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TECHNICAL MEMORANDUM

DATE: March 31, 2026 **PROJECT #:**9100.78

TO: Salinas Valley Basin Groundwater Agency

FROM: Stephen Hundt

REVIEWER: Staffan Schorr and Abby Ostovar, Ph.D.

PROJECT: Castroville and Eastside Canals and Alternatives Preliminary Feasibility Study

SUBJECT: Groundwater Modeling Results

INTRODUCTION

This appendix documents the groundwater modeling methods and assumptions used to evaluate project scenarios developed for the Castroville and Eastside Canals and Alternatives Preliminary Feasibility Study (C&E Study). In addition, it includes results for all scenarios. The modeling was conducted to support comparative, planning-level assessment of how potential Salinas River diversion project concepts could help reach groundwater sustainability goals in the Eastside Aquifer (Eastside), Langley Area (Langley), and 180/400-Foot Aquifer (180/400) Subbasins. For the 4 project concepts, 8 different scenarios were modeled:

1. Eastside Recharge Basins Project Concept
    a. 400 cfs Scenario
    b. 200 cfs Scenario
    c. 100 cfs Scenario
    d. 50 cfs Scenario
2. Northern Eastside Injection Project Concept
    a. 100 cfs Scenario
    b. 50 cfs Scenario
3. Coastal Injection Project Concept/Scenario
4. New Seawater Intrusion Project (NSIP) Concept/Scenario

The study context and project descriptions are provided in the main body of the report.

The sections that follow introduce the groundwater models used in this study and the assumptions used to represent project operations and boundary conditions under future scenarios. Model simulations were designed to evaluate relative changes in groundwater levels and seawater intrusion response across scenarios, rather than to predict precise future conditions.

GROUNDWATER MODELS

Simulations for the C&E project scenarios use 2 groundwater models: the Salinas Valley Operations Model (SVOM) and the Seawater Intrusion Model (SWIM), which are further described below.

Salinas Valley Operations Model (SVOM v1)

The Salinas Valley Operations Model (SVOM v1) was the primary groundwater model used to support the C&E project feasibility analysis. SVOM was applied to evaluate the groundwater level response and surface water–groundwater interactions associated with the proposed project scenarios and serves as the sole model used for all components of the Eastside Recharge Basins and Eastside Injection Scenarios.

SVOM v1 is based on the Salinas Valley Integrated Hydrologic Model (SVIHM) Version 1, an updated implementation of the original USGS SVIHM. SVIHM simulates coupled surface water and groundwater processes across the Salinas Valley using MODFLOW-OWHM Version 2, which represents dynamic interactions between water supply, water demand, and groundwater flow. Agricultural demands are estimated internally based on land use and climate inputs and are met through a combination of precipitation, groundwater pumping, surface water diversions and deliveries, and recycled water. For the C&E Study, all project scenarios were developed from a common future baseline simulation – Baseline Scenario – documented in Montgomery & Associates ([M&A] 2026), which is a status quo simulation with no additional projects or management actions. It assumes future conditions without incorporation of climate change.

The future Baseline Scenario employed the Surface Water Operations (SWO) module to dynamically simulate operations of Nacimiento and San Antonio Reservoirs in response to climatic inputs, reservoir operating rules, CSIP demands, and simulated Salinas River flows influenced by reservoir releases, tributary inflows, and surface water–groundwater exchange. For all C&E project scenarios, the SWO module was omitted, and reservoir releases and Salinas River Diversion Facility (SRDF) diversions from the future Baseline Scenario were applied as fixed inputs. This approach isolates the groundwater system response to proposed project actions while maintaining consistency in upstream reservoir operations across scenarios. The rationale for this modeling choice, and its implications for interpretation of results, are discussed further in subsequent sections of this appendix.

Seawater Intrusion Model (SWIM)

The SWIM was used to evaluate seawater intrusion response for the coastal injection project scenario, the NSIP scenario, and for the corresponding future baseline (status quo, no-project) condition for seawater intrusion. The SWI Model was used only where variable-density groundwater flow and simulation of seawater intrusion processes were required to assess the effectiveness of coastal injection for addressing seawater intrusion.

The SWIM is a variable-density, regional groundwater flow model developed by M&A (2023; 2024) to simulate seawater intrusion in the 180/400 Subbasin. The model represents coupled groundwater flow and salinity transport at the basin scale and is used to evaluate changes in groundwater levels and chloride distributions under alternative future conditions. The SWIM covers the entire coastal Salinas Valley and extends south to Chualar.

The SWIM and SVOM are linked only for the future Baseline Scenario. In the baseline configuration, outputs from the SVOM future Baseline Scenario—including river flows, recharge, and pumping distributions—were used to define boundary conditions and stresses for the SWIM and develop a SWIM Baseline Scenario.

The Coastal Injection project scenario evaluated with the SWIM was derived directly from the Baseline Scenario with 2 adjustments: (1) representation of additional diversion at the SRDF under the 11043 permit with a 50 cfs diversion capacity, and (2) introduction of coastal injection wells. All other inputs—including flows, recharge, and pumping derived from the SVOM future baseline—were held constant between the baseline and project scenarios.

The NSIP scenario evaluated with the SWIM was derived directly from the Baseline Scenario with 1 adjustment: all wells within the NSIP area were set to have no pumping. All other inputs—including flows, recharge, and pumping derived from the SVOM future baseline—were held constant between the baseline and project scenarios.

MODEL SCENARIO SETUP

Project scenarios were compared to either the Baseline Scenario run with the SVOM or the SWIM Baseline Scenario. Non-project assumptions were maintained as in the Baseline Scenario to isolate the effect of the projects. Projects were simulated to begin in 2035 (Water Year [WY] 2036). Infrastructure sizing and locations were co-developed with the engineering layouts and match the description in the main report.

Baseline Scenarios

The Baseline (status quo) Scenarios represents future groundwater and surface-water conditions assuming no new projects or management actions are implemented. This scenario is documented in M&A (2026) and is summarized in the main body of this report. In brief, groundwater flow modeling was conducted using the SVOM and the SWIM to project groundwater levels, surface-water flows, reservoir operations, agricultural and municipal pumping, and seawater intrusion through 2072 under a representative historical climate sequence. The Baseline Scenario reflects current reservoir operating rules, projected demands, and existing management practices, and provides the reference condition against which all project scenarios are evaluated.

The projected hydrology used in the SVOM is a representative 25-year climate sequence based on historical hydrology, repeated twice over the projection period to support water budget analysis across a range of hydrologic conditions. The sequence corresponds to the hydrology of water years 1993, 2019, 1975, and 1999-2020 to best match observed recent conditions and provide a representative mix of wet and dry years. Actual future climate is unknown; however, this provides a representative estimate through which potential projects can be assessed. Additional modeling could evaluate different sequences of wet and dry years and climate change.

All project scenarios are built directly from the Baseline Scenario, duplicating its time period, spatial properties, climate sequence, and boundary conditions, with only the specific project-related modifications described in the scenario definitions. The baseline serves primarily as a point of comparison for evaluating changes in groundwater levels, groundwater storage, and seawater intrusion attributable to the project concepts. In addition, baseline SVOM outputs are used to derive key inputs for the project analysis, including streamflows used to estimate water available for diversion under Permit 11043 (with additional constraints described in the main body and Appendix E), as well as reservoir releases and SRDF operations.

Reservoir operations in baseline and project scenarios

In the future Baseline Scenario, the SVOM SWO module was used to dynamically simulate reservoir releases and SRDF operations in response to climate, CSIP irrigation demands, and operating rules. In contrast, the SWO module was not active in the project scenarios; instead, reservoir releases and SRDF diversions from the baseline were applied as fixed inputs. This approach assumes that the projects do not affect reservoir operating decisions and allows the analysis to focus on the direct effects of recharge and diversion.

While this simplification supports clearer comparisons between the baseline and project scenarios, it does not account for potential changes in reservoir operations that could result from higher groundwater levels or increased baseflow. However, given the locations of the project scenarios, any such effects on reservoir operations are expected to be minimal. As a result, the approach is appropriate for this stage of analysis but may understate some secondary benefits of the projects.

Eastside Recharge Basins

The Eastside Recharge Basins project concept evaluates diversion of Salinas River water under Permit 11043 for recharge in the Eastside Subbasin, with 4 diversion capacities (400, 200, 100, and 50 cfs) simulated to represent a range of project sizes. Under this project concept, river water is diverted at the Castroville Canal Intake location and directed into recharge basins in the Eastside Subbasin after sediment is settled out. The project infrastructure ends at this point, but recharged water is assumed to be later extracted through private agricultural and municipal wells.

Recharge rates and timing

Recharge rates for the Eastside Recharge Basins scenarios were derived directly from the diversion estimates developed for each diversion capacity, as described in Appendix E. Average annual diversion volumes are summarized in Table 1, and interannual variability in total diversion at the Castroville Canal Intake volume is shown on Figure 1. For all scenarios, it was assumed that the recharge basins have sufficient infiltration capacity to recharge diverted water as soon as it is delivered, or, at a minimum, within the same monthly stress period in which the diversion occurs, consistent with the temporal resolution of the model.

Recharge rates were not constrained by simulated groundwater levels in the top model layer beneath the recharge basins. The applicability of this assumption was evaluated by comparing simulated groundwater levels to ground surface elevations in the uppermost model layer beneath and adjacent to the basins. In most locations and scenarios, simulated water levels remained below ground surface. However, in the 400 cfs scenario, simulated groundwater levels in a limited number of basins in the northern Eastside Subbasin regularly rise to or above ground surface. This suggests that, under those conditions, the modeled recharge rates may exceed the infiltration capacity implied by elevated water tables, and that recharge efficiency could be reduced relative to the modeled assumption in those specific locations.

Table 1. Projected Average Annual Diversions at Castroville Canal Intake
Compared to Historical Annual Diversions at Chualar

	400 cfs capacity (AFY)	**200 cfs capacity (AFY)**	**100 cfs capacity (AFY)**	**50 cfs capacity (AFY)**
Historical - WY 2000-2024	31,700	18,200	10,000	5,300
Historical - WY 2010-2024	29,300	16,200	8,600	4,400
Projected	26,800	17,200	9,700	5,100

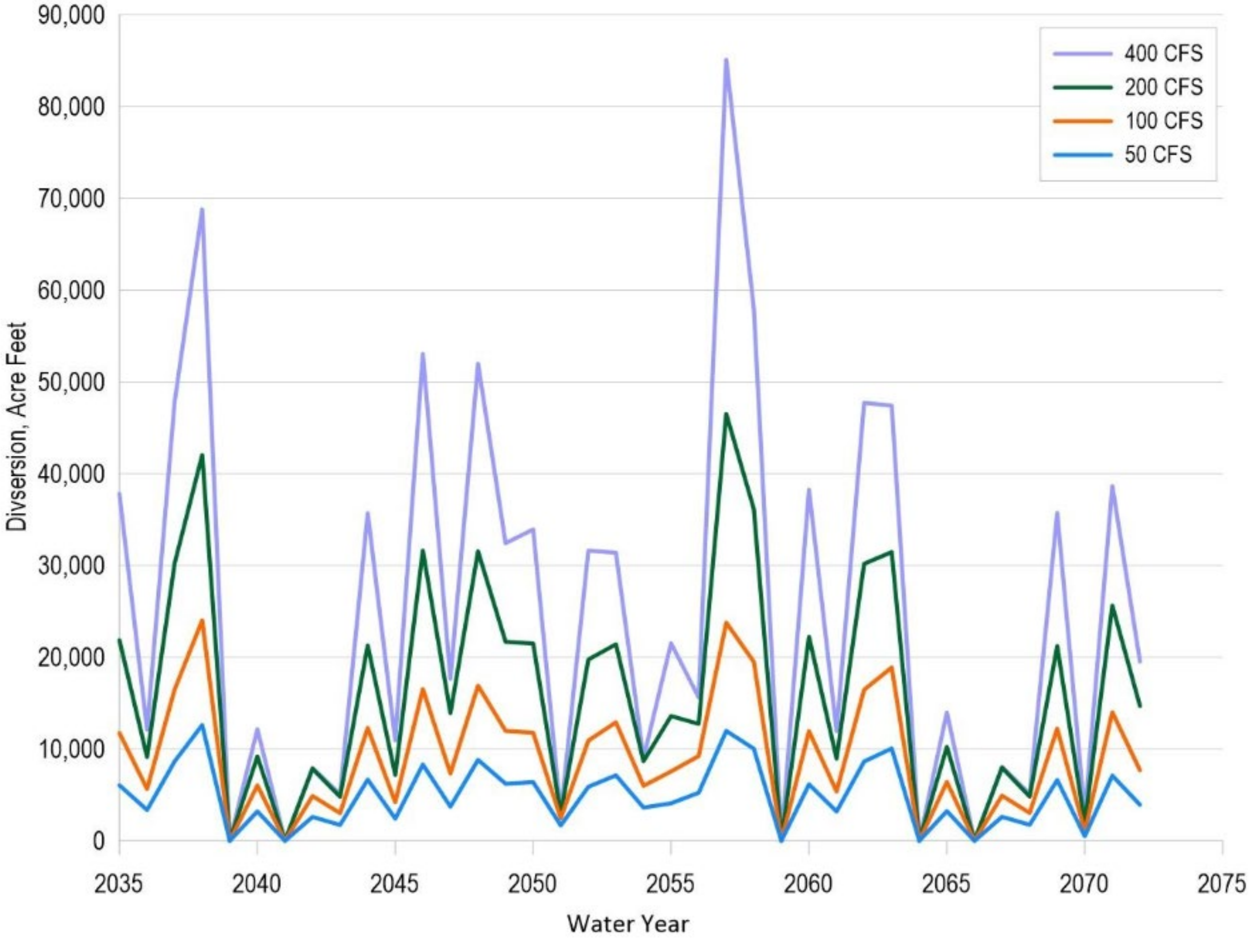


Figure 1. Projected Annual Diversions Under Various Diversion Capacities

Recharge basin locations

Recharge basins were distributed across the central and Eastside Subbasins, with the number and spatial extent of basins increasing with higher diversion and recharge rates. Basin placement was refined through an iterative process that considered modeled results and physical siting constraints.

Priority was given to areas within the Quail Creek and Alisal Creek alluvial fans, identified as favorable recharge locations as described in Appendix H. Additional basins were placed to spatially distribute recharge benefits and avoid excessive concentration of groundwater level increases near individual basins. This approach was intended to improve groundwater levels in portions of the Eastside Subbasin where RMS wells were simulated to fall below minimum thresholds (MTs) in the 2040–2041 evaluation period under baseline conditions. As diversion capacity increased, basins were extended farther south of Quail Creek and northward toward the vicinity of Gabilan Creek.

Several siting constraints were applied during basin selection. Recharge basins were generally not placed over areas underlain by the Salinas Valley Aquitard or mapped shallow clays, except where the clays were identified as very thin, to facilitate recharge to deeper aquifers. Basin locations were also selected to avoid proximity to stream channels, where elevated groundwater levels could be rapidly drained as baseflow, and to avoid areas of residential or commercial development.

The final basin layouts for each scenario are shown on Figure 2. Recharge was applied in model cells identified by intersecting basin footprint polygons with the model grid. Cells were selected such that the combined area of the selected cells approximately matched the surface area of each recharge basin.

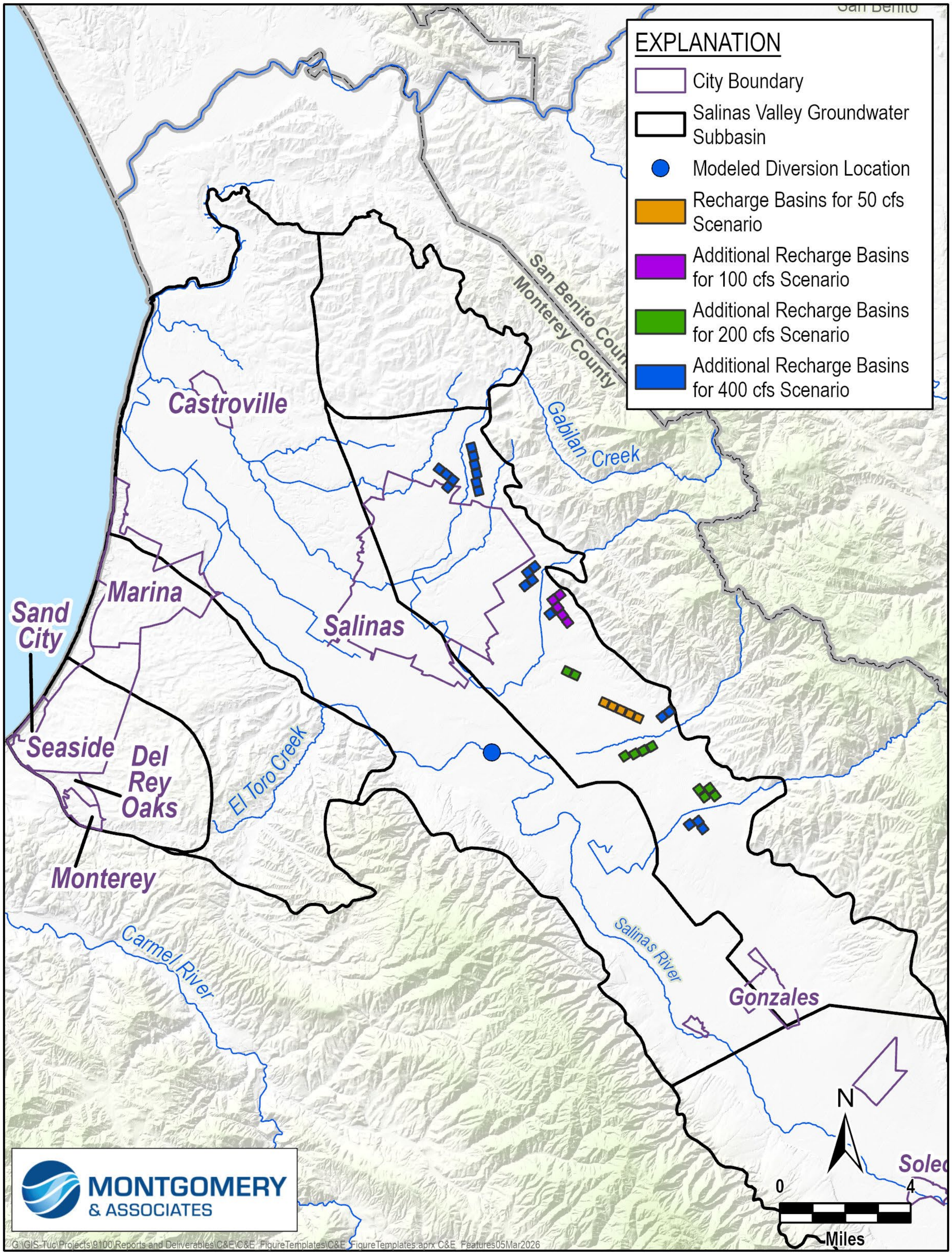


Figure 2. Location of Eastside Recharge Basin Scenarios

Removal of land from agricultural production

In addition to simulating recharge, the scenarios account for the removal of land within the recharge basin footprints from agricultural production. The model cells affected by this land use change were identified using a similar approach to that used for assigning recharge, although the total footprint was expanded by manually applying buffers around each basin to represent ancillary infrastructure and operational space.

Two modifications were applied within these footprints beginning in 2035. First, agricultural demand was removed by reducing potential evapotranspiration to zero in the affected cells. Second, any agricultural pumping wells located within the footprint were removed from the simulation after 2035.

The removal of land from agricultural production results in reduced groundwater pumping and associated increases in groundwater levels that are independent of recharge. These effects occur continuously after implementation, regardless of the timing or magnitude of diversions and recharge in any given year.

Recharge and diversion implementation

Recharge through the Eastside Recharge Basins was simulated using specified inflows applied via the MODFLOW WEL package to layer 1 of the model. For each scenario, the total recharge volume was divided evenly among the recharge basins and then distributed to the intersecting model cells in proportion to their intersecting area.

Diversion from the Salinas River was represented by adding an additional streamflow routing (SFR) segment at the Castroville Canal Intake location. For each monthly stress period, the calculated diversion volume was applied as an inflow to this segment from the upstream Salinas River reach. Outflow from the diversion segment was defined as leaving the model domain, representing conveyance of diverted water to the recharge basins.

Northern Eastside Injection

The Northern Eastside Injection project concept evaluates diversion of Salinas River water at the Castroville Canal Intake location for recharge via injection wells in the northern Eastside Subbasin. Diverted water is conveyed to surface storage, treated, and injected through a network of wells. Two diversion capacities were simulated—100 cfs and 50 cfs—to represent a range of project sizes and 2 options for surface storage.

Injection is assumed to be more suitable than surficial recharge in this area due to the presence of shallow clay layers that limit infiltration (see Appendix H). Storage and treatment are therefore integral components of this project concept.

Treatment and storage of diverted water

Treatment of diverted water prior to injection is required, as described in the main body of the report. Because diversion opportunities are irregular and episodic, treatment plant capacity was assumed to be substantially smaller than diversion capacity, necessitating surface storage to regulate flows.

Consistent with assumptions described in the main report and Appendix E, feasible treatment plant capacities were defined and corresponding storage volumes estimated. For the 100 cfs scenario, storage is assumed at a proposed reservoir site in the Gabilan Range near Alisal Creek; for the 50 cfs scenario, storage is assumed at the proposed Merritt Lake site. Assumed storage capacities of approximately 25,000 AF and 13,000 AF, respectively, support continuous treatment and injection at rates of 13 mgd and 6.5 mgd.

Injection rates and timing

Injection wells were assumed to have a maximum capacity of 400 gpm. The number of wells in each scenario was selected such that total injection capacity matches the assumed treatment plant capacity. Treated water was assumed to be distributed evenly among all wells.

No site-specific analysis of injection capacity was conducted based on well construction or local hydrogeology. The assumed per-well injection rate is lower than rates used in other injection-based simulations in the region and was selected to distribute recharge over a larger area and reduce localized mounding. Injection was assumed to occur continuously, subject to available treated water from storage. A summary of the injection wells for each scenario is provided in Table 2. The annual volume of injection under each scenario is shown on Figure 1.

Table 2: Injection wells for Scenario 2, Northern Eastside Injection

Scenario (Diversion Capacity)	Total Injection Well Capacity	# of Injection Wells	Flow Rate per Injection Well, gpm
100 cfs	13 mgd (20 cfs)	23	390
50 cfs	6.5 mgd (10 cfs)	12	375

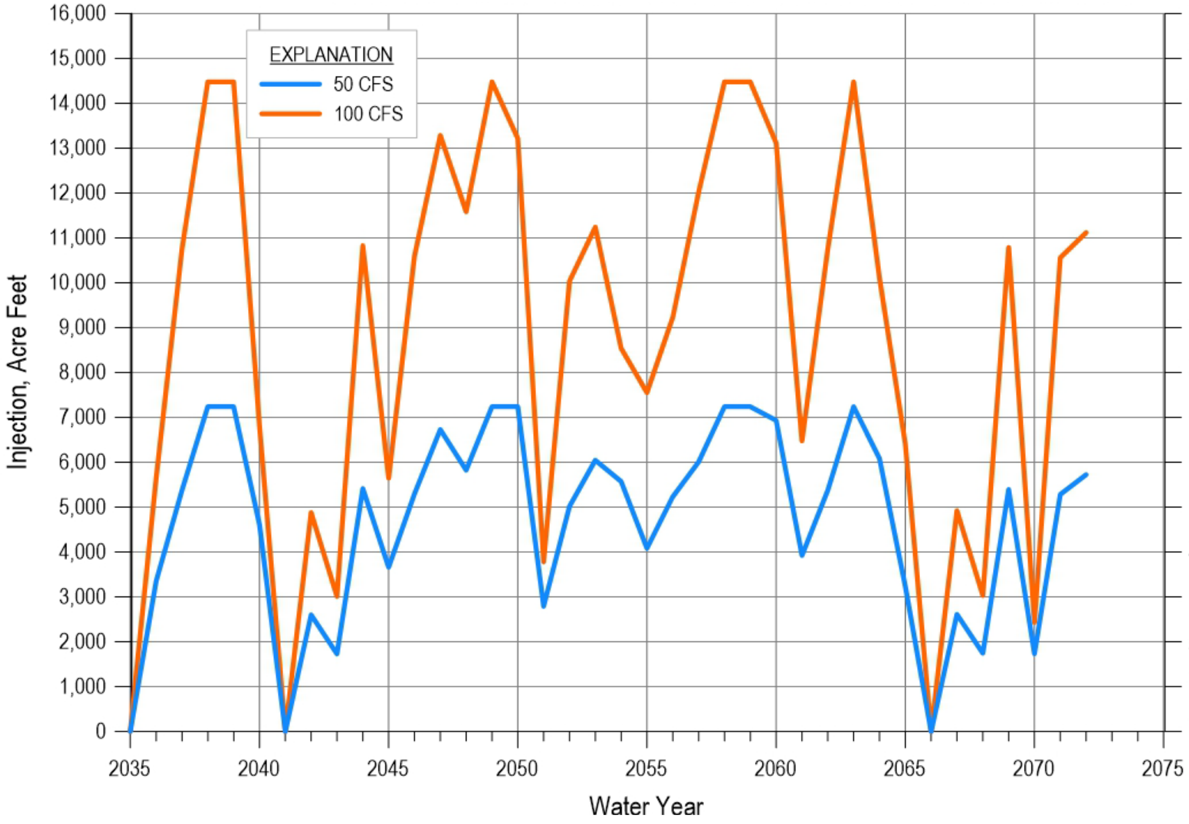


Figure 3. Projected Annual Injection, in acre-feet per year

Injection well locations and depths

Injection wells were placed within a broad area of the northern Eastside Subbasin where baseline modeling indicates the greatest groundwater level declines. Wells were randomly distributed within this area to achieve approximately even spacing. Wells included in the 50 cfs scenario represent a subset of those included in the 100 cfs scenario.

All wells inject into both the 180-Foot and 400-Foot Aquifer model layers, with injection apportioned between layers in proportion to layer thickness. The proposed layouts are presented on Figure 4 below.

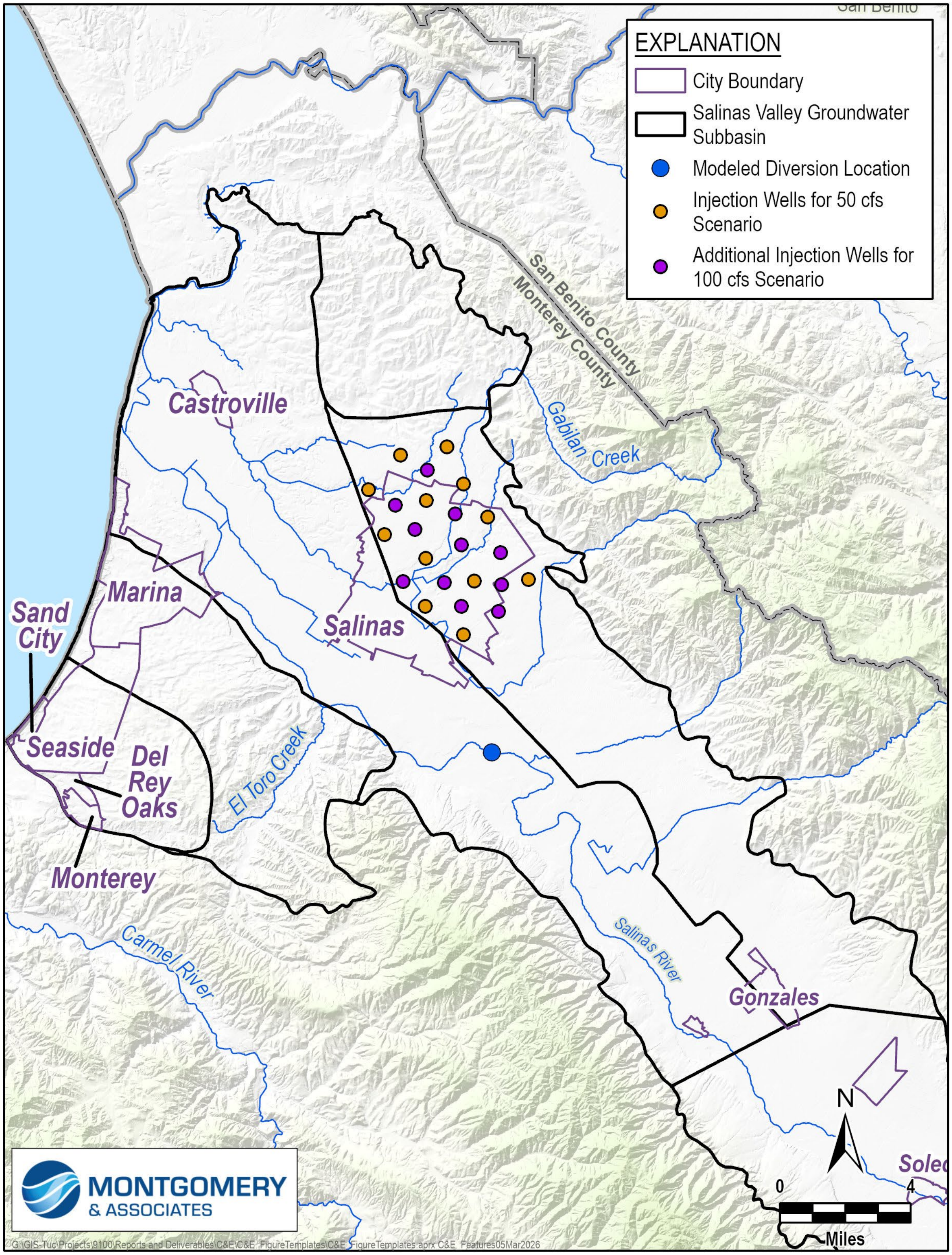


Figure 4. Injection Well Locations for Northern Eastside Injection Scenarios

Injection and diversion implementation

Injection was simulated using the MODFLOW WEL package, with specified inflows applied to the 180-Foot and 400-Foot Aquifer model layers in the Eastside Subbasin, consistent with each scenario's injection capacities.

Diversion from the Salinas River was represented in the same manner as for the Eastside Recharge Basins scenarios. Diversion volumes were calculated at the Castroville Canal Intake with diversions assumed to begin in 2035. Diverted water was removed from the streamflow routing network and conveyed to off-channel storage prior to treatment and injection.

Coastal Injection

The Coastal Injection project concept evaluates diversion of Salinas River water under Permit 11043 for groundwater injection in the coastal 180/400 Subbasin to address seawater intrusion. Water is diverted near the SRDF, conveyed to surface storage, treated, and injected through a network of wells. Only a single diversion capacity of 50 cfs was simulated, consistent with the available storage capacity at Merritt Lake.

Groundwater impacts were simulated using the SWIM. The SWIM baseline was developed using boundary conditions and fluxes derived from the SVOM future baseline simulation. The Coastal Injection scenario is identical to the SWIM baseline except for 2 modifications: (1) diversion of surface water from the Salinas River near the SRDF location and (2) injection of treated water into the coastal aquifer system.

Treatment and storage of diverted water

Like the Northern Eastside Injection project concept, treatment of diverted water is required prior to injection. Because diversion opportunities are irregular and episodic, treatment capacity was assumed to be substantially smaller than diversion capacity, requiring surface storage to regulate flows. Treatment and storage were defined for this scenario using the Merritt Lake site. Given the injection well location within the coastal 180/400 Subbasin, only the Merritt Lake storage option was carried forward; accordingly, the Coastal Injection scenario is limited to the 50 cfs diversion capacity.

Injection well locations and depths

Well placement was informed by prior analyses and iterative evaluation of groundwater modeling results, with the objective of most effectively mitigating seawater intrusion along the coastal front.

Injection was applied exclusively to the 400-Foot Aquifer. The 50 cfs diversion volume was considered insufficient to distribute injection across multiple aquifers, and the 400-Foot Aquifer was selected because it is the primary aquifer relied on for groundwater supply in the area and is where seawater intrusion is advancing most rapidly.

Injection rates and timing

Injection timing for the Coastal Injection scenario follows the same assumptions as the 50 cfs Eastside Injection scenario. Injection occurs at a relatively constant rate, is regulated by available treated water from storage, and is not directly tied to the timing of individual diversion events.

Injection and diversion implementation

Injection wells were implemented in the SWIM using the Well (WEL) package. Specified injection rates were applied to WEL cells representing injection wells screened in the 400-Foot Aquifer.

Diversion from the Salinas River was represented by removing water from the CLN feature representing the river channel. Water was removed at the location corresponding to the Salinas River Diversion Facility (SRDF).

NSIP

The NSIP concept evaluates the diverting of Salinas River water under Permit 11043 and supplementing it with additional sources to provide treated replacement water to existing groundwater users within the seawater intrusion area. This project concept is further described in the New Seawater Intrusion Project Evaluation (NSIP Evaluation) by Carollo Engineers (2026), and this groundwater modeling is of the Maximum Size NSIP Scenario, as the other 2 NSIP scenarios do not rely on Permit 11043. Under the Maximum Size scenario, water is diverted near the SRDF, conveyed to surface storage at Merritt Lake, treated, and delivered through a proposed distribution system serving users historically reliant on pumping from the Deep Aquifers within or near the seawater intrusion front.

A single scenario was simulated in which NSIP begins operation in October 2035 and provides an alternative water supply for irrigation. Correspondingly, beginning in October 2035, all groundwater pumping within the NSIP area ceases, with no compensating increase in pumping elsewhere. The volume of pumping removed is approximately 32,000 AF/year, as NSIP would directly deliver irrigation supply water from a combination of Salinas River water diverted under Permit 11043 and other sources. The timing and amount of surface water derived from a 100 cfs diversion was calculated in a similar manner to the other C&E scenarios. The NSIP Evaluation documents how this was combined with the other source waters, surface storage, and rate of distribution through the NSIP system.

Groundwater impacts were simulated using the SWIM. The SWIM Baseline Scenario was developed by M&A (2026b) using boundary conditions and fluxes derived from the SVOM future Baseline Scenario. The NSIP Scenario is identical to the SWIM Baseline Scenario except that pumping from all wells within the NSIP area was reduced to zero for all stress periods after October 2035.

Pumping removal implementation

Pumping cessation was implemented by modifying the Well (WEL) package only; all pumping rates for identified NSIP-area wells were set to zero beginning in October 2035. Many wells in SWIM are represented as screened across multiple model layers via the Connected Linear Network (CLN) module, with pumping drawn from the base of each well's CLN network. The CLN module was not modified, so inter-layer connections through each wellbore remain intact. This implementation is equivalent to assuming that wells cease pumping but are not decommissioned.

MODEL RESULTS

Groundwater impacts are assessed differently for the Eastside project concepts that use the SVOM than the coastal 180/400 project concepts that use the SWIM and compared to the SVOM Baseline Scenario and SWIM Baseline Scenario, respectively.

For the Eastside Recharge Basins and Northern Eastside Injection scenarios, results were analyzed in 4 main ways:

1. **Groundwater Level Difference from Baseline:** Groundwater level difference maps show which areas respond most to demand management. Difference maps are calculated for the average of November 2040 and 2041 water levels project scenario minus the baseline, so that positive values correspond to groundwater level rise. The average of these 2 years is used because across the model area, it is generally representative of average conditions and close to the SGMA sustainability deadline. Groundwater level change is not shown for model layer(s) where the aquifer is less than 1 foot thick, as they are defined as pass through cells (M&A 2025).

2. **Groundwater Level Hydrographs:** Groundwater level variation across the projected climate sequence are reviewed to understand the fluctuation across wet and dry years.

3. **Comparison to Groundwater Level SMC:** To assess the impacts of pumping reductions on sustainability, simulated heads at RMS wells are compared to the minimum thresholds and measurable objective for that well. For the SMC assessment, simulated timeseries in RMS wells are bias-adjusted based on the calibration of the historical model. Details on the bias adjustment can be found in the SVOM Update and Projected Baseline Simulation (M&A, 2026).

4. **Change in Groundwater Pumping, Flow, and Storage:** All water budgets are presented for the average of WY 2040-2064. This period represents a 25-year period with climate conditions representative of average historical climate, beginning 5 years after the projects have begun operating.

The Eastside Subbasin contains a single principal aquifer—the Basin Fill Aquifer—so all groundwater-level RMS wells are categorized as Basin Fill and are evaluated together for the SMC assessment. However, groundwater level change maps are presented by 180/400 Subbasin aquifer and the stratigraphically equivalent part of the aquifer in the Eastside Subbasin: the 180-Foot Aquifer and equivalent, the 400-Foot Aquifer and equivalent, and the Deep Aquifers and equivalents. These correspond to model layers 3-5, 7, and 9, respectively.

The Coastal Injection and NSIP scenarios use the SWIM to assess the effect on seawater intrusion in addition to groundwater levels. For these scenarios, results were analyzed in 3 main ways:

1. **Groundwater Level Difference from Baseline:** Groundwater level difference maps show which areas in each subbasin respond most to demand management. Difference maps are calculated for the average of November 2040 and 2041 water levels of the project scenario minus the baseline, so that positive values correspond to a relative increase in groundwater levels. The average of these 2 years is used because across the model area, it is representative of average conditions and close to the SGMA sustainability deadline. Groundwater level change is not shown for model layer(s) where the aquifer is less than 1 foot thick, as they are defined as pass through cells (M&A 2025).

2. **Seawater Intrusion Progression:** Maps of the 500 mg/L chloride isocontour at 2022, 2030, 2040, 2050, and 2060 show how seawater intrusion progresses over time in the 180-Foot Aquifer, 400-Foot Aquifer, and Deep Aquifers under the baseline and project scenarios.

3. **Comparison to Seawater Intrusion SMC:** Maps of the 500 mg/L isocontour in 2040 within the 400-Foot Aquifer for the baseline and project scenario show how close or far the project scenario comes to achieving sustainability.

Eastside Recharge Basins

Groundwater impacts of the Eastside Recharge Basin Scenarios were simulated using the SVOM. Model results show that all 4 Eastside Recharge Basin scenarios lead to higher groundwater levels relative to the Baseline Scenario. In some areas, groundwater levels increase or stabilize, while in others the primary benefit is reduced drawdown rather than full recovery. Groundwater level increases generally extend through most of the aquifer system, becoming slightly smaller with depth, but remaining evident in deeper layers.

Groundwater level change

Figure 5 through Figure 8 compare simulated 2040–2041 groundwater levels in the project scenarios to those of the Baseline Scenario for the 180-Foot and equivalent, 400-Foot and equivalent, and Deep Aquifers. In the figure, the aquifers shown are based on model layer extents and include stratigraphically equivalent aquifers within the same model layer, even if outside of the delineated extent of that aquifer. The results show several consistent patterns. In most cases, water-level increases are similar in the 180-Foot and 400-Foot Aquifers and their equivalents in the Eastside Subbasin and are slightly smaller in the deepest layers. This behavior is consistent with the conceptual model of the Eastside alluvial fans, which, despite containing localized low-permeability lenses, show no evidence of laterally extensive aquitards that would strongly impede vertical flow and substantially attenuate project impacts at depth—particularly for recharge distributed over a broad footprint, as in these scenarios.

The results also show that benefits do not spread uniformly away from the recharge basins, reflecting spatial variability in hydraulic properties. For example, in the 180-Foot and to a lesser extent, the 400-Foot Aquifers, transmissivity increases sharply near the boundary between the 180/400 and Eastside Subbasins. Lower transmissivity east of this boundary supports higher head gradients and greater water-level accumulation near the recharge areas compared to the higher-transmissivity zone to the west. Groundwater level increases are also simulated along portions of the Salinas River corridor, which may reduce stream seepage losses in some reaches and, in other areas, increase baseflow.

Caution Regarding 400 cfs Scenario: Figure 5 though Figure 8 show that in most scenarios groundwater level increases are distributed broadly across the central Eastside rather than being concentrated immediately adjacent to the recharge basins. This pattern reflects an iterative modeling process in which basin locations were progressively spread over a larger footprint to improve the spatial distribution of benefits.

This broadly distributed response is not maintained in the 400 cfs project scenario. In that scenario, recharge basins were placed farther north than the locations identified as most suitable for recharge (Appendix F) to reach a remaining cluster of northern Eastside wells that were not raised above their minimum thresholds by the 200 cfs project. Although this approach largely achieved that objective, the feasibility of surficial recharge at the specific modeled locations is uncertain.

In the model, the location of the northernmost recharge basins coincides with a zone of low transmissivity in both the surficial sediments and the underlying 180-Foot aquifer. As a result, recharge in this area produces extremely large and highly localized groundwater level increases immediately beneath and adjacent to the basins, with simulated rises of up to 160 feet relative to baseline and, in some cases, water levels exceeding ground surface.

This outcome is undesirable for 2 reasons. First, although modeled hydraulic properties are subject to considerable uncertainty, the results provide a clear warning regarding surficial recharge in this area. They underscore the fact that aquifer hydraulic properties represented in the model are bulk, equivalent values that necessarily simplify highly heterogeneous subsurface conditions. It is possible that even lower-permeability zones exist in the shallow subsurface that could substantially impede vertical and lateral flow, limiting basin recharge capacity and leading to ponding beneath recharge facilities even where surface infiltration rates appear favorable.

Second, the benefits of recharge in the 400 cfs scenario are not widely distributed. A more effective approach may have been to deliver less water to the northern Eastside basins and allocate more recharge to the central Eastside, where groundwater level increases are more broadly spread and less prone to extreme local mounding.

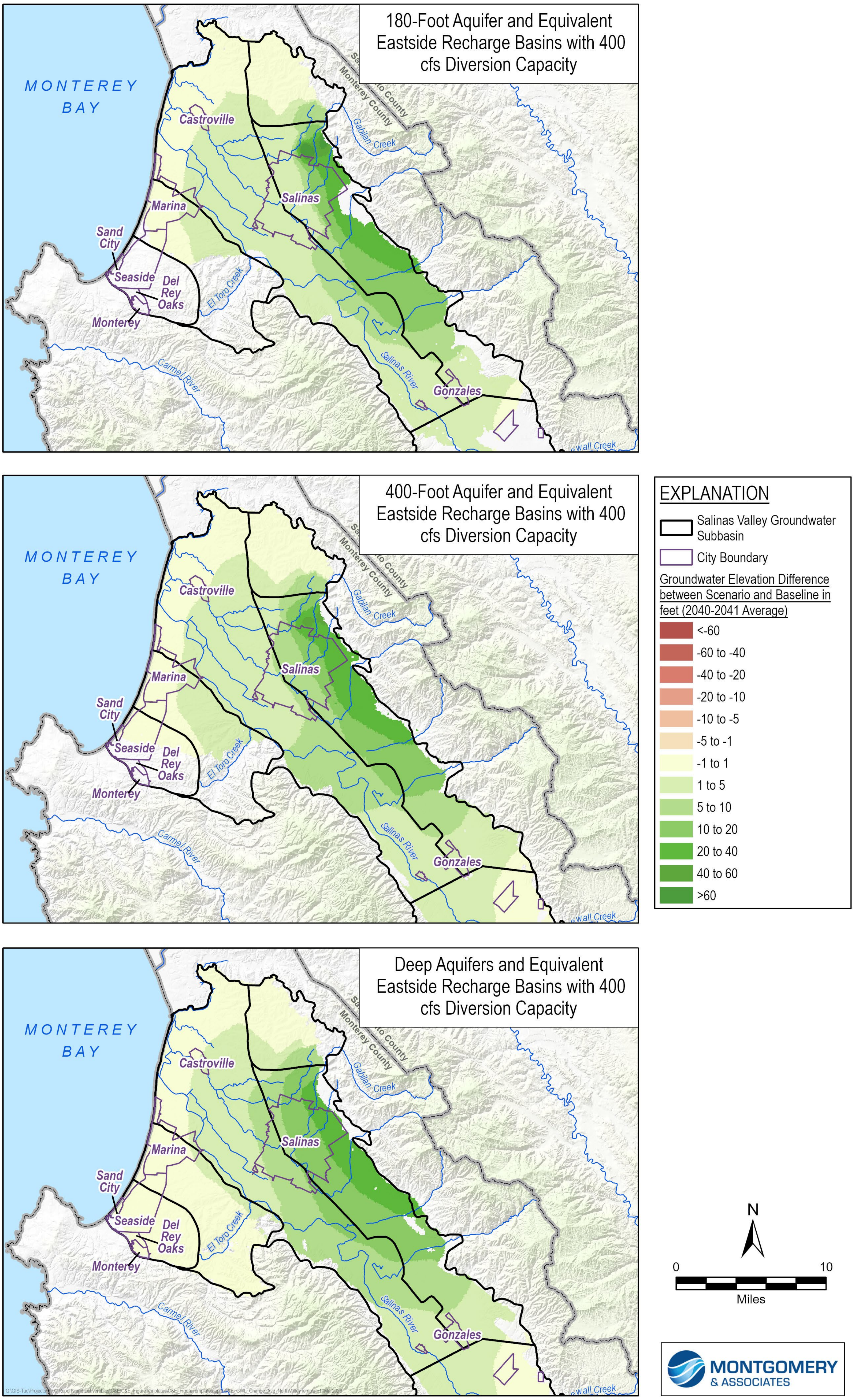


Figure 5. November 2040 and 2041 Average Difference from Baseline for Eastside Recharge Basin 400 cfs Scenario

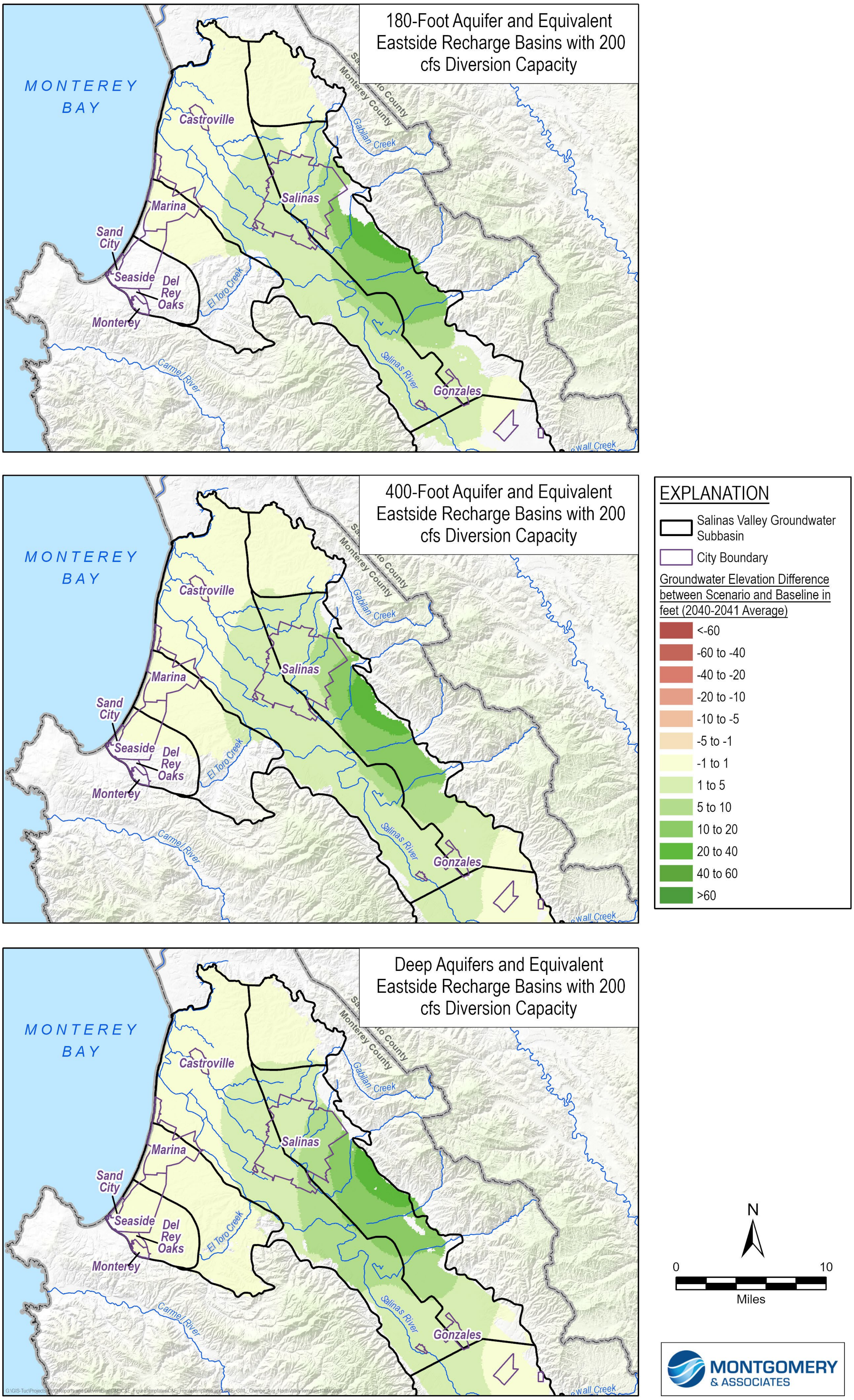


Figure 6. November 2040 and 2041 Average Difference from Baseline for Eastside Recharge Basin 200 cfs Scenario

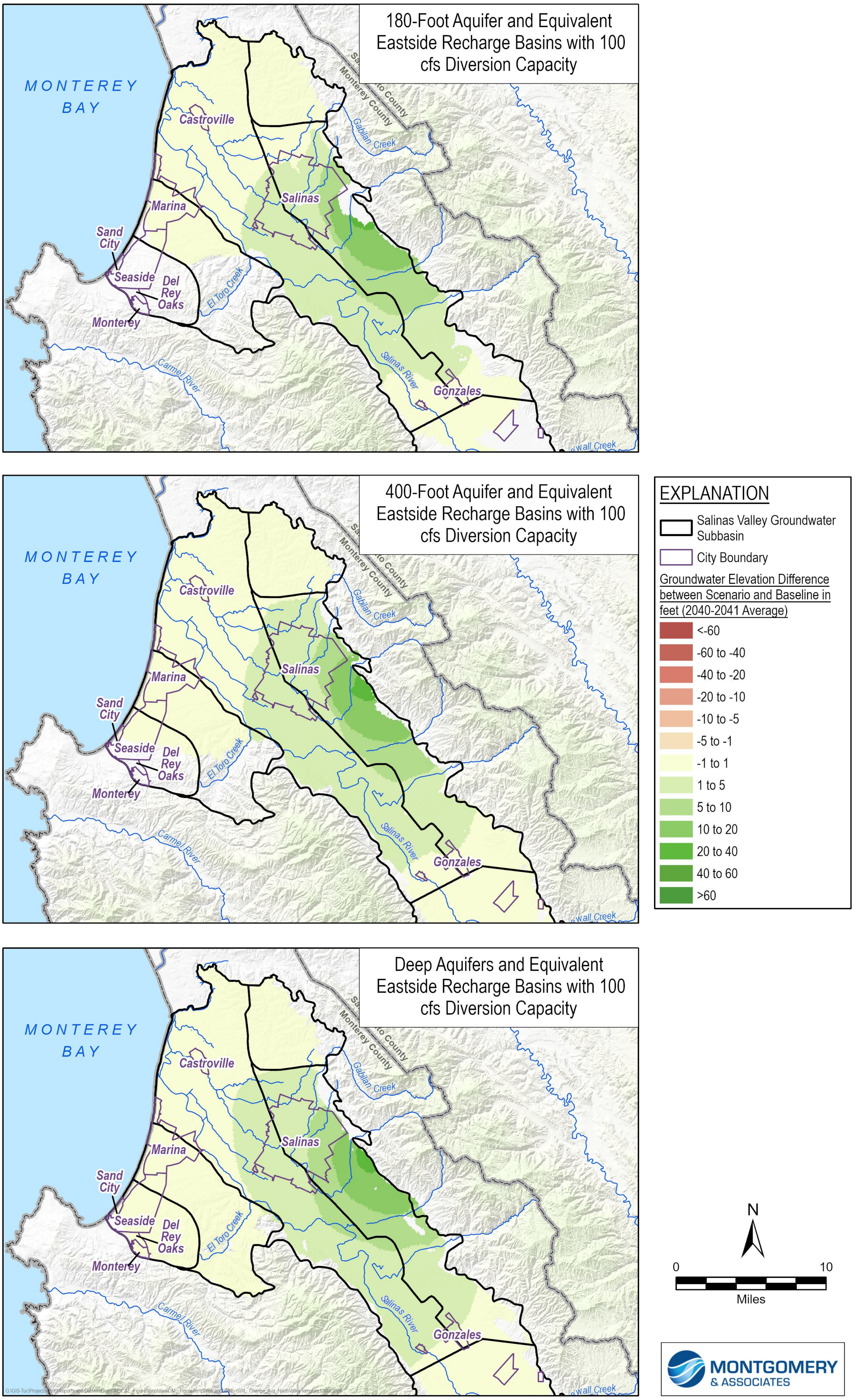


Figure 7. November 2040 and 2041 Average Groundwater Level Difference from Baseline for Eastside Recharge Basin 100 cfs Scenario

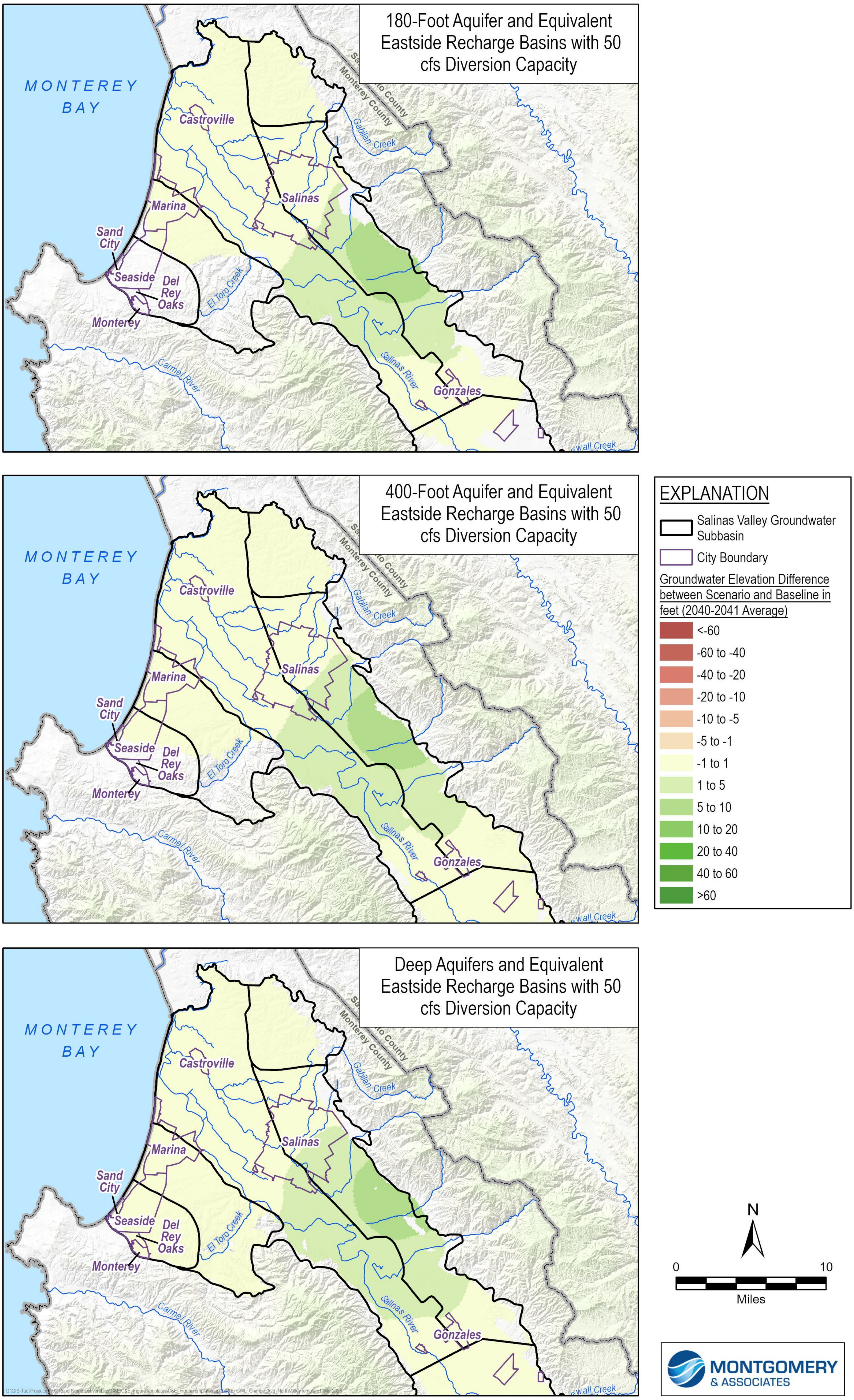


Figure 8. November 2040 and 2041 Average Difference from Baseline for Eastside Recharge Basin 50 cfs Scenario

Representative hydrographs

In many RMS wells, simulated groundwater levels rise above and fall below their minimum thresholds multiple times over the course of the simulation period. Several factors drive the observed patterns. First, the climate sequence used for the future projections (M&A, 2026) is a primary driver of both annual and multi-year variability. Drought years tend to draw down groundwater levels, increasing the number of wells below their minimum thresholds, while wet years generally have the opposite effect. Climate-driven patterns that are evident in the Baseline Scenario are amplified in the project scenarios because diversion and recharge volumes, and the associated groundwater level increases, are greater during wet years than during dry years.

The distance between the monitoring well and the recharge basins also affects the extent to which each scenario raises groundwater levels. Figure 9 shows the hydrograph for a well in the northern Eastside Subbasin. The 400 cfs diversion has a noticeably larger effect on groundwater levels than the other scenarios. This is in large part because only that scenario had recharge basins in this vicinity. On Figure 11, the 50 cfs scenario has the least effect on groundwater levels; however, it is not only the smallest diversion scenario, but that scenario also has no recharge basins in the vicinity of the monitoring well.

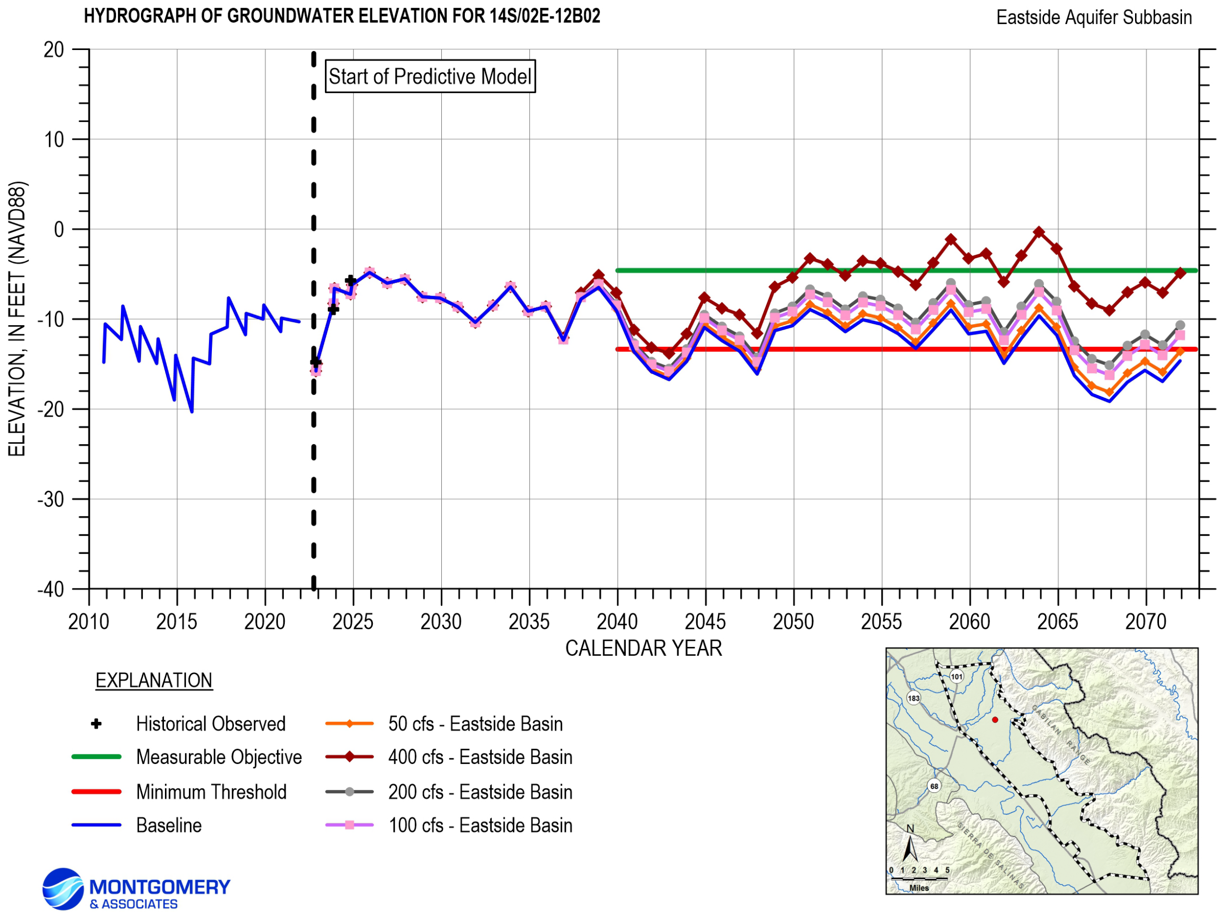


Figure 9. Simulated Groundwater Level Hydrograph for Baseline and Eastside Recharge Basin Scenarios in Well 14S02E12B02

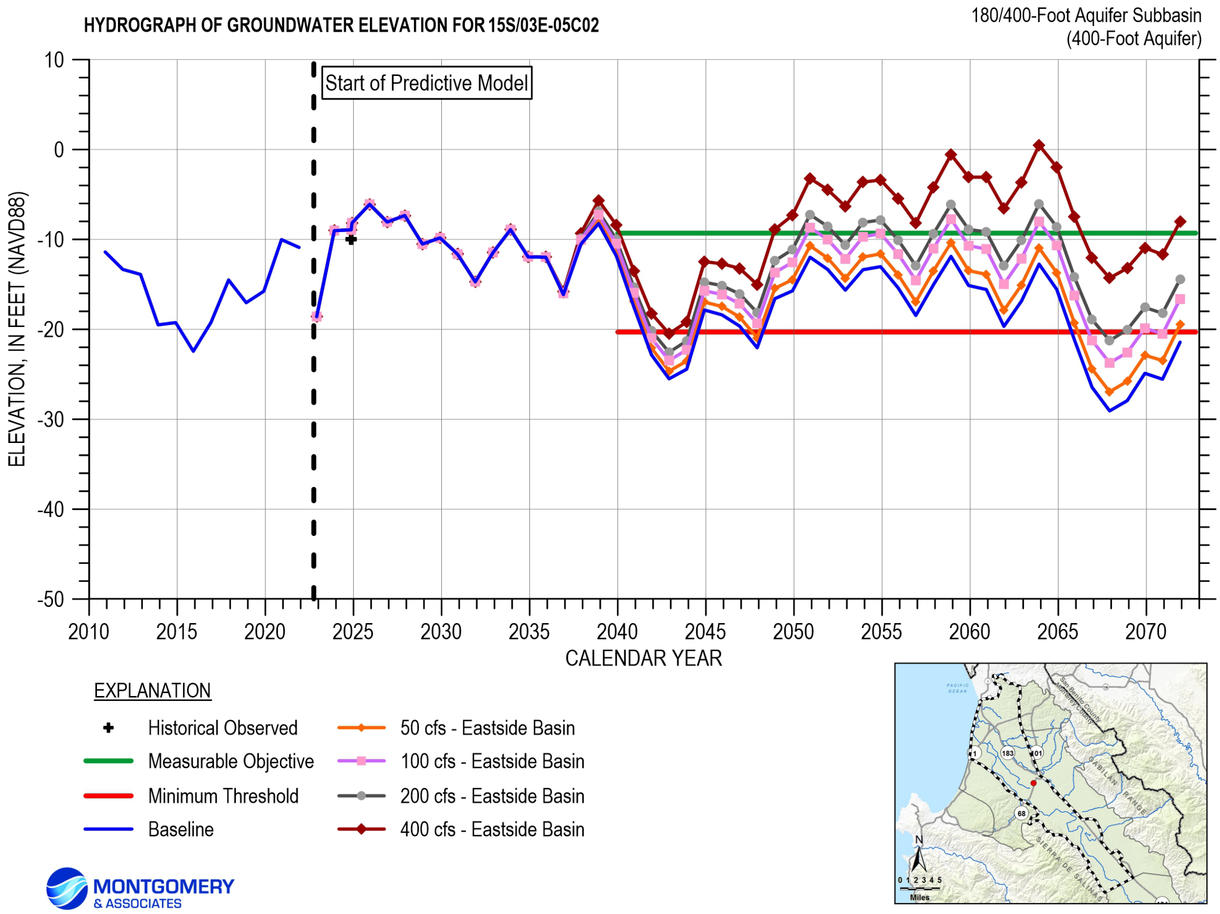


Figure 10. Simulated Groundwater Level Hydrograph for Baseline and Eastside Recharge Basin Scenarios in Well 15S03E05C02

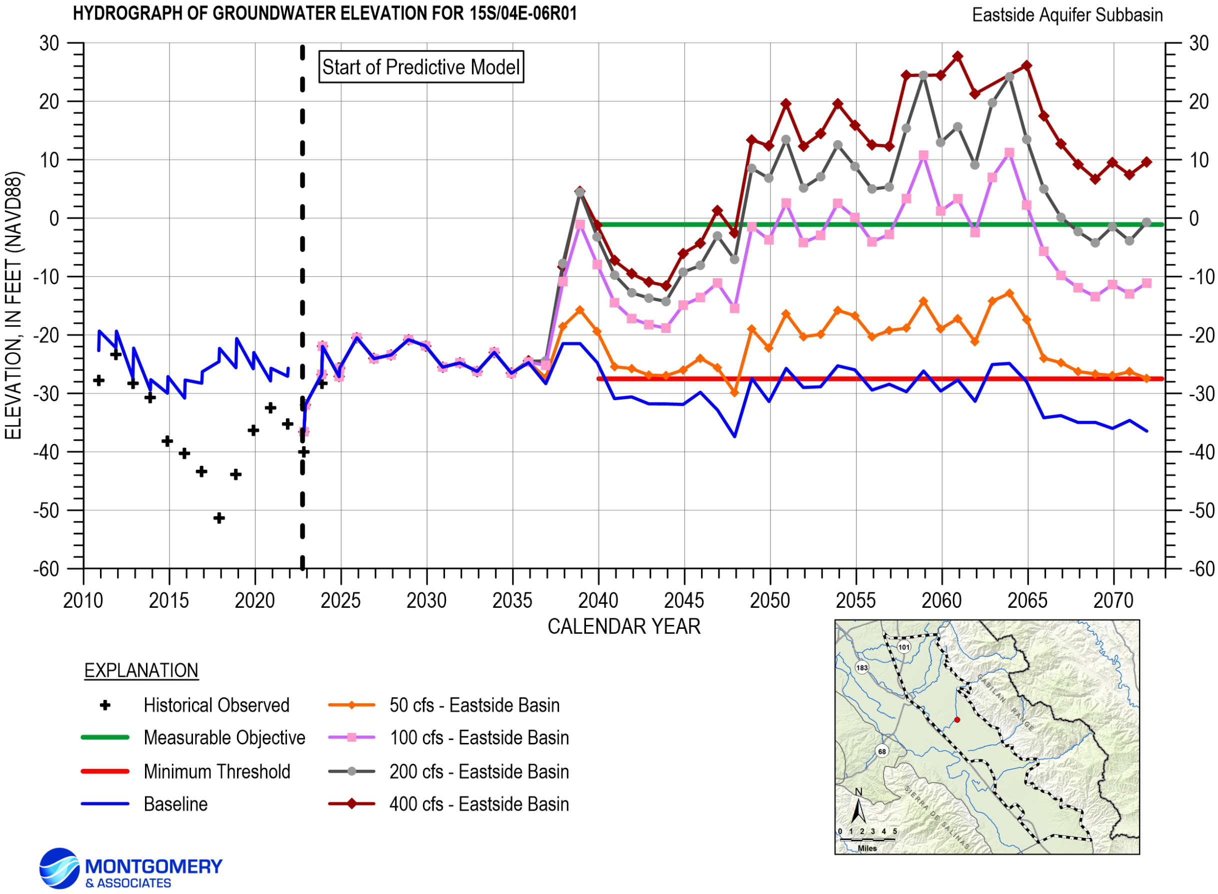


Figure 11. Simulated Groundwater Level Hydrograph for Baseline and Eastside Recharge Basin Scenarios in Well 15S04E06R01

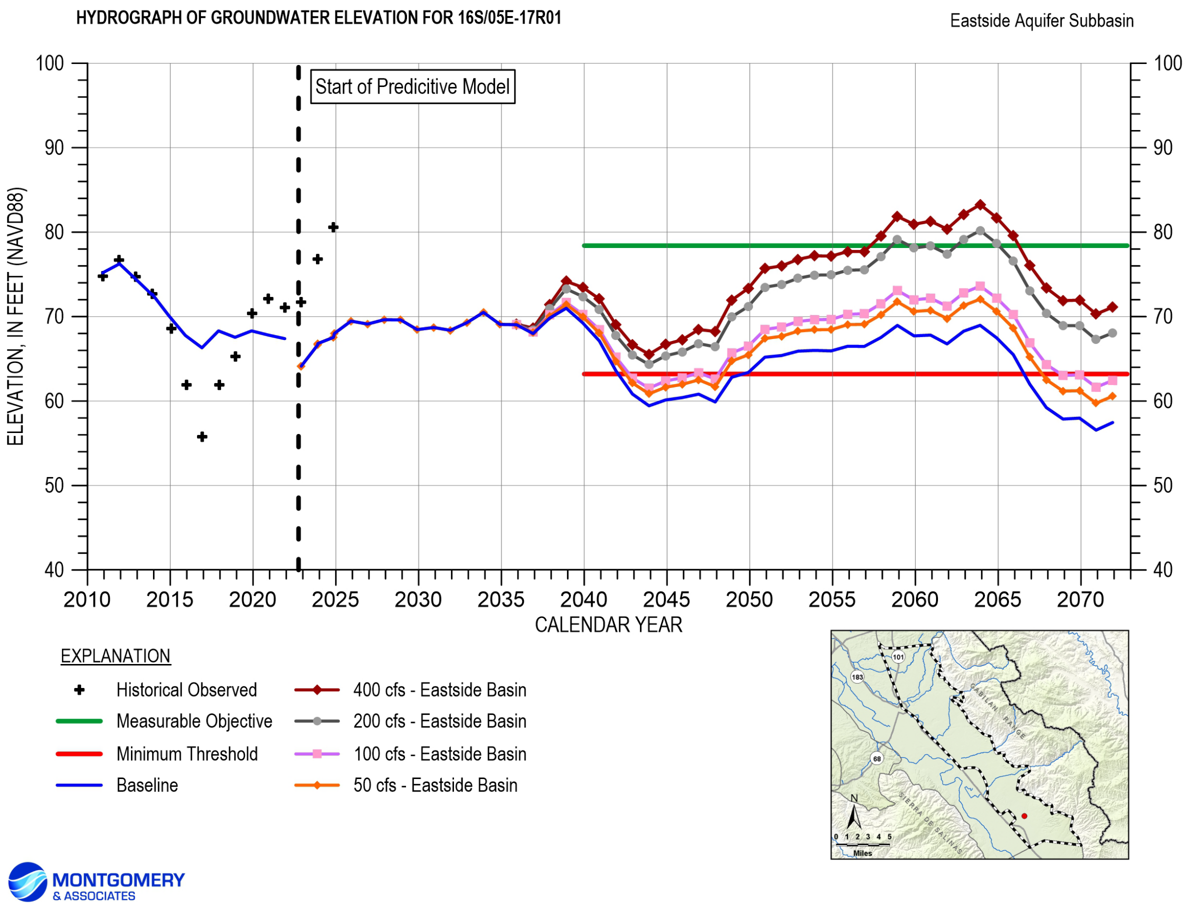


Figure 12. Simulated Groundwater Level Hydrograph for Baseline and Eastside Recharge Basin Scenarios in Well 16S05E17R01

Comparison to Groundwater Level SMC

Table 3 summarizes the percentage of wells for which simulated groundwater levels were below their minimum thresholds during the sustainability evaluation period of 2040–2041. For the Eastside Subbasin, the Baseline Scenario results in 62% of wells below their minimum thresholds during the evaluation period. The Eastside Recharge Basin projects lower this percentage to between 52% and 14%, an improvement of 10% to 48%. While not the target of these project concepts, the 180/400 Subbasin also sees modest improvements of 2% to 12%. As anticipated, scenarios with higher diversion and recharge volumes result in fewer RMS wells below minimum thresholds. Table cells highlighted in light green indicate the number of wells with groundwater levels below the minimum threshold is lower than 15%, and therefore there is no undesirable result.

Table 3 Percentage of RMS Wells with Water Levels Simulated Below Their MT During 2040-2041 Evaluation Period for the Eastside Recharge Basin Scenarios

Subbasin*	Wells Evaluated	Single well %	Baseline	Eastside Recharge Basins			
				50 cfs	100 cfs	200 cfs	400 cfs
Eastside	29	3%	62%	52%	31%	28%	14%
180/400	66	2%	73%	71%	68%	64%	61%

* Projects have no impact on percentages in other subbasins

Figure 13 shows the percentage of RMS wells in the Eastside Subbasin that are below their minimum thresholds at the end of November for each simulated year under the Baseline and Eastside Recharge Basin Scenarios. The relative improvements associated with the 4 proposed Eastside Recharge Basin scenarios vary from year to year.

In addition to the climate sequence discussed above, elapsed time also influences these patterns. In many wells and across all scenarios, time allows longer-term trends—primarily drawdown, but in some cases recovery—to become more fully expressed, resulting in wells falling progressively farther below their minimum thresholds. In the project scenarios, however, time allows groundwater level increases caused by the project’s recharge to accumulate after it begins 2035. This cumulative effect is evident in the simulated hydrographs for individual wells, such as those shown on Figure 9. These hydrographs also illustrate how benefits accumulate over time, with relative increases over the baseline often most pronounced during wet years when diversion and recharge volumes are highest.

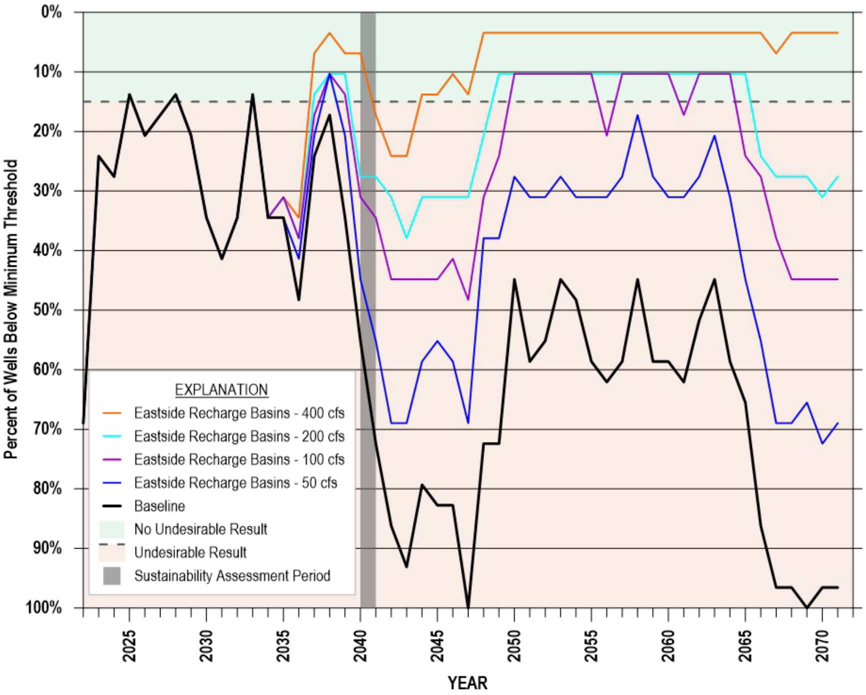


Figure 13. Percentage of RMS Wells with November Water Levels Simulated Below their MT for Years 2022-2072

A spatial pattern, not immediately apparent from this presentation of the results, is evident on Figure 13. In the 100, 200, and 400 cfs scenarios, there are many years in which the percentage of wells below their minimum thresholds remains unchanged, despite the presence of year-to-year variability in the baseline and 50 cfs scenarios. This plateau in benefit reflects the limited spatial extent of recharge from the basins: groundwater level increases are greatest near the recharge facilities and diminish with distance to varying degrees, depending on local hydrogeologic conditions.

The extent of the project benefit, measured in terms of wells rising above their minimum thresholds (and, in some cases, their measurable objectives) can be seen on Figure 14 through Figure 17, which map RMS well groundwater levels relative to the SMC in the Baseline Scenario. These figures show that the 50 cfs scenario, and even more so the 100 cfs scenario, leads to most of the RMS wells in the central portion of the Eastside Subbasin rising above their minimum thresholds. However, the cluster of wells in the northern Eastside Subbasin, in and around the City of Salinas, does not begin to see improvement until substantial recharge occurs in the basins to the east and northeast of the City.

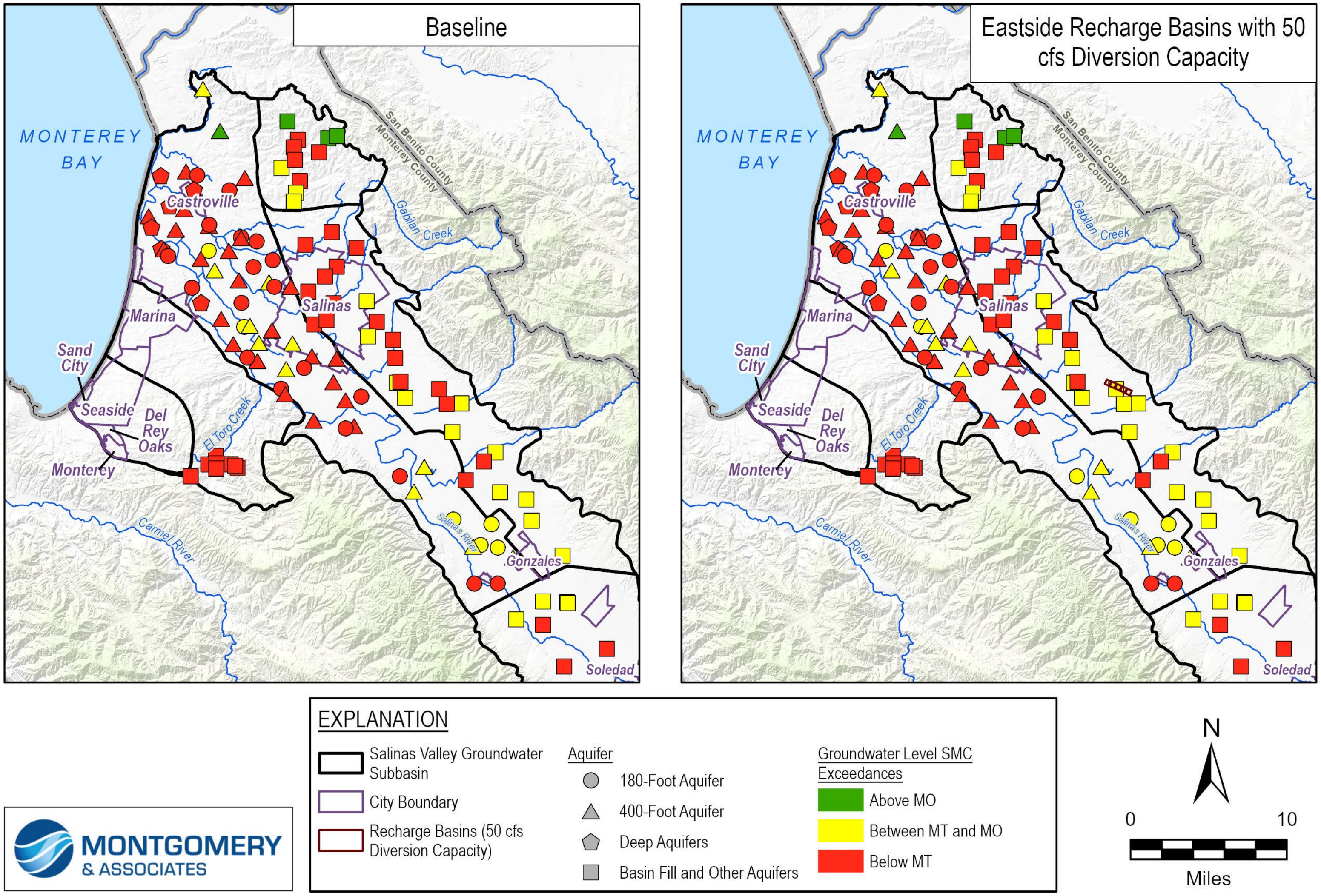


Figure 14. Groundwater Level SMC Assessment in the Baseline and Eastside Basin 50 cfs Scenario During 2040-2041 Evaluation Period

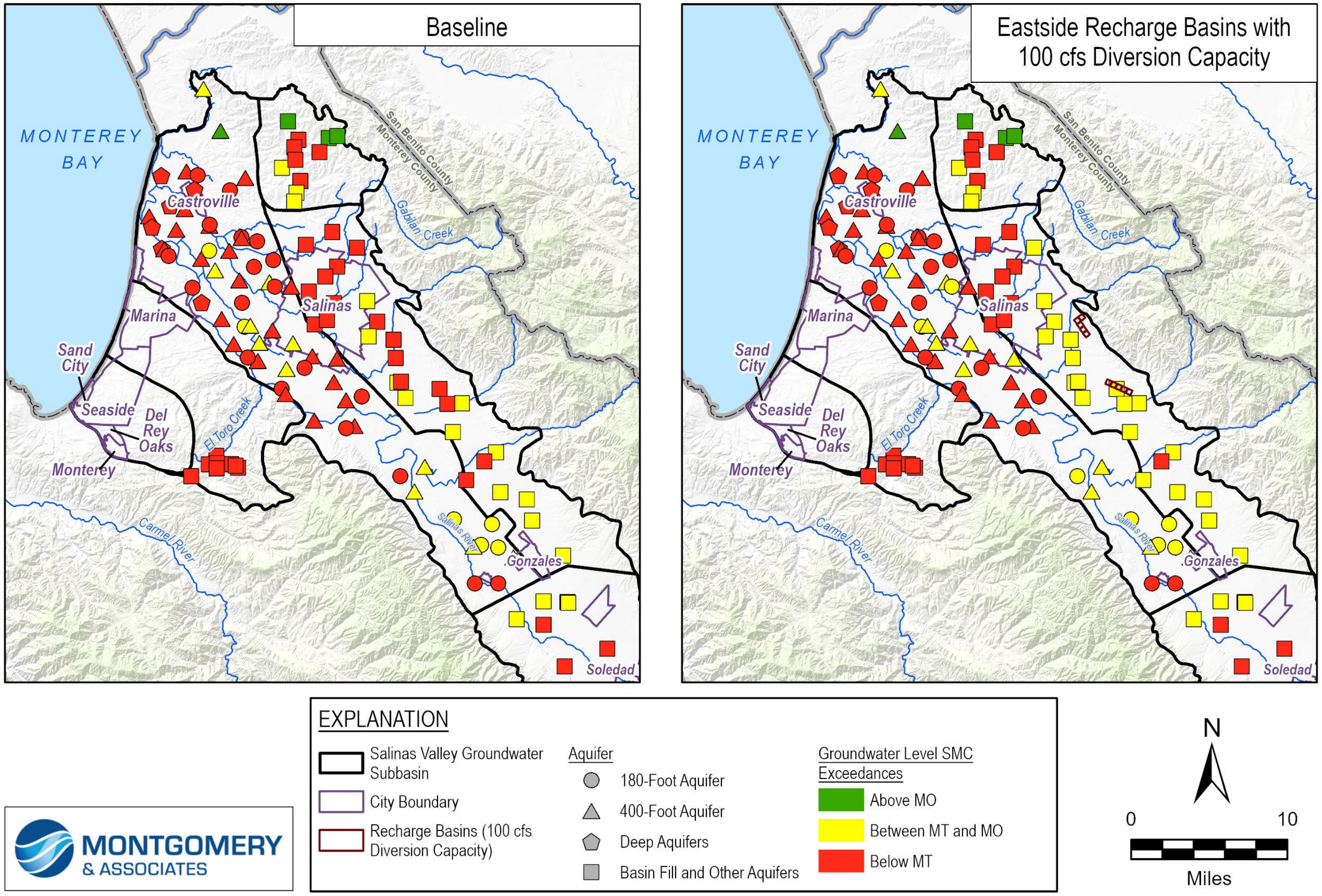


Figure 15. Groundwater Level SMC Assessment in the Baseline and Eastside Basin 100 cfs Scenario During 2040-2041 Evaluation Period

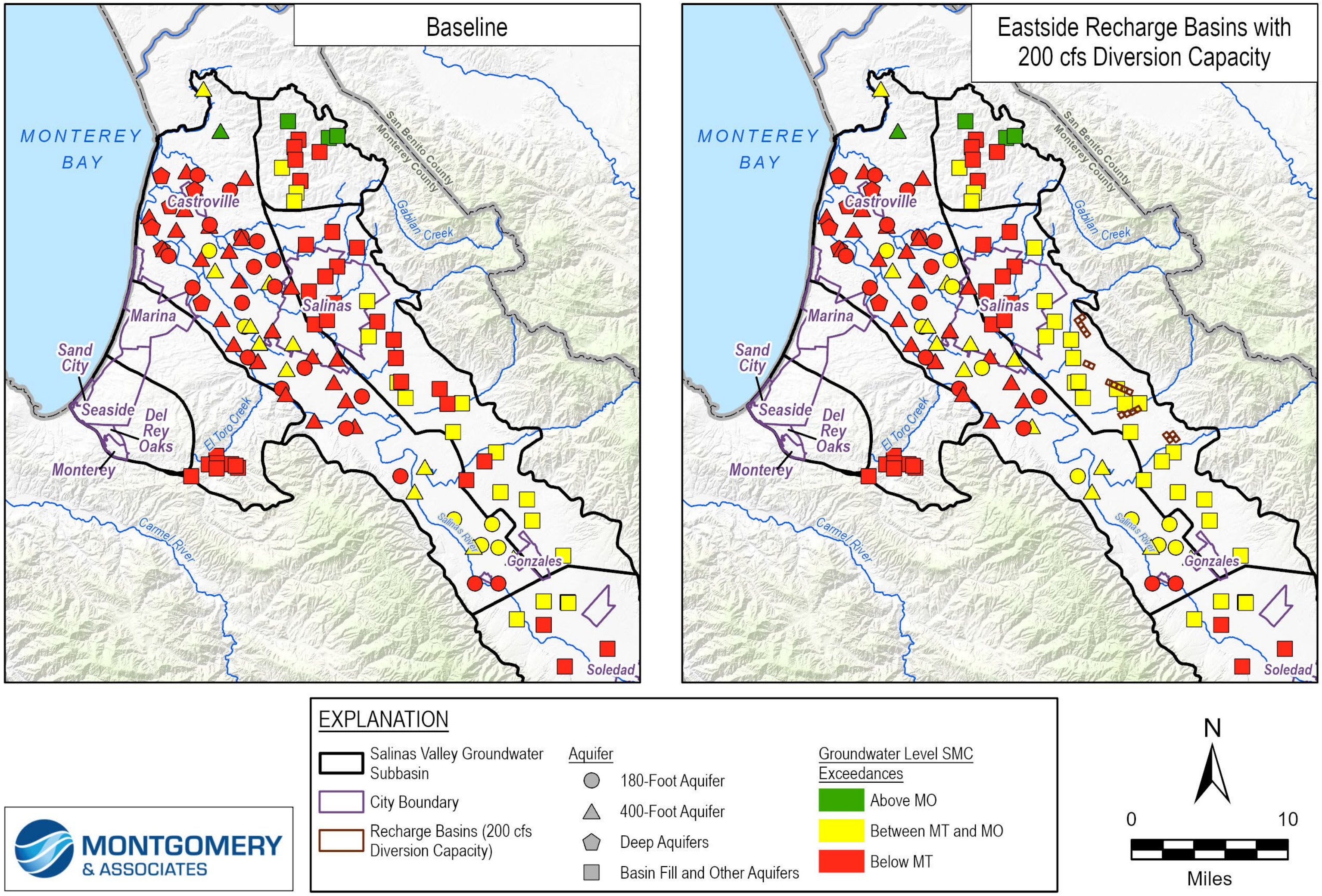


Figure 16. Groundwater Level SMC Exceedances in the Baseline and Eastside Basin 200 cfs Scenario During 2040-2041 Evaluation Period

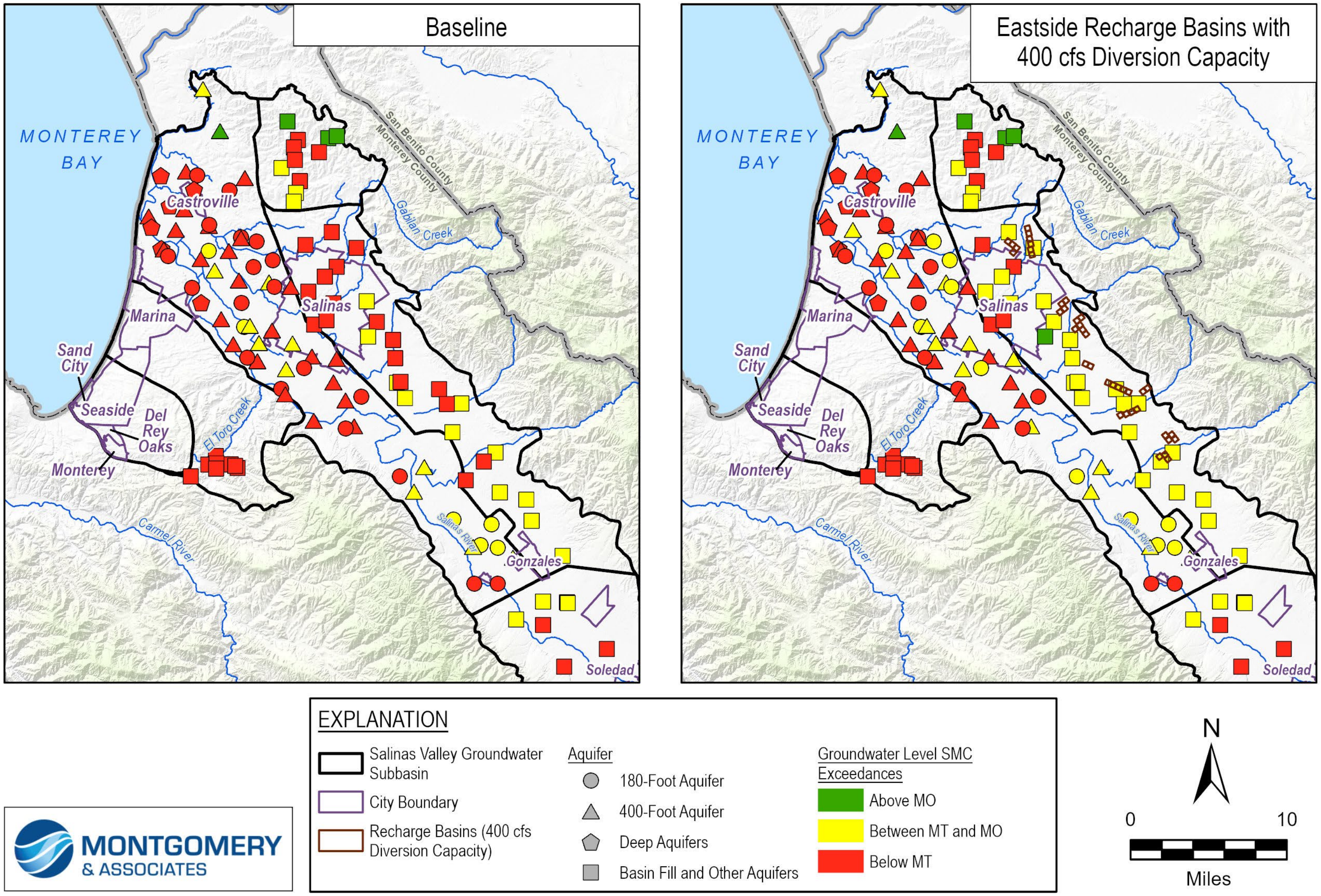


Figure 17. Groundwater Level SMC Exceedances in the Baseline and Eastside Basin 400 cfs Scenario During 2040-2041 Evaluation Period

Changes in groundwater pumping, flow, and storage

Table 4 summarizes the average annual net change in groundwater storage over the 25-year simulation period for all subbasins and model scenarios. For the Eastside Recharge Basin scenarios, modeled storage increases in the Eastside Subbasin range from approximately 1,100 to 7,700 AF/year relative to baseline. Two key patterns are evident. First, storage gains are not confined to the Eastside Subbasin; substantial increases also occur in adjacent subbasins. Second, the total net increase in groundwater storage is considerably smaller than the average annual recharge volumes applied by the projects.

These patterns are examined more closely in Table 5. Comparison of the model-wide change in groundwater storage with total project recharge shows that, on average, net increases in storage represent only about 35% to 49% of the applied recharge volumes. This reflects the integrated system response to recharge, including changes in flow gradients and boundary fluxes, rather than the fate of recharge water itself. The Eastside Subbasin accounts for approximately 60% of the total storage increase, with the remainder distributed among adjacent subbasins.

Table 4. Average Annual Net Storage Change over Model Years 2040-2064, for the Eastside Recharge Basin Scenarios

Scenario	Eastside	180/400	Langley	Forebay	Upper Valley	Monterey	Seaside
Baseline	-900	-500	600	-400	-200	-7,600	-2,600
Eastside Recharge Basins 50 cfs Scenario	200	-200	700	-300	-200	-7,400	-2,600
Eastside Recharge Basins 100 cfs Scenario	1,500	100	800	-200	-200	-7,100	-2,500
Eastside Recharge Basins 200 cfs Scenario	3,100	500	900	0	-200	-6,900	-2,500
Eastside Recharge Basins 400 cfs Scenario	6,800	1,100	2,200	100	-100	-6,200	-2,300

All values in AFY

Table 5. Relative Storage Increase by Eastside Recharge Basin Scenarios over Baseline for the Eastside Recharge Basin Scenarios

Scenario	Average annual project recharge (AF/year)	Storage increase								
		Model-wide average annual increase in storage (AF/year)	Model-wide storage increase as % of project recharge	% in Eastside	$ in 180/400	% in Langley	% in Monterey	% in Forebay	% in Seaside	% in Upper Valley
Eastside Recharge Basins 50 cfs Scenario	5,100	1,806	35%	61%	16%	4%	11%	6%	2%	0%
Eastside Recharge Basins 100 cfs Scenario	9,700	4,099	42%	60%	15%	6%	13%	4%	3%	0%
Eastside Recharge Basins 200 cfs Scenario	17,200	6,637	39%	61%	15%	4%	11%	6%	2%	0%
Eastside Recharge Basins 400 cfs Scenario	26,800	13,227	49%	59%	13%	12%	11%	4%	2%	0%

Stream seepage

Stream seepage results (Table 6) indicate that net seepage from streams to groundwater decreases under the recharge basin scenarios relative to Baseline Scenario, with the largest reductions occurring in the 180/400 Subbasin. This reduction is consistent with higher groundwater levels near the Salinas River corridor in the project scenarios, which reduces head gradients from the river to the aquifer and therefore reduces seepage losses. As shown in Table 7, model-wide seepage reductions represent a substantial fraction of applied project recharge, indicating that a portion of the project benefit manifests as reduced stream losses and redistributed boundary fluxes rather than as a one-for-one increase in stored groundwater.

Table 6. Average Annual Net Stream Seepage (into aquifer) over Model Years 2040-2064

Scenario	Eastside	180/400	Langley	Forebay	Monterey	Seaside	Upper Valley
Baseline	7,100	55,400	1,900	118,600	4,500	1,000	95,300
Eastside Recharge Basins 50 cfs Scenario	7,100	52,700	1,900	117,900	4,500	1,000	95,300
Eastside Recharge Basins 100 cfs Scenario	7,000	51,000	1,900	117,600	4,400	1,000	95,300
Eastside Recharge Basins 200 cfs Scenario	7,000	47,200	1,900	116,200	4,400	1,000	95,200
Eastside Recharge Basins 400 cfs Scenario	7,000	45,100	1,800	115,600	4,300	1,000	95,200

All values in AFY

Table 7. Relative Reduction in Stream Seepage by Project Scenarios over Baseline

		Stream seepage reduction								
	Average annual project recharge (AF/year)	**Model-wide average annual stream seepage reduction (AF/year)**	**Model-wide stream seepage reduction as % of project recharge**	**% in Eastside**	**% in 180/400**	**% in Langley**	**% in Monterey**	**% in Forebay**	**% in Seaside**	**% in Upper Valley**
Eastside Recharge Basins 50 cfs Scenario	5,100	-3,452	-68%	0%	78%	0%	1%	20%	0%	0%
Eastside Recharge Basins 100 cfs Scenario	9,700	-5,559	-57%	1%	79%	0%	2%	19%	0%	0%
Eastside Recharge Basins 200 cfs Scenario	17,200	-10,839	-63%	0%	76%	0%	1%	22%	0%	0%
Eastside Recharge Basins 400 cfs Scenario	26,800	-13,779	-51%	1%	75%	0%	2%	22%	0%	0%

Groundwater pumping

Groundwater pumping changes are summarized in Table 8. For the Eastside Recharge Basin scenarios, the primary modeled pumping reduction is attributable to removal of agricultural demand within recharge basin footprints beginning in 2035. As a result, pumping reductions occur consistently across years and are not tied to the timing of diversion and recharge events. Additional small decreases in groundwater pumping are seen in the 180/400 and Forebay Subbasins and are caused by an increase in transpiration of newly reachable groundwater by crops.

Table 8. Average Annual Groundwater Pumping over Model Years 2040-2064

Scenario	Eastside	180/400	Langley	Forebay	Monterey	Seaside	Upper Valley
Baseline	82,600	108,400	2,300	138,600	9,800	900	94,500
Eastside Recharge Basins 50 cfs Scenario	82,100	108,300	2,300	138,500	9,800	900	94,500
Eastside Recharge Basins 100 cfs Scenario	81,600	108,200	2,300	138,500	9,800	900	94,500
Eastside Recharge Basins 200 cfs Scenario	80,700	108,100	2,300	138,500	9,800	900	94,500
Eastside Recharge Basins 400 cfs Scenario	79,200	107,900	2,300	138,500	9,800	900	94,500

All values in AFY

Inter-subbasin groundwater flow

Inter-subbasin groundwater flows (Table 9) shift under the recharge basin scenarios in a manner consistent with increased heads in the Eastside Subbasin. In general, flows from the 180/400 Subbasin to the Eastside decrease as recharge increases, reflecting reduced hydraulic gradients across the subbasin boundary. Smaller changes are also simulated for other inter-subbasin flow components, indicating that project recharge alters regional gradients and redistributes groundwater movement beyond the immediate recharge footprint.

Table 9. Average Annual Inter-subbasin Flow over Model Years 2040-2064

Scenario	180/400 to Eastside	Forebay to Eastside	Langley to Eastside	Forebay to 180/400	Monterey to 180/400	Langley to 180/400	Upper valley to Forebay
Baseline	41,400	6,400	4,200	29,900	21,100	500	25,600
Eastside Recharge Basins 50 cfs Scenario	37,100	6,200	4,100	29,200	20,700	500	25,600
Eastside Recharge Basins 100 cfs Scenario	33,700	6,100	3,900	28,900	20,000	500	25,600
Eastside Recharge Basins 200 cfs Scenario	27,300	5,700	3,800	27,500	19,600	500	25,600
Eastside Recharge Basins 400 cfs Scenario	21,600	5,500	2,400	26,900	18,200	600	25,600

All values in AFY

Northern Eastside injection

Groundwater impacts of the 2 Northern Eastside Injection Scenarios were modeled with the SVOM. Both scenarios lead to higher groundwater levels relative to the Baseline Scenario, with benefits concentrated near the injection field and reflecting the lower transmissivity conditions in the northern Eastside Subbasin. Groundwater level increases also propagate into adjacent subbasins, and both scenarios reduce the percentage of RMS wells below their minimum thresholds during the 2040–2041 evaluation period, though neither avoids an undesirable result in the Eastside Subbasin. Compared to the recharge basin scenarios, the injection scenarios produce a more localized response and a larger share of storage gains in adjacent subbasins, particularly the Langley Subbasin.

Groundwater level change

Figure 18 and Figure 19 compare simulated 2040–2041 groundwater levels in the injection scenarios to the baseline scenario for the 180-Foot, 400-Foot, and Deep Aquifers. In the figure, the aquifers shown are based on model layer extents and include stratigraphically equivalent aquifers within the same model layer, even if outside of the delineated extent of that aquifer. As with the recharge basin scenarios, the vertical and lateral distribution of water-level increases reflects both the conceptual hydrogeology and spatial variability in hydraulic properties. However, because recharge is introduced through injection wells, the response is expected to be more localized near the injection field and more dependent on (1) the model layers in which injection was applied, and (2) the degree of vertical connectivity between aquifers in the Northern Eastside area. The low transmissivity zone in the northern Eastside Subbasin is evident where groundwater level rises are limited to the immediate vicinity of the injection wells.

Compared to the recharge basin scenarios, the injection scenarios produce more concentrated groundwater level increases near the recharge locations, consistent with the localized nature of injection and the lower transmissivity conditions in the northern Eastside. At the same time, model results indicate that groundwater level increases propagate into adjacent areas, including portions of the 180/400 and Langley Subbasins, reflecting regional hydraulic connectivity in the simulated system.

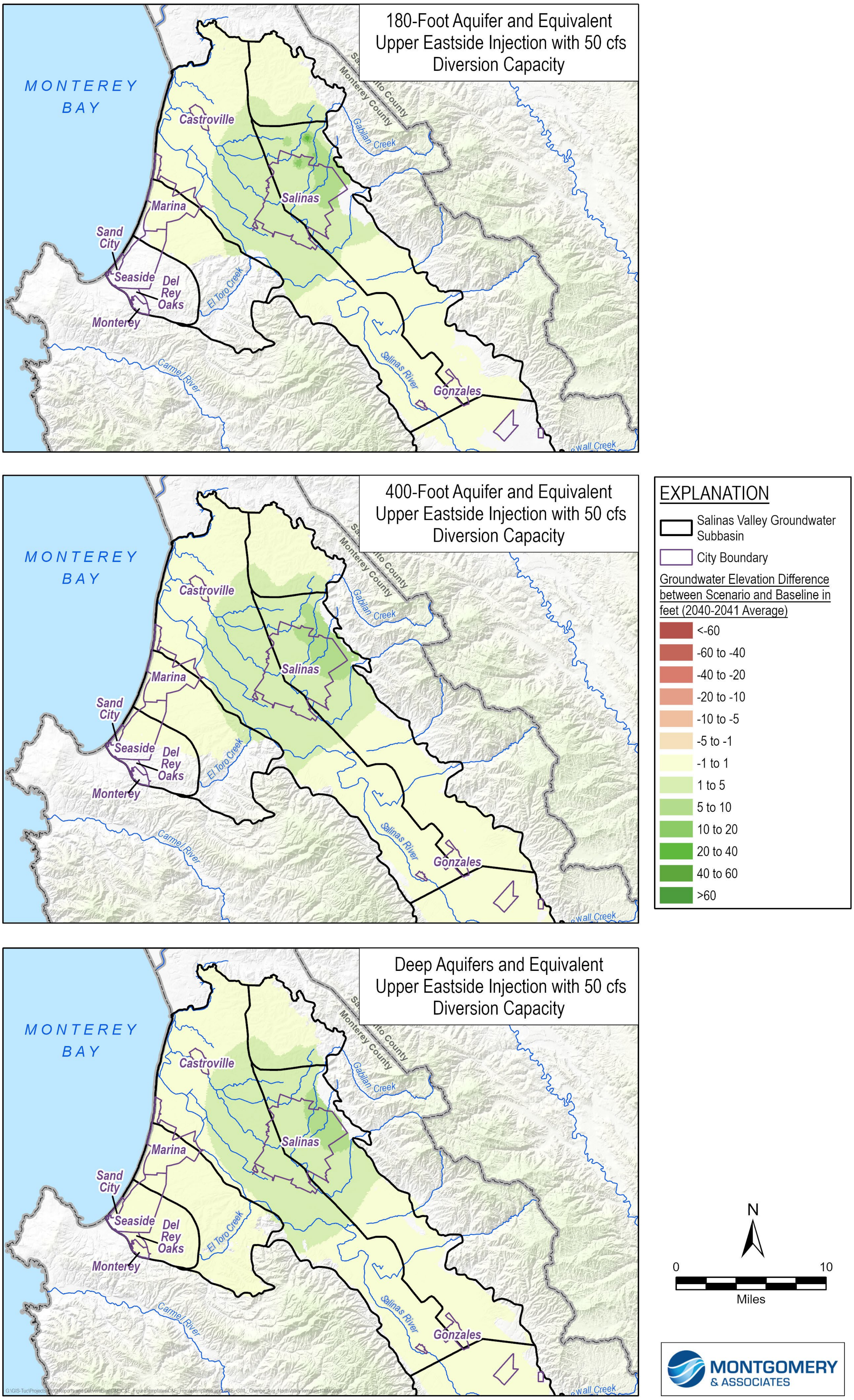


Figure 18. Difference Between North Eastside Injection Project (50cfs) Average November 2040-2041 Water Levels and Baseline Scenario for 180-Foot, 400-Foot, and Deep Aquifers

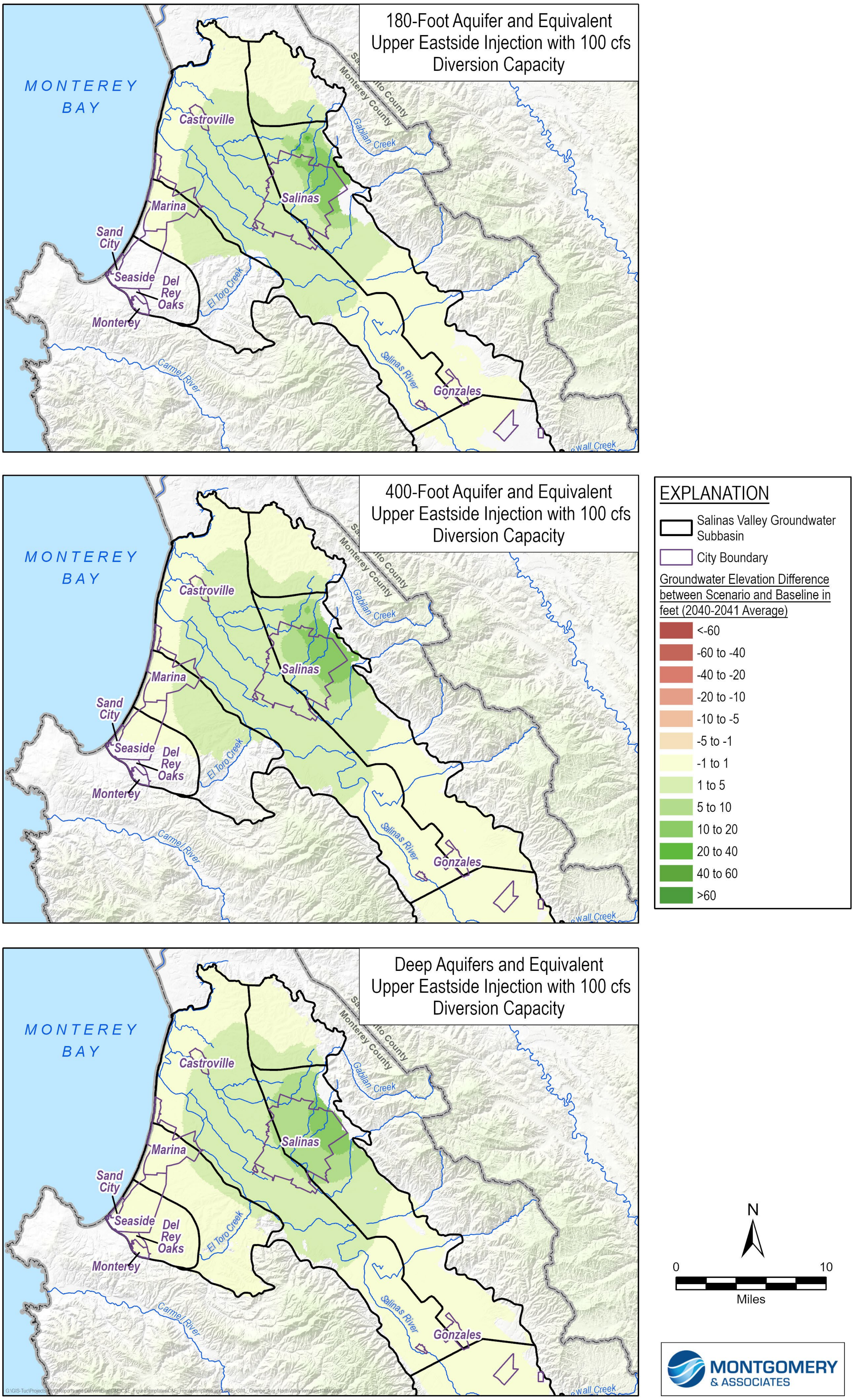


Figure 19. Difference Between North Eastside Injection Project (100cfs) Average November 2040-2041 Water Levels and Baseline Scenario for 180-Foot, 400-Foot, and Deep Aquifers

Representative hydrographs

In many RMS wells, simulated groundwater levels rise above and fall below their minimum thresholds multiple times over the course of the simulation period, as shown on Figure 20 to Figure 23. Several factors drive the observed patterns. First, the climate sequence used for the future projections (M&A, 2026) is a primary driver of both annual and multi-year variability. Drought years tend to draw down groundwater levels, increasing the number of wells below their minimum thresholds, while wet years generally have the opposite effect. Climate-driven patterns that are evident in the Baseline Scenario are amplified in the project scenarios because diversion and recharge volumes, and the associated groundwater level increases, are greater during wet years than during dry years. Due to surface water storage required for treatment, this amplification is less than under the recharge basin scenarios.

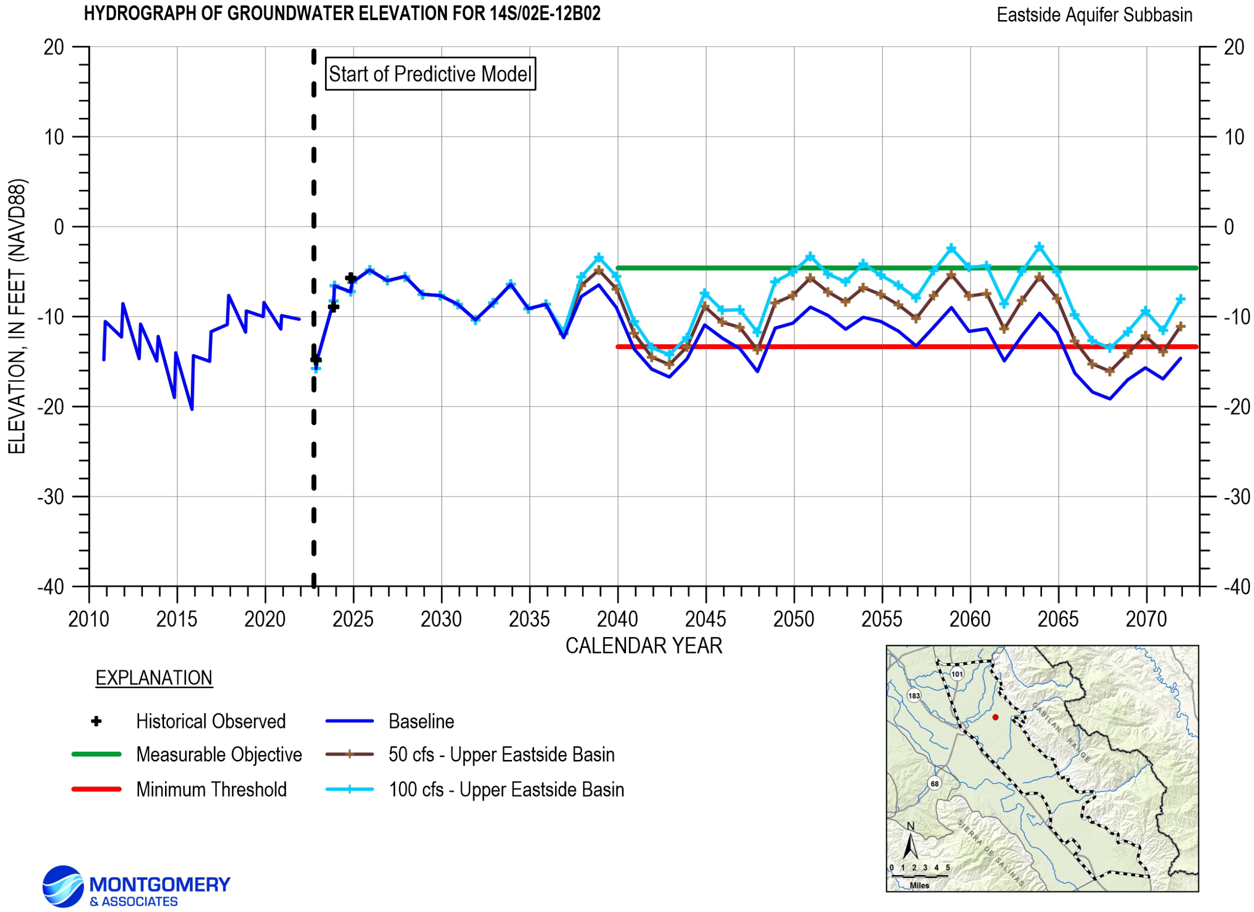


Figure 20. Simulated Groundwater Level Hydrograph for Baseline and Eastside Injection Scenarios in Well 14S02E12B02

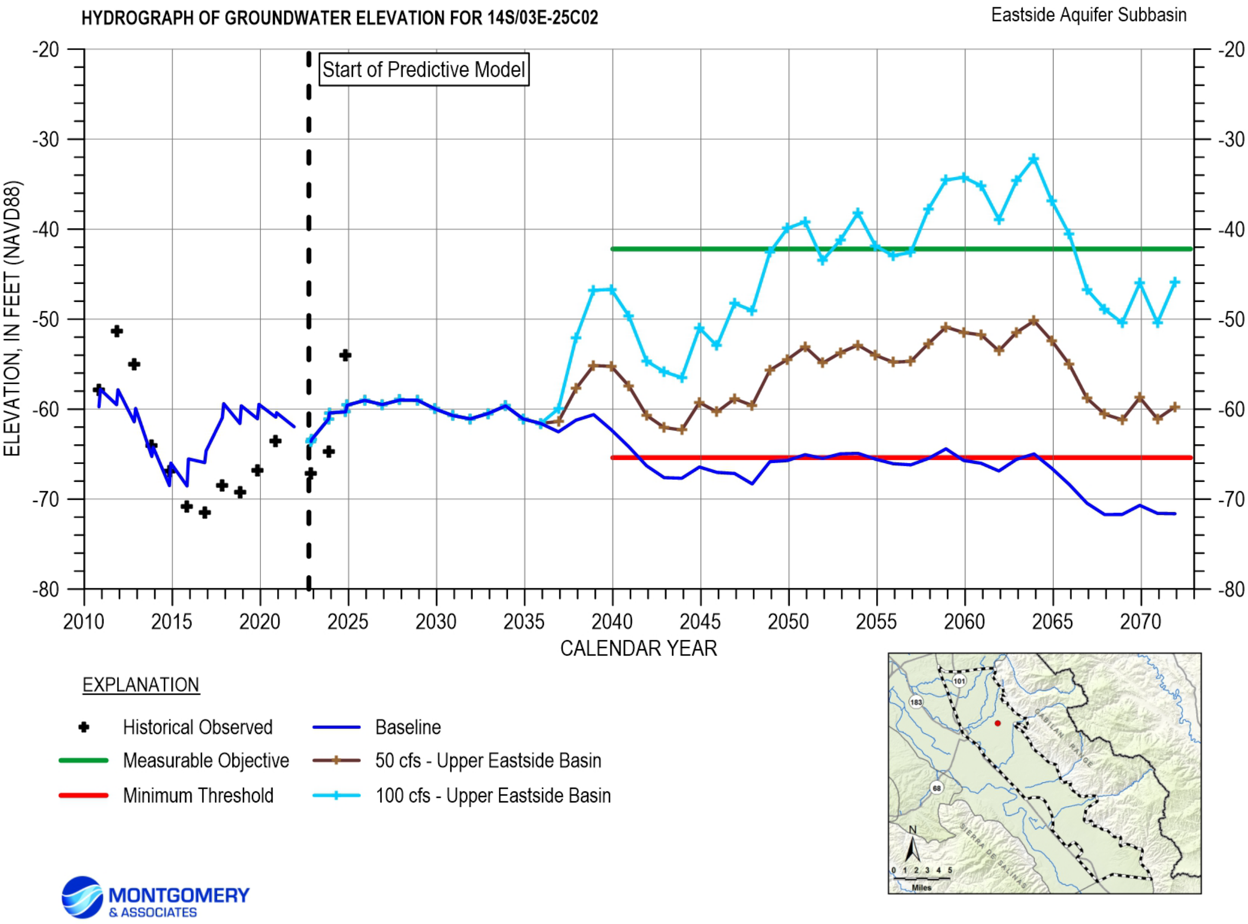


Figure 21. Simulated Groundwater Level Hydrograph for Baseline and Eastside Injection Scenarios in Well 14S03E25C02

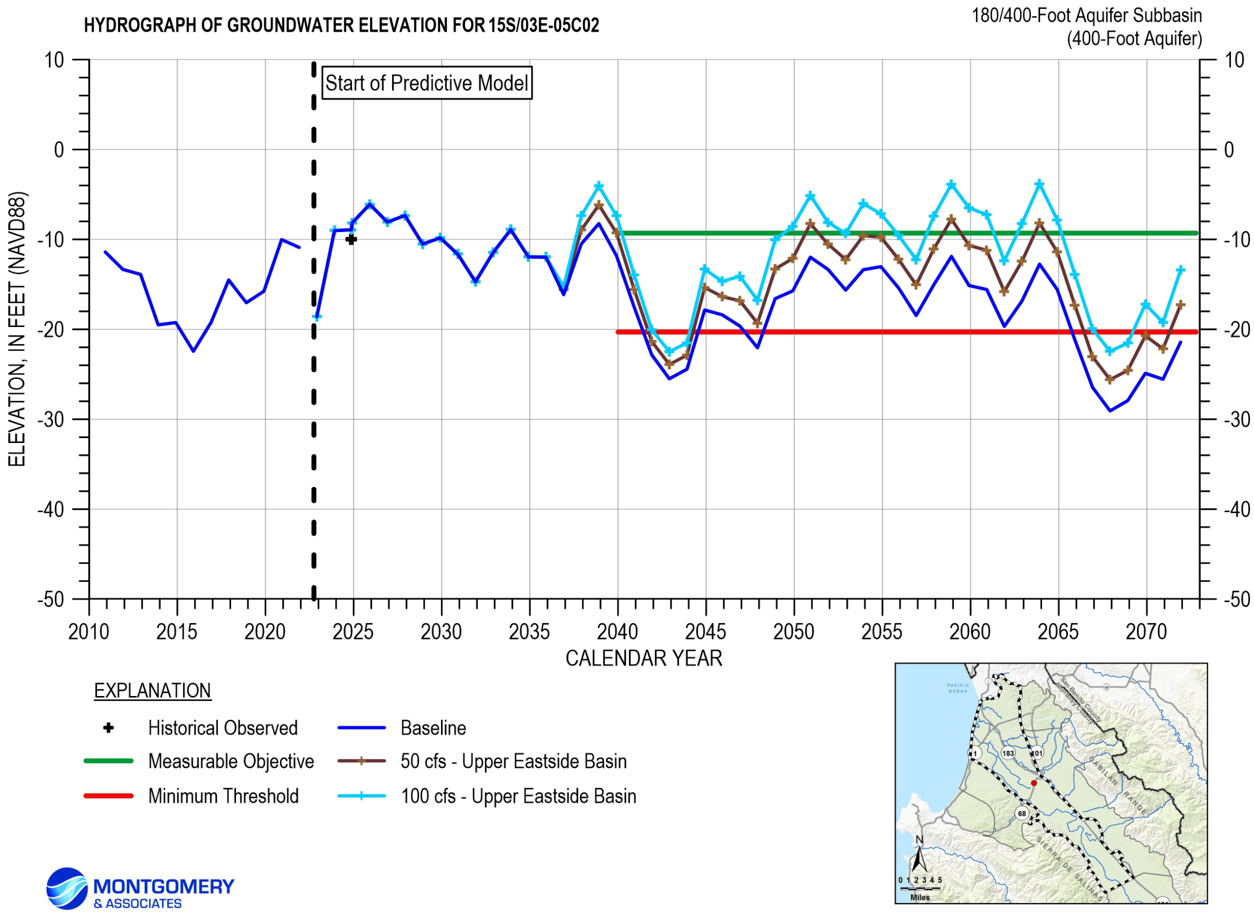


Figure 22. Simulated Groundwater Level Hydrograph for Baseline and Eastside Injection Scenarios in Well 15S03E05C02

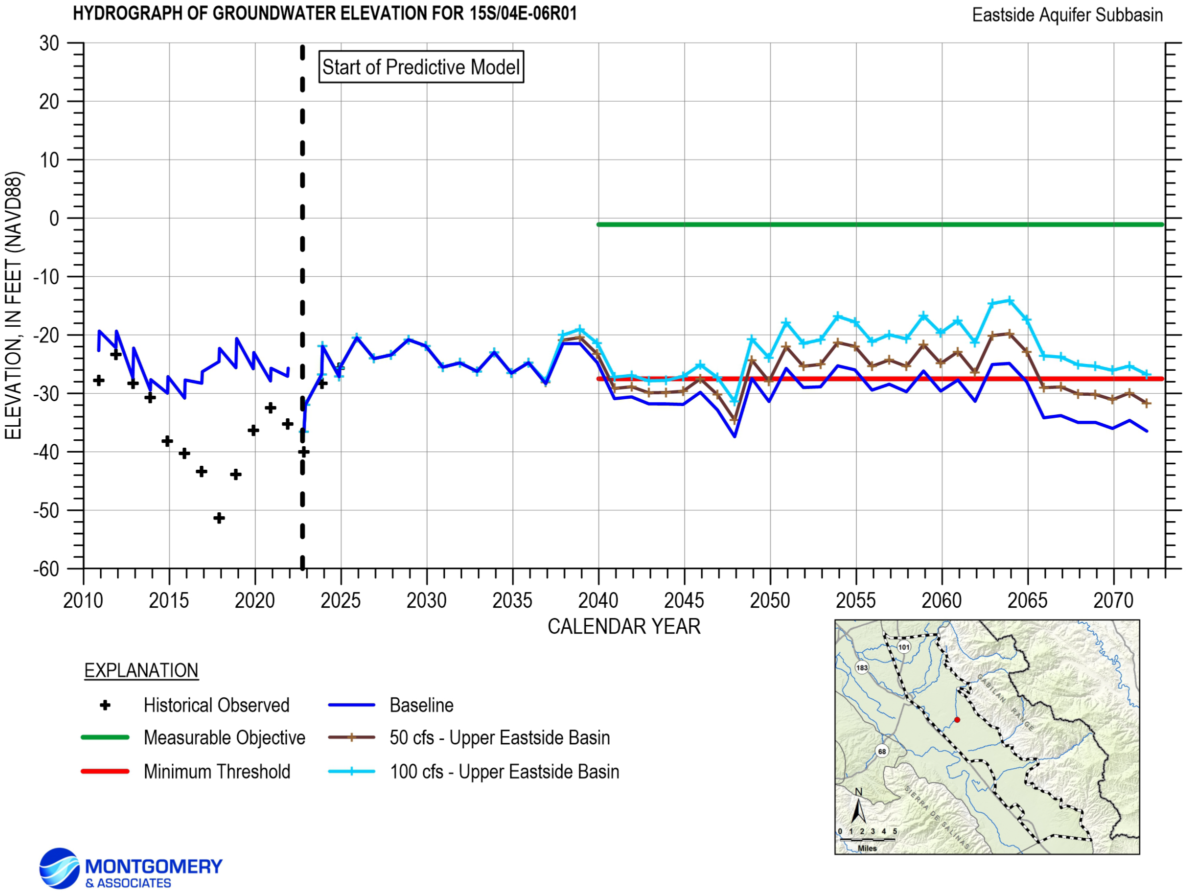


Figure 23. Simulated Groundwater Level Hydrograph for Baseline and Eastside Injection Scenarios in Well 15S04E06R01

Comparison to Groundwater Level SMC

Table 10 summarizes the percentage of RMS wells for which simulated water levels were below their minimum threshold during the 2040–2041 evaluation period.

Table 10. Percentage of RMS Wells with Water Levels Simulated Below Their MT During 2040-2041 Evaluation Period for the Northern Eastside Injection Scenarios

Subbasin*	Wells Evaluated	Single well %	Baseline	Northern Eastside Injection	
				50cfs	100cfs
Eastside	29	3%	62%	55%	38%
180/400	66	2%	73%	67%	62%

* Minimal effect in all other subbasins.

For the Eastside Subbasin, the Baseline (no project) Scenario results in 62% of wells below minimum thresholds during the evaluation period. The Northern Eastside injection scenarios reduce this percentage to 55% (50 cfs) and 38% (100 cfs), corresponding to improvements of 7% and 24%, respectively. As with the recharge basin scenarios, the 180/400 subbasin also shows modest improvements: baseline conditions yield 73% of wells below minimum threshold, which decreases to 67% (50 cfs) and 62% (100 cfs) under the injection scenarios. Neither injection scenario avoids an undesirable result in the Eastside Subbasin by the evaluation period, but both reduce the magnitude of exceedances relative to Baseline.

As in the recharge basin scenarios, many RMS wells rise above and fall below their minimum thresholds multiple times over the simulation period, reflecting both climate-driven variability and longer-term trends. Figure 24 shows the percentage of Eastside RMS wells below minimum thresholds at the end of November for each simulated year under the baseline and northern Eastside injection scenarios. Relative improvements vary from year to year, in part because diversion, storage, and injection volumes are higher in wetter years than in drier years, which amplifies climate-driven patterns evident in the baseline scenario. Time since project initiation also plays a role: after injection begins (assumed in 2035, consistent with the preceding section), benefits can accumulate over multiple years and become more evident in well hydrographs.

Model results indicate that groundwater level increases are concentrated in and around the injection field, where the baseline simulation shows a persistent groundwater depression in the northern Eastside area. This depression is influenced by a combination of relatively low aquifer permeability, limited vertical connectivity associated with shallow clay layers, and substantial municipal pumping in and around the City of Salinas.

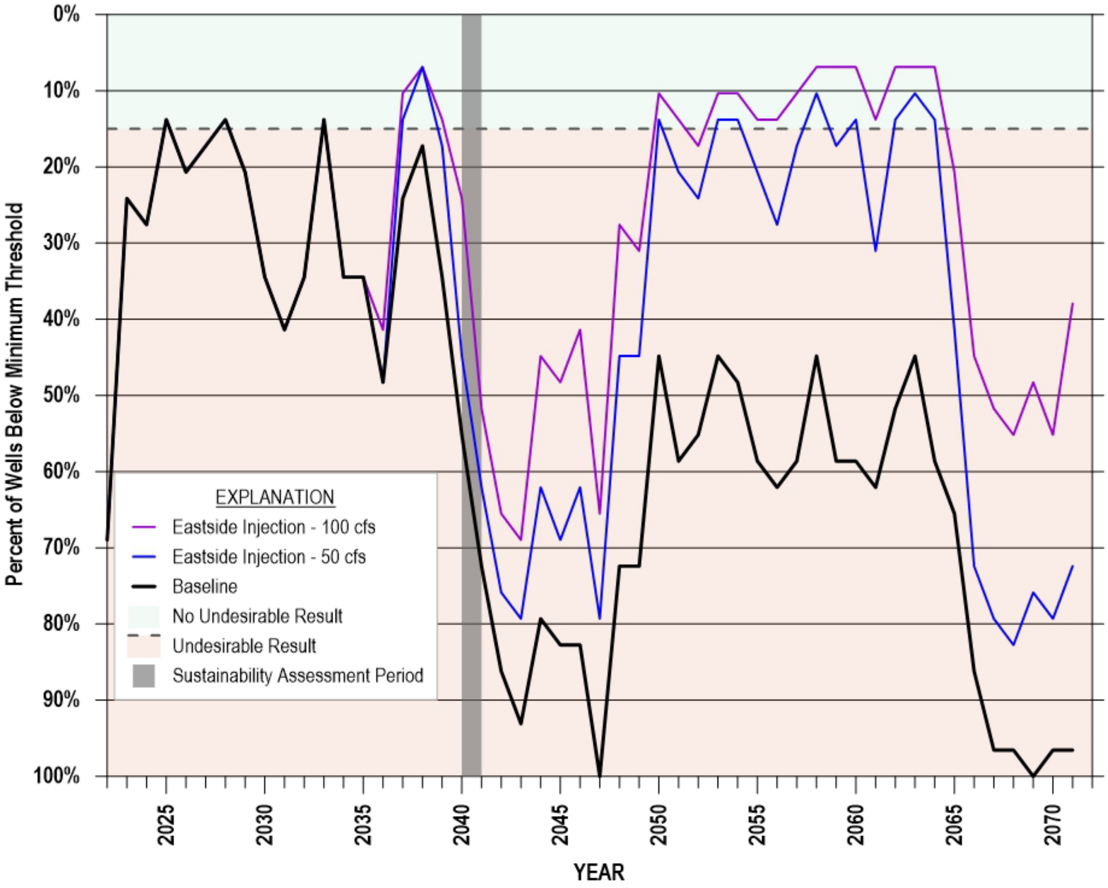


Figure 24. Percentage of RMS Wells with November Water Levels Simulated Below MT
(Baseline vs. Northern Eastside Injection Scenarios)

The extent of the project benefit, measured in terms of wells rising above their minimum threshold (and in some cases measurable objective) can be seen in which shows a map of SMC exceedances for the baseline scenario and on Figure 25 and Figure 26, which show the same for the upper eastside injection scenarios.

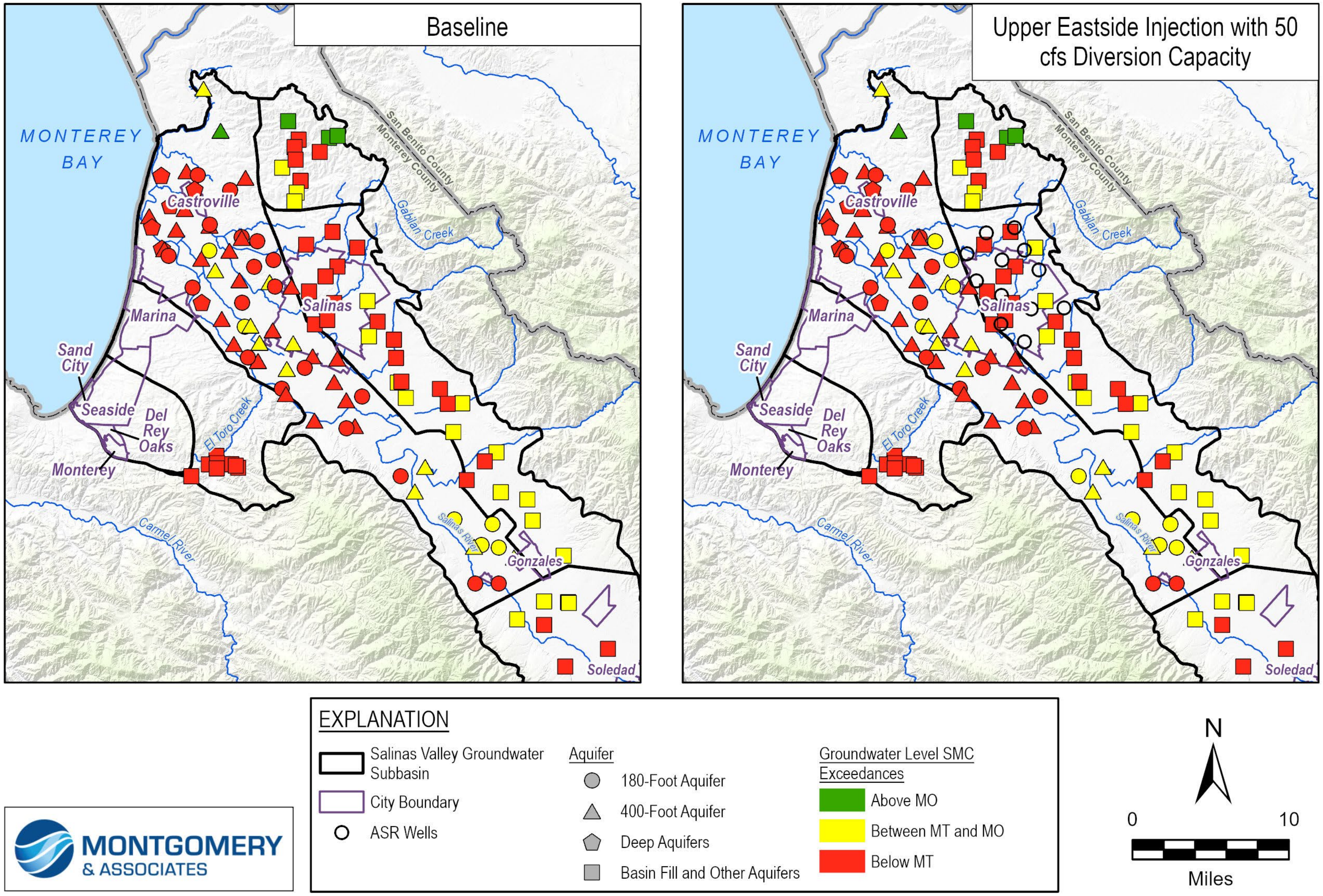


Figure 25. Groundwater Level SMC Exceedances in the Baseline and Eastside Injection Scenario (50 cfs) During 2040-2041 Evaluation Period

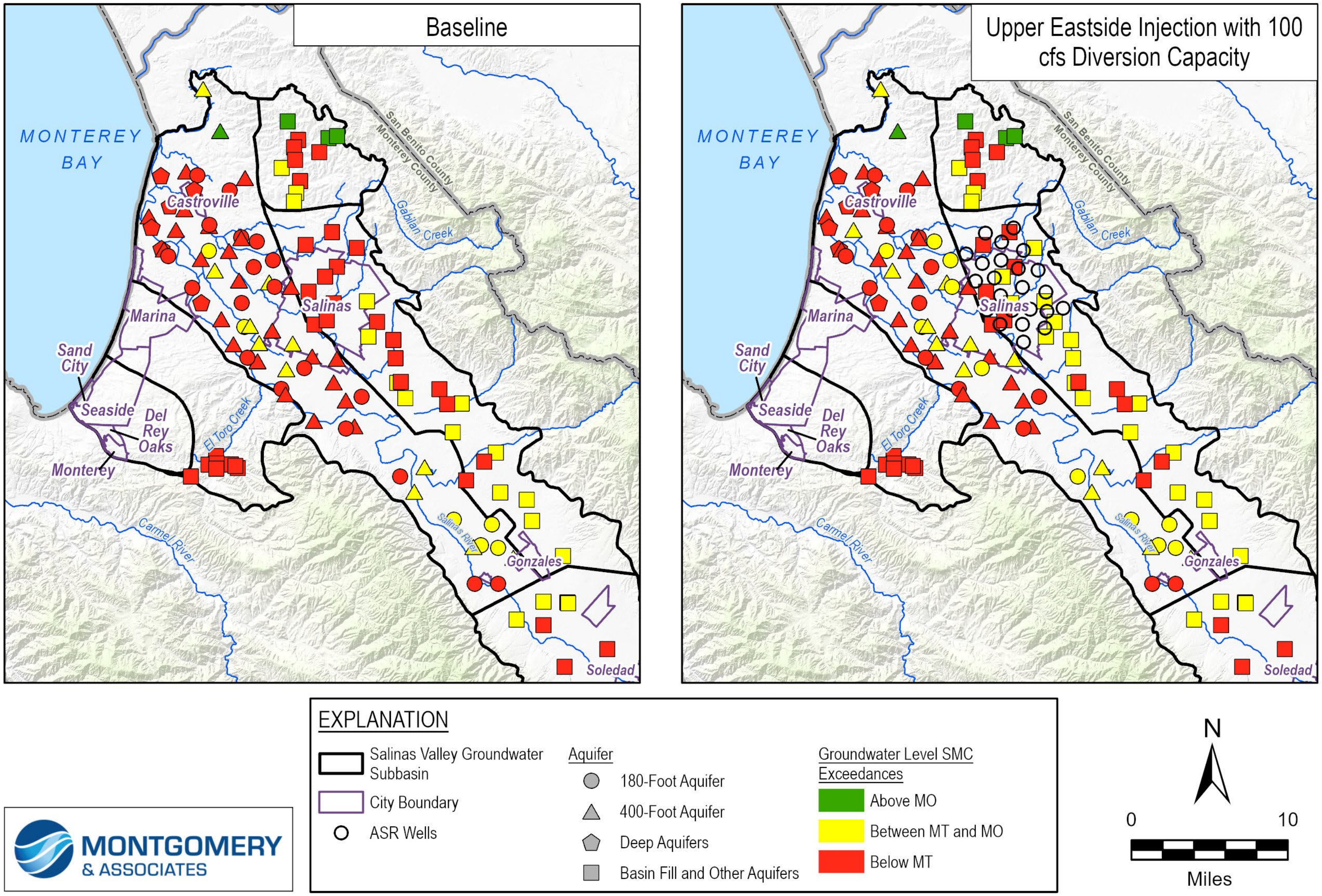


Figure 26. Groundwater Level SMC Exceedances in the Baseline and Eastside Injection Scenario (100 cfs) During 2040-2041 Evaluation Period

Changes to groundwater pumping, flow, and storage

Groundwater storage results for the Northern Eastside Injection scenarios are included in Table 11 and Table 12. Relative to baseline, the injection scenarios increase modeled storage in the Eastside Subbasin by approximately +1,100 to +2,000 AF/yr, depending on diversion capacity, and redistribute storage gains into adjacent subbasins.

Notably, compared to the recharge basin scenarios, the injection scenarios show a larger share of the model-wide storage increase occurring outside the Eastside Subbasin—particularly in Langley (and, to a lesser extent, other adjacent areas)—reflecting the proximity of injection to subbasin boundaries and the spatial distribution of the injection field. This is consistent with the more localized head increases near the injection field and the resulting redistribution of gradients across adjacent subbasins.

This pattern is also reflected in the model-wide storage response relative to project recharge. For the injection scenarios, the model-wide net storage increase represents approximately 46–48% of average annual project recharge. The distribution of storage gains differs from the recharge basin scenarios: for the injection cases, approximately 45–46% of the model-wide storage increase occurs in the Eastside, with a larger fraction occurring in Langley (16–18%) and 180/400 (about 13%), and smaller fractions distributed among the remaining subbasins.

Little to no change is seen in stream seepage and pumping under the Northern Eastside Injection scenarios.

Table 11. Average Annual Net Storage Change over Model Years 2040-2064, for the Northern Eastside Injection Scenarios

Scenario	**Eastside**	**180/400**	**Langley**	**Forebay**	**Upper Valley**	**Monterey**	**Seaside**
Baseline	-900	-500	600	-400	-200	-7,600	-2,600
Northern Eastside Injection 50 cfs Scenario	200	-200	1,100	-400	-200	-7,200	-2,500
Northern Eastside Injection 100 cfs Scenario	1,100	0	1,300	-300	-200	-6,800	-2,400

All values in AFY

Table 12. Relative Storage Increase by Eastside Recharge Basin Scenarios over Baseline for the Northern Eastside Injection Scenarios

Scenario	**Average annual project recharge (AF/year)**	**Storage increase**								
		Model-wide average annual increase in storage (AF/year)	**Model-wide storage increase as % of project recharge**	**% in Eastside**	**% in 180/400**	**% in Langley**	**% in Monterey**	**% in Forebay**	**% in Seaside**	**% in Upper Valley**
Northern Eastside Injection 50 cfs Scenario	5,100	2,455	48%	45%	13%	18%	18%	1%	5%	0%
Northern Eastside Injection 100 cfs Scenario	9,700	4,478	46%	46%	13%	16%	19%	1%	5%	0%

Inter-subbasin flow

Inter-subbasin groundwater flows (Table 13) shift under the injection scenarios in a manner consistent with increased heads in the northern Eastside Subbasin. In general, flows from the 180/400 Subbasin to the Eastside decrease as recharge increases, reflecting reduced hydraulic gradients across the subbasin boundary. Smaller changes are also simulated for other inter-subbasin flow components, indicating that project recharge alters regional gradients and redistributes groundwater movement beyond the immediate recharge footprint.

Table 13. Average Annual Inter-subbasin Flow over Model Years 2040-2064, in Acre-Feet per year for the Northern Eastside Injection Scenarios

Scenario	180/400 to Eastside	Forebay to Eastside	Langley to Eastside	Forebay to 180/400	Monterey to 180/400	Langley to 180/400	Upper Valley to Forebay
Baseline	41,400	6,400	4,200	29,900	21,100	500	25,600
Northern Eastside Injection 50 cfs Scenario	38,000	6,400	3,600	29,800	20,000	500	25,600
Northern Eastside Injection 100 cfs Scenario	34,900	6,300	3,300	29,700	19,100	600	25,600

Coastal Injection

The modeled groundwater benefits for the Coastal Injection Scenario are evaluated using the SWIM. The focus is on seawater intrusion in the 400-Foot Aquifer, as that is the groundwater goal targeted with this scenario. The Seawater Intrusion SMC is represented by the inland position of the 500 mg/L chloride isocontour. In addition, groundwater level changes and changes in groundwater storage and flow are also included.

Groundwater Level Change

Although the primary purpose of this scenario is addressing seawater intrusion, rather than achieving groundwater level SMC, the modeled mechanism is an increase in heads inland of the intrusion front. Figure 27 shows the difference in simulated groundwater levels during the 2040–2041 evaluation period under the Coastal Injection scenario relative to baseline, for the 180-Foot, 400-Foot, and Deep Aquifers. In the figure, the aquifers shown are based on model layer extents and include stratigraphically equivalent aquifers within the same model layer, even if outside of the delineated extent of that aquifer. In the 400-Foot Aquifer, groundwater levels in the vicinity of the injection wells increase by approximately 3 to 6 feet relative to baseline, with smaller but more widespread increases extending across parts of the northern 180-Foot and 400-Foot Aquifers and into the northern Eastside Subbasin and southwestern Langley Subbasin.

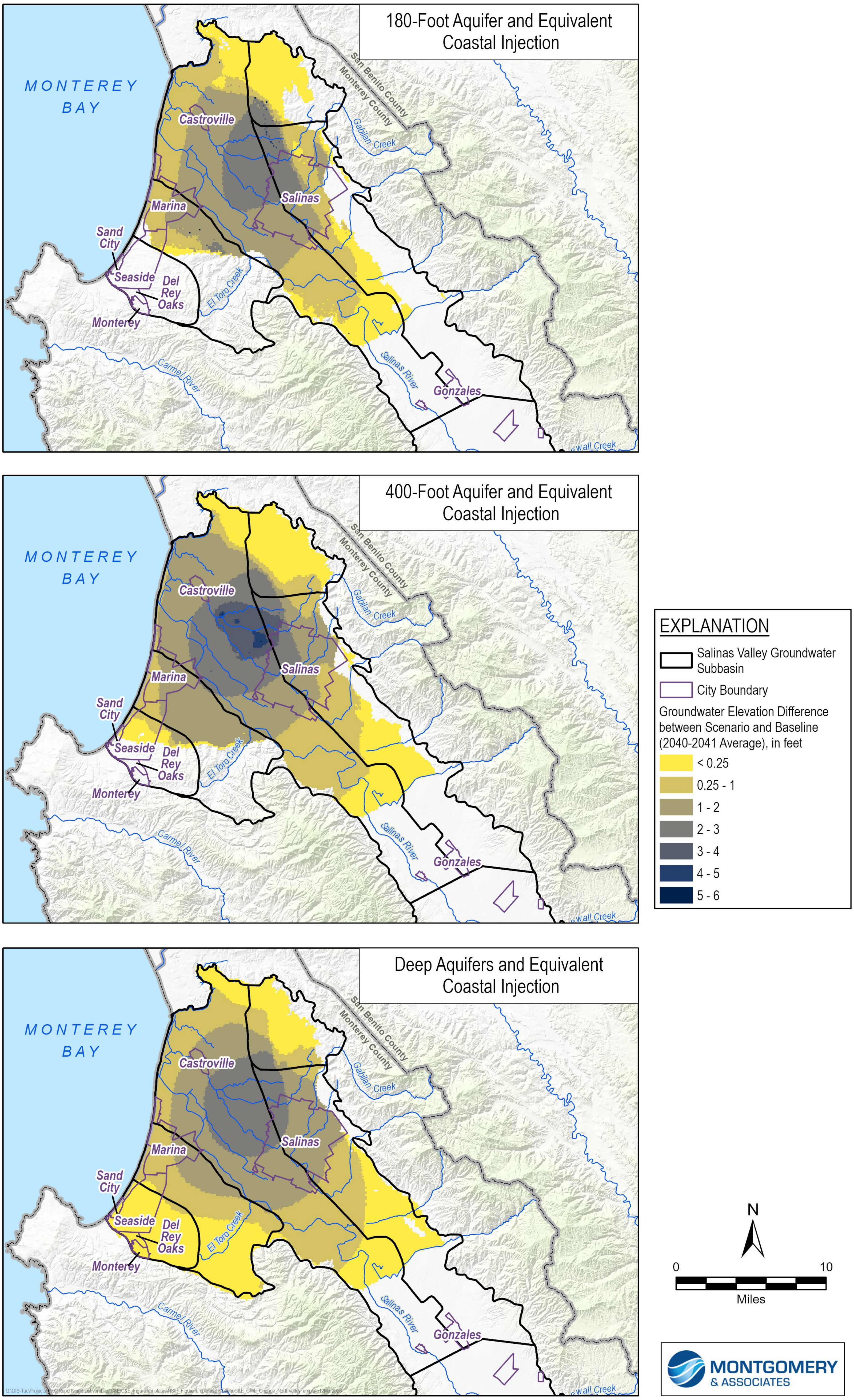


Figure 27. Difference Between Coastal Injection Average November 2040-2041 Water Levels and Baseline Scenario for 180-Foot, 400-Foot, and Deep Aquifers

Seawater intrusion progression

Only seawater intrusion in the 400-Foot Aquifer is reviewed because the Coastal Injection only injects into the 400-Foot Aquifer, leaving the 180-Foot and Deep Aquifers similar to the Baseline Scenario.

400-Foot Aquifer

The Coastal Injection Scenario results in only minor movement of the 500 mg/L isocontour in the 400-Foot Aquifer by 2040, as shown on Figure 28. The 180-Foot and Deep Aquifers, which do not receive injection under this scenario, show very little change in the position of the 500 mg/L isocontour by 2040. Figure 28, however, illustrates that the simulated progression of seawater intrusion in the 400-Foot Aquifer begins to diverge from baseline conditions over time. In later years, the project moderates the advance of several significant seawater intrusion plumes to the northwest, west, and southwest of the City of Salinas. The limited magnitude of this benefit is likely attributable to the relatively small diversion capacity (50 cfs), which results in recharge volumes that are approximately one-half to one-fifth of the highest capacities considered in the northern Eastside injection and Eastside recharge basin scenarios.

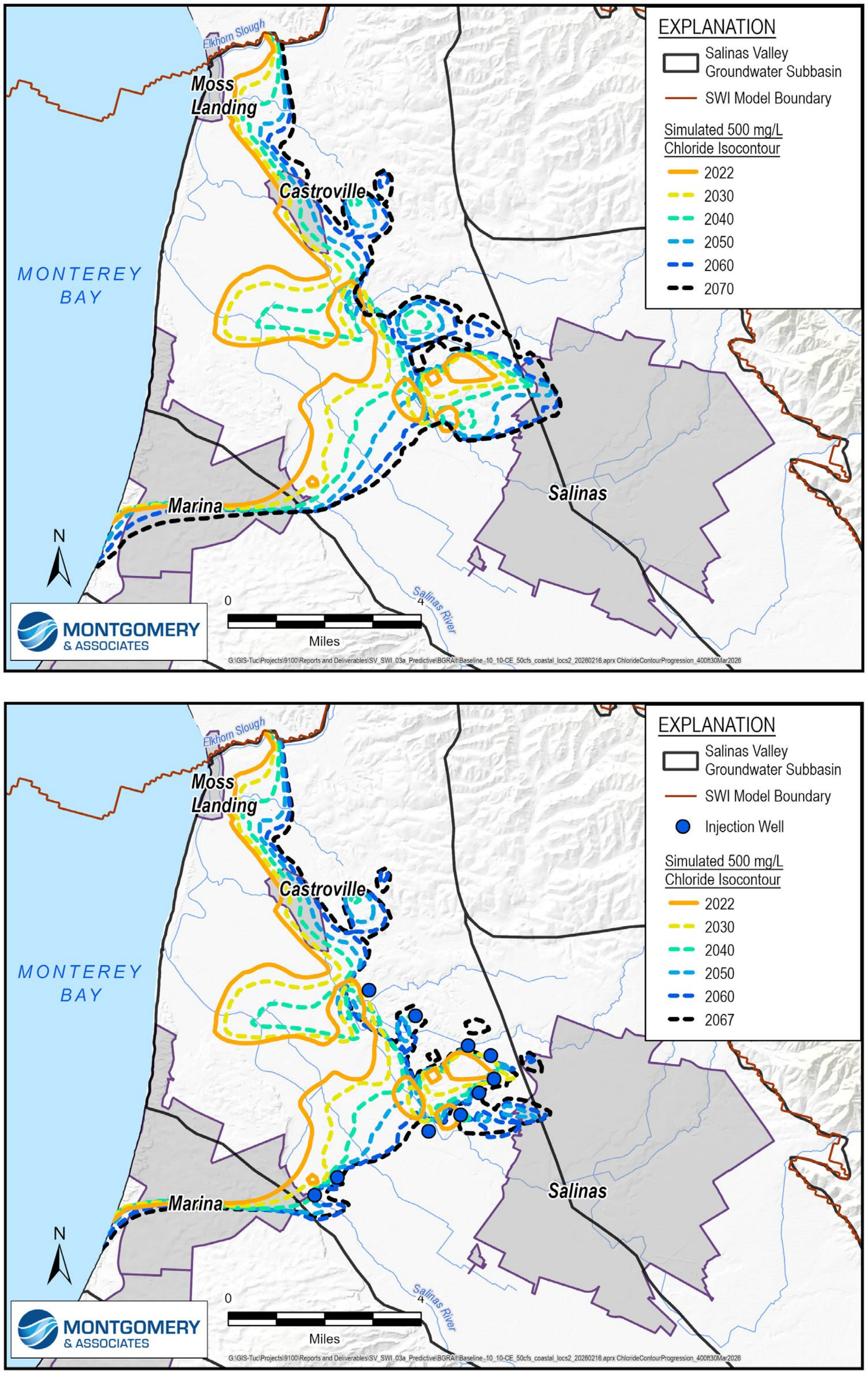


Figure 28. Simulated Progression of Seawater Intrusion in the 400-Foot Aquifer under the Baseline (top) and Coastal Injection Scenarios (bottom)

180-Foot Aquifer

While little difference is seen in 2040, the 180-Foot Aquifer shows slightly greater progression of the 500 mg/L isocontour over time (most noticeable after 2040) under the Coastal Injection scenario than under baseline conditions (Figure 33). There is no injection to the 180-Foot Aquifer under this scenario; however, relative head increases in the 400-Foot Aquifer may propagate upward through the Salinas Valley Aquitard into the 180-Foot Aquifer. Given the placement of several injection wells (screened in the 400-Foot Aquifer) upgradient of the seawater-intruded zone in the 180-Foot Aquifer, these relative head changes may locally increase landward gradients and contribute to the observed difference in the modeled 180-Foot Aquifer isocontour position. This result should be interpreted cautiously and highlights the importance of well placement and layer targeting in coastal injection design.

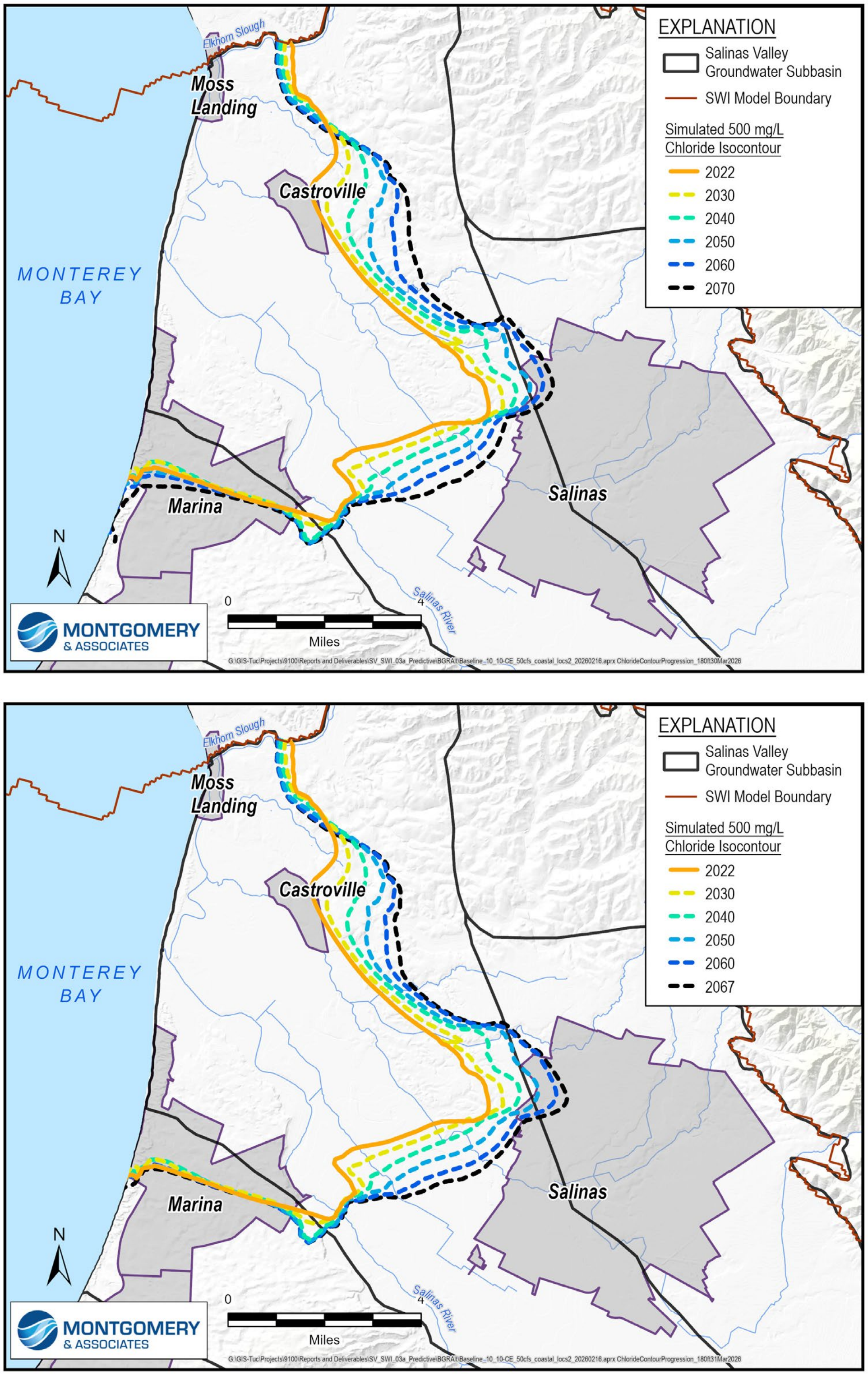
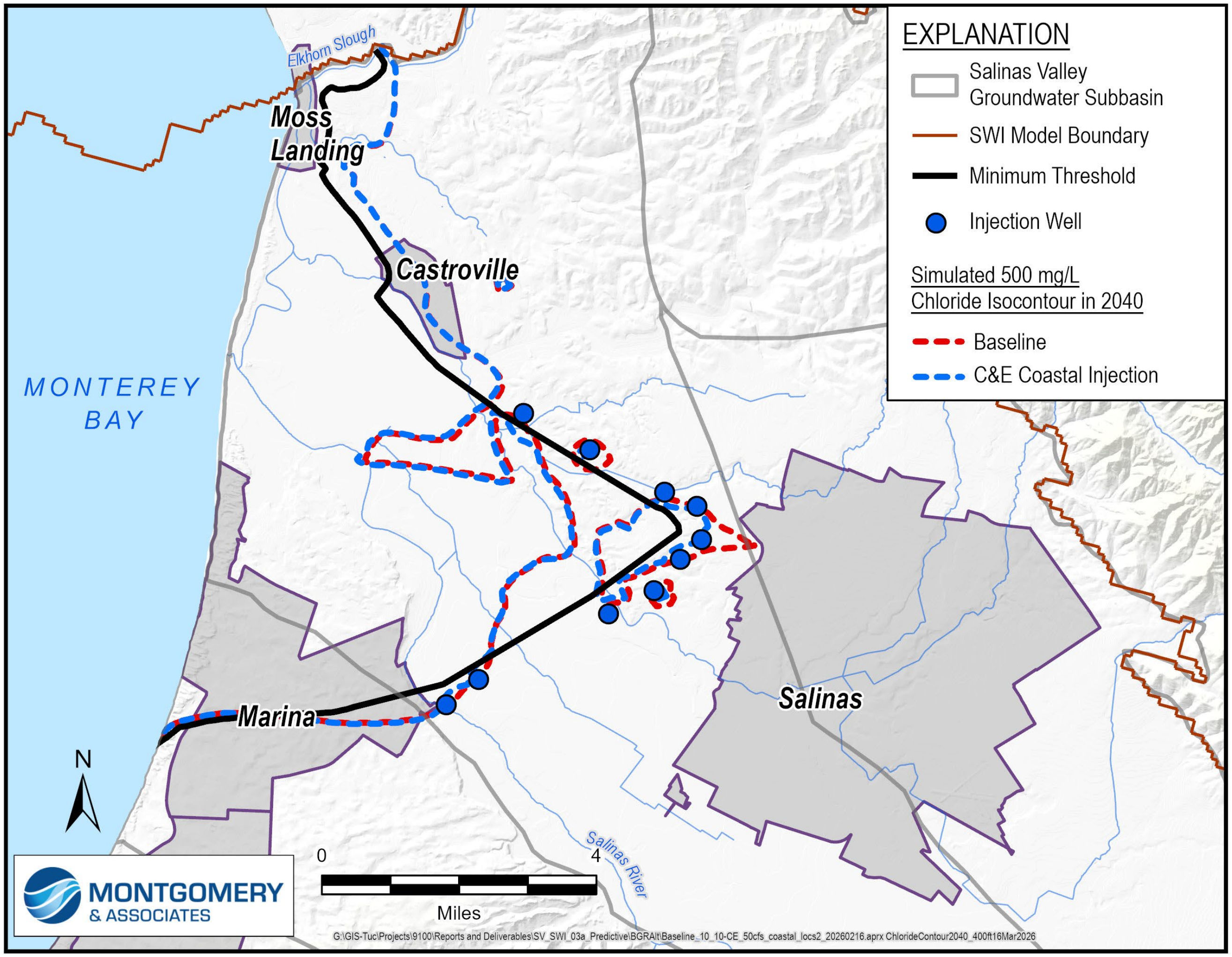


Figure 29. Simulated Progression of Seawater Intrusion in the 180-Foot Aquifer under the Baseline (top) and Coastal Injection Scenarios (bottom)

Comparison to Seawater Intrusion SMC

The project is anticipated to come online in 2035, giving it only 5 years of operation before the 2040 SGMA sustainability deadline. As shown on Figure 31, by 2040 the seawater intrusion 500 mg/L isocontour is minimally different from the Baseline Scenario. The scenarios diverge more over time.



G:\GIS-Tuc\Projects\9100\Reports and Deliverables\SV_SWI_03a_Predictive\BGRAlt\Baseline_10_10-CE_50cfs_coastal_locs2_20260216.aprx ChlorideContour2040_400ft16Mar2026

Figure 30. Simulated 500 mg/L Chloride Contour in the 400-Foot Aquifer in 2040
for the Baseline and Coastal Injection Scenari

NSIP

The modeled groundwater benefits for the NSIP Scenario are evaluated using the SWIM. Because the NSIP scenario targets both groundwater levels in the Deep Aquifers and seawater intrusion across multiple aquifers, results are reviewed for the 180-Foot, 400-Foot, and Deep Aquifers. The Seawater Intrusion SMC is represented by the inland position of the 500 mg/L chloride isocontour. Groundwater level changes and changes in groundwater storage and flow are also summarized.

Groundwater Level Change

Figure 1 shows the difference in simulated groundwater levels during the 2040–2041 evaluation period under the NSIP scenario relative to baseline for the 180-Foot, 400-Foot, and Deep Aquifers. In the figure, the aquifers shown are based on model layer extents and include stratigraphically equivalent aquifers within the same model layer, even if outside of the delineated extent of that aquifer. After groundwater extraction stops in 2035, groundwater levels rise, the most of which occurs in and near the area where extraction stopped. Relative water level increases exceed 20 feet in both the 180-Foot and 400-Foot Aquifers, with peak values of approximately 27 feet, and range from 1 to 5 feet in the Deep Aquifers. Changes in the Deep Aquifers are comparatively modest given that improved groundwater levels in those aquifers is a stated project goal. The increases are centered on the NSIP area but extend well beyond it, with changes greater than 1 foot reaching nearly to the model boundary near Chualar. Because fixed SWIM boundary conditions derived from the baseline simulation are used, this spatial extent suggests that relative increases farther upvalley may be suppressed, and results are likely most reliable near the NSIP area and coastward.

The largest relative increases in both the 180-Foot and 400-Foot Aquifers are concentrated northwest of the City of Salinas (Figure 1). The 400-Foot Aquifer exhibits the greatest and most widespread changes; the 180-Foot Aquifer shows similar peak values over a slightly smaller area; and the Deep Aquifers show comparatively modest changes. A pronounced step in the spatial pattern of relative increases occurs along the delineated edge of the alluvial fans to the east of the 180/400-Eastside Subbasin boundary, reflecting a transition to lower transmissivity to the east. This contrast appears to concentrate relative water level increases west of that transition, which may intensify the existing hydraulic gradient toward the northern Eastside groundwater depression. However, since groundwater levels to the east of this transition are already very low, the significance of this incremental change is uncertain relative to the pre-existing gradient.

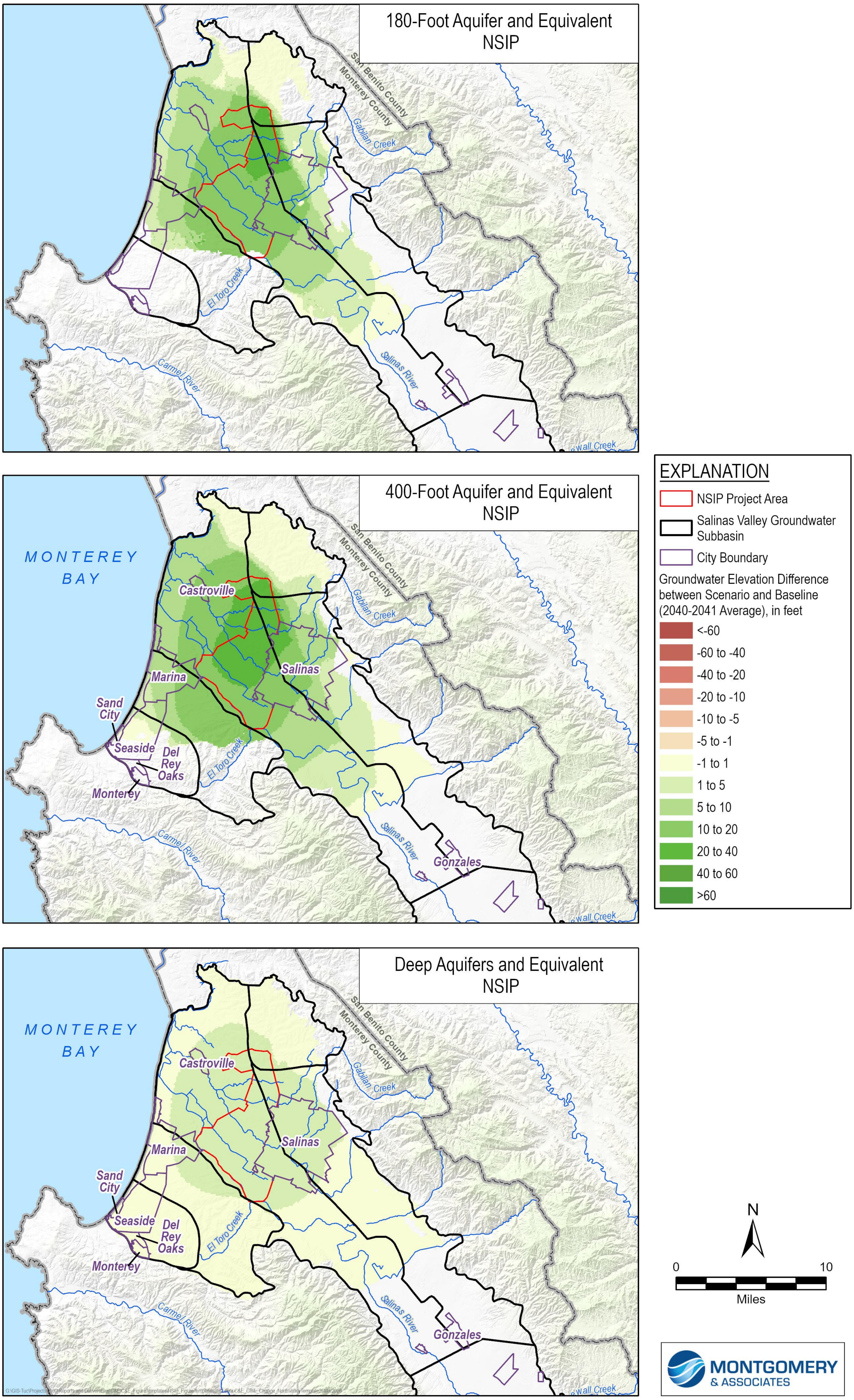


Figure 31. Difference Between Coastal Injection Average November 2040-2041 Water Levels and Baseline Scenario for 180-Foot, 400-Foot, and Deep Aquifers

Seawater Intrusion Progression

180-Foot Aquifer

The NSIP Scenario produces mixed results for seawater intrusion in the 180-Foot Aquifer and is not sufficient for meeting the seawater intrusion minimum threshold. (Figure 2). Along most of the front, seawater progression is modestly slowed relative to baseline, consistent with reduced landward head gradients across the NSIP area. However, the prominent bulge in the 500 mg/L isocontour presently located just west of the City of Salinas advances more rapidly under the NSIP scenario than under baseline conditions. This area lies within and east of the zone of greatest relative groundwater level increase—a region where seawater has already substantially intruded. Where the relative head increase occurs within the intruded zone rather than landward of the front—as seen on Figure 1 where the maximum relative head changes are shown—the effect may be analogous to a relative hydraulic ridge or peak with the potential to drive elevated-chloride water away from it. In this localized area, the inland component of that movement may contribute to the observed additional advance. Notably, the trajectory of this advance is directed toward a cluster of agricultural pumping wells situated within agricultural enclaves inside the urban footprint of the City of Salinas. These wells are represented consistently across all scenarios and are not responsible for the difference in intrusion progression between NSIP and baseline; however, within the model, the pumping at these wells creates a local groundwater low that may draw the simulated intrusion front preferentially toward this area.

This pattern can be contrasted with the Coastal Injection scenario, which produces only a minor increase in 180-Foot Aquifer intrusion relative to baseline. The Coastal Injection scenario injects exclusively into the 400-Foot Aquifer, so any effect on the 180-Foot Aquifer is indirect; head increases in the Deep Aquifers may propagate upward through the overlying aquitard, and it is possible that some upward migration of injected fresh water partially moderates the resulting gradient effect in the 180-Foot Aquifer. The far smaller volume of water involved and the different spatial relationship between the injection location and the existing intrusion front likely account for most of the difference in outcomes between the 2 scenarios in this aquifer.

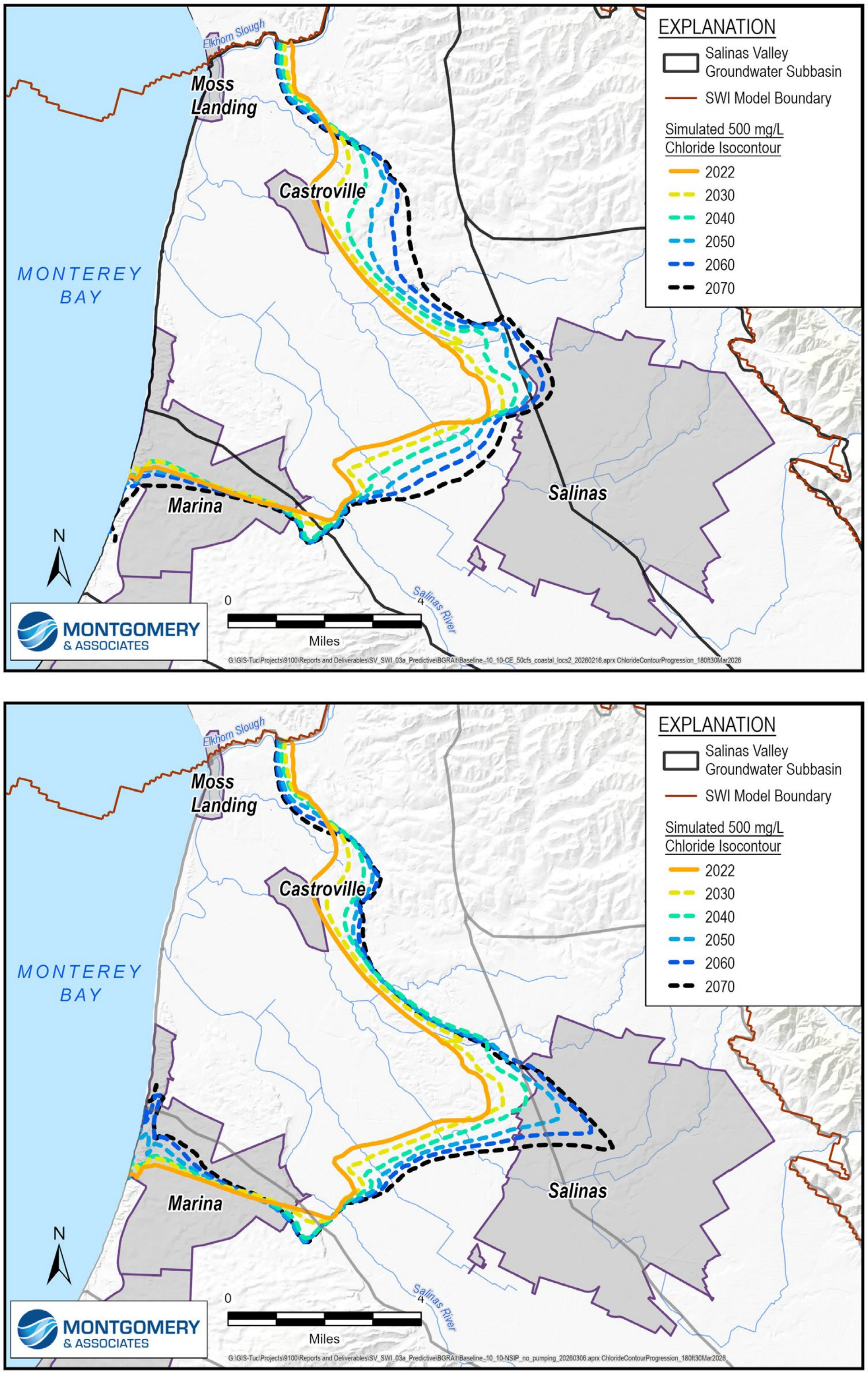


Figure 32. Simulated Progression of Seawater Intrusion in the 180-Foot Aquifer under the Baseline (top) and NSIP Scenarios (bottom)

400-Foot Aquifer

Changes in the 400-Foot Aquifer 500 mg/L isocontour under the NSIP scenario are more moderate than in the 180-Foot Aquifer (Figure 3). Differences from baseline are small throughout the simulation period. A slight additional advancement of chloride is apparent near the City of Salinas, consistent with the gradient dynamics described above, but its magnitude is substantially smaller than the corresponding change in the 180-Foot Aquifer.

Deep Aquifers

Seawater intrusion has not been observed in the Deep Aquifers of the 180/400 Subbasin. Under the NSIP scenario, there continued to be no intrusion in the Deep Aquifers.

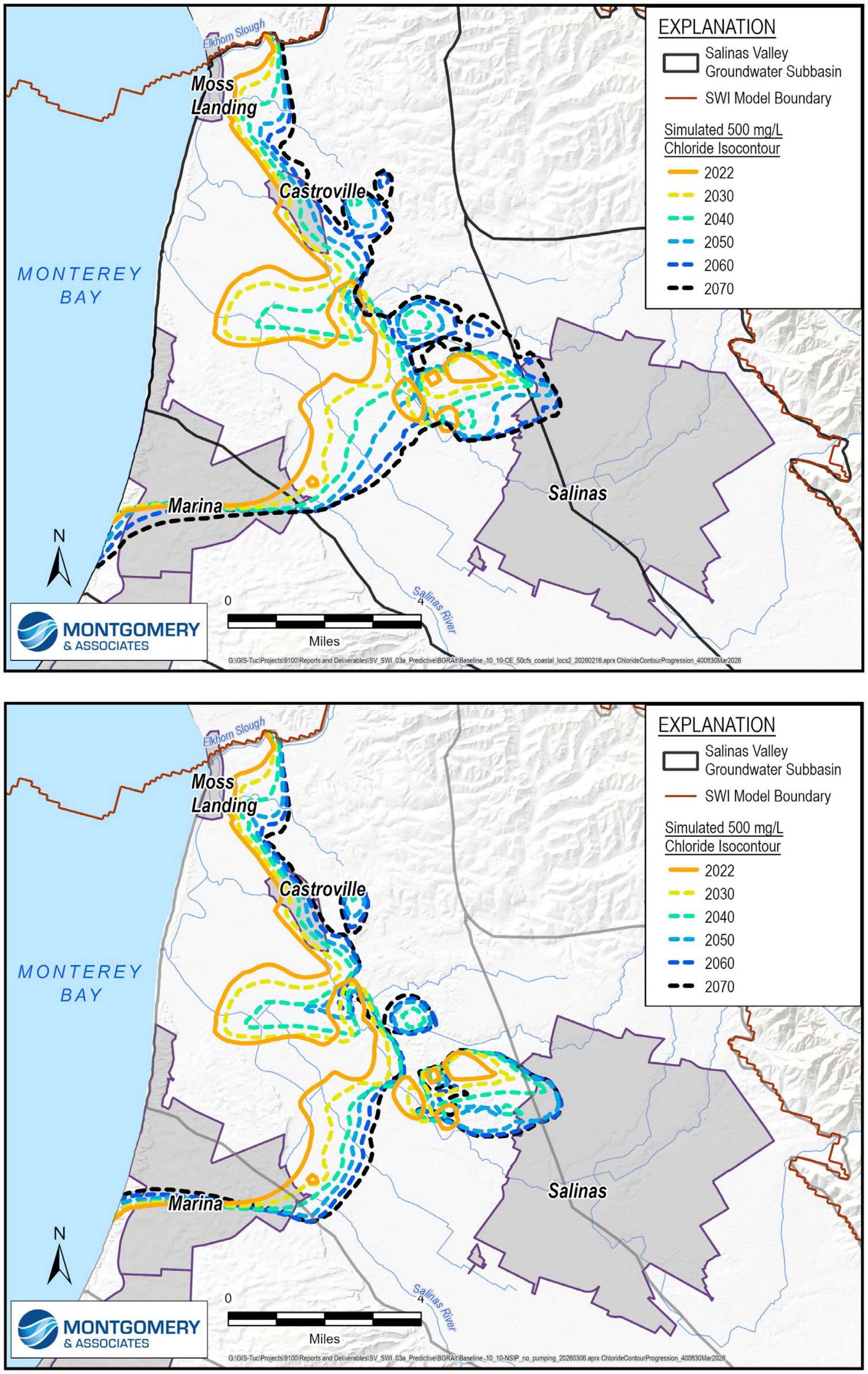


Figure 33. Simulated Progression of Seawater Intrusion in the 400-Foot Aquifer under the Baseline (top) and NSIP Scenarios (bottom)

Comparison to Seawater Intrusion SMC

The project is anticipated to come online in 2035, giving it only 5 years of operation before the first 2040 SGMA sustainability deadline. As can be seen in the Figure 4 and Figure 5, by 2040 the seawater intrusion 500 mg/L isocontour is minimally different from the Baseline Scenario in the 180-Foot and 400-Foot Aquifers. In both aquifers, the 500 mg/L isocontour is far from the minimum threshold in 2040. The scenarios diverge more over time. No difference is observed in the Deep Aquifers.

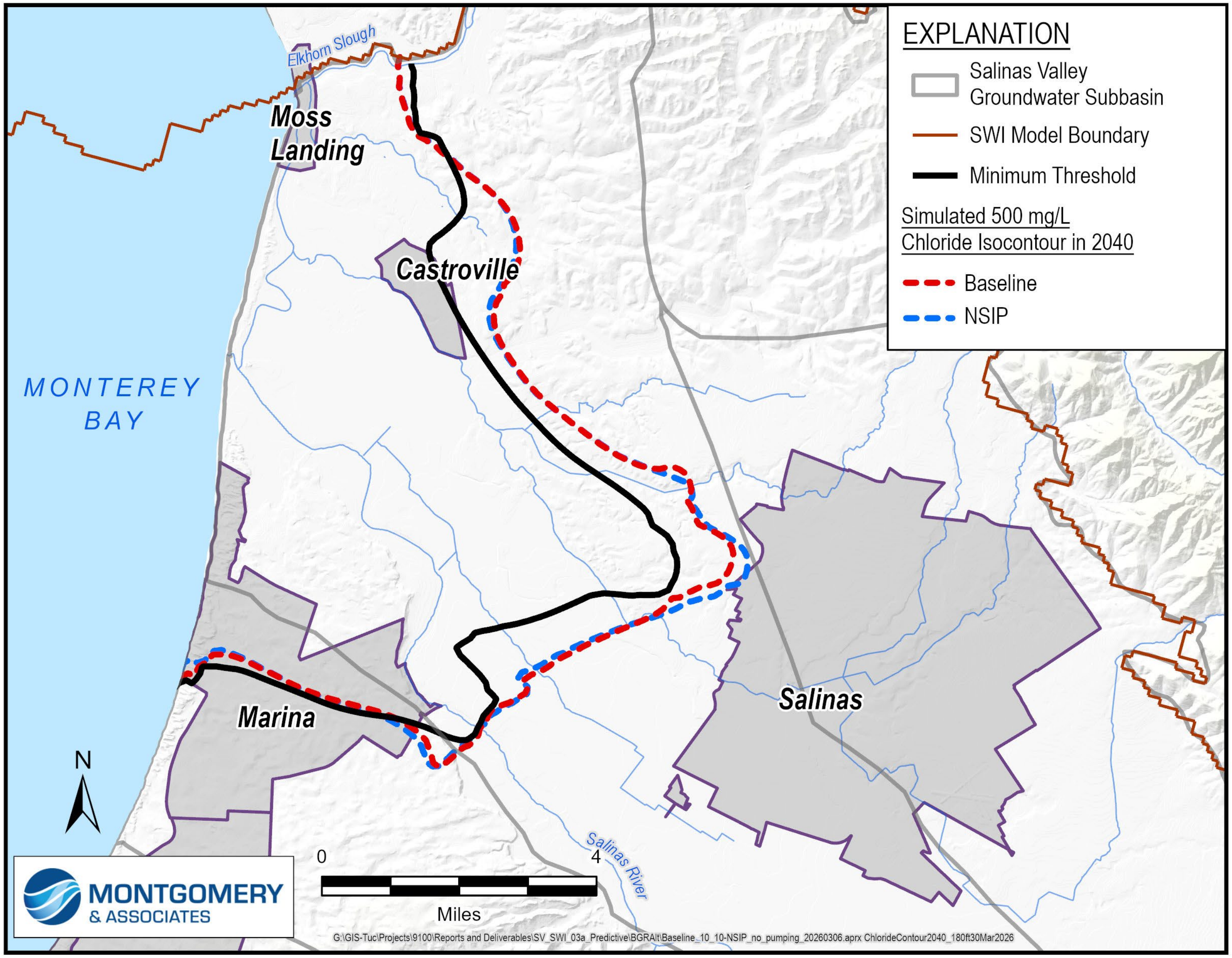


Figure 34. Simulated 500 mg/L Chloride Contour in the 180-Foot Aquifer in 2040 for the Baseline and NSIP Scenarios

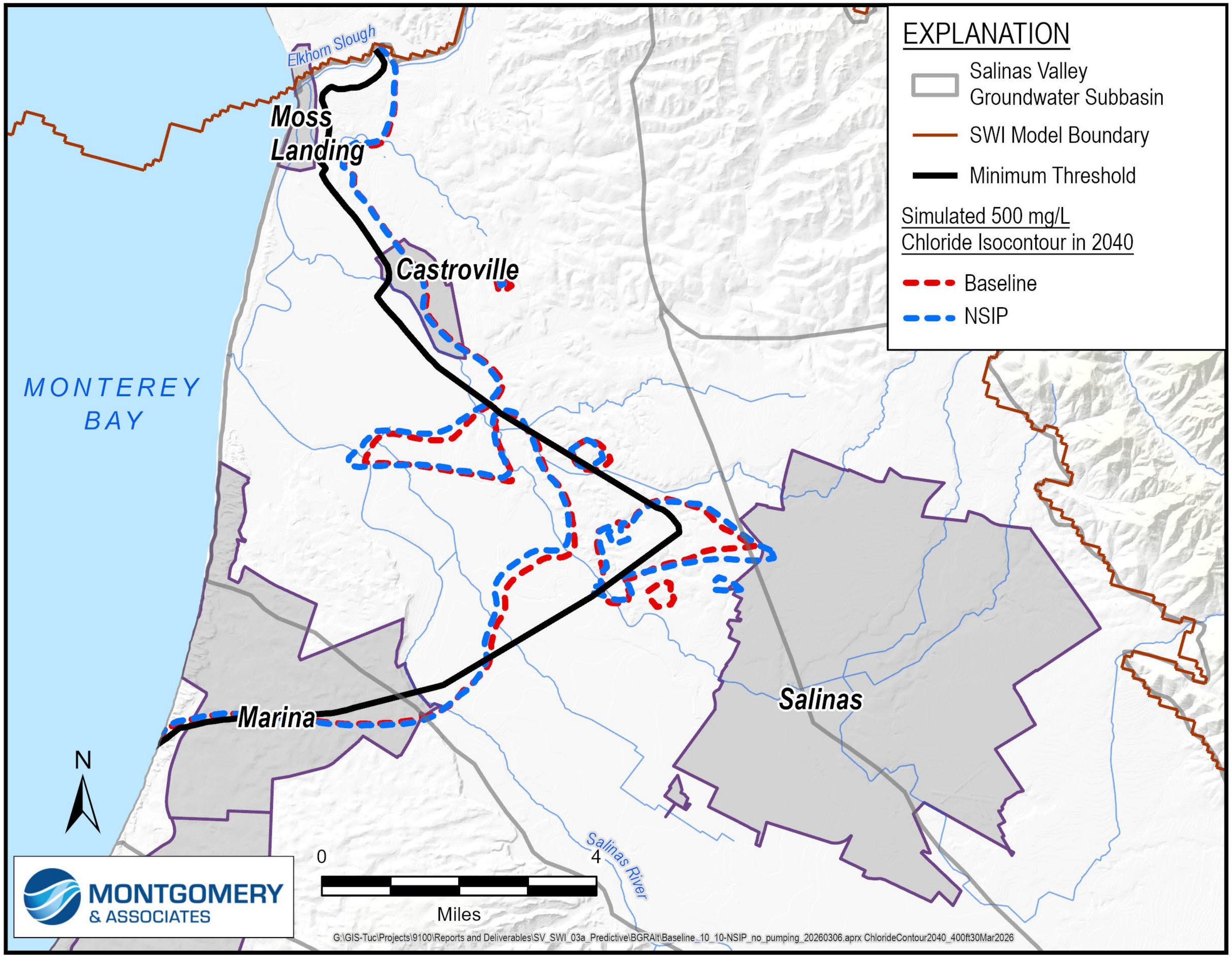


Figure 35. Simulated 500 mg/L Chloride Contour in the 400-Foot Aquifer in 2040 for the Baseline and NSIP Scenarios

DISCUSSION

The groundwater modeling results illustrate how recharge and injection projects influence groundwater levels, storage, and seawater intrusion under the assumed project configurations. Results are intended to support comparison among scenarios and to document key model behaviors and limitations, rather than to define preferred project outcomes.

Eastside Recharge Basins

- Recharge basin scenarios produce the largest and most spatially extensive groundwater level benefits, particularly within the Eastside Subbasin. RMS minimum threshold exceedances during the 2040–2041 evaluation period decline substantially relative to baseline and generally decrease with increasing diversion and recharge volume.
- Benefits vary strongly from year to year due to climate variability but accumulate after project initiation in 2035, with sustained periods of improved conditions evident in the higher-capacity scenarios.
- Recharge benefits are spatially limited in the northern Eastside; only the 400 cfs scenario, which includes more northerly basin placement, raises most northern RMS wells above their minimum thresholds. However, this scenario also produces extreme localized mounding in low-transmissivity areas, raising feasibility concerns and suggesting diminishing practical returns at higher recharge rates.

Northern Eastside Injection

- Injection scenarios provide moderate, localized groundwater level increases in the northern Eastside Subbasin and reduce RMS minimum threshold exceedances relative to baseline, but neither scenario achieves sustainability targets by the evaluation period.
- Compared to recharge basins, injection produces more concentrated groundwater elevation increases near the injection field and redistributes a larger share of storage gains to adjacent subbasins.

Coastal Injection

- Coastal injection primarily affects seawater intrusion rather than groundwater level SMCs. Modeled movement of the 500 mg/L chloride isocontour is minor by 2040 but diverges from baseline in later years, with localized moderation of intrusion in the 400-Foot Aquifer.
- Groundwater level increases of several feet near injection wells provide context for the intrusion response, but the small diversion volume limits the overall magnitude of

benefit. A slight increase in modeled intrusion in the 180-Foot Aquifer highlights the sensitivity of coastal systems to vertical gradients and well placement.

NSIP

- The NSIP scenario appears to produce the largest and most spatially extensive groundwater level increases of any scenario evaluated, with relative increases exceeding 20 feet in the 180-Foot and 400-Foot Aquifers across a broad area northwest of the City of Salinas. The spatial reach of these changes suggests that fixed SWIM boundary conditions may suppress simulated improvements further up-valley, and results are likely most reliable near the NSIP area and coastward. The comparatively modest response in the Deep Aquifers may also warrant consideration in the context of the project's goal of improving groundwater levels in those aquifers.

- Despite generating substantial groundwater level increases, the NSIP scenario appears to produce mixed outcomes for seawater intrusion. While higher groundwater levels may reduce landward gradients along much of the coastal front, relative head increases near the intrusion front locally intensify gradients in ways that drive chloride movement. In areas where intrusion already extends landward of the zone of greatest relative groundwater level increase, the effect may be analogous to a hydraulic ridge or peak forming within the intruded zone—potentially driving elevated-chloride water both seaward and, in this localized context, further inland toward the northern Eastside groundwater depression.

- Comparison with the Coastal Injection scenario suggests that the difference in intrusion outcomes between the 2 scenarios likely reflects both the much smaller scale of relative water level changes under Coastal Injection and the different spatial relationship between each project's footprint and the existing intrusion front, rather than a simple contrast in mechanism.

- The results across scenarios also illustrate a fundamental distinction between groundwater level and seawater intrusion responses to recharge and pumping changes. Groundwater level changes propagate as pressure waves and are approximately additive— from a groundwater level standpoint, injecting a given volume near a pumping well is nearly equivalent to simply reducing pumping by that amount, regardless of source water quality or timing. Chloride concentration responses, however, are driven by flow paths, source water quality, and mixing and spreading processes in ways that are highly sensitive to the configuration and timing of sources (including recharge and pumping reductions) and sinks (continued pumping), meaning scenarios with similar groundwater level effects may produce markedly different chloride outcomes. For interventions specifically targeting seawater intrusion, the details of location, timing, and water quality therefore matter considerably more than they do for groundwater level management.

LIMITATIONS

The C&E modeling scenarios described in this report help compare relative effects of different recharge and pumping reductions strategies. These simulations represent approximations of future groundwater conditions. In addition to the limitations described in the SVOM Model Update and Projected Baseline Simulation (M&A, 2026b), several scenario-specific assumptions and limitations apply to this phase of demand management modeling:

- Reservoir operations were kept constant at baseline conditions to isolate the effect of recharge and pumping reductions. For the Eastside Recharge Basin scenarios in particular, groundwater levels increase in the shallow sediments may increase baseflow enough that smaller reservoir releases would be needed to meet operational rules.
- Projections are based on a single baseline annual climate data series for estimated future conditions. While it provides an initial platform for assessing potential future conditions, projections are highly dependent on the years used for evaluation. Whether groundwater elevations at a particular RMS well are projected to be below the minimum threshold depends on the specified climate inputs to the baseline model. Further investigations could include the simulation of different potential baseline climate scenarios.
- The model does not simulate impacts of climate change. Future studies should evaluate if climate change could have significant implications.