Salinas Valley Basin GSA
Monterey Subbasin
GSP Overview

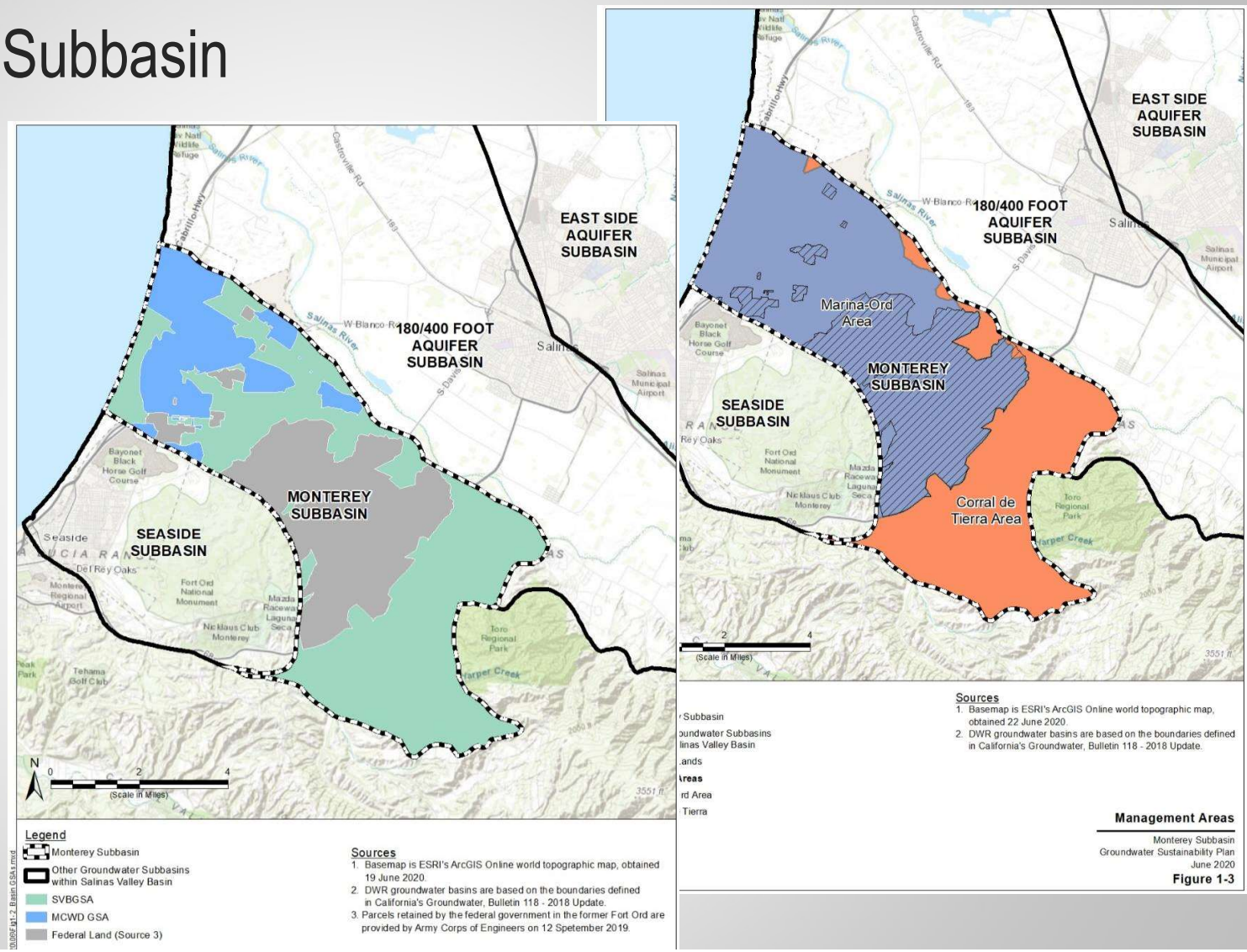
Presented to SVBGSA Board of Directors
September 9, 2021

Prepared by

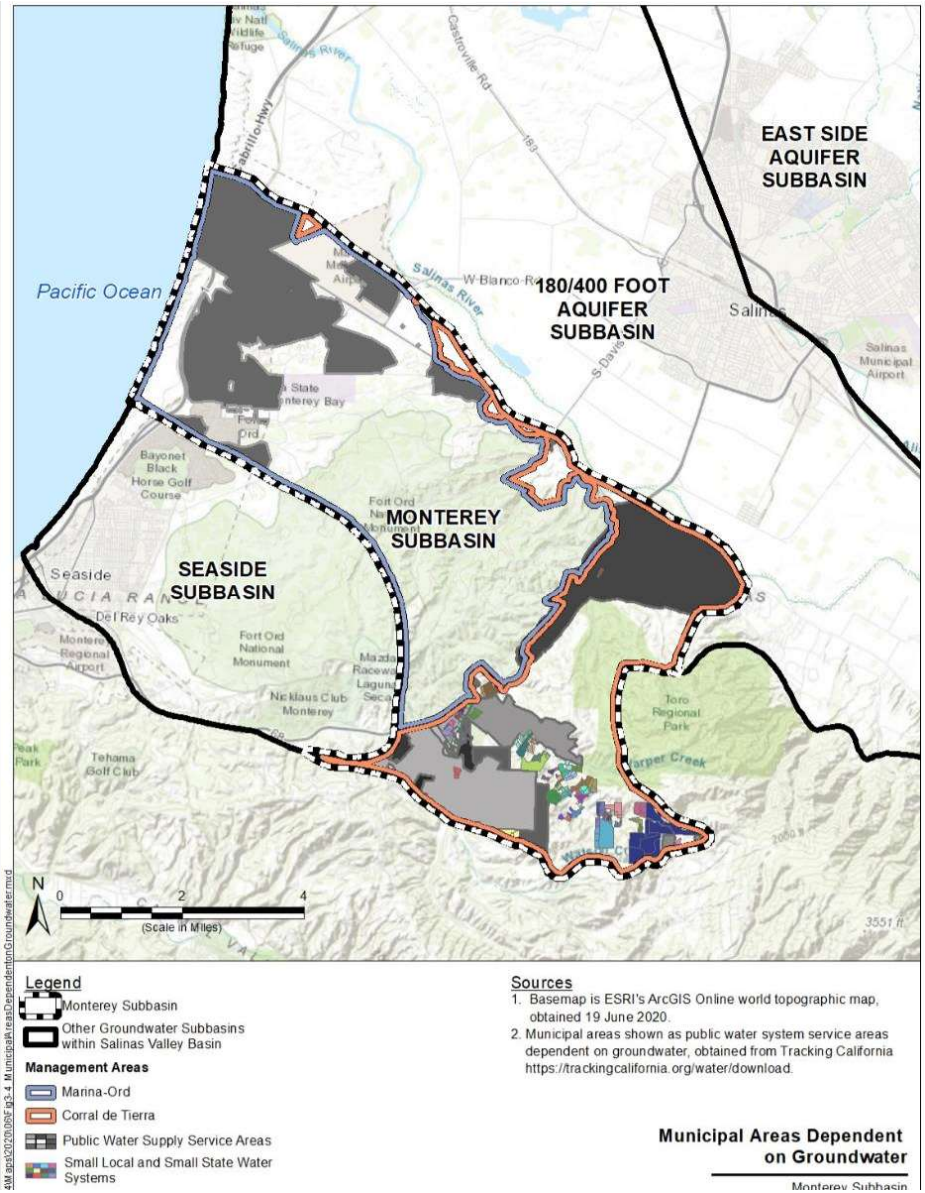
MONTGOMERY & ASSOCIATES

Monterey Subbasin

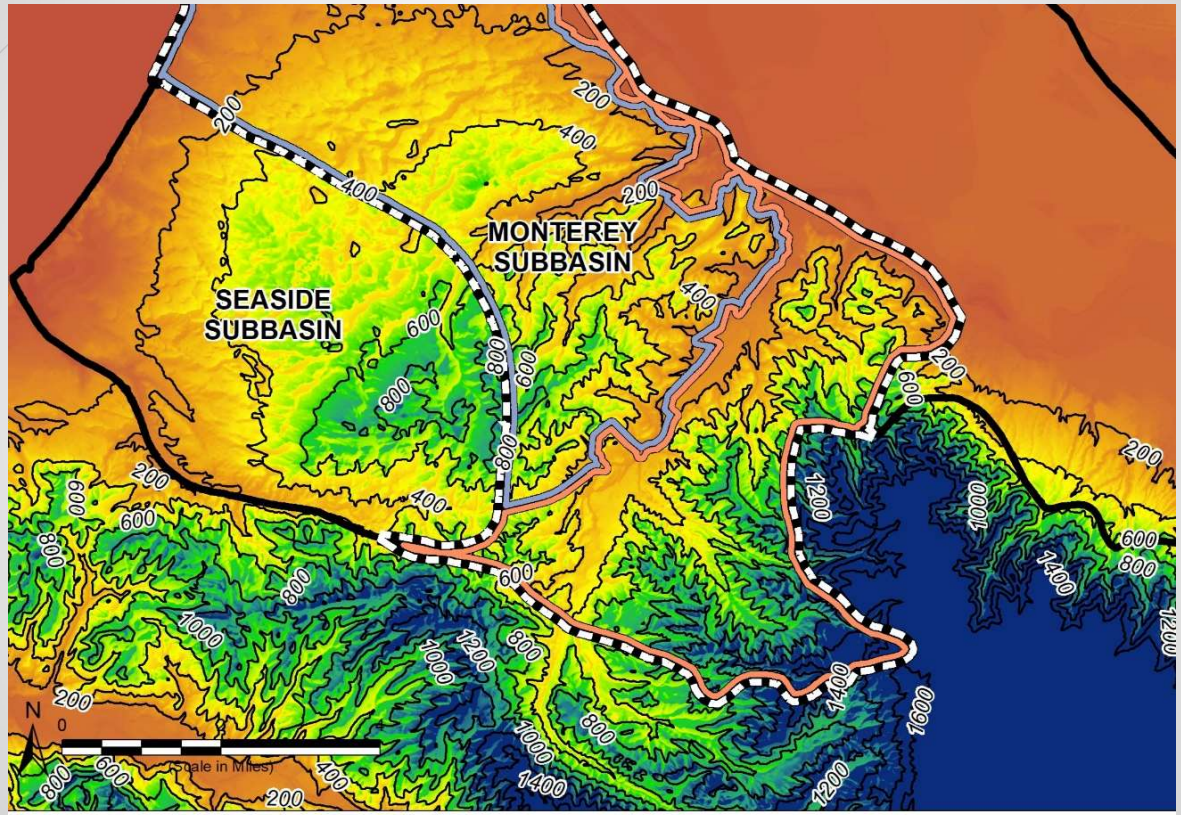
- 30,850 acres
- Mostly residential
- Management split with MCWD managing the Marina/Ord Management Area and SVBGSA managing the Corral de Tierra Management Area
- Former Fort Ord federal land between management areas – *not subject to SGMA and not in either management area*



Drinking Water Systems Dependent on Groundwater



Basin Setting - Topography



Legend

- Monterey Subbasin
- Other Groundwater Subbasins within Salinas Valley Basin
- Elevation Contour (200-ft interval)

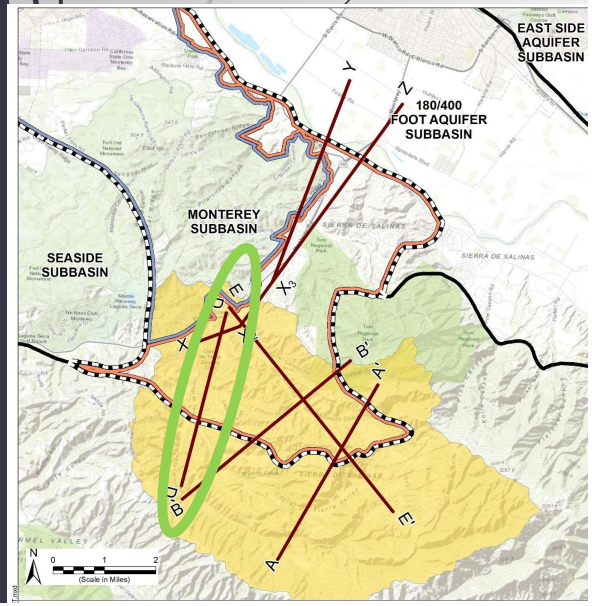
Management Areas

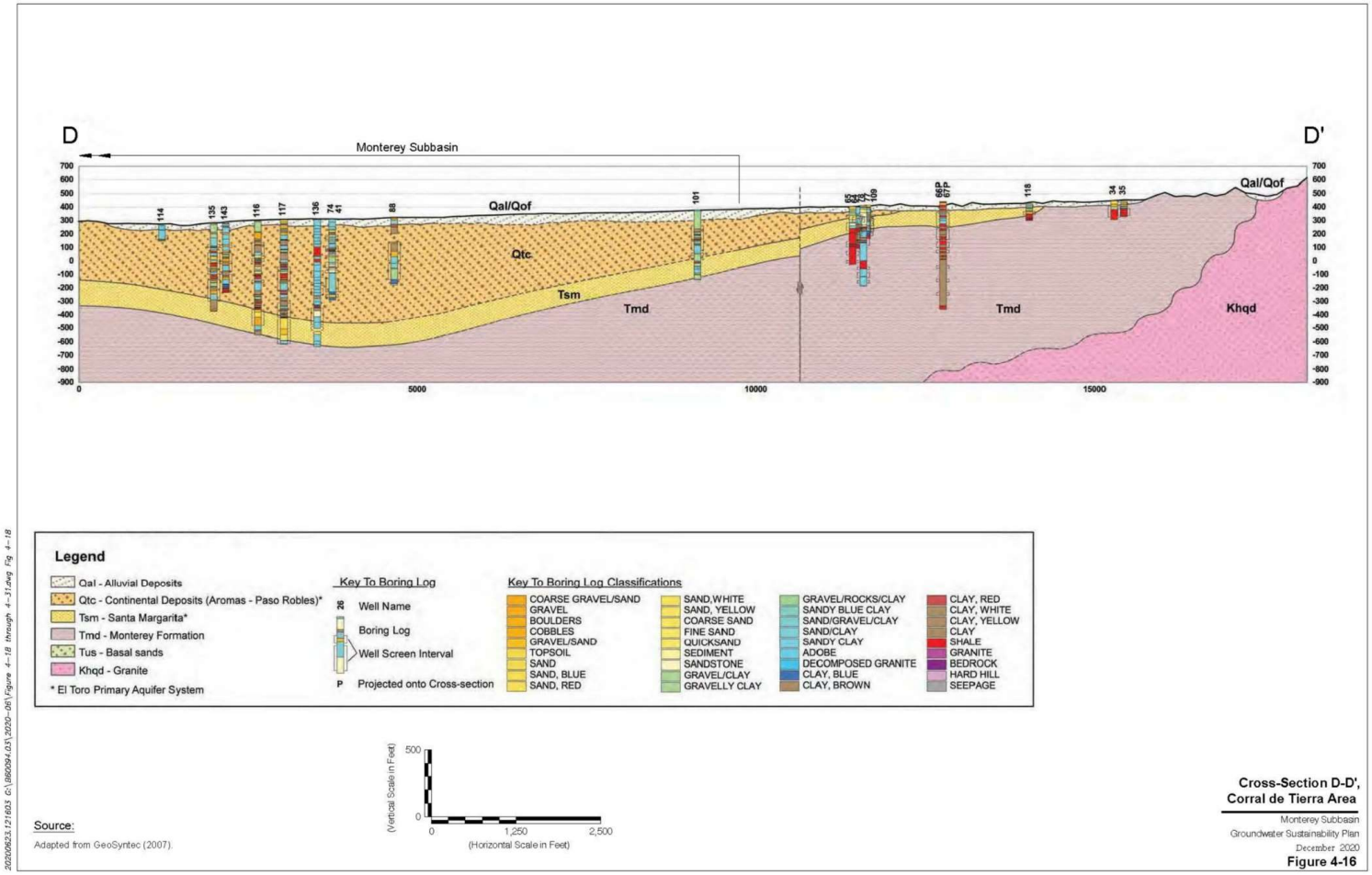
- Marina-Ord Area
- Corral de Tierra Area

Sources

1. Surface elevation data obtained from USGS NED (https://viewer.nationalmap.gov/basic/).

Hydrogeologic Conceptual Model





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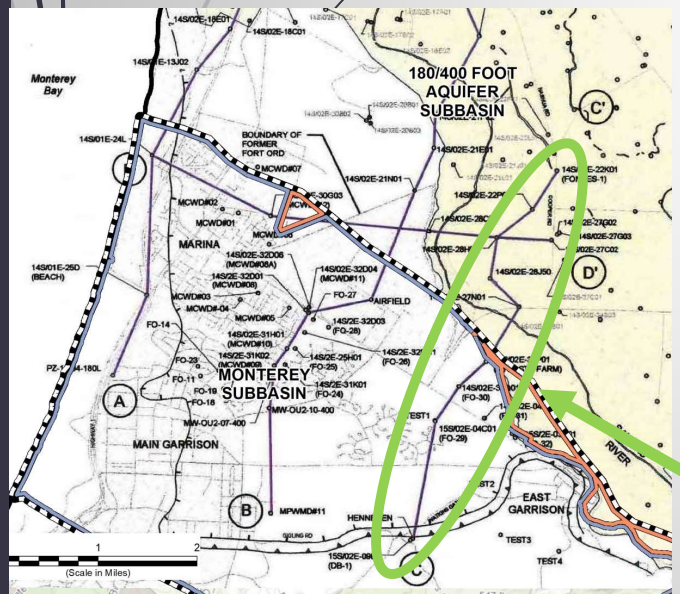
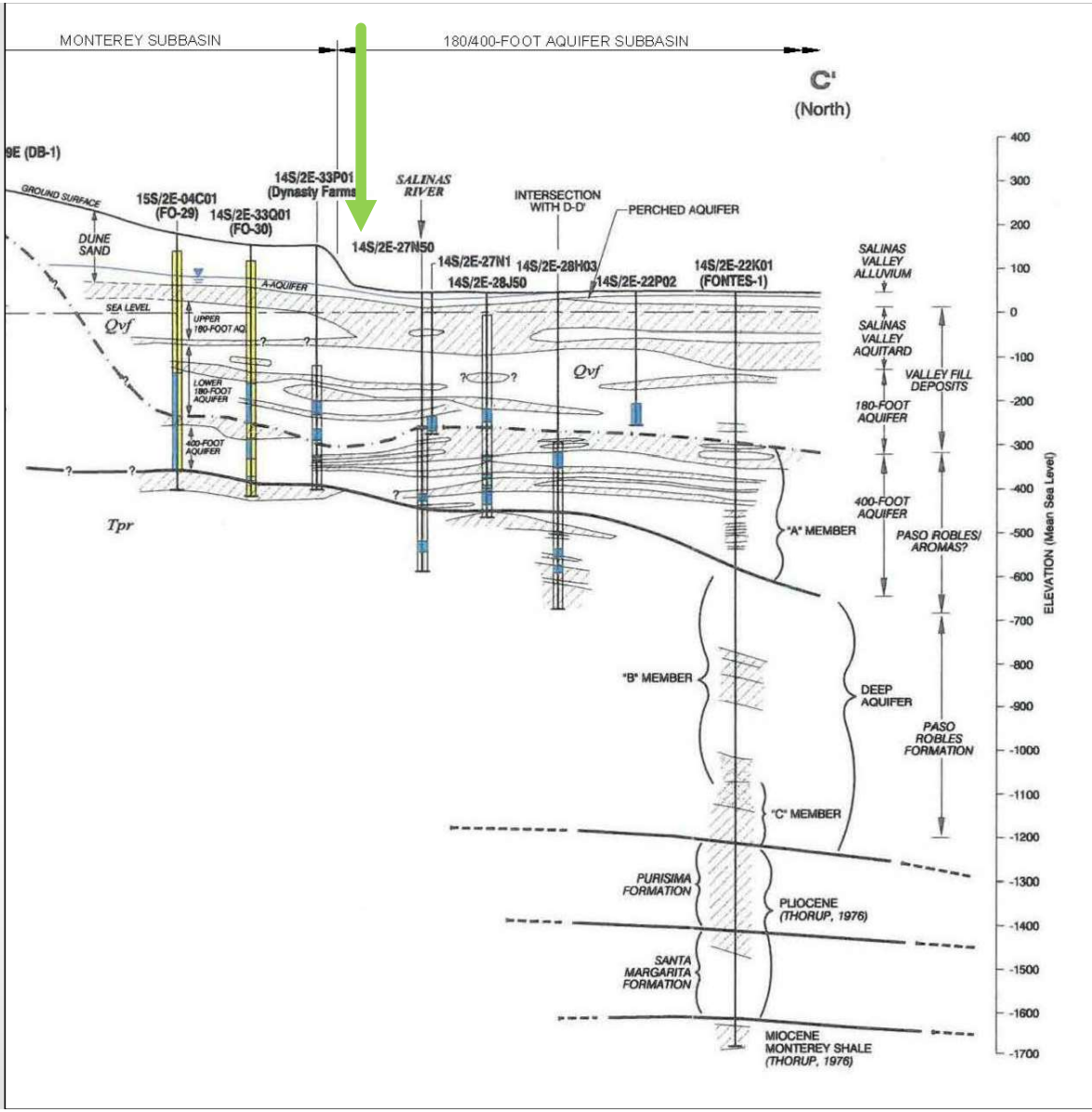
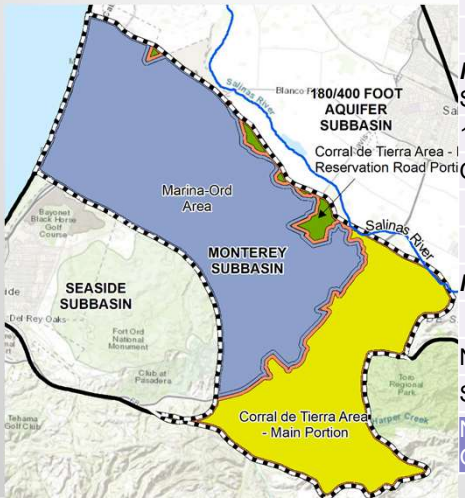




Historical Water Budget

Inflows/Outflows
Water Year 2004-2018

Generated from the Monterey Subbasin Model developed by EKI



Net Annual Groundwater Flows (AFY)	WHOLE SUBBASIN	MARINA/ ORD WATER BUDGET ZONE	CORRAL WATER BUDGET ZONE
Recharge			
Rainfall, leakage, irrigation	10,055	6,144	4435
Well Pumping			
MCWD (180-Ft and 400-Ft Aquifers)		-1,797	
MCWD (Deep Aquifers)		-2,262	
North of Reservation Road Portion		-287	
El Toro Primary Aquifer System			1295
Well Pumping Total	-5,641	-4,346	1296
Net Inter-Basin Flow (Presumed Freshwater)			
Seaside Subbasin	918	1,310	-392
180/400 Foot Aquifer Subbasin	-9,393	-5,761	-3632
Ocean	-524	-524	0
	-8,999	-4,975	-4024
Net Inter-basin Flow (Presumed Seawater)			
180/400 Foot Aquifer Subbasin	-2,872	-2,872	0
Ocean	2,872	2,872	
	0	0	
Net Intra-basin Flow	0	1544	-1544
Net Surface Water Exchange			
Salinas River Exchange	151		151
NET ANNUAL CHANGE IN GROUNDWATER STORAGE	4434	1632	2803

Upper Valley Chapter 6 – Water Budgets

Historical Water Budget

Modeled Historical Average Components (WY 2004–2018)	Basin Wide	Corral de Tierra
Groundwater Pumping	-5,641	-1,295
Net Stream Exchange	151	151
Recharge (Rainfall, leakage, irrigation)	10,055	3,910
Net Flow from Adjacent Subbasins/Basin	-8,999	-4,024
Net Storage Gain (+) or Loss ( )	**-4,434**	**-2,803**

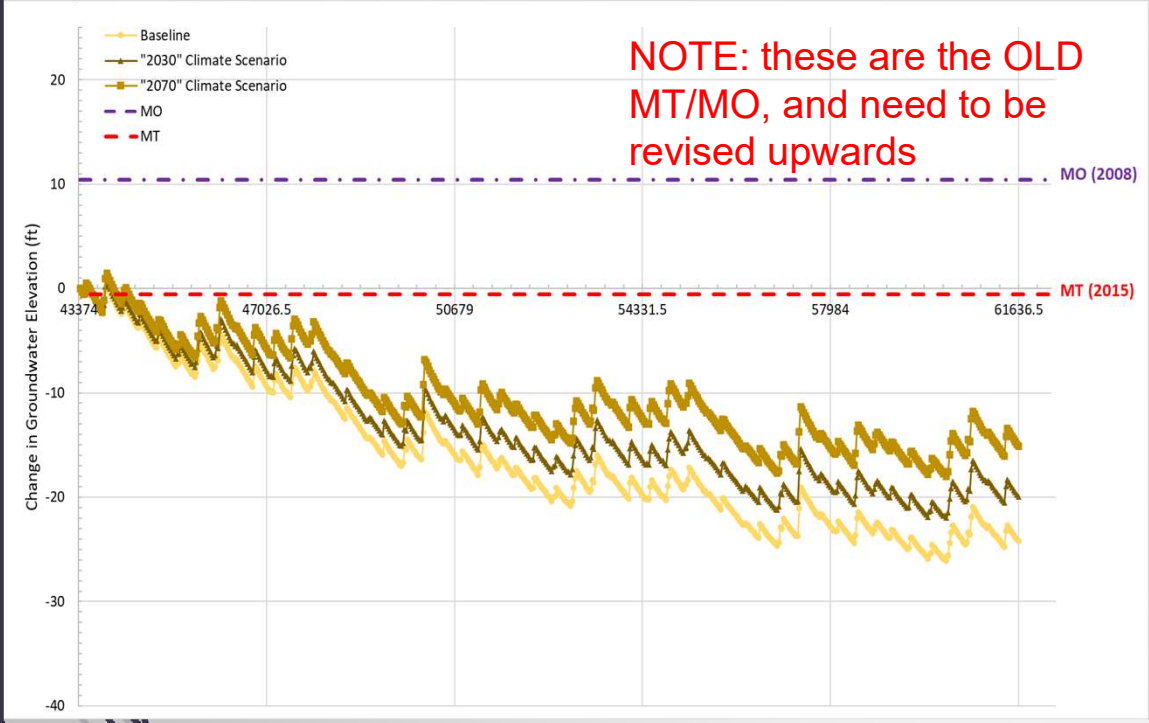
+ Indicates increase in storage

- Indicates decrease in storage

Historical Sustainable Yield

- The sustainable yield is the maximum amount of extraction that can occur without causing undesirable results as defined for each sustainability indicator.
- Typically, the sustainable yield is derived from subtracting the overdraft from the pumping; however, that results in a negative number.
- More data is needed to understand why groundwater levels have dropped so much.
- Corral de Tierra has experienced chronic declines in groundwater levels, ~27 feet (average) since 2000. This results in a decline in storage as well.

Groundwater Budget Summary



Corral de Tierra projected Groundwater Level decline when adjacent subbasins meet their Measurable Objectives (baseline, 2030 CC, 2070 CC

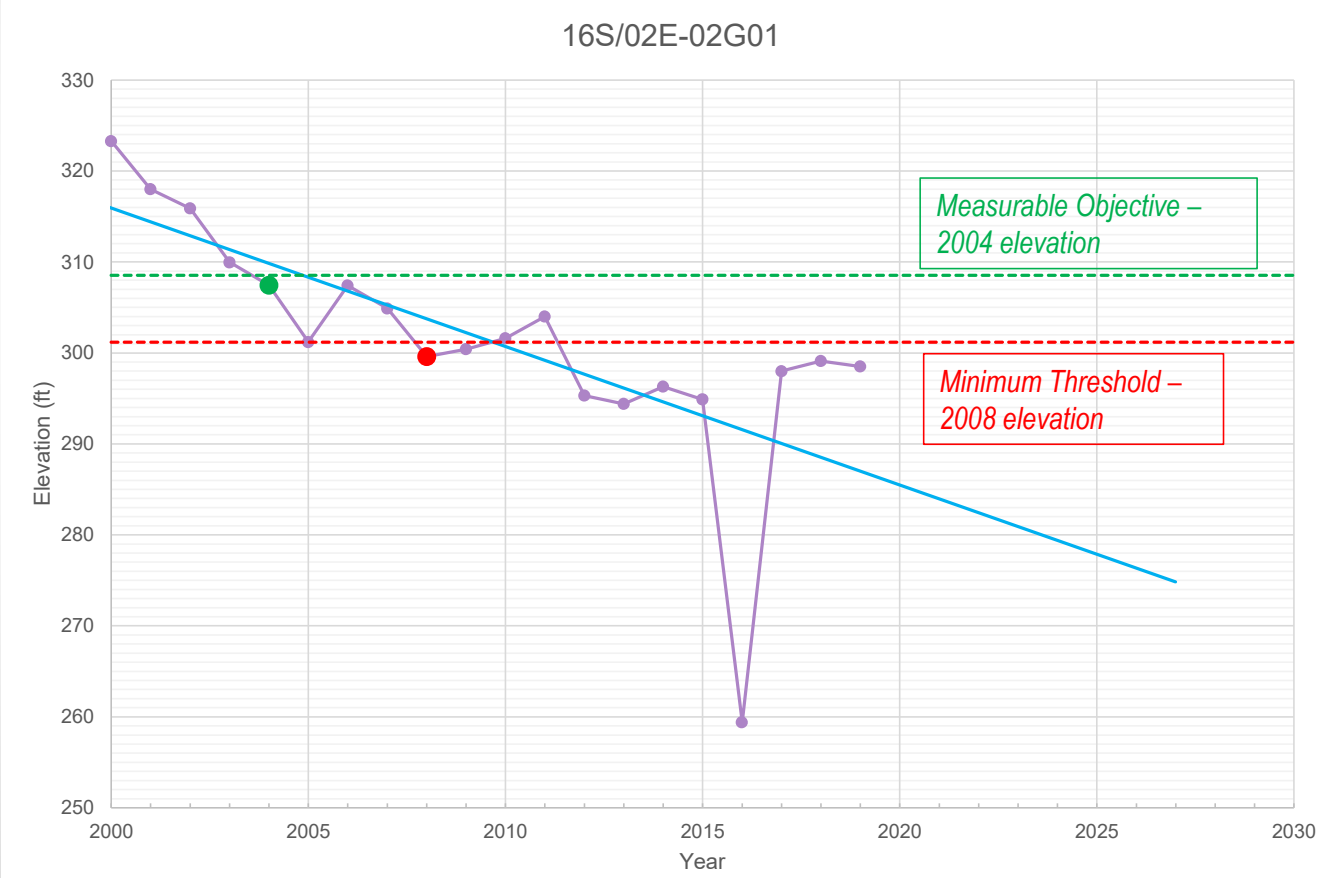
- Future water budget incorporates average climate change, but does not represent short-term climate change effects
- The future water budget is one of three simulations run for each 2030 and 2070:
  - Boundary conditions held at Minimum Thresholds
  - Boundary conditions held at Measurable Objectives
  - Boundary conditions held at SWI-protective levels
- Marina-Ord also has “with project” scenarios
- The water budget will be refined with future versions, and MCWD plans to integrate the Monterey Subbasin Model into the SVIHM/SVOM

Groundwater conditions/SMC – **Groundwater Levels**

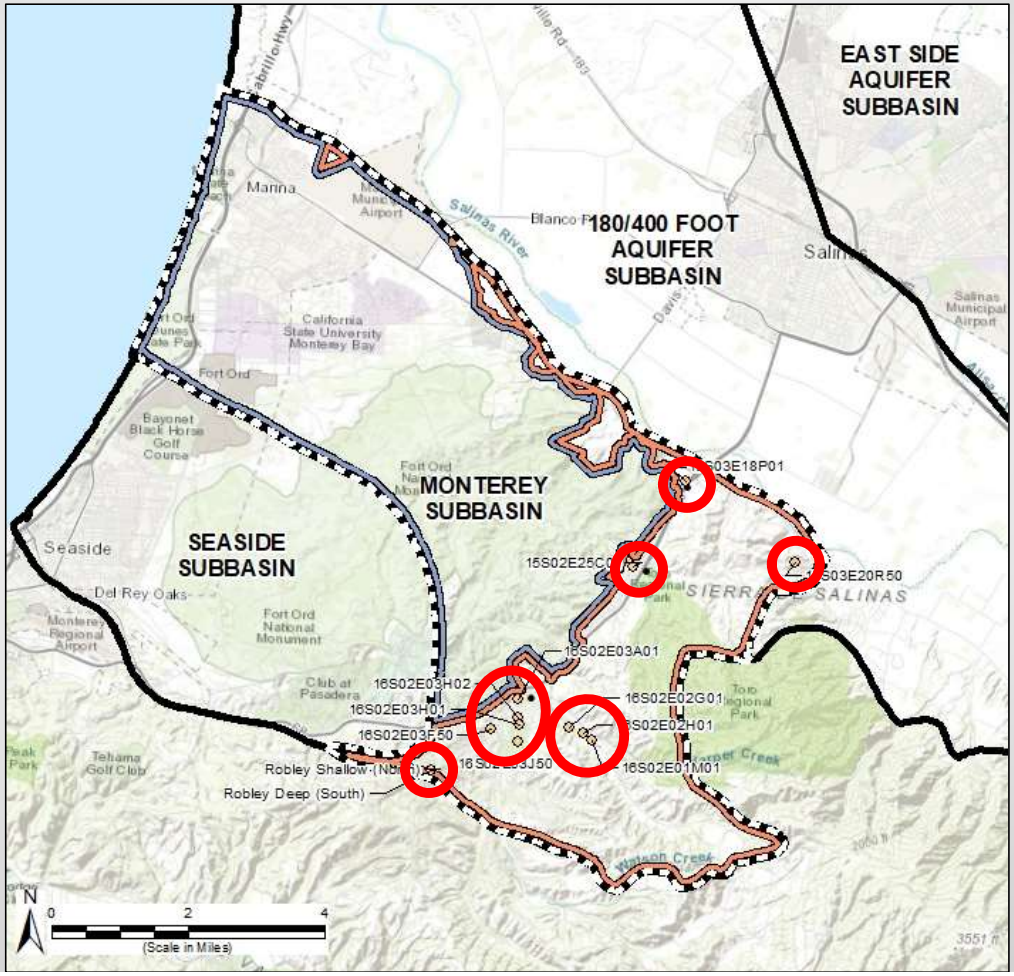
Corral de Tierra (El Toro Primary Aquifer System)	Marina-Ord (Dune Sands, 180-Ft, 400-Ft, Deep Aquifers)
Measurable Objective (MO): Set to 2004/2005 groundwater elevations REVISED	**Measurable Objective (MO):** Set to 2004 groundwater elevations.
Minimum Threshold (MT): Set to 2008 groundwater elevations REVISED	**Minimum Threshold (MT):** Minimum groundwater elevations observed between 1995 and 2015

Undesirable Result:
More than 20% of groundwater elevation minimum thresholds are exceeded in any principal aquifer

Example well - 16S/02E-02G01



Groundwater conditions/SMC – **Groundwater Levels**



Representative Monitoring Sites

Wells with groundwater levels below the <u>REVISED</u> MT in 2019 are circled in RED (all Corral RMS)

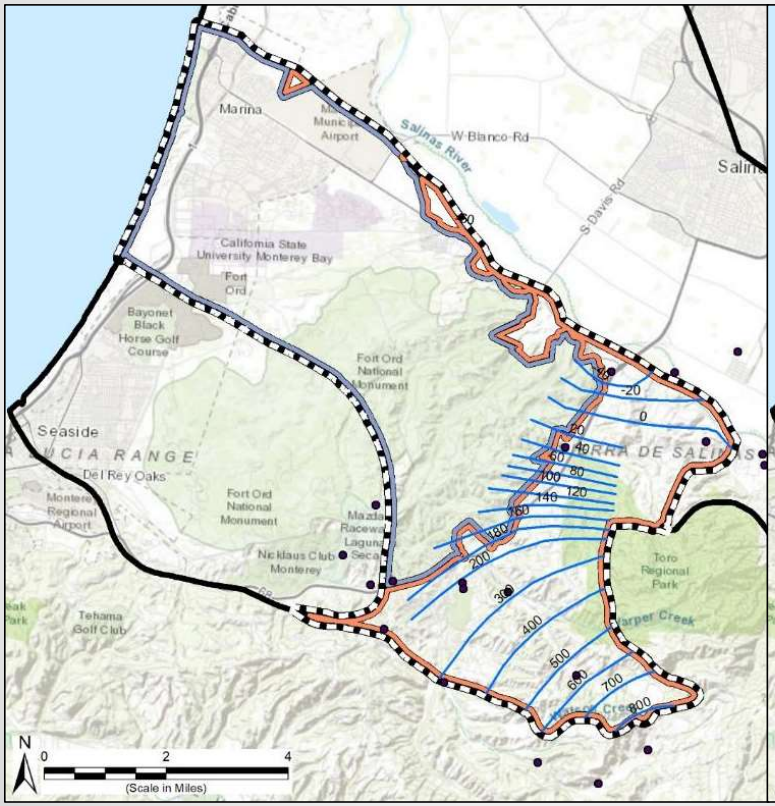
Groundwater conditions/SMC – **Groundwater Storage**

Whole Subbasin

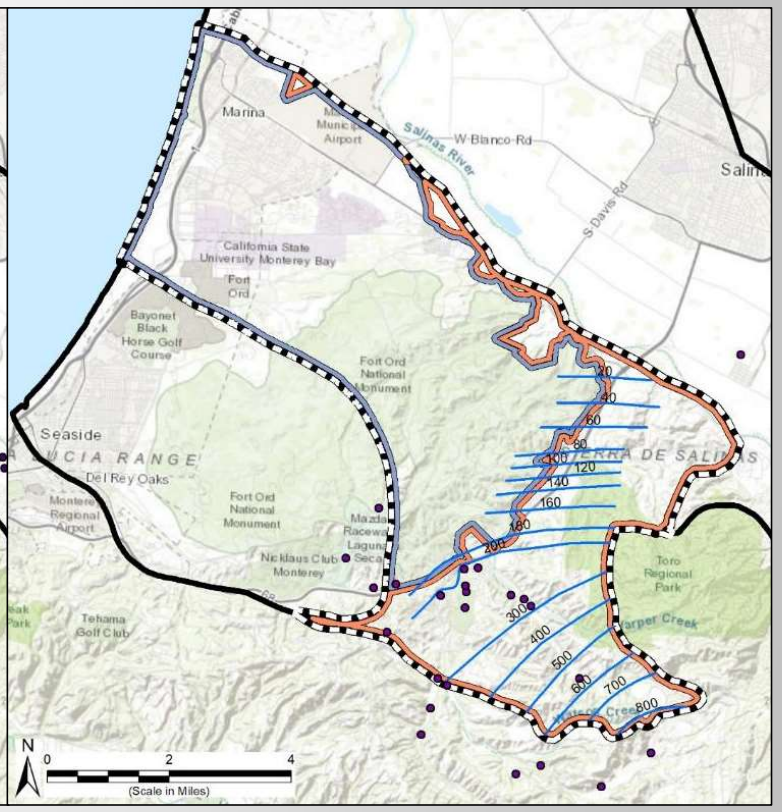
Measurable Objective (MO):
MO for Groundwater Levels and Seawater Intrusion will be used as proxy

Minimum Threshold (MT):
MT for Groundwater Levels and Seawater Intrusion will be used as proxy

Undesirable Result:
(1) exceedance of >20% of groundwater level MTs in either (a) both the Dune Sand and upper 180-Foot Aquifers, or (b) both the lower 180-Foot and 400-Foot Aquifers, or (c) the Deep Aquifers, or (d) the El Toro Primary Aquifer System; OR (2) Exceedance of seawater intrusion MTs.



2017 Fall



2018 Spring

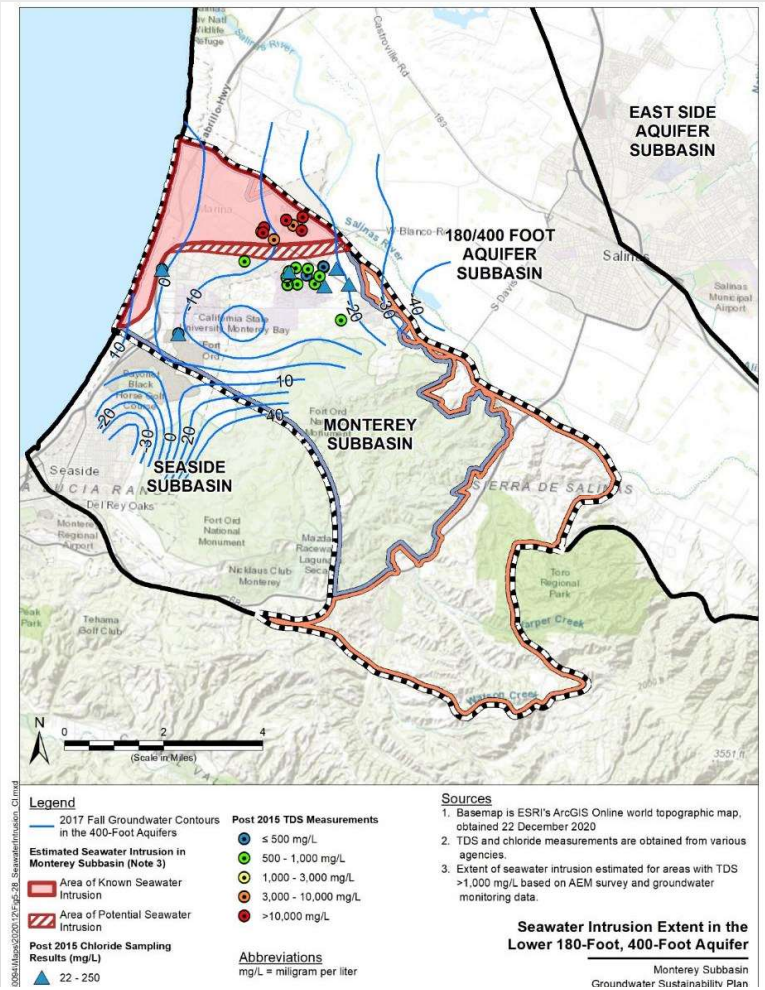
Groundwater conditions/SMC – **Seawater Intrusion**

Whole Subbasin

Measurable Objective (MO):
Identical to the MT

Minimum Threshold (MT):
The approximate location in 2015 of the 500 mg/L chloride concentration isocontour in the lower 180-Foot and 400-Foot Aquifers; ~ 3,500 feet from the coast in the Dune Sand Aquifer, upper 180-Foot Aquifer and Deep Aquifers. No seawater intrusion in the El Toro Primary Aquifer System.

Undesirable Result:
Any exceedance of the MT.



Groundwater conditions/SMC – Current Water Quality Exceedance Maps

Whole Subbasin

Measurable Objective (MO)

No additional exceedances of drinking water standards in potable supply wells or Basin Plan water quality objectives for agricultural supply wells as a result of GSP implementation. Exceedances are only measured in public water system supply wells and domestic and agricultural (ILRP) wells.

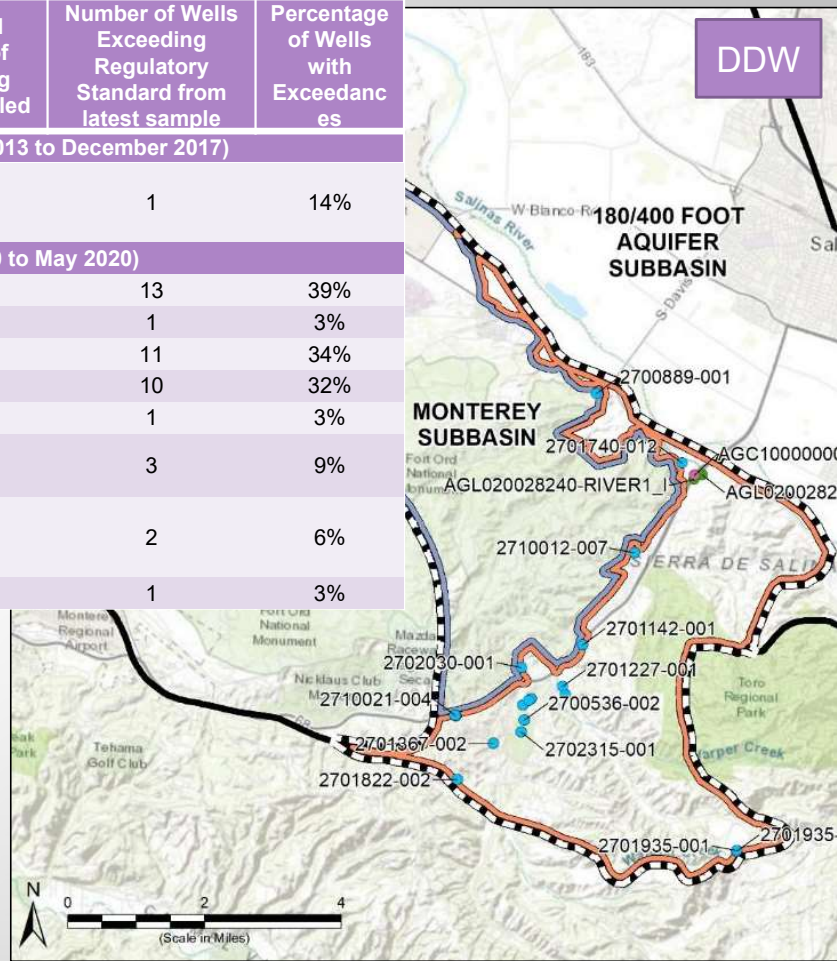
Minimum Threshold (MT)

Identical to the measurable objective.

Undesirable Result:

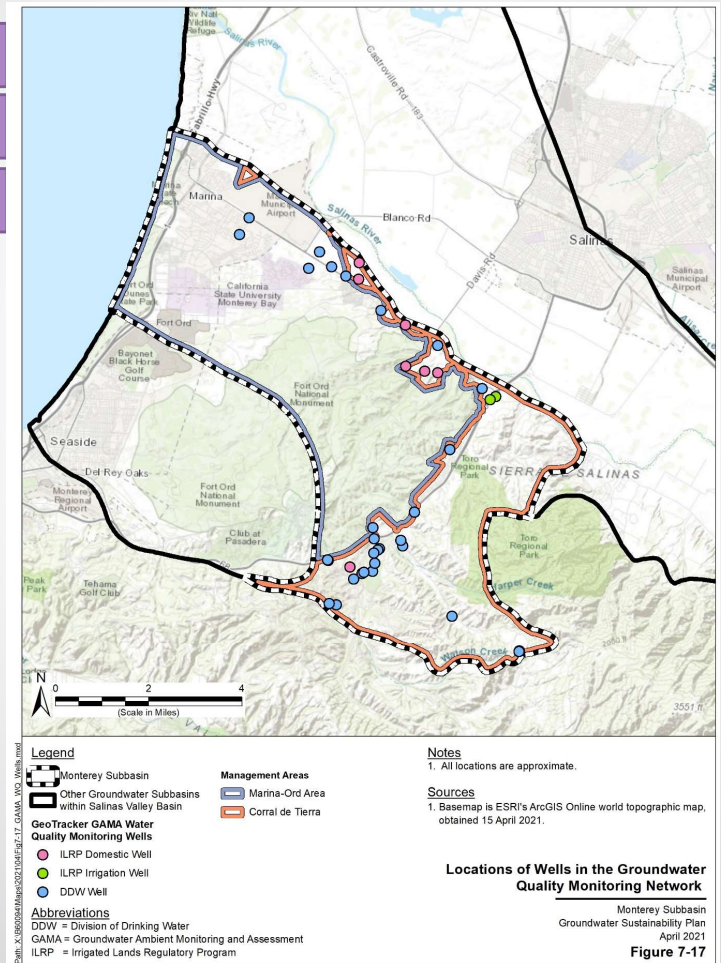
Any exceedances of MTs during any one year as a direct result of projects or management actions conducted pursuant to GSP implementation is considered as an undesirable result. (Still under discussion)

Constituent of Concern	Regulatory Exceedance Standard	Standard Units	Historical Number of Monitoring Wells Sampled	Number of Wells Exceeding Regulatory Standard from latest sample	Percentage of Wells with Exceedances
Domestic ILRP Wells (Data from March 2013 to December 2017)					
Total Dissolved Solids	1000	MG/L	7	1	14%
DDW Wells (Data from April 1990 to May 2020)					
Arsenic	10	UG/L	33	13	39%
Chloride	500	MG/L	33	1	3%
Iron	300	UG/L	32	11	34%
Manganese	50	UG/L	31	10	32%
Nickel	100	UG/L	33	1	3%
Specific Conductance	1600	UMHOS/CM	33	3	9%
Total Dissolved Solids	1000	MG/L	32	2	6%
Zinc	5	MG/L	32	1	3%



Groundwater conditions/SMC – Current Water Quality Exceedance Maps

- ILRP On Farm Domestic
- ILRP Irrigation Well
- DDW



Water Quality Monitoring Locations, not exceedance map

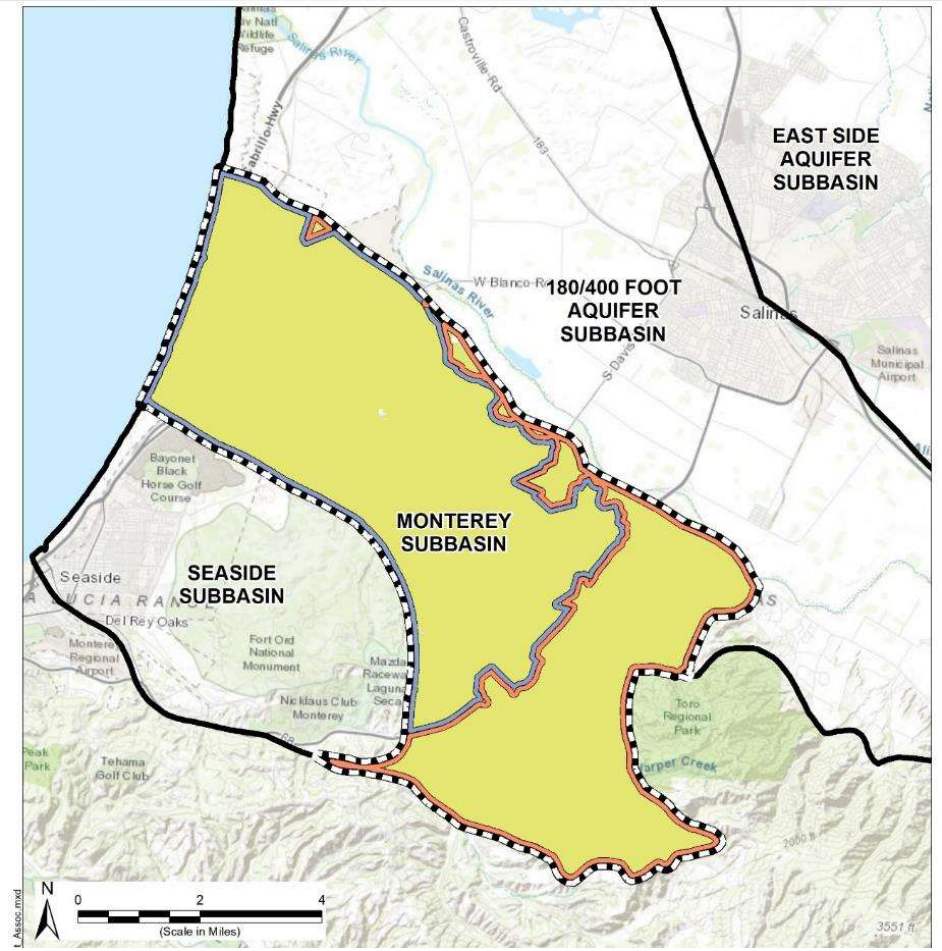
Groundwater conditions/SMC – **Subsidence**

Whole Subbasin

Measurable Objective (MO):
Identical to the MT.

Minimum Threshold (MT):
Zero net long-term subsidence, with no more than 0.1 foot per year of measured vertical displacement between June of one year and June of the subsequent year to account for InSAR measurement errors.

Undesirable Result:
Any exceedances of minimum thresholds during any one year due to lowered groundwater elevations is considered as an undesirable result.



- Negligible current subsidence
- Future subsidence due to groundwater conditions is unlikely
- Minimum threshold and measurable objective set at zero long-term subsidence

Groundwater conditions/SMC – **Interconnected Surface Water**

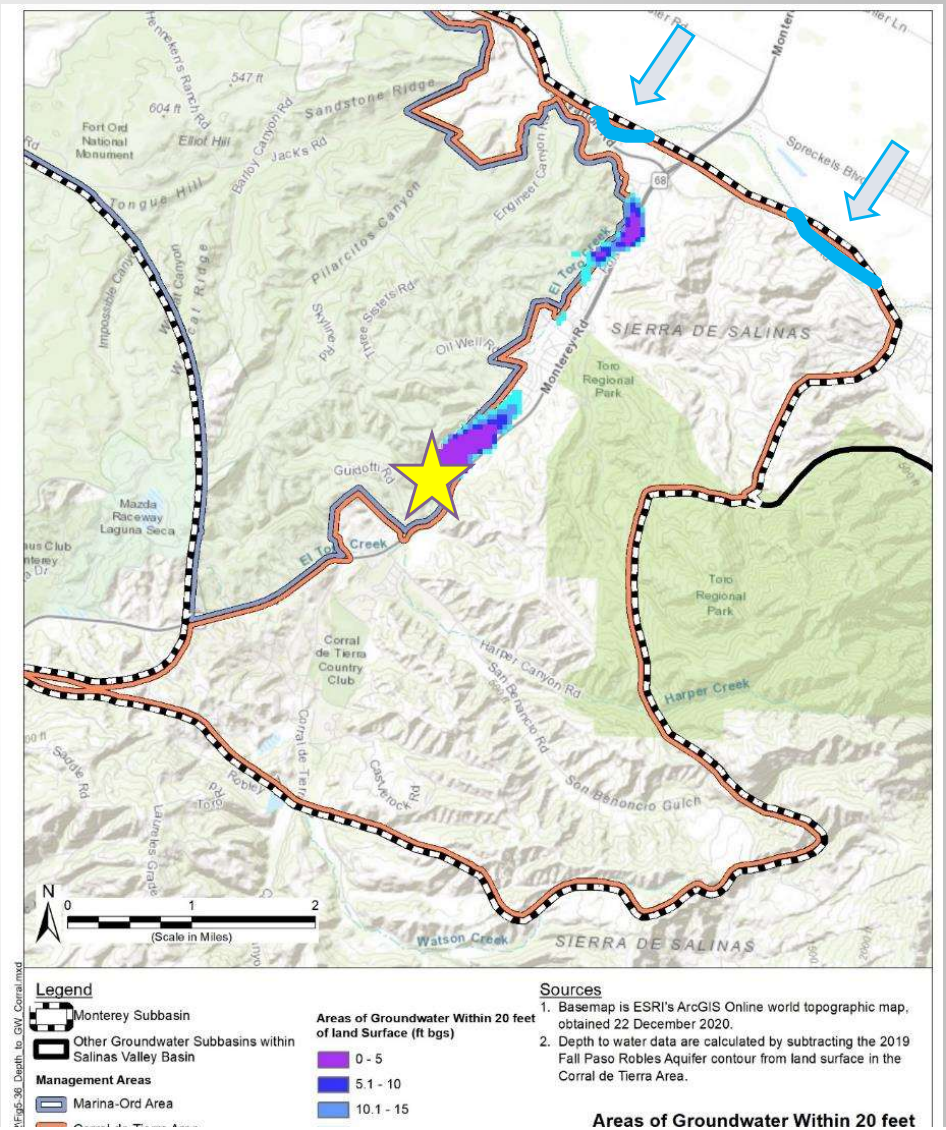
Whole Subbasin

Measurable Objective (MO):
Identical to MT.

Minimum Threshold (MT):
Minimum shallow groundwater elevations historically observed between 1995 and 2015 near locations of interconnected surface water.

Undesirable Result:
Any minimum threshold exceeded in a shallow groundwater well near any location of ISW for more than two consecutive years.

- No interconnected surface water monitoring points yet
- Proposed reactivating USGS El Toro Creek gage and installing a shallow well nearby to correlate flows (seasonal) with shallow groundwater elevations (Star)
- This map does not show the Salinas River where it crosses the Subbasin boundary. Added in presentation, will be added in next version.



Summary of Current Conditions in Relation to SMC

- Corral de Tierra has experienced chronic lowering of groundwater levels since before SGMA
- Since 2000, 27ft (average) groundwater levels decline
- El Toro Primary Aquifer System has historically elevated arsenic concentrations, which are not related to depth, groundwater elevations, or pumping. Rather they are more endemic to the geologic formations that comprise the El Toro Primary Aquifer System.
- Given that the Subbasin's extraction is a data gap, it is difficult to adequately model sustainable yield.

Projects and Management Actions

Winter Release with ASR and/or Direct Delivery

- **Description**: Release flows from reservoirs during the winter when there's less water loss to stream channels. Divert these flows and potentially any extra Permit 11043 water available for diversion at SRDF during winter. Winter flows will be treated and injected for CSIP users' extraction during the summer and/or delivered for direct municipal use.
- **Benefit:** Reduced pumping in the principal aquifers resulting in an in-lieu recharge benefit. Potential direct benefit to Marina Ord from 1,600- 4,500 AFY
- **Cost**: Multi-subbasin: $172 million; Unit Cost for 12,900 AFY ASR: $1,450/AF; Unit Cost for 3,600 AFY direct delivery: $1,100/

Regional Municipal Supply Project

- **Description:** Potential supplement to the seawater intrusion extraction barrier project. It would deliver water for direct potable use to municipal systems in the Eastside Subbasin.
- **Regional Project Benefit**: The proposed plant would produce up to 15,000 AF/yr. of desalinated water for the Salinas Valley. A portion of that would go to Eastside Subbasin.
- **Regional Capital Cost**: $375-$395 million, Unit Cost: $2,830-$2,950/AF

Multi-benefit Stream Channel Improvements

Prune native vegetation and remove non-native vegetation, manage sediment, and enhance floodplains for recharge. Includes 3 components:

1. **Stream Maintenance Program**, Multi-subbasin cost of $0.6M-$1.0M/yr.
2. **Invasive Species Eradication**, Multi-subbasin benefits of 2,790-20,880 AF/yr., cost of $16.5M or $60-$600/AF
3. **Floodplain Enhancement and Recharge**, benefits of 400 AF/yr. for 4 basins in Upper Valley alone, cost of $4.5M or $930/AF

Multi-Subbasin Projects

Pumping Allocations and Controls

Description: Pumping allocations and control based on various criteria (allocation structure not yet defined).

Project Benefit: Can be scaled to different levels.

Cost: Approximately $500,000 for establishment of pumping allocations and controls.

Wastewater Recycling and Reuse

Description: Upgrade existing CUS wastewater treatment plant and pipelines to expand beneficial reuse through irrigation and recharge in Corral de Tierra.

Project Benefit: 232 AFY.

Capital Cost: $28,635,000

Unit Cost: $11,750/AF, with potential additional cost savings.

CORRAL DE TIERRA

Check Dams

- **Description:** Construct check dams to slow surface water to increase recharge.
- **Project Benefit**: On average, 150 AFY of streamflow recharged.
- **Capital Cost**: $5,143,000,
- Unit Cost: $2,830/AF

Recharge with Surface Water Diversions

- **Description:** Potential supplement to the seawater intrusion extraction barrier project. It would deliver water for direct potable use to municipal systems in the Eastside Subbasin.
- **Project Benefit**: The proposed plant would produce up to 15,000 AF/yr. of desalinated water for the Salinas Valley. A portion of that would go to Eastside Subbasin.
- **Capital Cost**: $375-$395 million,
- Unit Cost: $2,830-$2,950/AF

Increase GW production from Upper Corral for Lower Corral Distribution

- **Description**: Construct extraction well in the Upper Corral de Tierra Valley and pipe water down to Lower Corral de Tierra for direct use by water system in lieu of current extraction.
- **Project Benefit**: 160 AFY
- **Capital Cost**: $13,275,000,
- Unit Cost: $6,550/AF

CORRAL DE TIERRA

Decentralized Residential In Lieu Recharge Projects

- Small-scale projects initiated by homeowners and business owners, including rooftop rainwater harvesting, rain gardens, and graywater systems
- **Benefit**: If 75 households install 5000-gallon rain barrels or graywater systems, it would save up to 5.3 AF/yr. or 0.97 AF/yr. respectively
- **Cost** to GSA (not for homeowner implementation or incentives):$50,000 for 5 workshops on rainwater harvesting and $50,000 for 5 workshops on graywater reuse

Decentralized Stormwater Recharge

Medium scale bioswales and recharge basins on non-agricultural land.

Benefit: If 1% of the Subbasin is converted from an area of runoff to an area of recharge, 182 AF/yr.

Cost to GSA (not for implementation or incentives): $150,000 - $200,000 to encourage projects through outreach, site assessments, and assistance with planning

CORRAL DE TIERRA

Implementation Actions

Support Implementation of 180/400 GSP and Seaside Watermaster Actions

Deep Aquifers Investigation

- Support completion of study of the Deep Aquifers to enable better management of groundwater and seawater intrusion.

Support Restrictions on Additional Wells in Deep Aquifers

- Collaborate and provide input to Monterey County as it finalizes proposed modifications to the well construction ordinance.

Adopt 2022/2023 Priority Actions for Deep Aquifers in Absence of new Well Construction Ordinance if Conditions Threaten Sustainability in Near Term

- To be determined (TBD). Priority actions will be developed based on findings reported from the Deep Aquifers study.

Implementation Actions

SWIG

- Participate in working group that is pulling together the best available science, data, and understanding of local seawater intrusion causes and potential resolutions.

SWI Modeling

- Develop seawater intrusion model for the Monterey Subbasin.

Incorporate Monterey Subbasin Model into SVIHM

- Refine construction and calibration of the SVIHM in the Monterey Subbasin using inputs developed for the Monterey Subbasin Model.

Implementation Actions

Well Registration

- Register all production wells, including domestic wells

Water Quality Partnership

- Form a working group for agencies and organizations to collaborate on addressing water quality concerns.

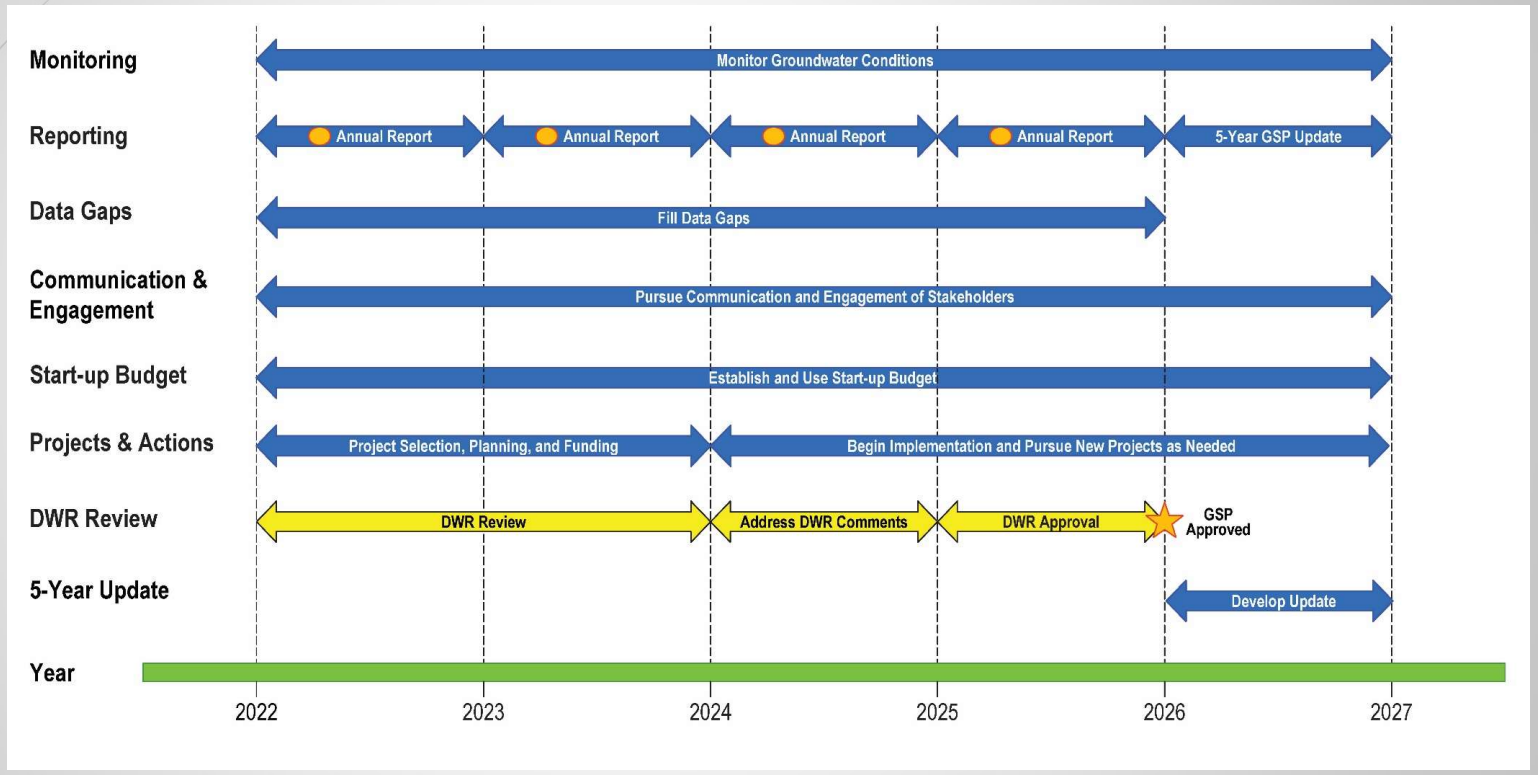
GEMS Expansion & Enhancement

- Update current MCWRA GEMS program, by collecting groundwater extraction data from wells in areas not currently covered by GEMS and improving data collection

Dry Well Notification System

- Develop a system for well owners to notify the GSA if their wells go dry. Refer those owners to resources to assess and improve their water supplies. Form a working group if concerning patterns emerge.

Implementation Schedule



Questions