharges by obtaining a Clean Water Act (CWA) section 402 National Pollutant Discharge Elimination System (NPDES) permit or a CWA section 404 dredge and fill permit.

10. Dischargers who utilize containment structures (such as retention ponds or reservoirs) to achieve treatment or control of the discharge of waste must manage, construct, and maintain such containment structures to avoid discharges of waste to groundwater and surface water that cause or contribute to exceedances of water quality objectives or impairment of beneficial uses. Dischargers may choose the method of compliance appropriate for the individual ranch, which may include, but is not limited to:

    a. Implementing chemical treatment (such as enzymes);
    b. Implementing biological treatment (such as wood chips);
    c. Recycling or reusing contained water to minimize infiltration or discharge of waste;
    d. Minimizing the volume of water in the containment structure to minimize percolation of waste; and/or
    e. Minimizing percolation of waste via a synthetic, concrete, clay, or low permeability soil liner.

11. Dischargers must implement proper handling, storage, disposal, and management of fertilizers, fumigants, pesticides, herbicides, rodenticides, and other chemicals to prevent or control the discharge of waste to waters of the state that causes or contributes to exceedances of water quality standards. All chemical storage areas must have appropriate secondary containment structures to protect water quality and prevent discharge through spillage, mixing, or seepage.

12. Dischargers must implement water quality protective management practices (such as source control or treatment) to prevent erosion, reduce stormwater runoff quantity and velocity, and hold fine particles in place.

13. Dischargers must minimize the presence of bare soil vulnerable to erosion and soil runoff to surface waters and implement erosion control, sediment, and stormwater management practices in non-cropped areas, such as unpaved roads and other heavy use areas.

14. Dischargers who utilize agricultural drainage pumps must implement management practices to dissipate flow and prevent channel and/or streambank erosion resulting in increased sediment transport and turbidity within surface water.

15. Dischargers must comply with any applicable stormwater permits.

16. Dischargers must implement best practicable treatment and control (BPTC) measures for the construction and maintenance of farm roads to minimize erosion and sediment discharges that contribute to nonpoint source pollution.

17. Dischargers must ensure that all farm roads are, to the extent possible, hydrologically disconnected from waters of the state by installing disconnecting drainage features, increasing the frequency of (inside) ditch drain relief as needed, constructing out-sloped roads, constructing energy dissipating structures, avoiding concentrating flows in unstable areas, and performing inspection and maintenance as needed to optimize access road performance.

18. Dischargers must ensure that farm road surfacing, especially within a segment leading to waters of the state, minimizes sediment delivery to waters of the state and maximizes road integrity.

19. Dischargers must ensure that farm roads are out-sloped whenever possible to promote even drainage of the farm road surface, prevent the concentration of stormwater flow within an inboard or inside ditch, and to prevent disruption of the natural sheet flow pattern off a hill slope to waters of the state.

20. Farm road stormwater drainage structures must not discharge onto unstable slopes, earthen fills, or directly into waters of the state. Drainage structures must discharge onto stable areas with straw bales, slash, vegetation, and/or rock riprap.

21. If used, chemical toilets or holding tanks must be maintained in a manner appropriate for the frequency and conditions of usage, sited in stable locations, and located outside of areas bordering surface waterbodies.

22. Dischargers who produce and apply compost in-house must comply with the following requirements:

    a. Materials and activities on-site must not cause, threaten to cause, or contribute to conditions of pollution, contamination, or nuisance;
    b. Activities must be set back at least 100 feet from the nearest surface waterbody and/or the nearest water supply well;
    c. Dischargers must implement practices to minimize or eliminate the discharge of waste that may adversely impact the quality or beneficial uses of waters of the state;
    d. Dischargers must manage the application of water to compost (including from precipitation events) to reduce the generation of wastewater;
    e. Working surfaces must be designed to prevent, to the greatest extent possible, ponding, infiltration, inundation, and erosion, notwithstanding precipitation events, equipment movement, and other aspects of the facility operations;
    f. Dischargers must maintain the following records in the Farm Plan. These records must be submitted to the Central Coast Water Board upon request.
        i. Total operational footprint of compost activities (in acres), including ancillary activities;
        ii. Compost operation records to provide background information on the composting operation history and a description of methods and operation used, including the following: feedstock types, volumes, sources, and suppliers. Description of the method of composting (e.g., windrow, static, forced air, mechanical). Description of how residuals are removed from the feedstocks and managed and/or disposed of.
        iii. Description of water supply.
        iv. Map detailing the location and size (in acres) of the working surface used for the storage of incoming feedstocks, additives, and amendments (receiving area); active and curing composting; final product; drainage patterns; location of any groundwater monitoring wells and water supply wells within and/or near the property boundary; location and distance (in feet) to nearby water supply wells (e.g., municipal supply, domestic supply, agricultural wells) from the nearest property boundary of the operation; identification of all surface waterbodies, including streams, ditches, canals, and other drainage

courses; and distances from the nearest property boundary of the operation to these surface waterbody areas.

v. Records of appropriate monitoring (dependent on method of composting) for composting to develop final product (temperature, turning, air flow, etc.).

vi. Records of final product use, including locations and volumes.

23. Disturbance (e.g., removal, degradation, or destruction) of existing, naturally occurring, and established native riparian vegetative cover (e.g., trees, shrubs, and grasses), unless authorized (e.g., Clean Water Act [CWA] section 404 permit and CWA section 401 certification, WDRs, waivers of WDRs, a California Department of Fish and Wildlife [CDFW] Lake and Streambed Alteration Agreement, or municipal ordinance), is prohibited. Dischargers must avoid disturbance in riparian areas to minimize waste discharges and protect water quality and beneficial uses.

24. In the case where disturbance of riparian areas is authorized, Dischargers must implement appropriate and practicable measures to avoid, minimize, and mitigate erosion and discharges of waste.

Additional Requirements

25. Upon the Central Coast Water Board's request, Dischargers must submit information regarding compliance with any DPR adopted or approved surface water or groundwater protection requirements to the Central Coast Water Board.

26. Upon the Central Coast Water Board's request, Dischargers must submit proof of an approved Lake and Streambed Alteration Agreement or other authorization or release from the CDFW to the Central Coast Water Board for any work conducted within the bed, bank, and channel, including riparian areas, of parcels enrolled in this order, that has the potential to result in erosion and discharges of waste to waters of the State.

27. Upon the Central Coast Water Board's request, Dischargers must submit proof of a Clean Water Act section 404 dredge and fill permit from the United States Army Corps of Engineers (USACE) for any work that has the potential to discharge wastes considered "fill" material, such as sediment, to waters of the United States to the Central Coast Water Board.

28. Dischargers must comply with DWR Bulletin 74-81 and supplement 74-90, Water Code sections 13700 through 13755, and any local permitting requirements associated with installation of new wells.

29. This Order does not authorize any act that results in the taking of a threatened or endangered species or any act that is now prohibited, or becomes prohibited in

the future, under either the California Endangered Species Act (Fish and Game Code sections 2050 to 2097) or the federal Endangered Species Act (16 U.S.C. sections 1531 to 1544). If a "take" will result from any act authorized under this Order, the Dischargers must obtain authorization for an incidental take prior to taking action. Dischargers are responsible for meeting all applicable requirements of the California and federal Endangered Species Acts for the discharge authorized by this Order.

30. Dischargers or a representative authorized by the Discharger must sign technical reports submitted to the Central Coast Water Board to comply with this Order. Any person signing or submitting a document must provide the following certification, whether written or implied:

"In compliance with Water Code section 13267, I certify under penalty of perjury that this document and all attachments were prepared by me, or under my direction or supervision, following a system designed to ensure that qualified personnel properly gather and evaluate the information submitted. To the best of my knowledge and belief, this document and all attachments are true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment."

CERTIFICATION

I, Matthew T. Keeling, Executive Officer, do hereby certify that this General Order with all its attachments is a full, true, and correct copy of an order adopted by the California Regional Water Quality Control Board, Central Coast Region on April XX, 2021.

____

Matthew T. Keeling, Executive Officer

Tables and Figures

Tables and Figures related to Part 2, Section C.1. Groundwater Protection

Table C.1-1. Groundwater Phase Areas

Groundwater Basin[1]	Groundwater Phase
Gilroy-Hollister Valley - Llagas Area	Phase 1, Phase 2
Salinas Valley - Forebay Aquifer	Phase 1, Phase 2
Salinas Valley - Upper Valley Aquifer	Phase 1, Phase 2
Santa Maria River Valley - Santa Maria	Phase 1, Phase 2
Santa Ynez River Valley	Phase 1, Phase 3
Corralitos - Pajaro Valley	Phase 2
Gilroy Hollister Valley - North San Benito	Phase 2
Salinas Valley - 180/400 Foot Aquifer	Phase 2
Salinas Valley - East Side Aquifer	Phase 2
San Luis Obispo Valley	Phase 2
All Other Basins and Areas Outside of Basins	Phase 3

[1]As defined in the 2019 California Department of Water Resources Bulletin 118.

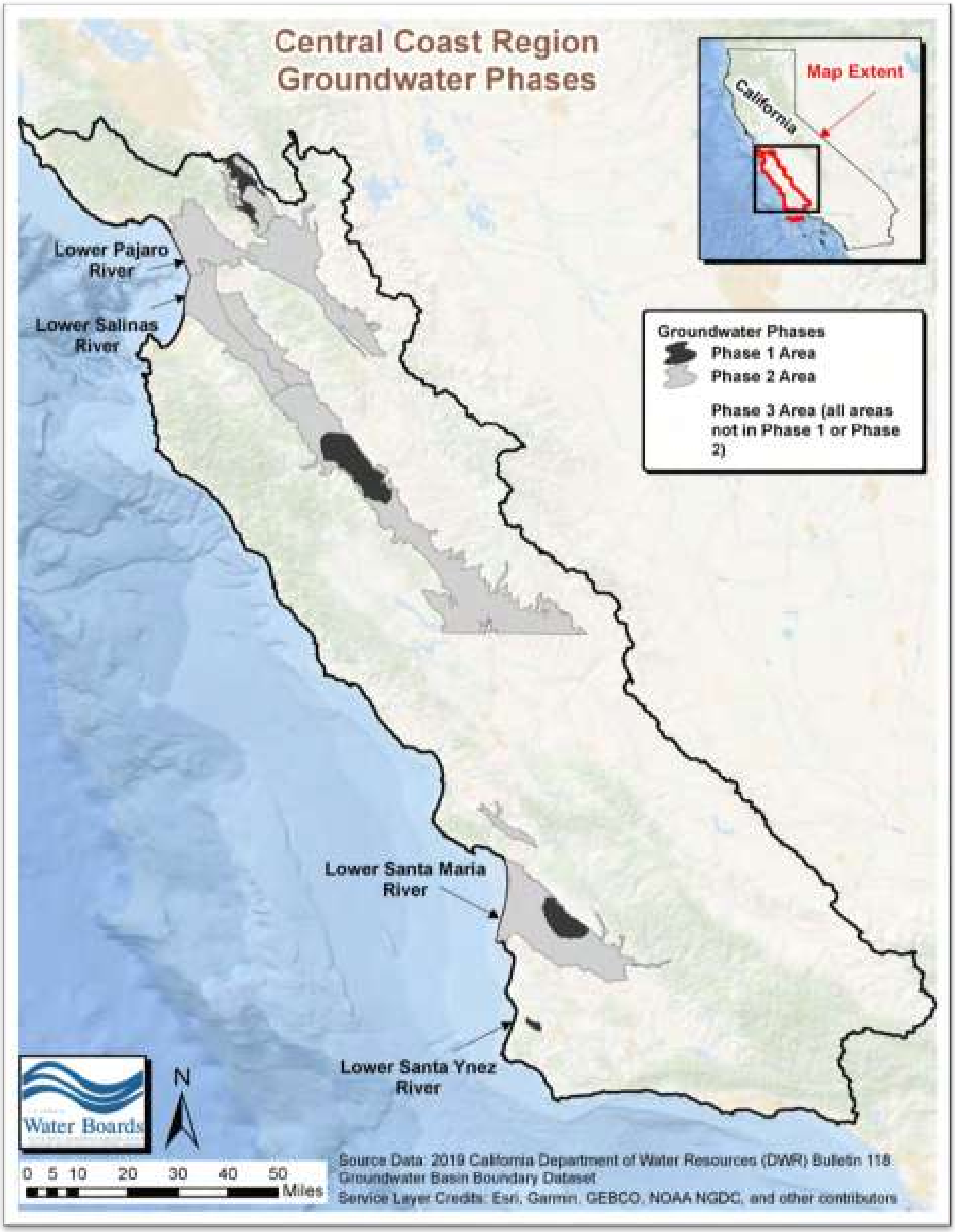


Figure C.1-1: Groundwater Phase Areas

Table C.1-2. Compliance Dates for Fertilizer Nitrogen Application Limits

Crop	90th Percentile A_{FER} =	Compliance Date	85th Percentile A_{FER} =	Compliance Date
Broccoli	295	12/31/2023	280	12/31/2025
Cauliflower	310		285	
Celery	360		330	
Lettuce	275		255	
Spinach	245		230	
Strawberry	320		295	
All Other Crops	500		480	

Note: For crops grown for less than one year (e.g., broccoli, lettuce, etc.), units are in pounds of nitrogen per acre per crop. In the situation where a Discharger grows a crop more than once during the year, e.g. grows a spring lettuce and a fall lettuce, the application limit applies to each of the crops separately: no more than 275 pounds of nitrogen per acre can be applied to the spring lettuce crop and no more than 275 pounds of nitrogen per acre can be applied to the fall lettuce crop. The two lettuce crops can be reported on separately or can be averaged together. For crops grown for more than one year (e.g., grapes, trees, etc.), units are in pounds of nitrogen per acre per year. The 90th and 85th percentile fertilizer nitrogen application limits were determined by using year 2014 to 2019 total nitrogen applied (TNA) reporting information.

Table C.1-3. Compliance Dates for Nitrogen Discharge Targets and Limits

	Compliance Date		
Compliance Pathway 1 $A_{FER} + (C \times A_{COMP}) + (O \times A_{ORG}) + A_{IRR} - R =$	Target	500	12/31/2023
	Target	400	12/31/2025
	Limit	300	12/31/2027
	Limit	200	12/31/2031
	Limit	150	12/31/2036
	Limit	100	12/31/2041
	Limit	50	12/31/2051
OR			
	Compliance Date		
Compliance Pathway 2 $A_{FER} + (C \times A_{COMP}) + (O \times A_{ORG}) = R$	Target	A = R	12/31/2023
	Target	A = R	12/31/2025
	Limit	A = R	12/31/2027
	Limit	A = R	12/31/2031
	Limit	A = R	12/31/2036
	Limit	A = R	12/31/2041
	Limit	A = R	12/31/2051
OR			
	Compliance Date		
Compliance Pathway 3 $A_{FER} + (C \times A_{COMP}) + (O \times A_{ORG}) - R =$	Target	300	12/31/2023
	Target	200	12/31/2025
	Limit	100	12/31/2027
	Limit	0	12/31/2031
	Limit	-50	12/31/2036
	Limit	-100	12/31/2041
	Limit	-150	12/31/2051

Note: All units are in pounds of nitrogen per acre per year and represent all crops grown and harvested on the entire ranch. The initial 2027 nitrogen discharge limits will be re-evaluated based on discharger reported nitrogen applied and removed data, new science, and management practice implementation and assessment before becoming effective.

A_{FER} is the amount of fertilizer nitrogen applied in pounds per acre.
C is the compost discount factor used to represent the amount of compost nitrogen mineralized during the year that the compost was applied.
A_{COMP} is the total amount of compost nitrogen applied in pounds per acre.
A_{IRR} is the amount of nitrogen applied in the irrigation water estimated from the volume required for crop evapotranspiration (ET) in pounds per acre.
O is the organic fertilizer discount factor used to represent the amount of nitrogen mineralized during the first 12 weeks in the year it was applied.
A_{ORG} is the total amount of organic fertilizer or amendment nitrogen applied in pounds per acre.
R is the amount of nitrogen removed from the field through harvest, sequestration, or other removal methods, in pounds per acre.

Note: Report due dates to confirm compliance with the fertilizer application limits and nitrogen discharge targets and limits are included in the MRP.

Tables and Figures related to Part 2, Section C.2. Third-Party Alternative Compliance Pathway for Groundwater Protection

Table C.2-1. Compliance Dates for Fertilizer Nitrogen Application Targets (Alternative Compliance Pathway)

Crop	90th Percentile A_{FER} =	Compliance Date	85th Percentile A_{FER} =	Compliance Date
Broccoli	295	12/31/2024	280	12/31/2026
Cauliflower	310		285	
Celery	360		330	
Lettuce	275		255	
Spinach	245		230	
Strawberry	320		295	
All Other Crops	500		480	

Note: For crops grown for less than one year (e.g., broccoli, lettuce, etc.), units are in pounds of nitrogen per acre per crop. In the situation where a Discharger grows a crop more than once during the year, e.g. grows a spring lettuce and a fall lettuce, the application limit applies to each of the crops separately: no more than 275 pounds of nitrogen per acre can be applied to the spring lettuce crop and no more than 275 pounds of nitrogen per acre can be applied to the fall lettuce crop. The two lettuce crops can be reported on separately or can be averaged together. For crops grown for more than one year (e.g., grapes, trees, etc.), units are in pounds of nitrogen per acre per year. The 90th and 85th percentile fertilizer nitrogen application targets were determined by using year 2014 to 2019 total nitrogen applied (TNA) reporting information.

Table C.2-2. Compliance Dates for Nitrogen Discharge Targets (Alternative Compliance Pathway)

	Target	Compliance Date
Compliance Pathway 1 $A_{FER} + (C \times A_{COMP}) + (O \times A_{ORG}) + A_{IRR} - R =$	500	12/31/2024
	400	12/31/2026
	300	12/31/2028
OR		
Compliance Pathway 2 $A_{FER} + (C \times A_{COMP}) + (O \times A_{ORG}) = R$	**Target**	**Compliance Date**
	A = R	12/31/2024
	A = R	12/31/2026
	A = R	12/31/2028
OR		
Compliance Pathway 3 $A_{FER} + (C \times A_{COMP}) + (O \times A_{ORG}) - R =$	**Target**	**Compliance Date**
	300	12/31/2024
	200	12/31/2026
	100	12/31/2028

Notes: All units are in pounds of nitrogen per acre per year and represent all crops grown and harvested on the entire ranch. All compliance pathway variables are defined above under **Table C.1-3**. The final 2028 nitrogen discharge targets will be re-evaluated based on discharger reported nitrogen applied and removed data, new science, management practice implementation and assessment, and third-party GWP collective numeric interim and final targets before becoming effective.

Tables and Figures related to Part 2, Section C.3. Surface Water Protection

Table C.3-1. Surface Water Priority Areas

HUC-8 Number[1]	HUC-8 Name	Surface Water Priority
18060008	Santa Maria	Priority 1
18060005	Salinas	Priority 2
18060002	Pajaro	Priority 3
18060015	Monterey Bay	Priority 3
18060010	Santa Ynez	Priority 3
18050003	Coyote	Priority 4
18050006	San Francisco Coastal South	Priority 4
18060004	Estrella	Priority 4
18060006	Central Coastal	Priority 4
18060003	Carrizo Plain	Priority 4
18060007	Cuyama	Priority 4
18060009	San Antonio	Priority 4
18060013	Santa Barbara Coastal	Priority 4
18060014	Santa Barbara Channel Islands	Priority 4
18070101	Ventura	Priority 4

[1]As defined by the National Hydrography Dataset Plus Watershed Boundary Dataset

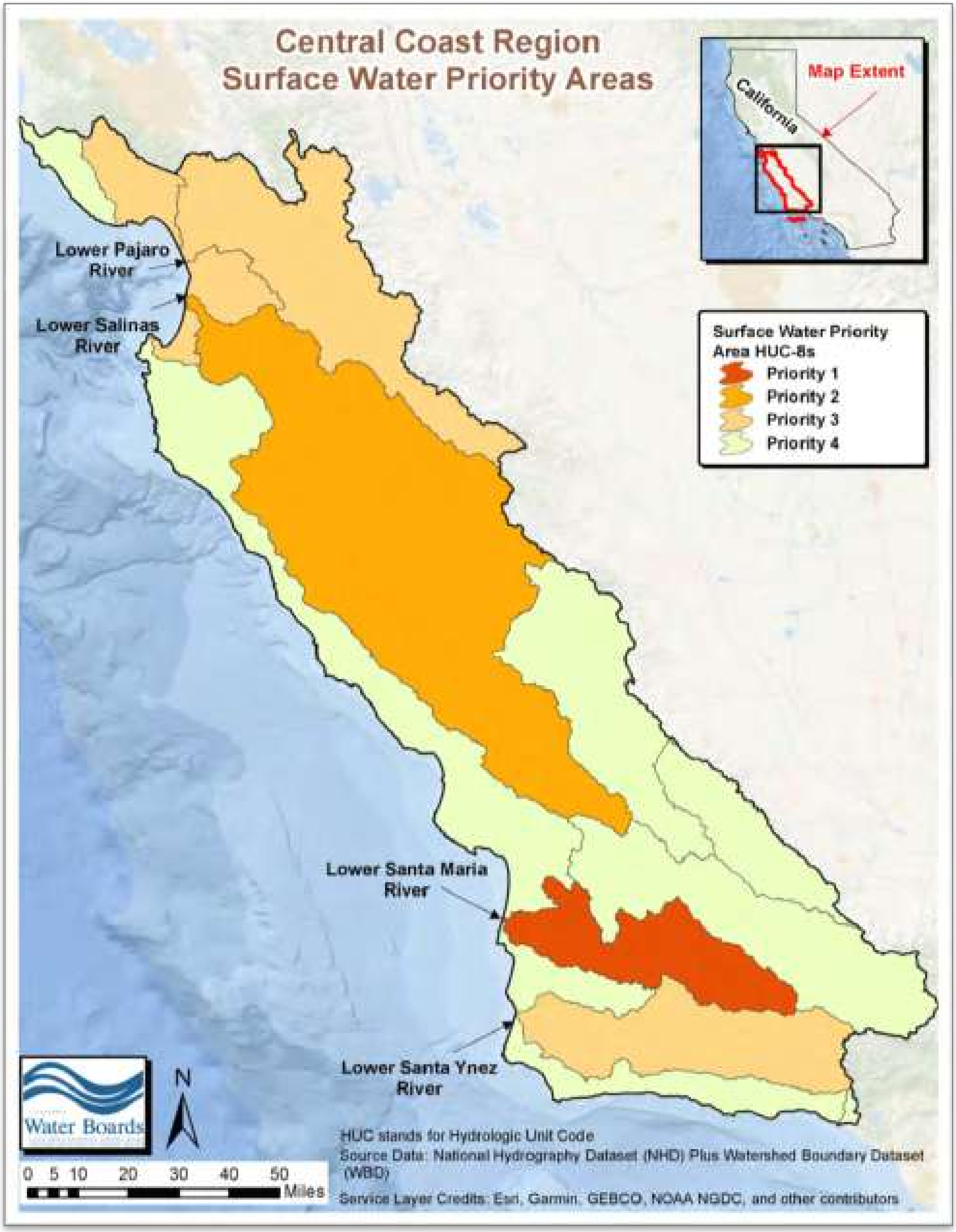


Figure C-3.1: Surface Water Priority Areas

Table C.3-1.3P. Surface Water Priority Areas (Third-Party Program)

High Priority	
305FUF	Furlong Creek at Frazier Lake Road
309ALG	Salinas Reclamation Canal at La Guardia
309CCD	Chualar Creek west of Highway 101
309CRR	Chualar Creek North Branch east of Highway 101
309ESP	Espinosa Slough upstream from Alisal Slough
309JON	Salinas Reclamation Canal at San Jon Road
309MER	Merrit Ditch upstream of Highway 183
309NAD	Natividad Creek upstream of Salinas Reclamation Canal
309OLD	Old Salinas River at Monterey Dunes Way
309QUI	Quail Creek at culvert on east side of Highway 101
309TEH	Tembladero Slough at Haro Street
312BCC	Bradley Canyon Creek at Culvert
312BCJ	Bradley Channel at Jones Street
312GVS	Green Valley at Simas
312MSD	Main Street Canal upstream of Ray Road at Highway 166
312OFC	Oso Flaco Creek at Oso Flaco Lake Road
312ORC	Orcutt Solomon Creek upstream of Santa Maria River
312ORI	Orcutt Solomon Creek at Highway 1
312SMA	Santa Maria River at Estuary
Medium Priority	
305BRS	Beach Road Ditch at Shell Road
305CAN	Carnadero Creek upstream of Pajaro River
305CHI	Pajaro River at Chittenden Gap
305FRA	Pajaro River Millers Canal at Frazier Lake Road
305LCS	Llagas Creek at Southside Avenue
305PJP	Pajaro River at Main Street
305SJA	San Juan Creek at Anzar Road
305TSR	Tequisquita Slough upstream of Pajaro River at Shore Road
305WCS	Watsonville Creek at Elkhorn Road / Hudson Landing
309ASB	Alisal Slough at White Barn
309BLA	Blanco Drain below Pump
309GAB	Gabilan Creek at Boronda Road
309MOR	Moro Cojo Slough at Highway 1
309RTA	Santa Rita Creek at Santa Rita Creek Park
310LBC	Los Berros Creek at Century Road
310PRE	Prefumo Creek at Calle Joaquin
310USG	Arroyo Grande Creek at old USGS Gauge
310WRP	Warden Creek at Wetlands Restoration Preserve
312OFN	Little Oso Flaco Creek
312SMI	Santa Maria at Highway 1
313SAE	San Antonio Creek at San Antonio Road east
314SYN	Santa Ynez River at 13th
315BEF	Bell Creek at Winchester Canyon Park
315FMV	Franklin Creek at Mountain View Lane
315GAN	Glenn Annie Creek
315LCC	Los Carneros Creek at Calle Real

Low Priority	
305COR	Salsipuedes Creek downstream of Corralitos Creek upstream of HWY 129
305WSA	Watsonville Slough at San Andreas Road
309GRN	Salinas River (Mid) at Elm Road in Greenfield
309SAC	Salinas River at Chualar
309SAG	Salinas River at Gonzales River Road Bridge
309SSP	Salinas River (Lower) at Spreckles Gauge
310CCC	Chorro Creek upstream of Chorro Flats
314SYF	Santa Ynez River at Flordale
314SYL	Santa Ynez River at River Park
315APF	Arroyo Paredon Creek at Foothill Bridge
All Other Areas	Low priority also includes all other areas not in high or medium priority areas

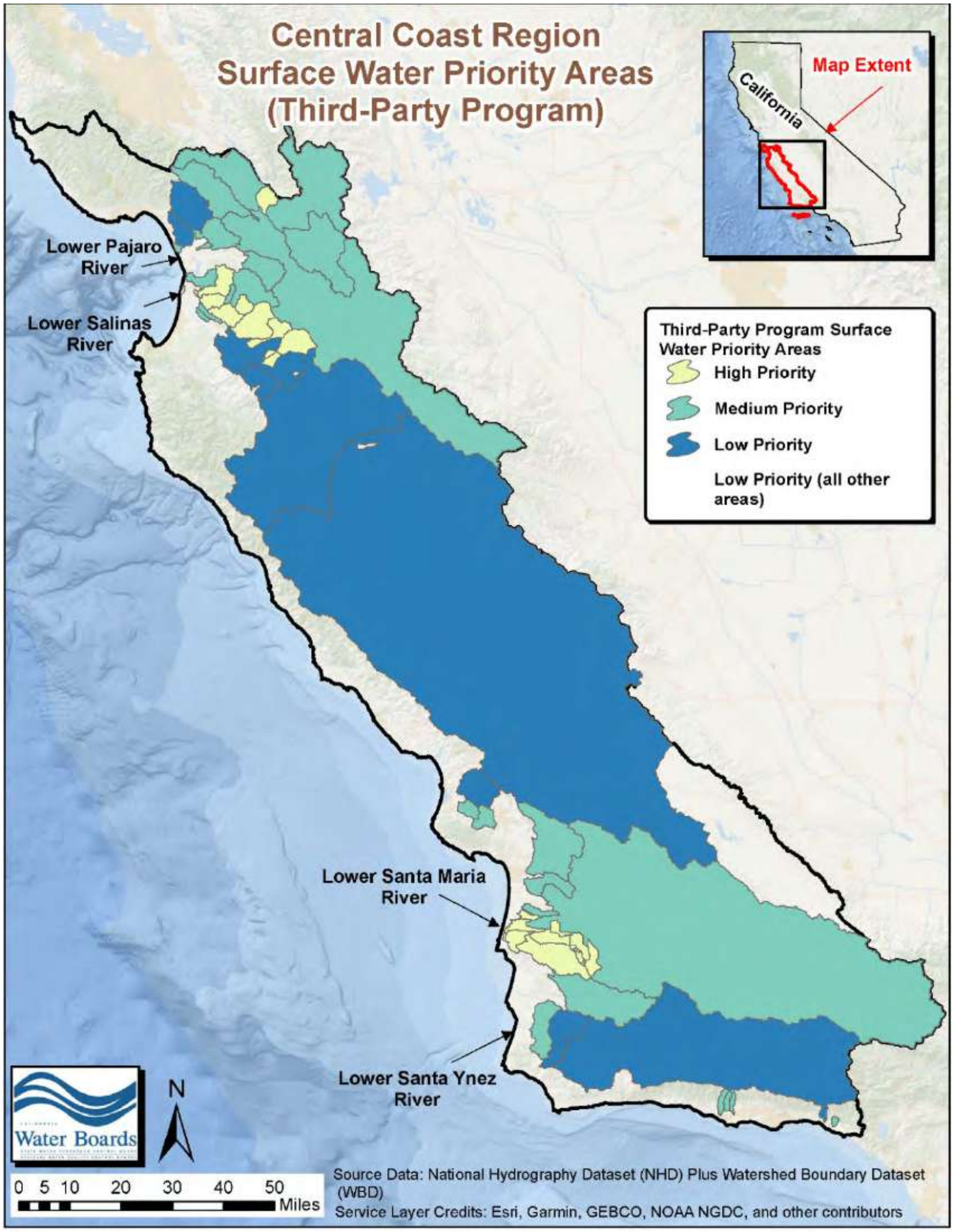


Figure C-3.1.3P: Surface Water Priority Areas (Third-Party Program)

Table C.3-2. Compliance Dates for Nutrient Limits (TMDL areas)

TMDL Project Name	Constituent	Matrix	Limit[1]	Units[2]	Compliance Date
Arroyo Paredon Nitrate TMDL	Nitrate, as N	Water Column	10.0	mg/L	12/31/2032
Bell Creek Nitrate TMDL	Nitrate, as N	Water Column	10.0	mg/L	12/31/2032
Franklin Creek Nutrients TMDL	Nitrate, as N	Water Column	10.0	mg/L	12/31/2032
Franklin Creek Nutrients TMDL	Total Nitrogen, as N	Water Column	Wet Season: 8.0	mg/L	3/4/2034
Franklin Creek Nutrients TMDL	Total Phosphorous	Water Column	Wet Season: 0.3	mg/L	3/4/2034
Franklin Creek Nutrients TMDL	Total Nitrogen, as N	Water Column	Dry Season: 1.1	mg/L	3/4/2044
Franklin Creek Nutrients TMDL	Total Phosphorous	Water Column	Dry Season: 0.075	mg/L	3/4/2044
Glen Annie Canyon, Tecolotito Creek, & Carneros Creek Nitrate TMDL	Nitrate, as N	Water Column	10.0	mg/L	12/31/2032
Los Berros Creek Nitrate TMDL	Nitrate, as N	Water Column	10.0	mg/L	12/31/2032
Los Osos Creek, Warden Creek, and Warden Lake Wetland Nutrient TMDL	Nitrate, as N	Water Column	10.0	mg/L	12/31/2032

TMDL Project Name	Constituent	Matrix	Limit[1]	Units[2]	Compliance Date
Lower Salinas River Watershed Nutrient TMDL	Ammonia (Un-Ionized), as N[3]	Water Column	0.025	mg/L	12/31/2032
Lower Salinas River Watershed Nutrient TMDL	Nitrate, as N	Water Column	10.0	mg/L	12/31/2032
Lower Salinas River Watershed Nutrient TMDL	Total Nitrogen, as N[4]	Water Column	Wet Season: 8.0	mg/L	5/7/2034
Lower Salinas River Watershed Nutrient TMDL	Nitrate, as N	Water Column	Wet Season: 8.0	mg/L	5/7/2034
Lower Salinas River Watershed Nutrient TMDL	Orthophosphate, as P	Water Column	Wet Season: 0.3	mg/L	5/7/2034
Lower Salinas River Watershed Nutrient TMDL	Total Nitrogen, as N[4]	Water Column	Dry Season: 1.7	mg/L	5/7/2044
Lower Salinas River Watershed Nutrient TMDL	Nitrate, as N	Water Column	Dry Season: 1.4 – 6.4[1]	mg/L	5/7/2044
Lower Salinas River Watershed Nutrient TMDL	Orthophosphate, as P	Water Column	Dry Season: 0.07 – 0.13[1]	mg/L	5/7/2044

TMDL Project Name	Constituent	Matrix	Limit[1]	Units[2]	Compliance Date
Pajaro River Watershed Nutrient TMDL	Ammonia (Un-ionized), as N[3]	Water Column	0.025	mg/L	12/31/2032
Pajaro River Watershed Nutrient TMDL	Nitrate, as N	Water Column	10.0	mg/L	12/31/2032
Pajaro River Watershed Nutrient TMDL	Total Nitrogen, as N	Water Column	Wet Season: 8.0	mg/L	12/31/2032
Pajaro River Watershed Nutrient TMDL	Nitrate, as N	Water Column	Wet Season: 8.0	mg/L	12/31/2032
Pajaro River Watershed Nutrient TMDL	Orthophosphate, as P	Water Column	Wet Season: 0.3	mg/L	12/31/2032
Pajaro River Watershed Nutrient TMDL	Total Nitrogen, as N[5]	Water Column	Dry Season: 1.1 – 2.1[1]	mg/L	7/12/2041
Pajaro River Watershed Nutrient TMDL	Nitrate, as N	Water Column	Dry Season: 1.8 – 3.9[1]	mg/L	7/12/2041
Pajaro River Watershed Nutrient TMDL	Orthophosphate, as P	Water Column	Dry Season: 0.04 – 0.14[1]	mg/L	7/12/2041
San Luis Obispo Creek Nitrate TMDL	Nitrate, as N	Water Column	10.0	mg/L	12/31/2032

TMDL Project Name	Constituent	Matrix	Limit[1]	Units[2]	Compliance Date
Santa Maria River Watershed Nutrients TMDL	Ammonia (Un-Ionized), as N[3]	Water Column	0.025	mg/L	12/31/2032
Santa Maria River Watershed Nutrients TMDL	Nitrate, as N	Water Column	10.0	mg/L	12/31/2032
Santa Maria River Watershed Nutrients TMDL	Nitrate, as N	Water Column	Wet Season or Year-Round: 5.7 – 8.0[1]	mg/L	5/22/2034
Santa Maria River Watershed Nutrients TMDL	Orthophosphate, as P	Water Column	Wet Season or Year-Round: 0.08 – 0.3[1]	mg/L	5/22/2034
Santa Maria River Watershed Nutrients TMDL	Nitrate, as N	Water Column	Dry Season: 4.3	mg/L	5/22/2044
Santa Maria River Watershed Nutrients TMDL	Orthophosphate, as P	Water Column	Dry Season: 0.19	mg/L	5/22/2044

[1]The Lower Salinas River Watershed Nutrient TMDL, Pajaro River Watershed Nutrient TMDL, and Santa Maria River Watershed Nutrient TMDL include load allocations for specific waterbody reaches within the TMDL project area. The limits for those TMDLs are summarized in this table as ranges; however, the exact load allocation values for each reach apply as described in the TMDL and Basin Plan and will be assessed as numeric limits for the purposes of this Order.
[2]mg/L is milligrams per liter
[3]Calculated using total ammonia and onsite instream measurements (field measurements) of pH and water temperature.
[4]Total nitrogen TMDL load allocation applies to Moro Cojo Slough only.
[5]Total nitrogen TMDL load allocation applies to the following sloughs: Watsonville, Harkins, Gallighan, and Struve.

Table C.3-3. Compliance Dates for Nutrient Limits (Non-TMDL areas)

Constituent Group	Constituent	Matrix	Limit	Units[1]	Compliance Date
Nutrients	Nitrate, as Nitrogen	Water Column	10.0	mg/L	12/31/2032
Nutrients	Ammonia (un-ionized), as Nitrogen[2]	Water Column	0.025	mg/L	12/31/2032

[1]mg/L is milligrams per liter
[2]Calculated using total ammonia and onsite instream measurements (field measurements) of pH and water temperature.

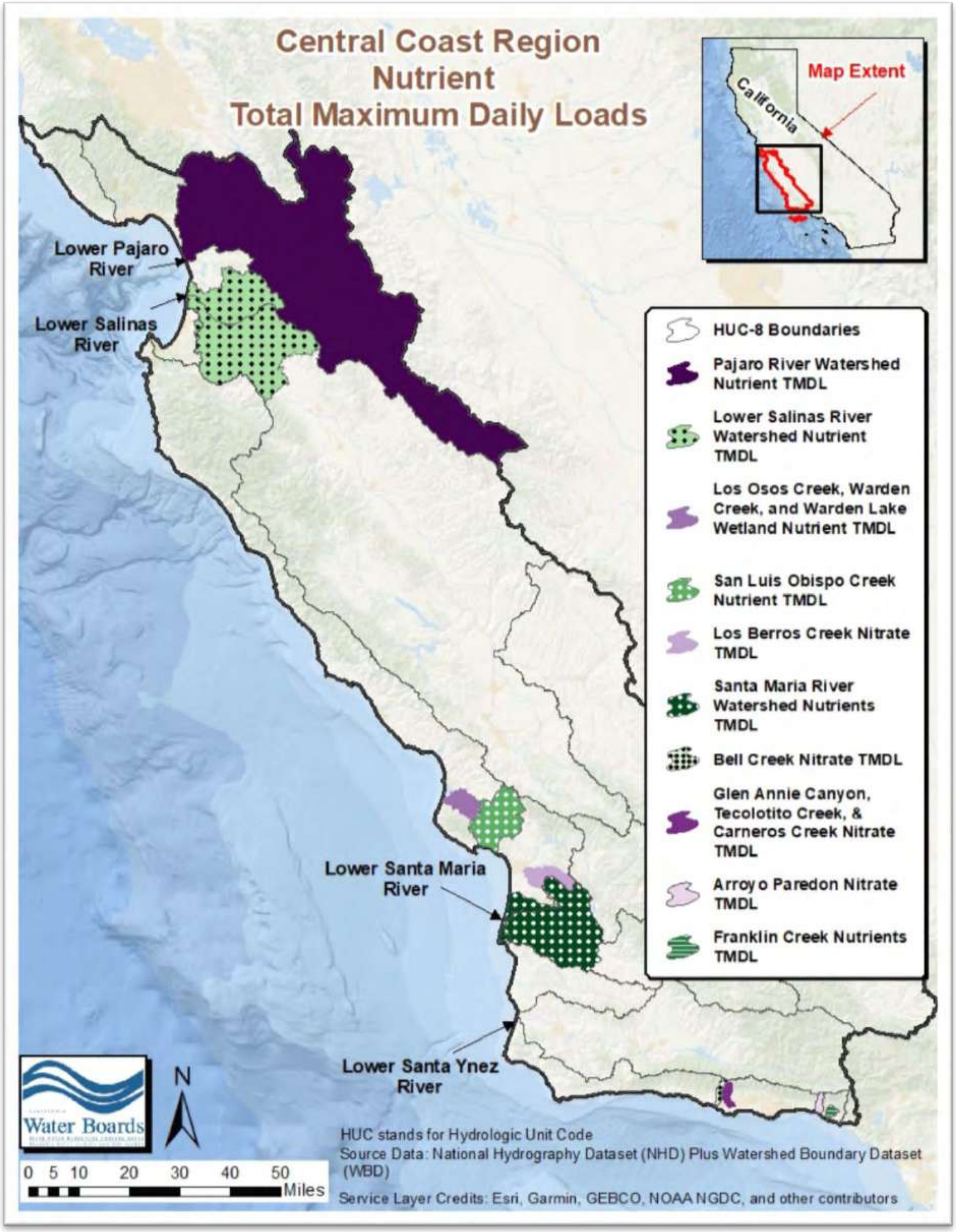


Figure C.3-2: Nutrient TMDL Areas

Table C.3-4. Compliance Dates for Pesticide and Toxicity Limits (TMDL areas)

TMDL Project Name	Constituent[1]	Matrix	Limit[2]	Units[3]	Compliance Date
Arroyo Paredon Diazinon TMDL	Additive Toxicity (Chlorpyrifos and Diazinon)	Water Column	Sum of Additive Toxicity, TU ≤ 1.0	TU	12/31/2032
Arroyo Paredon Diazinon TMDL	Diazinon	Water Column	CCC: 0.10 CMC: 0.16	µg/L	12/31/2032
Lower Salinas River Watershed Chlorpyrifos and Diazinon TMDL	Chlorpyrifos[4]	Water Column	CCC: 0.015 CMC: 0.025	µg/L	12/31/2032
Lower Salinas River Watershed Chlorpyrifos and Diazinon TMDL	Diazinon[4]	Water Column	CCC: 0.10 CMC: 0.16	µg/L	12/31/2032
Lower Salinas River Watershed Chlorpyrifos and Diazinon TMDL	Additive Toxicity (Chlorpyrifos and Diazinon)	Water Column	Sum of Additive Toxicity, TU ≤ 1.0	TU	12/31/2032

TMDL Project Name	Constituent[1]	Matrix	Limit[2]	Units[3]	Compliance Date
Lower Salinas River Watershed Sediment Toxicity and Pyrethroids in Sediment TMDL	Additive Toxicity (Pyrethroids)	Sediment	Sum of Pyrethroid TU < 1.0	TU	12/31/2032
Lower Salinas River Watershed Sediment Toxicity and Pyrethroids in Sediment TMDL	Aquatic Toxicity	Sediment	No significant toxic effect, 10-day, chronic exposure with *Hyalella azteca*	Survival endpoint	12/31/2032
Pajaro River Watershed Chlorpyrifos and Diazinon TMDL	Additive Toxicity (Chlorpyrifos and Diazinon)	Water Column	Sum of Additive Toxicity, TU ≤ 1.0	TU	12/31/2032
Pajaro River Watershed Chlorpyrifos and Diazinon TMDL	Chlorpyrifos	Water Column	CCC: 0.015 CMC: 0.025	µg/L	12/31/2032
Pajaro River Watershed Chlorpyrifos and Diazinon TMDL	Diazinon	Water Column	CCC: 0.10 CMC: 0.16	µg/L	12/31/2032

TMDL Project Name	**Constituent[1]**	**Matrix**	**Limit[2]**	**Units[3]**	**Compliance Date**
Pajaro River Watershed Chlorpyrifos and Diazinon TMDL	Aquatic Toxicity	Sediment	No significant toxic effect, 10-day, chronic exposure with *Hyalella azteca*	Survival and reproduction endpoints	12/31/2032
Pajaro River Watershed Chlorpyrifos and Diazinon TMDL	Aquatic Toxicity	Water Column	No significant toxic effect, 7-day, chronic exposure with *Ceriodaphnia dubia*	Survival and reproduction endpoints	12/31/2032
Santa Maria River Watershed Toxicity and Pesticide TMDL	Additive Toxicity (Chlorpyrifos and Diazinon)	Water Column	Sum of Additive Toxicity, TU ≤ 1.0	TU	12/31/2032
Santa Maria River Watershed Toxicity and Pesticide TMDL	Chlorpyrifos	Water Column	CCC: 0.015 CMC: 0.025	µg/L	12/31/2032
Santa Maria River Watershed Toxicity and Pesticide TMDL	Diazinon	Water Column	CCC: 0.10 CMC: 0.16	µg/L	12/31/2032

TMDL Project Name	Constituent[1]	Matrix	Limit[2]	Units[3]	Compliance Date
Santa Maria River Watershed Toxicity and Pesticide TMDL	Malathion	Water Column	CCC: 0.028 CMC: 0.17	µg/L	12/31/2032
Santa Maria River Watershed Toxicity and Pesticide TMDL	Additive Toxicity (Pyrethroids)	Sediment	Sum of Pyrethroid TU ≤ 1.0	TU	12/31/2032
Santa Maria River Watershed Toxicity and Pesticide TMDL	Aquatic Toxicity	Sediment	No significant toxic effect, 10-day, chronic exposure with *Hyalella azteca*	Survival endpoint	Not Defined[5]
Santa Maria River Watershed Toxicity and Pesticide TMDL	Aquatic Toxicity	Water Column	No significant toxic effect, 6-8 day, chronic exposure with *Ceriodaphnia dubia*	Survival and reproduction endpoints	Not Defined[5]
Santa Maria River Watershed Toxicity and Pesticide TMDL	4,4’-DDT (p,p-DDT)	Sediment	6.5	µg/kg o.c.	10/29/2044

TMDL Project Name	Constituent[1]	Matrix	Limit[2]	Units[3]	Compliance Date
Santa Maria River Watershed Toxicity and Pesticide TMDL	4,4'-DDE (p,p-DDE)	Sediment	5.5	µg/kg o.c.	10/29/2044
Santa Maria River Watershed Toxicity and Pesticide TMDL	4,4'-DDD (p,p-DDD)	Sediment	9.1	µg/kg o.c.	10/29/2044
Santa Maria River Watershed Toxicity and Pesticide TMDL	Total DDT (Sediment)	Sediment	10.0	µg/kg o.c.	10/29/2044
Santa Maria River Watershed Toxicity and Pesticide TMDL	Chlordane	Sediment	1.7	µg/kg o.c.	10/29/2044
Santa Maria River Watershed Toxicity and Pesticide TMDL	Dieldrin	Sediment	0.14	µg/kg o.c.	10/29/2044
Santa Maria River Watershed Toxicity and Pesticide TMDL	Endrin	Sediment	550.0	µg/kg o.c.	10/29/2044

TMDL Project Name	Constituent[1]	Matrix	Limit[2]	Units[3]	Compliance Date
Santa Maria River Watershed Toxicity and Pesticide TMDL	Toxaphene	Sediment	20.0	µg/kg o.c.	10/29/2044

[1]Toxic units and/or additive toxicity units are calculated using the relevant biological indicators, as described in the applicable TMDL, e.g. LC50, CCC, or CMC.
[2]CCC is Criterion Continuous Concentration or chronic (4-day (96-hour) average), not to be exceeded more than once in a three year period; CMC is Criterion Maximum Concentration or acute (1- hour average) not to be exceeded more than once in a three year period; the sum of additive toxicity is calculated by dividing each measured chemical concentration by that chemical's criterion (CCC or CMC) and summing those values as defined in the staff report for the respective TMDL project.
[3]µg/L is micrograms per liter; µg/kg is micrograms per kilogram; ng/g is nanograms per gram; o.c. means normalized for sediment organic carbon content; ppb is parts per million.
[4]Apply only when one of the two compounds (chlorpyrifos or diazinon) is present.
[5]A time schedule for aquatic toxicity was not identified in the Santa Maria River Watershed Toxicity and Pesticide TMDL; therefore, Dischargers in this area must comply with the aquatic toxicity compliance date defined in Table C.3-2.

Table C-3.5. Compliance Dates for Pesticide and Toxicity Limits (Non-TMDL areas)

Constituent Group	Constituent	Matrix	Limit[1]	Units[2]	Compliance Date
Pesticides	Acetamiprid	Water Column	2.10	µg/L	12/31/2032
Pesticides	Atrazine	Water Column	60.0	µg/L	12/31/2032
Pesticides	Bifenthrin	Sediment	0.52	µg/g o.c.	12/31/2032
Pesticides	Chlorpyrifos	Water Column	0.023	µg/L	12/31/2032
Pesticides	Chlorpyrifos	Sediment	1.77	µg/g o.c.	12/31/2032
Pesticides	Clothianidin	Water Column	0.05	µg/L	12/31/2032
Pesticides	Cyanazine	Water Column	27.0	µg/L	12/31/2032
Pesticides	Cyfluthrin	Sediment	1.08	µg/g o.c.	12/31/2032
Pesticides	Cypermethrin	Sediment	0.38	µg/g o.c.	12/31/2032
Pesticides	Danitol (fenpropathrin)	Sediment	1.10	µg/g o.c.	12/31/2032
Pesticides	Demeton-s-methyl sulfoxide (oxydemeton-methyl)	Water Column	46	µg/L	12/31/2032
Pesticides	Diazinon	Water Column	0.105	µg/L	12/31/2032
Pesticides	Dichlorvos	Water Column	0.0058	µg/L	12/31/2032
Pesticides	Dimethoate	Water Column	0.50	µg/L	12/31/2032
Pesticides	Dinotefuran	Water Column	23.5	µg/L	12/31/2032
Pesticides	Disulfoton (Disyton)	Water Column	0.01	µg/L	12/31/2032
Pesticides	Diuron	Water Column	80.0	µg/L	12/31/2032
Pesticides	Esfenvalerate	Sediment	1.54	µg/g o.c.	12/31/2032
Pesticides	Fenvalerate	Sediment	1.54	µg/g o.c.	12/31/2032
Pesticides	Glyphosate	Water Column	26,600	µg/L	12/31/2032
Pesticides	Imidacloprid	Water Column	0.01	µg/L	12/31/2032
Pesticides	Cyhalothrin, lambda	Sediment	0.45	µg/g o.c.	12/31/2032
Pesticides	Linuron	Water Column	0.09	µg/L	12/31/2032
Pesticides	Malathion	Water Column	0.049	µg/L	12/31/2032
Pesticides	Methamidophos	Water Column	4.50	µg/L	12/31/2032
Pesticides	Methidathion	Water Column	0.66	µg/L	12/31/2032

Constituent Group	Constituent	Matrix	Limit[1]	Units[2]	Compliance Date
Pesticides	Paraquat	Water Column	< 36.9	µg/L	12/31/2032
Pesticides	Parathion-methyl	Water Column	0.25	µg/L	12/31/2032
Pesticides	Permethrin	Sediment	10.83	µg/g o.c.	12/31/2032
Pesticides	Phorate	Water Column	0.21	µg/L	12/31/2032
Pesticides	Phosmet	Water Column	0.80	µg/L	12/31/2032
Pesticides	Simazine	Water Column	40.0	µg/L	12/31/2032
Pesticides	Thiacloprid	Water Column	0.97	µg/L	12/31/2032
Pesticides	Thiamethoxam	Water Column	0.74	µg/L	12/31/2032
Pesticides	Trifluralin	Water Column	2.40	µg/L	12/31/2032
Toxicity	Sediment Toxicity	Sediment	No significant effect based on chronic or acute toxicity to applicable test organism	Survival, growth, and reproduction endpoints[3]	12/31/2032
Toxicity	Water Column Toxicity	Water Column	No significant effect based on chronic or acute toxicity to applicable test organism	Survival, growth, and reproduction endpoints[3]	12/31/2032
Toxicity	Toxic Units	Sediment	Sum of additive toxicity ≤ 1	Toxic Unit (TU)[4]	12/31/2032
Toxicity	Toxic Units	Water Column	Sum of additive toxicity ≤ 1	Toxic Unit (TU)[4]	12/31/2032

[1]Attachment A to this Order describes the sources of the limits established in this table.
[2]µg/L is micrograms per liter; µg/kg is micrograms per kilogram; ng/g is nanograms per gram; o.c. means normalized for sediment organic carbon content; ppb is parts per million.
[3]Toxicity determinations will be pass/fail based on a comparison of the test organism's response (survival, growth, and reproduction) to the water sample compared to the control using the Test of Significant Toxicity (TST statistical approach), or a statistical t-test, based on the toxicity provisions in the State Water Board *Water Quality Control Plan for Inland Surface Waters, Enclosed Bays, and Estuaries in California* (in draft). If a sample is declared "fail" (i.e., toxic) for any endpoint, then the limit is not met. The most sensitive test species for each constituent must be used when evaluating toxicity.
[4]Toxic units (TU) and/or additive toxicity units are calculated using the relevant biological indicators, e.g. LC50, CCC, or CMC as follows: Calculate additive toxicity for organophosphate pesticides in non-TMDL watersheds as defined in the TMDL for Chlorpyrifos and Diazinon in the Lower Salinas River Watershed; and calculate TUs for pyrethroid pesticides in non-TMDL watersheds as defined in the TMDL for Sediment Toxicity and Pyrethroids in the Lower Salinas River Watershed.

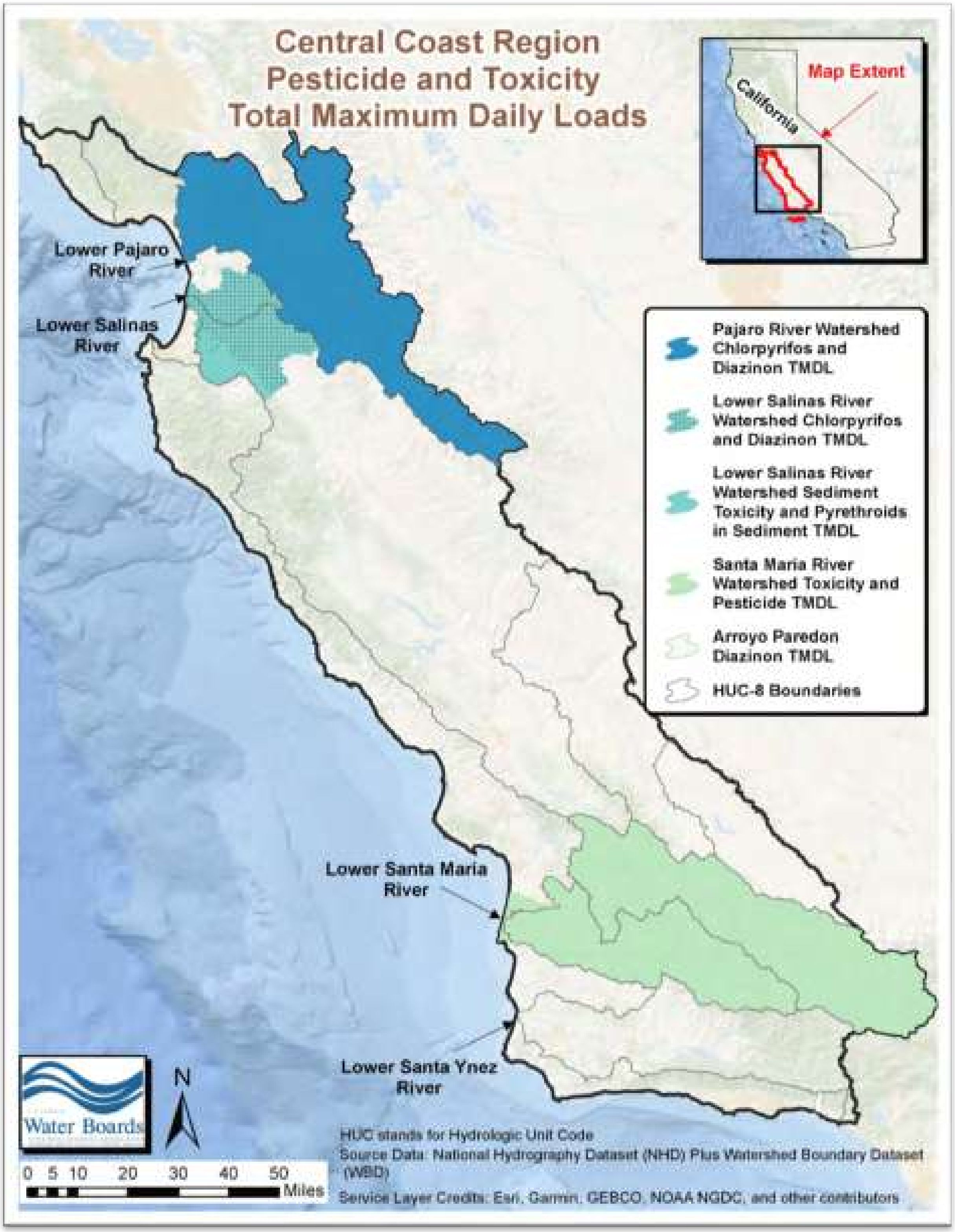


Figure C.3-3: Pesticide and Toxicity TMDL Areas

Table C.3-6. Compliance Dates for Sediment Limits (TMDL areas)

TMDL Project Name	Constituent	Limit[1]	Units	Compliance Date
Morro Bay Sediment TMDL	Sediment	285 – 6,662	Tons of sediment per year	12/3/2053
Pajaro River Watershed Sediment TMDL	Sediment	447 – 4,114	Tons of sediment per year	11/27/2051

[1]The Morro Bay Sediment TMDL and Pajaro River Watershed Sediment TMDL include load allocations for specific waterbody reaches within the TMDL project area. The limits for those TMDLs are summarized in this table as ranges; however, the exact load allocation values for each reach apply as described in the TMDL and Basin Plan and will be assessed as numeric limits for the purposes of this Order.

Table C.3-7. Compliance Dates for Turbidity Limits (Non-TMDL areas)

Constituent Group	Constituent	Beneficial Use	Limit	Units[1]	Compliance Date
Physical Parameters and General Chemistry	Turbidity	WARM	40.0	NTU	12/31/2032
Physical Parameters and General Chemistry	Turbidity	COLD	25.0	NTU	12/31/2032

[1]NTU is nephelometric turbidity units

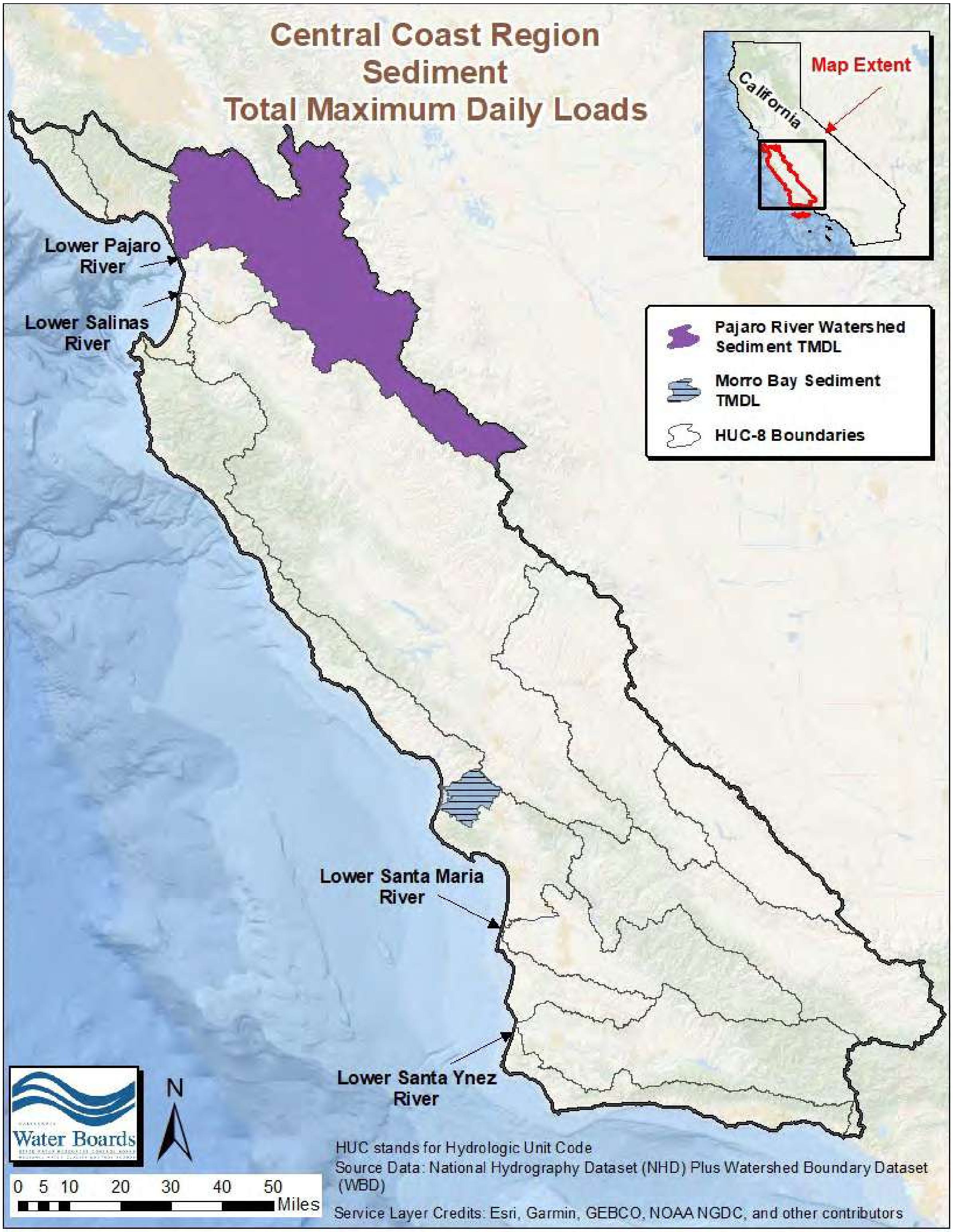


Figure C.3-4: Sediment TMDL Areas

Chapter 7

Appendix 7-F

Interconnected Surface Water Monitoring Network

MONTGOMERY & ASSOCIATES

APPENDIX 7F

INTERCONNECTED SURFACE WATER MONITORING NETWORK

The interconnected surface water (ISW) monitoring network in the Salinas Valley Groundwater Basin is based on the approach recommended by the Environmental Defense Fund (EDF, 2018), which uses groundwater elevations as surrogates for streamflow depletion rates. EDF notes that the change in hydraulic gradient between stream stage and surrounding groundwater elevations is representative of variance in interconnection between surface water and groundwater. Thus, monitoring the gradient also monitors interconnection. The gradient will be monitored by measured shallow groundwater elevations.

The ISW monitoring network focuses on adding wells near USGS stream gauges and MCWRA River Series measurement sites, as shown in Figure 1. Existing wells from the MCWRA's groundwater elevation monitoring programs will be used for the ISW monitoring network. Criteria for selecting an existing monitoring well include (1) a total well depth of approximately 200 feet or less, and (2) recent (post-2014) measured groundwater elevations that are shallow (generally about 30 feet below land surface). SVBGSA has identified 11 existing monitoring wells that fit these criteria, shown in Figure 1. Where possible, an individual monitoring well should be located between the ISW and any pumping centers, and at a distance away from the Salinas River and its tributaries so groundwater levels are not strongly driven by surface water flows (EDF, 2018). However, active pumping wells are distributed throughout the Salinas Valley, including in close proximity to ISW locations and existing monitoring wells. Distance from the Salinas River was considered when selecting existing monitoring wells, and review of historical groundwater level and streamflow measurements indicate that groundwater elevations in the selected wells are not strongly driven by surface water flows. Additionally, the lateral and vertical extent of the Salinas Valley Aquitard (SVA) was considered in the selection of existing wells to add to the ISW monitoring network, as the monitoring network only applies to surface water connected to principal aquifers. The SVA separates the shallow sediments from the principal aquifers in most of the 180/400-Foot Aquifer Subbasin and becomes intermittent towards the Monterey and Eastside Aquifer Subbasins. In the 180/400-Foot Aquifer Subbasin, connection is likely between the shallow sediments and the 180-Foot Aquifer where the potential existing monitoring wells are located, based in part on limited lithologic information available from the DWR's Online System for Well Completion Reports. These existing wells provide the best available tools for establishing an initial network for monitoring impacts on ISW from groundwater pumping. SVBGSA is in the process of establishing this monitoring network, and the network will be adjusted during GSP implementation as needed, particularly if any wells are determined to be ineffective or inaccessible for this purpose.

Table 1 provides a summary of the 11 selected wells, their corresponding USGS gauge or MCWRA River Series measurement site, and distance to the Salinas River or its tributaries. SVBGSA will request access from MCWRA to each well's groundwater elevation records and permission to add to the ISW monitoring network.

Table 1. Potential Existing Interconnected Surface Water Monitoring Wells

Well Name	Well Depth (ft)	Reference Point (ft)	Corresponding USGS Stream Gauge/ MCWRA River Series Measurement Site	Subbasin
16S/02E-02D01	106*	285.0	USGS Gauge in El Toro Creek near Spreckels	Monterey – Corral De Tierra
16S/04E-08H01	175	75.4	USGS Gauge in Salinas River near Chualar	180/400-Foot
16S/05E-31P02	115	118.2	River Series Site at Gonzalez	180/400-Foot
17S/06E-33R02	120	194.6	USGS Gauge in Salinas River at Soledad USGS Gauge in Arroyo Seco below Reliz Creek near Soledad	Forebay
18S/06E-03P01	195	189.0	USGS Gauge in Salinas River at Soledad USGS Gauge in Arroyo Seco below Reliz Creek near Soledad	Forebay
18S/07E-32G02	150	252.0	River Series Site at Greenfield	Forebay Aquifer
19S/07E-14H01	200	261.0	N/A (in Upper Valley near border with Forebay)	Upper Valley
20S/08E-07F01	189	292.4	River Series Site at King City	Upper Valley
21S/09E-16E01	100	358.0	River Series Site at San Lucas	Upper Valley
22S/10E-16P01	178	425.0	N/A (in between Bradley USGS Gauge and San Lucas River Series Site)	Upper Valley
23S/10E-14D01	142	462.7	USGS Gauge in Salinas River near Bradley	Upper Valley

*No well depth available, instead the depth of the bottom of screen interval is provided.

MONTGOMERY & ASSOCIATES

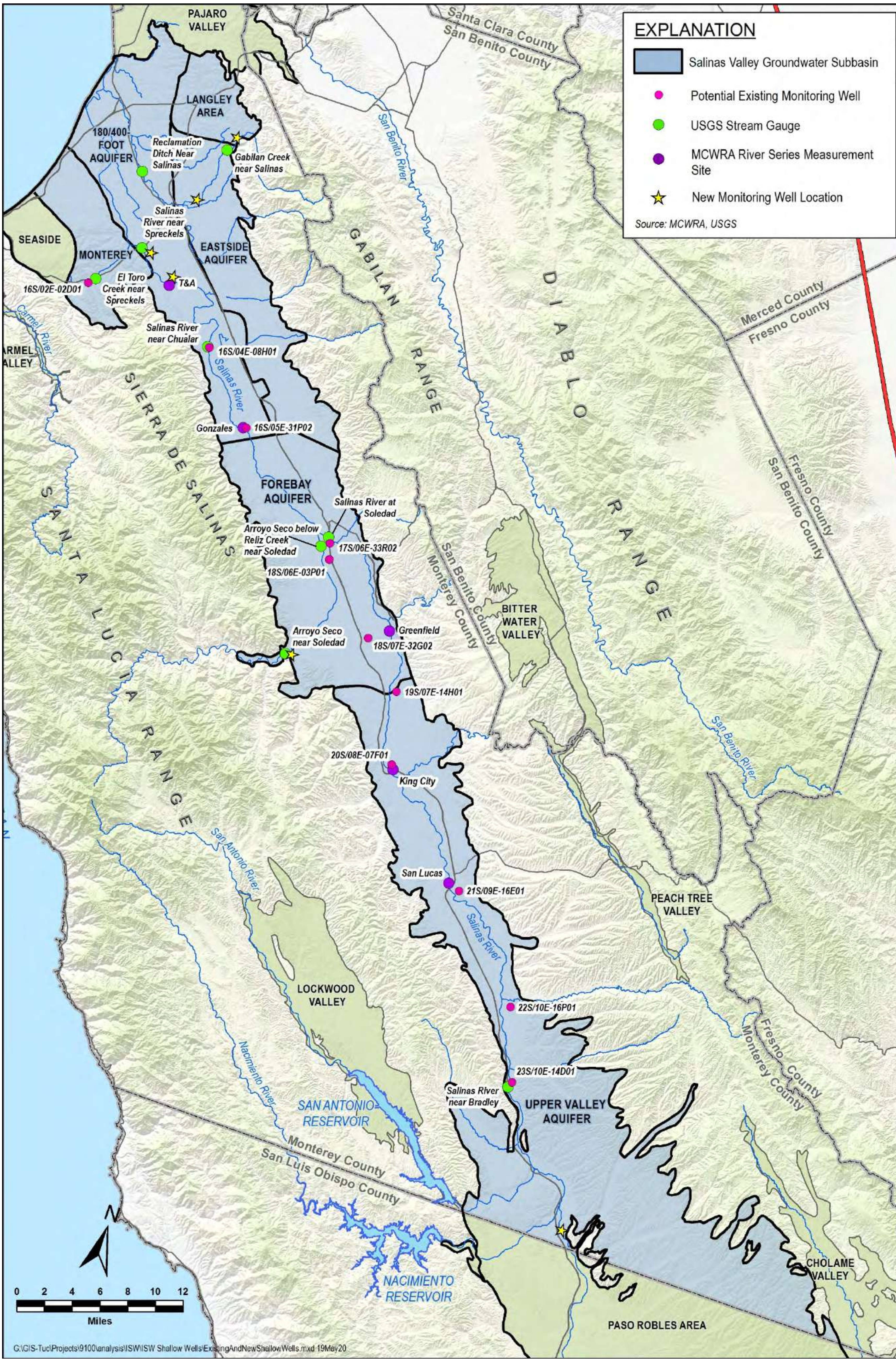


Figure 1. Locations of USGS Stream Gauges, MCWRA River Series Measurement Sites, Potential Existing Interconnected Surface Water Monitoring Wells, and Proposed New Interconnected Surface Water Monitoring Wells

Data gaps in the ISW monitoring network exist despite the identification of 11 existing monitoring wells. The SVBGSA will install new wells to fill these data gaps, as shown in Figure 1. As mentioned in the 180/400-Foot Aquifer Subbasin GSP, SVBGSA will drill and install up to two new wells for ISW monitoring in the Subbasin. SVBGSA will also drill one new shallow groundwater elevation monitoring well in each of the Langley Area, Eastside Aquifer, Forebay Aquifer, and Upper Valley Aquifer Subbasins:

- Langley Area Subbasin: Located along Gabilan Creek, which has a USGS gage located nearby in the Eastside Aquifer Subbasin.
- Eastside Aquifer Subbasin: Located nearby the identified ISW location within the City of Salinas on Natividad Creek, as shown in Chapter 8. This is the only potential location of ISW in the Eastside Subbasin.
- Forebay Aquifer Subbasin: Located along the upper Arroyo Seco, near the USGS gage on the Arroyo Seco. This area is a potential steelhead refugia.
- Upper Valley Aquifer Subbasin: Located along the Salinas River near the southern boundary of the basin, upstream of the San Antonio and Nacimiento Rivers.

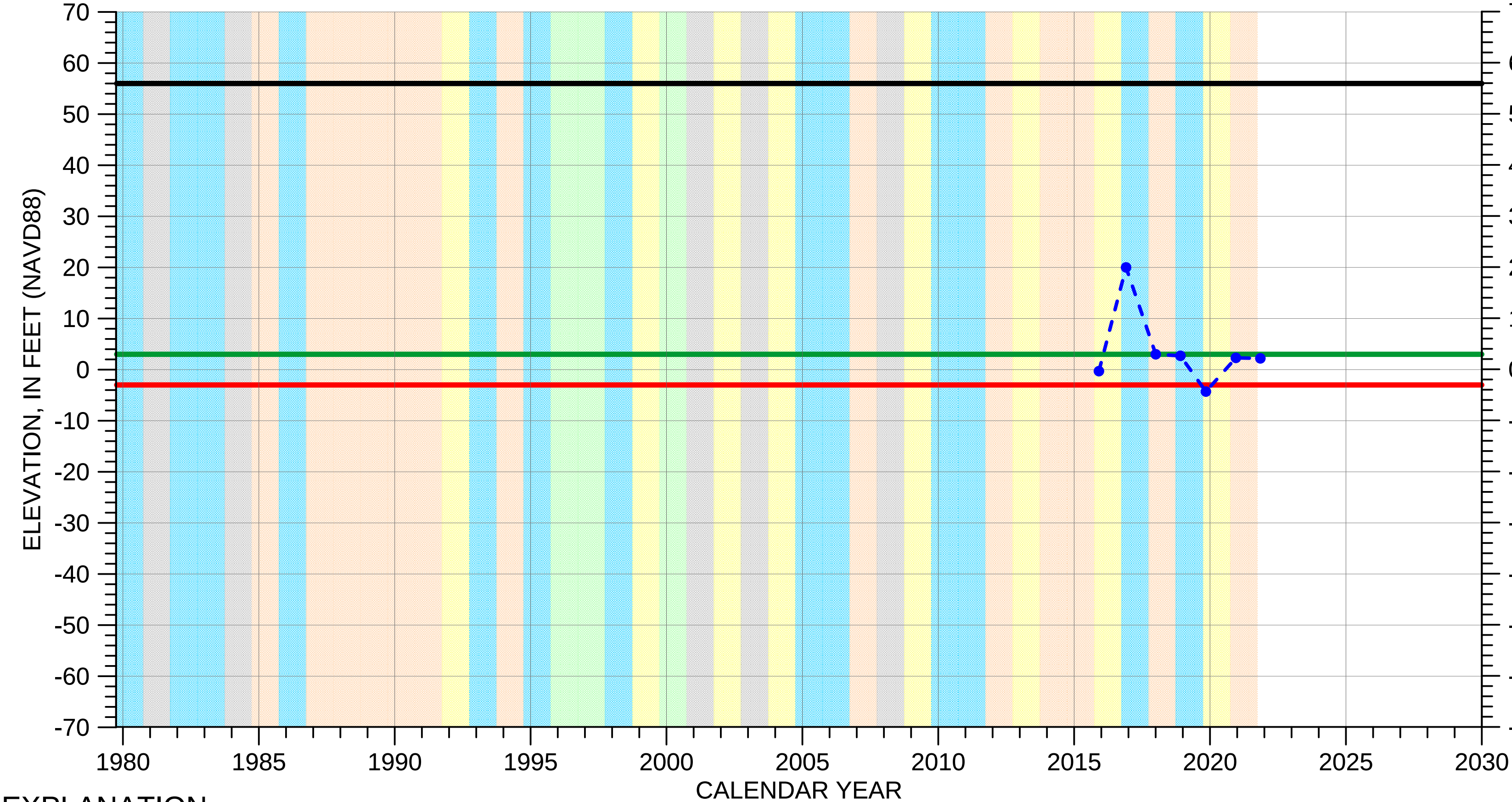
If feasible, the new ISW monitoring wells will be installed in conjunction with the new wells needed to fill the data gaps in the groundwater elevation monitoring networks in the 180/400-Foot Aquifer, Langley Area, and Upper Valley Aquifer Subbasins that are discussed in Chapter 7.

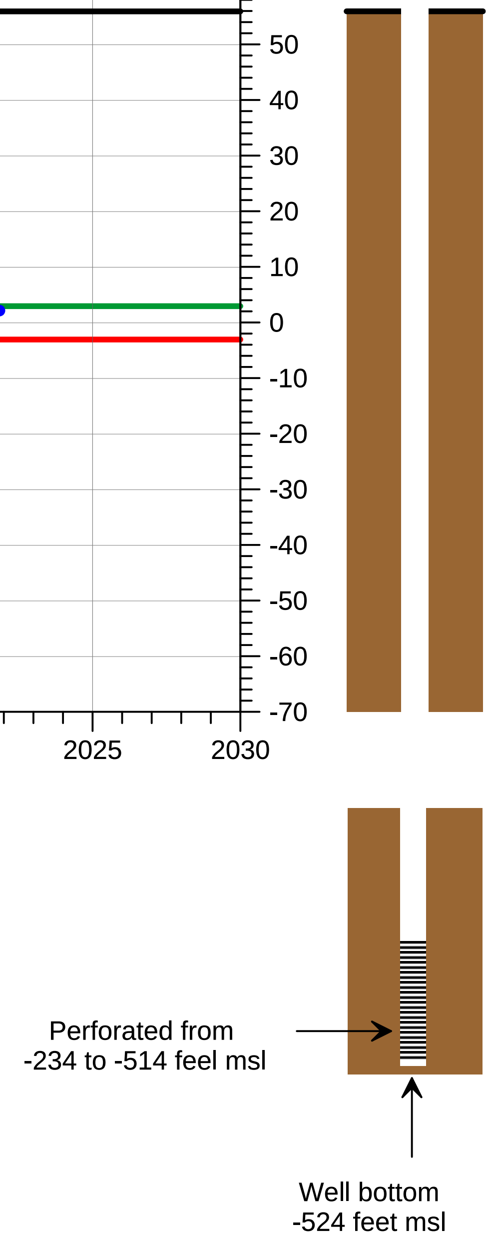
Chapter 8
Appendix 8-A

Hydrographs with Minimum Thresholds and Measurable Objectives

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 12S/02E-33H02

180/400-Foot Aquifer Subbasin



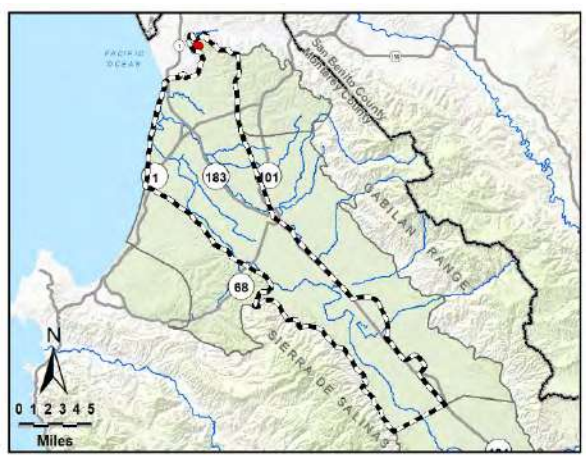


EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

WATER YEAR TYPE DESIGNATION

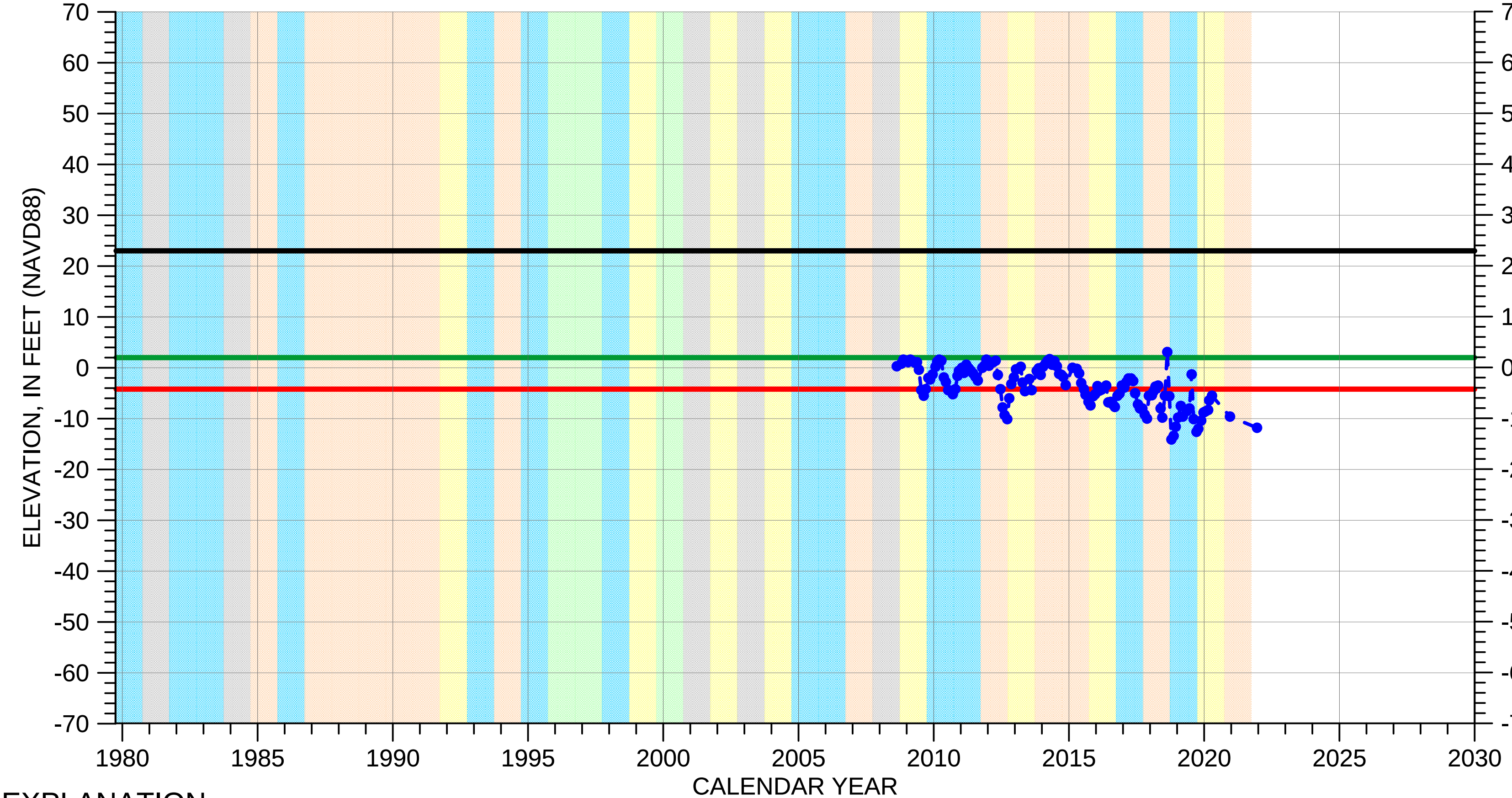
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET



\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch8\12S_02E-33H02.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 13S/01E-36J02

180/400-Foot Aquifer Subbasin

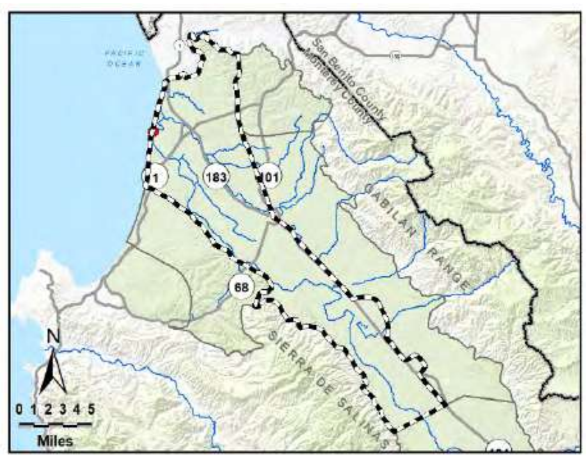


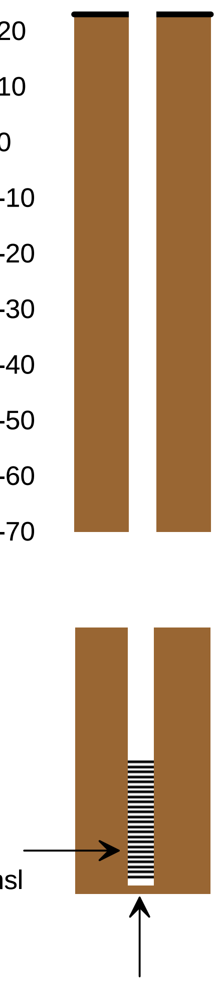
EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

WATER YEAR TYPE DESIGNATION

- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

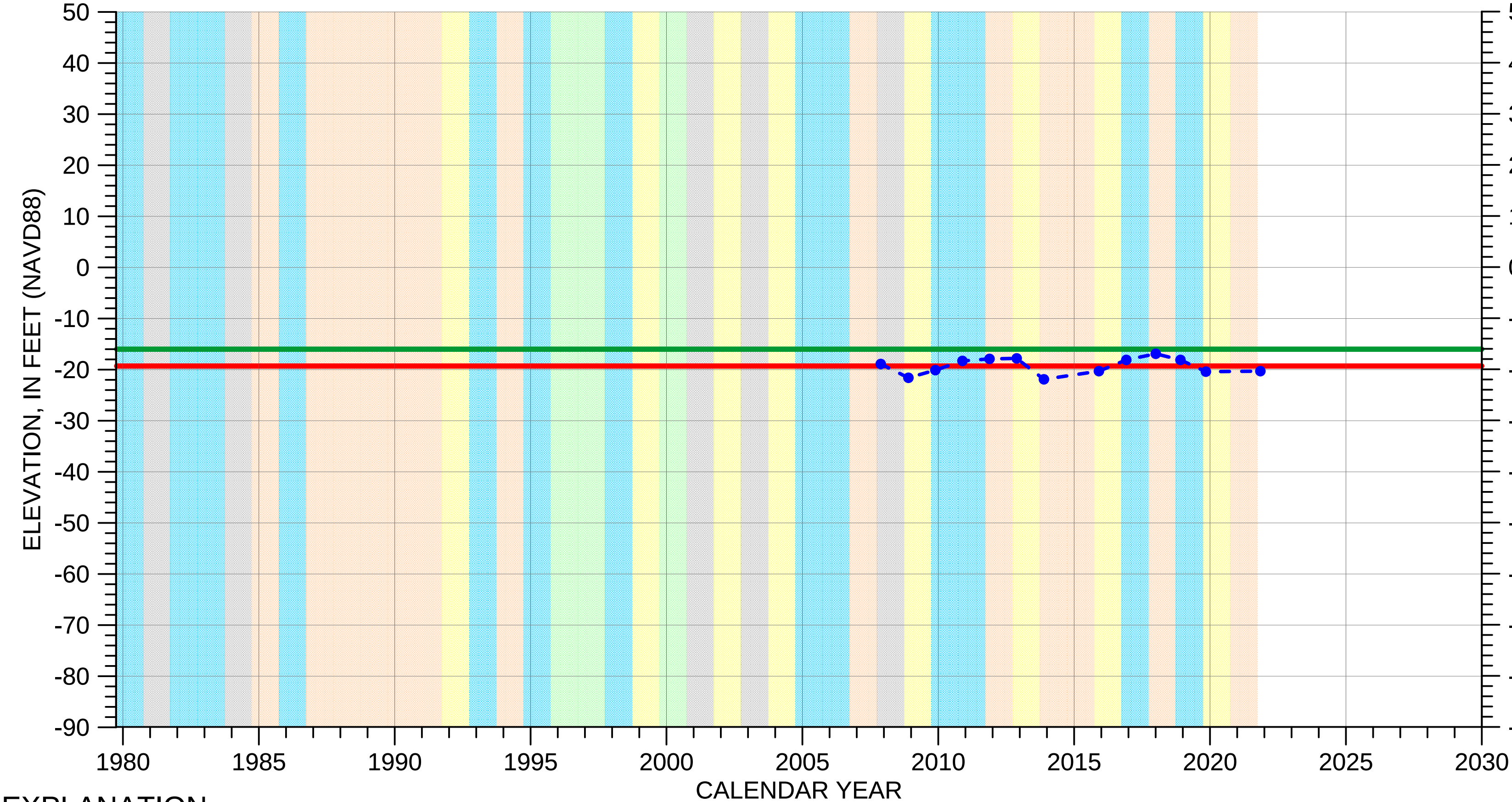


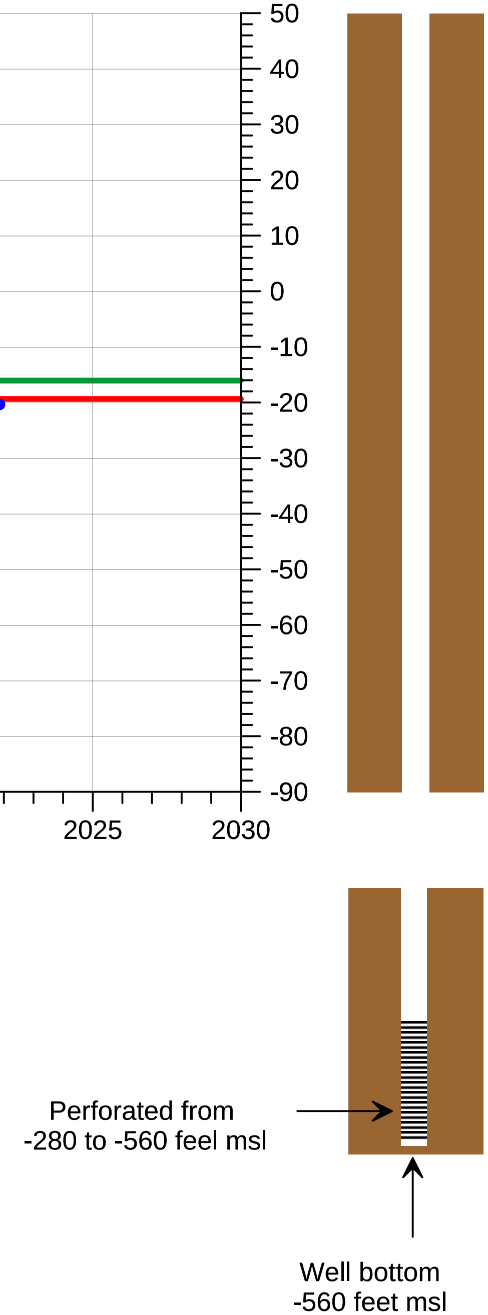


\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRA\NEWGRFs_Ch8\13S_01E-36J02.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 13S/02E-10K01

180/400-Foot Aquifer Subbasin



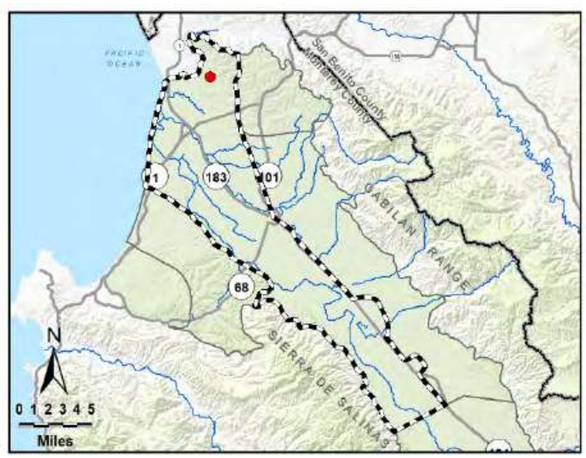


EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface (100 FT MSL)
- Measurable Objective
- Minimum Threshold

WATER YEAR TYPE DESIGNATION

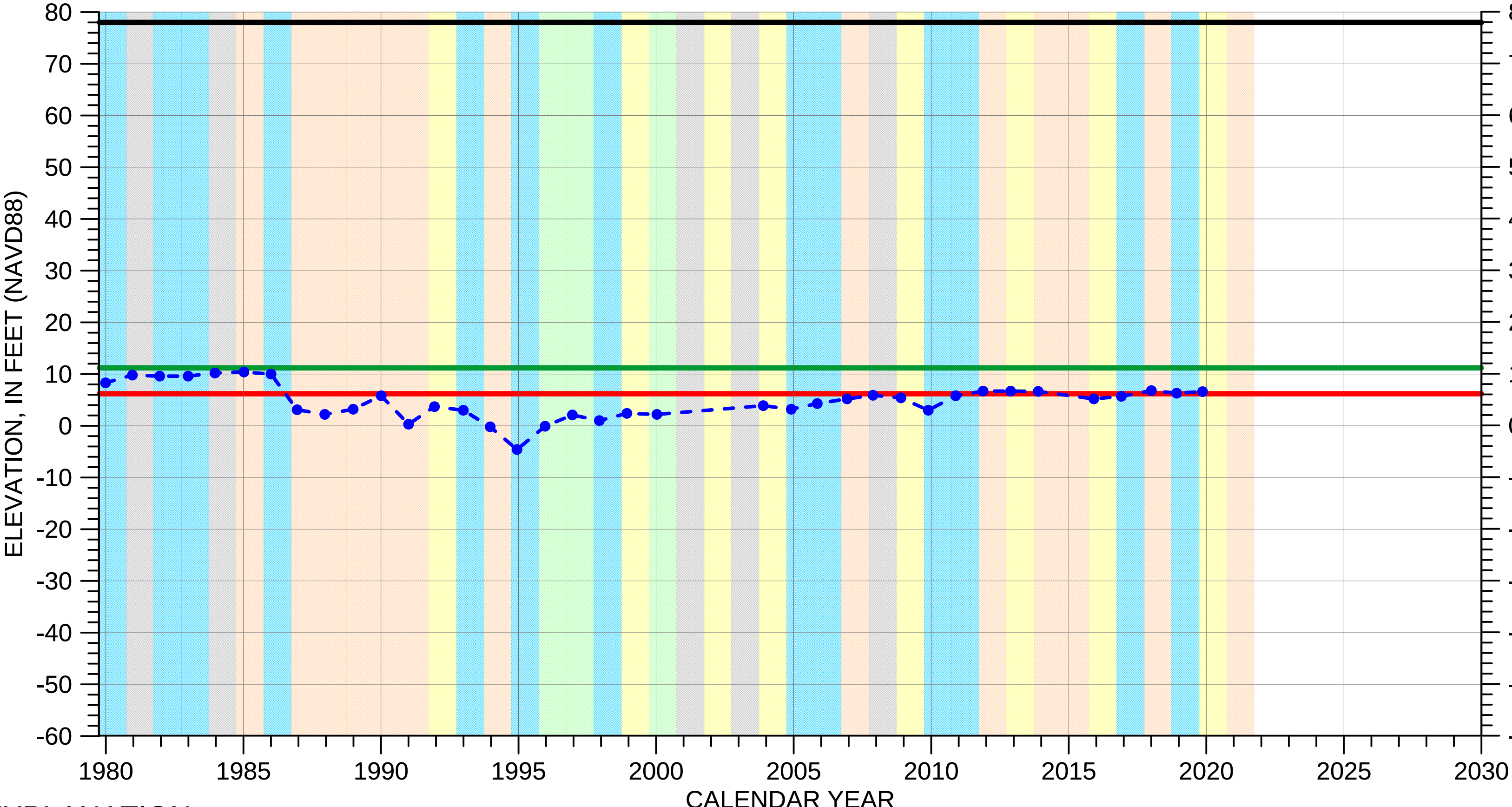
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET



\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRA\NEWGRFs_Ch8\13S_02E-10K01.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 13S/02E-13N01

180/400-Foot Aquifer Subbasin



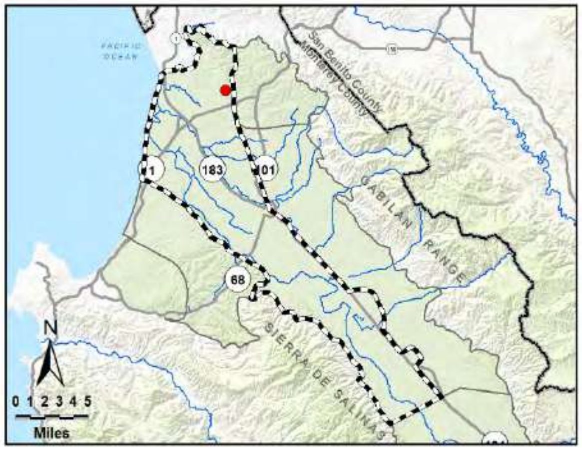
\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch813S_02E-13N01.grf

EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

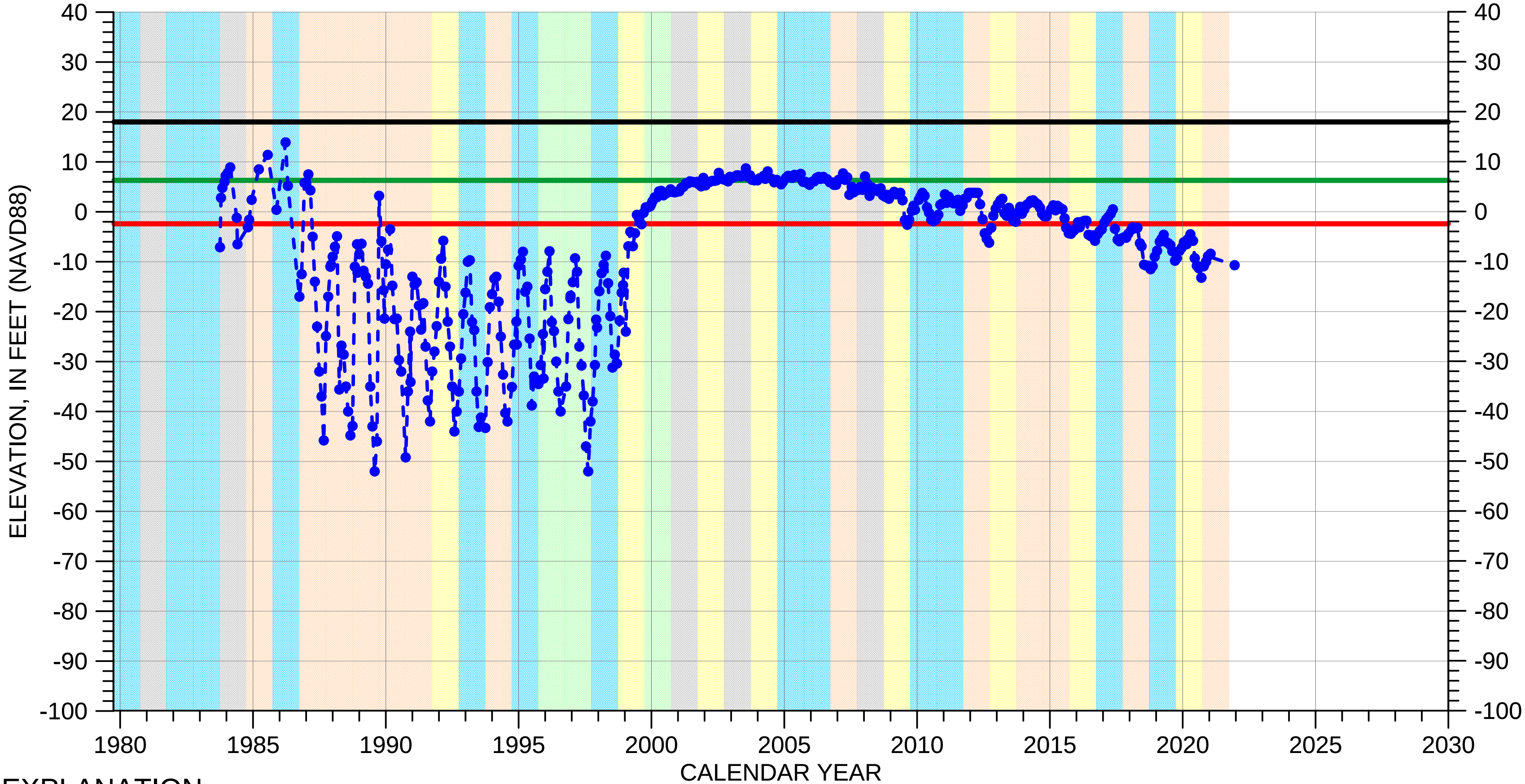
WATER YEAR TYPE DESIGNATION

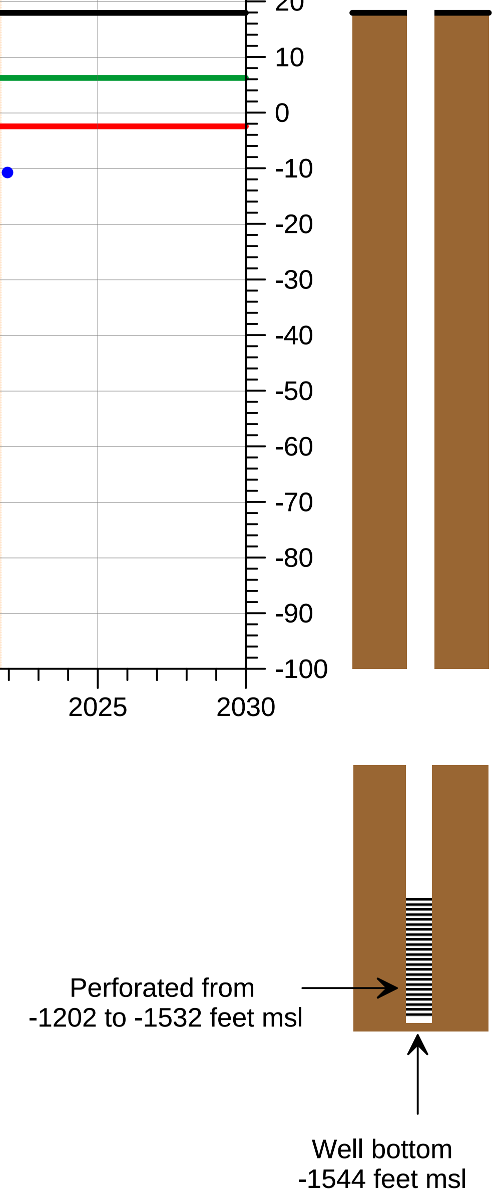
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET



HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 13S/02E-19Q03

180/400-Foot Aquifer Subbasin



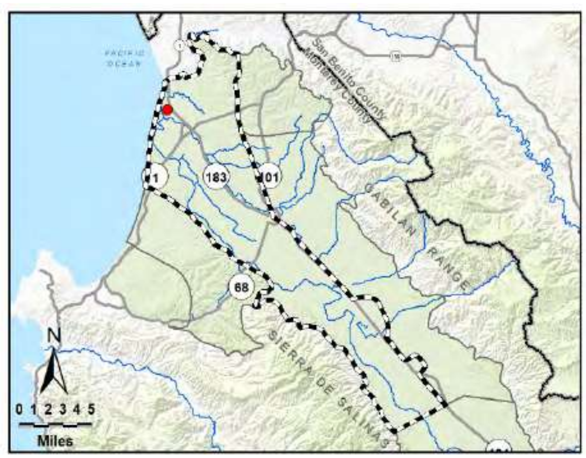


EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

WATER YEAR TYPE DESIGNATION

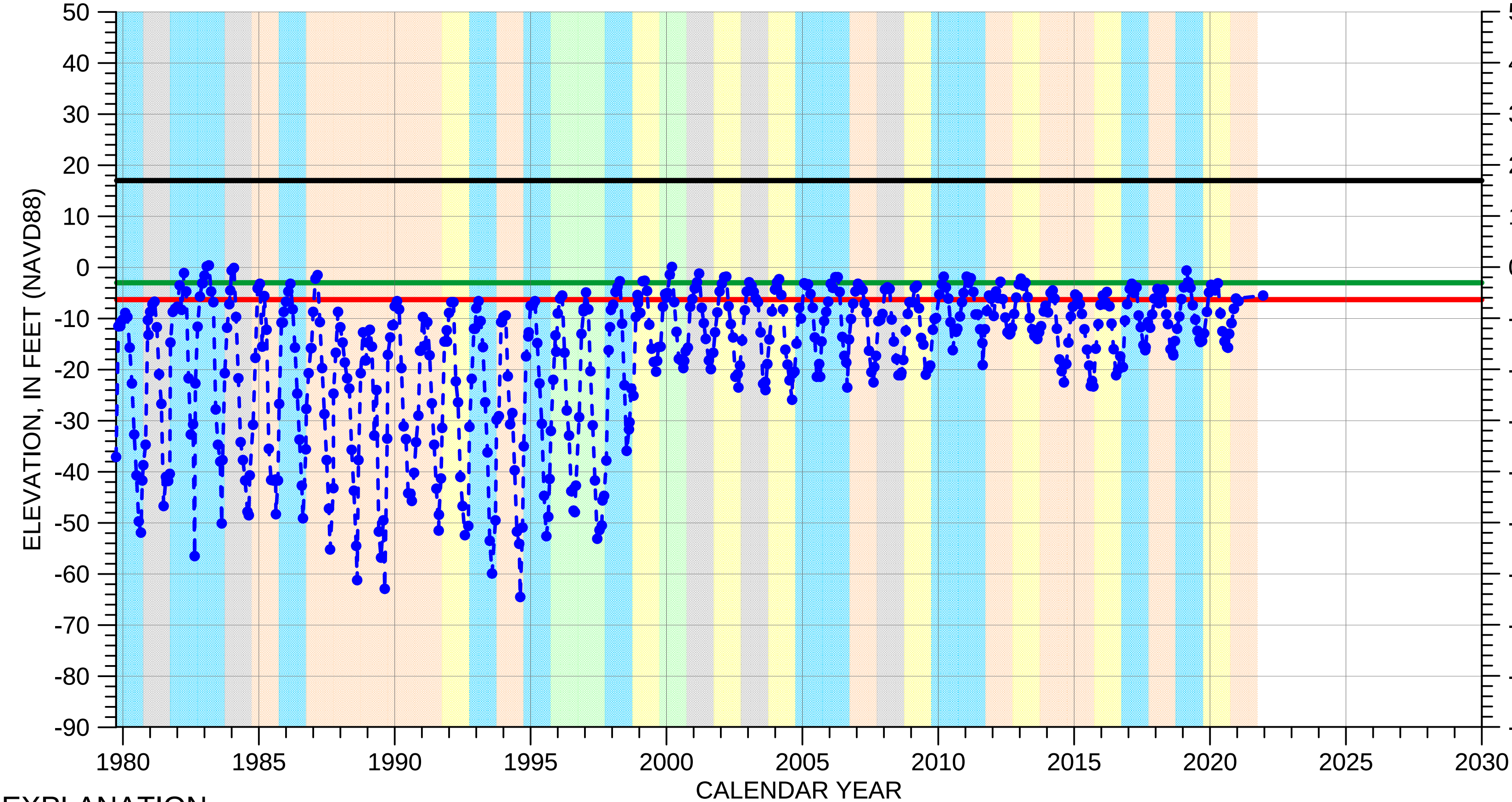
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

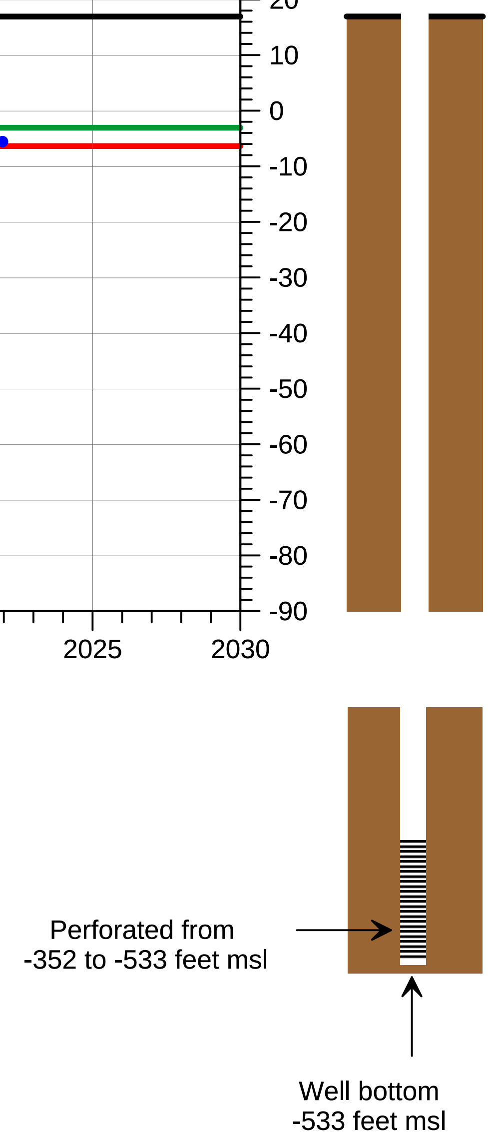


\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch8\13S_02E-19Q03.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 13S/02E-21N01

180/400-Foot Aquifer Subbasin



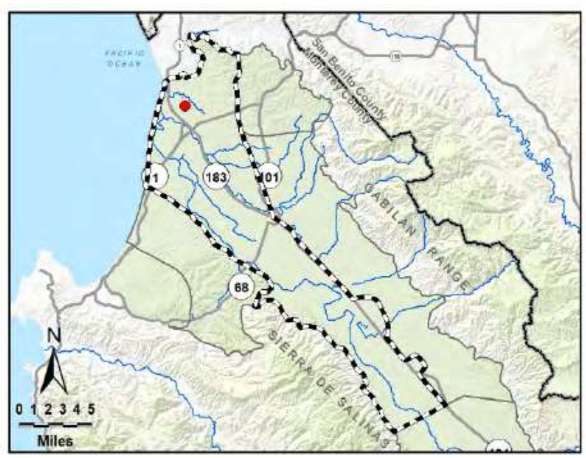


EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

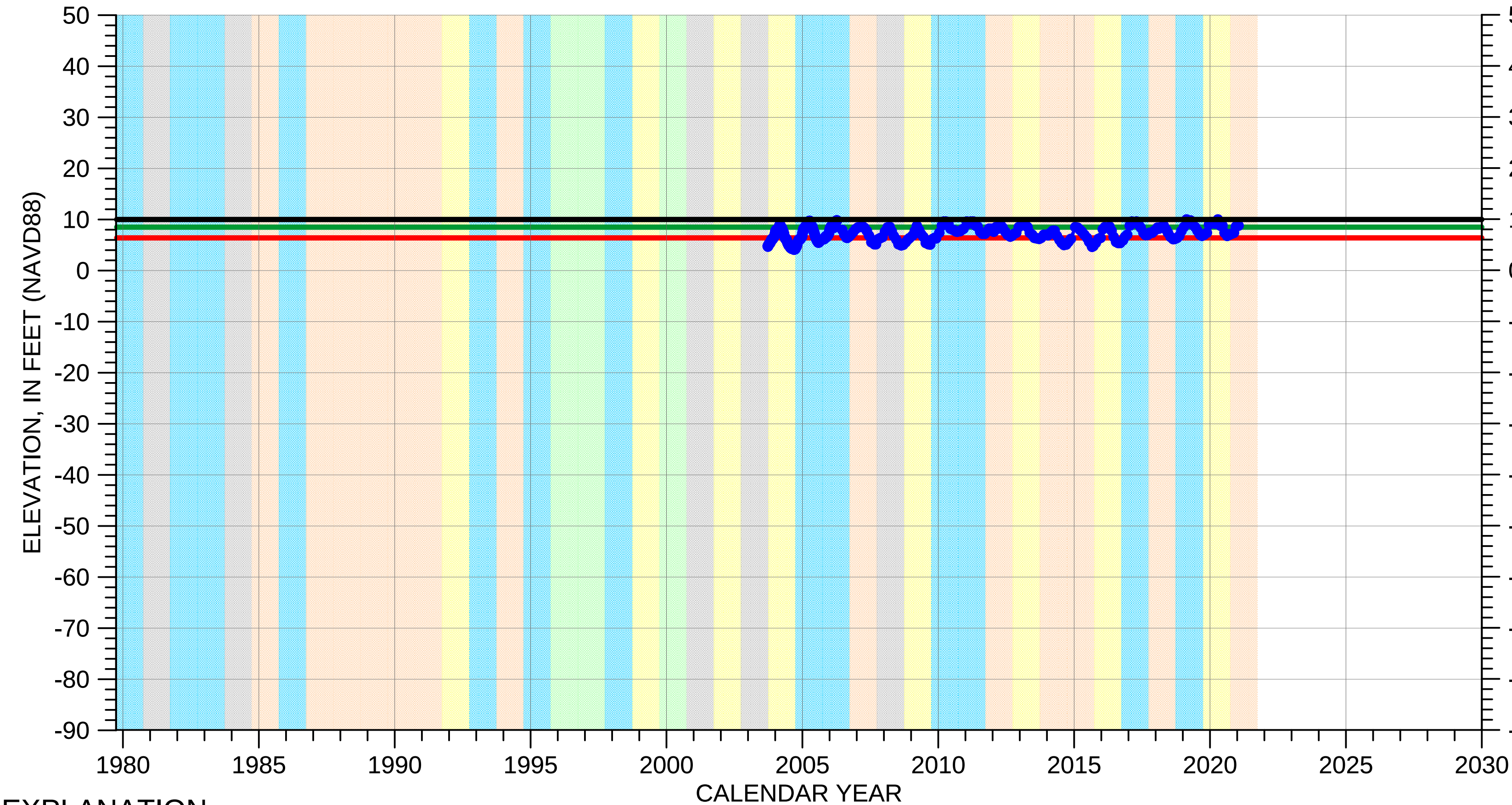
WATER YEAR TYPE DESIGNATION

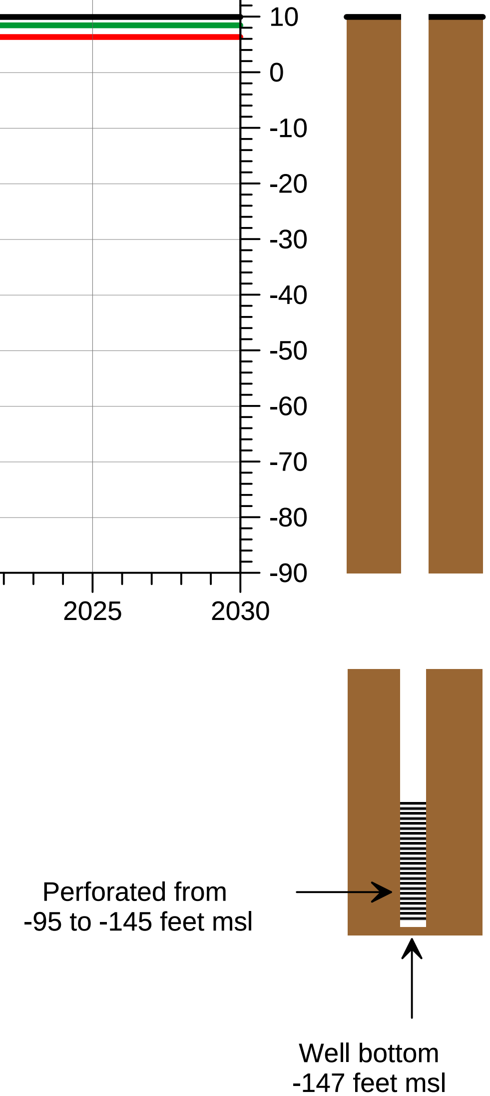
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET



\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch813S_02E-21N01.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 13S/02E-21Q01 180/400-Foot Aquifer Subbasin





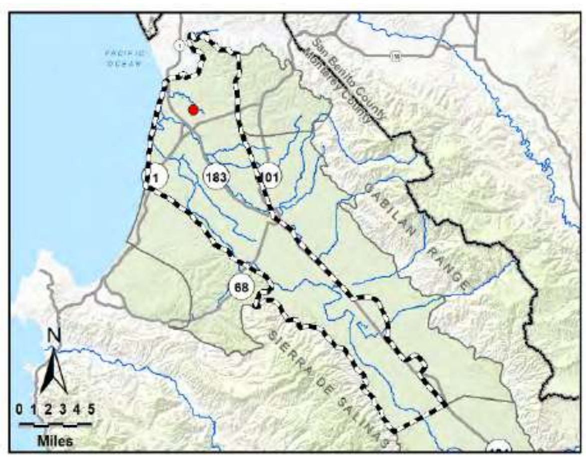
\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEW\GRFs_Ch8\13S_02E-21Q01.grf

EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

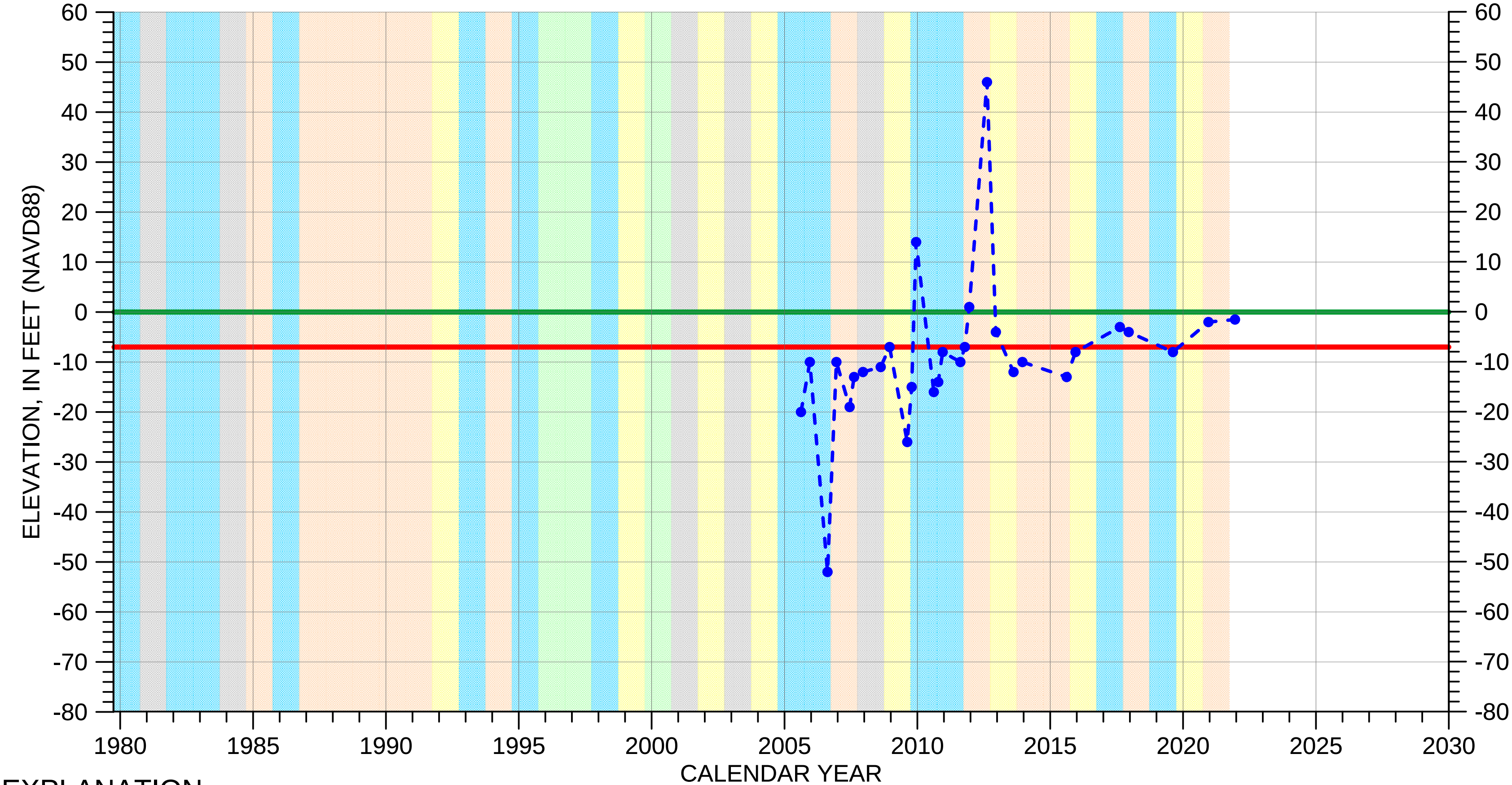
WATER YEAR TYPE DESIGNATION

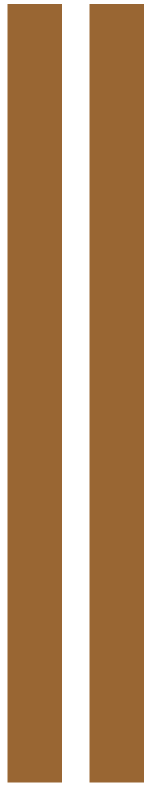
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET



HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 13S/02E-24N01

180/400-Foot Aquifer Subbasin



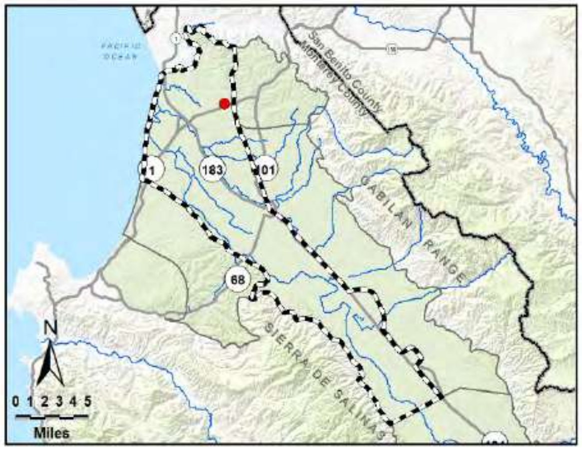


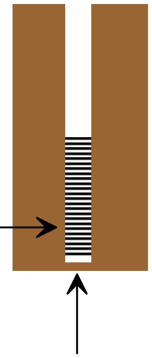
EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface (162 FT MSL)
- Measurable Objective
- Minimum Threshold

WATER YEAR TYPE DESIGNATION

- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

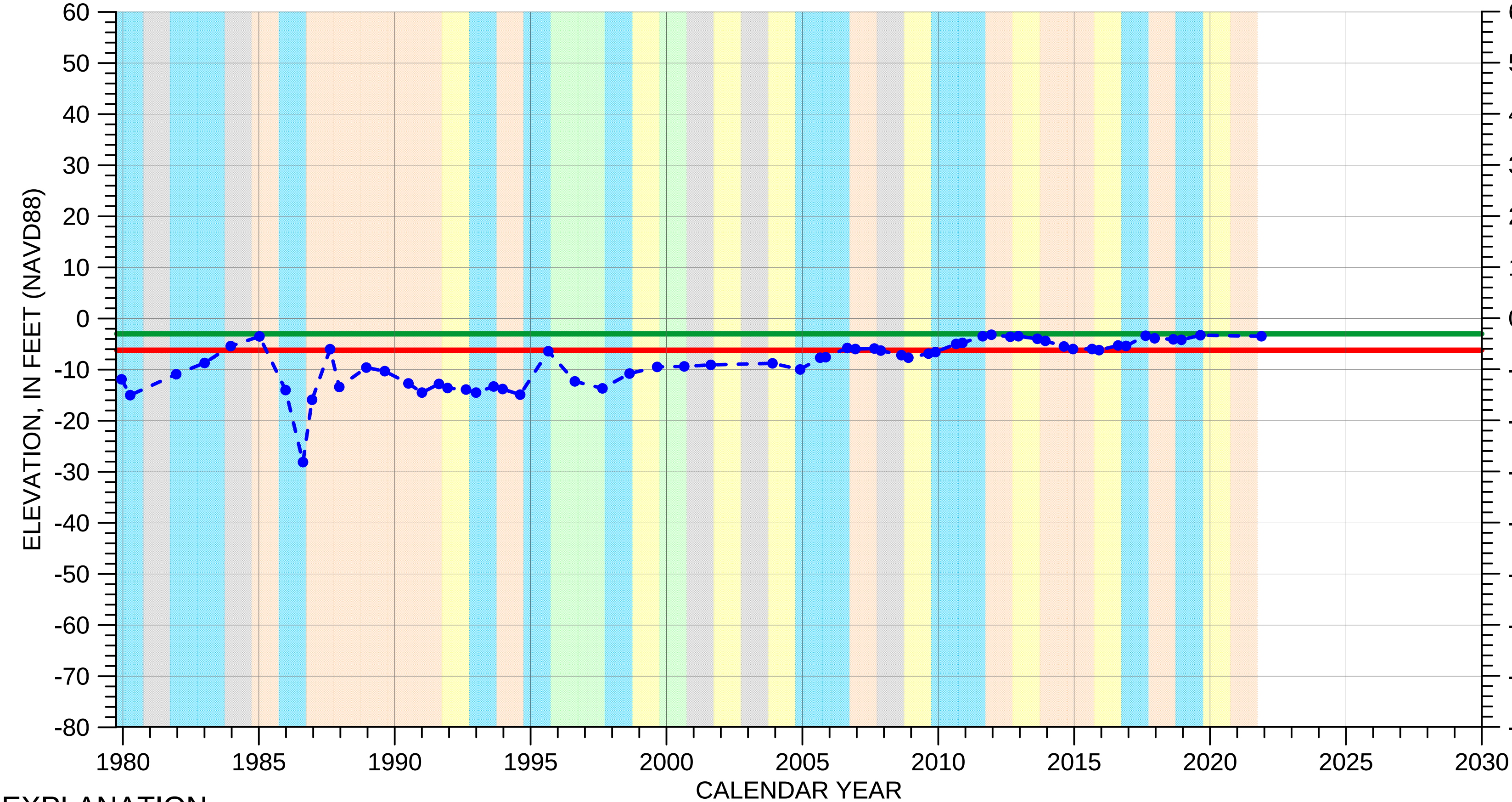




\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRA\NEW\GRFs_Ch8\13S_02E-24N01.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 13S/02E-26L01

180/400-Foot Aquifer Subbasin

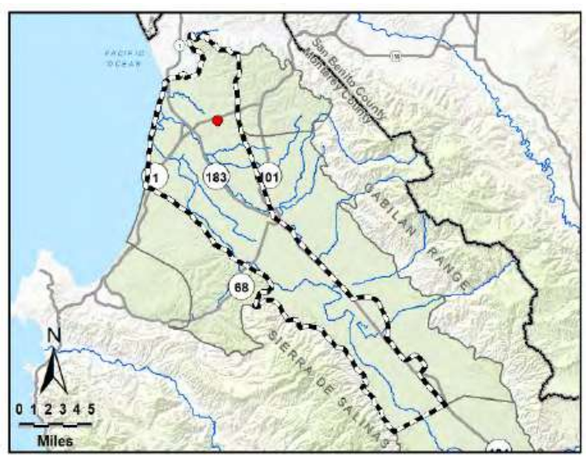


EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface (109 FT MSL)
- Measurable Objective
- Minimum Threshold

WATER YEAR TYPE DESIGNATION

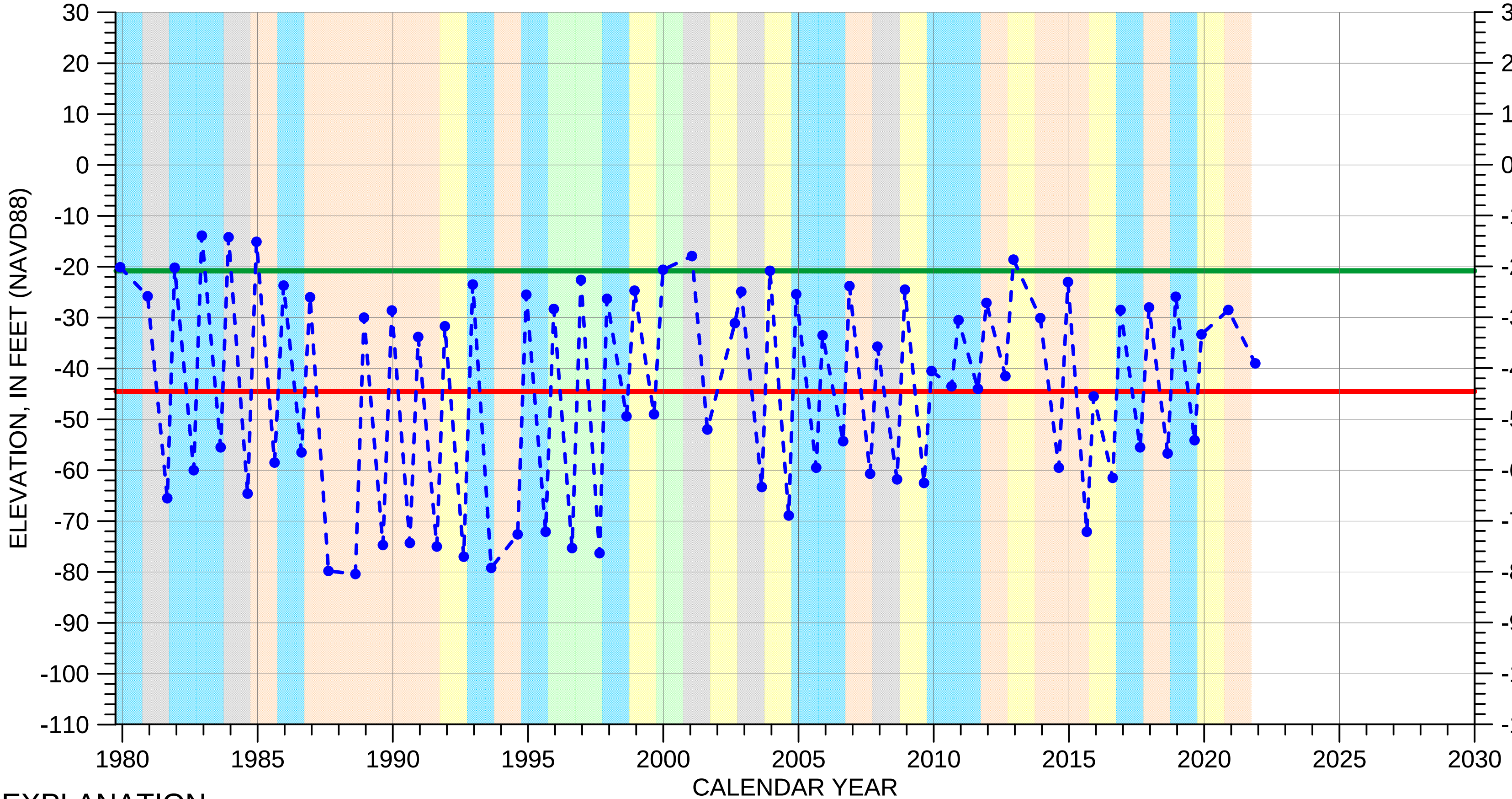
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET



\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch8\13S_02E-26L01.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 13S/02E-27P01

180/400-Foot Aquifer Subbasin

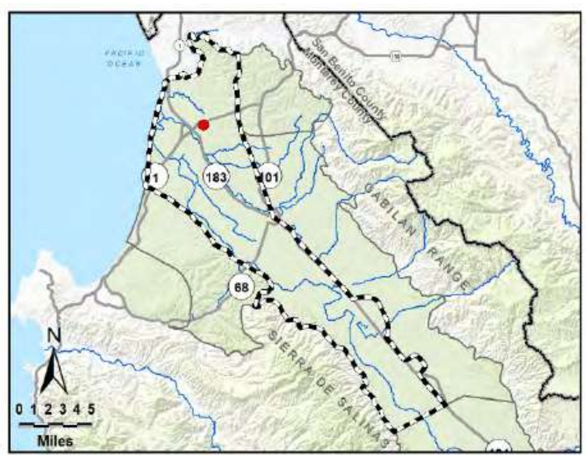


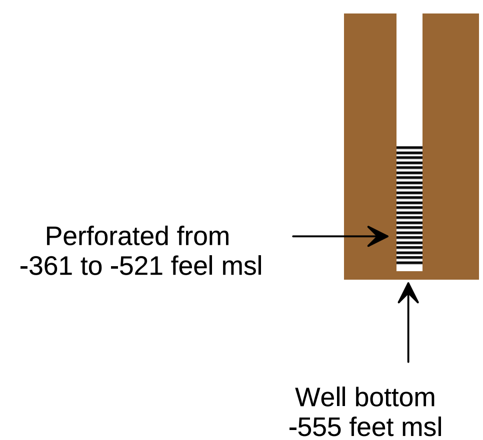
EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface (55 FT MSL)
- Measurable Objective
- Minimum Threshold

WATER YEAR TYPE DESIGNATION

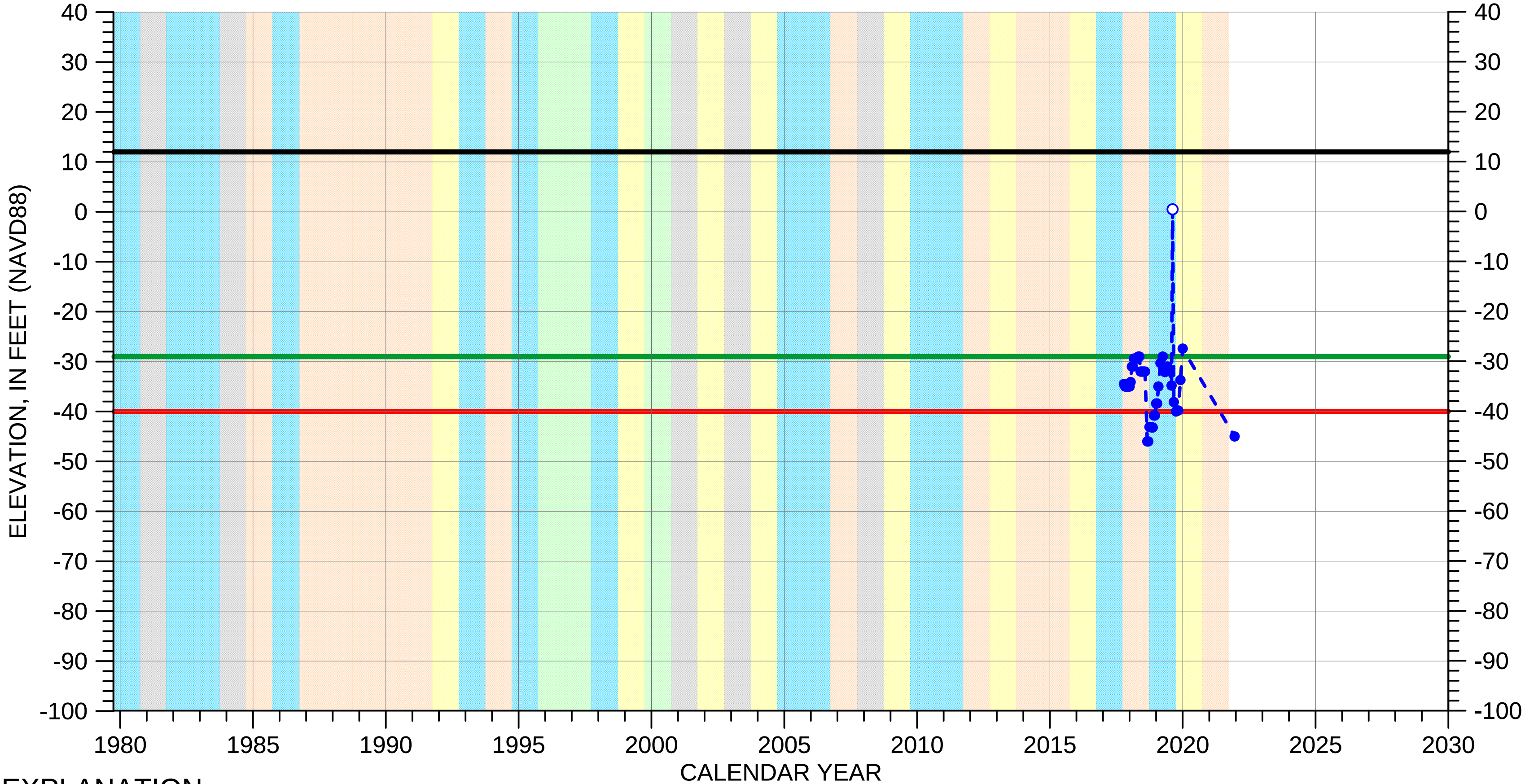
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

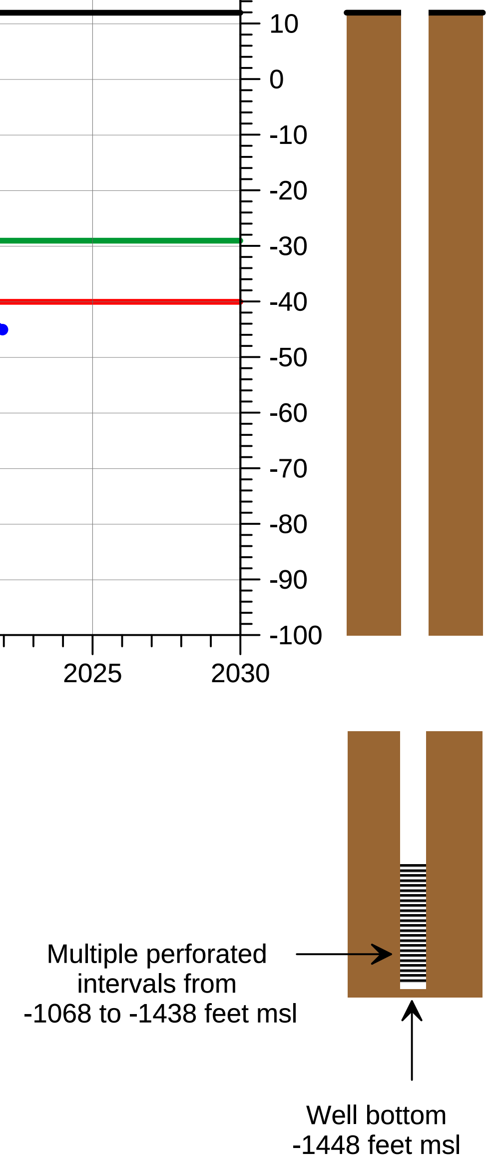




HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 13S/02E-28L03

180/400-Foot Aquifer Subbasin



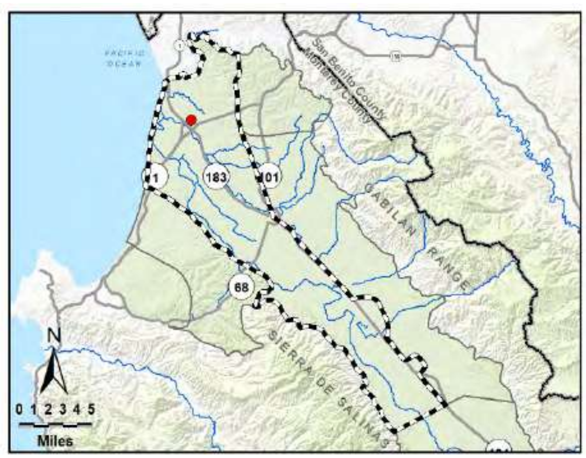


EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

WATER YEAR TYPE DESIGNATION

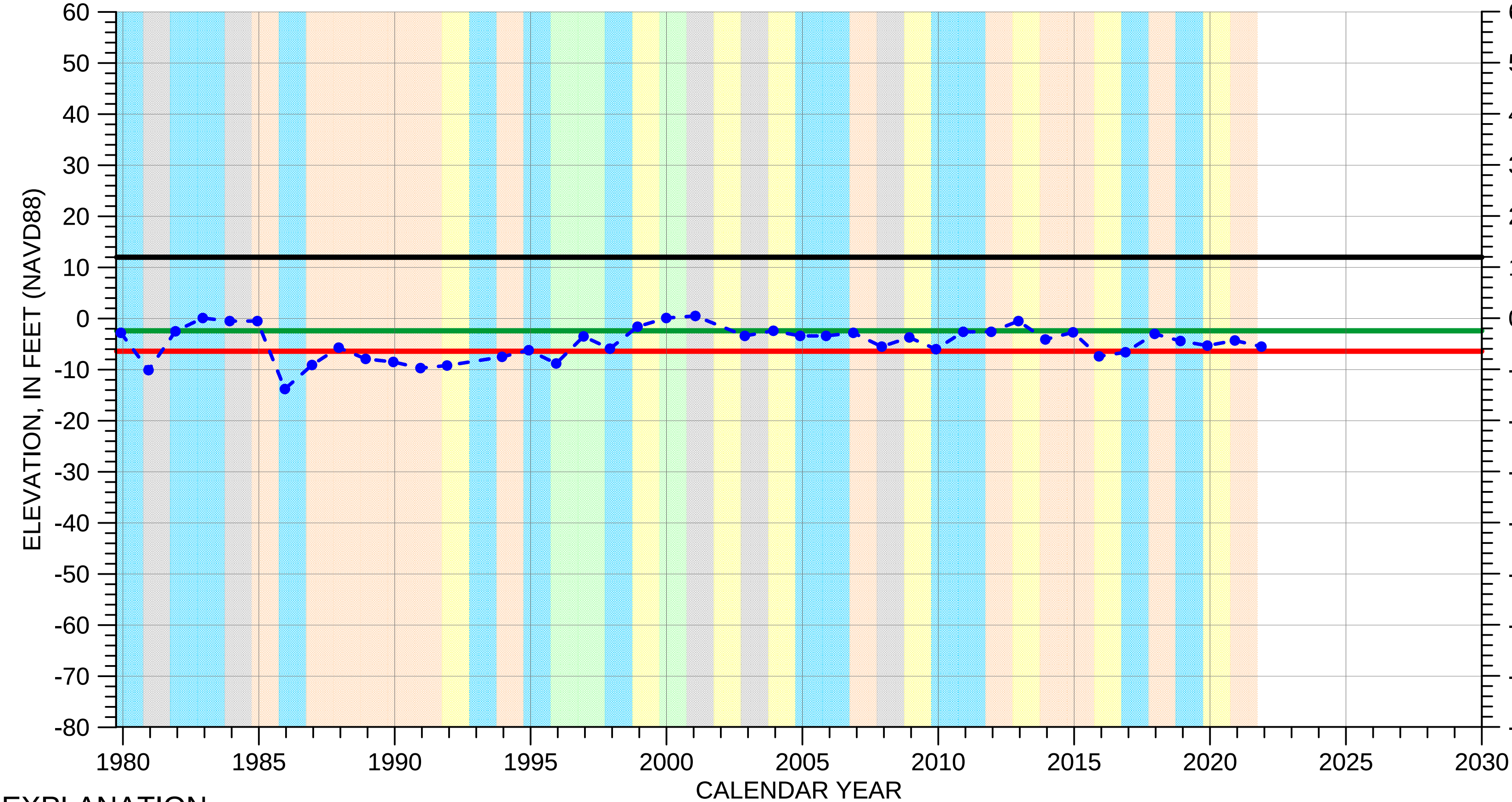
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

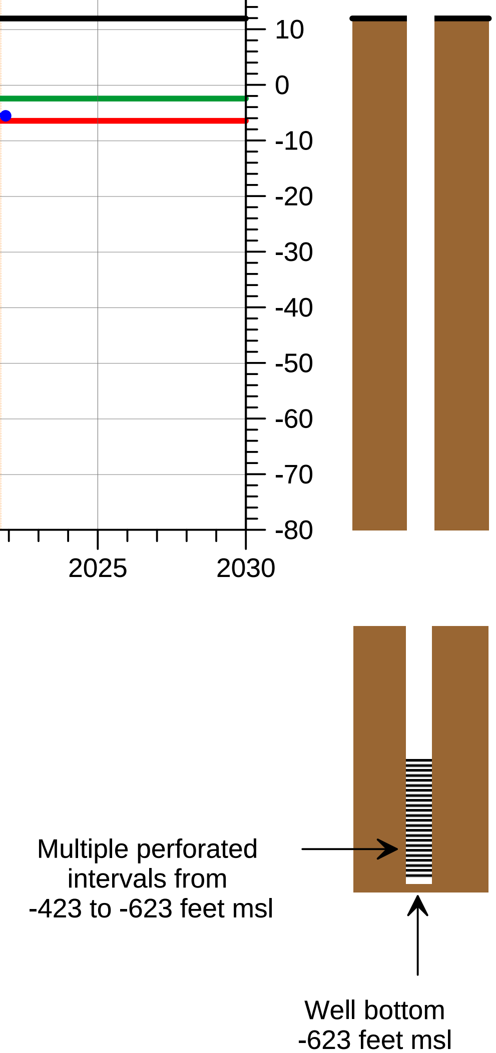


\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch813S_02E-28L03.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 13S/02E-29D03

180/400-Foot Aquifer Subbasin



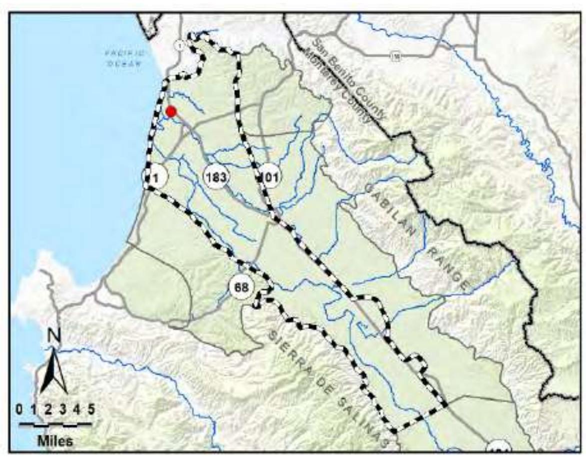


EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

WATER YEAR TYPE DESIGNATION

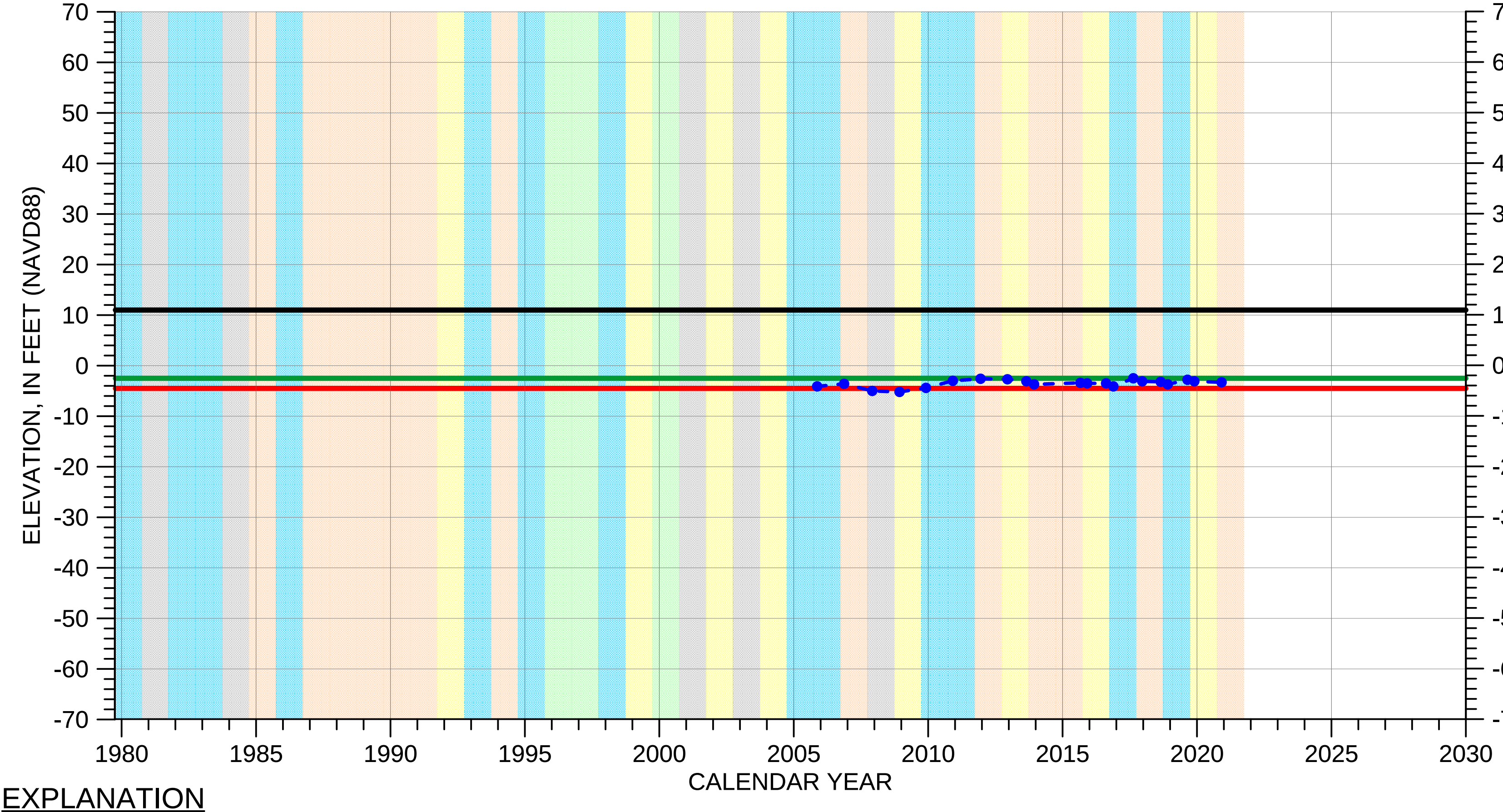
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

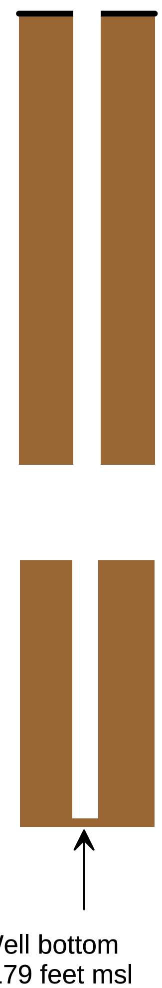


\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch8\13S_02E-29D03.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 13S/02E-29D04

180/400-Foot Aquifer Subbasin





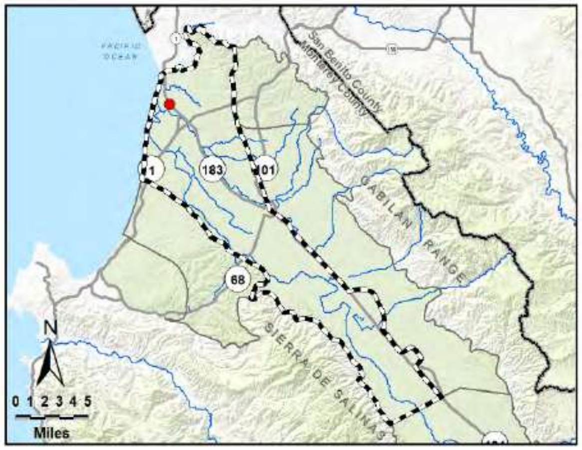
\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch8\13S_02E-29D04.grf

EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

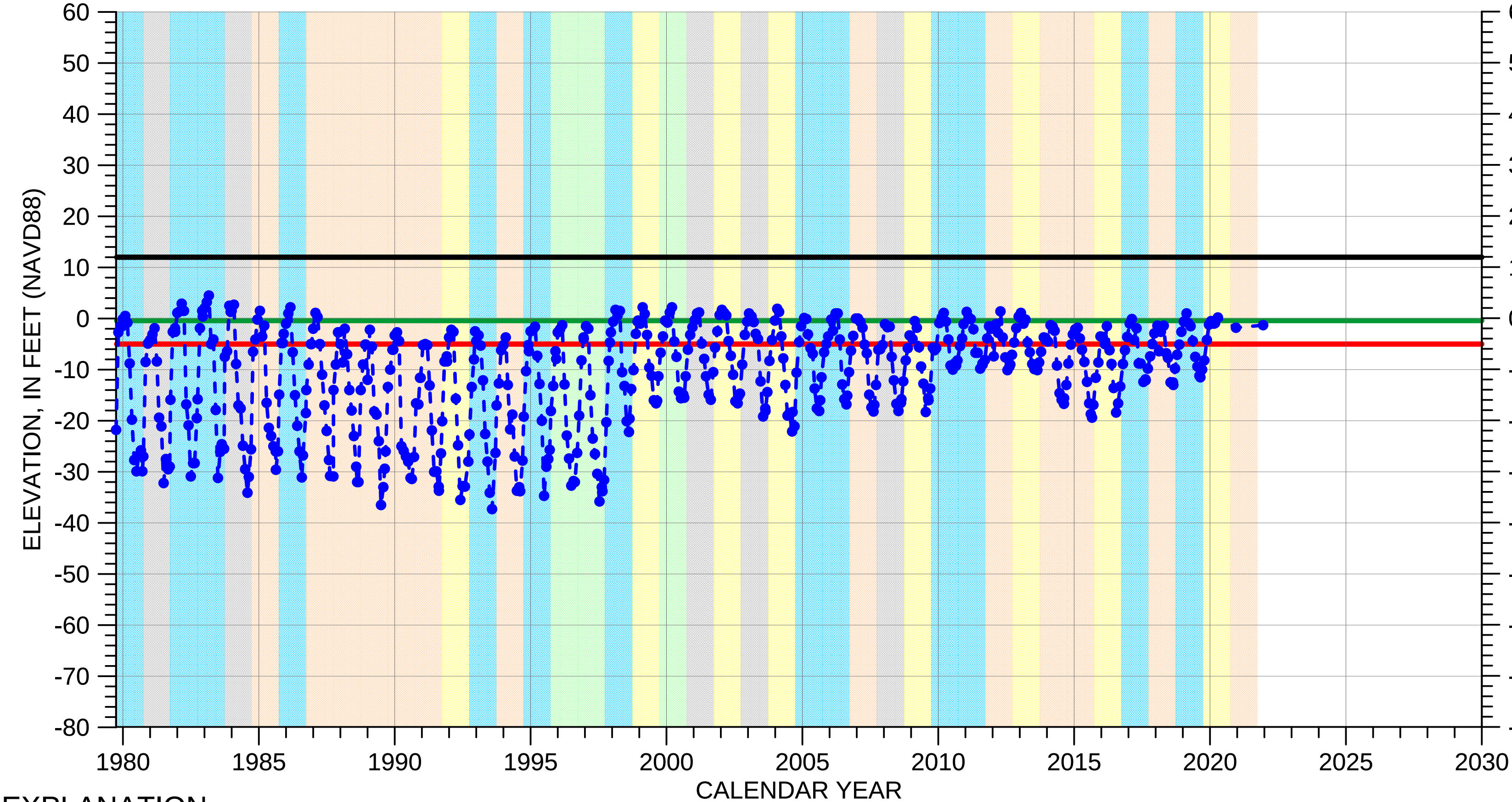
WATER YEAR TYPE DESIGNATION

- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET



HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 13S/02E-31N02

180/400-Foot Aquifer Subbasin



Perforated from
-314 to -518 feel msl

Well bottom
-566 feet msl

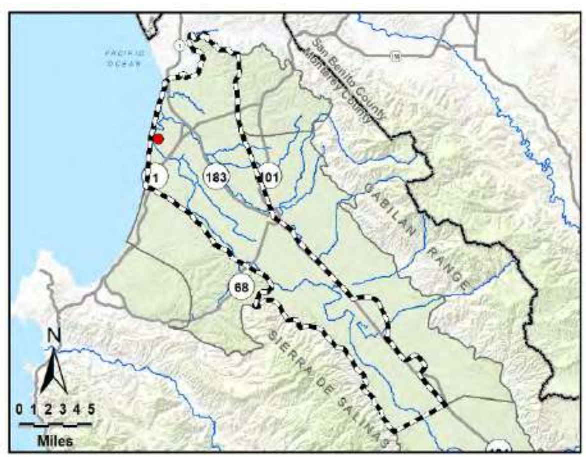
\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch813S_02E-31N02.grf

EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

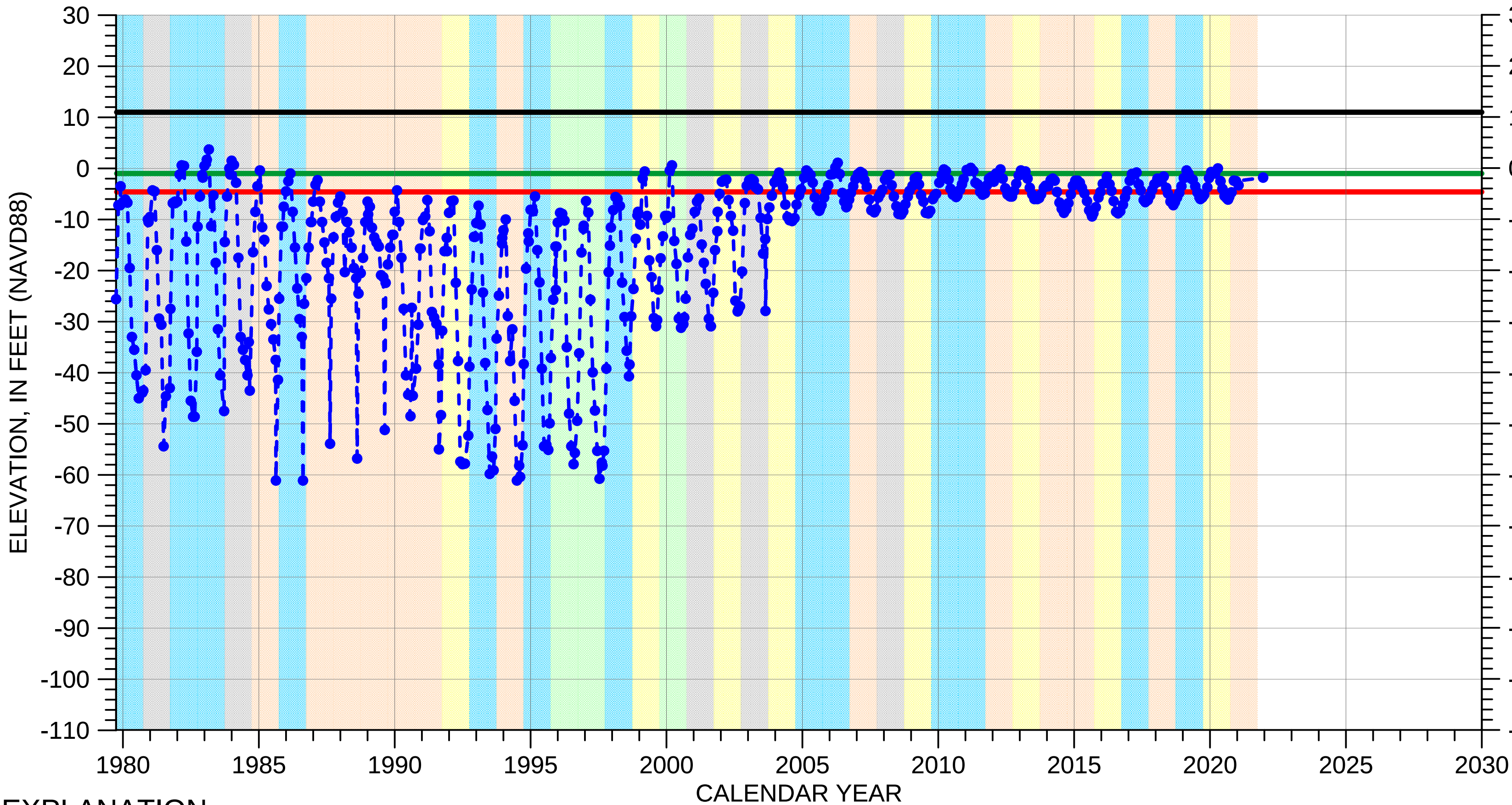
WATER YEAR TYPE DESIGNATION

- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET



HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 13S/02E-32A02

180/400-Foot Aquifer Subbasin

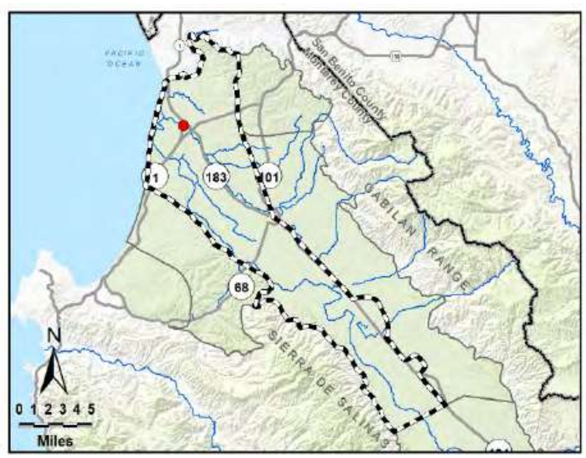


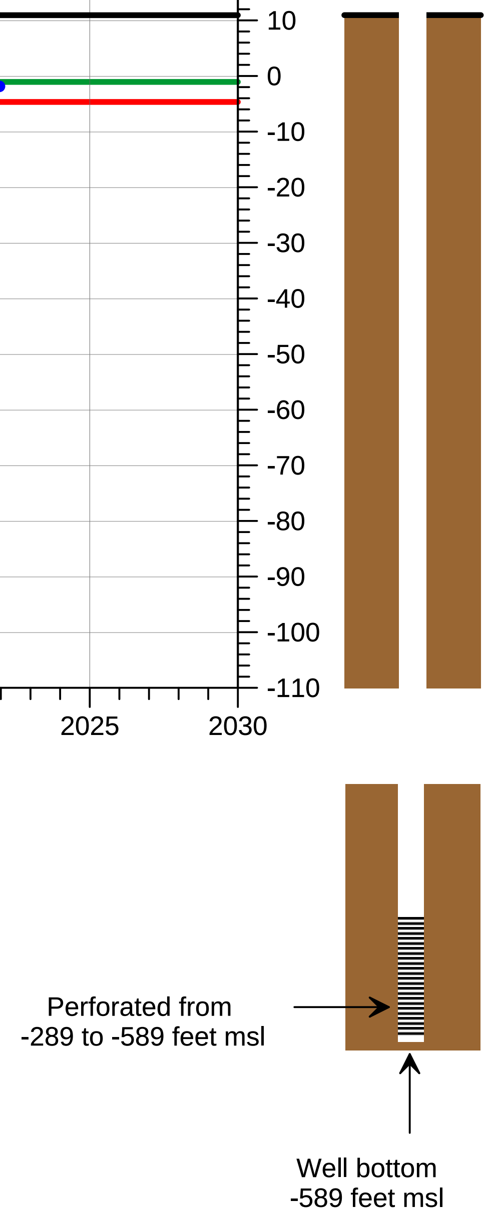
EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

WATER YEAR TYPE DESIGNATION

- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

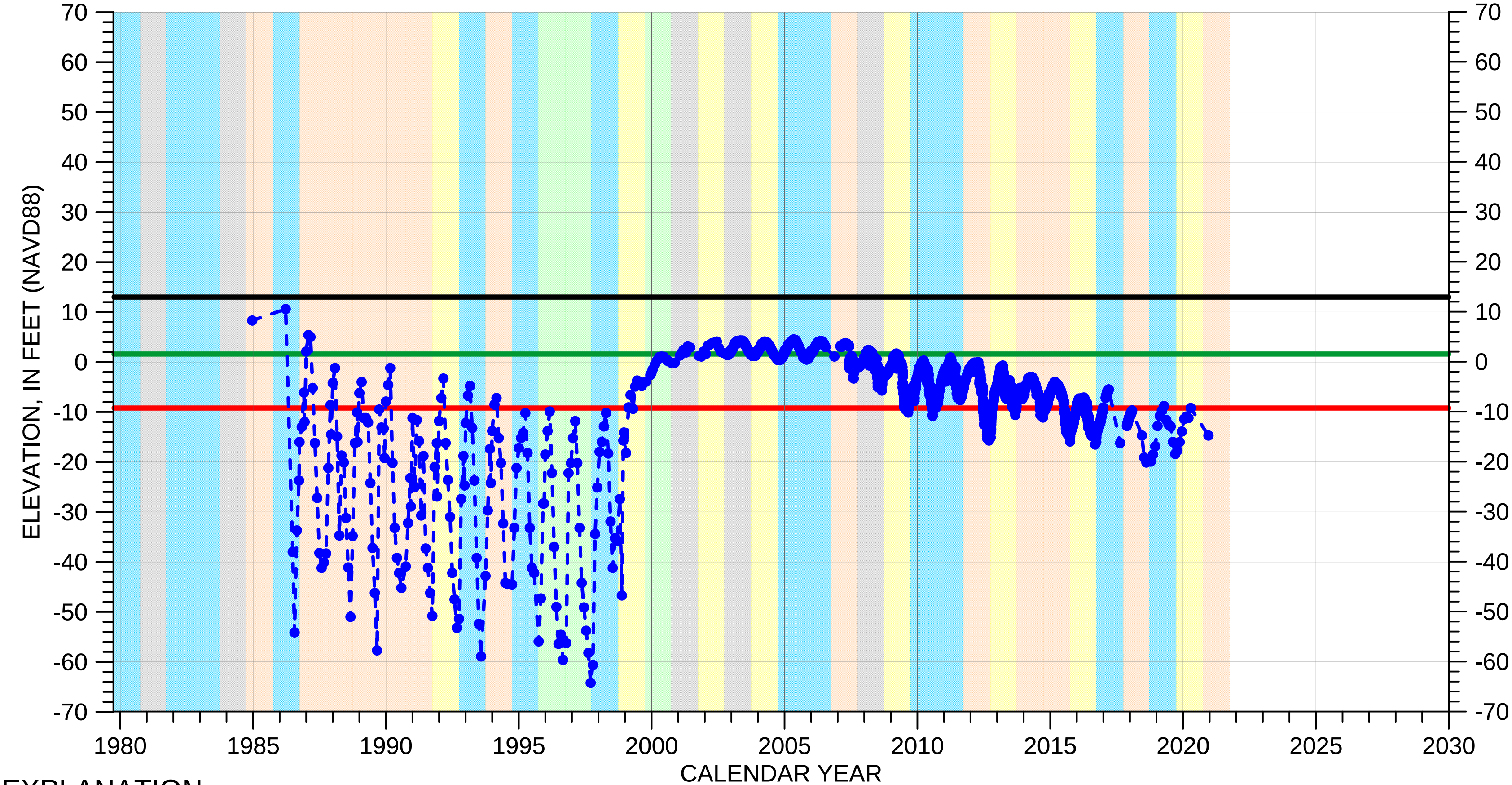




\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch8\13S_02E-32A02.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 13S/02E-32E05

180/400-Foot Aquifer Subbasin

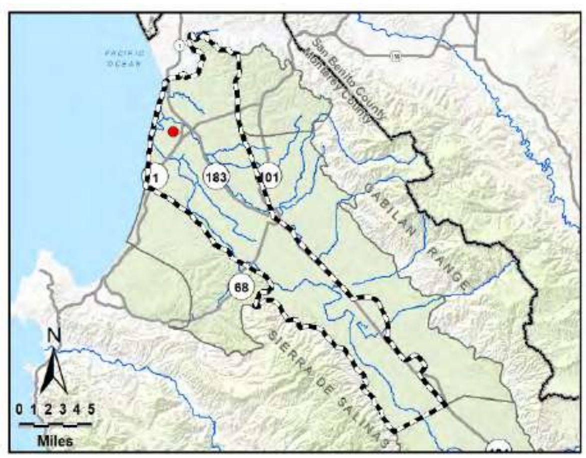


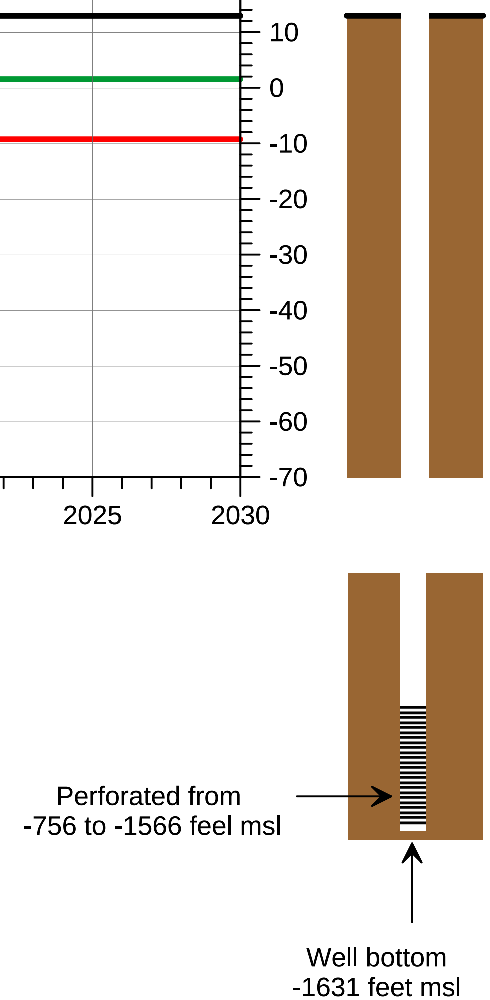
EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

WATER YEAR TYPE DESIGNATION

- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

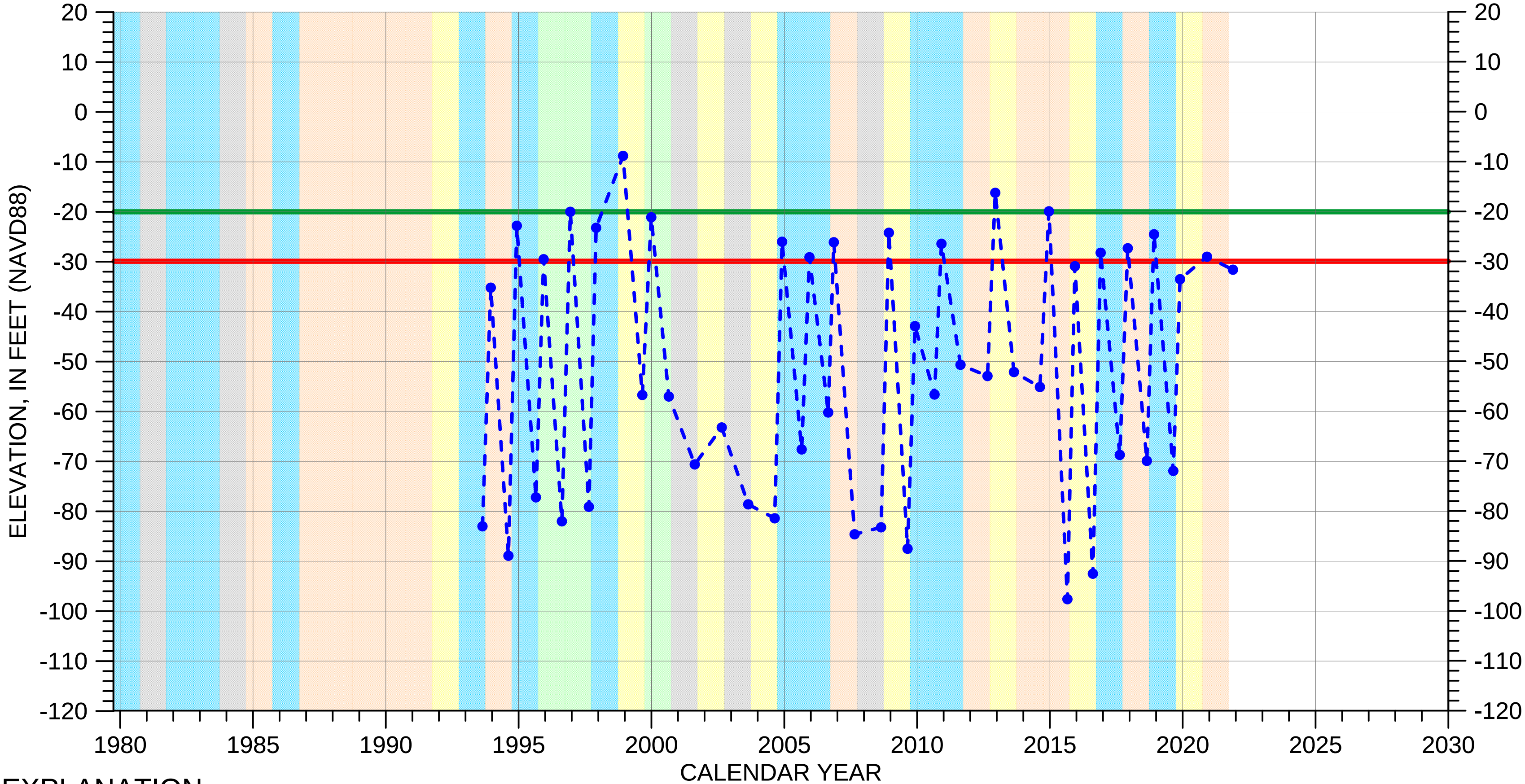




\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRA\NEW\GRFs_Ch8\13S_02E-32E05.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-02C03

180/400-Foot Aquifer Subbasin

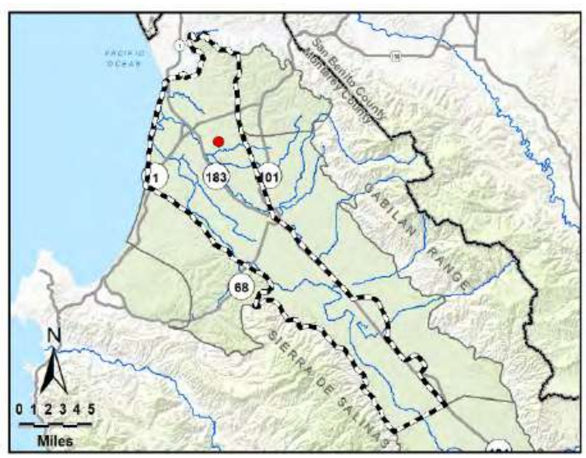


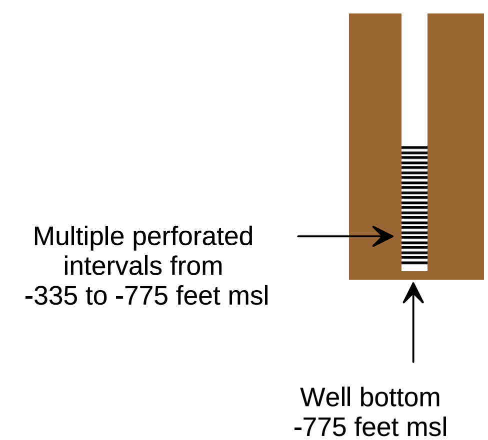
EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface (66 FT MSL)
- Measurable Objective
- Minimum Threshold

WATER YEAR TYPE DESIGNATION

- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

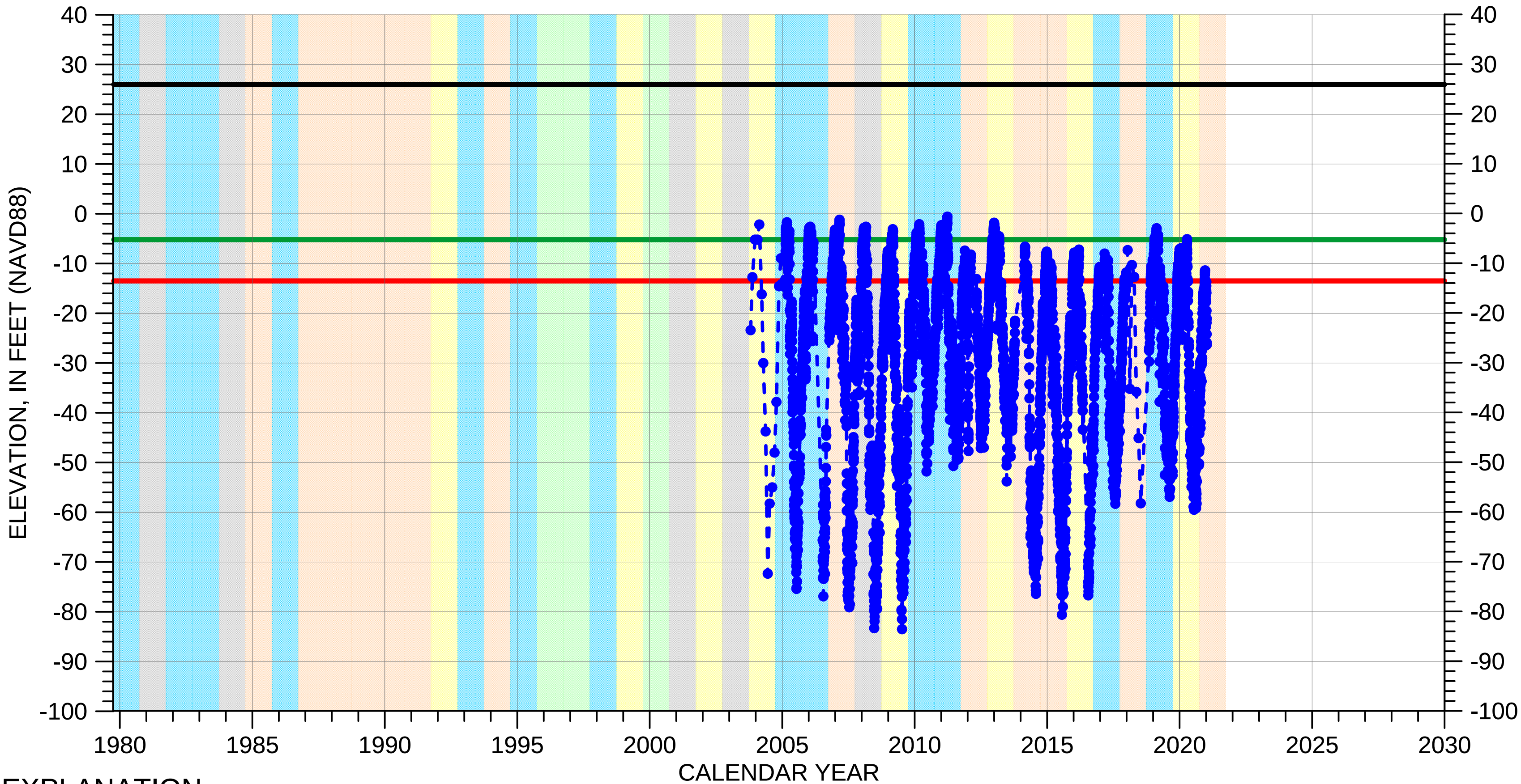




\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch814S_02E-02C03.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-03F03

180/400-Foot Aquifer Subbasin

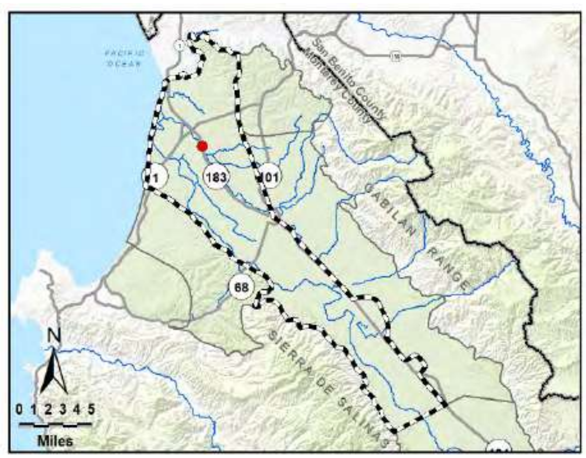


EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

WATER YEAR TYPE DESIGNATION

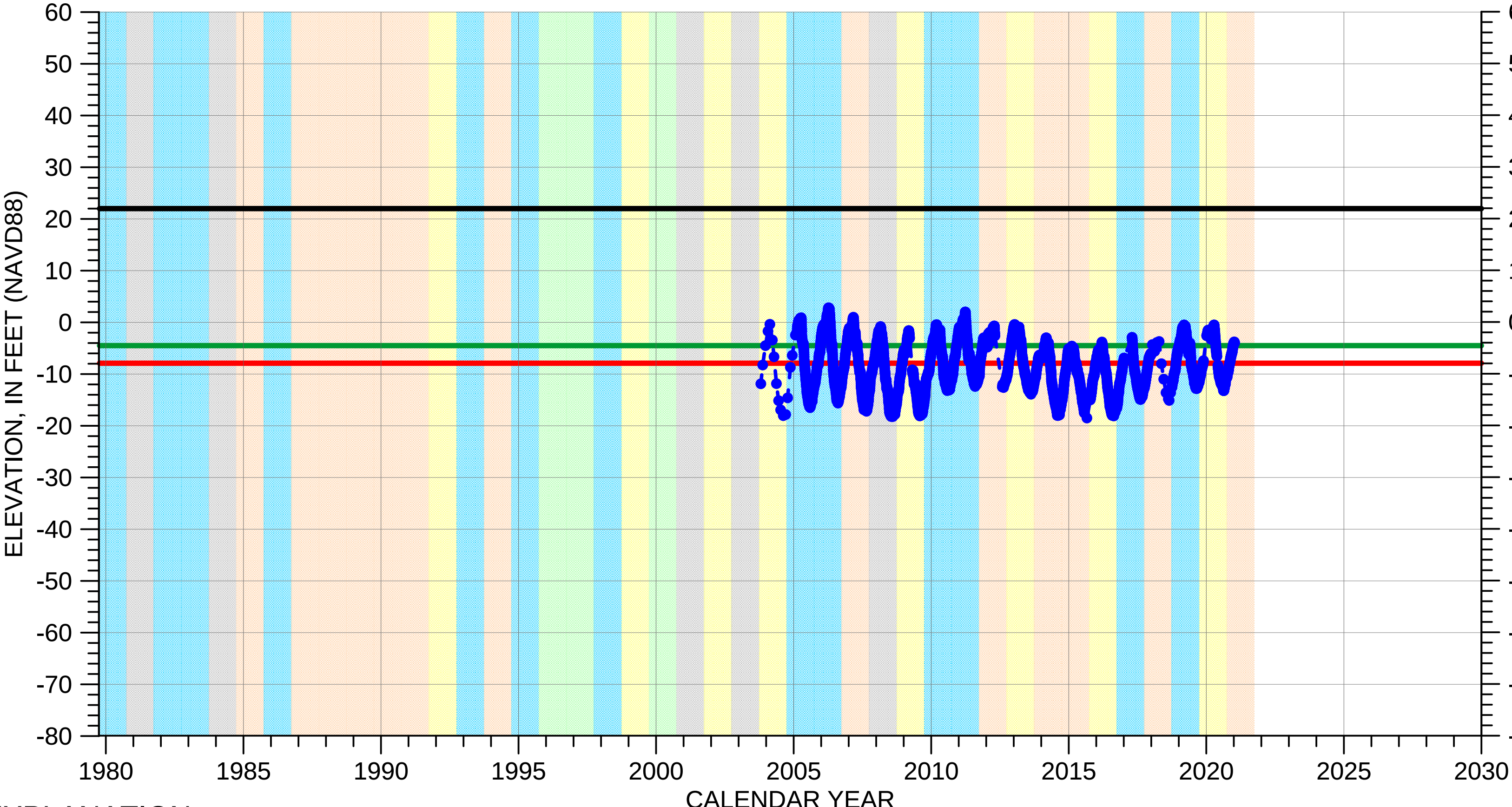
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

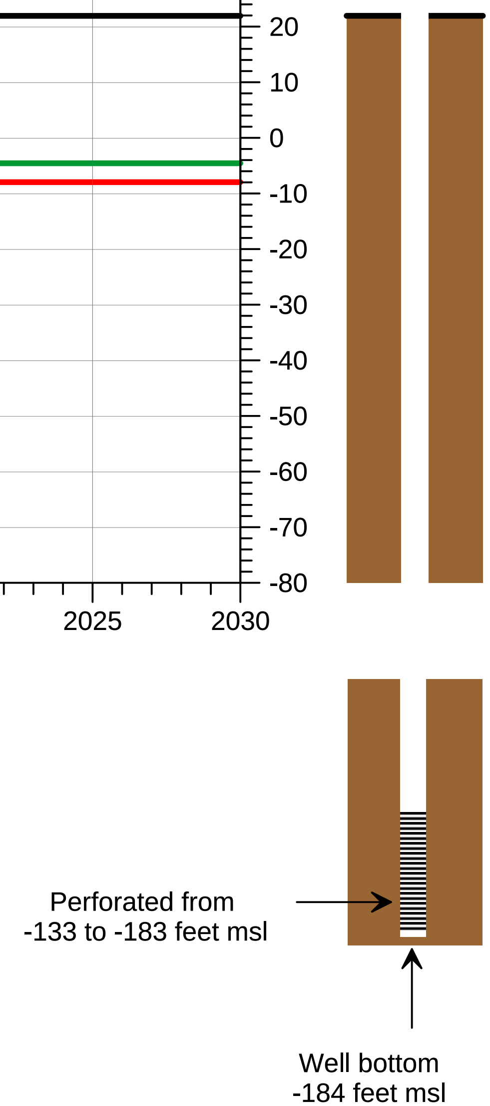


\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch8\14S_02E-03F03.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-03F04

180/400-Foot Aquifer Subbasin





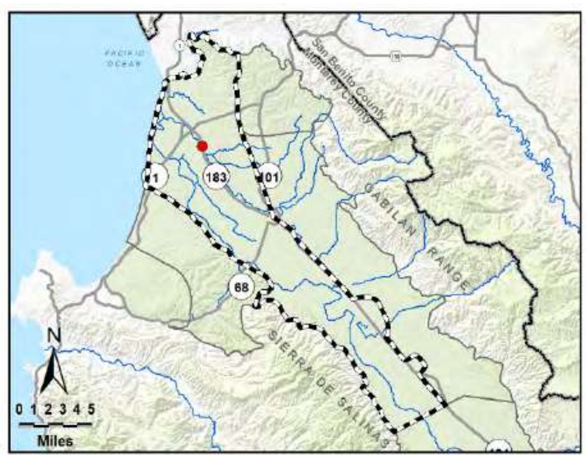
\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEW\GRFs_Ch8\14S_02E-03F04.grf

EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

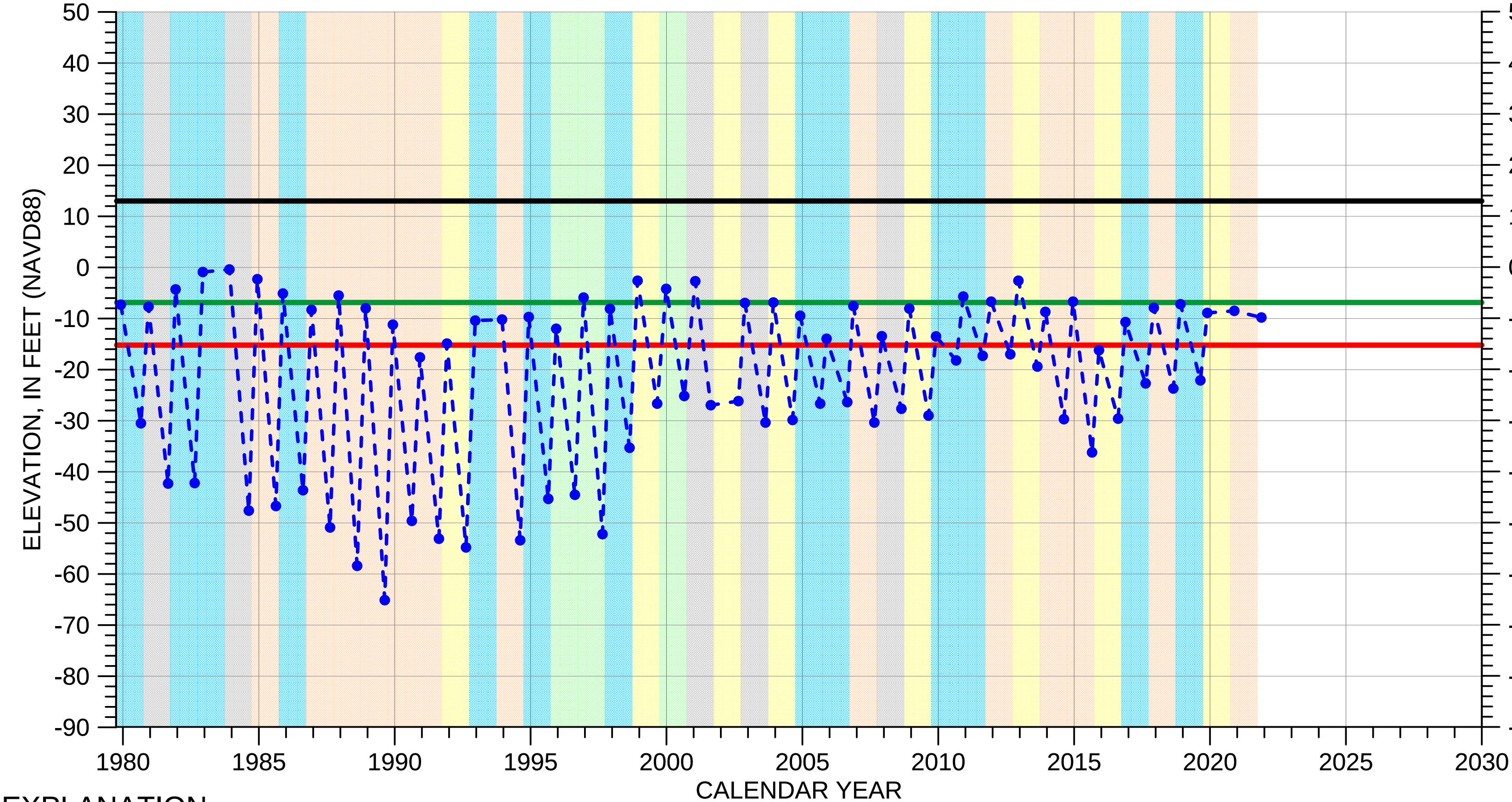
WATER YEAR TYPE DESIGNATION

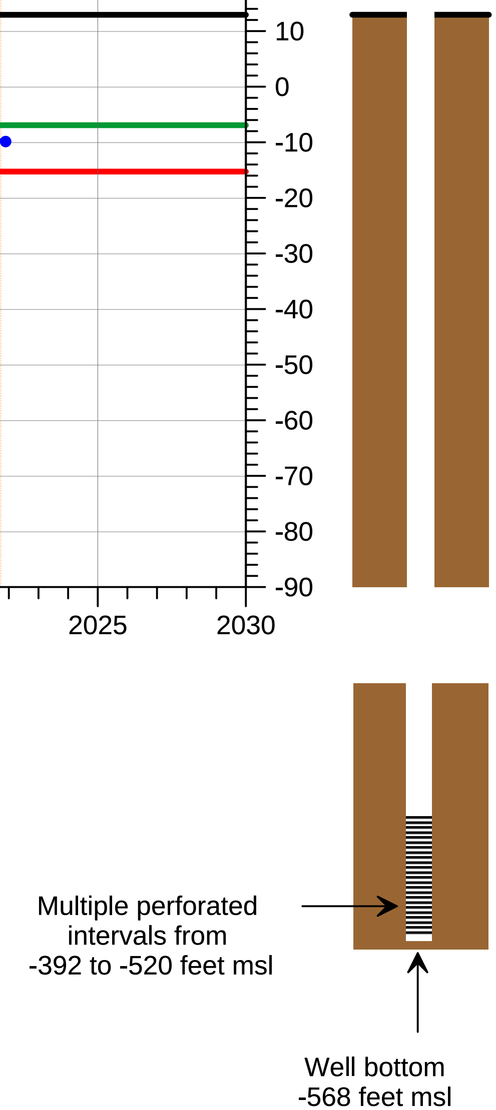
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET



HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-05F04

180/400-Foot Aquifer Subbasin



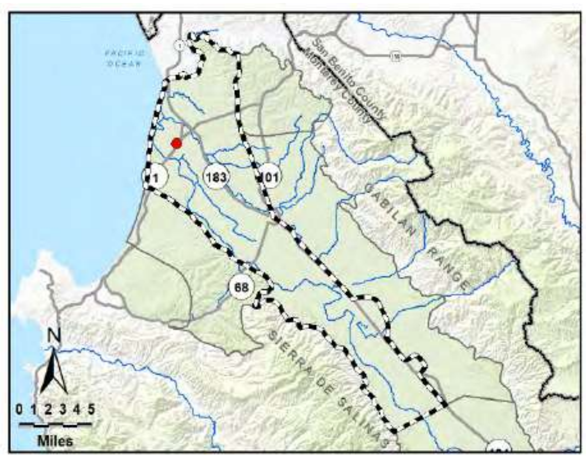


EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

WATER YEAR TYPE DESIGNATION

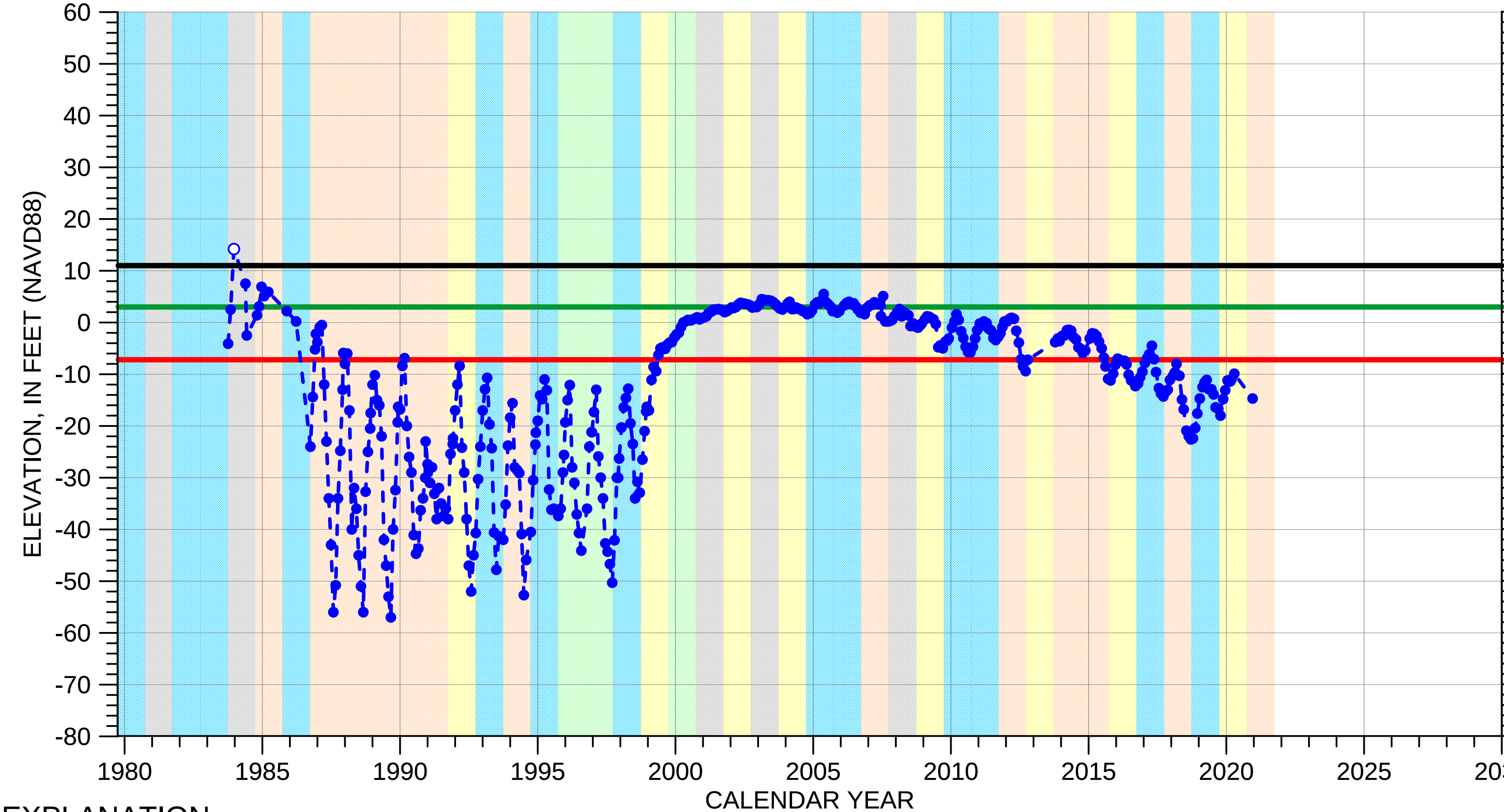
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

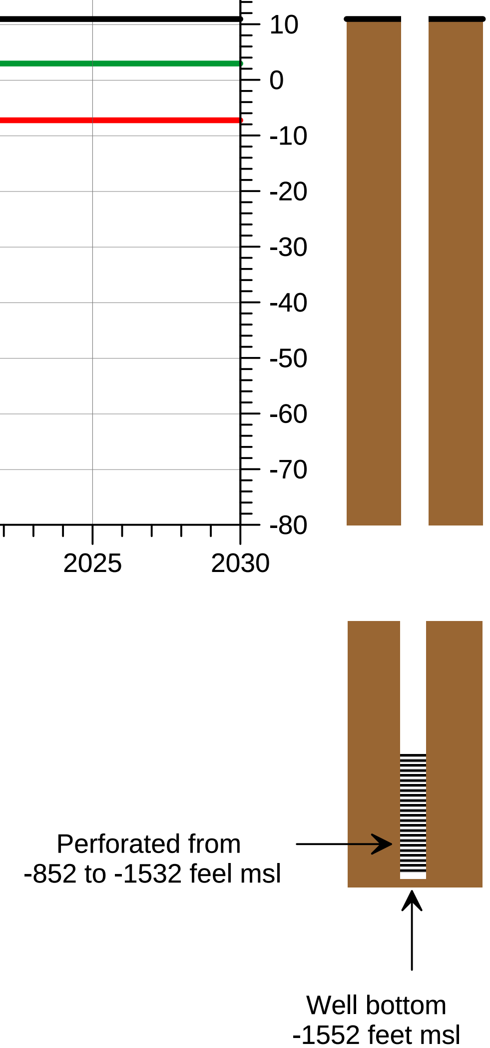


\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch814S_02E-05F04.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-06L01

180/400-Foot Aquifer Subbasin





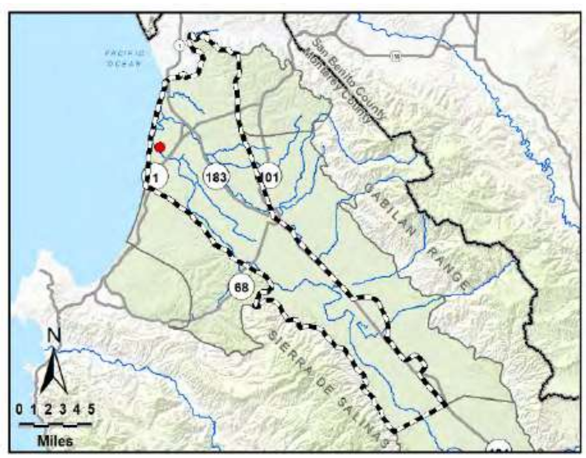
\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch8\14S_02E-06L01.grf

EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

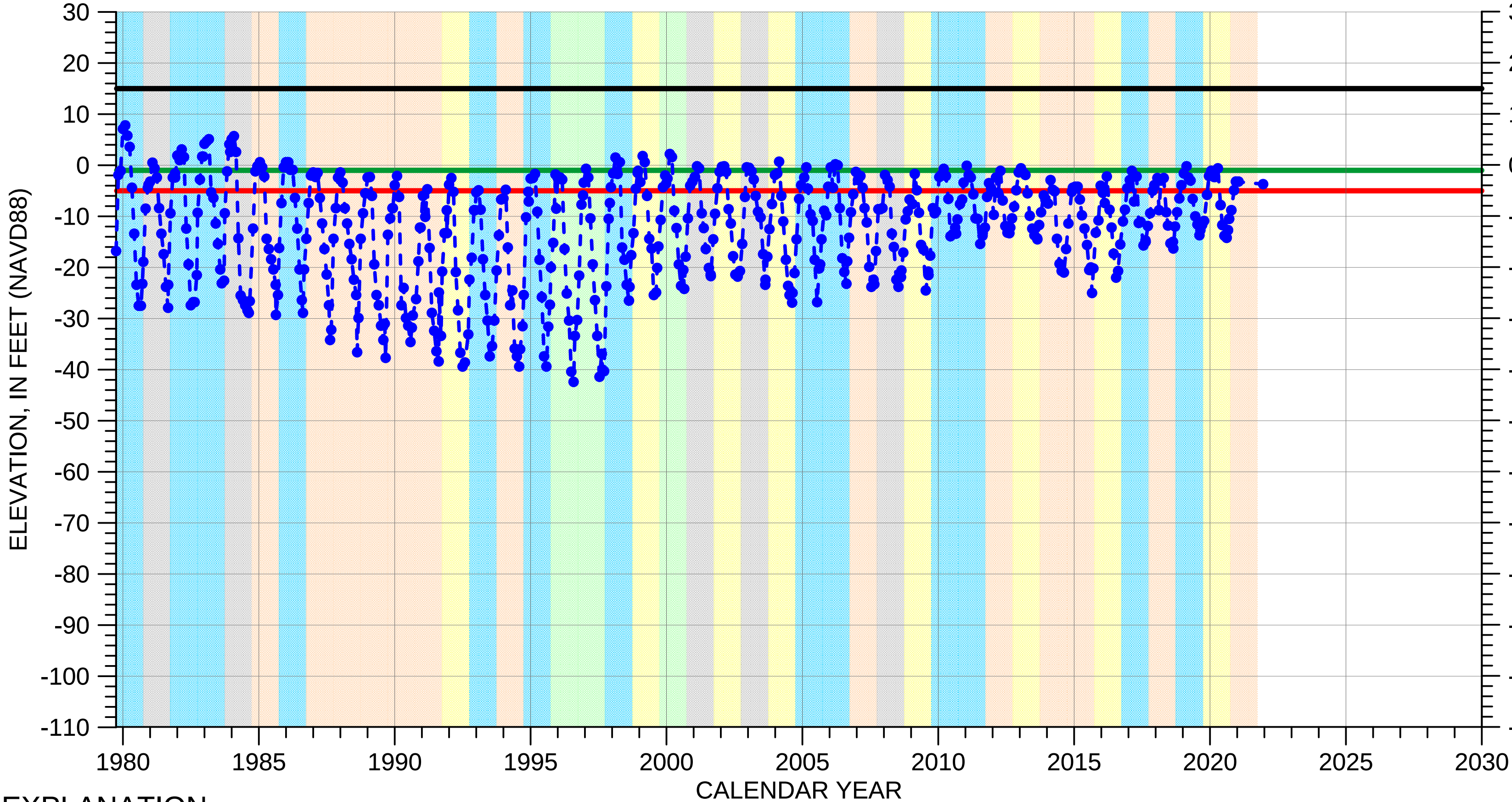
WATER YEAR TYPE DESIGNATION

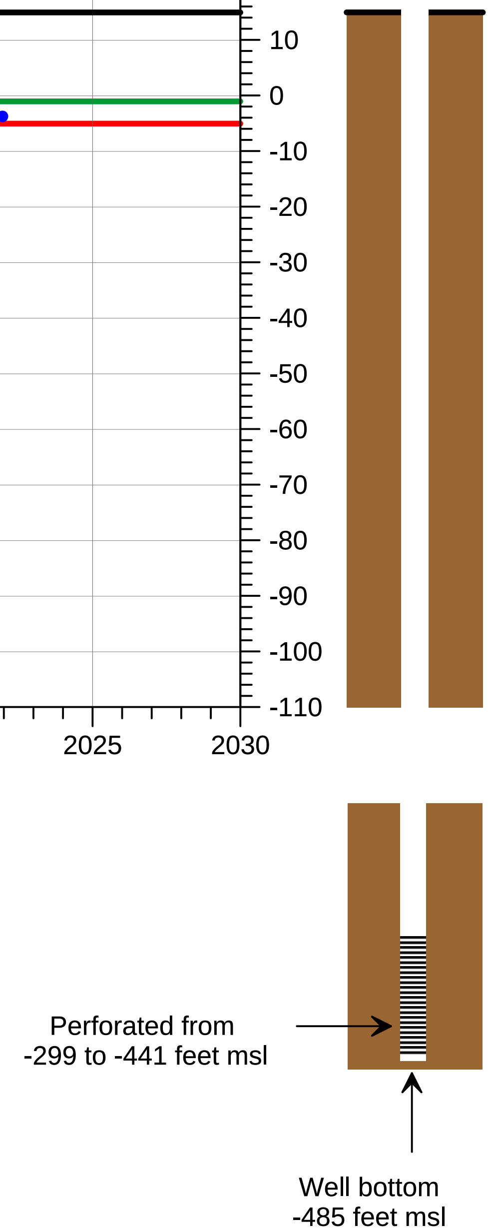
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET



HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-08M02

180/400-Foot Aquifer Subbasin



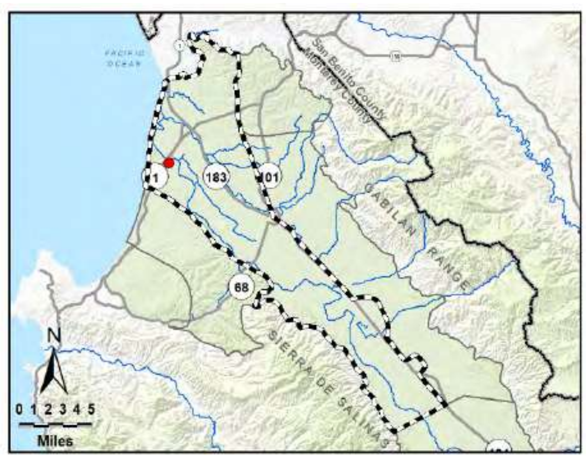


EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

WATER YEAR TYPE DESIGNATION

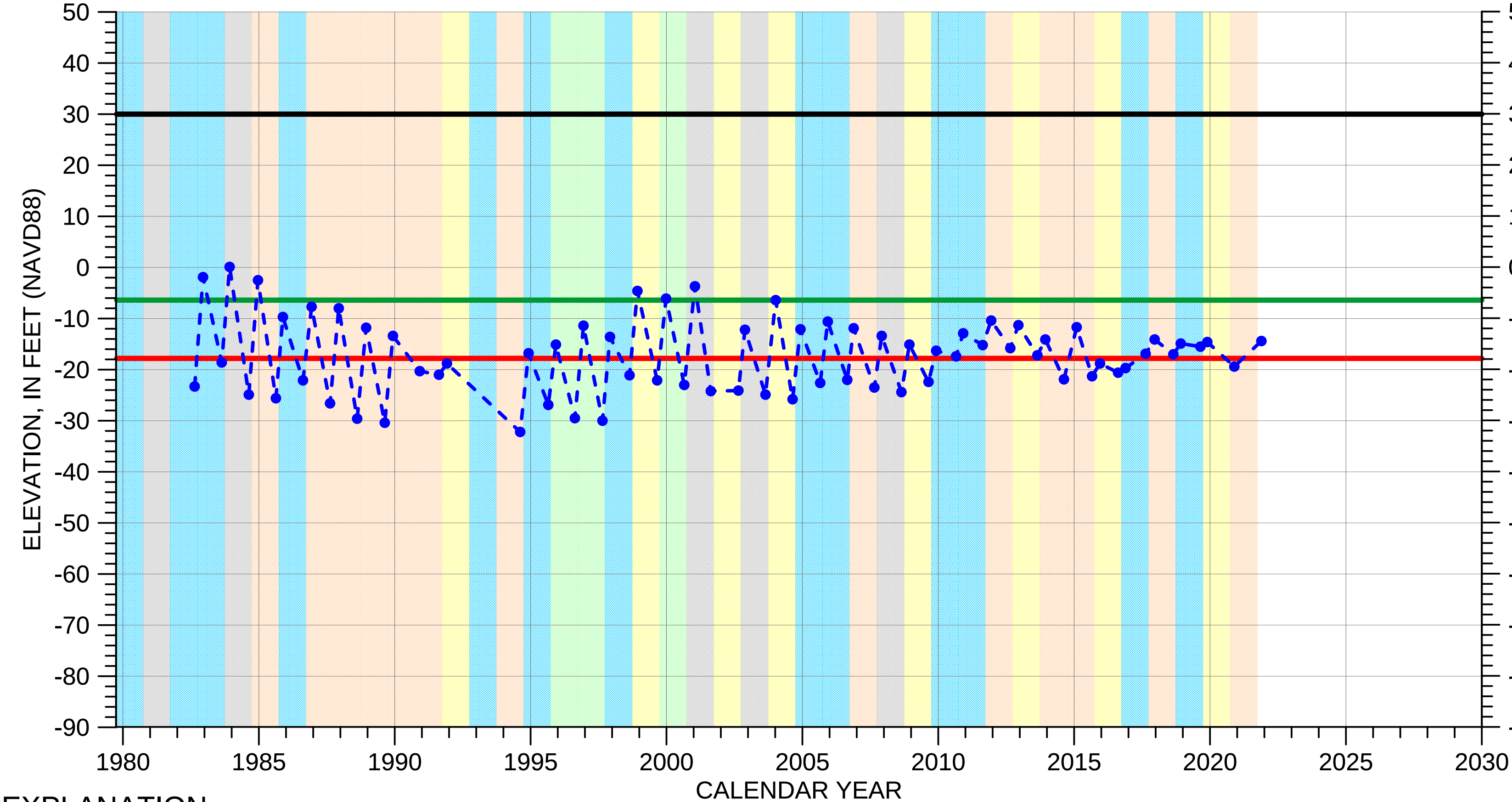
DRY	WET - NORMAL
DRY - NORMAL	WET
NORMAL	

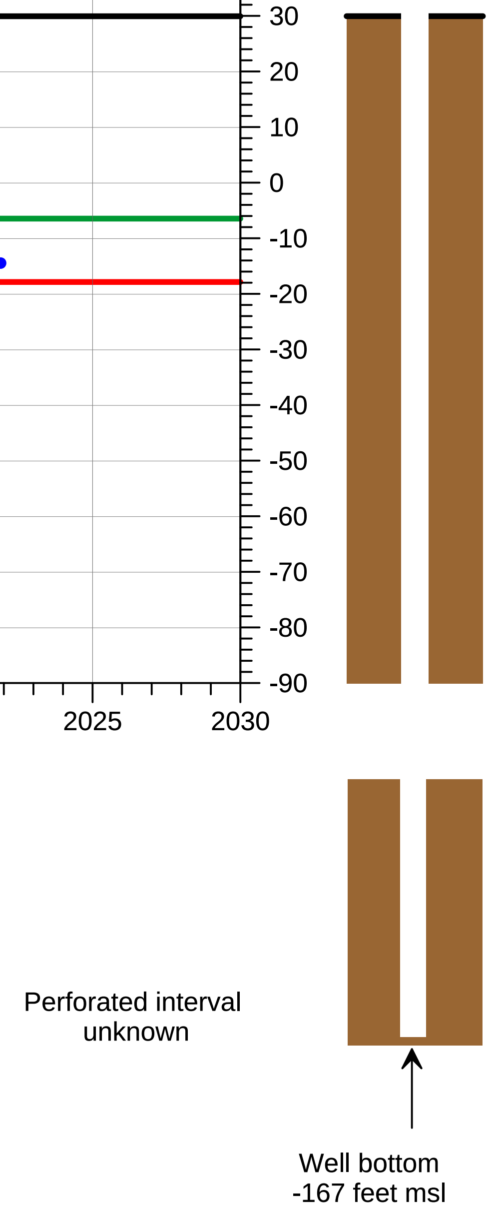


\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch814S_02E-08M02.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-10P01

180/400-Foot Aquifer Subbasin



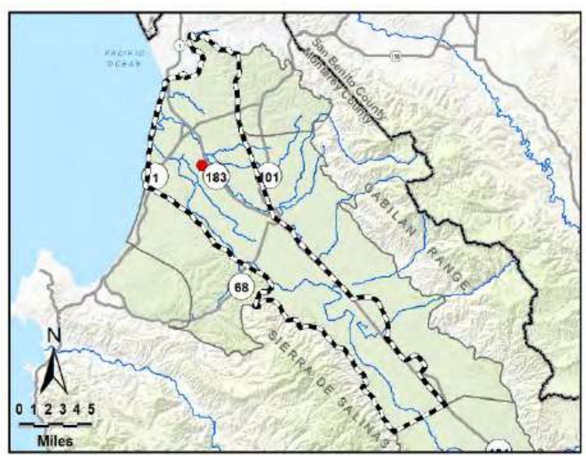


EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

WATER YEAR TYPE DESIGNATION

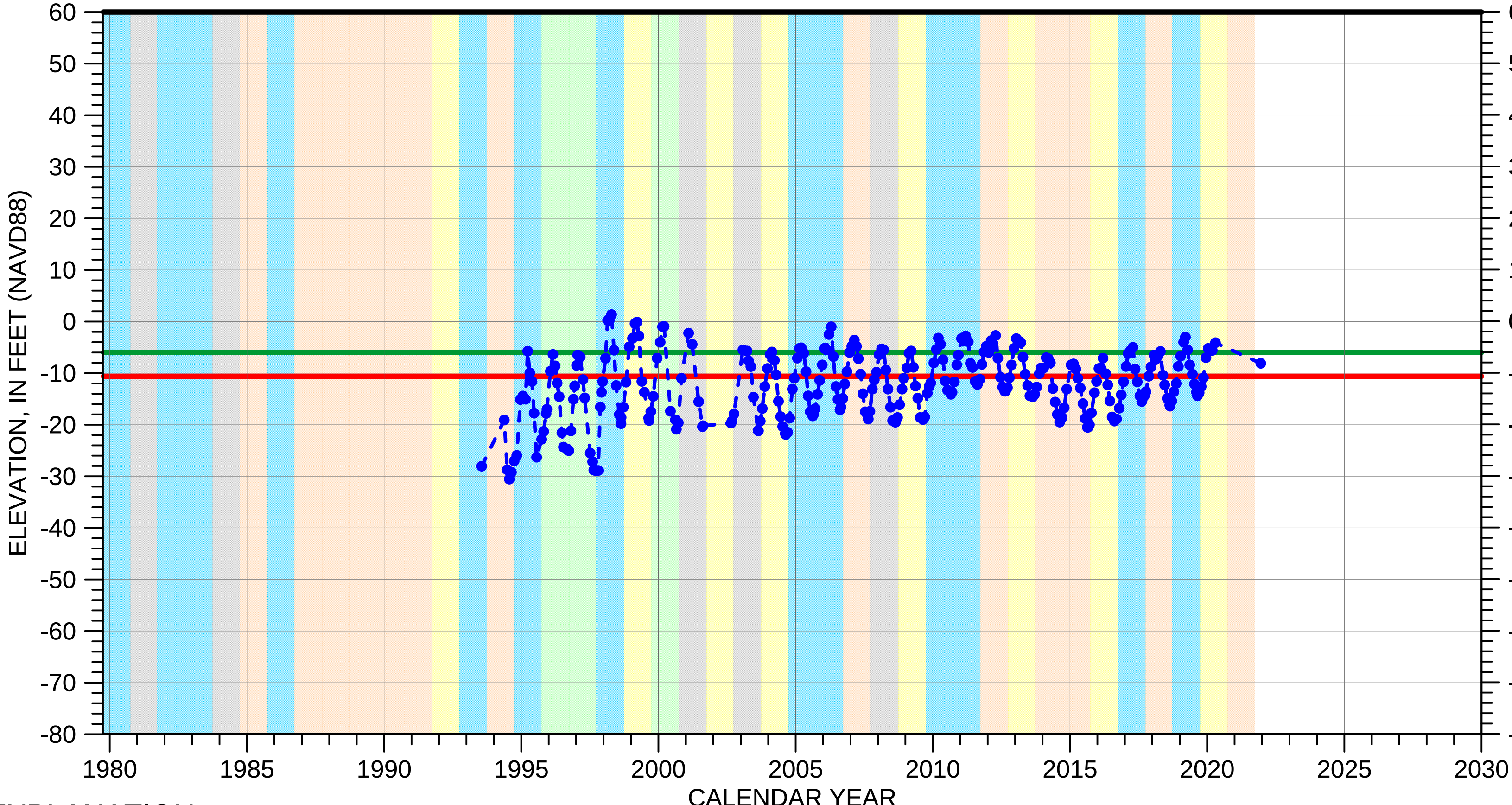
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

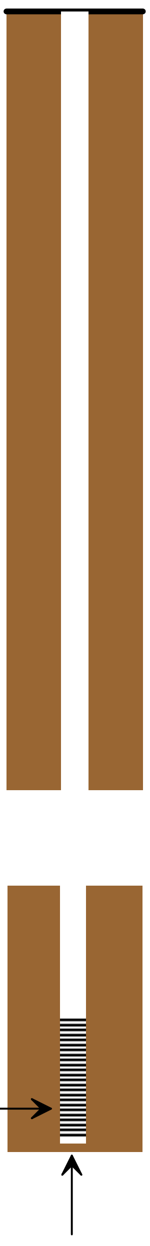


\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch814S_02E-10P01.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-11A02

180/400-Foot Aquifer Subbasin





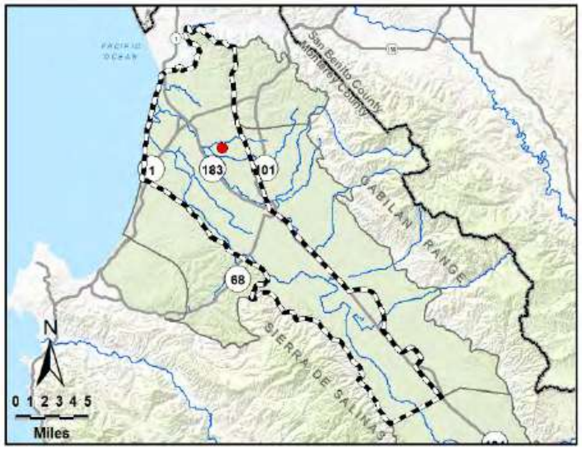
\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch8\14S_02E-11A02.grf

EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

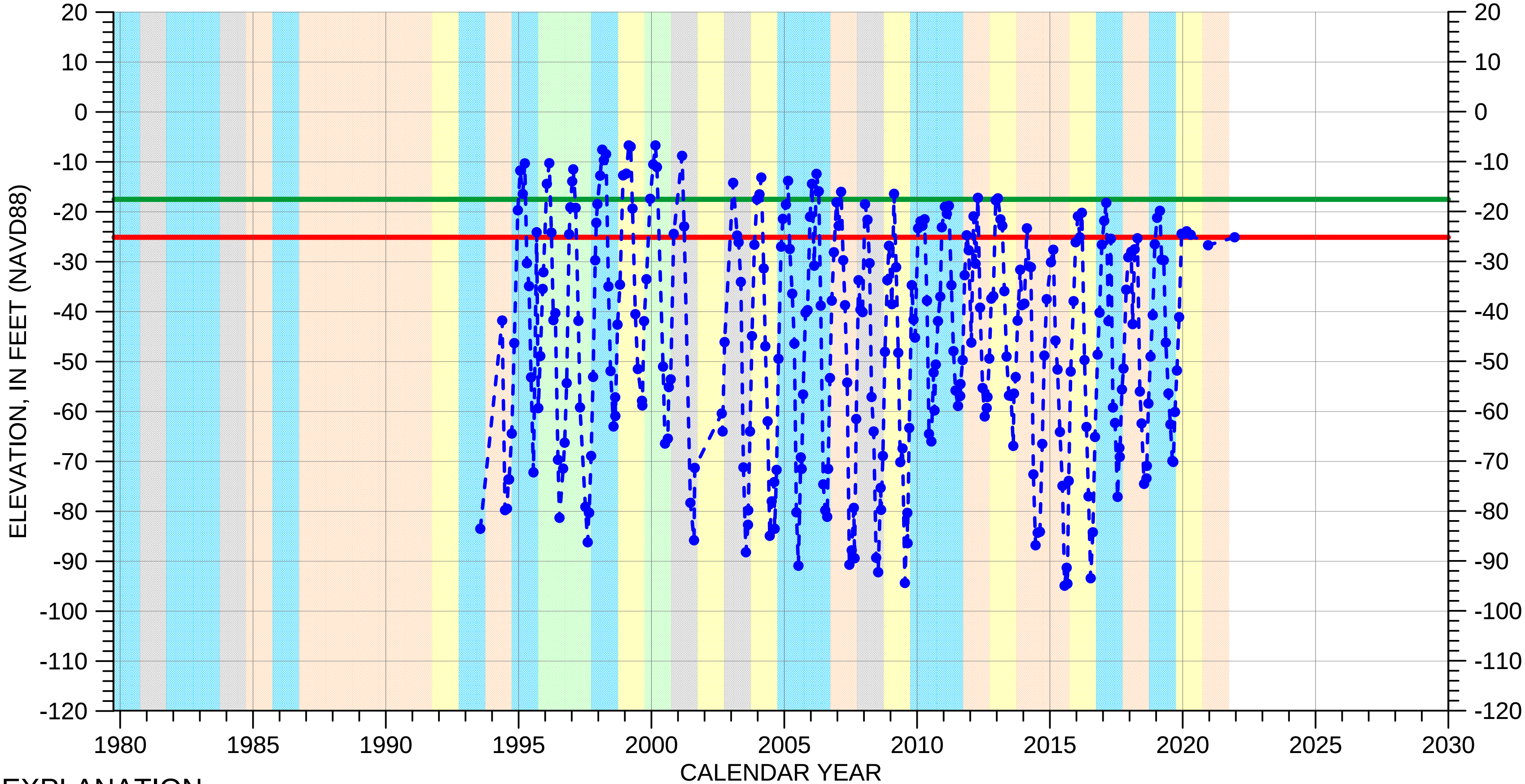
WATER YEAR TYPE DESIGNATION

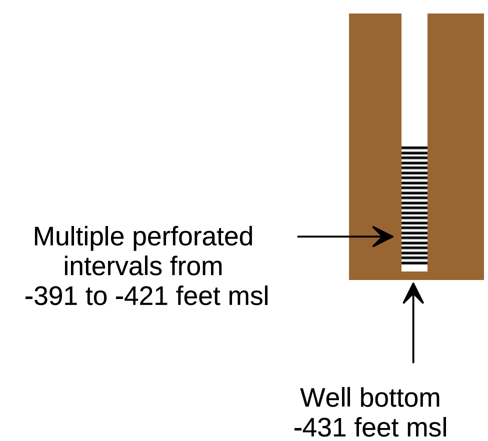
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET



HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-11A04

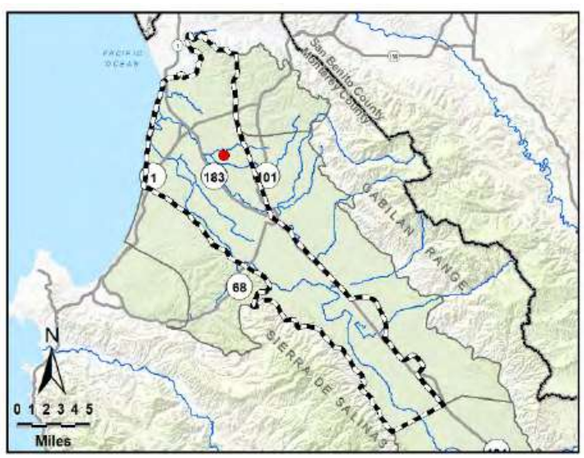
180/400-Foot Aquifer Subbasin





EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface (59 FT MSL)
- Measurable Objective
- Minimum Threshold



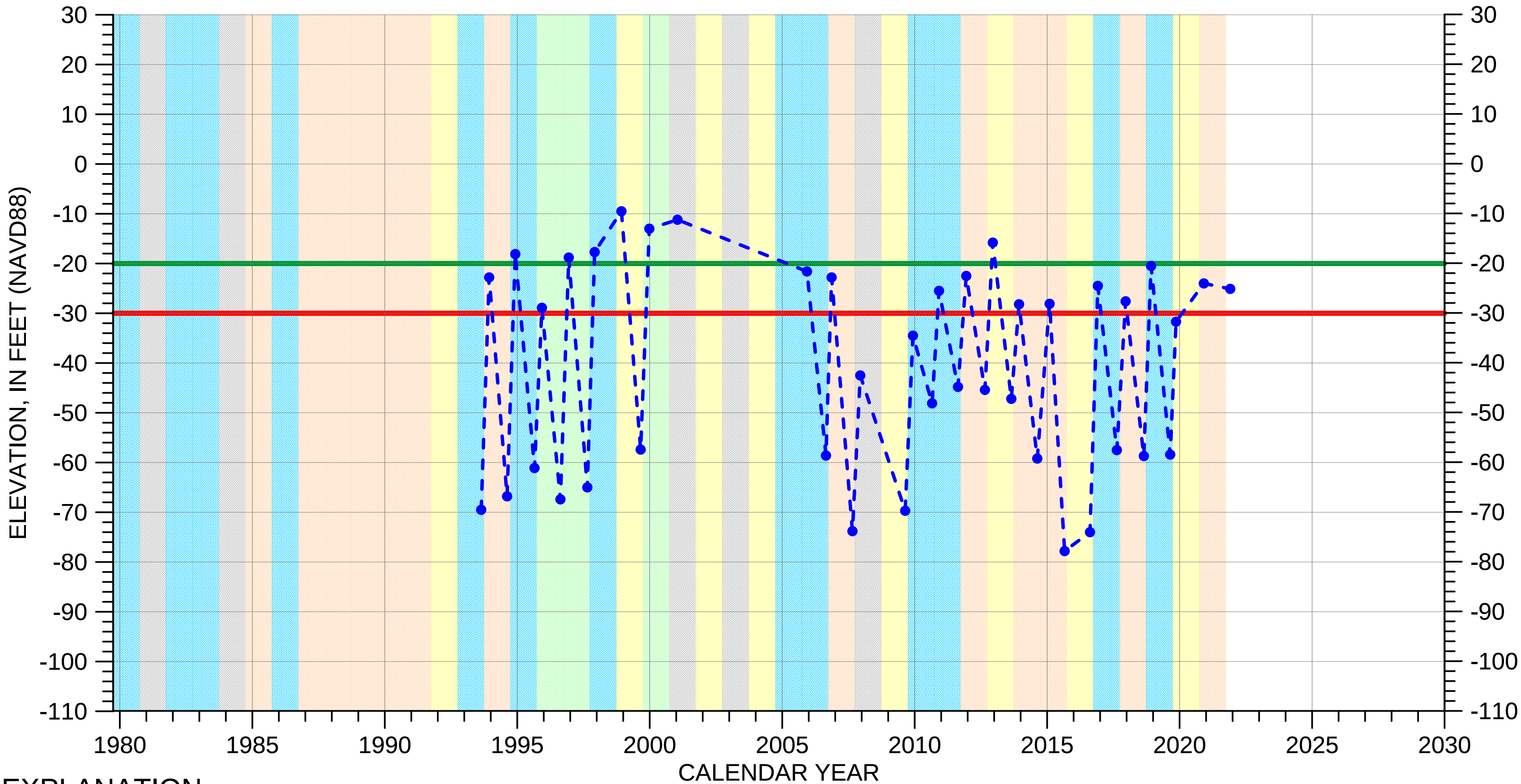
WATER YEAR TYPE DESIGNATION

- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch8\14S_02E-11A04.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-11M03

180/400-Foot Aquifer Subbasin

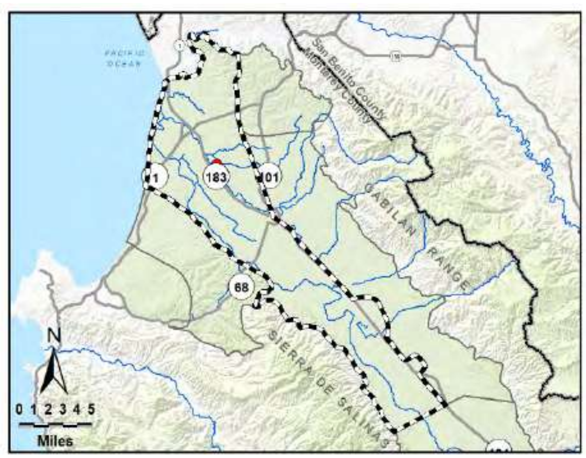


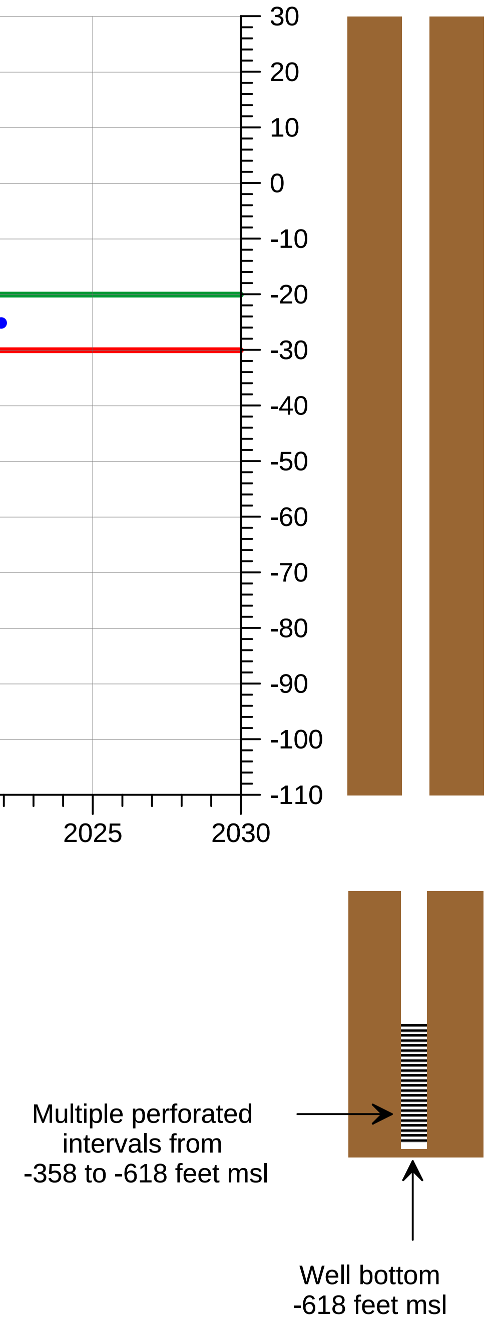
EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface (38 FT MSL)
- Measurable Objective
- Minimum Threshold

WATER YEAR TYPE DESIGNATION

- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

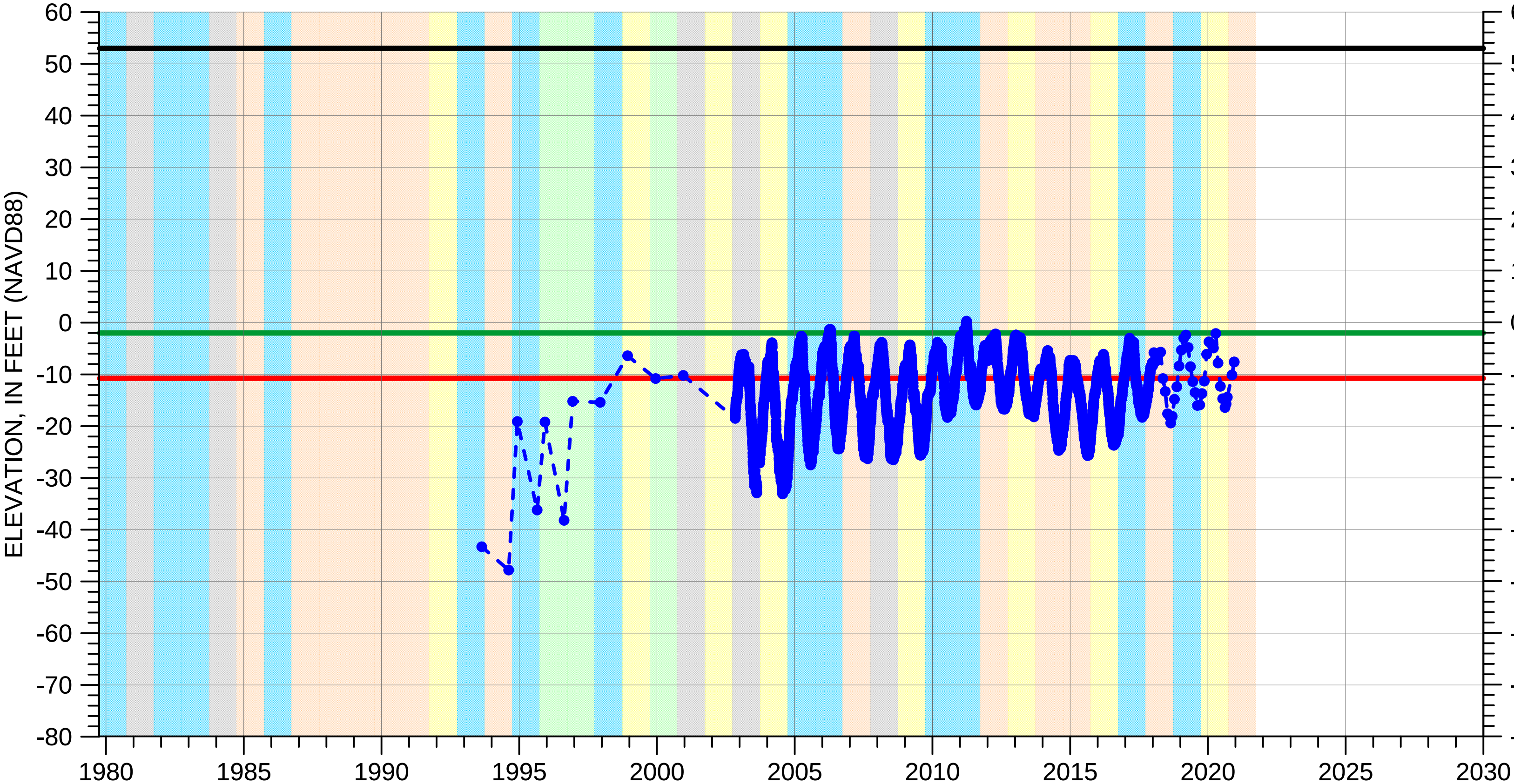




\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch8\14S_02E-11M03.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-12B02

180/400-Foot Aquifer Subbasin

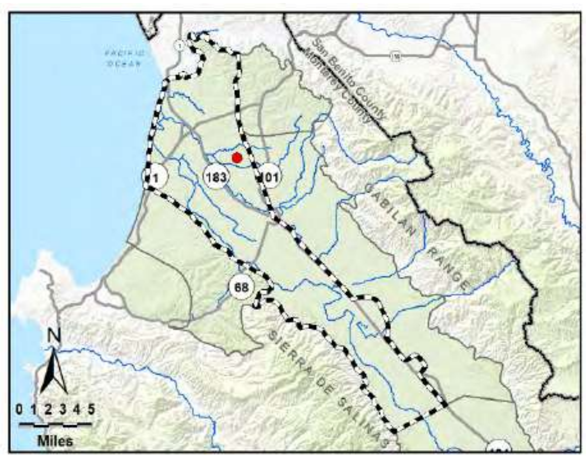


EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

WATER YEAR TYPE DESIGNATION

DRY	WET - NORMAL
DRY - NORMAL	WET
NORMAL	



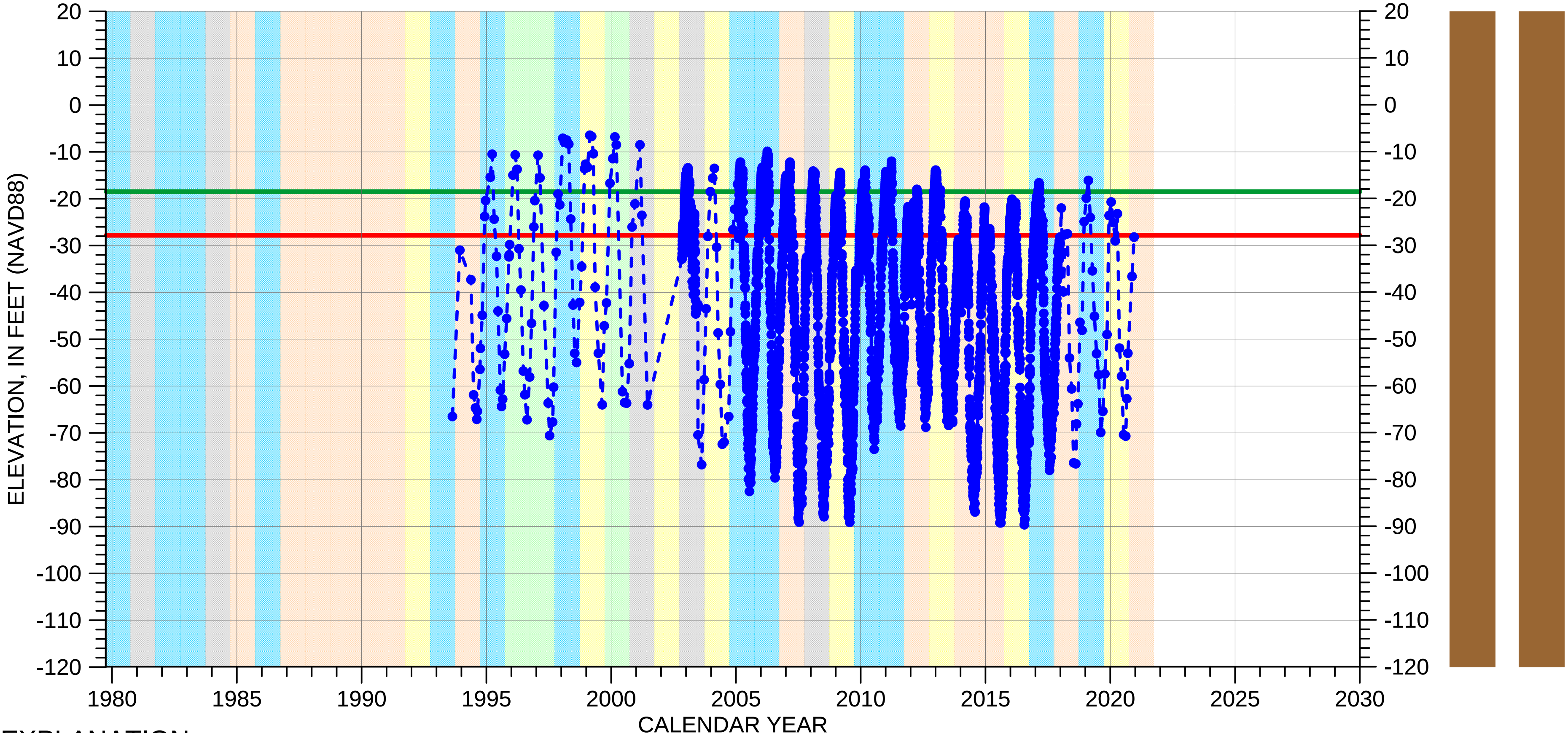
Perforated from -157 to -207 feet msl

Well bottom -212 feet msl

\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch8\14S_02E-12B02.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-12B03

180/400-Foot Aquifer Subbasin

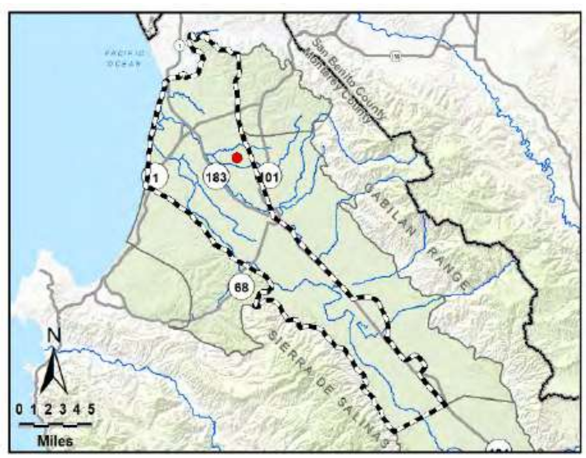


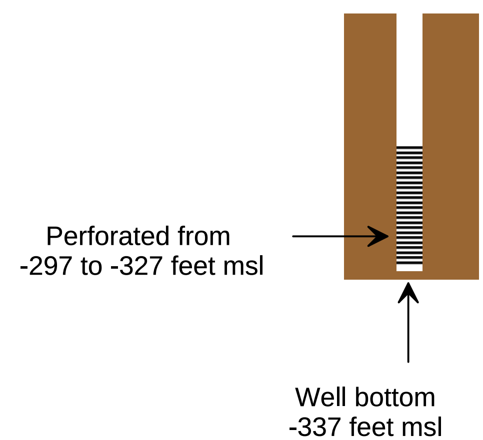
EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface (53 FT MSL)
- Measurable Objective
- Minimum Threshold

WATER YEAR TYPE DESIGNATION

- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

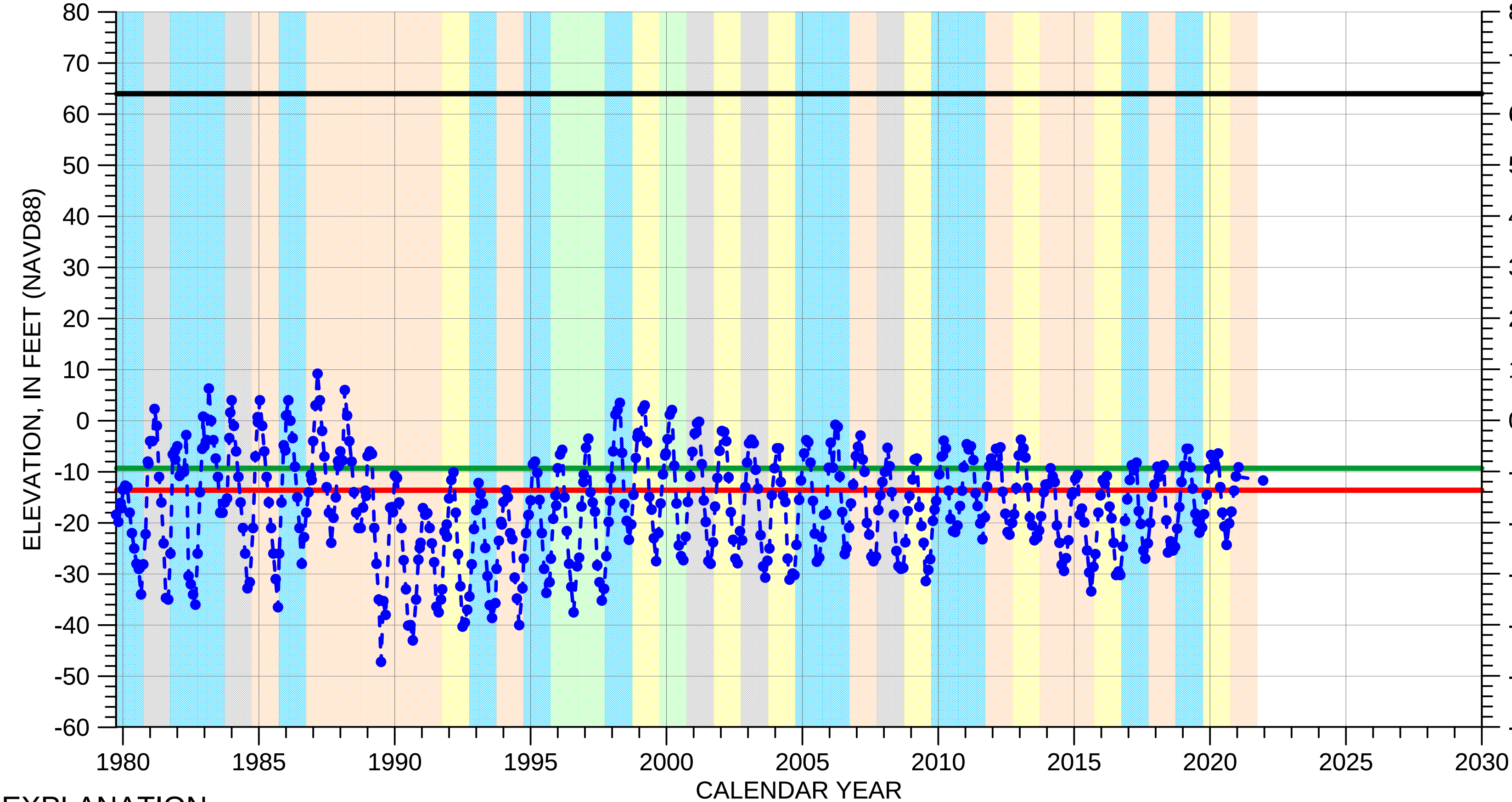


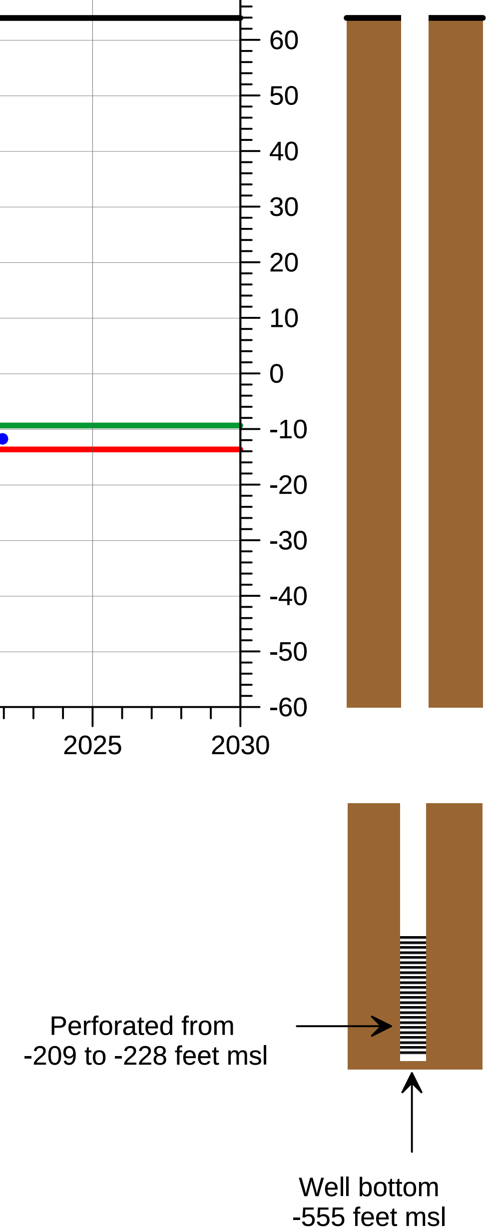


\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch8\14S_02E-12B03.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-12Q01

180/400-Foot Aquifer Subbasin



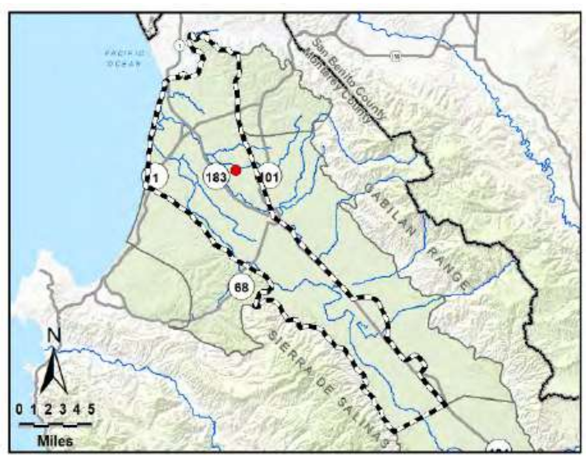


EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

WATER YEAR TYPE DESIGNATION

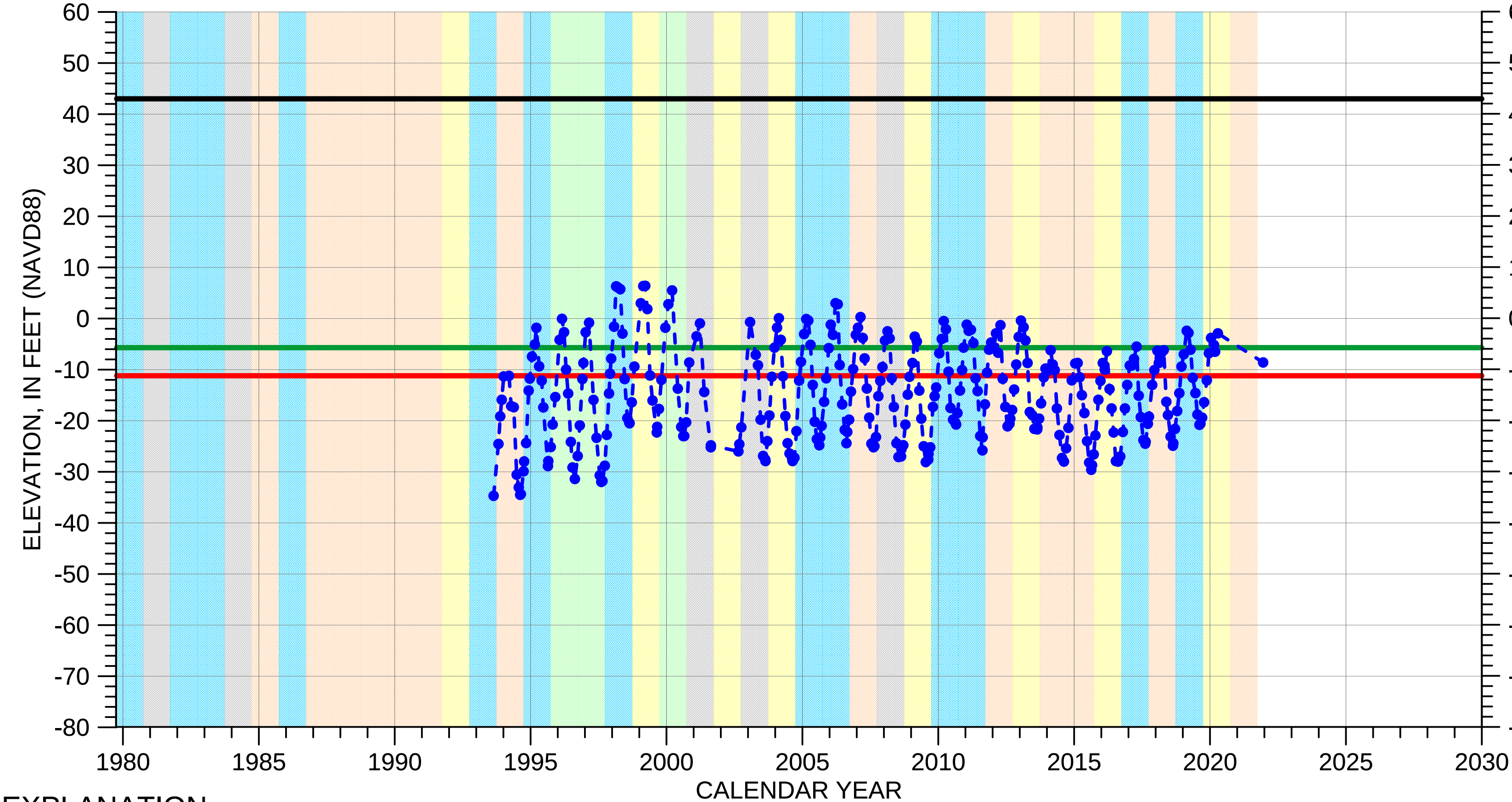
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET



\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch8\14S_02E-12Q01.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-13F03

180/400-Foot Aquifer Subbasin

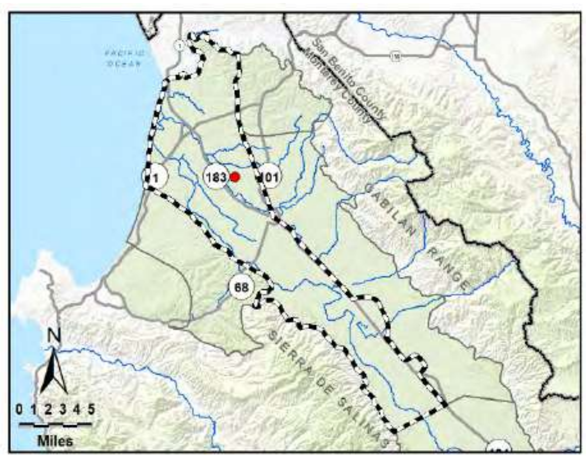


EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

WATER YEAR TYPE DESIGNATION

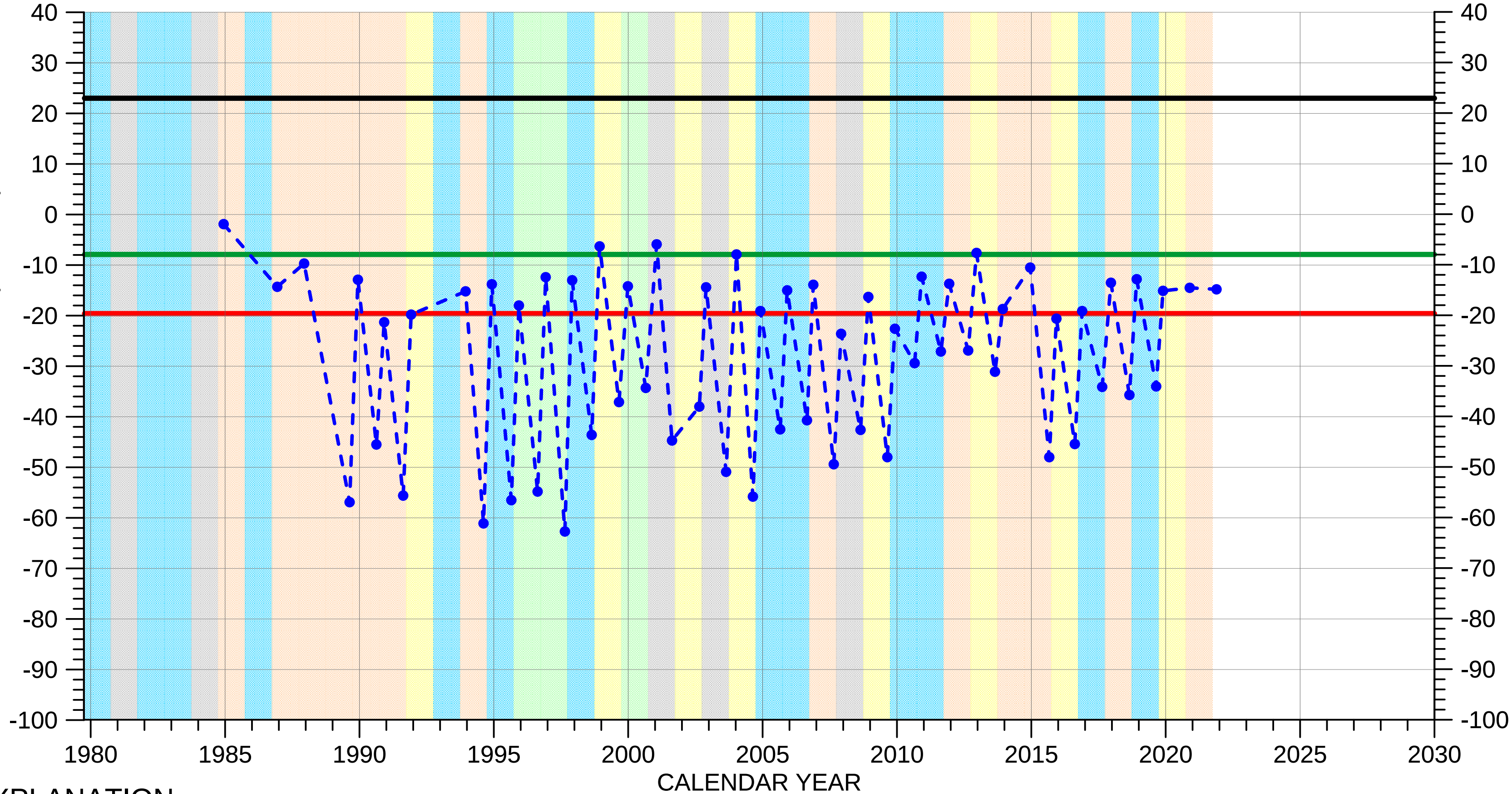
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET



\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch8\14S_02E-13F03.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-16A02

180/400-Foot Aquifer Subbasin

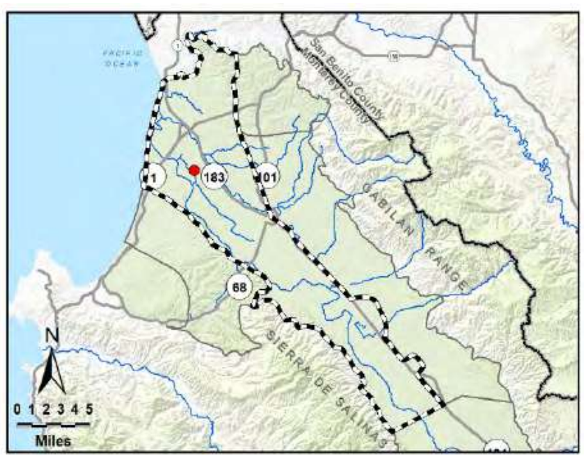


EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

WATER YEAR TYPE DESIGNATION

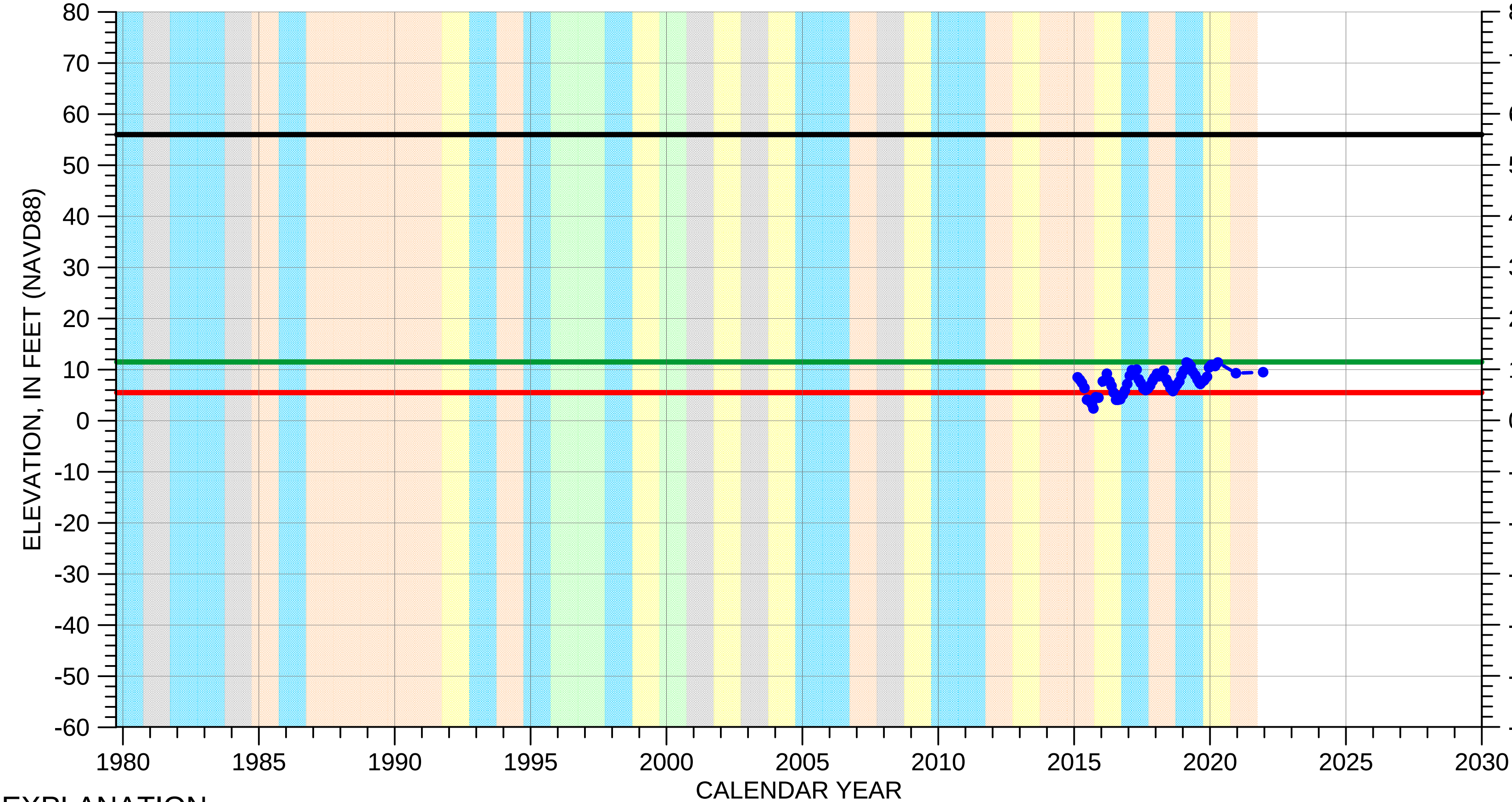
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET



\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch8\14S_02E-16A02.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-17C02

180/400-Foot Aquifer Subbasin

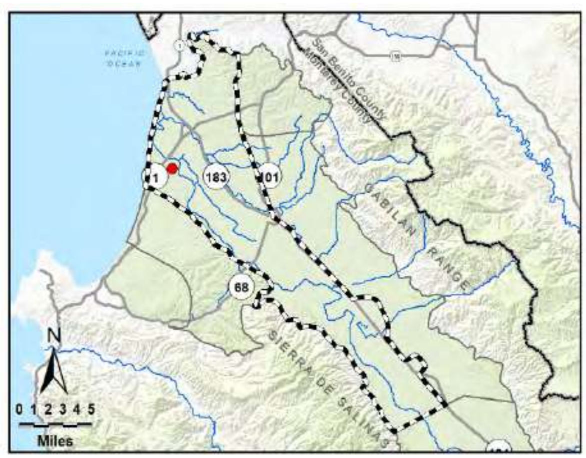


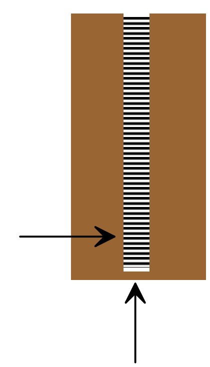
EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

WATER YEAR TYPE DESIGNATION

- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET





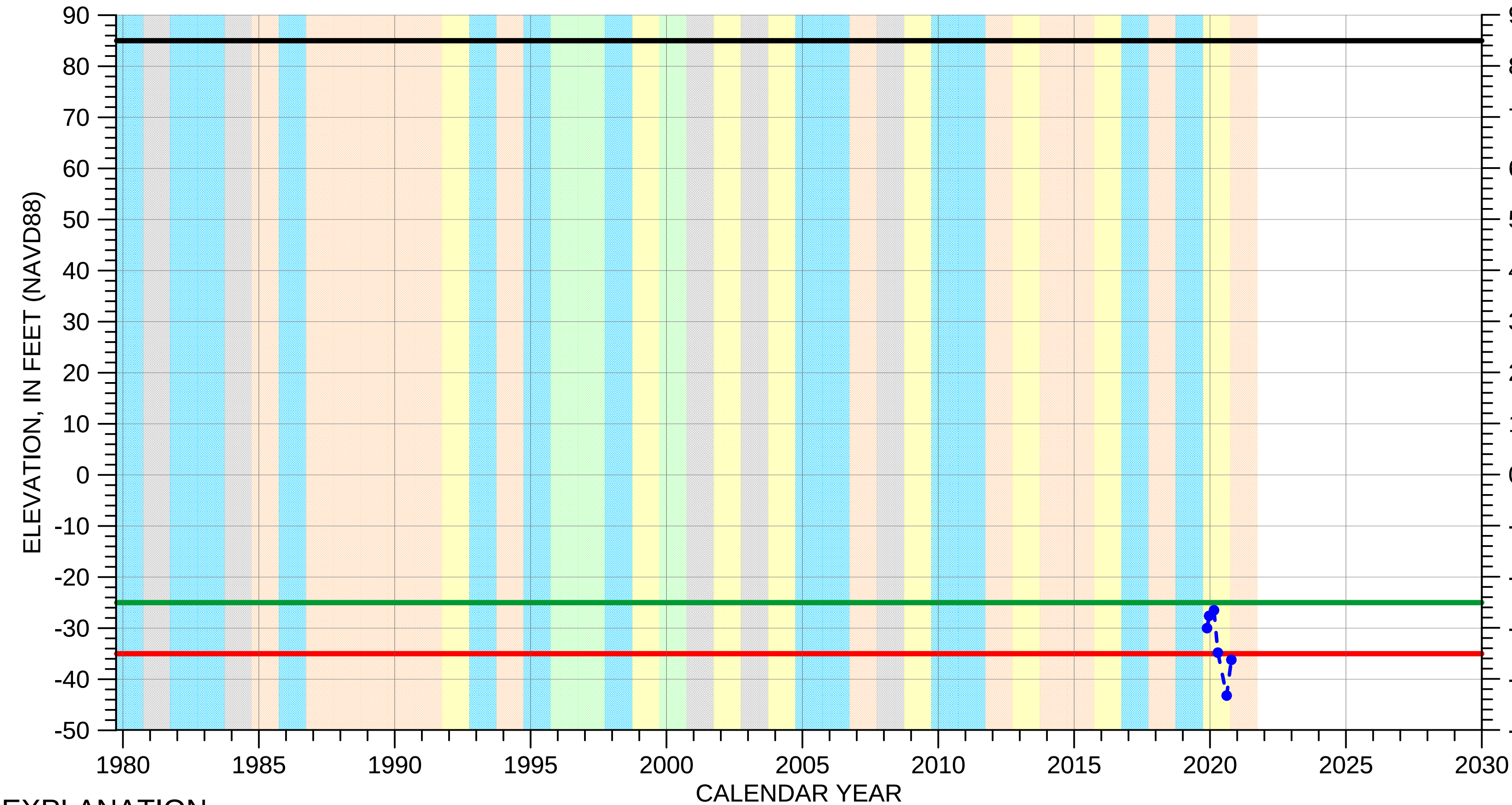
Perforated from
-24 to -84 feel msl

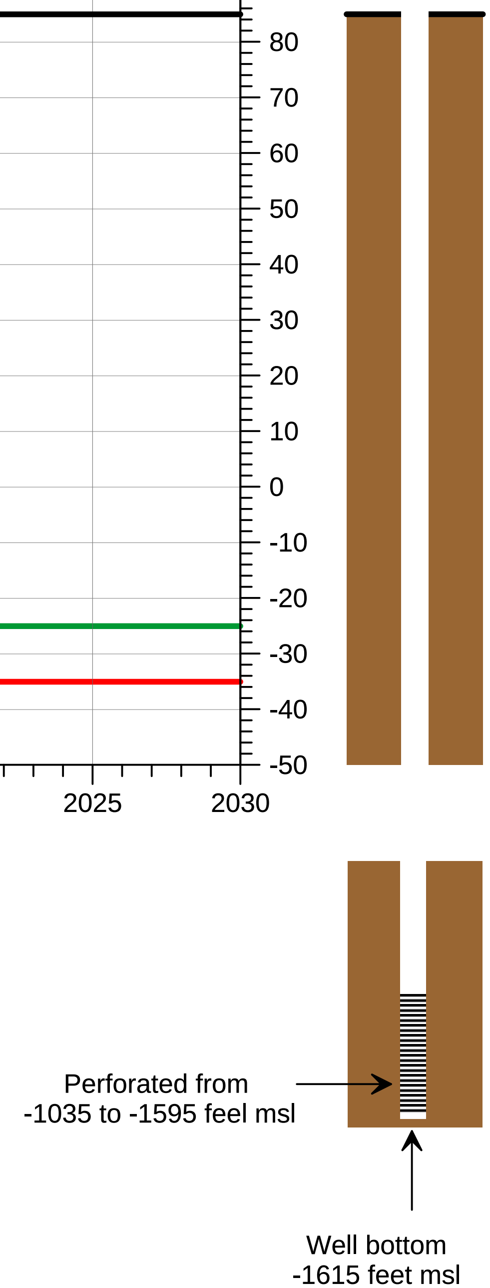
Well bottom
-84 feet msl

\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch8\14S_02E-17C02.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-18B01

180/400-Foot Aquifer Subbasin



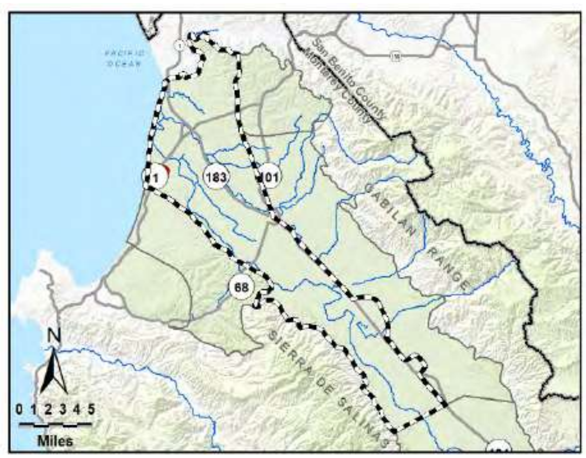


EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

WATER YEAR TYPE DESIGNATION

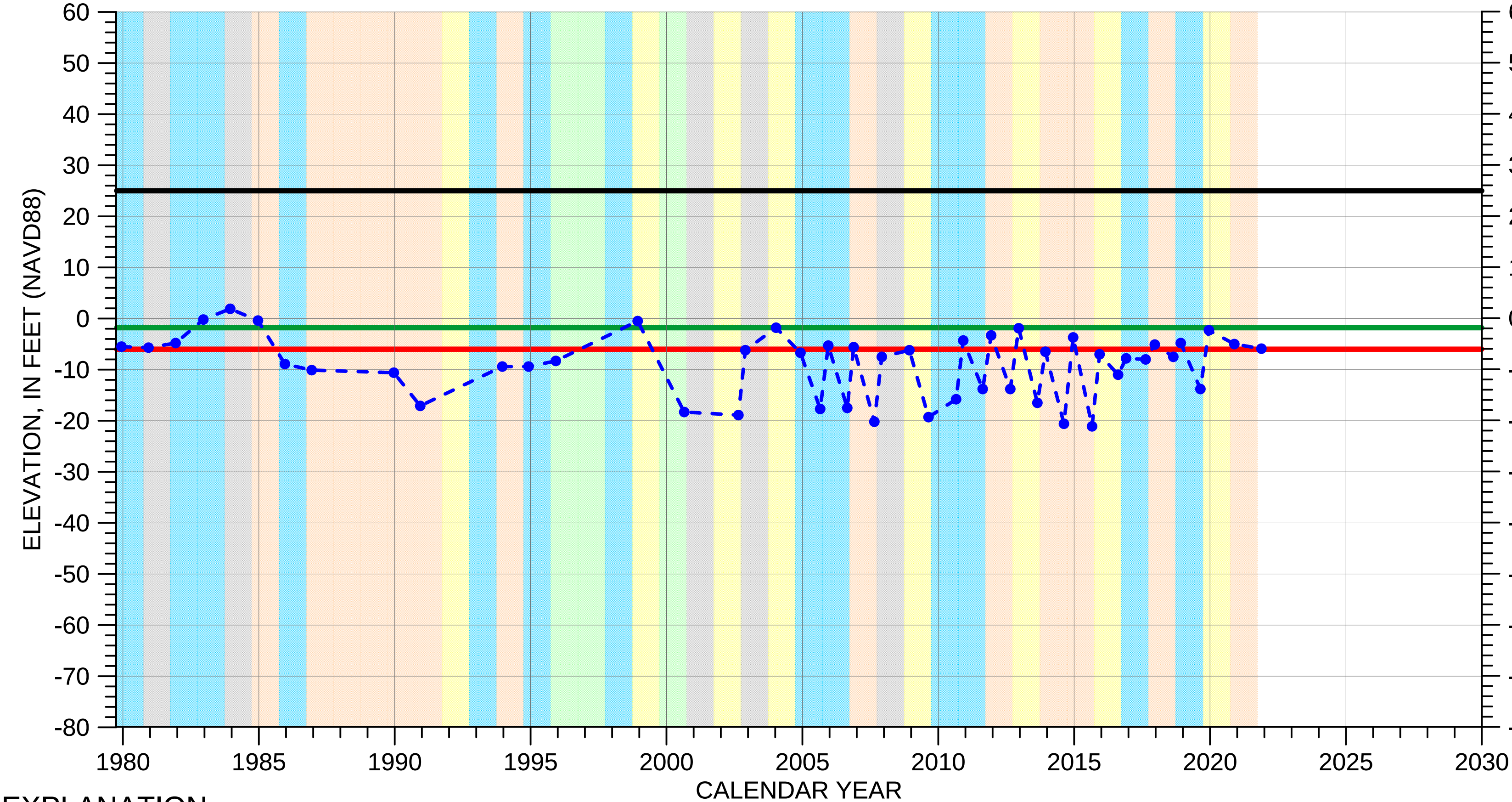
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

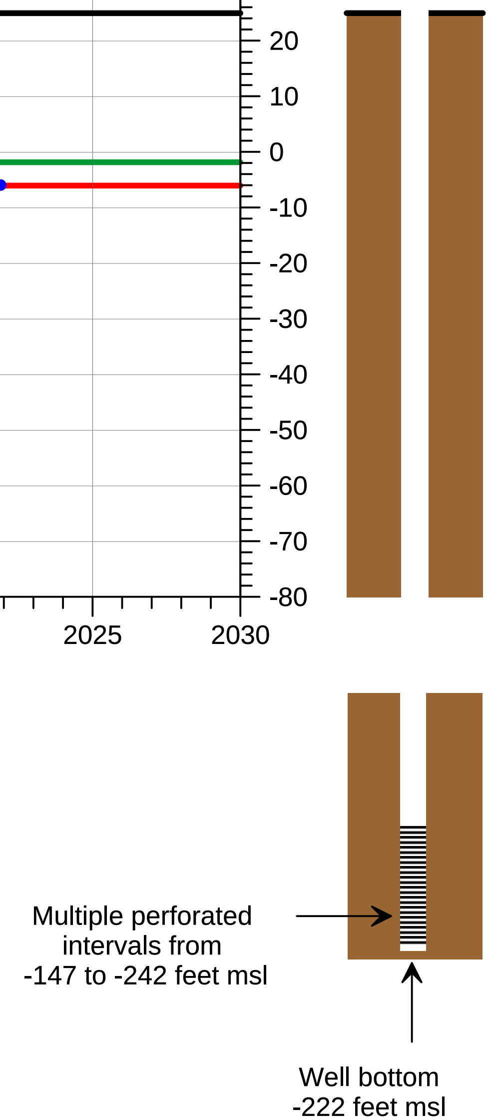


\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch8\14S_02E-18B01.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-21L01

180/400-Foot Aquifer Subbasin



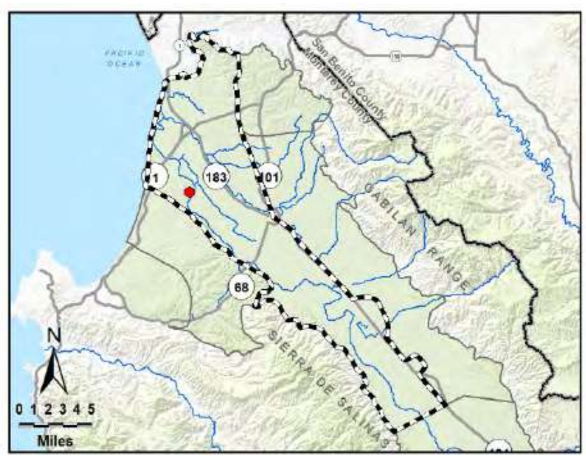


EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

WATER YEAR TYPE DESIGNATION

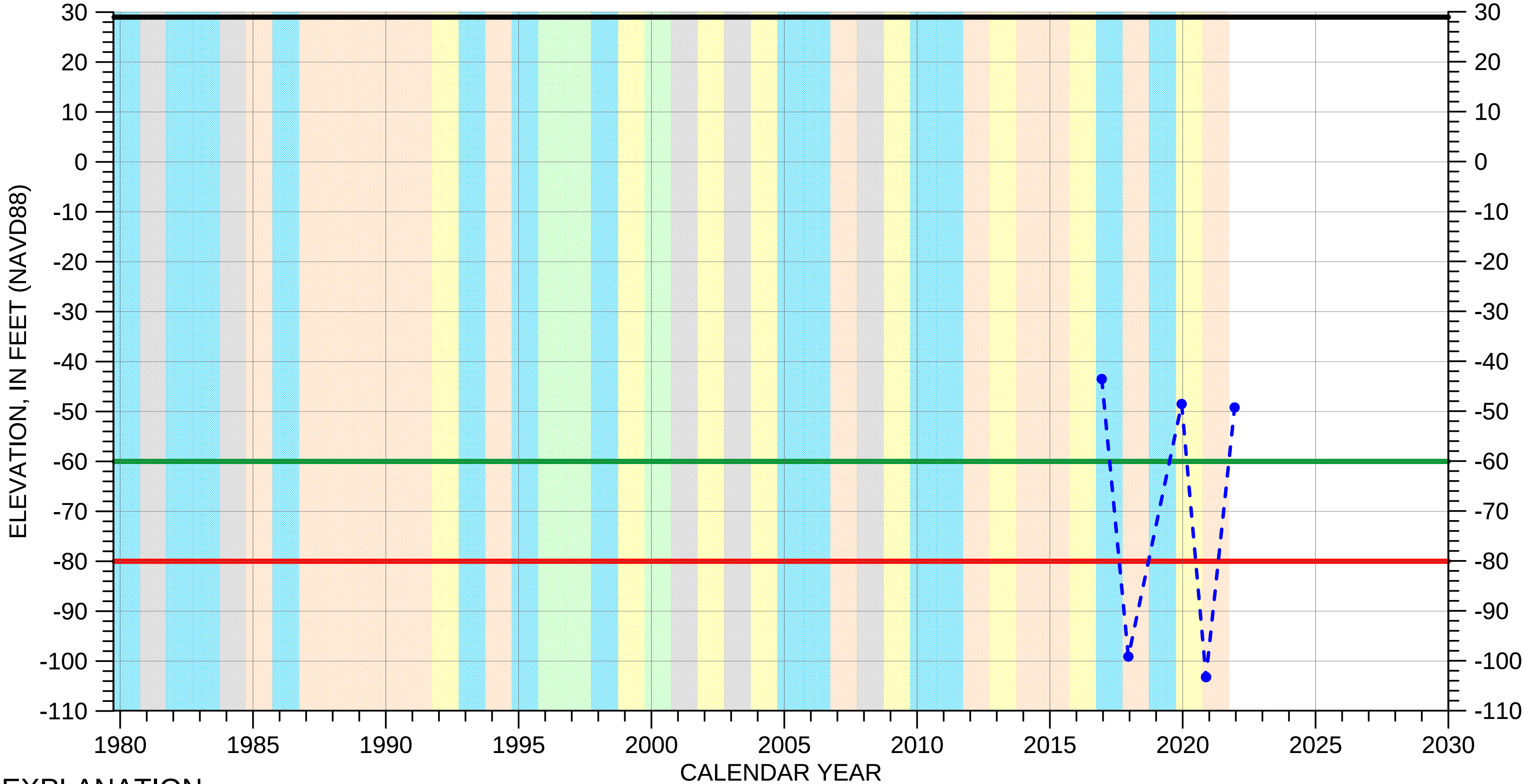
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET



\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEW\GRFs_Ch8\14S_02E-21L01.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-22A03

180/400-Foot Aquifer Subbasin

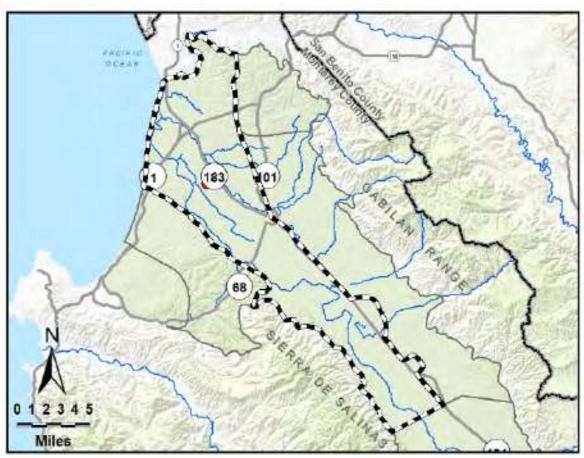


EXPLANATION

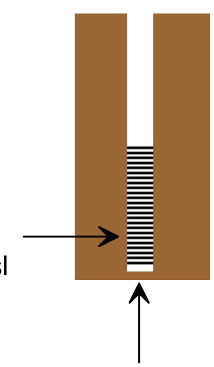
- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

WATER YEAR TYPE DESIGNATION

- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET



Perforated from
-951 to -1611 feel msl

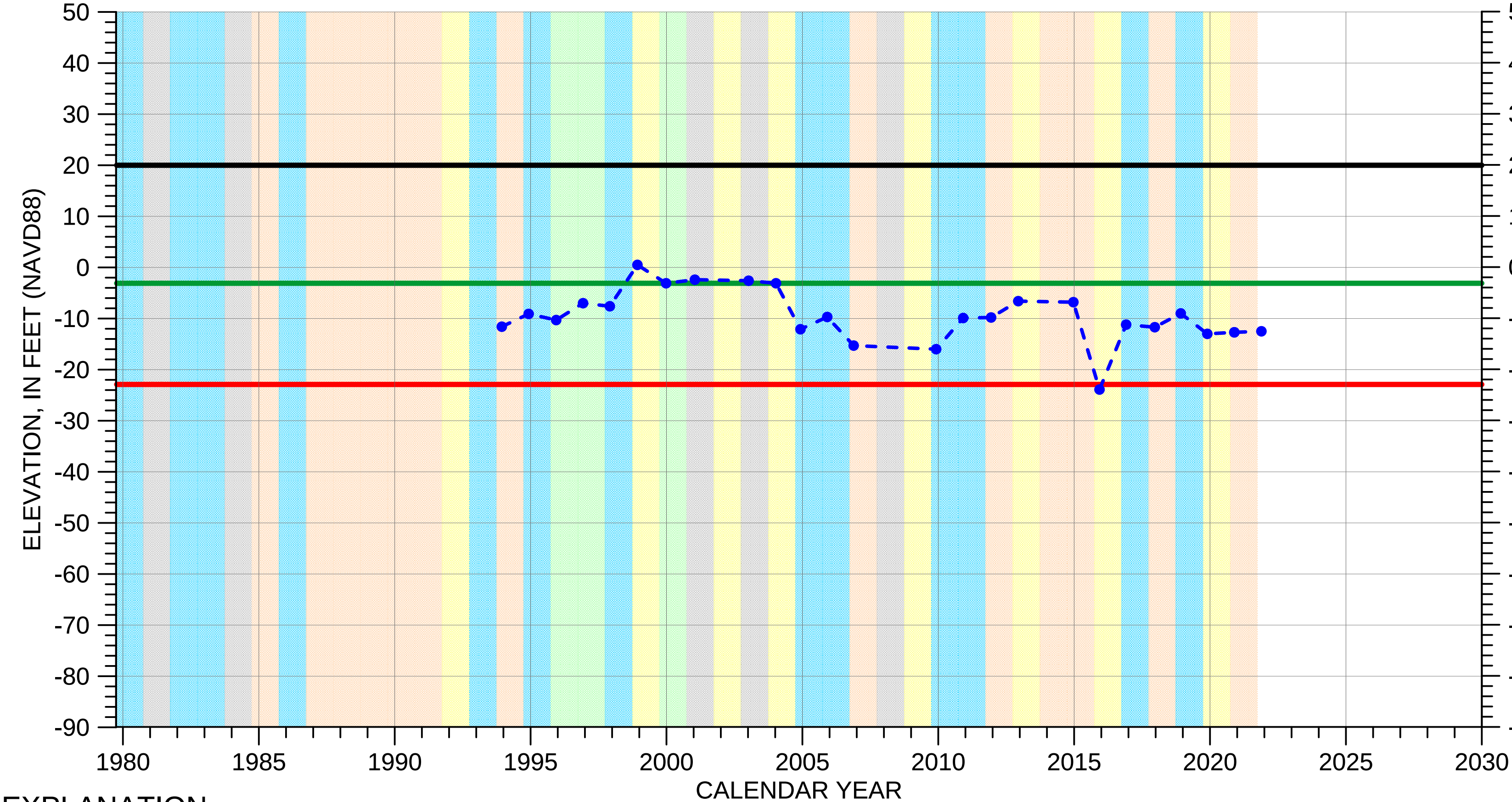


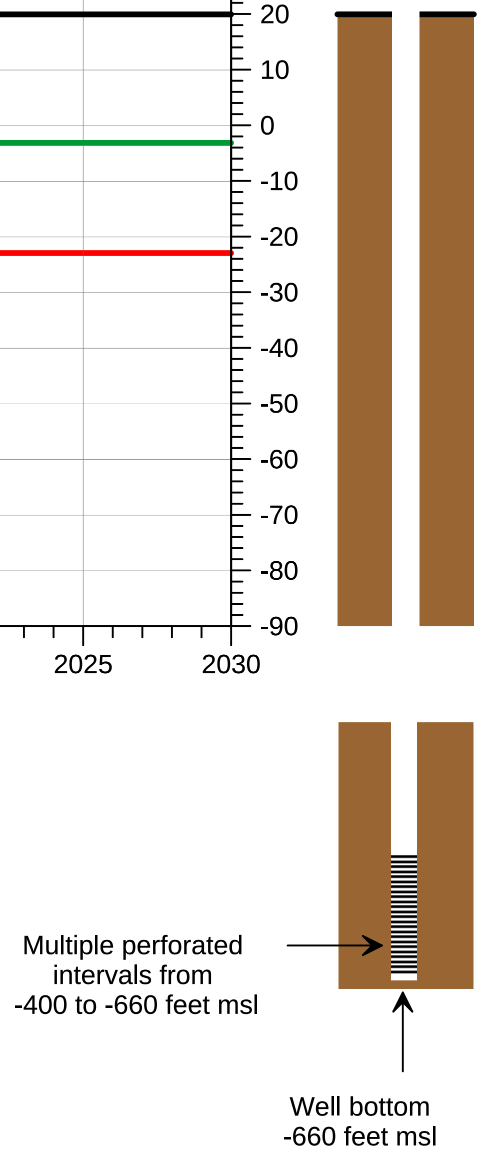
Well bottom
-1611 feet msl

\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch8\14S_02E-22A03.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-22L01

180/400-Foot Aquifer Subbasin





EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

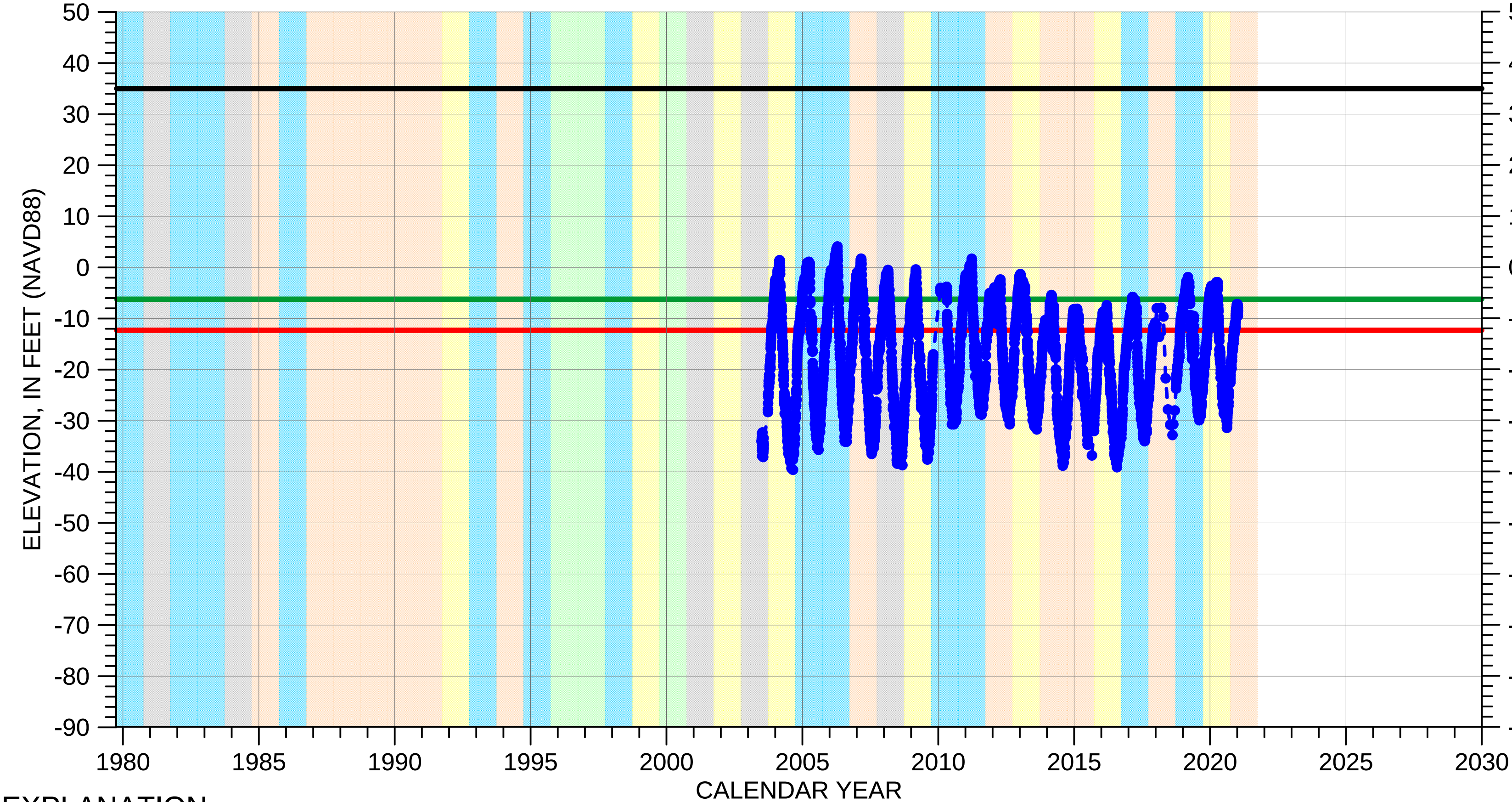
WATER YEAR TYPE DESIGNATION

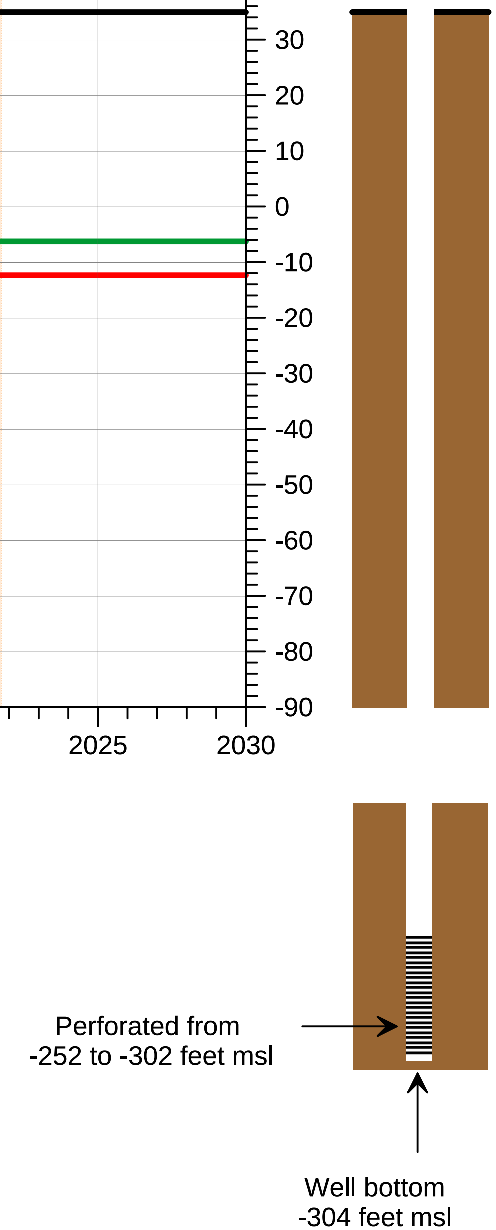
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRA\NEWGRFs_Ch8\14S_02E-22L01.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-26H01

180/400-Foot Aquifer Subbasin



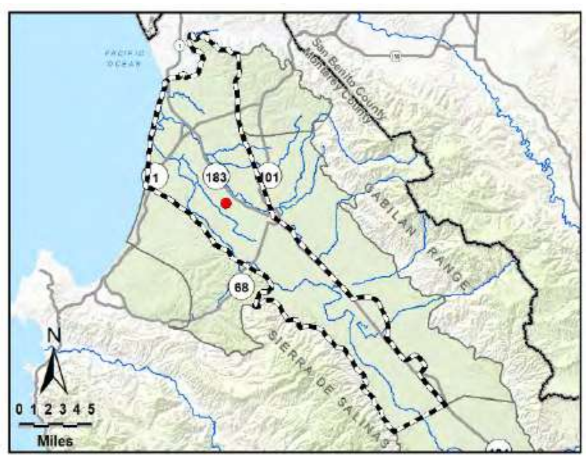


EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

WATER YEAR TYPE DESIGNATION

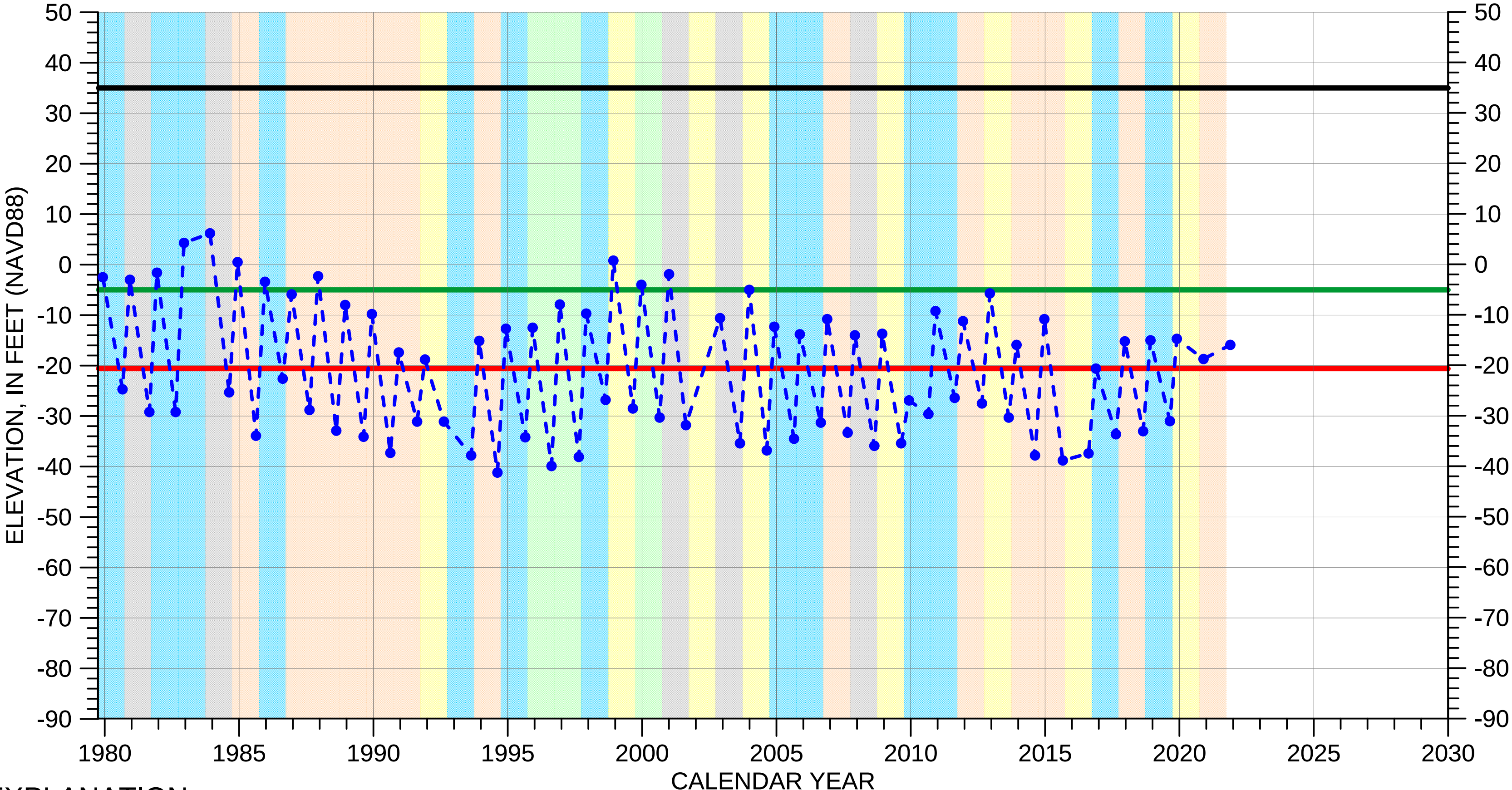
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET



\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch8\14S_02E-26H01.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-26J03

180/400-Foot Aquifer Subbasin



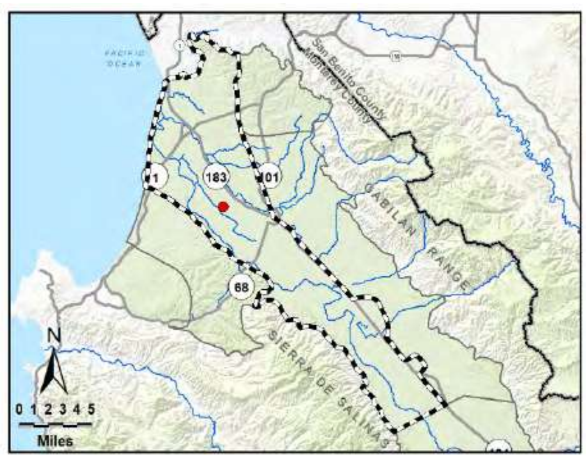
\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch8\14S_02E-26J03.grf

EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

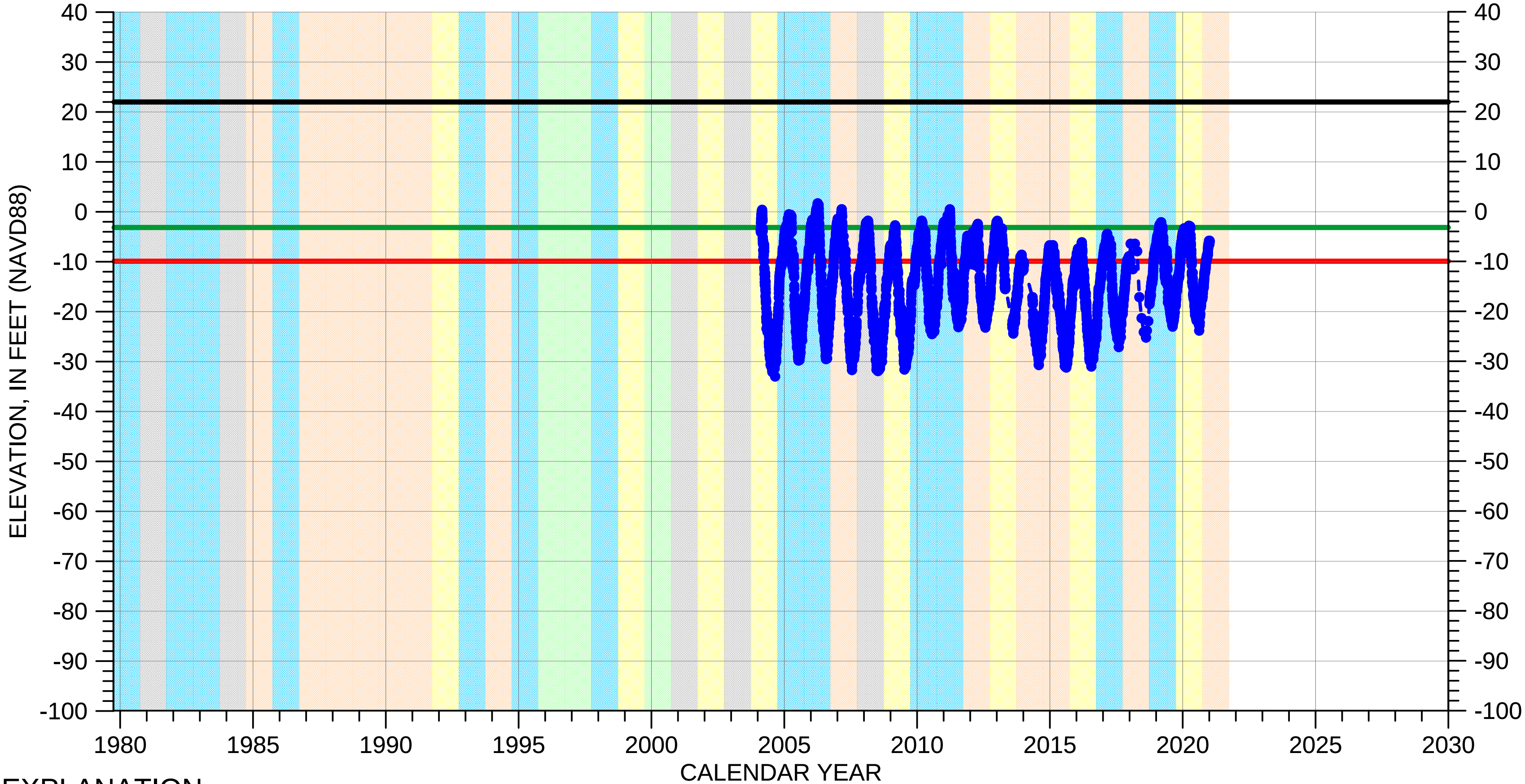
WATER YEAR TYPE DESIGNATION

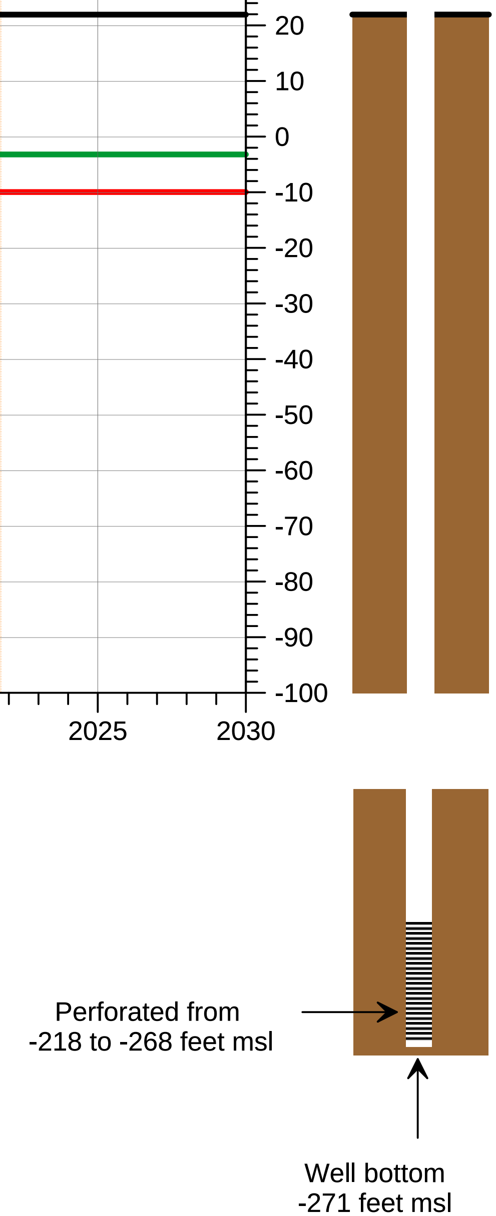
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET



HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-27A01

180/400-Foot Aquifer Subbasin



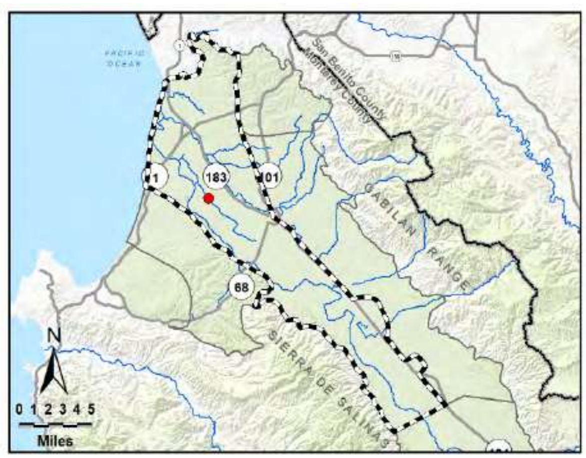


EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

WATER YEAR TYPE DESIGNATION

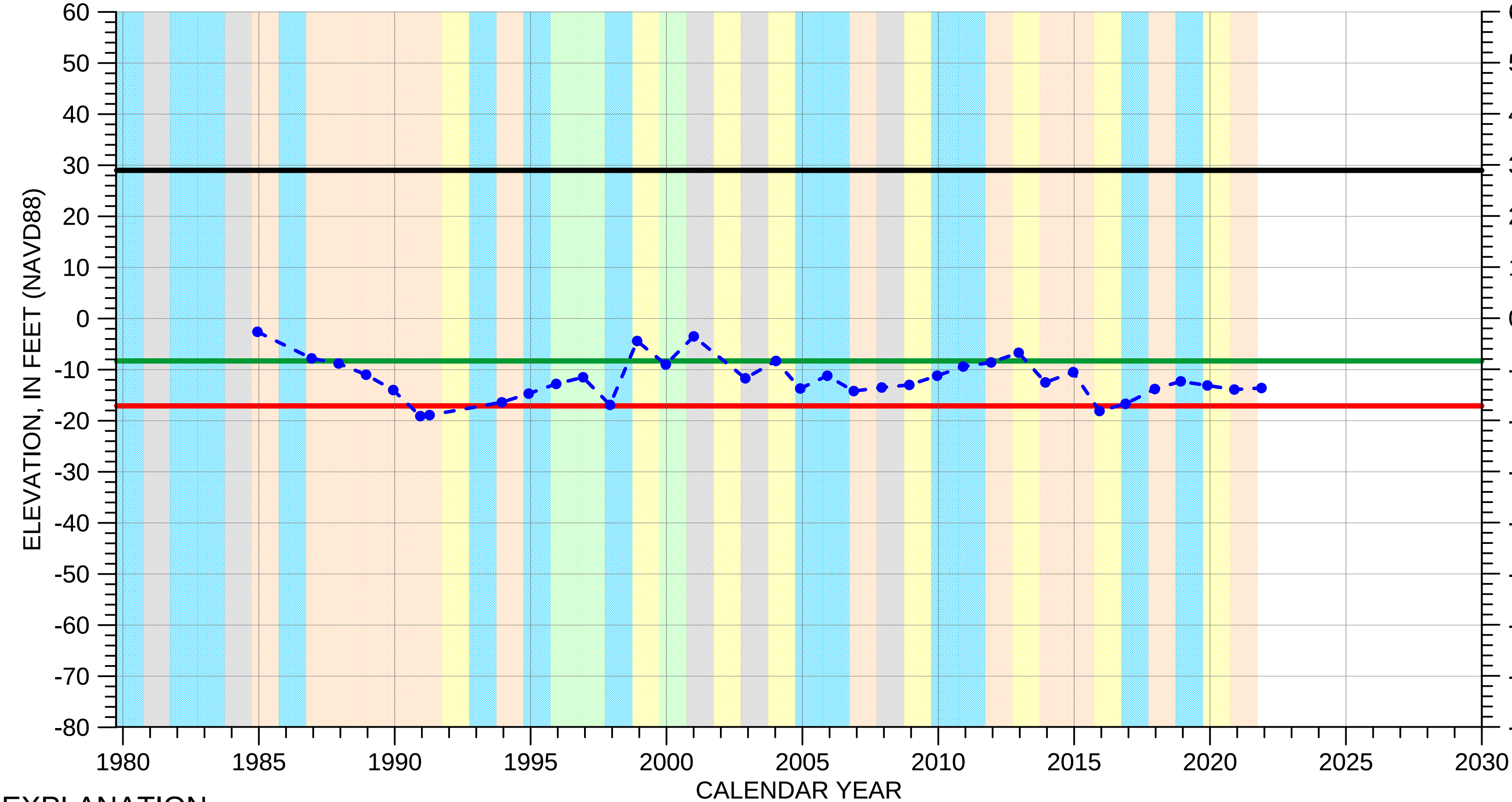
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

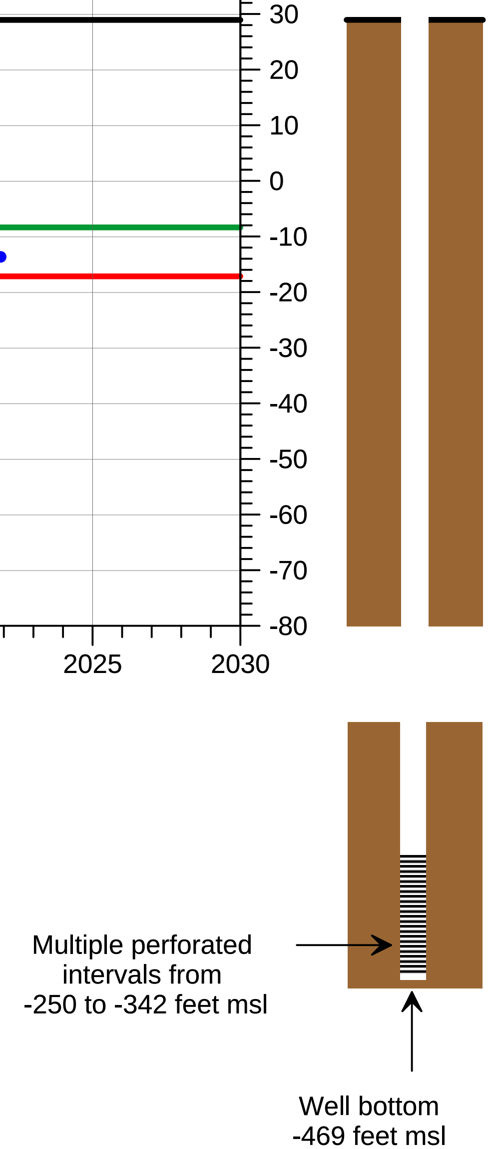


\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch8\14S_02E-27A01.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-27G03

180/400-Foot Aquifer Subbasin





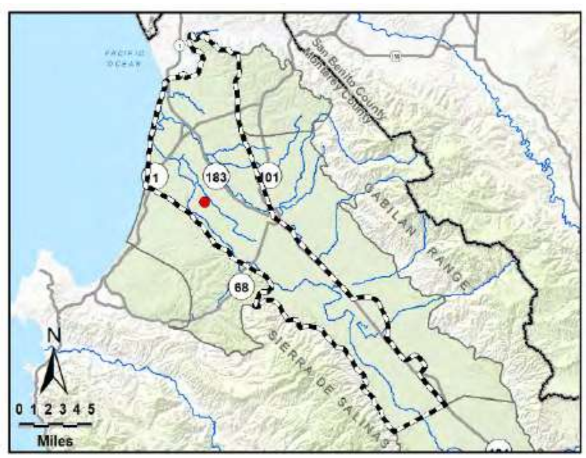
\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRA\NEWGRFs_Ch8\14S_02E-27G03.grf

EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

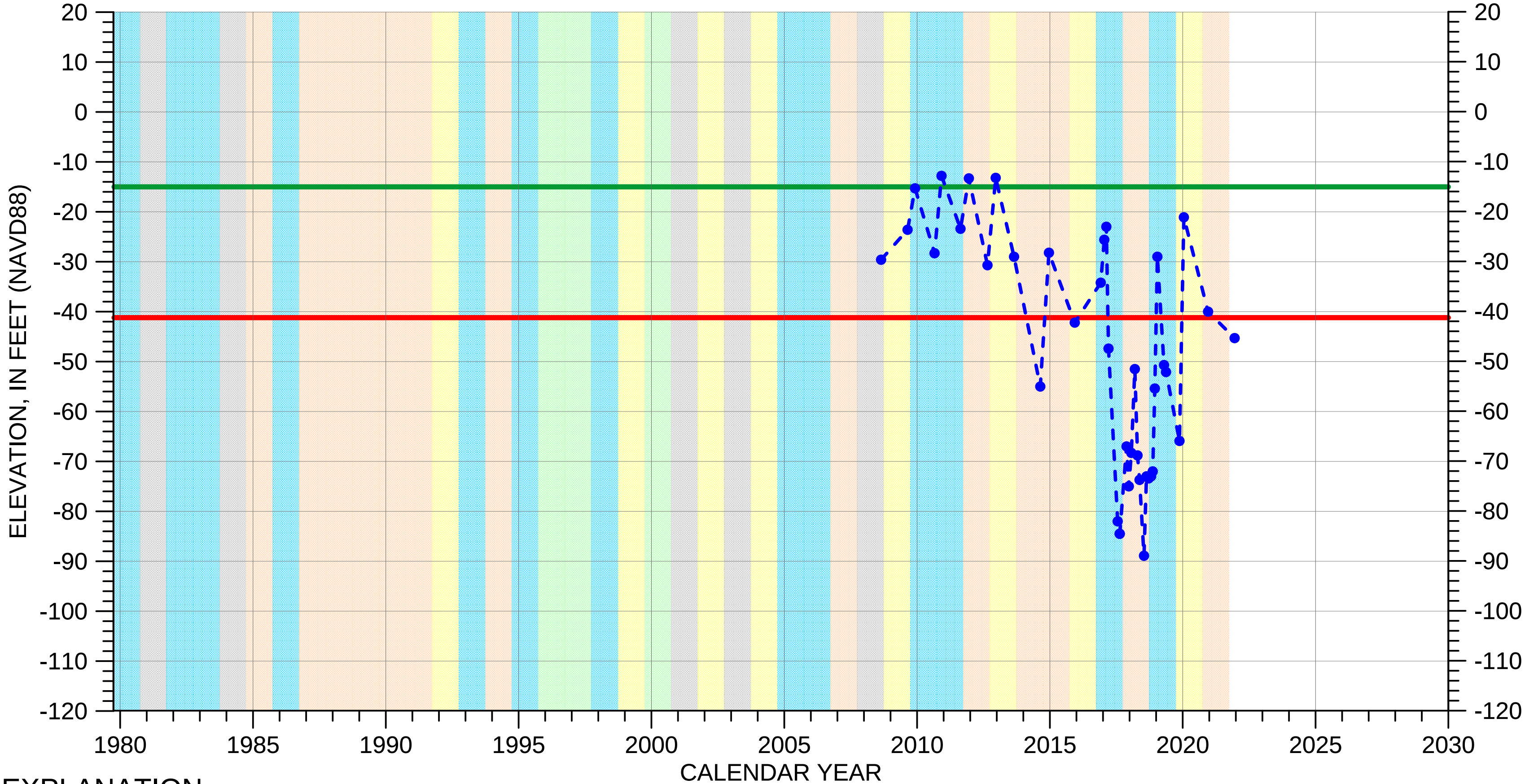
WATER YEAR TYPE DESIGNATION

- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET



HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-28C02

180/400-Foot Aquifer Subbasin

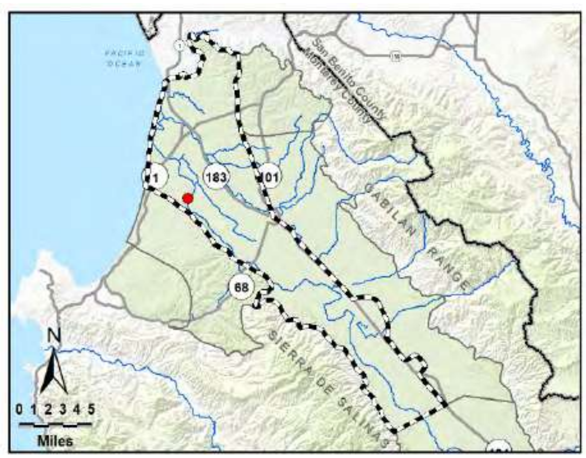


EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface (45 FT MSL)
- Measurable Objective
- Minimum Threshold

WATER YEAR TYPE DESIGNATION

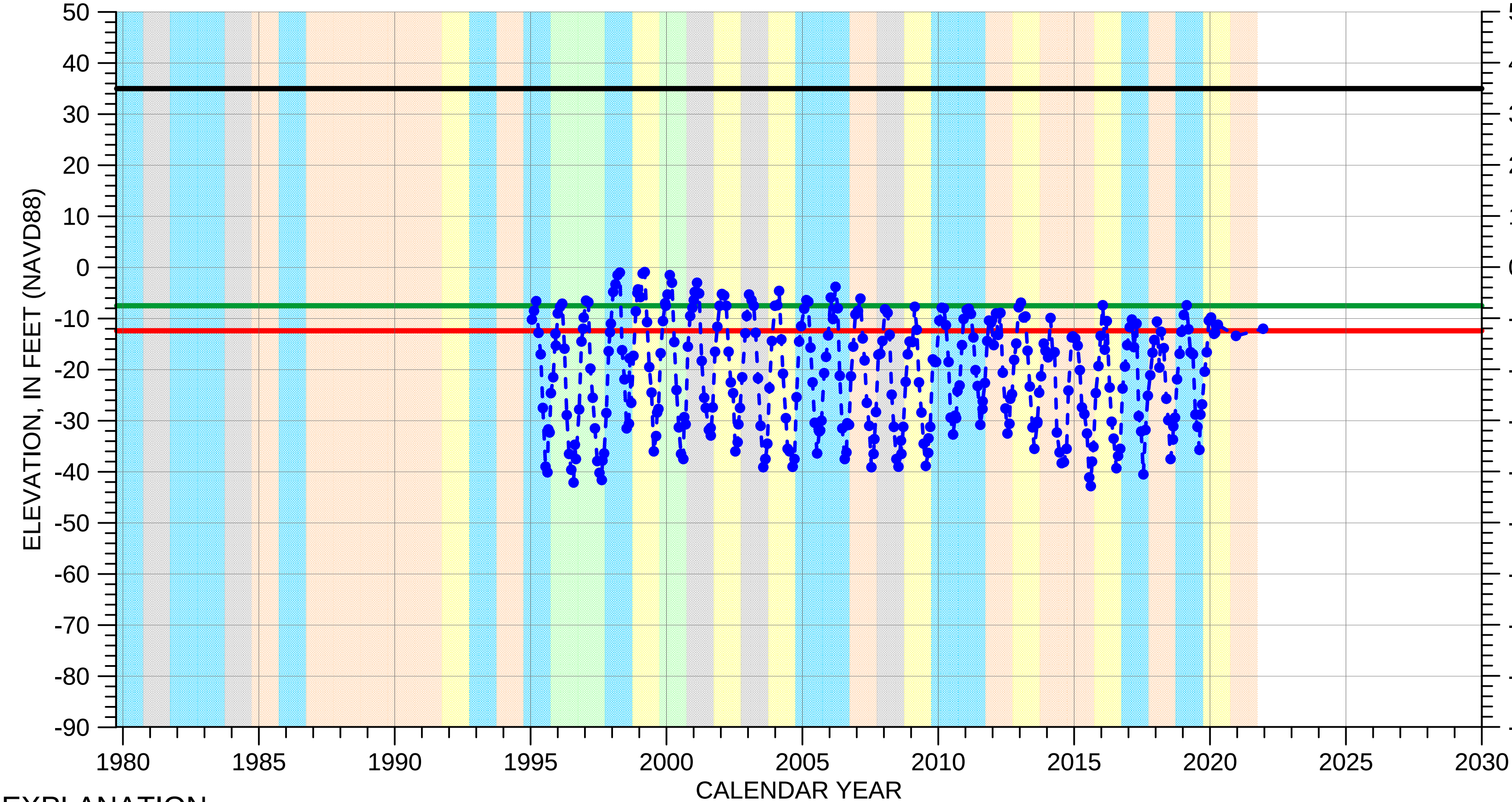
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

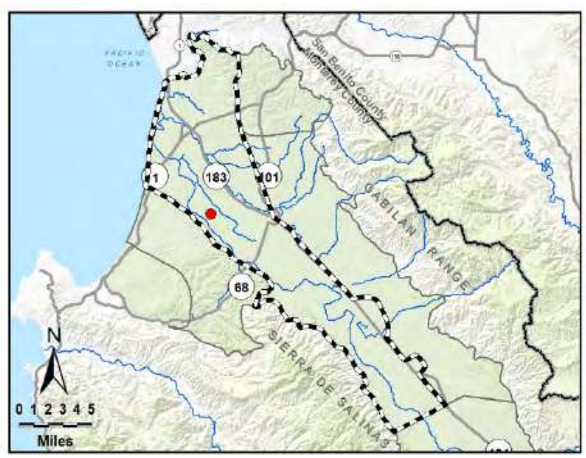


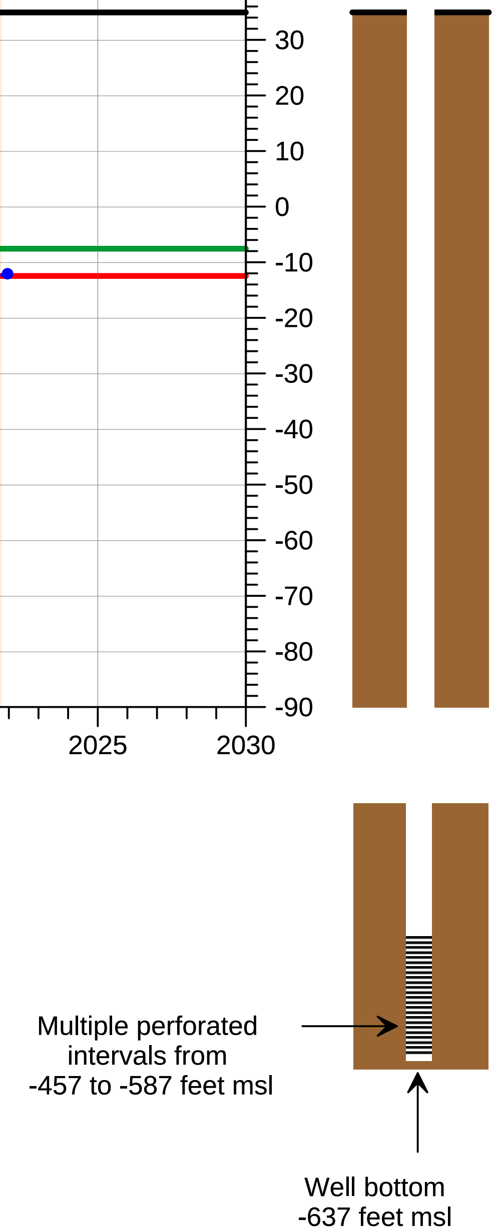
\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRA\NEW\GRFs_Ch8\14S_02E-28C02.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-34A03

180/400-Foot Aquifer Subbasin







EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

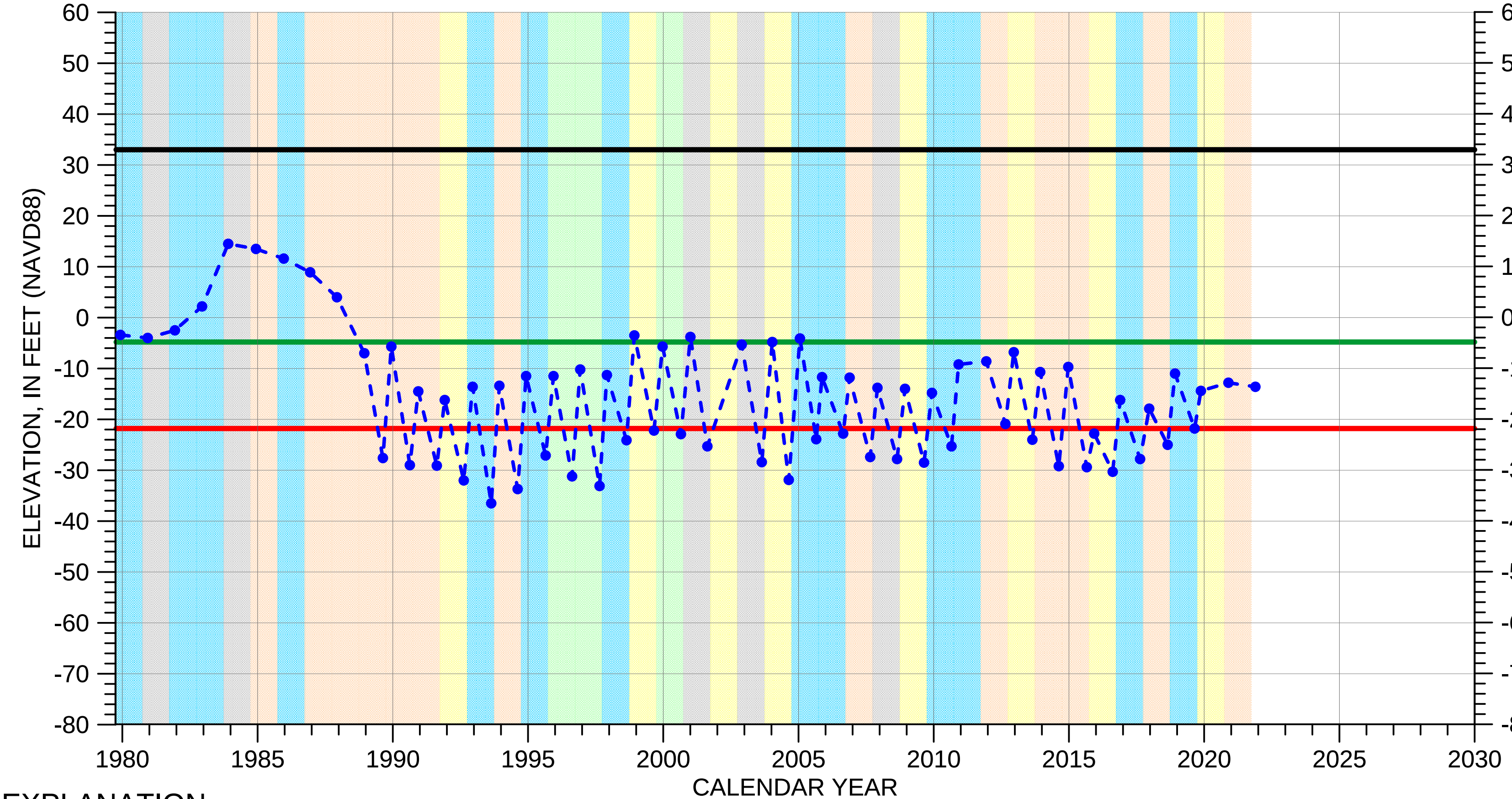
WATER YEAR TYPE DESIGNATION

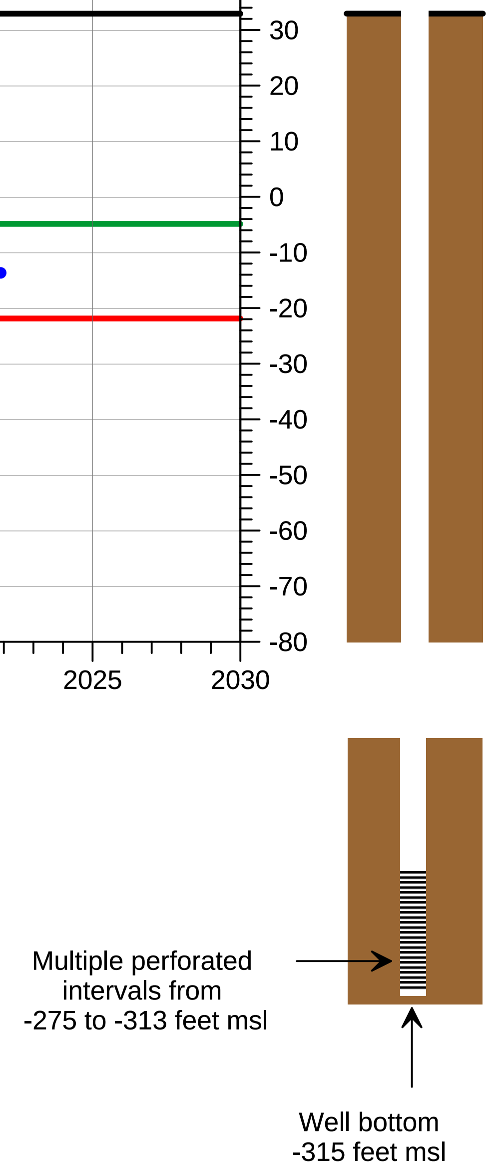
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch8\14S_02E-34A03.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-34B03

180/400-Foot Aquifer Subbasin



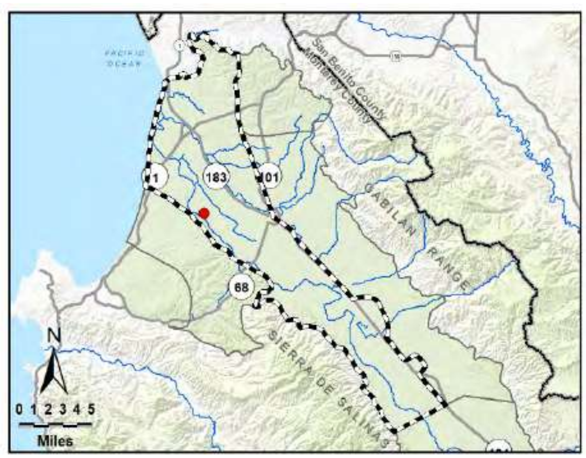


EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

WATER YEAR TYPE DESIGNATION

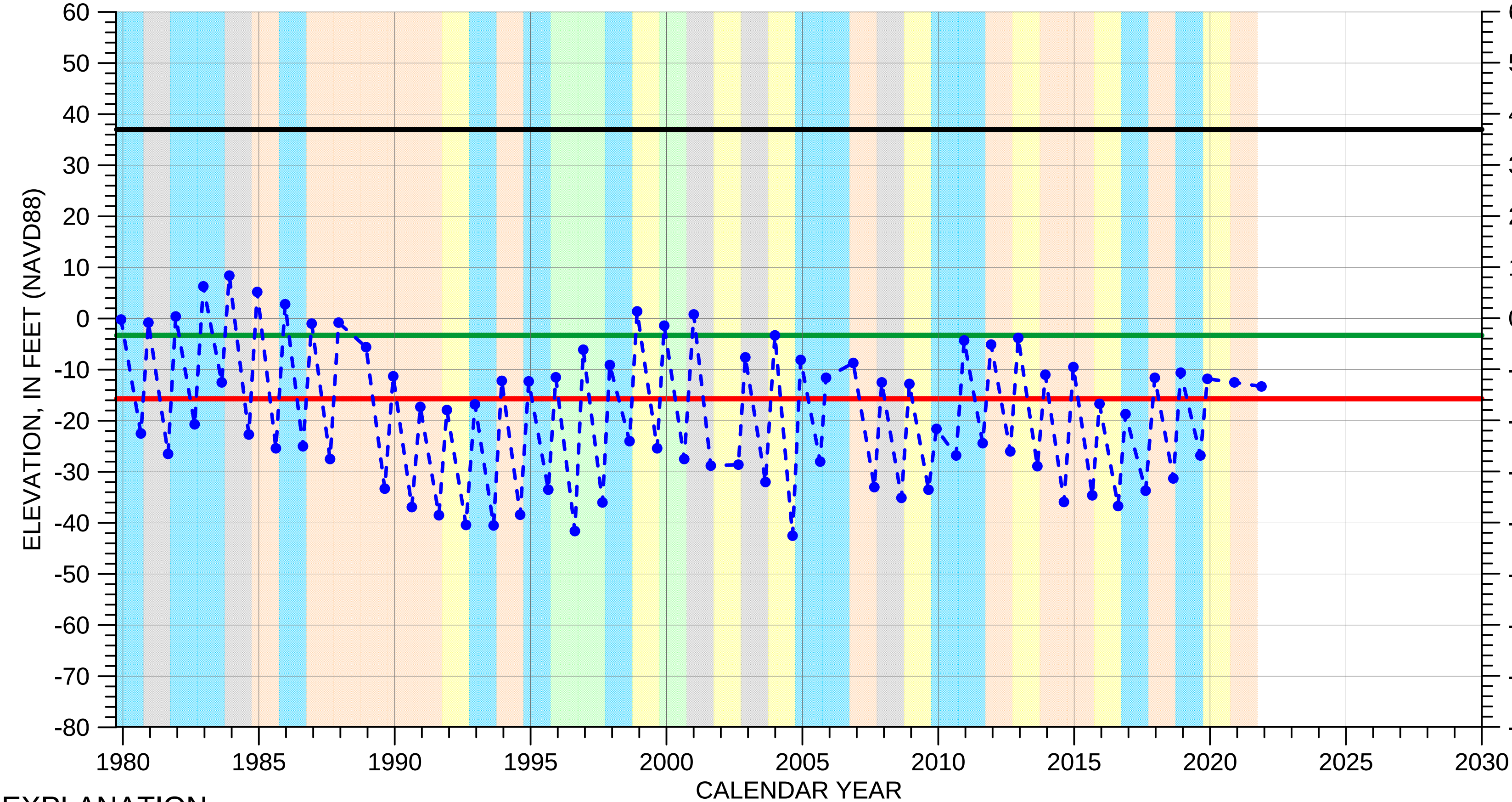
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET



\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch8\14S_02E-34B03.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-36E01

180/400-Foot Aquifer Subbasin

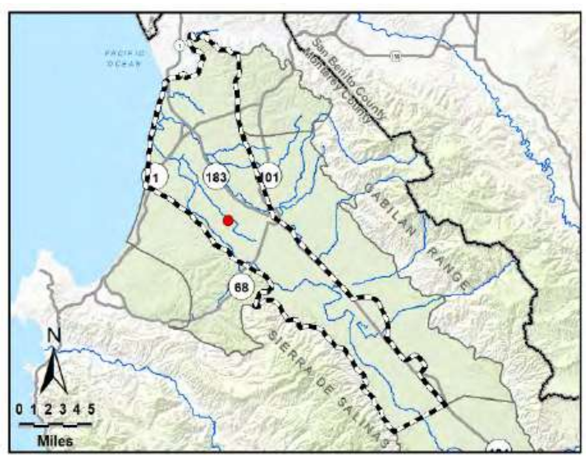


EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

WATER YEAR TYPE DESIGNATION

- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET



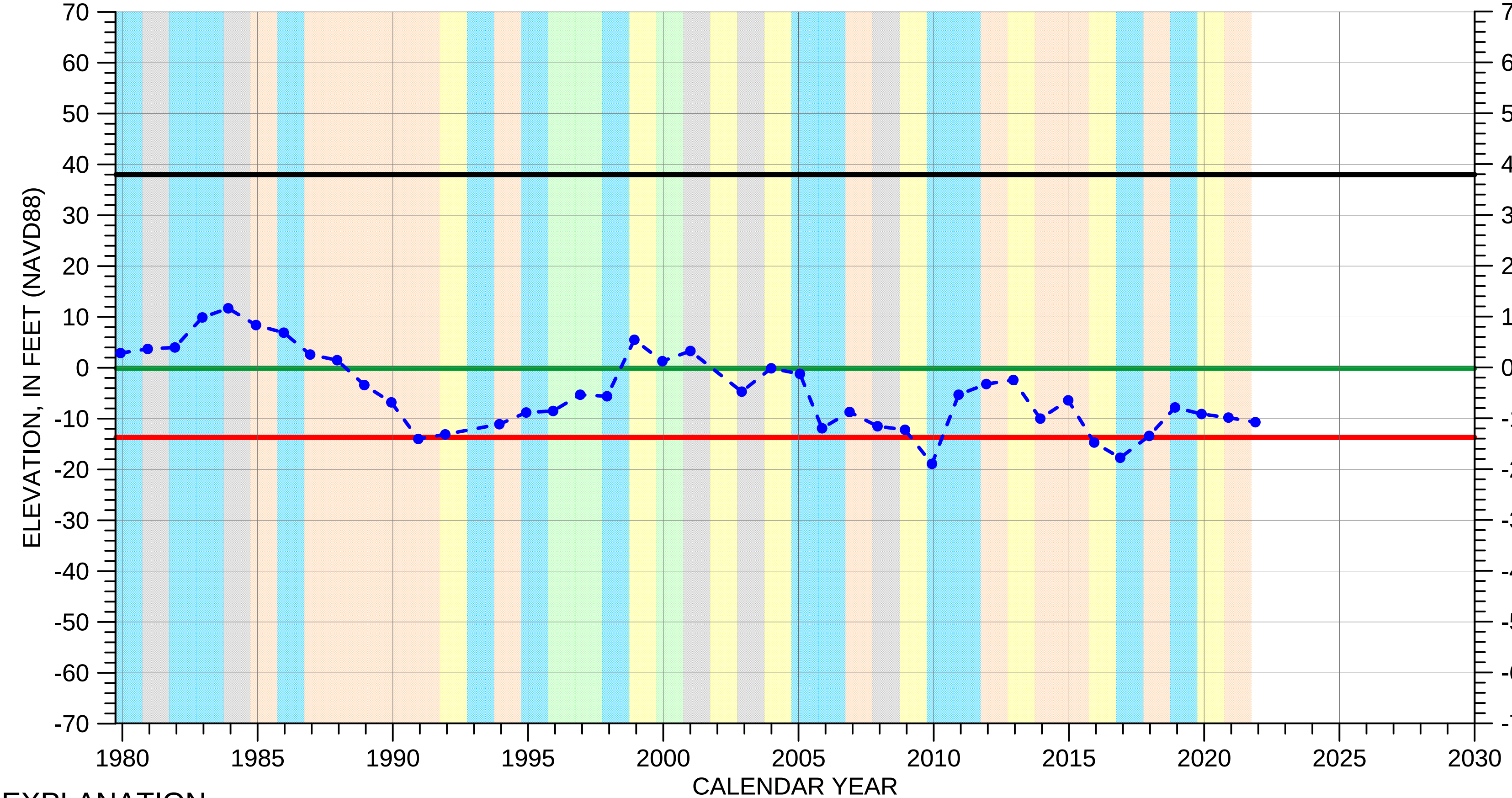
Perforated interval unknown

Well bottom
-165 feet msl

\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch8\14S_02E-36E01.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/02E-36G01

180/400-Foot Aquifer Subbasin



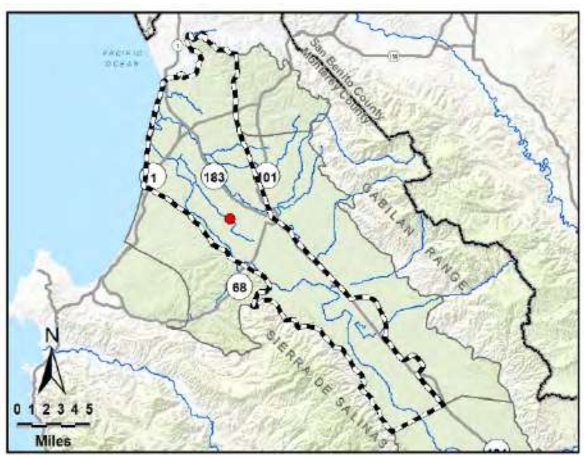
\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRA\NEWGRFs_Ch8\14S_02E-36G01.grf

EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

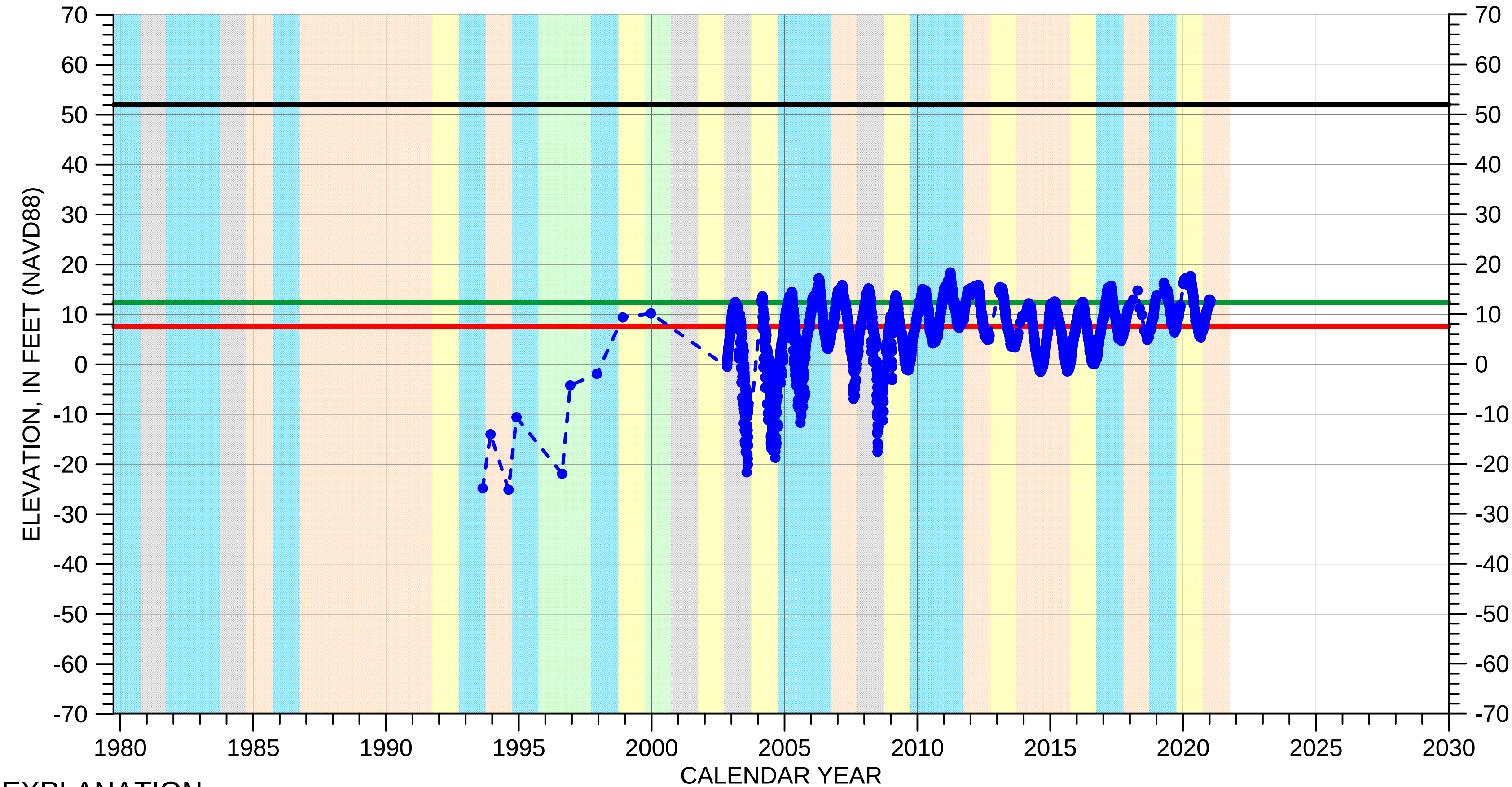
WATER YEAR TYPE DESIGNATION

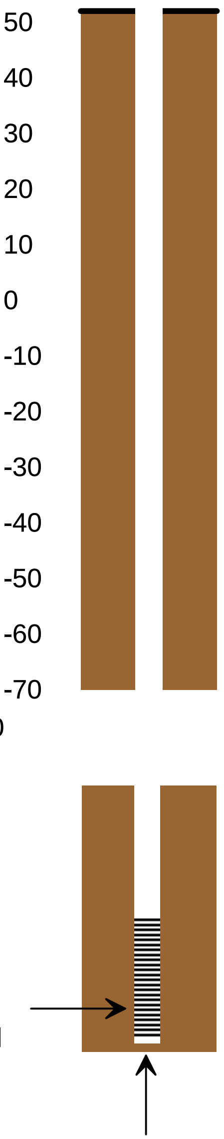
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET



HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/03E-18C01

180/400-Foot Aquifer Subbasin



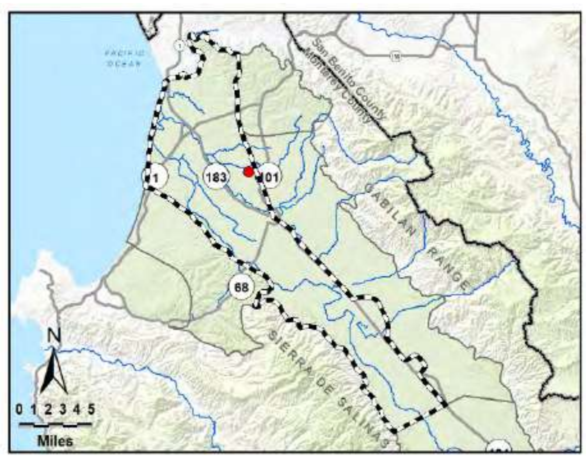


EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

WATER YEAR TYPE DESIGNATION

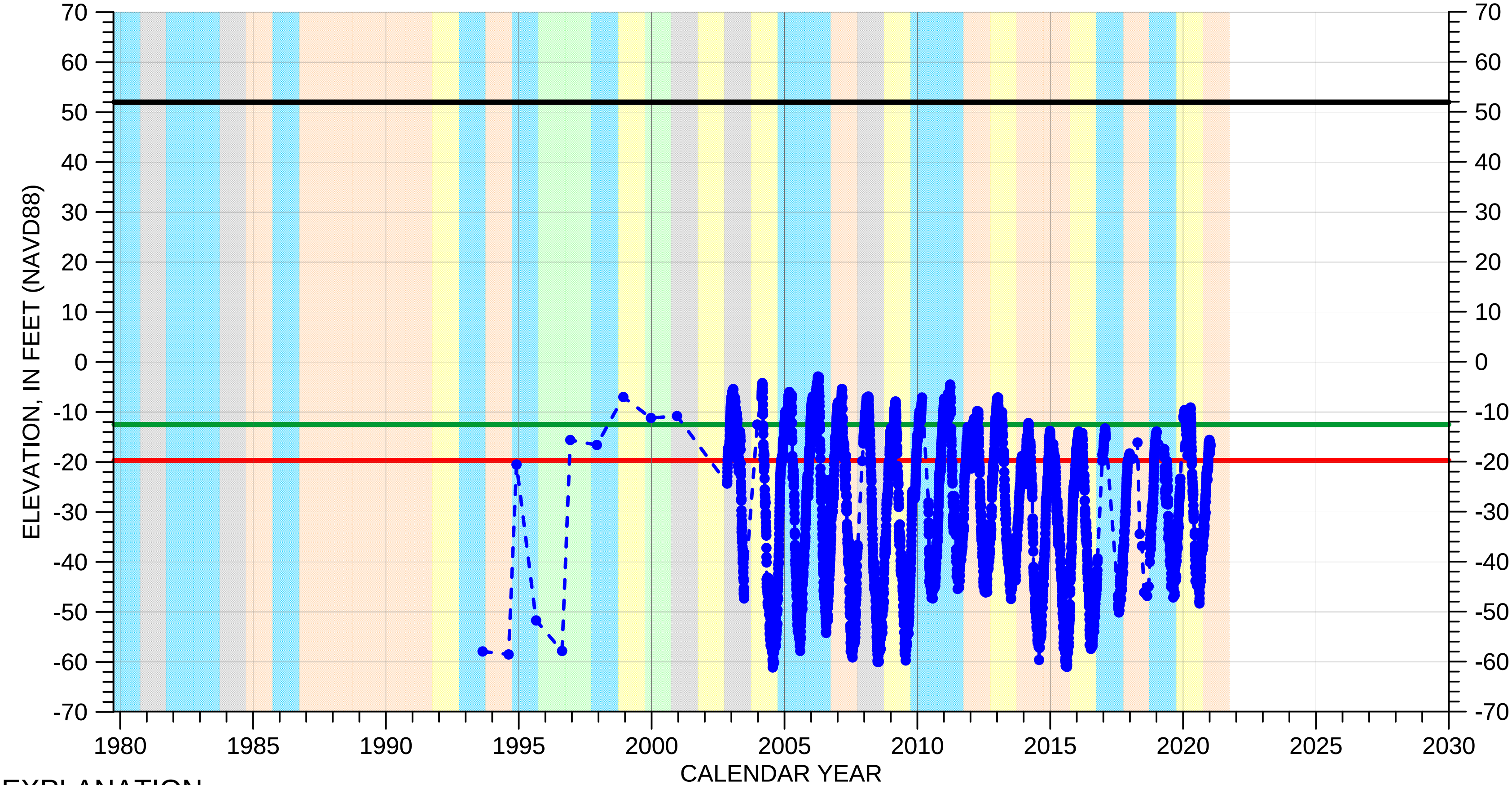
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

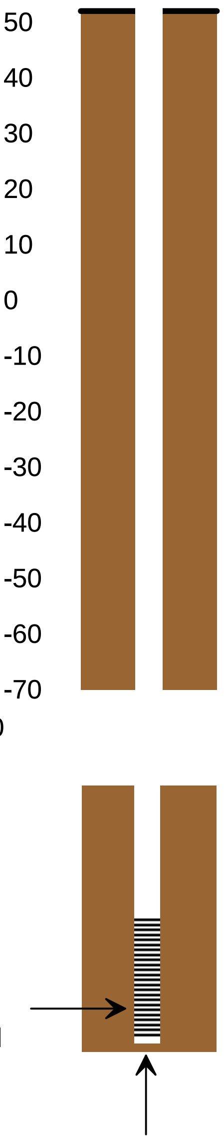


\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRA\NEWGRFs_Ch8\14S_03E-18C01.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/03E-18C02

180/400-Foot Aquifer Subbasin





Perforated from
-218 to -333 feet msl

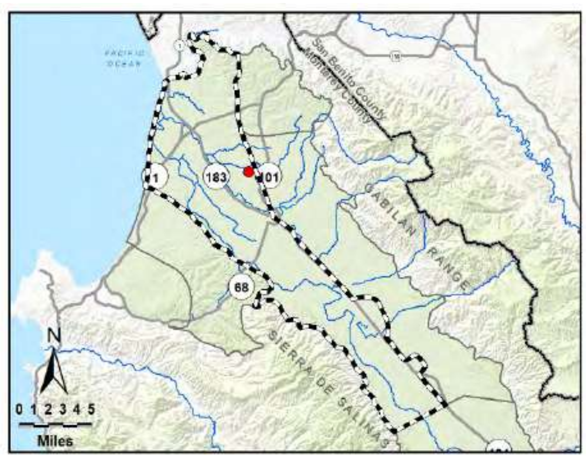
Well bottom
-343 feet msl

EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

WATER YEAR TYPE DESIGNATION

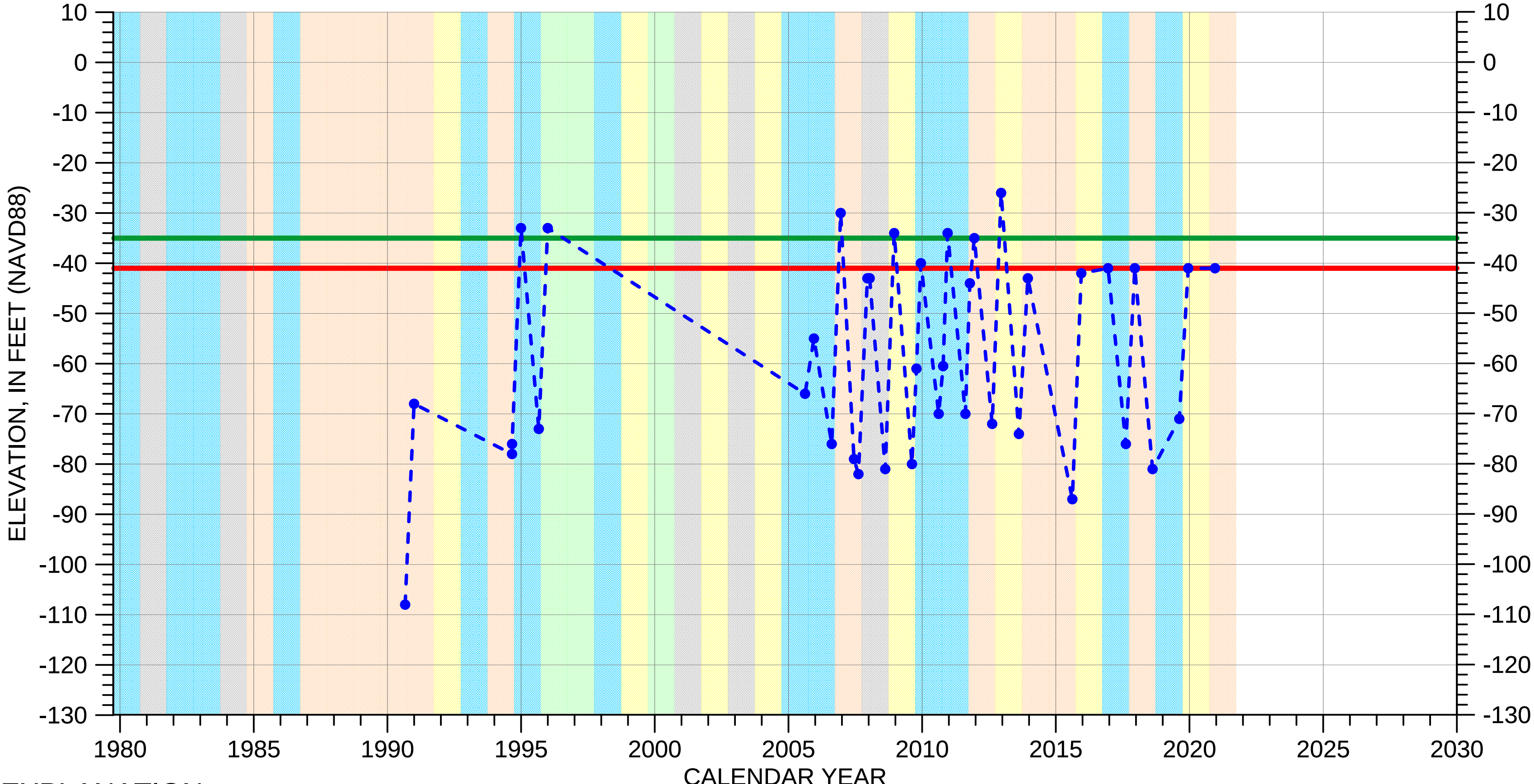
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET



\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch8\14S_03E-18C02.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/03E-20C01

180/400-Foot Aquifer Subbasin

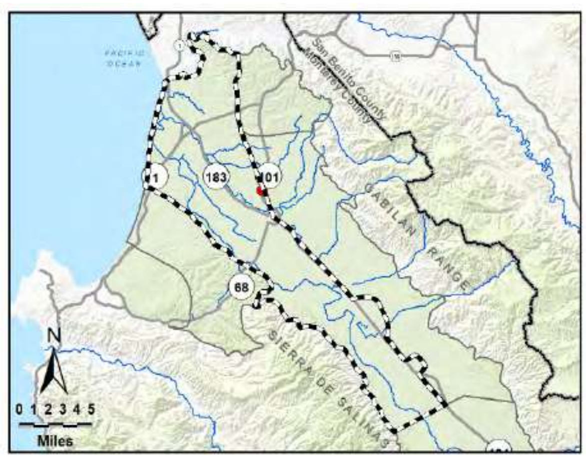


EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface (63 FT MSL)
- Measurable Objective
- Minimum Threshold

WATER YEAR TYPE DESIGNATION

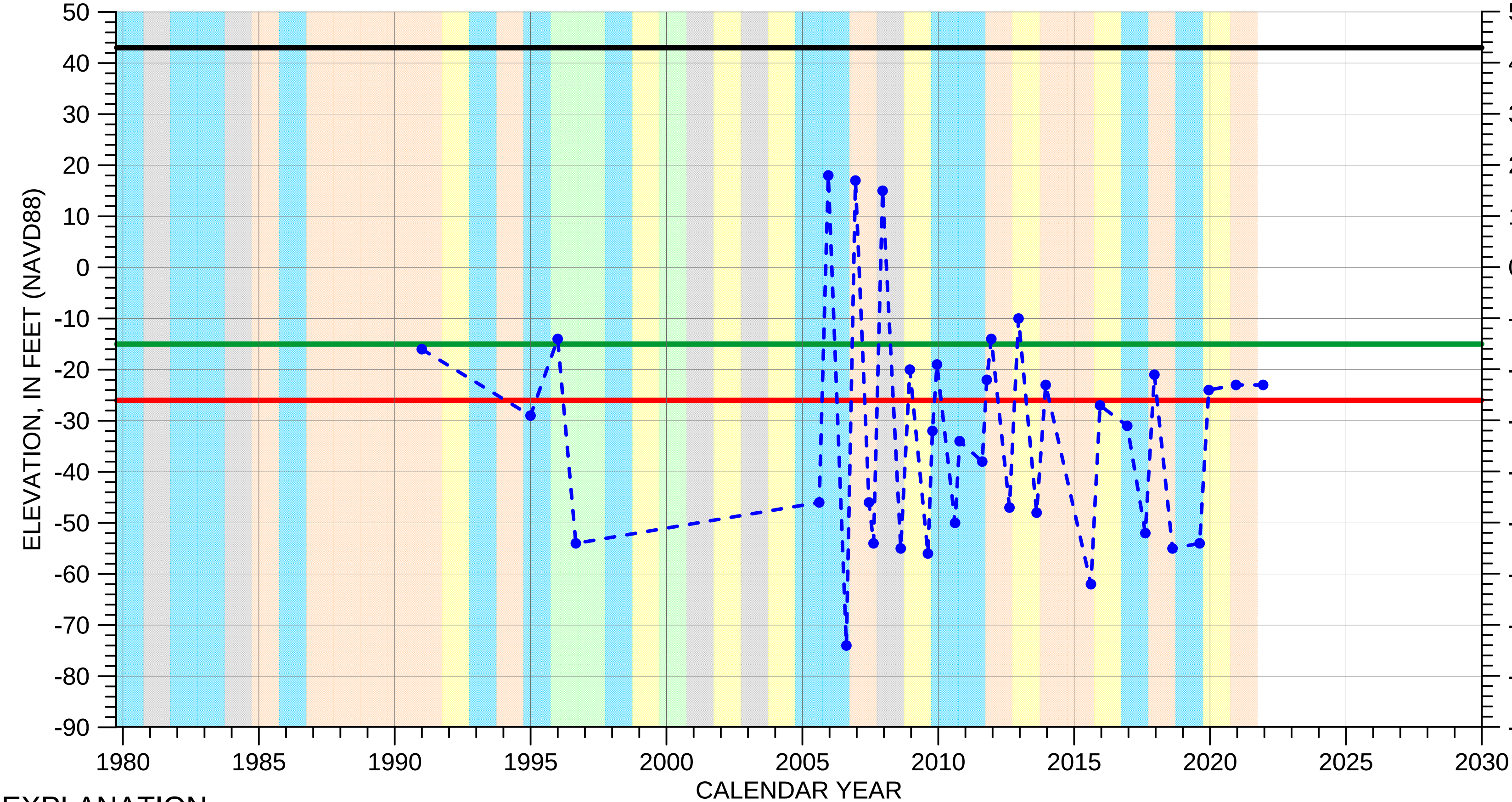
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

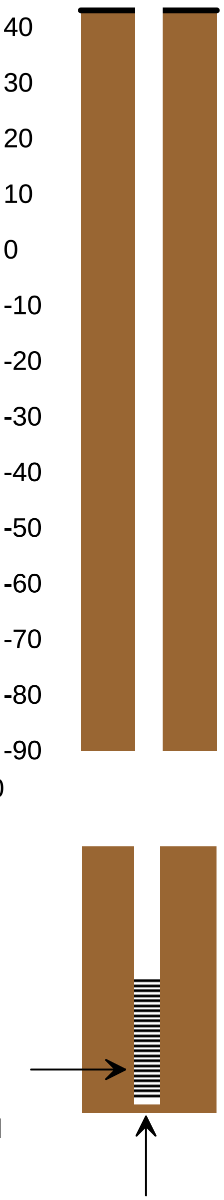


\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch8\14S_03E-20C01.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/03E-29F03

180/400-Foot Aquifer Subbasin





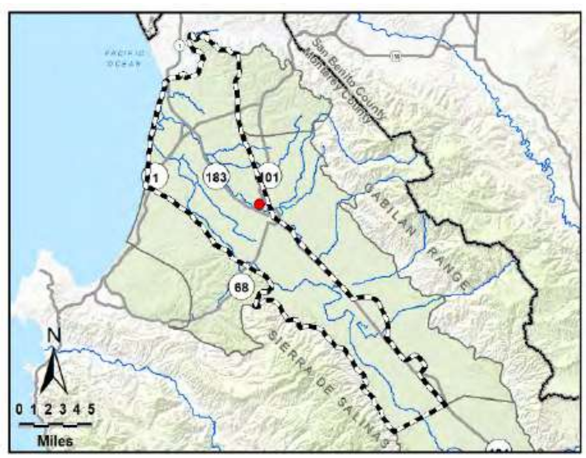
\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEW\GRFs_Ch8\14S_03E-29F03.grf

EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

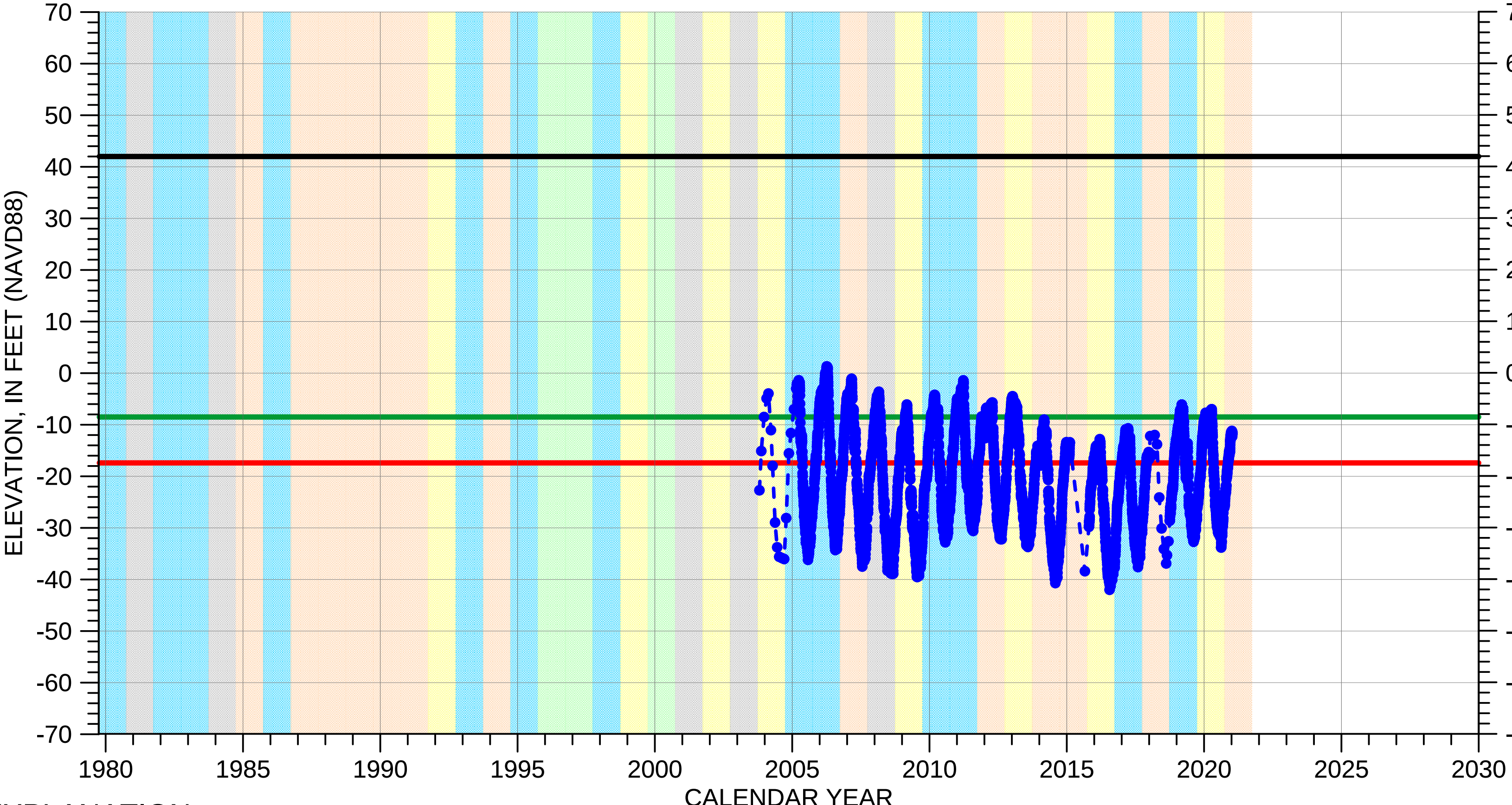
WATER YEAR TYPE DESIGNATION

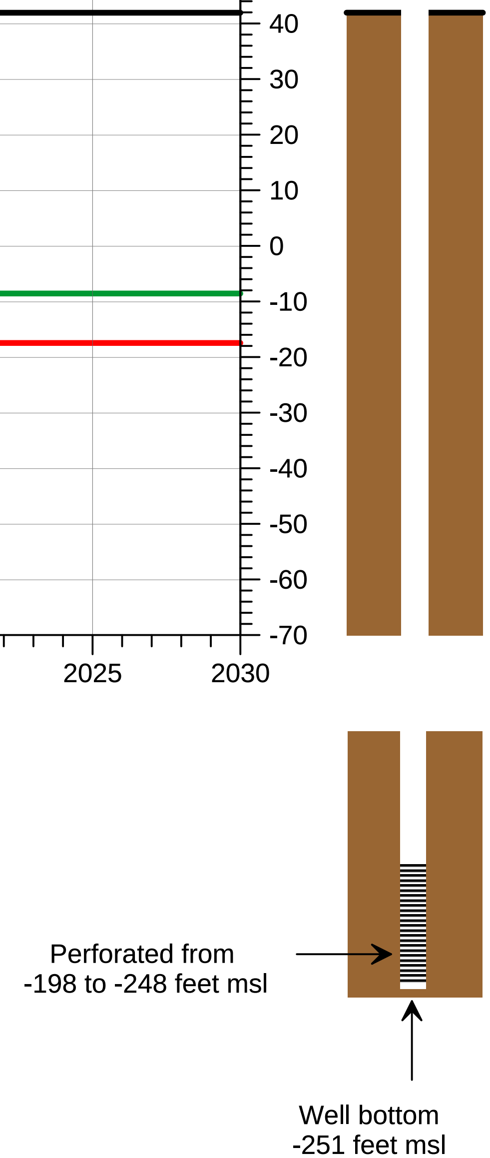
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET



HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/03E-30G08

180/400-Foot Aquifer Subbasin



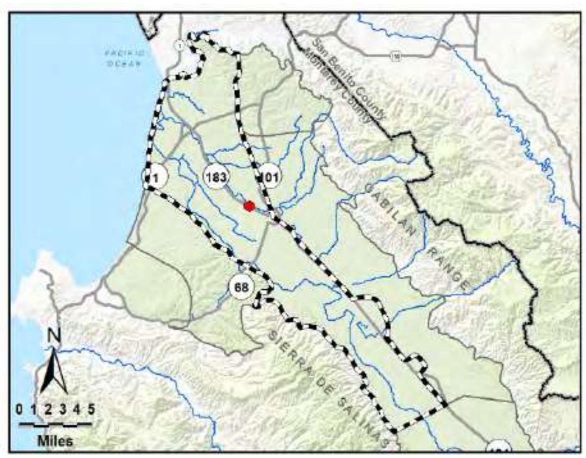


EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

WATER YEAR TYPE DESIGNATION

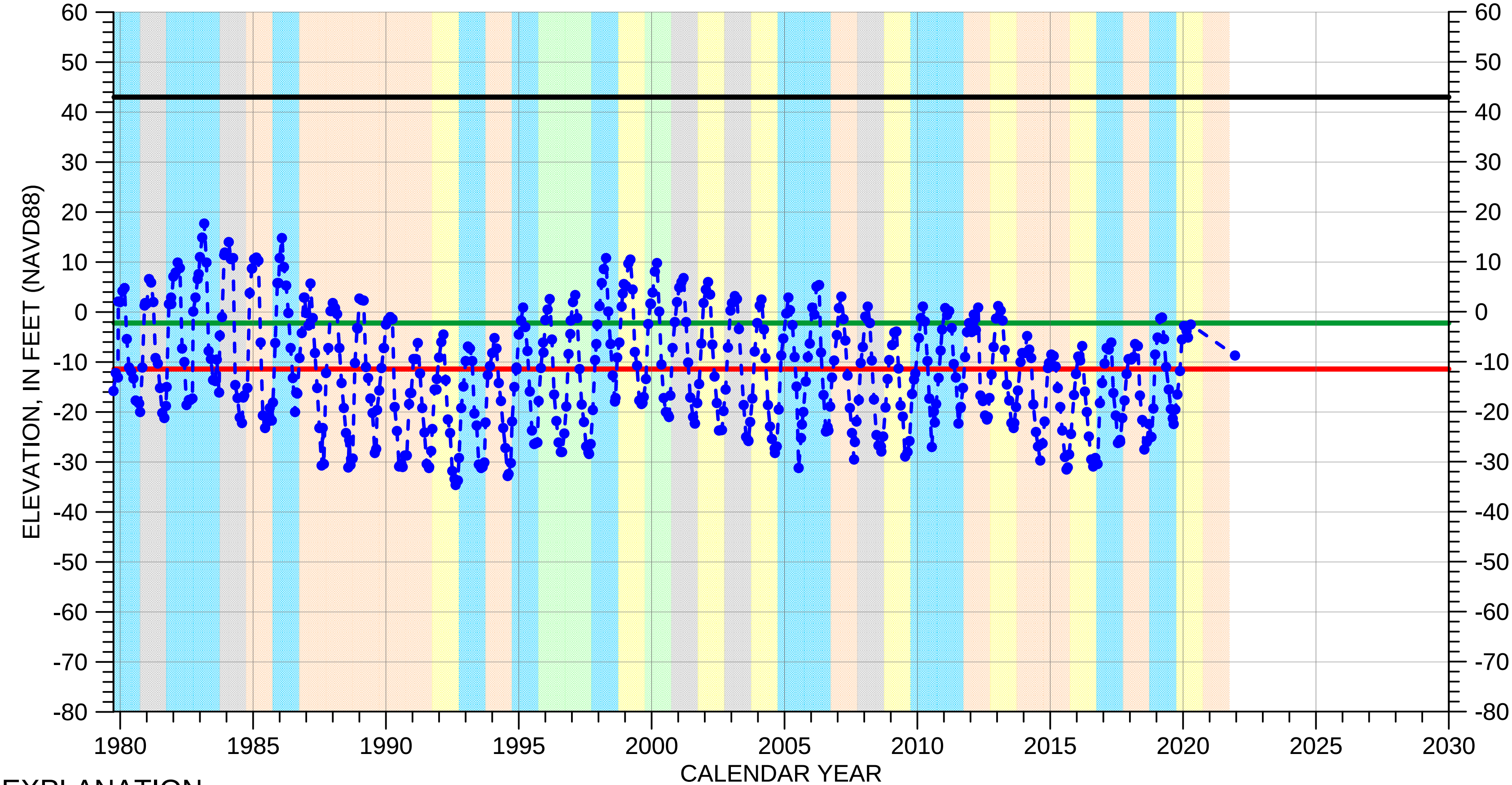
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET



\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRA\NEWGRFs_Ch8\14S_03E-30G08.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/03E-31F01

180/400-Foot Aquifer Subbasin



Perforated interval unknown

Well bottom -163 feet msl

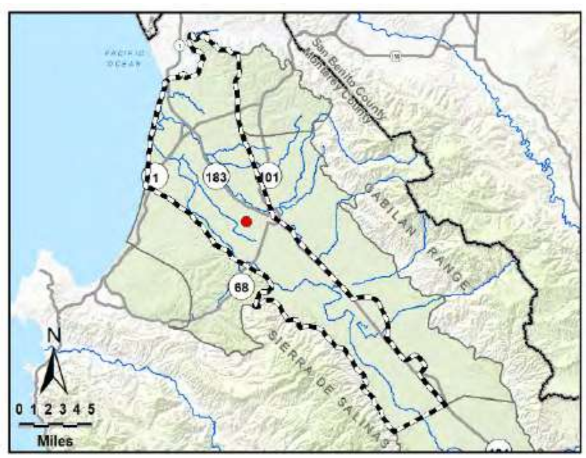
\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch8\14S_03E-31F01.grf

EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

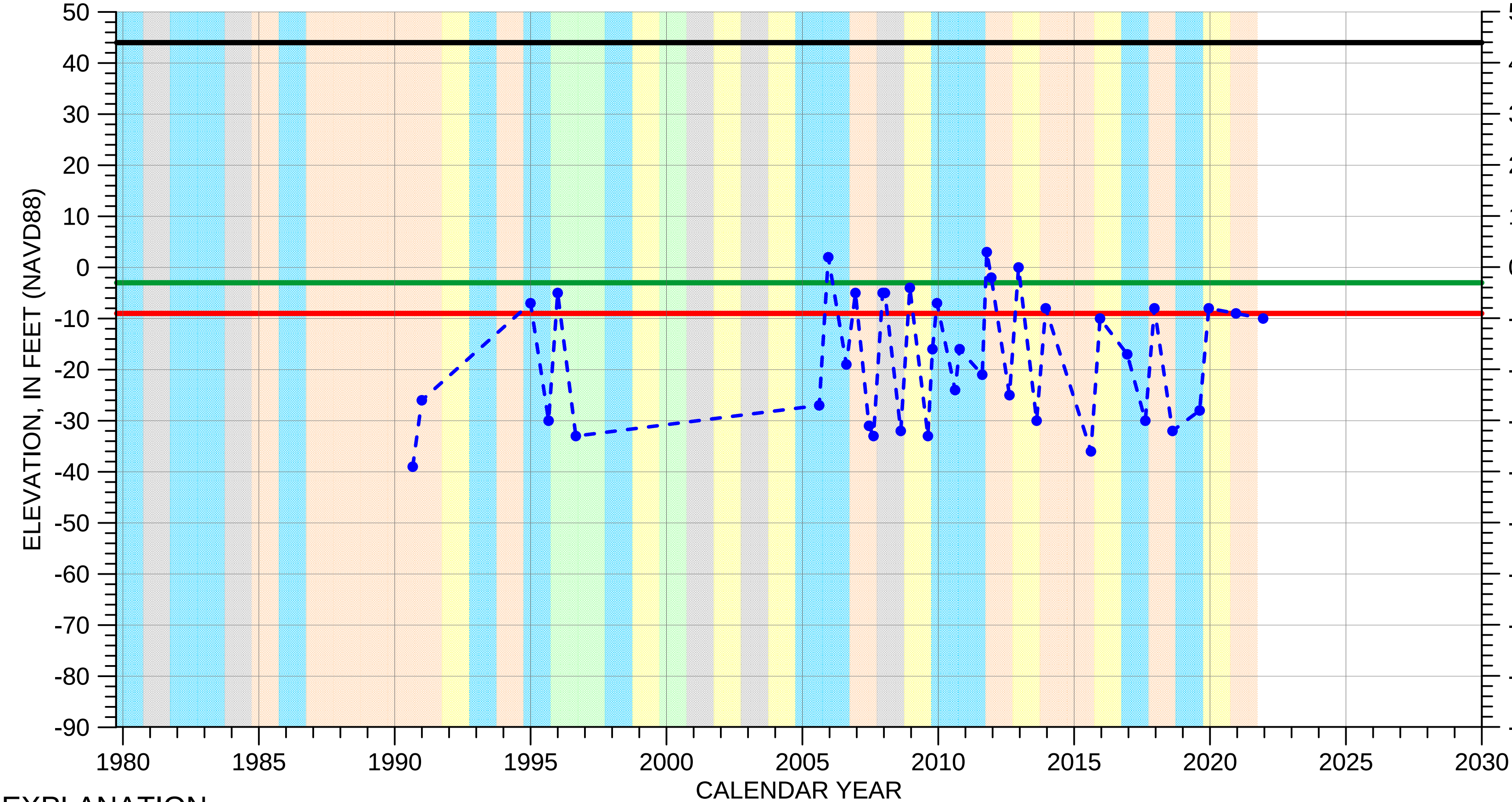
WATER YEAR TYPE DESIGNATION

- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET



HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 14S/03E-31L01

180/400-Foot Aquifer Subbasin

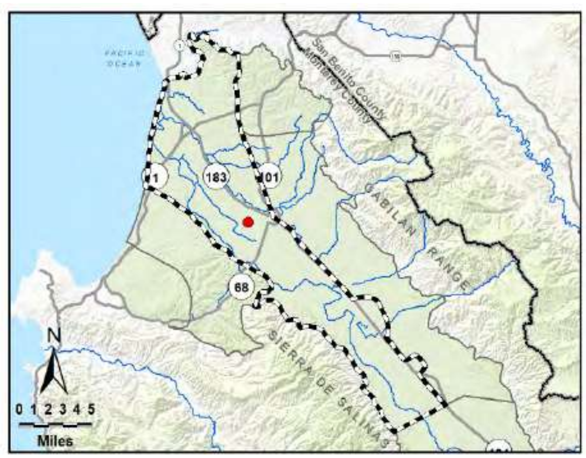


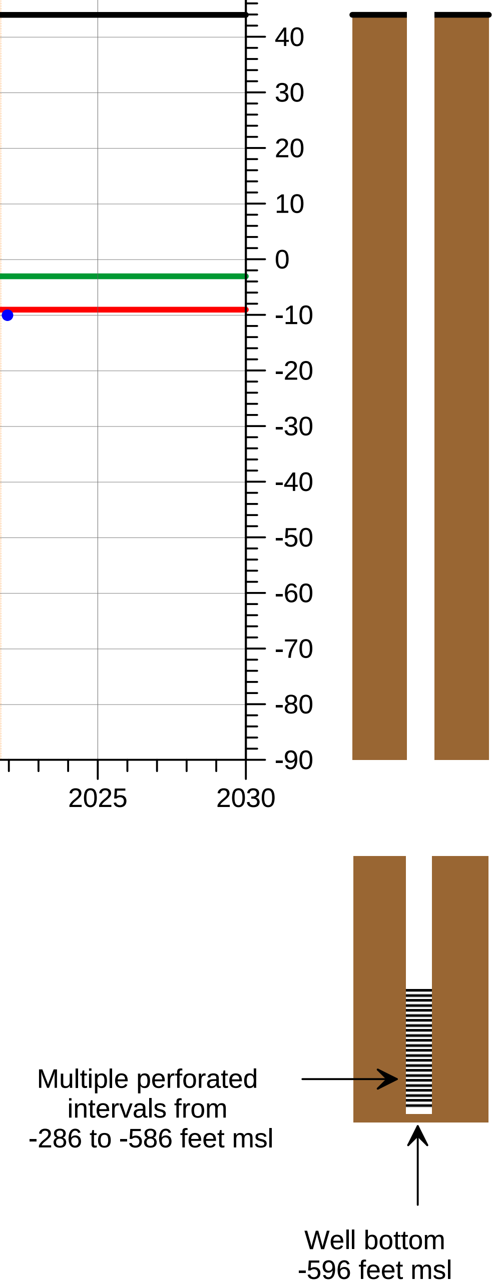
EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

WATER YEAR TYPE DESIGNATION

- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

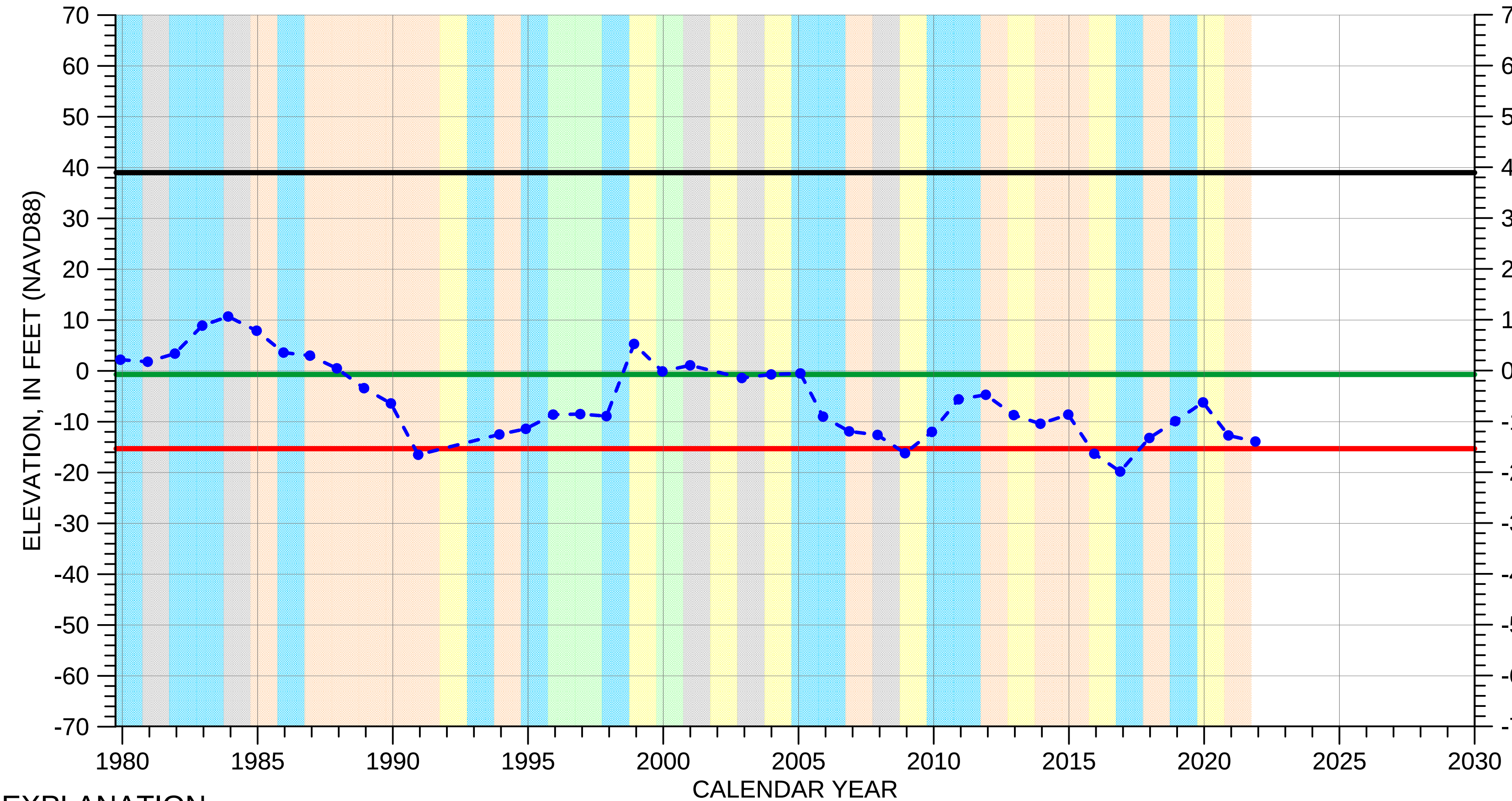


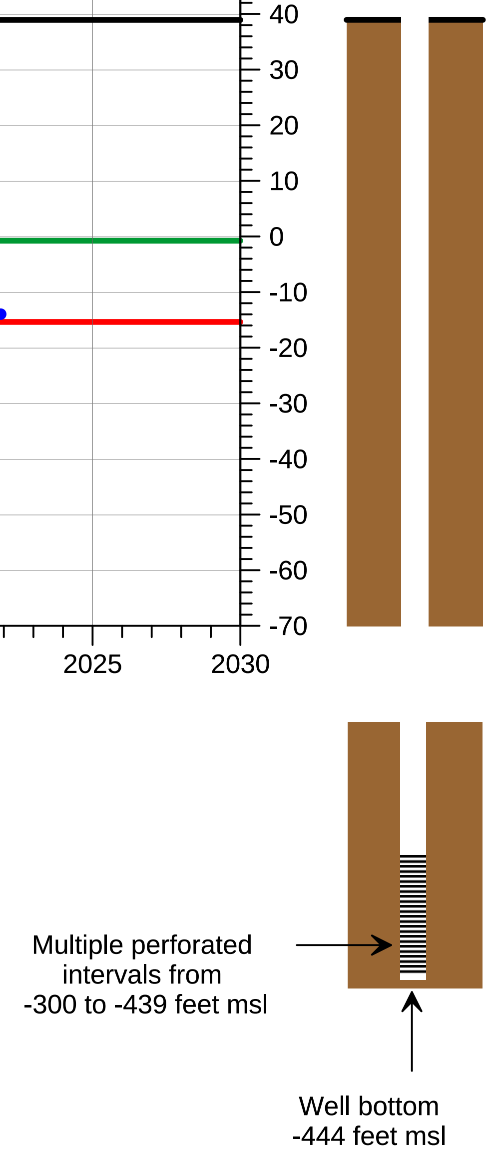


\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch8\14S_03E-31L01.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 15S/02E-01A03

180/400-Foot Aquifer Subbasin



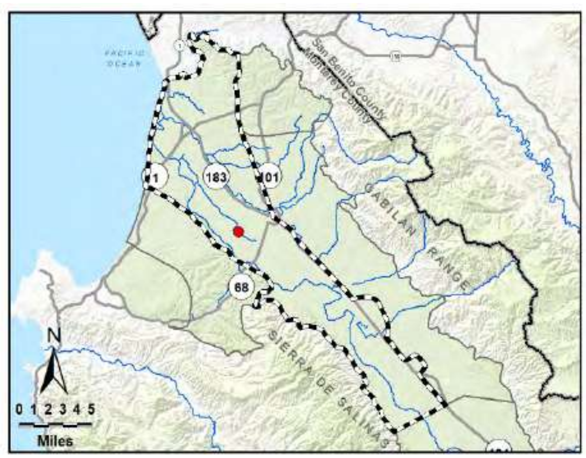


EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

WATER YEAR TYPE DESIGNATION

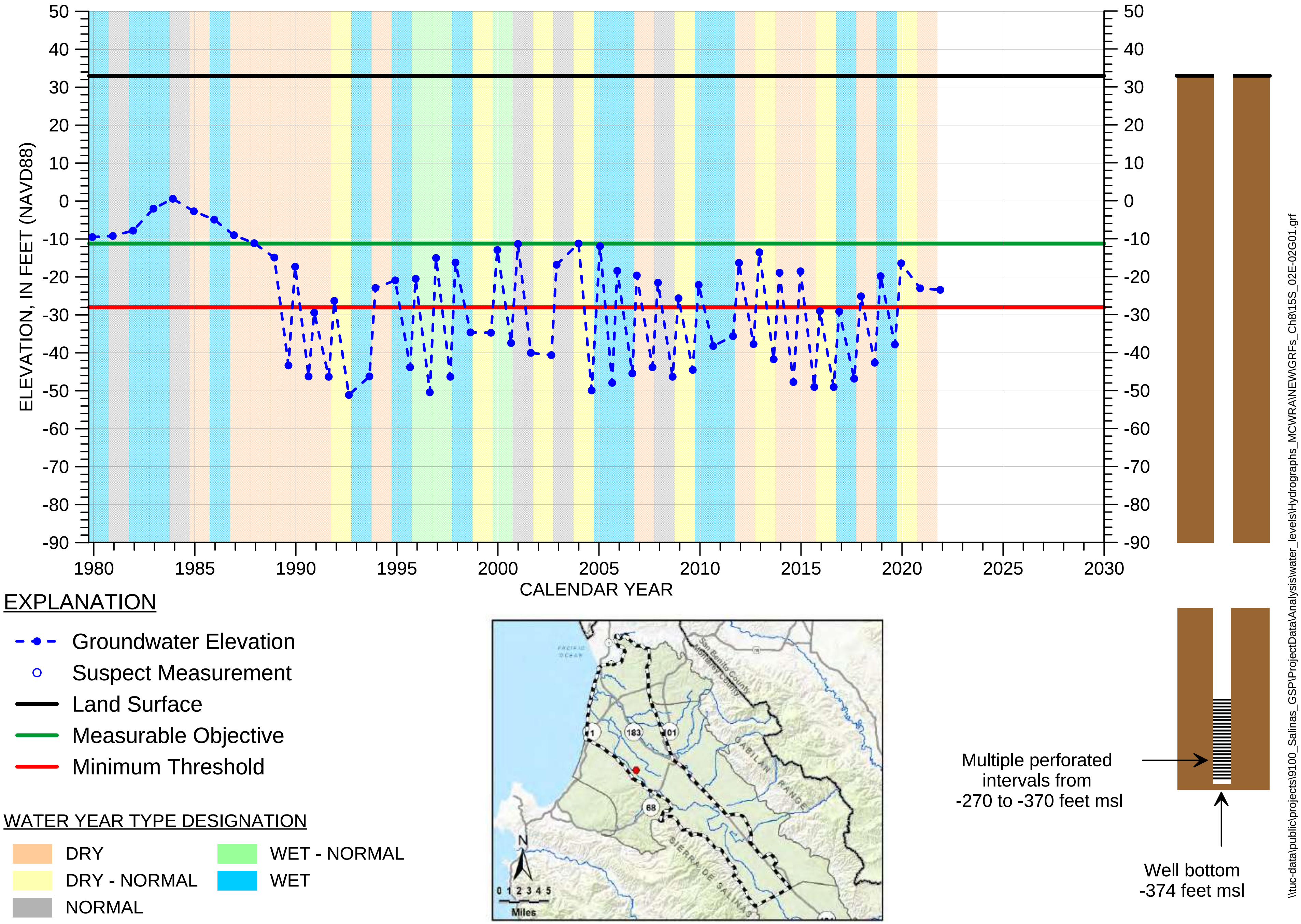
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET



\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch8\15S_02E-01A03.grf

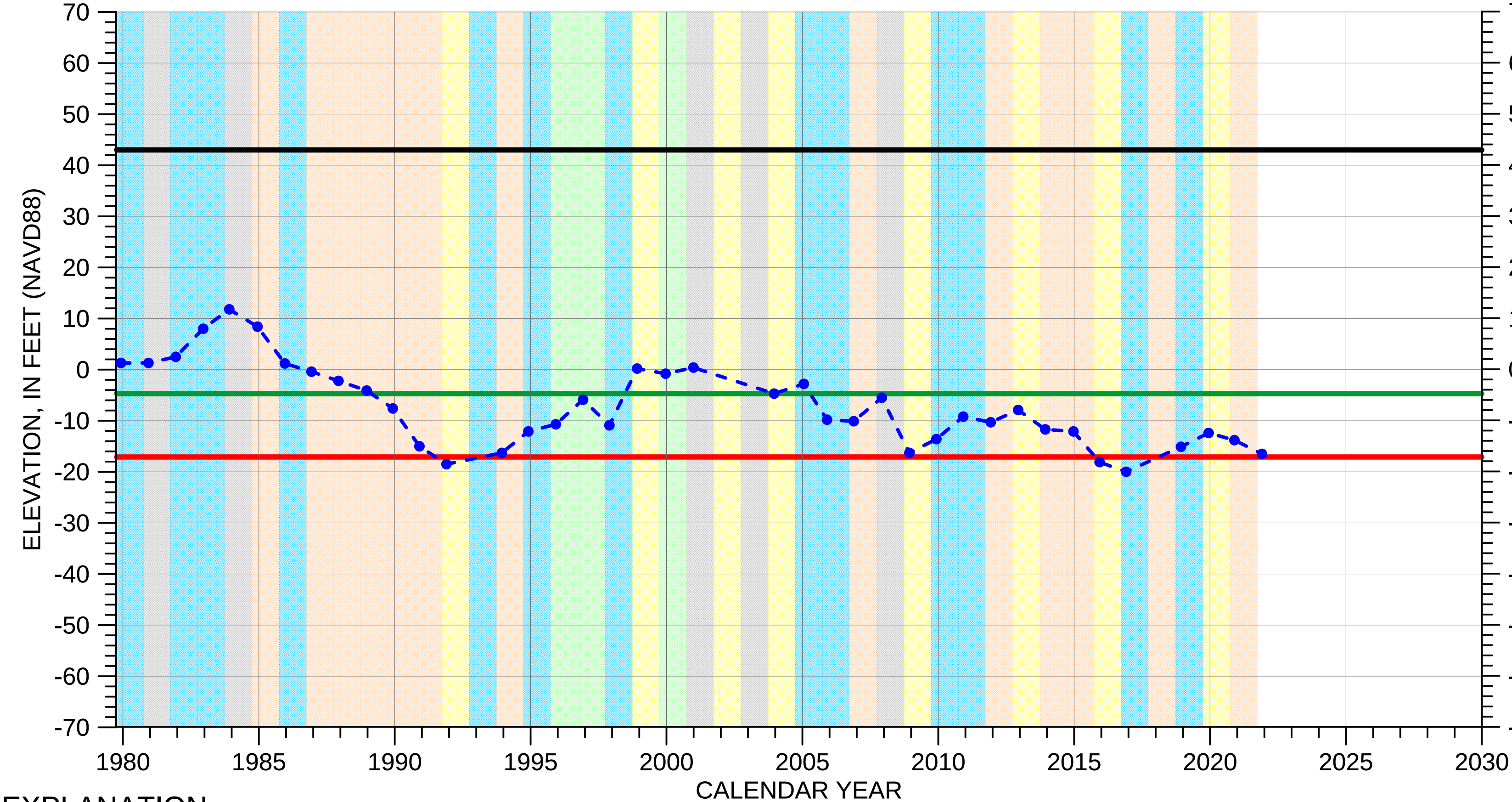
HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 15S/02E-02G01

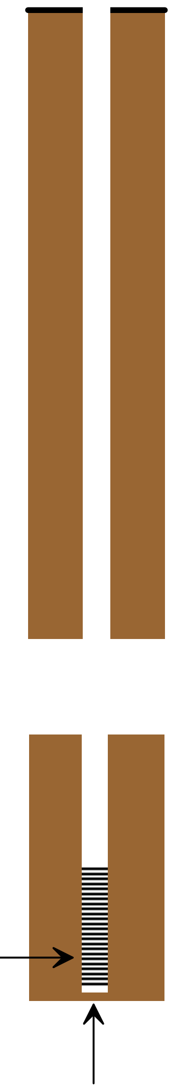
180/400-Foot Aquifer Subbasin



HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 15S/02E-12A01

180/400-Foot Aquifer Subbasin





Multiple perforated intervals from -383 to -464 feet msl

Well bottom -506 feet msl

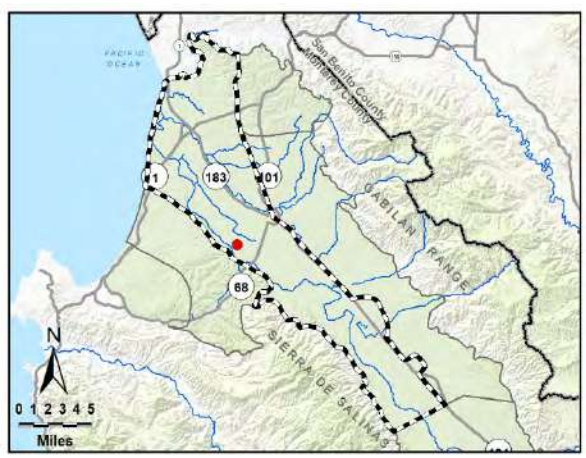
\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRA\NEWGRFs_Ch8\15S_02E-12A01.grf

EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

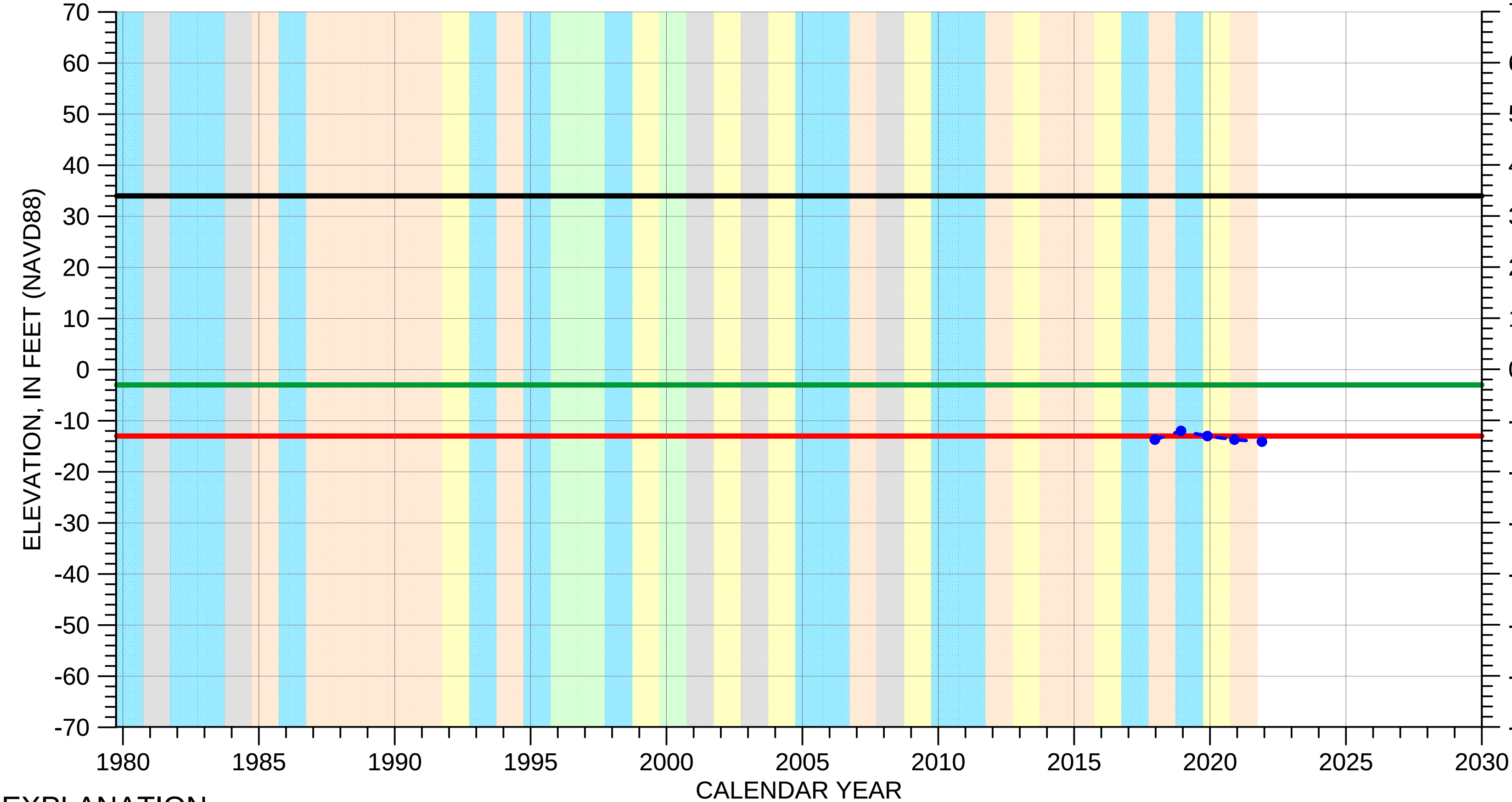
WATER YEAR TYPE DESIGNATION

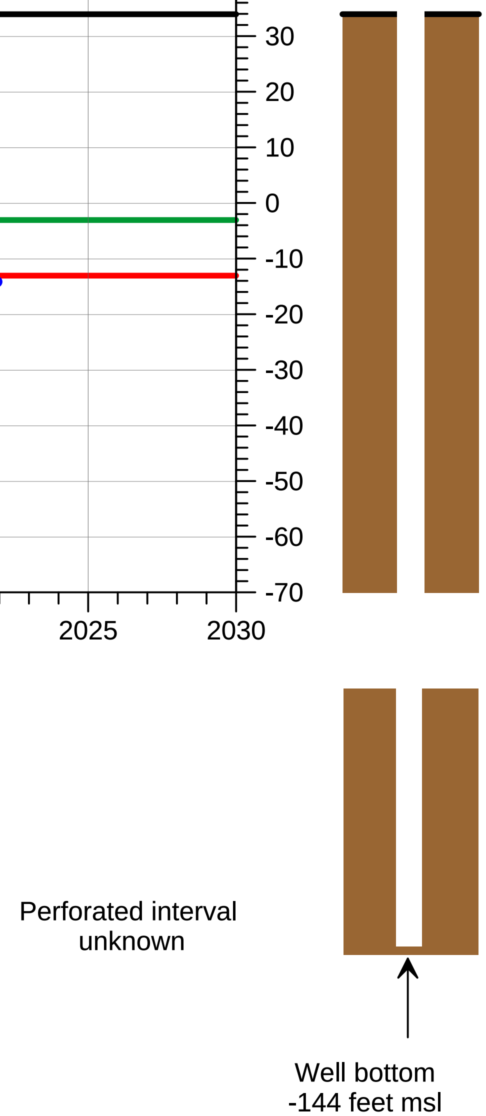
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET



HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 15S/02E-12C01

180/400-Foot Aquifer Subbasin



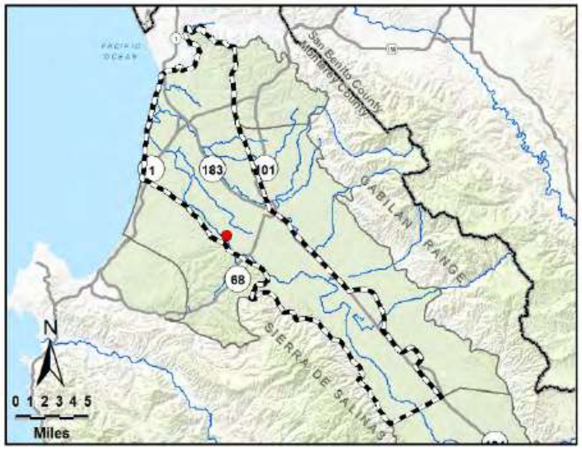


EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

WATER YEAR TYPE DESIGNATION

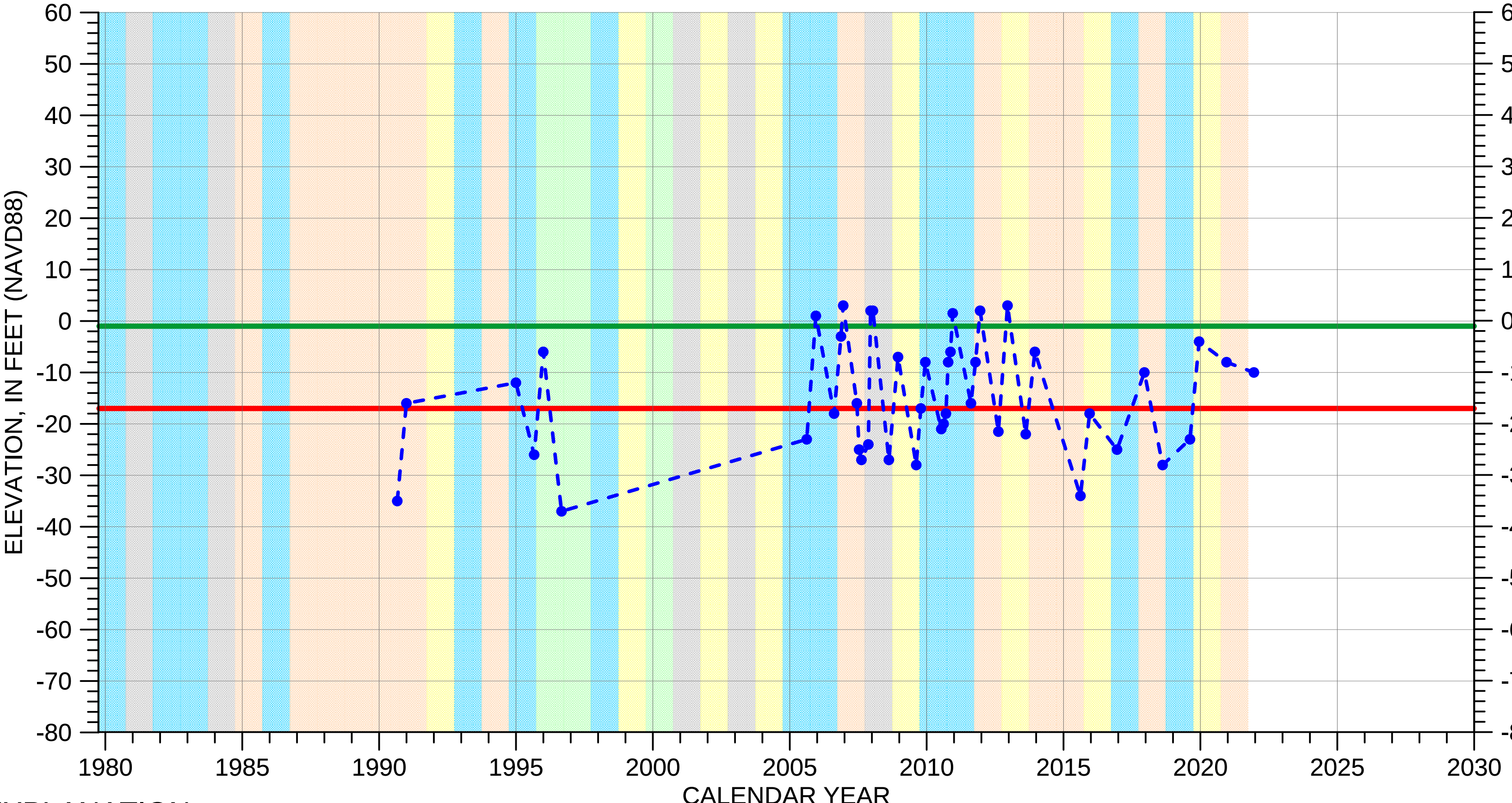
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET



\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch8\15S_02E-12C01.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 15S/03E-03R02

180/400-Foot Aquifer Subbasin

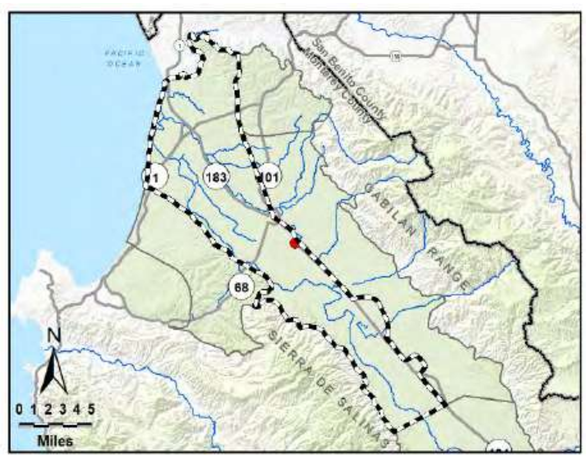


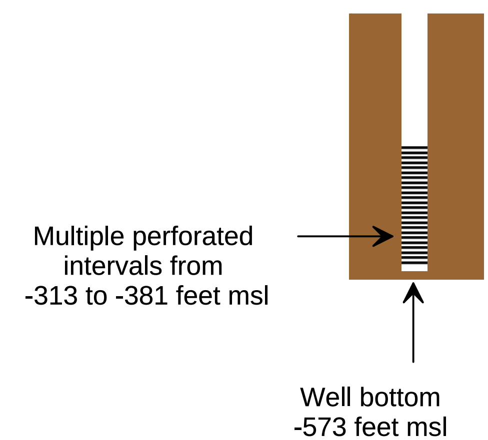
EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface (63 FT MSL)
- Measurable Objective
- Minimum Threshold

WATER YEAR TYPE DESIGNATION

- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

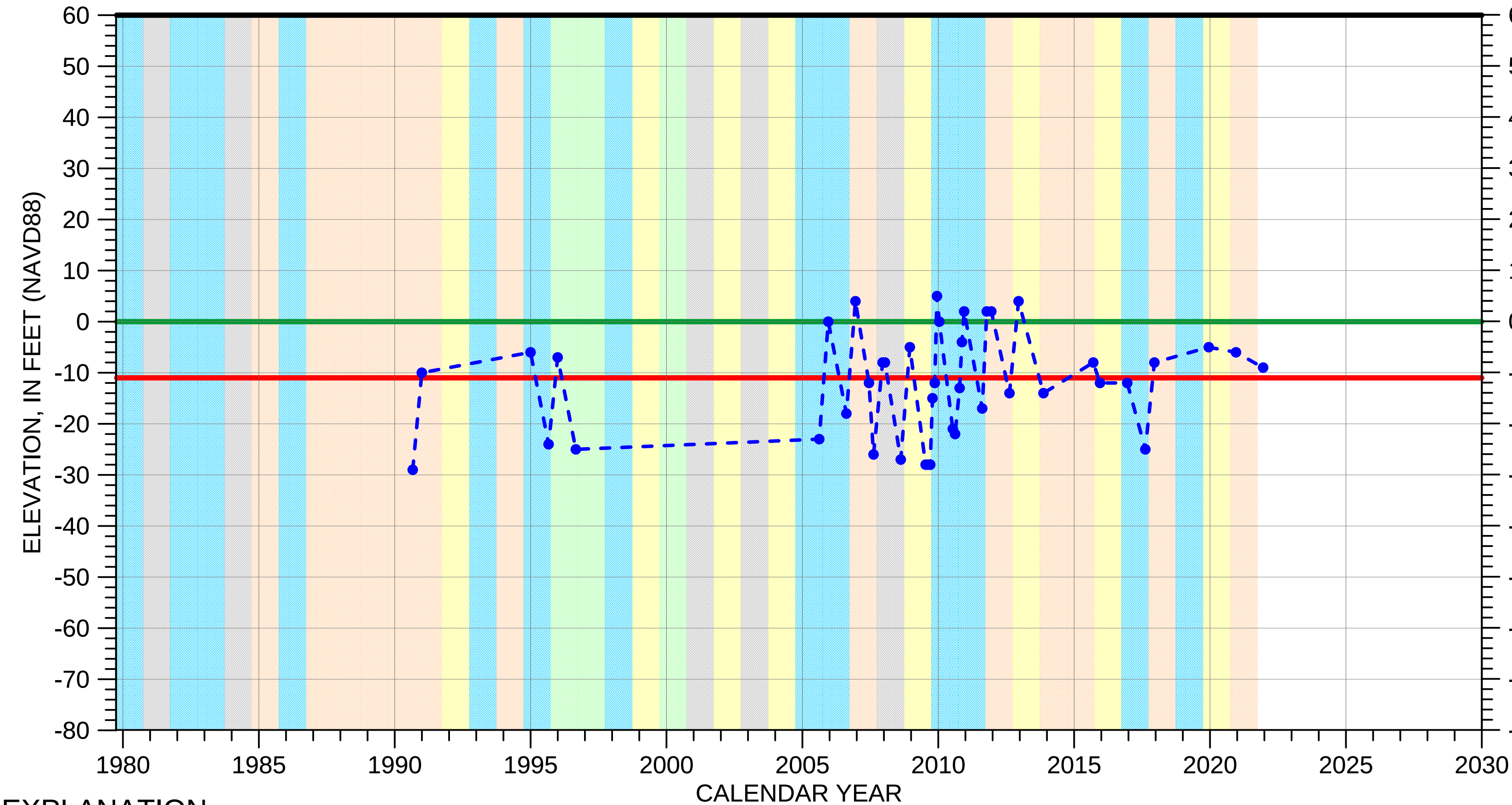


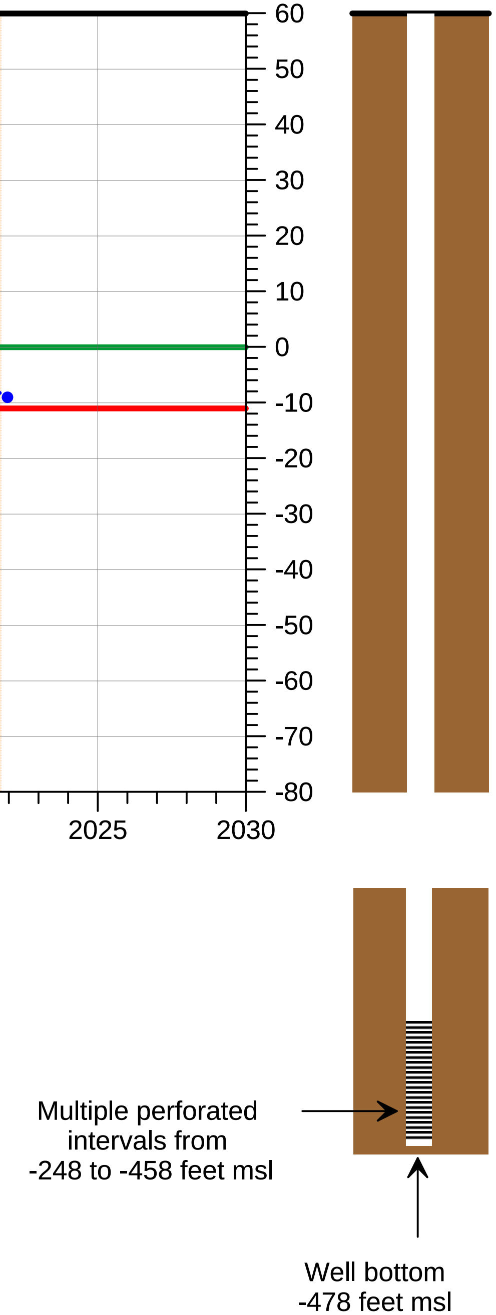


\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch8\15S_03E-03R02.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 15S/03E-04Q01

180/400-Foot Aquifer Subbasin



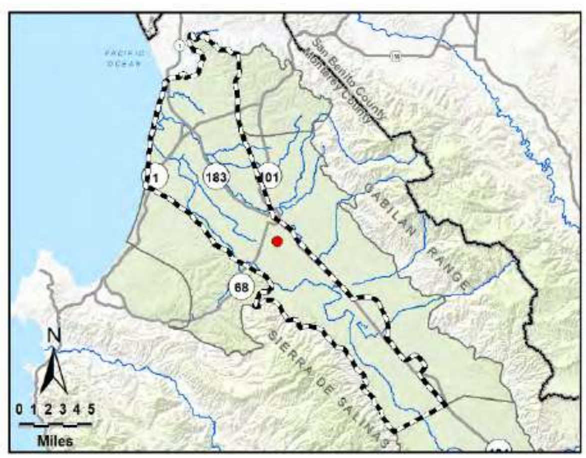


EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

WATER YEAR TYPE DESIGNATION

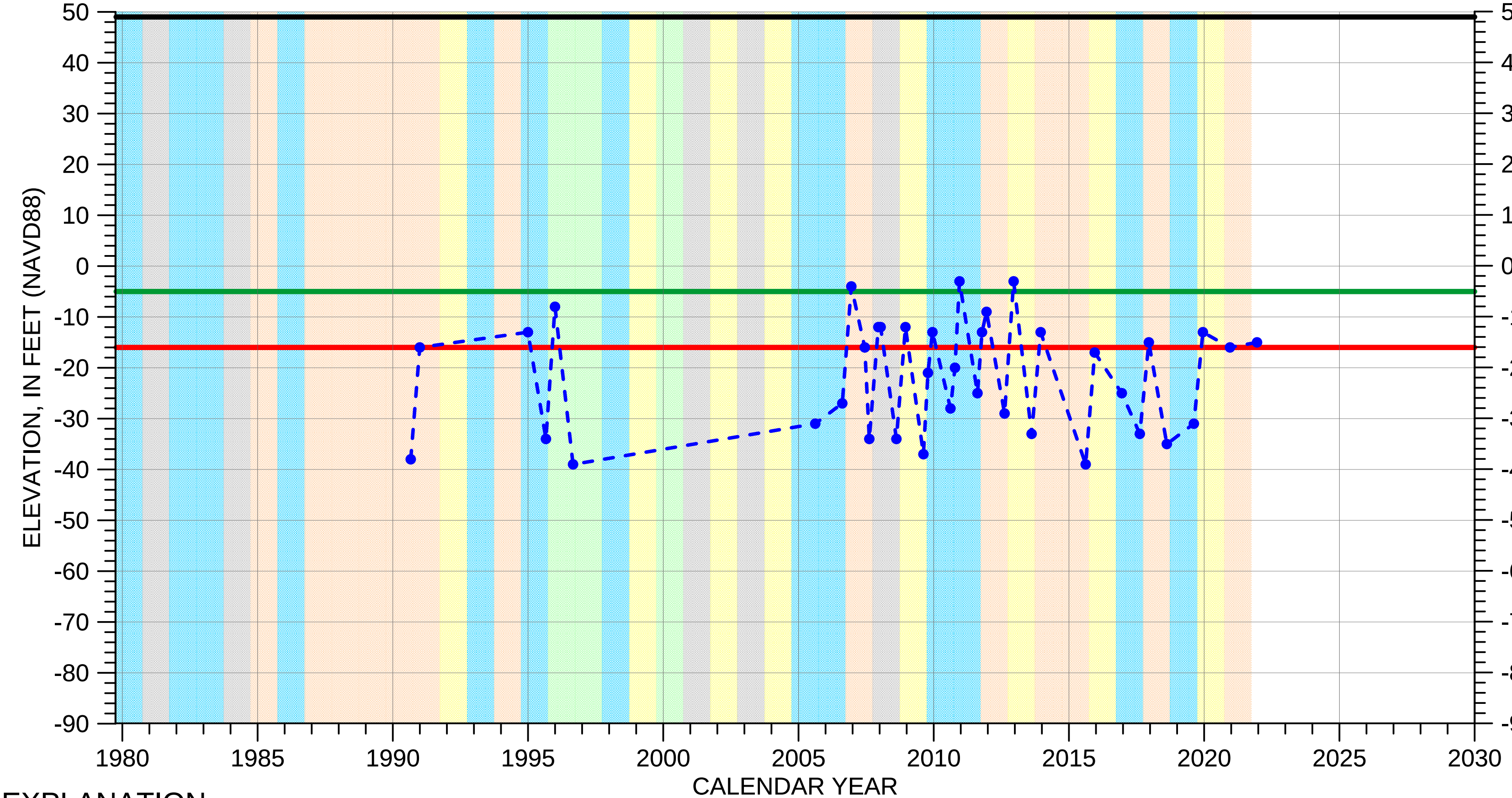
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET



\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch8\15S_03E-04Q01.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 15S/03E-05C02

180/400-Foot Aquifer Subbasin

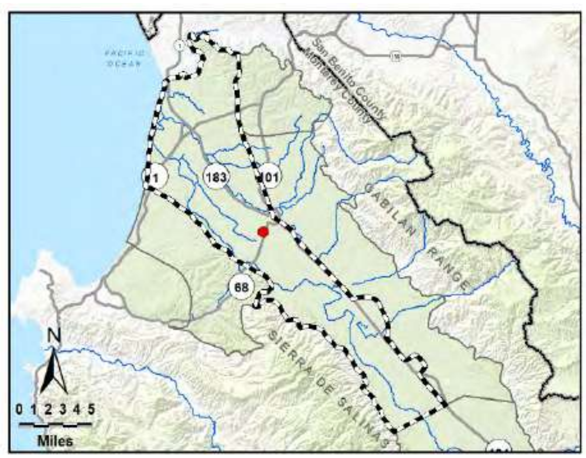


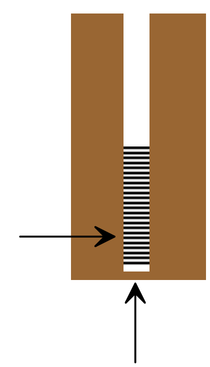
EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

WATER YEAR TYPE DESIGNATION

- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET





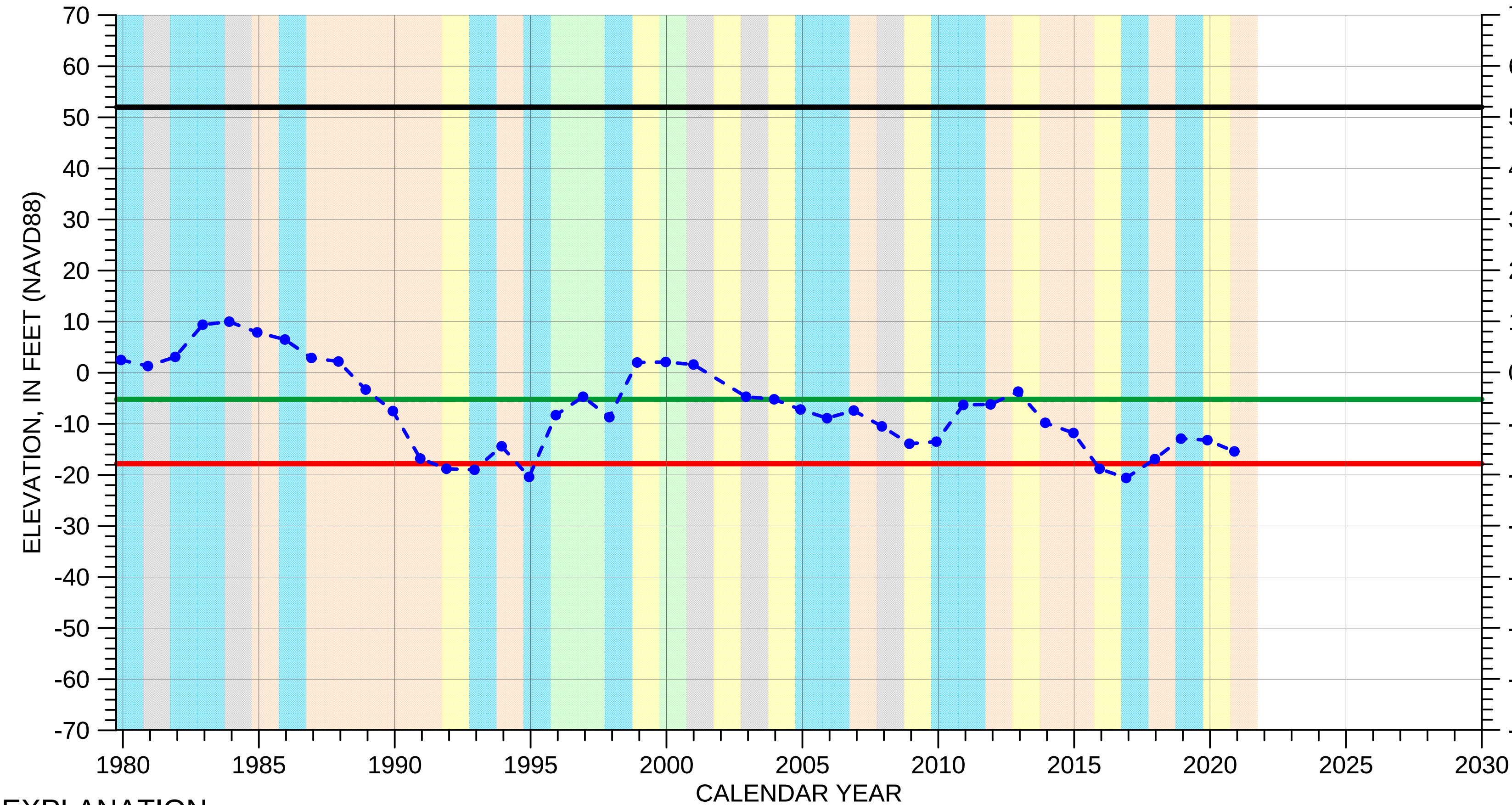
Multiple perforated intervals from -312 to -392 feet msl

Well bottom -569 feet msl

\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch8\15S_03E-05C02.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 15S/03E-08F01

180/400-Foot Aquifer Subbasin

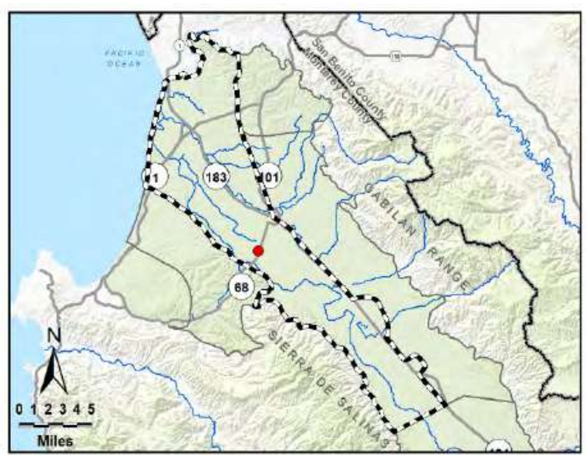


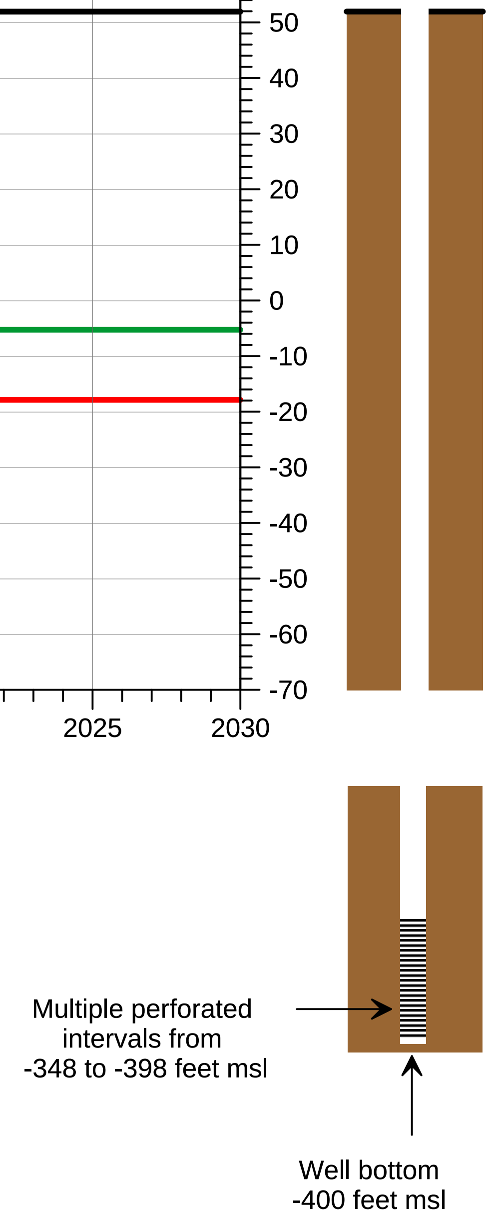
EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

WATER YEAR TYPE DESIGNATION

- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

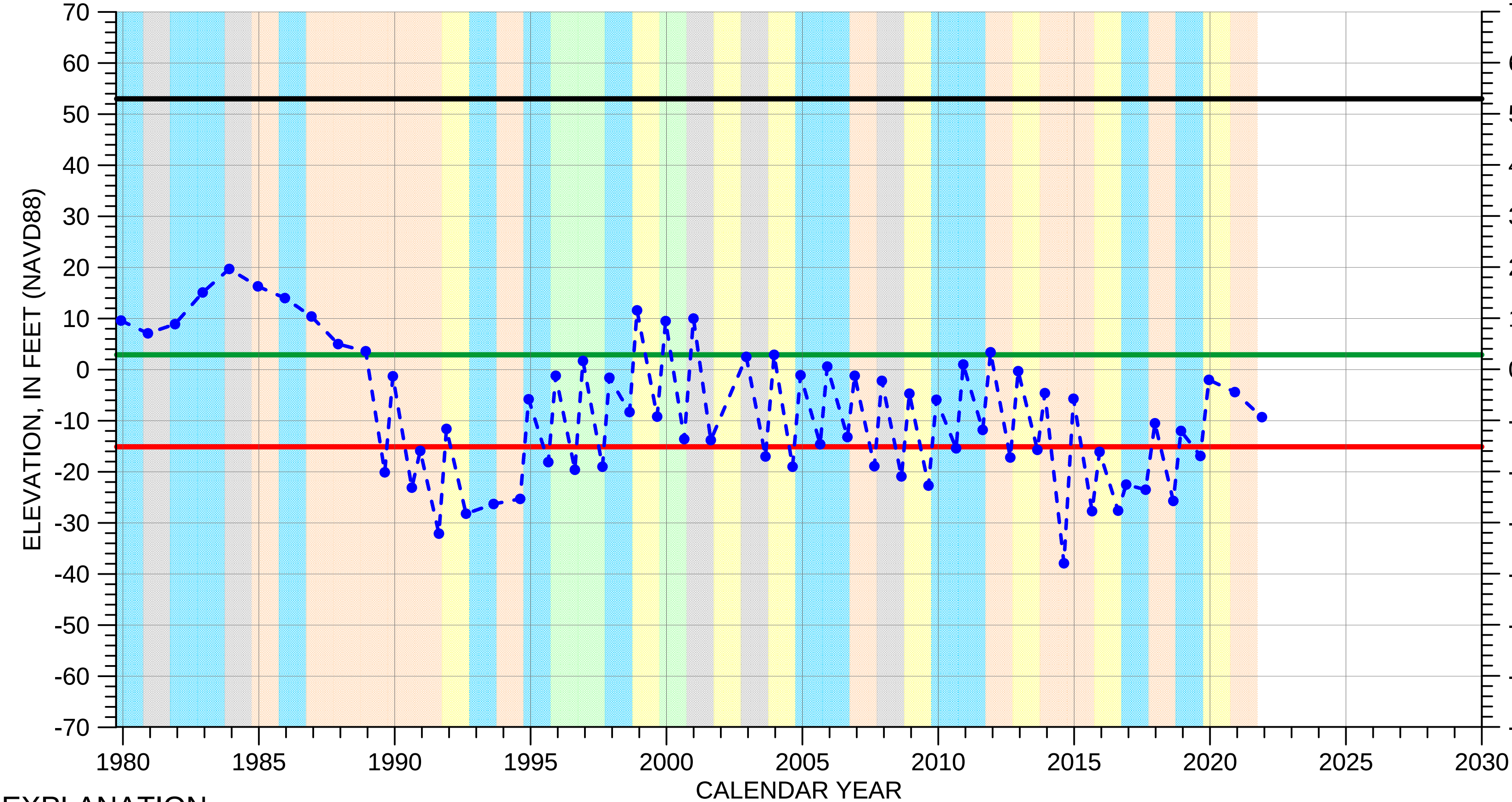


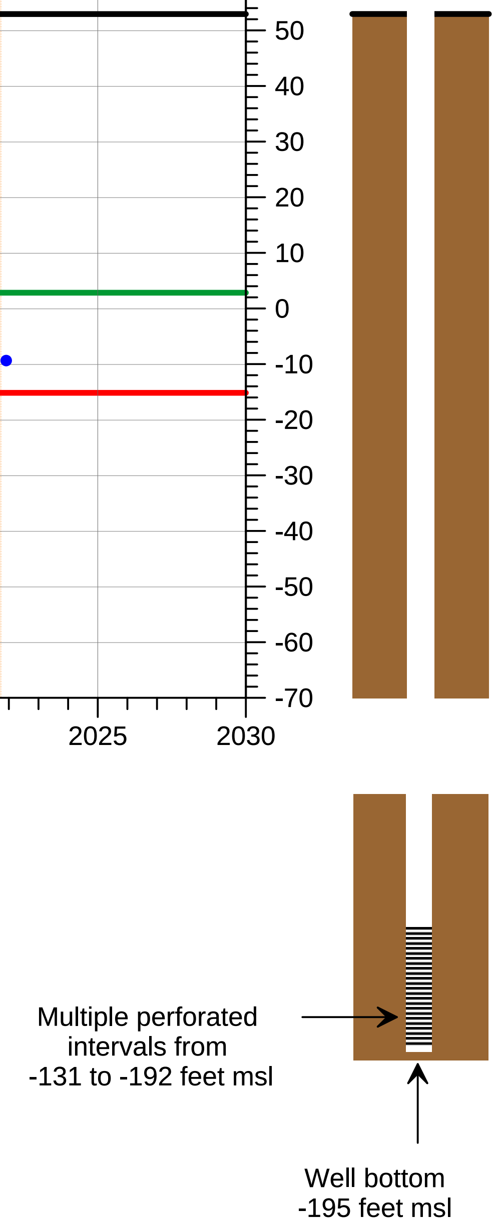


\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch8\15S_03E-08F01.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 15S/03E-09E03

180/400-Foot Aquifer Subbasin



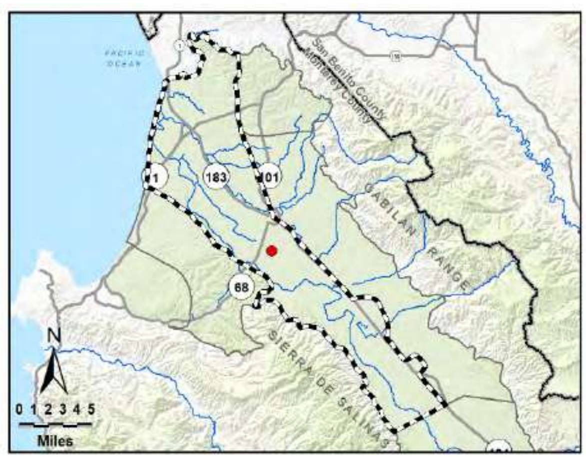


EXPLANATION

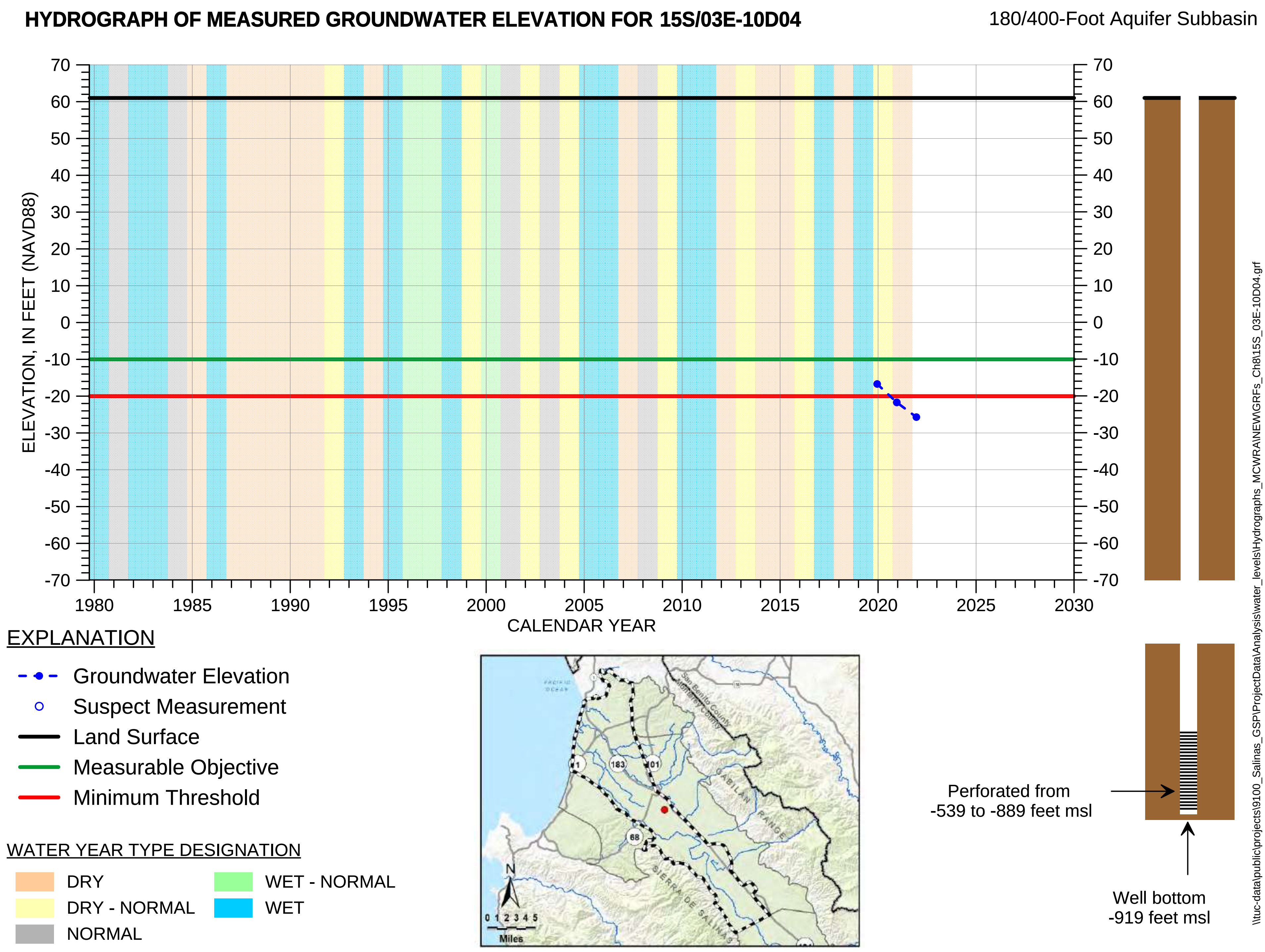
- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

WATER YEAR TYPE DESIGNATION

- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

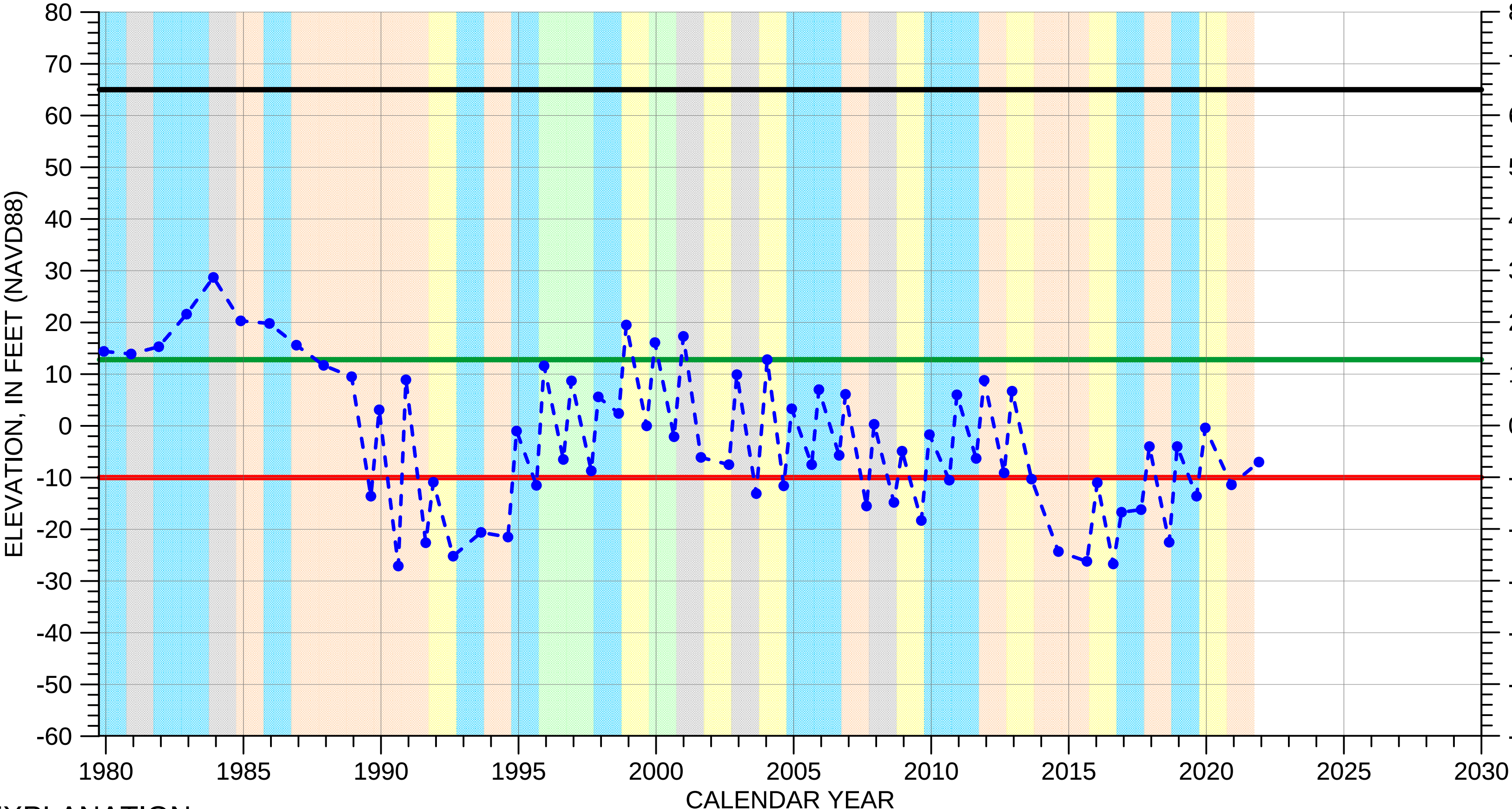


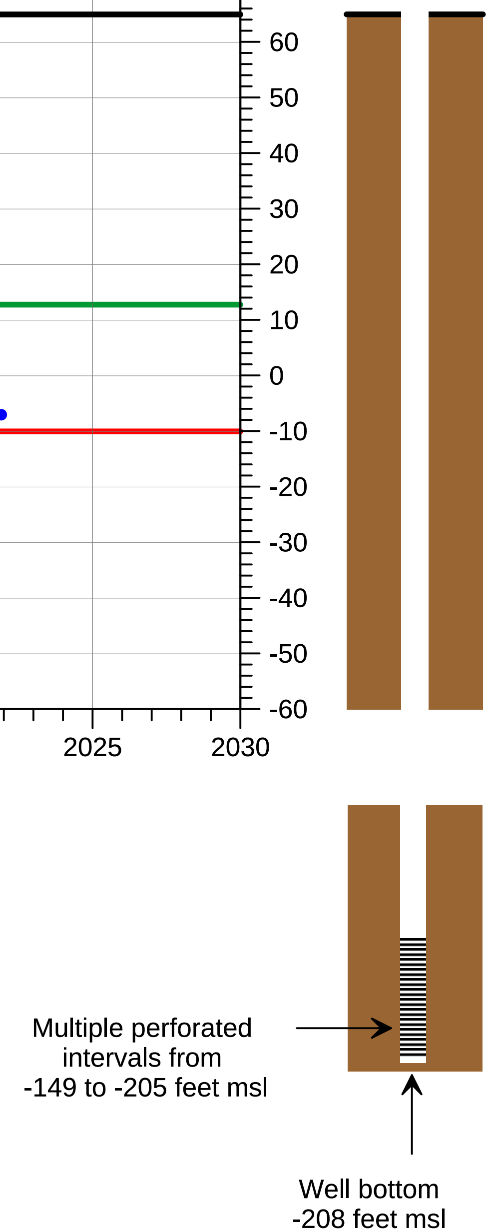
\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch8\15S_03E-09E03.grf


HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 15S/03E-10D04
180/400-Foot Aquifer Subbasin
ELEVATION, IN FEET (NAVD88)
CALENDAR YEAR
70
60
50
40
30
20
10
0
-10
-20
-30
-40
-50
-60
-70
1980
1985
1990
1995
2000
2005
2010
2015
2020
2025
2030
EXPLANATION
Groundwater Elevation
Suspect Measurement
Land Surface
Measurable Objective
Minimum Threshold
WATER YEAR TYPE DESIGNATION
DRY
DRY - NORMAL
NORMAL
WET - NORMAL
WET
Perforated from
-539 to -889 feet msl
Well bottom
-919 feet msl
183
101
68
1
GABILAN RANGE
SIERRA DE SALINAS
N
0 1 2 3 4 5
Miles
\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch8\15S_03E-10D04.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 15S/03E-13N01

180/400-Foot Aquifer Subbasin



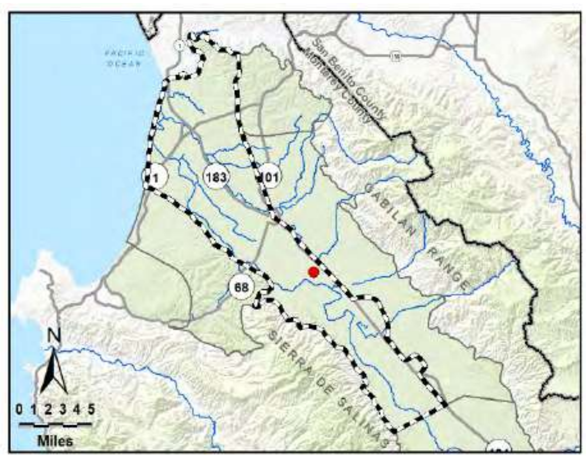


EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

WATER YEAR TYPE DESIGNATION

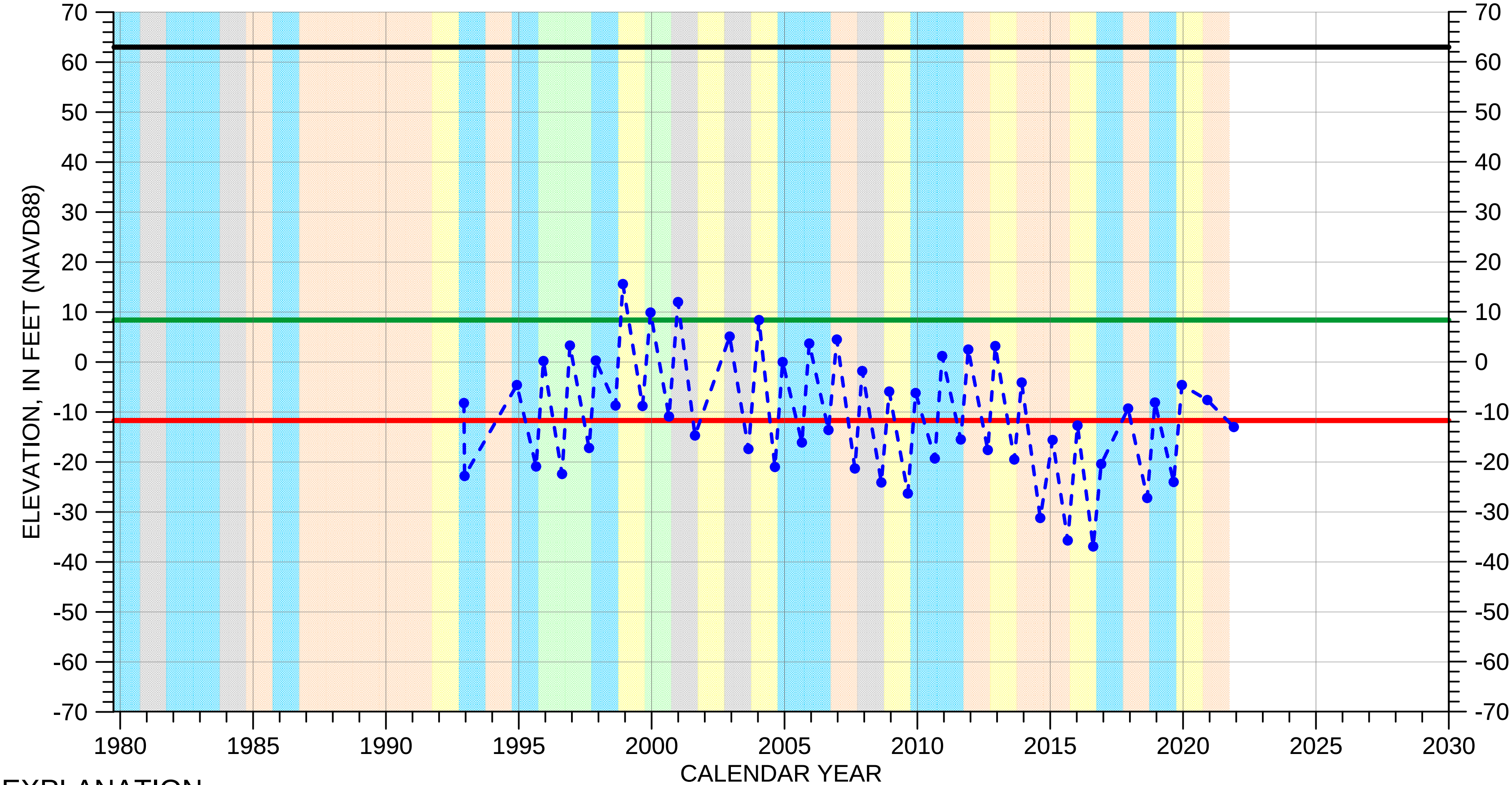
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

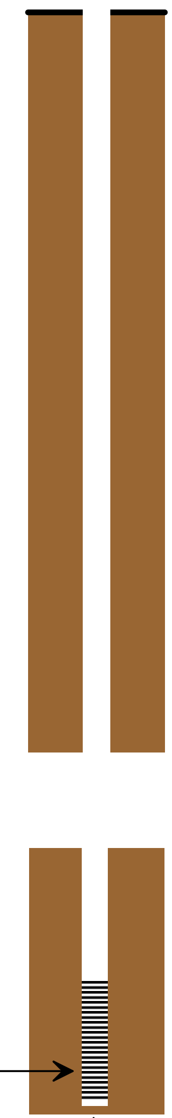


\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch8\15S_03E-13N01.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 15S/03E-14P02

180/400-Foot Aquifer Subbasin



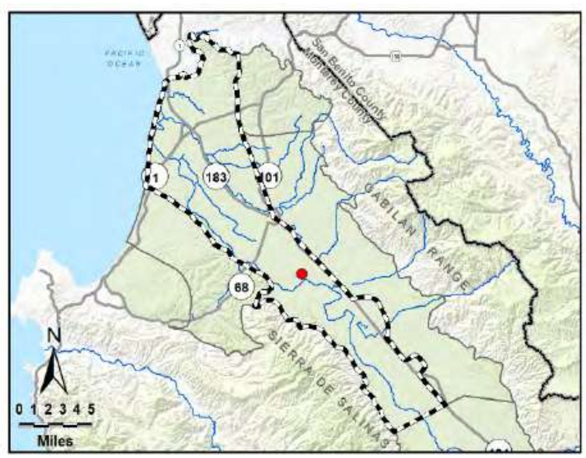


EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

WATER YEAR TYPE DESIGNATION

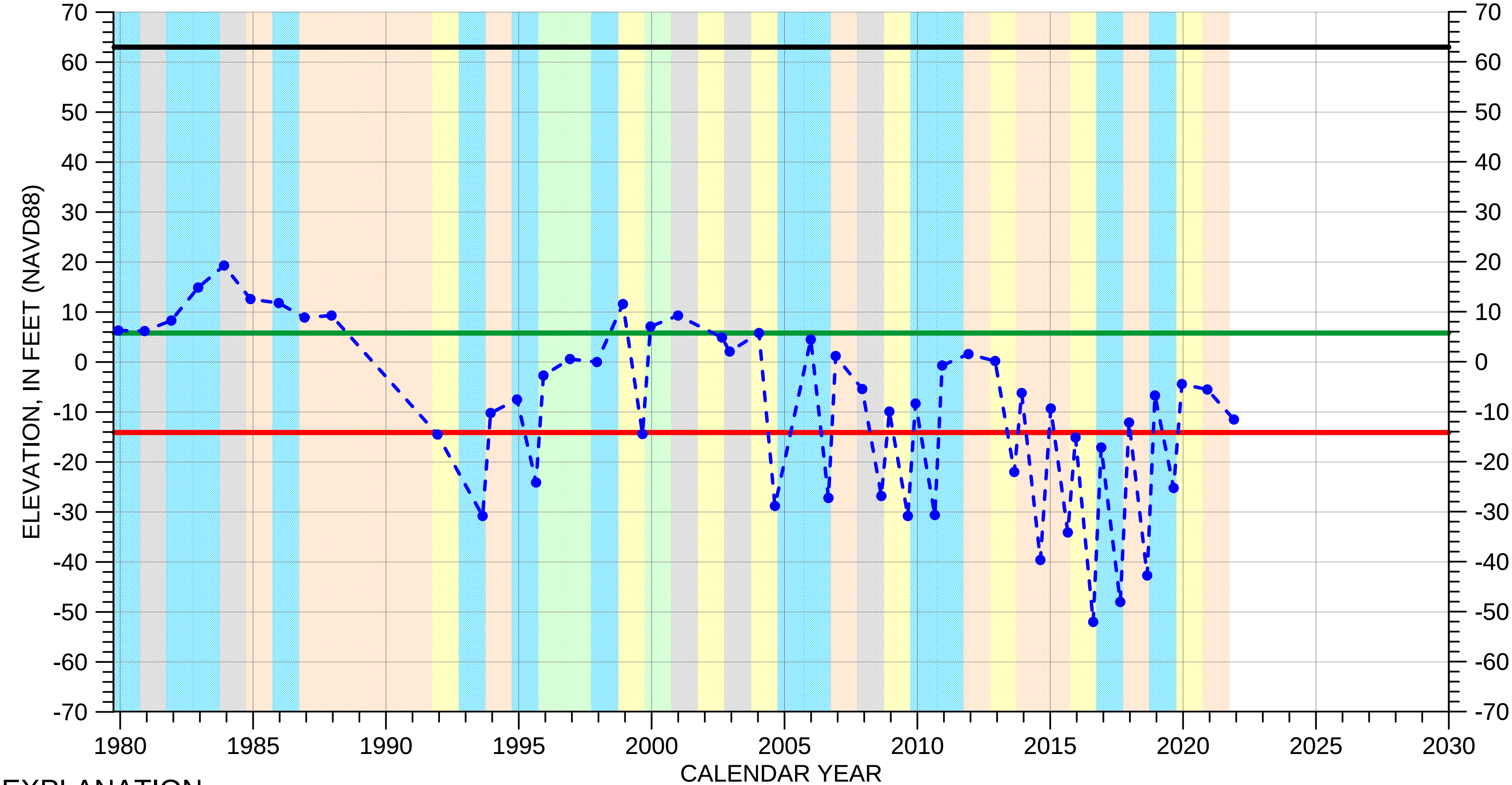
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

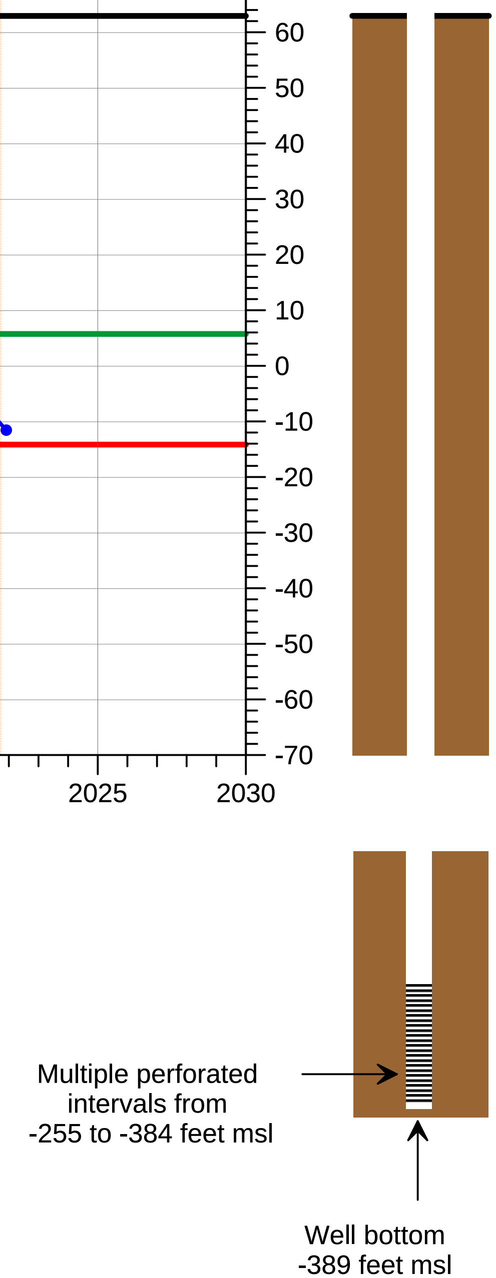


\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch8\15S_03E-14P02.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 15S/03E-15B01

180/400-Foot Aquifer Subbasin



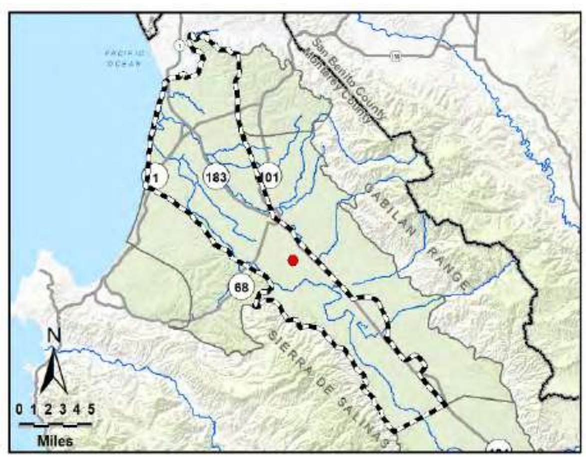


EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

WATER YEAR TYPE DESIGNATION

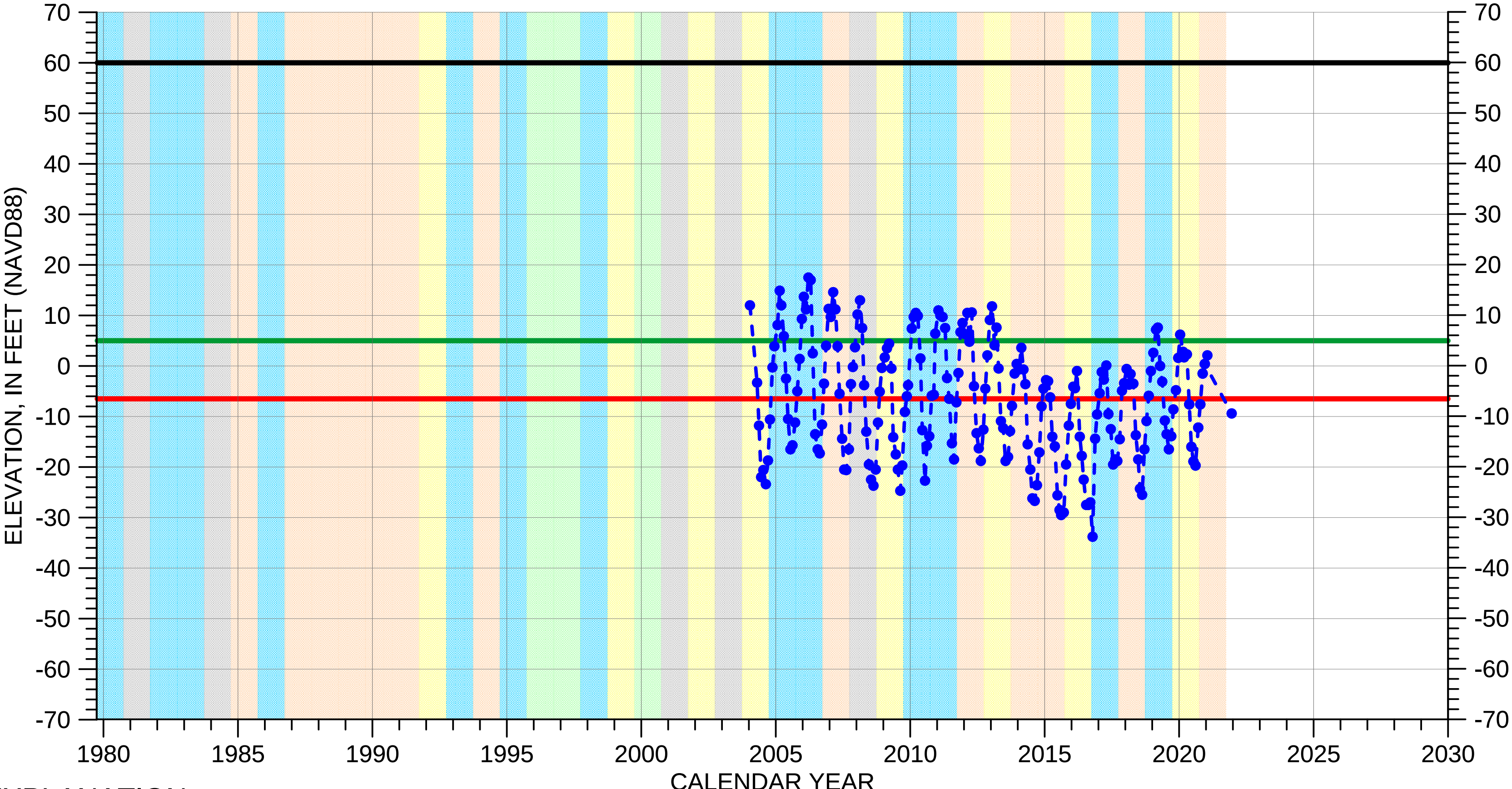
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET



\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch8\15S_03E-15B01.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 15S/03E-16F02

180/400-Foot Aquifer Subbasin



Perforated from
-368 to -511 feet msl

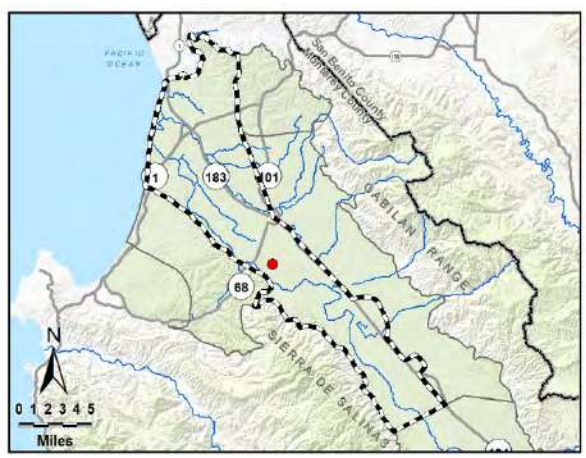
Well bottom
-533 feet msl

EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

WATER YEAR TYPE DESIGNATION

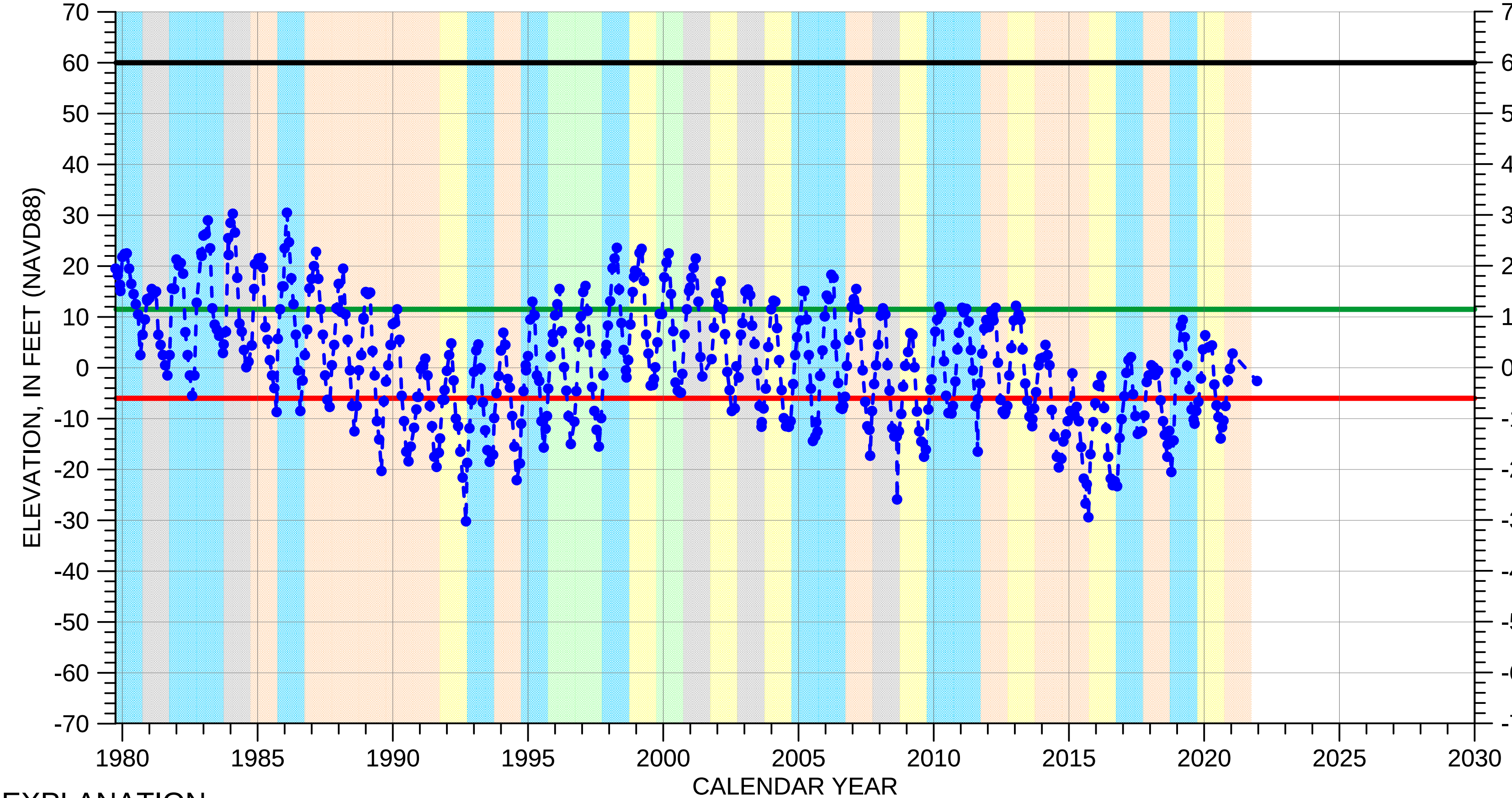
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET



\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch8\15S_03E-16F02.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 15S/03E-16M01

180/400-Foot Aquifer Subbasin

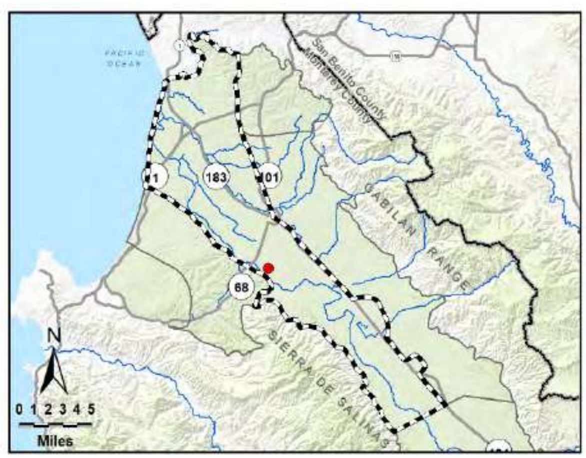


EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

WATER YEAR TYPE DESIGNATION

- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET



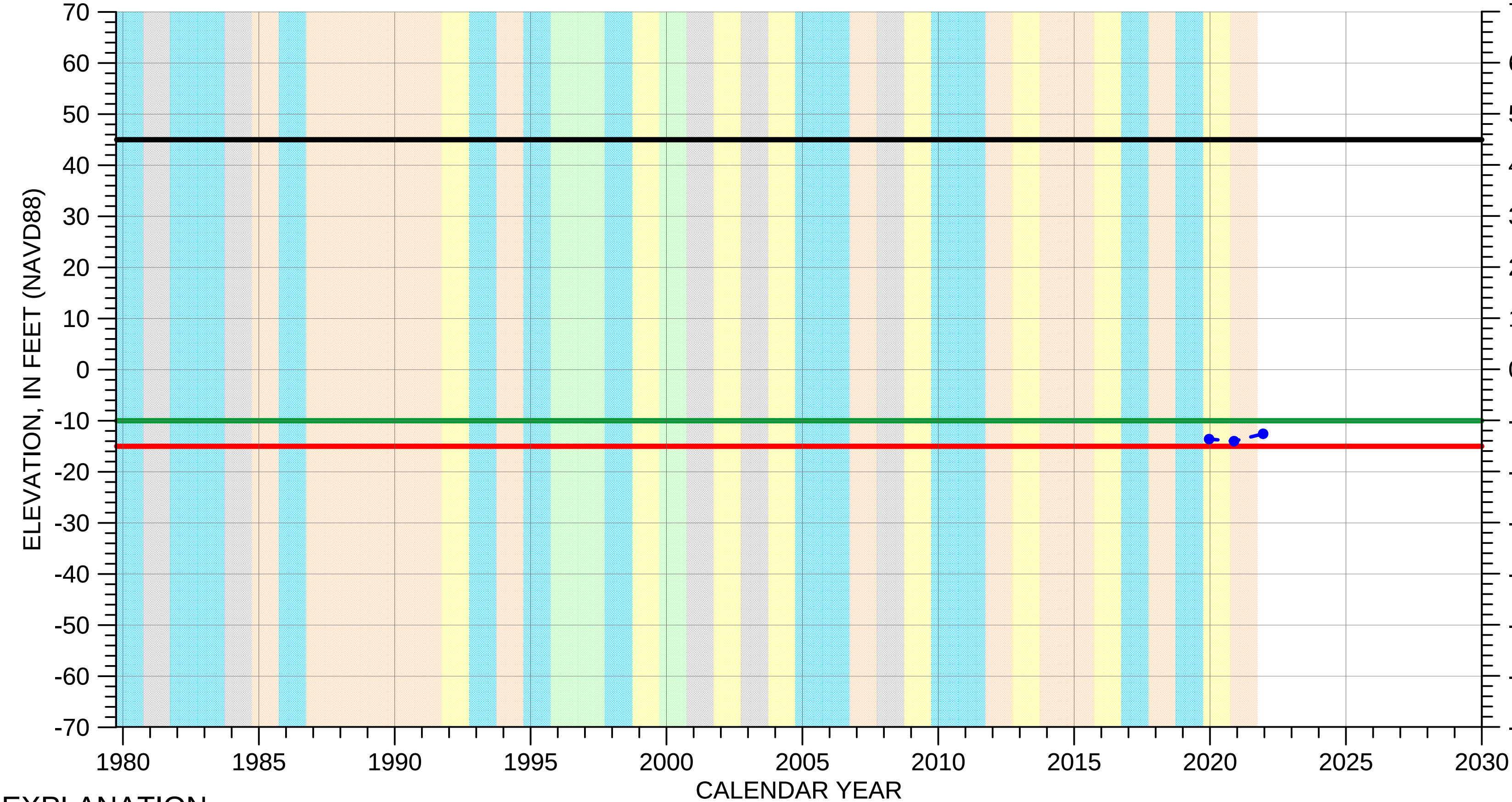
Perforated interval unknown

Well bottom elevation unknown

\\fuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRA\NEW\GRFs_Ch8\15S_03E-16M01.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 15S/03E-17E02

180/400-Foot Aquifer Subbasin

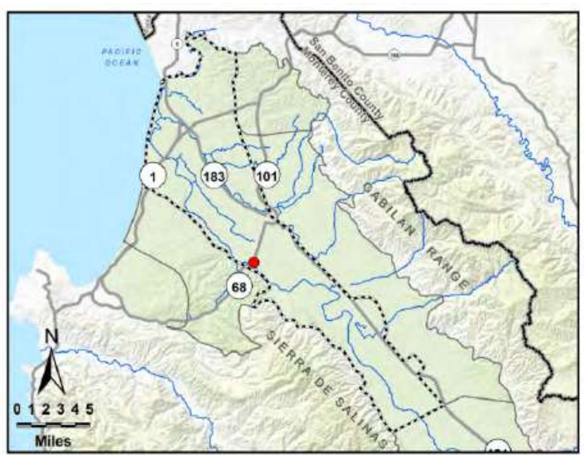


EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

WATER YEAR TYPE DESIGNATION

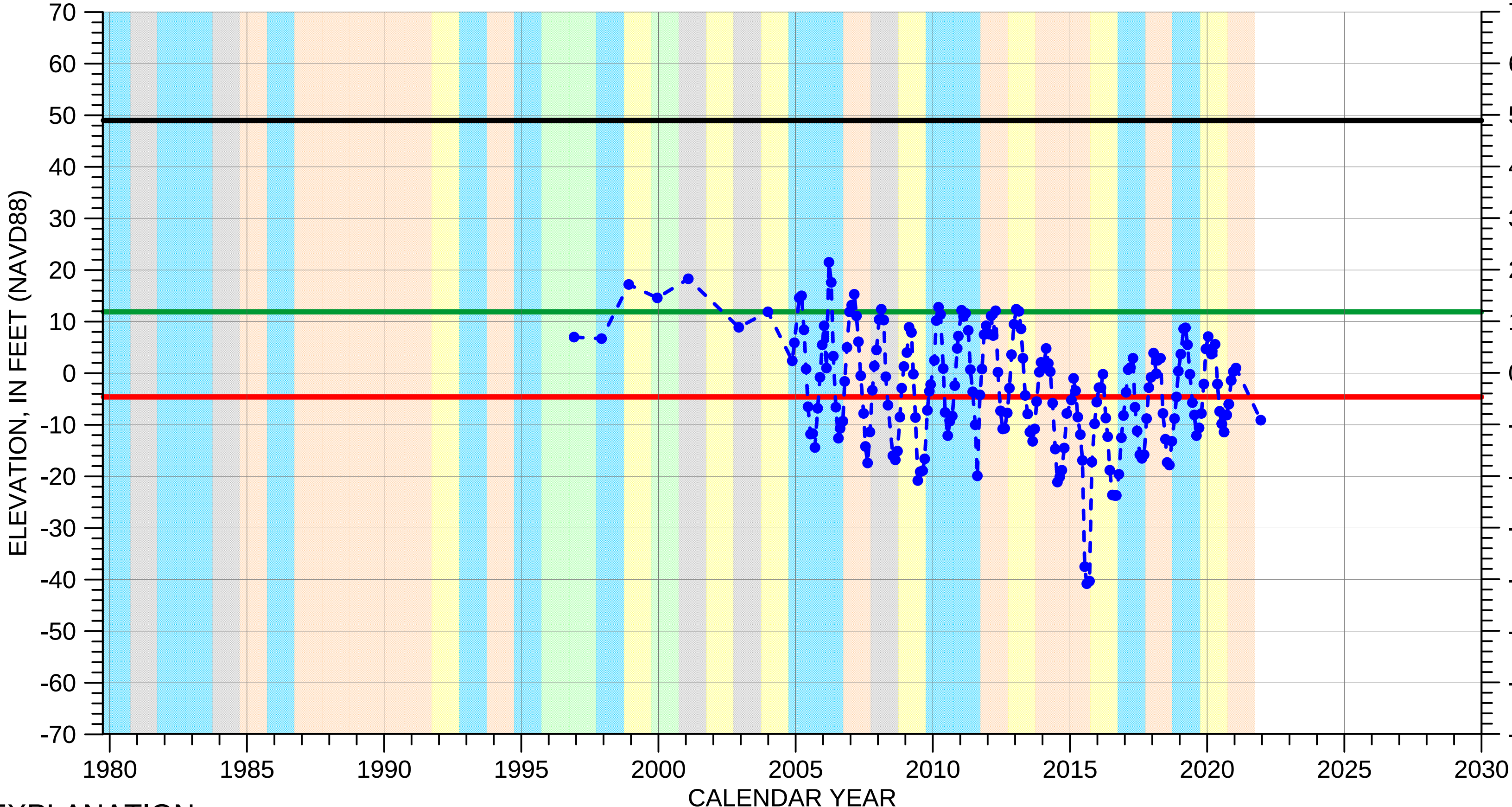
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

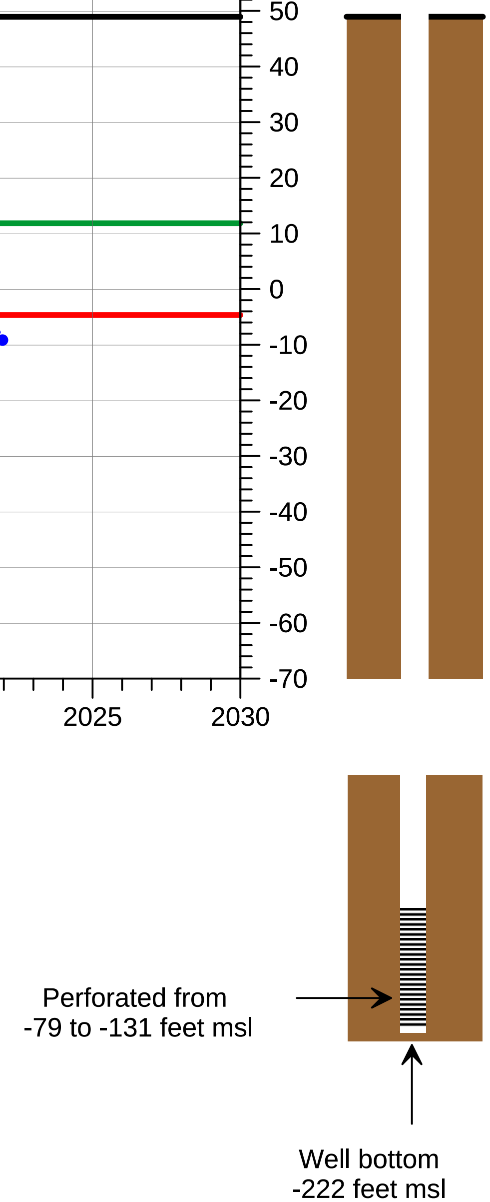


\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRA\NEWGRFs_Ch8\15S_03E-17E02.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 15S/03E-17M01

180/400-Foot Aquifer Subbasin





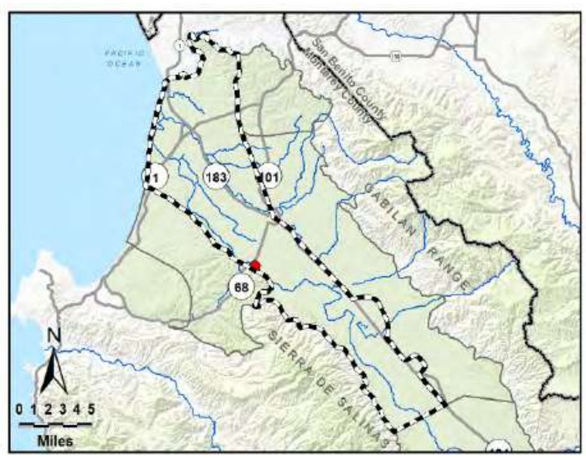
\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch8\15S_03E-17M01.grf

EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

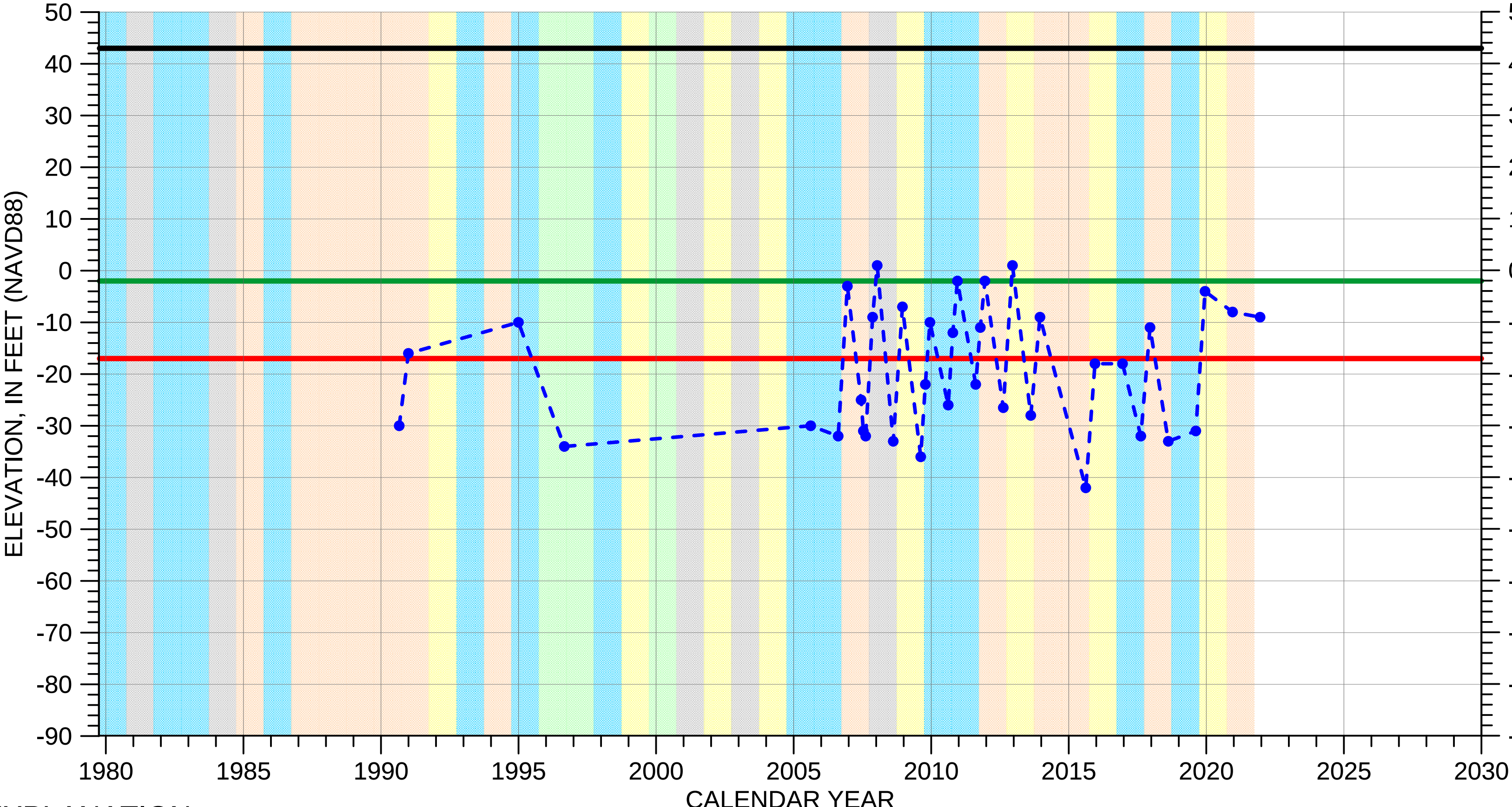
WATER YEAR TYPE DESIGNATION

- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET



HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 15S/03E-17P02

180/400-Foot Aquifer Subbasin

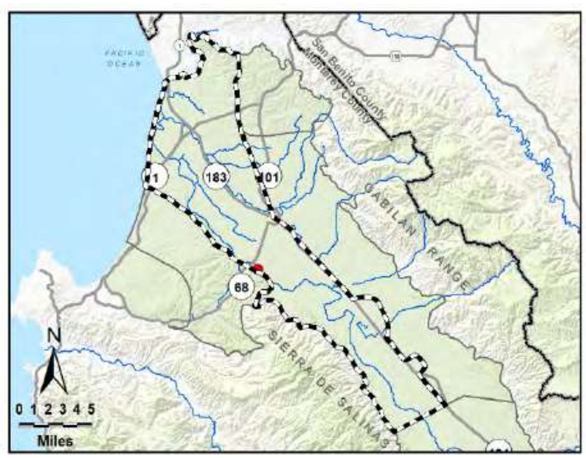


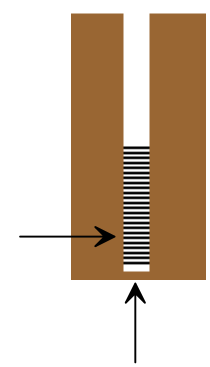
EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

WATER YEAR TYPE DESIGNATION

- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET





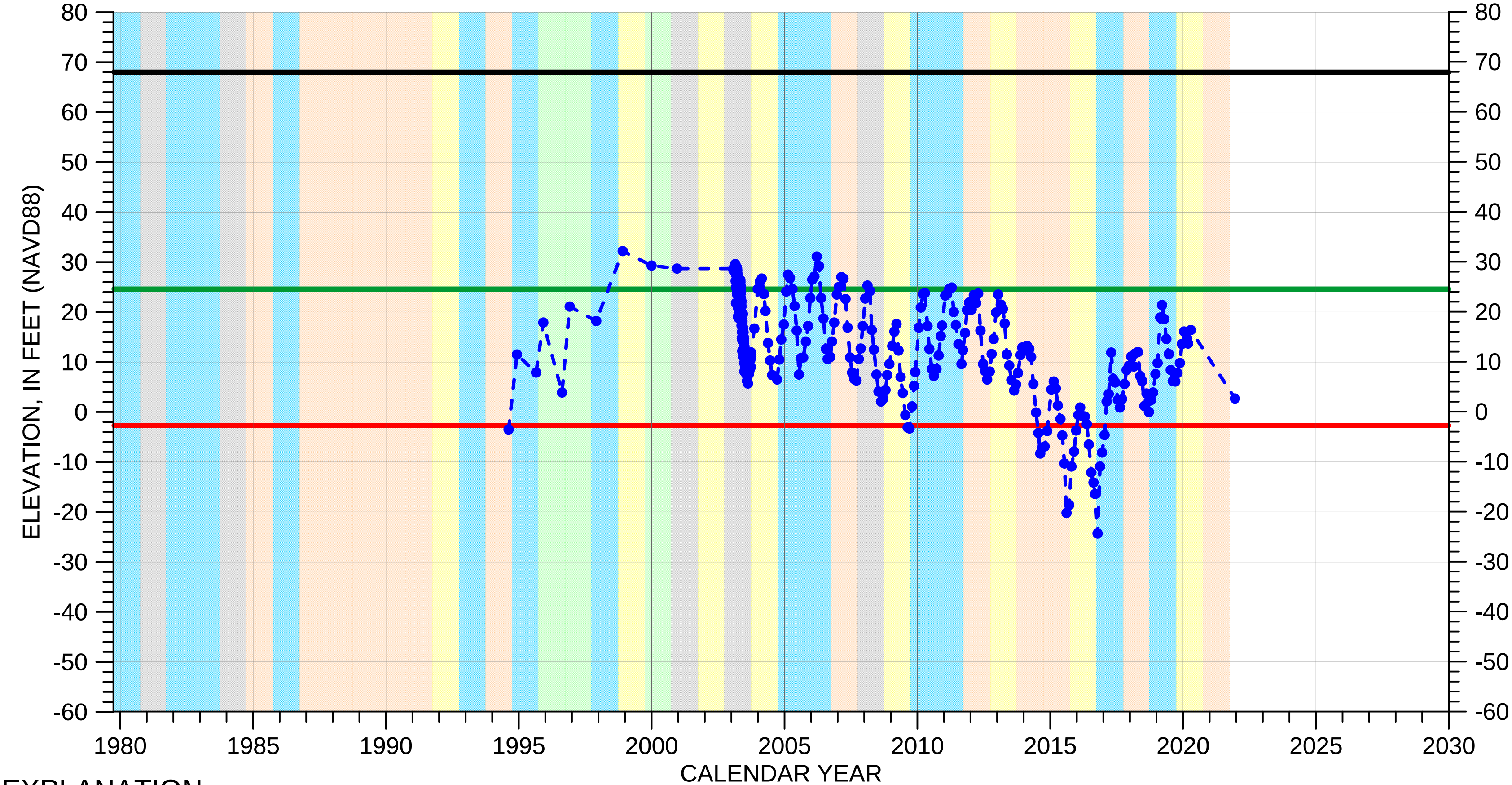
Multiple perforated intervals from -308 to -688 feet msl

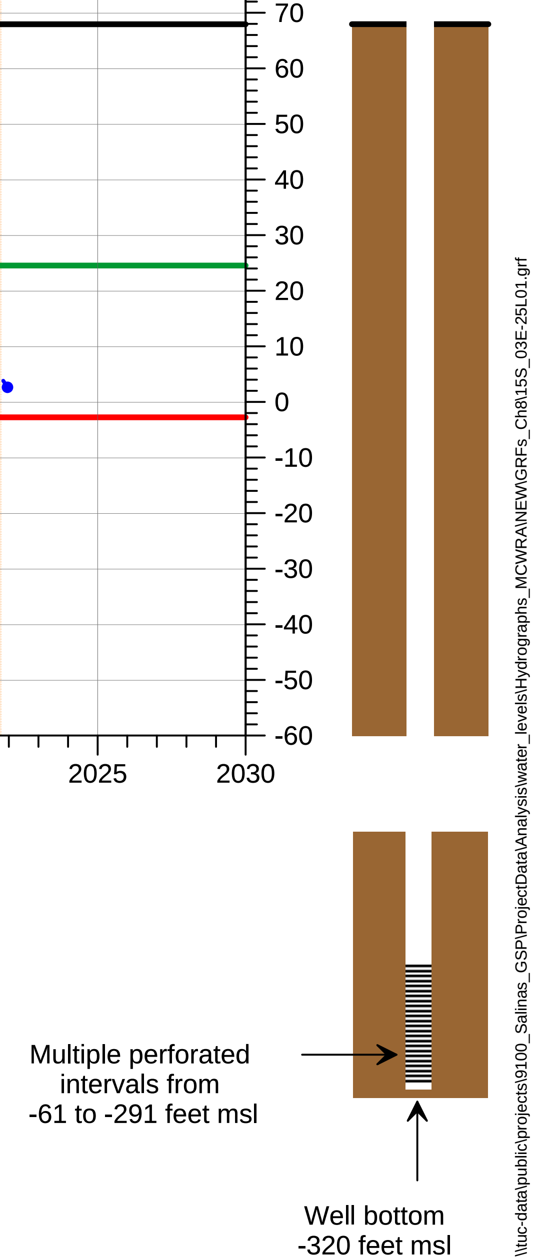
Well bottom -708 feet msl

\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch815S_03E-17P02.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 15S/03E-25L01

180/400-Foot Aquifer Subbasin



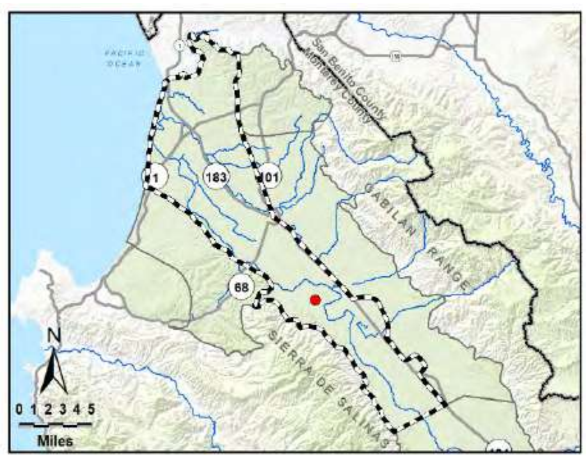


EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

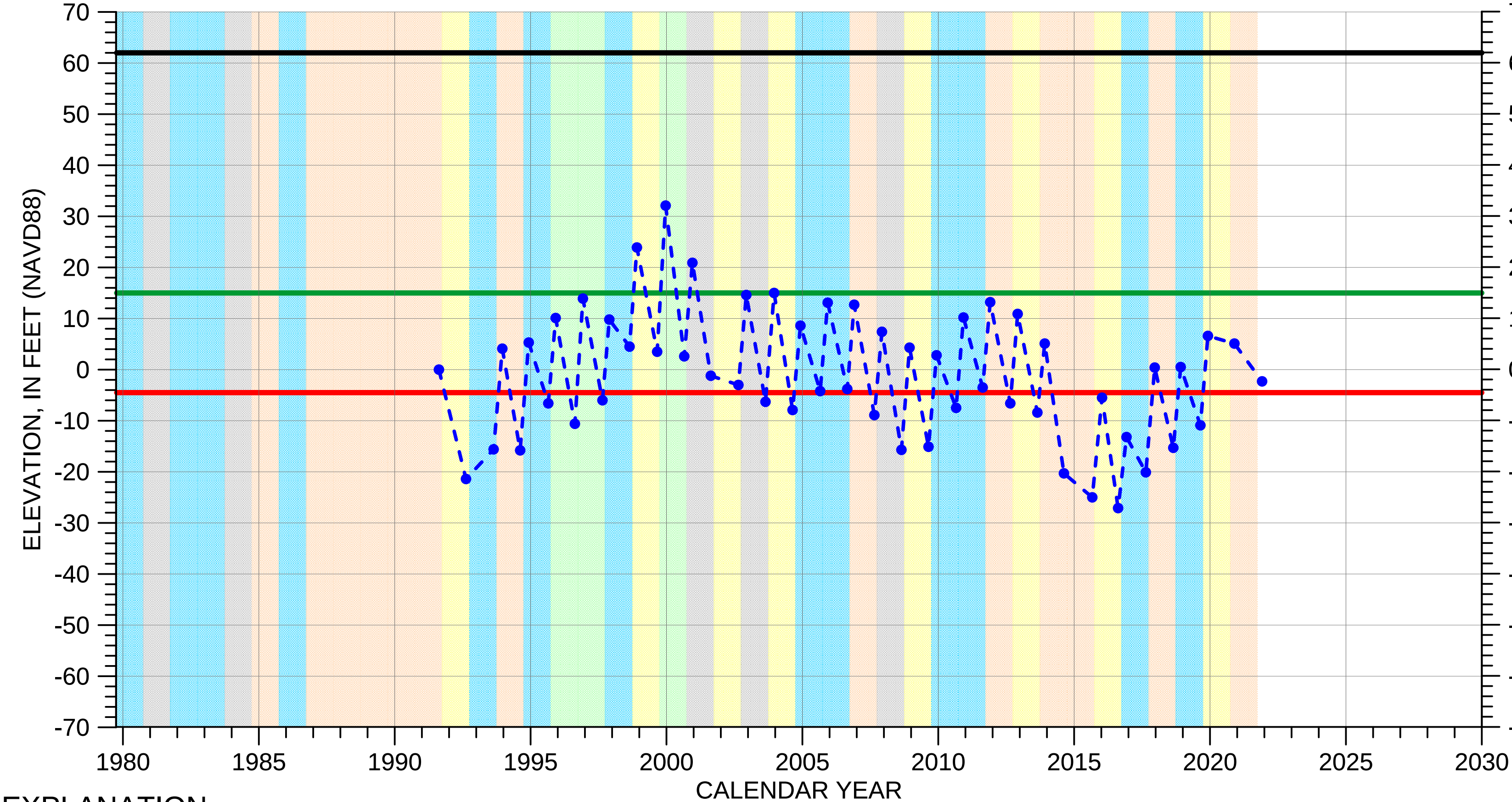
WATER YEAR TYPE DESIGNATION

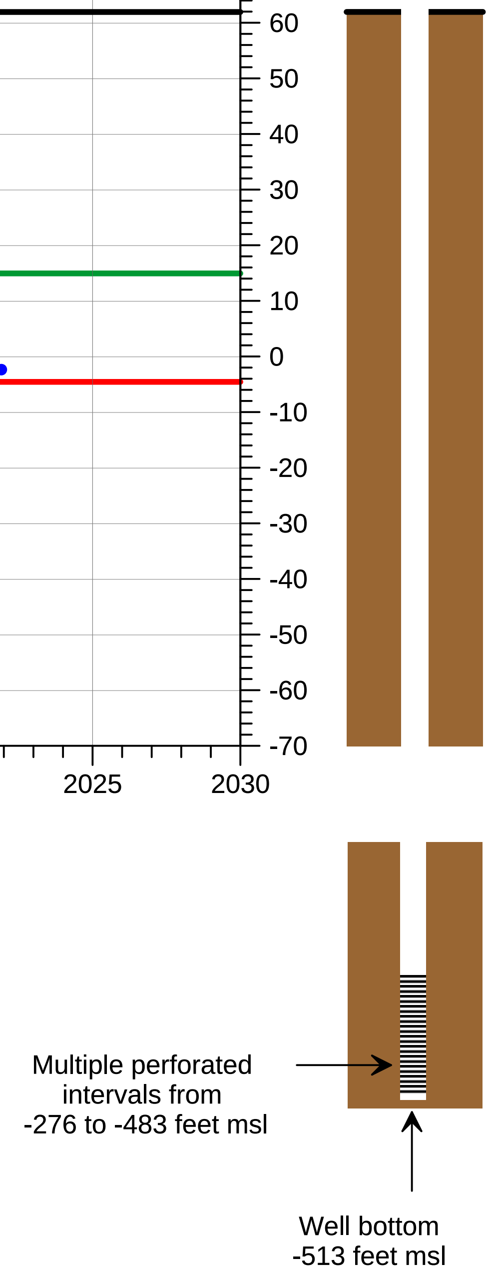
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET



HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 15S/03E-26A01

180/400-Foot Aquifer Subbasin



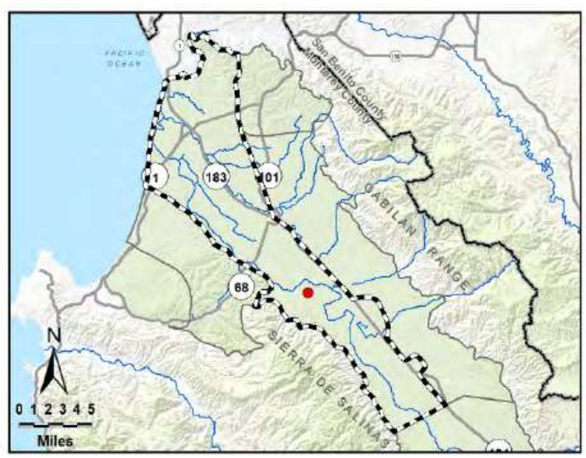


EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

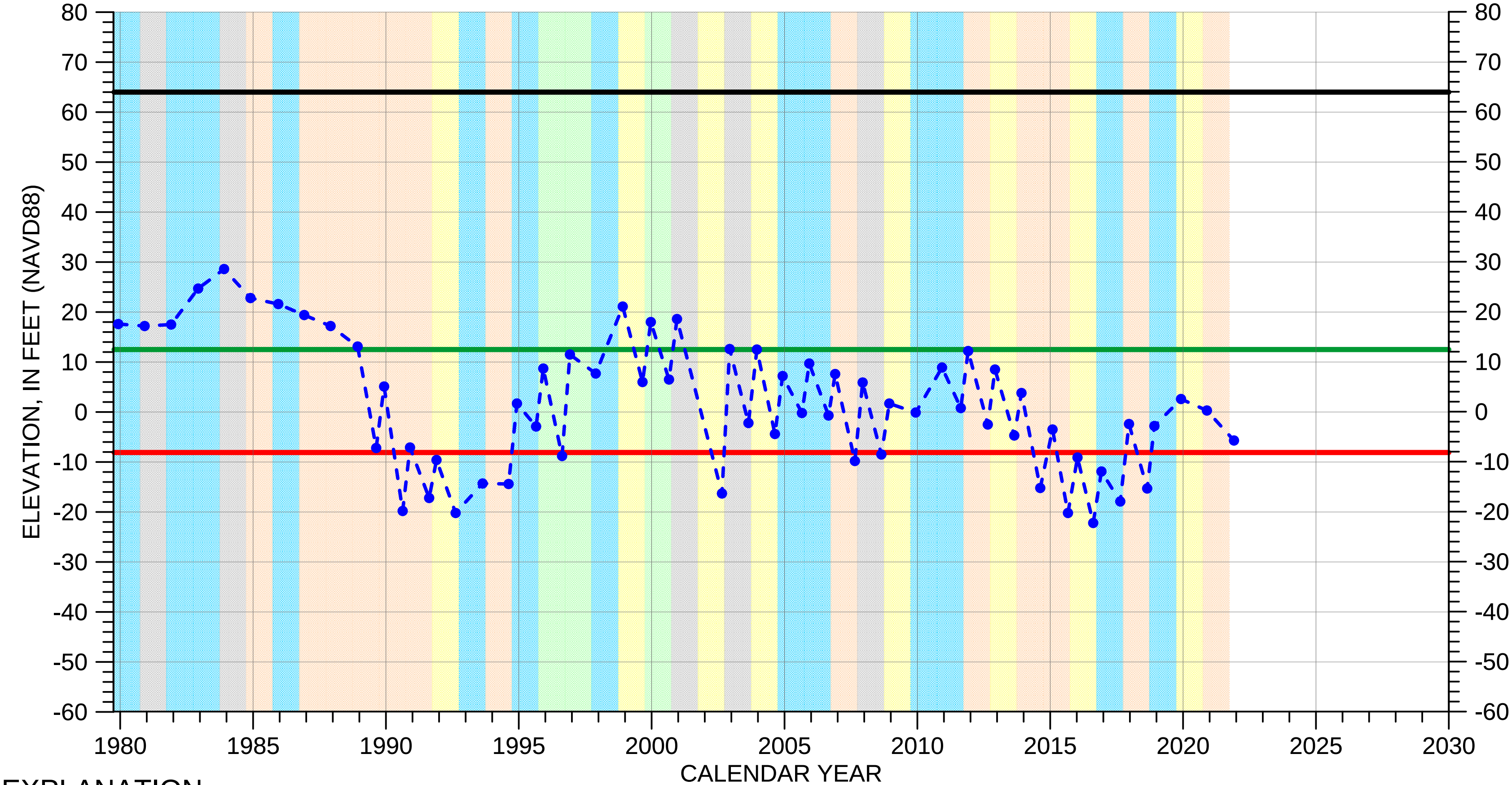
WATER YEAR TYPE DESIGNATION

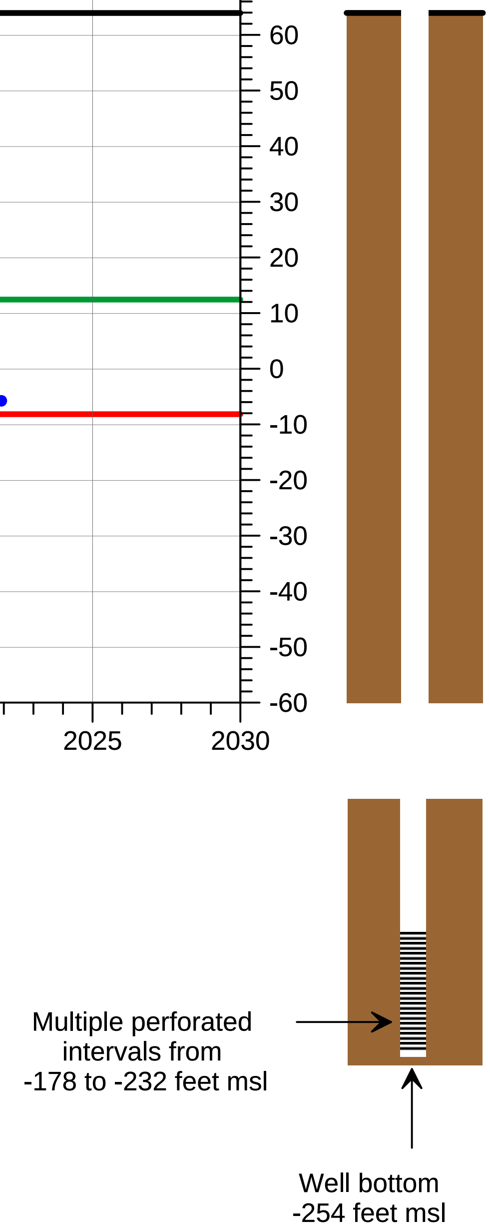
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET



HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 15S/03E-26F01

180/400-Foot Aquifer Subbasin



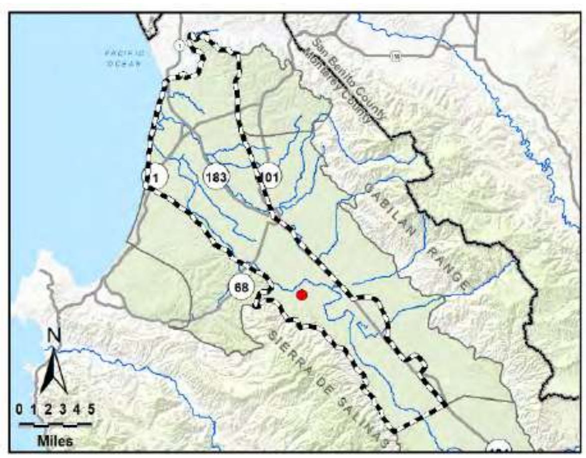


EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

WATER YEAR TYPE DESIGNATION

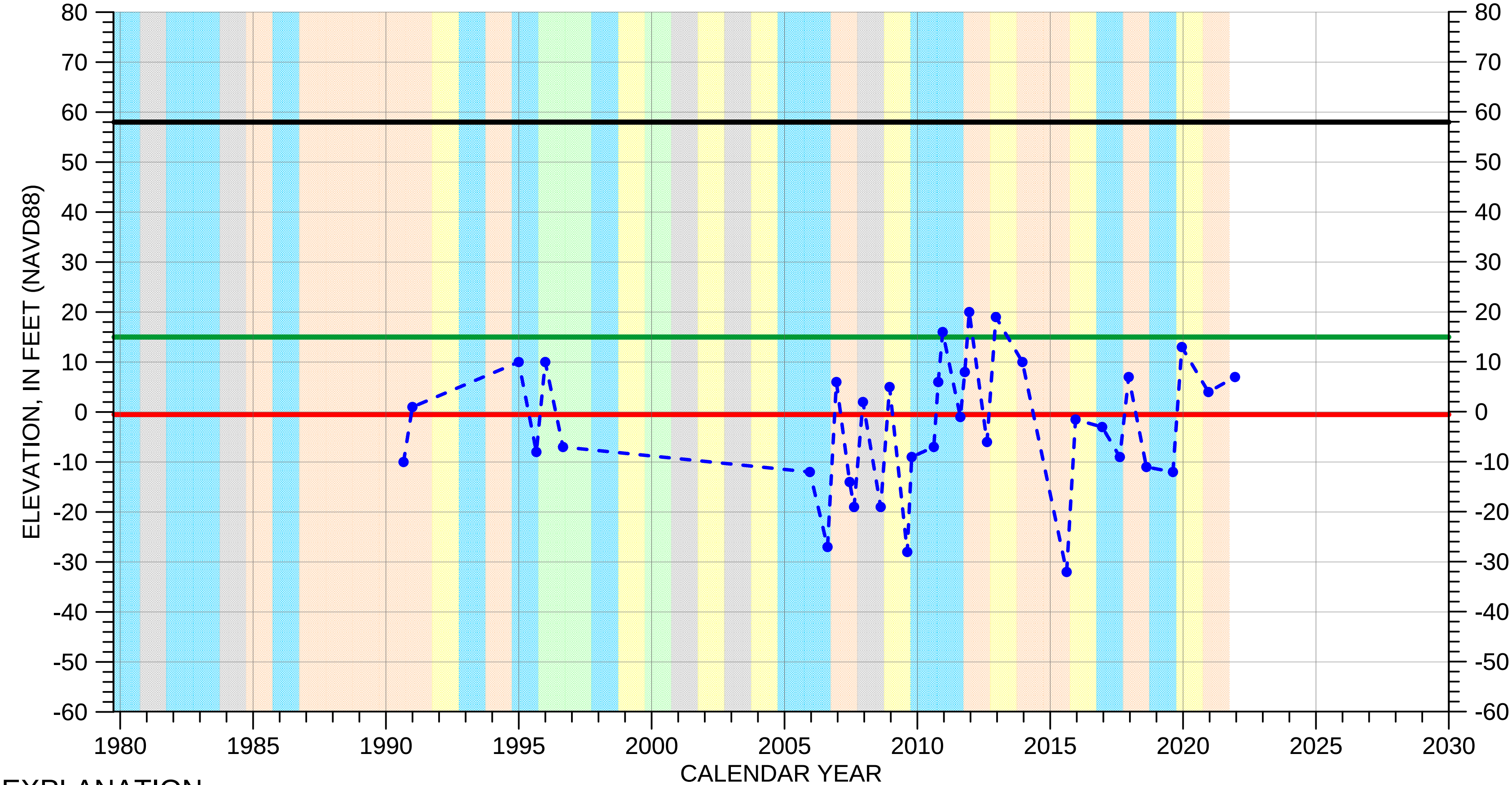
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET



\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch8\15S_03E-26F01.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 15S/03E-28B02

180/400-Foot Aquifer Subbasin



Multiple perforated intervals from -343 to -395 feet msl

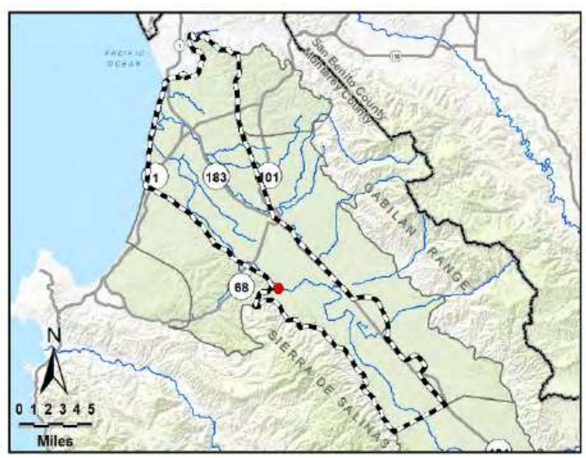
Well bottom -420 feet msl

EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

WATER YEAR TYPE DESIGNATION

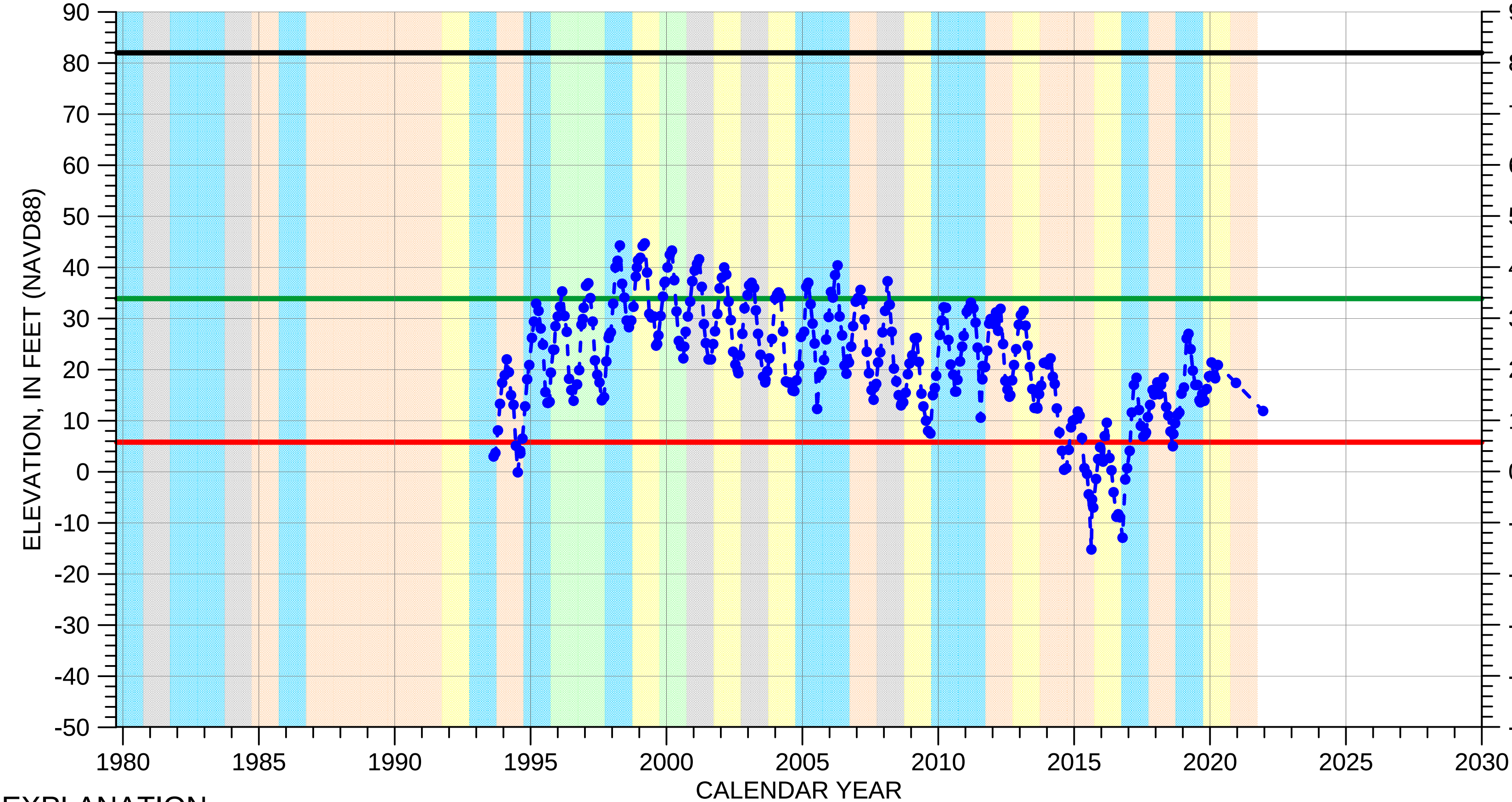
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET



\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRA\NEWGRFs_Ch8\15S_03E-28B02.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 15S/04E-29Q02

180/400-Foot Aquifer Subbasin



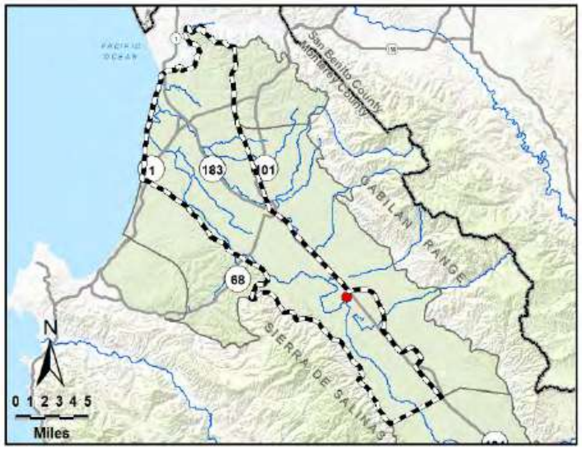
\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch8\15S_04E-29Q02.grf

EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

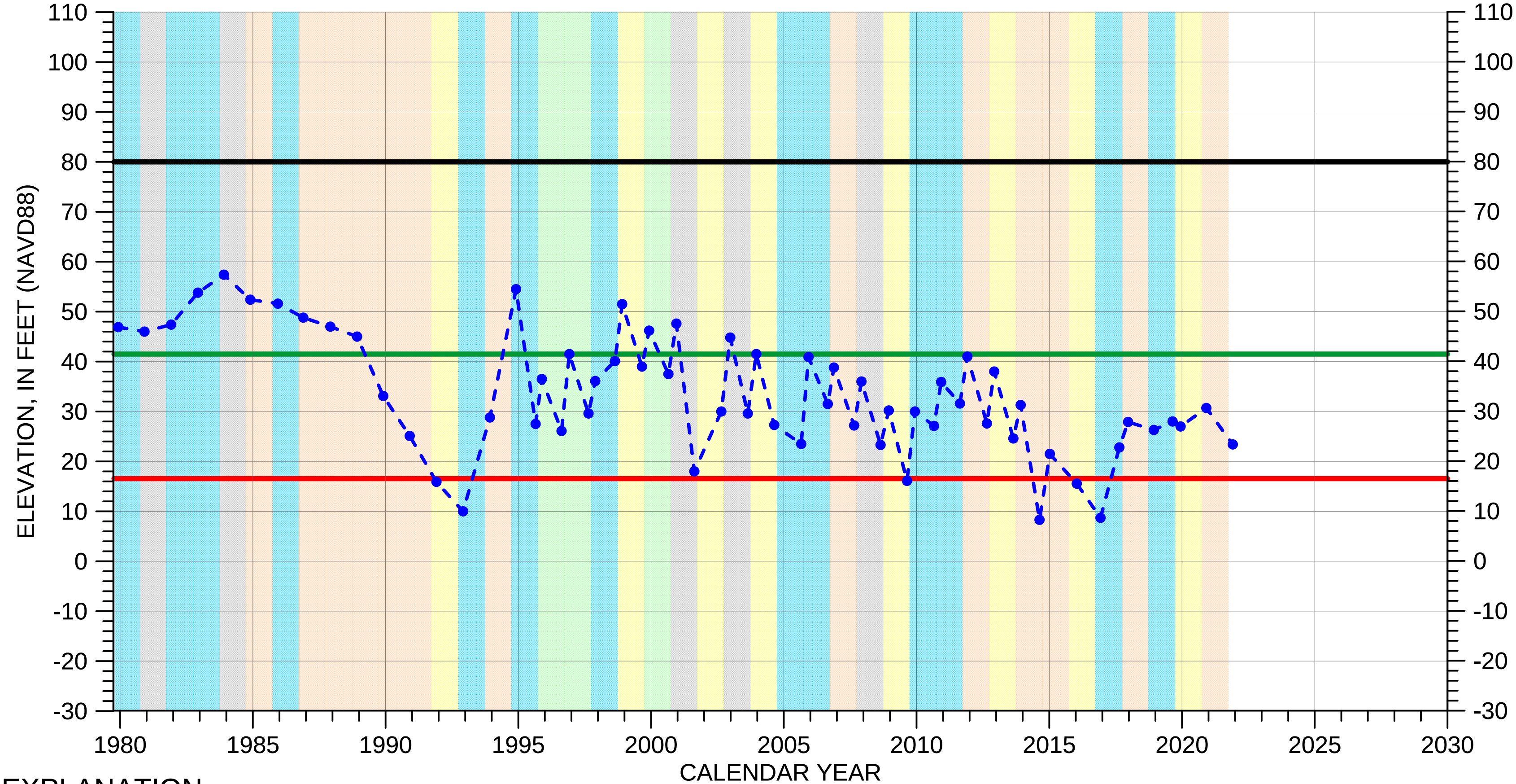
WATER YEAR TYPE DESIGNATION

- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET



HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 15S/04E-31A02

180/400-Foot Aquifer Subbasin

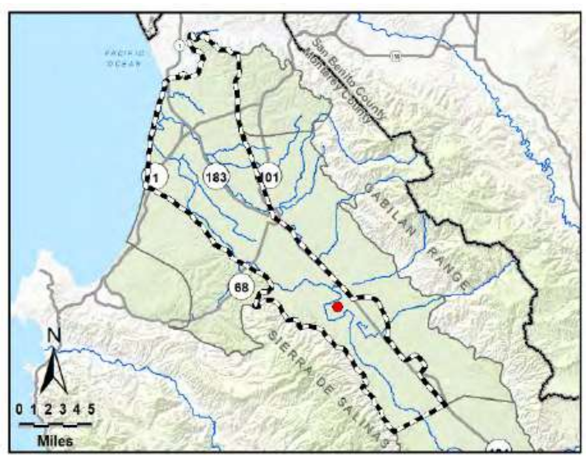


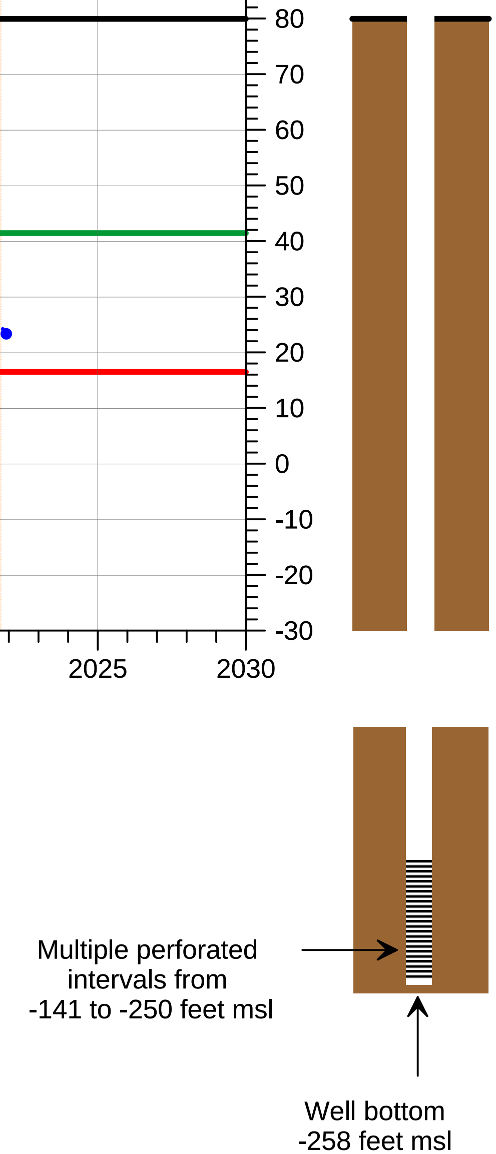
EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

WATER YEAR TYPE DESIGNATION

- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

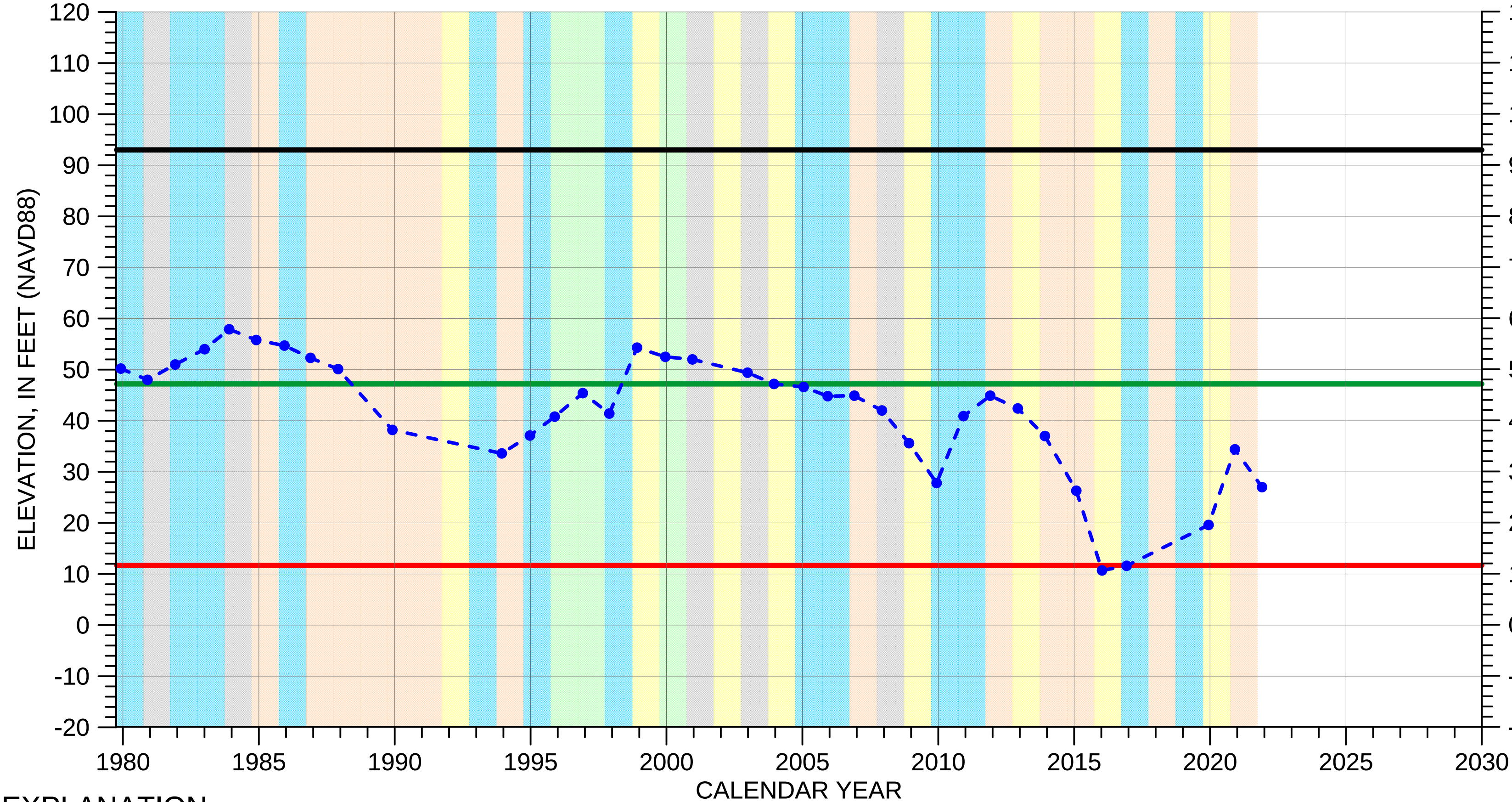


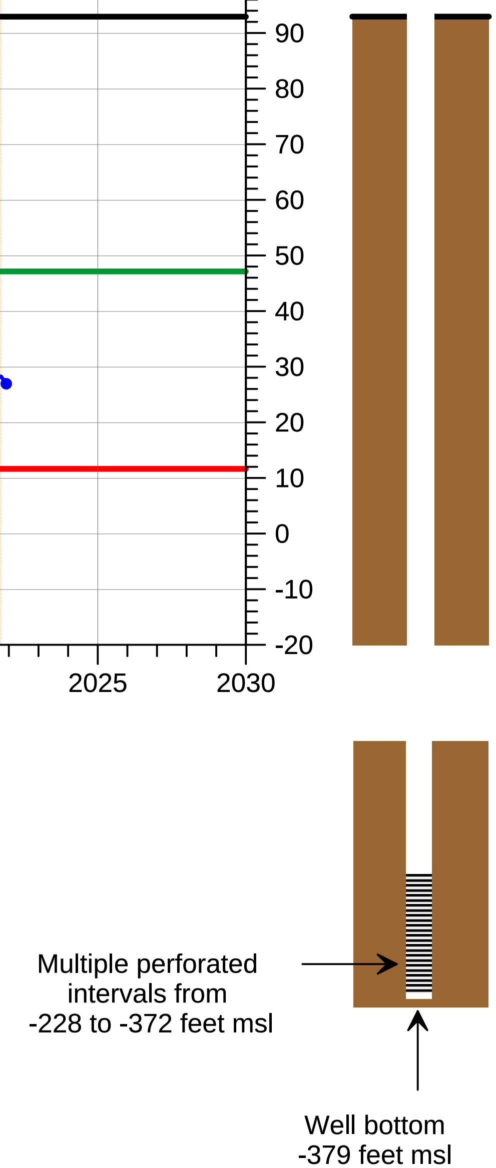


\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch8\15S_04E-31A02.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 16S/04E-04C01

180/400-Foot Aquifer Subbasin



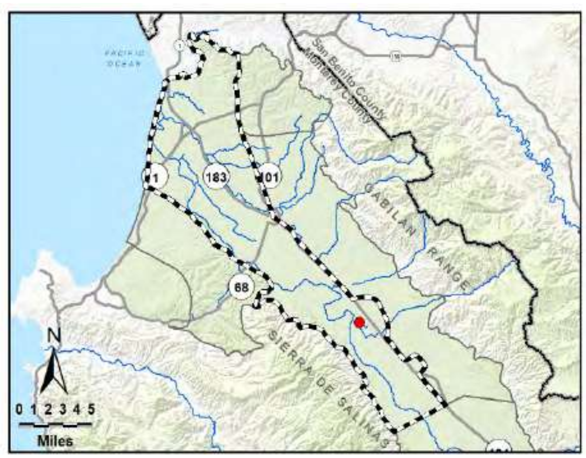


EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

WATER YEAR TYPE DESIGNATION

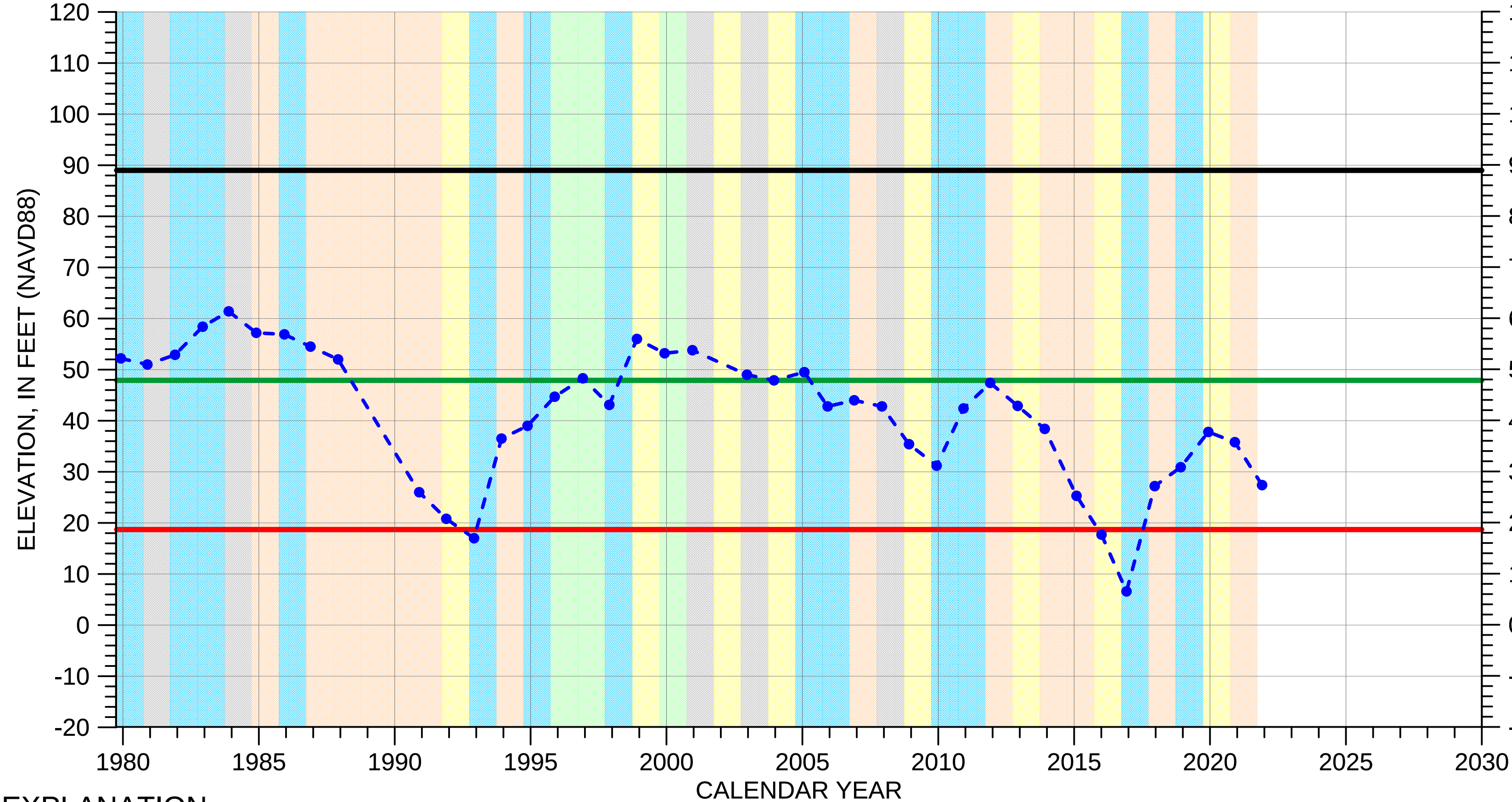
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET



\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch8\16S_04E-04C01.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 16S/04E-05M02

180/400-Foot Aquifer Subbasin

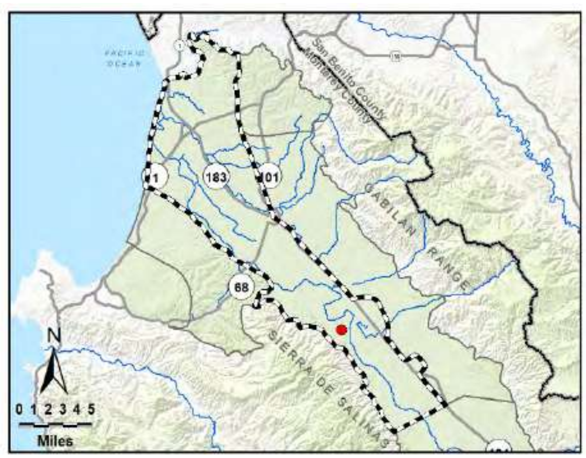


EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

WATER YEAR TYPE DESIGNATION

- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET



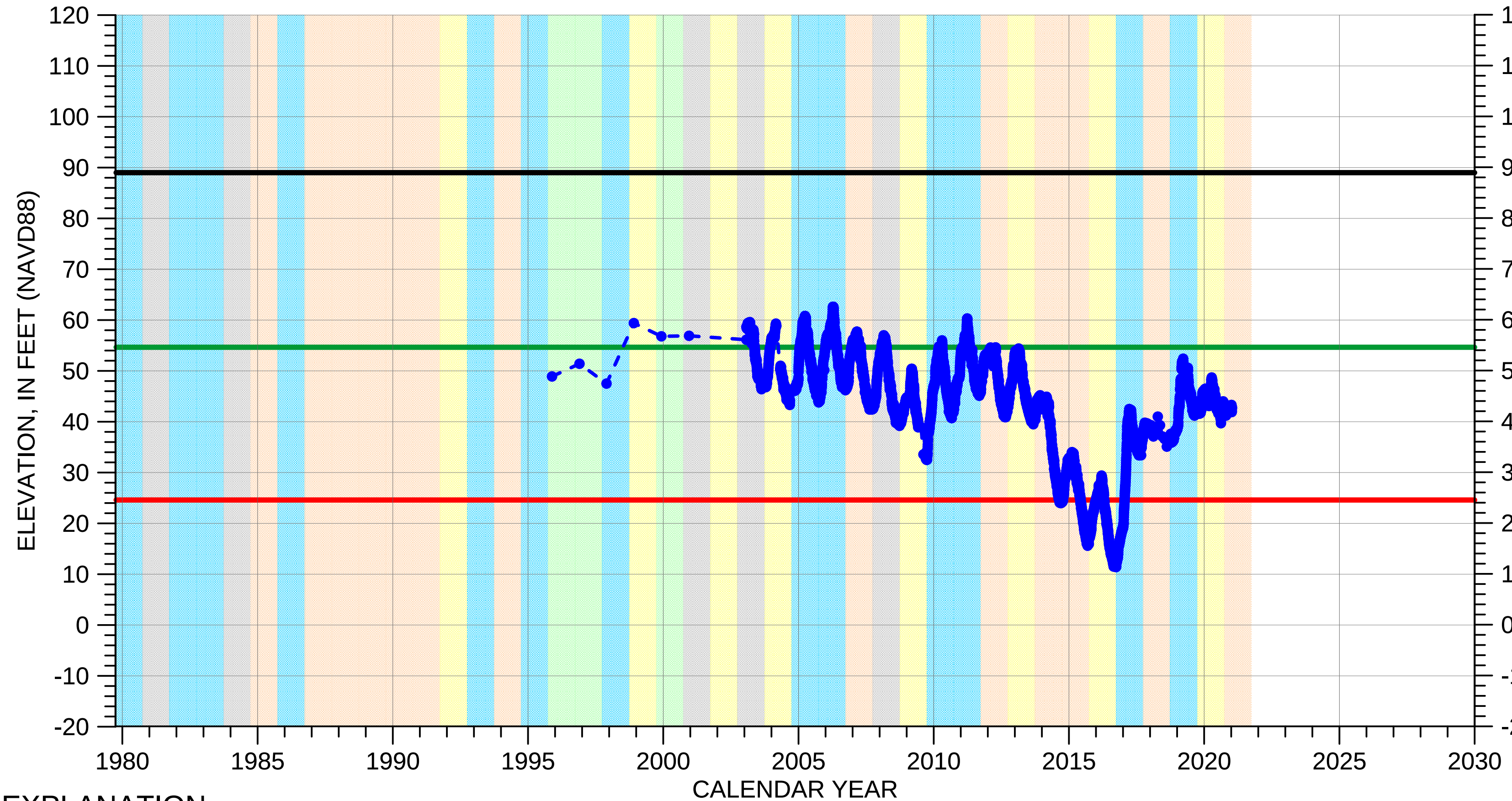
Perforated interval unknown

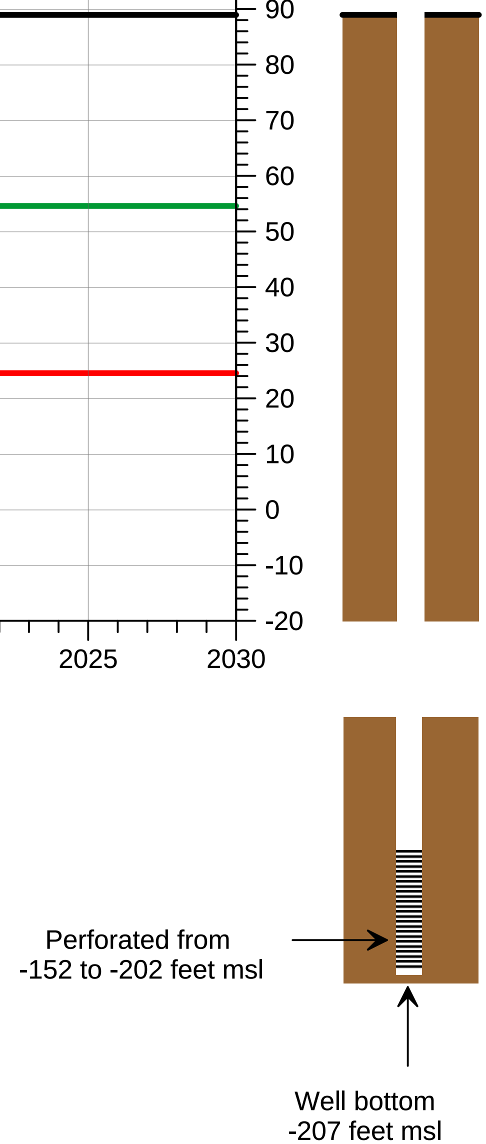
Well bottom
-178 feet msl

\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEW\GRFs_Ch8\16S_04E-05M02.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 16S/04E-08H03

180/400-Foot Aquifer Subbasin





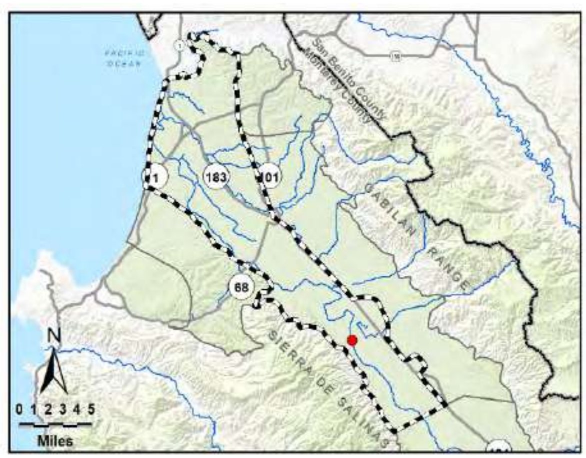
\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch8\16S_04E-08H03.grf

EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

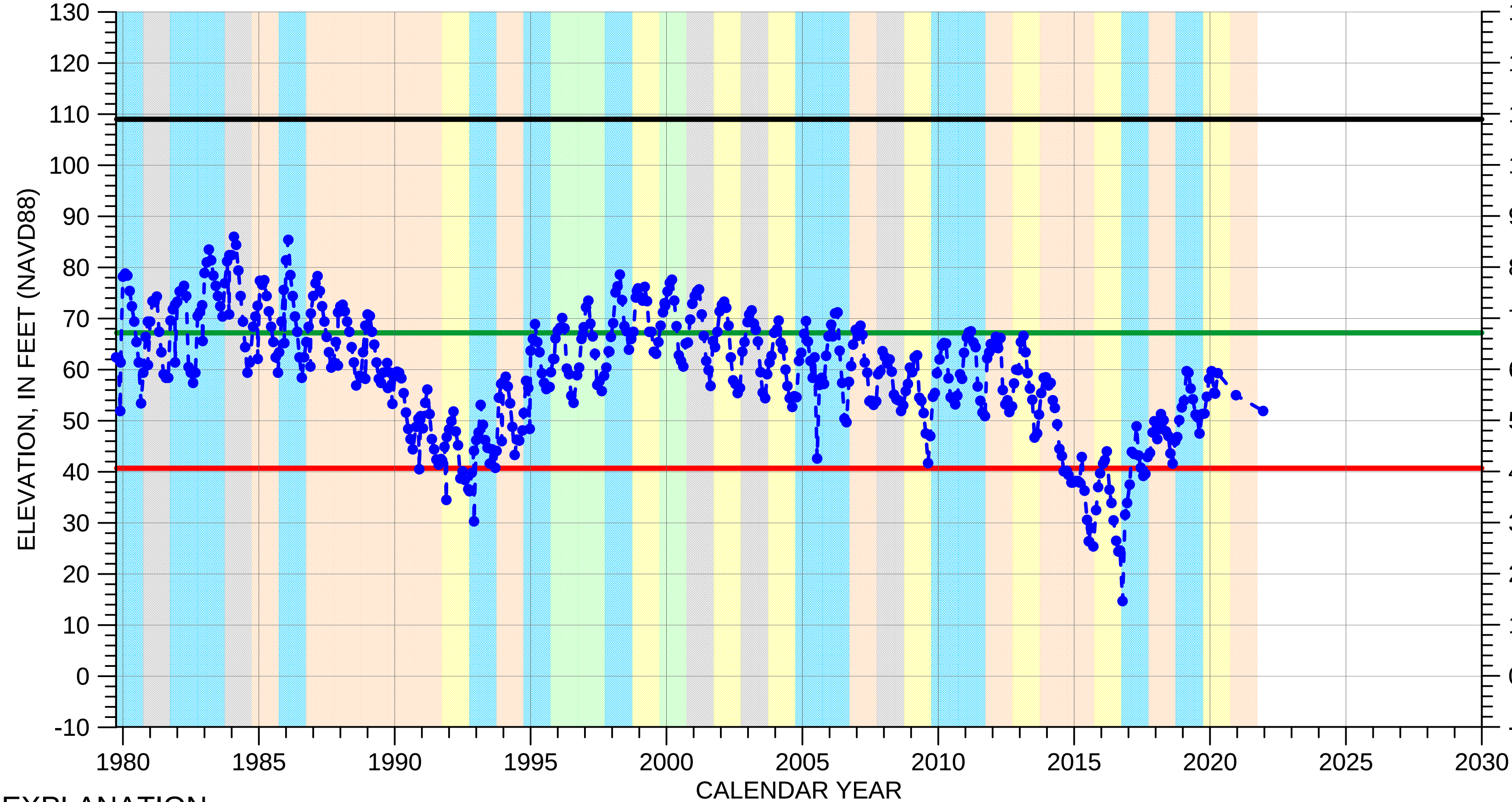
WATER YEAR TYPE DESIGNATION

- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET



HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 16S/04E-10R02

180/400-Foot Aquifer Subbasin

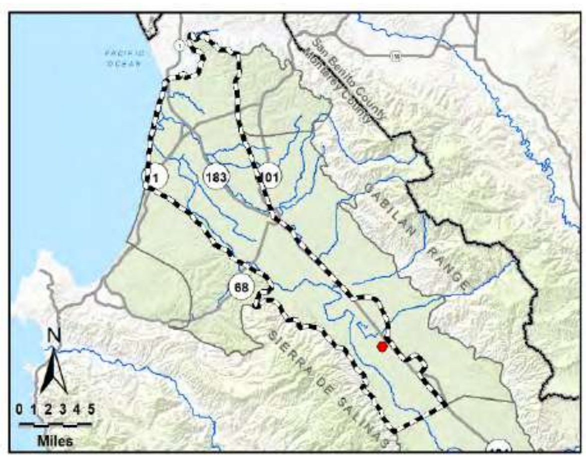


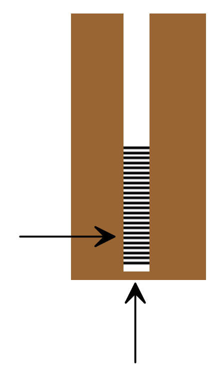
EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

WATER YEAR TYPE DESIGNATION

- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET





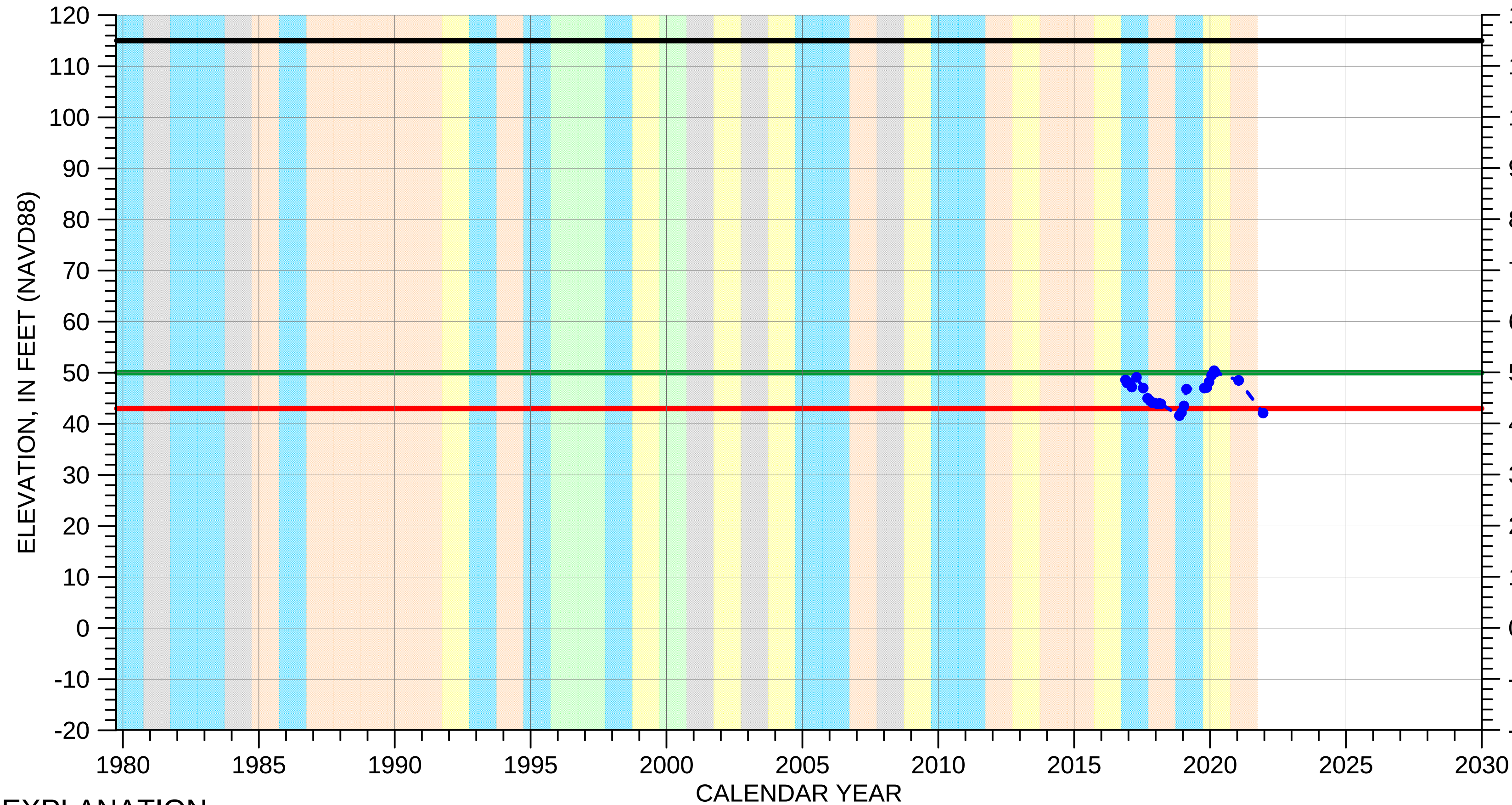
Multiple perforated intervals from -103 to -368 feet msl

Well bottom -375 feet msl

\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch8\16S_04E-10R02.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 16S/04E-11D51

180/400-Foot Aquifer Subbasin

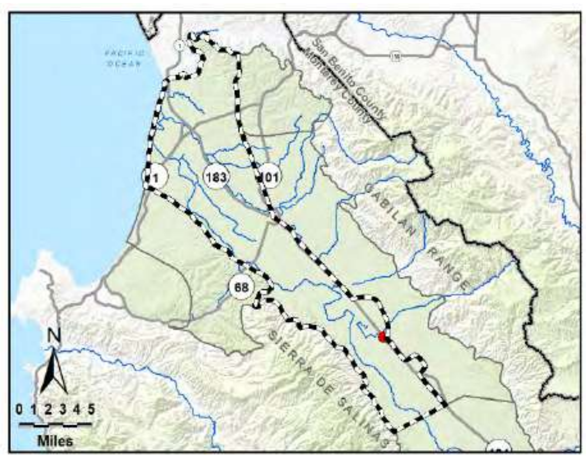


EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

WATER YEAR TYPE DESIGNATION

- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET



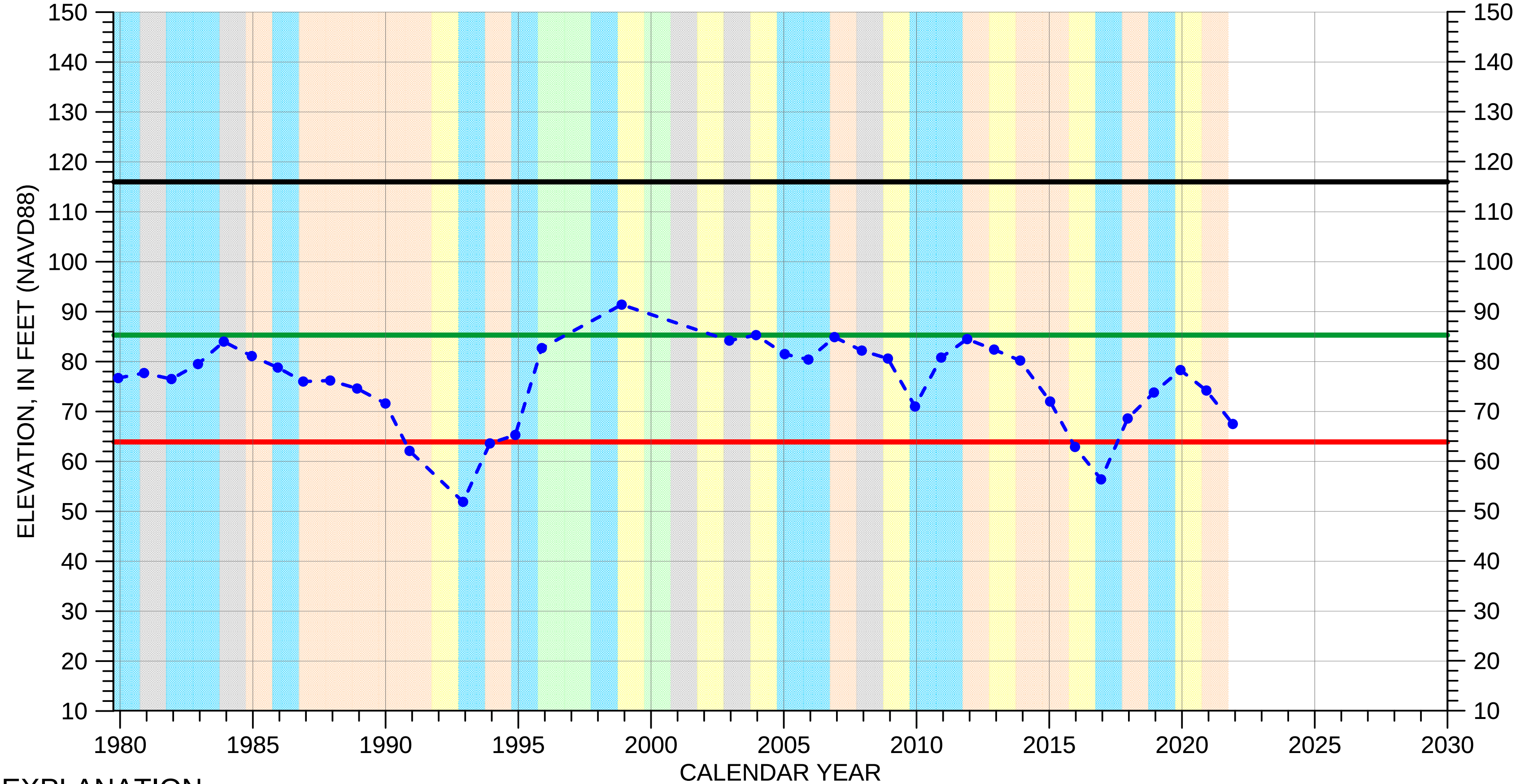
Perforated from
-425 to -875 feel msl

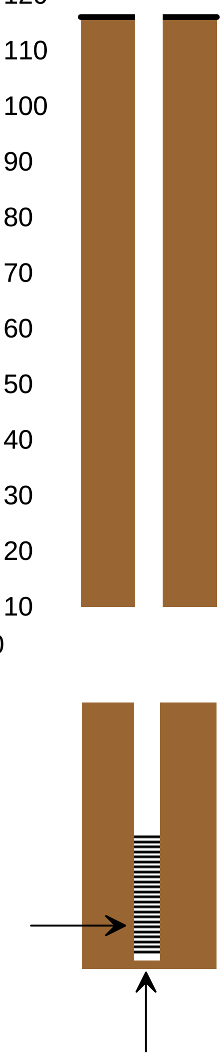
Well bottom
-885 feet msl

\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch816S_04E-11D51.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 16S/04E-13R02

180/400-Foot Aquifer Subbasin



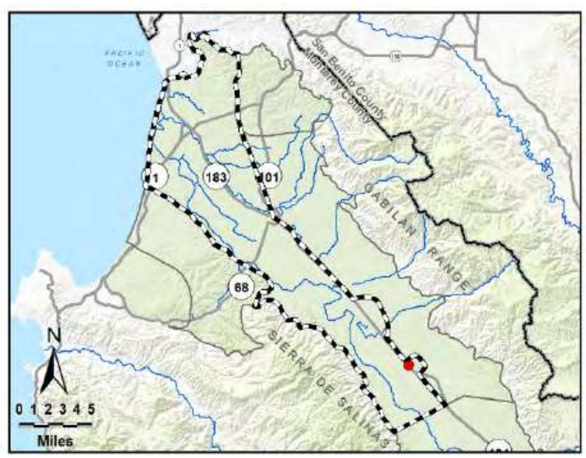


EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

WATER YEAR TYPE DESIGNATION

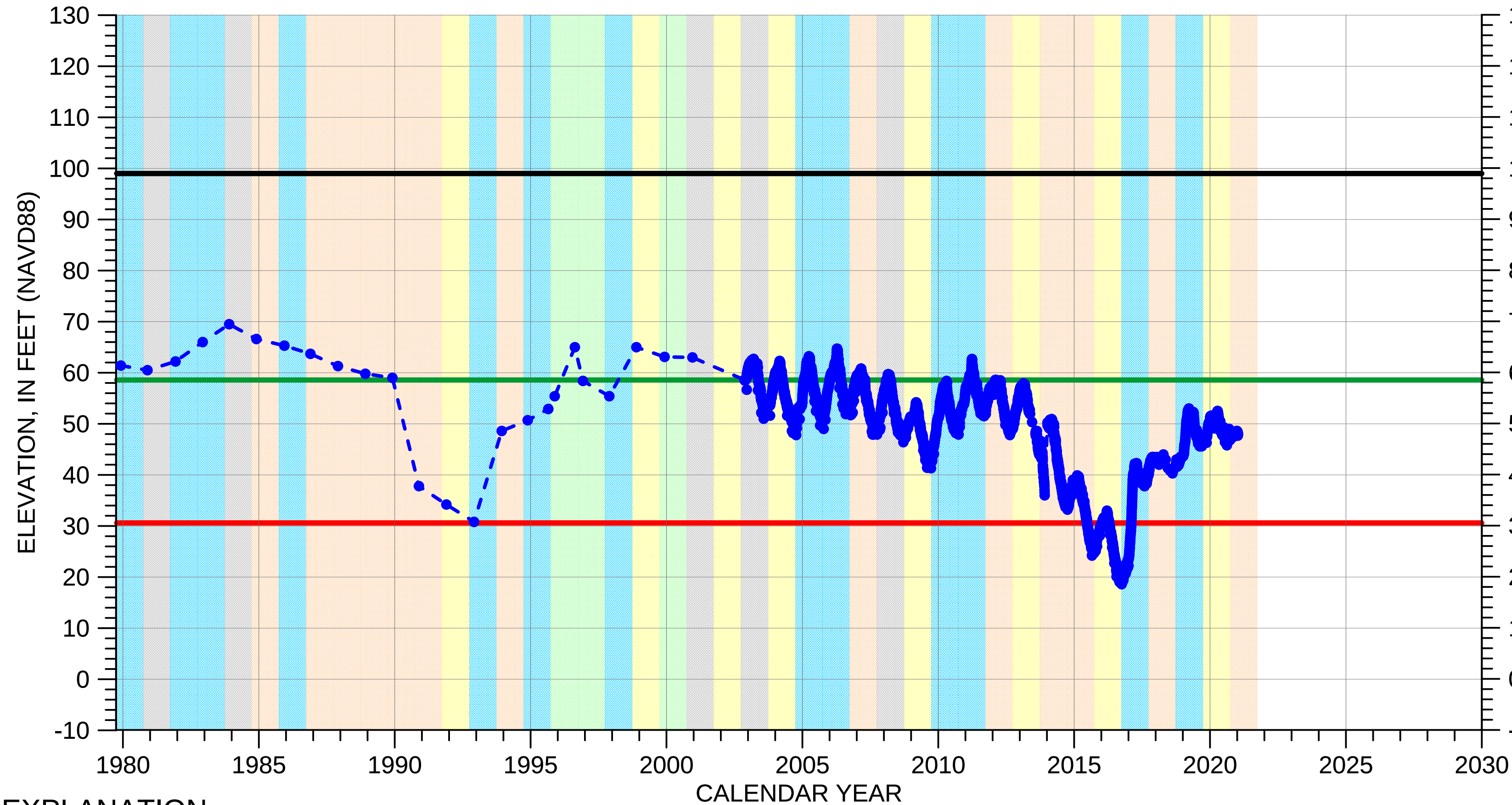
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET



\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch8\16S_04E-13R02.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 16S/04E-15D01

180/400-Foot Aquifer Subbasin

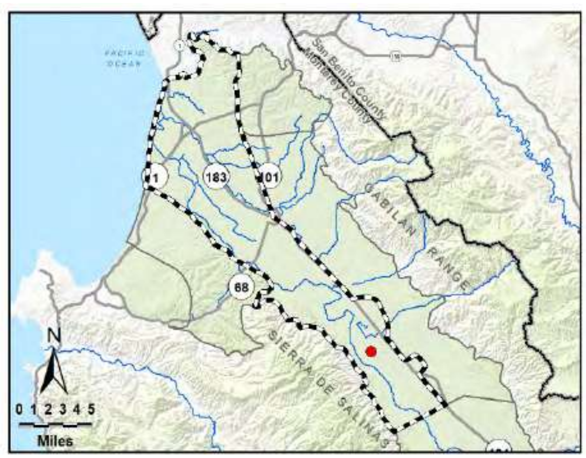


EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

WATER YEAR TYPE DESIGNATION

- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET



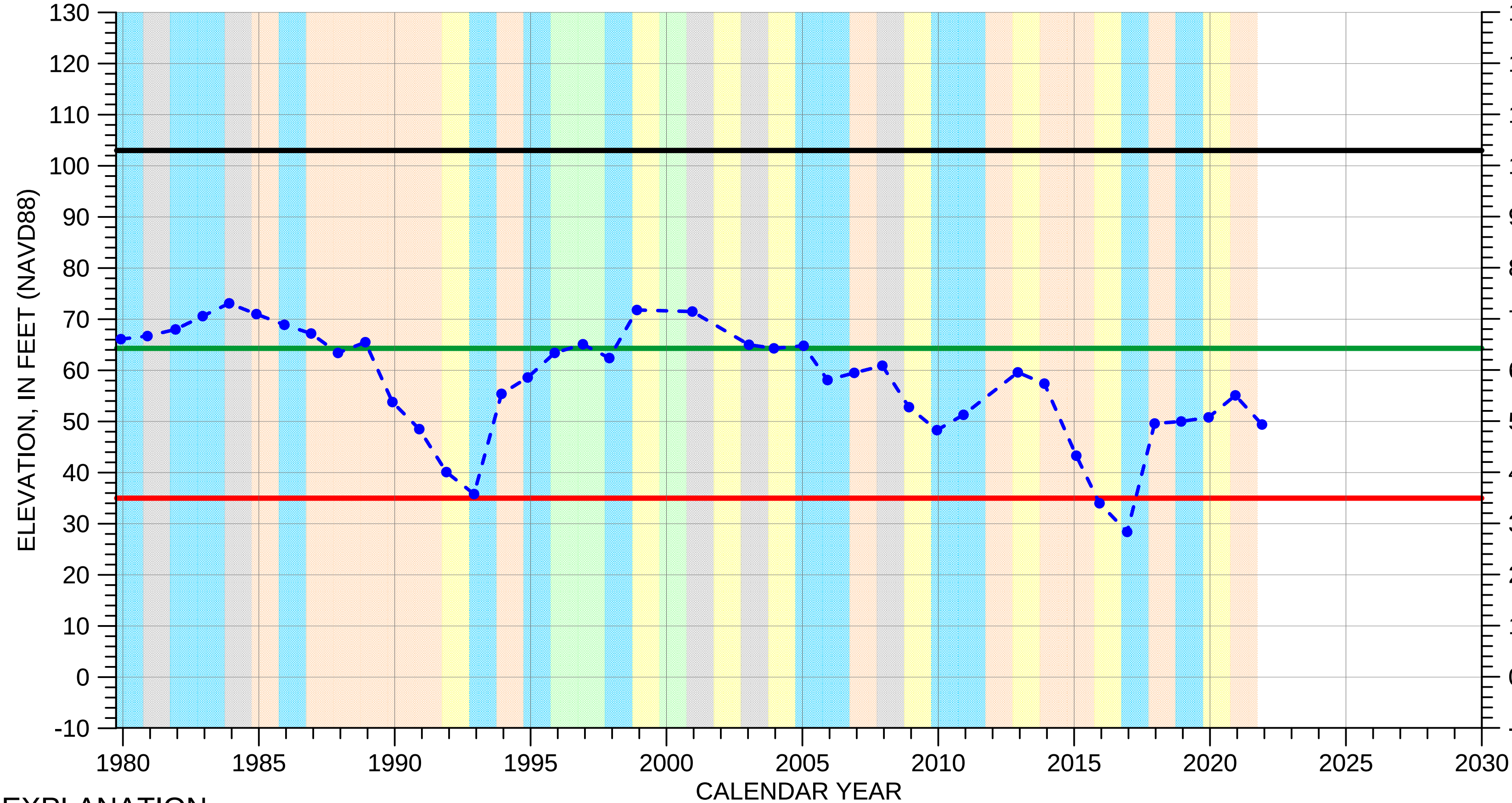
Perforated from
-71 to -259 feet msl

Well bottom
-285 feet msl

\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRA\NEWGRFs_Ch8\16S_04E-15D01.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 16S/04E-15R02

180/400-Foot Aquifer Subbasin

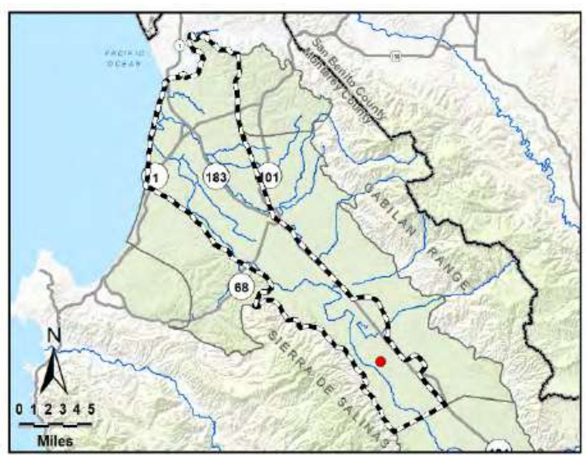


EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

WATER YEAR TYPE DESIGNATION

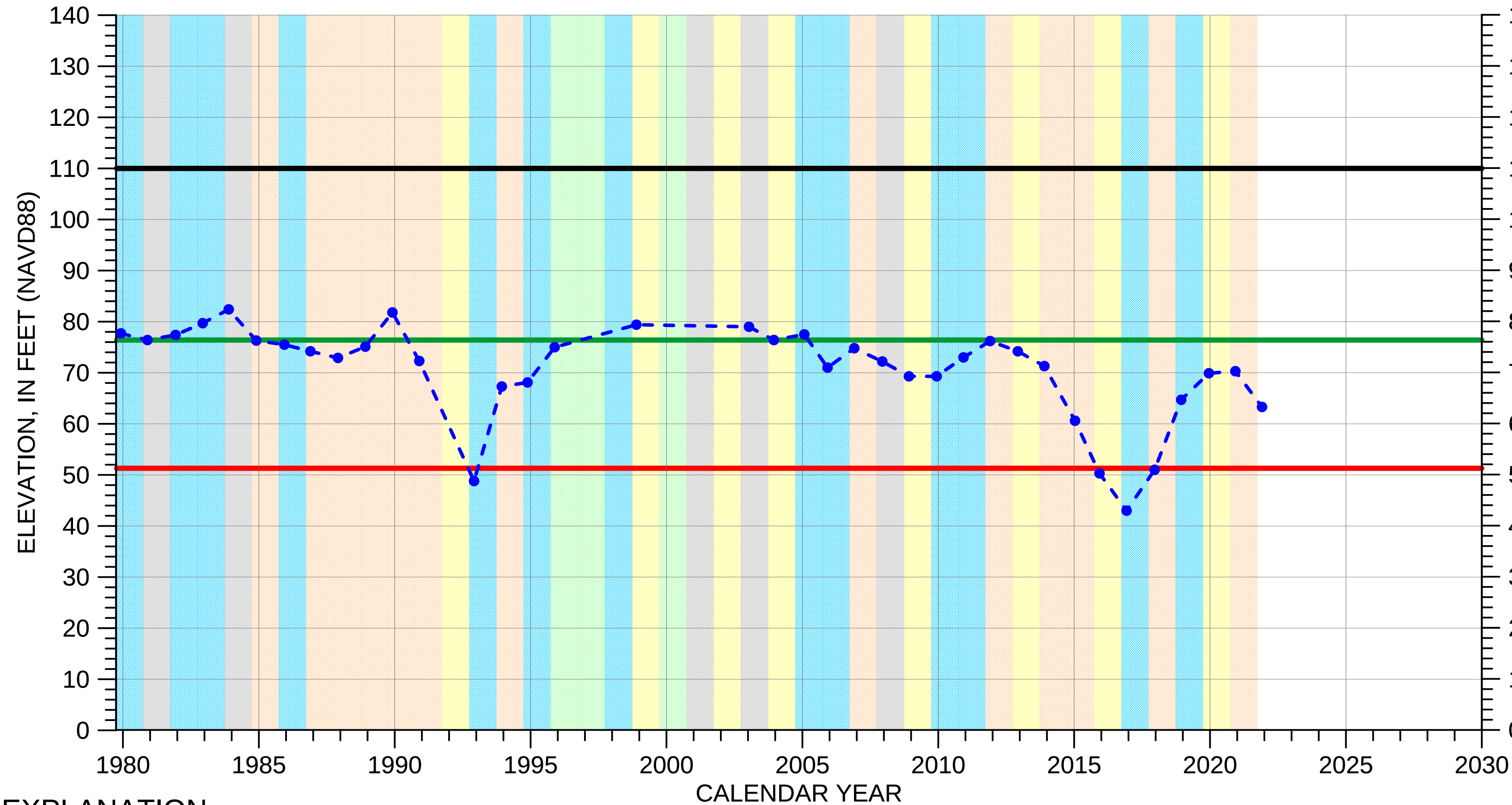
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

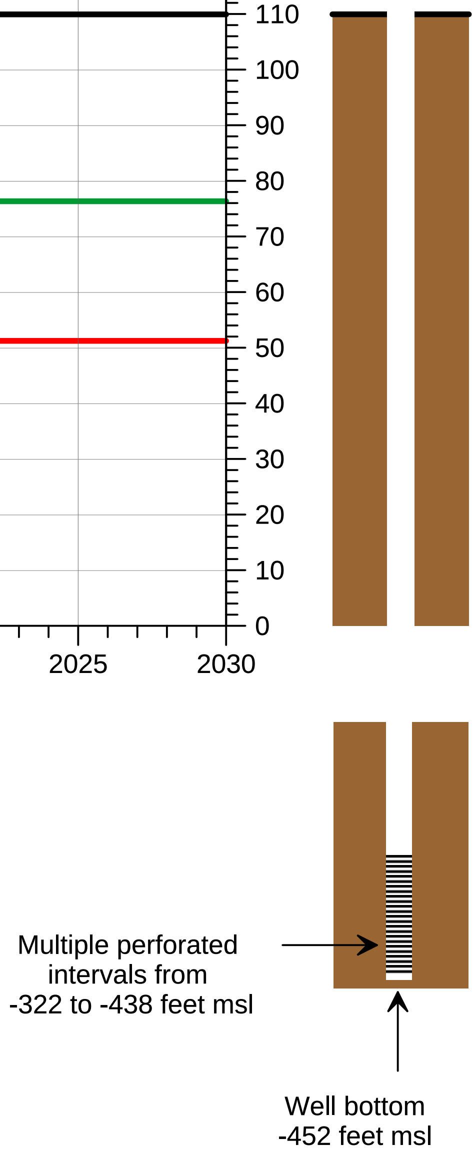


\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch8\16S_04E-15R02.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 16S/04E-25G01

180/400-Foot Aquifer Subbasin



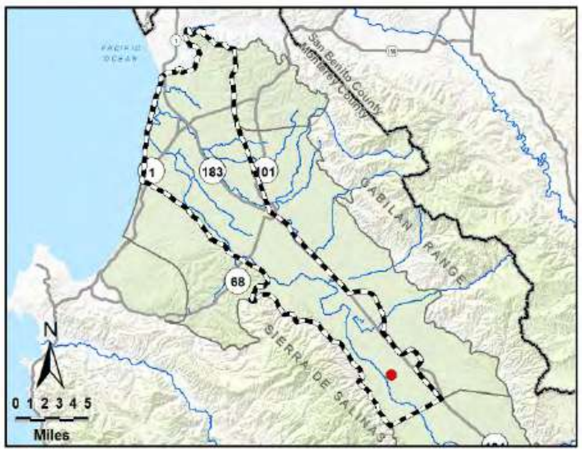


EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

WATER YEAR TYPE DESIGNATION

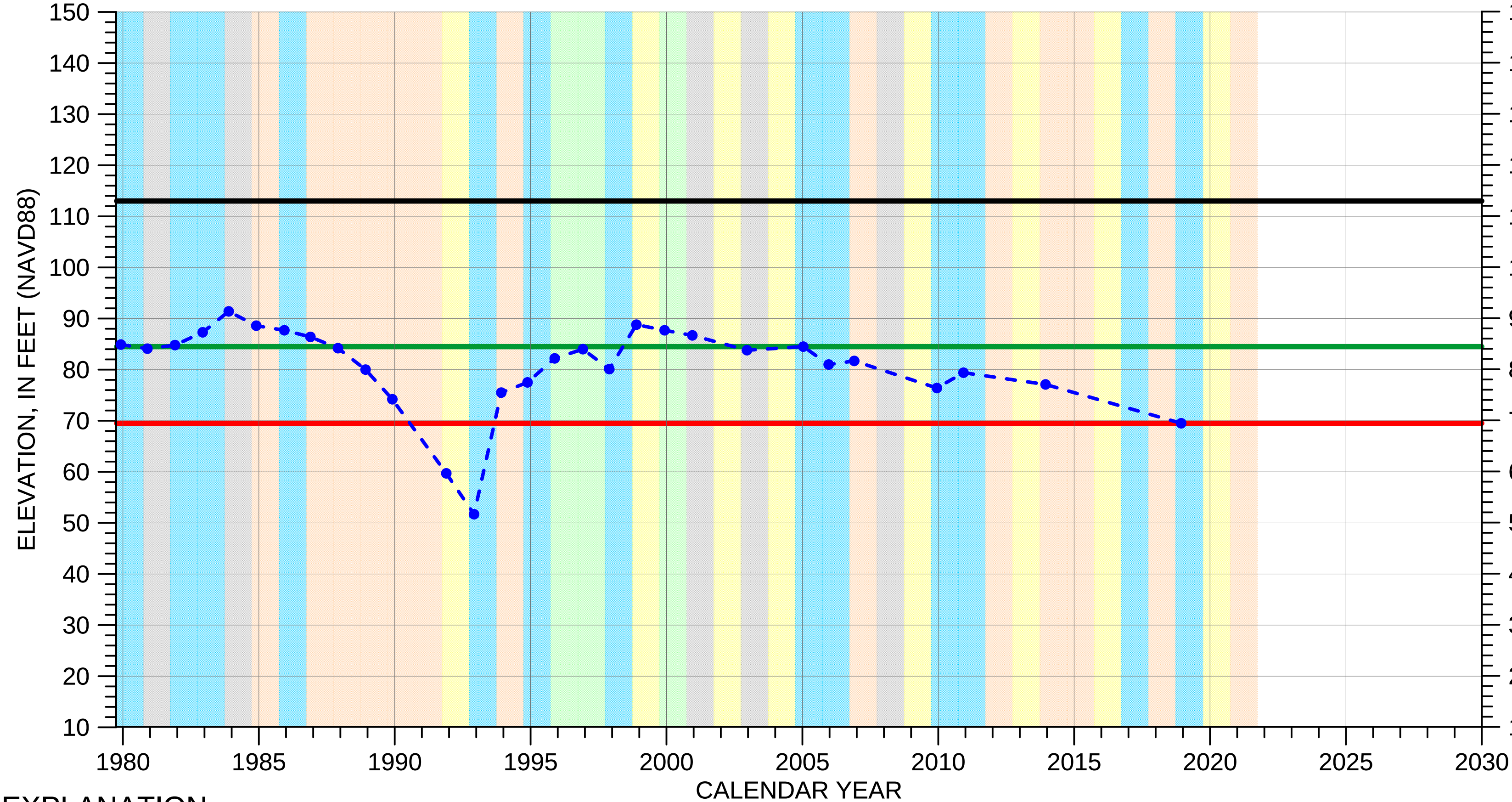
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET



\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch8\16S_04E-25G01.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 16S/04E-27B02

180/400-Foot Aquifer Subbasin

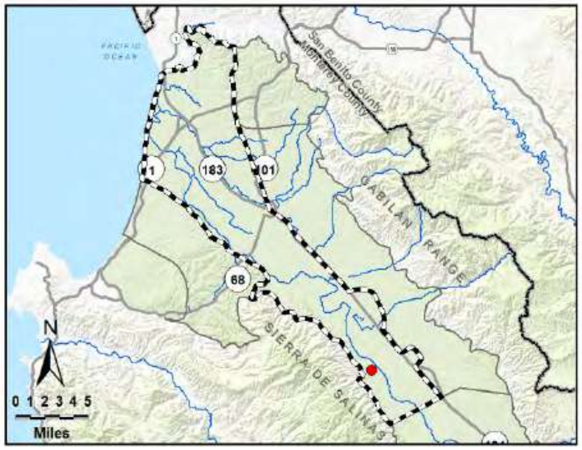


EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

WATER YEAR TYPE DESIGNATION

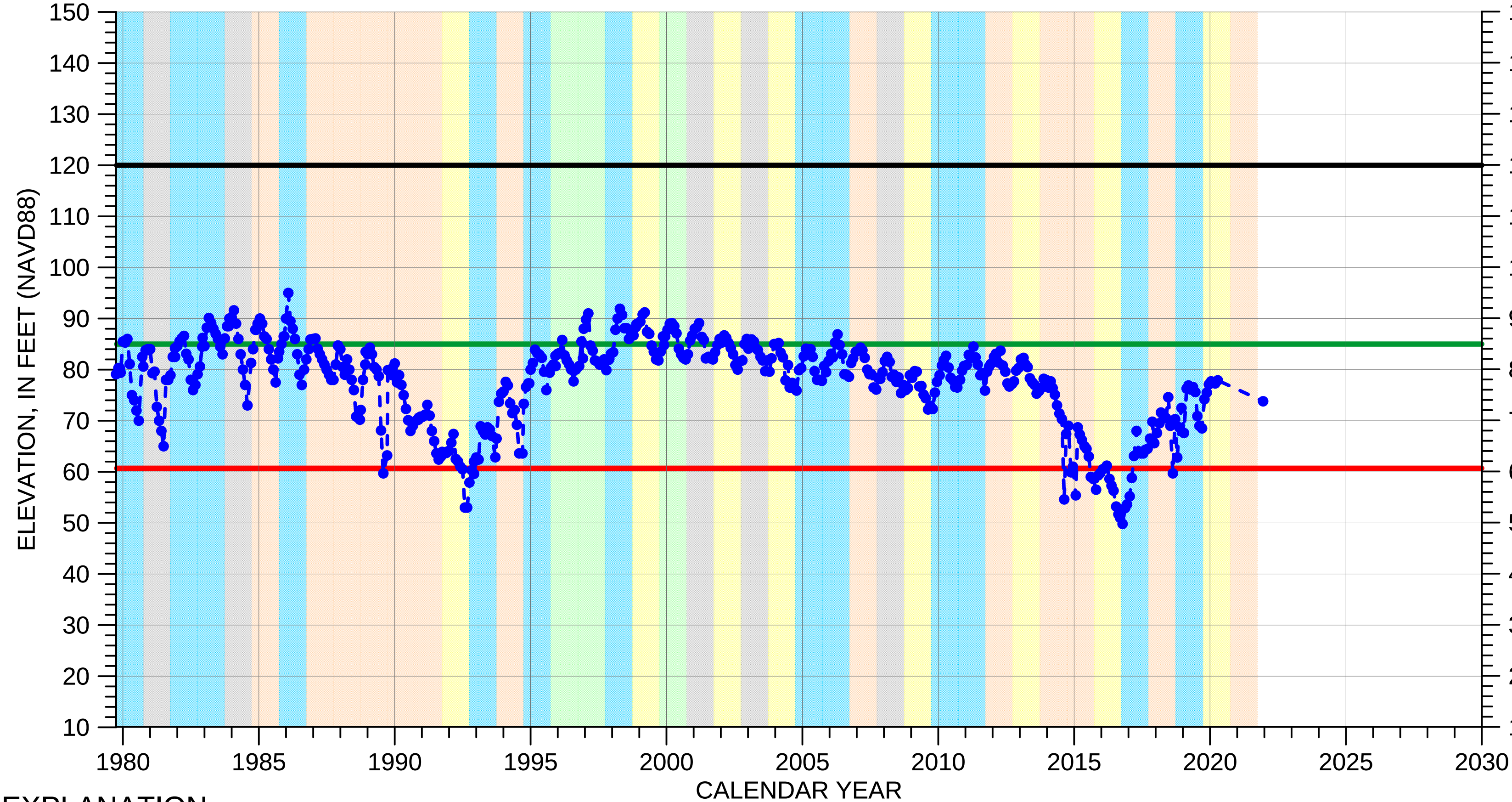
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET



\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch8\16S_04E-27B02.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 16S/05E-30E01

180/400-Foot Aquifer Subbasin

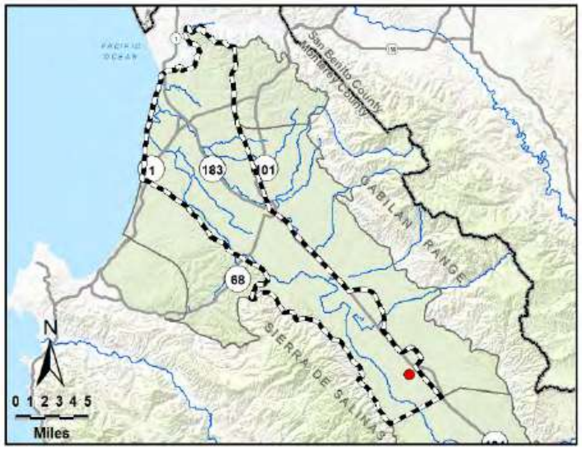


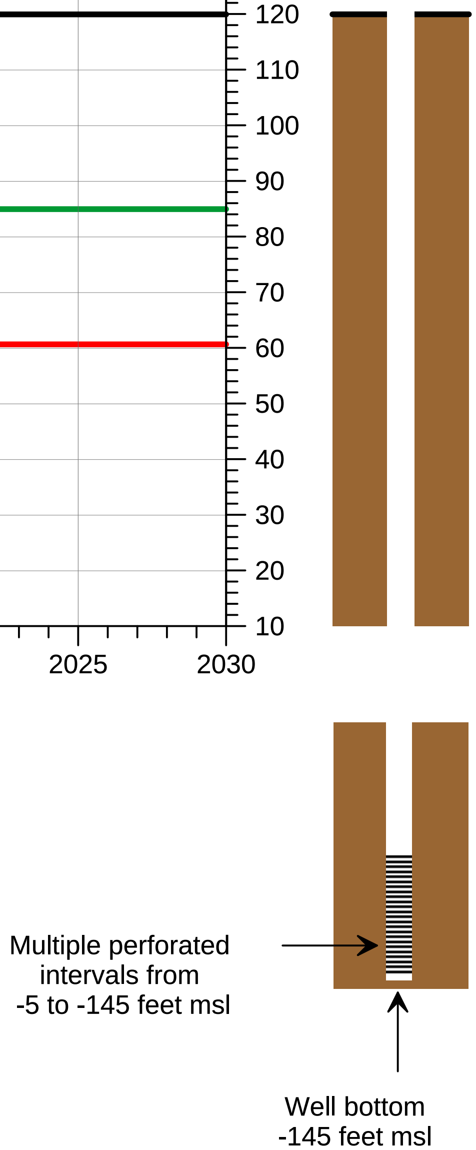
EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

WATER YEAR TYPE DESIGNATION

- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

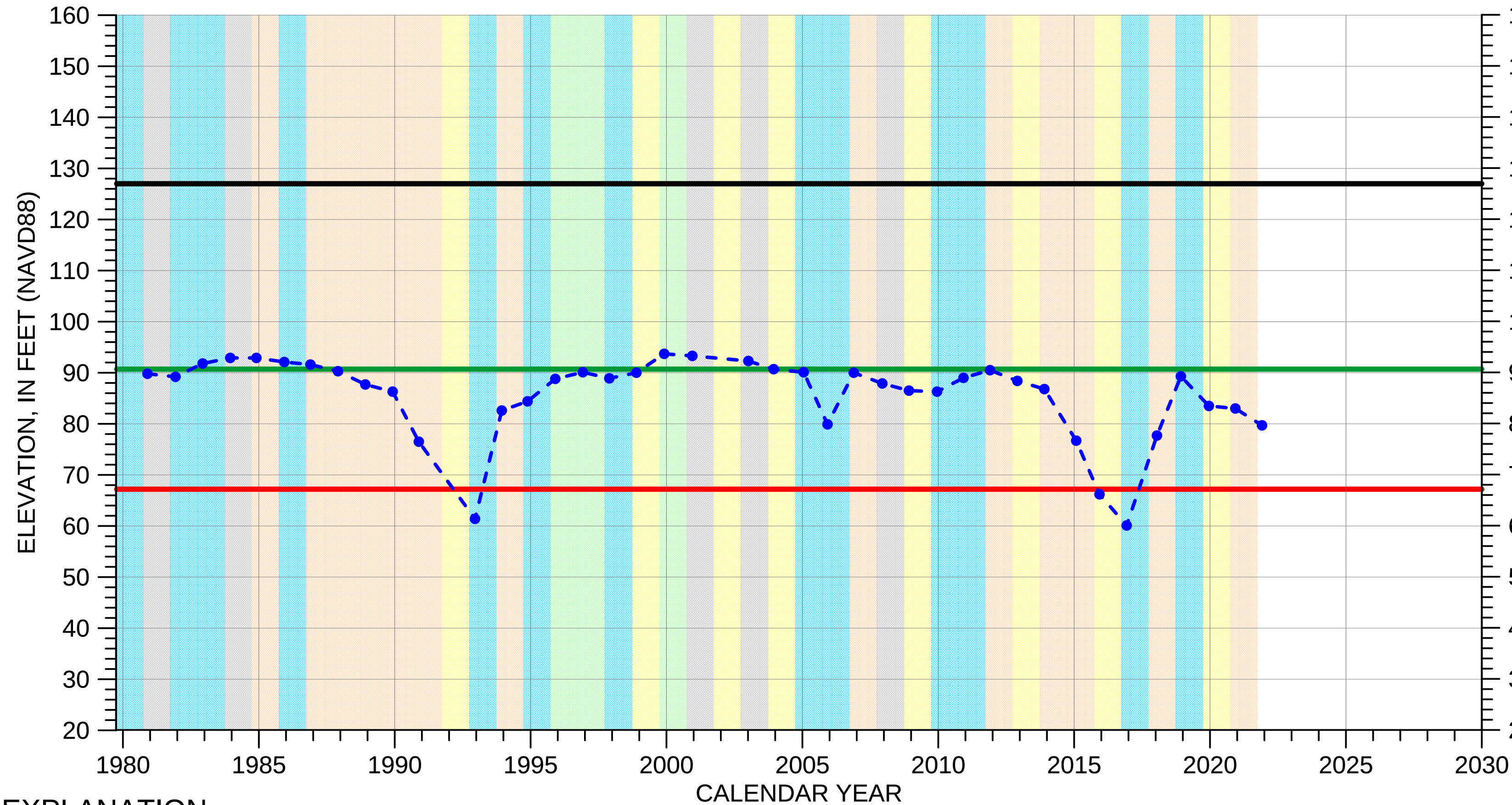




\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch8\16S_05E-30E01.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 16S/05E-30J02

180/400-Foot Aquifer Subbasin

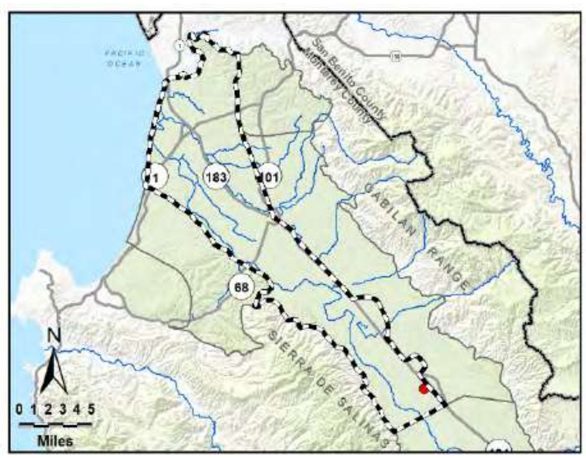


EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

WATER YEAR TYPE DESIGNATION

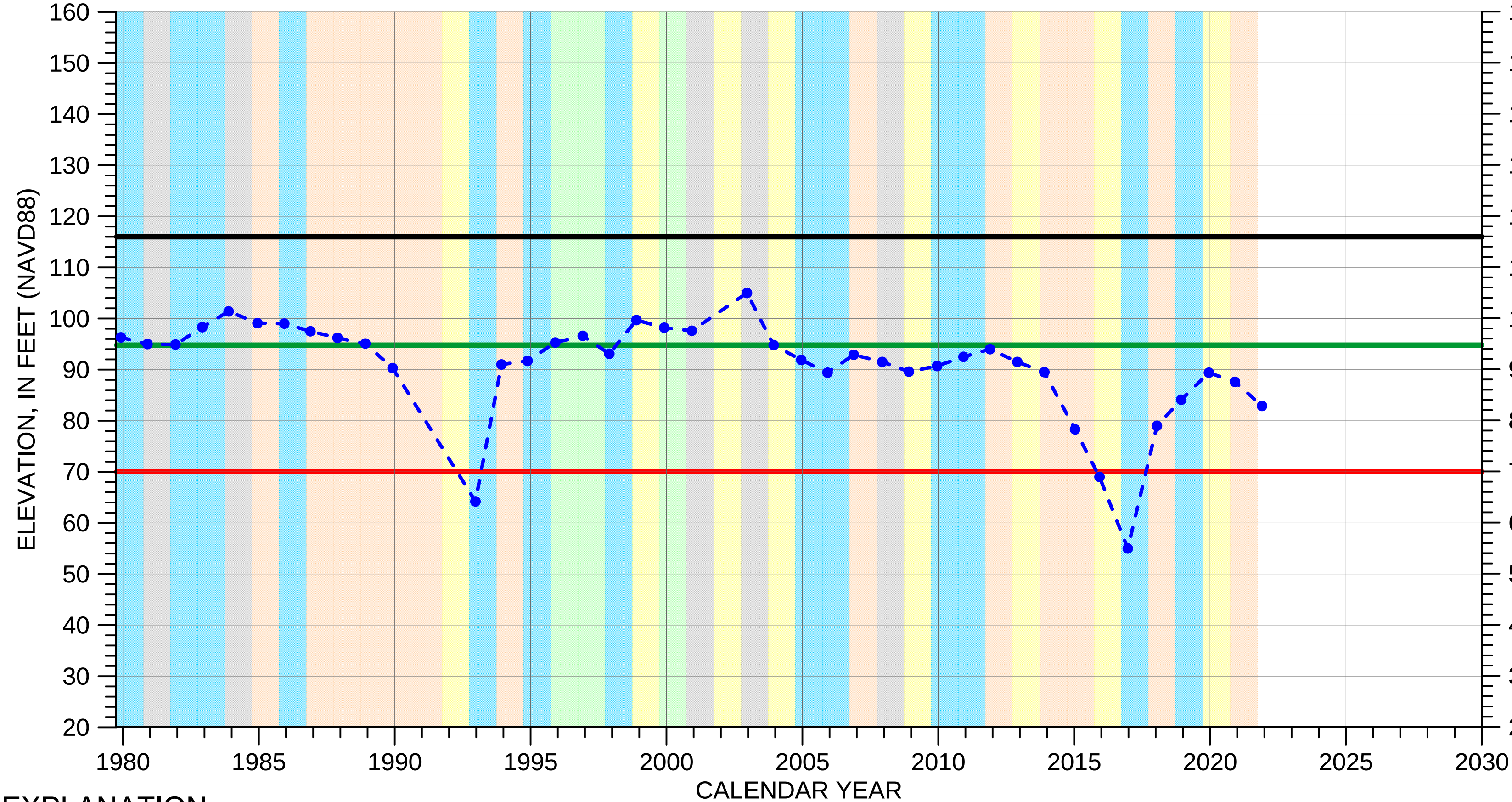
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET



\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRA\NEWGRFs_Ch8\16S_05E-30J02.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 16S/05E-31M01

180/400-Foot Aquifer Subbasin

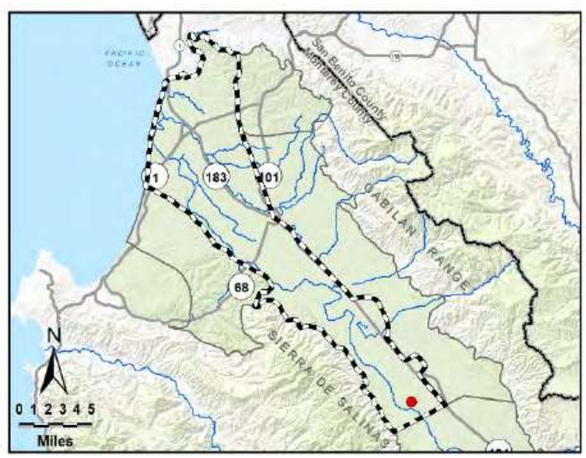


EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

WATER YEAR TYPE DESIGNATION

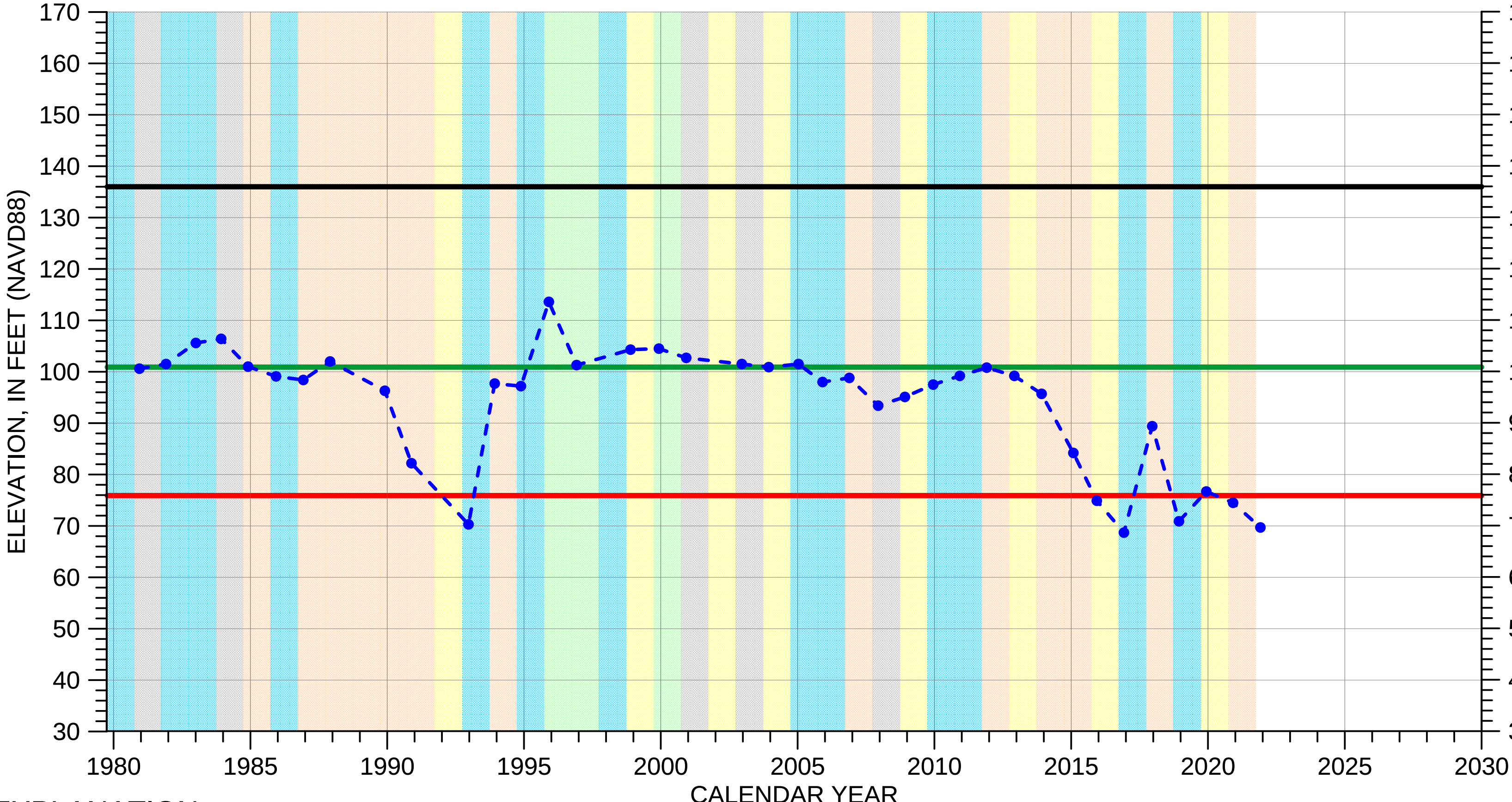
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET

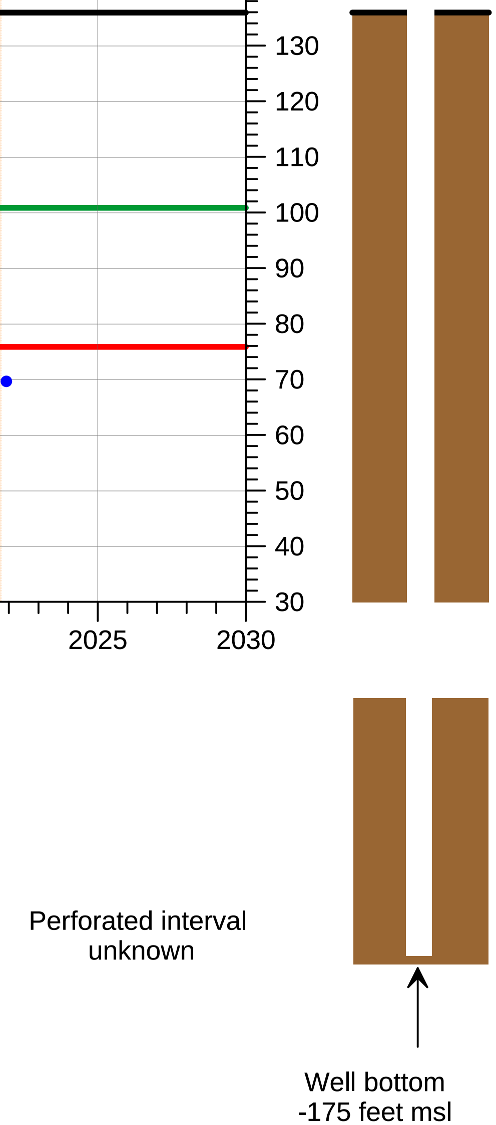


\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch8\16S_05E-31M01.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 17S/04E-01D01

180/400-Foot Aquifer Subbasin



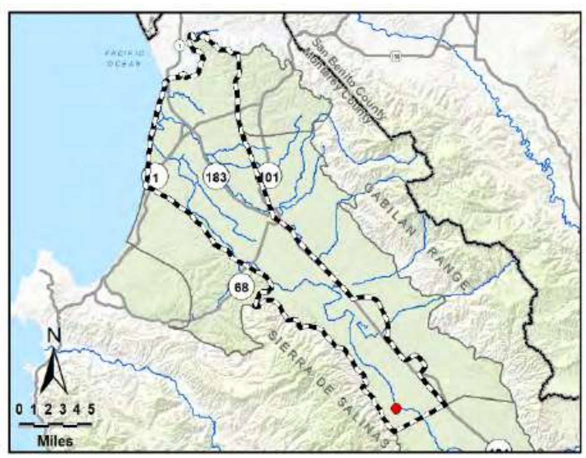


EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

WATER YEAR TYPE DESIGNATION

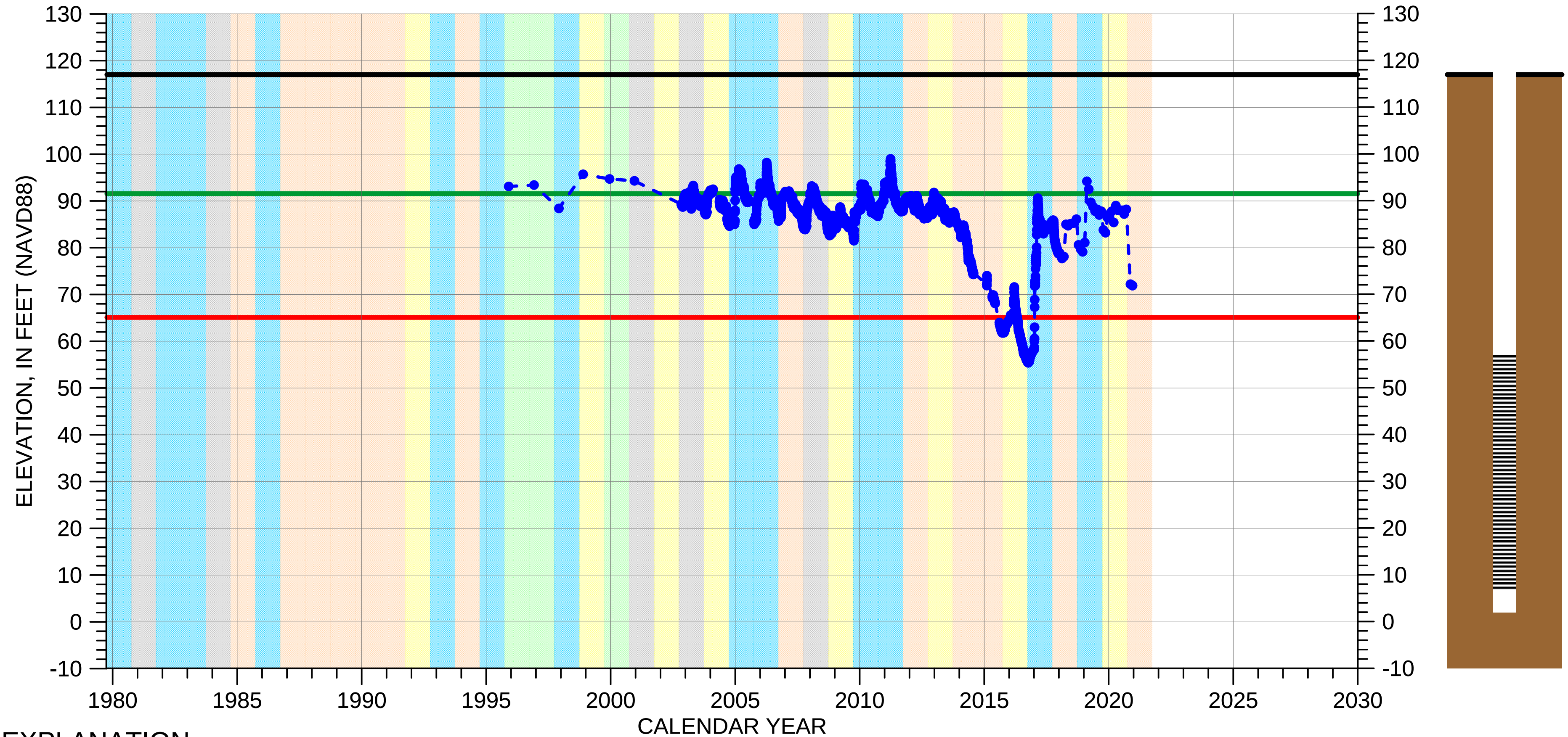
- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET



\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch8\17S_04E-01D01.grf

HYDROGRAPH OF MEASURED GROUNDWATER ELEVATION FOR 17S/05E-06C02

180/400-Foot Aquifer Subbasin

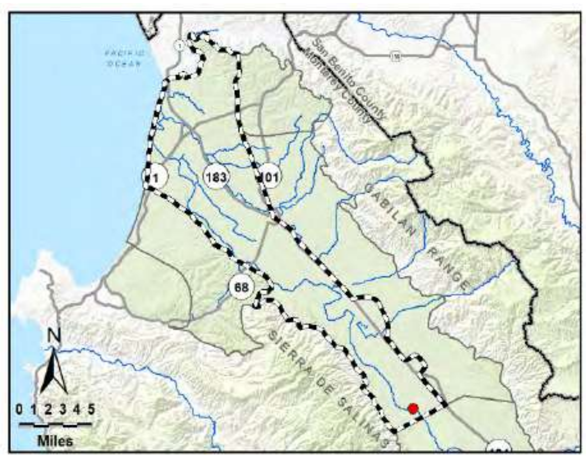


EXPLANATION

- Groundwater Elevation
- Suspect Measurement
- Land Surface
- Measurable Objective
- Minimum Threshold

WATER YEAR TYPE DESIGNATION

- DRY
- DRY - NORMAL
- NORMAL
- WET - NORMAL
- WET



\\tuc-data\public\projects\9100_Salinas_GSP\ProjectData\Analysis\water_levels\Hydrographs_MCWRANEWGRFs_Ch8\17S_05E-06C02.grf

Chapter 9
Appendix 9-A

Cost Estimates for Projects

APPENDIX 9. COST ESTIMATES FOR PROJECTS AND MANAGEMENT ACTIONS

PROJECTS INCLUDED:

Project P1: Multi-benefit stream channel improvements

Project P2: CSIP System Optimization

Project P3: Modify M1W Recycled Water Plant- Winter Modifications

Project P4: CSIP Expansion

Project P5: Seawater Intrusion Extraction Barrier

Project P6: Regional Municipal Supply Project

Project P7: Seasonal Releases from Reservoirs, with Aquifer Storage and Recovery in the 180/400-Foot Aquifer Subbasin

Project P8: Irrigation Water Supply Project

Project ES1: Floodplain Enhancement and Recharge

Project ES2: 11043 Diversion at Chualar

Project ES3: 11043 Diversion at Soledad

Project M1: MCWD Recycled Water Reuse through Landscape Irrigation and Indirect Potable Reuse

Project P1: Multi-benefit stream channel improvements

Component 2

RCD Arundo Eradication Cost Estimate

Five-year cost for treating arundo (includes three herbicide treatments and mowing or hand-cutting if applicable)								
Work activity	Cost/acre for arundo control contractor	Cost/acre for biomonitoring	Cost/acre for biological surveys	Cost/acre for RCD program administration	Total Cost/acre	Estimated acres remaining	Total Cost (Low Estimate	Total Cost (High Estimate)
Mowed arundo	$ 10,350.00	$ 356.04	$ 2,127.50	$ 2,495.50	$ 15,329.04	700	$ 10,730,328.00	$ 13,949,426.40
Unmowed arundo	$ 7,475.00	$ 349.60	$ 1,322.50	$ 1,759.50	$ 10,906.60	150	$ 1,635,990.00	$ 2,126,787.00
Hand-cut arundo	$ 34,500.00	$ 2,300.00	$ 2,875.00	$ 3,737.50	$ 43,412.50	50	$ 2,170,625.00	$ 2,821,812.50
						Est. cost of initial + retreatment	**$ 14,536,943.00**	**$ 18,898,025.90**

Cost of O&M	
WCS completed treatment on approximately 21 river miles in 2020	$151,599.00
Cost per river mile of 2020 treatment	$7,219.00
Cost per river mile rounded up	$7,500.00
*Cost includes biological surveys and monitoring	
*90 miles of river in Monterey County	
Cost for retreating whole river 1 time	$675,000.00
Cost to re-treat equivalent of whole river five times over 25 years	$3,375,000.00
Cost of helicopter survey to re-map arundo over whole river	$400,000.00
RCD admin costs @ 20% of contractor cost	$755,000.00
Total cost for O&M	**$4,130,000.00**
Average annual cost (total cost/25 years)	**$165,200.00**

Capital and Annualized Costs
Multi-Benefit Stream Channel Improvement - Component 2 - Low Estimate
(Preliminary Cost Estimate)

SUMMARY					
Line No.	**Description**		**Units**		**Total**
1	Project Yield (high estimate)		acre-feet per year		20,880
2	Facility Life		years		25
3	Interest Rate		%		6
4	Capital Cost		$		$14,536,943
5	Cost Recovery Factor		--		0.078
6	Annualized Capital Cost		$		$1,100,000
7	Annual O&M Cost		$		$165,200
8	Total Annualized Cost		$		$1,265,200
9	Unit Cost		$/AFY		$60
CAPITAL COSTS					
Line No.	**Capital**	**Quantity**	**Unit**	**Unit Cost**	**Total Cost**
10	Mowed arundo	700	Acres	$15,329	$10,730,328
11	Unmowed arundo	150	Acres	$10,907	$1,635,990
12	Hand-cut arundo	50	Acres	$43,413	$2,170,625
13	***Subtotal***				$14,536,943
OPERATIONS AND MAINTENANCE					
Line No.	**Markups**	**Quantity**	**Unit**	**Unit Cost**	**Total Cost**
16	O&M Estmate	1	LS	$165,200	$165,200
17	***Total O&M Cost***				$165,200

NOTES:
1. "Project Yield" based on: Range of 6,000 to 36,000 AF, assumed an average of 20,000 AF
2. "Facility Life" selected based on 25-yr anticipated life of facilities.
3. "Interest Rate" selected within expected range for public-financing options.
4. "Capital Cost" based on: Phase I and Phase II.
5. "Cost Recovery Factor" based on anticipated Facility Life and Interest Rate.
6. "Annualized Capital Cost" based on facility life and interest rate.
7. "Annual O&M Cost" estimate based on average annual needs for on going monitoring and maintenance (checmical treatment every 3 to 5 years).

Capital and Annualized Costs
Multi-Benefit Stream Channel Improvement - Component 2 - High Estimate
(Preliminary Cost Estimate)

SUMMARY					
Line No.	Description		Units		Total
1	Project Yield (low estimate)		acre-feet per year		2,790
2	Facility Life		years		25
3	Interest Rate		%		6
4	Capital Cost		$		$18,898,026
5	Cost Recovery Factor		--		0.078
6	Annualized Capital Cost		$		$1,500,000
7	Annual O&M Cost		$		$165,200
8	Total Annualized Cost		$		$1,665,200
9	Unit Cost		$/AFY		$600
CAPITAL COSTS					
Line No.	**Capital**	**Quantity**	**Unit**	**Unit Cost**	**Total Cost**
10	Mowed arundo	700	Acres	$19,928	$13,949,426
11	Unmowed arundo	150	Acres	$14,179	$2,126,787
12	Hand-cut arundo	50	Acres	$56,436	$2,821,813
13	***Subtotal***				$18,898,026
OPERATIONS AND MAINTENANCE					
Line No.	**Markups**	**Quantity**	**Unit**	**Unit Cost**	**Total Cost**
16	O&M Estmate	1	LS	$165,200	$165,200
17	***Total O&M Cost***				$165,200

NOTES:
1. "Project Yield" based on: Range of 6,000 to 36,000 AF, assumed an average of 20,000 AF
2. "Facility Life" selected based on 25-yr anticipated life of facilities.
3. "Interest Rate" selected within expected range for public-financing options.
4. "Capital Cost" based on: Phase I and Phase II.
5. "Cost Recovery Factor" based on anticipated Facility Life and Interest Rate.
6. "Annualized Capital Cost" based on facility life and interest rate.
7. "Annual O&M Cost" estimate based on average annual needs for on going monitoring and maintenance (checmical treatment every 3 to 5 years).

Component 3

Capital and Annualized Costs
Multi-Benefit Stream Channel Improvements - Component 3
(Preliminary Opinion of Probable Cost)

Line No.	Description		Units		Total
1	Project Yield		acre-feet per year		100
2	Facility Life		years		25
3	Interest Rate		%		6
4	Capital Cost		$		$1,116,000
5	Cost Recovery Factor		--		0.078
6	Annualized Capital Cost		$		$87,300
7	Annual O&M Cost		$		$6,000
8	Total Annualized Cost		$		$93,300
9	**Unit Cost**		$/AF		**$930**
CAPITAL COSTS					
Line No.	**Capital**	**Quantity**	**Unit**	**Unit Cost**	**Total Cost**
10	Mobilization/Demobilization	1	LS	$52,000	$52,000
11	Environmental and Stormwater	1	LS	$103,000	$103,000
12	Off-Stream Recharge Basin	8.5	AC	$48,500	$412,250
13	Land Acquisition	1	AC	$45,000	$45,000
14	*Subtotal*				$612,250
Line No.	**Markups**	**Quantity**	**Unit**	**Unit Cost**	**Total Cost**
15	Construction Contingency			30%	$124,000
16	General Conditions			15%	$92,000
17	Contractor Overhead and Profit			15%	$92,000
18	Sales Tax			9.25%	$11,300
19	Engineering, Legal, Admininstrative, Contingencies			30%	$184,000
20	***Total Capital Cost***				$1,116,000
OPERATIONS AND MAINTENANCE					
Line No.	**Description**	**Quantity**	**Unit**	**Unit Cost**	**Total Cost**
21	Detention Basin Maintenance	1	LS	$4,300	$4,300
22	Contingency			30%	$1,300
23	***Total O&M Cost***				$6,000

NOTES:
1. "Project Yield" based on: Assumed 100 acre-feet per year.
2. "Facility Life" selected based on 25-yr anticipated life of facilities.
3. "Interest Rate" selected within expected range for public-financing options.
4. "Capital Cost" includes land acquisition costs estimated for an area equivalent to 10% of required recharge basin area. Recharge basin unit cost assumes inclusion of site civil earthwork and access road improvements. Environmental and stormwater requirements are estimate at 15% of capital base costs for off-stream basins.
5. "Cost Recovery Factor" based on anticipated Facility Life and Interest Rate.
6. "Annualized Capital Cost" based on facility life and interest rate.

Project P2: CSIP System Optimization

Capital and Annualized Costs
P2. CSIP System Optimization
(Preliminary Cost Estimate)

Line No.	Description		Units		Total
1	Project Yield		acre-feet per year		5,000
2	Facility Life		years		25
3	Interest Rate		%		6
4	Capital Cost		$		$24,300,000
5	Cost Recovery Factor		---		0.078
6	Annualized Capital Cost		$		$1,901,000
7	Annual O&M Cost		$		$240,000
8	Total Annualized Cost		$		$2,141,000
9	Unit Cost		$/AF/yr.		**$430**
CAPITAL COSTS					
Line No.	**Capital**	**Quantity**	**Unit**	**Unit Cost**	**Total Cost**
10	Hydraulic Modeling & Irrigation S	1	EA	$1,000,000	$1,000,000
11	Upgrade A-1 Junction	1	EA	$2,000,000	$2,000,000
12	Additional Storage Reservoirs, 75 AF	1	EA	$1,200,000	$1,200,000
13	Pipeline - 36" Turnout Into New Basin	400	LF	$400	$160,000
14	Pipeline - 51" Pipe from Basin to CSIP Distribution	6,200	LF	$600	$3,720,000
15	Pipeline - Unknown Size	5,000	LF	$500	$2,500,000
16	Land Cost	12.5	AC	$45,000	$562,500
17	Subtotal (2019 estimate)				$11,142,500
18	***Subtotal escalated by 20% for inflation***				$13,371,000
Line No.	**Markups**	**Quantity**	**Unit**	**Unit Cost**	**Total Cost**
19	Plumbing Appurtenance Contingency			30%	$2,548,800
20	General Conditions			15%	$2,005,700
21	Contractor Overhead and Profit			15%	$2,005,700
22	Sales Tax			8.75%	$351,000
23	Engineering, Legal, Admininstrative, Contingencies			30%	$4,011,300
24	***Total Capital Cost escalated by 20% inflation***				$24,300,000
OPERATIONS AND MAINTENANCE					
Line No.	**Markups**	**Quantity**	**Unit**	**Unit Cost**	**Total Cost**
26	Irrigation Scheduling System (I&	1	LS	$40,000	$40,000
27	Labor	1	LS	$115,200	$115,200
28	Contingency			30%	$46,600
29	Total O&M Annual Cost (2019 estimate)				$200,000
30	***Total O&M Annual Cost escalated by 20% for inflation***				$240,000

NOTES:
1. "Project Yield" based on: 3700 AFY from avoided well pumping, 1800 AFY from additional extraction from SRDF.
2. "Facility Life" selected based on 25-yr anticipated life of facilities.
3. "Interest Rate" selected within expected range for public-financing options.
4. "Capital Cost" does not include additional treatment costs.
5. "Cost Recovery Factor" based on anticipated Facility Life and Interest Rate.
6. "Annualized Capital Cost" based on facility life and interest rate.
7. "Annual O&M Cost" estimate does not include O&M cost for treatment components of project.
8. "Unit Cost" estimate does not include unit cost for treatment components of project.

18, 24, 30. Costs escalated by 20% for inflation since original 2019 estimate.

Project P3: Modify M1W Recycled Water Plant- Winter Modifications

Capital and Annualized Costs
P3. Modify M1W Recycled Water Plant - Winter Modifications
(Preliminary Cost Estimate)

Line No.	Description		Units		Total
1	Project Yield		acre-feet per year		800
2	Facility Life		years		25
3	Interest Rate		%		6
4	Capital Cost		$		$8,967,402
5	Cost Recovery Factor		–		0.078
6	Annualized Capital Cost		$		$701,500
7	Annual O&M Cost		$		$12,100
8	Total Annualized Cost		$		$713,600
9	**Unit Cost**		$/AF/yr.		**$892**
CAPITAL COSTS					
Line No.	**Capital**	**Quantity**	**Unit**	**Unit Cost**	**Total Cost**
10	Pipeline and Diversion Structures	1	LS	$4,194,000	$4,194,000
11	Chlorine Contact Structure Modifications	1	LS	443,000.00	$443,000
12	Dry Scrubbers	1	LS	$2,005,520	$2,005,520
13	***Subtotal***				$6,642,520
Line No.	**Markups**	**Quantity**	**Unit**	**Unit Cost**	**Total Cost**
14	Engineering and Administration			35%	$2,324,882
15	***Total Capital Cost***				$8,967,402
OPERATIONS AND MAINTENANCE					
Line No.	**Markups**	**Quantity**	**Unit**	**Unit Cost**	**Total Cost**
16	Labor and Media Replacement Costs	1	LS	12,100.00	$12,100
17	***Total O&M Annual Cost***				$12,100

NOTES:
1. "Project Yield" based on: avoided wet weather groundwater pumping based on historical pumping records in the CSIP area.
2. "Facility Life" selected based on 25-yr anticipated life .
3. "Interest Rate" selected within expected range for public-financing options.
4. "Capital Cost" based on M1W, 2018, Winter Recycled Water Use Efficiency Improvements: Technical Project Report, December, escalated by 20% for inflation.
5. "Cost Recovery Factor" based on anticipated Facility Life and Interest Rate.
6. "Annual O&M Cost" based on M1W, 2018, Winter Recycled Water Use Efficiency Improvements: Technical Project Report, December, escalated by 20% for inflation.
13,15, 17. Cost escalation by 20% for inflation where based on 2019 estimate.

Project P4: CSIP Expansion

Capital and Annualized Costs
P4. CSIP Expansion
(Preliminary Cost Estimate)

Line No.	Description		Units		Total
1	Project Yield		acre-feet per year		7,000
2	Facility Life		years		25
3	Interest Rate		%		6
4	Capital Cost		$		$88,039,000
5	Cost Recovery Factor		--		0.078
6	Annualized Capital Cost		$		$6,887,300
7	Annual O&M Cost		$		$576,000
8	Total Annualized Cost		$		$7,463,300
9	Unit Cost		$/AF/yr.		**$1,070**
CAPITAL COSTS					
Line No.	**Capital**	**Quantity**	**Unit**	**Unit Cost**	**Total Cost**
10	Pipeline	68,640	LF	$500	$34,320,000
11	Booster Pump System, 5 MGD	3	EA	$34,139	$102,400
12	Turnouts	26	EA	$2,500	$65,000
13	Booster Station	2	EA	$1,500,000	$3,000,000
14	HDD	800	LF	$750	$600,000
15	Subtotal				$38,087,400
16	***Subtotal escalated by 20% for inflation***				$45,704,880
Line No.	**Markups**	**Quantity**	**Unit**	**Unit Cost**	**Total Cost**
17	Plumbing Appurtenance Contingency			30%	$13,711,440
18	General Conditions			15%	$6,855,700
19	Contractor Overhead and Profit			15%	$6,855,700
20	Sales Tax			8.75%	$1,199,800
21	Engineering, Legal, Admininstrative, Contingencies			30%	$13,711,500
22	***Total Capital Cost escalated by 20% inflation***				$88,039,000
OPERATIONS AND MAINTENANCE					
Line No.	**Markups**	**Quantity**	**Unit**	**Unit Cost**	**Total Cost**
23	Distribution System Maintenance	3500	Acre	$138	$480,000
24	Total O&M Annual Cost (2019 estimate)				$480,000
25	***Total O&M Annual Cost escalated by 20% for inflation***				$576,000

NOTES:
1. "Project Yield" based on: avoided wet weather groundwater pumping based on historical puming records, and updated by M1W based on average CSIP water demand.
2. "Facility Life" selected based on 25-yr anticipated life.
3. "Interest Rate" selected within expected range for public-financing options.
4. "Cost Recovery Factor" based on anticipated Facility Life and Interest Rate.
5. "Unit Cost" estimate does not include unit cost for treatment components of project.
16, 22, 25. Costs escalated by 20% for inflation since original 2019 estimate.

Project P5: Seawater Intrusion Extraction Barrier

Capital and Annualized Costs
P5. Seawater Intrusion Extraction Barrier
(Preliminary Cost Estimate)

Line No.	Description		Units		Total
1	Project Yield		acre-feet per year		-30,000
2	Facility Life		years		25
3	Interest Rate		%		6
4	Capital Cost		$		$122,866,000
5	Cost Recovery Factor		--		0.078
6	Annualized Capital Cost		$		$9,611,800
7	Annual O&M Cost		$		$11,731,700
8	Total Annualized Cost		$		$21,343,500
9	**Unit Cost**		$/AFY		**$710**
CAPITAL COSTS					
Line No.	**Capital**	**Quantity**	**Unit**	**Unit Cost**	**Total Cost**
10	Well Construction	18	EA	$750,000	$13,500,000
11	Well Pumps and Motors	18	EA	$150,000	$2,700,000
12	Well Head Infrastructure	18	EA	$125,000	$2,250,000
13	Electrical and Instrumentation	1	EA	$3,500,000	$3,500,000
14	Piping (8" to 36")	44,000	LF	$600	$26,400,000
15	Rehab Outfall	1	LS	$2,500,000	$2,500,000
16	Land Access	18	25%	$187,500	$3,375,000
17	Subtotal				$54,225,000
18	***Subtotal escalated by 20% for inflation***				$65,070,000
Line No.	**Markups**	**Quantity**	**Unit**	**Unit Cost**	**Total Cost**
19	Plumbing Appurtenance Contingency			30%	$17,046,000
20	General Conditions			15%	$9,760,500
21	Contractor Overhead and Profit			15%	$9,760,500
22	Sales Tax			8.75%	$1,708,100
23	Engineering, Legal, Admininstrative, Contingencies			30%	$19,521,000
24	***Total Capital Cost escalated by 20% inflation***				$122,866,000
OPERATIONS AND MAINTENANCE					
Line No.	**Description**	**Quantity**	**Unit**	**Unit Cost**	**Total Cost**
25	Power	1	LS	$2,652,590	$2,652,600
26	Equipment Repair & Replacement	1	LS	$1,366,200	$1,366,200
27	Operations Labor	1	LS	$3,324,420	$3,324,400
28	Miscellaneous	1	LS	$803,758	$803,800
29	Contingency			20%	$1,629,400
30	Total O&M Annual Cost (2019 estimate)				$9,776,400
31	***Total O&M Annual Cost escalated by 20% for inflation***				$11,731,680

NOTES:
1. "Project Yield" based on: 1000 gpm/well, 22 wells, 365 days project operation (Jan - Dec), 100% project operational utilization.
2. "Facility Life" selected based on 25-yr anticipated life of extraction wells.
3. "Interest Rate" selected within expected range for public-financing options.
4. "Capital Cost" based on: construction $750,000/well, 22 wells, land acquisition at @25%, pumps & motors $150,000/well, wellhead infrastructure $125,000/well, electrical & instrumentation $3,500,000.
5. "Cost Recovery Factor" based on anticipated Facility Life and Interest Rate.
6. "Annualized Capital Cost" based on well facilities only; estimate does not include capital costs for conveyance and treatment components of project.
7. "Annual O&M Cost" based on well operations and maintenance only; estimate does not include O&M cost for conveyance and treatment components of project.
8. "Unit Cost" based on well facilities only; estimate does not include unit cost for conveyance and treatment components of project.
18, 24, 31. Costs escalated by 20% for inflation since original 2019 estimate.

Project P6: Regional Municipal Supply Project

Capital and Annualized Costs
Regional Alternative Water Supply Project
(Preliminary Cost Estimate)

Line No.	Description		Units		Total
1	Project Yield		acre-feet per year		15,000
2	Facility Life		years		25
3	Interest Rate		%		6
4	Capital Cost		$		$309,387,000
5	Cost Recovery Factor		--		0.078
6	Annualized Capital Cost		$		$24,203,300
7	Annual O&M Cost		$		$11,874,000
8	Total Annualized Cost		$		$36,077,300
9	**Unit Cost**		$/AFY		**$2,405**
CAPITAL COSTS					
Line No.	**Capital**	**Quantity**	**Unit**	**Unit Cost**	**Total Cost**
10	SWRO Facility	13	MGD	$14,000,000	$182,000,000
11	Source Water Pipeline	58,080	LF	$400	$23,232,000
12	***Subtotal***				$205,232,000
Line No.	**Markups**	**Quantity**	**Unit**	**Unit Cost**	**Total Cost**
13	General Conditions			15%	$30,784,800
14	Contractor Overhead and Profit			18%	$36,941,800
15	Sales Tax			8.75%	$17,957,800
16	Engineering, Legal, Admininstrative, Contingencies			20%	$12,313,900
17	Bonds and Insurance			3%	$6,157,000
18	***Total Capital Cost***				$309,387,000
OPERATIONS AND MAINTENANCE					
Line No.	**Markups**	**Quantity**	**Unit**	**Unit Cost**	**Total Cost**
19	Desalination O&M	13	MGD	$913,400	$11,874,200
1	***Total O&M Annual Cost***				$11,874,000

NOTES:
1. "Facility Life" selected based on 25-yr anticipated life of extraction wells.
2. "Interest Rate" selected within expected range for public-financing options.
3. "Cost Recovery Factor" based on anticipated Facility Life and Interest Rate.

Project P7: Seasonal Releases from Reservoirs, with Aquifer Storage and Recovery in the 180/400-Foot Aquifer Subbasin

Capital and Annualized Costs
P7. Seasonal Release with ASR (direct delivery option not estimated)
(Preliminary Cost Estimate)

Line No.	Description		Units		Total
1	Project Yield		acre-feet per year		6,800
2	Facility Life		years		25
3	Interest Rate		%		6
4	Capital Cost		$		$166,954,000
5	Cost Recovery Factor		--		0.078
6	Annualized Capital Cost		$		$13,061,000
7	Annual O&M Cost		$		$4,349,000
8	Total Annualized Cost		$		$17,410,000
9	**Unit Cost**		$/AF/yr.		**$2,560**
CAPITAL COSTS					
Line No.	**Capital**	**Quantity**	**Unit**	**Unit Cost**	**Total Cost**
10	Well Construction	16	EA	$618,340	$9,893,400
11	Well Pumps and Motors	16	EA	$150,000	$2,400,000
12	Well Head Infrastructure	16	EA	$125,000	$2,000,000
13	Electrical and Instrumentation	16	10%	$61,800	$988,800
14	Percolation Basins, Site Civil Work	16	25%	$154,600	$2,473,600
15	Land Access	16	25%	$154,600	$2,473,600
16	Distribution Pipeline (4 mile)	21,120	LF	$650	$13,728,000
17	Filtration and Disinfection System	1	LS	$70,000,000	$70,000,000
18	Subtotal				$103,957,400
19	***Subtotal escalated by 20% for inflation***				$110,748,880
Line No.	**Markups**	**Quantity**	**Unit**	**Unit Cost**	**Total Cost**
20	General Conditions			15%	$16,612,300
21	Contractor Overhead and Profit			18%	$19,934,800
22	Sales Tax			8.75%	$9,690,500
23	Engineering, Legal, Admininstrative, Contingencies			20%	$6,644,900
24	Bonds and Insurance			3%	$3,322,500
25	***Total Capital Cost escalated by 20% inflation***				$166,954,000
OPERATIONS AND MAINTENANCE					
Line No.	**Description**	**Quantity**	**Unit**	**Unit Cost**	**Total Cost**
26	Power	1	LS	$1,152,800	$1,152,800
27	Equipment Repair & Replacement	1	LS	$1,188,000	$1,188,000
28	Operations Labor	1	LS	$211,200	$211,200
29	Miscellaneous	1	LS	$468,200	$468,200
30	Contingency			20%	$604,000
31	***Total O&M Annual Cost escalated by 20% for inflation***				$4,349,000

NOTES:

1. "Project Yield" based on: 49 CFS radial collector (22,000 GPM) and 50% facility up time.
2. "Facility Life" selected based on 25-yr anticipated life of extraction wells.
3. "Interest Rate" selected within expected range for public-financing options.
4. "Capital Cost" based on: construction $750,000/well, 22 wells, land acquisition at @25%, pumps & motors $150,000/well, wellhead infrastructure $125,000/well, electrical & instrumentation $3,500,000.
5. "Cost Recovery Factor" based on anticipated Facility Life and Interest Rate.
6. "Annualized Capital Cost" based on well facilities only; estimate does not include capital costs for conveyance and treatment components of project.
7. "Annual O&M Cost" based on well operations and maintenance only; estimate does not include O&M cost for conveyance and treatment components of project.
9. "Unit Cost" based on well facilities only; estimate does not include unit cost for conveyance and treatment components of project.
17. "Filtration and Disinfection System" cost added to original estimate; cost estimate from 2021, so no inflation applied to this line.

Project P8: Irrigation Water Supply Project

Capital and Annualized Costs
P8. Irrigation Water Supply Project
(Preliminary Cost Estimate)

Line N	Description		Units		Total
1	Project Yield		acre-feet per year		3,000
2	Facility Life		years		25
3	Interest Rate		%		6
4	Capital Cost		$		$5,925,000
5	Cost Recovery Factor		–		0.078
6	Annualized Capital Cost		$		$463,500
7	Annual O&M Cost		$		$867,600
8	Total Annualized Cost		$		$1,331,100
9	**Unit Cost**		$/AF/yr.		**$444**
CAPITAL COSTS					
Line N	**Capital**	**Quantity**	**Unit**	**Unit Cost**	**Total Cost**
10	Well Construction	3	EA	$750,000	$2,250,000
11	Well Pumps and Motors	3	EA	$200,000	$600,000
12	Well Head Infrastructure	3	EA	$125,000	$375,000
13	Electrical and Instrumentation	1	EA	$725,000	$725,000
14	Land Access	1	25%	$987,500	$987,500
15	Subtotal				$4,937,500
16	***Subtotal escalated by 20% for inflation***				$5,925,000
Line N	**Markups**	**Quantity**	**Unit**	**Unit Cost**	**Total Cost**
17	General Conditions			15%	$888,800
18	Contractor Overhead and Profit			18%	$1,066,500
19	Sales Tax			8.75%	$518,400
20	Engineering, Legal, Admininstrative, Contingencies			20%	$1,185,000
21	Bonds and Insurance			3%	$177,800
22	***Total Capital Cost escalated by 20% inflation***				$9,762,000
OPERATIONS AND MAINTENANCE					
Line N	**Description**	**Quantity**	**Unit**	**Unit Cost**	**Total Cost**
23	Electrical power	1	LS	$659,800	$659,800
24	Labor	1	LS	$28,800	$28,800
25	Other ancillary services, equip	1	LS	$34,400	$34,400
26	***Total O&M Annual Cost escalated by 20% for inflation***				$867,600

NOTES:
1. "Project Yield" based on: 3000 AFY
2. "Facility Life" selected based on 25-yr anticipated life of extraction wells.
3. "Interest Rate" selected within expected range for public-financing options.
4. "Capital Cost" based on: detail below; does not include additional treatment costs.
5. "Cost Recovery Factor" based on anticipated Facility Life and Interest Rate.
6. "Annualized Capital Cost" based on detail below.
7. "Annual O&M Cost" based on well operations and maintenance only; estimate does not include O&M cost for treatment components of project.
9. "Unit Cost" estimate does not include unit cost for treatment components of project.
16, 22, 26. Costs escalated by 20% for inflation since original 2019 estimate.

Project ES1: Floodplain Enhancement and Recharge

Capital and Annualized Costs
Eastside Subbasin - Project No. 6, Eastside Floodplain Enhancement and Recharge
(Preliminary Opinion of Probable Cost)

Line No.	Description		Units		Total
1	Project Yield		acre-feet per year		1,000
2	Facility Life		years		25
3	Interest Rate		%		6
4	Capital Cost		$		$12,596,000
5	Cost Recovery Factor		--		0.078
6	Annualized Capital Cost		$		$985,400
7	Annual O&M Cost		$		$64,000
8	Total Annualized Cost		$		$1,049,400
9	**Unit Cost**		$/AF		**$1,050**
CAPITAL COSTS					
Line No.	**Capital**	**Quantity**	**Unit**	**Unit Cost**	**Total Cost**
10	Mobilization/Demobilization	1	LS	$328,000	$328,000
11	Environmental and Stormwater	1	LS	$1,313,000	$1,313,000
11	No. 5, Natividad Road (Gabilan Ck)	40	AC	$48,500	$1,940,000
12	No. 6 Old Stage Natividad	1.1	AC	$48,500	$53,350
13	No. 7 Old Stage Alisal	7.1	AC	$48,500	$344,350
14	No 8 Old Stage Upper/Lower	18.1	AC	$48,500	$877,850
1	No. 11 Airport	32.7	AC	$48,500	$1,585,950
2	Land Access	1	LS	$450,000	$450,000
2	*Subtotal*				$6,892,500
Line No.	**Markups**	**Quantity**	**Unit**	**Unit Cost**	**Total Cost**
3	Construction Contingency			30%	$1,440,000
4	General Conditions			15%	$1,034,000
5	Contractor Overhead and Profit			15%	$1,034,000
6	Sales Tax			9.25%	$127,500
7	Engineering, Legal, Admininstrative, Contingencies			30%	$2,068,000
8	***Total Capital Cost***				$12,596,000
OPERATIONS AND MAINTENANCE					
Line No.	**Description**	**Quantity**	**Unit**	**Unit Cost**	**Total Cost**
9	Detention Basin Maintenance	1	LS	$49,500	$49,500
10	Contingency			30%	$14,900
11	***Total O&M Cost***				$64,000

NOTES:
1. "Project Yield" based on: Estimated detention basin benefits as provided in February 2021 presentation, *Salinas Valley Stormwater Plan Implementation*, Watershed Coordinator Support.
2. "Facility Life" selected based on 25-yr anticipated life of facilities.
3. "Interest Rate" selected within expected range for public-financing options.
4. Line 11, Environmental and stormwater requirements, are estimated at 25% of capital base costs for in-stream basins.
5. Line 12 incldes construction of the recharge basin; this cost assumes inclusion of site civil earthwork and access road improvements.
6. Line 13 land access costs are those for acquiring access to land for construction through an easement, license, or other mechansim.
7. "Cost Recovery Factor" based on anticipated Facility Life and Interest Rate.
8. "Annualized Capital Cost" based on facility life and interest rate.

Project ES2: 11043 Diversion at Chualar

Capital and Annualized Costs
11043 Diversion at Chualar
(Preliminary Cost Estimate)

Line No.	Description		Units		Total
1	Project Yield		acre-feet per year		4,600
2	Facility Life		years		25
3	Interest Rate		%		6
4	Capital Cost		$		$55,684,000
5	Cost Recovery Factor		--		0.078
6	Annualized Capital Cost		$		$4,356,200
7	Annual O&M Cost		$		$1,538,700
8	Total Annualized Cost		$		$5,894,900
9	**Unit Cost**		$/AFY		**$1,280**
CAPITAL COSTS					
Line No.	**Capital**	**Quantity**	**Unit**	**Unit Cost**	**Total Cost**
Phase I - Chualar Diversion					
10	Pipeline	23,750	LF	$600	$14,250,000
11	Radial Collector, Booster Pump System (32 MGD firm capacity)	1	LS	$4,334,000	$4,334,000
12	Radial Collector, Electrical and Controls	1	LS	$2,332,000	$2,332,000
13	Radial Collector, Concrete Structures and Laterals	1	LS	$4,992,000	$4,992,000
14	Infiltration Basins (including land costs)	1	EA	$3,000,000	$3,000,000
15	*Subtotal*				$28,908,000
Line No.	**Markups**	**Quantity**	**Unit**	**Unit Cost**	**Total Cost**
16	Plumbing Appurtenance Contingency			30%	$8,672,400
17	General Conditions			15%	$4,336,200
18	Contractor Overhead and Profit			15%	$4,336,200
19	Sales Tax			8.75%	$758,800
20	Engineering, Legal, Admininstrative, Contingencies			30%	$8,672,400
21	***Total Capital Cost***				$55,684,000
OPERATIONS AND MAINTENANCE					
Line No.	**Description**	**Quantity**	**Unit**	**Unit Cost**	**Total Cost**
22	Power	1	LS	$181,200	$181,200
23	Labor (Diversion Facilities, Basins)	1	LS	$710,400	$710,400
24	Equipment Repair & Replacement	1	LS	$213,100	$213,100
25	Miscellaneous Allowance	1	LS	$78,860	$78,900
26	Contingency			30%	$355,100
27	***Total O&M Cost***				$1,538,700

NOTES:
1. "Project Yield" based on: 25 cfs pumping 120 days per year at Chualar Diversion site with new radial collector well..
2. "Facility Life" selected based on 25-yr anticipated life of facilities.
3. "Interest Rate" selected within expected range for public-financing options.
4. "Capital Cost" does not include additional treatment costs.
5. "Cost Recovery Factor" based on anticipated Facility Life and Interest Rate.
6. "Annualized Capital Cost" based on facility life and interest rate.
7. "Unit Cost" estimate does not include unit cost for treatment components of project.

Project ES3: 11043 Diversion at Soledad

Capital and Annualized Costs
11043 Diversion at Soledad
(Preliminary Cost Estimate)

Line No.	Description		Units		Total
1	Project Yield		acre-feet per year		4,600
2	Facility Life		years		25
3	Interest Rate		%		6
4	Capital Cost		$		$104,688,000
5	Cost Recovery Factor		--		0.078
6	Annualized Capital Cost		$		$8,189,700
7	Annual O&M Cost		$		$1,538,700
8	Total Annualized Cost		$		$9,728,400
9	**Unit Cost**		$/AFY		**$2,110**
CAPITAL COSTS					
Line No.	**Capital**	**Quantity**	**Unit**	**Unit Cost**	**Total Cost**
Phase II - Soledad Diversion					
10	Pipeline	66,150	LF	$600	$39,690,000
11	Radial Collector, Booster Pump System (32 MGD firm capacity)	1	LS	$4,334,000	$4,334,000
12	Radial Collector, Electrical and Controls	1	LS	$2,332,000	$2,332,000
13	Radial Collector, Concrete Structures and Laterals	1	LS	$4,992,000	$4,992,000
14	Infiltration Basins (including land costs)	1	EA	$3,000,000	$3,000,000
15	*Subtotal*				$54,348,000
Line No.	**Markups**	**Quantity**	**Unit**	**Unit Cost**	**Total Cost**
16	Plumbing Appurtenance Contingency			30%	$16,304,400
17	General Conditions			15%	$8,152,200
18	Contractor Overhead and Profit			15%	$8,152,200
19	Sales Tax			8.75%	$1,426,600
20	Engineering, Legal, Admininstrative, Contingencies			30%	$16,304,400
21	***Total Capital Cost***				$104,688,000
OPERATIONS AND MAINTENANCE					
Line No.	**Description**	**Quantity**	**Unit**	**Unit Cost**	**Total Cost**
22	Power	1	LS	$181,200	$181,200
23	Labor (Diversion Facilities, Basins)	1	LS	$710,400	$710,400
24	Equipment Repair & Replacement	1	LS	$213,100	$213,100
29	Miscellaneous Allowance	1	LS	$78,860	$78,900
30	Contingency			30%	$355,100
31	***Total O&M Cost***				$1,538,700

NOTES:
1. "Project Yield" based on: 25 cfs pumping 120 days per year at Soledad Diversion site with new radial collector well.
2. "Facility Life" selected based on 25-yr anticipated life of facilities.
3. "Interest Rate" selected within expected range for public-financing options.
4. "Capital Cost" does not include additional treatment costs.
5. "Cost Recovery Factor" based on anticipated Facility Life and Interest Rate.
6. "Annualized Capital Cost" based on facility life and interest rate.
7. "Unit Cost" estimate does not include unit cost for treatment components of project.

Project M1: MCWD Recycled Water Reuse through Landscape Irrigation and Indirect Potable Reuse

Conceptual Cost Estimate
Project M3: Recycled Water Reuse Through Landscape Irrigation and Indirect Potable Reuse
2,400 AFY 180/400 Foot Aquifer Injection Alternative

Description	Quantity	Units	Unit Cost	Total	Basis for Cost
Capital Costs (a)					
AWPF Facility Expansion					
AWPF Expansion Construction Cost	1	LS	$10,930,000	$ 10,930,000	Costs for a 2,250 AFY expansion were presented in M1W Expansion Memo (M1W, 2018) based on a 30% design that was prepared. Costs were revised based on the increase in ENR CCI for San Francisco from February 2018 to October 2019 (approximately 2.9%) and then converted to a $/AF unit cost. This unit cost was used to estimate the cost of a 2,745 AFY expansion. Rounded up to the nearest $10,000.
Well Injection Facilities					
Mobilization and Demobilization	5	%	$16,983,216	$ 849,161	Based on Pure Water Monterey Winning Bid Schedule (SCI, 2018). For budgeting purposes, assumed same as M1W project.
General Site Work and Piping	1	LS	$1,891,000	$ 1,891,000	Based on Pure Water Monterey Winning Bid Schedule (SCI, 2018). Includes shoring, SWPPP, and traffic control. Costs for items such as paving and site preparation are assumed to be the same as the M1W project, but pipelines are assumed to be smaller as described in Section 3.2 of TM 3.
Injection Well Installation and Testing	5	EA	$960,000	$ 4,800,000	Based on Pure Water Monterey Winning Bid Schedule (SCI, 2018). Assumes 560-foot borehole and 550-foot deep well. 130-feet of screen.
Production Well Installation and Testing	2	EA	$620,000	$ 1,240,000	Based on Pure Water Monterey Winning Bid Schedule (SCI, 2018) and similar recent projects. Assumes 560-foot borehole and 550-foot deep well. 130-feet of screen.
Site Work at Each Well Site	7	EA	$860,000	$ 6,020,000	Based on Pure Water Monterey Winning Bid Schedule (SCI, 2018). Includes site improvements, well pads and pedestals, well pumps, and site piping. For budgeting purposes, assume same sizes as M1W project
Monitoring Wells	4	EA	$100,000	$ 400,000	Based on Pure Water Monterey Winning Bid Schedule (SCI, 2018). Assumes 550-foot deep 4-inch monitoring well.
Backflush Basin and Associated Appurtenances	1	LS	$15,000	$ 15,000	Based on Pure Water Monterey Winning Bid Schedule (SCI, 2018). For budgeting purposes, assume same size as M1W project (125-ft x 125-ft x 5-ft), and cut/fill can be balanced.
Electrical Building and Hydropneumatic Tank	1	LS	$77,216	$ 77,216	Based on Pure Water Monterey Winning Bid Schedule (SCI, 2018). For budgeting purposes, assume same size as M1W project
Electrical, Instrumentation, and Controls for Wells	1	LS	$2,360,000	$ 2,360,000	Based on Pure Water Monterey Winning Bid Schedule (SCI, 2018). For budgeting purposes, assume same size as M1W project.
Other Site Work (i.e. landscaping, road maintenance during construction, etc.)	1	LS	$180,000	$ 180,000	Based on Pure Water Monterey Winning Bid Schedule (SCI, 2018). For budgeting purposes, assume same size as M1W project
Purified Recycled Water Pipeline					
Purified Recycled Water Pipeline from AWPF to Injection Wells	23,760	LF	$250	$ 5,940,000	Assume 4.5-mile pipeline from AWPF to injection wells. Assumed maximum flow of 2,900 GPM. 16-inch diameter pipeline at $12/in-diameter foot plus 30% for various appurtenances ($250/LF). Rounded up to the nearest $10,000.
			Total Direct Costs	*$ 34,702,377*	
Contingency on Infrastructure Costs	30	%	$34,702,377	$ 10,410,713	Based on a Class 5 level estimate for conceptual cost estimates (AACEI, 2019).
Contingecy for Electrical Connection with PG&E at Each Well Site	7	EA	$200,000	$ 1,400,000	Assumes $200,000 per well site for connection and routing power lines to site.
Soft Costs: Planning, Environmental, Permitting, Engineering, Legal, mitigation, etc.	30	%	$45,113,090	$ 13,533,927	Assumes 30% of capital costs
Capital Costs Subtotal (rounded up to nearest $100,000)				**$ 60,100,000**	
Annualized over 25 year period at 6% interest				**$ 4,701,426**	

Conceptual Cost Estimate
Project M3: Recycled Water Reuse Through Landscape Irrigation and Indirect Potable Reuse
2,400 AFY 180/400 Foot Aquifer Injection Alternative

Description	Quantity	Units	Unit Cost	Total	Basis for Cost
Operating Costs					
Annual Operating Costs for AWPF, Injection wells, and Production Wells	1	LS	$ 2,400,000	$ 2,400,000	Costs for operation of a 2,250 AFY expansion were presented in M1W Expansion Memo (M1W, 2018). Operating costs were converted to a $/AF unit cost and used to estimate the cost of a 2,745 AFY expansion. An additional 5% was also added to account for the operational cost of each new production well. Rounded up to the nearest $10,000.
Annual Overhead costs for AWPF, Injection wells, and Production Wells	1	LS	$ 410,000	$ 410,000	Costs for overhead of a 2,250 AFY expansion were presented in M1W Expansion Memo (M1W, 2018). Operating costs were converted to a $/AF unit cost and used to estimate the cost of a 2,745 AFY expansion. An additional 5% was also added to account for the overhead cost of each new production well. Rounded up to the nearest $10,000.
Annual Energy Costs for Production Wells	1	LS	$ 300,000	$ 300,000	Energy costs are based on 200 HP pumps and an electricity price of $0.185/KWH. Energy costs for AWPF and injection wells are included in operating costs listed above. Rounded up to the nearest $10,000.
Annual Operating and Overhead Cost Subtotal				**$ 3,110,000**	

Total Costs		
Total Annualized Cost	**$ 7,820,000**	**per year over 25 years. Rounded up to nearest $10,000**
Total 30-Year Average Cost Per Acre-Foot (2,400 AFY)	**$ 3,300**	**per acre-foot. Rounded up to nearest $100**

Abbreviations:
AFY: acre feet per year
AWPF: advanced water purification facility
EA: each
ENR CCI: Engineering News-Record Construction Cost Index
gpm: gallons per minute
LF: lineal foot
LS: lump sum
M1W: Monterey One Water
MCWD: Marina Coast Water District

Notes
(a) Increase for general conditions, contractor overhead and profit, and sales tax are included in capital unit costs and thus are not added separately.

References
AACEI, 2019. *Recommended Practices and Standards*, Association for the Advancement of Cost Engineering International, March 2019 Update.
M1W, 2018, *Progress Report on Pure Water Monterey Expansion*, Monterey One Water, 10 May 2018.
Nellor et al, 2019, *Final Engineering Report, Pure Water Monterey Groundwater Replenishment Project*, Nellor Environmental Associates, Trussell Technologies, and Todd Groundwater, April 2019
SCI, 2018. *Schedule of Values for Pure Water Monterey, Injection Wells Ph2*, SCI Specialty Construction, May 2018.

Conceptual Cost Estimate
Project M3: Recycled Water Reuse Through Landscape Irrigation and Indirect Potable Reuse
2,400 AFY Deep Aquifer Injection Alternative

Description	Quantity	Units	Unit Cost	Total	Basis for Cost
Capital Costs (a)					
AWPF Facility Expansion					
AWPF Expansion Construction Cost	1	LS	$10,930,000	$ 10,930,000	Costs for a 2,250 AFY expansion were presented in M1W Expansion Memo (M1W, 2018) based on a 30% design that was prepared. Costs were revised based on the increase in ENR CCI for San Francisco from February 2018 to October 2019 (approximately 2.9%) and then converted to a $/AF unit cost. This unit cost was used to estimate the cost of a 2,745 AFY expansion. Rounded up to the nearest $10,000.
Well Injection Facilities					
Mobilization and Demobilization	5	%	$21,933,216	$ 1,096,661	Based on Pure Water Monterey Winning Bid Schedule (SCI, 2018). For budgeting purposes, assumed same as M1W project.
General Site Work and Piping	1	LS	$1,421,000	$ 1,421,000	Based on Pure Water Monterey Winning Bid Schedule (SCI, 2018). Includes shoring, SWPPP, and traffic control.
Injection Well Installation and Testing	5	EA	$2,130,000	$ 10,650,000	Based on Pure Water Monterey Winning Bid Schedule (SCI, 2018). Assumes 1,510-foot borehole and 1,500-foot deep well. 270-feet of screen.
Production Well Installation and Testing	1	EA	$1,270,000	$ 1,270,000	Based on Pure Water Monterey Winning Bid Schedule (SCI, 2018) and similar recent projects. Assumes 1,510-foot borehole and 1,500-foot deep well. 130-feet of screen.
Site Work at Each Well Site	6	EA	$860,000	$ 5,160,000	Based on Pure Water Monterey Winning Bid Schedule (SCI, 2018). Includes site improvements, well pads and pedestals, well pumps, and site piping. For budgeting purposes, assume same sizes as M1W project
Monitoring Wells	4	EA	$200,000	$ 800,000	Based on Pure Water Monterey Winning Bid Schedule (SCI, 2018). Assumes 1,500-foot deep 4-inch monitoring well.
Backflush Basin and Associated Appurtenances	1	LS	$15,000	$ 15,000	Based on Pure Water Monterey Winning Bid Schedule (SCI, 2018). For budgeting purposes, assume same size as M1W project (125-ft x 125-ft x 5-ft), and cut/fill can be balanced.
Electrical Building and Hydropneumatic Tank	1	LS	$77,216	$ 77,216	Based on Pure Water Monterey Winning Bid Schedule (SCI, 2018). For budgeting purposes, assume same size as M1W project
Electrical, Instrumentation, and Controls for Wells	1	LS	$2,360,000	$ 2,360,000	Based on Pure Water Monterey Winning Bid Schedule (SCI, 2018). Reduced by 40% due to half as many wells and one-quarter as many monitoring wells.
Other Site Work (i.e. landscaping, road maintenance during construction, etc.)	1	LS	$180,000	$ 180,000	Based on Pure Water Monterey Winning Bid Schedule (SCI, 2018). For budgeting purposes, assume same size as M1W project
Purified Recycled Water Pipeline					
Purified Recycled Water Pipeline from AWPF to Injection Wells	18480	LF	$250	$ 4,620,000	Assume 3.5-mile pipeline from AWPF to injection wells. Assumed maximum flow of 2,900 GPM. 16-inch diameter pipeline at $12/in-diameter foot plus 30% for various appurtenances ($250/LF). Rounded up to the nearest $10,000.
			Total Direct Costs	*$ 38,579,877*	
Contingency on Infrastructure Costs	30	%	$38,579,877	$ 11,573,963	Based on a Class 5 level estimate for conceptual cost estimates (AACEI, 2019).
Contingecy for Electrical Connection with PG&E at Each Well Site	6	EA	$200,000	$ 1,200,000	Assumes $200,000 per well site for connection and routing power lines to site.
Soft Costs: Planning, Environmental, Permitting, Engineering, Legal, mitigation, etc.	30	%	$50,153,840	$ 15,046,152	Assumes 30% of capital costs
Capital Costs Subtotal (rounded up to nearest $100,000)				**$ 66,400,000**	
Annualized over 25 year period at 6% interest				**$ 5,194,254**	

Conceptual Cost Estimate
Project M3: Recycled Water Reuse Through Landscape Irrigation and Indirect Potable Reuse
2,400 AFY Deep Aquifer Injection Alternative

Description	Quantity	Units	Unit Cost	Total	Basis for Cost
Operating Costs					
Annual Operating Costs for AWPF, Injection wells, and Production Wells	1	LS	$ 2,400,000	$ 2,400,000	Costs for operation of a 2,250 AFY expansion were presented in M1W Expansion Memo (M1W, 2018). Operating costs were converted to a $/AF unit cost and used to estimate the cost of a 2,145 AFY expansion. An additional 5% was also added to account for the operational cost of each new production well. Rounded up to the nearest $10,000.
Annual Overhead costs for AWPF, Injection wells, and Production Wells	1	LS	$ 410,000	$ 410,000	Costs for overhead of a 2,250 AFY expansion were presented in M1W Expansion Memo (M1W, 2018). Operating costs were converted to a $/AF unit cost and used to estimate the cost of a 2,145 AFY expansion. An additional 5% was also added to account for the overhead cost of each new production well. Rounded up to the nearest $10,000.
Annual Energy Costs for Production Wells	1	LS	$ 370,000	$ 370,000	Energy costs are based on 250 HP pumps and an electricity price of $0.185/KWH. Energy costs for AWPF and injection wells are included in operating costs listed above.
			Annual Operating and Overhead Cost Subtotal	**$ 3,180,000**	

Total Costs		
Total Annualized Cost	**$ 8,380,000**	**per year over 25 years. Rounded up to nearest $10,000**
Total 30-Year Average Cost Per Acre-Foot (2,400 AFY)	**$ 3,500**	**per acre-foot. Rounded up to nearest $100**

Abbreviations:
AFY: acre feet per year
AWPF: advanced water purification facility
EA: each
ENR CCI: Engineering News-Record Construction Cost Index
gpm: gallons per minute
LF: lineal foot
LS: lump sum
M1W: Monterey One Water
MCWD: Marina Coast Water District

Notes
(a) Increase for general conditions, contractor overhead and profit, and sales tax are included in capital unit costs and thus are not added separately.

References

AACEI, 2019. *Recommended Practices and Standards*, Association for the Advancement of Cost Engineering International, March 2019 Update.
M1W, 2018, *Progress Report on Pure Water Monterey Expansion,* Monterey One Water, 10 May 2018.
Nellor et al, 2019, *Final Engineering Report, Pure Water Monterey Groundwater Replenishment Project*, Nellor Environmental Associates, Trussell Technologies, and Todd Groundwater, April 2019
SCI, 2018. *Schedule of Values for Pure Water Monterey, Injection Wells Ph2*, SCI Specialty Construction, May 2018.

Chapter 9
Appendix 9-B

MCWRA Drought TAC

Drought Operations Technical Advisory Committee

Standards and Guiding Principles of Reservoir Operations During Drought Conditions

This document provides a foundation of standards and guiding principles to be used in the development of a proposed reservoir release schedule triggered under specific, seasonally defined conditions.

Standards: a level of quality or achievement that is considered acceptable or desirable.
Standards are in place to ensure that basic needs are met by partners through clearly defined behaviors that are acceptable. The drought operations technical advisory committee will strive to have attainable standards.

Guiding Principles: guide an organization towards its goals.
Guiding Principles are in place to ensure we continue to move toward our goals with flexibility and unity of effort.

Introduction

Prior to being formally established in 1991, the Monterey County Water Resources Agency (MCWRA) was the Monterey County Flood Control and Water Conservation District, established in 1947 and organized as a division of the Public Works Department of the County of Monterey. MCWRA provides services related to the control of flood and storm waters in Monterey County, conservation, protection of water quality, reclamation of water and the exchange of water. MCWRA is a public agency created by the State of California pursuant to the Monterey County Water Resources Agency Act (California Water Code, Appendix 52).

MCWRA owns and operates two dams along with associated reservoirs. Nacimiento Dam is on the Nacimiento River, a tributary to the Salinas River. Nacimiento Dam is approximately 12.3 river miles upstream of its confluence with the Salinas River and forms the Nacimiento Reservoir, with a maximum storage capacity of approximately 377,900 acre-feet. San Antonio Dam, on the San Antonio River is approximately 8.6 river miles upstream of its confluence with the Salinas River. San Antonio Dam forms the San Antonio Reservoir, with a maximum storage capacity of approximately 335,000 acre-feet of water. The Nacimiento and San Antonio Rivers enter the Salinas River at river miles 108 and 104, respectively, from its mouth at the Pacific Ocean in Monterey Bay.

The purpose of the Drought Operations Technical Advisory Committee (D-TAC) is to provide, when drought triggers occur, technical input and advice regarding the operations of Nacimiento and San Antonio Reservoirs. This document was developed by the members of the D-TAC to

provide a foundation of Standards and Guiding Principles to be used in the development of a proposed reservoir release schedule triggered under specific, seasonally defined conditions.
A Habitat Conservation Plan (HCP) is currently being developed to address the effects of reservoir operations and other actions on Federally endangered species and will further address drought operations in the Salinas River system. Documents and procedures developed by the D-TAC will be considered during development of the HCP. MCWRA will convene with stakeholders to determine if modifications to these drought procedures are warranted in light of the terms of the final HCP. Drought operations developed by the D-TAC will also consider management actions and sustainability criteria within the Groundwater Sustainability Plans for the Salinas Valley groundwater basin.

Formation of the D-TAC

The D-TAC was formed through a settlement agreement (Appendix A) to develop Standards and Guiding Principles and proposed reservoir release schedules for MCWRA drought operations. The D-TAC is an ad hoc committee of independent third-party experts with expertise in any of the following fields: hydrology, hydrogeology, hydrologic modeling, civil engineering, ecology, or fish and wildlife biology. The experts are retained and paid for, but not employed by any interested person or organization. The U.S. Fish and Wildlife Service, National Marine Fisheries Service, California Department of Fish and Wildlife, State Water Resources Control Board, Salinas Valley Basin Groundwater Sustainability Agency and the Monterey County Water Resources Agency are using in-house staff as D-TAC members. Each time a Drought Trigger occurs, the chair of the D-TAC shall rotate, in alphabetical order, by the name of the organization D-TAC members represent. Organizations with multiple members will only have one-person chair in the rotation.

D-TAC Members (ordered alphabetically by organization):

- Donald Baldwin, Environmental Scientist, - California Department of Fish and Wildlife
- Dennis Michniuk, District Biologist Coastal Fisheries - California Department of Fish and Wildlife
- Robert Abrams, PhD, PG, CHg – Grower-Shipper Association
- William Stevens, Natural Resource Management Specialist - National Marine Fisheries Service
- Shaunna Murray, Senior Water Resources Engineer – Monterey County Water Resources Agency
- Germán Criollo, PE, Associate Hydrologist – Monterey County Water Resources Agency
- Jason Demers, Associate Engineer – Monterey County Water Resources Agency
- Emily Gardner, Dep. General Manager – Salinas Valley Basin Groundwater Sustainability Agency
- Curtis Weeks, PE, - Salinas Valley Water Coalition
- Mark Ogonowski, Senior Fish and Wildlife Biologist – U.S. Fish and Wildlife Service

Facilitation and Support:

- Howard Franklin, PG, Senior Hydrologist – Monterey County Water Resources Agency
- Nicole Koerth, GIT, Hydrologist – Monterey County Water Resources Agency

D-TAC Triggers

Drought Triggers, or reservoir storage thresholds for when the D-TAC shall meet to develop a release schedule, are defined in Exhibit B of the Settlement Agreement (Appendix A). These triggers are based on operational considerations and not water year type. The storage thresholds defined assume that MCWRA can make conservation releases to the Salinas River Diversion Facility (SRDF) for two months and maintain minimum releases until September.

A Drought Trigger occurs if the following criteria is met:

- At the October Reservoir Operations Advisory Committee meeting of each year, MCWRA staff will present an updated reservoir release schedule and the then-current forecast for December 1st storage at Nacimiento and San Antonio Reservoirs. If the December 1st forecasted combined reservoir storage volume at Nacimiento and San Antonio Reservoirs is below 220,000 acre-feet and the San Antonio Reservoir's December 1st forecasted storage is below 82,000 acre-feet, the D-TAC process shall commence.
- The MCWRA will schedule the first D-TAC meeting to occur no earlier than February 15th and the D-TAC will meet as needed through March 31st. The D-TAC will develop a recommended release schedule that is consistent with the Standards and Guiding Principles.
- If at any time between December 1st and March 31st the actual reservoir storage volumes equals or exceeds the combined or individual minimum storage thresholds, the D-TAC process will terminate, and no release schedule will be prepared by the D-TAC.

Standards:

- The proposed reservoir release operations schedule triggered under specific, seasonally defined conditions of drought will be developed based on the best available scientific knowledge, data, and understanding of the environmental biology, hydrology and hydrogeology of the Salinas Valley; under the technical expertise of the members of the D-TAC.
- The proposed reservoir release schedule will be implemented based on specific tools and templates made available to the D-TAC. These are discussed further in the Implementation Procedures section.
- The proposed reservoir release schedule will acknowledge, address, and balance the water needs of various stakeholders for limited resources during a drought.

Guiding Principles:

- MCWRA is a public agency charged with the long-term management of water resources in the Salinas Valley and is also the flood control agency for Monterey County. Therefore, any releases of water from Nacimiento or San Antonio Reservoirs will be made with consideration given first to safety, including flow conditions and the structural integrity of Nacimiento and San Antonio Dams.
- MCWRA operates Nacimiento and San Antonio Reservoirs under regulatory authorizations; as well as through legal agreements (Appendix C).
- Any reservoir release schedule developed by the D-TAC should:
  - When conservation releases are made, maintain geographic equity to fullest extent possible;
  - Comply with applicable regulations and agreements relating to the operation of Nacimiento and San Antonio Reservoirs;
  - Avoid, to the extent possible, consecutive years where only minimum releases are made from the reservoirs;
  - Avoid, to the extent possible, adverse effects to native species and their habitats;
  - Safely use existing MCWRA infrastructure while balancing water availability and use; and
  - Avoid, to the extent possible, adverse impacts to valley-wide agricultural operations.

Implementation Procedures:

- The D-TAC will use a MCWRA provided template when developing the release schedule. The specific actions will also be described in a narrative form to expound upon the actions taken for each month shown in the release schedule.
- The release schedule will be developed for April through December of the current year. If significant inflow occurs during this period, then modifications to the release schedule will be made through existing MCWRA protocols.
- The D-TAC will develop a dry winter scenario narrative for the following January- March period to allow for the possibility of multiple dry winter release operations.
- The reservoir release schedule includes estimated values for demands, releases and associated reservoir elevations and storage volumes. It serves as a guideline for reservoir operations. Actual operations will require the flexibility to respond to current hydrologic and facility conditions.
- The release schedule will be updated on a monthly basis for discussion at the Reservoir Operations Committee.
- Reservoir releases will be made under direction of the MCWRA Board of Directors or Board of Supervisors through the adoption of a reservoir release schedule or dry winter release priorities, to be executed by MCWRA staff.

Summary Actions

The Standards and Guiding Principles Document and any recommended release schedule prepared by the D-TAC will first be received by the Reservoir Operations Advisory Committee. The Reservoir Operations Advisory Committee will meet to discuss the Standards and Guiding Principles or release schedule and will solicit information, data and public comment regarding appropriate MCWRA operations during droughts. Following receipt of public input regarding the Standards and Guiding Principles or any subsequent release schedule, the Reservoir Operations Advisory Committee will then prepare a written recommendation regarding reservoir operations which will be transmitted to the MCWRA Board of Directors for consideration and action. Any interested party that dissents from the Reservoir Operations Committee's recommendation may submit separate written comments to the MCWRA Board of Directors. The MCWRA Board of Directors will determine, in accordance with applicable law, whether MCWRA will adopt and implement the Standards and Guiding Principles or release schedule, provided the MCWRA General Manager may, in his sole discretion, refer the question of whether MCWRA should adopt and implement the Standards and Guiding Principles or a release schedule to the MCWRA Board of Supervisors for final determination. In the event the MCWRA General Manager elects not to refer the question of adoption and implementation of Standards and Guiding Principles or a release schedule to the MCWRA Board of Supervisors, the decision of the MCWRA Board of Directors regarding such questions shall constitute final agency action for all purposes. The MCWRA Board of Directors (or MCWRA Board of Supervisors, if applicable) will retain full discretion and authority to accept or reject, in whole or in part, the written recommendations of the Reservoir Operations Advisory Committee.

APPENDICES

Appendix A: *Settlement Agreement Between Monterey County Water Resources Agency, The Agency Board of Supervisors, the Agency Board of Directors, the County of Monterey, the County Board of Supervisors, and the Salinas Valley Water Coalition; November 15, 2019*

- https://www.co.monterey.ca.us/Home/ShowDocument?id=98911

Documents referenced in Exhibit B of the Settlement Agreement

- *Salinas Valley Water Project, Engineer's Report, January 2003*
  - https://www.co.monterey.ca.us/home/showdocument?id=24202
- *Final Environmental Impact Report/Environmental Impact Statement for the Salinas Valley Water Project*
  - *Draft, June 2001:* https://www.co.monterey.ca.us/home/showdocument?id=24180
  - *Final Volume 1, April 2002:* https://www.co.monterey.ca.us/home/showdocument?id=24186
  - *Final Volume 2, April 2002:* https://www.co.monterey.ca.us/home/showdocument?id=24188
- *Salinas Valley Water Project EIR Addendum, July 17, 2007*
  - https://www.co.monterey.ca.us/home/showpublisheddocument?id=98572

Appendix B: *Definition of Terms*

Appendix C: *Monterey County Water Resources Agency's Water Rights and Agreements*

Appendix B: Definition of Terms

Adult Steelhead Upstream Migration Releases – Reservoir releases made to facilitate upstream migration of adult steelhead between February 1st- March 31st, when triggers are met. If the 1) combined storage of Nacimiento and San Antonio reservoirs is greater than 220,000 AF, 2) 340 cfs or higher flows are present at the Arroyo Seco near Soledad gage (USGS streamflow gage 11152000), and 3) 173 cfs or higher flows are present at the Arroyo Seco below the Reliz Creek gage (USGS streamflow gage 11152050), MCWRA will provide flows of at least 260 cfs at the Salinas River near Chualar (USGS streamflow gage 11152300) for five or more consecutive days, when the river mouth is open to the ocean.

Block Flow Releases – Reservoir releases made to facilitate the downstream migration of smolts and rearing juvenile steelhead in the Salinas River beginning March 15th in normal-category type years. The following triggers must be meet for releases to be made 1) water year type is dry-normal, normal or wet-normal, 2) combined storage of Nacimiento and San Antonio reservoirs is 150,000 AF or more on March 15th, and 3) 125 cfs or higher at the Nacimiento River below Sapaque Creek gage (USGS streamflow gage 111489000) or 70 cfs at the Arroyo Seco below Reliz Creek gage (USGS streamflow gage 11152050). Amount and duration of block flow depends on when the flows are triggered.

Conservation Pool – Water in reservoirs used for groundwater recharge, operation of the Salinas River Diversion Facility, water supply, fish migration, and fish habitat requirements. Volume of 289,013 acre-feet between 687.8 feet and 787.75 feet in Nacimiento Reservoir and volume of 282,000 acre-feet between 666 feet and 774.5 feet in San Antonio Reservoir.

Conservation Releases – Water discharged for the purpose of recharging the groundwater basin.

Dead Pool – The storage between the bottom of the reservoir and elevation 670 feet for Nacimiento Reservoir, the invert of the intake structure of the low-level outlet works, and elevation 645 feet for San Antonio Reservoir, the invert of the intake structure of the outlet works. The volume of the Dead Pool is 10,300 acre-feet in Nacimiento Reservoir and 10,000 acre-feet in San Antonio Reservoir. Water cannot flow out by gravity out of Nacimiento Reservoir below 670 feet elevation and out of San Antonio below 645 feet elevation.

Downstream Migration of Juvenile Steelhead and Kelts Releases – Reservoir releases and SRDF bypass flows made to enhance migration opportunities for juvenile steelhead and post-spawn adult steelhead (kelts) made in years when block flow releases for smolt migration don't occur by April 1st.

Dry Year – Water year in which unimpaired annual mean flow at the USGS streamgage on the Arroyo Seco near Soledad (USGS streamgage 11152000) falls in the 75-100% percentile of mean annual flows ranked in descending order (as defined in the Salinas Valley Water Project Flow Prescription for Steelhead Trout in the Salinas River).

Environmental Compliance – Conforming to any environmental regulatory requirements currently imposed or those that become imposed in the future.

Flood Pool – Water used to temporarily store flood water during the winter. Volume of 66,587 acre-feet between 787.75 feet and 800 feet in Nacimiento Reservoir and volume of 30,000 acre-feet between 774.5 feet and 780 feet in San Antonio Reservoir.

Maximum Reservoir Elevation – Maximum reservoir elevation that can be sustained, and the level at which the reservoir is considered full. Elevation of 800 feet in Nacimiento Reservoir and 780 feet in San Antonio Reservoir.

Minimum Releases – Reservoir releases made to provide steelhead spawning and rearing habitat flows. Minimum releases are 60 cfs from Nacimiento Dam as long as the water surface elevation of Nacimiento Reservoir is above 687.8 feet, and 10 cfs from San Antonio Dam as long as the water surface elevation of San Antonio Reservoir is above 666 feet.

Minimum Pool – The storage above Dead Pool and below Conservation Pool. This is between elevation 670 feet and 687.8 feet in Nacimiento Reservoir. The volume of this pool is 12,000 acre-feet which is reserved for use by the County of San Luis Obispo per the 1959 San Luis Obispo County Agreement. In San Antonio Reservoir, minimum pool is between elevation 670 feet and 687.7 feet, with a volume of 12,000 acre-feet.

Minimum Recreation Elevation – Lowest Nacimiento Reservoir elevation at which most of the boat ramps around the reservoir are useable and which most private property owners have access to the reservoir.

Natural Flow – Water that would exist in a stream at a given point in time in the absence of human activity *(Source: https://www.waterboards.ca.gov/waterrights/board_info/faqs.html)*

NWP Intake Elevation – Lowest Nacimiento Reservoir elevation at which San Luis Obispo County can take water through the Nacimiento Water Project. Elevation of 670 feet.

Operations Ratio – The ratio of empty space in the conservation pools of San Antonio and Nacimiento Reservoirs, with Nacimiento as the numerator. Historically, this ratio was defined as 3 to 1, and reservoir releases were made in such a manner that the ratio was reached prior to halting releases at onset of the rainy season.

Salinas River Diversion Facility (SRDF) – A component of the Salinas Valley Water Project that consists of an inflatable Obermeyer dam and a river intake structure to provide treated river water to growers within the Castroville Seawater Intrusion Project service area. This facility is located approximately 5 river miles upstream of the mouth of the Salinas River.

Salinas Valley Water Project (SVWP) – A project developed by MCWRA and Salinas Valley interests that consists of the modifications of the spillway at Nacimiento Dam and the construction of the Salinas River Diversion Facility, near the city of Marina. The goals of the project are to help stop seawater intrusion, improve flood control, recharge Salinas Valley groundwater, and improve conditions for steelhead trout.

Top of Dam – The dam crest. Elevation of 825 feet at Nacimiento Dam and 802 feet at San Antonio Dam.

Water Year – The 12-month period from October 1st through September 30th. The water year is designated by the calendar year in which it ends, and which included 9 out of the 12 months. For examples, the year ending on September 30th, 1959 is called “1959 water year”.

Water Year Type – Determination of water year type (e.g. dry, normal, wet) is made based on unimpaired annual mean flows at the USGS streamgage on the Arroyo Seco near Soledad (USGS Streamgage 11152000). Annual mean flows are ranked in descending order and stream flow corresponding to the 25th and 75th percentile are selected as the thresholds. Wet years are defined as flows below the 25th percentile, Normal years between the 25th and 75th percentile, and Dry years above the 75th percentile. Year type determinations are made on March 15th (preliminary) and April 1st (official) of each year. (as defined in the Salinas Valley Water Project Flow Prescription for Steelhead Trout in the Salinas River).

Appendix C: Monterey County Water Resources Agency's Water Rights and Agreements

Nacimiento Reservoir

Water Rights License 7543 – License for Diversion and Use of Water, No. 7543, from the California State Water Resources Control Board, was issued November 4, 1965.

This license was last amended September 5, 2008 to specify that the place of use of water from this license changed to include 421,435 acres of land comprising MCWRA's Zone 2C assessment zone, to add a point of rediversion at the Salinas River Diversion Facility (SRDF), and to add fish flow requirements that were consistent with the June 21, 2007, National Marine Fisheries Service (NMFS) biological opinion issued to the U.S. Army Corps of Engineers (biological opinion).

License No. 7543 gives MCWRA the right to store 350,000 AF from October 1 of each year to July 1 of the succeeding year and to withdraw a maximum of 180,000 AF per year. The purpose of use are for irrigation, domestic, municipal, industrial, and recreational uses.
Documents for this can be found in Appendix B of the Nacimiento Dam Operation Policy: *https://www.co.monterey.ca.us/Home/ShowDocument?id=63151*

Water Rights Permit 21089 – Permit for Diversion and Use of Water, No. 21089, from the California State Water Resources Control Board, was issued March 23, 2001. This permit was last amended September 5, 2008, to specify that the place of use of water from this license changed to include 421,435 acres of land comprising MCWRA's Zone 2C assessment zone, to add a point of rediversion at the SRDF, and to add fish flow requirements that were consistent with the NMFS biological opinion.

The original reservoir volume computations submitted and subsequently approved in License No. 7543, were based on United States Geological Survey (USGS) Quad sheets from the 1940s. In the early 1990s, aerial surveys with increased accuracy showed that the actual volume of Nacimiento Reservoir was greater than the 350,000 AF in License 7543. In order to correct this discrepancy, MCWRA filed water rights Application No. 30532. Nacimiento Dam has never been modified in any way to increase storage and the reservoir volume is unchanged from the time of the dam's construction, with the exception of the inflow of silt from natural runoff which has decreased storage volume.

As a result of this application, MCWRA has a permit to collect to storage 27,900 AF per annum from October 1 of each year to July 1 of the succeeding year. The total quantity of water collected to storage under this permit and License 7543 shall not exceed 377,900 AF per year.

Documents for this can be found in Appendix B of the Nacimiento Dam Operation Policy:
https://www.co.monterey.ca.us/Home/ShowDocument?id=63151

Water Rights Permit 19940 – Permit for Diversion and Use of Water, No. 19940, from the California State Water Resources Control Board, was issued December 31, 1986. Permit 19940 gives MCWRA the right to divert up to 500 cfs through the Hydroelectric Plant from January 1 to December 31 of each year for irrigation, domestic, municipal, industrial and recreational uses. Diversion under this permit is incidental to releases being made for other purposes.

Documents for this can be found in Appendix B of the Nacimiento Dam Operation Policy:
https://www.co.monterey.ca.us/Home/ShowDocument?id=63151

San Luis Obispo County Agreement – MCWRA's Water Rights License No. 7543 is subject to an agreement between MCWRA and SLO District which gives SLO District the right to use 17,500 AF of water annually from Nacimiento Reservoir. The SLO District Board has adopted a policy designating a portion of the total, approximately 1,750 acre-feet per year (AFY), for use around Nacimiento Reservoir; Heritage Ranch Community Services District (HRCSD) has agreements with SLO District which collectively entitle HRCSD to use 889 AFY of the 1,750 AFY; pursuant to these agreements, HRCSD takes its allotment from a well gallery in the Nacimiento River downstream of the Dam. SLO District can use up to the remaining 15,750 AF per water year through the NWP. The agreement also provides that MCWRA shall not make conservation releases during the water year that result in a reservoir elevation below 687.8 feet on September 30 of each year in order to assure SLO District of its rights and entitlements to water under the terms of the agreement (i.e. in order to assure the maintenance of a minimum storage pool of 12,000 AF above the present low-level outlet works for SLO District use). The original agreement is dated October 19, 1959, and it has been amended six different times in 1959, 1967, 1970, 1977, 1988, and 2007. These documents are collectively referred to as the SLO County Agreement.
Documents for this can be found in Appendix C of the Nacimiento Dam Operation Policy:
https://www.co.monterey.ca.us/Home/ShowDocument?id=63151

Nacimiento Water Company Agreement – The 1984 agreement with MCWRA allows the Nacimiento Water Company a water allocation of up to 600 AF per year to be extracted from wells within the floodage easement of Nacimiento Reservoir. The Nacimiento Water Company shall pay MCWRA quarterly for water from the allocation on the basis of AF used at a rate determined by this agreement.
Documents for this can be found in Appendix D of the Nacimiento Dam Operation Policy:
https://www.co.monterey.ca.us/Home/ShowDocument?id=63151

San Antonio Reservoir

Water Rights License 12624 - License for Diversion and Use of Water, No. 12624, from the California State Water Resources Control Board, was issued December 2, 1965 and amended April 22, 1990. This license was most recently amended September 5, 2008 to specify that the place of use of water from this license changed to include 421,435 acres of land comprising MCWRA's Zone 2C assessment zone, to add a point of rediversion at the SRDF, and to add fish flow requirements consistent with the June 21, 2007, National Marine Fisheries Service BO.

License No. 12624 gives MCWRA the right to store 220,000 AF from October 1 of each year to July 1 of the succeeding year and to withdraw a maximum of 210,000 AF per year for municipal, domestic, industrial, irrigation, and recreational uses.

The amended license can be found on the CA State Water Resources Control Board website: *https://www.waterboards.ca.gov/waterrights/board_decisions/adopted_orders/orders/2008/wro2008_0037dwr.pdf*