Groundwater Sustainability Plan

Monterey Subbasin

Marina Coast Water District Groundwater Sustainability Agency
Salinas Valley Basin Groundwater Sustainability Agency

Final Draft

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List of Abbreviations

AB	Assembly Bill
AEM	airborne electromagnetic
AF	acre-foot
AFF	Aqueous Film-Forming Foam
AFY	acre-feet per year
Ag	Agricultural
AGF	Aqua Geo Frameworks
AMBAG	Association of Monterey Bay Area Governments
ARAS	applicable or relevant and appropriate
ASBS	Areas of Special Biological Significance
ASR	Aquifer Storage and Recovery
ATW	Advanced treated water
AWPF	Advanced Water Purification Facility
AWTP	Advanced Water Treatment Plant
BLM	U.S. Bureau of Land Management
BMP	Best Management Practice
BMPs	Best Management Practices
BOS	bottom of screen
CA	California
CALGreen	California Green
CASGEM	California Statewide Groundwater Elevation Monitoring
CCC	California Coastal Commission
CCGC	Central Coast Groundwater Coalition
CCR	California Code of Regulations
CCRWQCB	Central Coast Regional Water Quality Control Board
CCTAG	Climate Change Technical Advisory Group
CDFW	California Department of Fish and Wildlife
CEQA	California Environmental Quality Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFI	Community Facilities and Infrastructure
cfs	cubic feet per second
CIFP	Capital Improvement and Financing Plan
COCs	constituents of concern
COVID	coronavirus disease of 2019
CPE	Communication and public engagement
CPUC	California Public Utilities Commission
CSD	Community Services District
CSIP	Castroville Seawater Intrusion Project
CSLC	California State Lands Commission

CT	Carbon Tetrachloride
CUS	California Utility Service
CWC	California Water Code
DAC	Disadvantaged Community
DACs	disadvantaged communities
DDW	Division of Drinking Water
DEM	digital elevation model
DMS	Data Management System
DOF	Department of Finance
DOSD	Division of Safety of Dams
DPR	direct potable reuse
DTSC	Department of Toxic Substances Control
DWR	California Department of Water Resources
EHRS	Environmental Health Review Services
EIR	Environmental Impact Report
EPA	U.S. Environmental Protection Agency
ESCA	Environmental Services Cooperative Agreement
ESD	Explanations of Significant Difference
ET	evapotranspiration
FFA	Federal Facility Agreement
fm	formation
FO	Fort Ord
FODIS	Fort Ord Data Integration System
FORA	Fort Ord Reuse Authority
ft	foot
ft msl	foot mean sea level
ft/ft	foot per foot
GAMA	Groundwater Ambient Monitoring and Assessment Program
GDE	Groundwater dependent ecosystem
GEMS	Groundwater Extraction Management System
GMP	Groundwater Management Plan
GPCD	Gallons per Capita per Day
gpm/ft	gallon per minute per foot
GPS	Global Positioning System
GRRP	Groundwater Replenishment Reuse Project
GSA	Groundwater Sustainability Agency
GSP	Groundwater Sustainability Plan
HCM	Hydrogeologic Conceptual Model
HCP	Habitat Conservation Plan
HLA	Harding Lawson Associates
HMP	Habitat Management Plan

HSC	Healthy and Sustainable Communities
HUC	Hydrologic Unit Codes
ILRP	Irrigated Lands Regulatory Program
InSAR	Interferometric Synthetic Aperture Radar
IPR	indirect potable reuse
IRWM	Integrated Regional Water Management
IRWMP	Integrated Regional Water Management Plan
ISW	interconnected surface water
IWRMP	Integrated Regional Water Management Plan
JPA	Joint Powers Authority
Kqm	granitic rocks of the Galiban Range
LCIP	Local Coastal Implementation Plan
LCLUP	Local Coastal Land Use Plan
LCP	Local Coastal Program
LF	linear foot
LU	land use
LUST	leaking underground storage tank
M&I	municipal & industrial
MBARD	Monterey Bay Air Resources District
MBAS	Methylene blue active substances
MBGWFM	Monterey Subbasin Groundwater Flow Model
MBNMS	Monterey Bay National Marine Sanctuary
MCC	Monterey County Code
MCFCWCD	Monterey County Flood Control and Water Conservation District
MCHD	Monterey County Health Department
MCL	Maximum Contaminant Level
MCPWD	Monterey County Public Works Department
MCWD	Marina Coast Water District
MCWRA	Monterey County Water Resources Agency
MG	million gallon
mg/L	milligram per liter
MGD	million gallon per day
Mmy	Monterey Formation
MOA	Memorandum of Agreement
MPWMD	Monterey Peninsula Water Management District
MRSWMP	Monterey Regional Stormwater Management Program
MRWPCA	Monterey Regional Water Pollution Control Agency
Msm	Santa Margarita Sandstone
Msu	Unnamed Miocene Sedimentary Rocks
MTBE	methyl tert butyl ether
Mus	Unnamed Miocene Sandstone

MWELO	Model Water Efficient Landscape Ordinance
M&I	Municipal and Industrial
NAD	North American Datum
NAD83	North American Datum of 1983
NAVD 88	North American Vertical Datum of 1988
NEPA	National Environmental Policy Act
NLs	notification levels
NMFS	National Marine Fisheries Service
NOAA	National Oceanic & Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NRCS	USDA Natural Resources Conservation Service
O&M	Operations and Maintenance
ohm/cm	ohms centimeter
OS	open space
OSWCR	Online System for Well Completion Reports
OU	Operable Unit
OUCTP	Operable Unit Carbon Tetrachloride Plume
PCE	tetrachloroethylene
PFAS	per- and poly-fluoroalkyl substances
PFBS	perfluorobutanesulfonic acid
PFHxA	perfluorohexanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
PLSS	Public Land Survey System
PS	public service
PWM	Pure Water Monterey
Q	alluvium
QA/QC	Quality Assurance/Quality Control
Qae	Aromas Sand
Qal	Alluvium
QAPP	Quality Assurance Project Plan
Qd	Dune Sand
Qfl	Floodplain Deposits
Qo/Qvf	Old Alluvium / Valley Fill Deposits
Qod	Older Dune Sand
Qof	Pleistocene Dissected Alluvium
QT	Paso Robles Formations
Qt	Terrace deposit
Qtc	Colluvium and talus, undivided
RCDMC	Resource Conservation District of Monterey County

RFP	Request for Proposals
RGP	Regional General Permit
RI/FS	Remedial Investigation Feasibility Study
RMA	Routine Maintenance Agreement
RMS	Representative Monitoring Site
ROD	Records of Decision
ROW	Right of Way
RP	reference point
RTP	Regional Treatment Plant
RUWAP	Regional Urban Water Augmentation Project
RWQCB	Regional Water Quality Control Board
SAFER	Safe and Affordable Funding for Equity and Resilience
SB	Senate Bill
SBMMP	Seaside Basin Monitoring and Management Program
SCEP	Stakeholder Communication and Engagement Plan
SDRF	State Disaster Response Fund
SGMA	Sustainable Groundwater Management Act
SMC	Sustainable Management Criteria
SMCL	secondary maximum contaminant level
SMCs	sustainable management criteria
SMP	Salinas River Stream Maintenance Program
SRDF	Salinas River Diversion Facility
SSURGO	Soil Survey Geographic Database
SVA	Salinas Valley Aquitard
SVBGSA	Salinas Valley Basin Groundwater Sustainability Agency
SVIHM	Salinas Valley Integrated Hydrologic Model
SVOM	Salinas Valley Operational Model
SVRP	Salinas Valley Reclamation Plant
SVWP	Salinas Valley Water Project
SWI	seawater intrusion
SWIG	Seawater Intrusion Working Group
SWPPP	State Water Board Stormwater Pollution Prevention Plan
SWRCB	State Water Resources Control Board
TAC	Technical Advisory Committee
TAMC	Transportation Agency for Monterey County
TBD	to be determined
TCE	trichloroethylene
TDS	total dissolved solids
Tsm	Santa Margarita Sandstone
U.S.	United States
ug	micrograms

ug/L	micrograms per liter
US	United States
US EPA	United States Environmental Protection Agency
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	United States Geological Survey
UV	ultraviolet
UWMP	Urban Water Management Plan
VOC	volatile organic compound
WDR	Waste Discharge Requirement
WL	water level
WWTP	Wastewater Treatment Plant
WY	water year

EXECUTIVE SUMMARY

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ES.1 Introduction

On September 16, 2014, the California legislature enacted the Sustainable Groundwater Management Act (SGMA) whose primary purpose is to achieve and/or maintain sustainability within the state's high and medium priority groundwater basins. Key tenets of SGMA are the concept of local control, use of best available data and science, and active engagement and consideration of all beneficial uses and users of groundwater. As such, SGMA empowers certain local agencies to form Groundwater Sustainability Agencies (GSAs) whose purpose is to manage basins sustainably through the development and implementation of Groundwater Sustainability Plans (GSPs). Under SGMA, GSPs are required to contain certain elements, the most significant of which include: a Sustainability Goal; a description of the area covered by the GSP ("Plan Area"); a description of the Basin Setting, including the hydrogeologic conceptual model, historical and current groundwater conditions, and a water budget; locally-defined sustainability criteria; networks and protocols for monitoring sustainability indicators; and a description of projects and/or management actions that will be implemented to achieve or maintain sustainability. SGMA also requires a significant element of stakeholder outreach to ensure that beneficial uses and users of groundwater are given the opportunity to provide input into the GSP development and implementation process.

This GSP covers the entire Monterey Subbasin (Department of Water Resources [DWR] Basin 3-004.10), which encompasses 30,850 acres (or 48.2 square miles) in the northwestern Salinas Valley Groundwater Basin in the Central Coast region of California (Figure ES-1). The Monterey Subbasin (Subbasin) has been designated by the California Department of Water Resources (DWR) as medium priority. As such, the Subbasin is required to develop a GSP by January 2022 and achieve sustainability by 2042. The GSP has been co-developed by the Marina Coast Water District Groundwater Sustainability Agency (MCWD GSA) and the Salinas Valley Basin Groundwater Sustainability Agency (SVBGSA) pursuant to a Framework Agreement. The Framework Agreement outlines the Management Areas to be established within the Subbasin, which are later formalized in this GSP. The Framework Agreement further establishes a basis for information developed by the two agencies to be integrated into a single GSP for the Monterey Subbasin.

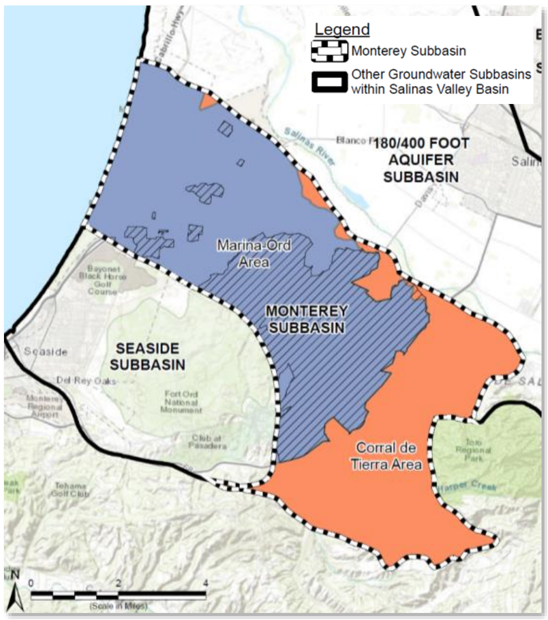

Figure ES-1. Monterey Subbasin

ES.2 Communications and Stakeholder Engagement

The Subbasin GSAs (MCWD GSA and SVBGSA) developed a Framework Agreement regarding GSP development. Pursuant to this agreement, the GSAs have established two Management Areas within the Subbasin. These Management Areas include the Marina-Ord Management Area (Marina-Ord Area) and the Corral de Tierra Management Area (Corral de Tierra Area) (Figure ES-2). The Marina-Ord Area consists of the lands within the City of Marina, City of Seaside, and the former Fort Ord. The Corral de Tierra Area consists of the remainder of the Subbasin, which includes lands generally located south of State Route 68 and a few parcels along the northern subbasin boundary with the 180/400-Foot Aquifer Subbasin.

MCWD GSA has prepared GSP components for the Marina-Ord Area and the SVBGSA has prepared GSP components for the Corral de Tierra Area. Both GSAs have worked collaboratively to develop and implement stakeholder engagement plans for the GSP. Each GSA has also guided stakeholder engagements efforts within their respective Management Areas.

As part of intra-basin coordination, regular Technical Subcommittee meetings have been held by the GSAs and Steering Committee meetings were scheduled and held on an as needed basis. In addition, stakeholders and beneficial users within each management area have been provided a variety of opportunities for public engagement including: GSA Board meetings, Stakeholder

Workshops, One-on-one meetings with selected stakeholders, and Website communications. SVBGSA also established a SVBGSA Monterey Subbasin Planning Committee that met 13 times to develop and provide feedback on draft GSP chapters. The Monterey Subbasin GSA websites (https://www.mcwd.org/governance_meetings.html and https://svbgsa.org) also contain materials presented at meetings as well as a schedule for upcoming meetings and other workshops open to the public.

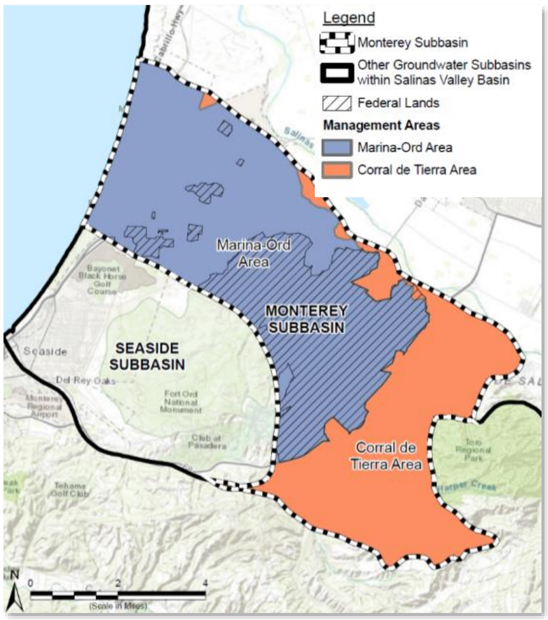

Figure ES-2. Management Areas

ES.3 Plan Area

The Monterey Subbasin is a medium-priority groundwater subbasin in the northwestern Salinas Valley Groundwater Basin in the Central Coast region of California. The Subbasin is covered by the MCWD GSA and SVBGSA and lies entirely within Monterey County. The Subbasin is bounded on the northeast by the 180/400-Foot Aquifer Subbasin (DWR Basin 3-004.01) and on the southwest by the Seaside Subbasin (DWR Basin 3-004.08). The GSAs have established two management areas within the Subbasin, which are the Marina-Ord Area and the Corral de Tierra Area.

The majority of the Subbasin is undeveloped land. Urban uses, including the municipalities of Marina and Seaside, make up primary water users in the Subbasin. Small areas of agriculture, approximately 500 acres of truck nursery and berry crops, are located along the northern subbasin boundary adjoining the 180/400-Foot Aquifer Subbasin. Urban and agricultural water users in the Subbasin rely entirely on groundwater.

A significant number of groundwater monitoring programs exist in the Subbasin and data from these programs have been used to develop the GSP and will continue to be utilized as a part of GSP implementation. The programs and entities that conduct them include:

- California Statewide Groundwater Elevation Monitoring (CASGEM) Program;
- United States Geological Survey (USGS);
- Groundwater Ambient Monitoring and Assessment (GAMA) Program;
- State Water Resource Control Board's (SWRCB's) Division of Drinking Water;
- MCWD, Monterey County Water Resources Agency (MCWRA), and Monterey Peninsula Water Management District (MPWMD);
- Central Coast Regional Water Quality Control Board (CCRWQCB); and
- United States Army Corps of Engineers.

ES.4 Hydrogeologic Conceptual Model

The Monterey Subbasin is located at the northwestern end of the Salinas Valley Groundwater Basin, an approximately 90-mile-long alluvial basin underlying the elongated, intermountain valley of the Salinas River. The Subbasin includes the portions of the Monterey Bay coastal plain, south of the approximate location of the Reliz Fault, as well as upland areas to the southeast of the coastal plain. Topography generally slopes down to the northwest towards Monterey Bay, ranging from sea level at the shoreline to 1,900 ft msl in the southeastern corner of the Subbasin. Soils within the Subbasin are predominantly of Hydrologic Soil Group A in the coastal plain area, indicating high infiltration rates and low runoff potential. In the Fort Ord hills area, soils predominately belong to Hydrologic Soil Groups C and D, with below average and low infiltration rates, respectively, and moderately high and high runoff potential, respectively. A mix of Hydrologic Soil Groups A through D exists in the Corral de Tierra Area east of El Toro Creek.

The Monterey Subbasin is hydrostratigraphically complex and represents a transition zone between the more defined, laterally continuous aquifer system along the central axis of the Salinas Valley and the less continuous aquifer systems towards the Sierra de Salinas. The water-bearing strata within the Subbasin include river and sand dune deposits of Holocene and Pleistocene age, the Aromas Sand and Paso Robles Formation of Plio-Pleistocene age, the Purisima Formation of Pliocene age, and the Santa Margarita Formation of Miocene age (Greene, 1970; Harding ESE, 2001; Geosyntec, 2007). The Monterey Formation of Miocene age, or the bottom of the Subbasin, represents the relatively non-water-bearing bedrock that underlies the Subbasin.

Hydrostratigraphy in the Marina-Ord Area consists of a series of laterally continuous aquifers consistent with the aquifers that form the distinguishing features of the northern Salinas Valley. The principal aquifers within the Marina-Ord Area include the unconfined Dune Sand Aquifer and the confined aquifers known as the 180-Foot Aquifer, the 400-Foot Aquifer, and the Deep Aquifers. Hydraulic conductivity of the aquifers underlying the Marina-Ord Area varies by aquifer and location. Groundwater production generally occurs from the 180/ 400-Foot Aquifers and the Deep Aquifers.

Natural groundwater recharge occurs through infiltration of surface water, deep percolation of excess applied irrigation water, and deep percolation of infiltrating precipitation. Most of the Marina-Ord Area has good recharge potential due to the high permeability of the Dune Sand Aquifer which subsequently recharges the underlying 180-Foot and 400-Foot Aquifers.

Within the southern Corral de Tierra Area, the aquifers have historically been described by their geologic names, such as the Aromas Sand, Paso Robles Formation, and Santa Margarita Sandstone (Geosyntec, 2007; Yates 2005). Based on best available information as well as many wells that span multiple formations, these geologic formations are grouped together to form the El Toro Primary Aquifer System for the Corral de Tierra Area. Natural groundwater recharge occurs through infiltration of surface water if and where it occurs, and deep percolation of infiltrating precipitation. Most of the Corral de Tierra Area has good recharge potential due to the high permeability of soils which subsequently recharges the underlying sandy, gravelly layers of the Aromas Sand and Paso Robles Formation.

The primary surface water bodies in the Subbasin are the Salinas River, and Toro Creek, which is generally perennial below the confluence with Watson Creek (Feikert, 2001). Recorded streamflows at USGS gage 11152540 from 1961 to 2001 indicate a mean annual streamflow of 1,590 AFY for Toro Creek, however not all years registered flow (GeoSyntec, 2007). The Salinas River crosses into the Subbasin in two locations in the Corral de Tierra Area and may provide some recharge in areas that do not have the Salinas Valley Aquitard that generally defines the 180/400-Foot Aquifer Subbasin.

ES.5 Current and Historical Groundwater Conditions

Groundwater conditions in the Subbasin are described for each of DWR's six sustainability indicators identified below.

- Chronic Lowering of Groundwater Levels – Groundwater elevations have generally been stable for over three decades in the Dune Sand Aquifer, the upper and lower 180-Foot Aquifer, and the 400-Foot Aquifer within the northern Marina-Ord Area. Since the mid-2000s, groundwater levels have been declining in 400-Foot Aquifer wells located in the southwestern portion of the Marina-Ord Area and in Deep Aquifer wells. Decreases in groundwater elevations in the Deep Aquifers are the result of increased production from the Deep Aquifers in the Salinas Valley Groundwater Basin. Groundwater level declines observed in the Deep Aquifers range from about 20 ft to 50 ft over the last two decades. Groundwater level declines have also been observed historically within the El Toro Primary Aquifer System in the Corral de Tierra Area. Groundwater level declines in the El Toro Primary Aquifer System range from about 20 ft to 80 ft over the last two decades.

- Changes in Groundwater Storage – Modeling results indicate an average annual loss of storage of 4,434 acre-feet per year (AFY) over the historical period (Water Year [WY] 2004-2018) in the Monterey Subbasin. This loss in storage is due to declining groundwater levels. There has been a minimal loss in storage due to seawater intrusion during the historical period as there has been negligible expansion of the seawater intrusion front. Seawater that enters the Monterey Subbasin from the ocean flows toward the 180/400-Foot Aquifer Subbasin boundary, where groundwater levels are lower in the seawater intruded aquifers.
- Seawater Intrusion – Seawater intrusion has been documented in the northern portion of the Monterey Subbasin in the lower 180-Foot and 400-Foot Aquifers. MCWRA and others have implemented a series of engineering projects and management actions to address seawater intrusion within the Salinas Valley Groundwater Basin. These projects and actions include the development of the Castroville Seawater Intrusion Project (CSIP), the Salinas Valley Water Project (SVWP), and well construction moratoriums, among other actions. Although these actions have managed to slow the advancement of the seawater intrusion front and reduce its impacts, seawater intrusion remains an ongoing threat. To date, seawater intrusion has not been reported in the Deep Aquifers.
- Groundwater Quality – Known groundwater quality concerns in the Marina-Ord Area include elevated chloride and TDS concentrations and legacy point-source contamination from former Fort Ord. Such point source contamination is being addressed by the United States Army Corps of Engineers (Army) and includes contaminants such as Volatile Organic Compounds (VOCs) and per- and poly-fluoroalkyl substances (PFAS). The primary source of high TDS and chloride concentrations in groundwater within the Marina-Ord Area is seawater intrusion. In the Corral de Tierra Area, the most prevalent water quality concern is naturally occurring arsenic.
- Subsidence – No measurable subsidence has been recorded anywhere in the Monterey Subbasin.
- Depletion of Interconnected Surface Waters – Surface water streams within the Subbasin are generally small intermittent streams that flow only after storm events, and are unlikely to be connected to groundwater, except for the lower reaches of El Toro Creek and two potential locations along the Salinas River near the Monterey-180/400-Foot Aquifer Subbasin boundary where the Salinas River intercepts the Subbasin in a small portion of the Corral de Tierra Area.

ES.6 Water Budget Information

Water budgets provide an accounting and assessment of the total annual volume of surface water and groundwater entering and leaving the Subbasin. This GSP presents three water budgets – historical (Water Year [WY] 2004-2018), current (WY 2015-2018), and a 50-year projected (WY 2019-2068) water budget period. Water budgets for each timeframe are presented for the Subbasin as a whole. In addition, zone budgets are presented for each management area.

The water budget information is based on the numerical Monterey Subbasin Groundwater Flow Model (i.e., "Monterey Subbasin Model" or "MBGWFM"), which was developed for the Subbasin. The MBGWFM uses the USGS Newton formulation of the Modular Three-Dimensional Groundwater Modeling platform (MODFLOW-NWT) to solve the governing groundwater flow equations. Table ES-1 summarizes inflows to and outflows from the basin-wide groundwater system by water source type during the historical water budget period and current water budget period. Water budget components include recharge, well pumping, net inter-basin flow, and net river exchange.

ES.6.1 Historical Water Budget Period

Although estimated groundwater recharge (10,055 AFY) exceeded pumping in the Monterey Subbasin (5,651 AFY) during the historical period, the net estimated annual change in groundwater storage in the Monterey Subbasin was -4,434 AFY. This value is negative indicating a loss of storage during the historical period. Inter-basin outflows accounted for the majority of the Subbasin's groundwater outflow over the historical period. Net inter-basin outflows (8,999 AFY) well exceeded groundwater pumping and were close to the total estimated recharge in the Subbasin. These estimated outflows are reflective of the large inland gradients that exist between the Monterey Subbasin and the 180/400-Foot Aquifer Subbasin. Groundwater levels in the 180/400-Foot Aquifer Subbasin are more than 40 feet below sea level in the 180- and 400-Foot Aquifers and have recently declined to over 100 feet below sea level in the Deep Aquifers. These results demonstrate the relationship and interdependence between inter-basin inflows, outflows, and the Subbasin water budget and the need for coordinated sustainable groundwater management in all of these subbasins.

The loss in storage is reflected in the groundwater level declines that have been observed in the 400-Foot Aquifer and Deep Aquifers within the Marina-Ord Area and within the El Toro Primary Aquifer in the Corral de Tierra Area. The negative net annual change in storage indicates that the Monterey Subbasin was in overdraft during the historical period.

ES.6.2 Current Water Budget Period

The current basin-wide water budget is based upon water years 2015 through 2018 and is also presented in Table ES-1. The current water budget includes the same water budget components as the historical water budget but characterizes basin conditions over a much shorter period of time during which recharge was much higher than during the historical period. As such, the net annual change in groundwater storage (-1,609 AFY) was much smaller during the current period. However, this value is likely not representative of long-term conditions as it is not reflective of the long-term hydrologic cycle.

Table ES-1. Historical and Current Groundwater Water Budget Results, Monterey Subbasin

Net Annual Groundwater Flows (AFY) (a)	Historical Annual Inflows/Outflows WY 2004 - 2018	Current Annual Inflows/Outflows WY 2015 - 2018
Recharge		
● Rainfall, leakage, irrigation	**10,055**	**12,060**
Well Pumping		
● Well Pumping	**-5,641**	**-5,274**
Net Inter-Basin Flow (Presumed Freshwater) (b)		
● Seaside Subbasin	918	1,334
● 180/400-Foot Aquifer Subbasin	-9,393	-9,307
● Ocean	-524	-574
	-8,999	**-8,547**
Net Inter-Basin Flow (Presumed Seawater) (b)		
● 180/400-Foot Aquifer Subbasin	-2,872	-3,258
● Ocean	2,872	3,258
	0	**0**
Net Surface Water Exchange		
● Salinas River Exchange	**151**	**153**
NET ANNUAL CHANGE IN GROUNDWATER STORAGE	**-4,434**	**-1,609**

Notes:

(a) Positive values indicate a net inflow and negative values indicate a net outflow.
(b) All seawater inflows from the ocean are presumed to leave the Monterey Subbasin across the 180/400-Foot Aquifer Subbasin boundary, as evidenced by negligible expansion of the seawater intrusion front in the Monterey Subbasin over the historical time period.

ES.6.3 Projected Water Budget Period

Projected water budgets provide estimates of future conditions of water supply and demand within a basin, as well as the aquifer response to implementation of the Plan over the planning and implementation horizon. The projected water budget uses the same tools and methodologies that were used for the historical and current water budget, with updated inputs for climate variables (i.e., precipitation and ET), land use (water demand), and future subbasin boundary conditions. Given that historical water budget results indicate that conditions in the Monterey Subbasin are highly sensitive to conditions in adjacent subbasins, projected water budget results are presented for three alternative sets of boundary conditions in the 180/400-Foot Aquifer Subbasin. These boundary conditions include:

- Minimum Threshold (MT) Boundary Conditions: where groundwater levels along the Monterey Subbasin and 180/400-Foot Aquifer Subbasin boundary are raised to water level MTs established in the 180/400-Foot Aquifer Subbasin GSP.
- Measurable Objective (MO) Boundary Conditions: where groundwater levels along the Monterey and 180/400-Foot Aquifer Subbasin boundary are raised to water level MOs established in the 180/400-Foot Aquifer Subbasin GSP.

- Seawater Intrusion (SWI) Protective Boundary Conditions: Where groundwater levels along the Monterey Subbasin and 180/400-Foot Aquifer Subbasin boundary are set to levels protective against further seawater intrusion within the 180- and 400- Foot aquifers. In the absence of the installation of a hydraulic injection and/or extraction barrier, these SWI protective elevations represent the minimum groundwater elevations that would be needed in the coastal portions of the 180/400-Foot Aquifer Subbasin to stop further seawater intrusion consistent with the MTs for seawater intrusion established in the 180/400-Foot Aquifer Subbasin GSP.

Each of these boundary condition scenarios is predicated on the assumption that the 180/400-Foot Aquifer Subbasin will be managed to its SMCs over the 50-year projected model period. In addition, boundary conditions for the Seaside Subbasin, which is an adjudicated subbasin, are assumed to remain stable at Fall 2017 levels[1].

The chief purpose of this projected water budget analysis is to assess the magnitude of the net water supply deficit that would need to be addressed through Projects and Management Actions to prevent Undesirable Results and achieve the Sustainability Goal.

Projected water budget results are also presented for three alternative sets of hydrology and climate conditions including:

- Baseline (Historical Analog) Conditions: a 50-year analog period developed using a sequence of historical hydrologic input information that reflects the Subbasin's long-term average hydrologic conditions
- 2030 ("Near future") Climate Conditions: A water budget scenario based on 2030 climate change factors published by DWR.
- 2070 ("Late future") Climate Conditions: A water budget scenario based on 2070 "central tendency" climate change factors published by DWR.

Table ES-2 shows the water budget results under a "no project" scenario, which assumes all future projected water demands in the Monterey Subbasin will be met with groundwater. This table provides water budget results under the identified variable boundary conditions and 2030 climate conditions. As shown in Table ES-2**Error! Reference source not found.**, the net annual c hange in groundwater storage is expected to be minimum.

[1] Or at the established MTs (i.e., based on 2015 water levels) in the Corral de Tierra Area wherever they were below MTs at the end of the Historical Period. See discussion in Section 6.5.2.

Table ES-2. Comparison of Projected Water Budget Results Under "No Project" Scenarios with Variable Boundary Conditions and 2030 Climate Condition, Monterey Subbasin

Net Annual Groundwater Flows (a) (AFY)	Historical Annual Inflows/Outflows (WY 2004-2018)	Projected Annual Inflows/Outflows 2030 Climate Conditions		
		Minimum Threshold Boundary Conditions	Measurable Objective Boundary Conditions	Seawater Intrusion Protective Boundary Conditions
Recharge				
● Rainfall, leakage, irrigation	**10,055**	**10,928**	**10,928**	**10,928**
Well Pumping				
● Well Pumping	**-5,641**	**-10,955**	**-10,955**	**-10,955**
Net Inter-Basin Flow				
● Seaside Subbasin	918	2,414	1,258	-453
● 180/400-Foot Aquifer Subbasin	-12,265	-5,583	-3,412	-295
● Ocean (Presumed Freshwater)	-524	-725	-752	-794
● Ocean (Presumed Seawater)	2,872	2,939	2,369	1,308
	-8,999	**-955**	**-537**	**-234**
Net Surface Water Exchange				
● Salinas River Exchange	**151**	**261**	**254**	**279**
NET ANNUAL CHANGE IN GROUNDWATER STORAGE	**-4,434**	**-721**	**-310**	**18**

Notes:

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

As shown in this table, the projected net annual change in groundwater storage ranges between -721 and 18 AFY for the "No Project" scenario. The net annual change in groundwater storage is significantly lower than that calculated for the historical period (-4,434 AFY) and indicates that Monterey Subbasin inflows and outflows would be close to balanced under any of these boundary condition scenarios. A review of climate scenario results indicates that this conclusion is true under all identified climate change scenarios, as rainfall and recharge are projected to increase under future climate scenarios within the Subbasin. As such, these projected water budget results indicate that overdraft conditions within the Monterey Subbasin will be substantially mitigated if adjacent basins are managed sustainably and SMCs are achieved.

Projected water level elevations for the "No Project" scenario were also compared to water level MTs and MOs established in the Marina-Ord Area WBZ and Corral de Tierra Area WBZ, to determine if projects and management actions need to be implemented to meet SMCs in these Management Areas. Figure ES and Figure ES depict average projected changes in groundwater elevations at RMS wells in the Marina-Ord Area and Corral De Tierra WBZ under the "No Project" scenario with variable boundary conditions. These figures also identify the average change in water levels required to reach MTs and MOs at RMS wells in each management area.[2]

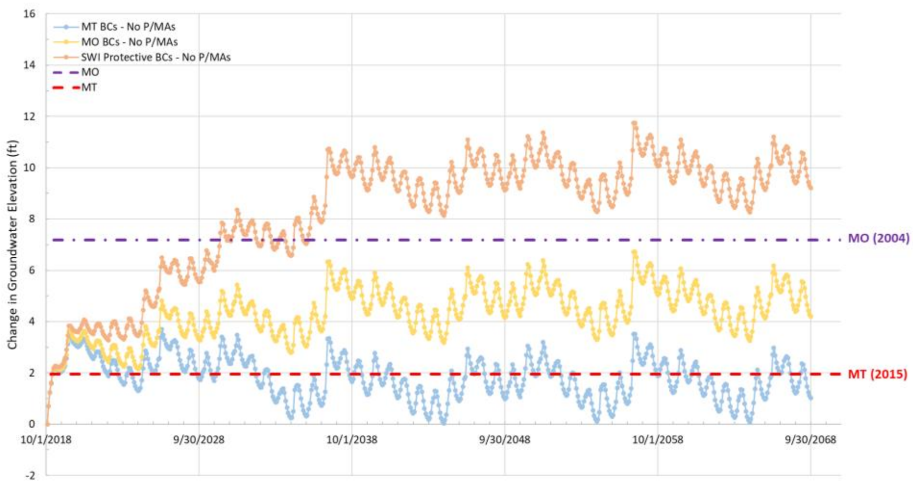

Figure ES-3. Comparison of Groundwater Elevation Changes Under "No Project" Scenario with Various Boundary Conditions and 2030 Climate Condition, Marina-Ord Area WBZ

[2] This figure shows average projected groundwater elevation changes in the 35 RMS wells in the Marina-Ord Area with respect to those modeled at the end of the historical period (i.e., 2018). The MT and MO elevations shown on this graph reflects their average elevations with respect to 2018 water levels at the RMS wells. For example, MTs, which are set based on 2015 water levels, are on average 2 feet higher than 2018 water levels in these RMS wells.

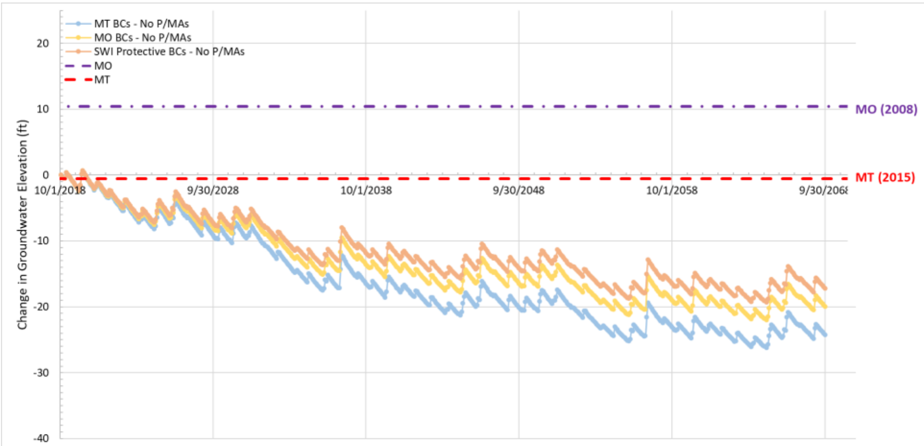

Figure ES-4. Comparison of Groundwater Elevation Changes Under "No Project" Scenario with Various Boundary Conditions and 2030 Climate Condition, Corral de Tierra Area WBZ

As shown on Figure ES, groundwater elevations in the Marina-Ord Area WBZ are projected to stabilize under all boundary conditions scenarios within the first ten years of GSP implementation. However, the resulting average groundwater elevation varies significantly between the various boundary scenarios. These results indicate that projects and/or management actions may be required to consistently maintain water levels above MTs and to achieve MOs within the Marina-Ord Area unless SWI protective boundary conditions are achieved in the adjacent subbasins.

As shown on Figure ES, groundwater elevations in the Corral de Tierra Area WBZ are projected to stabilize in the last ten years of the 50-year analog period. However, they stabilize at levels that are on average 17 to 25 feet lower than groundwater elevation MTs and 28 to 36 feet lower than groundwater elevations MOs even if SMCs are achieved in adjacent subbasins under these boundary condition scenarios. These results suggest that projects and/or management actions will be required to raise water levels above MTs and to achieve MOs within the Corral de Tierra Area WBZ.

ES.6.4 Sustainble Yield

SGMA defines sustainable yield as "the maximum quantity of water, calculated over a base period representative of long-term conditions in the Subbasin and including any temporary surplus, that can be withdrawn annually from a groundwater supply without causing an undesirable result" (CWC §10721(w)). Determination of the sustainable yield for the Subbasin is supported by water budget information and, more importantly, depends upon whether undesirable results are avoided within the timeframes required by SGMA. As discussed above, the attainment of MTs and MOs, which are established to avoid undesirable results and achieve basin sustainability, should be considered in the estimation of sustainable yield under SGMA.

The sustainable yield of the Monterey Subbasin is significantly affected by recharge, pumping, and conditions in adjacent subbasins. As such, the sustainable yield established based on historical overdraft has significant uncertainty, does not address all undesirable results. It also does not consider future conditions in adjacent subbasins which are projected to change as these subbasins move toward sustainability. A first-order estimate of the historic sustainable yield based on overdraft is provided Section 6.5. The historical and current sustainable yield estimates are for information only and do not guide groundwater management activities in this GSP.

Projected water budget results have been used to estimate the projected sustainable yield. The sustainable yield has been evaluated by Management Area (i.e., water budget zone) as conditions vary and independent SMCs have been established for each area.

Projected water budget results under the “no project” scenario support the conclusion that 9,870 AFY can be pumped from the Marina-Ord Area WBZ without long-term loss in storage. These calculations provide only first-order estimates of the magnitude of the Marina-Ord Area WBZ sustainable yield. Comparison of projected groundwater levels within the Marina-Ord Area WBZ under the “no project” and “project” scenarios presented in Section 9.6 with established groundwater level MTs and MOs provides significant insight regarding the projected sustainable yield as defined under SGMA. As discussed above, the attainment of MTs and MOs for all sustainability indicators, which are established to avoid undesirable results and achieve basin sustainability, should be considered in the estimation of sustainable yield under SGMA. As discussed in Sections 6.5.4, 9.6, and 9.6.1, projected groundwater level data indicate that:

- Under the “no project” scenario, groundwater levels in RMS wells stabilize and are generally higher than MTs during non-drought periods under all identified boundary conditions and climate scenarios, and reach MOs if SWI Protective Boundary Conditions are achieved in adjacent subbasins.

- Under the “Project” scenario, groundwater levels stabilize and are higher than MTs and reach MOs in RMS wells within the Marina-Ord Area WBZ, if MT and MO boundary conditions are achieved in adjacent subbasins, respectively.

These results indicate that the projected sustainable yield of the Marina-Ord Area WBZ ranges from approximately 4,400 AFY if adjacent subbasins are managed to their groundwater level MTs and adjudication goals as defined in their respective groundwater planning documents, to approximately 9,900 AFY if adjacent subbasins are managed to SWI protective groundwater levels[3]. As such, the actual sustainable yield of the Marina-Ord area will be impacted by the

[3] In the absence of the installation of a seawater intrusion extraction or injection barrier, SWI Protective Boundary Conditions will be required to achieve seawater intrusion MTs in the 180/400-Foot Aquifer Subbasin.

groundwater levels achieved and methods used to address seawater intrusion and reach SWI MTs within adjacent subbasins, e.g., groundwater recharge, seawater intrusion extraction or injection barrier, or a combination of methods. Therefore, a coordinated approach will be required to reach sustainability within the Monterey subbasin and adjacent subbasins. Further, although these projected budget results provide potential insight into the sustainable yield of the Marina-Ord Area, confirmation that these quantities could be extracted without inducing seawater intrusion has to be verified.

A first-order estimate of the projected sustainable yield of the Corral de Tierra Area WBZ is 2,100 AFY. This estimate of sustainable yield is the sustainable yield to hold groundwater levels where they are after the first 20 years of GSP implementation if there are no projects undertaken. Since groundwater levels are declining, this groundwater level would be significantly below current groundwater levels in the Corral de Tierra Area and below the groundwater level MTs. Therefore, this sustainable yield estimate of 2,100 AFY is likely an overestimate of the true sustainable yield where all undesirable results are avoided.

ES.7 Monitoring Networks

The MCWD GSA and SVBGSA developed the Monterey Subbasin's SGMA Monitoring Network to: (1) collect sufficient data to assess sustainability indicators relevant to the Subbasin, (2) evaluate potential impacts to the beneficial uses and users of groundwater, and (3) assess the effectiveness of the P/MAs implemented by the GSAs. The proposed SGMA Monitoring Network was developed to ensure sufficient spatial distribution and spatial density. The monitoring networks for the six sustainability indicators are described below.

- Chronic Lowering of Groundwater Levels – The sustainability indicator for chronic lowering of groundwater levels is evaluated by monitoring groundwater elevations in designated monitoring wells. The groundwater elevation monitoring network in the Marina-Ord Area consists of over 390 wells, in which water levels are measured by U.S. Army, MCWRA, MPMWD, and/or the Seaside Groundwater Basin Watermaster. The groundwater elevation monitoring network in the Corral de Tierra Area consists of 13 wells, in which water levels are measured by MCWRA. Of these actively monitored wells, 35 have been selected as groundwater elevation representative monitoring site (RMS) wells in the Marina-Ord Area (2 to 6 wells per principal aquifer) and 13 have been selected as groundwater elevation RMS wells in the Corral de Tierra Area. In addition, the GSAs will incorporate groundwater level data from wells in adjacent subbasins and will continue to collaborate with agencies in adjacent subbasins. Areas where data gaps have been identified and additional monitoring is needed will be addressed by identifying an existing well or wells that meet valid monitoring well criteria, or drilling a new well or wells in these areas.
- Changes in Groundwater Storage – Data and minimum thresholds used to define undesirable results for chronic lowering of groundwater levels and seawater intrusion will also be used to assess reduction of groundwater storage. As such, the reduction of

groundwater storage monitoring network will consist of the same RMS wells as those used for groundwater elevation and seawater intrusion monitoring.

- Seawater Intrusion – The sustainability indicator for seawater intrusion is evaluated using the location of the 500 milligrams per liter (mg/L) chloride isoconcentration contour that is based on chloride concentrations, equivalent total dissolved solids (TDS) concentrations, and/or specific conductivity measurements. The seawater intrusion monitoring network consists of 42 RMS wells in the Marina-Ord area that are monitored by MCWD, U.S. Army, MCWRA, MPMWD, and/or the Seaside Groundwater Basin Watermaster. Areas where data gaps in this network have been identified overlap with areas where groundwater elevation monitoring data gaps exist and will be addressed concurrently.
- Groundwater Quality – The sustainability indicator for degraded water quality is evaluated by monitoring groundwater quality at a network of existing water supply wells. Separate minimum thresholds are set for the constituents of concern for public water system supply wells, on-farm domestic wells, and agricultural supply wells. Therefore, although there is a single groundwater quality monitoring network, different wells in the network are reviewed for different constituents. Constituents of concern for drinking water are assessed at public water supply wells and on-farm domestic wells, and constituents of concern for crop health are assessed at agricultural supply wells. There is adequate spatial coverage to access the groundwater quality in the Subbasin, and as new domestic and agricultural supply wells are added to Ag Order 4.0, they will be added to the monitoring program.
- Subsidence – DWR has, and will be, collecting land subsidence data using InSAR satellite data, and will make these data available to GSAs. This subsidence dataset represents the best available data for the Monterey Subbasin and will therefore be used as the subsidence monitoring network.
- Depletion of Interconnected Surface Waters – Shallow groundwater elevations near potential locations of interconnected surface water will be used as a proxy metric for this indicator. As such, the interconnected surface water monitoring network will be comprised of RMS sites adjacent to potential interconnected surface waters where minimum thresholds and measurable objectives based on shallow groundwater levels are developed for depletion of interconnected surface water. Given the stable groundwater patterns in the Dune Sand Aquifer, there is no significant and unreasonable depletion of interconnected surface water under current conditions in the Marina-Ord Area. One RMS well is included in the interconnected surface water monitoring network in this area. In the event that future groundwater activities in the Subbasin or the adjacent 180/400-Foot Aquifer Subbasin may influence the condition of the Marina vernal ponds and/or the Dune Sand Aquifer, the GSAs will work with project proponents to install additional shallow groundwater monitoring wells. In the Corral de Tierra Area, the level of surface water interconnection with the principal aquifer is unclear. An analysis of shallow groundwater levels is used to identify areas of potential interconnection between surface

water and groundwater. There are currently no known existing wells that could be included in the interconnected surface water monitoring network near the El Toro Creek or Salinas River. To fill this data gap, SVBGSA will work to install one shallow well near El Toro Creek into the interconnected surface water monitoring network and may work with the United States Geological Survey (USGS) to reactivate the stream gauge along Toro Creek. The conjunctive data collection will help correlate the potential seasonal flows with shallow groundwater and assess both the interconnectivity as well as the relationship with deeper wells in the area.

Data collected from the SGMA Monitoring Network will be uploaded to a Data Management System to be established and managed for the Monterey Subbasin and reported to the DWR in accordance with the Monitoring Protocols developed for the Subbasin.

ES.8 Sustainable Management Criteria

Sustainable Management Criteria (SMCs) are the metrics by which groundwater sustainability is judged under SGMA. Key terms related to SMCs under SGMA include the following:

- **Sustainability indicator** refers to any of the effects caused by groundwater conditions occurring throughout the Subbasin that, when significant and unreasonable, cause undesirable results, as described in California Water Code §10721(x).

  The six sustainability indicators relevant to this subbasin include chronic lowering of groundwater levels; reduction of groundwater storage; degraded water quality; land subsidence; seawater intrusion; and depletion of interconnected surface waters.

- **Undesirable Results** occur when significant and unreasonable effects for any of the sustainability indicators are caused by groundwater conditions occurring throughout the Subbasin.

  The GSP Emergency Regulations requires that the description of undesirable results include (1) the cause of groundwater conditions that would lead to or has led to undesirable results; (2) a quantitative description of the combination of minimum threshold exceedances that cause significant and unreasonable effects in the Subbasin (i.e., the undesirable result criteria); and (3) potential effects that may occur or are occurring from undesirable results. An example undesirable result criteria could be defined as: more than 10% of the measured groundwater elevations being lower than the minimum thresholds.

- **Significant and Unreasonable Conditions**

  Significant and unreasonable is not defined in the Regulations. However, the definition of undesirable results states, "Undesirable results occur when significant and unreasonable effects … are caused by groundwater conditions…". The SGMA BMP states that "the GSAs must consider and document the conditions at which each of the six sustainability indicators become significant and unreasonable, including reasons for justifying each *particular threshold selected." Therefore, this GSP adopts the phrase significant and unreasonable conditions to be the qualitative description of conditions used to justify selected minimum thresholds and undesirable results criteria.*

- **Measurable objectives** refer to specific, quantifiable goals for the maintenance or improvement of specified groundwater conditions that have been included in an adopted Plan to achieve the sustainability goal for the Subbasin.

  Measurable objectives are goals that the GSP is designed to achieve.

- **Minimum threshold** refers to a numeric value for each sustainability indicator used to define undesirable results.

  Minimum thresholds are quantitative indicators of an unreasonable condition.

- **Interim milestone** refers to a target value representing measurable groundwater conditions, in increments of five years, set by an Agency as part of a Plan.

  Interim milestones are targets such as groundwater elevations that will be achieved every five years to demonstrate progress towards sustainability.

The SMCs detailed in Table ES-3 define the Subbasin's future conditions and commit the GSA to actions that will meet these objectives.

Table ES-3. Sustainable Management Criteria Summary

Sustainability Indicator	Measurement	Minimum Threshold	Measurable Objective	Undesirable Result	Interim Milestones
Chronic lowering of groundwater levels	Measured through the groundwater elevation representative monitoring well network within each management area	**Marina-Ord Area:** Minimum groundwater elevations historically observed between 1995 and 2015 in the Dune Sand, 180-Foot, 400-Foot, and Deep Aquifers.	**Marina-Ord Area:** Groundwater elevations observed in 2004 in the Dune Sand, 180-Foot, 400-Foot, and Deep Aquifers.	Over the course of any one year, exceedance of more than 20% of groundwater level minimum thresholds 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.	**Whole Subbasin:** Interim milestones are described in Table 8-3 for each RMS well that is defined in Chapter 7.
		Corral de Tierra Area: Groundwater elevations observed in 2015 in the El Toro Primary Aquifer System.	**Corral de Tierra Area:** Groundwater elevations observed in 2008 in the El Toro Primary Aquifer System.		

Sustainability Indicator	Measurement	Minimum Threshold	Measurable Objective	Undesirable Result	Interim Milestones
Reduction in groundwater storage	Measured through the groundwater elevation and seawater intrusion representative monitoring well networks.	**Whole Subbasin:** Minimum thresholds for chronic lowering of groundwater levels and seawater intrusion will be used as a proxy for reduction of groundwater storage minimum threshold.	**Whole Subbasin:** Measurable objectives for chronic lowering of groundwater levels and seawater intrusion will be used as a proxy for reduction of groundwater storage measurable objective.	Over the course of any one year, (1) exceedance of more than 20% of groundwater level minimum thresholds 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 minimum thresholds.	**Whole Subbasin:** Groundwater elevation and seawater intrusion interim milestones described respectively in Table 8-3 and Section 8.9.4.2 will serve as a proxy for reduction of groundwater storage interim milestones.

Sustainability Indicator	Measurement	Minimum Threshold	Measurable Objective	Undesirable Result	Interim Milestones
Seawater intrusion	Measured through seawater intrusion representative monitoring well network.	**Whole Subbasin:** The approximate location in 2015 of the 500 mg/L chloride concentration isocontour in the lower 180-Foot and 400-Foot Aquifers; Approximately 3,500 feet from the coast in the Dune Sand Aquifer, upper 180-Foot Aquifer and Deep Aquifers. This distance is generally consistent with the location of Highway 1 in the Monterey Subbasin and seaward of groundwater extraction wells in the Subbasin. No seawater intrusion in the El Toro Primary Aquifer System.	**Whole Subbasin:** Measurable objective is identical to the minimum threshold.	Any exceedance of the minimum threshold is considered as an undesirable result.	**Whole Subbasin:** Identical to minimum thresholds and measurable objectives. No seawater intrusion above 500 mg/L chloride in RMS wells.

Sustainability Indicator	Measurement	Minimum Threshold	Measurable Objective	Undesirable Result	Interim Milestones
Degraded groundwater quality	Groundwater quality data downloaded annually from state sources.	**Whole Subbasin:** 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. See Table 8-5 for the list of constituents.	**Whole Subbasin:** Measurable objective is identical to the minimum threshold.	Any exceedances of minimum thresholds during any one year as a direct result of projects or management actions conducted pursuant to GSP implementation is considered as an undesirable result.	**Whole Subbasin:** Identical to minimum thresholds and measurable objectives, which represent current conditions
Subsidence	Measured using DWR-provided InSAR data.	**Whole Subbasin:** 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.	**Whole Subbasin:** Measurable objective is identical to the minimum threshold.	Any exceedances of minimum thresholds during any one year due to lowered groundwater elevations is considered as an undesirable result.	**Whole Subbasin:** Identical to minimum thresholds and measurable objectives, which represent current conditions.

Sustainability Indicator	Measurement	Minimum Threshold	Measurable Objective	Undesirable Result	Interim Milestones
Depletion of interconnected surface water (ISW)	Measured through shallow groundwater elevations as a proxy near potential locations of ISW in the ISW representative monitoring well network.	**Whole Subbasin:** Minimum shallow groundwater elevations historically observed between 1995 and 2015 near locations of interconnected surface water.	**Whole Subbasin:** Identical to minimum threshold shallow groundwater elevations.	Any minimum threshold exceeded in a shallow groundwater well near any location of ISW for more than two consecutive years.	**Whole Subbasin:** Identical to minimum thresholds and measurable objectives, which represent current conditions.

ES.9 Projects and Management Actions

This GSP identifies projects and management actions that will allow the Monterey Subbasin to attain sustainability in accordance with §354.42 and §354.44 of the GSP Emergency Regulations. The goal of the projects and management actions is to address significant and unreasonable results related to the chronic lowering of groundwater levels and seawater intrusion in each management area.

The GSP highlights the hydraulic connection between the Monterey Subbasin and both the adjacent critically overdrafted 180/400-Foot Aquifer Subbasin and Seaside Subbasin. Reaching sustainability and achieving measurable objectives within the Monterey Subbasin will be affected by groundwater conditions and management within these adjacent subbasins and the greater Salinas Valley Basin. Therefore, projects, management actions, and implementation actions will need to be coordinated between subbasins to achieve sustainability. Regional coordination projects and multi-subbasin projects are included when they have the potential to directly benefit this Subbasin. Therefore, the Subbasin Groundwater Sustainability Agencies (GSAs) have developed a SGMA implementation approach that includes regional coordination actions, participating in regional, multi-basin projects, in addition to implementing local projects and management actions.

The projects and management actions for this GSP are summarized in Table 9-1 and include these major categories:

- **Multi-subbasin Projects** – Projects that provide supply augmentation to the Monterey Subbasin that require infrastructure or rely on a supply source outside the Monterey Subbasin. These projects are generally identified in multiple Salinas Valley Subbasin GSPs and expand upon how the project would be applied in the Monterey Subbasin. These multi-subbasin projects include:
    - Seasonal Release from Reservoirs with ASR and Direct Delivery
    - Regional Municipal Supply through brackish water desalination extracted from seawater intrusion barrier
    - Multi-benefit Stream Channel Improvements
- **Marina-Ord Area Local Projects and Management Actions** – Projects and management actions to be led by MCWD (or Marina-Ord Area agencies) that will primarily benefit the Marina-Ord Area. These projects and management actions include:
    - MCWD Demand Management Measures – Continued Conservation
    - Stormwater Recharge Management
    - Recycled Water Reuse through Landscape Irrigation and Indirect Potable Reuse
    - Monitoring Wells

- **Corral de Tierra Area Local Projects and Management Actions** – Projects and management actions to be led by SVBGSA that will primarily benefit the Corral de Tierra Area. These projects and management actions include:
    - Pumping Allocation and Control
    - Check Dams
    - Recharge from Surface Water Diversions
    - Wastewater Recycling for Reuse
    - Decentralized Residential In-lieu Recharge Projects
    - Decentralized Stormwater Recharge Projects
    - Increase Groundwater Production in the Upper Corral de Tierra Valley for Distribution to Lower Corral de Tierra Valley (Artesian Well)

The potential projects presented in the GSP, if implemented in aggregate, are adequate to supply the entirety of projected groundwater demands in the Marina-Ord Area and significantly impact the projected demand in the Corral de Tierra Area.

The MCWD GSA and SVBGSA are the same GSAs covering the adjacent 180/400-Foot Aquifer Subbasin and will be directly leading joint efforts to achieve sustainability and mitigate any residual overdraft. As described herein, regional, or multi-subbasin projects and management actions will need to be coordinated. For example, in the event that a seawater intrusion extraction barrier is constructed in the 180/400-Foot Aquifer Subbasin, impacts to groundwater levels, seawater intrusion, and cross-boundary flows will need to be assessed.

To demonstrate this future coordination, Implementation Action 1 (Support Implementation of the 180/400-Foot Aquifer Subbasin GSP and Seaside Watermaster Actions) describes the GSAs' plan to support projects and actions in adjacent subbasins, particularly those that will improve groundwater conditions near Monterey Subbasin boundaries and reduce the potential for seawater intrusion and decrease cross-boundary outflows from the Monterey Subbasin.

ES.10 Plan Implementation

Key GSP implementation activities to be undertaken by the MCWD GSA and SVBGSA over the next five years include:

- Data collection, monitoring, and reporting;
    - Annual monitoring and reporting
    - Updating the Data Management System
    - Improving monitoring networks
    - Addressing identified data gaps in the Hydrogeologic Conceptual Model (HCM)

- Conducting intra-basin and inter-basin coordination;
- Continuing communication and stakeholder engagement;
- Conducting periodic evaluations of the GSP;
- Implementing projects and management actions and preparing grant applications; and
- Developing a funding strategy.

1 INTRODUCTION

1.1 Purpose of the Groundwater Sustainability Plan (GSP or Plan)

The purpose of this Groundwater Sustainability Plan (GSP) is to meet the regulatory requirements set forth in the three-bill legislative package consisting of Assembly Bill (AB) 1739 (Dickinson), Senate Bill (SB) 1168 (Pavley), and SB 1319 (Pavley), collectively known as the Sustainable Groundwater Management Act (SGMA). SGMA defines sustainable groundwater management as the "management and use of groundwater in a manner that can be maintained during the planning and implementation horizon without causing undesirable results". Undesirable results are defined by the Sustainable Groundwater Management Act (SGMA) as any of the following effects caused by groundwater conditions occurring throughout the Subbasin:

- Chronic lowering of groundwater levels indicating a significant and unreasonable depletion of supply;
- Significant and unreasonable reduction of groundwater storage;
- Significant and unreasonable seawater intrusion;
- Significant and unreasonable degraded water quality;
- Significant and unreasonable land subsidence; and/or
- Depletions of interconnected surface water that have significant and unreasonable adverse impacts on beneficial uses of the surface water.

The Monterey Subbasin (Subbasin) has been designated by the California Department of Water Resources (DWR) as medium priority. The Monterey Subbasin is one of the nine subbasins in the Salinas Valley. It is located at the northwestern end of the Salinas Valley and borders the Pacific Ocean (Figure 1-1). This document satisfies the GSP requirement for the Monterey Subbasin and meets all of the regulatory standards.

This GSP has been co-developed by the Marina Coast Water District Groundwater Sustainability Agency (MCWD GSA) and the Salinas Valley Basin Groundwater Sustainability Agency (SVBGSA) to meet SGMA regulatory requirements by January 31, 2022, deadline for medium and high priority basins while reflecting local needs and preserving local control over water resources. This GSP provides a path to achieve and document sustainable groundwater management within 20 years following Plan adoption and preserves the long-term sustainability of locally-managed groundwater resources now and into the future. This GSP was approved by the MCWD GSA Board on DATE and by the SVBGSA Board on DATE (Appendix 1-A).

1.2 Sustainability Goal

The sustainability goal of the Monterey Subbasin is to manage groundwater resources for long-term community, financial, and environmental benefits to the Subbasin's residents and businesses. The goal of this GSP is to ensure long-term viable water supplies to local communities at a reasonable cost. In addition, because the Subbasin is hydrologically connected with other Salinas Valley Basin Subbasins, this GSP aims to develop a coordinated approach to groundwater management within this Subbasin and neighboring Subbasins. The Subbasin will achieve long-term sustainability through implementation of inter- and intra-basin coordination as well as projects and management actions.

Several projects and management actions are included in this GSP and detailed in Chapter 9. These projects and management actions will diversify the Subbasin's water supply portfolio, increase supply reliability, and protect the Subbasin's groundwater resources against seawater intrusion. The Subbasin's historical efforts to invest in water conservation will continue under SGMA.

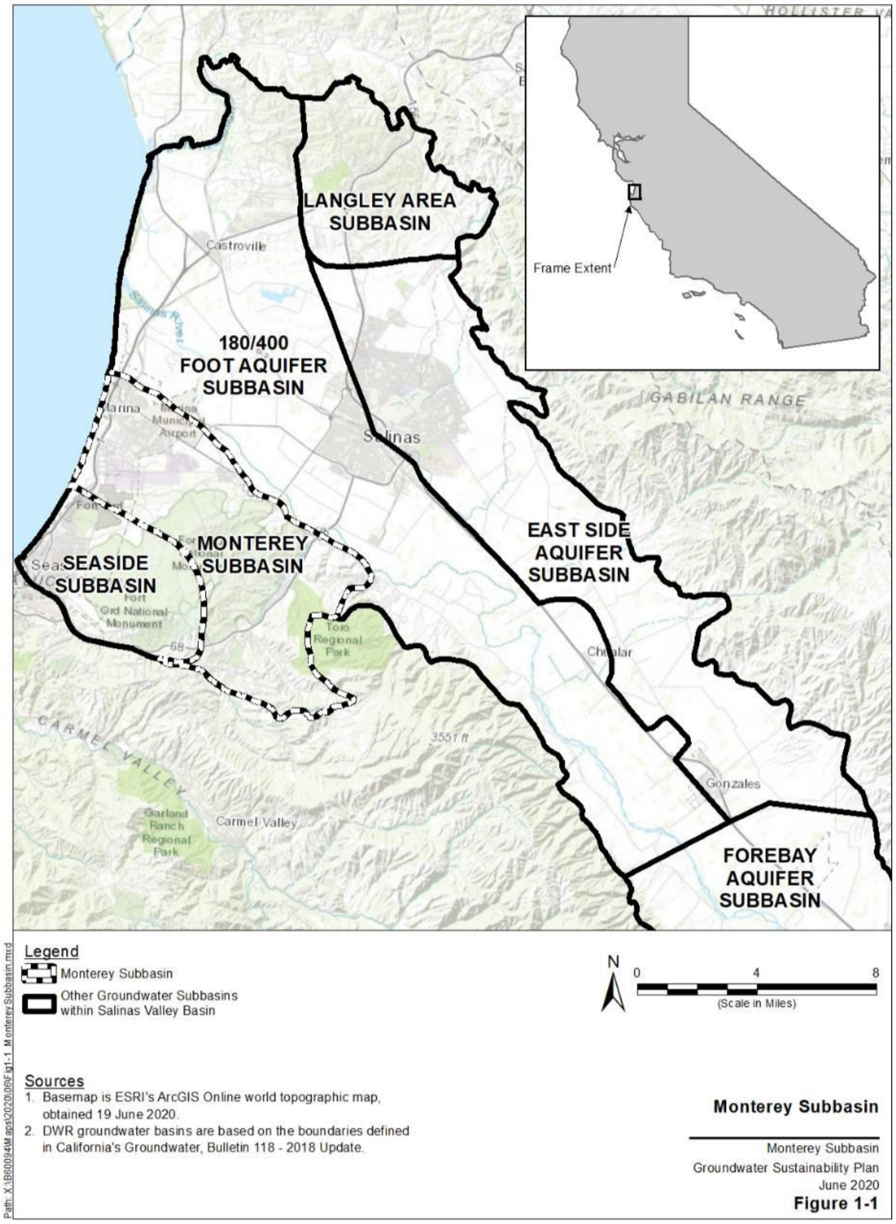

Figure 1-1. Monterey Subbasin

1.3 Agency Information

The Monterey Subbasin is within the jurisdiction of the MCWD GSA and SVBGSA. The GSA boundaries are shown on Figure 1-2.

1.3.1 Name and Mailing Address of the Agency

This GSP has been prepared by MCWD GSA and SVBGSA. The following contact information is provided for each GSA that is a signatory to this GSP, pursuant to California Water Code §10723.8.

Marina Coast Water District Groundwater Sustainability Agency
Attn.: Remleh Scherzinger, General Manager
11 Reservation Road
Marina, CA 93933
http://www.mcwd.org

Salinas Valley Groundwater Sustainability Agency
Attn.: Donna Meyers, General Manager
1441 Schilling Place
Salinas, CA 93901
https://svbgsa.org

1.3.2 Organization and Management Structure of the Agencies

1.3.2.1 MCWD GSA

The MCWD GSA is a single agency GSA formed by MCWD and covering the areas within the MCWD service area within Monterey Subbasin, except for those areas owned by a federal government entity and thus not subject to SGMA. The GSA areas are shown on Figure 1-2. The MCWD GSA Board is comprised of the members of the MCWD Board.

1.3.2.2 SVBGSA

The SVBGSA is a Joint Powers Authority (JPA). The JPA membership comprises the County of Monterey, Monterey County Water Resources Agency (MCWRA), City of Salinas, City of Soledad, City of Gonzales, City of King, the Castroville Community Services District (CSD), and Monterey One Water (formerly the Monterey Regional Water Pollution Control Agency). The SVBGSA is governed and administered by an eleven-member Board of Directors, representing public and private groundwater interests throughout the Valley. When a quorum is present, a Majority Vote is required to conduct business. Some business items require a Super Majority Vote or a Super Majority Plus Vote. A Super Majority requires an affirmative vote by eight of the eleven Board members. A Super Majority Vote is required for:

- Approval of a GSP
- Amendment of budget and transfer of appropriations
- Withdrawal or termination of Agency members

A Super Majority Plus requires an affirmative vote by eight of the eleven Board members, including an affirmative vote by three of the four agricultural representatives. A Super Majority Plus Vote is required for:

- Decisions to impose fees not requiring a vote of the electorate or property owners
- Proposals to submit to the electorate or property owners' decisions to impose fees or taxes
- Limitations on well extractions (pumping limits)

In addition to the Board of Directors, SVBGSA includes an Advisory Committee consisting of Directors and non-Directors. The Advisory Committee is designed to ensure participation by, and input to, the Board of Director by constituencies whose interests are not directly represented on the Board. The SVBGSA's GSA activities are led by a contract General Manager.

1.3.3 Plan Managers

The plan managers for this GSP are Remleh Scherzinger, General Manager of the MCWD, and Donna Meyers, General Manager of the SVBGSA. The contact information for Mr. Scherzinger and Ms. Meyers is provided below.

Remleh Scherzinger
General Manager
Marina Coast Water District
11 Reservation Road, Marina, CA93933-2099
831-883-5910
rscherzinger@mcwd.org

Donna Meyers
General Manager
Salinas Valley Basin Groundwater Sustainability Agency
1441 Schilling Place
Salinas, CA 93901
meyersd@svbgsa.org
https://svbgsa.org

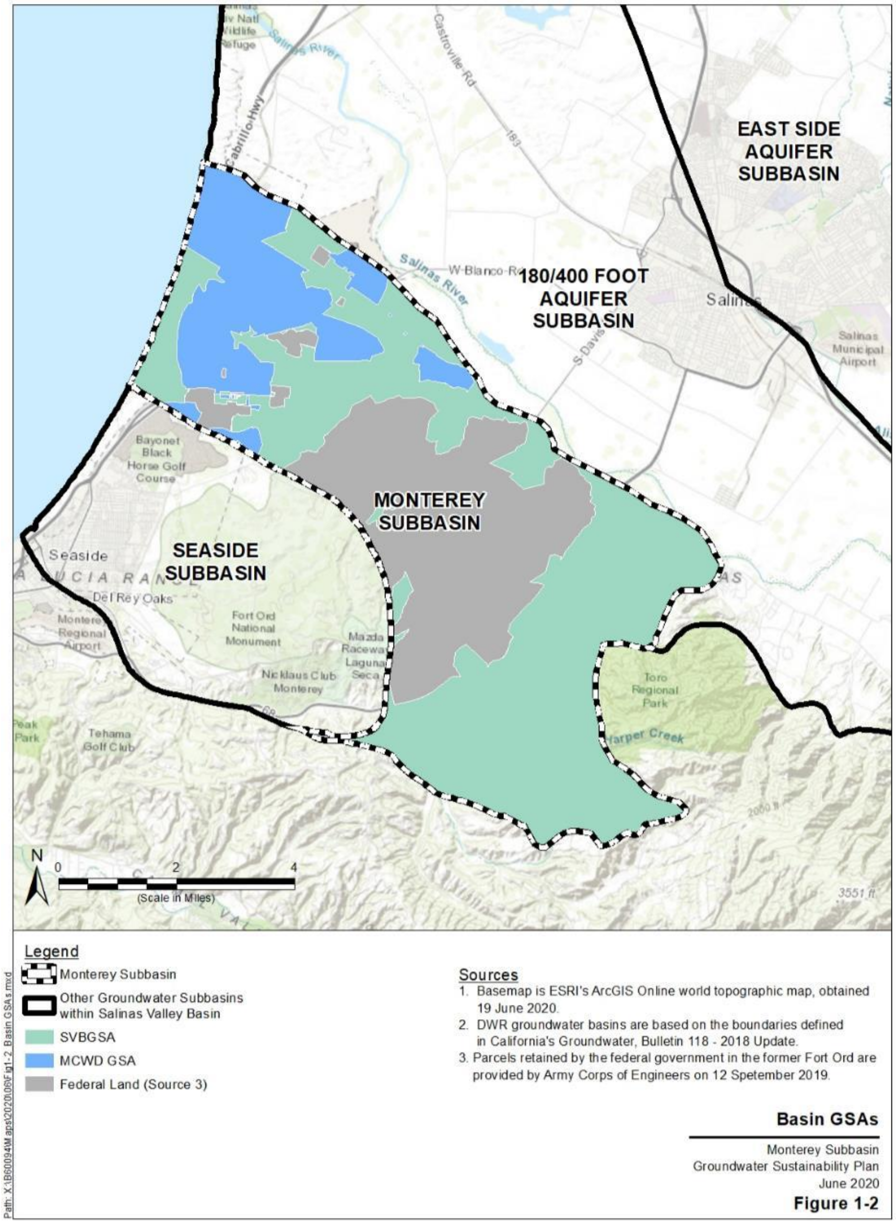

Figure 1-2. Subbasin GSAs

1.3.4 Legal Authority of the GSAs

Both GSAs involved in the development of this GSP were formed in accordance with the requirements of California Water Code §10723 et seq.

1.3.4.1 MCWD GSA

MCWD GSA is formed in accordance with the requirements of California Water District Law, California Water Code §34000 by MCWD. MCWD provides water supply to residents within its service area within the City of Marina and the former Fort Ord, and is therefore a local agency under California Water Code §10721 with the authority to establish itself as a GSA.

1.3.4.2 SVBGSA

SVBGSA is a JPA that was formed in accordance with the requirements of California Government Code §6500 et seq. In accordance with California Water Code §10723 et seq, the JPA signatories are all local agencies under California Water Code §10721 with water or land use authority and are all independently eligible to serve as GSAs:

- The County of Monterey has land use authority over the unincorporated areas of the County, including areas overlying the Monterey Subbasin. The County of Monterey is therefore a local agency under California Water Code §10721 with the authority to establish itself as a GSA.
- The Monterey County Water Resources Agency (MCWRA) is a California Special Act District with broad water management authority in Monterey County.
- The City of Salinas is incorporated under the laws of the State of California. The City provides water supply and land use planning services to its residents.
- The City of Soledad is incorporated under the laws of the State of California. The City provides water supply and land use planning services to its residents.
- The City of Gonzales is incorporated under the laws of the State of California. The City provides water supply and land use planning services to its residents.
- The City of King is incorporated under the laws of the State of California. The City provides water supply and land use planning services to its residents.
- The Castroville Community Services District is a local public agency of the State of California, organized and operating under the Community Services District Law, Government Code §6100 et seq. Castroville CSD provides water services to its residents.
- Monterey One Water is itself a joint powers authority whose members include many members of the SVBGSA.

Upon establishing itself as a GSA, the SVBGSA retains all the rights and authorities provided to GSAs under California Water Code §10725 et seq. as well as the powers held in common by the members.

1.3.5 Coordination Agreements

As the MCWD GSA and SVBGSA have developed a single GSP for the entire Monterey Subbasin, a Coordination Agreement per GSP Emergency Regulations §357.4 is not required between these two parties. Nonetheless, MCWD GSA and SVBGSA have successfully entered into a Framework Agreement regarding responsibilities and coordination for GSP development in the 180/400 Subbasin and the Monterey Subbasin, included as Appendix 1-B. The Framework Agreement was adopted by MCWD GSA in December 2018 and SVBGSA in January 2019.

The Framework Agreement outlines the Management Areas to be established within the Subbasin, which are later formalized in this GSP (see Figure 1-3 and detailed discussion below). According to the Framework Agreement, MCWD GSA has prepared GSP components for the Marina-Ord Management Area and SVBGSA has prepared GSP components for the Corral de Tierra Management Area. The Framework Agreement further establishes a basis for information developed by the two agencies to be integrated into a single GSP for the Monterey Subbasin, including a coordination and stakeholder engagement process, information exchange principles, as well as the acknowledgement that coordinated methodologies are to be developed for the water budget and monitoring network analysis.

1.4 Management Areas

This GSP establishes two Management Areas within the Monterey Subbasin in accordance with GSP Emergency Regulations §351(r) and §354.20. The Management Areas include

- Marina-Ord Area: This Management Area consists of the lands within the City of Marina, City of Seaside, and the former Fort Ord, which are generally located north of State Route 68; and
- Corral de Tierra Area: This Management Area consists of the remainder of the Subbasin, which includes lands generally south of State Route 68 and a few parcels located along the northern subbasin boundary with the 180/400-Foot Aquifer Subbasin.

The Management Areas are developed considering the differences in jurisdictional, water use sector, and aquifer characteristics within these areas.

Jurisdictional and water use sector information for the Subbasin is presented in Section 3.1. Water use sectors within the Marina-Ord Area include municipal water use and minimal groundwater remediation use. The sole water purveyor within the Marina-Ord Area is the MCWD, which serves water within its service area and will serve any future redevelopment within the former Fort Ord. Water use sectors in the Corral de Tierra Area include municipal water use supplied by various small water systems as well as agricultural and grazing water use.

Aquifer characteristics within these Management Areas are discussed in Section 4.2 In general, hydrostratigraphy in the vicinity of the City of Marina consists of a series of laterally continuous aquifers consistent with the aquifers that form the distinguishing features of the northern Salinas

Valley. Within the southern Corral de Tierra Area, the typical aquifer sequence recognized in the northern Salinas Valley is not present.

The Management Areas are developed to facilitate GSP implementation in these areas. Specifically, the establishment of the Marina-Ord Area allows MCWD GSA to plan, fund, and implement sustainable groundwater management for the redevelopment of the former Fort Ord, within and outside of its current jurisdictional area. Whereas, SVBGSA will tailor the management approach in the Corral de Tierra Area towards drinking water and agricultural users.

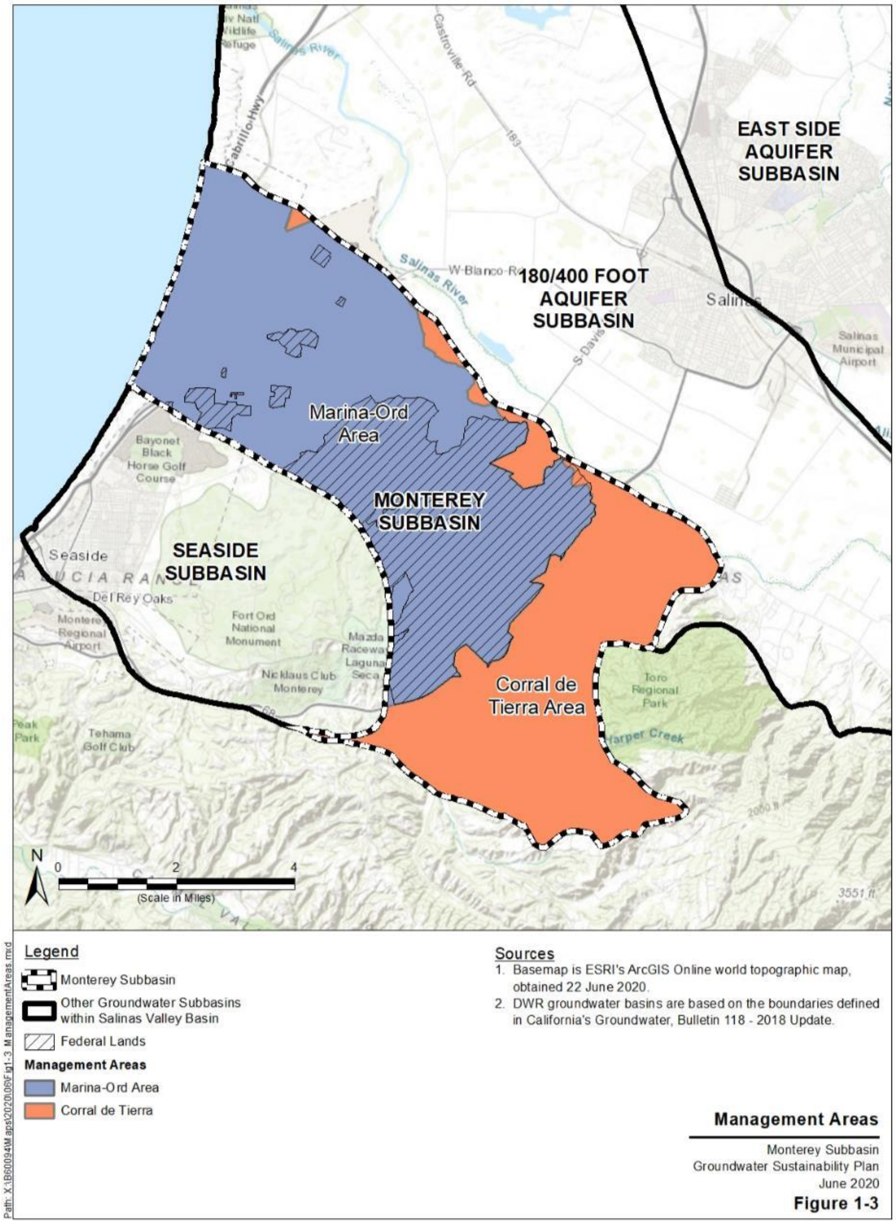

Figure 1-3. Subbasin Management Areas

1.5 Overview of this GSP

The GSP covers the entire Monterey Subbasin and is developed jointly by the MCWD GSA and the SVBGSA. This GSP is developed in concert with GSPs for five other Salinas Valley Groundwater Basin subbasins subject to SGMA: the 180/400-Foot Aquifer Subbasin, the Forebay Aquifer Subbasin, the Upper Valley Aquifer Subbasin, the Langley Area Subbasin, and the Eastside Aquifer Subbasin. While this GSP is focused on the Monterey Subbasin, the GSP will be implemented in accordance with SVBGSA's role in maintaining and achieving sustainability for all subbasins within the Salinas Valley Groundwater Basin. The Monterey Subbasin is referred to as the Subbasin throughout this GSP, and the collection of Salinas Valley Groundwater Subbasins are collectively referred to as the Basin or the Valley.~~Some of the projects and programs presented in this GSP are part of a cohesive set of projects and programs designed to achieve sustainability throughout the entire Salinas Valley Groundwater Basin. The Monterey Subbasin is referred to as the Subbasin throughout this GSP, and the collection of Salinas Valley Groundwater Basin subbasins are collectively referred to as the Basin or the Valley.~~

Chapter 2 details the stakeholders that participated, and the processes followed to develop this GSP. Stakeholders worked together to gather existing information, define sustainable management criteria for the Subbasin, and develop a list of projects and management actions.

Chapters 3 through 6 describe the Basin Setting, present the hydrogeologic conceptual model, and describe historical and current groundwater conditions. It further establishes estimates of the historical, current, and future water budgets based on the best available information.

Chapter 7 and 8 proceed to detail required monitoring networks and define local sustainable management criteria.

Chapter 9 outlines projects and management actions for reaching sustainability in the Subbasin by 2042.

Additionally, GSP topics are discussed respectively for the Marina-Ord and Corral de Tierra Areas as necessary, acknowledging the hydrogeological differences and data gaps between these Management Areas. As part of the two GSAs' collaborative GSP development process, components for the Marina-Ord Area were prepared by MCWD GSA, and components for the Corral de Tierra Area were prepared by SVBGSA.

This GSP will be updated and adapted as new information and more refined models become available. This includes updating sustainable management criteria as well as projects and management actions to reflect updates and future conditions. Adaptive management will be reflected in the required five-year assessments and annual reports.

2 COMMUNICATIONS AND STAKEHOLDER ENGAGEMENT

This chapter includes a summary of information relating to notification and communication by the Groundwater Sustainability Agencies (GSAs) with other agencies and interested parties during Groundwater Sustainability Plan (GSP) development pursuant to GSP Emergency Regulations §354.10.

The Subbasin GSAs developed a Framework Agreement regarding GSP development as described in Section 1.3.5. The Framework Agreement states that the Marina Coast Water District (MCWD) GSA will prepare GSP components for the Marina-Ord Area of the Monterey Subbasin and that the Salinas Valley Basin Groundwater Sustainability Agency (SVBGSA) will prepare GSP components for the Corral de Tierra Area of the Monterey Subbasin for incorporation into a single GSP. The Framework Agreement further states that the parties agree to work collaboratively to develop and implement stakeholder engagement plans for the GSPs while each party is responsible for guiding efforts within their respective plan preparation areas.

2.1 GSA Decision-Making Process

This section describes each GSA's governance structure and decision-making processes.

2.1.1 <u>MCWD GSA Governance Structure</u>

The MCWD GSA is a single agency GSA formed by MCWD within the Monterey Subbasin (Subbasin; California Department of Water Resources [DWR] 3-004.10) and 180/400-Foot Aquifer Subbasin (DWR 3-004.01) of the Salinas Valley Basin. The MCWD GSA Board is comprised of the members of the MCWD Board. GSA Board meetings are held jointly with MCWD Board meetings every third Monday of each month and are open to the public.

Key GSP development and implementation decisions are made by the GSA Board of Directors (Board). The Board considers staff, stakeholder, and public input captured and evaluated by the Steering Committee, MCWD stakeholder workshops, and direct communication with interested parties. The Board is the final decision-making body for adoption of GSPs completed by the GSA.

2.1.2 <u>SVBGSA Governance Structure</u>

SVBGSA is governed by a local and diverse 11-member Board and relies on robust science and public involvement for decision-making. The Board meets monthly, and all meetings are open to the public. The Board is the final decision-making body for adoption of GSPs completed by the GSA.

The SVBGSA Advisory Committee advises the SVBGSA Board. The Advisory Committee is comprised of 25 members. The Advisory Committee strives to include a range of interests in groundwater in the Salinas Valley and outlined in SGMA. Advisory Committee members live in the Salinas Valley or represent organizations with a presence or agencies with jurisdiction in the Basin including:

- All groundwater users
- Municipal well operators, Public-Utilities Commission-Regulated water companies, and private and public water systems
- County and city governments
- Planning departments/land use
- Local landowners
- Underrepresented communities (URCs)
- Business and agriculture
- Rural residential well owners
- Environmental uses
- ~~Water supply and management surface water users (if connection between surface and groundwater)~~

The Advisory Committee, at this time, does not include representation from:

- Tribes
- Federal government

The Advisory Committee will review its charter following GSP completion for additional members if identified as necessary by the Board. The Advisory Committee provides input and recommendations to the Board and uses consensus to make recommendations to the Board. The Advisory Committee was established by Board action and operates according to a Committee Charter which serves as the bylaws of the Advisory Committee. The Advisory Committee reviews and provides recommendations to the Board on groundwater-related issues that may include:

- Development, adoption, or amendment of the GSP
- Sustainability goals
- Monitoring programs
- Annual work plans and reports
- Modeling scenarios
- Inter-basin coordination activities
- Projects and management actions to achieve sustainability
- Community outreach
- Local regulations to implement SGMA
- Fee proposals
- General advisory

Subbasin planning committees were established in May 2020 by the Board of Directors to inform and guide planning for the five GSPs due in January 2022. Membership is 7-12 people per Subbasin Planning Committee and all meetings are Brown Act meetings.

Together the Board, Advisory Committee, and Subbasin Planning Committees are working to complete the six GSPs required within the SVBGSA jurisdiction. Subsequent to that, SVBGSA will complete a Salinas Valley Basin-wide Integrated Implementation Plan (IIP) that will detail project portfolios and groundwater sustainability programs to meet SGMA compliance for subbasins by 2042 and maintain sustainability through 2050. Once all the GSPs are filed, the Subbasin Planning Committees will transition to implementation committees.

2.2 Intra-basin Coordination

The MCWD GSA and SVBGSA have made intra- and inter-basin coordination a priority to ensure successful GSP development. Pursuant to the Framework Agreement, the GSAs has organized and convened regular meetings for coordinating GSP development and implementation for the Subbasin:

- The **Technical Committee** includes staff and technical consultants from MCWD GSA and SVBGSA. The Technical Committee meets bi-weekly to review draft GSP content prepared by each GSA and resolve differences.
- The **Steering Committee** includes the General Manager and one Board Member from each GSA, who will update each GSA Board of Directors. The Steering Committee reports back to each GSA's board. The Steering Committee oversees implementation of the Framework Agreement, reviews matters elevated by the Technical Committee, and works to reach consensus. The Steering Committee meetings are subject to the California Open Meeting Law ("Brown Act") and are open to the public.

These coordinated efforts, along with ~~implementation of individual agency engagement strategies, aims~~individual agency engagement strategies, aim to create a consistent understanding of subbasin conditions among stakeholders and facilitate integration of local and regional projects and management actions needed to achieve groundwater sustainability.

2.3 Communication and Public Engagement by MCWD GSA

MCWD GSA's program for Communication and Engagement is designed to effectively engage a variety of relevant stakeholders in the development of a GSP that will guide the GSA to demonstrate sustainability by January 31, 2042, and maintain sustainability through the Sustainable Groundwater Management Act (SGMA)'s 50-year planning timeline. Pursuant to the Framework Agreement, MCWD GSA's communication program focuses on development and implementation of GSP components within the Marina-Ord Area.

The GSA's Communication and Engagement efforts aim to support a GSP that best meets the needs of beneficial uses and users of groundwater in the Marina-Ord Area and reflects and incorporates stakeholder input as appropriate. As MCWD is the only water supplier within the Marina-Ord Area where water use is dominantly urban use, communication with stakeholders and beneficial users within the Marina-Ord Area hinges on dialogues with key stakeholder agencies identified in Section 2.3.1 below.

MCWD GSA's goal is to engage stakeholders early in the decision-making process to consider their interests and concerns and be open and transparent in any decisions that will have a substantial impact on beneficial users of groundwater in the Subbasin.

2.3.1 Defining and Describing Stakeholders in the Marina-Ord Area

MCWD GSA has identified beneficial uses and users of groundwater within the Marina-Ord Area per the interests listed in California Water Code (CWC) §10723.2, as well as additional stakeholders of interest.

Agriculture. There are no agricultural groundwater users within the Marina-Ord Area.

Domestic Water Users. Due to well installation requirements of the Monterey County and MCWD, only domestic wells that pre-date County and City ordinances or for urban irrigation may exist within the Marina-Ord Area. Although minimal, the exact quantity of domestic wells is not well known.

Municipal Well Operators and Public Water Systems. MCWD is the only municipal well operator and public water system within the Marina-Ord Area. MCWD provides water service to the City of Marina, City of Seaside, and the former Fort Ord Army Base. A portion of the former Fort Ord is retained for use by the U.S. Army, while the remainder is being converted to civilian use for redevelopment.

Local Land Use Planning Agencies. There are several local land use planning agencies located within the Marina-Ord Area, including the City of Marina, the City of Seaside, and the County of Monterey.

Environmental Users of Groundwater. Potential groundwater dependent ecosystems exist in the Marina-Ord Area within the lands of the City of Marina and Fort Ord National Monument. Lands within the Fort Ord National Monument are not subject to SGMA. The U.S. Army currently conducts remedial activities within the Fort Ord National Monument under the guidance of the Fort Ord Habitat Management Plan (U.S. Army, 1997) as well as U.S. Fish and Wildlife Services Biological Opinions.

Surface Water Users. There are no surface water users within the Marina-Ord Area.

The Federal Government. The U.S. Army and the U.S. Bureau of Land Management manage federal lands within the Marina-Ord Area that are not subject to SGMA. MCWD is the exclusive water purveyor to the U.S. Army for all Army and Federal facilities within the Marina-Ord Area. There is no current or planned groundwater use by the Bureau of Land Management on its lands.

California Native American Tribes. There are no identified California Native American tribal lands within the Subbasin.

Disadvantaged Communities (DACs). Census Tracts 141.02 and 142.04, which are recognized as Disadvantage Community Tracts, as well as several Disadvantage Community Block Groups (a statistical division of a census tract), overly the Marina-Ord Area (Figure 2-1). There are no Disadvantaged Community Places identified within the area[4]. Some of these disadvantaged community areas are missing income data and may include the student population from California State University Monterey Bay. These recognized disadvantaged communities are located within the urban areas of the City of Marina and receive water service from MCWD.

Groundwater Monitoring Entities. Monterey Peninsula Water Management District (MPWMD) and Monterey County Water Resources Agency (MCWRA) are Monitoring Entities in the Subbasin under the California Statewide Groundwater Elevation Monitoring (CASGEM) Program. Additionally, these agencies have water management authority in portions of the Marina and Ord Areas. The U.S. Army also monitors groundwater within former Fort Ord as part of its groundwater remedial efforts to address legacy groundwater contamination. Collaboration with these water agencies and the U.S. Army will be integral to the sustainable management of the Subbasin.

Other Groundwater Management Entities. The Monterey Subbasin is adjacent to the critically-overdrafted, high-priority 180/400-Foot Aquifer Subbasin and the adjudicated Seaside Subbasin of the Salinas Valley Basin. SGMA compliance within the 180/400-Foot Aquifer Subbasin is carried out by the MCWD GSA and SVBGSA. The adjudicated Seaside Subbasin is managed by the Seaside Groundwater Basin Watermaster. MCWD will inform, involve, and collaborate with SVBGSA and the Seaside Groundwater Basin Watermaster to ensure sustainable management of groundwater across basins.

Monterey One Water (M1W; formerly the Monterey Regional Water Pollution Control Agency) is a wastewater and recycled water agency serving municipalities of northern Monterey County including the Marina and Ord Areas. M1W provides advanced treated wastewater for Indirect Potable Reuse in the Seaside Subbasin and for irrigation in the Monterey Subbasin (the Pure Water Monterey). MCWD is collaborating with M1W to develop a new indirect potable reuse project to provide additional water supply and support future developments in the Marina and Ord Areas. MCWD will continue collaboration with M1W to develop reliable and cost-effective projects that benefit sustainable management of the Subbasin.

2.3.2 Venues for Public Engagement

MCWD GSA intends to provide a variety of opportunities for engagement with stakeholders. Below are the primary venues that MCWD GSA currently provides and will continue to provide to engage stakeholders and the public. Stakeholder input received has informed and/or are incorporated into corresponding sections of the GSP.

[4] DACs are identified based on having an average household income less than 80% of the State median, and Severely Disadvantaged Communities (SDACs) are identified based on having an average household income less than 60% of the State median (US Census American Community Survey, 2014).

MCWD GSA Board Meetings

MCWD GSA Board meetings are open to the public and are a venue for public engagement. During selected Board meetings, MCWD GSA's technical team provides status updates of GSP development, presents on key technical issues, and presents recommendations for the GSA Board to consider.

Stakeholder Workshops

Stakeholder workshops have been held to communicate progress on GSP technical components to stakeholders and to receive input on upcoming decisions and work efforts. Quarterly Stakeholder workshops that were open to the public were held during GSP development.

Additionally, MCWD GSA has been publicizing all stakeholder workshops and public meetings on its website (http://www.mcwd.org/governance_meetings.html) and to its list of stakeholders. MCWD GSA directly invites agencies and municipalities identified in Section 2.3.1 to each meeting through emails and mailings as appropriate.

One-on-One Meetings

The GSA's staff and technical team contacted interested parties for one-on-one meetings and conference calls to facilitate their input during the preparation of GSP materials and prior to the more formal meetings. The one-on-one meetings have been a venue for communication with targeted interest on specialized topics.

Website Communication

MCWD GSA has been and will continue to update its website with stakeholder workshop and GSA Board meeting materials, as well as additionally update the website with key GSP updates. Draft GSP chapters available for public review are posted on the website. A live GSP comment form is available on the website for ongoing comment submission on GSP chapters.

2.3.3 Public meeting summary

The list below identifies public meetings, workshops, and direct outreach specific to GSP development.

- MCWD Board meetings
    - GSP development planning and kickoff on March 19, 2018
    - SGMA update on April 16, 2018
    - SGMA update on May 20, 2019
    - GSP development update on February 16, 2021
    - GSP development update on August 16, 2021
    - GSP development update on October 18, 2021
    - GSP public hearing and adoption on January XX, ~~December~~ 2022~~1~~

- MCWD Stakeholder Workshops
  - Stakeholder Workshop #1 on August 25, 2020;
  - Stakeholder Workshop #2 on November 17, 2020;
  - Stakeholder Workshop #3 on March 11, 2021;
  - Stakeholder Workshop #4 5
  - on XX SeptemberOctober 13, 2021; and
  - Stakeholder Workshop #5 on October 27, 2021.
- Direct Outreach
  - Website and live comment form maintenance
  - Interested parties list maintenance
  - One-on-one stakeholder meetings

This list will be updated throughout GSP implementation. Detailed meeting minutes and materials are available on the GSA website.

2.3.4 Communication and Public Engagement during GSP Implementation

MCWD GSA communication and public engagement actions that have taken place during GSP development will continue during GSP implementation, including

- Periodic GSA Board meeting updates and stakeholder workshops;
- One-on-one stakeholder communications;
- Posting of relevant announcements and information on the GSA website;
- Stakeholder list maintenance; and
- Stakeholder Communication and Engagement Plan (SCEP) evaluation and updates.

Continued communication and public engagement will be conducted in accordance with the GSAs' Implementation Agreement as described in Section 10.1.

MCWD GSA has been and will continue to hold periodic stakeholder workshops to inform the public on the progress of implementing the plan, including the status of projects and management actions. Meeting information and other materials from GSA Board meetings and public workshops will continue to be available on the MCWD GSA's website (https://www.mcwd.org/gsa_about.html). Meeting materials for past and future GSA Board that are open to the public are available at (https://www.mcwd.org/governance_meetings.html).

Critical to the success of the Monterey GSP will be public understanding of the projects and management actions planned for sustainability, as well as sustainability implementation actions and other groundwater management activities. These important actions are specifically described in Chapter 9. The GSAs' schedule to implement them during the first five years of GSP implementation is described in Sections 10.5 and 10.8. In addition, each project or management action may be subject to public noticing requirements during its planning and implementation phases, as detailed in their respective project descriptions in Chapter 9.

Additional important actions of GSP implementation will be the production of the required Annual Report by April 1 each year for the Monterey Subbasin. The Annual Report covers annual data collected each water year from October 1 through September 30. It is anticipated that the annual report will be prepared through a collaborated effect between the Subbasin GSAs. The Annual Report provides an annual benchmark for the Subbasin GSAs to provide to the public and stakeholders to assess progress towards sustainability. The Annual Report also includes assessment of the six sustainable management criteria (SMCs) for the Subbasin. The Annual Report provides an important opportunity to reengage subbasin stakeholders in its review and to discuss sustainability status and goals.

2.4 Communication and Public Engagement by SVBGSA

Given the importance of the Monterey GSP to the Corral de Tierra Area communities, residents, landowners, farmers, ranchers, businesses, and others, SVBGSA's program for communication and engagement is based on inclusive stakeholder input as the primary component of the Monterey GSP process. In order to encourage ongoing stakeholder engagement SVBGSA deployed the following strategies in the preparation of the Monterey Subbasin GSP and the Corral de Tierra Area:

- An inclusive outreach and education process conducted that best supports the success of a well- prepared GSP that meets SGMA requirements.
- Kept the public informed by distributing accurate, objective, and timely information.
- Invited input and feedback from the public at every step in the decision-making process.
- Established a Subbasin Planning Committee for the Subbasin and completed a comprehensive planning process with this Committee including engagement on key items with the Board of Directors and Advisory Committee
- Publicly noticed drafts of the Monterey Subbasin GSP and allowed for required public comment periods as required by SGMA.

Additionally, a rigorous review process for each chapter in the Monterey GSP and for the final plan was completed. This process ensured that stakeholders had multiple opportunities to review and comment on the development of the chapters.

2.4.1 Defining and Describing Stakeholders in the Corral de Tierra Area

SVBGSA has identified beneficial uses and users of groundwater within the Corral de Tierra Area in accordance with the interests listed in CWC §10723.2, as well as additional stakeholders of interest.

Agriculture. Includes row crops, field crops, vineyards, orchards, cannabis, and rangeland.

Domestic Water Users. Includes urban water use assigned to non-agricultural water uses in the census-designated places and rural residential wells used for drinking water. Urban water use includes small local water systems, small state water systems, and small and large public water systems. Stakeholders associated with this beneficial use include residential well owners, members of mutual water companies and local small or state small water systems and California Public Utilities Commission (CPUC)-regulated water companies including Alco Water Corporation, California Water Service Company, and California American Water.

California Native American Tribes. There are no identified California Native American tribal lands within the Subbasin.

Underrepresented communities (URCs) and Disadvantaged Communities (DACs). There are no identified URCs or DACs within the Corral de Tierra Area.

Environmental Users. Environmental users include the habitats and associated species maintained by conditions related to surface water flows and groundwater dependent ecosystems (GDEs). Environmental users include native vegetation and managed wetlands. Stakeholders associated with this beneficial use include the following: Sustainable Monterey County, League of Women Voters of Monterey County, Landwatch Monterey County, Friends and Neighbors of Elkhorn Slough, California Native Plant Society Monterey Chapter, Trout Unlimited, Surfriders, the Nature Conservancy (TNC) and the Carmel River Steelhead Association.

Local Land Use Planning Agencies and Groundwater Monitoring Entities: The local land use planning agency located within the Corral de Tierra Area is the County of Monterey. The groundwater monitoring entity is the Monterey County Water Resources Agency (MCWRA) in the Subbasin under the California Statewide Groundwater Elevation Monitoring (CASGEM) Program. Stakeholders associated with this beneficial use include the following: Monterey County, Monterey County Environmental Health Department and land use nonprofits such as Sustainable Monterey County, League of Women Voters of Monterey County, and Landwatch Monterey County.

Other Groundwater Management Entities. The Monterey Subbasin is adjacent to the critically-overdrafted, high-priority 180/400-Foot Aquifer Subbasin and the adjudicated Seaside Subbasin of the Salinas Valley Basin. SGMA compliance within the 180/400-Foot Aquifer Subbasin is carried out by the MCWD GSA and SVBGSA. The adjudicated Seaside Subbasin is managed by the Seaside Groundwater Basin Watermaster. SVBGSA will inform, involve, and collaborate with MCWD GSA and the Seaside Groundwater Basin Watermaster to ensure sustainable management of groundwater across basins.

2.4.2 Venues for Public Engagement and Public Meeting Summary

SVBGSA subbasin planning committees are comprised of local stakeholders and Board members and were appointed by the Board of Directors following a publicly noticed application process by the SVBGSA. Subbasin planning committees do the comprehensive work of plan development, review, and recommendations, with assistance provided by SVBGSA staff and technical consultants.

These committees represent constituencies that are considered important stakeholders to develop comprehensive subbasin plans for the Salinas Valley or are not represented on the Board. The SVBGSA GSP Subbasin planning committee was convened in July 2020. A list of the SVBGSA Subbasin Planning Committee members is included in the Acknowledgements section of this GSP.A list of the Corral de Tierra Management Area SVBGSA GSP Subbasin Planning Committee is included in the Acknowledgements section of this GSP.

Subbasin planning committee meetings are subject to the Brown Act and are noticed publicly on the SVBGSA website. Public comment is taken on all posted agenda items. Subbasin planning committees have been engaged in an iterative planning process that combines education of pertinent technical topics through presentations and data packets and receiving GSPs chapters for review and comment. A live GSP comment form is available on the SVBGSA website for ongoing comment submission on all GSP chapters. All GSP chapters were posted for public review and comment.

GSP chapters that have been taken to the SVBGSA Subbasin Planning Committee were also taken to the SVBGSA Advisory Committee for further review and comments. Community engagement and public transparency on SVBGSA decisions are paramount to building a sustainable and productive solution to groundwater sustainability in the Basin. At the conclusion of the planning process in August 2021 for the Monterey GSP, the SVBGSA held more than 32 38 planning meetings and technical workshops on each aspect of the Monterey Subbasin GSP.

In addition to regularly scheduled committee meetings, a series of workshops were held for the Monterey Subbasin Planning Committee as detailed below. These workshops are informational for committee members, stakeholders, and the general public and cover pertinent topics to be included in the GSPs. Workshops were timed to specific chapter development for the GSP. Subject matter experts were brought in as necessary to provide the best available information to Subbasin Planning Committee members.

Table 2-1. Subject Matter Workshops Held During GSP Preparation

Topic	Date
Brown Act and Conflict of Interest	July 22, 2020
Sustainable Management Criteria	July 28, 2020
Water Law	August 10, 2020
Salinas Valley Watershed Overview	August 26, 2020
Web Map Workshop	September 30, 2020
Town Hall – Domestic Wells & Drinking Water	October 28, 2020
Pumping Allocations	November 18, 2020
Funding Mechanisms	January 27, 2021
Water Budgets	February 24, 2021
Communications and Implementation	March 31, 2021
Technical Modeling Workshop – Salinas Valley Integrated Hydrologic Model (SVIHM) & Salinas Valley Operational Model (SVOM)	June 30, 2021

SVBGSA is focused on communication and public engagement targeted at the public, including beneficial users, regarding the development of the GSP for the Monterey Subbasin. actions (CPE Actions) that have taken place during GSP development will continue during implementation of all SVBGSA GSPs. CPE Actions provide the SVBGSA Board and staff a guide to ensure consistent messaging about SVBGSA requirements and other related information. CPE Actions provide ways that beneficial users and other stakeholders can provide timely and meaningful input into the GSA decision-making process. CPE Actions also ensure beneficial users and other stakeholders in the Basin are informed of milestones and offered opportunities to participate in GSP implementation and plan updates.

Notice and communication, as required by GSP Emergency Regulations §354.10, was focused on providing the following activities during the development of the Monterey Subbasin GSP**:**

- Clear decision-making process on GSP approvals and outcomes
- Robust public engagement opportunities
- Encouragement of active involvement in GSP development

2.4.3 Goals for Communication and Public Engagement

Ultimately, the success of the Monterey Subbasin GSP will be determined by the collective action of every groundwater user. In order to meet ongoing water supply needs, both for drinking water and for economic livelihoods, the Subbasin must achieve and maintain sustainability into the future. This outreach engages the public early and frequently, and keeps the internal information flow seamless among staff, consultants, committee members and the SVBGSA Board regarding the goals and objectives of the Monterey Subbasin GSP and associated monitoring and implementation activities.

Communications and Public Engagement (CPE) Actions provide outreach during the Subbasin planning efforts and assists SVBGSA in being receptive to stakeholder needs through communication tools. The CPE Actions also forecast how SVBGSA will communicate during GSP implementation.

The goals of the CPE Actions are:

1. To keep stakeholders informed through the distribution of accurate, objective, and timely information while adhering to SGMA requirements for engagement (noted above).
2. To articulate strategies and communications channels that will foster an open dialogue and increase stakeholder engagement during the planning process.
3. To invite input from the public at every step in the decision-making process and provide transparency in outcomes and recommendations.
4. To ensure that the Board, staff, consultants, and committee members have up-to-date information and understand their roles and responsibilities.
5. To engage the public on GSP Implementation progress especially for project and management actions and Annual Reports.

2.4.4 Communication and Outreach Objectives

The following are the communications and outreach objectives of the CPE Actions:

- Expand Audience Reach
- Maintain a robust stakeholder list of interested individuals, groups and/or organizations.
- Secure a balanced level of participants who represent the interests of beneficial uses and users of groundwater.
- Increase Engagement
- Keep interested stakeholders informed and aware of opportunities for involvement through email communications and/or their preferred method of communications.
- Publish meeting agendas, minutes, and summaries on the SVBGSA website: www.svbgsa.org.
- Inform and obtain comments from the general public through GSP online comment form and public meetings held on a monthly basis.
- Facilitate productive dialogues among participants throughout the GSP planning process.
- Seek the input of interest groups during the planning and implementation of the GSP and any future planning efforts.
- Increase GSP Awareness

- Provide timely and accurate public reporting of planning milestones through the distribution of outreach materials and posting of materials on the SVBGSA website for the GSP.
- Secure quality media coverage that is accurate, complete, and fair.
- Utilize social media to engage with and educate the general public.
- Track Efforts
- Maintain an active communications tracking tool to capture stakeholder engagement and public outreach activities and to demonstrate the reporting of GSP outreach activities.

2.4.5 Target Audiences and Stakeholders

SVBGSA stakeholders consist of other agencies and interested parties including all beneficial users of groundwater or representatives of someone who is. Under the requirements of SGMA, all beneficial uses and users of groundwater must be considered in the development of GSPs, and GSAs must encourage the active involvement of diverse social, cultural, and economic elements of the population.

There are a variety of audiences targeted within the Basin whose SGMA knowledge varies from high to little or none. Given this variance, SVBGSA efforts are broad and all-inclusive. Target audiences include:

- SVBGSA Board of Directors, Advisory Committee and Subbasin Planning Committees
- SVBGSA Groundwater Sustainability Fee Payers
- Partner agencies including Monterey County Environmental Health Department, County of Monterey, MCWRA, and the Greater Monterey County Integrated Regional Water Management Group (RWMG)
- Municipal and public water service providers
- Private and local small or state small water system providers
- Local municipalities and communities
- Elected officials within the Basin
- Beneficial uses and users of groundwater including, agriculture, domestic wells and local small or state small water systems, and environmental uses such as wetlands
- Diverse social, cultural, and economic segments of the population within the Basin including URCs
- The general public

Stakeholder involvement and public outreach is critical to the GSP development because it helps promote the plan based on input and broad support. The following activities summarize involvement opportunities and outreach methods to inform target audiences and stakeholders.

It is important to note that levels of interest will evolve and shift according to the GSP's implementation opportunities and priorities.

2.4.6 Stakeholder Database

A stakeholder database of persons and organizations of interest will be created and maintained. The database will include stakeholders that represent the region's broad interests, perspectives, and geography. It will be developed by leveraging existing stakeholder lists and databases and by conducting research of potential stakeholders that may be interested in one or all of the following categories: municipal users and groundwater users including agricultural, urban, industrial, commercial, institutional, rural, environmental, URCs, state lands and agencies, and integrated water management.

2.4.7 Key Messages and Talking Points

SVBGSA developed key messages focused on getting to know your GSA, an overview of groundwater sustainability planning for our community, and how we intend to continue outreach through implementation. These messages were guided by the underlying statements:

- The GSP process, both planning and implementation, is transparent and direct about how the GSP will impact groundwater users.

~~The GSP planning process is transparent and direct about how the GSP will impact groundwater users.~~

- SVBGSA represents the groundwater interests of all beneficial uses/users of the Corral de Tierra Area equitably and transparently to ensure that the Subbasin achieves and maintains sustainable groundwater conditions.
- SVBGSA is committed to working with stakeholders using an open and transparent communication and engagement process.
- As the overall GSP will be more comprehensive with an engaged group of stakeholders providing useful information, SVBGSA will create as many opportunities as possible to educate stakeholders and obtain their feedback on GSP implementation and plan updates.

These messages are being used by SVBGSA as the basis for specific talking points/questions and answers (Q&A) to support effective engagement with audiences (Appendix 2).

2.4.8 Engagement Strategies

SVBGSA utilizes a variety of tactics to achieve broad, enduring, and productive involvement with stakeholders during the development and implementation of the GSP. Below are activities that SVBGSA uses to engage the public currently and anticipated activities for GSP implementation:

- Develop and maintain a list of interested parties

- Offer public informational sessions and subject-matter workshops and provide online access via Facebook Live or via Zoom
- Basin tours (currently on hold due to coronavirus disease [COVID] restrictions)
- SVBGSA Web Map Portal
- Salinas Valley Subbasin GSP Web Map
- Monterey Subbasin Area Web Map
- Annual Report presentations
- FAQS – Offer Frequently Asked Questions (FAQs) on several topics including SGMA, SVBGSA, GSP, projects, Monitoring Program, Annual Report, Programs and Groundwater Sustainability Fee
- Science of Groundwater – new examples (studies, etc.)
- Board, Advisory Committee, and other Committee Meetings
- Regular public notices and updates; Brown Act compliance
- Develop talking points for various topics and evolve as necessary
- Subbasin Implementation Committees
- Each subbasin's planning committee for GSP development will transition to a subbasin implementation committee to be convened for GSP updates and annual report reviews.
- Integrated Implementation Committee
- The Integrated Implementation Committee will be convened to discuss Basin wide aspects to the 6 GSPs in the Basin including public outreach.
- Online communications
- SVBGSA website: maintain with current information
- SVBGSA Facebook page: maintain and grow social media presence
- Direct email via Mailchimp newsletter
- Mailings to most-impacted water users and residents – topics to include: Annual Report dashboard, What does your GSA do with the Sustainability Fee?, newsletter that accompanies each tax bill.
- Media coverage. Appendix 2-B includes SVBGSA's media policy.
- Op-eds in the local newspapers
- Press releases
- Radio interviews
- Promote/Celebrate National Groundwater Week (held in December)

- Co-promotional opportunities and existing channels with agencies, committees, and organizations including email newsletters, social media, board meetings and mailings to customers.
- Talks and presentations to various stakeholder groups, associations, community organizations, and educational institutions.
- Educational materials

2.4.9 CPE Actions Timeline and Tactics

CPE Actions and GSP milestone requirements by phase include:

- Prior to initiating plan development: Share how interested parties may contact the GSA and participate in development and implementation of the plan submitted to DWR. (23 California Code of Regulations §353.6)
- Prior to GSP development: Establish and maintain an interested persons' list. (California Water Code §10723.4)
- Prior to and with GSP submission:
    - Record statements of issues and interests of beneficial users of basin groundwater including types of parties representing the interests and consultation process
    - Lists of public meetings
    - Inventory of comments and summary of responses
    - Communication section in GSP (23 California Code of Regulations §354.10) that includes: agency decision-making process, identification of public engagement opportunities and response process, description of process for inclusion, and method for public information related to progress in implementing the plan (status, projects, actions)

- Supporting tactics to be used to communicate messages and supporting resources available through GSP development and GSP implementation:
- SVBGSA website, updated regularly to reflect meetings and workshop offerings
- Direct email via Mailchimp sent approximately monthly to announce board meetings, special workshop offerings and other opportunities for engagement
- Outreach to local media to secure coverage of announcements and events, radio interviews, op-ed placement
- Workshops, information sessions and other community meetings
- Social media, specifically Facebook, updated regularly to share information and support other outreach efforts

2.4.10 CPE Actions – Annual Evaluation and Assessment

The annual evaluation and assessment of CPE Actions will include:

- What worked well?
- What didn't go as planned?
- Are stakeholders educated about the GSP development process and their own role?
- Is the timeline for implementation of the GSP clear?
- Has the GSA received positive press coverage?
- Do diverse stakeholders feel included?
- Has there been behavior changes related to the program goals? Or improved trust/relationships among participants?
- Community meeting recaps and next steps
- Lessons learned
- Budget analysis

2.4.11 Communication and Public Engagement during GSP Implementation

The communication and public engagement outlined above is also applicable, and is intended to continue through, GSP Implementation. Critical to the success of the Monterey GSP will be public understanding of the projects and management actions planned for sustainability, as well as sustainability implementation actions and other groundwater management activities.

Additional important actions of GSP implementation will be the production of the required Annual Report by April 1 each year for the Monterey Subbasin. The Annual Report covers annual data collected each water year from October 1 through September 30. The Annual Report provides an annual benchmark for SVBGSA to provide to the public and stakeholders to assess progress towards sustainability. The Annual Report also includes assessment of the six Sustainable Management Criteria (SMCs) for the Subbasin. The Annual Report provides an important opportunity to reengage the Monterey Subbasin Committee in its review and to discuss sustainability status and goals.

2.5 Public comments on the GSP

Appendix 2-C includes a table that summarizes the public comments received as well as the Subbasin GSAs' responses and revisions made to the GSP. Appendix 2-D~~C~~ includes written public comments received during the GSP development. ~~Appendix 2-D includestables that a table that summarizes the public comments received during the GSP development as well as the Subbasin GSAs' responses and revisions made to the GSP.~~ Additional detailed responses are included in

Appendix 2-E. ~~Tables~~ Contents in Appendices~~x~~ 2-C through 2-E will be updated as more comments are received during GSP implementation.

2.6 Underrepresented Communities and DACs

As described in Section 2.3.1, disadvantaged communities are recognized within the urban areas of the City of Marina. These areas are shown on Figure 2-1. Due to well installation requirements of the Monterey County and the City of Marina, only a very small number of domestic wells that pre-date County and City ordinances exist within the city. In turn, these communities rely on water services provided by MCWD. The Subbasin GSAs has engaged residents of disadvantaged communities during the development and implementation of the GSP through engagement of MCWD customers and coordination with the City of Marina.

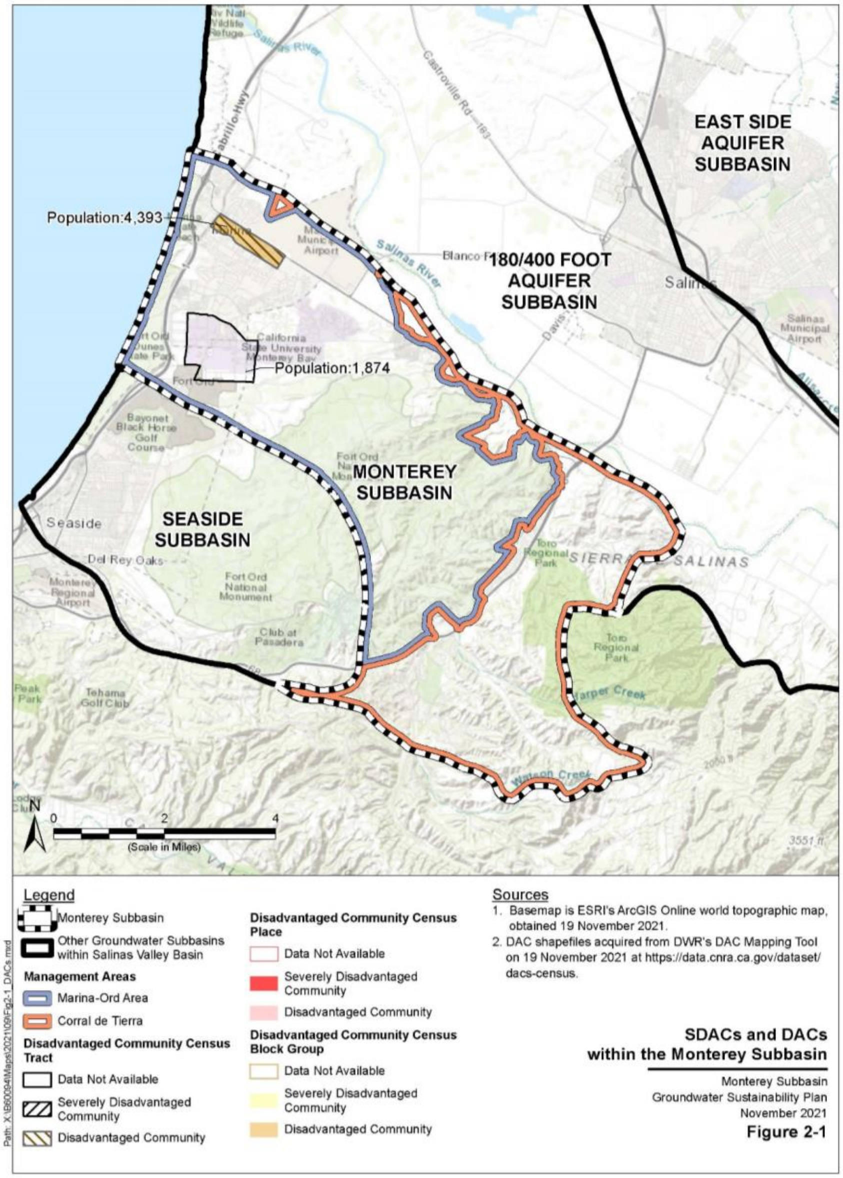

Figure 2-1. SDACs and DACs within the Monterey Subbasin

3 PLAN AREA

This section presents a description of the Plan Area, and a summary of the relevant jurisdictional boundaries and other key land use features potentially relevant to the sustainable management of groundwater in the Monterey Subbasin. This section also describes the water monitoring programs, water management programs, and general plans relevant to the Subbasin and their influence on the development and execution of this Groundwater Sustainability Plan (GSP).

3.1 Summary of Jurisdictional Areas and Other Features

3.1.1 Plan Area Setting

This GSP covers the entire Monterey Subbasin (Department of Water Resources [DWR] Basin 3-004.10), which encompasses 30,850 acres (or 48.2 square miles) in the northwestern Salinas Valley Groundwater Basin in the Central Coast region of California (see Figure 3-1). The Subbasin is covered by the Marina Coast Water District Groundwater Sustainability Agency (MCWD GSA) and the Salinas Valley Basin Groundwater Sustainability Agency (SVBGSA) and lies entirely within Monterey County. The Subbasin is bounded on the northeast by the 180/400-Foot Aquifer Subbasin (DWR Basin 3-004.01) and on the southwest by the Seaside Subbasin (DWR Basin 3-004.08).

The GSAs have established two Management Areas within the Subbasin, as discussed in Section 1.4 and shown on Figure 3-1. These Management Areas are described as follows:

- Marina-Ord Area: This Management Area consists of the lands within the City of Marina, City of Seaside, and the former Fort Ord; and
- Corral de Tierra Area: This Management Area consists of the remainder of the Subbasin, which includes lands that are generally south of State Route 68 and a few parcels located along the northern subbasin boundary with ~~between the former Fort Ord and~~ the 180/400-Foot Aquifer Subbasin. ~~includes a parcel located between the City of Marina and the former Fort Ord.~~

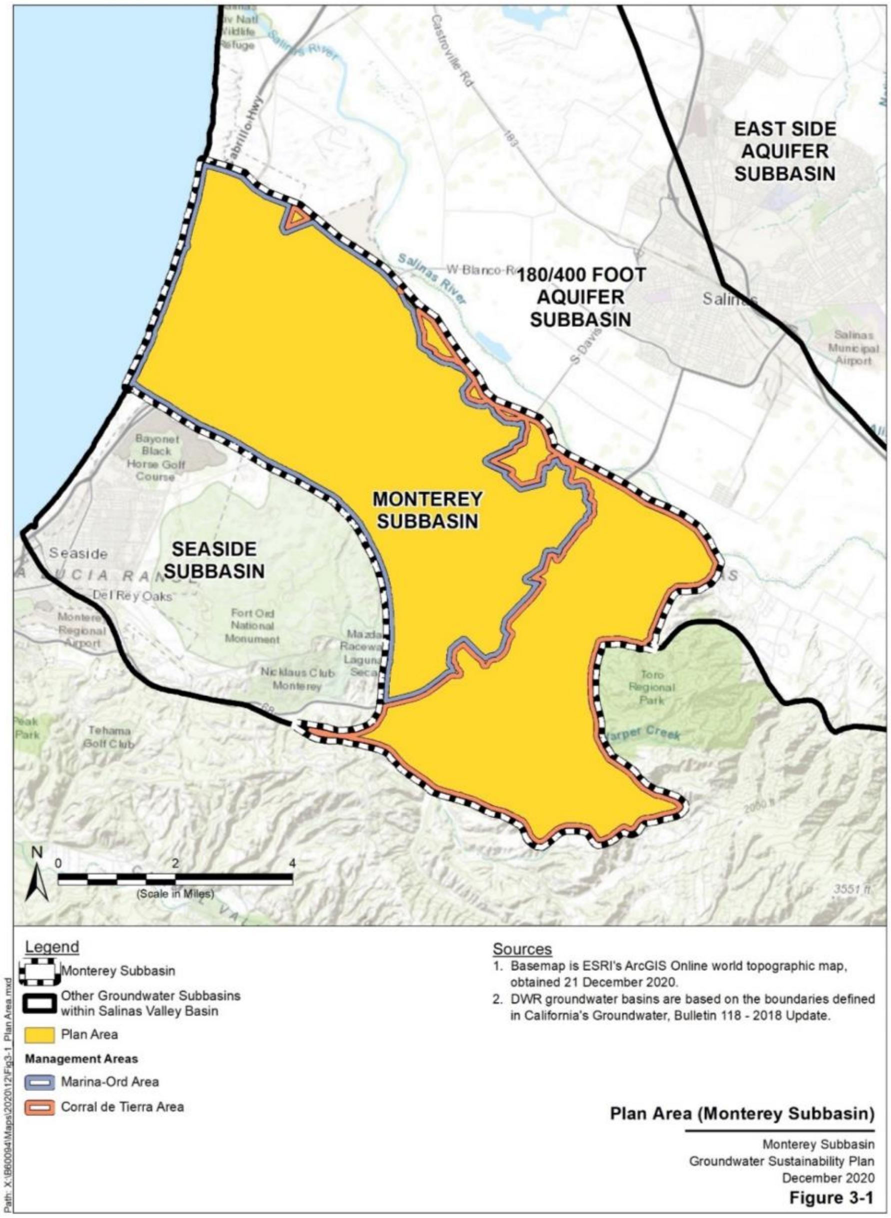

Figure 3-1. Plan Area (Monterey Subbasin)

3.1.2 Jurisdictional Boundaries

The Subbasin falls entirely within Monterey County and contains the municipalities of Marina and Seaside. The City of Marina is located in the northern portion of the Subbasin and is a community of approximately 22,000 residents (DOF, 2020). The City of Seaside is on Highway 1 approximately two miles south of the City of Marina, and has a population of approximately 34,000 (DOF, 2020).

A large portion of the Subbasin was home to the 45-square mile former Fort Ord military base. The base was closed in 1994 and had since been undergoing conversion to civilian use. As of 2019, most of the property transfers have been completed, and environmental cleanup is ongoing. A large portion of the land is transferred to the Bureau of Land Management (BLM) as part of the National Conservation Lands and consists of the Fort Ord National Monument. A small portion of the base was retained by the U.S. Army for an active military installation. As shown on Figure 3-2, a total of 9,200 acres of the Subbasin is federally owned lands managed by the U.S. Army and the BLM located at the former Fort Ord. Those lands are not subject to the Sustainable Groundwater Management Act (SGMA).

The Fort Ord Dunes State Park, a state-owned park, is located along the western boundary of the Subbasin adjacent to the Pacific Ocean, with a total area of 916 acres.

According to the information made available by the DWR[5] in support of GSP development, there are no tribal lands within or in the vicinity of the Subbasin.

Areas under federal and state jurisdiction are shown on Figure 3-2.

[5] SGMA Data Viewer: https://sgma.water.ca.gov/webgis/?appid=SGMADataViewer

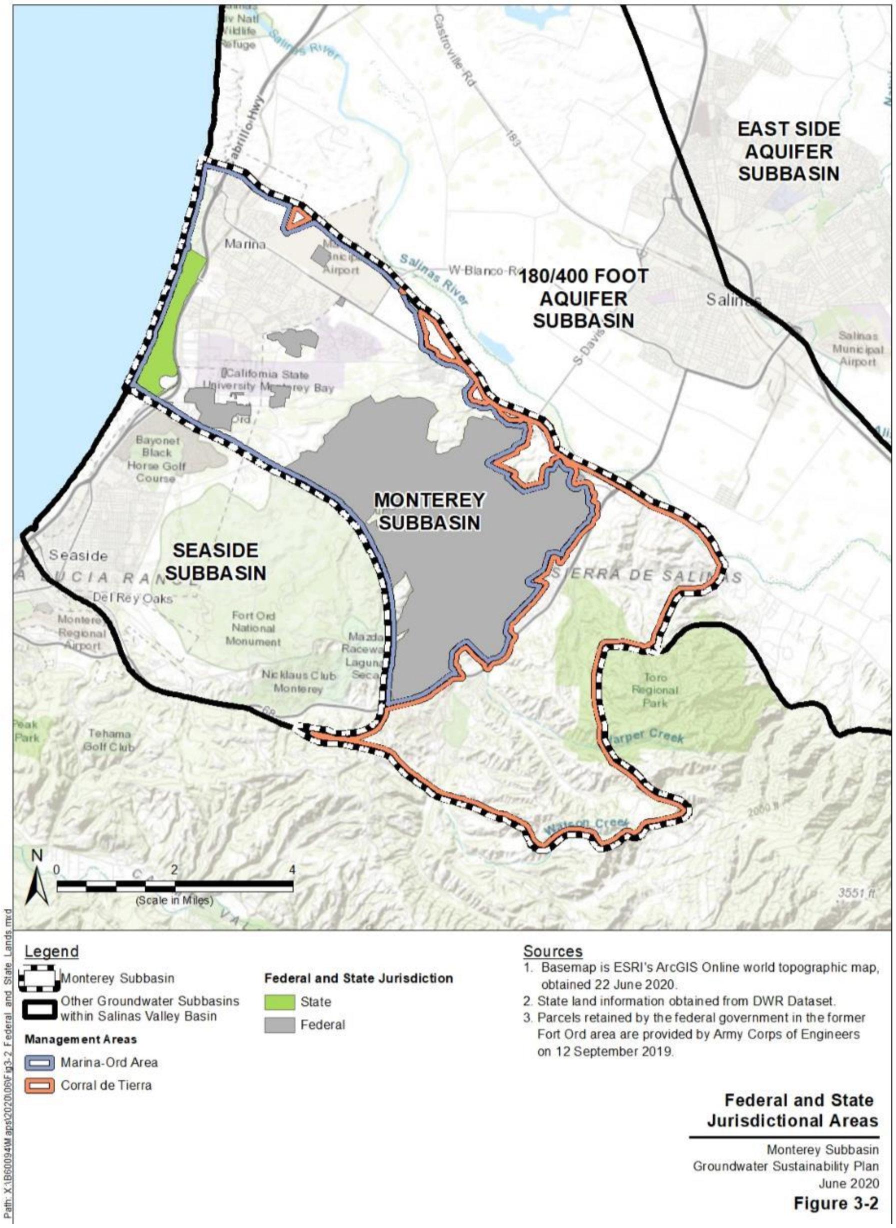

Figure 3-2. Federal and State Jurisdictional Areas

3.1.3 Agencies with Water Management Responsibilities

As shown on Figure 3-3, the main water supplier in the Subbasin is MCWD, which has a service area covering the entire City of Marina and all parcels within the Ord Subarea that currently receive potable water or that have received final land use development approvals by the applicable land use jurisdiction within its jurisdictional boundary. Within the former Fort Ord, MCWD is the exclusive water purveyor to all non-Federal lands and the U.S. Army for all Army and Federal facilities. By a 2001 deed from the Army through the Fort Ord Reuse Authority, MCWD owns all the water infrastructure within the former Fort Ord (MCWD, 2016). A small portion of MCWD's service area further extends into the 180/400-Foot Aquifer Subbasin.

The MCWD provides sewer collection services within its jurisdictional boundaries. Wastewater collected by MCWD is conveyed to the Monterey One Water (formerly Monterey Regional Water Pollution Control Agency) Regional Treatment Plant located in the 180/400-Foot Aquifer Subbasin.

The public water systems in the whole Monterey Subbasin are listed in Table 3-1 and shown on Figure 3-4. There are also over 60 State Small Water Systems (5-14 connections) and Local Small Water Systems (2-4 connections) in the Monterey Subbasin that provide water.

Table 3-1. Public Water Systems in the Monterey Subbasin

Water System No	Agency Name	Acres
CA2710017	Marina Coast Water District	19,476
CA2710012	California Water Service Company - Salinas Hills	2,626
CA2710004	California American Water Company - Monterey District	2,368
CA2710021	Toro Water Service No 2710021	2,168
CA2702009	Laguna Seca Recreation Water System	487
CA2700612	Laguna Seca Water Company	77
CA2702315	Corral De Tierra Country Club Water System	71
CA2701367	Tierra Meadows Home Owners Association Water System	44
CA2700775	Tierra Verde Mutual Water Company	21
CA2700731	Z Ranch Mutual Water Company	18
CA2702030	Cypress Community Church Water System	17
CA2700536	Corral De Tierra Estates Water Company	6
CA2701740	Bluffs Water System	6
CA2701681	Exxon Station Water System	1
	Total	**27,385**

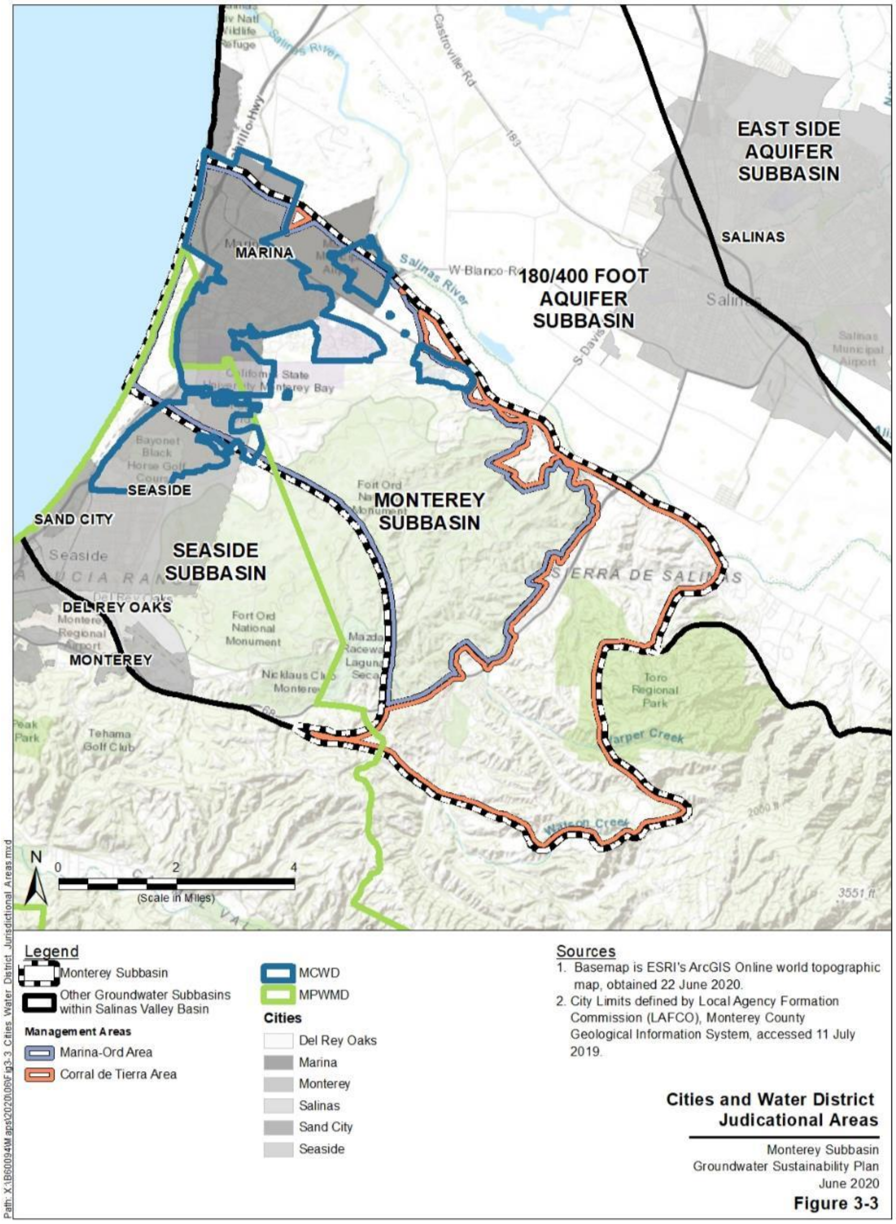

Figure 3-3. Cities and Water District Jurisdictional Areas

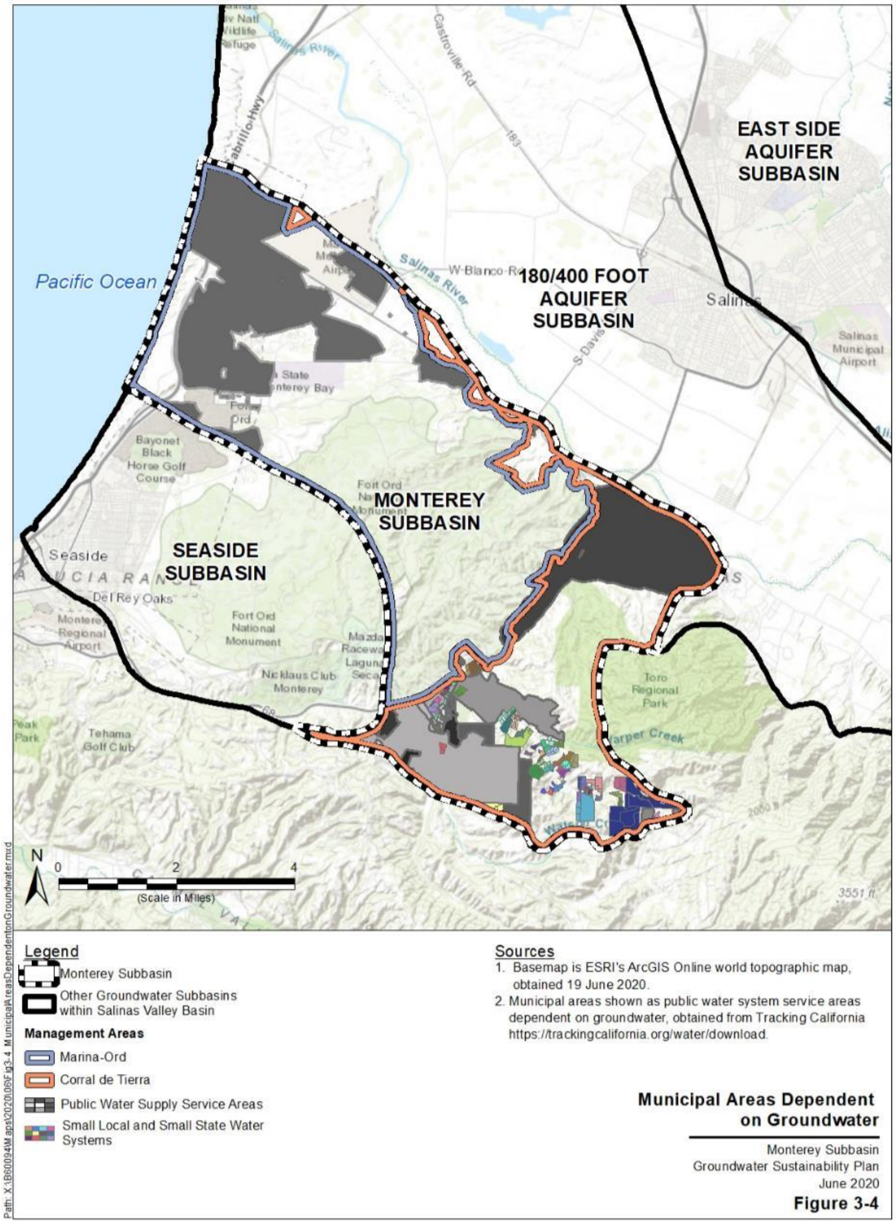

Figure 3-4. Water Providers (Communities Dependent on Groundwater)

Other agencies with water management responsibilities within the Subbasin include the Monterey County Water Resources Agency (MCWRA) and the Monterey Peninsula Water Management District (MPWMD). MCWRA governance areas include all lands within Monterey County, which includes the Subbasin. MPWMD manages groundwater and surface water in areas on the Monterey Peninsula and in the Carmel River Basin and includes the City of Seaside, which extends into the Subbasin. Management programs of these agencies are further discussed in Section 3.2.

3.1.4 Adjudicated Areas and Alternative Areas

The Subbasin is not adjudicated and does not contain any areas covered by an Alternative Plan. However, this subbasin shares a jurisdictional boundary with the Seaside Adjudicated Subbasin. This boundary is based on a presumed groundwater flow divide between the two subbasins and may be vulnerable to future pumping or impacts to the groundwater conditions in either Subbasin. The adjudicated area is not managed by MCWD or the SVBGSA. The adjudicated Seaside Subbasin is managed by the Seaside Basin Watermaster.

3.1.5 Existing Land Use and Water Use

Land use planning authority in the Subbasin is the responsibility of the County of Monterey and, the cities of Marina and Seaside. Redevelopment of the former Fort Ord was under the oversight of the Fort Ord Reuse Authority (FORA), established in 1994 and recently terminated in June 2020. Prior to its termination, FORA allocated assets/liabilities and transitioned land use planning within former Fort Ord to each of the local jurisdictions, including the Cities of Marina and Seaside, the City of Monterey, and the County of Monterey., and the Fort Ord Reuse Authority, which oversees reuse planning at the former Fort Ord.

Figure 3-5 shows simplified land use designations within the Monterey Subbasin. The majority of the Subbasin is undeveloped land. Urban is the primary developed land use within the Subbasin, with approximately 5,500 acres of urban coverage. Small areas of agriculture, approximately 500 acres of truck nursery and berry crops, are located along the northern Subbasin boundary adjoining the 180/400-Foot Aquifer Subbasin. Urban and agricultural water uses in the Subbasin rely entirely on groundwater.

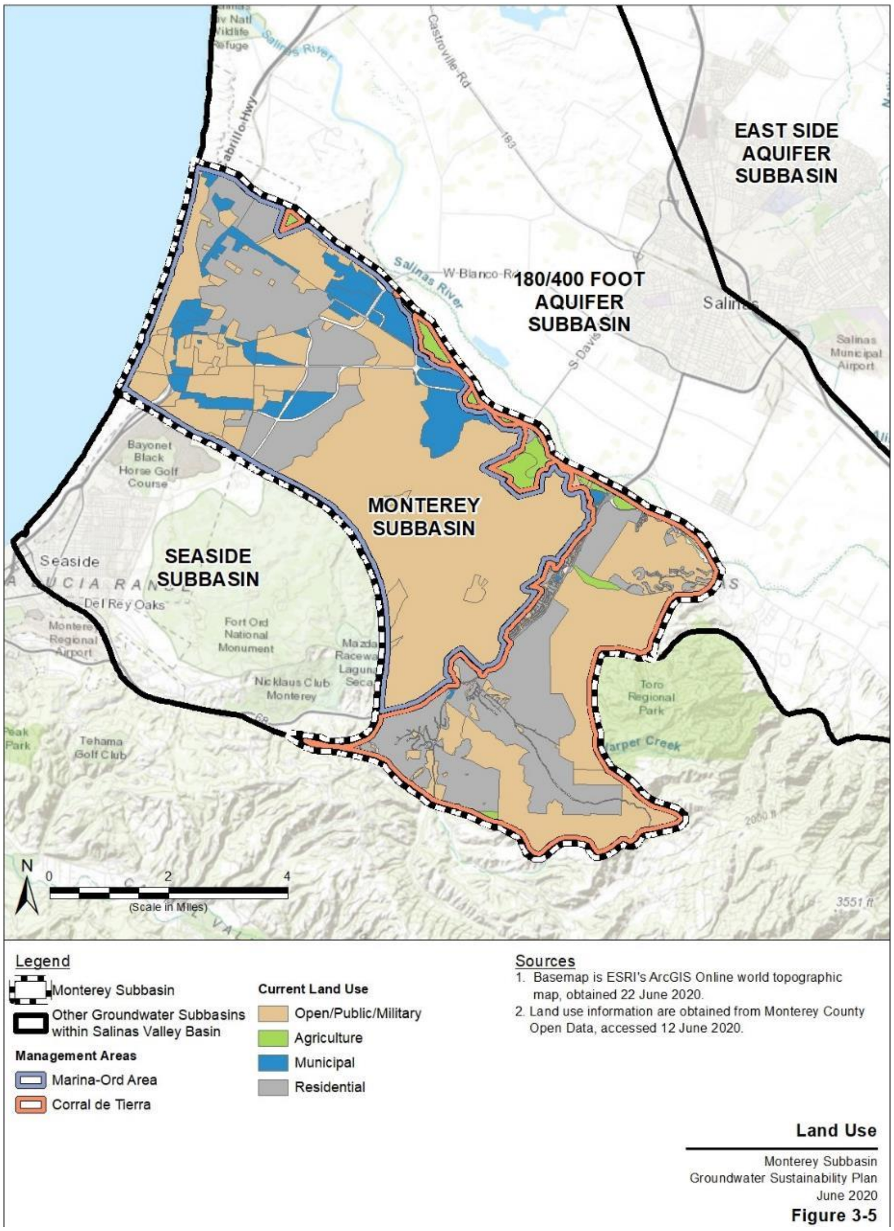

Figure 3-5. Land Use

3.1.6 Well Density per Square Mile

Figure 3-6 through Figure 3-8 show the density of wells per square mile within the Subbasin, based on Well Completion Report records compiled by DWR. According to these records, 102 production wells, 304 domestic wells, and 17 public supply wells have been installed within the Public Land Survey Systems (PLSS) sections that fall partially or entirely within the Subbasin.

Groundwater is the primary water source for all water use sectors in the Subbasin. Municipal areas dependent on groundwater within the Subbasin are shown on Figure 3-4.

Within the Marina-Ord Area, MCWD is the exclusive water purveyor to all non-federal lands and to the Army for all Army and Federal facilities within the former Fort Ord. Due to well installation requirements of the Monterey County and the City of Marina (see Section 3.5.4), only a very small number of domestic wells that pre-date County and City ordinances exist within the Marina-Ord Area. Fort Ord contamination and seawater intrusion limit the use of the majority of these wells. In turn, these communities rely on water services provided by MCWD. MCWD operates seven active production wells that supply approximately 3,200 acre-feet per year (AFY) to its residents.

Within the Corral de Tierra Area, there are hundreds of domestic wells and small community water system wells shown in Figure 3-4 (GeoSyntec, 2007). The average domestic well depth is approximately 430 feet. The majority of these small systems are clustered in the Watson Creek and Harper Creek watersheds. The most recent and best available published historical groundwater demand in the Corral de Tierra Area southeast of Highway 68 estimated a groundwater extraction rate of 1,256 AFY for the El Toro Planning area which is an area that encompasses the Calera Creek, Watson Creek, Corral de Tierra, San Benancio Gulch, and El Toro Creek watersheds (GeoSyntec, 2007).. ~~The report estimated this groundwater extraction based on reports published and data collected in the 1990s (GeoSyntec, 2007).~~ The El Toro Planning area encompasses a large portion of the Corral de Tierra Area within the Monterey Subbasin as well as communities in the Sierra de Salinas immediately outside of the Subbasin. Therefore, the estimated volumes are not perfectly representative of the current water use in the Corral de Tierra Area. A more detailed analysis of groundwater extraction is included in Chapter 6. Groundwater is primarily used for municipal, domestic, and agricultural purposes.

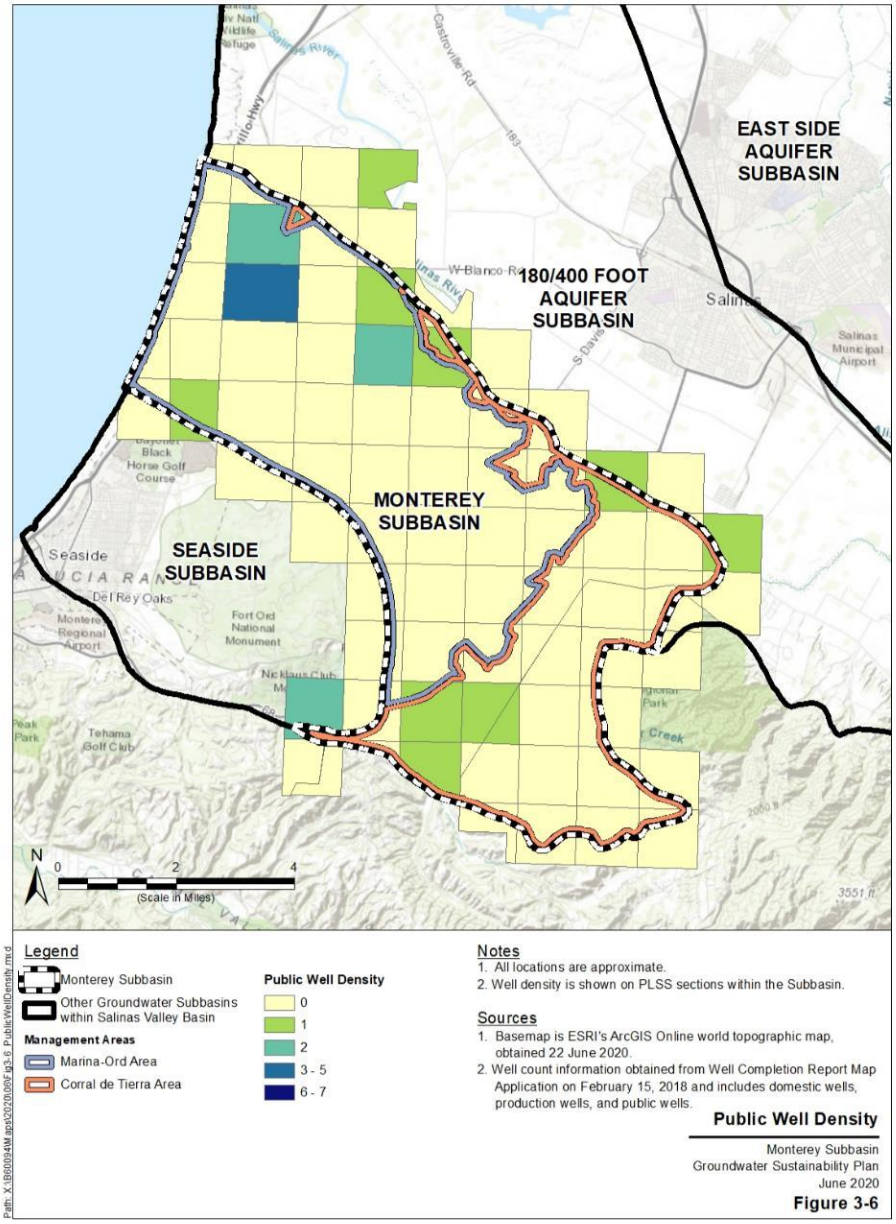

Figure 3-6. Public Well Density

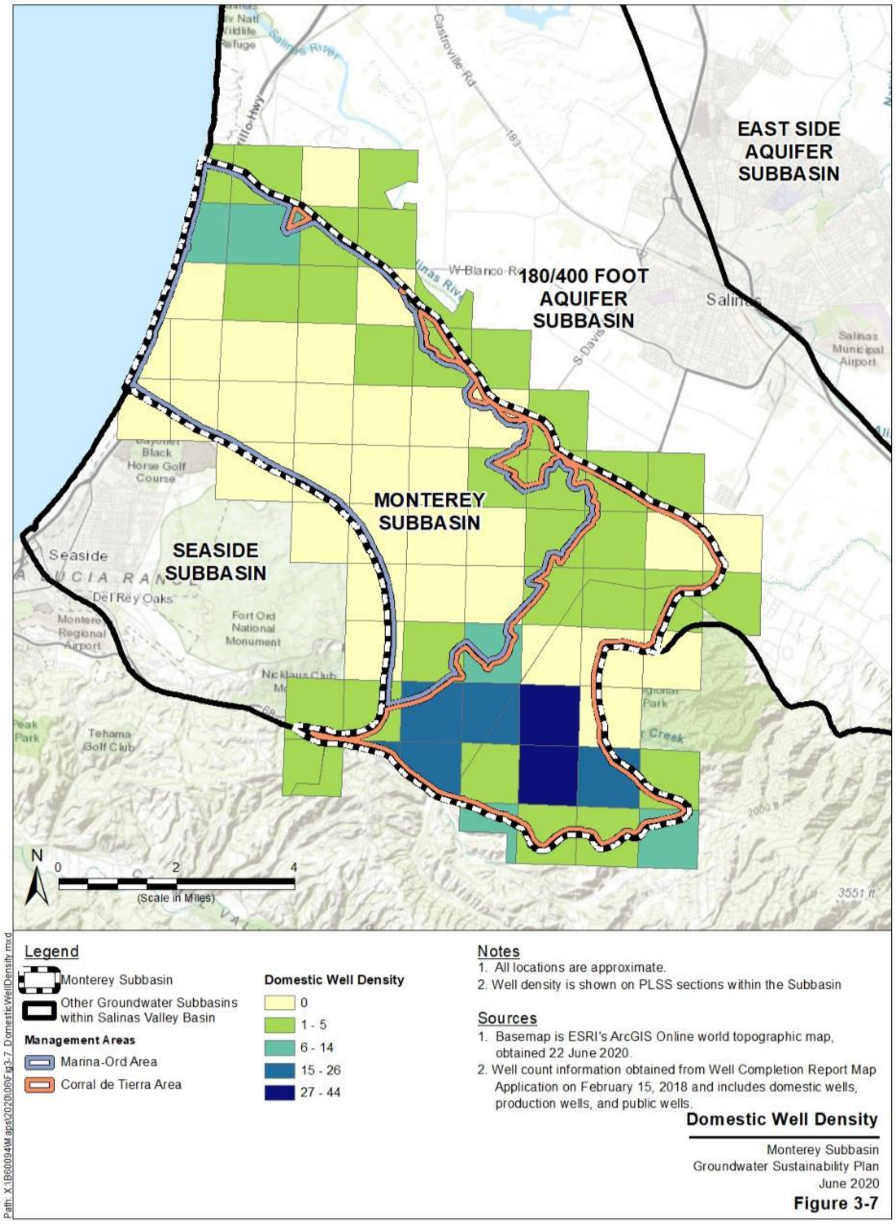

Figure 3-7. Domestic Well Density

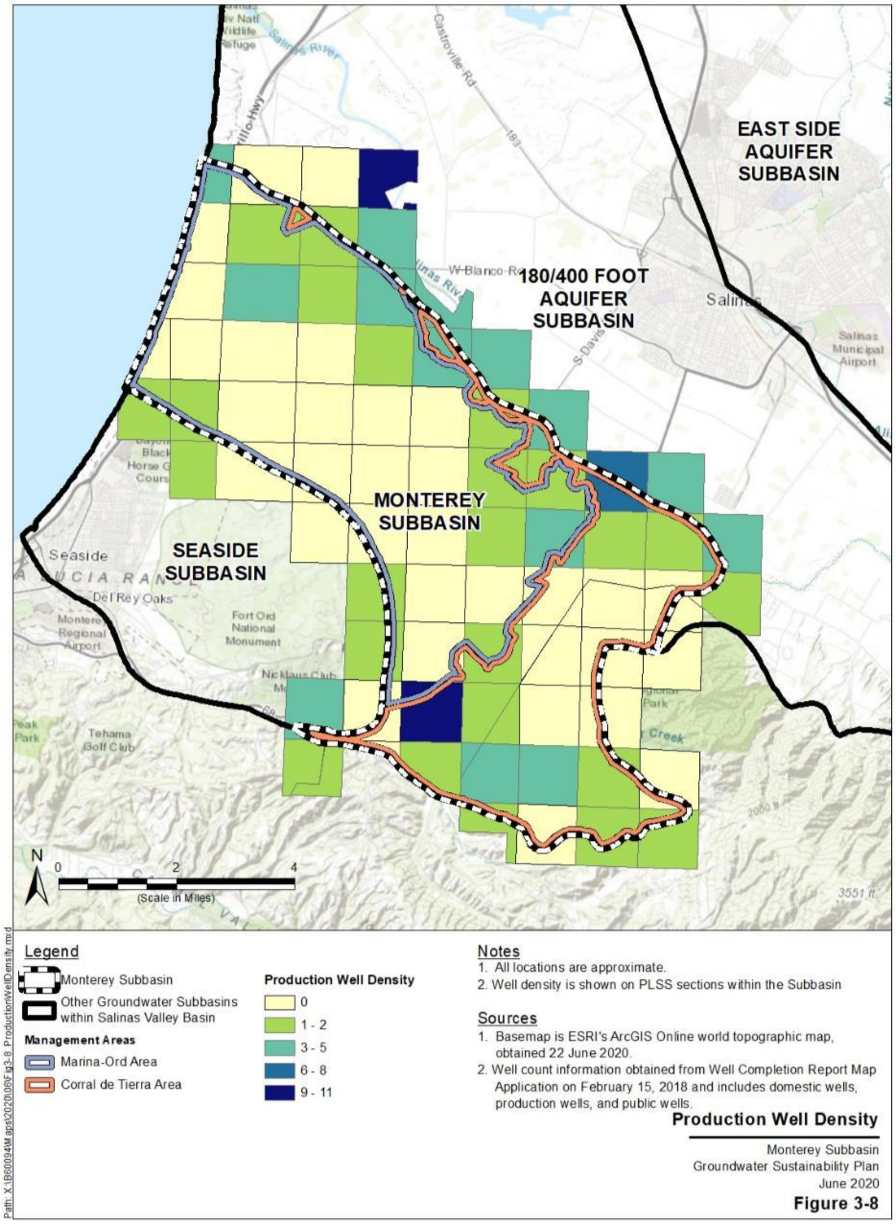

Figure 3-8. Production Well Density

3.2 Water Resources Monitoring and Management Programs

3.2.1 Existing Monitoring Programs

Existing groundwater monitoring in the Subbasin includes:

- The California Statewide Groundwater Elevation Monitoring (CASGEM) Program tracks long-term groundwater elevation trends in groundwater basins throughout California. The CASGEM program's mission is to establish a permanent, locally-managed program of regular and systematic monitoring in all of California's alluvial groundwater basins. In the Subbasin, MCWRA and MPWMD are the CASGEM monitoring entities.
- The United States Geological Survey (USGS) collects surface water and groundwater data across the United States. Existing USGS monitoring wells and stream gauges are located within the Monterey Subbasin.
- The Groundwater Ambient Monitoring and Assessment (GAMA) Program is a comprehensive groundwater quality monitoring program created by the State Water Resources Control Board (SWRCB) in 2000. The GAMA Program monitors groundwater quality trends throughout California, including within the Monterey Subbasin.
- The SWRCB's Division of Drinking Water monitors groundwater quality from public water system wells. There are 15 active public water systems located within the Subbasin.
- Local small or state small water system wells are regulated by the Monterey County Department of Public Health. Local small water systems serve 2 to 4 service connections and state small water systems serve 5 to 14 connections.
- MCWD, MCWRA, and MPWMD each conduct periodic monitoring for groundwater elevation and quality in their production wells or selected wells in their respective areas. Additionally, MCWD has installed transducers in selected production wells.
- Multiple sites are monitoring groundwater quality as part of investigation or compliance monitoring programs through the Central Coast Regional Water Quality Control Board (CCRWQCB).
- MCWRA monitors seawater intrusion with a network of 152 monitoring wells, most wells located within the 180/400-Foot Aquifer Subbasin. The seawater intrusion monitoring network comprises a combination of production wells and dedicated monitoring wells.
- MCWRA collects groundwater extraction information from production wells in the Subbasin that have discharge pipes of three inches or greater in diameter. These data have been collected since 1993. Extraction information is self-reported by well owners, and this program does not extend into the entire geographic area of the Monterey Subbasin.

- Multiple sites are monitoring groundwater quality as part of investigation or compliance monitoring programs through the Central Coast Regional Water Quality Control Board (CCRWQCB).
- The U.S. Army Corps of Engineers (the Army) conducts periodic monitoring for groundwater elevation and quality for remediation purposes in the former Fort Ord. Several additional sites are monitored for groundwater elevation and quality as part of investigation or compliance monitoring programs through the Central Coast Regional Water Quality Control Board.

Well locations of the above monitoring programs are shown on Figure 3-9.

Groundwater elevation from CASGEM, USGS, SWRCB, as well as MCWRA, MPWMD, and the Army's monitoring networks, have been used to characterize groundwater level conditions (see Section 5.1 Groundwater Elevations and Flow Direction). Water quality data from MCWRA, MPWMD, and the Army's monitoring networks, in coordination the Airborne Electromagnetic (AEM) Surveys have been used to characterize seawater intrusion and identify water quality concerns (see Section 5.3 Seawater Intrusion and Section 5.4 Groundwater Quality Concerns).

For surface water, there are no surface water inflows beyond those produced from seasonal precipitation in the Subbasin (GeoSyntec, 2007). The USGS monitored streamflows for El Toro Creek at station 11152540 until 2001 (GeoSyntec, 2007). The logarithmic mean of 525 AFY is representative of average flows as shown in Figure 4-24 and Figure 4-25 in Section 4 (GeoSyntec, 2007). As of 2021, there are no active surface gauges in the Corral de Tierra Area.

3.2.1.1 Limits to Operational Flexibility

The existing monitoring networks will be integral to the ongoing monitoring and reporting that will be conducted pursuant to this GSP. For the above-mentioned monitoring programs, the Monterey Subbasin GSP will incorporate the CASGEM program into its monitoring network, as applicable. The MCWD, MCWRA (a member of SVBGSA), and MPWMD also conduct routine groundwater quality monitoring as part of their management efforts. These existing programs will continue and will inform GSP implementation. The Monterey Subbasin Monitoring Network is further described in Section 7 Monitoring Network.

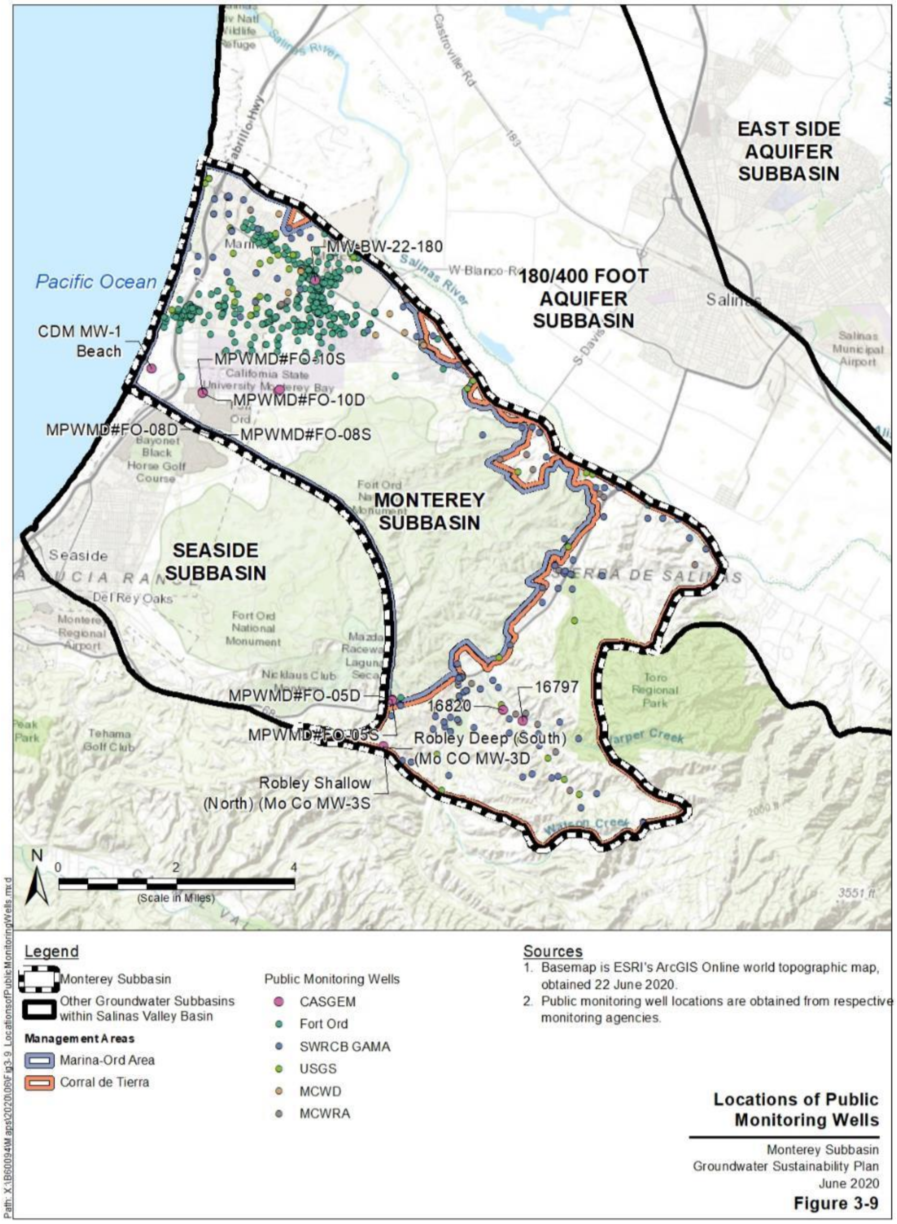

Figure 3-9. Locations of Public Monitoring Wells

3.2.2 Existing Management Programs

The following groundwater management programs exists within the Monterey Subbasin.

3.2.2.1 Integrated Regional Water Management

The majority of the Monterey Subbasin falls within the Greater Monterey County Integrated Regional Water Management Region (Greater Monterey County Region), while a portion of the Subbasin along the southern boundary is within the Monterey Peninsula-Carmel Bay-South Monterey Bay Region (Monterey Peninsula Region). These portions of the Subbasin are therefore included in the Greater Monterey County Integrated Regional Water Management Plan (IWRMP) and the Monterey Peninsula Region IWRMP, respectively.

The Greater Monterey County Region includes the entire Monterey County, excluding the Pajaro River Watershed Region and the Monterey Peninsula Region. The Greater Monterey County IRWMP was adopted in April 2013 and updated in September 2018. The water supply goals for the Greater Monterey County Region, according to the IRWMP (Monterey County, 2018), include the following:

- Improve water supply reliability and protect groundwater and surface water supplies;
- Protect and improve surface, groundwater, estuarine and coast water quality, and ensure the provision of high-quality, potable, affordable drinking water for all communities in the region;
- Develop, fund, and implement integrated watershed approaches to flood management through collaborative and community-supported processes;
- Protect, enhance, and restore the region’s ecological resources while respecting the rights of private property owners;
- Promote regional communication, cooperation, and education regarding water resources management;
- Ensure the provision of high-quality, potable, affordable water and healthy conditions for disadvantaged communities (DACs); and
- Adapt the region’s water management approach to deal with impacts of climate change using science-based approaches, and minimize the regional causal effects.

The Monterey Peninsula Region consists of approximately 350 square miles along the Monterey Bay and the Carmel River Valley. The Monterey Peninsula IRWMP was adopted in 2014 and was updated to comply with new IRWM Program Guidelines in September 2019. Key goals and priorities for the Monterey Peninsula Region, according to the IRWMP (2019), include the following:

- Meet existing water supply replacement needs for the Carmel River system and Seaside Subbasin;
- Maximize use of recycled water and other reuse and where feasible, expand sewer services to areas with onsite systems to increase sources of water for recycling;

- Develop opportunities for stormwater capture and reuse pursuant to the Stormwater Resource Plan;
- Evaluate, advance, or create water conservation throughout the Region;
- Improve water supply needs to achieve multiple benefits, beneficial uses and environmental flows;
- Seek long-term sustainable supplies for adopted future demand estimates;
- Improve ocean water quality, including Areas of Special Biological Significance (ASBS), by minimizing pollutants in stormwater discharges;
- Improve inland surface water quality for environmental resources (e.g. steelhead), including headwaters and tributaries of streams, and to protect potable water supplies;
- Protect and improve water quality in groundwater basins, especially where at risk from seawater intrusion;
- Develop regional projects and plans necessary to protect critical infrastructure and sensitive habitats from flood damage and sea level rise, in particular, along the Carmel Bay and South Monterey Bay shoreline; Identify cooperative, integrate strategies for protecting both infrastructure and environmental resources, including from climate change impacts; and

Foster collaboration among regional entities as an alternative to litigation through ongoing meetings of the RWMG and regional data sharing. The Monterey Peninsula Region consists of approximately 350 square miles along the Monterey Bay and the Carmel River Valley. The Monterey Peninsula IRWMP was adopted in 2014 and is currently undergoing an update to comply with new IRWM Program Guidelines. Key goals and priorities for the Monterey Peninsula Region, according to the IRWMP (2014), include the following:

- Meet existing water supply replacement needs for the Carmel River system and Seaside Subbasin;
- Maximize use of recycled water and other reuse, including gray water systems, and stormwater capture and use;
- Improve ocean water quality, including Areas of Special Biological Significance (ASBS), by minimizing pollutants in stormwater discharges;
- Improve inland surface water quality for environmental resources (e.g. steelhead) and potable water supplies;
- Protect and improve water quality in groundwater basins;
- Develop regional projects and plans necessary to protect existing infrastructure and sensitive habitats from flood damage, erosion, and sea level rise, in particular, along the South Monterey Bay shoreline and Carmel Valley;
- Identify cooperative, integrate strategies for protecting both infrastructure and environmental resources, including from climate change impacts; and
- Foster collaboration among regional entities as an alternative to litigation.

IRWMP and GSP development are complementary management processes. To the extent that the issues identified for the greater IRWMP regions affect the Subbasin, these issues will be identified in the following sections of this GSP. The implementation of this GSP will contribute to the sustainable use of water supplies within the IRWMP regions. The IRWM program is not expected to limit operational flexibility in the Subbasin.

3.2.2.2 MCWRA Management of the Salinas Valley Groundwater Basin

The MCWRA was formed in 1947 by State law, originally as the Monterey County Flood Control and Water Conservation District (MCFCWCD), and established by the Monterey County Flood Control and Water Conservation District Act (District Act). The prevention of seawater intrusion was a principal reason for the enactment of the District Act in 1947. Since then, the MCWRA has developed projects and programs to reduce the adverse impacts from pumping and seawater intrusion within the 180/400-Foot Aquifer Subbasin. As shown on Figure 3-10, Zones 2C, 2Y, and 2Z cover a majority of the Monterey Subbasin, including most of the land north of Harper Canyon. The areas not covered by these zones include a small portion of the City of Marina, and San Benoncio Gulch and Calera Canyon along Corral de Tierra Road up to the intersection with State Route 68. A description of the zones is provided below[6]:

- Under provisions of the District Act, the MCFCWCD established the Zone 2 and Zone 2A benefit assessment zones to fund the construction of Nacimiento Reservoir and the San Antonio Reservoir, respectively. In 2003, MCWRA created 2C to fund operation and maintenance of the reservoirs and eliminate charges in Zones 2 and 2A.
- Zone 2Y was established to collect assessments for the operation and maintenance of the Castroville Seawater Intrusion Project.
- Zone 2Z was established to collect assessment for the operation and maintenance of the Salinas Valley Reclamation Project.

[6] Annexation Zone https://www.co.monterey.ca.us/home/showdocument?id=22209

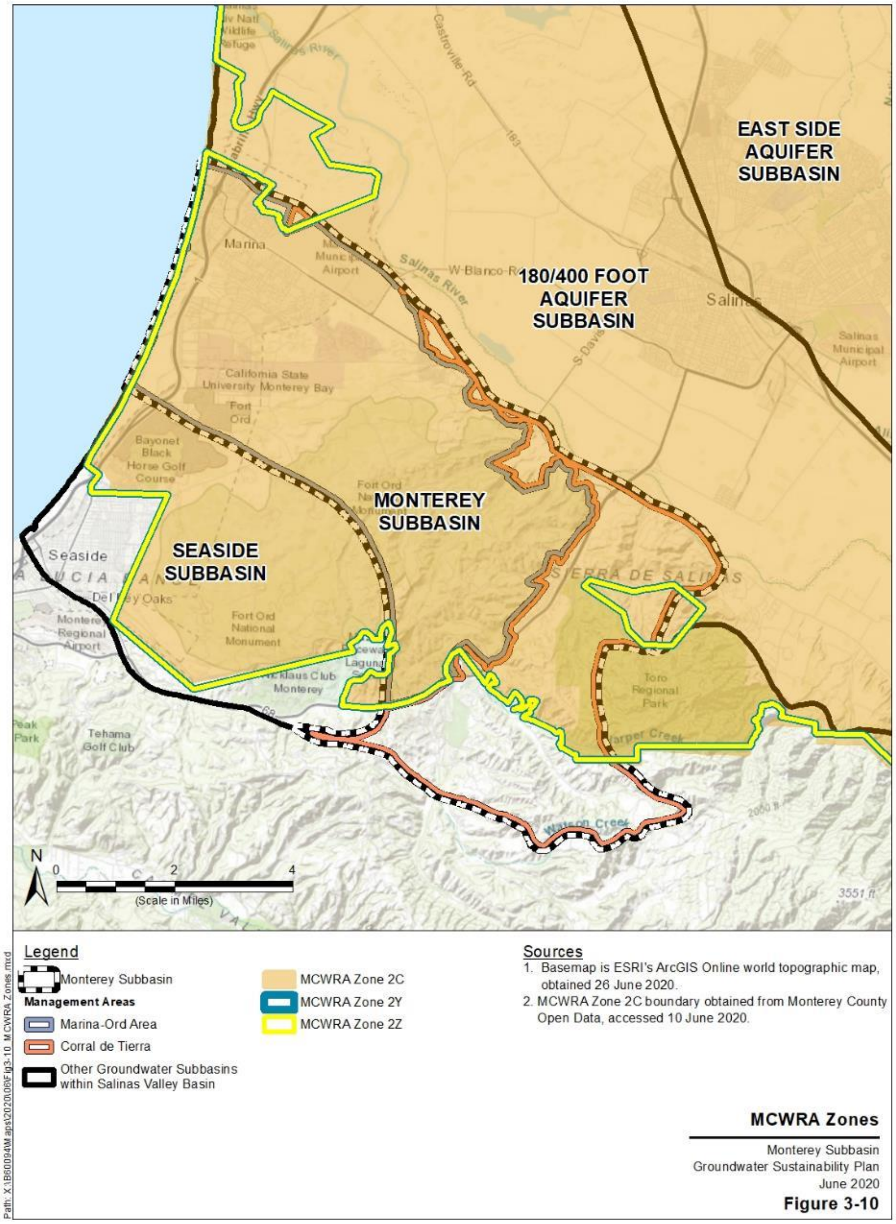

Figure 3-10. MCWRA Zones

In 1990, the District Act was repealed and replaced by the existing Monterey County Water Resources Agency Act (Agency Act); however, much of the District Act was carried over into the Agency Act. The District Act and then the Agency Act have been the foundation of groundwater management within Monterey County. Additional information on MCWRA monitoring programs and well permitting programs is provided in Sections 3.2.1 and 3.5.4, respectively.

1993 and 1996 Annexation Agreements. MCWRA established annexation zones to institute water supply projects and collect assessments to fund them under various Monterey County Ordinances. The two major historic groundwater users within the Subbasin, the Federal Government and the MCWD, respectively entered into annexation agreements with MCWRA in 1993 and 1996 to be annexed to Zones 2 and 2A[7]. The 1996 Annexation Agreement and Groundwater Mitigation Framework for Marina Area Lands was the fifteenth annexation to Zones 2 and 2A since 1991.[8] In the annexation agreements, the MCWRA recognized that MCWD and the Federal Government had been pumping groundwater for many years and had strong claims to groundwater rights[9] MCWD and the Federal Government agreed that all non-Federal lands within the annexed areas would pay assessments to MCWRA Zones 2 and 2A (later superseded by Zones 2C, 2Y, and 2Z) for regional projects to protect the Salinas Valley Groundwater Basin and reduce seawater intrusion. The Annexation Agreements are attached as Appendix 3-A.

~~This GSP will identify the amount of assessments paid by Marina area and non-Federal Fort Ord lands, what those funds were used for, what benefits those lands have received from those payments, and what benefits those lands could receive in the future to help achieve groundwater sustainability within the Monterey Subbasin.~~

Under the 1993 and 1996 Annexation Agreements, the Federal Government agreed to limit groundwater pumping from the Salinas Valley Groundwater Basin ("Basin") to 6,600 AFY, and MCWD agreed to limit pumping from the Basin to 3,020 AFY, respectively; MCWD's share to be used to serve the City of Marina[10](MCWRA/U.S. Army, 1993; MCWRA/MCWD, 1996). In 2001, the Federal Government transferred ownership of the Fort Ord water system infrastructure to

[7] The MCWRA Board of Directors adopted an Annexation Policy dated March 29, 1993, which provided for the process for lands not then included within Zones 2 and 2A to be annexed into both zones subject to the annexation process in Agency Act §43, the preparation of final environmental documents, and the setting of annexation fees.
[8] 1996 Annexation Agreement, Section 3.1.
[9] Section 45 of the Agency Act provided MCWRA to develop a water allocation formula for groundwater users in the County "to preserve agricultural access to an adequate water supply and to preserve agriculture as a mainstay of the Salinas Valley economy". Board of Supervisors Resolution 91-476 adopted September 24, 1991, directed MCWRA staff to prepare information for a water allocation formula for Zone 2 and 2A and bring it back to the Board on or before January 1, 1992, and further directed MCWRA staff to prepare an emergency allocation ordinance for Zones 2 and 2A for consideration by the Board no later than April 1, 1992. While a draft report was prepared, the draft report was never approved by the Board.
[10] In addition, under the 1996 Annexation Agreement, 920 AFY of groundwater was allocated to Armstrong Ranch development, and 500 AFY (of brackish water) to CEMEX in the adjacent 180/400-Foot Aquifer Subbasin.

MCWD, including the ability to pump no more than 4,871 AFY[11] of groundwater (of the 6,600 AFY described in the 1993 Agreement) from the Basin. MCWD is using the 4,871 AFY of groundwater to provide water service to those jurisdictions within the former Fort Ord, which are entitled to water service pursuant to the Fort Ord Base Reuse Plan (Section 3.5.1.4). Under a long-term water service agreement with the Army, MCWD provides water service to all Federal activities within the former Fort Ord utilizing the Army's groundwater pumping rights.

To protect the 180-Foot and 400-Foot aquifers, the 1993 and 1996 Annexation Agreements limit the volume of groundwater that MCWD can extract from the 180-Foot and 400-Foot Aquifers. To offset that limitation, the 1996 Annexation Agreement provides "…*that the '900-foot'*[12] *aquifer should be managed to provide safe, sustained use of the water resource, and to preserve to MCWD the continued availability of water from the '900-foot' aquifer."*

The 1993 and 1996 Annexation Agreements further provided that MCWRA will seek to develop a replacement potable water supply, such that most groundwater pumping within Fort Ord and Marina Area Lands could be curtailed. However, by Resolution 00-172 adopted on April 25, 2000, the Board of Supervisors of the MCWRA indicated that the MCWRA has no contractual obligation to fund such a system using assessments from MCWRA Zones 2A or 2B (the resolution does not mention other potential sources of funds). MCWD is developing new water supplies to support redevelopment of the former Fort Ord and to supplement its groundwater supplies. These efforts are incorporated in this GSP and discussed further in Section 9.1 Project Descriptions.

MCWRA Groundwater Export Prohibition. The Monterey County Water Resources Agency Act, §52.21 prohibits the export of groundwater from any part of the Salinas Valley Groundwater Basin, including the Monterey Subbasin. In particular, the Act states:

> *For the purpose of preserving [the balance between extraction and recharge], no groundwater from that basin may be exported for any use outside the basin, except that use of water from the basin on any part of Fort Ord shall not be deemed such an export. If any export of water from the basin is attempted, the Agency may obtain from the superior court, and the court shall grant, injunctive relief prohibiting that exportation of groundwater.*

The Agency Act was adopted at a time when the Seaside Subbasin was considered to be hydrologically separate from the Salinas Valley Groundwater Basin, but the above Agency Act section expressly made use of Salinas Valley groundwater within any part of Fort Ord, even

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[11] Under Article 2.a of Amendment No. 1 dated October 23, 2001, to the Memorandum of Agreement between the U.S. Government acting through the Secretary of the Army and FORA, the Army agreed to reserve only 1,691 AFY, or 38 AFY less than the amount actually reserved by the Army in the October 23, 2001 deed. The 38 AFY was to be transferred to FORA and then to MCWD. FORA was to allocate the 38 AFY to the City of Seaside for the benefit of Bay View Mobile Home Park subject to use limitations prescribed in Amendment No. 1 to be administered by the City of Seaside pursuant to its land use authority. MCWD has requested FORA and the City of Seaside to correct this oversight with the Army but it has not been yet corrected.

[12] aka the Deep Aquifer. Section 5.3 of the 1996 Annexation Agreement.

though within the Seaside Subbasin, as being exempt from the export prohibition. In 2003, DWR included the Seaside Subbasin within the Salinas Valley Groundwater Basin, which DWR now designates as the Seaside Subbasin.

County Moratorium on Accepting and Processing New Well Permits. On May 22, 2018, the Monterey County Board of Supervisors adopted Ordinance No. 5302 pursuant to Government Code Section 65858. The ordinance was an Interim Urgency Ordinance, which took effect immediately upon adoption. The ordinance prohibits the acceptance or processing of any applications for new wells in the defined Area of Impact within the Monterey Subbasin and the 180/400-Foot Aquifer Subbasin, with stated exceptions including municipal wells and replacement wells. Pursuant to Section 65858, the ordinance was originally only effective for 45 days to July 5, 2018, but at the June 26, 2018, Board meeting, the Board of Supervisors on a 4-1 vote extended the ordinance to May 21, 2020, by adoption of Ordinance No. 5303. During the moratorium, the County has stated that it will conduct further studies to assess groundwater conditions in the Subbasin. The ordinance expired on May 21, 2020. The County has initiated a planning process to receive input on a possible new ordinance and to address the California Supreme Court's decision in *Protecting Our Water & Environmental Resources v. County of Stanislaus* (2020), 10 Cal. 5th 479, concerning environmental review of new well permits. Well construction applications for the Deep Aquifers are currently being reviewed and permitted on a case-by-case basis.

3.2.2.3 Groundwater Management Plans

MCWRA developed a Groundwater Management Plan (GMP) that is compliant with Assembly Bill 3030 and Senate Bill 1938 legislation (MCWRA, 2006). This GMP exclusively covered the Salinas Valley in Monterey County. As discussed above, the MCWRA was established in 1947 with the responsibility to manage water resources in the Salinas Valley. Therefore prior to 2006, MCWRA has already been implementing a formal groundwater management program including surface water monitoring and groundwater monitoring. The GMP was developed to formalize and extend those ongoing management efforts in the Salinas Valley Groundwater Basin.

The GMP identified three objectives for groundwater management:

- **Objective 1**: Development of Integrated Water Supplies to Meet Existing and Projected Water Requirements. This objective encourages the integrated uses of various water sources, such as surface water, groundwater, recycled water, and possibly desalinated brackish and saline water to meet the water demand.
- **Objective 2**: Determination of Sustainable Yield and Avoidance of Overdraft. This objective is to assess groundwater basin conditions by quantifying basin yield and evaluating historical impacts including seawater intrusion and groundwater storage decline and to implement existing and new management measures to address those issues.

- **Objective 3**: Preservation of Groundwater Quality for Beneficial Use. This objective is to preserve groundwater quality by minimizing seawater intrusion and accumulations of minerals in the groundwater basin.

To meet these three objectives, the plan identified 14 elements that should be implemented by MCWRA:

- **Plan Element 1:** Monitoring of Groundwater Levels, Quality, Production, and Subsidence
- **Plan Element 2:** Monitoring of Surface Water Storage, Flow, and Quality
- **Plan Element 3:** Determination of Basin Yield and Avoidance of Overdraft
- **Plan Element 4:** Development of Regular and Dry Year Water Supply
- **Plan Element 5:** Continuation of Conjunctive Use Operations
- **Plan Element 6:** Short-Term and Long-Term Water Quality Management
- **Plan Element 7:** Continued Integration of Recycled Water
- **Plan Element 8:** Identification and Mitigation of Groundwater Contamination
- **Plan Element 9:** Identification and Management of Recharge Areas and Wellhead Protection Areas
- **Plan Element 10:** Identification of Well Construction, Abandonment, and Destruction Policies
- **Plan Element 11:** Continuation of Local, State and Federal Agency Relationships
- **Plan Element 12:** Continuation of Public Education and Water Conservation Programs
- **Plan Element 13:** Groundwater Management Reports
- **Plan Element 14:** Provisions to Update the Groundwater Management Plan

The GMP and GSP developments are complementary management processes. To the extent that the issues identified for Monterey County affect the Monterey Subbasin, these issues will be identified in the following sections of this GSP. The implementation of this GSP will contribute to the sustainable use of water supplies within Monterey County.

3.2.2.4 Urban Water Management Plans

Marina Coast Water District 2020 Urban Water Management Plan

The Marina Coast Water District was formed in 1960. Today MCWD serves municipal and industrial water uses within the City of Marina and the former Fort Ord. The MCWD most recently updated its Urban Water Management Plan (UWMP) in June 2021 (MCWD, 2021). The UWMP describes the service area; reports historical and projected population; identifies historical and projected water demand by category (single-family, multi-family, commercial, industrial, institutional/government, and other); and describes the distribution system and identifies losses.

Water use during 2021 within the MCWD service area was approximately 3,100 AFY. The 2020 UWMP anticipates that projected water demand within the entire District would be 9,584 AFY by 2040, including 2,974 AFY within the City of Marina and 6,610 AFY for the existing and future developments within the Ord Community (i.e., former Fort Ord). This projected water demand by 2035 within the Ord Community is 1,693 AFY short of the 6,600 AFY groundwater supply outlined in the 1993 Annexation Agreement (MCWRA/U.S. Army, 1993; see Section 3.2.2.2)[13]. ~~MCWD's recent water demand projection in its 2020 Master Plan (MCWD, 2020) projects that total buildout water demand (i.e. beyond 2035) for the entire District sums to approximately 9,300 AFY, consistent with that projected in the 2020 UWMP.~~

Additional water supplies such as recycled water will be used to meet this potential shortfall within the Ord Community. In 2021, MCWD takes delivery of the first 600 AFY of advanced treated water from the Pure Water Monterey (PWM) Project out of MCWD's total 1,427 AFY PWM entitlement (see discussion of the PWM Project in Section 9.1 Project Descriptions). Prior to the development of the 2020 UWMP, MCWD conducted a joint-study with FORA and Monterey One Water (M1W) that identified a new indirect potable reuse project to develop an additional 927 AFY ~~identified as an additional~~ water supply ~~need under~~for implementation of the Fort Ord Base Reuse Plan (EKI, 2020). The project is further described in Section 9.1.

MCWD is also a key potable and recycled water transmission hub owner connecting the North Marina and North Ord areas with the yet to be developed South Ord area, which includes portions of the Cities of Seaside, Del Rey Oaks, and Monterey. MCWD owns the potable water transmission pipeline, which MCWD will use to serve the South Ord area. The pipeline is currently being used by California American Water (Cal Am) for its Carmel River Aquifer Storage and Recovery (ASR) Project to convey injection water and to convey recovered water to its Monterey District, but MCWD has the first priority of use as the pipeline's owner. It is anticipated that this potable pipeline will also be used to convey recovered PWM water for direct use in California American Water's Monterey District although no agreement for such use has been negotiated. MCWD also owns the new 10-mile transmission pipeline for the PWM Project, which will deliver advanced treated water to MCWD recycled water customers and to the PWM injection wells in the Seaside Subbasin.

In addition, the MCWD UWMP includes a number of demand management measures including:

- Water Waste Prevention Ordinances
- Metering
- Conservation Pricing
- Public Education and Outreach

[13] The 6,600 AFY of groundwater supply for MCWD's Ord Community service area was further allocated by FORA to each land use jurisdiction within the area. The 2015 UWMP further compared projected water demand by 2035 with groundwater supply allocation for each jurisdiction. Considering only the jurisdictions with shortfalls, the sum of jurisdictional shortfalls is anticipated to be 2,901 AFY by 2035.

- Programs to Assess and Manage Distribution System Real Loss
- Water Conservation Program Coordination and Staffing Support
- Water Survey Programs for Residential Customers
- Residential Plumbing Retrofits
- Residential Ultra-Low Flow Toilet Replacement Programs
- High-Efficiency Washing Machine Rebate Programs
- Commercial, Industrial, and Institutional Accounts
- Landscape Conservation Programs and Incentives

MCWD's implementation of demand management measures resulted in MCWD receiving state-wide recognition of its water conservation achievements during the last drought.

California Water Service – Salinas District 2020 Urban Water Management Plan

A portion of the California Water Service area extends into the area located along the northern portion of State Route 68 in the Corral de Tierra Area of the Subbasin. Its 2020 Urban Water Management Plan (UWMP) (California Water Service, 2016) describes the service area; reports historic and projected population; identifies historical and projected water demand by category such as single-family, multi-family, commercial, industrial, institutional/government, and other; and describes the distribution system and identifies system losses.

The California Water Service UWMP also includes a number of demand management measures including:

- Water Waste Prevention Ordinances
- Metering
- Conservation Pricing
- Public Education and Outreach
- Programs to Assess and Manage Distribution System Real Loss
- Water Conservation Program Coordination and Staffing Support
- Rebates and give-aways
- Plumbing fixture replacement and Direct Installation Programs
- Irrigation equipment and landscape efficiency improvements

California Water Service's UWMP notes that groundwater will remain its sole supply due to uncertainties regarding the cost and implementation of other options, such as surface water diversion or desalination. However, the UWMP recognizes that it would be beneficial for California Water Service to diversify its supply portfolio. There is currently one active production well and four inactive production wells within the Subbasin.

3.2.2.5 CCRWQCB Agricultural Order

In 2017, the Central Coast Regional Water Quality Control Board (CCRWQCB) issued Agricultural Order No. R3-2017-0002, a Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands (CCRWQCB, 2017). The permit requires that growers implement practices to reduce nitrate leaching into groundwater and improve receiving water quality. Specific requirements for individual growers are structured into three tiers based on the relative risk their operations pose to water quality.

Growers must enroll, pay fees, and meet various monitoring and reporting requirements according to the tier to which they are assigned. All growers are required to implement groundwater monitoring, either individually or as part of a cooperative regional monitoring program. Growers electing to implement individual monitoring and not participate in the regional monitoring program implemented by the Central Coast Groundwater Coalition (CCGC) are required to test all on-farm domestic wells and the primary irrigation supply well for nitrate or nitrate plus nitrite, and general minerals; including, but not limited to, TDS, sodium, chloride and sulfate.

In April 2021, the CCRWQCB issued Agricultural Order No. R3-2021-0040 included new Irrigated Lands Regulatory Program (ILRP) Waste Discharge Requirements (WDR) for farming operations in the Salinas Valley Groundwater Basin area. The permit requires that growers implement practices to reduce nitrate leaching into groundwater and improve receiving water quality. Under the new Ag Order on-farm domestic wells will be monitored for 1,2,3-trichloropropane among the other constituents that were monitored under Ag Order 3.0. Specific requirements for individual growers are structured into 3 phases based on the relative risk their operations pose to water quality. Each of the 3 phases encompasses a different area of the Central Coast Basin. Monitoring under Ag Order 4.0 will start in 2027 in the Monterey Subbasin.

~~3.2.2.6 Negotiations with the CCRWQCB staff and Board Members for the next iteration of the Agricultural Order are on-going, and expected to be finalized in early 2021, with the adoption of a new Irrigated Lands Regulatory Program (ILRP) Waste Discharge Requirements (WDR) for farming operations in the Salinas Valley Groundwater Basin area. As mandated by the SWRCB, specific reporting requirements for nitrogen applications and removal, irrigation and surface water discharge management, and groundwater quality monitoring will be included with quantifiable milestones. While the outcome is not certain, the expectation is that the next Agricultural Order will be more complex with additional compliance reporting measures for all growers.~~

~~3.2.2.7~~3.2.2.6 Water Quality Control Plan for the Central Coast Basins

The Water Quality Control Plan for the Central Coastal Basin (Basin Plan) was most recently updated in June 2019 (SWRCB, 2019). ~~The Water Quality Control Plan for the Central Coastal Basin was most recently updated in September 2017 (SWRCB, 2017).~~ The objective of the Basin

Plan is to outline how the quality of the surface water and groundwater in the Central Coast Region should be managed to provide the highest water quality reasonably possible. Water Quality Objectives for both groundwater (drinking water and irrigation) and surface water are provided in the Basin Plan.

The Basin Plan lists beneficial users, describes the water quality which must be maintained to allow those uses, provides an implementation plan, details SWRCB and CCRWQCB plans and policies to protect water quality and a statewide surveillance and monitoring program, as well as regional surveillance and monitoring programs. The SWRCB's Sources of Drinking Water Policy, adopted in Resolution No. 88-63 and incorporated in its entirety in the CCRWQCB's Basin Plan, provides that water with TDS less than or equal to 3,000 mg/L is considered suitable or potentially suitable for drinking water beneficial uses.

Present and potential future beneficial uses for inland waters in the Basin are: surface water and groundwater as municipal supply; agricultural; groundwater recharge; recreational water; sport fishing; warm fresh water habitat; wildlife habitat; rare, threatened or endangered species; and, spawning, reproduction, and/or early development of fish.

~~3.2.2.8~~3.2.2.7 *Title 22 Drinking Water Program*

The SWRCB Division of Drinking Water (DDW) regulates public water systems in the State to ensure the delivery of safe drinking water to the public. A public water system is defined as a system for the provision of water for human consumption that has 15 or more service connections or regularly serves at least 25 individuals daily at least 60 days out of the year. Private domestic wells, wells associated with drinking water systems with less than 15 residential service connections, industrial, and irrigation wells are not regulated by the DDW.

The DDW enforces the monitoring requirements established in Title 22 of the California Code of Regulations (CCR) for public water system wells, and all the data collected must be reported to the DDW. Title 22 also designates the Maximum Contaminant Levels (MCLs) for various waterborne contaminants, including volatile organic compounds, non-volatile synthetic organic compounds, inorganic chemicals, radionuclides, disinfection byproducts, general physical constituents, and other parameters.

~~3.2.2.9~~3.2.2.8 *Limits to Operational Flexibility*

This GSP has been developed to be coordinated with the requirements, management plans and monitoring programs administered by other jurisdictions in the area, including SVBGSA, MCWRA, MCWD GSA, CCRWQCB, and the Federal Government. For example:

- The IRWMP and GSP development are complementary management processes. To the extent that the issues identified for the greater IRWMP region affect the Subbasin, these issues will be discussed in the following sections of this GSP. The implementation of this GSP will contribute to the sustainable use of water supplies within the IRWMP region and the IRWMP is not expected to limit operational flexibility in the Subbasin.

- The purpose and objective of MCWRA's groundwater management of the Subbasin, which focuses on providing regional solutions to protection of the Subbasin and preventing seawater intrusion, aligns with the goals of this GSP. The GSP will augment and integrate with MCWRA's historical management of the Subbasin.

Some of the existing management and regulatory programs include well registration, extraction monitoring, new well restrictions, pumping allowances and restrictions, recharge requirements and/or water quality protection standards that will limit operational flexibility. These limits to operational flexibility have already been incorporated into the projects and programs included in this GSP. Examples of limits on operational flexibility include:

- Pumping allowances in the MCWRA annexation agreements with MCWD and the Federal Government may restrict groundwater use. However, current groundwater use by MCWD within the City of Marina and the former Fort Ord is well below the annexation agreement pumping allowances. These agreements are not expected to adversely affect the Subbasin's ability to reach sustainability.
- The groundwater export prohibition included in the Agency Act prevents export of water out of the Subbasin. This prohibition is not expected to adversely affect the Subbasin's ability to reach sustainability.
- The Basin Plan and the Title 22 Drinking Water Program restrict the quality of water that can be recharged into the Subbasin as well as the location of groundwater recharge.
- Well construction restrictions within the Former Fort Ord (see Section 3.5.4.2) as well as the County's Interim Urgency Ordinance[14], which imposes a temporary moratorium on wells in the Area of Impact (see Section 3.5.4.3), may limit certain activities and the Subbasin GSAs' ability to access certain sources of water. However, the moratorium is not expected to adversely affect the Subbasin's ability to reach sustainability.

3.3 Conjunctive Use Programs

There is no existing conjunctive use program within the Monterey Subbasin. The Pure Water Monterey Project is an advanced water recycling project with a conjunctive use component under development by MPWMD, M1W, and MCWD. The project is discussed in Section 9.1 Project Descriptions.

3.4 Groundwater Cleanup at the Former Fort Ord

The former Fort Ord military base consists of 27,827 acres across the Monterey, 180/400-Foot Aquifer, and Seaside Subbasins. Within the Monterey Subbasin, the former Fort Ord encompasses more than half of the Subbasin's area. The Fort Ord military base was established

[14] The Interim Urgency Ordinance expired in May 2021.

in 1917 by the U.S. Army as a maneuver area and field artillery target range. The base was officially closed in 1994.

Remedial investigation and cleanup action at Fort Ord led by the Army began in 1986. The cleanup activities at Fort Ord have included groundwater and soil remediation associated with industrial and waste disposal activities, and later included munitions cleanup. The site was added to the National Priorities List on February 21, 1990. The Army was designated as the lead agency and the U.S. Environmental Protection Agency (EPA) was designated as the lead regulatory agency for the Superfund process at Fort Ord. A Federal Facility Agreement was signed by the Army, U.S. EPA, the California Department of Toxic Substances Control, and the CCRWQCB in 1990.

As of 2021, groundwater remediation is ongoing at three sites: Operable Unit (OU) 2, Sites 2 and 12, and Operable Unit Carbon Tetrachloride Plume (OUCTP), for volatile organic compound (VOC) constituents of concern.

Activity and use limitations are in place at the former Fort Ord such as zoning restrictions, deed or access restrictions, and well installation restrictions. County Ordinance No. 04011 of 2005 was adopted to prohibit and/or regulate new water wells in areas within the former Fort Ord due to groundwater contamination constraints. Well construction is prohibited in areas overlying or adjacent to the contamination plumes in the former Fort Ord (i.e., Prohibition Zone) and is subject to special review in areas that may be impacted by the contamination plumes (i.e., Consultation Zone). The Prohibition and Consultation Zones were last updated in 2016 and are shown on Figure 3-11.

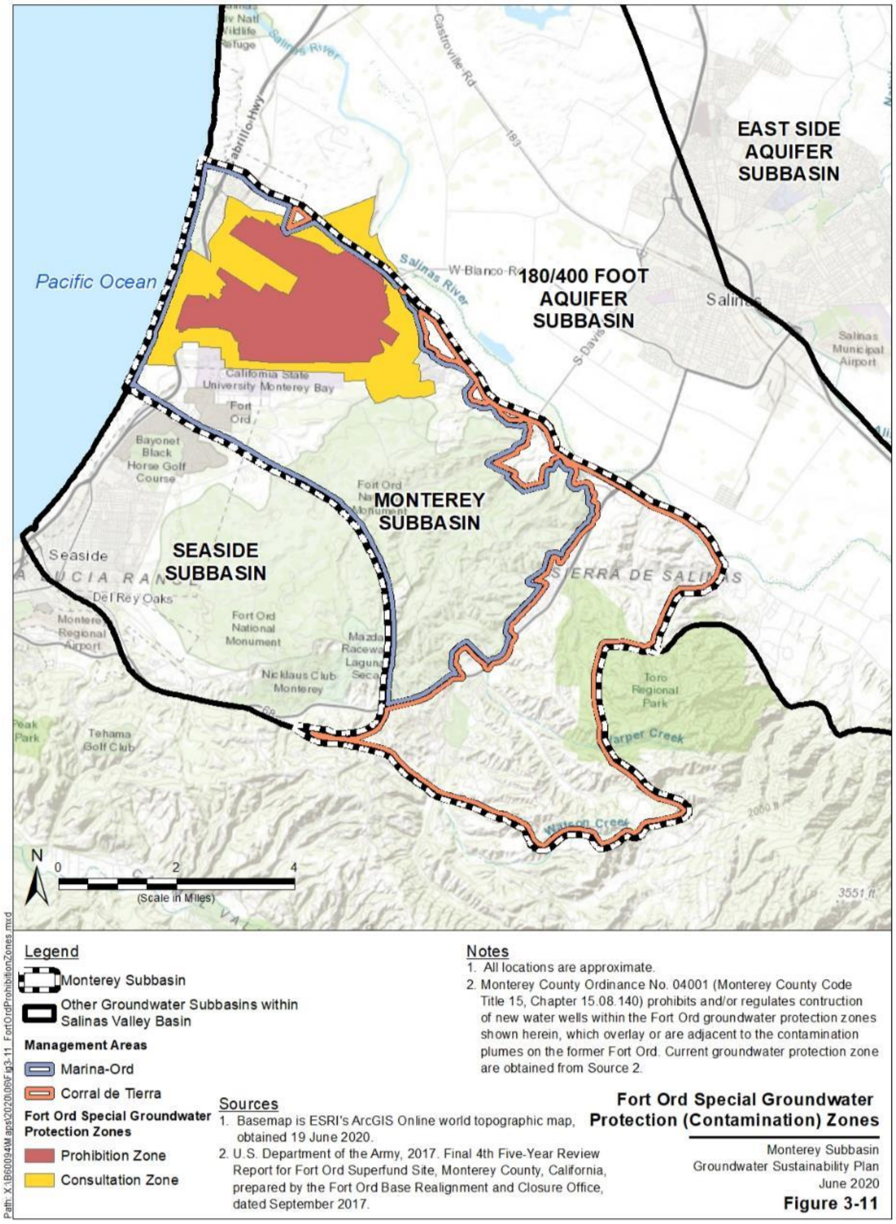


Figure 3-11. Fort Ord Special Groundwater Protection (Contamination) Zones

3.5 Land Use Elements or Topic Categories of Applicable General Plans

Monterey County and the cities of Marina and Seaside have land use authority over all or portions of the Monterey Subbasin. Additionally, the Fort Ord Reuse Authority oversees reuse of the former Fort Ord army base within the Subbasin. Land use is an important factor in water management, as described below. The following sections provide a general description of these land use plans and how implementation may affect groundwater in the Monterey Subbasin. The following descriptions were taken from publicly available general plans at the time of the GSP preparation.

3.5.1 General Plans and Other Land Use Plans

This section identifies relevant policies in the current General Plans that could: (1) affect water demands in the Monterey Subbasin (e.g., due to population growth and development of the built environment), (2) influence the GSP's ability to achieve sustainable groundwater use, and (3) affect implementation of General Plan land use policies.

3.5.1.1 Monterey County General Plan

Relevant elements of the Monterey County General Plan (Monterey County 2010) are summarized in Table 3-2.

Table 3-2. Monterey County General Plan Summary

Element	Goal / Policy	
Land Use	LU-1.4	Growth areas shall be designated only where an adequate level of services and facilities such as water, sewerage, fire and police protection, transportation, and schools exist or can be assured concurrent with growth and development. Phasing of development shall be required as necessary in growth areas in order to provide a basis for long-range services and facilities planning.
Open Space	OS-3.8	The County shall cooperate with appropriate regional, state and federal agencies to provide public education/outreach and technical assistance programs on erosion and sediment control, efficient water use, water conservation and re-use, and groundwater management. This cooperative effort shall be centered through the Monterey County Water Resources Agency.
et. seq. Public Services	GOAL PS-2	Assure an adequate and safe water supply to meet the county's current and long-term needs.
	PS-2.1	Coordination among, and consolidation with, those public water service providers drawing from a common water table to prevent overdrawing the water table is encouraged.

Element	Goal / Policy	
	PS-2.2	The County of Monterey shall assure adequate monitoring of wells in those areas experiencing rapid growth provided adequate funding mechanisms for monitoring are established in the CIFP.
	PS-2.3	New development shall be required to connect to existing water service providers where feasible. Connection to public utilities is preferable to other providers.
	PS-2.4	Regulations for installing any new domestic well located in consolidated materials (e.g., hard rock areas) shall be enacted by the County.
	PS-2.5	Regulations shall be developed for water quality testing for new individual domestic wells on a single lot of record to identify: a) Water quality testing parameters for a one-time required water quality test for individual wells at the time of well construction. b) A process that allows the required one-time water quality test results to be available to future owners of the well. Regulations pursuant to this policy shall not establish criteria that will prevent the use of the well in the development of the property. Agricultural wells shall be exempt from the regulation.
	GOAL PS-3	Ensure that new development is assured a long-term sustainable water supply.
	PS-3.1	Except as specifically set forth below, new development for which a discretionary permit is required, and that will use or require the use of water, shall be prohibited without proof, based on specific findings and supported by evidence, that there is a long-term, sustainable water supply, both in quality and quantity to serve the development [see Plan for list].
	PS-3.2	Specific criteria for proof of a Long-Term Sustainable Water Supply and an Adequate Water Supply System for new development requiring a discretionary permit, including but not limited to residential or commercial subdivisions, shall be developed by ordinance with the advice of the General Manager of the Water Resources Agency and the Director of the Environmental Health Bureau. A determination of a Long-Term Sustainable Water Supply shall be made upon the advice of the General Manager of the Water Resources Agency. The following factors shall be used in developing the criteria for proof of a long-term sustainable water supply and an adequate water supply system: [see Plan for list]
	PS-3.3	Specific criteria shall be developed by ordinance for use in the evaluation and approval of adequacy of all domestic wells. The following factors shall be used in developing criteria for both water quality and quantity including, but not limited to: [see Plan for list]
	PS-3.4	The County shall request an assessment of impacts on adjacent wells and instream flows for new high-capacity wells, including high-capacity urban and

Element	Goal / Policy	
		agricultural production wells, where there may be a potential to affect existing adjacent domestic or water system wells adversely or in-stream flows, as determined by the Monterey County Water Resources Agency. In the case of new high-capacity wells for which an assessment shows the potential for significant adverse well interference, the County shall require that the proposed well site be relocated or otherwise mitigated to avoid significant interference. The following factors shall be used in developing criteria by ordinance for use in the evaluation and approval of adequacy of all such high-capacity wells, including but not limited to: a) Effect on wells in the immediate vicinity as required by the Monterey County Water Resources Agency or Environmental Health Bureau. b) Effects of additional extractions or diversion of water on in-stream flows necessary to support riparian vegetation, wetlands, fish, and other aquatic life including migration potential for steelhead, for the purpose of minimizing impacts to those resources and species. This policy is not intended to apply to replacement wells.
	PS-3.5	The Monterey County Health Department shall not allow construction of any new wells in known areas of saltwater intrusion as identified by Monterey County Water Resources Agency or other applicable water management agencies: a) Until such time as a program has been approved and funded that will minimize or avoid expansion of salt water intrusion into useable groundwater supplies in that area; or b) Unless approved by the applicable water resource agency. This policy shall not apply to deepening or replacement of existing wells, or wells used in conjunction with a desalination project.
	PS-3.6	The County shall coordinate and collaborate with all agencies responsible for the management of existing and new water resources.
	PS-3.7	A program to eliminate overdraft of water basins shall be developed as part of the Capital Improvement and Financing Plan (CIFP) for this Plan using a variety of strategies, which may include but are not limited to: a) Water banking; b) Groundwater and aquifer recharge and recovery; c) Desalination; d) Pipelines to new supplies; and/or e) A variety of conjunctive use techniques. The CIFP shall be reviewed every five years in order to evaluate the effectiveness of meeting the strategies noted in this policy. Areas identified to be at or near overdraft shall be a high priority for funding.
	PS-3.8	Developments that use gray water and cisterns for multi-family residential and commercial landscaping shall be encouraged, subject to a discretionary permit.

Element	Goal / Policy	
	PS-3.9	A tentative subdivision map and/or vesting tentative subdivision map application for either a standard or minor subdivision shall not be approved until the applicant provides evidence of a long-term sustainable water supply in terms of yield and quality for all lots that are to be created through subdivision.
	PS-3.10	In order to maximize agricultural water conservation measures to improve water use efficiency and reduce overall water demand, the County shall establish an ordinance identifying conservation measures that reduce agricultural water demand.
	PS-3.11	In order to maximize urban water conservation measures to improve water use efficiency and reduce overall water demand, the County shall establish an ordinance identifying conservation measures that reduce potable water demand
	PS-3.12	The County shall maximize the use of recycled water as a potable water offset to manage water demands and meet regulatory requirements for wastewater discharge, by employing strategies including, but not limited to, the following: a) Increase the use of treated water where the quality of recycled water is maintained, meets all applicable regulatory standards, is appropriate for the intended use, and re-use will not significantly impact beneficial uses of other water resources. b) Work with the agricultural community to develop new uses for tertiary recycled water and increase the use of tertiary recycled water for irrigation of lands currently being irrigated by groundwater pumping. c) Work with urban water providers to emphasize use of tertiary recycled water for irrigation of parks, playfields, schools, golf courses, and other landscape areas to reduce potable water demand. d) Work with urban water providers to convert existing potable water customers to tertiary recycled water as infrastructure and water supply become available.
	PS-3.13	To ensure accuracy and consistency in the evaluation of water supply availability, the Monterey County Health Department, in coordination with the MCWRA, shall develop guidelines and procedures for conducting water supply assessments and determining water availability. Adequate availability and provision of water supply, treatment, and conveyance facilities shall be assured to the satisfaction of the County prior to approval of final subdivision maps or any changes in the General Plan Land Use or Zoning designations.
	PS-3.14	The County will participate in regional coalitions for the purpose of identifying and supporting a variety of new water supply projects, water management programs, and multiple agency agreements that will provide additional domestic water supplies for the Monterey Peninsula and Seaside Subbasin, while continuing to protect the Salinas and Pajaro River groundwater basins from saltwater intrusion. The County will also participate in regional groups including representatives of the Pajaro Valley Water Management Agency and the County of Santa Cruz to identify and support a variety of new water supply,

Element	Goal / Policy	
		water management and multiple agency agreement that will provide additional domestic water supplies for the Pajaro Groundwater Basin. The County's general objective, while recognizing that timeframes will be dependent on the dynamics of each of the regional groups, will be to complete the cooperative planning of these water supply alternatives within five years of the adoption of the General Plan and to implement the selected alternatives within five years after that time.
	PS-3.15	The County will pursue expansion of the Salinas Valley Water Project (SVWP) by investigating expansion of the capacity for the Salinas River water storage and distribution system. This shall also include, but not be limited to, investigations of expanded conjunctive use, use of recycled water for groundwater recharge and seawater intrusion barrier, and changes in operations of the reservoirs. The County's overall objective is to have an expansion planned and in service by the date that the extractions from the Salinas Valley groundwater basin are predicted to reach the levels estimated for 2030 in the EIR for the Salinas Valley Water Project. The County shall review these extraction data trends at five-year intervals. The County shall also assess the degree to which the Salinas Valley Groundwater Basin (Zone 2C) has responded with respect to water supply and the reversal of seawater intrusion based upon the modeling protocol utilized in the Salinas Valley Water Project EIR. If the examination indicates that the growth in extractions predicted for 2030 are likely to be attained within ten years of the date of the review, or the groundwater basin has not responded with respect to water supply and reversal of seawater intrusion as predicted by the model, then the County shall convene and coordinate a working group made up of the Salinas Valley cities, the MCWRA, and other affected entities. The purpose will be to identify new water supply projects, water management programs, and multiple agency agreements that will provide additional domestic water supplies for the Salinas Valley. These may include, but not be limited to, expanded conjunctive use programs, further improvements to the upriver reservoirs, additional pipelines to provide more efficient distribution, and expanded use of recycled water to reinforce the hydraulic barrier against seawater intrusion. The county's objective will be to complete the cooperative planning of these water supply alternatives within five years and to have the projects on-line five years following identification of water supply alternatives.

The Monterey County General Plan does not include population projections; however, the Association of Monterey Bay Area Governments (AMBAG) has developed population projections through 2050, as shown in Table 3-3.

The County imposed a B-8 Zoning overlay in 1992 to the western portions of the El Toro Planning area due to declining groundwater elevations and the concern for build-out demand negatively impacting future supplies. This overlay is shown in Figure 3-12. This zoning limits any development to single-family homes on lots that existed before 1991. This zoning overlay only covers a small portion of the Corral de Tierra Management area.

Table 3-3. Monterey County Population Projections (AMBAG, 2018)

							Change 2015-2040	
Geography	2015	2020	2025	2030	2035	2040	Numeric	Percent
AMBAG Region	**762,676**	**791,600**	**816,900**	**840,100**	**862,200**	**883,300**	**120,624**	**16%**
Monterey County	**432,637**	**448,211**	**462,678**	**476,588**	**489,451**	**501,751**	**69,114**	**16%**
Carmel-By-The-Sea	3,824	3,833	3,843	3,857	3,869	3,876	52	1%
Del Rey Oaks	1,655	1,949	2,268	2,591	2,835	2,987	1,332	80%
Gonzales	8,411	8,827	10,592	13,006	15,942	18,756	10,345	123%
Greenfield	16,947	18,192	19,425	20,424	21,362	22,327	5,380	32%
King City	14,008	14,957	15,574	15,806	15,959	16,063	2,055	15%
Marina	20,496	23,470	26,188	28,515	29,554	30,510	10,014	49%
Marina balance	19,476	20,957	22,205	22,957	23,621	24,202	4,726	24%
CSUMB (portion)	1,020	2,513	3,983	5,558	5,933	6,308	5,288	518%
Monterey	28,576	28,726	29,328	29,881	30,460	30,976	2,400	8%
Monterey balance	24,572	24,722	25,324	25,877	26,456	26,972	2,400	10%
DLI & Naval Postgrad	4,004	4,004	4,004	4,004	4,004	4,004	0	0%
Pacific Grove	15,251	15,349	15,468	15,598	15,808	16,138	887	6%
Salinas	159,486	166,303	170,824	175,442	180,072	184,599	25,113	16%
Sand City	376	544	710	891	1,190	1,494	1,118	297%
Seaside	34,185	34,301	35,242	36,285	37,056	37,802	3,617	11%
Seaside balance	26,799	27,003	27,264	27,632	28,078	28,529	1,730	6%
Fort Ord (portion)	4,450	4,290	4,340	4,490	4,690	4,860	410	9%
CSUMB (portion)	2,936	3,008	3,638	4,163	4,288	4,413	1,477	86%
Soledad	24,809	26,399	27,534	28,285	29,021	29,805	4,996	20%
Soledad balance	16,510	18,100	19,235	19,986	20,722	21,506	4,996	30%
SVSP & CTF	8,299	8,299	8,299	8,299	8,299	8,299	0	0%
Balance Of County	104,613	105,361	105,682	106,007	106,323	106,418	1,805	2%
San Benito County	**56,445**	**62,242**	**66,522**	**69,274**	**72,064**	**74,668**	**18,223**	**32%**
Hollister	36,291	39,862	41,685	43,247	44,747	46,222	9,931	27%
San Juan Bautista	1,846	2,020	2,092	2,148	2,201	2,251	405	22%
Balance Of County	18,308	20,360	22,745	23,879	25,116	26,195	7,887	43%
Santa Cruz County	**273,594**	**281,147**	**287,700**	**294,238**	**300,685**	**306,881**	**33,287**	**12%**
Capitola	10,087	10,194	10,312	10,451	10,622	10,809	722	7%
Santa Cruz	63,830	68,381	72,091	75,571	79,027	82,266	18,436	29%
Santa Cruz balance	46,554	49,331	51,091	52,571	54,027	55,266	8,712	19%
UCSC	17,276	19,050	21,000	23,000	25,000	27,000	9,724	56%
Scotts Valley	12,073	12,145	12,214	12,282	12,348	12,418	345	3%
Watsonville	52,562	53,536	55,187	56,829	58,332	59,743	7,181	14%
Balance Of County	135,042	136,891	137,896	139,105	140,356	141,645	6,603	5%

Sources: Data for 2015 are from the U.S. Census Bureau and California Department of Finance. Forecast years were prepared by AMBAG and PRB.

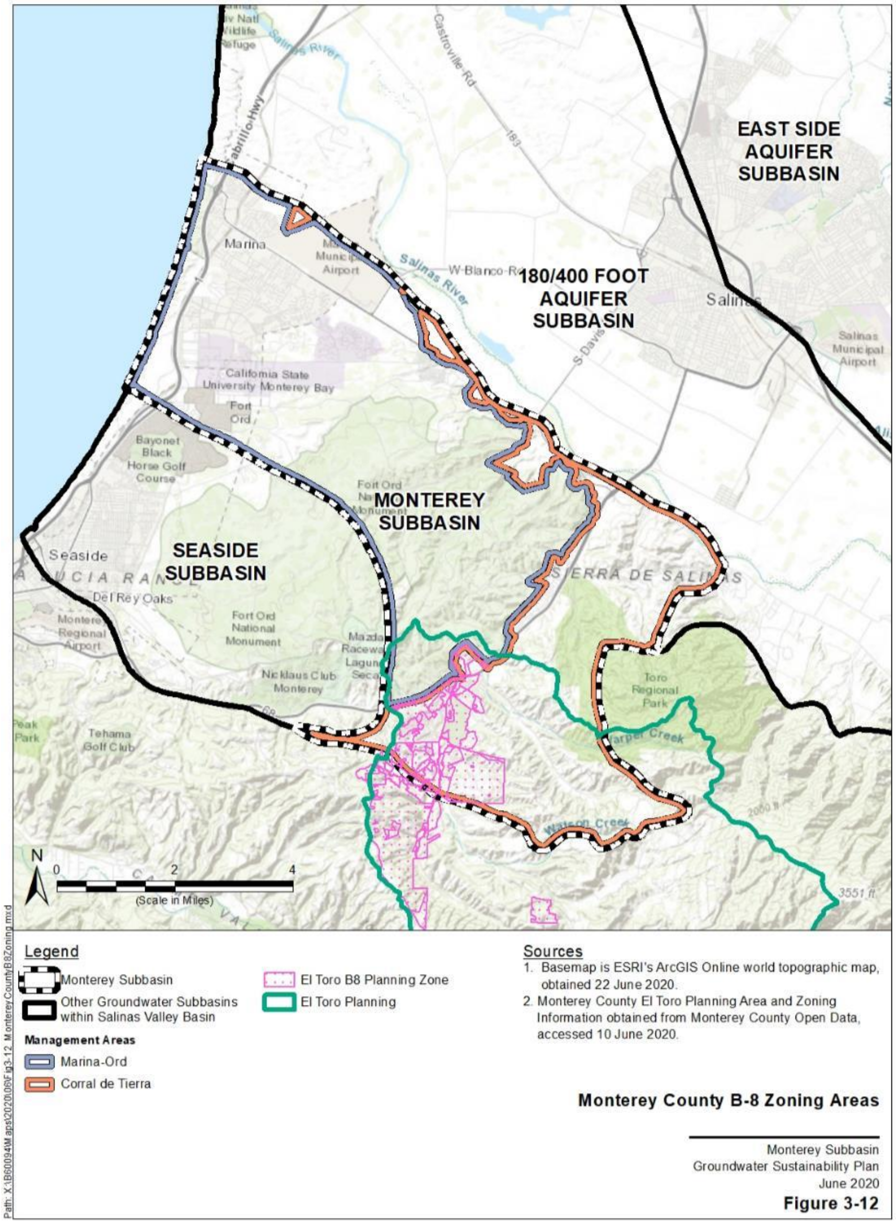


Figure 3-12. Monterey County B-8 Zoning Areas

3.5.1.2 City of Marina General Plan

The City of Marina was founded in 1915 and incorporated in 1975. The first General Plan was adopted in 1978. The overall goal of the Marina General Plan is "the creation of a community which provides a high quality of life for all its residents; which offers a broad range of housing, transportation, and recreation choices; and which conserves irreplaceable natural resources" (City of Marina, 2010).

The General Plan recognizes that future water demands will require changes in the management of water resources in the area. Water conservation, reclamation, and reuse will constitute major components of future water management efforts. The policies and programs of the General Plan are designed to promote water conservation, the use of recycled water to protect water quality, and to ensure that the demand of future community development does not exceed the capacity to provide water in an environmentally acceptable way [3.42].

The General Plan includes the following measures related to water-supply planning:

- New developments must have identified water sources [3.45].
- A 15% reserve will be maintained between demand and supply. When demand exceeds 85% of the available supply, no new development will be allowed until supplemental water sources are identified [3.47].

The primary responsibility for water resource management in Marina rests with MCWD as the water purveyor, and MCWRA as the entity responsible for managing the surface water and groundwater resources of the Salinas Valley Groundwater Basin.

3.5.1.3 City of Seaside General Plan

The City of Seaside is in the process of updating its general plan to a planning horizon of 2040. The plan "seeks to protect the coastal system and preserve the natural habitat that extends beyond the City's boundaries in balance with Seaside's desire to be developed as a well-rounded mixed-use community. Equity, sustainability, collaboration, and innovation are centrally embedded in the General Plan goals, policies, and actions to achieve a mixed use urbanscape." (Seaside, 2019)

The primary responsibility for water resource management in the City of Seaside within the Monterey Subbasin rests with MCWD, the water purveyor, and MCWRA, which is the entity responsible for managing the surface water and groundwater resources of the Salinas Valley Groundwater Basin. The plan acknowledges an inadequate supply of water on the Monterey Peninsula as a constraint for new developments and establishes programs to work with MCWD to develop water conservation methods and secure water supply for both existing and proposed uses within the city.

The Seaside General Plan includes the following goals, policies, and implementation measures that are related to groundwater or land use management, and that could potentially influence the implementation of this GSP.

- **Goal HSC-8**: Buildings and landscapes that promote water conservation, efficiency, and the increased use of recycled water.
- **Goal HSC-11**: New construction that meets a high-level of environmental performance.
- **Goal CFI-2:** A sustainable water supply that supports existing community needs and long-term growth.
- **Goal CFI-3:** Clean and sustainable groundwater.

3.5.1.4 Fort Ord Base Reuse Plan

The former Fort Ord, which covers more than half of the Subbasin's area, is currently under redevelopment. Redevelopment of the former Fort Ord was under the oversight of the Fort Ord Reuse Authority (FORA), established in 1994 and recently terminated in June 2020. Prior to its termination, FORA allocated assets/liabilities and transitioned land use planning within former Fort Ord to each of the local jurisdictions, including the Cities of Marina and Seaside, the City of Monterey, and the County of Monterey. The governing document of Fort Ord's redevelopment, the Fort Ord Base Reuse Plan, was incorporated into each individual jurisdictional area's land use plans, which are then incorporated into MCWD's UWMP as described in Section 3.2.2.4.

The Fort Ord Base Reuse Plan, Final Reassessment Report (EMC, 2012), projected a total water demand of 9,000 AFY at buildout. This projected water demand is an additional 2,400 AFY over and above the 6,600 AFY groundwater supply described under the 1993 Annexation Agreement (MCWRA/U.S. Army, 1993; see Section 3.2.2.2). Development of the 2,400 AFY of additional water supply was identified as one of the mitigation measures for redevelopment of the former Fort Ord. As described in Section 3.4 above, within the former Fort Ord, MCWD has been designated as the exclusive (1) water and sewer collection service provider and (2) developer and implementer of all new water supplies for all non-Federal lands. Under an exclusive contract with the Army, MCWD is responsible for providing water and sewer collection services for the Army and other Federal agencies within the former Fort Ord. Water demand projections associated with implementation of the Fort Ord Base Reuse Plan are included in MCWD's UWMP (Section 3.2.2.4).

The following efforts have been conducted by FORA and MCWD to support implementation of the Fort Ord Base Reuse Plan:

In 2005, the FORA and MCWD Boards of Directors both approved the Regional Urban Water Augmentation Project (RUWAP) Hybrid Alternative, which included recycled water and desalination supply components providing 1,200 AFY each. FORA and MCWD then agreed upon a modified RUWAP Hybrid Alternative that would provide 1,427 AFY of recycled water to the former Fort Ord (via the ~~M1W Pure Water Monterey Project described in Section 9.1~~~~*Reycleed*~~*Recycled Water Reuse Through Landscape Irrigation and Indirect Potable Reuse* project described in Section 9.4.6). The FORA Board Resolution No. 07-10 (May 2007) allocated the 1,427 AFY of RUWAP recycled water to the various land use jurisdictions (EMC, 2012).

In 2015, the FORA Board of Directors endorsed a joint water supply planning process between FORA, M1W, and MCWD to identify the "Additional Water Augmentation Component." In 2016, MCWD, M1W, and FORA entered into an agreement to fund an analysis to identify alternatives to supply the additional 973 AFY of Water Augmentation (i.e., the total of 2,400 AFY required by the EIR subtracted by 1,427 AFY to be provided by the RUWAP). The Three Parties (FORA, MCWD, and M1W) recognize there may be a number of options to meet the 973 AFY "Additional Water Augmentation Component," and through this Water Supply Augmentation Study, aim to systematically identify and evaluate the potential supply augmentation alternatives, and select a preferred option. The three-party Water Supply Augmentation Study began in 2018 and was completed in June 2020. Water supply options being evaluated include brackish water and seawater desalination, increased water conservation measures, additional advanced treatment water (ATW), and indirect potable reuse/groundwater recharge and replenishment (IPR). IPR was selected by the study as the water supply alternative and is discussed further in Section 9.4.2.

3.5.1.5 California Coastal Act and Local Coastal Programs

The Subbasin consists of approximately three miles of Monterey Bay coastline that are within the California Coastal Zone.

The California Coastal Act requires that local governments in the Coastal Zone create and implement Local Coastal Programs (LCPs) to conserve coastal-dependent land use. The Cities of Marina and Seaside have approved LCPs for Coastal Zones within their respective incorporated limits. The LCPs each consists of a Local Coastal Land Use Plan (LCLUP) and a Local Coastal Implementation Plan (LCIP) (City of Marina 2013a, 2013b; City of Seaside 2013a, 2013b). Additionally, a portion of the Subbasin's Coastal Zone consists of the Fort Ord Dunes State Park managed by the California Department of Parks and Recreation which is located west of Highway 1 and south of the City of Marina.

This GSP has been developed to be coordinated with the goals, policies, and requirements administered by the Marina and Seaside LCLUPs as well as the California Coastal Commission. Policies in the local LCLUPs related to habitat management have been incorporated into the sustainable management criteria included in this GSP. Requirements to obtain and comply with coastal development permits have been incorporated into the projects and management actions included in this GSP.

3.5.2 Effects of Land Use Plan Implementation on Water Demand

The general plans detailed above guide future growth and development within their jurisdictional areas. This additional growth, particularly with redevelopment of the former Fort Ord, may place additional demands on groundwater resources within the Subbasin. However, the goals, policies, and implementation measures established by the existing land use plans are complementary to sustainable groundwater management of the Subbasin relative to future land use development and conservation. For example:

- The Monterey County General Plan encourages the growth areas to be designated only where adequate level of services and facilities such as water exists or can be ensured concurrent with growth and development. The plan initiates a program to eliminate overdraft of water basins as part of the Capital Improvement and Financing Plan (CIFP). The program includes various strategies such as water banking, groundwater and aquifer recharge as well as looking for new water sources such as expansion of the Salinas Valley Water Project (SVWP). The Monterey County General Plan aligns with the GSP.
- The City of Marina General Plan prohibits any new development that requires water allocation in excess of the available supply or in excess of its designated water allocation for that portion of former Fort Ord within the City. The plan encourages the City to work closely with MCWD to supply water to the current infrastructures prior to or concurrent with new developments while the existing or new developments should utilize water more efficiently.
- The City of Seaside plans to remove water supply constraints for development and redevelopment of the City by working with regional water suppliers. The plan also encourages coordination with regional and local water suppliers and participation in water conservation programs.
- The Fort Ord Reuse Plan relies on the nearby cities, such as City of Seaside and City of Marina, and Monterey County to manage the former Ford Ord area. Implementation of former Fort Ord's redevelopment will be pursuant to these local jurisdictions' land use plans and policies.

3.5.3 Effects of GSP Implementation on Water Supply Assumptions

Successful implementation of this GSP will help to ensure that the Subbasin groundwater supply is sustainably managed as set forth by SGMA. Therefore, implementation of this GSP is not anticipated to significantly affect the current water supply assumptions or land use plans.

Within the Marina-Ord Area, implementation of this GSP may induce management and project costs to be funded by MCWD to secure water supply for future development within the former Fort Ord, which will be supported by fees levied on such new developments for new water supplies. Within the Corral de Tierra Area, implementation of this GSP will induce management and project costs, and may include allocations and/or ~~the~~ a water charges framework ~~will promote voluntary pumping reductions and impose a tiered pumping fee structure~~. Therefore, implementation of this GSP may induce changes in the cost of groundwater, and as a result, changes in land use changes based on financial decisions by individual development within this area. However, there is no direct impact from GSP implementation on land use management.

3.5.4 Well Permitting Process

The Monterey County Well Program[15] is responsible for well permitting within the Subbasin, including the construction, destruction, and repairs or modifications of domestic, irrigation, agricultural, cathodic protection, monitoring or heat exchange wells.

The Public Service element of the Monterey County General Plan addresses permitting of individual wells in rural or suburban areas. New residential or commercial lots in rural or suburban areas with limited utility services must be a minimum area of 2.5 acres if a well is the water source. Existing lots (of any size) can use an onsite well if they are outside of a water system service area. Existing lots within an established water system service area can use wells if they are greater than 2.5 acres or have a connection to a public sewage system. Table 3-4 summarizes the Monterey County General Plan's water supply guidelines for new lots (Monterey County, 2010, Table PS-1). Table 3-5 depicts the decision matrix from the Monterey County General Plan for permitting new wells for existing lots (Monterey County, 2010, Table 3-2).

Table 3-4. Monterey County Water Supply Guidelines for New Lots

Major Land Groups	Water Well Guidelines
Public Lands	Individual Wells Permitted in Areas with Proven Long-Term Water Supply
Agriculture Lands	Individual Wells Permitted in Areas with Proven Long-Term Water Supply
Rural Lands	Individual Wells Permitted in Areas with Proven Long-Term Water Supply
Rural Centers	Public System; Individual Wells Allowed in limited situations
Community Areas	Public System

Table 3-5. Monterey County Well Permitting Guidelines for Existing Lots

Characteristics of Property	Water Connection Existing or Available from the Water System	Not Within a Water System or a Water Connection Unavailable
Greater than or equal to 2.5 Acres connected to a Public Sewage System or an onsite wastewater treatment system	Process Water Well Permit	Process Water Well Permit
Less than 2.5 Acres and connected to a Public Sewage System	Process Water Well Permit	Process Water Well Permit
Less than 2.5 Acres and connected to an onsite wastewater treatment system	Do not Process Water Well Permit	Process Water Well Permit

On August 29, 2018, the State Third Appellate District Court of Appeal published an opinion in *Environmental Law Foundation v. State Water Resources Control Board* (No. C083239), a case that has the potential to impact future permitting of wells near navigable surface waters to which

[15] https://www.co.monterey.ca.us/government/departments-a-h/health/environmental-health/drinking-water-protection/wells

they may be hydrologically connected. The Court of Appeal found that while groundwater itself is not protected by the public trust doctrine, the doctrine does protect navigable waters from harm caused by extraction of groundwater if it adversely affects public trust uses. Further, it found that the County (Siskiyou County in this case), as a subdivision of the State, shares responsibility for administering the public trust. Monterey County is responsible for well permitting. Therefore, it has a responsibility to consider the potential impacts of groundwater withdrawals on public trust resources when permitting wells near areas where groundwater may be interconnected with navigable surface waters.

Moreover, California Supreme Court's decision in *Protecting Our Water and Environmental Resources v. County of Stanislaus* (2020) held that Stanislaus County could not categorically classify its issuance of groundwater well construction permits as ministerial decisions exempt from environmental review under the CEQA. Chapter 15.08 of the Monterey County Code sets forth the application and decision-making process for the County in considering applications for well construction permits. The Chapter sets forth certain technical requirements that appear to be purely ministerial in their application; however, the Chapter also gives the Health Officer discretion to impose unspecified conditions on a permit, grant variances, and deny an application if in his/her judgment it would defeat the purposes of the Chapter. The Monterey County Code has not yet been amended, so permits are currently issued according to Chapter 15.08 and the 2010 General Plan, as applicable. The Monterey County Health Department, Environmental Health Bureau issues well permits and receives input from the County of Monterey Housing and Community Development to determine what, if any, level of CEQA review is necessary.

Additional prohibitions and restrictions on well drilling within the Monterey Subbasin area described below.

3.5.4.1 Marina Coast Water District Ordinance No. 31

MCWD Ordinance No. 31 (codified as Chapter 3.32 of the MCWD Code and Ordinances) prohibits water wells to be constructed or reconstructed within the boundary of MCWD, except wells constructed by MCWD. Exceptions apply to shallow wells that are less than one-hundred feet deep for non-potable purposes and wells that predate the ordinance.

3.5.4.2 Well Construction Restrictions within the Former Fort Ord

County Ordinance No. 04011 of 2005 was adopted to prohibit and/or regulate new water wells in areas within the former Fort Ord due to groundwater contamination constraints. Well construction is prohibited in areas overlying or adjacent to the contamination plumes in the former Fort Ord (i.e., Prohibition Zone) and is subject to special review in areas that may be impacted by the contamination plumes (i.e., Consultation Zone). The Prohibition Zone and Consultation Zone within the former Fort Ord are shown on Figure 3-11 above.

3.5.4.3 Interim Moratorium on New Well Permits within Area of Impact (Expired)

On May 22, 2018, the Monterey County Board of Supervisors adopted Ordinance No. 5302 pursuant to Government Code Section 65858. The interim ordinance was an urgency measure to prohibit approval of wells in a defined, seawater intruded "Area of Impact" and in the Deep Aquifers of the Salinas Valley Groundwater Basin in the unincorporated area of Monterey County, due to the immediate threat to the public health, safety, and welfare posed by new wells in these areas. The ordinance imposed a moratorium on the County Health Department accepting and processing new well permits; it was not a moratorium on additional groundwater pumping from existing wells. It also had stated exceptions, including municipal wells and replacement wells. The ordinance was an Interim Urgency Ordinance which took effect immediately upon adoption. Pursuant to Section 65858, the ordinance was originally only effective for 45 days to July 5, 2018, but at the June 26 Board meeting, the Board of Supervisors on a 4-1 vote extended the ordinance to May 21, 2020, by adoption of Ordinance No. 5303. The "Area of Impact" overlaps with the northern third of the Subbasin, as shown on Figure 3-13. The County has not yet completed proposed modifications to the well construction ordinance and the moratorium on well construction permit applications has expired since May 2021. Well construction applications for the Deep Aquifers are currently being reviewed and permitted on a case-by-case basis.

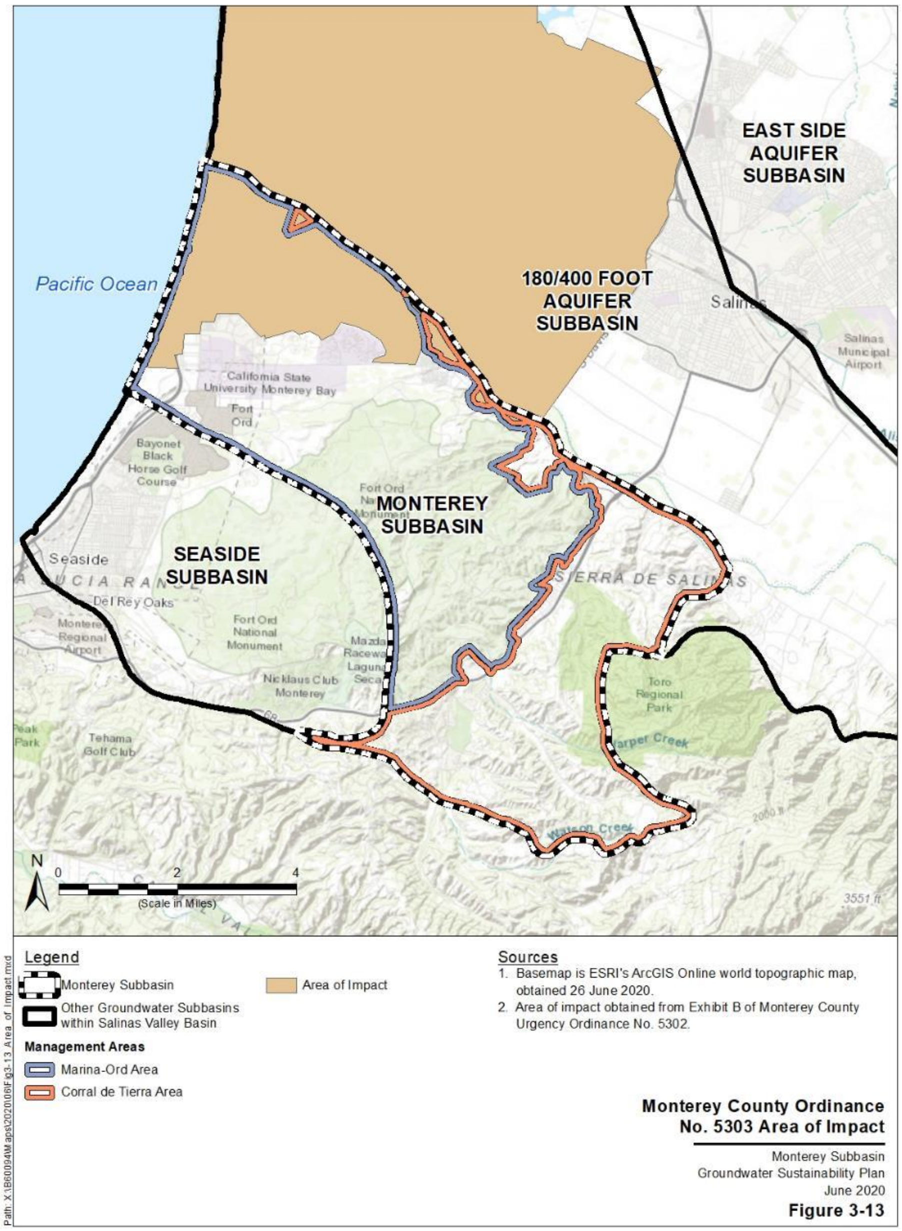


Figure 3-13. Monterey County Ordinance No. 5303 Area of Impact

4 HYDROGEOLOGIC CONCEPTUAL MODEL

This section presents the hydrogeologic conceptual model (HCM) for the Subbasin. As described in the Hydrogeological Conceptual Model Best Management Practices (BMP) document (DWR, 2016), an HCM provides, through descriptive and graphical means, an understanding of the physical characteristics of an area that affect the occurrence and movement of groundwater, including geology, hydrology, land use, aquifers and aquitards, and water quality. This HCM serves as a foundation for subsequent Basin Setting analysis, including water budgets (Chapter 6), numerical models, monitoring network development (Chapter 7), and the development of sustainable management criteria (Chapter 8).

4.1 General Description

The Monterey Subbasin (Subbasin; DWR Basin No. 3-004.10) is located at the northwestern end of the Salinas Valley Groundwater Basin, an approximately 90-mile long alluvial basin underlying the elongated, intermountain valley of the Salinas River. The Subbasin includes the portions of the Monterey Bay coastal plain, south of the approximate location of the Reliz Fault, as well as upland areas to the southeast of the coastal plain. The Subbasin is bordered by the 180/400-Foot Aquifer Subbasin to the northeast and by the adjudicated Seaside Subbasin to the southwest (Figure 4-1 and Figure 4-2).

4.1.1 Geological and Structural Setting

The Subbasin geology forms the physical framework in which groundwater occurs and moves. The geology described here is based on previously published scientific reports from investigations conducted by the USGS, State of California, other consulting firms, and academic institutions.

The Salinas Valley was formed through periods of structural deformation and periods of marine and terrestrial sedimentation in a tectonically active area on the eastern edge of the Pacific Plate. The water-bearing sediments of the Salinas Valley are over 2,000 feet thick in places and are composed of unconsolidated marine and alluvial sediments of Pliocene and younger age (Brown & Caldwell, 2015). Within the Monterey Subbasin, the water-bearing strata include river and sand dune deposits of Holocene and Pleistocene age, the Aromas Sand and Paso Robles Formation of Plio-Pleistocene age, the Purisima Formation of Pliocene age, and the Santa Margarita Formation of Miocene age (Greene, 1970; Harding ESE, 2001; Geosyntec, 2007). The Monterey Formation of Miocene age represents the relatively non-water-bearing bedrock that underlies the Subbasin (see Section 4.1.2.2, Bottom of the Basin).

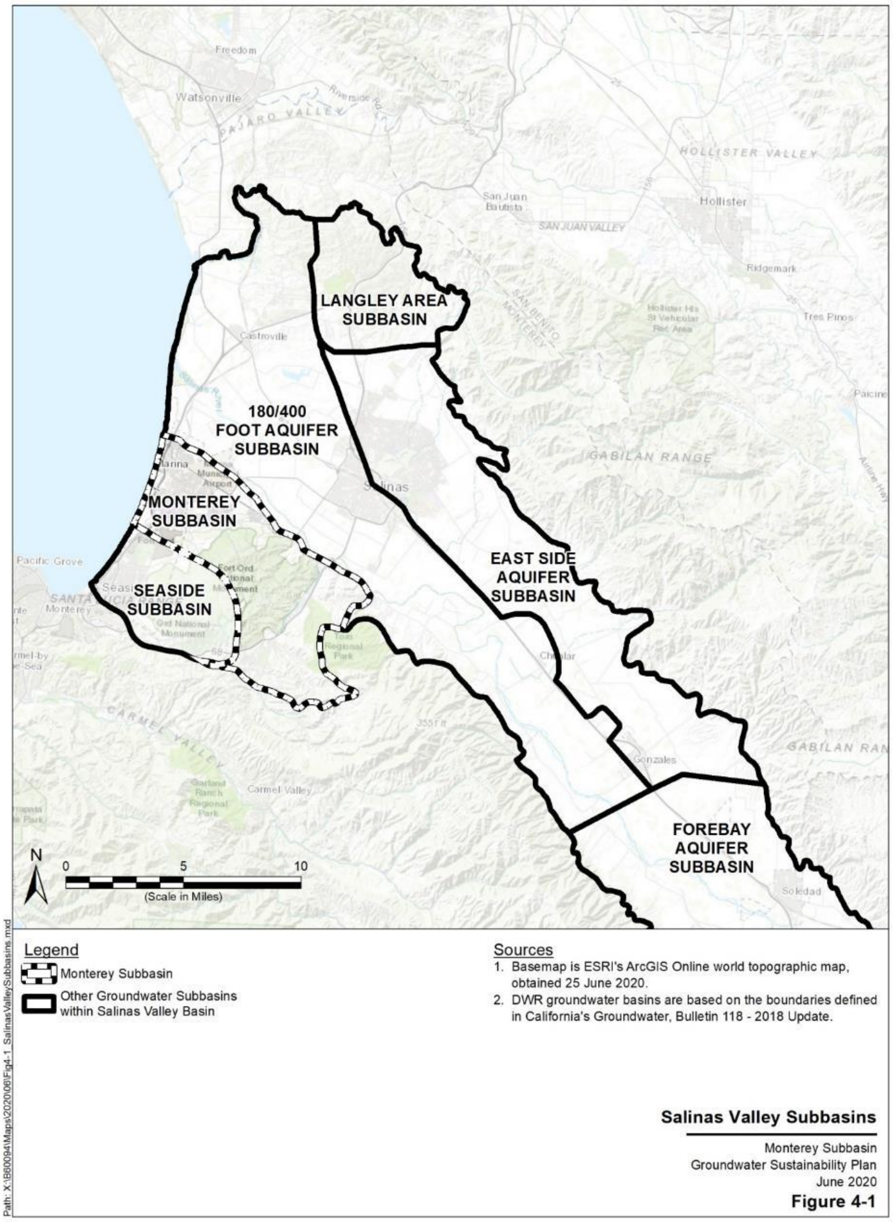


Figure 4-1. Salinas Valley Subbasins

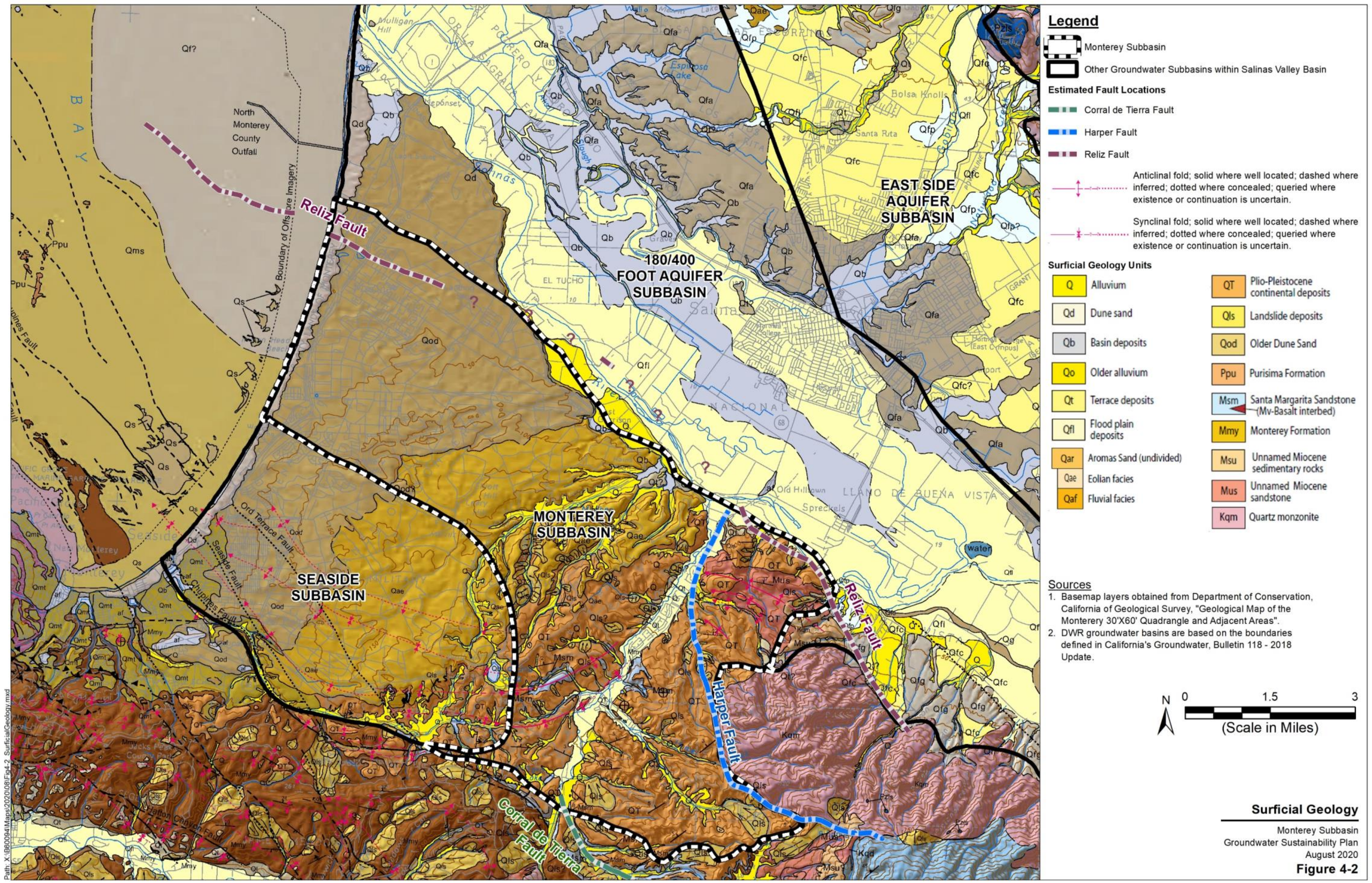


Figure 4-2. Surficial Geology

4.1.1.1 Geologic Formations

Major geologic units of the Monterey Subbasin are described below, starting at the ground surface and moving downwards through the strata from youngest to oldest. The corresponding designation on Figure 4-2 Surficial Geology is provided in parenthesis.

- *Alluvium, Flood Plain Deposits, Landslide Deposits (Q, Qfl, Qls)* – Holocene Alluvium consists of unconsolidated stream and basin deposits that occur at the base of eastern Subbasin hillslopes. These deposits have gradational contacts with the Floodplain Deposits (Qfl) that occur along El Toro Creek and its tributaries. The Floodplain Deposits consist predominately of unconsolidated layers of mixed sand, gravel, silt, and clay that were deposited in a fluvial environment by the Salinas River and its tributaries. Numerous landslides are present in upland portions of the Subbasin such as San Benancio, Harper, and Corral de Tierra Canyons.
- *Older Dune Sand (Qod)* – This Pleistocene unit blankets most of the northwestern portions of the Subbasin and is the predominant surface deposit present in approximately one-third of the Subbasin. This unit only exists southwest of the Salinas River and is up to 250 feet thick. This sand is predominately fine- to medium-grained, with thin, gentle to moderate cross-bedding (Harding ESE, 2001).
- *Older Alluvium (Qo)* – This Pleistocene unit comprises alternating, interconnected beds of fine-grained and coarse-grained deposits, predominately associated with alluvial fan depositional environments. The Older Alluvium underlies the coastal Marina-Ord Area but is not exposed at the ground surface. This unit underlies the Older Dune Sand, and in the Marina-Ord Area has been referred to in some reports as Valley Fill Deposits, which is described as including an estuarine clay layer (Salinas Valley Aquitard) and underlying sand and gravel fluvial sequence (Harding ESE, 2001).
- *Aromas Sand (Qae)* – This Pleistocene unit is composed of cross-bedded sands containing some clayey layers (Harding ESE, 2001). This unit was deposited predominately in an eolian, high-energy alluvial, alluvial fan, and shoreline environments, with the predominant deposition environment being eolian (Harding ESE, 2001; Greene, 1970; Dupre, 1990). The Aromas Sand likely extends into the northern portion of the 180/400-Foot Aquifer Subbasin (MCWRA, 2017). The Aromas Sand is exposed throughout the ridge and hilltops in the southeastern portion of the Subbasin, while the unit is buried beneath Older Dune Sand and Alluvium in the vicinity of the City of Marina. The thickness of the Aromas Sand varies within the Subbasin and is up to 300 feet thick (Harding ESE, 2001; Muir, 1982). Although a clayey or hard red bed is often observed at the basal contact with the underlying Paso Robles Formation, the stratigraphic relationship between the Aromas Sand and the Paso Robles Formation is difficult to discern due to lithologic similarities and the complex interface between them (Harding ESE, 2001; Dupre, 1990)

- *Paso Robles Formation (QT)* – This Pliocene to lower Pleistocene unit is composed of lenticular beds of sand, gravel, silt, and clay from terrestrial deposition (Thorup, 1976; Durbin *et al*, 1978). The depositional environment is largely fluvial but also includes alluvial fan, lake, and floodplain deposition (Durbin, 1974; Harding ESE, 2001; Thorup, 1976; Greene, 1970). The individual beds of fine and coarse materials typically have thicknesses of 20 to 60 feet (Durbin *et al*, 1978). Durham (1974) reports that the thickness of the Paso Robles Formation is variable due to erosion of the upper part of the unit. Varying thicknesses ranging from 500 feet to 1,000 feet are found within the Subbasin. Outcrops of the Paso Robles Formation occur in the central and southern portions of the Subbasin.
- *Purisima Formation (Ppu)* – This Pliocene unit consists of interbedded siltstone, sandstone, conglomerate, clay and shale deposited in a shallow marine environment (Greene, 1977; Harding ESE, 2001). The Purisima Formation has been found in boreholes near the cities of Marina and Seaside; however, the unit is missing from the more inland portions of the Monterey and Seaside Subbasins (Harding ESE, 2001; HydroMetrics, 2009; Geosyntec, 2007). The Purisima Formation ranges in thickness from 500 to 1,000 feet (Feeney and Rosenberg, 2003).
- *Santa Margarita Sandstone (Msm)* –The Miocene Santa Margarita Sandstone is a friable, arkosic sandstone. In the northern portion of the Subbasin, the Paso Robles Formation conformably overlays the Purisima Formation, which interfingers with the Santa Margarita Sandstone (Durbin, 2007; Hydrometrics, 2009). Towards the boundaries with the Seaside Subbasin and the Corral de Tierra Area, the Paso Robles unconformably overlays over the Santa Margarita Sandstone. Outcrops of the Santa Margarita Sandstone are found in the Corral de Tierra Area.
- *Monterey Formation (Mmy)* – The Monterey Formation (Miocene) is a shale or mudstone deposited in a shallow marine environment (Harding ESE, 2001; Greene, 1977). As discussed below, the Monterey Formation is relatively impervious. The top of the Monterey Formation is defined as the bottom of the Subbasin (Section 4.1.2.2).
- *Unnamed Miocene Sandstone (Mus)* – An unnamed Miocene sandstone unit (Mus) underlies the Monterey Formation. The Mus unit consists of an upper part of marine arkosic sandstone and conglomerate; and a lower part of continental sandstone and conglomerate (Wagner, et al. 2002). This unit is exposed in the Corral de Tierra Area near the eastern and southern Subbasin boundaries. This unit is sometimes referred to as the Basal Sandstone in other reports (GeoSyntec, 2007).
- *Unnamed Miocene Sedimentary Rocks (Msu)* – Miocene metamorphic sedimentary rocks (Msu) are deposited on granitic rocks of the Galiban Range (Kqm). The Msu unit is comprised of granitic conglomerate and arkosic sandstone of marine and non-marine sources (Wagner, et al. 2002). This unit is exposed in the Corral de Tierra Area near the eastern Subbasin boundary. These unnamed Miocene units (i.e., Mus and Msu) are approximately 250 feet thick (Geosyntec, 2007).

4.1.1.2 Surface Geology

As shown on Figure 4-2, the predominant surficial geologic unit covering the coastal plain portion of the Subbasin is "Qod" (i.e., Older Dune Sand [Pleistocene]). South of the coastal plain area, the Eolian facies of Aroma Sand “Qae” (Pleistocene) comprises the hills of the Fort Ord area. Further south near Highway 68 and in the Corral de Tierra Area, the predominant surficial geologic unit is “QT” (Paso Robles Formation [Plio-Pleistocene]). Other minor units in the area include "Q” (Alluvium [Holocene]), and “Qls” (Landslide Deposits [Pleisto-Holocene]), found in thin strips along the intermittent tributaries to El Toro Creek, which is a tributary to the Salinas River (as discussed above); and "Qls" (landslide deposits) that exist in pockets in the upland areas.

4.1.2 Subbasin Extent

4.1.2.1 Lateral Basin Boundaries

The Monterey Subbasin is bounded by the following combination of Subbasin boundaries and physical boundaries of the Salinas Valley Basin:

Two subbasins are adjacent to the Monterey Subbasin.

1. The 180/400-Foot Aquifer Subbasin. The northeastern boundary with the 180/400-Foot Aquifer Subbasin is divided into two parts: the northern part coincides with a buried trace of the Reliz Fault (DWR, 2016); the southern part follows the contact between Aromas Sand / Paso Robles Formations (Qae/QT) and alluvium (Q). The Reliz Fault does not appear to be a barrier to groundwater flow between these subbasins (see Section 4.2.2.3).
2. The Seaside Subbasin. The southwestern boundary with the Seaside Subbasin is based on an inferred groundwater divide. The boundary with the Seaside Subbasin was formally established in the Seaside Basin Adjudication Amended Decision (Superior Court of California, 2007).

Two additional physical features bound the Monterey Subbasin.

1. The Monterey Bay shoreline bounds the northwestern edge of the Subbasin.
2. The Sierra de Salinas bound the eastern and southern edge of the Subbasin. One part of this boundary follows the contact between Pleistocene units and the Cretaceous quartz monzonite, and another part of this boundary generally follows the contact between Pleistocene units and Miocene rocks as shown on Figure 4-2.

4.1.2.2 Bottom of the Basin

The bottom of the Monterey Subbasin is defined herein as the top of Monterey Formation. The Monterey Formation has low hydraulic conductivity as it is comprised of shale and diatomite (Yates, 2002) and yields water that is generally of low water quality (Geosyntec, 2007). Figure 4-3 shows contours that define the top elevation of the Monterey Formation for most of the Monterey Subbasin.

The deepest groundwater production wells in the Subbasin generally extend to depths within the Purisima or Santa Margarita Formations above the Monterey Formation, and are found closer to the coast. Along the northeastern boundary of the Subbasin, where the Monterey Formation is overlain by the Purisima Formation (Durbin 2007, Yates and others 2005, Greene 1970, Greene 1977), the deepest groundwater extractions are from MCWD wells MCWD-10, -11, and -12, which are screened across Paso Robles and Purisima Formations from 780 ft bgs to 1,840 ft bgs. In the Corral de Tierra Area, many wells are screened in the Aromas Sand and Paso Robles Formation continental deposits as well as the Santa Margarita Sandstone. Slightly south of the Corral de Tierra Area, outside of the Subbasin, a number of wells tap both the Monterey Formation and the unnamed sandstone and conglomerate unit (GeoSyntec, 2007; Feeney, 2003).

The top of the Monterey Formation ranges from an elevation of 1,000 feet in the Corral de Tierra Area to -2,400 feet near the coast, or from approximately 700 feet below land surface in the Corral de Tierra Area to over 2,000 feet below land surface near the coast. As shown on Figure 4-3 and Figure 4-4, there is a set of an east/northeast trending highs and lows on the surface of the Monterey Formation near the Ord-Corral de Tierra boundary. This reflects the mapped structural deformation of the unit in this area illustrated by the pink anticline and synclines in Figure 4-2. Additionally, the depth to the Monterey Formation can illustrate the structural, depositional, and erosional complexity which defines this hydrostratigraphic setting (Figure 4-4).

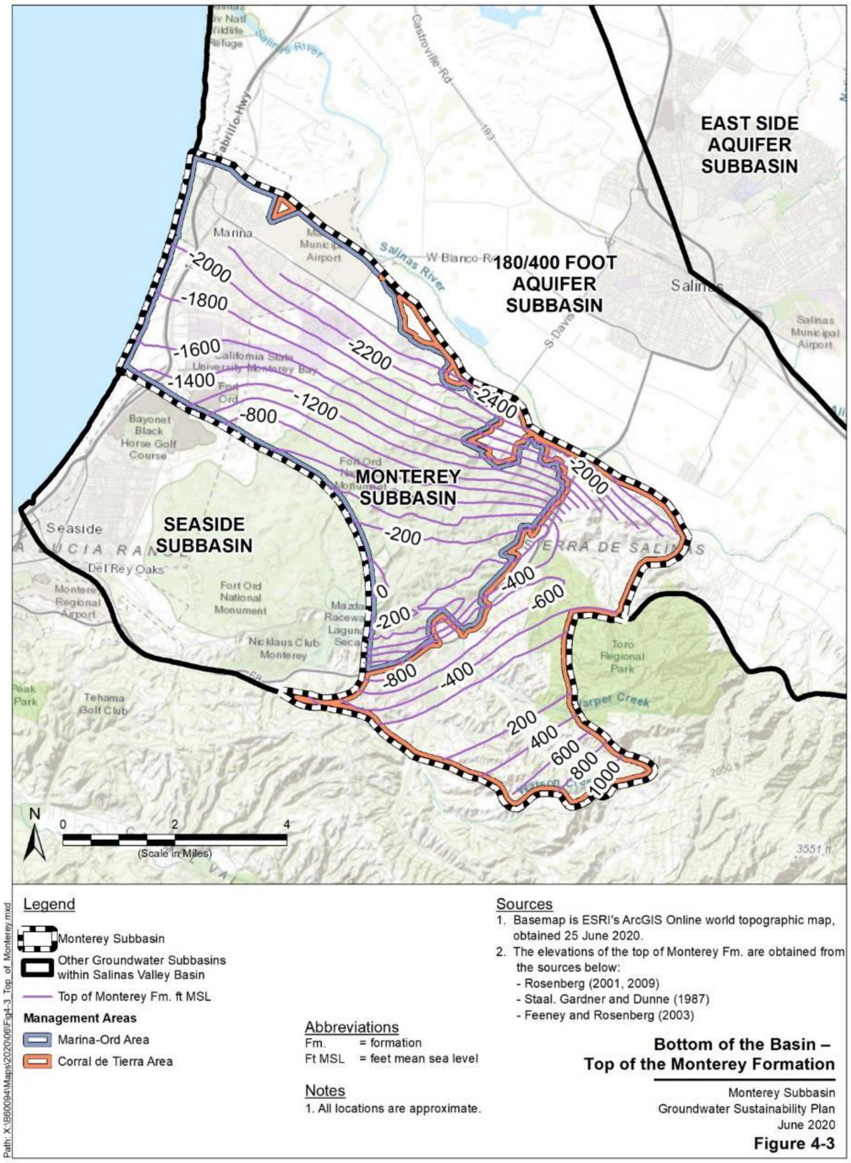


Figure 4-3. Bottom of the Basin – Top of the Monterey Formation

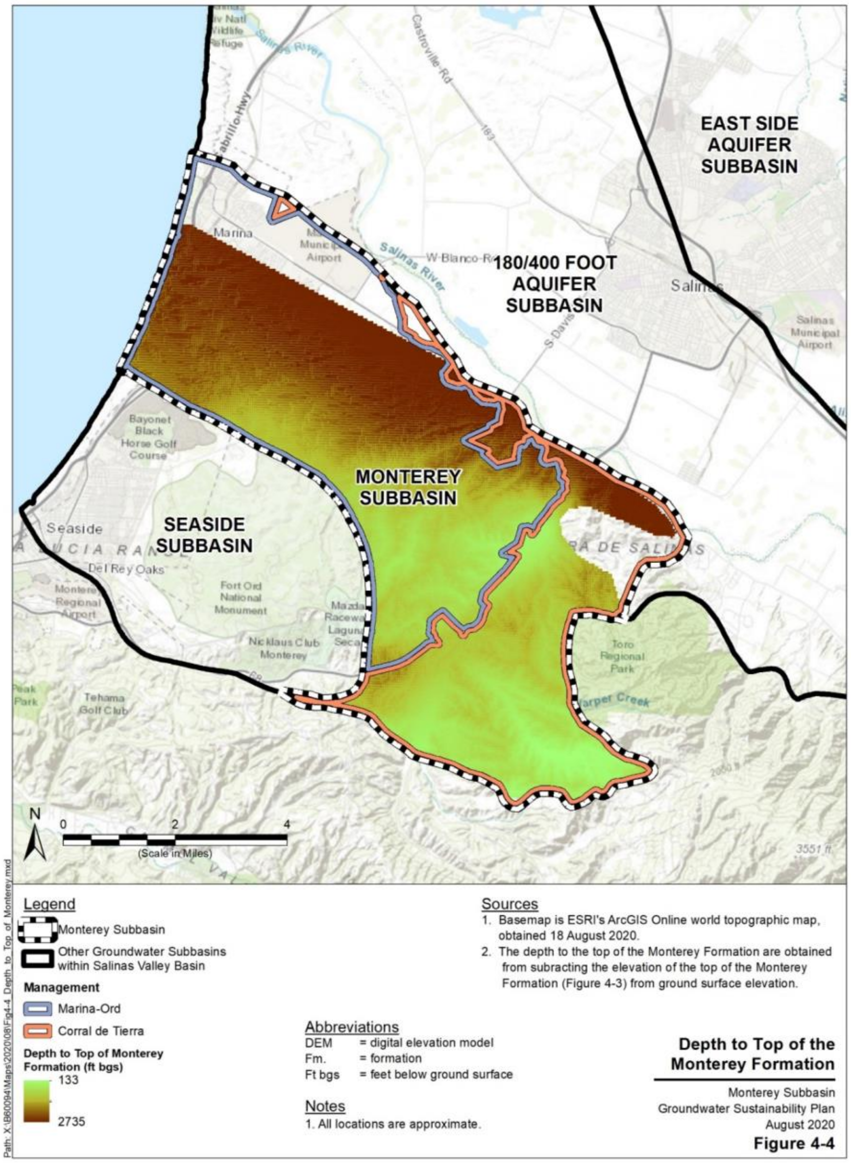


Figure 4-4. Depth to Top of the Monterey Formation

4.1.3 Physical Characteristics

4.1.3.1 Topographic Information

Figure 4-5 shows the topography within the Monterey Subbasin. Topography generally slopes down to the northwest towards Monterey Bay, ranging from sea level at the shoreline to 1,900 ft msl in the southeastern corner of the Subbasin.

In the coastal area of the Subbasin, the topography is shaped by active coastal sand dunes, followed by coastal plain and older stabilized sand dunes. Coastal sand dunes are present along a narrow quarter-mile-wide stretch of land where the Subbasin meets the bay. These coastal dunes rise to approximately 100 feet in elevation and grade eastward into a narrow coastal plain varying in width from one to two miles. Older sand dunes dominate the topography in the northwestern portion of the Subbasin and the majority of the Marina-Ord Area (CH2M, 2004).

The topography of the southeastern uplands area is characterized by low hills and small sub-watersheds with well-defined drainages. Runoff from these areas is northeastward towards the Salinas River Valley by way of El Toro Creek or other smaller tributaries.

4.1.3.2 Soil Characteristics

The soils of the Subbasin are derived from the underlying geologic formations and influenced by the historical and current patterns of climate and hydrology. Soil types can influence groundwater recharge and are an important consideration for the siting of potential artificial recharge projects.

Soils within the Subbasin are shown on Figure 4-6, and are based on the U.S Department of Agriculture Natural Resources Conservation Service (USDA-NRCS) Soil Survey Geographic Database (SSURGO). Soils within the Subbasin are relatively coarse in texture, with the predominant types being sand, loamy sand, and fine sandy loam. Textures are generally coarser near the coast and finer to the south.

Figure 4-7 shows the infiltration potential of soils based on SSURGO's Hydrologic Soil Group designations. Soils within the Subbasin are predominantly of Hydrologic Soil Group A in the coastal plain area, indicating high infiltration rates and low runoff potential. In the Fort Ord hills area, soils predominately belong to Hydrologic Soil Groups C and D, with below-average and low infiltration rates, respectively, and moderately high and high runoff potential, respectively. A mix of Hydrologic Soil Groups A through D exist in the Corral de Tierra Area east of El Toro Creek.

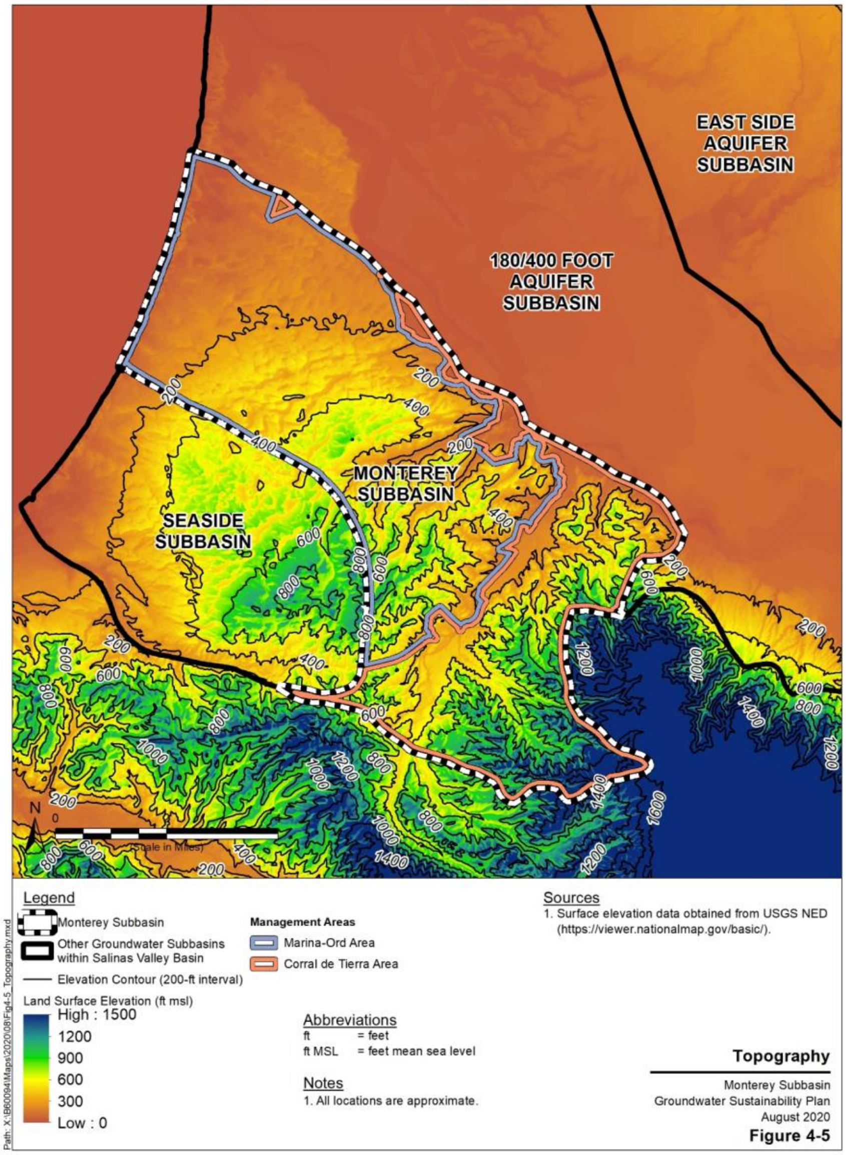


Figure 4-5. Topography

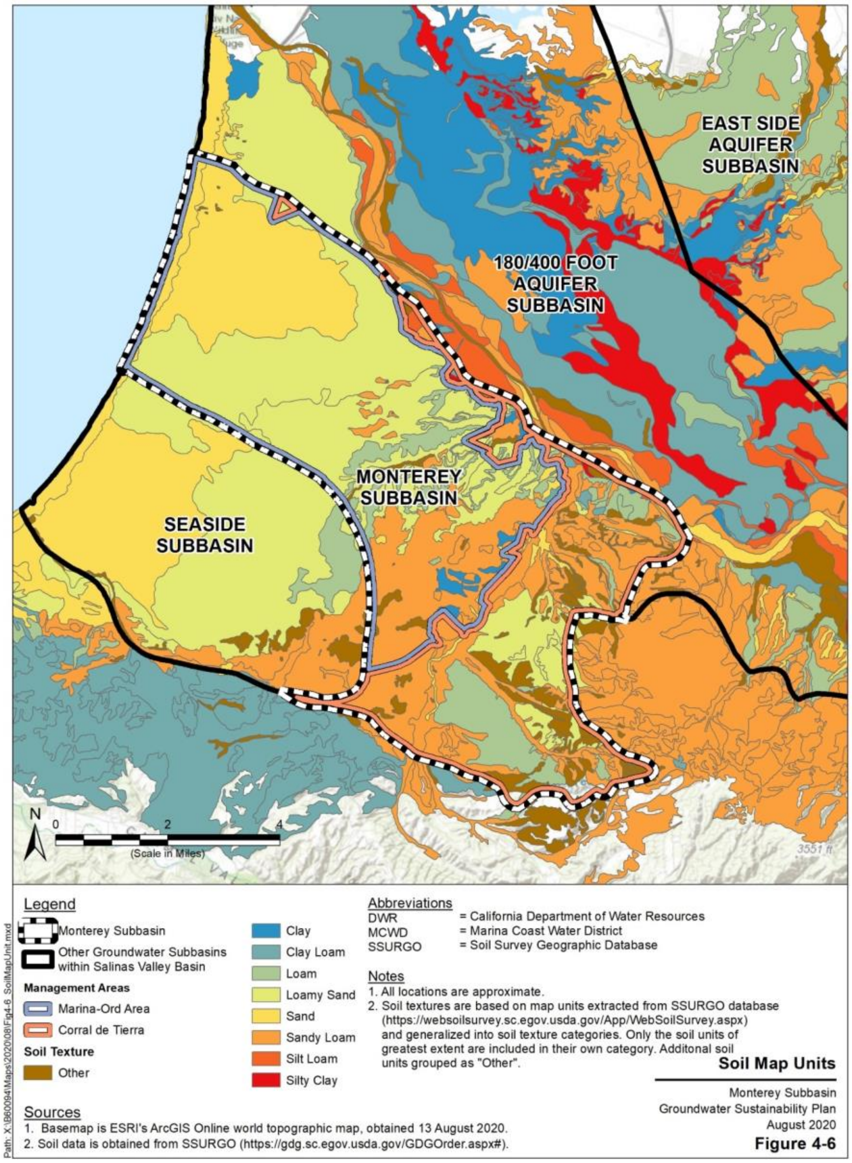


Figure 4-6. Soil Map Units

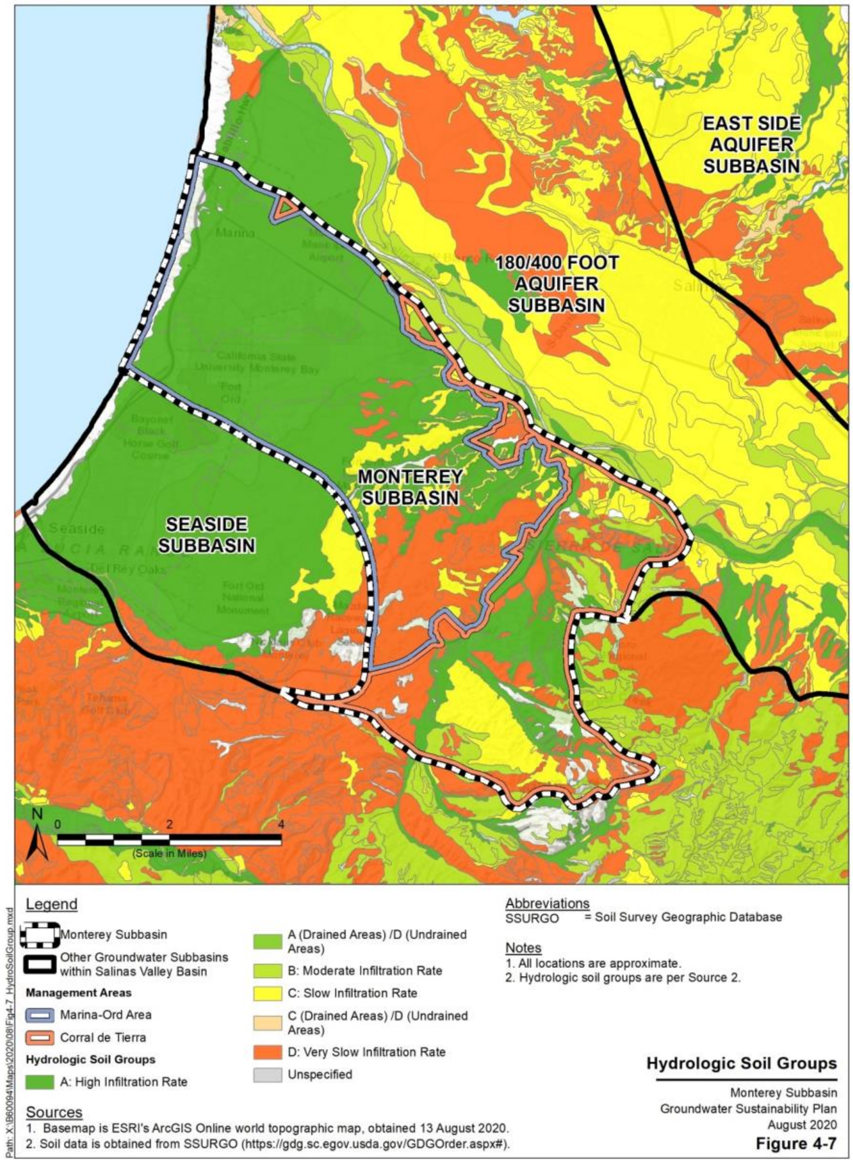


Figure 4-7. Hydrologic Soil Group

4.1.3.3 Recharge and Discharge Areas

Most of the Marina-Ord Area has good recharge potential for the Dune Sand Aquifer, which subsequently recharges the underlying 180-Foot and 400-Foot Aquifers due to the high infiltration potential of the soils. This recharge is discussed further below in the general water quality section. There is uncertainty regarding the location and recharge mechanism for the Deep Aquifers (see discussion for each aquifer in Section 4.2.2). Additionally, due to the prevailing hydraulic gradient, the Subbasin currently receives an inflow of seawater across the coastal northwestern boundary. Return flow from urban irrigation is not likely a significant source of recharge, and there are currently no artificial recharge projects within the Subbasin. Discharge of groundwater from the Subbasin is predominantly through groundwater pumping from private and municipal supply wells and groundwater remediation extraction wells.

Soils of varying infiltration potential exist in the Corral de Tierra Area. Recharge from precipitation to the Aromas Sand/Paso Robles continental deposits and the Santa Margarita Sandstone in the southern Corral de Tierra Area is approximately 2 to 3 inches of the total annual precipitation (GeoSyntec, 2007; Fugro, 1996). This equals around 10 to 20 percent of average precipitation, which is approximately 16 inches of rain per year (Fugro, 1996). There is also a minimal volume of recharge from septic systems, and it is assumed that this recharge is to the shallow alluvial sediments (Yates, 2002). Recharge to the unnamed sandstone and conglomerate likely occurs in areas of higher elevation in the Sierra de Salinas south of the Monterey Subbasin (GeoSyntec, 2007).

~~Groundwater discharge to El Toro Creek causes the creek to flow perennially starting at a location below the Corral de Tierra Country Club, according to several previous investigations~~According to several previous investigations, groundwater discharge to El Toro Creek causes the creek to flow perennially starting at a location below the Corral de Tierra Country Club. Streamflow data for the period 1961 to 2002 from USGS gage 11152540, located north of San Benancio Road, indicate a mean annual streamflow of 1,590 AFY (GeoSyntec, 2007). It has not been determined what portion of this mean annual streamflow is attributable to groundwater discharge and what portion is attributable to runoff.

4.2 Subbasin Hydrogeology

The Monterey Subbasin is hydrostratigraphically complex and represents a transition zone between the more defined, laterally continuous aquifer system along the central axis of the Salinas Valley and the less continuous aquifer systems towards the Sierra de Salinas. Past hydrostratigraphic analyses of the Subbasin have generally focused on areas where groundwater production and remediation activities have occurred, i.e., in the vicinity of the City of Marina, in the eastern portion of the former Fort Ord, and within the southern Corral de Tierra Area. Limited subsurface information exists in the central portion of the Subbasin (i.e., the BLM-managed Federal Land area). The description of the hydrogeology presented herein is based on the best available information for the Subbasin. Hydrogeologic information for the Marina-Ord Area and the Corral de Tierra Area are described independently given the uncertainty regarding the connections between the different aquifers and strata identified in these areas.

4.2.1 Cross Sections

4.2.1.1 Cross Sections in the Marina-Ord Area

Figure 4-8 through Figure 4-12 present cross-sections that illustrate the geologic setting and hydrostratigraphy beneath the Marina-Ord Area. These cross-sections are derived from *Hydrogeologic Investigation of the Salina Valley Basin in the Vicinity of the Fort Ord and Marina* (Harding ESE, 2001).

Figure 4-8. Cross-Section Locations, Marina-Ord Area

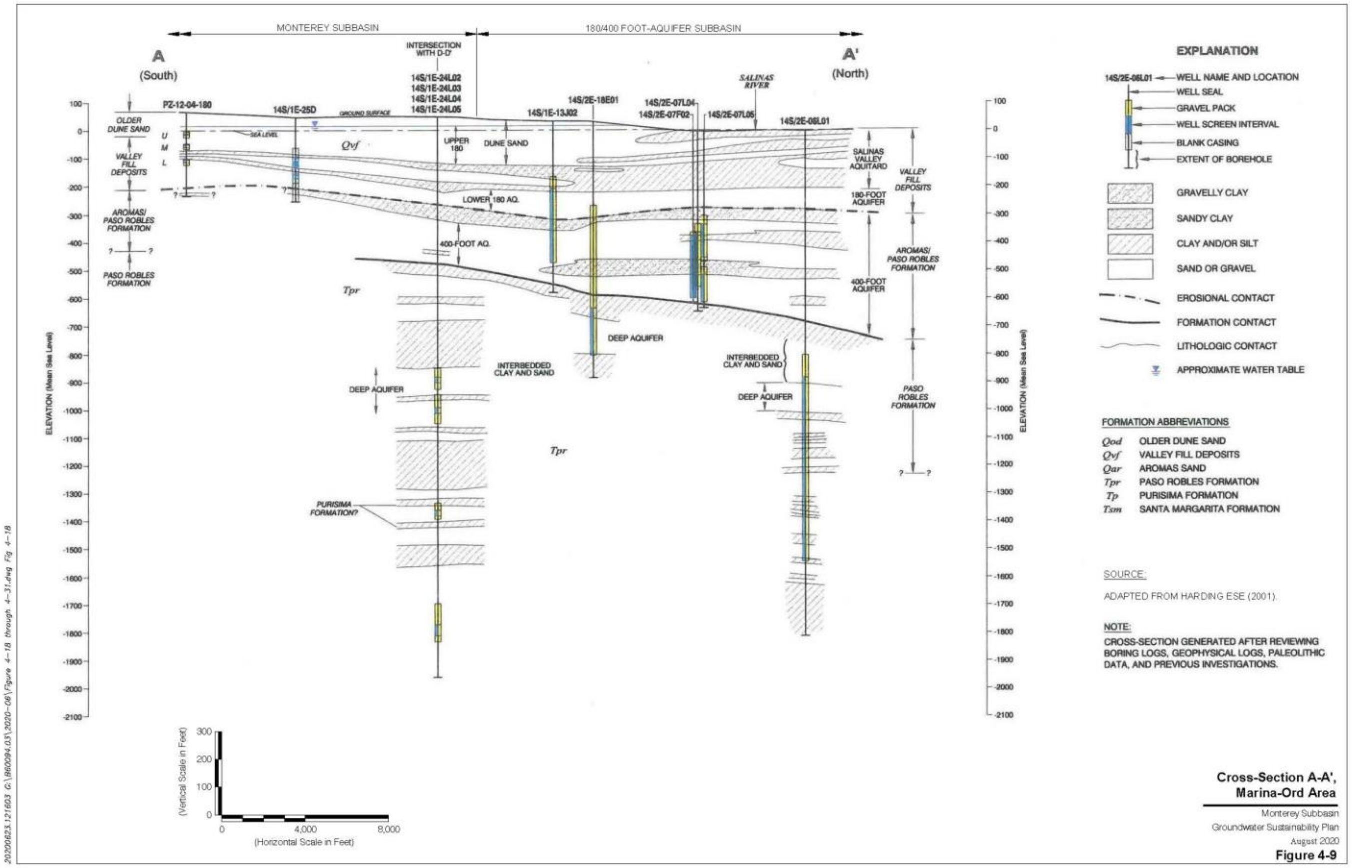


Figure 4-9. Cross-Section A-A', Marina-Ord Area

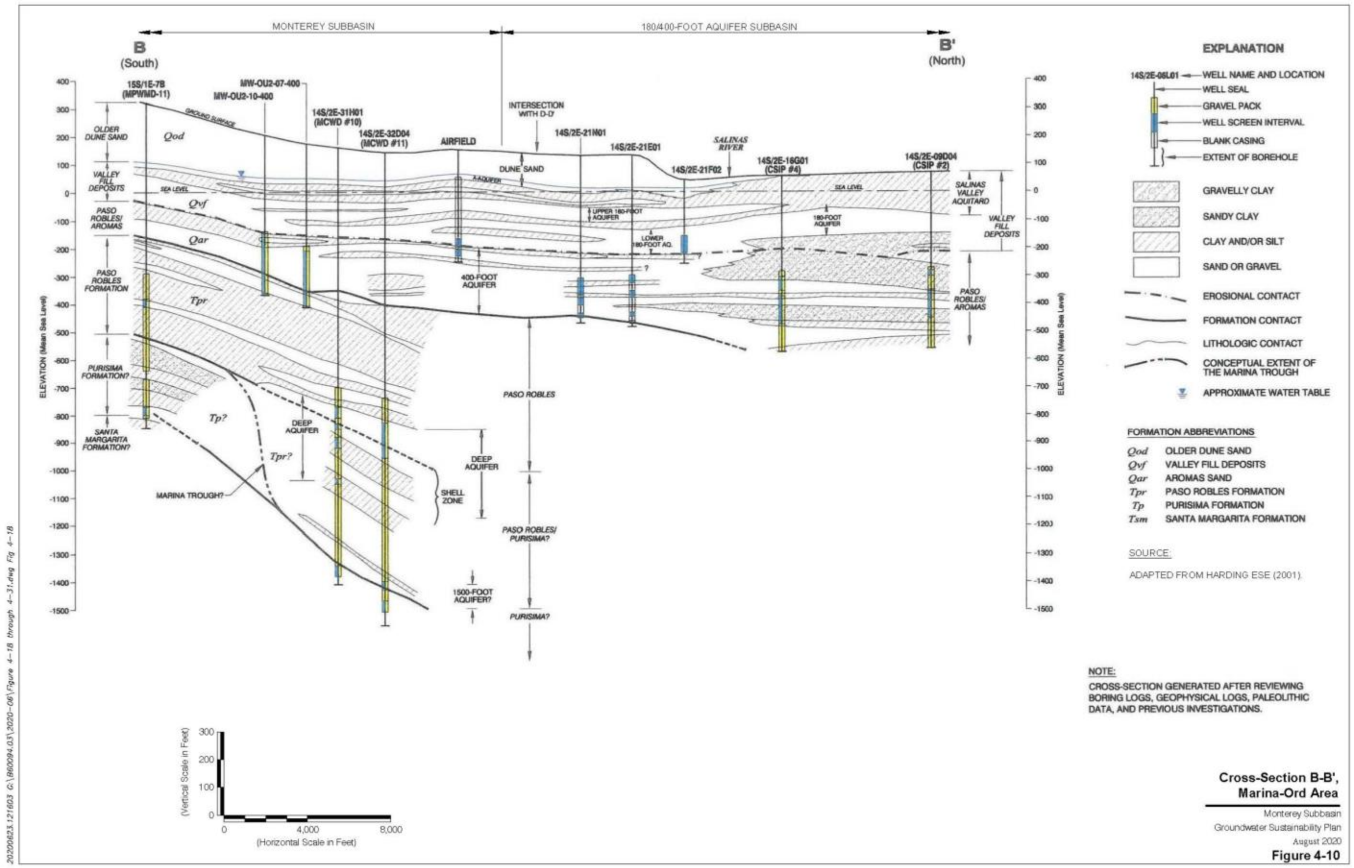


Figure 4-10. Cross-Section B-B', Marina-Ord Area

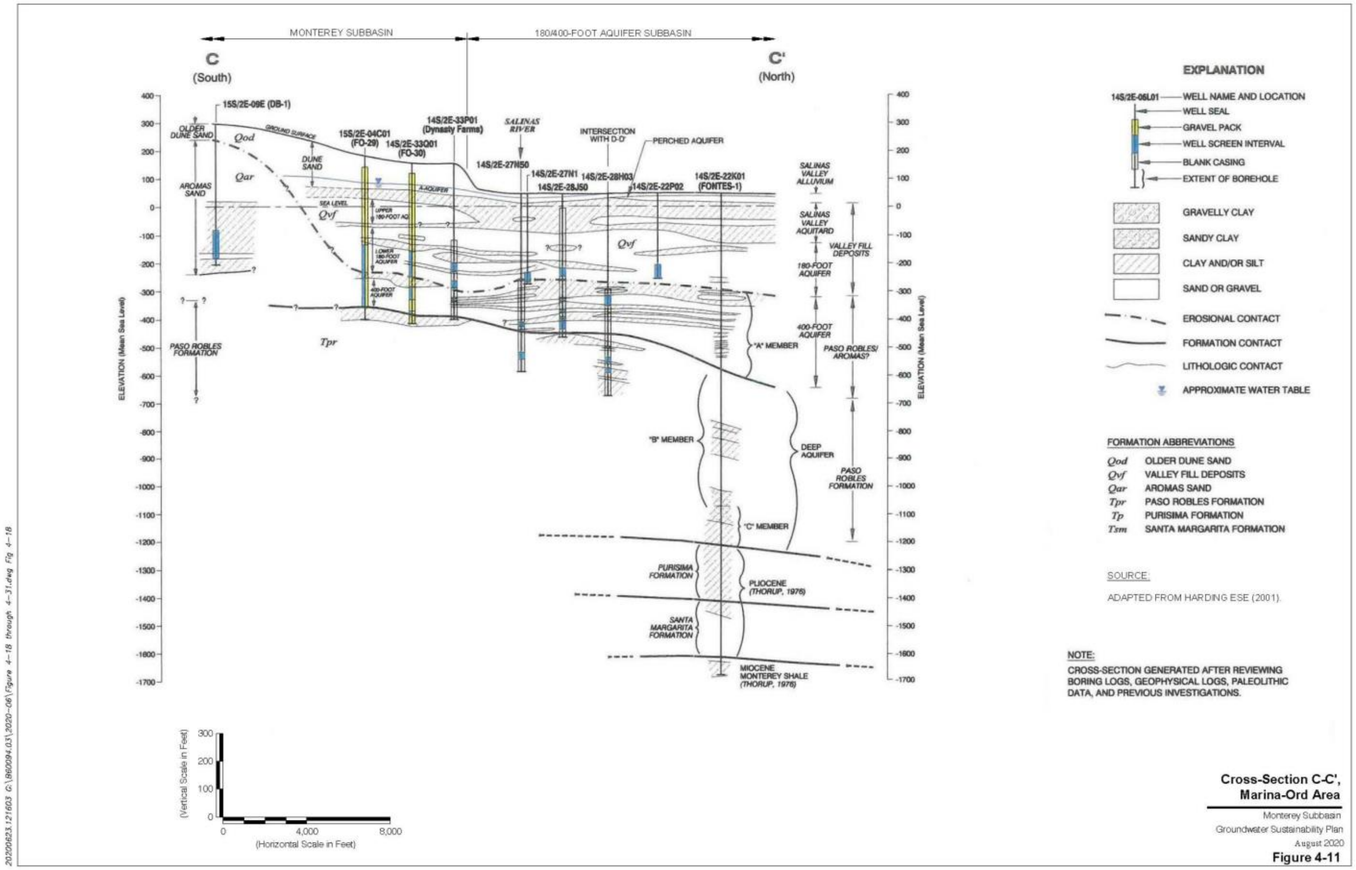


Figure 4-11. Cross-Section C-C', Marina-Ord Area

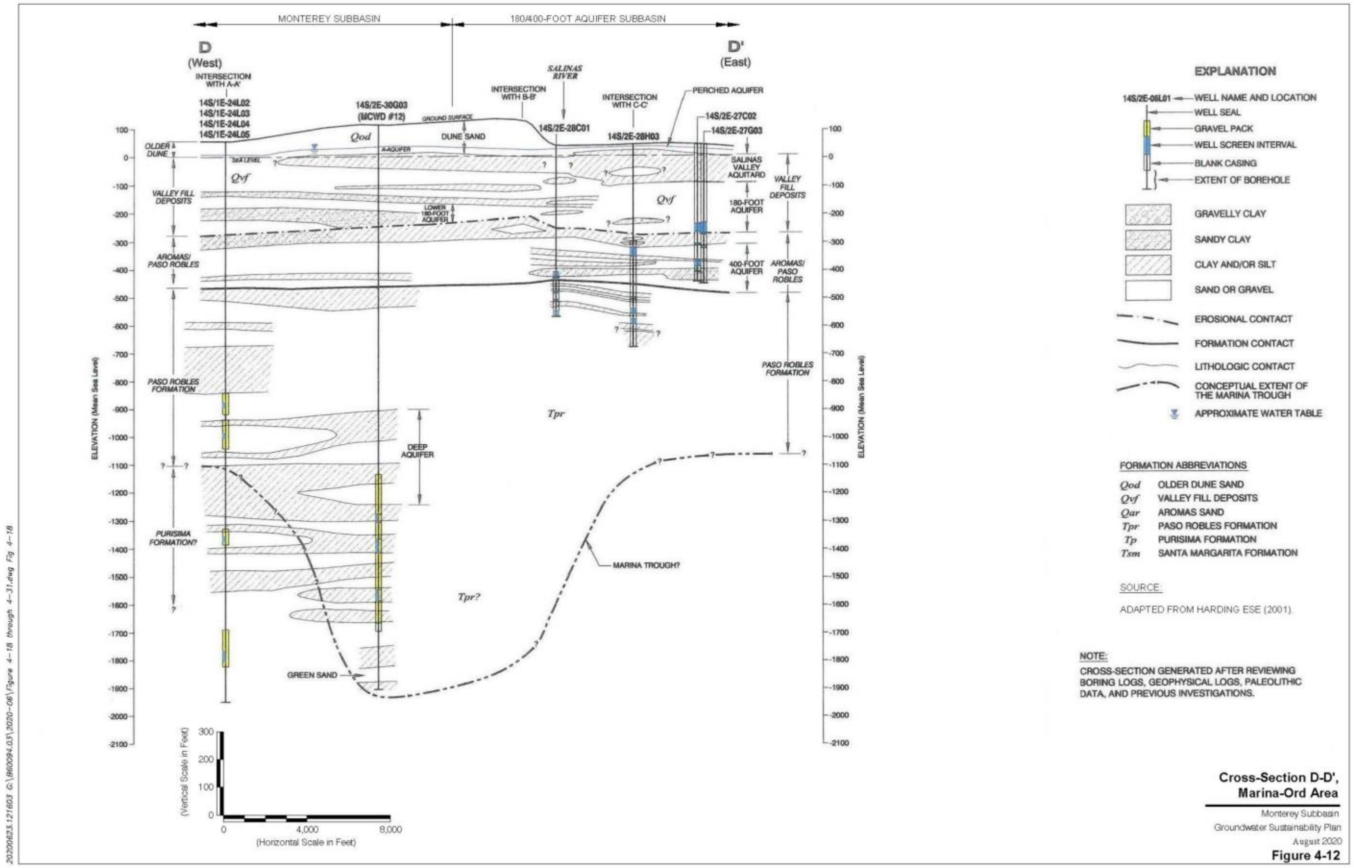


Figure 4-12. Cross-Section D-D', Marina-Ord Area

4.2.1.2 Cross Sections in the Corral de Tierra Area

Figure 4-13 through Figure 4-18 present cross-sections that illustrate the geologic setting beneath the Corral de Tierra Area as well as a geologic map of the area that shows the geologic formations present at the ground surface. The legends in each of the figures present the age sequence of the geologic materials from the youngest unconsolidated Quaternary sediments to the oldest pre-Cretaceous basement rock where it may be present.

The cross-sections for the Corral de Tierra Area are derived from the *El Toro Groundwater Study* (GeoSyntec, 2007) and the *Supplement to the El Toro Study* (GeoSyntec, 2010). These cross-sections illustrate the faulted and warped geologic features of the area.

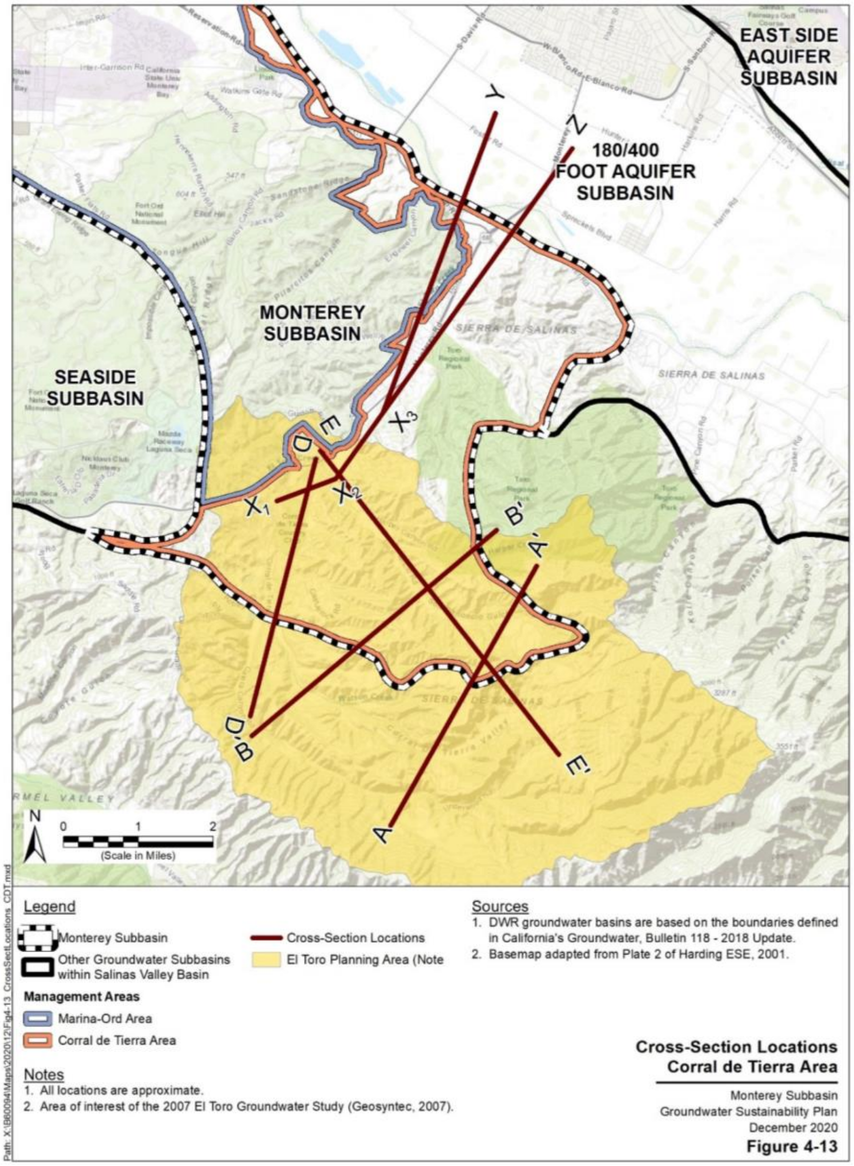


Figure 4-13. Cross-Section Locations, Corral de Tierra Area

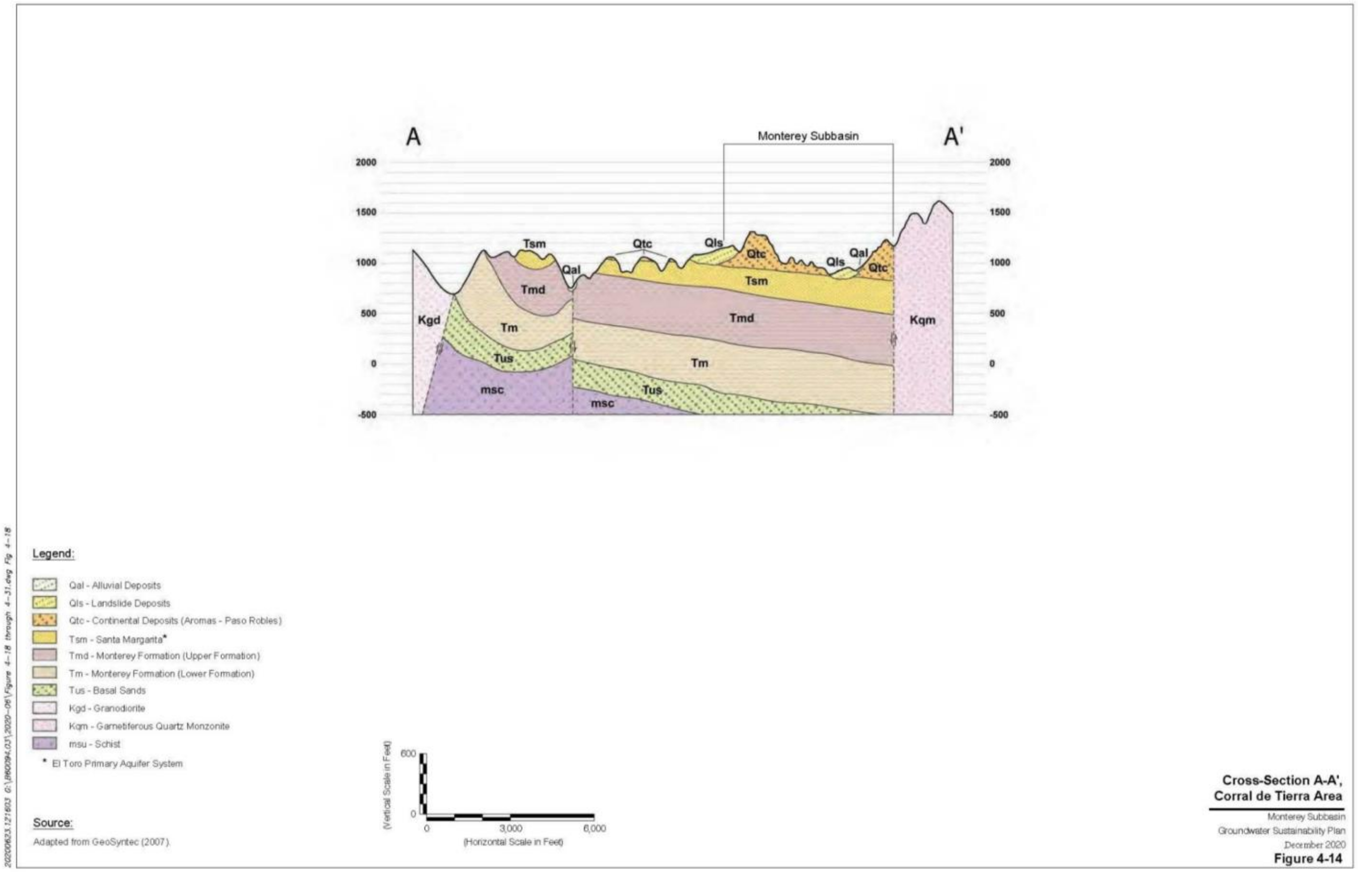


Figure 4-14. Cross-Section A-A', Corral de Tierra Area

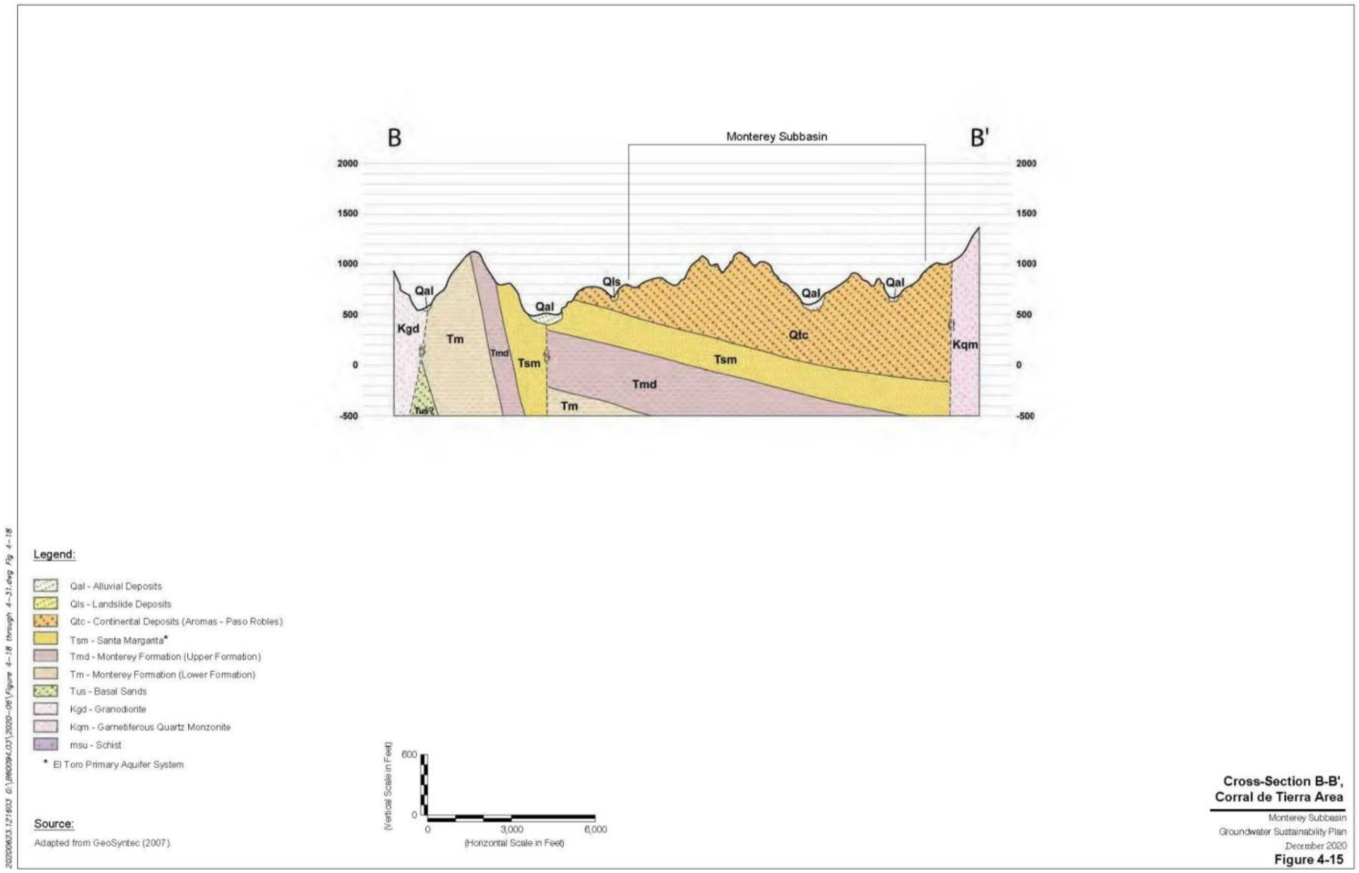


Figure 4-15. Cross-Section B-B', Corral de Tierra Area

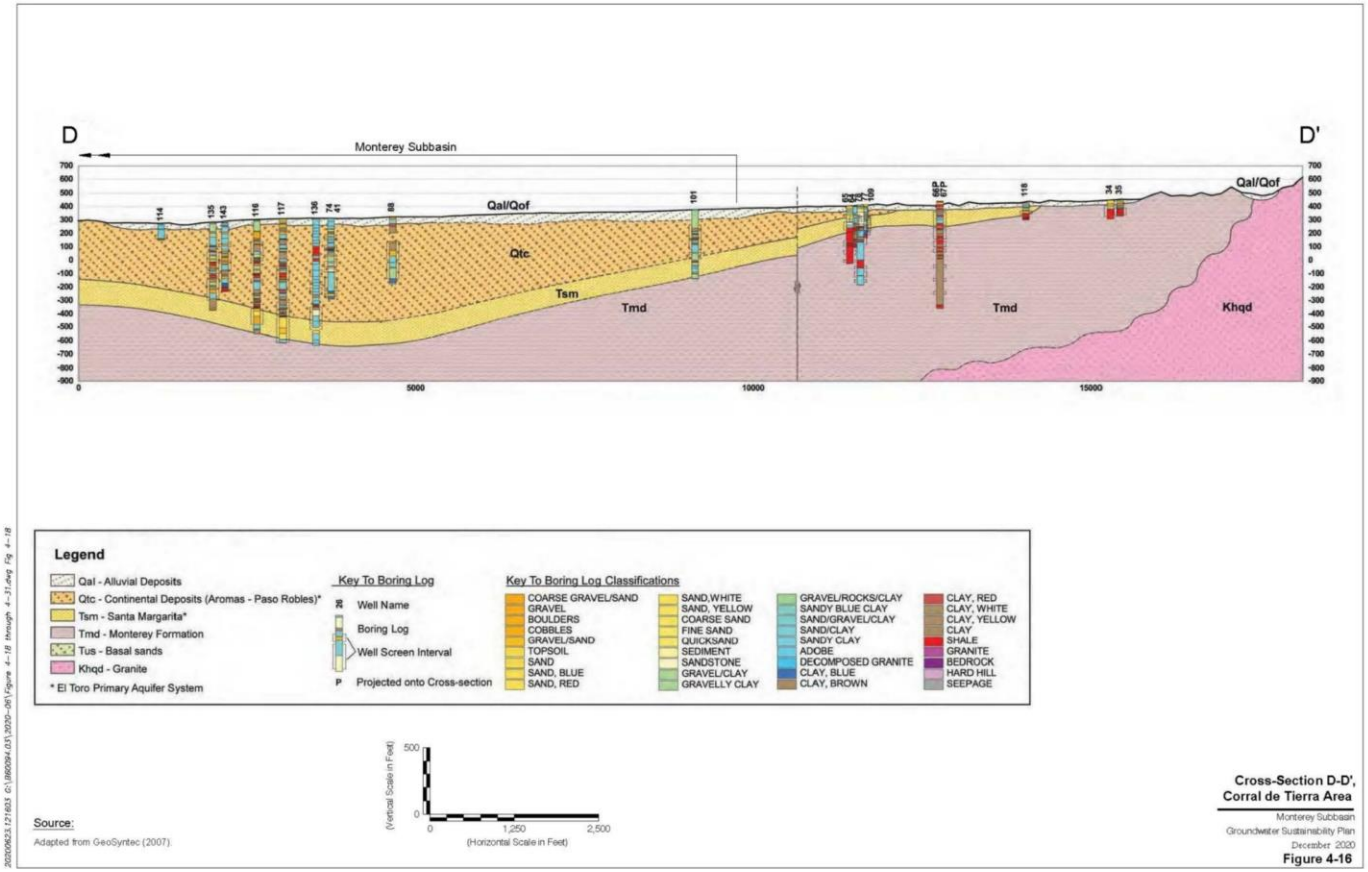


Figure 4-16. Cross-Section D-D', Corral de Tierra Area

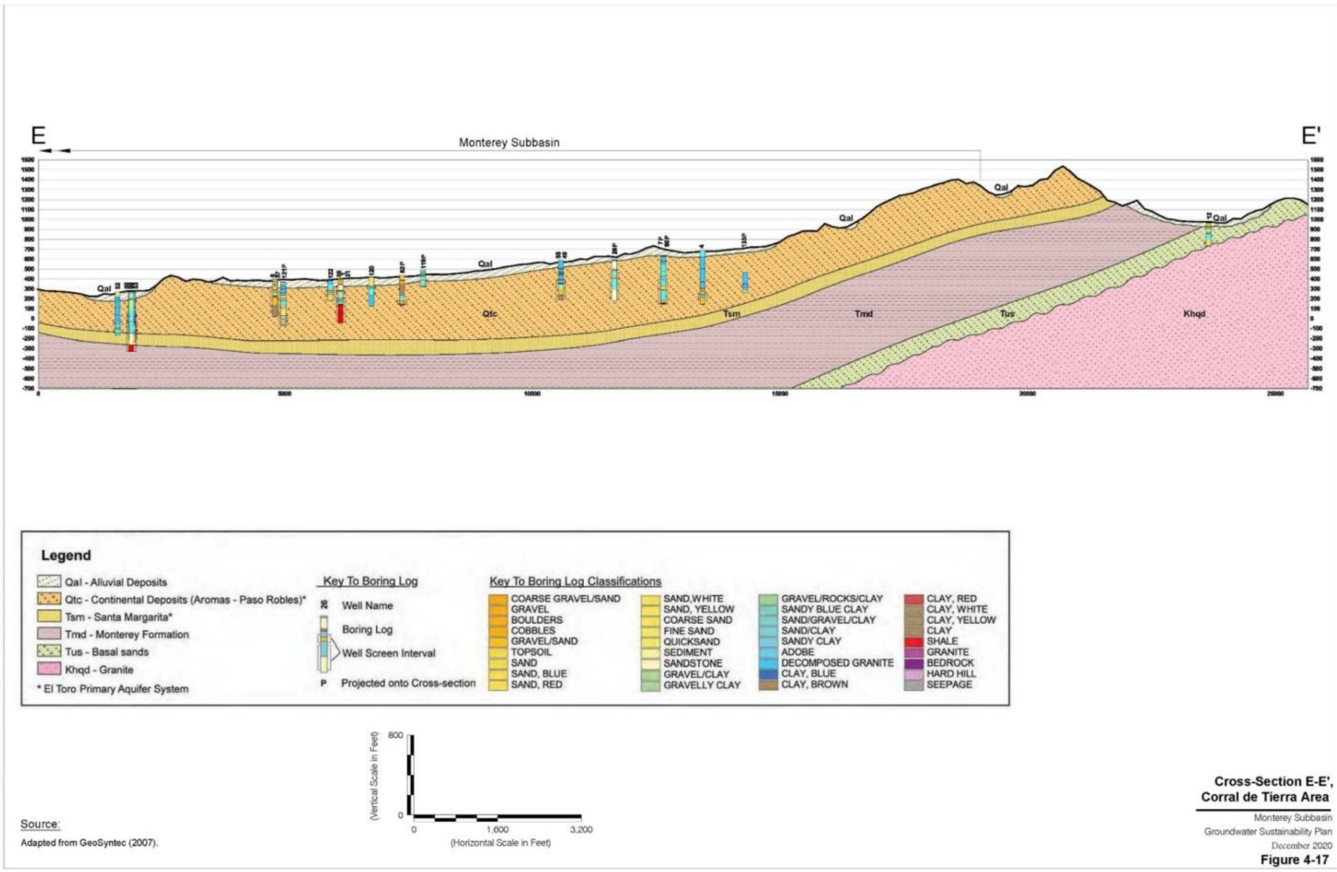


Figure 4-17. Cross-Section E-E', Corral de Tierra Area

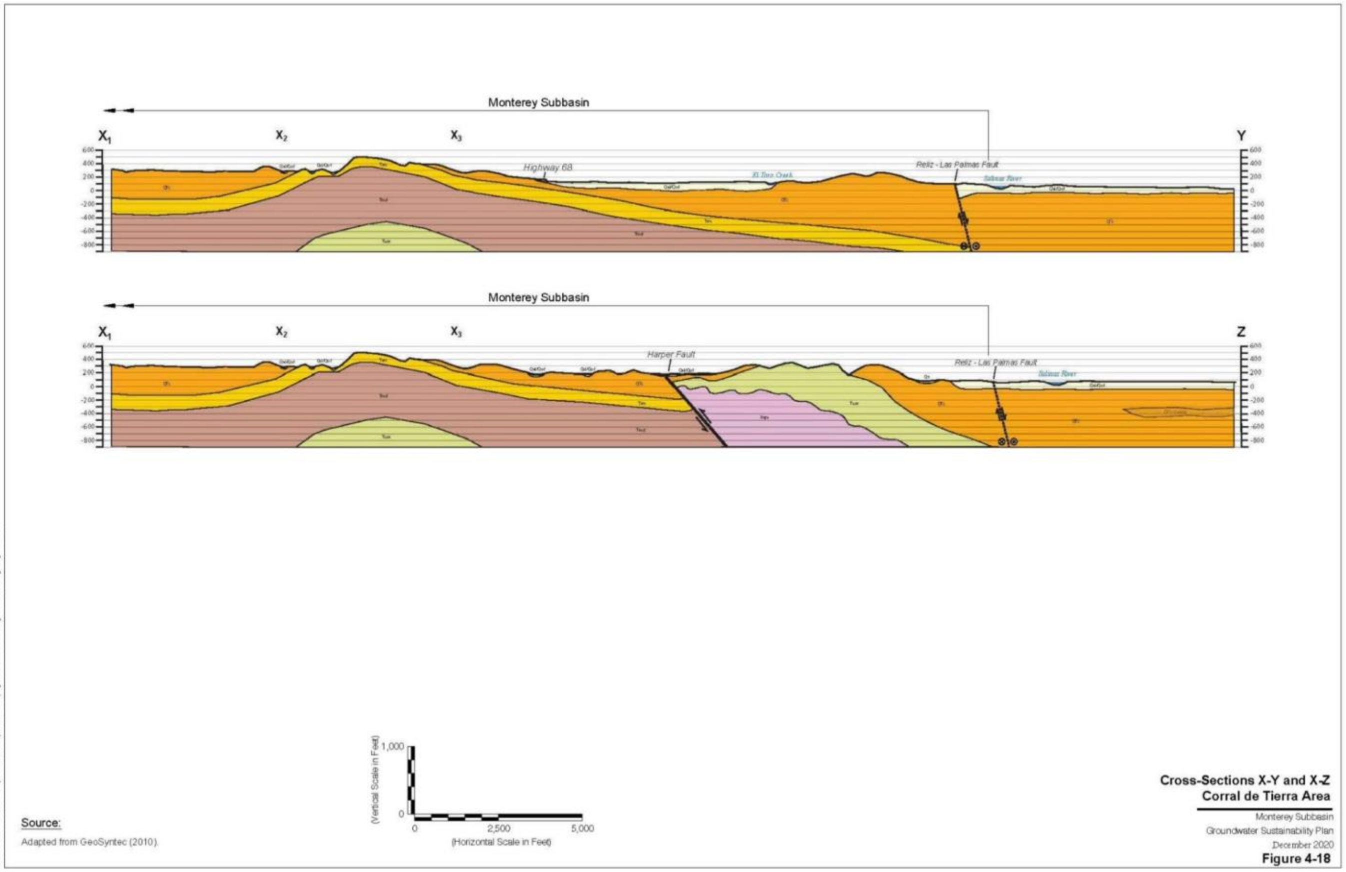


Figure 4-18. Cross-Section X-Y and X-Z, Corral de Tierra Area

4.2.2 Principal Aquifers and Aquitards

Hydrostratigraphy in the Marina-Ord Area consists of a series of laterally continuous aquifers consistent with the aquifers that form the distinguishing features of the northern Salinas Valley. The aquifers that have historically been identified in the Marina-Ord Area in previous reports include the unconfined Dune Sand Aquifer and the confined aquifers known as the 180-Foot Aquifer, the 400-Foot Aquifer, and the Deep Aquifers. Within the southern Corral de Tierra Area, the aquifers have historically been described by their geologic names, such as the Aromas Sand, Paso Robles Formation, and Santa Margarita Sandstone (Geosyntec, 2007; Yates 2005). Based on the best available information, these geologic formations are grouped together to form the El Toro Primary Aquifer System for the Corral de Tierra Area, which is described in more detail below. These geologic formations also comprise portions of the 400-Foot Aquifer and the Deep Aquifers in the northern Salinas Valley including the Marina-Ord Area. Even though the geology is the foundation for the principal aquifers of the Subbasin, the principal aquifers are not solely determined by the geologic formations. These relationships will be described in more detail in the sections below.

The following set of principal aquifers and aquitards are defined in the Monterey Subbasin:

- Dune Sand Aquifer
- Fort-Ord/Salinas Valley Aquitard
- 180-Foot Aquifer
- 180/400-Foot Aquitard
- 400-Foot Aquifer
- 400-Foot/Deep Aquitard
- Deep Aquifers
- El Toro Primary Aquifer System

The principal aquifer and aquitard designations and relationships to geologic formations are illustrated in . This table is based on the 2017 Monterey County Water Resources Agency's *Recommendations to address the expansion of seawater intrusion in the Salinas Valley groundwater basin* report, but has been modified to reflect specific hydrogeologic conditions and relationships within the Subbasin (Harding ESE, 2001; Rosenberg & Feeney, 2003).

Table 4-1. Generalized Geologic-Hydrogeologic Relationships

Period/Epoch	Geological Unit	Principal Aquifers and Aquitards Corral de Tierra Area	Principal Aquifers and Aquitards Marina Ord Area
Holocene	Recent Dune Sand (Qd) Older Dune Sand (Qod)	N/A	**Dune Sand Aquifer**
Pleistocene	Old Alluvium / Valley Fill Deposits (Qo/Qvf)		Fort Ord-Salinas Valley Aquitard **180-Foot Aquifer**
	Aromas Sand (Qae)		180/400-Foot Aquitard
	Paso Robles Formation (QT)	**El Toro Primary Aquifer System**	**400-Foot Aquifer** 400-Foot/Deep Aquitard
Pliocene	Purisima Formation (Ppu)		**Deep Aquifers**
	Santa Margarita Formation (Msm)		
Miocene	Monterey Formation (Mmy)	N/A (Minimally Water-Bearing)	N/A (Minimally Water-Bearing)

Not all of these principal aquifers occur across the entire Monterey Subbasin due to the complex geologic setting present. The Dune Sand and 180-Foot Aquifers are generally not present in the Corral de Tierra Area, although they are present in the Marina-Ord area. ~~In the Marina-Ord Area, the 180-Foot Aquifer is connected to the 180-Foot Aquifer in the 180/400-Foot Aquifer Subbasin.~~ The Paso Robles, Santa Margarita, and Purisima Formations are generally present across the whole subbasin, even though the correlated principal aquifers are not.

These formations and correlated principal aquifers are also in connection with the equivalent principal aquifers in the 180/400-Foot and Seaside Subbasins. Groundwater connection between the Marina-Ord Area and the 180/400-Foot Aquifer Subbasin is relatively well established based on ~~with both~~ water levels ~~and with seawater intrusion~~ observed in the 180-Foot, 400-Foot, and Deep Aquifers as well seawater migration between subbasins in the 180-Foot and 400-Foot Aquifers~~.~~. ~~In the Marina-Ord Area, the 180-Foot Aquifer is connected to the 180-Foot Aquifer in the 180/400-Foot Aquifer Subbasin.~~As discussed below, the 400-Foot Aquifer is comprised of the top 200 feet of the Paso Robles Formation and the Aromas Sand, while the Deep Aquifers are comprised of the remainder of the Paso Robles Formation, the Purisima Formation and the Santa Margarita Formation. Due to its geologic composition, the 400-Foot Aquifer has been believed to be connected to the shallow Paso Robles Aquifer and the Deep Aquifers have been believed to be connected to the deep Santa Margarita Aquifer in the Seaside Subbasin (Yates, 2005).

The Paso Robles and Santa Margarita Formations comprise the El Toro Primary Aquifer System in the Corral de Tierra Area. In the Seaside Subbasin, these are the same geologic formations that forms the Seaside Subbasin's shallow Paso Robles Aquifer and deep Santa Margarita Aquifer. They are grouped together in the Corral de Tierra Area as many wells are screened across both formations and local geochemistry of groundwater indicates they generally act as a single aquifer in this locale. Groundwater connection between the Corral de Tierra Area and the Seaside Subbasin's Laguna Seca Area is relatively well established with production wells screened in the Paso Robles and Santa Margarita Formations. However, Tthe geologic and hydrostratigraphic transition between Marina-Ord and Corral de Tierra Areas and the Marina-Ord Area through the former Fort Ord or the transition between the Corral de Tierra Area and the 180/400-Foot Aquifer Subbasin is not as well studied or understood.

4.2.2.1 *Marina-Ord Area*

Water-bearing geologic units in the Marina-Ord Area include the Dune Sands, the Old Alluvium / Valley Fill Deposits, the Aromas Sands, the Paso Robles Formation, the Purisima Formation, and the Santa Margarita Sandstone. These geologic units form a series of laterally continuous aquifers consistent with the aquifers that form the distinguishing features of the northern Salinas Valley. The following set of principal aquifers and aquitards are defined in the Marina-Ord Area:

- Dune Sand Aquifer
- Fort-Ord/Salinas Valley Aquitard
- 180-Foot Aquifer
- 180/400-Foot Aquitard
- 400-Foot Aquifer
- 400-Foot/Deep Aquitard
- Deep Aquifers

The principal aquifer and aquitard designations and relationships to geologic formations are illustrated in Table 4-1. This table is based on the 2017 Monterey County Water Resources

Agency's *Recommendations to address the expansion of seawater intrusion in the Salinas Valley groundwater basin* report, but has been modified to reflect specific hydrogeologic conditions and relationships within the Subbasin (Harding ESE, 2001; Rosenberg & Feeney, 2003).

Table 4-1. Generalized Geologic-Hydrogeologic Relationships

Period/Epoch	Geological Unit	Principal Aquifers and Aquitards
Holocene	Recent Dune Sand (Qd) Older Dune Sand (Qod)	**Dune Sand Aquifer**
Pleistocene	Old Alluvium / Valley Fill Deposits (Qo/Qvf)	Fort Ord-Salinas Valley Aquitard
		180-Foot Aquifer
	Aromas Sand (Qae)	180/400-Foot Aquitard
		400-Foot Aquifer
	Paso Robles Formation (QT)	400-Foot/Deep Aquitard
Pliocene	Purisima Formation (Ppu)	**Deep Aquifers**
	Santa Margarita Formation (Msm)	
Miocene	Monterey Formation (Mmy)	N/A (Minimally Water-Bearing)

4.2.2.1.1 Dune Sand Aquifer

The Dune Sand Aquifer is composed of fine to medium, well-sorted dune sands of Holocene age (Ahtna Engineering, 2013). The Dune Sand Aquifer is also sometimes referred to as the "A-Aquifer" beneath Fort Ord (Harding Lawson Associates (HLA, 1994; Jordan et al., 2005; Harding ESE, 2001). Groundwater in the Dune Sand Aquifer is unconfined. The aquifer is perched away from the coast, in areas where the Fort Ord-Salinas Valley Aquitard (FO-SVA) exists and groundwater in the 180-Foot Aquifer has fallen below the bottom elevation of the FO-SVA. It is hydraulically connected to the underlying 180-Foot Aquifer in areas nearer to the coast. The average saturated thickness of the Dune Sand Aquifer is approximately 50 feet. As shown on Figure 4-7, the sandy soils of this aquifer have high infiltration potential.

A north-south trending groundwater divide exists in the Dune Sand Aquifer. West of the groundwater divide, groundwater in the Dune Sand Aquifer flows westward, and both recharge the 180-Foot Aquifer and flow to the Pacific Ocean near the edge of the FO-SVA. Water from the Dune Sand Aquifer that recharges the 180-Foot Aquifer flows in response to gradients in the 180-Foot Aquifer, which is currently eastward (i.e., inland). East of the groundwater divide, groundwater in the Dune Sand Aquifer flows northeastward towards the Salinas River. A conceptual model of this groundwater flow is shown on Figure 4-19 below.

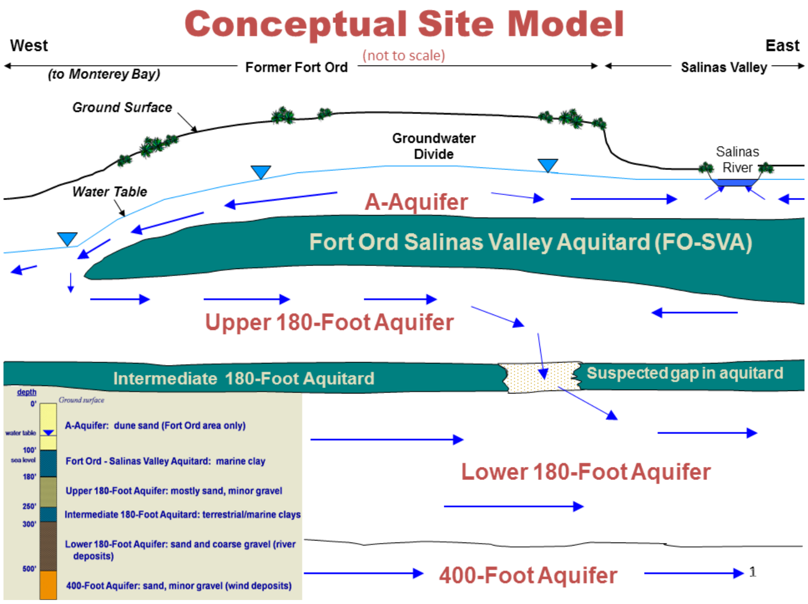


Figure 4-19. Conceptual Model of Principal Aquifers in the Marina-Ord Area

This aquifer is recharged primarily by rainfall infiltration and in turn provides a source of deep percolation into the upper 180-Foot aquifer and eventually into the lower 180-Foot and 400-Foot Aquifers in the Monterey Subbasin (HLA, 1994).

Extraction and infiltration activities associated with remediation in the former Fort Ord take place within the Dune Sand Aquifer.

4.2.2.1.2 <u>Fort Ord-Salinas Valley Aquitard</u>

The Fort Ord-Salinas Valley Aquitard (FO-SVA) is composed of laterally extensive blue or yellow sandy clay layers with minor interbedded sand layers (Harding ESE, 2001; DWR, 2003). The FO-SVA generally correlates to the Pleistocene Older Alluvium stratigraphic unit, which is shown as Valley Fill. The FO-SVA was deposited in a shallow sea during a period of relatively high sea level. Harding ESE noted that the FO-SVA beneath the former Fort Ord might be formed under a different depositional event than the Salinas Valley Aquitard (SVA) unit beneath the Salinas Valley (e.g., estuarine deposits vs. flood plain deposits). However, the two clay units are hydraulically equivalent (Harding ESE, 2001).

The FO-SVA is generally encountered at depths of less than 150 feet. While this clay layer is relatively continuous in the northern portion of the Valley, it is not monolithic across the Subbasin. The clay layer is missing in some areas and pinches out in certain areas.

Within the Subbasin, the FO-SVA is continuous beneath the City of Marina and most of Fort Ord (Harding ESE, 2001; Kennedy/Jenks, 2004; Ahtna Engineering, 2013; MACTEC, 2006). The extent of the FO-SVA is illustrated on Figure 4-20. The FO-SVA thins towards the Monterey Subbasin/Seaside Subbasin boundary as well as toward the coast, where it appears to pinch out near Highway 1 (Harding ESE, 2001). The thinning and pinching out of the FO-SVA in these locations increases the vertical hydraulic connection between the Dune Sand Aquifer and underlying 180-Foot Aquifer.

4.2.2.1.3 <u>180-Foot Aquifer</u>

The FO-SVA generally overlies and confines the 180-Foot Aquifer. The 180-Foot Aquifer consists of interconnected sand and gravel beds that are from 50 to 150 feet thick. The sand and gravel layers of this aquifer are interlayered with clay lenses (Ahtna Engineering, 2013). This aquifer is correlated to the Older Alluvium (Valley Fill) or upper Aromas Sand formations (Harding ESE, 2001; Kennedy-Jenks, 2004; Ahtna Engineering, 2013).

The gravels, sands, and interspersed clays of the 180-Foot Aquifer are found in the vicinity of the City of Marina and extend a short distance southwest beyond the extent of the FO-SVA (HLA, 1994). Beneath the ocean, the sediments "extend to submarine outcrops on the floor and canyon walls of Monterey Bay (Harding ESE, 2001; Todd Engineers, 1989; Greene, 1977; DWR, 1946). As discussed above, the aquifer is confined where overlain by the FO-SVA. It may become unsaturated where groundwater elevation is lower than the bottom elevation of the FO-SVA, or unconfined where the FO-SVA pinches out. The 180-Foot Aquifer is found generally at depths between 100 and 400 ft bgs beneath the Marina-Ord Area, with varying thickness.

South of the City of Marina, in a portion of the former Fort Ord, the 180-Foot Aquifer is separated into an "upper" zone of sandy deposits with some gravel and a "lower" zone of gravel with sand and clay lenses; the two zones are separated by a thin clay layer (Ahtna Engineering, 2013). Data collected within the former Fort Ord show that significant head differences exist between the upper and lower zones of the 180-Foot Aquifer.

The 180-Foot Aquifer receives recharge from the overlying Dune Sand Aquifer as well as percolation through the FO-SVA, and rainfall and surface water infiltration in areas where the FO-SVA does not exist. This recharge mechanism is also supported by the similar geochemistry between the Dune Sand Aquifer and the 180-Foot Aquifer (Section 4.2.4.1). Subsurface inflows and outflows to the 180-Foot Aquifer also occur from 180-Foot Aquifer of the 180/400-Foot Aquifer Subbasin and from the Aromas Sand southeast of the former Fort Ord where there may be a hydrologic connection (HLA, 1994).

The primary uses of the 180-Foot Aquifer are for municipal water supply in the lower 180-Foot Aquifer. Extraction and infiltration activities associated with remediation in the former Fort Ord also take place within the 180-Foot Aquifer.

4.2.2.1.4 180/400-Foot Aquitard

The base of the 180-Foot Aquifer is the 180/400-Foot Aquitard. This aquitard consists of interlayered clay and sand layers, including a marine blue clay layer (DWR, 2003). The 180/400-Foot aquitard varies in thickness and quality across the Subbasin, and "varies laterally throughout the Fort Ord area" (MACTEC, 2006). Therefore, areas of hydrologic connection between the 400-Foot and 180-Foot Aquifers exist, and Fort Ord is one of several locations where this aquitard is thin or discontinuous (Kennedy-Jenks, 2004).

4.2.2.1.5 400-Foot Aquifer

The 400-Foot Aquifer is comprised of fine to medium-grained sand with varying degrees of interbedded clay lenses (Ahtna Engineering, 2013). The 400-Foot Aquifer appears to be composed of portions of the Aromas Sand near the coast, and the upper 200 feet of the Paso Robles Formation (HLA, 1994; Harding ESE, 2001), although it is sometimes difficult to delineate the transition between the two formations (Harding ESE, 2001). It is usually encountered between 270 and 470 feet below ground surface in the Marina-Ord area. The upper portion of the 400-Foot Aquifer merges and interfingers with the 180-Foot Aquifer in some areas where the 180/400-Foot Aquitard is missing (DWR, 1973).

Due to its geologic composition, the 400-Foot Aquifer has been believed to be connected to the shallow Paso Robles aquifer in Seaside Subbasin (Yates, 2005). In the Seaside Subbasin, this aquifer consists of several continuous water-producing zones and unconfined zones where granular materials of the Paso Robles Formation are in contact with surficial deposits.

Recharge to this aquifer likely occurs from both the overlying 180-Foot Aquifer and outcrops of the Aromas Sand and Paso Robles Formations in and near the Corral de Tierra Area. Groundwater flow direction in the 400-Foot Aquifer is influenced by groundwater pumping and the connection with neighboring Subbasins.

The primary uses of the 400-Foot Aquifer are for municipal supply in the Marina-Ord Area.

4.2.2.1.6 400-Foot/Deep Aquitard

The base of the 400-Foot Aquifer is the 400-Foot/Deep Aquitard. In some areas of the Salinas Valley Basin, this aquitard can be several hundred feet thick (Kennedy-Jenks, 2004). However, boring logs in the Marina-Ord Area indicate that a series of aquitards underly the 400-Foot Aquifer and extend into the Deep Aquifers. There is no analysis available for the spatial occurrence or geologic composition of the 400-Foot/Deep Aquitard. It is likely comprised of Paso Robles Formation deposits.

4.2.2.1.7 Deep Aquifers

The Deep Aquifers are also collectively referred to as the 900-Foot Aquifer or 900-Foot and 1500-Foot Aquifers in the northern Salinas Valley. The Deep Aquifers are up to 900 feet thick and have alternating sandy-gravel layers and clay layers which do not differentiate into distinct aquifer and aquitard units (DWR, 2003). The Deep Aquifers may also refer to all the water-bearing sediments beneath the 400-Foot Aquifer.

Within the Monterey Subbasin, the Deep Aquifers comprise the middle and lower portions of the Paso Robles Formation, the Purisima Formation, and the Santa Margarita Sandstone (Hanson et al., 2002; Yates, 2005). The Deep Aquifers are also likely connected to the deep Santa Margarita aquifer in Seaside Subbasin (Yates, 2005). The Deep Aquifers overlie the low permeability Monterey Formation, which is the bottom of the Subbasin.

Due to the geologic formations' depositional environments, the Deep Aquifers consist of alternating layers of sand and gravel mixtures with discontinuous clays rather than distinct, coherent aquifers and aquitards (Brown and Caldwell, 2015). There is a strong likelihood of flow through these confining layers (MCWRA, 2018).

The recharge mechanisms for the Deep Aquifers are not well known. There is likely some recharge from overlying aquifers, as downward vertical gradients exist (Thorup, 1976; Feeney and Rosenberg, 2003). Additional recharge may come from outcrops of Santa Margarita Sandstone or Paso Robles Formation in the Corral de Tierra Area. There are no known recharge mechanisms or pathways for the Purisima Formation other than from leakage from overlying aquifers, and there are no surficial outcrops of the Purisima Formation in the Salinas Valley Basin (Feeney and Rosenberg, 2003). Some extractions may be supported by depletion of groundwater storage (Feeney and Rosenberg, 2003). Specific storage was calculated at 0.000013, which suggests that the volume of groundwater that can be removed from storage is not large (Feeney and Rosenberg, 2003).

Oxygen and deuterium analyses of water from the Deep Aquifers suggest that, unlike the upper aquifer system (i.e., 180-Foot and 400-Foot Aquifers), water in the Deep Aquifers was not recharged under current climatic conditions (MCWRA, 2017). Additionally, tritium and carbon-14 analyses of Deep Aquifers water indicate that it was recharged thousands of years before present (Hanson et al., 2002). Age dating of groundwater by USGS indicates that groundwater in the Deep Aquifers near the Monterey Coast maybe 25,000 to 30,000 years old (Hanson et al., 2002).

The Deep Aquifers are used primarily for municipal water supply in the Marina-Ord Area.

4.2.2.2 Corral de Tierra Area

There is one single principal aquifer in the Corral de Tierra Area called the El Toro Primary Aquifer System. Groundwater is produced from the following water-bearing geologic units: the Aromas Sands, the Paso Robles Formation, and the Santa Margarita Sandstone. These water-bearing geologic units are grouped together to form the El Toro Primary Aquifer System (GeoSyntec, 2007). These formations are grouped into one functional primary aquifer due to many wells being screened across more than one formation in this area. The longer screen lengths allow for better well yields as this design accesses more saturated thickness of the aquifer.

The shallowest water-bearing sediments within the Corral de Tierra Area are thin and occur along stream corridors. These sediments range from 0 to 120 feet thick and are a part of the Holocene alluvium unit (GeoSyntec, 2007). The geologic map in Figure 4-2 shows this unit as Q; the cross-sections in Figure 4-14 through Figure 4-18 show this unit as Qal and Qof. Several small domestic wells draw groundwater from these local alluvial aquifers, but these volumes of groundwater are minimal (GeoSyntec, 2007). Since this volume of groundwater is neither economic nor significant, these shallow sediments are not considered a principal aquifer, nor are they included in the El Toro Primary Aquifer System. Groundwater in these sediments is hydraulically connected to both the small streams found in the area and the principal aquifer due to a lack of continuous or regional aquitard to interrupt infiltration and percolation (El Toro Creek, San Benancio Gulch, Watson Creek, and Calera Creek; see Section 4.3) (GeoSyntec, 2007).

Beneath the shallow sediments, the following principal aquifer is recognized as the distinguishing hydrostratigraphic feature of this area:

- El Toro Primary Aquifer System

Immediately outside the southern end of the Subbasin, small amounts of groundwater are also produced from the Monterey Formation and the unnamed sandstone, which underlies the Monterey Formation (Anderson-Nichols and Co., 1981). Additional information regarding hydrogeology of these formations can be found in the *El Toro Groundwater Study* and the *Seaside Groundwater Basin Modeling and Protective Groundwater Elevations* report (Geosyntec, 2007; HydroMetrics, 2009). This volume of groundwater is neither economic nor significant; there is no known extraction from the unnamed sandstone within the Corral de Tierra Area. Additionally, the Monterey Formation is defined as the bottom of the Subbasin. As such, neither the Monterey Formation nor the unnamed sandstone is considered a principal aquifer, nor are they included in the El Toro Primary Aquifer System.

4.2.2.2.1 El Toro Primary Aquifer System

The El Toro Primary Aquifer System is comprised of the Aromas Sands, the Paso Robles Formation, and the Santa Margarita Sandstone together. Many production wells are screened across more than one unit in the Corral de Tierra Area, thereby causing the hydrostratigraphy to effectively function as one aquifer.

Within the Corral de Tierra Area, the eolian Aromas Sands deposits are up to 200 feet thick and comprise the hills in the Area. The Paso Robles Formation comprises a series of nonmarine, semi-consolidated continental deposits that consist of fine to coarse-grained sands and gravels of Plio-Pleistocene age. Due to local variations of conformability and similarity of sediments, these units are sometimes referred to collectively as continental deposits (GeoSyntec, 2007). The geologic map in Figure 4-2 shows the Aromas Sand and Paso Robles Formation units as Qae and QT, respectively. The Aromas Sand and Paso Robles units are grouped together and shown on the cross-sections as undifferentiated Qtc.

The Paso Robles Formation is frequently found at the surface in the Corral de Tierra Area. The uppermost 200 feet of the Paso Robles Formation deposits are recognized as forming much of the 400-Foot Aquifer in the greater Salinas Valley Groundwater Basin (Harding ESE, 2001). The remaining portions of the Paso Robles Formation form portions of the Deep Aquifers closer to the coast. Erosion has impacted the available thickness of the Paso Robles Formation. The transition between the outcropped locations in the Corral de Tierra Area to the subterranean portions in the Marina-Ord area is not well understood due to the lack of available data through the Fort Ord area. Subsequently, the relationship to the 400-Foot Aquifer through this area is not yet defined.

The Santa Margarita Sandstone is a Miocene-aged, marine, white, thick and locally cross-bedded, very fine to coarse-grained sandstone with an average thickness of 100 to 300 feet in the Subbasin. The geologic map in Figure 4-2 shows this unit as Msm. In the geologic cross-sections, this unit is shown as Tsm. The Santa Margarita Sandstone correlated with the Deep Aquifers closer to the coast, and where it is encountered at significant depth from the surface. However, there are portions of the Santa Margarita Sandstone that crop out in the hills northwest of highway 68, which is more northwest than the cross-sections shown in Figure 4-27 and Figure 4-28. This exemplifies the extent to which structural deformation has shaped this region's hydrostratigraphy and added complexity to understanding the principal aquifers across the Subbasin.

Recharge to the El Toro Principal Aquifer System is through precipitation and through the streambeds and alluvial sediments. Groundwater flow direction is generally northward and towards heavy pumping centers like the Laguna Seca region and the lower Corral de Tierra Canyon region.

The primary use of groundwater from the El Toro Primary Aquifer System is urban (municipal and domestic), with minimal agricultural supply.

4.2.2.3 Interconnectivity

Hydrostratigraphy in the Marina-Ord Area consists of a series of laterally continuous aquifers consistent with the aquifers that form the distinguishing features of the northern Salinas Valley. The aquifers that have historically been identified in the Marina-Ord Area in previous reports include the unconfined Dune Sand Aquifer and the confined aquifers known as the 180-Foot Aquifer, the 400-Foot Aquifer, and the Deep Aquifers. Within the southern Corral de Tierra Area, the aquifers have historically been described by their geologic names, such as the Aromas Sand, Paso Robles Formation, and Santa Margarita Sandstone (Geosyntec, 2007; Yates 2005). Based on the best available information, these geologic formations are grouped together to form the El Toro Primary Aquifer System for the Corral de Tierra Area, which is described in more detail below. These geologic formations also comprise portions of the 400-Foot Aquifer and the Deep Aquifers in the northern Salinas Valley including the Marina-Ord Area. Even though the geology is the foundation for the principal aquifers of the Subbasin, the principal aquifers are not solely determined by the geologic formations. These relationships will be described in more detail in the sections below.

4.2.3 Structural Restrictions to Flow

There are no known structural restrictions to flow beneath the Marina-Ord Area.

A buried trace of the Reliz Fault (also known as the Reliz-King City Fault or King City Fault) has been said to generally align with the boundary between the Monterey Subbasin and the 180/400-Foot Aquifer Subbasin. However, the location of this fault is poorly constrained or defined. Beneath the bottom of the Subbasin, the Monterey Formation is displaced downward on the northeast side of the Reliz Fault by as much as 1,000 ft (Durbin, 2007). There is no sign of the fault affecting “late Pleistocene or younger sediments” (HLA, 1994; Feeney and Rosenberg, 2003). This fault does not appear to impede groundwater flow in the Dune Sand Aquifer, the 180-Foot Aquifer, or the 400-Foot Aquifer, based on observed groundwater elevation and seawater intrusion conditions across the Subbasin boundary (see Chapter 5).

The Corral de Tierra Area is surrounded by several structural features. It is bounded on the east by the Reliz Fault and the Corral de Tierra Fault to the southwest (GeoSyntec, 2007). The Harper Fault is between these two other faults, closer to the Reliz Fault (GeoSyntec, 2007). All of these faults strike to the northwest and steeply dip to the northeast. A northeast striking syncline occurs roughly along Highway 68. A deeper anticlinal feature is shown in Figure 4-2 near San Benancio Creek and appears to be orthogonal to the syncline, which parallels Highway 68 (GeoSyntec, 2010). Additional east-trending anticlines are shown near the boundary between the Seaside Subbasin and the Corral de Tierra Area. Despite all structural features which bound and deform the Corral de Tierra Area, none seem to indicate any barrier to flow to the rest of the Monterey Subbasin, or to the neighboring Seaside or 180/400-Foot Aquifer Subbasins. Rather, the corner of the Seaside and Corral de Tierra boundary seems to be a location of divergence of groundwater flow, where some groundwater continues to the Seaside Subbasin by way of the Laguna Seca area, and some groundwater continues to the Marina-Ord Area by way of the Fort Ord National Monument, as shown in Chapter 5. This corner features a dip-rise-dip appearance on the surface of the Monterey Formation.

4.2.4 General Water Quality

This section presents a general discussion of the natural fresh groundwater quality in the Monterey Subbasin, focusing on general geochemistry. The distribution and concentrations of specific constituents of concern, including seawater intrusion, are discussed further in Chapter 5. This discussion is based on data from previous reports. Key diagrams are included in Appendix 4-A.

4.2.4.1 Marina-Ord Area

Dune Sand Aquifer

Groundwater in the Dune Sand Aquifer has a sodium-chloride chemical character. Groundwater in this aquifer is primarily fresh; minimal seawater intrusion has occurred in this aquifer.

180-Foot Aquifer

Water quality in the 180-Foot Aquifer beneath the Marina-Ord Area is distinct from the water quality in the Salinas Valley and has a more sodium-chloride chemical character (i.e., a higher proportion of sodium and chloride) (HLA, 1994). West of the SVA, groundwater quality is similar throughout the combined Dune Sand Aquifer and 180-Foot Aquifer (HLA, 1994). Groundwater in both aquifers is likely recharged from precipitation infiltrating through similar geologic materials.

The Dune Sand Aquifer contributes recharge to the 180-Foot Aquifer, as groundwater from this aquifer flows westward until it reaches the SVA, after which it turns eastward within the 180-Foot aquifer. While seawater intrusion has occurred in the lower 180-Foot Aquifer in the northern portion of the Subbasin, groundwater in the upper 180-Foot Aquifer remains fresh.

400-Foot Aquifer

Water quality in the 400-Foot Aquifer is chemically distinct from the water quality of the overlying Dune Sand and 180-Foot Aquifer. The 400-Foot Aquifer has a calcium-bicarbonate chemical character (HLA, 1994). However, some wells have higher concentrations of chloride, which is indicative of seawater intrusion. Wells screened in the gravel layers of the 400-Foot Aquifer have elevated concentrations of sodium. This characteristic is similar to that of wells screened in the gravel layers of the 180-Foot Aquifer and those in the Salinas Valley (HLA, 1994).

Seawater intrusion has occurred in the 400-Foot Aquifer in the northern portion of the Subbasin.

Deep Aquifers

Groundwater in the Deep Aquifer system is distinct from the overlying aquifers, having a sodium-bicarbonate chemical character with relatively low concentrations of calcium (Harding ESE, 2001; Hanson et al., 2002). Water quality generally worsens (i.e., increasing chloride concentrations) with depth (Feeney and Rosenberg, 2003). Ratios of chloride-to-boron and isotope analysis (18O, 2H, 3H, 14C) were used to infer the sources and age of groundwater (Hanson et al., 2002). Groundwater in the upper portions of the Deep Aquifers had similar chloride-to-boron ratios to groundwater in the overlying aquifers, which suggests a similar source of recharge. Groundwater in the deepest sections of the Deep Aquifers is enriched in chloride with respect to surface waters in the Salinas Valley, and isotope analysis indicated the Deep Aquifers were not recharged under recent climatic conditions. Isotope analysis also revealed that the groundwater in the Deep Aquifers might have been recharged thousands of years ago (Hanson et al., 2002).

No seawater intrusion has been observed in the Deep Aquifers.

4.2.4.2 Corral de Tierra Area

Groundwater in the El Toro Primary Aquifer System has an intermediate chemical character (no dominant cation or anion) but the chemical composition varies slightly between lithologic units. Uniform moderate to high TDS concentrations were found throughout the El Toro Primary Aquifer System, which supports the hydraulically connected geologic units. Isotope analysis further indicates that groundwater throughout the El Toro Primary Aquifer System has similar recharge sources (Geosyntec, 2007).

4.2.5 Aquifer Properties

4.2.5.1 Marina-Ord Area

Hydraulic conductivity information of the aquifers underlying the Marina-Ord Area is obtained from previous reports and presented below. Transmissivity information is included in Appendix 4-A.

Dune Sand Aquifer

The measured horizontal hydraulic conductivity of the Dune Sand Aquifer ranges from 0.14 to 120 feet per day (ft/d), and vertical conductivity ranges from 0.6 to 4.0 ft/d (HLA, 1994; HLA, 1999; MACTEC, 2006; HydroGeoLogic, Inc., 2006; Jordan et al., 2005). Measured horizontal hydraulic conductivity of the Dune Sand Aquifer is shown on Figure 4-20.

180-Foot Aquifer

Measured horizontal hydraulic conductivities in the 180-Foot Aquifer in the Fort Ord area range from 1.7 to 390 ft/d (HLA, 1994; HLA, 1999; MACTEC, 2006; HydroGeoLogic, Inc., 2006; Jordan et al., 2005). Measured horizontal hydraulic conductivities of the 180-Foot and 400-Foot Aquifers are shown on Figure 4-21.

400-Foot Aquifer

Measured horizontal hydraulic conductivities in the 400-Foot Aquifer in the Fort Ord area range from 33 to 237 ft/d. MCWD's production wells MCWD-29, MCWD-30, and MCWD-31 have specific capacities ranging from 70 gallons per minute per foot (gpm/ft) to 127.3 gpm/ft (MCWD, 2019).

Deep Aquifers

Measured horizontal hydraulic conductivities in the Deep Aquifers are generally lower than the overlying 180-Foot and 400-Foot Aquifers. The measured horizontal hydraulic conductivity in Deep Aquifers ranges from 2.2 to 37 ft/d (Figure 4-22). Specific capacities of MCWD's Deep Aquifer wells range from 10.8 gpm/ft to 22.5 gpm/ft (MCWD, 2019).

Age dating of groundwater by USGS indicates that groundwater in the Deep Aquifers near the Monterey Coast may be 25,000 to 30,000 years old (Hanson et al., 2002). An interval with dated marine water was found at approximately 1,000 ft bgs in this area. ~~MCWRA agreed that additional~~A study to assess the potential recharge to this aquifer zone ~~was~~ is ~~needed but no study or funds was~~ in progress, and a request of Statements of Qualifications (RFQ) was released in September 2021(SVBGSA, 202~~0~~1).

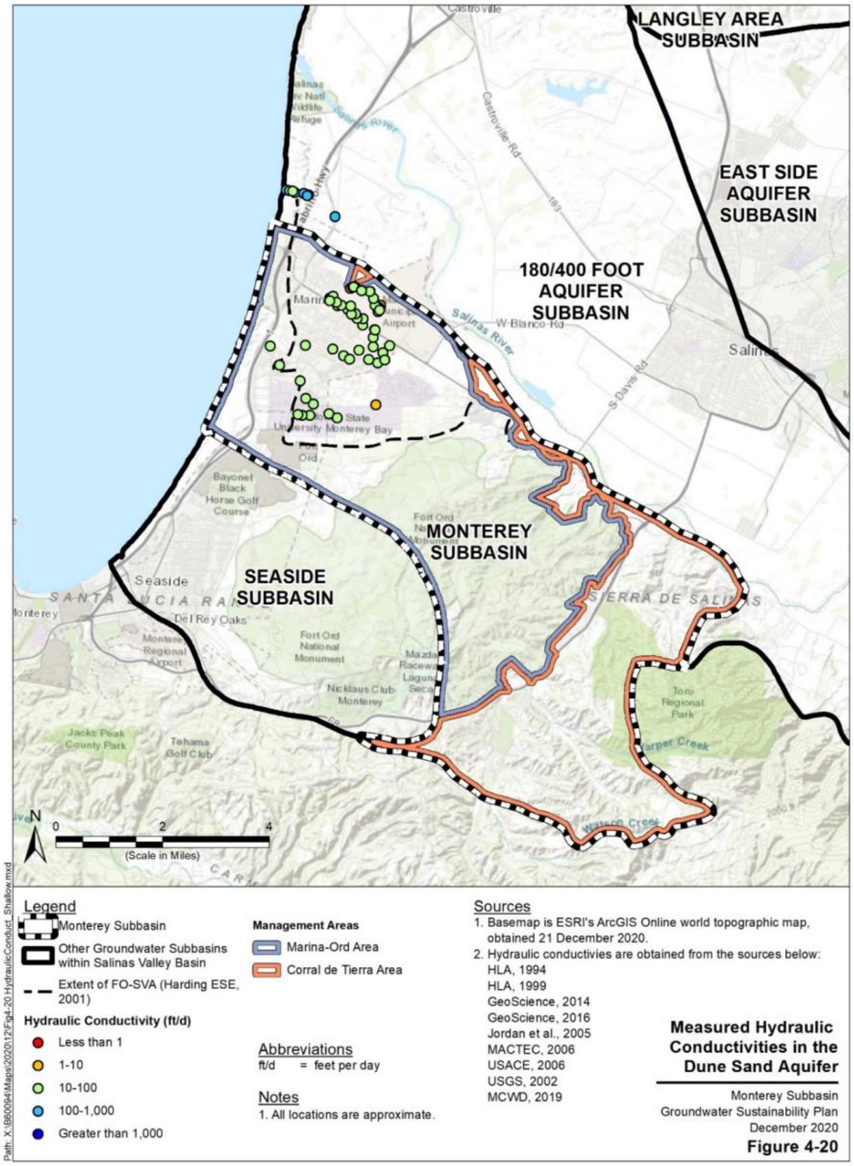


Figure 4-20. Measured Hydraulic Conductivities in the Dune Sand Aquifer

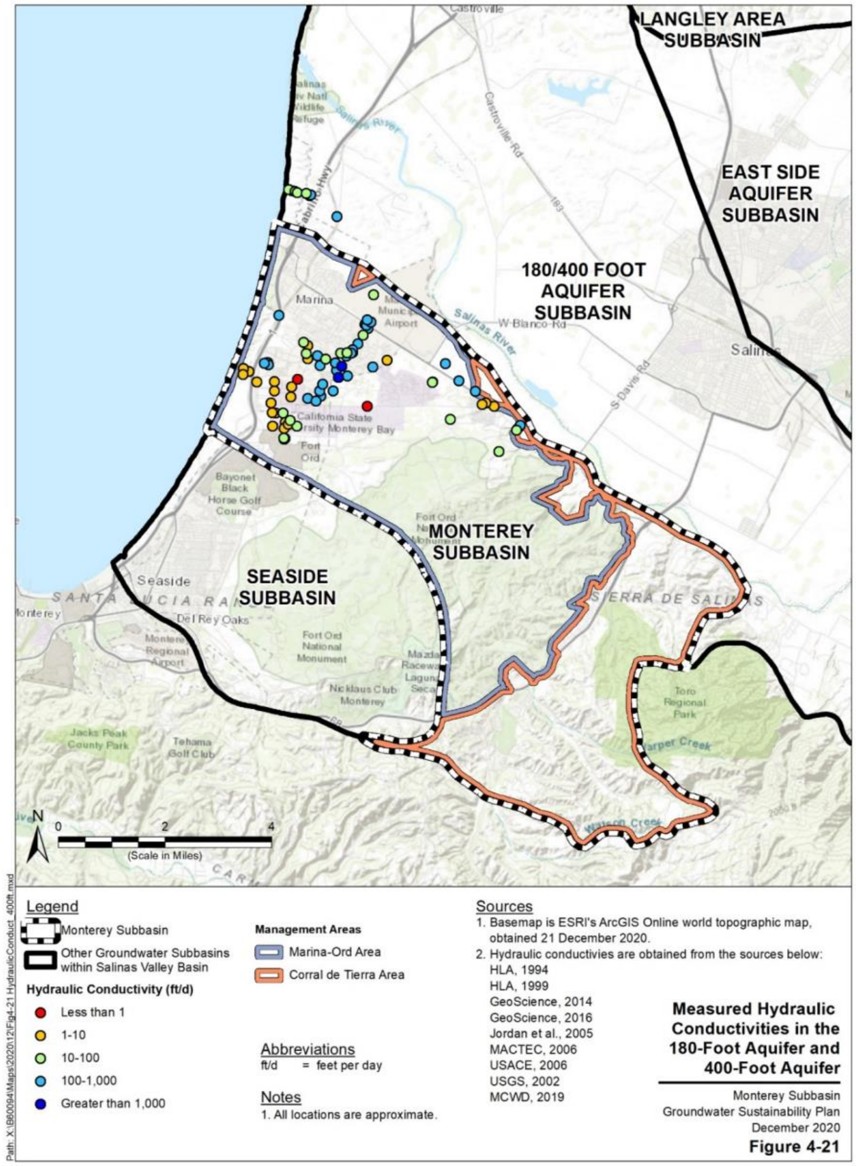


Figure 4-21. Measured Hydraulic Conductivities in the 180-Foot Aquifer and 400-Foot Aquifer

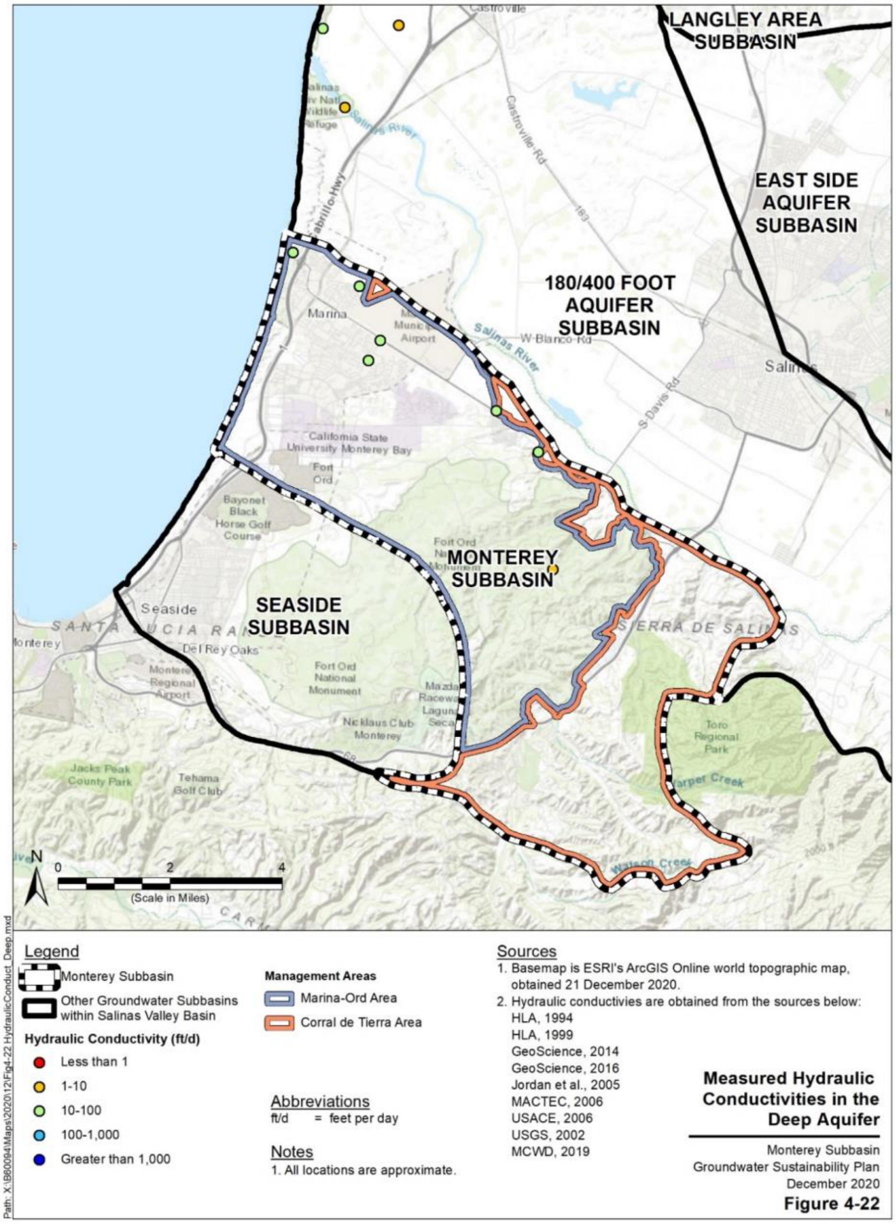


Figure 4-22. Measured Hydraulic Conductivities in the Deep Aquifers

4.2.5.2 *Corral de Tierra Area*

The most comprehensive compilation of hydraulic conductivities in the Corral de Tierra Area comes from the *Seaside Groundwater Basin Modeling and Protective Groundwater Elevations* (HydroMetrics, 2009). This study describes a model that covers the adjudicated Seaside Subbasin and the Monterey Subbasin. This study collected previously published hydraulic conductivity values for the geologic units encountered in the region. The model separates the aquifer by geologic formation, and Table 4-2 shows hydraulic conductivity estimated for the Paso Robles Formation and the Santa Margarita Sandstone.

The study also estimated storage coefficients, which relate to an aquifer's ability to store groundwater for each of the principal aquifers. These include specific yield (set at a value of 0.08 for the unconfined aquifers) and specific storage (set at a value of 0.0006 for the confined aquifers) (HydroMetrics, 2009). These values were selected for the Seaside model. Specific storage values range from 5×10^{-5} to 5×10^{-3} for confined aquifers, and specific yield values may range from 0.1 to 0.01 in unconfined aquifers (Todd, 1980).

Table 4-2. El Toro Primary Aquifer Hydraulic Conductivity Values (modified from HydroMetrics WRI, 2009)

Principal Aquifer	Geologic Formation	Hydraulic Conductivity (feet per day)	Source	Reference
El Toro Primary Aquifer System	Paso Robles	20	Pump Test	Fugro West, Inc., 1997
		2	Model Calibration	Yates et al., 2005
	Santa Margarita	63	Pump Test	Fugro West, Inc., 1997
		3-5	Model Calibration	Yates et al., 2005

Since many wells are screened across both the Paso Robles Formation and the Santa Margarita Sandstone, aquifer properties for the El Toro Primary Aquifer System reflect a composite of properties (GeoSyntec, 2007). The saturated thickness of the El Toro Primary Aquifer System is greatest near highway 68, as shown by high well yields and significant storage (GeoSyntec, 2007).

4.3 Surface Water Bodies

Surface water features and subwatersheds at the 12-digit Hydrological Code (HUC-12) level within the Subbasin are shown on Figure 4-23.

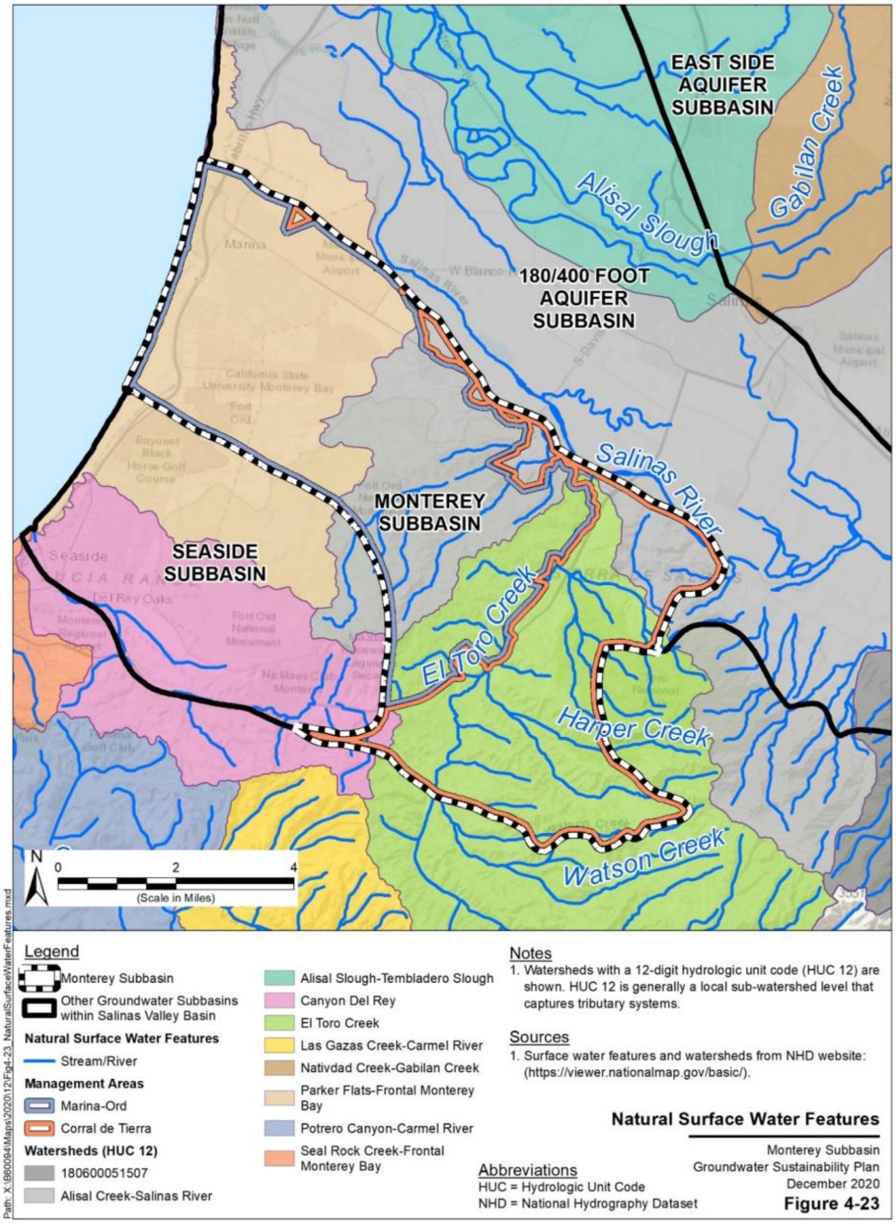


Figure 4-23. Natural Surface Water Features

Coastal areas of the Subbasin drain toward Monterey Bay. Runoff is minimal due to the high rate of surface water infiltration into the permeable dune sand. Consequently, well-developed natural drainages are absent throughout much of this area (Harding, 2004).

Small intermittent streams found in the Subbasin include the San Benancio Gulch, Watson Creek, and Calera Creek (GeoSyntec, 2007). These streams generally flow northeastward and are tributaries to the Salinas River. Flows in these creeks respond rapidly to rainfall, and they are usually dry in the summer months. These creeks have a “flashy” nature and readily lose water to streambed seepage. (Hydrometrics, 2009). These streams flow less than 25 percent of the year (GeoSyntec, 2007).

El Toro Creek is a perennial stream below the confluence with Watson Creek below the Corral de Tierra golf course (Feikert, 2001). Recorded streamflows at USGS gage 11152540 from 1961 to 2001 indicate a mean annual streamflow of 1,590 AFY (GeoSyntec, 2007). This means annual streamflow was calculated for the entire record from 1961 to 2001. However, El Toro Creek did not record flow every year, with notable dry periods from 1985 to 1992 (Figure 4-24).

Yates and others (2005) concluded that local streams (i.e., El Toro Creek and smaller streams) contribute insignificantly to groundwater recharge. Along limited reaches, these streams gain streamflow from groundwater discharge. However, the stream-aquifer exchanges are not thought to be significant to either the groundwater budget or to the response of the groundwater basin to pumping (Durbin, 2007).

Due to the intermittent nature and minimal amount of streamflow, there are no surface water rights registered with the SWRCB within the Subbasin.

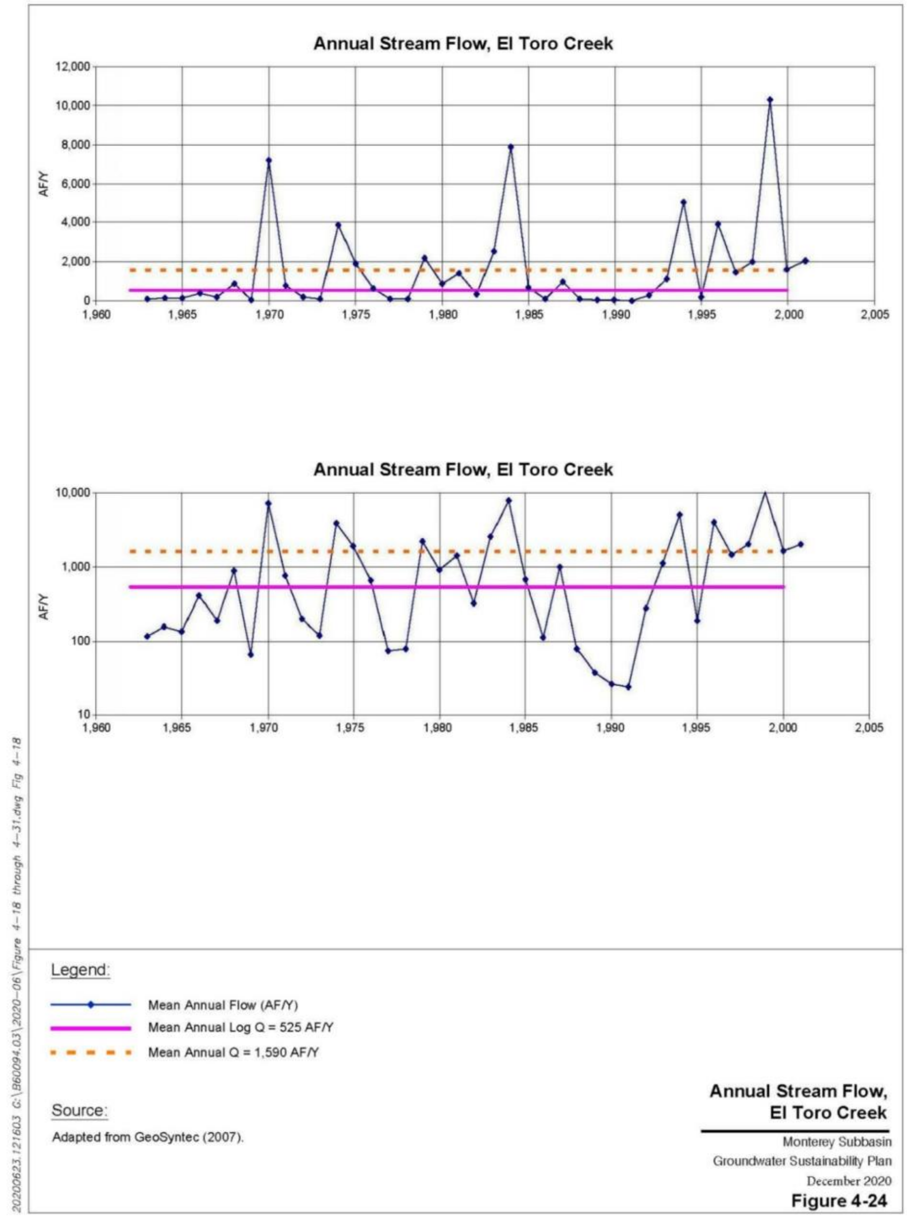


Figure 4-24. Annual Stream Flow, El Toro Creek

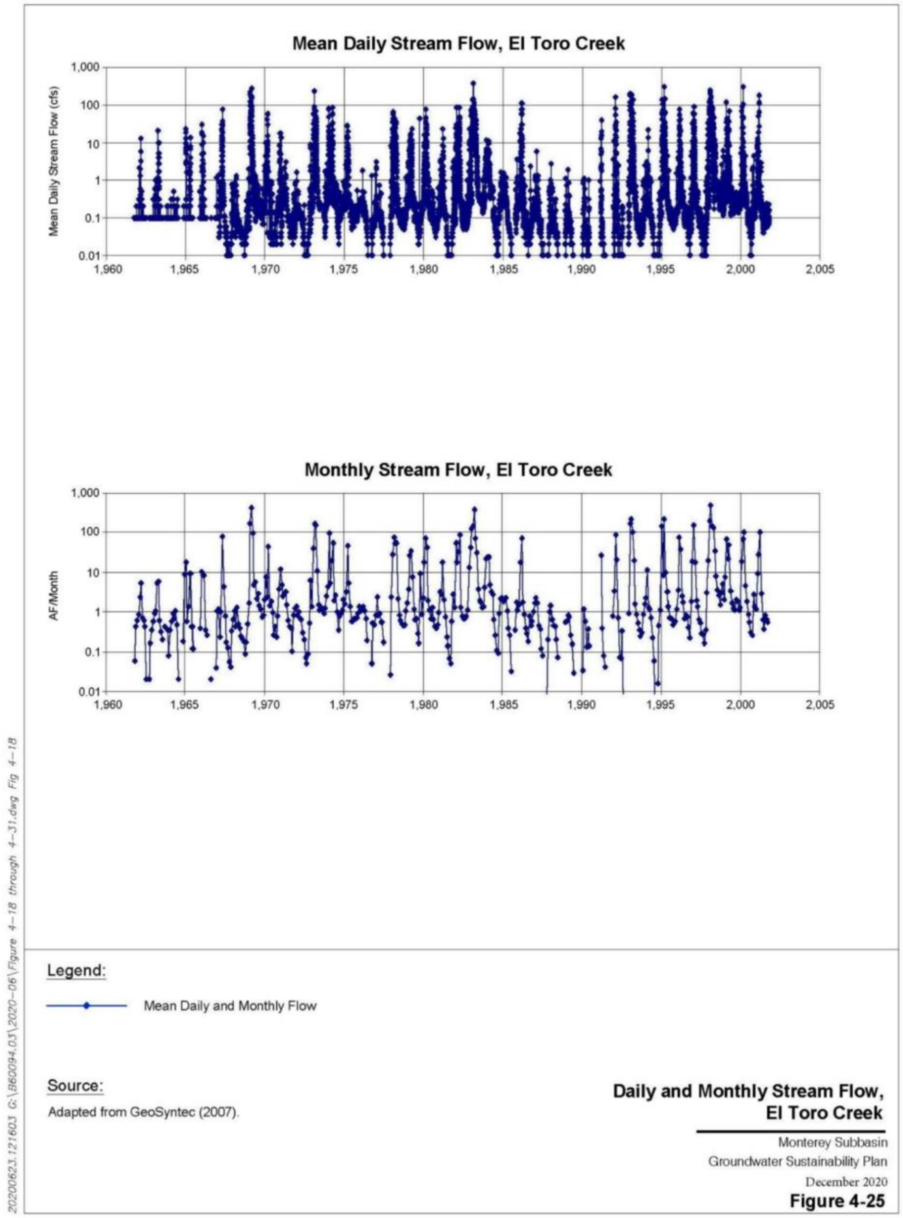


Figure 4-25. Daily and Monthly Stream Flow, El Toro Creek

4.3.1 Source and Point of Delivery for Imported Water Supplies

There are no known sources of imported water for this subbasin. Groundwater is the only source of water for this subbasin.

4.4 Data Gaps

A significant portion of the Subbasin remains undeveloped to date, which includes federal lands located in the Fort Ord hills area and lands in the lower El Toro Creek area (i.e., northern portion of the Corral de Tierra Area). As such, limited to no subsurface information is available in these areas. Regardless, many comprehensive studies have been conducted in areas where groundwater development has been active; and the hydrogeologic conceptual model for those areas is well developed.

One significant data gap exists in the hydrogeologic conceptual model for the Subbasin. This data gap relates to the location and magnitude of recharge to the Marina-Ord Area Deep Aquifers, one of the major production aquifers within the Subbasin and within other subbasins of the Salinas Valley Groundwater Basin. As described in Chapters 7, the GSP will include ongoing data collection and monitoring that will allow continued refinement and quantification of the groundwater system. Chapter 10 includes activities to address the identified data gaps and improve the hydrogeologic conceptual model.

5 CURRENT AND HISTORICAL GROUNDWATER CONDITIONS

This section presents information on historical and current groundwater conditions within the Subbasin based on available data. The Groundwater Sustainability Agencies (GSAs) gathered information from multiple monitoring agencies within the Subbasin to establish the best comprehensive understanding of the Subbasin's groundwater conditions. Source of data used to inform this assessment includes data from Marina Coast Water District (MCWD), Monterey County Water Resources Agency (MCWRA), Fort Ord, Monterey Peninsula Water Management District (MPWMD), California Department of Water Resources (DWR), United States Geological Survey (USGS), Monterey Peninsula Landfill, and Seaside Groundwater Basin Watermaster records, various state and federal databases, and other reports.

For the purpose of this Chapter:

(a) "Current Conditions" or "Current Period" refers to third-quarter 2017 and second-quarter 2018.

(b) "Historical Conditions" or "Historical Period" refers to Water Years (WY) 2004 through 2018 (i.e., October 2003 through September 2018).

The 15-year Historical Conditions period is used to develop the historical water budget as well as assess groundwater elevation and water quality trends. As discussed further below, this period is climatically close to normal/average rainfall conditions measured in the vicinity of the Subbasin since 1895. It includes a significant drought period between 2012 and 2015, as well as other drier and wetter than normal years. In some cases, other periods of record are also discussed in this section when either (a) the discussion is constrained by the time periods of available datasets (e.g., for land subsidence), or (b) characterization of groundwater conditions is improved by incorporation of data from other time periods.

This chapter summarizes information related to the six sustainability indicators defined under the Sustainable Groundwater Management Act (SGMA), including:

1. Chronic lowering of groundwater levels;
2. Changes in groundwater storage;
3. Seawater intrusion;
4. Groundwater quality;
5. Subsidence; and
6. Depletion of interconnected surface waters.

In addition, the chapter discusses groundwater dependent ecosystems (GDEs). GDEs are not a SGMA-defined sustainability indicator but are an important part of Groundwater Sustainability Plans (GSPs).

As discussed in the Hydrogeological Conceptual Model (HCM), the principal aquifers of the Marina-Ord Area are mostly the same as the layered principal aquifers in the 180/400-Foot

Aquifer Subbasin. The principal aquifer in the Corral de Tierra Area is the El Toro Primary Aquifer System, which combines the water-bearing geologic units into one functional aquifer. These geologic formations are present across the Subbasin and include the Aromas Sands, Paso Robles Formation, and the Santa Margarita Sandstone. However, the Dune Sands and 180-Foot Aquifers, and their unique geology are not present in the Corral de Tierra Area. The hydrologic connection between the Management Areas is undefined with the best available data and information, but the presence of the same geologic unitsaquifer. The Dune Sand and 180-Foot aquifersAquifers of the Marina-Ord Area, and their unique geology are not present in the Corral de Tierra Area. However, the Aromas Sands, Paso Robles Formation, and the Santa Margarita Sandstone are present across the subbasin and are the foundation for the aquifers defined in Chapter 4. The hydrologic connection between these two areas is undefined with the best available data and information, but the presence of the same geologic units indicates some connection. The groundwater conditions outlined below are the best attempt to describe both the unique areas as well as the connection despite the uncertainty and with the understanding that implementation actions will begin to address these data gaps.

5.1 Groundwater Elevations and Flow Direction

Subbasin groundwater elevations are presented using the following methodologies:

- Maps of groundwater elevation contours that show the geographic distribution of groundwater elevations at a specific time. The contours represent lines of equal groundwater elevation in feet above the NAVD88 vertical datum.
- Hydrographs of individual wells that show the variations in groundwater elevation at individual wells over an extended period.
- Vertical hydraulic gradients in a single location that assess the potential for vertical groundwater flow direction.

5.1.1 Data Sources

Groundwater elevations have been assessed based on data collected and compiled from various agencies, including MCWD, MCWRA, Fort Ord, MPWMD, DWR's California Statewide Groundwater Elevation Monitoring (CASGEM) database, USGS, Monterey Peninsula Landfill, and Seaside Groundwater Basin Watermaster. Multiple datasets were reconciled and processed for quality assurance/quality control prior to analysis of groundwater conditions. These "data cleaning" efforts included the identification and removal of potentially erroneous data points through examination of hydrographs and information recorded based on the quality of the measurement. For the purposes of this analysis, the periods of Fall 2017 and Spring 2018 and are used to represent seasonal low and high conditions during the Current Period. They are also considered representative of current land and water use conditions.

5.1.2 Groundwater Elevation Contours and Horizontal Groundwater Gradients

Groundwater elevation contours for each principal aquifer during Fall 2017 and Spring 2018[16] are presented on Figure 5-1 to Figure 5-10. Groundwater flow directions and groundwater levels observed during these periods in the Marina-Ord Area and Corral de Tierra Area are summarized below.

5.1.2.1 Marina-Ord Area

The Principal Aquifers in the Marina Ord Area include: the Dune Sand Aquifer, 180-Foot Aquifer, 400-Foot Aquifer, and Deep Aquifers. In the Marina-Ord Area, the 180-Foot Aquifer contains two distinct layers, known as the upper- and lower- 180-Foot Aquifer. Conditions in both layers of the 180-Foot Aquifer are described herein. Both layers are hydraulically connected to the Principal Aquifer known also known as the 180-Foot Aquifer in the adjacent 180/400-Foot Aquifer Subbasin.

Dune Sand Aquifer

As discussed in Chapter 4 and shown in Figure 5-1 and Figure 5-5, the Dune Sand Aquifer only exists in the Marina-Ord Area within the dune sand deposits located in the western portion of the Subbasin.

- Groundwater elevations in the Dune Sand Aquifer range from 90 ft NAVD88 in the central portion of the Marina-Ord Area to approximately 5 ft NAVD88 near the coast where the Dune Sand Aquifer merges with the upper 180-Foot Aquifer, west of the SVA. Groundwater level data for the Dune Sand Aquifer are limited in the southern portion of the Marina-Ord Area near the Monterey-Seaside Subbasin boundary and at the eastern extent of the dune sands.
- A groundwater divide exists in the Dune Sand Aquifer within the Marina-Ord Area. West of the groundwater divide, groundwater in the Dune Sand Aquifer flows westward towards the Pacific Ocean and recharges the 180-Foot Aquifer where the SVA pinches out. Upon entering the 180-Foot Aquifer, groundwater abruptly reverses direction and flows eastward (i.e., inland). East of the groundwater divide, groundwater in the Dune Sand Aquifer flows to the northeast toward the 180/400-Foot Aquifer Subbasin and the Salinas River.
- During the Current Period, the average magnitude of the horizontal gradient in the Dune Sand Aquifer was approximately 0.011 ft/ft west of the groundwater divide and 0.007 ft/ft east of the groundwater divide.

[16] Data between August 15, 2017 and December 15, 2017, are used to develop groundwater contours for the Fall 2017 season. For wells that have multiple measurements during this period, priority was given to measurements taken closer to August 27, 2017. Data between January 15, 2018 and April 15, 2018, are used to develop groundwater contours for the Spring 2018 season, with priority given to measurements taken closer to March 5, 2018.

180-Foot Aquifer

The 180-Foot Aquifer is subdivided into the upper 180-Foot Aquifer and the lower 180-Foot Aquifer in the Marina-Ord Area, based on the ~~unique~~ stratigraphy described in multiple studies focused on this area (Ahtna Engineering, 2013; Harding ESE, 2001; detailed in Chapter 4). Groundwater elevations and gradients observed in these two zones of the 180-Foot Aquifer are described below.

Upper 180-Foot Aquifer

- Groundwater elevations in the upper 180-Foot Aquifer are highest at the coastline and generally decrease inland to the east/northeast. Flow directions are generally to the northeast toward the 180/400-Foot Aquifer Subbasin.
- In Fall 2017 (Figure 5-2), groundwater elevations range from 5 ft NAVD88 along the coast to -20 ft NAVD88 at the Monterey- 180/400-Foot Aquifer Subbasin boundary. Groundwater elevations are generally higher in Spring 2018. This increase is likely the result of increased recharge and reductions in pumping in the Salinas Valley Basin.
- Groundwater elevations are near sea level at the coastline and are below sea level further inland. This inland gradient allows high salinity water to flow into the Subbasin (see Section 5.3 Seawater Intrusion). However, inflow from the Dune Sand Aquifer protects the upper 180-Foot Aquifer from seawater intrusion.
- During the current period, the average horizontal gradient in the 180-Foot Aquifer was 0.0012 ft/ft in Fall 2017 and 0.0008 ft/ft in Spring 2018 (Figure 5-6).

Lower 180-Foot Aquifer

As discussed in Chapter 4, the lower 180-Foot Aquifer is hydraulically connected to the 400-Foot Aquifer in the Marina-Ord Area due to the discontinuous nature of the 180/400-Foot Aquitard within this region. As such, groundwater elevations and gradients in the lower 180-Foot Aquifer are similar to those in the 400-Foot Aquifer in the Marina Ord Area of the Subbasin, which is further described below.

400-Foot Aquifer

Figure 5-3 and Figure 5-7 show groundwater elevation contours within the 400-Foot Aquifer in the Marina-Ord Area. These groundwater elevations and gradients are consistent with those observed in the lower-180 Foot Aquifer. Groundwater elevations in the 400-Foot Aquifer have been plotted in combination with groundwater elevations within the Paso Robles Aquifer identified in the adjacent Seaside Subbasin. Available data indicates that these aquifers are potentially hydraulically connected. However, there is also a possible connection between the Seaside Subbasin Paso Robles Aquifer with the upper portion of the Deep Aquifers in the Monterey Subbasin.

- Groundwater elevations in the 400-Foot Aquifer are highest in the southern portion of the Monterey Subbasin and generally decrease to the north and east. Flow directions are generally toward the northeast and the 180/400-Foot Aquifer Subbasin. A flow divide occurs along the Monterey-Seaside Subbasin boundary.

- A local groundwater depression exists just north of the Monterey-Seaside Subbasin boundary, where a potential connection between the 400-Foot Aquifer and the Deep Aquifers may be located (see Section 5.1.3).
- In Fall 2017, groundwater elevations in the Marina-Ord Area ranged from 0 ft NAVD88 at the coast to -40 ft NAVD88 at the Monterey- 180/400-Foot Aquifer Subbasin boundary. Groundwater elevations were generally higher in Spring 2018. This increase is likely the result of increased recharge and reductions in pumping in the Salinas Valley Basin.
- Groundwater elevations are near sea level at the coastline and below sea level further inland. Based on available cross-sections (e.g., Harding ESE, 2001; see Chapter 4), the formations that make up this aquifer extend offshore and likely outcrop beneath a veneer of Pleistocene or Holocene marina sediments that is thin (i.e., less than 5 meters) across much of the offshore shelf but thicker (i.e., up to 32 meters) near the Salinas River Delta (Johnson et al., 2016). These conditions allow high salinity water to flow into this aquifer in the northern portion of the Subbasin.
- During the Current Period, the average magnitude of the horizontal gradient in the 400-Foot Aquifer was 0.0011 ft/ft in Fall 2017 and 0.0006 ft/ft in Spring 2018.

Deep Aquifers

As discussed in Chapter 4, the Deep Aquifers consist of multiple aquifers and aquitards that appear to be somewhat hydraulically connected. Given the absence of data for the multiple layers that make up this aquifer, this assessment generally describes conditions in the Deep Aquifers as a whole.

Figure 5-4 and Figure 5-8 show groundwater elevation contours within the Deep Aquifers in combination with groundwater elevation contours within the Santa Margarita Aquifer in the Seaside Subbasin. Available data indicate that these aquifers are potentially hydraulically connected.

- Groundwater elevations in the Deep Aquifers are highest in the southeastern portion of the Marina-Ord Area and generally decrease toward the northwest. Flow directions are generally toward the north, suggesting some recharge from mountain ranges south of the Subbasin and flow into a pumping trough just north of the Monterey-180/400-Foot Aquifer Subbasin boundary near West Blanco Road and Nashua Road. A local groundwater high exists just north of the Monterey-Seaside Subbasin boundary between the Seaside Subbasin and Monterey-180/400-Foot Aquifer Subbasin pumping centers.
- In Fall 2017, groundwater elevations ranged from 160 ft NAVD88 near the southeastern Subbasin boundary to -60 ft NAVD88 in the north near the Monterey/180/400-Foot Aquifer Subbasin boundary. Groundwater elevations were generally higher in Spring 2018.

- During the Current Period, the average magnitude of horizontal gradients in the Deep Aquifers, identified on the basis of contours shown on Figures 5-1 and 5-2, ranged between 0.0006 ft/ft in Fall 2017 to 0.0004 ft/ft in Spring 2018 in the Marina Ord Area. However, since groundwater elevations shown on these figures may represent multiple aquifers within the Deep Aquifers due to varying screen lengths and depths, the direction and magnitude of these gradients may not accurately represent conditions throughout the Deep Aquifers.
- Groundwater elevations in the Deep Aquifers are significantly lower than those in the 400-Foot Aquifer and have been ~~are~~ consistently below sea level since the late 1980s. These data suggest that the Deep Aquifers are at risk of seawater intrusion from locations where these formations outcrop on the ocean floor near the rim of the Monterey Canyon (Hartwell et al., 2015; Johnson et al., 2016) and from leakage from the overlying seawater intruded aquifers.

5.1.2.2 Corral de Tierra Area

Figure 5-9 through Figure 5-10 show groundwater elevation contours within the El Toro Primary Aquifer System in the Corral de Tierra Area. Groundwater in the El Toro Primary Aquifer System generally flows from the south toward the north, northwest, and northeast with a potential groundwater flow divide occurring near the Monterey-Seaside Subbasin boundary in the Laguna Seca area. There may be localized depressions around pumping centers, but there is not sufficient data to show them ~~as shown~~ in the groundwater elevation contours in the following figures. Additionally, the Monterey Formation, which is the bottom of the Subbasin, is uplifted in this locale due to structural deformation and may impact some flow direction. In Fall 2017, the groundwater elevations in the El Toro Primary Aquifer System ranged from approximately 800 ft to -40 ft NAVD88 from south to north.

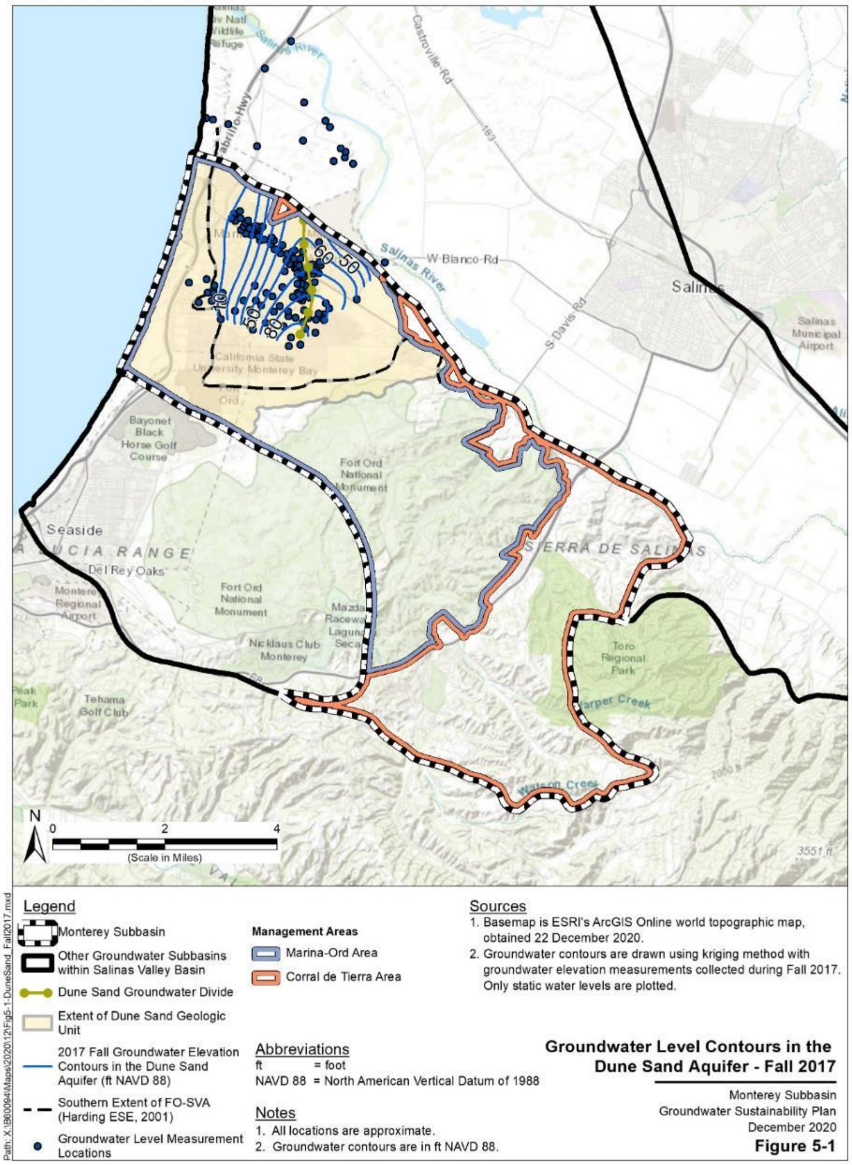


Figure 5-1. Groundwater Elevation Contours in the Dune Sand Aquifer - Fall 2017

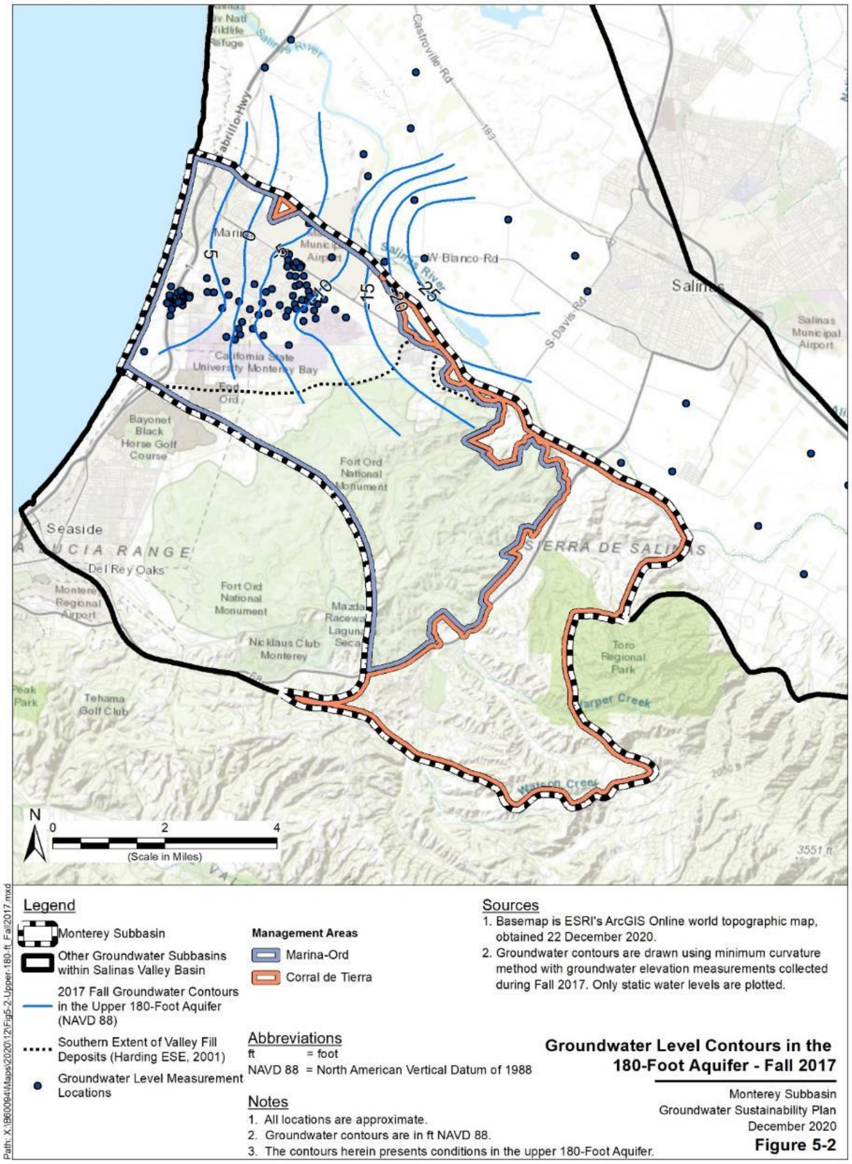


Figure 5-2. Groundwater Elevation Contours in the 180-Foot Aquifer - Fall 2017

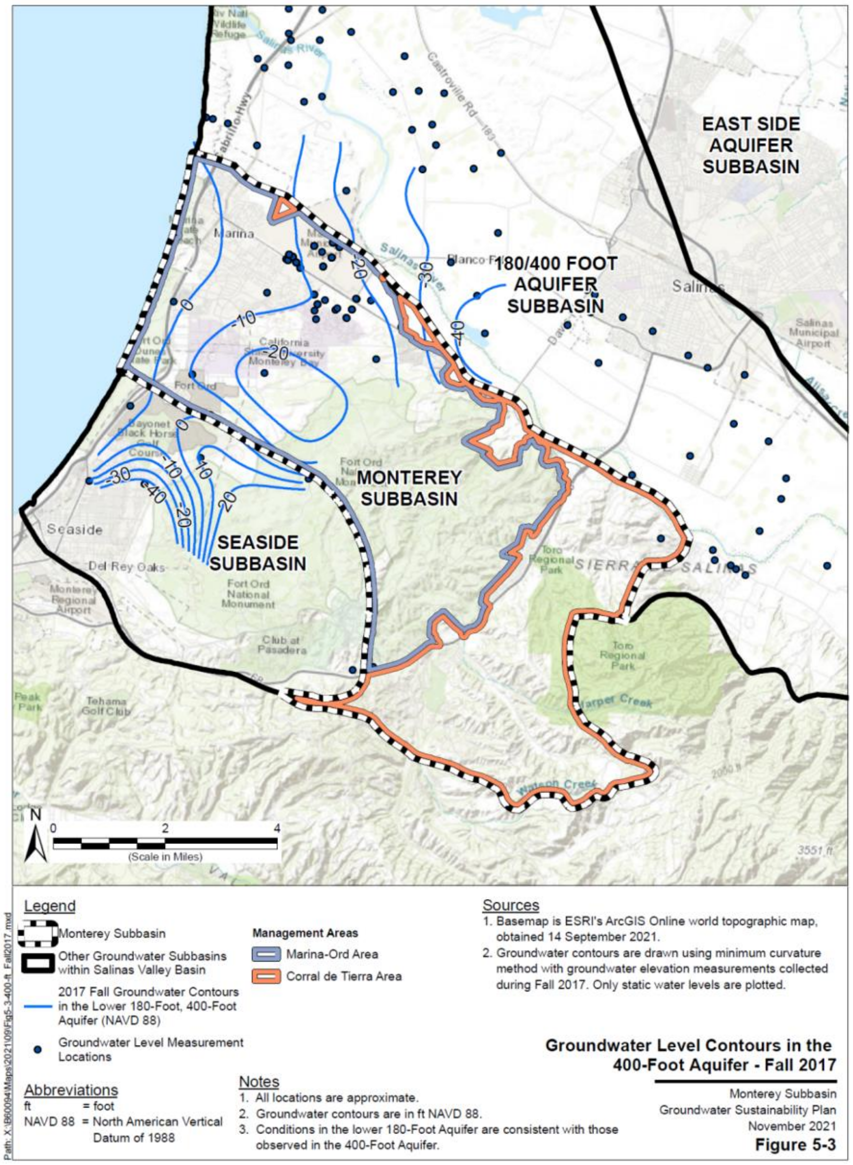


Figure 5-3. Groundwater Elevation Contours in the 400-Foot Aquifer - Fall 2017

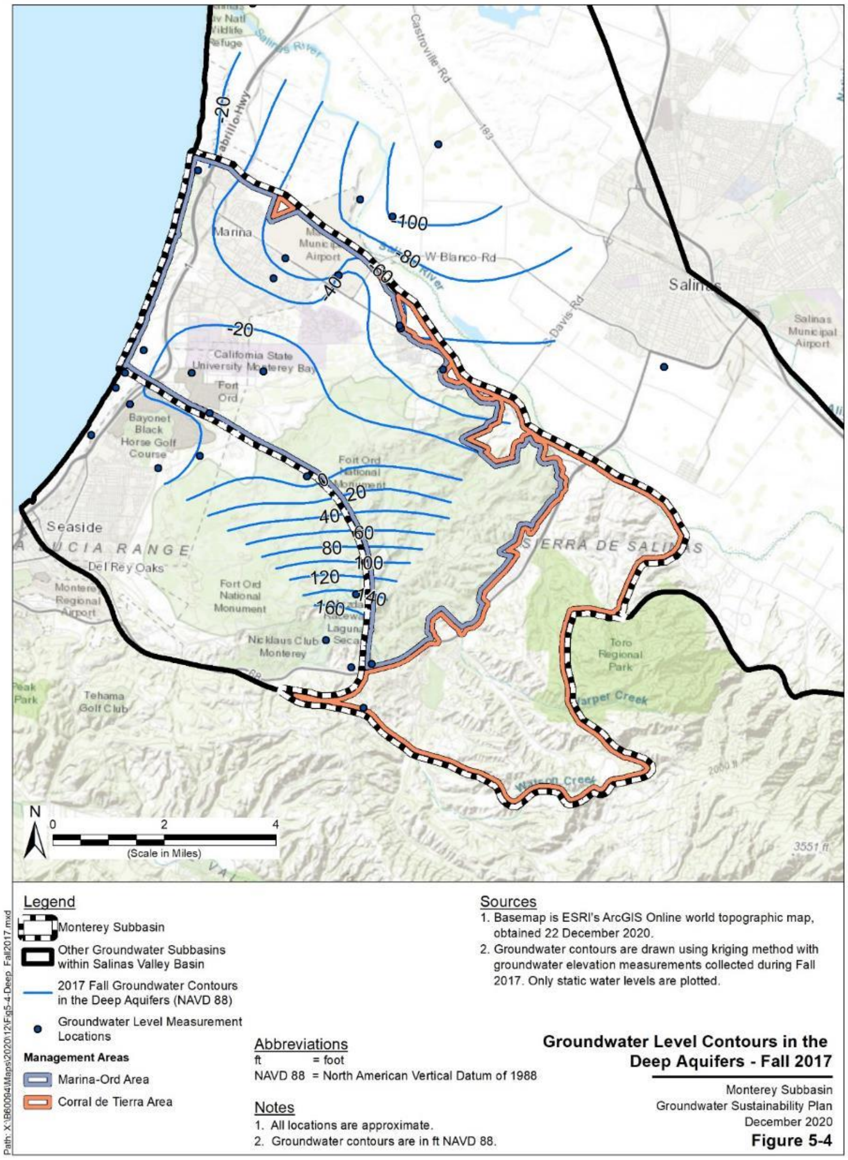


Figure 5-4. Groundwater Elevation Contours in the Deep Aquifers - Fall 2017

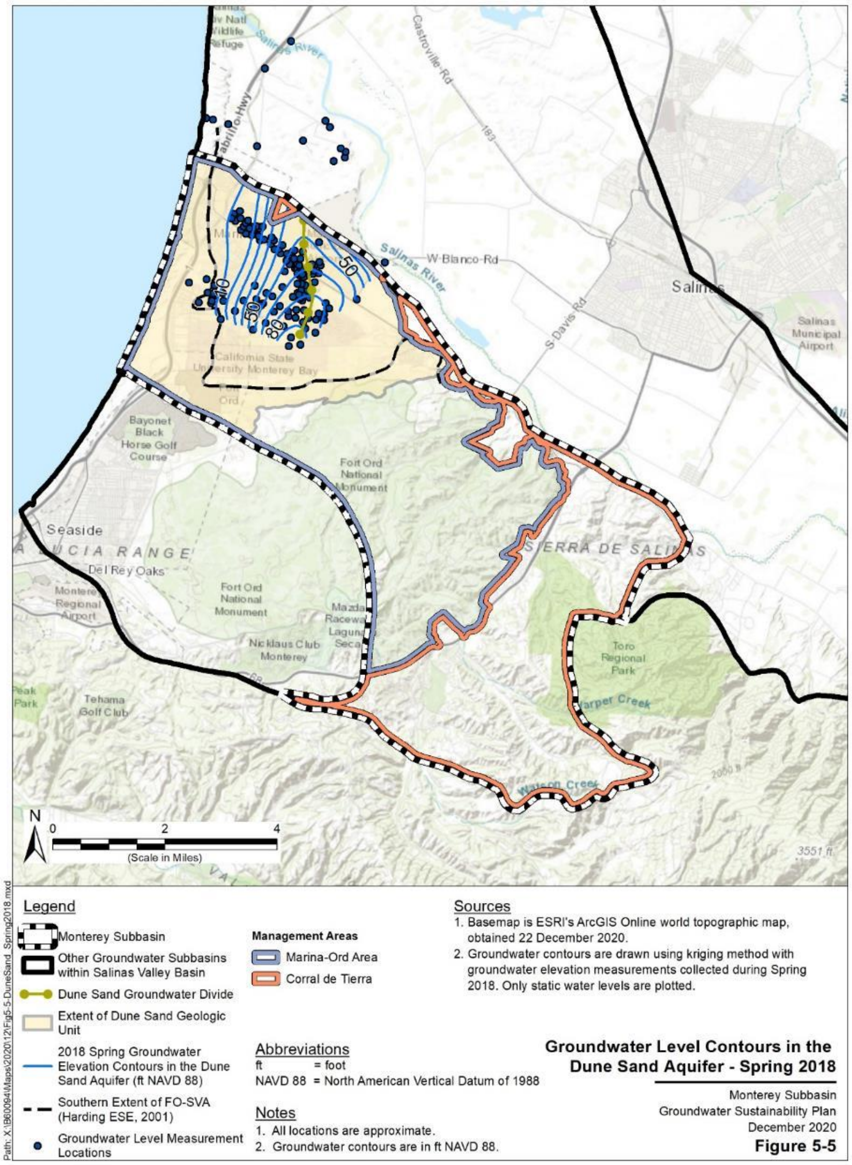


Figure 5-5. Groundwater Elevation Contours in the Dune Sand Aquifer – Spring 2018

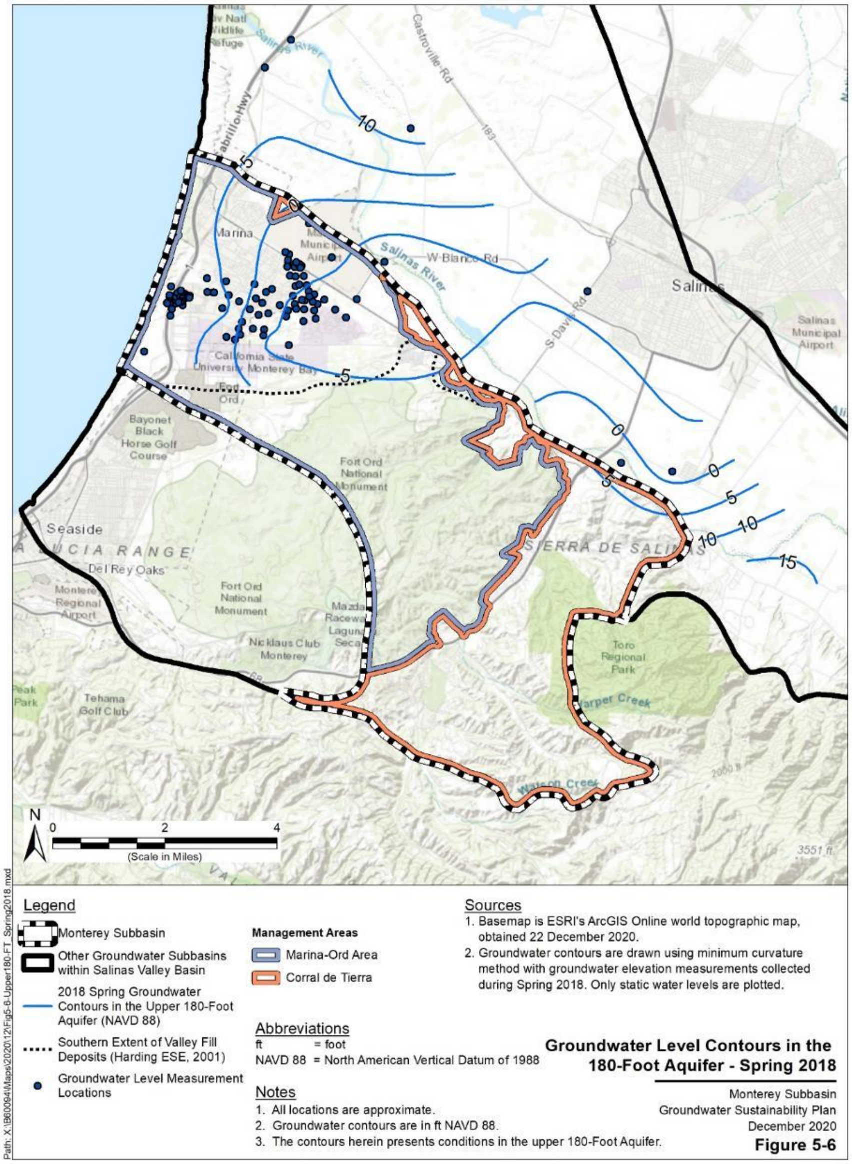


Figure 5-6. Groundwater Elevation Contours in the 180-Foot Aquifer – Spring 2018

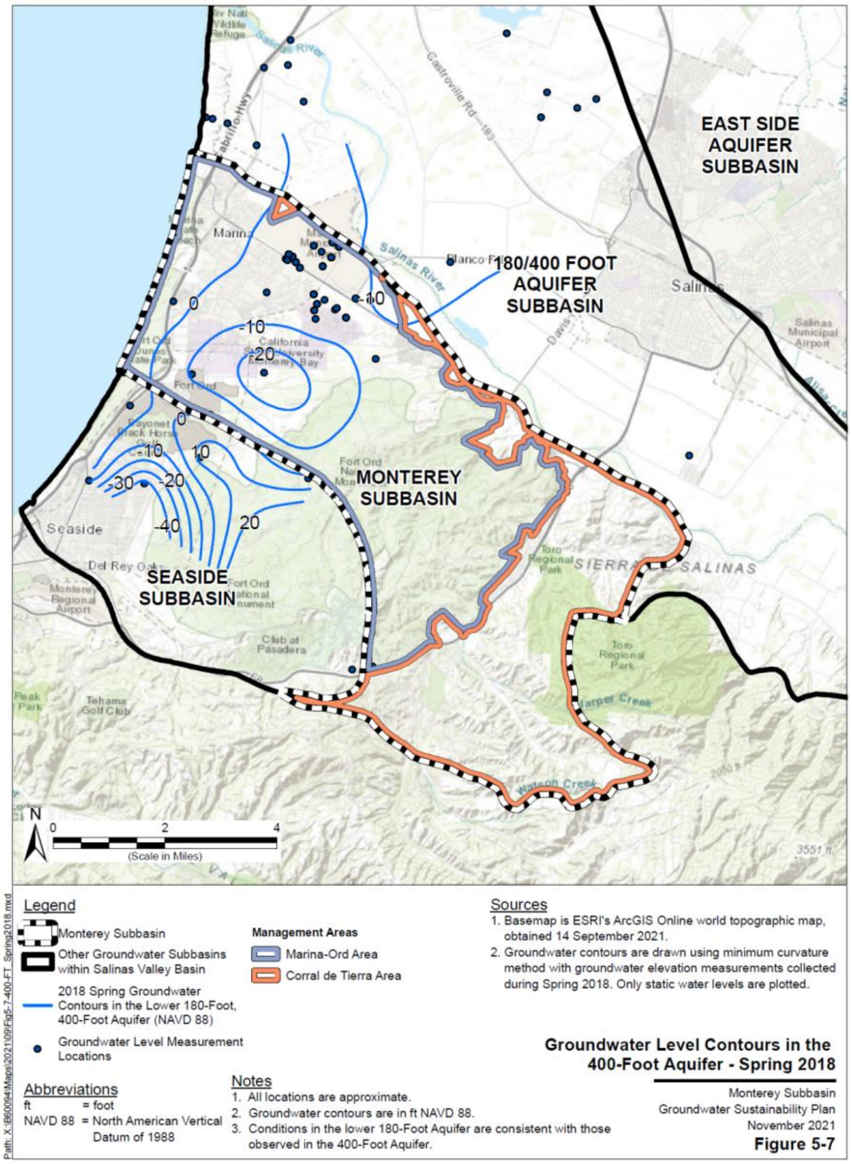


Figure 5-7. Groundwater Elevation Contours in the 400-Foot Aquifer – Spring 2018

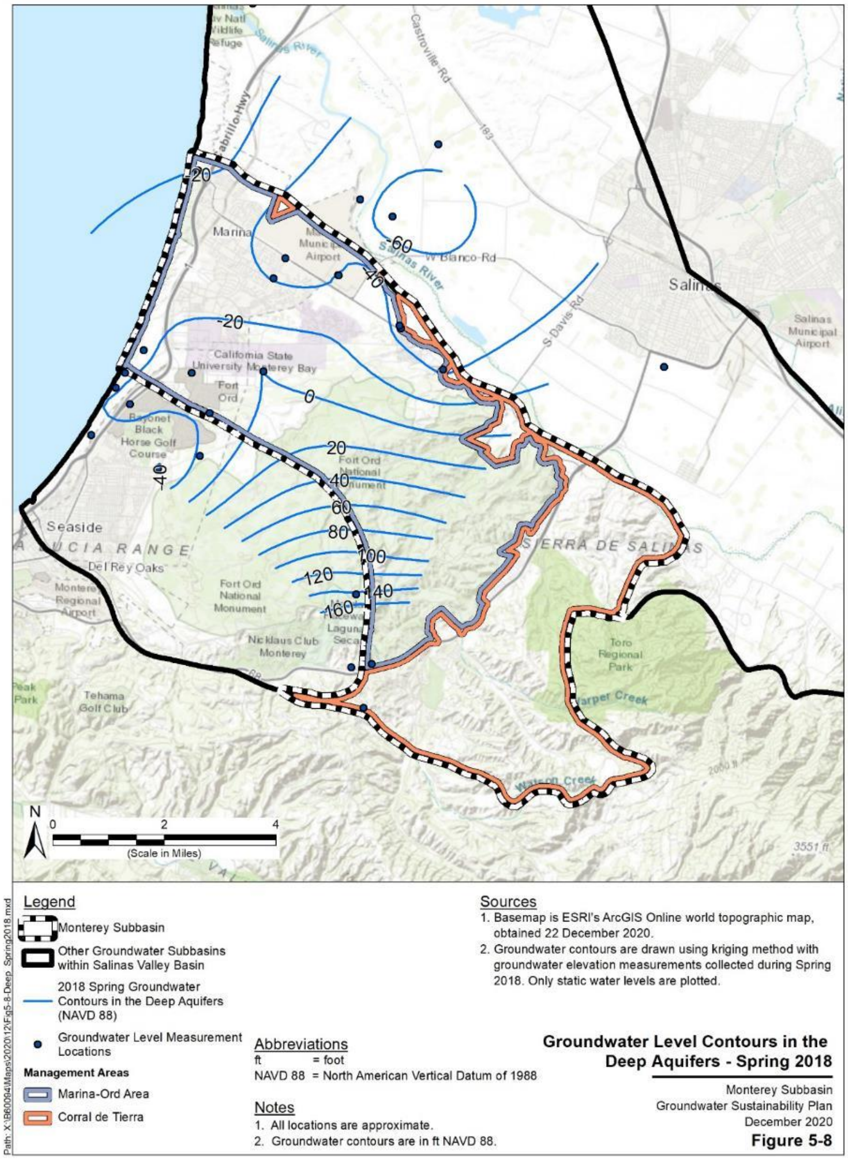


Figure 5-8. Groundwater Elevation Contours in the Deep Aquifers – Spring 2018

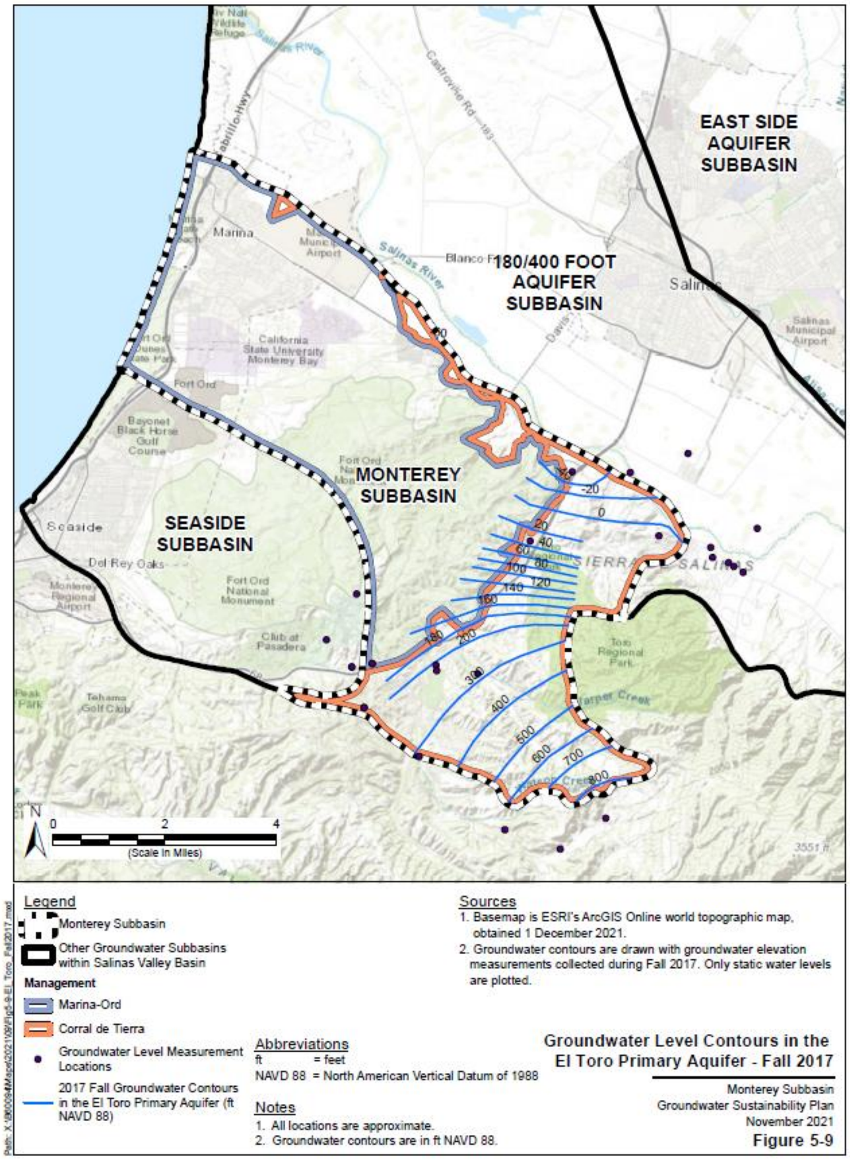


Figure 5-9. Groundwater Level Contours in the El Toro Primary Aquifer - 2017 Fall

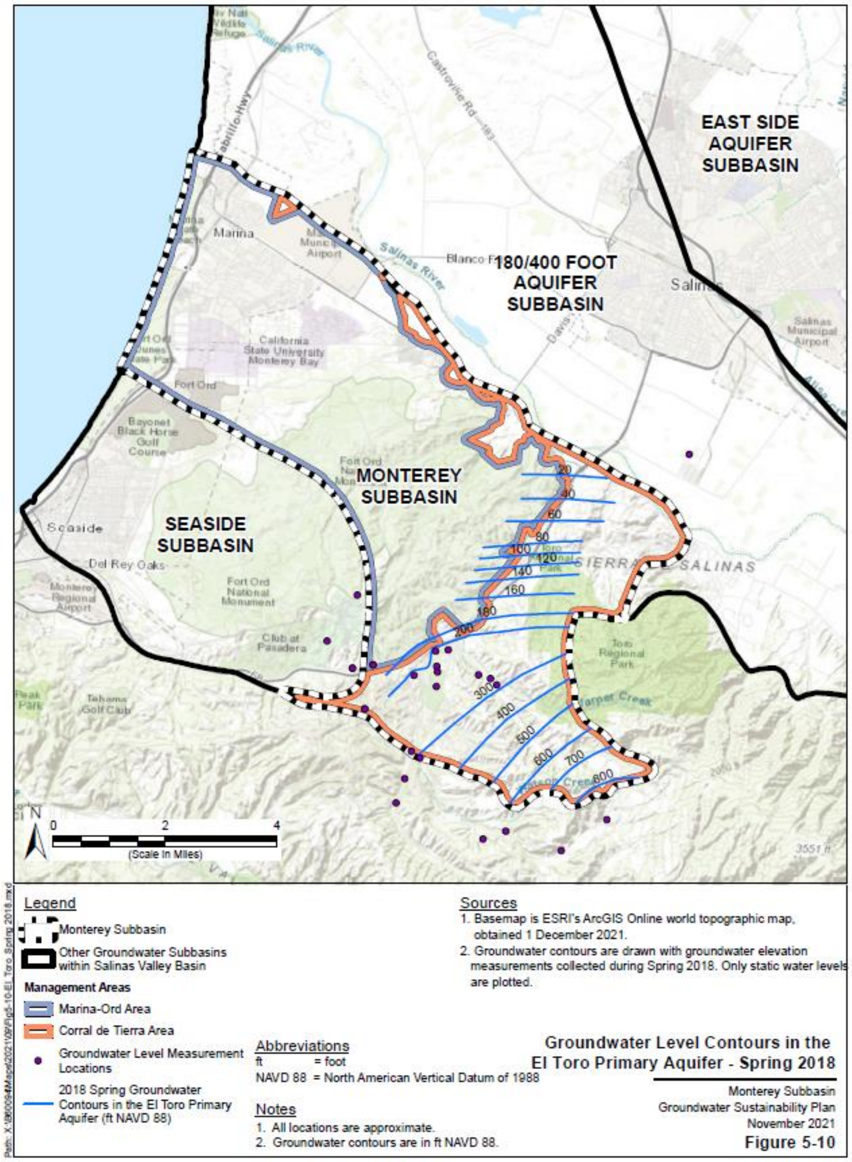


Figure 5-10. Groundwater Level Contours in the El Toro Primary Aquifer - 2018 Spring

5.1.3 Long-Term Groundwater Elevation Trends

Representative temporal trends in groundwater elevations can be assessed with hydrographs that plot changes over time. Wells were selected for hydrograph analysis based on their length of record and location. Wells believed to be representative of conditions across various areas of the Subbasin were selected. Additionally, a linear regression of the water level data over a 15-year period (i.e., 2004 through 2018) was used to evaluate long-term groundwater elevation trends for selected wells.

Figure 5-11 through Figure 5-15, and Figure 5-17 depict the locations and hydrographs of representative wells within each principal aquifer and their hydrographs. The large versions of the hydrographs for these wells, as well as other representative monitoring wells, are included in Appendix 8-A. The following sections summarize trends in groundwater elevations within each principal aquifer within the Marina-Ord Area and the Corral de Tierra Area.

5.1.3.1 Marina-Ord Area

Dune Sand Aquifer

- Groundwater elevations in the Dune Sand Aquifer have been generally stable for over three decades. and do not show large seasonal variations, unlike the groundwater elevations in the deeper aquifers 180-Foot, 400-Foot and Deep Aquifers which are caused byshow large seasonal variations due to agricultural pumping seasonally relative to deeper aquifersin the neighboring Salinas Valley groundwater subbasins. Consistent with most shallow unconfined aquifers that receive direct recharge from rainfall, water levels in the Dune Sand Aquifer increase and decrease during extended wet and dry periods. Most wells in this aquifer show slightly decreasing trends during the past 15 years following a prior period of increasing water levels. Linear trendline slopes over this period ranged from -0.761 feet per year (ft/yr) to 0.0222 ft/yr (Figure 5-11).

180-Foot Aquifer

Upper 180-Foot Aquifer

- Groundwater elevations have been stable in the upper 180-Foot Aquifer in the past thirty years. During the past 15 years, wells in this aquifer have shown no significant trend. Linear trendline slopes over this period ranged from -0.0363 ft/yr to 0.0161 ft/yr (Figure 5-12). Seasonal fluctuations in this aquifer have been as large as 10 ft.

*Lower 180-Foot Aquife***r**

- Groundwater elevations in the lower 180-Foot Aquifer are generally equivalent to those observed in the 400-Foot Aquifer, which is described below.

400-Foot Aquifer

- Groundwater elevations have been stable over the past thirty years in wells in this aquifer in the northern Marina-Ord Area. During the past 15 years, groundwater elevation trends in wells screened in the 400-Foot aquifer in this area have been generally flat. Linear trendline slopes over the last 15-year period ranged from -2.02 ft/yr to 0.108 ft/yr (Figure 5-13). Seasonal fluctuations in this aquifer have been as large as 30 ft.

Two CASGEM wells in the southwestern portion of the Marina-Ord Area, MPWMD#FO-10 and MPWMD#FO-11, show consistent decreasing trends over the past 15-years. Additionally, groundwater elevations in these wells are significantly lower than those to the north near the City of Marina and the south in the Seaside Subbasin. When water levels in these wells are plotted in conjunction with other 400-Foot Aquifer wells in the Marina Ord Area, they indicate the presence of a localized depression in the groundwater potentiometric surface of the 400-Foot Aquifer. However, there is no known extraction in the Monterey Subbasin in the vicinity of these wells, and groundwater elevation trends observed in these wells are similar to those measured in the Deep Aquifers. These data suggest that (1) these wells are screened within sediments that connect directly to the Deep Aquifers; or (2) leakage is occurring from the 400-Foot Aquifer into the Deep Aquifers in the vicinity of these wells.

Deep Aquifers

- Groundwater production from the Deep Aquifers in the 180/400--Foot Aquifer Subbasin began in the mid-1970s. Within the Monterey Subbasin, MCWD's production in the Deep Aquifers began in 1985. At this time, groundwater elevations were close to sea level in the Deep Aquifers within the Marina-Ord Area of the Monterey Subbasin (Feeney and Rosenberg, 2003).
- Groundwater elevations in the Deep Aquifers within the Marina-Ord Area declined rapidly in the first few years of MCWD's extraction from the Deep Aquifers, ~~Groundwater elevation trends in the Deep Aquifers within the Marina Ord area were generally steady~~but stabilized ~~from~~ beginning in the early 1990s, and stayed stable through the mid-2000s. During this time period, rates of groundwater extraction from the Deep Aquifers ranged from 2,000 AFY to 2,300 AFY from MCWD wells. Rates of groundwater extraction from agricultural production wells screen in the Deep Aquifers in the 180/400--Foot Aquifer Subbasin ~~agricultural production wells~~ were approximate 2,000 AFY during this period, resulting in a combined production rate of approximately 4,000 AFY from the Deep Aquifers (Figure 5-16)[17].
- ~~but~~ Groundwater elevations in the Deep Aquifers have shown a consistent decline since the mid-2000s~~that time~~. Linear trendline slopes in representative wells within the Marina-Ord area over the past 15 years have ranged from -2.~~79~~84 ft/yr to ~~-0.177~~0.749 ft/yr (Figure 5-14 and Figure 5-15).

[17] During this period, MCWD and MCWRA entered into the 1996 Annexation Agreement (see Section 3.2.2.2) where the parties agreed *"… that the '900-foot' aquifer* (aka the Deep Aquifers) *should be managed to provide safe, sustained use of the water resource, and to preserve to MCWD the continued availability of water from the '900-foot' aquifer."*

- The USGS multi-completion well (014S001E24L) near the Monterey Coast shows varying potentiometric heads between screen intervals with similar long-term trends. These data indicate that the Deep Aquifers are comprised of a series of aquifer zones and aquitards that are influenced by groundwater production within these zones. As evidenced by groundwater elevations measured in 014S001E24L and 14S02E33E, groundwater elevations in the upper portion of the Deep Aquifers (approximately 900 ft bgs) are lower than those in the lower portion of the Deep Aquifers (approximately 1,500 ft bgs). Groundwater elevation trends in the upper portion of the Deep Aquifers have also shown a steeper decreasing trend than the lower portion of the Deep Aquifers over the past 15 years.
- Similar declines in groundwater elevations are observed in Deep Aquifers wells located in the adjacent 180/400-Foot Aquifer Subbasin near Cooper Road and Blanco Road. Figure 5-15 shows long-term hydrographs for wells located near the Monterey-180/400-Foot Aquifer Subbasin boundary. As shown on these hydrographs, groundwater elevations in wells located near Cooper Road and Blanco Road have declined more than 5 ft/year over the past 15 years.
- The observed decline in groundwater elevations in the Deep Aquifers is the result of increased groundwater production from the Deep Aquifers. ~~in the Monterey and~~ 180/400-Foot Aquifer Subbasin~~s.~~ Information collected by the MCWRA (Figure 5-16) shows that groundwater production from the Deep Aquifers increased from approximately 2,500 AFY in 2008 to over 10,000 AFY in 2019 (MCWRA, 2020). Approximately 30 new Deep Aquifers production wells were permitted and constructed within the 180/400-Foot Aquifer Subbasin during this period (MCWRA, 2020). Groundwater pumping from the Deep Aquifers within the Monterey Subbasin is limited to ~~entirely associated with~~ MCWD's municipal production, which has been relatively stable ~~at 2,500 AFY~~at quantities ranging from 2,000 AFY to 2,500 AFY since 19~~90~~90 and is we~~i~~ll within the limit established within the Annexation Agreements with MCWRA as detailed in Chapter 3. ~~The increase in~~ Increases in g~~G~~groundwater production from the ~~Deep Aquifer~~Deep Aquifers are~~is~~ primarily occurring ~~immediately~~ in the ~~north of the Monterey~~ 180/400-Foot Aquifer Subbasin immediately north of the Monterey Subbasin. ~~boundaryThese new production wells were installed near Cooper Road and Blanco Road, where t~~The 180-Foot and 400-Foot Aquifers are seawater intruded in this area and no alternative water source is available, i.e., it is outside the existing Castroville Seawater Intrusion Project (CSIP) service area.

5.1.3.2 Corral de Tierra Area

Groundwater elevations have been monitored since the 1960s in several wells, which are screened in the El Toro Primary Aquifer System in the Corral de Tierra Area. Of these wells, a few wells show groundwater elevation declines of up to 60 to 80 feet. On average, long-term groundwater elevations declines are 40-50 feet (Figure 5-17) (GeoSyntec, 2007).

According to the 2007 *El Toro Groundwater Study* report, the majority of long-term hydrographs exhibit a downward trend in groundwater elevations with an average rate of decline of -0.6 ft/yr (GeoSyntec, 2007). Since 1999, some hydrographs show larger rates of groundwater elevation decline, averaging 1.8 feet per year (GeoSyntec, 2007). The Laguna Seca area, which is in the Seaside Subbasin west of the Corral de Tierra Area, shows similar groundwater elevation declines and has been demonstrated to be hydrogeologically connected to the El Toro area (GeoSyntec, 2007; Hydrometrics, 2009).

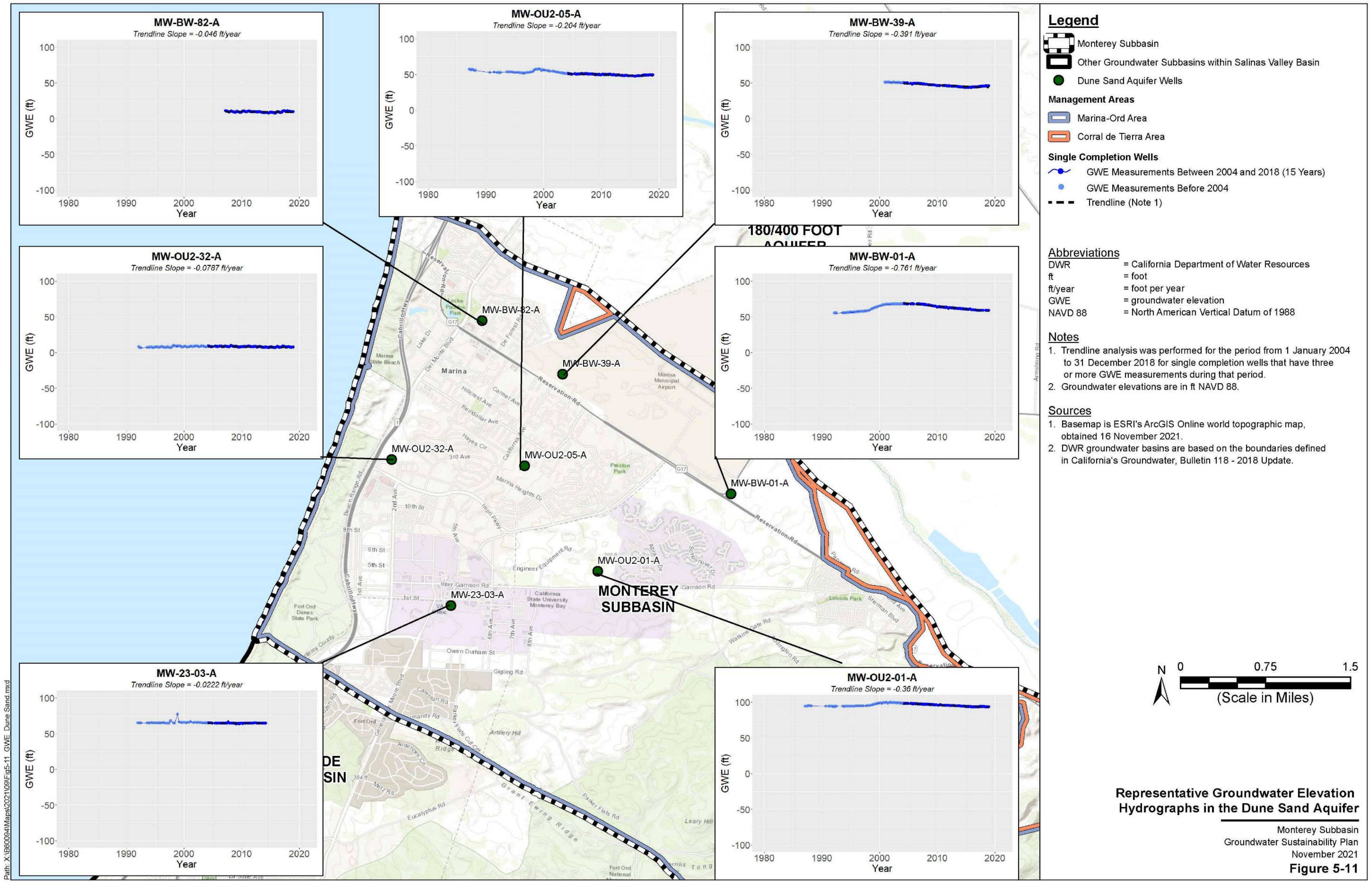


Figure 5-11. Representative Groundwater Elevation Hydrographs in the Dune Sand Aquifer

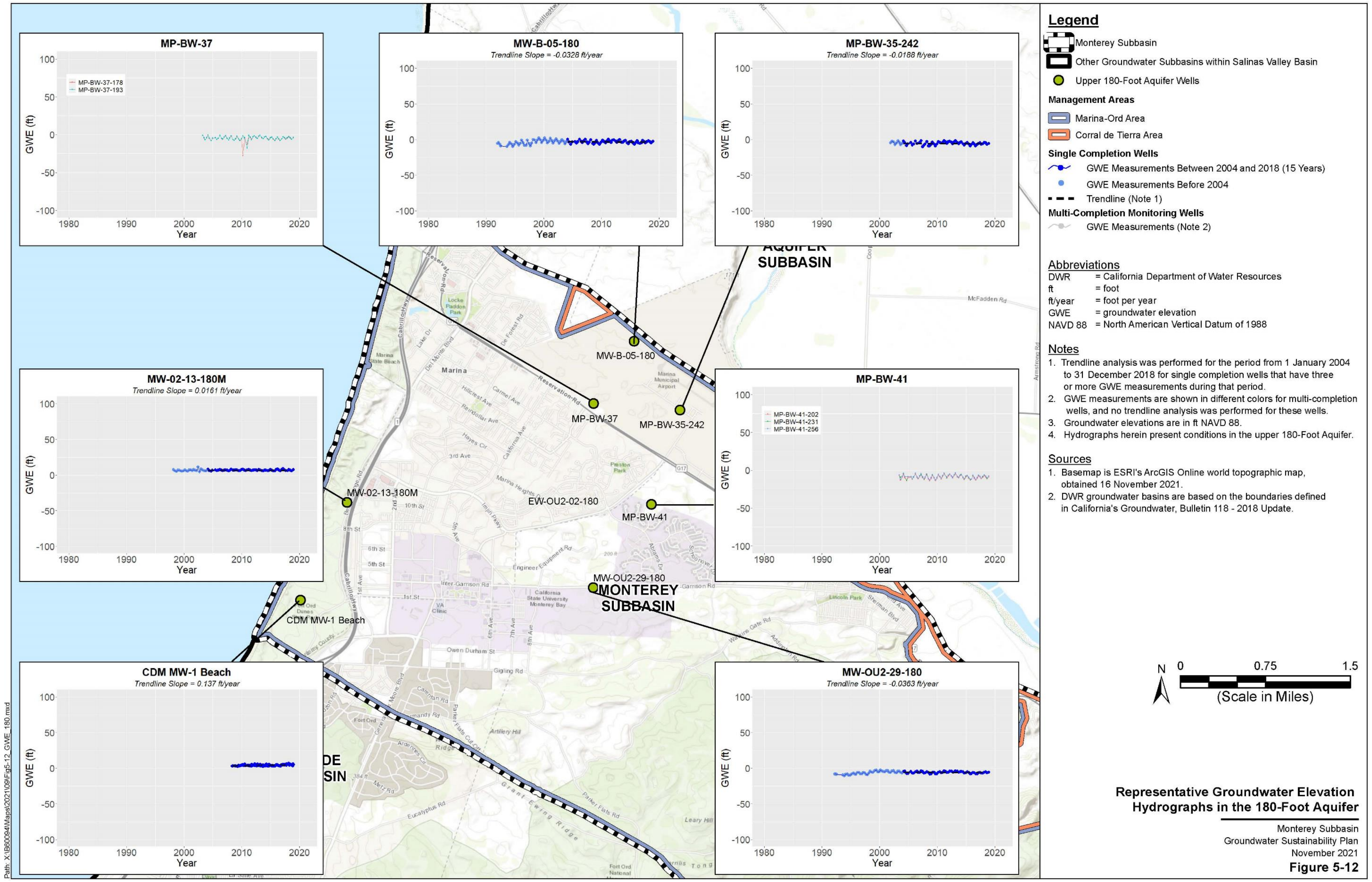


Figure 5-12. Representative Groundwater Elevation Hydrographs in the 180-Foot Aquifer

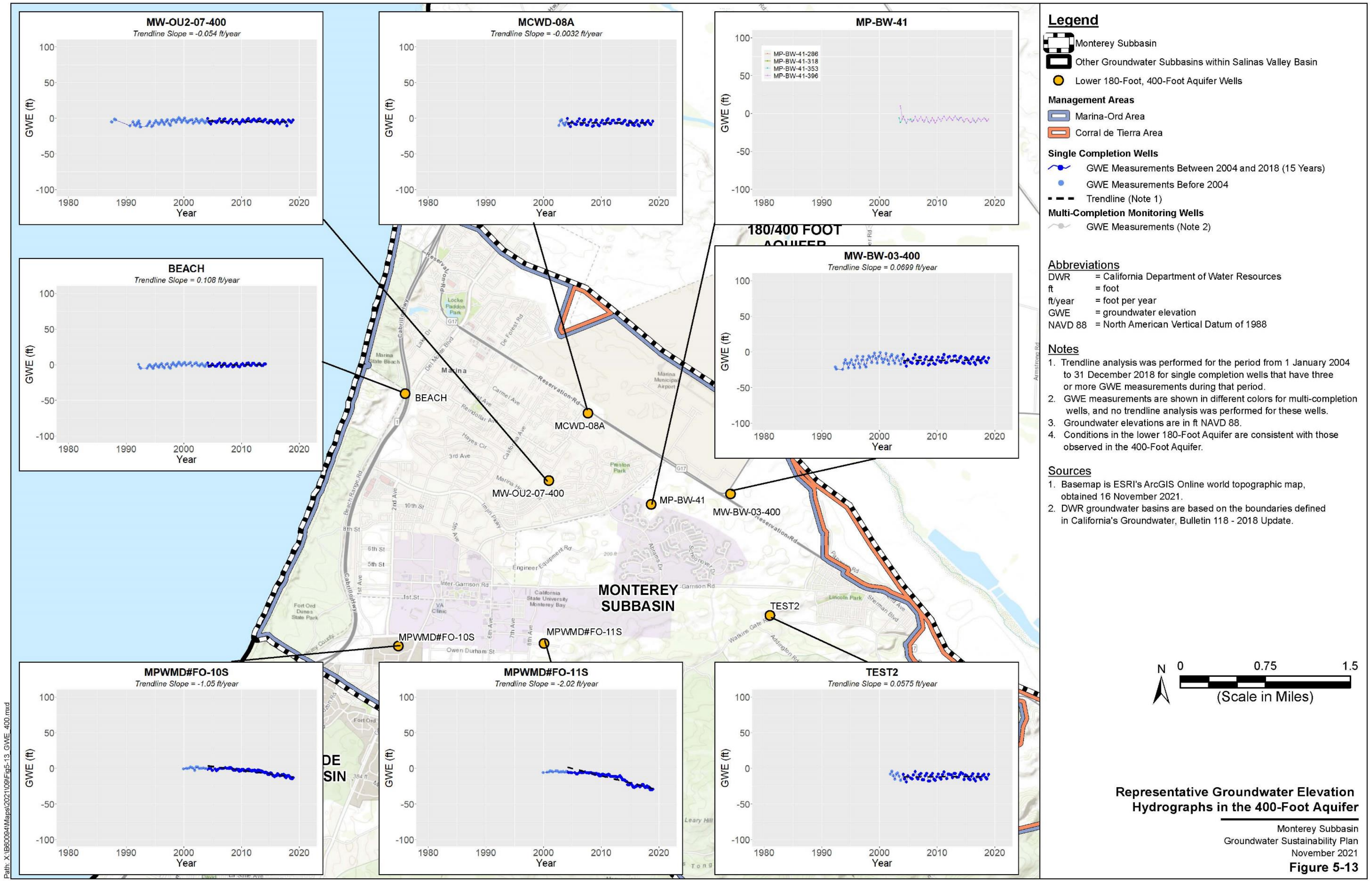


Figure 5-13. Representative Groundwater Elevation Hydrographs in the 400-Foot Aquifer

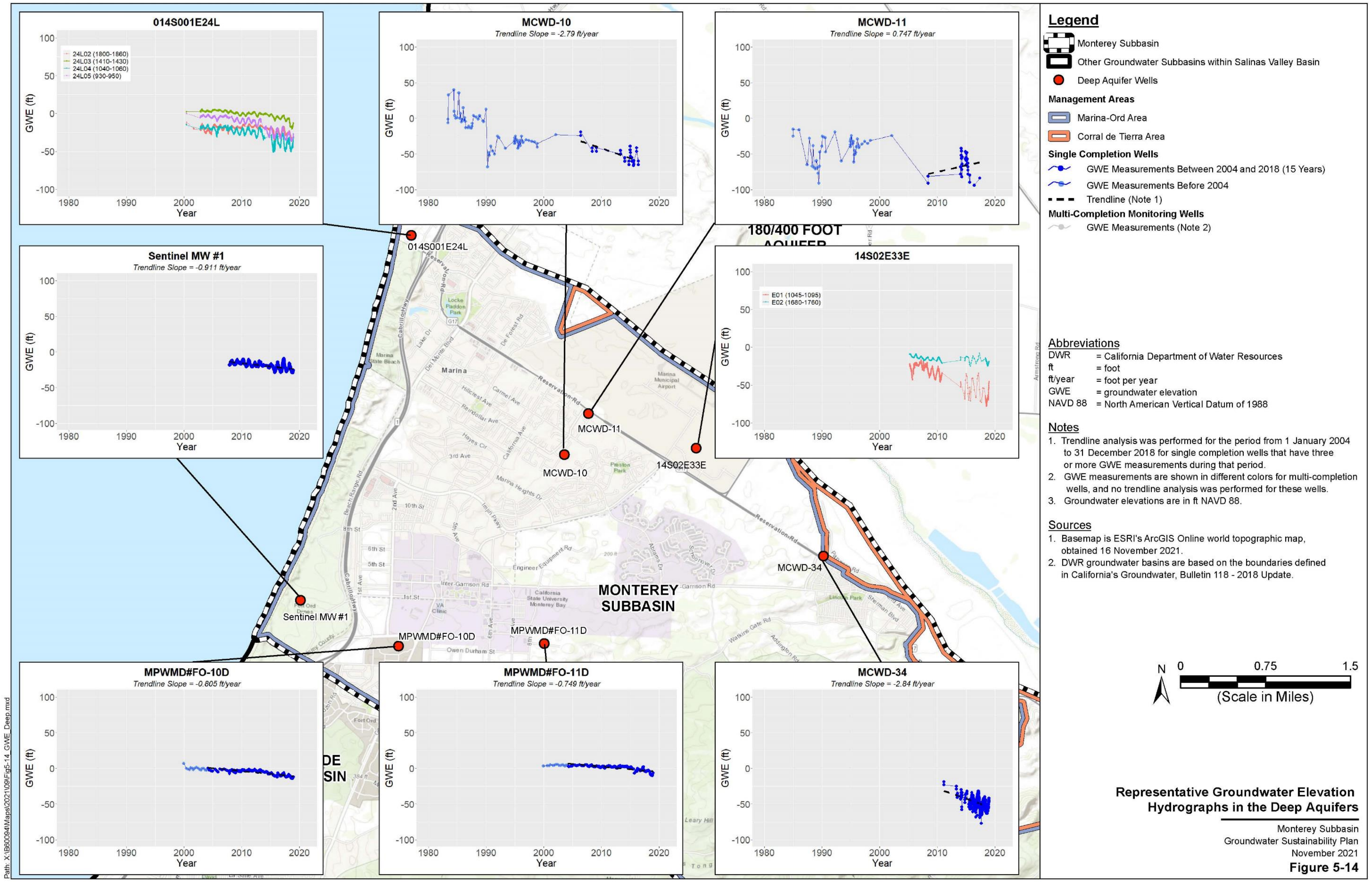


Figure 5-14. Representative Groundwater Elevation Hydrographs in the Deep Aquifers

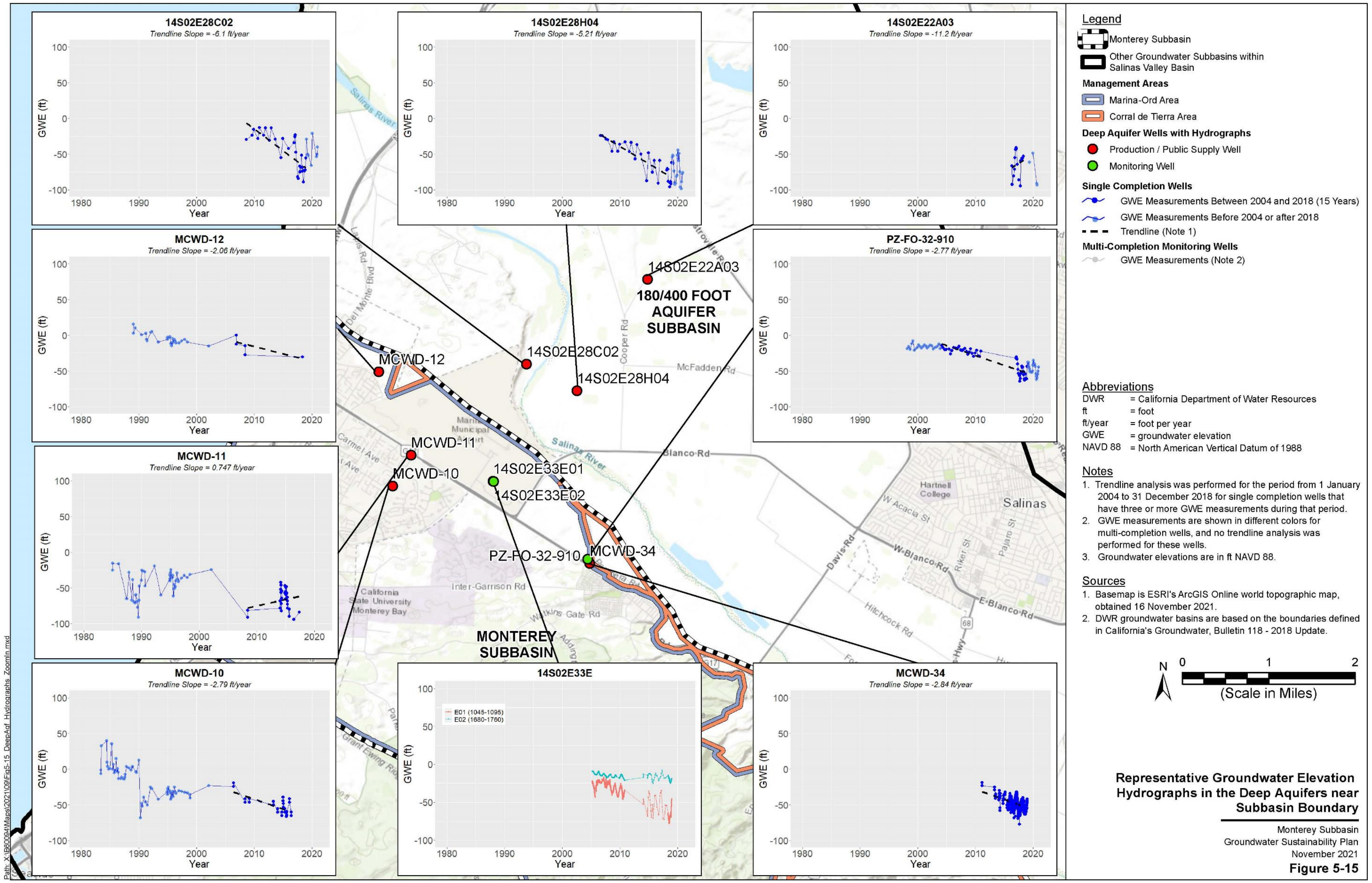
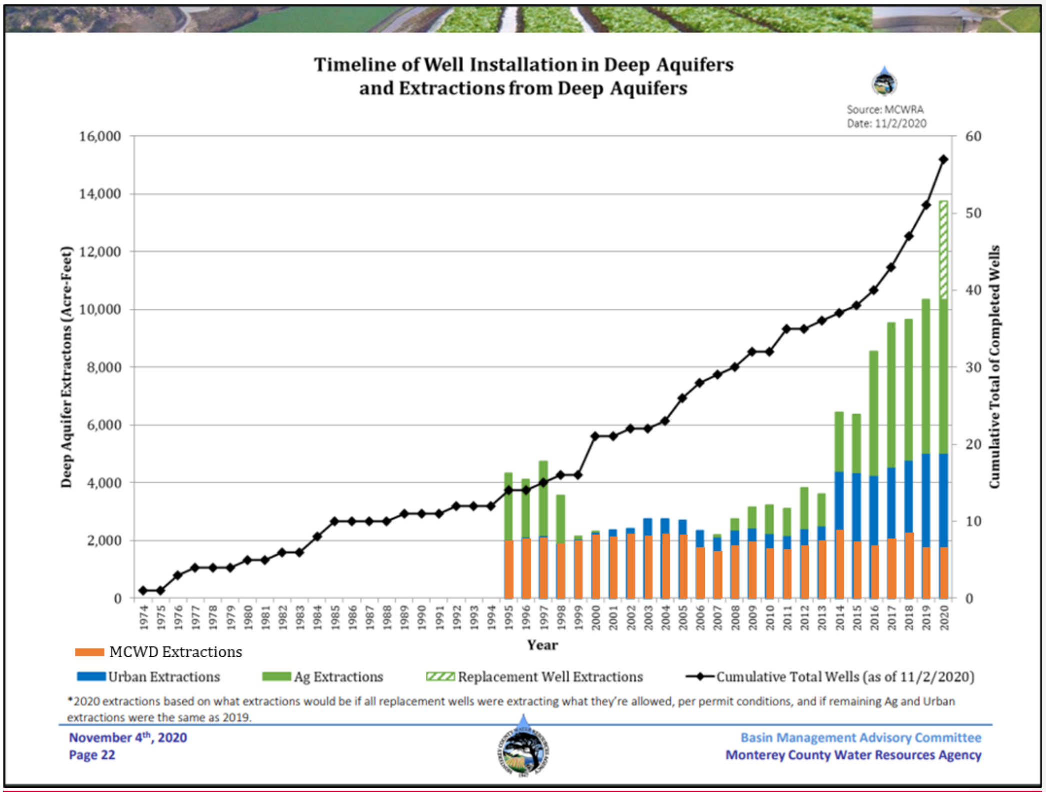


Figure 5-15. Representative Groundwater Elevation Hydrographs in the Deep Aquifers near Subbasin Boundary

Figure 5-16. Timeline of Well Installation in Deep Aquifer and Extraction from Deep Aquifers


Timeline of Well Installation in Deep Aquifers
and Extractions from Deep Aquifers
Source: MCWRA
Date: 11/2/2020
Deep Aquifer Extractons (Acre-Feet)
Cumulative Total of Completed Wells
Year
MCWD Extractions
Urban Extractions
Ag Extractions
Replacement Well Extractions
Cumulative Total Wells (as of 11/2/2020)
*2020 extractions based on what extractions would be if all replacement wells were extracting what they're allowed, per permit conditions, and if remaining Ag and Urban extractions were the same as 2019.
November 4th, 2020
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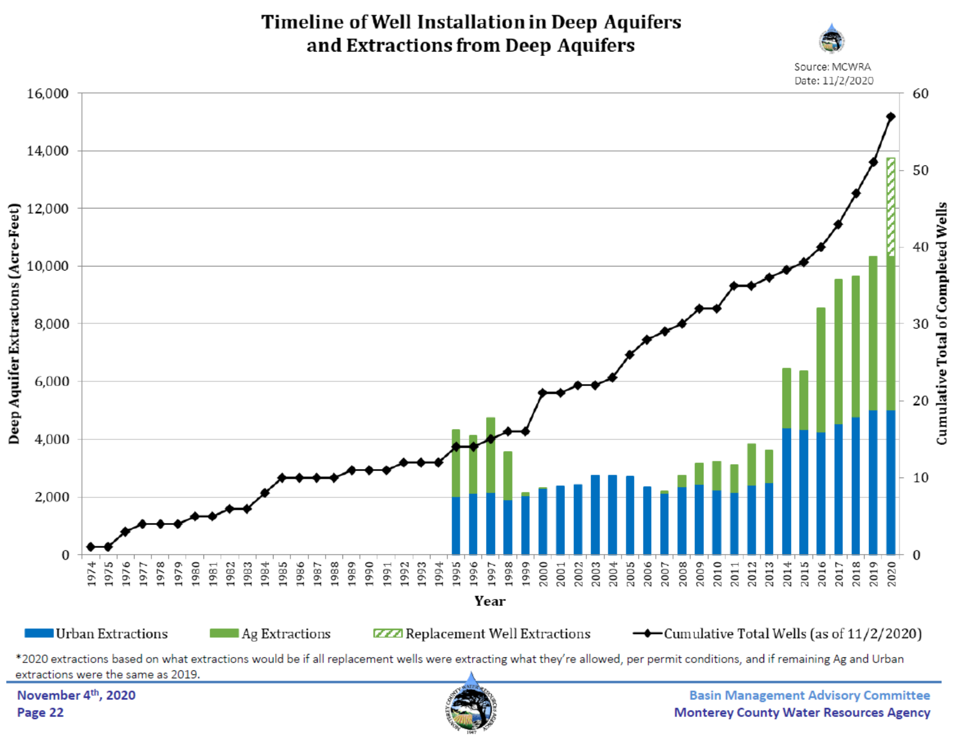
Basin Management Advisory Committee
Monterey County Water Resources Agency



Note: This figure is adapted from MCWRA's Basin Management Advisory Committee presentation on November 4, 2020. This figure represents groundwater extraction from the Deep Aquifers within the area defined by the Groundwater Extraction Management System (GEMS) ordinance. The figure was adapted to show the portion of Deep Aquifers extraction within the Monterey Subbasin, which is primarily by MCWD (orange) vs. other agricultural and urban Deep Aquifers extraction (blue and green) located in the 180/400-Foot Aquifer Subbasin. Area is defined by Groundwater Extraction Management System (GEMS) ordinance and represents all extractions reported from the Deep Aquifers, most of which is within the 180/400-Ft Aquifer Subbasin, not the Monterey Subbasin.

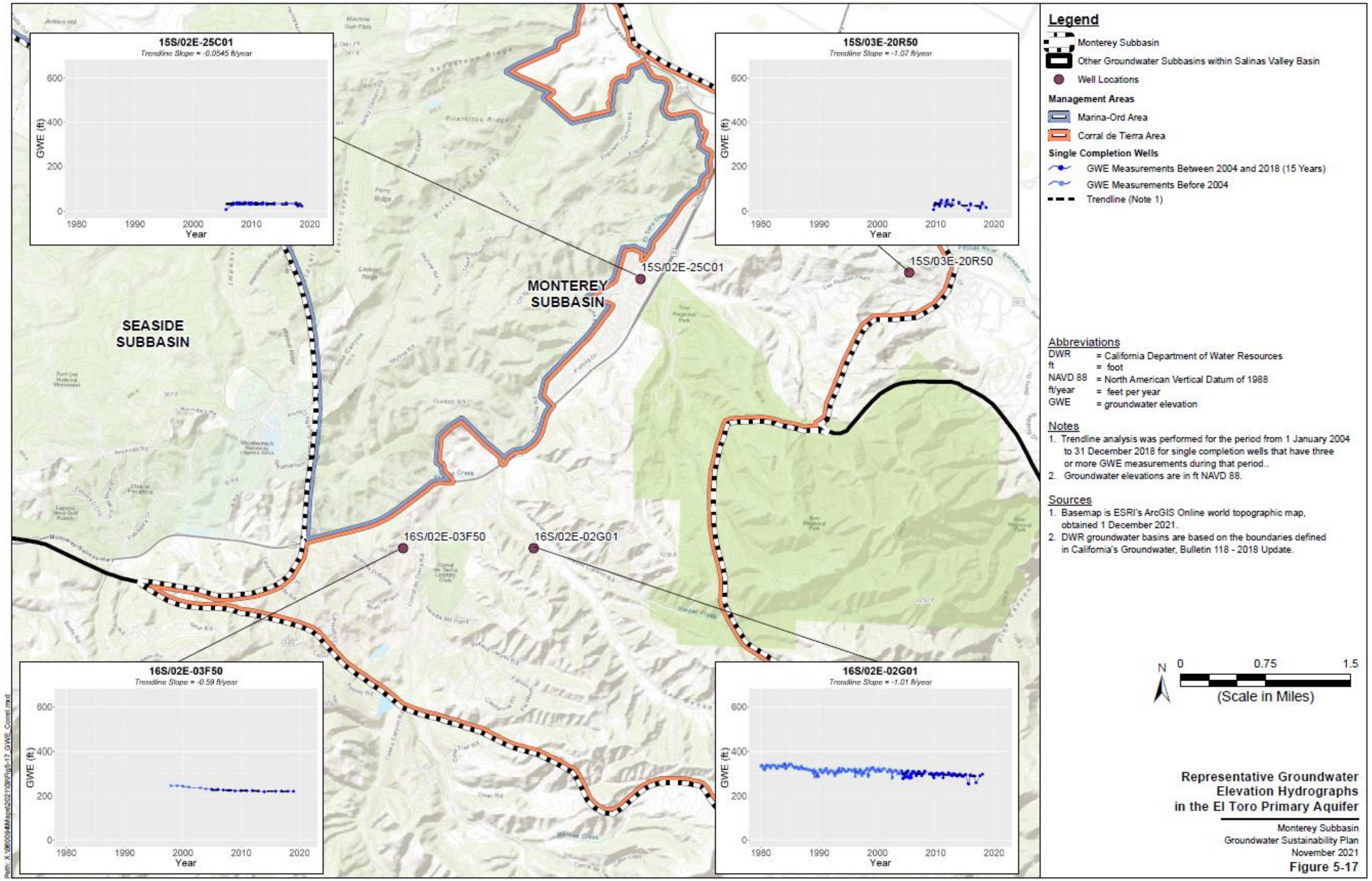
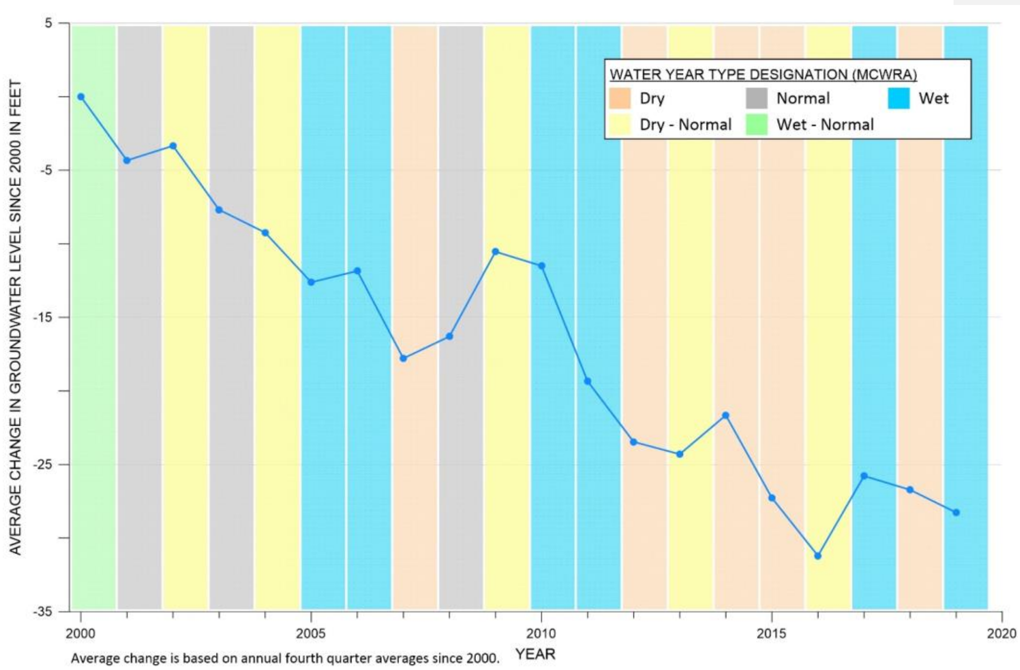


Figure 5-17. Representative Groundwater Elevation Hydrographs in the El Toro Primary Aquifer

Another way of looking at temporal groundwater elevation trends is shown on Figure 5-18, which presents a graph of cumulative groundwater elevation change for the El Toro Primary Aquifer System. The graph of cumulative change in groundwater elevation is based on the average change in Fall groundwater elevations for designated wells in the subarea each year. The average decline since 2000 is approximately -27 feet. MCWRA uses Fall groundwater elevations because these measurements are taken after the end of the irrigation season and before seasonal recharge from winter precipitation increases in groundwater levels. The cumulative groundwater elevation change plot is therefore an estimated average hydrograph for wells in the subarea. Although this plot does not reflect the groundwater elevation change at any specific location, it provides a general illustration of how the average groundwater elevation in the subarea changes in response to climatic cycles, groundwater extraction, and water-resources management at the Subbasin scale.

The graph of cumulative elevation change and the specific hydrographs presented in Appendix 8-B show a long-term decline in groundwater elevations in the Subbasin over time.

Figure 5-18. Cumulative Groundwater Elevation Change for the Corral de Tierra Area



5.1.4 Vertical Hydraulic Groundwater Gradients

Downward vertical hydraulic gradients exist in many portions of the Subbasin. These downward vertical gradients are caused by areal surface recharge, groundwater extraction from deeper Aquifers, and laterally extensive aquitards, which exist in the Marina-Ord Area. These vertical hydraulic gradients can impact the magnitude and direction of groundwater flow between principal aquifers and increase the potential for downward migration of highly saline water in seawater intruded areas, if pathways exist between aquifers.

Evaluation of vertical gradients can be accomplished by examination of groundwater elevations measured in collocated wells screened in different aquifers. This approach requires water level information from wells that: (a) have known well construction information, (b) are only screened in one Principal Aquifer, (c) have contemporaneous measurements (i.e., water levels measured at least in the same year and season), and (d) are in close spatial proximity to each other. It is important to note that a difference in groundwater elevation between principal aquifers does not, in and of itself, establish a vertical flow.

Figure 5-19 shows four sets of wells located in the central portion of the Marina-Ord Area and one set of wells located near the coast that meet the identified criteria. The hydrographs for each set of wells illustrate the difference in groundwater elevations between Principal Aquifers. In the central Marina-Ord Area, groundwater elevations are approximately 70 ft lower in the 180-Foot Aquifer and 400-Foot Aquifer than in the Dune Sand Aquifer. Groundwater elevations are approximately 60 ft lower in Deep Aquifers than in the 180-Foot and 400-Foot Aquifers. Near the Monterey Coast, there is no appreciable groundwater elevation difference between the Dune Sand Aquifer and the 180-Foot Aquifer.

Figure 5-20 shows estimated vertical gradients between the 400-Foot Aquifer and the Deep Aquifers in the Fall of 2017. These estimated vertical gradients are calculated based on the difference groundwater elevation contours for the 400-Foot Aquifer and Deep Aquifers shown on Figure 5-3 and Figure 5-4, respectively. As shown on Figure 5-20, groundwater elevations in the Deep Aquifers are 20 to 60 ft lower than those in the 400-Foot Aquifer in the northwestern portion of the Subbasin where the lower 180-Foot/400-Foot Aquifer is seawater intruded.

While many wells in the Corral de Tierra Area are screened in both the Paso Robles Formation and the Santa Margarita Sandstone, some wells are screened more in the Paso Robles Formation and some are screened more in the Santa Margarita Sandstone. Downward vertical hydraulic gradients have been recorded in the Laguna Seca subarea of the adjacent Seaside Subbasin (Yates, 2002). Therefore, there is an expectation that downward vertical gradients exist between the Paso Robles Formation and the Santa Margarita Sandstone within the El Toro Primary Aquifer System (GeoSyntec, 2007). Figure 5-21shows hydrographs between wells screened exclusively in the Paso Robles Formation (shallow) and the Santa Margarita Sandstone (deep) in the Corral de Tierra Area near the Laguna Seca region. There is an approximate 75-foot difference in the water levels between the two water-bearing formations. Due to the sediments that comprise these water-bearing formations, there is likely downward vertical flow between the formations as a result of these gradients.

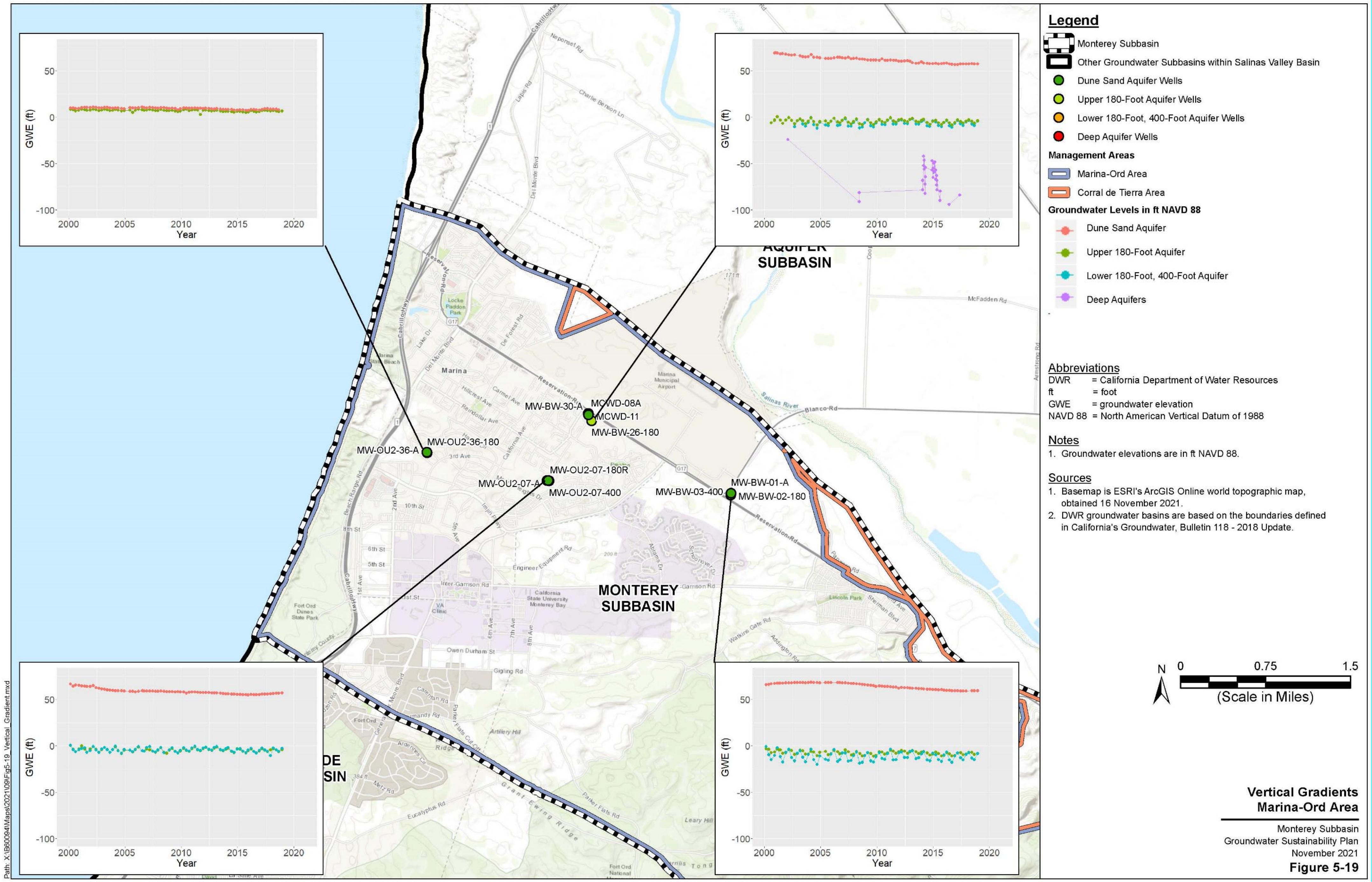


Figure 5-19. Vertical Gradients, Marina-Ord Area

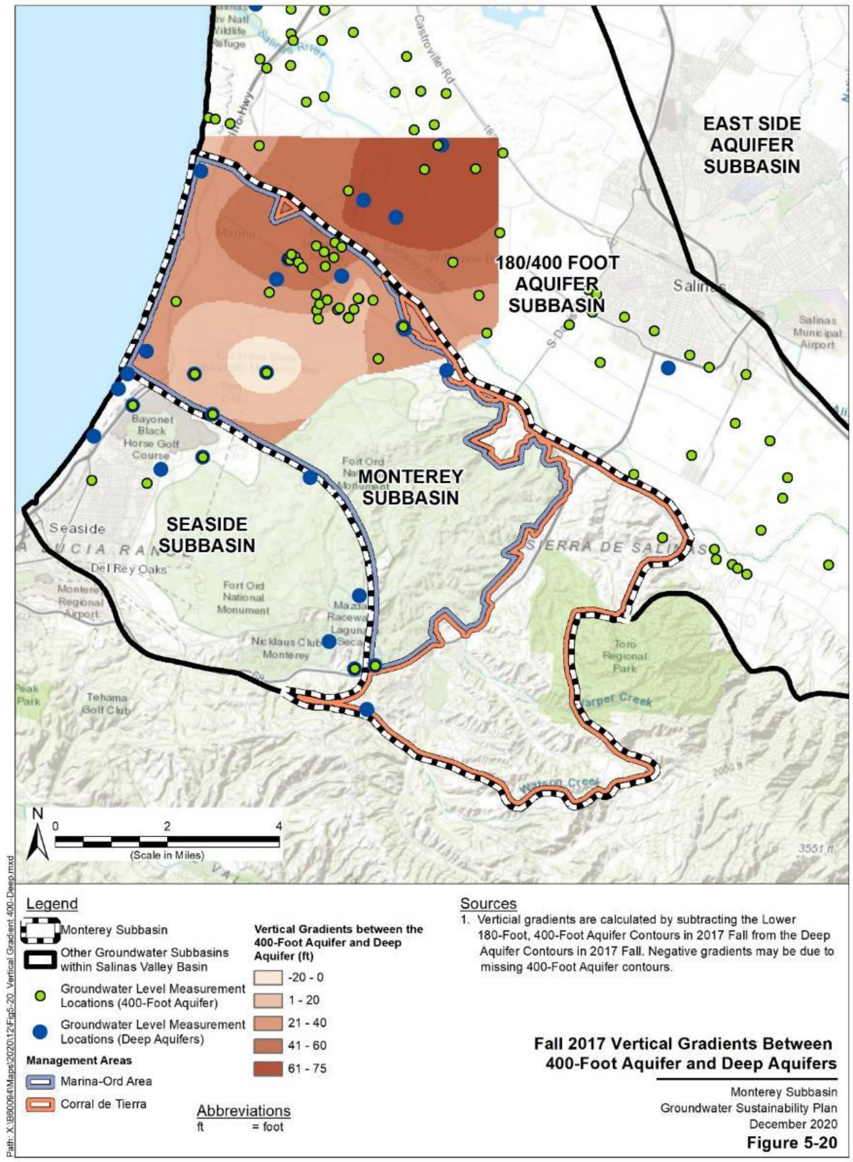


Figure 5-20. Fall 2017 Vertical Gradients Between 400-Foot Aquifer and Deep Aquifers

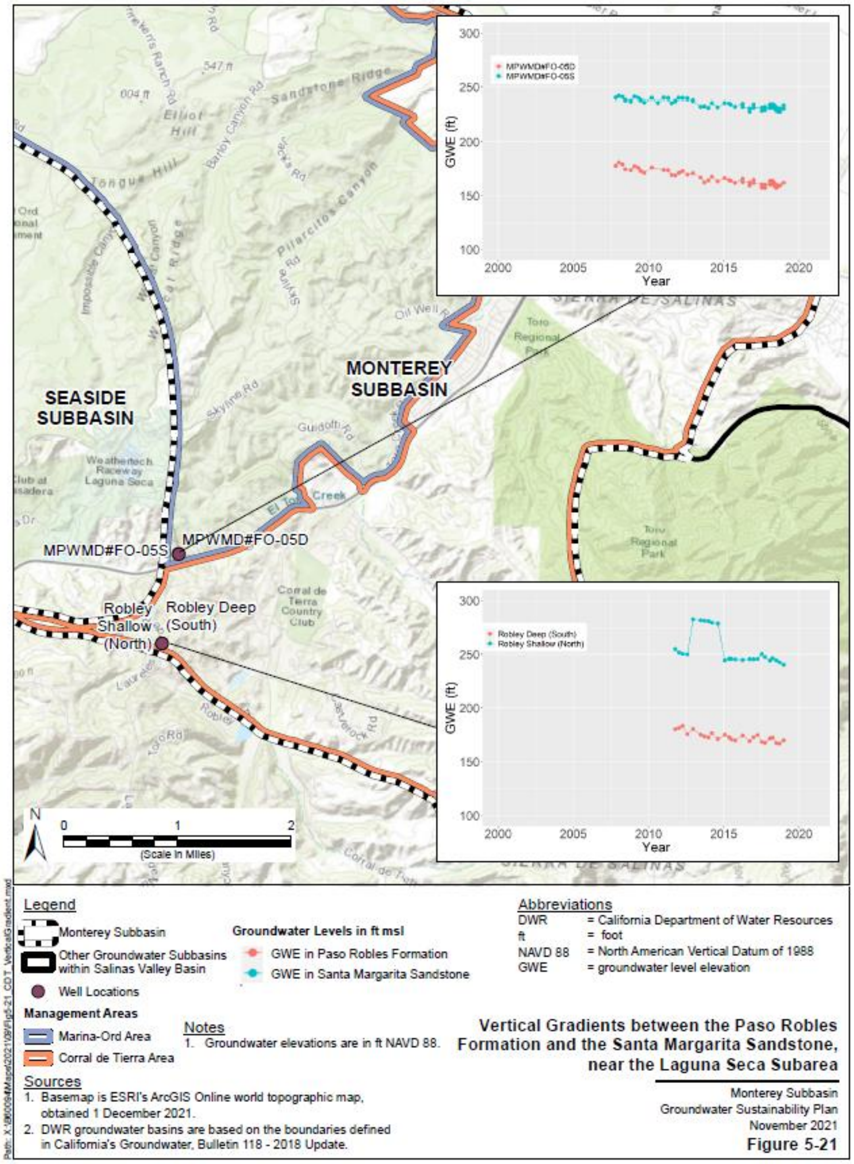


Figure 5-21 Vertical Gradients between the Paso Robles Formation and the Santa Margarita Sandstone, near the Laguna Seca Subarea

5.2 Change in Groundwater Storage

Estimate change in storage for the Monterey Subbasin was simulated for the historical period (i.e., WY 2004-2018) using the numerical model developed for the Monterey Subbasin. A description of the numerical model and results are detailed in Chapter 6. Changes of storage estimates for the historical period are detailed in Appendix 6-A and summarized below.

Annual average change in storage within the Monterey Subbasin was estimated to be -4,434 AFY during WY 2004-2018. The cumulative change in storage over this 15-year period was estimated to be -66,517 AF. Seawater inflow to the Monterey Subbasin across the ocean boundary during the historical period is presumed to leave the Subbasin across the 180/400-Foot Aquifer Subbasin boundary, given that there has been negligible expansion of the seawater intrusion front during the historical period (Section 5.3.4).

Change of storage estimates were additionally calculated for each of the management area water budget zones (WBZs)[18]. Within the Marina-Ord Area WBZ, the annual average change in storage over the historical period was estimated at -1,632 AFY for a cumulative change in storage of -24,478 AF. The majority of this loss occurred within the 400-Foot and Deep Aquifers, consistent with recent groundwater elevation trends described in Section 5.1.3 above. Within the Corral de Tierra Area WBZ, the annual average change in storage over the historical period was estimated to be -2,803 AFY for a cumulative change in storage of -42,039 AF.

There are inherent uncertainties using numerical models as they can only approximate physical systems and have limitations in how they compute data. The uncertainty associated with the model estimates is explored further in Section 6.7. However, the groundwater model selected to perform this analysis represents the best available tool for estimating water budget and change in storage. A detailed discussion of data input and assumptions into the Monterey Subbasin Groundwater Flow Model (MBGWFM) is included in Sections 6.1 and 6.2 and Appendix 6-B. As additional groundwater elevation, aquifer properties, and groundwater extraction data become available, they will be used to refine the representation of these aquifers as part of future modeling efforts.

5.3 Seawater Intrusion

Groundwater overdraft in the larger Salinas Valley Basin has resulted in landward groundwater gradients near the coast and created an influx of highly saline water in the coastal aquifers. Seawater intrusion has been documented in the Salinas Valley Basin since the 1940s (DWR,

[18] As described in Chapter 6, the Marina-Ord Area WBZ includes the Marina-Ord Area as well as well as the Reservation Road portion of the Corral de Tierra Area, as they share the same principal aquifers; the Corral de Tierra Area WBZ includes the main portion of the Corral de Tierra Area underlain by the El Toro Primary Aquifer System.

1946). Within the Monterey Subbasin, seawater intrusion has been documented in the northern portion of the lower 180-Foot and 400-Foot Aquifers.

The negative impact of seawater intrusion on local water resources and the agricultural economy has been the primary motivation for many studies dating back to 1946 (DWR, 1946). MCWRA and others have implemented a series of engineering and management projects, including well construction moratoriums, developing the Castroville Seawater Intrusion Project (CSIP) system, and implementing the Salinas Valley Water Project (SVWP), among other actions to halt seawater intrusion. Although those actions have managed to slow the advance of intrusion and reduce its impacts, seawater intrusion remains an ongoing threat.

5.3.1 Data Sources

Water quality data discussed in this section was obtained from various local monitoring agencies, including MCWD, MCWRA, Fort Ord, MPWMD, and the Seaside Groundwater Basin Watermaster. These data are augmented by results from two airborne electromagnetic (AEM) surveys conducted by MCWD in 2017 and 2019.

5.3.1.1 Water Quality Data

The extent and advancement of seawater intrusion within the Subbasin have been monitored by local monitoring agencies. The following TDS, chloride, as well as specific conductivity data are analyzed herein:

- Water quality data collected by MCWRA, MPWMD, and the Seaside Basin Watermaster;
- Water quality data collected by MCWD in December 2018 from MCWD wells and Fort Ord monitoring wells (EKI, 2019).

These water quality data are shown on Figure 5-24 and discussed in detail in Section 5.3.3.

5.3.1.2 Geophysical Data

Geophysical data considered in this GSP include AEM data obtained for the northern Salinas Valley and induction logging data obtained from Sentinel Wells installed along the Monterey and Seaside Subbasin coastline.

In 2017 and 2019, MCWD retained geophysical consultants (Aqua Geo Frameworks; AGF) and Stanford University researchers to obtain and analyze AEM data within the northern Salinas Valley Basin (Stanford/Aqua Geo Frameworks; Aqua Geo Frameworks, 2019). During these surveys, a helicopter carrying electronic geophysical equipment surveyed resistivity of subsurface geology over an approximately 15-mile by 7-mile area along the coastal 180/400-Foot Aquifer and Monterey Subbasins. The studies' goal was to evaluate the understanding of the hydrostratigraphy in the study area and to interpret the distribution of groundwater quality indicated by available well data. A first round of AEM data were collected in April 2017, shortly after the 2014-2016 drought. A second round of AEM data were collected in May 2019, which is more representative of a wetter hydrologic condition. The data collected during each round of

AEM were "inverted" to develop a three-dimensional picture of the distribution of electrical resistivity.

The AEM survey measures the resistivity of a volume of subsurface material composed of sediments containing air and/or water (Stanford/Aqua Geo Frameworks, 2018). While measurement of the electrical resistivity of the water alone (typically reported as the inverse parameter, electrical conductivity) can be a direct indicator of the salinity of the water (i.e., the more salts in the water, the lower the electrical resistivity), the electrical resistivity of a volume of subsurface material is determined not just by the salinity of the water, but is also affected by the texture and mineralogy of the sediments and the volume of water present. Very simply, increasing the amount of clay, the amount of water, and/or the salinity of the water all decrease the electrical resistivity.

A part of the studies' scope was to investigate the relationship between inverted AEM data and water quality. The following interpretation of AEM data has been experimentally developed for the study area.

Table 5-1. Experimental Interpretation of AEM Resistivity Data in the Northern Salinas Valley

TDS Concentration in Groundwater	**AEM Resistivity** Within general or unknown aquifer materials (Stanford/Aqua Geo Frameworks, 2018)	**AEM Resistivity** Within the sandy/gravelly 180-Foot and 400-Foot Aquifers (Aqua Geo Frameworks, 2019)
Greater than 10,000 mg/L	Less than 5 ohm/cm	Less than 7.2 ohm/cm
Less than 3,000 mg/L	Greater than 25 ohm/cm	Greater than 13.2 ohm/cm

The Stanford study found that very high resistivity (greater than 25 ohm/cm) or very low resistivity (smaller than 5 ohm/cm) are indicative of fresh groundwater and high salinity groundwater, respectively. Moderate AEM resistively in the range of 5 to 25 ohm/cm can be indicative of either higher salinity or higher amount of clay in subsurface materials, thus the exact water quality associated with these resistivity values is more difficult to discern. In the known extents of sandy and gravelly 180-Foot and 400-Foot Aquifers, AGF has developed an experimental relationship whereby AEM resistivity of greater than 13.2 ohm/cm and less than 7.2 ohm/cm are indicative of fresh groundwater and high salinity groundwater, respectively.

The AEM surveys have found that high salinity groundwater as a result of seawater intrusion exists within the lower 180-Foot Aquifer and 400-Foot Aquifers of the Monterey Subbasin. This volume of high salinity groundwater is overlain by fresh groundwater in the Dune Sand and upper 180-Foot Aquifers. The results of the AEM study are consistent with water quality data collected within the Subbasin (EKI, 2019). No significant difference was found between seawater intrusion conditions in 2017 and 2019 within the Subbasin.

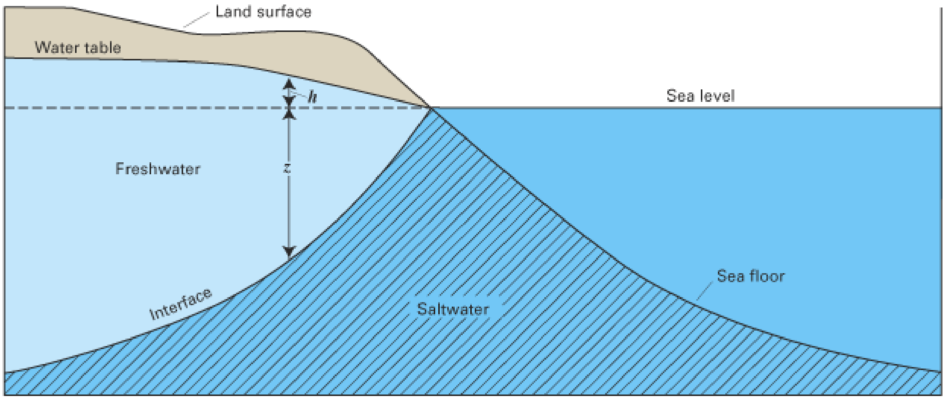
Induction logging within a well measures the fluid conductivity within the adjacent formation. Although this method does not provide exact measurements of water quality, it can be used to monitor changes in conductivity (i.e., groundwater salinity) over time. The Seaside Basin Watermaster constructed and maintains four Sentinel Wells along the coast to detect potential seawater intrusion. The northern-most well, SBMW-1, is located within the Monterey Subbasin. The Watermaster conducts semi-annual induction logging within these wells. During baseline monitoring of SBMW-1 in 2007, it has been documented that very high conductivities indicative of saline groundwater were observed in depths from 125 feet to approximately 350-400 feet (Feeney, 2007). There has been no significant change in salinity observed in this well since 2007 (Montgomery & Associates, 2019).

5.3.2 Defining Seawater Intrusion

Coastal aquifers usually contain two sets of flow going into opposite directions: lower density freshwater flowing seaward and higher density seawater flowing inland. When groundwater levels in aquifers connected to the ocean fall to near or below sea level, flows across the ocean/land boundary become predominantly onshore flows (Barlow, 2003). As higher density seawater flows inland, it forms a seawater wedge beneath the less dense fresh groundwater until the water table achieves equilibrium, as shown on Figure 5-22.

The freshwater depth above sea level and the freshwater depth below the sea level in the wedge are related to each other through the Ghyben-Herzberg Relation, which states that for every foot of freshwater above sea level there is approximately 40 feet of freshwater below sea level (Barlow, 2003). For a given depth within the subsurface, therefore, the potentiometric head must be at least 1/40 of that depth above sea level in order for freshwater to be present at that depth. For example, for freshwater to be present within the 180-Foot Aquifer and 400-Foot Aquifer (i.e., with bottom depths of approximately -250 ft NAVD88 and -500 ft NVAD88, respectively), the potentiometric surface in those aquifers needs to be maintained at an elevation of at least 6.3 ft NVAD88 and 12.5 ft NAVD88, respectively. In a complexly layered aquifer system like the Salinas Valley Basin, each aquifer may have its own seawater wedge, with a seawater front at different horizontal distances from the shoreline, depending on each aquifer' relative hydraulic connection to pumping wells and the Pacific Ocean (Yates and Wiese, 1988).

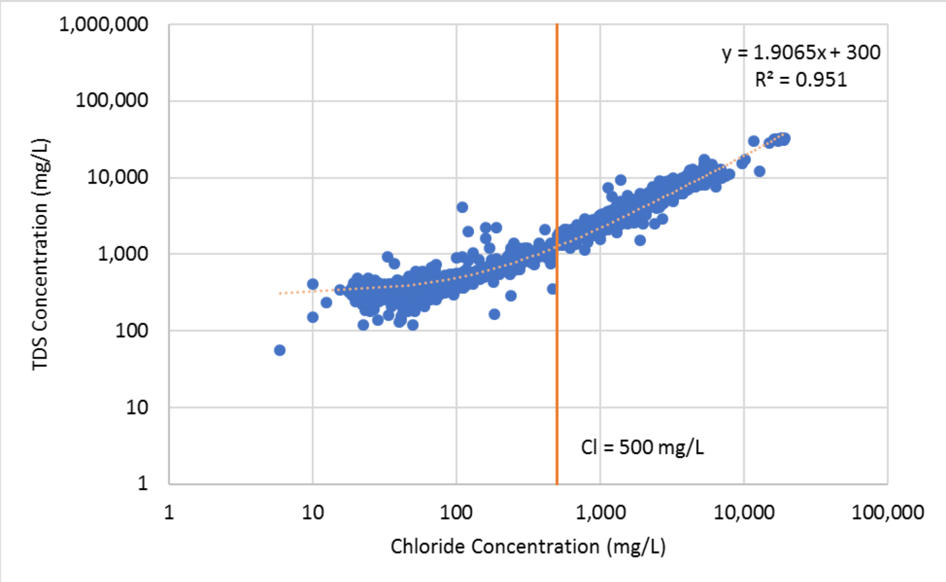
Figure 5-22. Ghyben-Herzberg Relation (Barlow, 2003)



The definition of seawater intrusion is generally based on a TDS or chloride concentration threshold and is dependent on local beneficial uses and groundwater protection strategies. In the larger Salinas Valley Basin, MCWRA has defined the seawater intrusion threshold as 500 mg/L of chloride. This chloride concentration is significantly lower than the 19,000 mg/L chloride concentration typical of seawater, but it represents a concentration that impact use of the water. Additionally, groundwater in the Marina-Ord aquifers has low natural TDS generally less than 500 mg/L, and the primary source of salinity in this area is seawater intrusion. Therefore, this GSP adopts the seawater intrusion threshold as 500 mg/L of chloride, or 1,000 mg/L of TDS as a surrogate where chloride data are unavailable.

TDS has been identified as a surrogate for chloride to define seawater intrusion due to the scarcity of actual chloride measurements within the Subbasin and the excellent correlation between these two parameters in the Marina-Ord aquifers. Groundwater in the Marina-Ord aquifers has low natural TDS generally less than 500 mg/L and the primary source of salinity in this area is seawater intrusion. The strong correlation between these water quality parameters within the seawater intruded lower 180-Foot/400-Foot Aquifer is shown on Figure 5-23 below. Appendix 5-A further examines this correlation and establishes a quantitative relationship to allow conversion between TDS and chloride concentrations detected in this aquifer.

Figure 5-23. Relationship Between TDS and Chloride Concentrations in the Lower 180-Foot, 400-Foot Aquifer



It should be noted that the seawater-affected groundwater quality may well be sufficient for many beneficial uses. In other words, while the definition of seawater intrusion front as the 500 mg/L chloride threshold (or 1,000 mg/L of TDS as a surrogate) is a useful guideline for identifying when some seawater intrusion effect may be detected, this does not necessarily mean that the groundwater within the affected region is no longer suitable for current or potential beneficial uses. Specifically, the following beneficial use standards on TDS apply to groundwater within the seawater intruded area of the Subbasin:

- The State of California has adopted an upper Secondary Maximum Contaminant Level (SMCL) for TDS of 1,000 mg/L, and a short-term maximum SMCL of 1,500 mg/L for drinking water.
- Under SWRCB Resolution 88-63, the state considers all groundwater containing TDS at concentrations less than 3,000 mg/L as having potential beneficial use as a domestic and municipal supply. This Resolution is adopted as part of the RWQCB's Water Quality Protection Plan for the region.

- The Federal Clean Water Act defines groundwater containing less than 10,000 mg/L TDS as an Underground Source of Drinking Water.
- SWRCB Resolution 68-16, also known as the Antidegradation Policy, requires that the existing high quality of waters be maintained to the maximum extent possible, and allows degradation only if it is consistent with maximum benefit to the people of the state, will not unreasonably affect present and potential beneficial uses, and will not result in water quality lower than applicable standards.

5.3.3 Seawater Intrusion Maps and Cross-sections

Figure 5-24 shows recent (post-2015) TDS concentrations in each of the coastal aquifers. As shown on Figure 5-24, TDS concentrations measured in the Dune Sand, upper 180-Foot, and Deep Aquifers monitoring locations are generally below 1,000 mg/L, indicating that there is no or minimal seawater intrusion in these aquifers. In the lower 180-Foot and 400-Foot Aquifers, TDS concentrations of over 10,000 mg/L are observed up to four miles inland near the northern Monterey Subbasin boundary.

As shown on Figure 5-25, cross-sections A-A' and B-B' (Figure 5-26 and Figure 5-27) run perpendicular to the coastline and show relevant TDS data (measured at designed well screen intervals) and 2019 AEM survey data along these transects. Cross-section B-B' is located within the Monterey Subbasin; however, AEM data along this cross-section are sporadic due to the absence of AEM data in urban areas where high density of utilities interferes with AEM data collection. Cross-section A-A' runs immediately north of the Monterey Subbasin, and provides insight regarding the vertical delineation of seawater intrusion within the coastal areas of the Monterey Subbasin.

TDS and AEM data shown on these cross-sections confirm that seawater intrusion in the Monterey Subbasin primarily exists in the lower 180-Foot Aquifer and 400-Foot Aquifer, whereas groundwater in the Dune Sand and upper 180-Foot Aquifers remains fresh. TDS concentrations are dramatically different in different depths of the multi-completion wells (e.g., MP-BW-37), and the highest TDS concentration occurs in approximately 360 to 400 feet below ground surface (ft bgs). It appears that seawater intrusion in these two aquifers forms a unified intrusion wedge due to the discontinuity of the 180/400-Foot Aquitard near the coast. The data are consistent with the Ghyben-Herzberg Relation, which accounts for the downward movement of high-density seawater, overlain by lighter freshwater.

Based on available TDS and AEM data, Figure 5-28 depicts the estimated extent of seawater intrusion within the Monterey Subbasin. As shown on Figure 5-28, seawater intrusion within the Monterey Subbasin extends as far as four miles inland. This estimated extent of seawater intrusion is consistent with available chloride data, which only exist for non-seawater intruded areas. No additional data exist between MCWD production well MCWD-30 and the cluster of wells located northwest of MCWD's production wells, where TDS concentrations exceed 10,000 mg/L. Therefore, the actual location of the seawater intrusion front where groundwater TDS concentrations exceed 1,000 mg/L and/or chloride concentrations exceed 500 mg/L is unknown.

The location of the seawater intrusion front in the vicinity of these wells has been identified as a data gap.

The estimated extent of sweater intrusion shown on Figure 5-28 is generally consistent with MCWRA's mapped extent of the current (2019) seawater intrusion front in the 400-Foot Aquifer (see Appendix 5-B). MCWRA also maps a similar seawater intrusion front in the 180-Foot Aquifer in the Monterey Subbasin. However, as discussed Chapter 4 and shown above, the 180-Foot Aquifer in the Subbasin is divided by an intermediate aquitard into an upper zone and a lower zone. There is no observed seawater intrusion in the upper portion of the 180-Foot Aquifer. Therefore, MCWRA's maps are only consistent with data collected from the lower 180-Foot Aquifer.

Figure 5-28 also presents the mapped Fall 2017 groundwater elevations for the lower 180-Foot Aquifer and the 400-Foot Aquifer. The figure shows that depressed groundwater elevations in the 180/400-Foot Aquifer Subbasin are creating inland groundwater gradients that are contributing to seawater intrusion within the Monterey Subbasin. This observed inland gradient is generally parallel to the current seawater intrusion front.

Since groundwater elevations in the Deep Aquifers are lower than sea level and also lower than groundwater elevations within the 400-Foot Aquifer, there is a significant risk that seawater intrusion will occur in this aquifer. Such seawater intrusion could either occur from lateral migration of seawater within the Deep Aquifers from subsea outcrops located further off-shore or and/or downward vertical migration from the intruded 400-Foot Aquifer. However, the locations and mechanisms of the Deep Aquifers recharge are not well understood. Therefore, the likelihood of and potential timeframe for seawater intrusion in this aquifer is unknown.

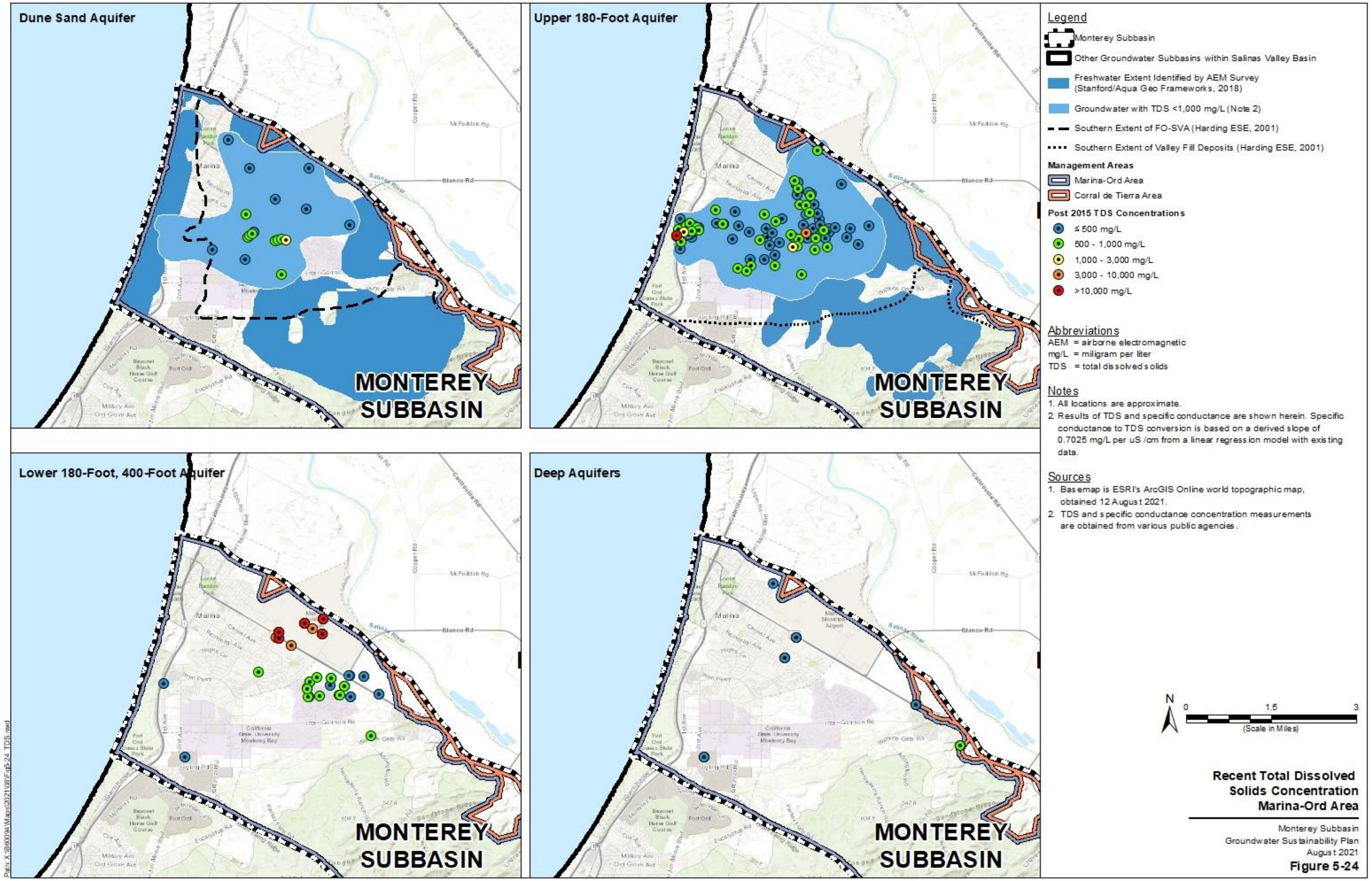


Figure 5-24. Recent Total Dissolved Solids Concentration, Marina-Ord Area

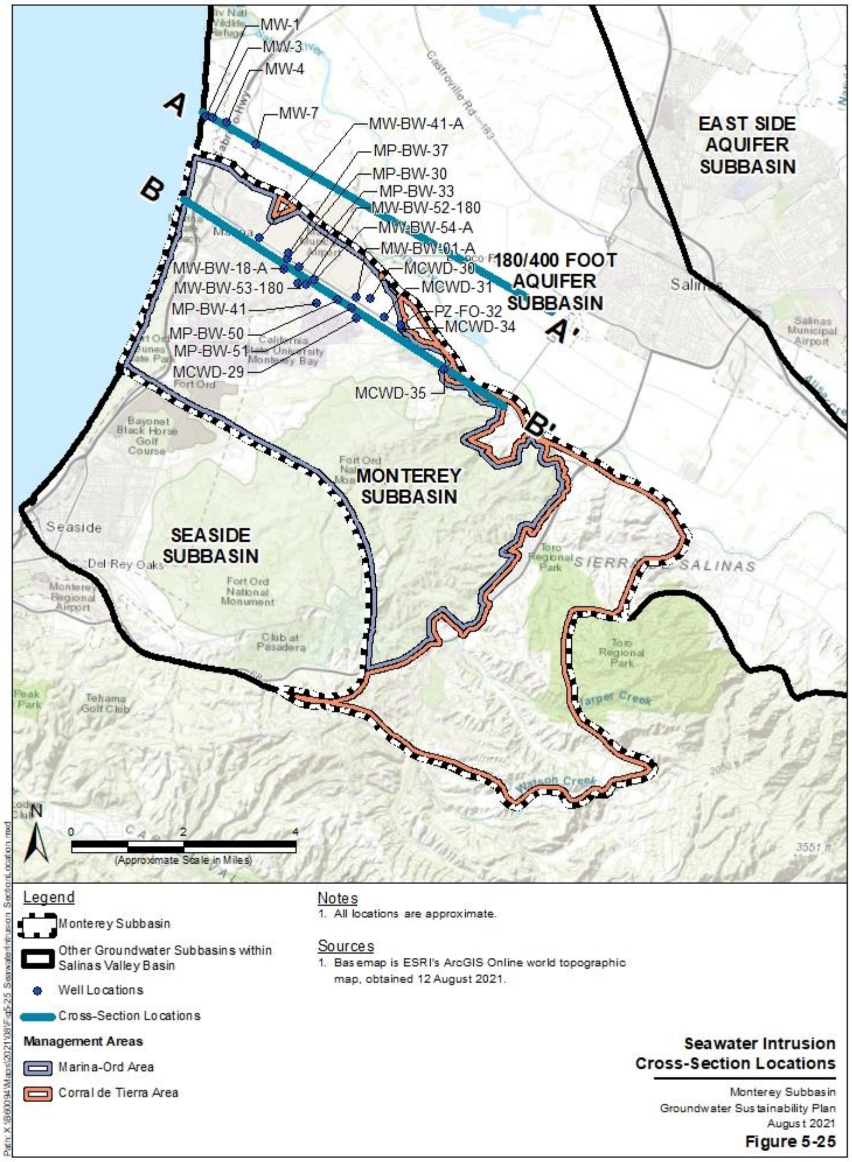


Figure 5-25. Seawater Intrusion Cross-Section Locations

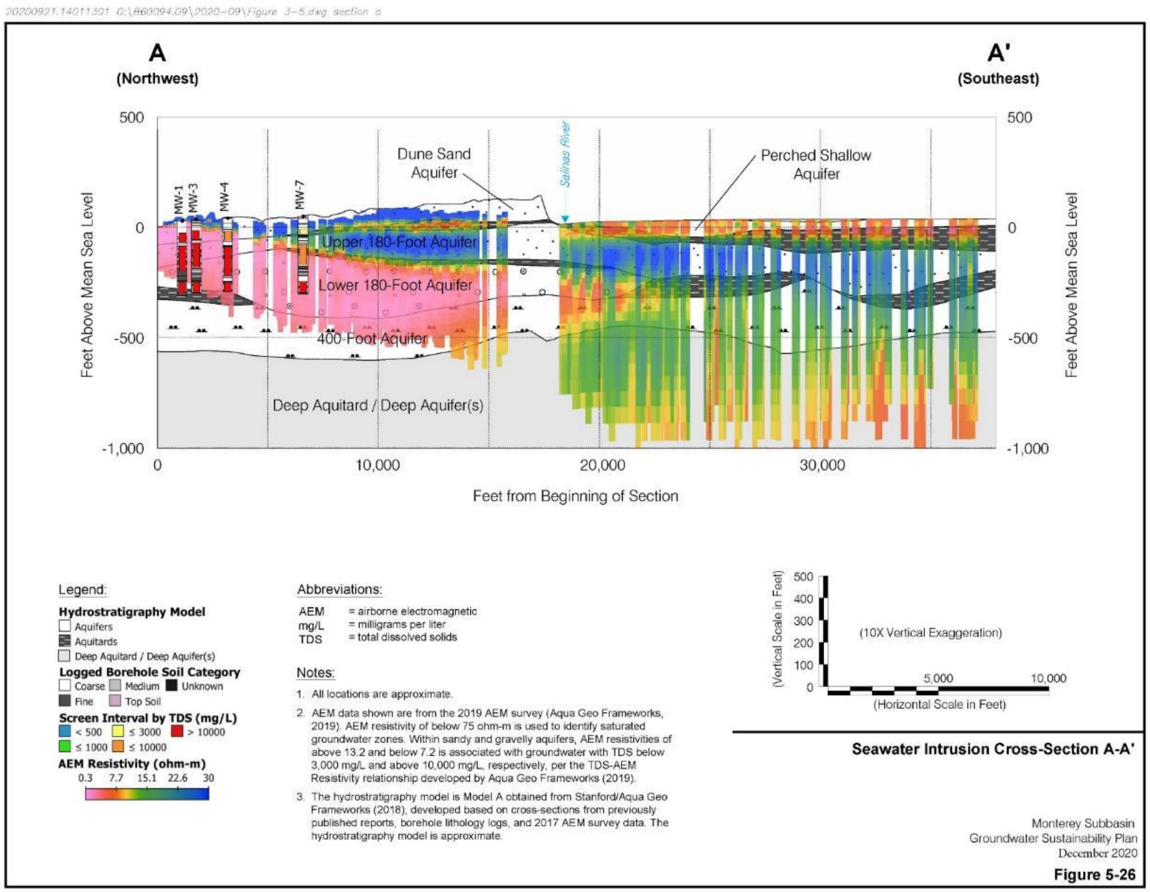


Figure 5-26. Seawater Intrusion Cross-Section A-A'

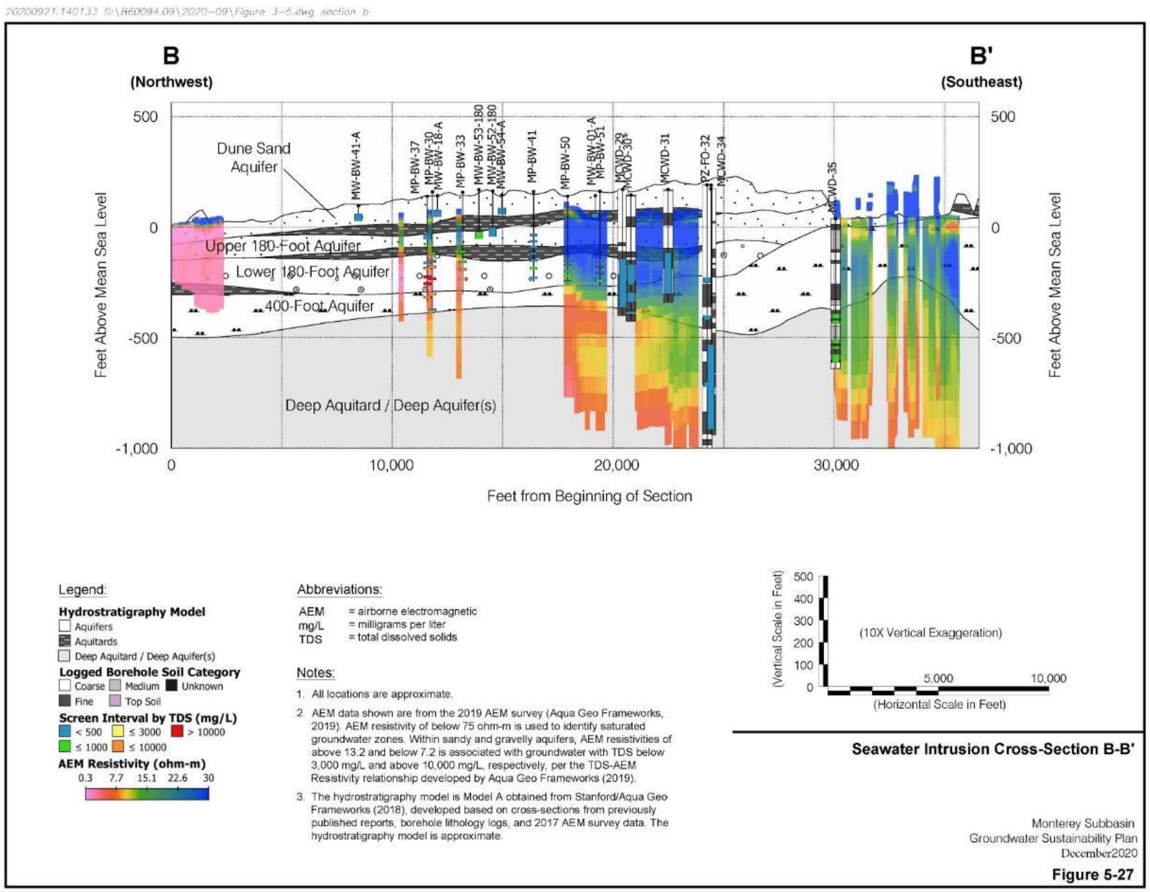


Figure 5-27. Seawater Intrusion Cross-Section B-B'

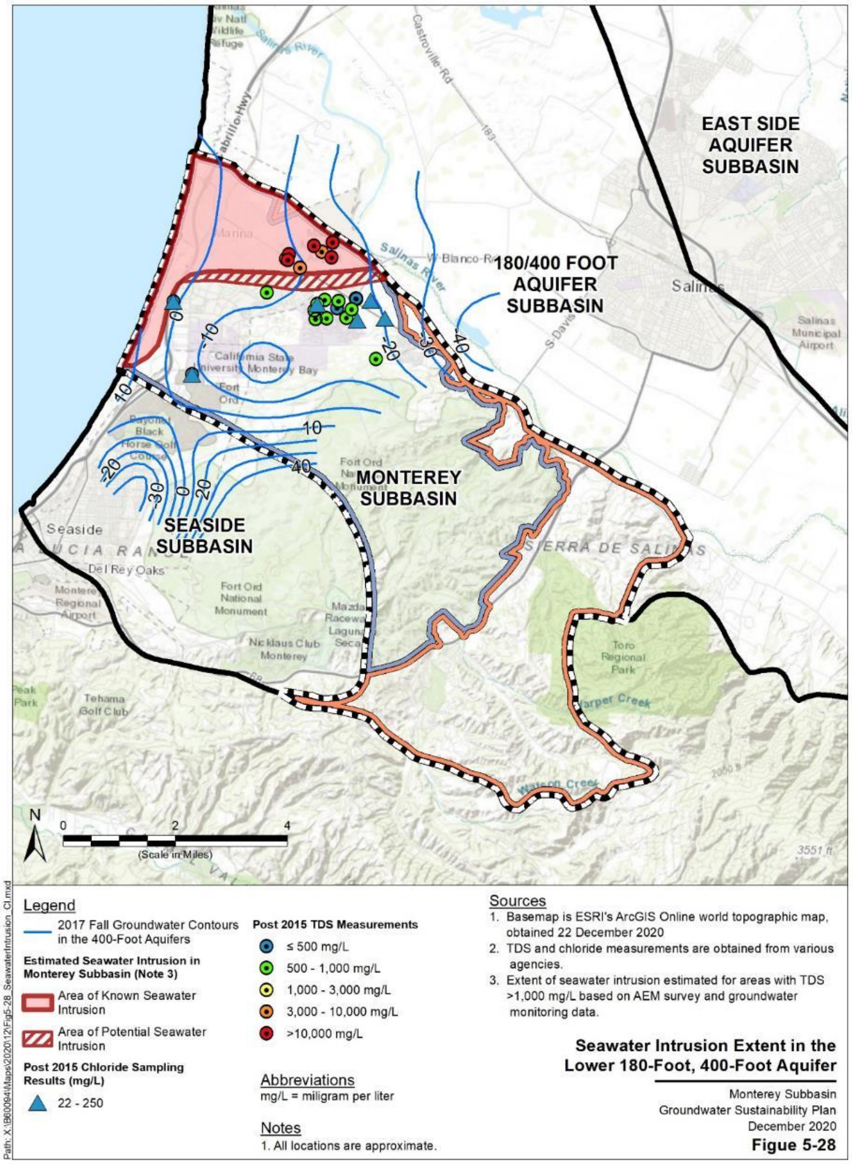


Figure 5-28. Seawater Intrusion Extent in the Lower 180-Foot, 400-Foot Aquifer

5.3.4 Historical Progression of Seawater Intrusion

Seawater intrusion has been documented in the Salinas Valley Basin since the 1940s (DWR, 1946). However, consistent records of the water quality indicators related to seawater intrusion within the Subbasin are only available back to the 2000s and at selected locations. Thus, the spatial variability of water quality data is insufficient to access the historical rate of seawater intrusion within the Subbasin prior to this time period. In this section, TDS trends in selected wells near the seawater intrusion front are presented to evaluate historical seawater intrusion rates during this time period.

Seven wells screened within the lower 180-Foot and 400-Foot Aquifers with relatively long TDS records are shown on Figure 5-29. Increasing Long-term trends in TDS concentrations are observed in areas that are seawater intruded. Additionally, high TDS groundwater has migrated downward within the seawater intruded area. TDS concentrations have increased in wells screens MP-BW-35-467 (i.e., screened 467 ft bgs at MP-BW-35) and MP-BW-37-460 (screened 460 ft bgs at MP-BW-37) between 2008 and 2018. Also, TDS concentrations detected in wells MCWD-30 and MCWD-09 fluctuate significantly, which indicates that saline groundwater exists close proximately to these wells.

The lateral extent of seawater intrusion within the Subbasin has been relatively stable over the past two decades. Specifically, immediately northwest of the seawater intrusion front, screens located from approximately 300 ft bgs to 400 ft bgs in multi-port wells MP-BW-37 and MP-BW-35 have been seawater intruded for nearly 20 years, or since 2001 when the wells were installed and records were available. ~~, or as long as records exist for this well.~~ Immediately southeast of the seawater intrusion front, wells MCWD-30 ~~and~~, MCWD-29, and the multi-port wells MP-BW-42 have shown relatively stable TDS concentrations at or below ~~500~~ 1,000 mg/L over the past two decades. Although there has been some increase in TDS concentration in wells that were previously seawater intruded, there has been no observed expansion of the location of seawater intruded area over the historic period.

~~two~~One CASGEM well~~s~~ in the southwestern portion of the Marina-Ord Area, MPWMD#FO-10 ~~and MPWMD#FO-11~~, showed a recent increase in ~~increasing~~ TDS concentration in ~~recent years~~2020. Induction logging on the well suggested that the increase in TDS concentration was not due to casing leakage. However, the exact cause of the elevated TDS/chloride concentration is unknown. The GSAs will collect additional data in the vicinity during GSP implementation in collaboration with the Seaside Basin Watermaster. ~~Seaside Basin Watermaster conducted induction logging on MPWD#FO-10 in early 2021 to study its geophysical characteristics (Feeney, 2021).~~ ~~Although the study did not confirm the exact cause of the elevated TDS/chloride concentration, it indicated that the well was not cross-connected through casing leakage.~~

The current seawater intrusion front is parallel to the groundwater flow direction in the lower 180-Foot and 400-Foot Aquifers; therefore, seawater continues to flow across the area that is intruded towards the 180/400-Foot Aquifer Subbasin, while there is minimal migration of seawater intrusion to inland areas of the Monterey Subbasin.

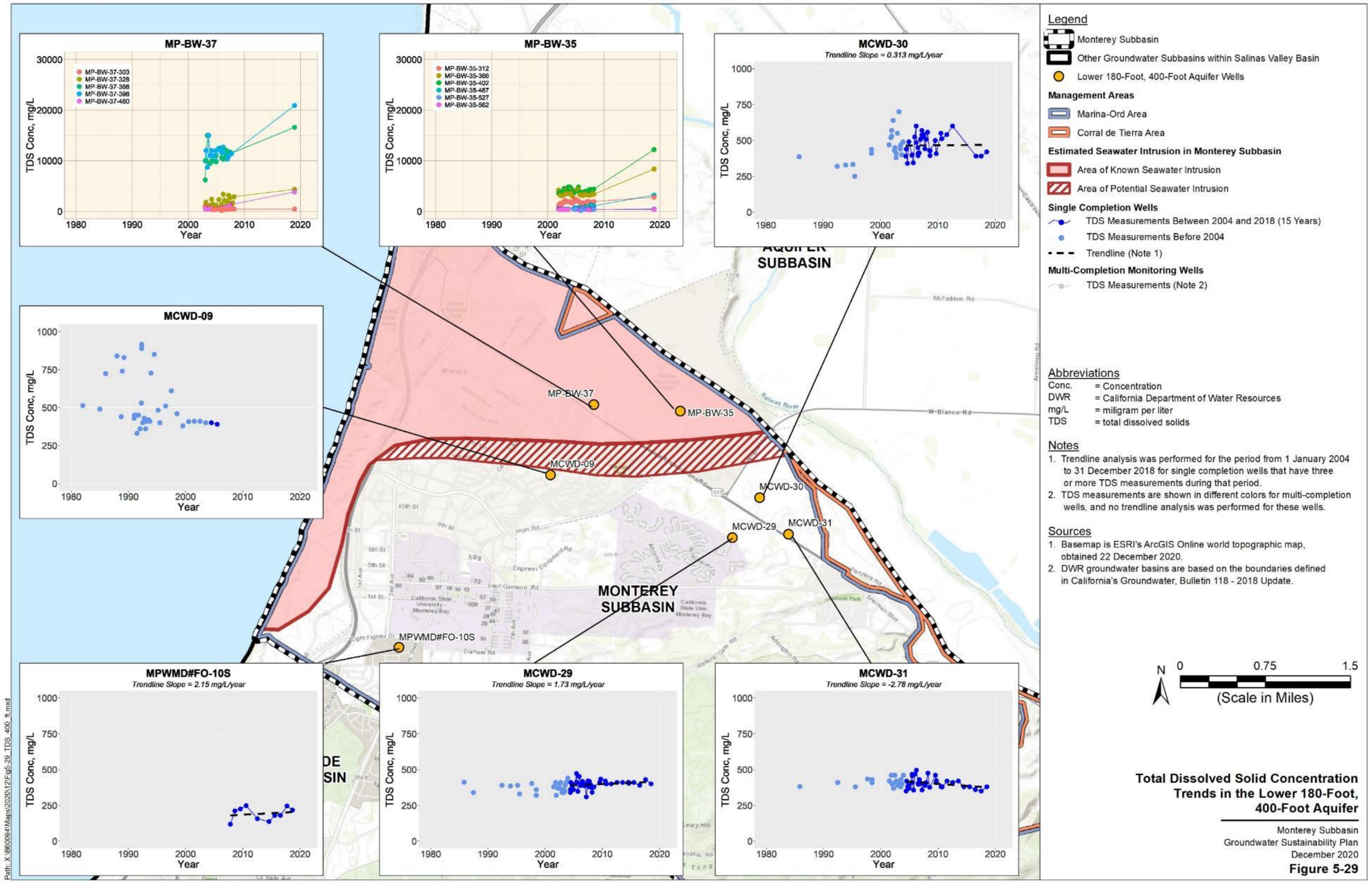


Figure 5-29. Total Dissolved Solid Concentration Trends in the Lower 180-Foot, 400-Foot Aquifer

5.4 Groundwater Quality Concerns

This section presents a summary of current groundwater quality conditions. The GSAs do not have regulatory authority over groundwater quality which is under the purview of other state and federal agencies (e.g., the Regional Water Quality Control Board). Projects and management actions implemented by MCWD and SVBGSA must not further degrade groundwater quality.

The known groundwater quality concerns in the Marina-Ord Area aquifers are elevated chloride and TDS concentrations and point-source contaminants such as Volatile Organic Carbons (VOCs) and per- and poly-fluoroalkyl substances (PFAS). The primary source of high TDS and chloride concentrations in groundwater within the Marina-Ord Area is seawater intrusion, as described above in Section 5.3.

In the Corral de Tierra Area, the most prevalent water quality concern is arsenic.

5.4.1 Data Sources

The assessment of groundwater quality conditions is based on comparing data compiled from various monitoring agencies to applicable screening levels for the various beneficial uses (i.e., Maximum Contaminant Levels [MCLs] for domestic/municipal and industrial (M&I) use and various thresholds for irrigated agricultural use).

Groundwater quality samples are collected within the Monterey Subbasin on a regular basis for various studies and programs. Groundwater quality samples have also been collected on a regular basis for compliance with regulatory programs, including drinking water and contamination cleanup programs. Groundwater quality data for this assessment were collected from:

- The US Army Corps of Engineers Fort Ord Data Integration System (FODIS);
- The USGS Groundwater Ambient Monitoring and Assessment Program (GAMA) reports (Kulongoski and Belitz, 2005; Burton and Wright, 2018);
- State Water Resources Control Board's GAMA website (SWRCB, 2020a);
- State Water Resource Control Board's GeoTracker website (SWRCB, 2020b);
- State Water Resources Control Board's Safe Drinking Water Information System (SWRCB, 2020c); and
- The California Department of Toxic Substance Control's Envirostor website (DTSC, 2020).

5.4.2 Distribution and Concentrations of Point-Source Contamination

Clean-up and monitoring of point source pollutants are generally under the responsibility of either State or Federal regulatory agencies such as the Central Coast Regional Water Quality Control Board (CCRWQCB), California State Department of Toxic Substances Control (DTSC), the

United States Environmental Protection Agency (U.S. EPA), and/or the United States Armed Forces. There are a number of active point-source contamination sites within the Subbasin, as identified on the SWRCB GeoTracker website[19] and the DTSC EnviroStor website[20]. These sites, shown on Figure 5-30 and listed in Table 5-2, are primarily located within the former Fort Ord and are a part of Fort Ord's environmental cleanup program.

The former Fort Ord was placed on EPA's National Priorities List (NPL) in 1990 following environmental investigations conducted in 1984 and 1986. The same year, a Federal Facility Agreement (FFA) was signed by the Army, U.S. EPA, DTSC, and the CCRWQCB. The FFA established schedules for performing remedial investigations and feasibility studies and required remedial actions be completed as expeditiously as possible. The base-wide Remedial Investigation Feasibility Study (RI/FS) commenced in 1991. The Army performs these activities pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) also known as Superfund.

Groundwater remedial action objectives and aquifer cleanup goals at Fort Ord are established within the Records of Decision (ROD) and subsequent Explanations of Significant Difference (ESD) prepared for each operable unit where groundwater impacts have been detected. These documents are part of the administrative record and have been endorsed by state and federal agencies. The ROD documents selected remedy and cleanup levels that comply with the federal and state requirements that are applicable or relevant and appropriate (ARAS) to the site, such as drinking water Maximum Contaminant Levels (MCLs) and CCRWQCB Basin Plan Water Quality Objectives.

The approximate extent of contamination plumes that have historically been identified in groundwater within former Fort Ord are delineated by the location of the well prohibition area, also shown on Figure 5-30 and described in detail in Chapter 3. These contamination plumes are primarily located within the Dune Sand and 180-Foot Aquifers. No contamination has been detected in the 400-Foot Aquifer and the Deep Aquifers. The most frequently detected chemicals in these areas are trichloroethene (TCE) and carbon tetrachloride (CT). In addition, there is one cleanup program site located within the City of Marina and a Leaking Underground Storage Tank (LUST) cleanup site located by Highway 68.

[19] http://geotracker.waterboards.ca.gov
[20] https://www.envirostor.dtsc.ca.gov/public/

Table 5-2. List of Active Point Source Contamination Sites

Label	Site Name	Site Type	Status	Constituents of Concern
1	Don's One Hour Dry Cleaners	Cleanup Program Site	Open - Verification Monitoring	Other Chlorinated Hydrocarbons, Tetrachloroethylene (PCE)
2	Fort Ord - Fort Ord - Sites 2 and 12	Military Cleanup Site	Open - Remediation	Chlorinated Hydrocarbons
3	Fort Ord - Fort Ord OU1 (Fritzsche Army Airfield Fire Drill Area, On-Site Plume)	Military Cleanup Site	Open - Remediation	Gasoline, Chlorinated Hydrocarbons
4	Fort Ord - Fort Ord OU1 (Off-Site Plume)	Military Cleanup Site	Open - Remediation	Gasoline, Chlorinated Hydrocarbons
5	Fort Ord - Fort Ord - OU2	Military Cleanup Site	Open - Remediation	Gasoline, Chlorinated Hydrocarbons
6	Fort Ord - Fort Ord - OUCTP	Military Cleanup Site	Open - Remediation	Chlorinated Hydrocarbons
7	Former Exxon - Corral De Tierra	LUST Cleanup Site	Open - Eligible for Closure	Gasoline, MTBE / TBA / Other Fuel Oxygenates
8	Fort Ord Reuse Authority (Early Transfer)	Federal Superfund	Active	--
9	Fort Ord - East Garrison (VCA)	Federal Superfund	Certified	--
10	Fort Ord State Park-MOU with DPR	Federal Superfund	Active	--
11	Fort Ord Reuse Authority MOA	Federal Superfund	Active	--

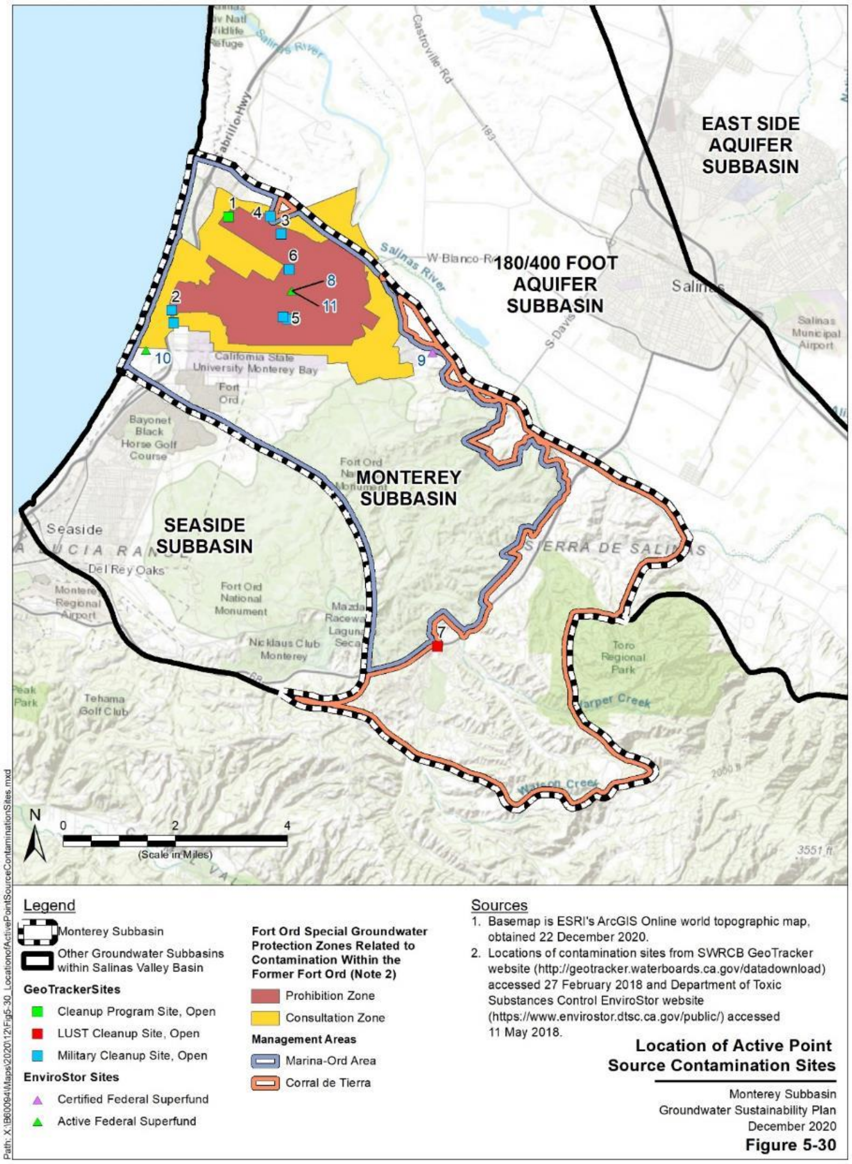


Figure 5-30. Location of Active Point Source Contamination Sites

To date, no point-source contaminants have been detected above MCLs in domestic/M&I supply wells within the Subbasin. However, as of June 2019, trichloroethylene (TCE), carbon tetrachloride (CT), perfluorobutanesulfonic acid (PFBS), and perfluorohexanoic acid (PFHxA) have been detected above their respective detection limits in MCWD supply wells screened in the 180- and 400-Foot Aquifers-.

- Trichloroethylene (TCE) and carbon tetrachloride (CT): TCE and CT are among the major chemicals of concern detected in groundwater within Fort Ord Operable Unit 2 (OU2) and Operable Unit Carbon Tetrachloride Plume (OUCTP). These operable units are located in the center of the Marina-Ord Area southeast of MCWD production wells. TCE was detected in MCWD lower 180-Foot, 400-Foot Aquifer production wells since the 2000s and was most recently detected at concentrations ranging from 0.57 ug/L in MCWD-30 to 1.80 ug/L in MCWD-29 in June 2019[21]. CT was also recently detected in these wells at low concentrations. Figure 5-31 illustrates TCE concentrations detected in Fort Ord monitoring wells and MCWD production wells in June 2019. As shown on Figure 5-31, within the former Fort Ord, TCE exceeding the MCL (5 ug/L) was detected in monitoring wells in the Dune Sand Aquifer as well as the upper and lower 180-Foot Aquifers. Discontinuity of aquitards and the downward vertical groundwater gradient have contributed to the downward migration of contamination. The closest monitoring well with TCE concentration detected above the MCL is located in the lower 180-Foot Aquifer one-mile upgradient of MCWD production wells.
- Perfluorobutanesulfonic acid (PFBS) and perfluorohexanoic acid (PFHxA): PFBS and PFHxA are Per- poly-fluoroalkyl substances (PFASs), which is a group of emerging man-made contaminants that were used in firefighting foam, protective coatings, and stain and water-resistant products until the 2000s. During MCWD's January 2020 PFAS sampling event, PFBS and PFHxA were detected in lower 180-Foot, 400-Foot Aquifer production well MCWD-29. There are no current drinking water regulations in California for these two substances. To date, no sampling of PFBS and PFHxA has been conducted in non-MCWD wells.

  In 2019, the USACE conducted a review of historical activities with the potential to cause PFAS contamination at the Fort Ord (USACE, 2019). The study identified that the primary mechanism for release of PFAS was through the historical use of Aqueous Film-Forming Foam (AFF) in former fire drill areas, aviation areas, and subsequent transport to landfill and sewage treatment areas. Additionally, groundwater sampling for the two PFAS contaminants with established regulatory limits (Perfluorooctanoic acid [PFOA] and perfluorooctanesulfonic acid [PFOS]) was conducted as part of the study. The United States Environmental Protection Agency (U.S. EPA) issued a lifetime health advisory for PFOA and PFOS in drinking water at a total concentration of 0.07 ug/L. Even though no MCLs have been promulgated, the California SWRCB established notification levels (NLs)

[21] The MCL for TCE is 5 ug/L.

for PFOA and PFOS at 0.0051 ug/L and 0.0065 ug/L, respectively. PFOA and PFOS were measured above their respective NLs in the Dune Sand 180-Foot Aquifers that are adjacent to the Fort Ord OU2 Landfill.

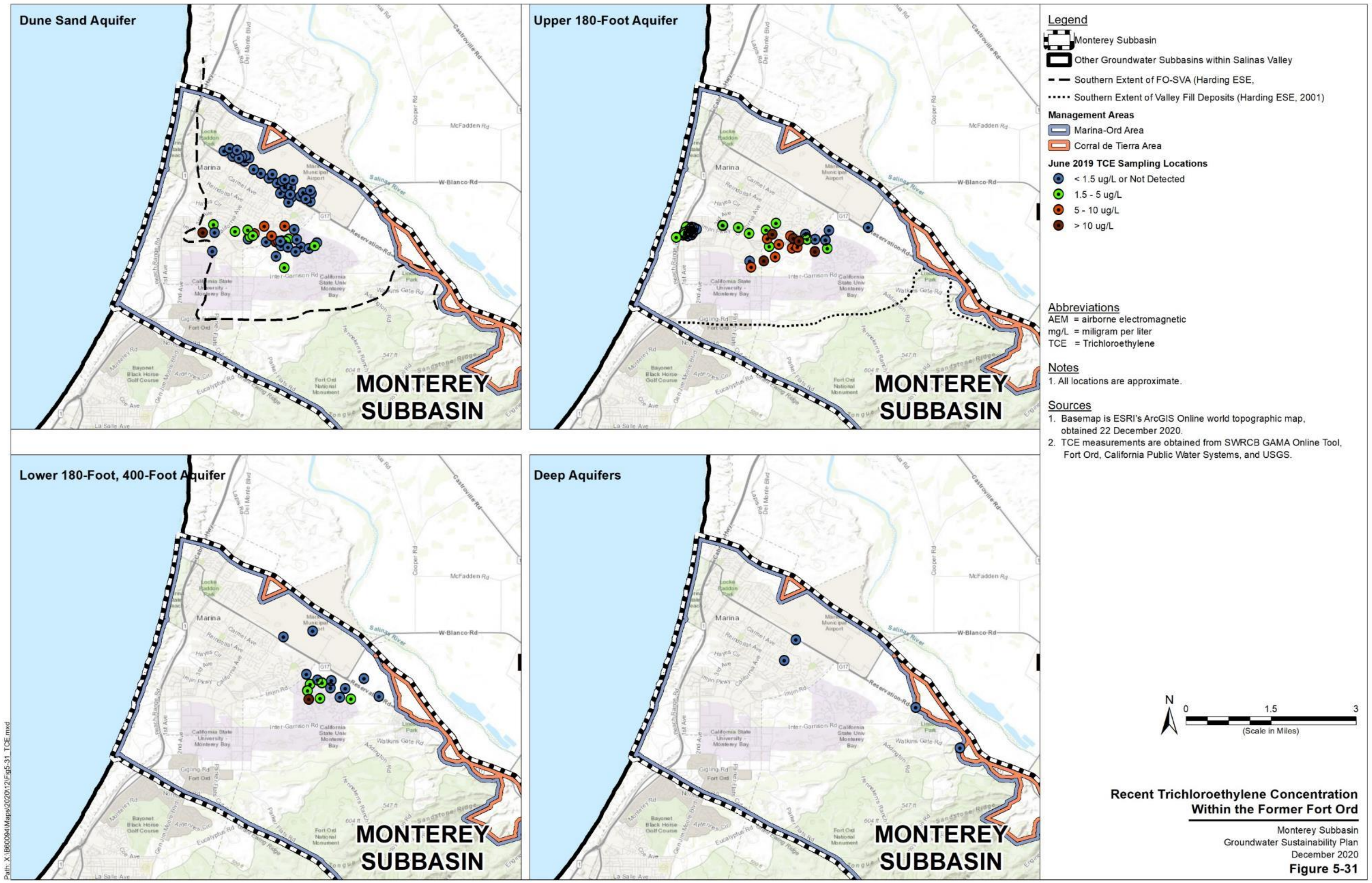


Figure 5-31. Recent TCE Concentration within the Former Fort Ord

5.4.3 Distribution and Concentrations of Diffuse or Natural Groundwater Constituents

In addition to the single point source of groundwater contamination described above, the CCRWQCB monitors and regulates activities and discharges that can contribute to non-point source pollutants, which are constituents released to groundwater over large areas.

In the El Toro Primary Aquifer System, the most prevalent non-point source water quality concern is arsenic. It has been reported that primary and secondary MCLs are exceeded in several wells in the area, with arsenic being a constituent of concern for additional groundwater development (GeoSyntec, 2007). In addition, nitrate and coliform bacteria may present problems in areas with more dense occurrences of septic tanks and shallow wells (GeoSyntec, 2007). Concentrations of TDS range from 355 to 1650 mg/L (DWR 1967; GeoSyntec, 2007). However, there is some variability between hydrostratigraphic units.

Groundwater quality conditions in the Subbasin were summarized in two USGS water quality studies. The USGS 2005 GAMA study in the Salinas Valley characterized deeper groundwater resources used for public water supply (Kulongoski and Belitz, 2005). The USGS 2018 GAMA study in the Salinas Valley focused on domestic well water quality (Burton and Wright, 2018). All quality-assured data collected for these two studies and the GAMA Program are publicly available through the SWRCB GAMA and GeoTracker groundwater information systems (SWRCB, 2020a; SWRCB, 2020b).

Table 5-3 reports the constituents of concern in the Monterey Subbasin based on GAMA and GeoTracker data. These data include on-farm domestic wells monitored under the Irrigation Lands Regulatory Program (ILRP), irrigation supply wells sampled under ILRP, as well as public supply wells monitored under the Division of Drinking Water (DDW) programs. As such, Table 5-3 compares sampling results to applicable screening levels for the various beneficial uses (i.e., Tittle 22 MCLs for domestic/ Municipal and Industrial (M&I) use and various thresholds for irrigated agricultural use from the CCRWQCB's 2019 Basin Plan). The number of wells that exceed the regulatory standard for any given constituent of concern is based on the latest sample for each well in the monitoring network. Not all wells have been sampled for all constituents of concern. Therefore, the percentage of wells with exceedances is the number of wells that exceed the regulatory standard divided by the total number of wells that have ever been sampled for that constituent of concern. Figure 5-32 shows the location of GAMA/GeoTracker database wells with identified exceedances of a regulatory standard in its latest sample.

As shown on Table 5-3, arsenic is the only constituent with a primary MCL standard and a significant percentage of wells with exceedances found within the Subbasin. It should be noted that ILRP often does not sample for arsenic. Thus, the impact arsenic has had on ILRP on-farm domestic and irrigation wells is unknown. This will be a data gap addressed during GSP implementation, especially in shallow domestic wells.

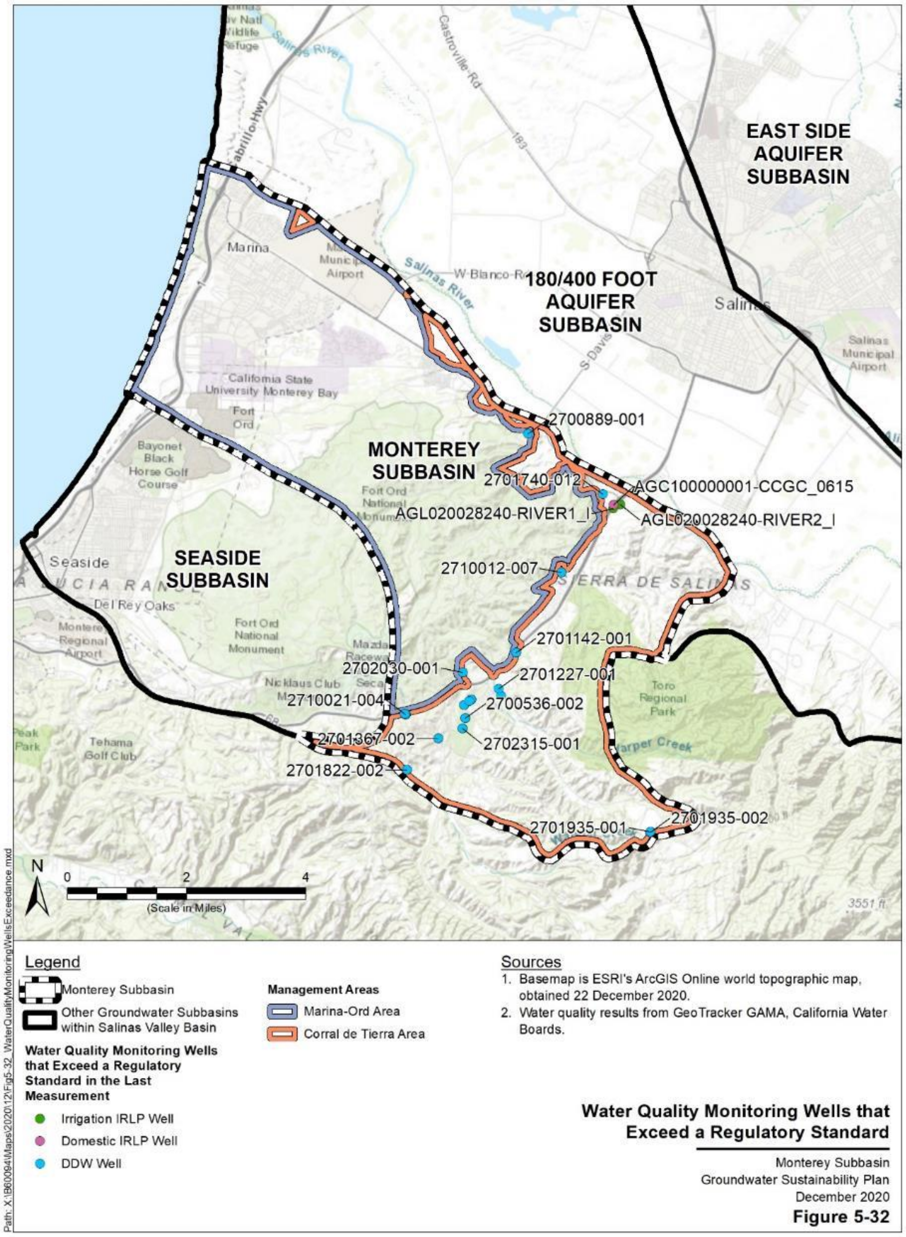
Iron and manganese have been detected above their respective secondary MCLs in over 10% of DDW wells. The only two irrigation ILRP wells within the Subbasin, located along the northern

Subbasin boundary, have shown exceedances of total Nitrate and Nitrite. However, no nitrate exceedances have been identified in any domestic or public drinking water supply wells.

Table 5-3. GAMA/GeoTracker Water Quality Summary[22]

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
On-Farm 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	29	7	24%
Benzo(a)Pyrene	0.2	MG/L	21	1	5%
Chromium	50	UG/L	29	2	7%
1,2 Dibromo-3-chloropropane	0.2	UG/L	13	2	15%
Dinoseb	7	UG/L	26	3	12%
Iron	300	UG/L	30	13	43%
Hexachlorobenzene	1	UG/L	12	1	8%
Manganese	50	UG/L	29	11	38%
Nickel	100	UG/L	24	1	4%
Specific Conductance	1600	UMHOS/CM	30	2	7%
1,2,3-Trichloropropane	0.005	UG/L	24	1	4%
Total Dissolved Solids	1000	MG/L	30	2	7%
Vinyl Chloride	0.5	UG/L	37	3	8%
Zinc	5	MG/L	30	1	3%

[22] Inactive, abandoned, or destroyed wells are excluded from this analysis.



Water Quality Monitoring Wells that Exceed a Regulatory Standard

Figure 5-32

Figure 5-32. Water Quality Monitoring Wells that Exceed a Regulatory Standard

5.5 Land Subsidence

Land subsidence, or the lowering of ground surface, can be caused by excessive groundwater withdrawal that lowers the potentiometric head in compressible fine-grained layers, resulting in depressurization and compaction of those fine grain layers. Land subsidence can be elastic or inelastic. Elastic subsidence is reversible (i.e., the land surface rises again after the potentiometric head increases), whereas inelastic subsidence is irreversible (i.e., the compaction of fine-grained layers is permanent). Inelastic subsidence is considered an undesirable result.

5.5.1 Data Sources

This assessment uses Interferometric Synthetic Aperture Radar (InSAR) satellite data[23] from June 2015 to September 2019. These are the only available data used for estimating subsidence in this GSP.

5.5.2 Subsidence Mapping

Figure 5-33 presents a map showing the average annual subsidence rate in the Monterey Subbasin over the period from June 2015 and September 2019. The yellow area on the map is the area with measured average annual changes in ground elevation of between -0.1 and 0.1 foot per year. As discussed further in Chapter 8, because of inherent error in the InSAR measurement methodology, any measured ground level changes between -0.1 and 0.1 foot per year are not considered subsidence. The map shows that no measurable subsidence has been recorded anywhere in the Monterey Subbasin.

[23] https://gis.water.ca.gov/arcgisimg/rest/services/SAR/Vertical_Displacement_TRE_ALTAMIRA_v2019_Total_Since_20150613_Mosaic/ImageServer

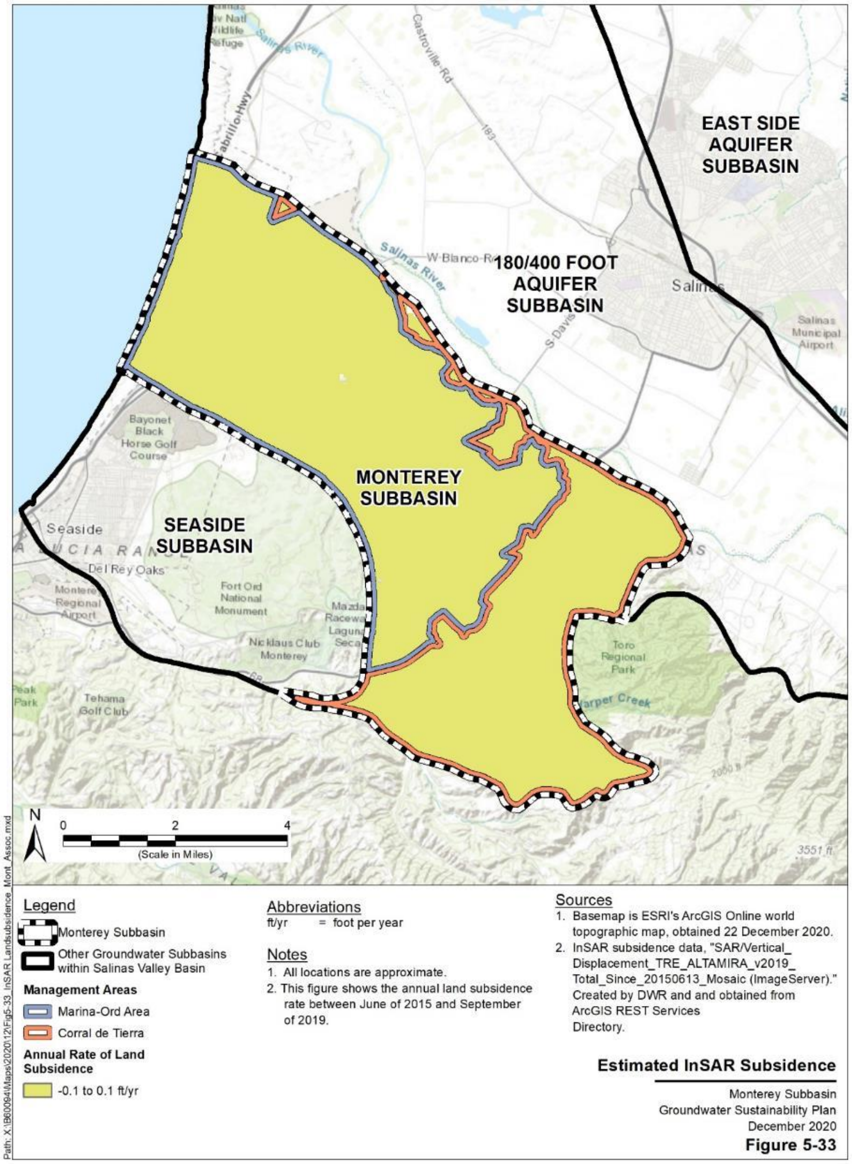


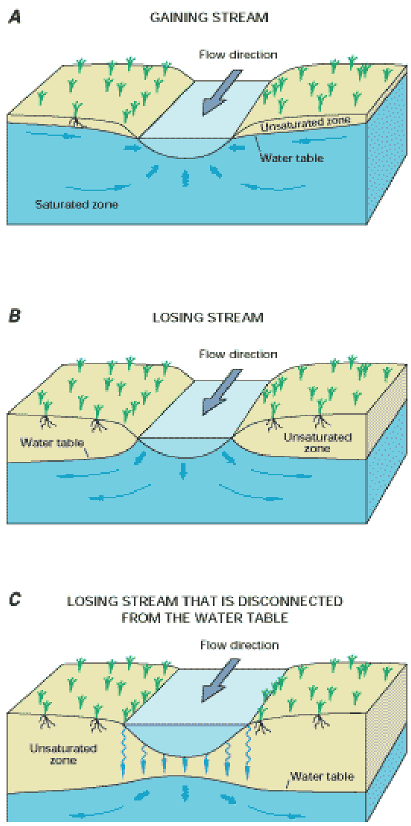
Figure 5-33. Estimated InSAR Subsidence

5.6 Interconnected Surface Water Systems

~~THIS SECTION WILL BE UPDATED WHEN THE SVIHM BECOMES AVAILABLE~~

Surface water that is connected to the groundwater flow system is referred to as interconnected surface water. If the groundwater elevation in an aquifer that is hydraulically connected to a stream (or other surface water body) is higher than the water level in the stream, the stream is said to be a gaining stream because it gains water from the surrounding underlying groundwater. If the groundwater elevation is lower than the water level in the stream, it is termed a losing stream because it loses water to the surrounding groundwater flow system. If the groundwater elevation is well below the streambed elevation and there is an unsaturated zone between the stream and the groundwater, the stream and groundwater are considered to be disconnected. These concepts are illustrated in Figure 5-34.

Figure 5-34. Conceptual Representation of Interconnected Surface Water (Winter et. al., 1999)



5.6.1 Data Sources

This analysis of interconnected surface water is based on the best available data but contains significant uncertainty. The main source of information for this analysis will be the Monterey Subbasin groundwater model and the SVIHM when they become available. Subject to limitations related to model resolution and overall accuracy, the models will be able to provide a detailed picture of the distribution of hydraulically connected surface water and groundwater in the Subbasin. The assessment herein uses groundwater elevation measured in the shallow-most principal aquifers (i.e., the Dune Sand Aquifer in the coastal Marina-Ord area and the Aromas Sands/Paso Robles Aquifer in the upland Corral de Tierra Area) to identify potential hydraulic connection. As shown below, shallow groundwater elevation is limited within the Subbasin and additional groundwater monitoring wells may be necessary to verify groundwater elevations adjacent to surface water bodies. This is a data gap that will be addressed during GSP implementation. An evaluation of surface water depletion rates is provided in Chapter 6.

5.6.2 Analysis of Surface Water and Groundwater Interconnection

As described in Section 4.3, surface water streams within the Subbasin are generally small intermittent streams that flow only after storm events, and are unlikely to be connected to groundwater, except for the lower reaches of El Toro Creek and two potential locations along the Salinas River near the Monterey-180/400-Foot Aquifer Subbasin boundary where the Salinas River intercepts the Subbasin in a small portion of the Corral de Tierra Area.

El Toro Creek is a perennial stream below the confluence with Watson Creek below the Corral de Tierra golf course, and runoff-dependent above this point (Feikhart, 2001). Recorded streamflows at USGS gage 11152540 from 1961 to 2001 indicate a mean annual streamflow of 1,590 AFY (GeoSyntec, 2007). This mean annual streamflow was calculated for the entire record from 1961 to 2001. However, El Toro Creek did not record flow every year. It is unclear whether the perennial sections of streamflow in El Toro Creek are supported by groundwater from a principal aquifer. This will be further evaluated as more data becomes available. Other analyses may include locations of shallow groundwater. In the Salinas Valley Basin, groundwater that is within 20 feet of land surface may be assumed to be connected to surface water based on streambed incision. This may not be the case in tributaries such as El Toro Creek. No areas of groundwater within 20 feet of land surface were found in the Corral de Tierra Area in Fall 2017 (Figure 5-35). However, in 2019, there were some areas of groundwater within 20 feet of land surface recorded in the Corral de Tierra Area along El Toro Creek (Figure 5-36). However, there ~~were~~was no area of groundwater within 20 feet of land surface recorded in the Corral de Tierra Area along the Salinas River in Fall 2019.

Another type of surface water that exists within the Subbasin includes ponds and lakes located within the City of Marina and within the Fort Ord federal land area. These surface water features are known as vernal ponds (discussed further in Section 5.7.1 below); however, some of these features are known to contain open water well into the dry season (WRA, 2020). As shown on Figure 5-35 and discussed in Section 5.7 below, groundwater elevations in the Dune Sand Aquifer in the vicinity of the City of Marina are within 20 ft of ground surface and are at similar levels in nearby Dune Sand Aquifer wells. Therefore, the ponds in the vicinity of City of Marina may be supported by groundwater in the Dune Sand Aquifer. There are several shallow groundwater wells within approximately 1,500 feet of the Marina Ponds. No existing shallow groundwater exists in the ponds' vicinity within the former Fort Ord federal lands area.

For areas of the Subbasin that are connected to surface water and groundwater extraction exits, a detailed analysis of hydraulic connection is required. These areas may ~~require additional evaluation of hydraulic interaction,~~collection of shallow groundwater elevations and analysis ~~which will be possible~~through a numerical model~~, once available~~. Additional data are needed to reduce uncertainty and refine the map of interconnected surface waters.

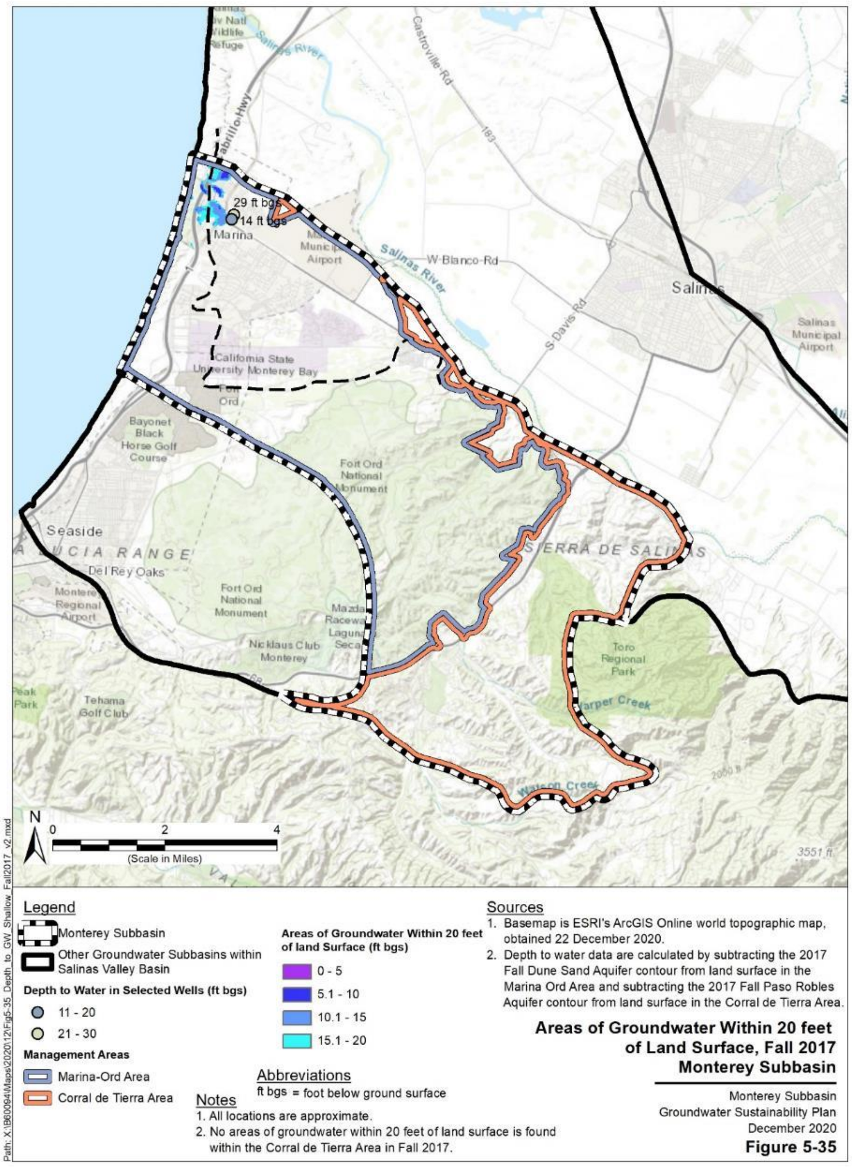


Figure 5-35. Areas of Groundwater Within 20 feet of Land Surface, Fall 2017, Monterey Subbasin

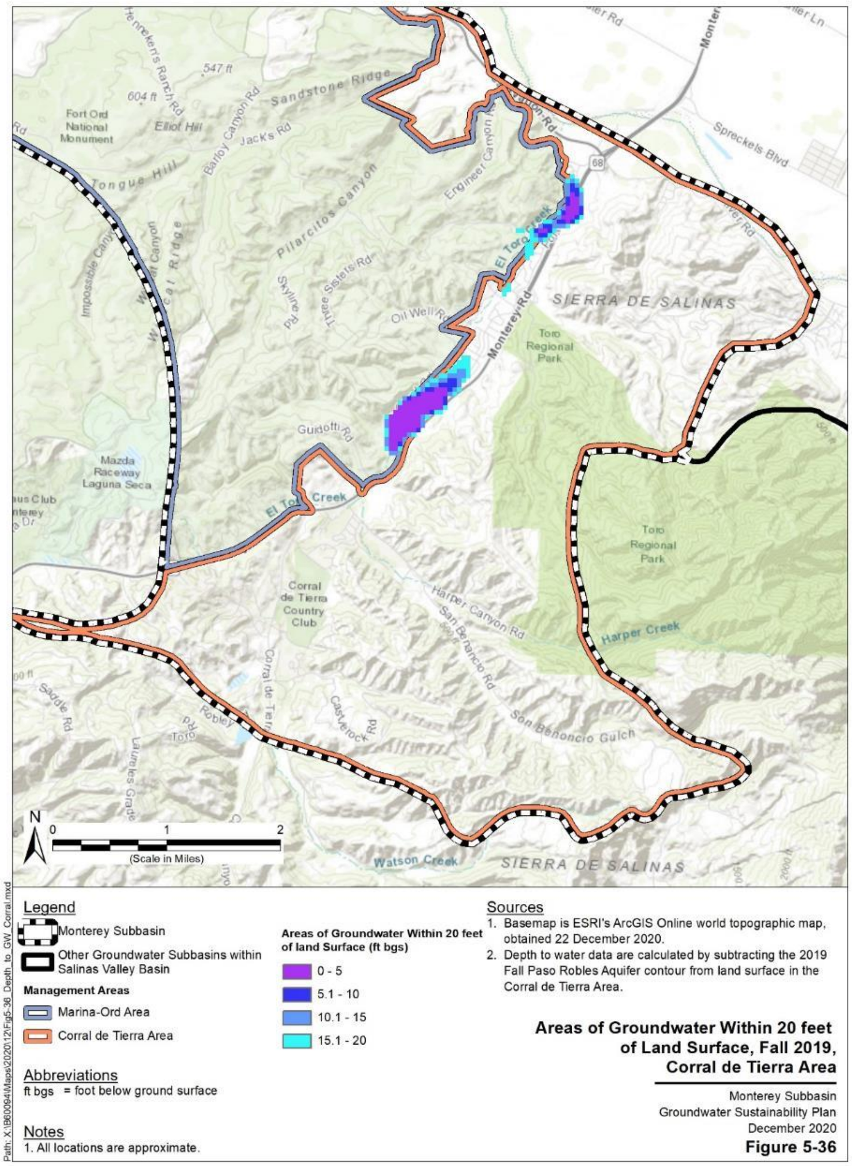


Figure 5-36. Areas of Groundwater Within 20 feet of Land Surface, Fall 2019, Corral de Tierra Area

5.7 Groundwater Dependent Ecosystems

Groundwater Dependent Ecosystems (GDEs) are natural communities (flora and fauna) that depend on near-surface groundwater as a source of water. While GDEs are not a sustainability indicator as defined by SGMA, they are considered a beneficial use of groundwater and are potentially affected by other sustainability indicators such as chronic lowering of groundwater levels, and therefore must be considered in GSPs. Two main types of ecosystems are commonly associated with groundwater: wetlands associated with the surface expression of groundwater and vegetation that typically draws water from a shallow water table.

GDEs may provide critical habitat for threatened or endangered species. Areas designated as critical habitats for threatened or endangered species contain the physical or biological features that are essential to the conservation of these species, and may need special management or protection (USFWS, 2017). A list of threatened and endangered species that might rely on GDEs in the Subbasin was compiled using information from the U.S. Fish and Wildlife Service (USFWS), California Department of Fish and Wildlife (CDFW), and The Nature Conservancy (TNC). Several steps were taken to determine which threatened and endangered species were likely found in the Subbasin and of those, which were likely to rely on the GDE habitat. A list of threatened and endangered species for Monterey County was downloaded from the USFWS website and cross-referenced to species identified in the CDFW California Natural Diversity Database. The threatened and endangered species for Monterey County was further cross-referenced with the TNC Critical Species LookBook to identify which species are likely to depend on groundwater, as indicated in .

Ten threatened and endangered species, including the Southern California Steelhead, and the California Red-legged Frog, were identified as likely to rely directly on groundwater in Monterey County, several of which may be found in the Subbasin. Ten species were identified as likely to rely indirectly on groundwater, and the remaining species are unknown with respect to whether they directly rely on GDEs or groundwater. All species listed have the potential for groundwater dependence. There are eight species that appear in both the federal and state list for threatened or endangered species.

Table 5-4. Federal and State Listed Threatened and Endangered Species, and Respective Groundwater Dependence for Monterey County

Groundwater Dependence	Common Name	Federal Status	State Status
Direct	California black rail	-	Threatened
	California red-legged frog	Threatened	-
	California Ridgway's rail	Endangered	Endangered
	longfin smelt	-	Threatened
	Santa Cruz long-toed salamander	Endangered	Endangered
	steelhead - central California coast DPS	Threatened	-
	steelhead - south-central California coast DPS	Threatened	-
	Tidewater Goby	Endangered	-
	tricolored blackbird	-	Threatened
Direct and Indirect	arroyo toad	Endangered	-
Indirect	bald eagle	-	Endangered
	bank swallow	-	Threatened
	Belding's savannah sparrow	-	Endangered
	California condor	Endangered	Endangered
	California least tern	Endangered	Endangered
	least Bell's vireo	Endangered	Endangered
	southwestern willow flycatcher	Endangered	Endangered
	Swainson's hawk	-	Threatened
	willow flycatcher	-	Endangered
Unknown	Bay checkerspot butterfly	Threatened	-
	California tiger salamander	Threatened	Threatened
	foothill yellow-legged frog	-	Endangered
	San Joaquin kit fox	Endangered	Threatened
	short-tailed albatross	Endangered	-
	Smith's blue butterfly	Endangered	-
	vernal pool fairy shrimp	Threatened	-

The areas in the Monterey Subbasin where GDEs may be found are in the Vernal Pools, along the lower reaches of Toro Creek, and in the Salinas River where it crosses into the Subbasin. These areas are likely supported by saturated, shallow alluvium, but more investigation is needed to determine whether a continuous saturated zone connects to the principal aquifer(s). This area will require more analysis into the near surface stratigraphy to determine the connection of the principal aquifer to surface water.

Figure 5-37 shows the distribution of potential GDEs within the Subbasin based on the Natural Communities Commonly Associated with Groundwater (NCCAG) Dataset (DWR, 2020b). The NCCAG dataset maps vegetation, wetlands, springs, and seeps in California that are commonly associated with groundwater. These include: (1) wetland features commonly associated with the surface expression of groundwater under natural, unmodified conditions; and (2) phreatophytes. This map does not account for the depth to groundwater or level of interconnection between surface water and groundwater. Actual rooting depth data are limited and will depend on the plant species and site-specific conditions, and availability to other water sources.

The NCCAG dataset and the additional shallow groundwater analysis are not a determination of GDEs by DWR or the GSAs, but rather represent the best available data to provide a starting point for this GSP, as well as to direct monitoring, fill data gaps, guide implementation, and support other field activities initiated or partnered by the GSAs. Field data are needed to ascertain the degree to which identified ecosystems are groundwater dependent, rather than sustained by soil moisture.

Additional resources that contributed to an initial mapping of GDE locations are the CDFW Vegetation Classification and Mapping program (VegCAMP), the USFWS National Wetlands Inventory, and the USFWS online mapping tool for listed species critical habitat, as described in the methodology for the NCCAG development which is publicly accessible on the NC dataset website: https://gis.water.ca.gov/app/NCDatasetViewer/.

Figure 5-37 shows the distribution of potential GDEs within the Subbasin based on DWR's mapping of "Natural Communities Commonly Associated with Groundwater" (NCCAG), modified by information from local habitat management plans and studies. Three GDE and potential GDE units were identified in the Monterey Subbasin and are described below.

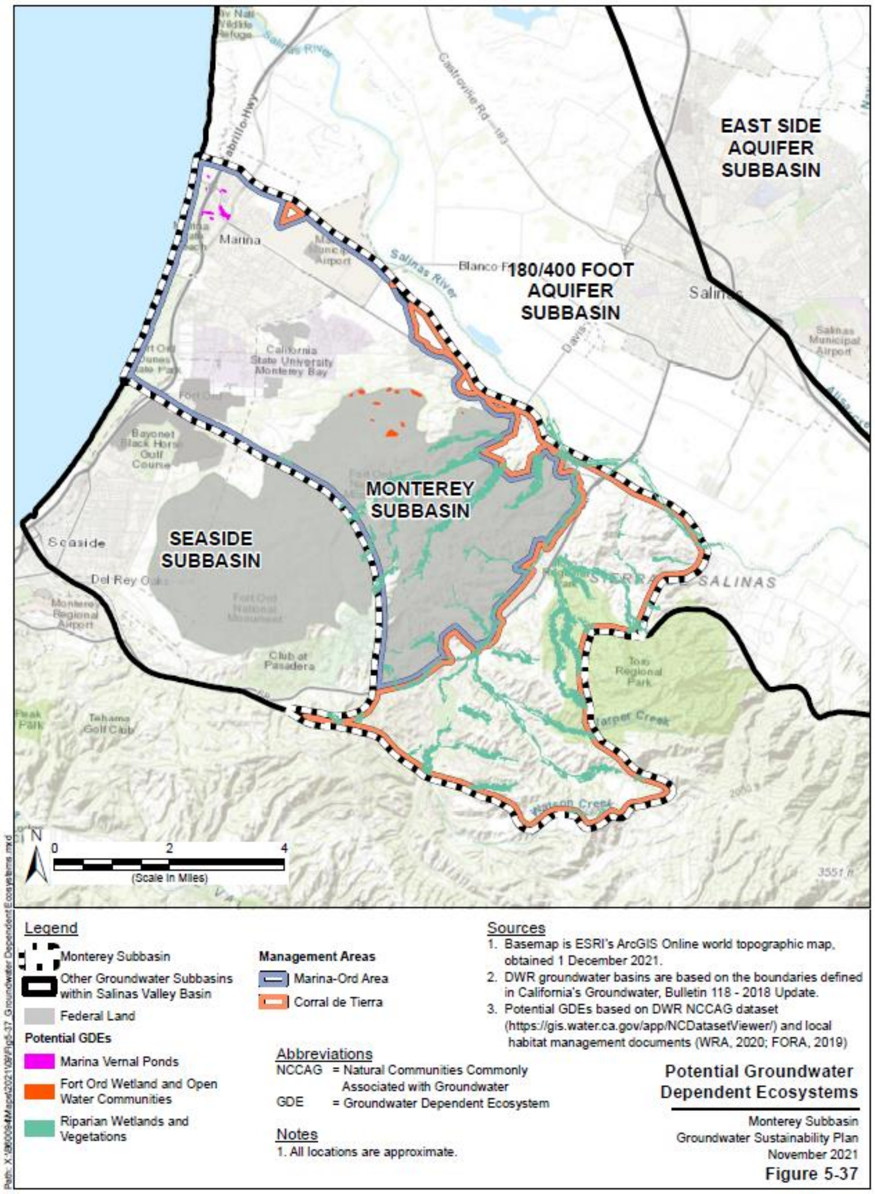

EAST SIDE AQUIFER SUBBASIN
180/400 FOOT AQUIFER SUBBASIN
MONTEREY SUBBASIN
SEASIDE SUBBASIN
Marina
Salinas
Seaside
Del Rey Oaks
SALINAS
Salinas River
Watson Creek
N
0
2
4
(Scale in Miles)
Legend
Monterey Subbasin
Other Groundwater Subbasins within Salinas Valley Basin
Federal Land
Potential GDEs
Marina Vernal Ponds
Fort Ord Wetland and Open Water Communities
Riparian Wetlands and Vegetations
Management Areas
Marina-Ord Area
Corral de Tierra
Sources
1. Basemap is ESRI's ArcGIS Online world topographic map, obtained 1 December 2021.
2. DWR groundwater basins are based on the boundaries defined in California's Groundwater, Bulletin 118 - 2018 Update.
3. Potential GDEs based on DWR NCCAG dataset (https://gis.water.ca.gov/app/NCDatasetViewer/) and local habitat management documents (WRA, 2020; FORA, 2019)
Abbreviations
NCCAG = Natural Communities Commonly Associated with Groundwater
GDE = Groundwater Dependent Ecosystem
Notes
1. All locations are approximate.
Potential Groundwater Dependent Ecosystems
Monterey Subbasin
Groundwater Sustainability Plan
November 2021
Figure 5-37

Figure 5-37. Potential Groundwater Dependent Ecosystems

5.7.1 Coastal Vernal Ponds within the City of Marina

Vernal ponds are located in the northwestern portion of the Subbasin within the City of Marina. These vernal ponds are "seasonal ponds which expand during the wet season and support marshy wetlands much of the years" (City of Marina, 2013). A recent study conducted by the WRA Environmental Consultants (2020) identified the hydrologic conditions of the Marina vernal ponds and included site visits in June 2020. The study concluded that the ponds rely upon groundwater and should therefore be considered GDEs (WRA, 2020).

WRA observed five aquatic and three upland biological communities at the six ponds. Among those communities were Willow Riparian Forest, Coastal Freshwater Marsh, and Costal Saltwater Marsh communities totaling 19.51 acres. These communities were observed with features that are dependent upon groundwater. Specifically, species that rely on a source of year-round water supply were identified within each pond. A high-water level was observed at each pond similar to the groundwater elevations in the Dune Sand Aquifer. All ponds except for Pond 5 contained open water at the time of the site visit in June 2020.

The study concluded that vegetation associated with the GDEs at these ponds was in good condition.

5.7.2 Wetlands and Open Water Communities Within the Former Fort Ord

Several wetland and open water communities, including vernal ponds and freshwater marshes, are located in the northeastern Fort Ord area (ICF, 2019). There are no shallow groundwater data available in the vicinity of these wetland and open water communities within the former Fort Ord. Therefore, additional shallow groundwater information and field reconnaissance is necessary to verify the existence of these potential GDEs, and whether they constitute true GDEs.

These potential GDEs within the former Fort Ord are located within the federal land areas of the Subbasin not subject to SGMA. Several of these communities are located within the Fort Ord Munition Response Area where munition investigation activities that may disturb these wetlands have been carried out by FORA under the Environmental Services Cooperative Agreement (ESCA) with the Army. These communities as well as other natural resources within the former Fort Ord are being managed and monitored by the USACE, FORA, and ESCA Remediation Response (RP) Team pursuant to the Fort Ord Habitat Management Plan (HMP; USACE, 1997), the FORA Habitat Conservation Plan (HCP; FORA, 2019), and the US Fish and Wildlife Service (USFWS) Biological Opinions (BOs) applicable to Fort Ord. The HMP and BOs identify mitigation measures to minimize impacts during pre-disposal activities. The HCP supersedes the HMP as the primary species and habitat conservation planning document for non-Federal recipients of Fort Ord lands.

5.7.3 Riparian Wetlands and Vegetations

Areas of riparian wetlands and vegetation near local streams and creeks have been identified as NCCAG within the Subbasin. The NCCAG datasets are based on aerial imagery interpretation and are not verified with field studies. These potential GDEs need to be combined with additional analyses to determine whether these wetlands and vegetation are truly groundwater dependent.

Additional shallow groundwater data and field reconnaissance are necessary to verify whether these communities truly rely on groundwater and whether shallow groundwater that these locations are connected with one of the principal aquifers, as not all riparian ecosystems are groundwater dependent; some may be sustained by soil water content. As discussed above, riparian areas that appear to have near-surface groundwater (within 20 feet of land surface) within the principal 400-Foot/Aromas Sands/Paso Robles Aquifer are only identified along El Toro Creek. Insufficient shallow well data are available to sufficiently confirm the depth to groundwater near these potential GDEs.

Therefore, these GDE units remain as potential GDEs and should be verified by additional shallow groundwater data in the vicinity of these units, updated field methodologies, and on-the-ground tracking.

5.7.4 Groundwater Dependent Ecosystems

GDEs refer to ecological communities or species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface. Two main types of ecosystems are commonly associated with groundwater: wetlands associated with the surface expression of groundwater and vegetation that typically draws water from a shallow water table.

GDEs may provide critical habitat for threatened or endangered species. Areas designated as critical habitat for threatened or endangered species contain the physical or biological features that are essential to the conservation of these species, and may need special management or protection (USFWS, 2017). A list of threatened and endangered species that might rely on GDEs in the Subbasin was compiled using information from the U.S. Fish and Wildlife Service (USFWS), California Department of Fish and Wildlife (CDFW), and The Nature Conservancy (TNC). Several steps were taken to determine which threatened and endangered species were likely found in the Subbasin and of those, which were likely to rely on GDE habitat. A list of threatened and endangered species for Monterey County was downloaded from the USFWS website and cross-referenced to species identified in the CDFW California Natural Diversity Database. The threatened and endangered species for Monterey County was further cross-referenced with the TNC Critical Species LookBook to identify which species are likely to depend on groundwater, as indicated in Table 5-4.

Ten threatened and endangered species, including the Southern California Steelhead, and the California Red-legged Frog, were identified as likely to rely directly on groundwater in Monterey County, several of which may be found in the Subbasin. Ten species were identified as likely to rely indirectly on groundwater, and the remaining species are unknown with respect to whether they directly rely on GDEs or groundwater. All species listed have the potential for groundwater dependence. There are 8 species that appear in both the federal and state list for threatened or endangered species.

Table 5-4. Federal and State Listed Threatened and Endangered Species, and Respective Groundwater Dependence for Monterey County

Groundwater Dependence	Common Name	Federal Status	State Status
Direct	California black rail	-	Threatened
	California red-legged frog	Threatened	-
	California Ridgway's rail	Endangered	Endangered
	longfin smelt	-	Threatened
	Santa Cruz long-toed salamander	Endangered	Endangered
	steelhead - central California coast DPS	Threatened	-
	steelhead - south-central California coast DPS	Threatened	-
	Tidewater Goby	Endangered	-
	tricolored blackbird	-	Threatened
Direct and Indirect	arroyo toad	Endangered	-
Indirect	bald eagle	-	Endangered
	bank swallow	-	Threatened
	Belding's savannah sparrow	-	Endangered
	California condor	Endangered	Endangered
	California least tern	Endangered	Endangered
	least Bell's vireo	Endangered	Endangered
	southwestern willow flycatcher	Endangered	Endangered
	Swainson's hawk	-	Threatened
	willow flycatcher	-	Endangered
Unknown	Bay checkerspot butterfly	Threatened	-
	California tiger salamander	Threatened	Threatened
	foothill yellow-legged frog	-	Endangered
	San Joaquin kit fox	Endangered	Threatened
	short-tailed albatross	Endangered	-
	Smith's blue butterfly	Endangered	-
	vernal pool fairy shrimp	Threatened	-

The areas in the Monterey Subbasin where GDEs may be found are in the Vernal Pools, along the lower reaches of Toro Creek, and in the Salinas River where it crosses into the Subbasin. These areas are likely supported by saturated, shallow alluvium, but more investigation is needed to determine whether a continuous saturated zone connects to the principal aquifer(s). This area will require more analysis into the near surface stratigraphy to determine the connection of the principal aquifer to surface water.

Figure 5-37 shows the distribution of potential GDEs within the Subbasin based on the Natural Communities Commonly Associated with Groundwater (NCCAG) Dataset (DWR, 2020b). The NCCAG dataset maps vegetation, wetlands, springs, and seeps in California that are commonly associated with groundwater. These include: 1) wetland features commonly associated with the surface expression of groundwater under natural, unmodified conditions; and 2) phreatophytes. This map does not account for the depth to groundwater or level of interconnection between surface water and groundwater. Actual rooting depth data are limited and will depend on the plant species and site-specific conditions, and availability to other water sources.

The NCCAG dataset and the additional shallow groundwater analysis are not a determination of GDEs by DWR or the GSAs, but rather represent the best available data to provide a starting point for this GSP, as well as to direct monitoring, fill data gaps, guide implementation, and support other field activities initiated or partnered by the GSAs. Field data are needed to ascertain the degree to which identified ecosystems are groundwater dependent, rather than sustained by soil moisture.

Additional resources that contributed to an initial mapping of GDE locations are the CDFW Vegetation Classification and Mapping program (VegCAMP), the USFWS National Wetlands Inventory, and the USFWS online mapping tool for listed species critical habitat, as described in the methodology for the NCCAG development which is publicly accessible on the NC dataset website: https://gis.water.ca.gov/app/NCDatasetViewer/.

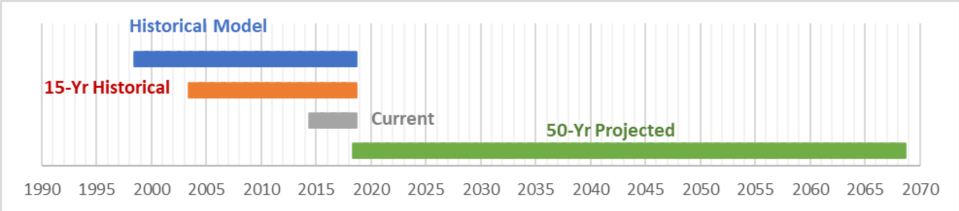
6 WATER BUDGET INFORMATION

~~*On August 25, 2021 the SVBGSA Monterey Subbasin Planning Committee received an updated presentation on the potential relationship between groundwater elevations and arsenic concentrations in the Corral de Tierra Area. The committee discussed new options for the groundwater elevations Sustainable Management Criteria (SMCs), and passed a motion to raise the minimum thresholds and measurable objectives in the Corral de Tierra Area to 2008 and 2004/2005 elevations respectively. These changes have not yet been incorporated into the modeling results, or the rest of the GSP. This statement is here as a placeholder for the reader, and as a reminder to the GSP process that stakeholder input is valuable to the development and implementation of sustainable management of groundwater resources. No changes to the SMCs for the Marina-Ord Area are proposed.*~~

This section presents information on the water budget for the Monterey Subbasin (Subbasin). Consistent with the Groundwater Sustainability Plan (GSP) Emergency Regulations §354.18 (23-California Code of Regulations [CCR] Division 2 Chapter 1.5 Subchapter 2) and California Department of Water Resources' (DWR) Water Budget Best Management Practices (BMP) (DWR, 2016b), this water budget provides an accounting of the total annual volume of water entering and leaving the Subbasin for historical, current, and projected future conditions.

Three water budget time periods are presented herein:

- A historical water budget period representing 15 years of historical hydrology for the period Water Year[24] (WY) 2004-2018 and calibrated to historical data[25];
- A current conditions water budget period representing average conditions over a recent four-year period (WY 2015-2018), validated against recent data; and
- A 50-year projected water budget period (WY 2019-2068), which results presented as averages for comparison to historical and current conditions.



[24] The DWR-defined Water Year runs from October of the previous year to September of the current year (e.g. Water Year 2015 is October 1, 2014 – September 30, 2015.

[25] The historical model spans the 20-year period WY 1999-2018 and includes a five-year equilibration period (WY 1999 – 2003) before historical water budget information is reported. The historical model is calibrated to observed water levels within the Basin from October 1999 – September 2018.

As discussed in Section 6.1 below, detailed historical and current water budgets are presented for both the land surface system (e.g., precipitation, applied water, and plant evapotranspiration [ET]) and groundwater system (e.g., pumping, cross-boundary flows). To facilitate planning for future sustainability, this GSP also assesses potential future groundwater conditions under various scenarios.

Water budgets for each timeframe are presented for the Subbasin as a whole. In addition, zone budgets are presented for each management area. The Reservation Road portion of the Corral de Tierra has, however, been grouped with the Marina-Ord Area zone budget as it has similar hydrostratigraphy and groundwater from the Marina-Ord Area flows through this area into the 180/400-Foot Aquifer subbasin, without a significant change in storage. As such, zone water budgets are presented for the following areas, as shown on Figure 6-1:

- A basin-wide water budget encompassing the entire Subbasin;
- The Marina-Ord Area – water budget zone (WBZ) includes the Marina-Ord Area as well as the Reservation Road portion of the Corral de Tierra Area, as they share the same principal aquifers;
- The Corral de Tierra Area - Water Budget Zone includes the main portion of the Corral de Tierra Area underlain by the El Toro Primary Aquifer System.

A breakout of the water budget for the Reservation Road portion of the Corral de Tierra Area is included in Appendix 6-A for informational purposes.

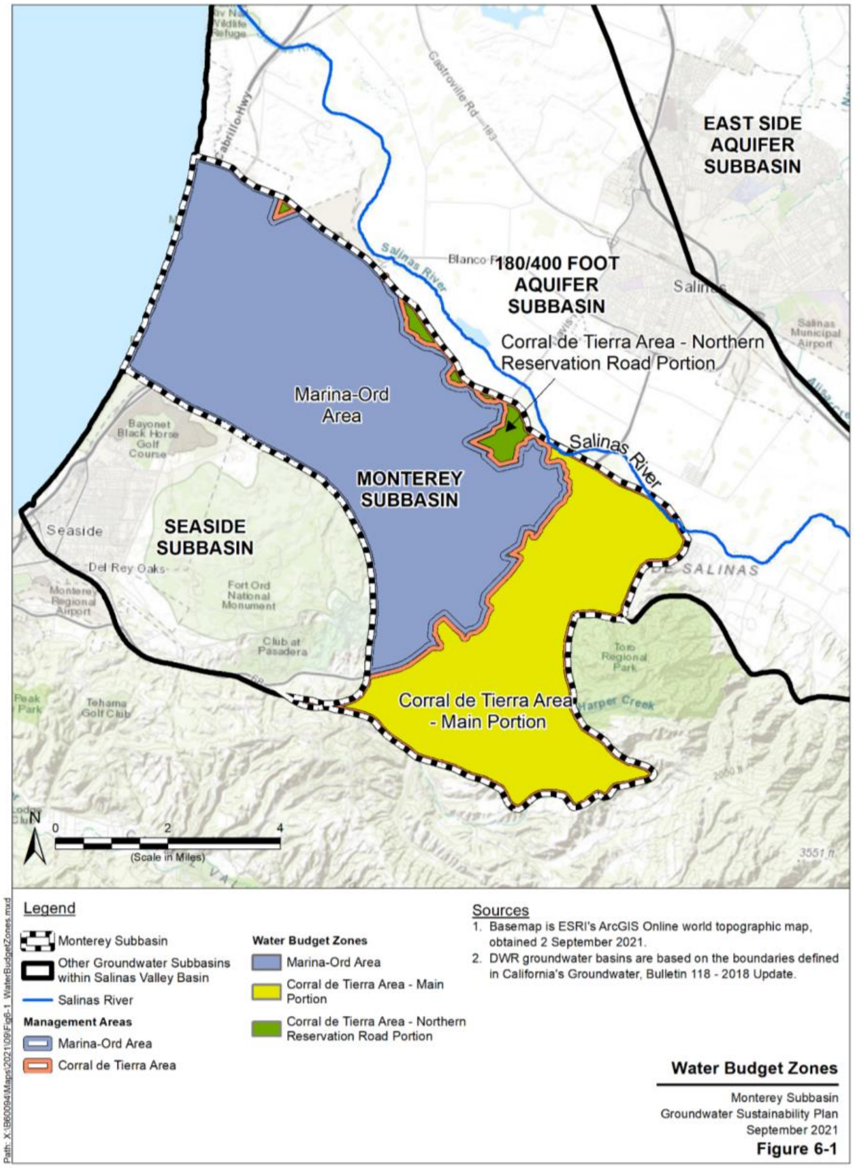


Figure 6-1. Water Budget Zones

6.1 Water Budget Method

The water budget information presented herein is based on the use of a numerical groundwater flow model developed for the Subbasin, the Monterey Subbasin Groundwater Flow Model (herein referred to as "Monterey Subbasin Model" or "MBGWFM")[26]. The MBGWFM uses the United States Geological Survey (USGS) Newton formulation of the Modular Three-Dimensional Groundwater Modeling platform (MODFLOW-NWT) platform to solve the governing groundwater flow equations. The MBGWFM divides the spatial model domain of the Subbasin into a gridded network of cells, applies data-driven assumptions of groundwater system properties at those cells, applies stresses such as recharge and pumping, and calculates groundwater levels in the cells and groundwater fluxes between cells by solving a system of equations based on groundwater flow principles. Figure 6-2 shows the active extent of the MBGWFM grid.

[26] The SVIHM encompasses the entire Salinas Valley Groundwater Basin and was used to develop water budgets for other Salinas Valley Groundwater Basin GSPs. However, the MCWD GSA and SVBGSA did not select the SVIHM for the Monterey Subbasin as the SVIHM does not accurately reflect hydrologic conditions within the Monterey Subbasin. A detailed discussion of the SVIHM's and the MBGWFM's current construction and calibration results can be found in a technical memorandum presented to the SVBGSA Advisory Committee on April 2, 2021 (Appendix 6-C).

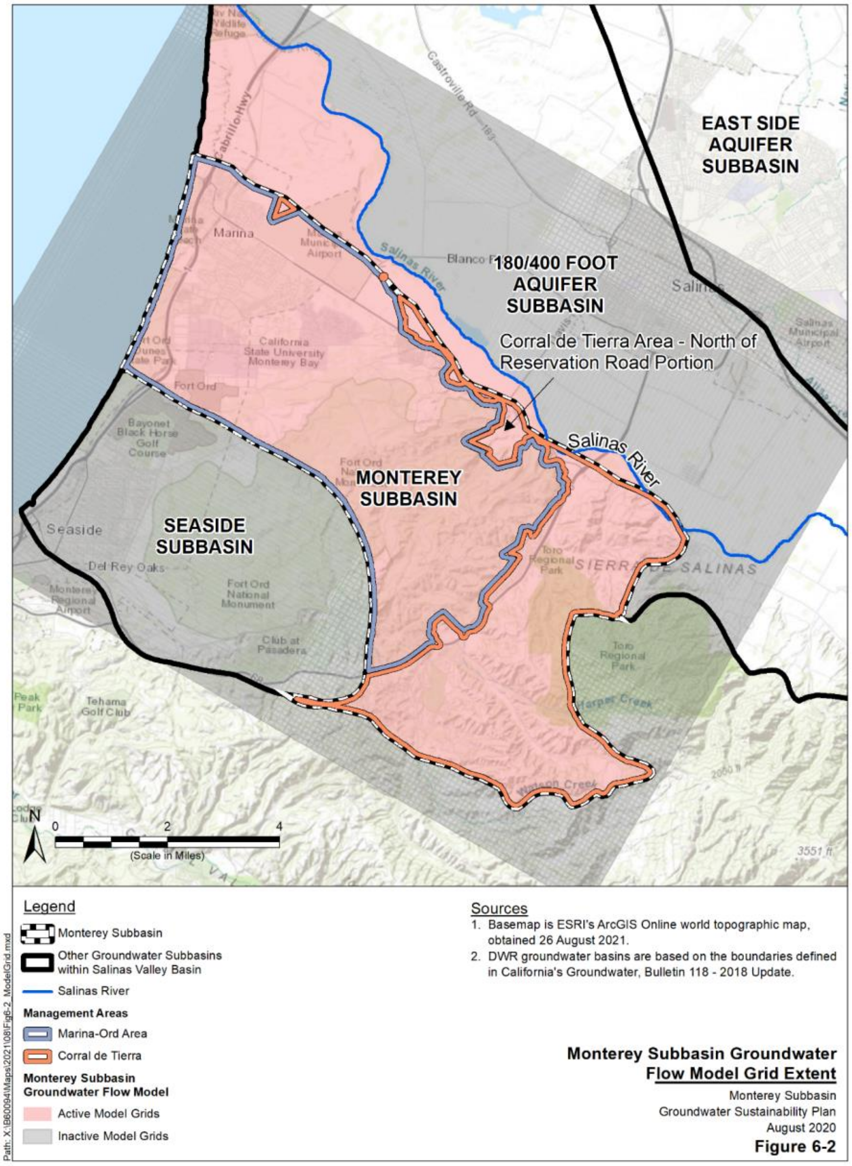


Figure 6-2 Monterey Subbasin Groundwater Flow Model Grid Extent

Details on the MBGWFM development are provided in Appendix 6-B. Key aspects of the MBGWFM include:

- Grid whose active extent covers the entire extent of the Subbasin, as defined by DWR, as well as a small portion of the 180/400-Foot Aquifer Subbasin south of the Salinas River;
- Eight model layers representing the primary aquifer and aquitards in the Subbasin consistent with the Subbasin's Hydrogeological Conceptual Model (HCM), which includes the Dune Sand Aquifer, Salinas Valley Aquitard, Upper 180-Foot Aquifer, 180-Foot Aquitard, Lower 180-Foot Aquifer, 180/400-Foot Aquitard, 400-Foot Aquifer, and Deep Aquifers (the latter two layers together represent the El Toro Primary Aquifer System within the Corral de Tierra Area);
- Transient boundary conditions tied to historical water level observations within the 180/400-Foot Aquifer Subbasin, simulated water levels from the Watermaster's Seaside Basin Groundwater Flow Model (Hydrometrics 2009 & 2018) ~~existing groundwater flow models (within the Seaside Area Subbasin this refers to the Watermaster's Seaside Basin Groundwater Flow Model developed by HydroMetrics/Montgomery & Associates)~~, and freshwater equivalent sea levels along the Monterey Coast;
- Transient simulation of Salinas River flows and surface water-groundwater interactions using MODFLOW's River (RIV) package;
- Spatially variable groundwater recharge based on the soil moisture budget accounting model (SMB); and
- Groundwater pumping from Marina Coast Water District (MCWD) production wells based on pumping records, pumping from Corral de Tierra Area wells estimated by the Wallace Group for the Salinas Valley Basin Groundwater Sustainability Agency (SVBGSA), and other production wells in the active portion of the 180/400-Foot Aquifer Subbasin based on Monterey County Water Resources Agency (MCWRA) pumping records.

Model calibration is an assessment of how a model simulates observed historical conditions. Generally, a model's calibration is evaluated through calibration error statistics – statistics of the normalized magnitude of the error between simulated water levels and observed water levels. A general rule of thumb in assessing model calibration is that the model is considered calibrated when the normalized calibration error statistics[27] are less than 10%. As discussed in Appendix 6-B, the MBGWFM has been calibrated against 30,354 historical water level measurements to achieve normalized calibration error statistics of less than 2% and thus adequately represents the

[27] Calibration error statistics include mean absolute residual, residual standard deviation, root mean squared error (RMSE), and coefficient of determination (R-squared).

historical conditions of the Subbasin. Therefore, it is appropriate to use the MBGWFM to estimate water budgets for the Monterey Subbasin.

Water budget information is extracted from simulated model results for the spatial and temporal domain of interest. The land surface processes (e.g., precipitation, applied water, and plant evapotranspiration [ET]) are simulated by the SMB. The SMB calculates deep percolation on a grid cell basis, which is then specified as recharge in the MBGWFM. Similarly, the SMB calculates private irrigation pumping as the residual ET demand on irrigated lands that is unmet by precip and deliveries of municipal waterthe SMB calculates the demand that is unmet by municipal water deliveries and precipitation, which is specified as private irrigation well pumping in the MBGWFM. Private irrigation pumping reflects the demand of the private well owners located in North of Reservation Road portion of the Corral de Tierra Area. Therefore, the land surface processes are integrated into the groundwater system processes. To quantify all required water budget components as specified in the GSP Emergency Regulations (CCR §354.18(b), this GSP presents results from both the SMB for the land surface system and the MBGWFM for the groundwater system.

6.1.1 Data Sources

Per 23-CCR §354.18(e), the best-available data were used to evaluate the water budget for the Subbasin and include the following:

- Precipitation records, mapped to the MBGWFM grid, from the 4-kilometer Parameter-elevation Regressions on Independent Slopes Model (PRISM)[28] dataset, *Daily, October 1998 – September 2018*
- Reference ET Data from California Irrigation Management Information System (CIMIS) Salinas North #116 and Laguna Seca #229 stations; *Daily, October 1998 – September 2018*
- Spatial Land Use Data including:
    - MCWD current land use survey from the District's 2020 Water Master Plan, *Static, March 2020*
    - DWR historical land use survey, *Static, Fall 2014.*[29]
    - U.S. Department of Agriculture (USDA) Forest Service Region 5 Classification and Assessment with Landsat of Visible Ecological Groupings (CALVEG)[30] dataset for Zone 5 (Central Valley), *Static, March 2020*

[28] https://prism.oregonstate.edu/recent/
[29] Available online at https://gis.water.ca.gov/app/CADWRLandUseViewer/
[30] Available online at https://www.fs.usda.gov/detail/r5/landmanagement/resourcemanagement/?cid=stelprdb5347192

- Pumping Records including:
  - MCWD pumping volumes from District-owned production wells from the District's internal operations records, *Monthly, October 1998- September 2018*.
  - MCWRA pumping volumes from production wells within the active model portion of the 180/400-Foot Aquifer Subbasin, *Monthly, October 1998- September 2018*.
  - Estimated Corral de Tierra pumping is based on extraction reported to MCWRA and State Water Resources Control Board (SWRCB) where data are available, and is approximated based on the number of deliveries for the small water systems and parcel size for the *de minimis* users (i.e., domestic wells).
- Historical Groundwater Level Records from selected wells within the Monterey and 180/400-Foot Aquifer Subbasins; *Seasonal, Fall 1998 – Spring 2018 (data availability varies by well)*
- Delivery Records including:
  - MCWD delivery volumes from the District's internal operations records, *Monthly, October 1998 – September 2018*
  - Delivery volumes for the California American Water (Cal Am) and California Water Service (CWS) service areas within the Subbasin, compiled by the Seaside Watermaster, *Monthly, October 1998 – September 2018*
- Salinas River Flow Data from the USGS Spreckels Gauge #11152500, *Monthly, October 1998 – September 2018*
- Various SMB input datasets, including:
  - Soil properties (i.e., hydrologic group, wilting point, field capacity, soil porosity, saturated hydraulic conductivity, and depth) from the United States Department of Agriculture (USDA) Soil Survey Geographic Database (SSURGO)
  - Curve numbers for runoff for agriculture, urban, and native vegetation classifications including conifer forest/woodland, hardwood forest/woodland, mixed conifer and hardwood forest/woodland, shrub, herbaceous, and barren from USDA, 1989, and
  - Crop coefficients and canopy storage properties for native, agricultural, and urban land use types from California Polytechnic State University's Irrigation Training and Research Center (ITRC)
- Model outputs from the Seaside Basin Groundwater Flow Model (Hydrometrics 2009 & 2018), used to simulate cross-boundary subsurface flows with the Seaside Area Subbasin.

6.2 Water Budget Components

Principal components of the Subbasin water budget have been classified into (1) land surface system and (2) groundwater system categories, and are described in detail below.

6.2.1 Land Surface System Water Budget Components

The SMB accounts for most processes relevant to the land surface system budget quantification, including the following:

Precipitation within the Subbasin is available as a 4-kilometer gridded dataset from PRISM. Precipitation falling on Basin lands serves to wet the near-surface soil and then either evaporates, contributes to crop or natural vegetation water demand, or when intense enough, percolates through the root zone to eventually recharge groundwater. The SMB uses daily precipitation rates estimated by PRISM, which provides a representation of the spatial distribution of precipitation over the entire extent of the Subbasin.

Applied Water is a combination of (1) MCWD deliveries of groundwater pumped from MCWD-owned wells into their distribution system, (2) CWS and Cal Am deliveries of groundwater pumped from CWS and Cal Am wells into their distribution systems, and (3) applied water from private irrigation wells which provide groundwater directly to crops and/or golf courses. MCWD, CWS, and Cal Am deliveries comprise a large majority of total applied water in the Subbasin, and are estimated from the water agencies' local operations records. As outdoor deliveries were not specifically tabulated in the operations records, it was assumed that 25% of total deliveries during the summer irrigation period (i.e., April through September) were used to meet outdoor demands, consistent with information provided in the MCWD Urban Water Management Plan (UWMP) (Schaff & Wheeler, 2021). Private irrigation pumping is limited to the ~230 acres of agricultural lands north of the Monterey Subbasin boundary and in the North of the Reservation Road portion of the Corral de Tierra Area, as well as the Corral de Tierra Country Club, and is calculated by the SMB as the residual crop water demand during the summer irrigation period after accounting for contributions from precipitation.

ET is estimated by the SMB for all land use classes using a crop coefficient method, where reference ET data from the two CIMIS stations proximate to the Subbasin are scaled by land-use specific, monthly crop coefficients. The SMB also incorporates an ET stress function that reduces ET when soil moisture is low (i.e., at the wilting point). The SMB calculates an actual ET rate based on the potential ET and with consideration of the available soil moisture. See Appendix 6-B for details.

Runoff is calculated as the amount of precipitation and applied water that does not infiltrate the soil, but rather drains off the land. The SMB calculates rainfall excess runoff based on the U.S. Department of Agriculture (USDA) Soil Conservation Service (SCS) curve number method, with curve numbers a function of land use type, soil hydrologic group, and antecedent moisture. The SMB also calculates saturation excess runoff based on soil depth and porosity, although the occurrence of this type of runoff is very rare (i.e., only occurs on thin, low permeability soils during times of high deliveries of applied water or after intense rainfall events).

Root zone storage is calculated on a running basis throughout each SMB daily time step. It is increased by precipitation and applied water and decreased by ET and recharge. Soil moisture also feeds back into the calculation of curve number runoff and ET, as described above.

Recharge to the groundwater system is calculated by the SMB to occur when soil moisture exceeds the field capacity of the soil, after infiltration of the precipitation remaining after curve number runoff and after ET. Recharge is limited to a fraction of the saturated hydraulic conductivity of soil. When the soil is unable to recharge the entire amount of soil moisture in excess of field capacity, the soil moisture can exceed field capacity, eventually building up to reach soil porosity and causing saturation excess runoff, although such occurrence is very rare, as mentioned above.

Stream-groundwater interactions are calculated by the MBGWFM based on Salinas River stage, assumed streambed properties, and the surrounding model-calculated groundwater levels. More information is provided under the groundwater system below. As discussed in Section 4.3, the El Toro Creek is mostly intermittent and includes a perennial reach below the confluence with Watson Creek. Stream gauge data was unavailable for the El Toro Creek for the historical period and thus El Toro Creek was not directly simulated in the model. Direct modeling of the El Toro Creek will be considered in future model updates and as more information becomes available.

6.2.2 Groundwater System Water Budget Components

The MBGWFM accounts for all water flow processes relevant to groundwater system budget quantification. Some values originate from the SMB, whereas others are direct inputs to or outputs from the MBGWFM.

Recharge from excess precipitation and applied water is calculated by the SMB, as described above. Additionally, leakage from water distribution systems contributes to groundwater recharge. Consistent with information provided in the MCWD UWMP (Schaaf & Wheeler, 2021), leakage is estimated as 5% of the total delivered water to MCWD, CWS, and Cal Am service areas, which are entirely supplied by groundwater.

Groundwater pumping includes pumping from MCWD-owned wells and other water systems and private wells in the Corral de Tierra Area. Figure 6-3 shows MBGWFM simulated groundwater pumping by WBZ and management area. Groundwater pumping from MCWD-owned wells is based on MCWD reported data. Groundwater pumping from wells in the Corral de Tierra Area was estimated by the Wallace Group. Using 2019 as an example historical year, 78% of pumped groundwater in the Corral de Tierra is used by municipal and mutual water systems. The Groundwater Extraction Management System (GEMS) maintained by the Monterey County Water Resources Agency (MCWRA) only covers Zones 2, 2A, and 2B which overlap only covers partthe Corral de Tierra Area. Therefore, these pumping estimates were calculated also using 2019 pumping reported by public water systems to the state, as well as estimates based on land use type, acreage, parcels, and de minimis use. For parcels that are not included in mutual water systems or municipal water systems, analysis of aerial imagery, parcel size analysis, and engineering judgment were used to estimate extraction irrigated areas fed by private wells.

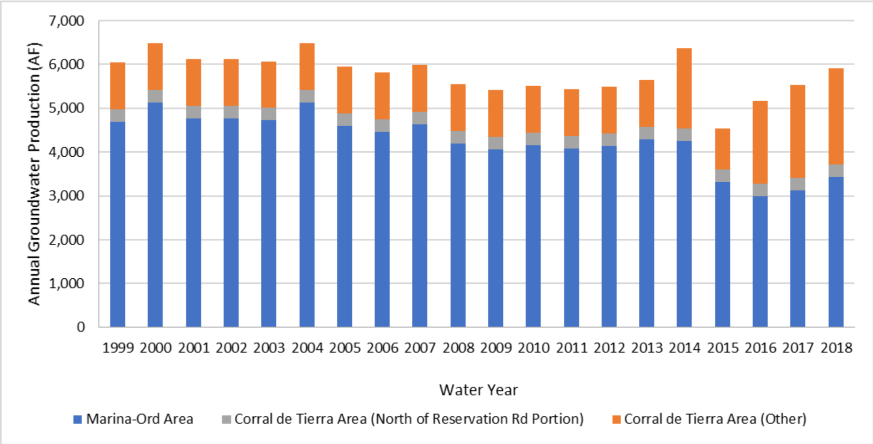


Figure 6-3. MBGWFM Simulated Historical Period Groundwater Pumping

Inter-Basin Cross-Boundary Flow

- Subsurface exchanges with the 180/400-Foot Aquifer Subbasin are calculated by the MBGWFM using a general head boundary condition. The MBGWFM calculates subsurface flow based on observed historical groundwater elevations at wells within the 180/400-Foot Aquifer Subbasin proximate to the northern active model boundary, distances from those wells to the active model boundary, and lateral hydraulic conductivities at boundary cells.

- Subsurface exchanges with the Seaside Area Subbasin are calculated by the MBGWFM using a general head boundary condition. The MBGWFM calculates subsurface flow based on modeled groundwater head outputs at the Seaside boundary from the historical Seaside Basin Groundwater Flow Model (Hydrometrics 2009 & 2018) and lateral hydraulic conductivities at boundary cells. However, as described in Appendix 6B, there are notable differences in hydrogeologic conceptualization and geometry between the MBGWFM and the Seaside Model. it is noted that the model layers of the Seaside Basin Groundwater Flow Model and the MBGWFM are not aligned perfectly. The MBGWFM has one model layer representing the formations that comprise the upper and lower portions of Deep aquifers and the El Toro Primary Aquifer System, while the Seaside Basin model delineates the Paso Robles Aquifer and Santa Margarita Aquifer as a separate model layers.The Seaside Model defines aquifer units differently than the MBGWFM and includes a different number of layers. The discrepancies between the two models will be rectified in early GSP implementation to better assess flows between these subbasinsSince the formations of those aquifers are not aligned vertically between the models, further refinement of the model layers will ultimately be needed to better assess flows between these Subbasins. Early GSP implementation will include improving the MBGWFM boundary conditions so that the two models have more closely aligned hydrogeologic conditions at their shared boundary.boundary cells.However, it is noted that the model layers of theSeaside Basin Groundwater Flow Model at the MBGWFMultimately to better assess flows between these Subbasins

- Subsurface exchanges with the Pacific Ocean are calculated by the MBGWFM using a constant head boundary condition. The MBGWFM calculates subsurface flow based on freshwater equivalent sea levels along the Monterey Coast[31]. This subsurface flow exchange with the ocean may consist of seawater or freshwater and is not explicitly distinguished within the model.

- Because the Subbasin is bounded on the east and southeast by mostly metamorphic bedrock formations, they are treated as no-flow boundaries and therefore it is assumed that the Subbasin does not receive subsurface inflows from these areas.

Stream-groundwater interactions are calculated by the MBGWFM based on the Salinas River stage, assumed streambed properties, and the surrounding model-calculated groundwater levels. Salinas River stage is directly provided as input to the RIV package of the MBGWFM based on monthly flow measurements recorded at the USGS Spreckels Gauge (Site #11152500). Corresponding stream-groundwater exchanges are calculated based on modeled hydraulic gradients between the streambed and underlying groundwater system. The Salinas River is the only major surface water body explicitly modeled in the MBGWFM. As discussed above, there is currently insufficient data to directly model the El Toro Creek. All other contributing streams to

[31] Freshwater equivalent sea levels are calculated based on the equivalent freshwater head formula presented in the Report (USGS, 2002) (see Appendix 6-B, Section 2.4.2.3.2). The depths and distances at which principal aquifer units (namely, the Aromas Sand and Paso Robles Formations) outcrop along the seafloor were estimated to inform corresponding freshwater equivalent heads at the aquifer-seafloor interface.

the Subbasin are ephemeral in nature and either flow into the Salinas River during precipitation events or otherwise dry up before leaving the Subbasin, likely contributing to additional groundwater recharge.

Change in groundwater storage is calculated by the MBGWFM by solving the groundwater flow equation. The groundwater storage inflows and outflows extracted from the MBGWFM are referenced to the groundwater storage domain instead of the groundwater system domain. For the purposes of this GSP, change in groundwater storage is calculated as the groundwater system inflows minus the groundwater system outflows. Therefore, a positive change in storage indicates an increase in groundwater storage, and a negative change in storage indicates a decrease in groundwater storage.

Water budget information for the historical and current water budget periods is presented in Section 6.4 below and water budget information for the projected future scenarios is presented in Section 6.5 below.

6.3 Water Budget Time Frames

Time periods must be specified for each of the three required water budgets. The GSP Emergency Regulations require water budgets for historical conditions, current conditions, and projected conditions.

6.3.1 Historical Water Budget Time Period

23-CCR §354.18(c)(2) requires quantification of historical water budget components for at least the past ten years. Additionally, per DWR's Water Budget BMP, the water budget should represent average hydrology, with both wet and dry years (DWR, 2016b).

The historical water budget is intended to evaluate how past land use and water supply availability has affected aquifer conditions and the ability of groundwater users to operate within the sustainable yield. GSP Emergency Regulations require that the historical water budget include at least the most recent ten years of water budget information. DWR's Water Budget BMP document further states that the historical water budget should help develop an understanding of how historical conditions concerning hydrology, water demand, and surface water supply availability or reliability have impacted the ability to operate the Subbasin within the sustainable yield. Accordingly, historical conditions should include the most reliable historical data that are available for GSP development and water budgets calculations.

As shown on Figure 6-4, the long-term average precipitation on subbasin lands based on PRISM records was 15.46 inches per year (in/yr) between the period of 1896 through 2019. Using these historical rainfall records, a 15-year period representing WY 2004-2018 was defined as the historical water budget period. The average precipitation based on PRISM data over the historical water budget period (WY 2004-2018) is 15.50 in/yr and is similar to the long-term average. This historical water budget time period contains a variety of water year types and therefore adequately represents average hydrologic conditions for purposes of quantifying the historical subbasin water budget.

In addition to the historical water budget and calibration period, a five-year preconditioning period (WY 1998-2003) was established to allow the model to stabilize from initial conditions, resulting in a total 20-year model evaluation period.

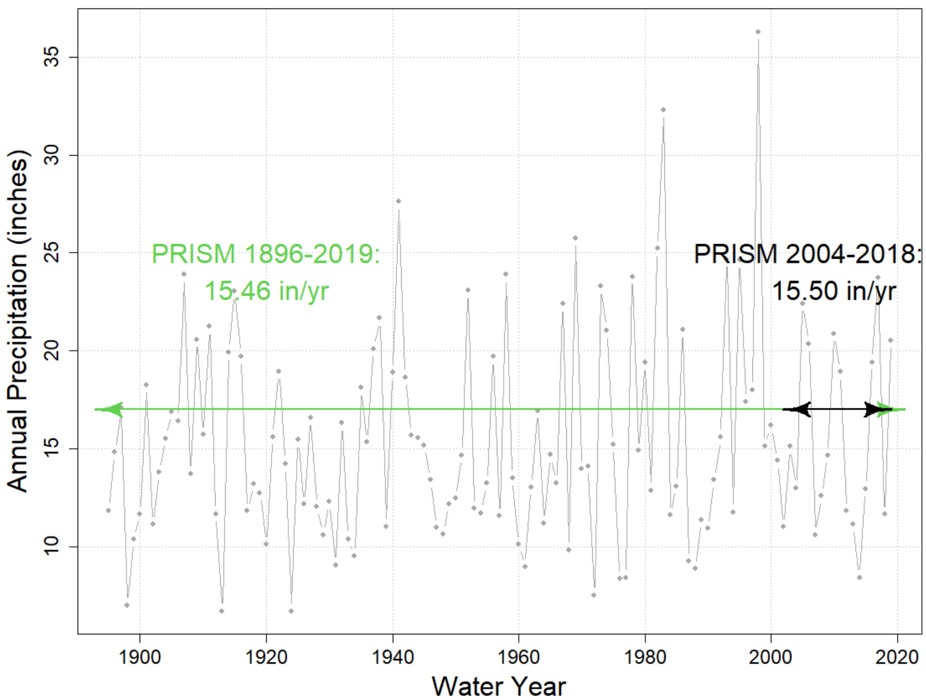


Figure 6-4. Monterey Subbasin Long-Term Precipitation Records

6.3.2 <u>Current Water Budgets Time Period</u>

A four-year period representing WY 2015-2018 was defined as the current water budget period, which is reflective of recent patterns of climate, groundwater use, and boundary conditions. As shown on Figure 6-4, the average precipitation falling on subbasin lands based on PRISM data between WY 2015-2018 was 16.94 in/yr.

The current water budget is intended to allow the Groundwater Sustainability Agencies (GSAs) and DWR to understand the existing supply, demand, and change in storage under the most recent population, land use, and hydrologic conditions. Current conditions are generally the most recent conditions for which adequate data are available and that represent recent climatic and hydrologic conditions. Current conditions are not well defined by DWR but can include an average over a few recent years with various climatic and hydrologic conditions.

6.3.3 Projected Water Budgets Time Period

Per 23-CCR §354.18(e)(2)(A), the projected water budgets must use 50 years of historical precipitation, evapotranspiration, and streamflow information as the basis for evaluating future conditions under baseline and climate-modified scenarios. To develop the required 50 years of projected hydrologic input information, an "analog period" was created by repeating select sequences of the historical hydrologic record in a way that maintains long-term historical average hydrologic conditions, as detailed below.

The projected water budget is intended to quantify the estimated future baseline conditions. The projected water budget estimates the future baseline conditions concerning hydrology, water demand, and surface water supply over a 50-year planning and implementation horizon. It is based on historical trends in hydrologic conditions which are used to project forward 50 years while considering projected climate change and sea-level rise if applicable.

To develop the required 50 years-worth of hydrologic input information, first an "analog period" was created from 20 years-worth of historical information (WY 1999-2018) by combining the years in a specific way that, on average, maintained the long-term average hydrologic conditions. This approach allowed for the creation of a complete 50-year period to inform the projected water budget analysis, even when certain component datasets were not available for that length of time. The sequence of actual years that were combined to create the 50-year analog period is as follows:

- Analog Years 1-20: Based on actual years 1999-2018
- Analog Years 21-40: Based on actual years 1999-2018
- Analog Years: 41-50: Based on actual years 1999-2008

The above mapping of actual years to analog years within the required 50-year projected water budget period applies to precipitation and ET datasets.

6.4 Historical and Current Water Budget

This section presents water budget results from the calibrated MBGWFM and associated SMB. Results are presented below in terms of both annual values and averages during the historical water budget period (WY 2004–2018) and the current water budget period (WY 2015-2018).

Historical and current water budget information is presented for the following areas as shown on Figure 6-5 through Figure 6-7:

- The basin-wide water budget encompassing the entire subbasin (Section 6.4.1);
- The Marina-Ord Area – Water Budget Zone (Marina-Ord Area WBZ) which includes the Marina-Ord Area as well as the Reservation Road portion of the Corral de Tierra Area (Section 6.4.2); and
- The Corral de Tierra Area – Water Budget Zone (Corral de Tierra Area WBZ) which includes the main portion of the Corral de Tierra Area underlain by the El Toro Primary Aquifer System (Section 6.4.3).

6.4.1 Basin-Wide Water Budget

Table 6-1 summarizes inflows to and outflows from the basin-wide groundwater system by water source type during the historical water budget period (WY 2004–2018) and the current water budget period (WY 2015-2018). Water budget components include: recharge, well pumping, net inter-basin flow, and net river exchange. Positive values indicate a net inflow to the Monterey Subbasin and negative values indicate a net outflow from the Subbasin. Further description regarding the modeling of each of these water budget components is described Section 6.2 and provided in Appendix 6-B.

Table 6-1. Historical and Current Groundwater Water Budget Results, Monterey Subbasin

Net Annual Groundwater Flows (AFY) (a)	Historical Annual Inflows/Outflows WY 2004 – 2018	Current Annual Inflows/Outflows WY 2015 – 2018
Recharge		
● Rainfall, leakage, irrigation	**10,055**	**12,060**
Well Pumping		
● Well Pumping	**-5,641**	**-5,274**
Net Inter-Basin Flow (Presumed Freshwater) (b)		
● Seaside Subbasin	918	1,334
● 180/400-Foot Aquifer Subbasin	-9,393	-9,307
● Ocean	-524	-574
	-8,999	**-8,547**
Net Inter-Basin Flow (Presumed Seawater) (b)		
● 180/400-Foot Aquifer Subbasin	-2,872	-3,258
● Ocean	2,872	3,258
	0	**0**
Net Surface Water Exchange		
● Salinas River Exchange	**151**	**153**
NET ANNUAL CHANGE IN GROUNDWATER STORAGE	**-4,434**	**-1,609**

Notes:

(c) Positive values indicate a net inflow and negative values indicate a net outflow.
(d) All seawater inflows from the ocean are presumed to leave the Monterey Subbasin across the 180/400-Foot Aquifer Subbasin boundary, as evidenced by negligible ~~no observed~~ expansion of the seawater intrusion front in the Monterey Subbasin over the historical time period. See further discussion in Section 6.4.1.1.3.

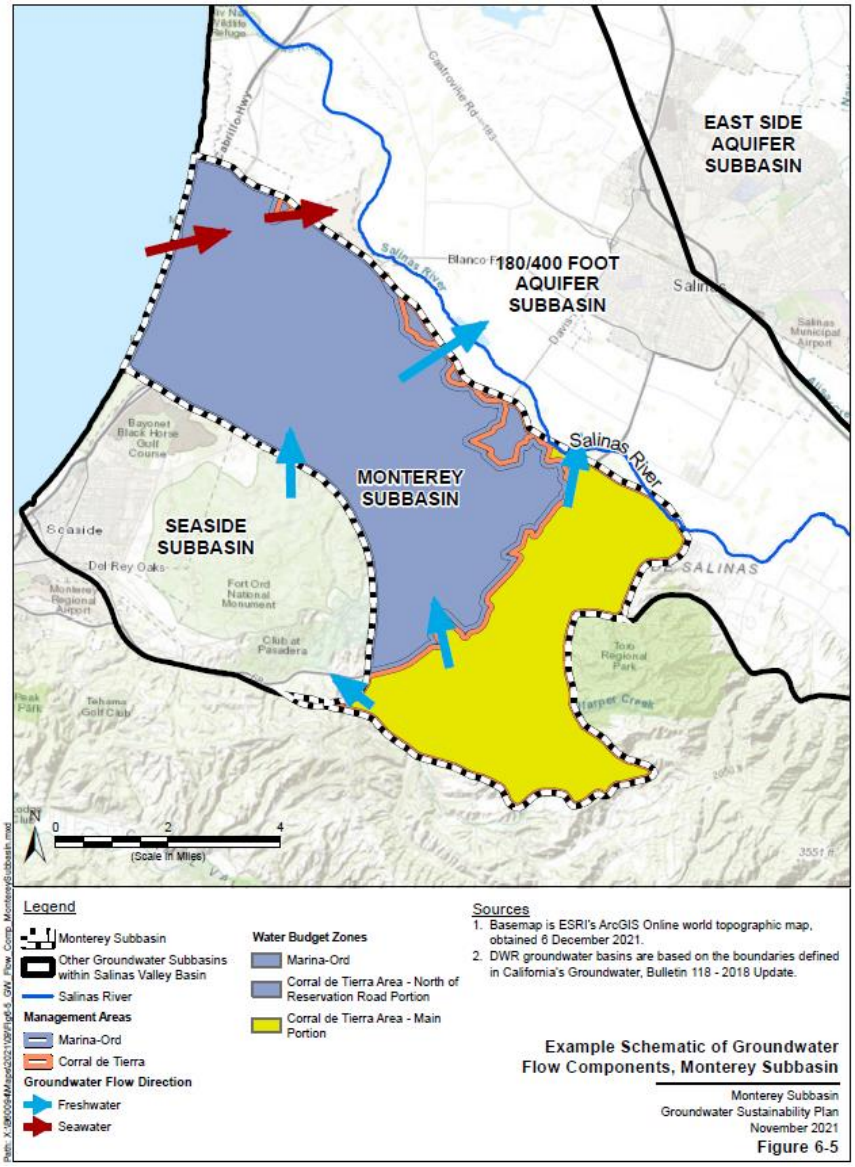


Figure 6-5. Example Schematic of Groundwater Flow Components, Monterey Subbasin

6.4.1.1 Historical Water Budget

6.4.1.1.1 Recharge

Estimated average annual recharge to the Subbasin during the historical period was 10,055 AFY. This recharge was estimated utilizing the SMB and incorporates land surface system processes and estimated leakage of total delivered water by MCWD. Outputs from the SMB are included in Appendix 6-A.

6.4.1.1.2 Well Pumping

The estimated average annual well pumping in the Subbasin during the historical period was 5,641 AFY. It includes pumping from MCWD-owned wells and pumping from other water systems and private wells in the Corral de Tierra Area.

This value is significantly less than the estimated annual recharge to the Subbasin (10,055 AFY) during the historical period. The annual well pumping value is negative in Table 6-1 as it represents an outflow from the Subbasin.

6.4.1.1.3 Net Inter-basin Flows

Net annual inter-basin flows represent the sum of inflows and outflows along the entire boundary of each adjacent subbasin and the ocean. They represent the aggregate groundwater flow in all principal aquifers across a given boundary. The basis for calculating these flows and calibrating conditions along each of the model boundaries during the historical and current period is outlined in Section 6.2.2 and described in Appendix 6-B.

Estimated net inter-basin flows include:

- Subsurface groundwater flows between the Monterey Subbasin and the adjacent subbasins including the Seaside Subbasin and the 180/400-Foot Aquifer Subbasin and
- Subsurface groundwater flows between the Monterey Subbasin and the ocean.

They are further subdivided by type (i.e., presumed freshwater and presumed seawater). Although the MBGWFM does not specifically distinguish between seawater and freshwater, freshwater and seawater inflow and outflow components can be estimated based on the following assumptions:

- Inflows into the Monterey Subbasin across the ocean boundary are 100% seawater, as ocean water is presumed to saline.
- Outflows from the Monterey Subbasin across the ocean boundary are 100% freshwater, because outflows to the ocean generally only occur within the Dune Sand Aquifer which contains freshwater (see Appendix 6-A and Section 5.3.3).

- Seawater inflows into the Monterey Subbasin during the historical period were equivalent to seawater outflows to the 180/400-Foot Aquifer Subbasin, as (1) there has been negligible ~~no observed~~ expansion of the seawater intrusion front within the Monterey Subbasin over the historical period and (2) groundwater from the coastal portion of the Monterey Subbasin flows toward the 180/400-Foot Aquifer Subbasin in the lower 180- and 400-Foot aquifers where seawater intrusion has been observed.

Figure 6-5 depicts the general direction of inter-basin cross boundary flows between the subbasins and the ocean, including the direction of presumed freshwater and seawater inflows and outflows from the Subbasin. The estimated magnitude of each of these inter-basin cross boundary flows are itemized in Table 6-1 and described below.

Based on the assumptions above, it is estimated that net annual freshwater outflows from the Monterey Subbasin averaged 8,999 AFY during the historical period. These net annual freshwater outflows consisted of the following inter-basin flows:

- 918 AFY of net annual inflows from the Seaside Subbasin into the Monterey Subbasin. These flows are represented as positive in Table 6-1 because they represent an inflow from the Seaside Subbasin into the Monterey Subbasin. The estimated magnitude of these inflows is generally consistent with those estimated by the Seaside Basin Groundwater Flow Model (Hydrometrics 2009 & 2018) over the same time period (i.e., 935 AFY) (see Appendix 6-B). However, as discussed in Section 6.2.2, the MBGWFM will be refined within the first five years of GSP implementation to better characterize and improve the accuracy of these estimated cross boundary flows with respect to the model layers, formations, and principal aquifers.

- 9,393 AFY of net outflows from the Monterey Subbasin into the 180/400-Foot Aquifer Subbasin. These flows are identified as negative in Table 6-1 as they represent an outflow from the Monterey Subbasin. These estimated outflows are very significant and are reflective of the large inland gradients that exist between the Monterey subbasin and the 180/400-Foot Aquifer Subbasin. ~~As discussed in Chapter 5, groundwater levels in the~~ 180/400-Foot Aquifer Subbasin ~~are more than 40 feet below sea level in the 180- and 400-Foot Aquifers and have recently declined to over 100 feet below sea level in the Deep Aquifers.~~

- 524 AFY of net outflows from the Monterey Subbasin into the ocean. These outflows generally occur within the Dune Sand Aquifer (see Appendix 6-A), which contains fresh water and has seaward hydraulic gradients.

Estimated net annual seawater inter-basin flows averaged 0 AFY. Based on model results, the magnitude of these net annual seawater flows consisted of the following:

- 2,872 AFY of net seawater inflows into the Monterey Subbasin from the ocean. The majority of these inflows occur within the Lower 180- and 400-Foot Aquifers where seawater intrusion is occurring.

- 2,872 AFY of net seawater outflows from the Monterey Subbasin into the 180/400-Foot Aquifer Subbasin. The magnitude of these presumed seawater inter-basin outflows is assumed to be equivalent based on estimated inflows into the Monterey Subbasin across the ocean boundary, given that there has been negligible ~~no observed~~ expansion of the seawater intrusion front within the Monterey Subbasin over the historical period.

6.4.1.1.4 Net River Exchange

The estimated annual net river exchange was 151 AFY over the historical period. It represents inflows to the Subbasin that occur along the Salinas River, which intersects the Subbasin in a small portion of the Corral De Tierra Area[32].

6.4.1.1.5 Net Annual Change in Groundwater Storage

Change in groundwater storage is the sum of all flow components pertaining to the groundwater system as shown in Table 6-1. Although estimated groundwater recharge (10,055 AFY) exceeded pumping in the Monterey Subbasin (5,651 AFY) during the historical period, the net estimated annual change in groundwater storage in the Monterey Subbasin was -4,434 AFY. This value is negative indicating a loss of storage during the historical period. Inter-basin outflows accounted for the majority of the Subbasin's groundwater outflow over the historical period. Net inter-basin outflows (8,999 AFY) well exceeded groundwater pumping and were close to total estimated recharge in the Subbasin. These estimated outflows are reflective of the large inland gradients that exist between the Monterey Subbasin and the 180/400-Foot Aquifer Subbasin. As discussed in Chapter 5, groundwater levels in the 180/400-Foot Aquifer Subbasin are more than 40 feet below sea level in the 180- and 400-Foot Aquifers and have recently declined to over 100 feet below sea level in the Deep Aquifers. Although there are also areas of the Monterey Subbasin where groundwater levels are below sea level, groundwater levels in the 180/400-Foot Aquifer Subbasin are significantly lower and draw groundwater inland. Meanwhile, groundwater levels in the southern Corral de Tierra Area, which lies in the upland portions of the Monterey Subbasin, can be as high as 800 ft above sea level. As such, very significant hydraulic gradients exist between the Corral de Tierra Area and the 180/400-Foot Aquifer Subbasin. These water budget results demonstrate the relationship and interdependence between inter-basin inflows, outflows, and the Subbasin water budget and the need for coordinated sustainable groundwater management in all of these subbasins.

[32] Stream gauge data was unavailable from El Toro Creek for the historical period, and thus El Toro Creek was not directly simulated in the model.

The loss in storage is reflected in the groundwater level declines that have been observed in the 400-Foot Aquifer and Deep Aquifers within the Marina-Ord Area and within the El Toro Primary Aquifer in the Corral de Tierra Area. The negative net annual change in storage indicates that the Monterey Subbasin was in overdraft during the historical period.

6.4.1.2 Current Water Budget

The current basin-wide water budget is based upon water years (WY) 2015 through 2018 and is also presented in Table 6-1. The current water budget includes the same water budget components as the historical water budget (see Section 6.2) but characterizes basin conditions over a much shorter period of time. The current period includes one wet year (2017), two above normal years (2016 and 2018), and one dry year (2015). Although the current water budget includes both dry and wet years, average precipitation during this period (16.94 in/yr) was higher than the historical period (15.50 in/yr). As such, recharge was much higher than during the historical period. The magnitude of other groundwater budget components include: well pumping, net freshwater inter-basin flows and net river exchange stayed relatively constant with historic values, which resulted in a much smaller net annual change in groundwater storage (-1,609 AFY) during the current period. However, this value is likely not representative of long-term conditions as it is not reflective of the long-term hydrologic cycle.

6.4.2 The Marina-Ord Area – Water Budget Zone

Table 6-2 summarizes the Marina-Ord Area WBZ budget during the historical water budget period (WY 2004–2018) and current water budget period (WY 2015-2018). Similar to the basin-wide budget, water budget components included in the Marina-Ord Area WBZ include: recharge, well pumping, and net inter-basin flow. In addition, the Marina-Ord Area WBZ includes estimated net intra-basin flows from the Corral de Tierra Area. There is no surface water exchange component as the Salinas River does not extend into the Marina-Ord Area WBZ.

Positive values in Table 6-2 indicate a net inflow to the Marina-Ord Area WBZ and negative values indicate a net outflow from the Marina-Ord Area WBZ. Further description regarding the modeling of each of these water budget components is described Section 6.2 and provided in Appendix 6-B.

Table 6-2. Historical and Current Groundwater Water Budget Results, Marina-Ord Area

Net Annual Groundwater Flows (AFY) (b)	Historical Annual Inflows/Outflows WY 2004 - 2018	Current Annual Inflows/Outflows WY 2015 - 2018
Recharge		
● Rainfall, leakage, irrigation	**6,144**	**7,624**
Well Pumping		
● MCWD (180-Foot and 400-Foot Aquifers)	-1,797	-773
● MCWD (Deep Aquifers)	-2,262	-2,445
● Reservation Road Portion	-287	-285
	-4,346	**-3,503**
Net Inter-Basin Flow (Presumed Freshwater) (c)		
● Seaside Subbasin	1,310	1,715
● 180/400-Foot Aquifer Subbasin	-5,761	-6,450
● Ocean	-524	-574
	-4,975	**-5,308**
Net Inter-Basin Flow (Presumed Seawater) (c)		
● 180/400-Foot Aquifer Subbasin	-2,872	-3,258
● Ocean	2,872	3,258
	0	**0**
Net Intra-basin Flow		
● Corral de Tierra Area (Water Budget Zone)	**1,544**	**1,397**
NET ANNUAL CHANGE IN GROUNDWATER STORAGE	**-1,632**	**209**

Notes:

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

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

(c) All seawater inflows from the ocean are presumed to leave the Monterey Subbasin across the 180/400-Foot Aquifer Subbasin boundary, as evidenced by negligible ~~no observed~~ expansion of the seawater intrusion front in the Monterey Subbasin over the historical time period. See further discussion in Section 6.4.2.1.3.

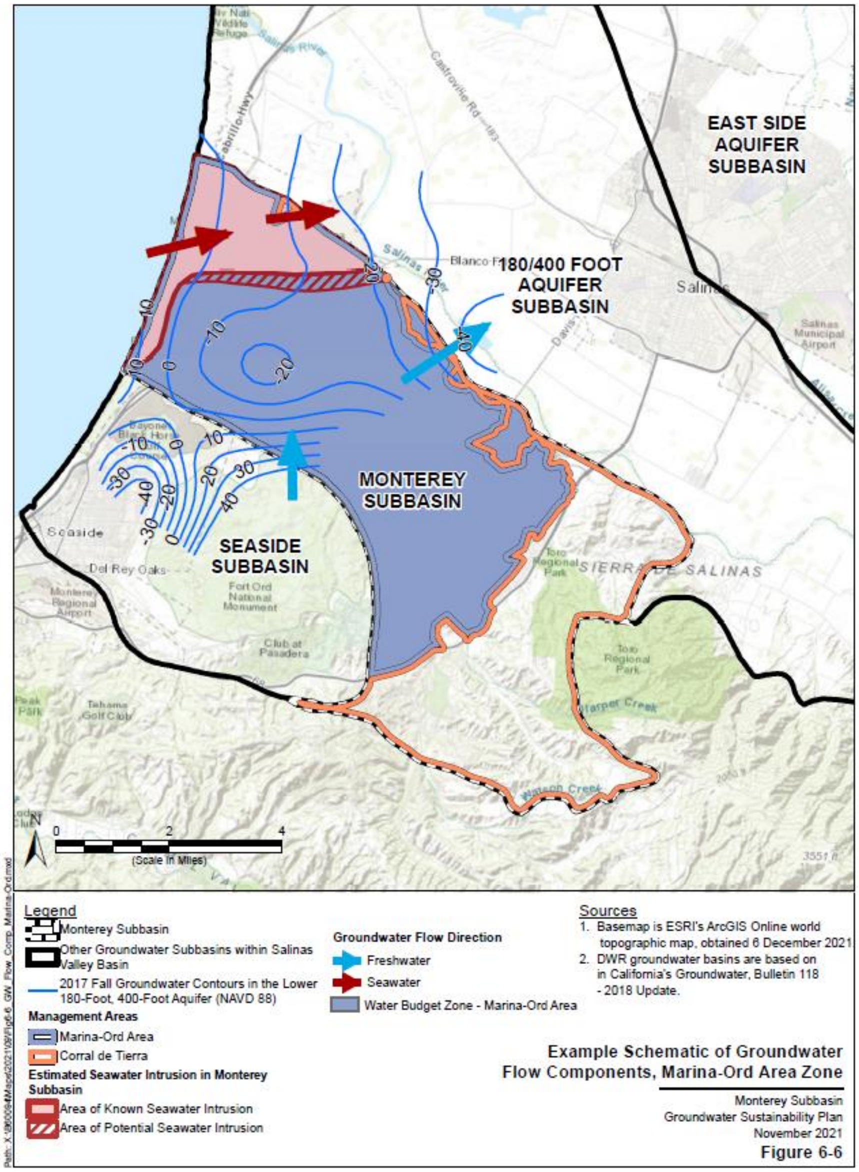


Figure 6-6. Example Schematic of Groundwater Flow Components, Marina-Ord Area Zone

6.4.2.1 Historical Water Budget

6.4.2.1.1 Recharge

Estimated average annual recharge to the Marina-Ord Area WBZ during the historical period was 6,144 AFY. This recharge was estimated utilizing the SMB and incorporates land surface system processes and estimated leakage of total delivered water by MCWD. Outputs from the SMB are included in Appendix 6-A.

6.4.2.1.2 Well Pumping

Estimated average annual well pumping in the Marina-Ord Area WBZ was 4,346 AFY and included:

- 1,797 AFY by MCWD from the 180- and 400-Foot Aquifers;
- 2,262 AFY by MCWD from the Deep Aquifers; and
- 287 AFY from Corral de Tierra North of Reservation Rd.

The estimated well pumping in the Marina-Ord Area WBZ was significantly lower than the average annual recharge during the historical period. The well pumping values are negative in Table 6-2 as they represent an outflow from the Marina-Ord Area WBZ.

6.4.2.1.3 Net Inter-basin and Intra-basin Flows

Figure 6-6 depicts the general direction of presumed freshwater and seawater cross-boundary flows to and from the Marina-Ord Area WBZ within the Lower 180- and 400- Foot Aquifer zone where the majority of seawater intrusion is occurring. Net inter-basin and intra-basin flows from the Marina-Ord Area WBZ include:

- Presumed freshwater and seawater inter-basin flows between the Marina-Ord Area WBZ, the ocean and adjacent subbasins; and
- Presumed freshwater intra-basin flows between the Marina-Ord Area WBZ and the Corral de Tierra Area WBZ.

The estimated magnitude of each of these net inter- and intra- basin cross boundary flows are itemized in Table 6-2 and described below. These net inter- and intra- basin cross boundary flows represent the aggregate flow in all principal aquifers across each subbasin and management area boundary.

Estimated net annual freshwater inter-basin outflows from the Marina-Ord Area WBZ averaged 4,975 AFY during the historical period. These net annual freshwater outflows consisted of the following inter-basin flows:

- 1,310 AFY of net annual inflows from the Seaside Subbasin into the Marina-Ord Area WBZ.
- 5,761 AFY of net outflows from the Marina-Ord Area WBZ into the 180/400-Foot Aquifer Subbasin.
- 524 AFY of net outflows from the Marina-Ord Area WBZ into the ocean. These outflows generally occur within the Dune Sand Aquifer (see Appendix 6-A), which contains fresh water and has seaward hydraulic gradients.

Estimated net annual seawater inter-basin flows from the Marina-Ord Area WBZ averaged 0 AFY. Based on model results, the magnitude of these net annual seawater flows consisted of:

- 2,872 AFY of net seawater inflows from the Marina-Ord Area WBZ from the ocean. The majority of these inflows occur within the Lower 180- and 400-Foot Aquifers where seawater intrusion is occurring.
- 2,872 AFY of net seawater outflows from the Marina-Ord Area WBZ into the 180/400-Foot Aquifer Subbasin. The magnitude of these presumed seawater inter-basin outflows is assumed to be equivalent based on estimated inflows into the Marina-Ord Area WBZ across the ocean boundary, given that that there has been negligible ~~no observed~~ expansion of the seawater intrusion front within the Marina-Ord Area WBZ over the historical period.

Further quantification of these net cross boundary flows by principal aquifer are provided in Appendix 6-A.

Estimated net annual freshwater intra-basin inflows from the Corral de Tierra Area WBZ into the Marina-Ord Area WBZ averaged 1,544 AFY over the historical period. As discussed in Section 6.4.3, the Corral de Tierra Area WBZ is located in the Santa Lucia range where groundwater naturally flows toward lower lying coastal areas of the Monterey subbasin and the 180/400-Foot Aquifer Subbasin.

6.4.2.1.4 Net Annual Change in Groundwater Storage

Similar to basin-wide water budget results, groundwater recharge (6,144 AFY) exceeded pumping in the Marina-Ord Area WBZ (4,346 AFY) during the historical period. However, the net estimated annual change in groundwater storage in the Marina-Ord Area WBZ was -1,632 AFY. Net inter-basin outflows from the Marina-Ord Area WBZ (4,975 AFY) were very significant. These results demonstrate the relationship and interdependence between inter-basin inflows, outflows, and the Marina-Ord Area WBZ water budget and the need for coordinated sustainable groundwater management in all subbasins.

6.4.2.2 Current Water Budget

The current water budget for the Marina-Ord Area WBZ is based upon water years 2015 through 2018 and is also presented in Table 6-2. The current water budget includes the same water budget components as the historical water budget (see Section 6.2) but characterizes basin conditions over a much shorter period of time. The current period includes one wet year (2017), two above normal years (2016 and 2018), and one dry year (2015). Although the current water budget includes both dry and wet years, precipitation during this period (16.94 in/yr) was higher than the historical period (15.50 in/yr). As such, recharge was much higher than during the historical period. In addition, due to MCWD's water conservation efforts groundwater pumping in the Marina-Ord Area WBZ has decreased since the beginning of the historical period. Average pumping during the current period (3,503 AFY) was lower than average pumping during the historical period (4,346 AFY). These factors resulted in a net increase in groundwater storage (209 AFY) during the current period. However, this value is likely not representative of long- term conditions as it is not reflective of the long-term hydrologic cycle.

The current water budget results also quantify net annual inter-basin flows into the Marina-Ord Area WBZ. These net annual inter-basin flows represent the sum of inflows and outflows along the entire boundary with each adjacent subbasin and the ocean. They represent the aggregate groundwater flow in all principal aquifers across a given boundary.

These water budget results indicate that total net freshwater and seawater annual outflows from the Marina-Ord Area WBZ into to the 180/400-Foot Aquifer Subbasin during the current period were 9,709 AFY. These total net freshwater and seawater annual outflows are substantially higher than those averaged during the historical period (8,633 AFY). This increase in outflows is consistent with observed declines in groundwater levels within the 180/400-Foot Aquifer Subbasin between 2004 and 2018 (see chapter 5). Increased annual outflows from the Marina-Ord Area WBZ to the 180/400-Foot Aquifer Subbasin during the current period resulted in increased inflows from the ocean and the Seaside Subbasin during this period. These results demonstrate the relationship and interdependence between inter-basin inflows and outflows in the Marina-Ord Area and the need for coordinated sustainable groundwater management in all of these subbasins.

6.4.3 The Corral de Tierra Area – Water Budget Zone

Table 6-3 summarizes the Corral de Tierra Area WBZ budget during the historical water budget period (WY 2004–2018) and current water budget period (WY 2015-2018). Similar to the basin-wide budget, water budget components included in the Corral de Tierra Area WBZ include: recharge, well pumping, net inter-basin flow, and net river exchange[33]. In addition, the Corral de Tierra Area WBZ includes estimated net intra-basin flows to the Marina-Ord Area. Positive values

[33] Stream gauge data was unavailable from El Toro Creek for the historical period, and thus El Toro Creek was not directly simulated in the model. The net river exchange values are based on the estimated Salinas River exchange.

indicate a net inflow to the Corral de Tierra Area WBZ and negative values indicate a net outflow from the Corral de Tierra Area WBZ. Further description regarding the modeling of each of these water budget components is described Section 6.2 and provided in Appendix 6-B.

Table 6-3. Historical and Current Groundwater Water Budget Results, Corral de Tierra Area Zone

Net Annual Groundwater Flows (AFY) (b)	Historical Annual Inflows/Outflows WY 2004 - 2018	Current Annual Inflows/Outflows WY 2015 - 2018
Recharge		
● Rainfall, leakage, irrigation	**3,910**	**4,435**
Well Pumping		
● El Toro Primary Aquifer System	**-1,296**	**-1,771**
Net Inter-Basin Flow (Presumed Freshwater) (c)		
● Seaside Subbasin	-392	-381
● 180/400-Foot Aquifer Subbasin	-3,632	-2,857
● Ocean	0	0
	-4,024	**-3,238**
Net Intra-basin Flow		
● Marina-Ord Area (Water Budget Zone)	**-1,544**	**-1,397**
Net Surface Water Exchange		
● Salinas River Exchange	**151**	**153**
NET ANNUAL CHANGE IN GROUNDWATER STORAGE	**-2,803**	**-1,818**

Notes:

(a) The Corral de Tierra Area Zone Budget does not include inflows to and outflows from the portion of Corral de Tierra Area that is north of Reservation Rd.
(b) Positive values indicate a net inflow and negative values indicate a net outflow.
(c) Net cross boundary flows are reflective of 100% freshwater as no seawater inflows to the Subbasin reach the Corral de Tierra Area.

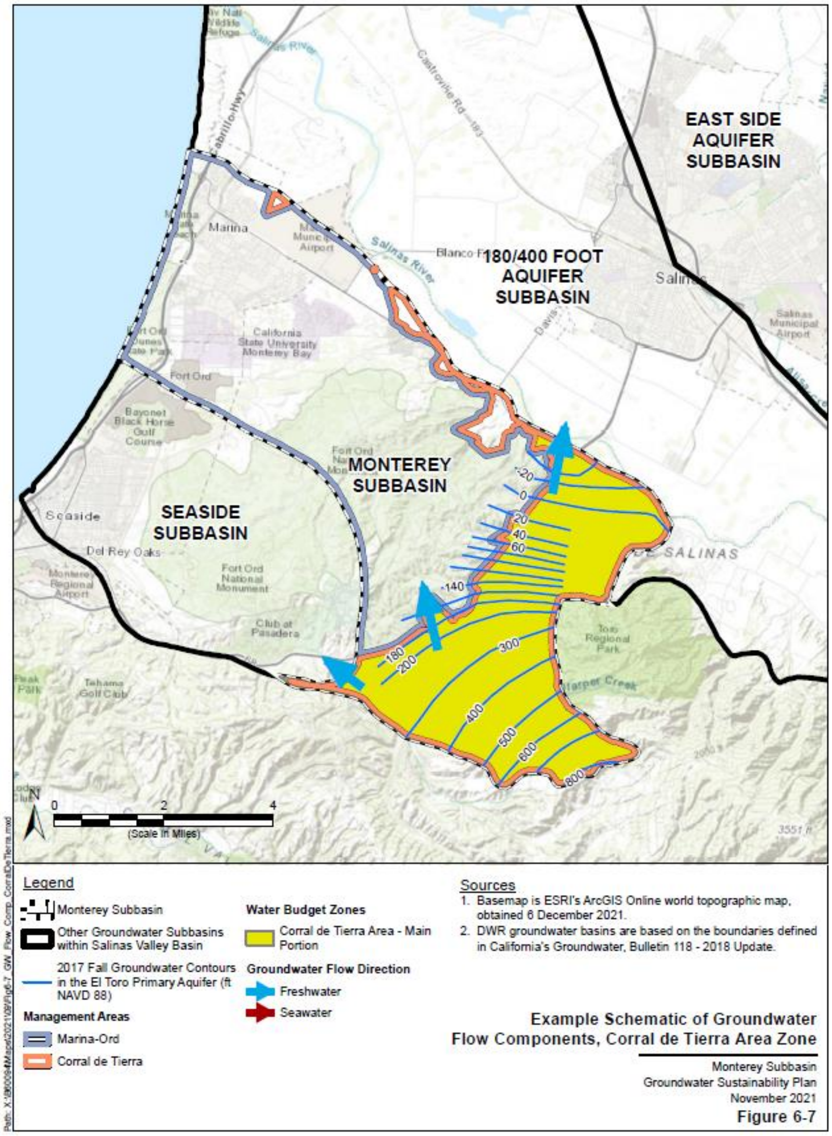


Figure 6-7. Example Schematic of Groundwater Flow Components, Corral de Tierra Area Zone

6.4.3.1 Historical Water Budget

6.4.3.1.1 Recharge

Estimated average annual recharge to the Corral de Tierra Area WBZ during the historical period was 3,910 AFY. This recharge was estimated utilizing the SMB and incorporates land surface system processes. Outputs from the SMB are included in Appendix 6-A.

6.4.3.1.2 Well Pumping

Estimated average annual well pumping in the Corral de Tierra Area WBZ during the historical period was 1,295 AFY. The well pumping values are negative in Table 6-3 and represent an outflow from the Corral de Tierra Area WBZ. It is important to note this area is characterized by many domestic wells and small water systems, which have different reporting requirements than other groundwater extractors. This means that pumping in the Corral de Tierra Area is estimated using the known data and may be missing a significant amount of pumping. This is a data gap that will be addressed during implementation as described in Chapter 10.

6.4.3.1.3 Net Inter-basin and Intra-basin Flows

Table 6-3 depicts the general direction of groundwater cross-boundary flows to and from the Corral de Tierra Area WBZ. These cross-boundary flows consist of freshwater flows:

- Between the El Toro Primary Aquifer System in the Corral de Tierra Area WBZ and the multiple principal aquifers in adjacent subbasins; and
- Between the principal aquifers in the Marina-Ord Area WBZ and the El Toro Primary Aquifer System in the Corral de Tierra Area WBZ.

The estimated magnitude of each of these inter- and intra- basin cross boundary flows are itemized in Table 6-3 and described below. These

Estimated net annual freshwater inter-basin outflows from the Corral de Tierra Area WBZ averaged 4,024 AFY during the historical period. These net annual freshwater outflows consisted of the following inter-basin flows:

- 392 AFY of net annual outflows from the Corral de Tierra Area WBZ into the Seaside Subbasin.
- 3,602 AFY of net annual outflows from the Corral de Tierra Area WBZ into the 180/400-Foot Aquifer Subbasin.

Estimated net annual freshwater intra-basin inflows from the Corral de Tierra Area WBZ into the Marina-Ord Area WBZ averaged 1,544 AFY over the historical period. As shown on Figure 4-5, the Corral de Tierra Area WBZ is located in the Santa Lucia Range and land surface elevations ranges from 300 feet to 1,900 feet above mean sea level. Groundwater from this area naturally flows toward lower lying coastal areas of the Monterey Subbasin where the Marina-Ord Area is located and the El Toro Creek Canyon which connects to lower lying areas of the 180/400-Foot Aquifer Subbasin.

6.4.3.1.4 Net Annual Change in Groundwater Storage

Similar to basin-wide water budget results, groundwater recharge (3,910 AFY) exceeded pumping in the Corral de Tierra Area WBZ (1,295 AFY) during the historical period. It is important to note that recharge is not immediately available to the locations and depths of the principal aquifer that are experiencing the most pumping. Recharge and pumping are also not always occurring within the same time periods. In addition, the net estimated annual change in groundwater storage in the Corral de Tierra Area WBZ was -2,803 AFY based on groundwater modeling results, which is over twice the amount of groundwater pumping during this period. This discrepancy is partly due to the data gap related to pumping from small water systems and *de minimis* wells which characterize the area and have different reporting requirements than larger water systems and agricultural users. Net inter-basin outflows from the Corral de Tierra Area WBZ (4,024 AFY) were very significant and close to the area's groundwater recharge. These results demonstrate that extraction data and estimates may underestimate actual extraction in the area and the interdependence of groundwater budgets between subbasins.

6.4.3.2 Current Water Budget

The current water budget for the Corral de Tierra Area WBZ is based upon water years 2015 through 2018 and is also presented in Table 6-3. The current water budget includes the same water budget components as the historical water budget but characterizes basin conditions over a much shorter period of time. Although the current water budget includes both dry and wet years, precipitation during this period (16.94 in/hr) was higher than the historical period (15.50 in/yr). The increased precipitation during this period is the result of higher than average precipitation in the years following the 2012-2016 drought period. As such, recharge was much higher than during the historical period. As shown in Table 6A-3 in Appendix 6-A, groundwater pumping in the Corral de Tierra Area WBZ increased during the period of WY 2004-2018. Therefore, average pumping during the current period (1,771 AFY) was higher than average pumping during the historical period (1,296 AFY). The net change in groundwater storage during the current period (-1,818 AFY) was smaller than that of the historical period (-2,803 AFY).

The current results also indicate that net annual outflows from the Corral de Tierra Area WBZ into to the 180/400-Foot Aquifer Subbasin and the Marina-Ord Area WBZ during the current period were 3,238 AFY and 1,397 AFY, respectively. These total net freshwater annual outflows are lower than those averaged during the historical period. These results indicate that increased groundwater pumping and observed groundwater elevation declines between 2004 and 2018 (see Chapter 5) have resulted in less groundwater leaving the Corral de Tierra Area WBZ. These results demonstrate that extraction data and estimates may underestimate actual extraction in the area, and the degree of interdependence of groundwater budgets between subbasins.

6.5 Projected Water Budget

Per 23-CCR §354.18(e)(2), projected water budgets are required as a way to estimate future conditions of water supply and demand within a basin, as well as the aquifer response to implementation of the Plan over the planning and implementation horizon. To develop the projected water budget, the same tools and methodologies that were used for the historical and current water budget were used, with updated inputs for climate variables (i.e., precipitation and ET), land use (water demand), and future Subbasin boundary conditions. Given that historical water budget results indicate that conditions in the Monterey Subbasin are highly sensitive to conditions in adjacent subbasins, projected water budget results are presented for three alternative sets of boundary conditions in the 180/400-Foot Aquifer Subbasin. These boundary conditions include:

- Minimum Threshold (MT) Boundary Conditions
- Measurable Objective (MO) Boundary Conditions, and
- Seawater Intrusion (SWI) Protective Boundary Conditions.

Each of these boundary condition scenarios is predicated on the assumption that the 180/400-Foot Aquifer Subbasin will be managed to its SMCs over the 50-year projected model period. In addition, boundary conditions for the Seaside Subbasin, which is an adjudicated subbasin, are assumed to remain stable at Fall 2017 levels[34] (as further described in Section 6.5.2).

The chief purpose of this projected water budget analysis is to assess the magnitude of the net water supply deficit that would need to be addressed through Projects and Management Actions to prevent Undesirable Results (discussed further in Chapters 8 and 9) and achieve the Sustainability Goal. This section describes the development and results of the projected water budget for the entire subbasin and by water budget zones.

6.5.1 Projected Scenarios Data Sources

Per the GSP Emergency Regulations 23-CCR §354.18(c)(3), the projected water budgets must use "50 years of historical precipitation, evapotranspiration, and streamflow" for estimating future hydrology, "the most recent land use, evapotranspiration, and crop coefficient information" for estimating future water demand. To develop the required 50 years of projected hydrologic input information, an "analog period" was created by repeating select sequences of the historical hydrologic record in a way that maintains long-term historical average hydrologic conditions. The analog period used for projected water budget simulations is discussed in detail in Section 6.3.3.

[34] Or at the established MTs (i.e., based on 2015 water levels) in the Corral de Tierra Area wherever they were below MTs at the end of the Historical Period. See discussion in Section 6.5.2.

Per 23-CCR §354.18(e), the best-available data were used to develop the projected water budgets for the Subbasin and include the following:

- Monthly Precipitation, ET, and Salinas River flows from the historical simulation period. See Section 6.1.1. for details on the historical data sources.
- Monthly climate change factors for precipitation and ET, and for the 2030 and 2070 Central Tendency scenarios (DWR, 2020). Precipitation and ET climate change factors are spatially variable and mapped to a variable infiltration capacity (VIC) grid. Climate change factors for the VIC grid cells which intersect the Subbasin were used to vary historical precipitation and ET estimates.
- Future MCWD land use from the District's 2020 Water Master Plan. The historical urban footprint within MCWD was adjusted to include future planned urban developments.
- Future MCWD demands from the District's 2020 UWMP (Schaff & Wheeler, 2021). Projected demands from 2020-2040 were used to adjust groundwater pumping assumptions within MCWD-owned wells and subsequent deliveries of irrigation water in the MCWD service area.
- Water Augmentation Alternatives Study for Former Fort Ord Area (EKI, 2020). Projected recycled water or other augmented supply availability within MCWD was used to develop a "Project" based scenario where future MCWD groundwater demands are partially offset by augmented surface water supplies, as described in detail in Section 9.6.1.
- Water Level Sustainability Criteria for the 180/400-Foot Aquifer Subbasin Representative Monitoring Network. Minimum Thresholds and Measurable Objectives defined for nearby representative monitoring sites (RMS) included in the 180/400-Foot Aquifer Subbasin GSP were used to develop projected groundwater elevations along the northern active model boundary.
- Projected Sea Level Conditions from the 180/400-Foot Aquifer Subbasin GSP were used to develop projected sea levels along the Monterey Coast.
- Seaside Basin Groundwater Flow Model. September 2017 historical groundwater elevations output from the Seaside model (Hydrometrics 2009 & 2018) were used to develop projected groundwater elevations at the Seaside Area Subbasin boundary. However, aAs discussed in Section 6.2.2 and Appendix 6-B, the Seaside BSubbasin model represents principal aquifer units differently than the MBGWFM and includes a different number of layers. Therefore, a few simplifying assumptions were made to link head outputs from the Seaside model into each layer of the MBGWFM along the Seaside boundary to ensure cross-boundary flow estimates were in close agreement between the two modelsboundary condition heads output from the Seaside Basin Groundwater Flow

> ~~Model represent the Paso Robles and Santa Margarita aquifers separately, while the MBGWFM represents the Deep Aquifers and the El Toro Primary Aquifer System as one model layer due to the lack of data.~~ ~~The translation of heads from the Seaside Model created uncertainties in the MBGWFM, which is also discussed in see Section 6.7.~~ The ~~MBGWFM's~~ boundary conditions will be revisited ~~assumptions will be improved~~ and/or a regional model including both subbasins will be created to address these discrepancies~~ise issue~~ in model layers within this first five years of GSP implementation.

There is less information regarding projected future water demands and land use data available for the Corral de Tierra Area, and as such a few assumptions needed to be made for the model development and projected water budget runs associated with these inputs. Further description regarding each of the assumptions included in projected model simulations is provided below.

6.5.1.1 Projected Water Demands and Land Use

Projected basin-wide water demand and land use are based on (a) projected urban development within MCWD's projected future service area through 2040, and (b) current land use and continued pumping in the Corral de Tierra Area at estimated 2018 extraction rates. The 2018 pumping (i.e., 2,474 AFY) is taken from the very end of the current period to best encapsulate the known maximum amount of pumping in the Corral de Tierra Area. It includes ongoing extraction of 286 AFY from the Reservation Road portion and 2,188 AFY from the remainder of the Corral de Tierra Area.

MCWD's projected service area is located within the Marina-Ord Area and portions of the Seaside Subbasin and 180/400-Foot Aquifer Subbasin. Based on information provided in Table 4.10 of MCWD's 2020 UWMP (Schaff & Wheeler, 2021), water demand within the MCWD service area is anticipated to increase from 3,367 AFY in 2020 to 8,314 AFY by 2040[35]. For the purposes of these projected water budgets, it has been assumed that potable water demands for the entire MCWD future service area would be supplied by pumping from existing MCWD wells in the Marina-Ord Area. This groundwater pumping has been divided roughly evenly between the 180/400-Foot Aquifer and Deep Aquifers based on the pumping distributions inferred from MCWD's historical operations.

Projected basin-wide land use was adjusted from historical land use to reflect projected development within MCWD's projected future service area. Land use information was obtained from MCWD's 2020 Water Master Plan, consistent with local land use plans and approved development. As discussed above in Section 6.2.1, this projected land use data serves as an input to the SMB that calculates projected runoff and recharge as a result of land use changes.

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[35] An additional 1,270 AFY are anticipated to be met by recycled water or other augmented surface water supplies, to meet a total demand of 9,584 AFY by 2040.

6.5.1.2 Projected Hydrology and Variable Climate Scenarios

Projected water budget results are presented for three alternative sets of hydrology and climate conditions which have been identified as:

- Baseline (Historical Analog) Conditions
- 2030 ("Near future") Climate Conditions, and
- 2070 ("Late future") Climate Conditions

To develop the required 50 years-worth of hydrologic input information, first an "analog period" was created from 20 years-worth of historical information (WY 1999-2018) by combining the years in a specific way that, on average, maintained the long-term average hydrologic conditions. This approach allowed for the creation of a complete 50-year period to inform the projected water budget analysis, even when certain component datasets were not available for that length of time. The analog period used for projected water budget simulations is discussed in detail in Section 6.3.3.

- Baseline Climate Scenario: As discussed in Section 6.3.3, a 50-year analog period was created to inform the project water budget analysis. This hydrologic input information was developed using a sequence of historical hydrologic input information that reflects the Subbasin's long-term average hydrologic conditions.
- 2030 Climate Change Scenario: In order to estimate the potential effects on the projected water budget of climate change during GSP implementation period (i.e., between 2020 and 2040), a water budget scenario based on 2030 climate change factors published by DWR was developed. For this scenario, precipitation and ET were both adjusted using the monthly 2030 change factors published by DWR. Constant head boundary conditions along the Monterey Coast are adjusted using projected 2030 sea levels.
- 2070 Climate Change Scenario*:* In order to estimate the potential effects on the projected water budget of climate change towards the end of the planning and implementation horizon (i.e., 50 years out into the future), a water budget scenario based on 2070 "central tendency" climate change factors published by DWR was developed. It should be noted that estimates of climate change impacts on water supplies this far into the future have significant uncertainty. For this scenario, precipitation and ET were both adjusted using the monthly 2070 "central tendency" change factors published by DWR. Constant head boundary conditions along the Monterey Coast are adjusted using projected 2070 sea levels.

6.5.1.3 Projected Subbasin Boundary Conditions

Historical water budget results demonstrate that conditions in the Monterey Subbasin are highly sensitive to conditions in adjacent subbasins. As such, projected water budget results are presented for three alternative sets of boundary conditions in the 180/400-Foot Aquifer Subbasin, which have been identified as:

- Minimum Threshold (MT) Boundary Conditions
- Measurable Objective (MO) Boundary Conditions, and
- Seawater Intrusion (SWI) Protective Boundary Conditions.

Each of these boundary condition scenarios is predicated on the assumption that (a) the 180/400-Foot Aquifer Subbasin will be managed to its SMCs over the 50-year projected model period. In addition, it has been assumed that the and (b) Seaside subbasin, which is an adjudicated subbasin, will be managed to its adjudication requirementssustainably such that groundwater levels remain stable at 20178 levels into the future. However, the Seaside Basin Watermaster's modeling (using the Seaside Basin Groundwater Flow Model) found that it would be impossible for the Laguna Seca subarea of the Seaside subbasin to be managed such that groundwater levels would remain stable in that subarea in the future. The reason for this is that even if all pumping within the Laguna Seca Subarea were to be discontinued (an infeasible undertaking) groundwater would flow in an easterly direction out of the Laguna Seca subarea and into the Corral de Tierra subarea. This would be caused by low groundwater levels in the Corral de Tierra subarea compared to groundwater levels in the easterly portion of the Laguna Seca subarea. This highlights the importance of raising groundwater levels within the Corral de Tierra in order to not impede the ability of the Seaside subbasin to be sustainably managed.

The 180/400-Foot Aquifer Subbasin has been designated as a critically overdrafted subbasin by DWR, and is subject to the Sustainable Groundwater Management Act (SGMA). The GSP for the 180/400-Foot Aquifer Subbasin establishes MTs and MOs for both groundwater levels and seawater intrusion. These SMCs have been utilized to simulate potential future boundary conditions along the 180/400-Foot Aquifer Subbasin for the projected water budget. Groundwater levels along the northern active model boundary (just north of the Monterey Subbasin boundary) were established as follows over the 50-year projected model period for each boundary condition scenarios:

- MT Boundary Condition: Groundwater levels in RMS wells located near the Monterey Subbasin are raised from 2018 model predicted values to water level MTs established in the 180/400-Foot Aquifer GSP during the 20-year GSP implementation period (i.e., between 2020 and 2040) and then kept constant for the following 30 years of the projected model period.
- MO Boundary Condition: Groundwater levels in RMS wells located near the Monterey Subbasin raised from 2018 model predicted values to water level MOs following their five year interim milestone (IM) trajectories established in the 180/400-Foot Aquifer GSP during the 20-year GSP implementation period (i.e., between 2020 and 2040) and then kept constant for the following 30 years of the projected model period.

- SWI Protective Boundary Condition: Groundwater levels along the entire boundary of the Monterey Subbasin and 180/400-Foot Aquifer Subbasin are raised from 2018 model predicted values to levels protective against further seawater intrusion within the 180- and 400- Foot aquifers. These SWI protective elevations are projected over the 20-year GSP implementation period (i.e., between 2022 and 2042). In the absence of the installation of a hydraulic injection and/or extraction barrier, these SWI protective elevations represent the minimum groundwater elevations that would be needed in the coastal portions of the 180/400-Foot Aquifer Subbasin to stop further seawater intrusion consistent with the MTs for seawater intrusion established in the 180/400-Foot Aquifer Subbasin GSP[36]. Seawater intrusion has not been observed to date in the Deep Aquifers. As such groundwater levels in Deep Aquifer RMS wells located near the Monterey Subbasin are set at water level MOs established in the 180/400-Foot Aquifer GSP, consistent with the MO Boundary Condition.

The Seaside Subbasinbasin is subject to adjudication requirements that require that rates of groundwater extraction within the Subbasin not exceed the estimated basin safe yield. As such, in all three boundary conditions scenarios, groundwater levels in the adjudicated Seaside basin are assumed to remain stable into the future. Ffor the projected simulations, a simplifying assumption was made that the Seaside Subbasin will maintain Fall 2017 water levels over the long term. As such, September 2017 water level outputs from the Seaside Model were used to define specified heads along the Seaside Ssubbasin boundary for all projected simulations.

One exception to this assumption is along the southeastern edge of the Seaside-Monterey boundary (i.e., near Laguna Seca). In this area, simulated Fall 2017 water levels from the Seaside Model are already below the Minimum Thresholds (MTs), which are based on 2015 groundwater levels for wells in the Corral de Tierra Management Area. MTs for these wells are 170 feet above mean sea level [ft msl], (see Sections 7 and 8)-. As such, projected water levels were adjusted to 170 ft msl in the Monterey Groundwater Flow model for boundary cells whose simulated water levels were below 170 ft (see section 2.4.2.2.2 of Appendix 6-B). However, as noted in Section , and contrary to the language in Section , it should be noted that the Seaside Basin Watermaster predictive modeling of the Laguna Seca subarea of the Seaside subbasin found that groundwater levels in the eastern portion of the Laguna Seca subarea could not be managed such that groundwater levels would remain stable, even if all pumping in the Laguna Seca subarea stopped, because of projected declines in groundwater levels the effects of pumping in the Corral de Tierra Area. Further analysis of the interconnection between these areas and these boundary conditions will be This boundary condition assumption discrepancy will be addressed and performed resolved during the early stage of implementation of the GSP. Water levels along the

[36] SWI Protective elevations were calculated for the 180 Foot Aquifers and the 400 Foot Aquifer based upon the *Ghyben-Herzberg Relationequivalent freshwater head formula presented in the USGS 2002 Report (USGS, 2002)* (*Barlow, 2003*) (see Appendix 6-B, Section 2.4.2.3.2).

~~Seaside Subbasin boundary have been set to model predicted values at the end of the Historical Period (i.e., September 2018) in the Marina-Ord Area or at the established MTs (i.e. based on 2015 water levels) in the Corral de Tierra Area wherever they were below MTs at the end of the Historical Period.~~

~~*The SVBGSA Subbasin Committee updated their groundwater levels SMCs at the August 25, 2021 special meeting. This will be changed in the next version.*~~

6.5.2 Projected Water Budget Scenarios

All of ~~these~~ the projected water budget scenarios presented in this chapter are based upon projected future water demands and land use ~~changes described~~changes described in Section 6.5.1 above. They assume that, in the absence of any projects, these projected water demands will be met through groundwater pumping from the Monterey Subbasin. Projected water budgets are ~~additionally~~ provided for project-based scenarios for each management area in Section 9.6.

The "No Project" scenarios do not incorporate the potential benefits of any new projects or management actions. However, these projected water budgets do assume that benefits from the following ongoing projects/management actions will continue into the future:

- *Stormwater Recharge Management* within the Marina-Ord Area (Section 9.4.4, project M1); and
- *MCWD Demand Management Measures* within the Marina-Ord Area (Section 9.4.5, project M2).

Further description of the anticipated benefits of these projects is included in Chapter 9.

~~"No Project" Scenarios~~

Projected water budgets for two "No Project" scenarios have been developed. These projected water budgets assess basin inflows and outflows under a range of potential future boundary conditions and climate conditions described in Section 6.5.1 above. They include:

- "No Project" Scenario with Variable Boundary Conditions: This scenario estimates the projected water budget under variable boundary conditions with the 180/400-Foot Aquifer Subbasin as described in Section 6.5.1.2 including:
    - MT Boundary Conditions;
    - MO Boundary Conditions, and
    - SWI Protective Boundary Conditions.

As described in Section 6.5.1.3, boundary conditions with the Seaside subbasin are kept constant as part of this projected water budget scenario. This water budget scenario does not include the implementation of any new projects. It assumes 2030 Climate Conditions versus Baseline climate conditions, as 2030 Climate conditions (i.e., recharge and seawater level rise) fall within the middle of the range of projected climate scenarios used to estimate basin recharge and seawater level rise. An overview of projected budget results for this scenario is included in Section 6.5.4. Additional details regarding specific inflows and outflow components are detailed in Appendix 6-B.

- "No Project" Scenario with Variable Climate Conditions: This scenario estimates the projected water budget under the variable climate conditions described in Section 6.5.1.3 including:
    - Baseline Climate conditions
    - 2030 Climate Conditions;
    - 2070 Climate Conditions

This water budget scenario does not include the implementation of any new projects. It assumes MO boundary conditions at the 180/400-Foot Aquifer Subbasin boundary, as these boundary conditions fall within the middle of the range of projected boundary conditions. As described in section 6.5.1.3, boundary conditions with the Seaside subbasin are kept constant. An overview of projected budget results for this scenario is included in Section 6.5.4. Additional details regarding specific inflows and outflow components are detailed in Appendix 6-B.

~~*6.5.2.1 "Project" Scenarios*~~

~~*6.5.2.2 Projected Water budgets are provided for one "Project" based scenario, which includes:*~~

~~*6.5.2.3 Marina-Ord Water Augmentation Project Scenario with Variable Boundary Conditions: This scenario assumes that a portion of MCWD's projected water demand will be satisfied through some form of water supply augmentation. For evaluation purposes, this projected water budget assumes that all recycled water generated by MCWD will be used to augment water supplies within its service area. This project is consistent with the Recycled Water Reuse Through Landscape Irrigation and Indirect Potable Reuse project described in Chapter 9 (Section 9.4.6, project M3). It simulates an incremental increase in augmented water supplies beginning at 600 AFY in 2023 and up to 5,495 AFY by 2040. These augmented water supplies are currently modeled as "in-lieu" of groundwater pumping, i.e. through direct, proportional reductions in groundwater pumping from*~~

~~*MCWD-owned wells relative to the "no project" pumping demands described in Sections 6.5.1.1 and 6.5.2.1.*~~

~~*6.5.2.4 An overview of projected budget results for this "Project" based scenario included in Section 6.5.5. Additional details regarding specific inflows and outflow components are detailed in Appendix 6B.*~~

~~*6.5.2.5 No project scenarios were run for the Corral de Tierra area at this time.*~~

~~6.5.2.6~~6.5.2.1 Projected Water Budget Scenario Results

Consistent with historical and current water budget results, projected water budget information for each scenario is assessed for:

- The entire Monterey Subbasin;
- The Marina-Ord Area WBZ; and
- The Corral de Tierra Area WBZ.

An overview of these "No Project" ~~projected~~ water budget results are summarized in the following section~~s~~ and tables.

- ~~Section 6.5.4: "No Project" Scenario Results:~~
- Table 6-4 through Table 6-6: "No Project" Scenario with Variable Boundary Conditions and 2030 Climate Condition for Monterey Subbasin, Marina-Ord Area WBZ, and Corral de Tierra Area WBZ;
- Table 6-7: "No Project" Scenario with Variable Climate Conditions and Measurable Objective Boundary Condition for the Monterey Subbasin;

~~Section 6.5.5: "Project" Scenario Results:~~

- ~~Table 6-8: Marina-Ord Water Augmentation "Project" Scenario with Variable Boundary Conditions and 2030 Climate Condition.~~

These tables summarize the magnitude of water budget components associated with each projected water budget scenario. The water budget components include: recharge, well pumping, net inter-basin flow, net intra-basin flow[37], and net river exchange. Similar to historical and current water budget results, positive values identified in these tables indicate a net inflow to the Subbasin or WBZ and negative values indicate a net outflow from the Subbasin or WBZ.

[37] Intra-basin flows are only included in WBZ water budget tables as they are not relevant to basin-wide results.

However, unlike historical and current water budget results, only ocean inter-basin flows are characterized as freshwater or seawater. Net inter-basin flows between subbasins are not subdivided between those that are presumed to be freshwater versus seawater, as it is difficult to predict if seawater inflows from the ocean will continue to pass through the Monterey Subbasin into the 180/400-Foot Aquifer Subbasin as they did during the historical period. It is anticipated that the magnitude and direction of seawater flows could change as the magnitude and direction of inter-basin flows and gradients change. In particular, any inflows within the 180-Foot and 400-Foot Aquifers from the 180/400-Foot Aquifer Subbasin into the Monterey Subbasin are likely to be saline and could cause expansion of the seawater intrusion front in the Monterey Subbasin. Such inflows could occur as a result of increased water levels in the 180/400-Foot Aquifer Subbasin or increases in groundwater extraction within the in addition to future pumping conditions that shift this gradient towards the Monterey Subbasin.. As such, projected water budgets should be viewed with caution and cannot be used to assess actual changes in freshwater storage in the Subbasin. However, they can be used to assess overall inflows and outflows from the Subbasin and predict the relative magnitude of seawater inflows from the ocean under each scenario.

In addition, Figure 6-8 through Figure 6-9 identify average projected changes in groundwater elevations at RMS wells within the identified management area WBZs under "No Project" and "Project" scenarios. The figures also identify the average change in water levels required to reach MTs and MOs at RMS wells within the identified management area WBZs. Although not well specific, these graphs indicate if water level MTs and MOs will be reached within the associated management area WBZ under these "No Project" and "Project" scenarios.

"No Project" Scenario Results

Due to the strong interdependence of conditions within the Monterey Subbasin and conditions in adjacent subbasins, water budget results are presented for three alternative sets of boundary conditions including:

- MT Boundary Conditions;
- MO Boundary Conditions, and
- SWI Protective Boundary Conditions.

These alternative boundary conditions are further described in Section 6.5.1.2 above. Each of these conditions is predicated on the assumption that the adjacent Seaside Subbasin and 180/400-Foot Aquifer Subbasin will be managed sustainably as determined in their respective planning documents over the projected 50-year analog period.

For comparison purposes, these results are presented along with the basin-wide water budget for the historical period (WY 2004-2018). 2030 climate conditions have been assumed for all projected water budget boundary condition scenarios. 2030 climate conditions fall within the middle of the range of projected climate scenarios, which are used to estimate basin recharge and seawater level rise. Impacts of climate variability are also assessed based on the baseline, 2030, and 2070 climate Scenarios. However, the projected water budget results indicate that the climate scenarios have a much smaller impact on changes in storage and groundwater levels within the Subbasin than the identified boundary conditions.

The magnitude of each of the budget components is generally described on a basin-wide basis. Predicted net annual changes in storage and changes in groundwater levels are also discussed by management area WBZ, as each management area has its own RMS wells and sustainable management criteria.

Table 6-4. Comparison of Projected Water Budget Results Under "No Project" Scenarios with Variable Boundary Conditions and 2030 Climate Condition, Monterey Subbasin

Net Annual Groundwater Flows (a) (AFY)	Historical Annual Inflows/Outflows (WY 2004-2018)	Projected Annual Inflows/Outflows 2030 Climate Conditions		
		Minimum Threshold Boundary Conditions	Measurable Objective Boundary Conditions	Seawater Intrusion Protective Boundary Conditions
Recharge				
● Rainfall, leakage, irrigation	**10,055**	**10,928**	**10,928**	**10,928**
Well Pumping				
● Well Pumping	**-5,641**	**-10,955**	**-10,955**	**-10,955**
Net Inter-Basin Flow				
● Seaside Subbasin	918	2,414	1,258	-453
● 180/400-Foot Aquifer Subbasin	-12,265	-5,583	-3,412	-295
● Ocean (Presumed Freshwater)	-524	-725	-752	-794
● Ocean (Presumed Seawater)	2,872	2,939	2,369	1,308
	-8,999	**-955**	**-537**	**-234**
Net Surface Water Exchange				
● Salinas River Exchange	**151**	**261**	**254**	**279**
NET ANNUAL CHANGE IN GROUNDWATER STORAGE	**-4,434**	**-721**	**-310**	**18**

Notes:

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

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

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

Notes:

(a) The Marina-Ord Area Zone Budget includes inflows to and outflows from the portion of Corral de Tierra that is north of Reservation Rd.
(b) Positive values indicate a net inflow and negative values indicate a net outflow.

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

Net Annual Groundwater Flows (a) (AFY)	Historical Annual Inflows/Outflows (WY 2004-2018)	Projected Annual Inflows/Outflows (b) 2030 Climate Conditions		
		Minimum Threshold Boundary Conditions	Measurable Objective Boundary Conditions	Seawater Intrusion Protective Boundary Conditions
Recharge				
● Rainfall, leakage, irrigation	**3,910**	**4,105**	**4,105**	**4,105**
Well Pumping				
● Well Pumping	**-1,296**	**-2,188**	**-2,188**	**-2,188**
Net Inter-Basin Flow				
● Seaside Subbasin	-392	-99	-103	-107
● 180/400-Foot Aquifer Subbasin	-3,632	-1,734	-1,485	-1,466
	-4,024	**-1,833**	**-1,588**	**-1,573**
Net Intra-basin Flow				
● Marina-Ord Area (Water Budget Zone)	**-1,544**	**-923**	**-1,026**	**-985**
Net Surface Water Exchange				
● Salinas River Exchange	**151**	**261**	**254**	**279**
NET ANNUAL CHANGE IN GROUNDWATER STORAGE	**-2,803**	**-578**	**-443**	**-362**

Notes:

(a) The Corral de Tierra Area Zone Budget does not include inflows to and outflows from the portion of Corral de Tierra Area that is north of Reservation Rd.
(b) Positive values indicate a net inflow and negative values indicate a net outflow.

Table 6-7. Comparison of Projected Water Budget Results Under "No Project" Scenarios with Variable Climate Conditions and Measurable Objective Boundary Condition, Monterey Subbasin

Net Annual Groundwater Flows (a) (AFY)	Historical Annual Inflows/Outflows (WY 2004-2018)	Projected Annual Inflows/Outflows (b) (c) Measurable Objective Boundary Conditions		
		Baseline Climate Conditions	2030 Climate Conditions	2070 Climate Conditions
Recharge				
● Rainfall, leakage, irrigation	**10,055**	**10,152**	**10,928**	**11,952**
Well Pumping				
● Well Pumping	**-5,641**	**-10,955**	**-10,955**	**-10,955**
Net Inter-Basin Flow				
● Seaside Subbasin	918	1,527	1,258	885
● 180/400-Foot Aquifer Subbasin	-12,265	-3,071	-3,412	-3,901
● Ocean (Presumed Freshwater)	-524	-721	-752	-804
● Ocean (Presumed Seawater)	2,872	2,288	2,369	2,534
	-8,999	**24**	**-537**	**-1,286**
Net Surface Water Exchange				
● Salinas River Exchange	**151**	**259**	**254**	**249**
NET ANNUAL CHANGE IN GROUNDWATER STORAGE	**-4,434**	**-520**	**-310**	**-40**

Notes:

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

6.5.3 Projected Annual Basin-Wide Inflows/Outflows

Table 6-4 and Table 6-7 summarize projected annual inflows and outflows from the basin-wide groundwater system by water source type for the "No Project" scenario under variable boundary and climate scenarios.

6.5.3.1 Projected Recharge

Table 6-4 and Table 6-7 indicate that the estimated average annual recharge to the Subbasin during the projected 50-year analog period (10,152 AFY) is generally consistent with the historical period under the baseline climate conditions. Projected recharge in the Subbasin increases by approximately 7.6 percent under 2030 Climate Conditions and by approximately 17.7 percent under 2070 Climate Conditions.

6.5.3.2 Projected Well Pumping

The projected recharge is generally consistent with or exceeds projected average annual well pumping in the Subbasin (10,955 AFY) under the "No Project" scenario. As discussed in Section 6.5.1.1, this well pumping reflects (a) projected water demands within MCWD's projected future service area through 2040, and (b) current land use and continued pumping in the Corral de Tierra Area WBZ at estimated 2018 extraction rates (i.e., 2,188 AFY) and in the Corral de Tierra North of Reservation Portion (i.e., 268 AFY). Total projected pumping rates are higher than pumping rates estimated over the historical period (5,641 AFY).

6.5.3.3 Projected Net Inter-Basin Flows

Projected net annual inter-basin outflows range up to 1,286 AFY for all identified boundary and climate change scenarios presented in Table 6-4 and Table 6-7. These projected net annual inter-basin outflows are significantly below those estimated for the historical period (8,999 AFY). The decrease in net inter-basin outflows principally reflects a reduction in outflows to the 180/400-Foot Aquifer Subbasin. This reduction in outflows is primarily the result of the projected increases in water levels at the boundary of the 180/400-Foot Aquifer subbasin as this basin reaches its determined MTs, MOs and/or SWI protective elevations. The magnitude of these outflows sequentially decreases as water levels at this boundary increase from MTs, to Mos, to SWI protective elevations.

As expected, ocean inflows into the Subbasin also decrease as water levels at this boundary increase from MTs, to MOs, and to SWI protective elevations (see Table 6-7). However, there is little reduction in net ocean inflows between the historical water budget and the projected baseline water budgets under MT or MO boundary conditions. Consistent with historical groundwater flow patterns, it is anticipated that a substantial percentage of ocean inflows will pass through the Monterey Subbasin into the 180/400-Foot Aquifer Subbasin under the MT and MO boundary condition scenarios, as MTs and MOs in the 180/400-Foot Aquifer Subbasin are below sea level near the coast and are generally lower than MT and MOs established within the

Monterey Subbasin along the Subbasin boundary. Further, projected water budgets also indicate that substantial groundwater outflows from the Monterey Subbasin continue to occur into the 180/400-Foot Aquifer Subbasin under MT and MO boundary condition scenarios. Estimated ocean inflows are significantly reduced under the SWI protective boundary conditions (i.e., 1,308 AFY under the 2030 climate scenario). Variable climate condition results presented in Table 6-7 indicate that ocean inflows generally increase under 2030 and 2070 climate conditions relative to baseline conditions due to sea-level rise.

All model estimated ocean inflows should, however, be viewed with caution as the MBGWFM is not a dual-density model and therefore cannot accurately assess the seawater/freshwater interface. Monitoring will be used to verify that expansion of the seawater intrusion front does not occur in the Monterey Subbasin consistent with established SMCs.

Projected net annual inflows from the Seaside Subbasin into the Monterey Subbasin also appear to be influenced by projected 180/400-Foot Aquifer boundary conditions. As shown in Table 6-4 and Table 6-7, these net annual inflows:

- Increase relative to historical inflows in the projected water budget for the MT boundary condition scenario;
- Stay in the same range as historical inflows under MO conditions depending on future climate conditions (see Table 6-7); and
- Become slightly negative (i.e., become outflows) under SWI Protective Boundary Conditions and 2030 climate conditions.

However, inflows from the Seaside Subbasin into the Monterey Subbasin will also be significantly influenced by groundwater levels in the Seaside Subbasin, which have been assumed to stay constant at 2017~~8~~ levels[38]. ~~However, as noted in Section 6.7, and contrary to the language in Section 6.5.4.1.3, the Seaside Basin Watermaster's predictive modeling found that it would be impossible for the Laguna Seca subarea of the Seaside subbasin to be managed such that groundwater levels would remain stable in that subarea if groundwater levels continue to fall within the Corral de Tierra Area.~~ Further analysis of potential inflows and outflows along the Seaside Subbasin boundary is proposed as part of future modeling efforts identified in implementation action Future Modeling of Seawater Intrusion and Projects, Section 9.5.6.

Further quantification of projected net cross-boundary flows by management area WBZ are provided in Section 6.5.3.3 and are further discussed in Appendix 6-B. Net annual changes in storage and groundwater levels are described by management area WBZ in Sections 6.5.4 and 6.5.5 below.

[38] Or at the established MTs (i.e., based on 2015 water levels) in the Corral de Tierra Area wherever they were below MTs at the end of the Historical Period.

6.5.3.4 Projected Net River Exchange

The projected estimated annual net river inflows[39] range between 261 and 279 AFY for the variable boundary condition and climate change scenarios presented in Table 6-4 and Table 6-7. These inflows occur in the Corral de Tierra Area WBZ along the Salinas River and are slightly higher than those estimated during the historical period (151 AFY) and are a relatively small component of the Subbasin's water budget.

6.5.3.5 Basin-wide Projected Net Annual Change in Groundwater Storage

The net annual change in basin-wide groundwater storage ranges between -721 and 18 AFY for the "No Project" scenario projected boundary condition and climate scenarios presented in Table 6-4 and Table 6-7. The net annual change in groundwater storage is significantly lower than that calculated for the historical period (-4,434 AFY), and indicates that inflows and outflows to the Subbasin would be slightly negative to balanced under this range of boundary and climate conditions. However, further assessment for each management area is required to evaluate where overdraft is occurring within the Subbasin, and to compare projected water levels with management area-specific SMCs to assess the Subbasin sustainable yield. Projected net annual changes in groundwater storage and groundwater levels in the Marina-Ord and Corral de Tierra Area WBZs are provided in Sections 6.5.4.2 and 6.5.4.3, respectively.

6.5.4 Marina-Ord Area WBZ Projected Net Annual Change in Storage and Projected Changes in Water Elevations Relative to SMCs

Table 6-5 summarizes projected annual inflows, outflows, and net change in storage within the Marina-Ord Area WBZ under variable boundary conditions. As shown on this table, the projected net annual change in groundwater storage ranges between -143 and 379 AFY for the "No Project" scenario within the Marina-Ord Area WBZ. The net annual change in groundwater storage is significantly lower than that calculated for the historical period (-1,632 AFY), and indicates that the Marina-Ord Area WBZ inflows and outflows would be essentially balanced under any of these boundary condition scenarios. The climate scenario results presented in Appendix 6-A indicate that this conclusion is true under all identified climate change scenarios. As such, these projected water budget results suggest that this management area will not be in overdraft if adjacent basins are managed sustainably and SMCs are achieved.

However, the potential for expansion of the seawater intrusion front within the Marina-Ord Area WBZ must be considered under projected water budget scenarios. Although ocean (i.e., seawater) inflows into the Marina-Ord Area WBZ are generally equal to or lower than those observed during the historical period, it is difficult to predict if (a) these seawater inflows will

[39] Stream gauge data was unavailable from El Toro Creek for the historical period, and thus El Toro Creek was not directly simulated in the model. The net river exchange is based on the Salinas River.

continue to pass through the Monterey Subbasin into the 180/400-Foot Aquifer Subbasin as they did during the historical period or if (b) changes in boundary conditions and increased extraction in the Subbasin could cause saline groundwater from the 180/400-Foot Aquifer Subbasin or ocean to flow further inland within the Monterey Subbasin. It is noted that MCWD has significant operational flexibility regarding extraction rates from its wells and could potentially modify the location and depth at which groundwater is extracted to limit such impacts. Further assessment and monitoring are required pursuant to this GSP to verify that expansion of the seawater intrusion front, which has been identified as an undesirable result, does not occur under all future scenarios.

In addition, projected water level elevations for the "No Project" scenario must be compared to water level MTs and MOs established in the Marina-Ord Area WBZ, to determine if projects and management actions need to be implemented to meet these sustainability criteria. Figure 6-8 depicts average projected changes in groundwater elevations at RMS wells in the Marina-Ord Area WBZ under the "No Project" scenario with variable boundary conditions. This figure also identifies the average change in water levels required to reach MTs and MOs at RMS wells in the Marina-Ord Area WBZ.[40] As shown on Figure 6-8, groundwater elevations are projected to stabilize under all boundary conditions scenarios within the first ten years of GSP implementation. However, the resulting average groundwater elevation varies significantly between the various boundary scenarios. The under baseline "no project" scenario results imply that groundwater elevations in RMS wells within the Marina-Ord Area WBZ will:

- generally reach MTs under MT Boundary Conditions, but fall below MTs during drought periods;
- be below MOs under MO Boundary Conditions, and
- be well above MOs and MTs at SWI Protective Boundary Conditions.

Figure 6-9 presents the effects of variable climate scenarios on groundwater elevations within Marina-Ord Area WBZ under the "No Project" scenario with MO Boundary Conditions. This figure indicates that variable climate conditions have limited impacts on projected water levels in RMS wells relative to boundary condition scenarios.

[40] This figure shows average projected groundwater elevation changes in the 35 RMS wells in the Marina-Ord Area with respect to those modeled at the end of the historical period (i.e., 2018). The MT and MO elevations shown on this graph reflects their average elevations with respect to 2018 water levels at the RMS wells. For example, MTs, which are set based on the minimum fall measurements in 1995 to 2015 water levels, are on average 2 feet higher than 2018 water levels in these RMS wells.

In aggregate, these results suggest that projects and/or management actions may be required to consistently maintain water levels above MTs and to achieve MOs within the Marina-Ord Area unless SWI Protective Boundary Conditions are achieved in the adjacent subbasins.

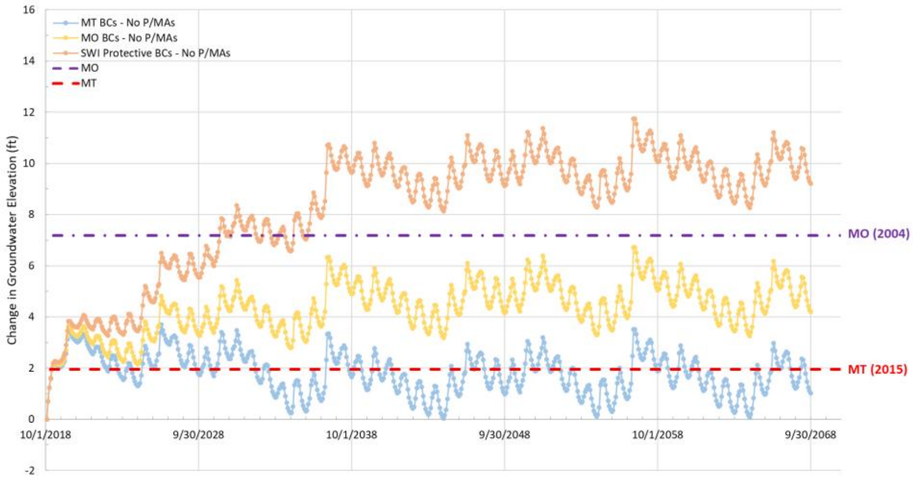


Figure 6-8. Comparison of Groundwater Elevation Changes Under "No Project" Scenario with Various Boundary Conditions and 2030 Climate Condition, Marina-Ord Area WBZ

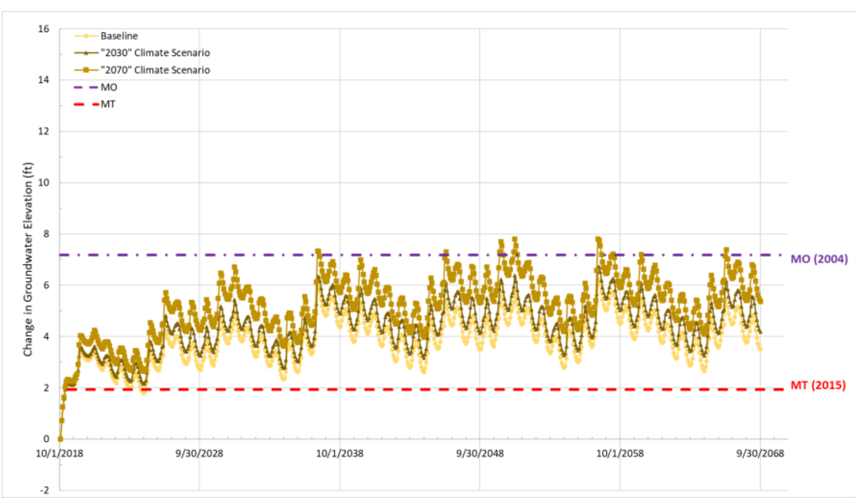


Figure 6-9. Comparison of Groundwater Elevation Changes Under "No Project" Scenario with Various Climate Condition and Measurable Objective Boundary Condition, Marina-Ord Area WBZ

6.5.5 Corral de Tierra Area WBZ Net Annual Change in Groundwater Storage and Projected Changes in Groundwater Elevations relative to SMCs

Table 6-6 summarizes projected annual inflows and outflows from the Corral de Tierra Area WBZ under variable boundary conditions. The projected net annual change in groundwater storage ranged between -578 and -362 AFY in the Corral de Tierra Area WBZ for the "No Project" scenario under variable boundary conditions. The net annual change in groundwater storage is significantly lower than that calculated for the historical period (-2,803 AFY), but is still in slight overdraft over the entirety of the 50-year analog period. The climate scenario results presented in Appendix 6-A indicate that this conclusion is true under all of the identified climate change scenarios. As such, these projected water budget results suggest that this management area will be in overdraft even if adjacent basins are managed to their MOs and no projects are undertaken.

Figure 6-10 depicts average projected changes in groundwater elevations at RMS wells in the Corral de Tierra Area WBZ under the "No Project" scenario with variable boundary conditions. This figure also identifies the average change in water levels required to reach MTs and MOs at RMS wells in the Corral de Tierra Area WBZ. As shown on Figure 6-10, groundwater elevations in RMS wells within the Corral de Tierra Area WBZ appear to stabilize in the last ten years of the 50 year analog period. However, they stabilize at levels that are on average 17 to 25 feet lower than groundwater elevation MTs and 28 to 36 feet lower than groundwater elevation MOs even if SMCs are achieved in adjacent subbasins under these boundary condition scenarios.

Figure 6-11 presents the effects of variable climate scenarios on groundwater elevations within Corral de Tierra Area WBZ under the "No Project" scenario with MO Boundary conditions. This figure indicates that variable climate conditions have limited impacts on projected water levels in RMS wells relative to boundary condition scenarios.

In aggregate, these results suggest that projects and/or management actions will be required to raise water levels above MTs and to achieve MOs within the Corral de Tierra Area WBZ.

~~*On August 25, 2021 the SVBGSA Monterey Subbasin Planning Committee received an updated presentation on the potential relationship between groundwater elevations and arsenic concentrations in the Corral de Tierra area. The committee discussed new options for the groundwater elevations SMCs specific to the Corral de Tierra Management area, and passed a motion to raise the minimum thresholds and measurable objectives to 2008 and 2004/2005 elevations respectively. These changes have not yet been incorporated into the modeling results, or the rest of the GSP. This statement is here as a placeholder for the reader, and as a reminder to the GSP process that stakeholder input is valuable to the development and implementation of sustainable management of groundwater resources.*~~

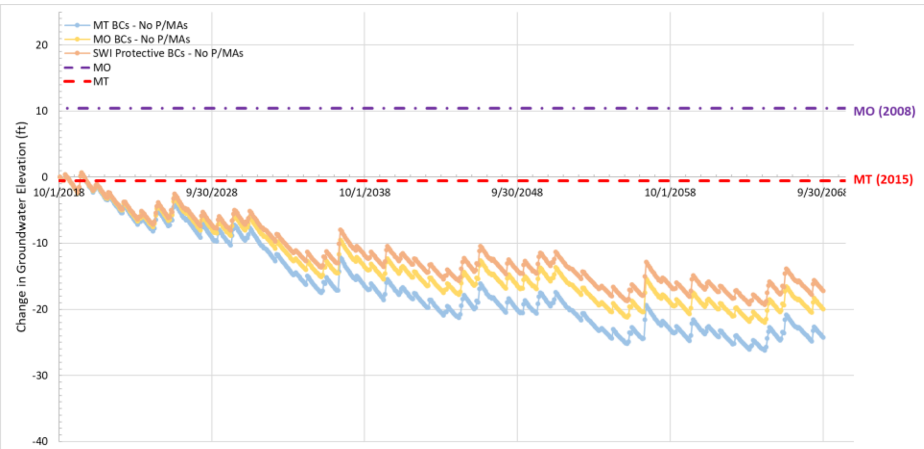


Figure 6-10. Comparison of Groundwater Elevation Changes Under "No Project" Scenario with Various Boundary Conditions and 2030 Climate Condition, Corral de Tierra Area WBZ

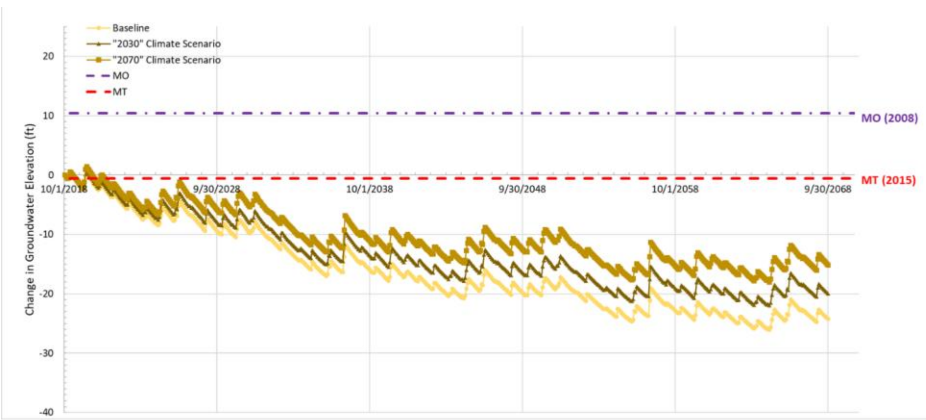


Figure 6-11. Comparison of Groundwater Elevation Changes Under "No Project" Scenario with Various Climate Condition and Measurable Objective Boundary Condition, Corral de Tierra Area WBZ

~~6.5.6 "Project" Scenario Results~~

~~6.5.7 Table 6-8 summarizes projected water budget results for the Marina-Ord Water Augmentation "Project" scenario with variable boundary conditions. The Marina-Ord water augmentation scenario is described in Section 6.5.2.2. It results in an average annual pumping rate over the 50-year analog period of 4,488 AFY within the Marina-Ord Area WBZ. This average annual pumping rate is below the estimated average annual recharge within the Subbasin under all projected climate scenarios, which range~~

~~**between (6,356 AFY and 7,509 AFY)[41]. This average annual pumping rate represents a 4,279 AFY reduction in projected pumping from the "No Project" scenario".**~~

~~[41] See Tables 6A-4 and 6A-5 in Appendix 6A.~~

6.5.8		6.5.9	6.5.10 Minimum Threshold Boundary Conditions	6.5.11 Measurable Objective Boundary Conditions	6.5.12 Seawater Intrusion Protective Boundary Conditions
6.5.13 Recharge		6.5.14	6.5.15	6.5.16	6.5.17
6.5.18	6.5.19 Rainfall, leakage, irrigation	6.5.20 6,144	6.5.21 6,823	6.5.22 6,823	6.5.23 6,823
6.5.24 Well Pumping		6.5.25	6.5.26	6.5.27	6.5.28
6.5.29	6.5.30 Well Pumping (c)	6.5.31 -4,346	6.5.32 -4,488	6.5.33 -4,488	6.5.34 -4,488
6.5.35 Net Inter-Basin Flow		6.5.36	6.5.37	6.5.38	6.5.39
6.5.40	6.5.41 Seaside Subbasin	6.5.42 1,310	6.5.43 1,776	6.5.44 612	6.5.45 -1,115
6.5.46	6.5.47 180/400-Foot Aquifer Subbasin	6.5.48 -8,633	6.5.49 -6,833	6.5.50 -4,901	6.5.51 -1,788
6.5.52	6.5.53 Ocean (Presumed Freshwater)	6.5.54 -524	6.5.55 -738	6.5.56 -764	6.5.57 -806
6.5.58	6.5.59 Ocean (Presumed Seawater)	6.5.60 2,872	6.5.61 2,617	6.5.62 2,047	6.5.63 989
6.5.64	6.5.65	6.5.66	6.5.67	6.5.68	6.5.69
6.5.70	6.5.71	6.5.72 -4,975	6.5.73 -3,178	6.5.74 -3,006	6.5.75 -2,721
6.5.76 Net Intra-basin Flow		6.5.77	6.5.78	6.5.79	6.5.80

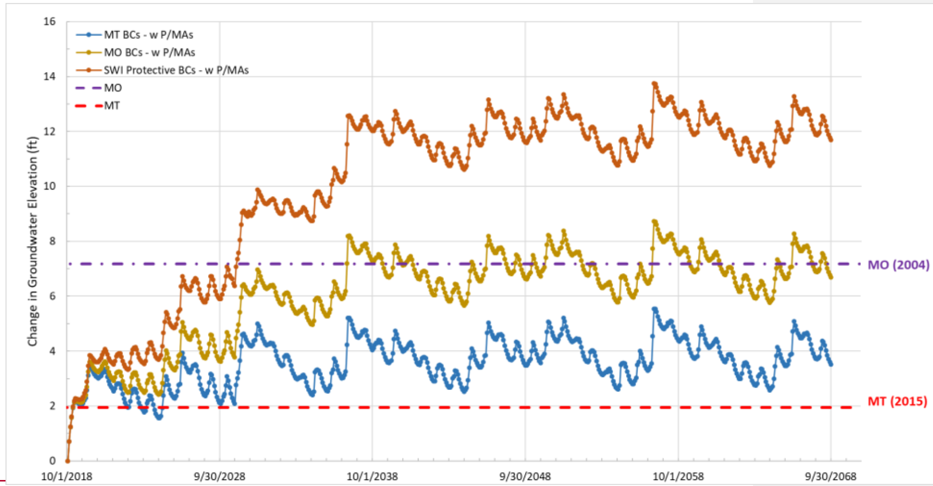
6.5.81 I	6.5.82 Corral de Tierra Area (Water Budget Zone)	6.5.83 1,544	6.5.84 898	6.5.85 1,001	6.5.86 958
6.5.87 Net Surface Water Exchange		6.5.88 -	6.5.89 -	6.5.90 -	6.5.91 -
6.5.92 I	6.5.93 Salinas River Exchange	6.5.94 0	6.5.95 0	6.5.96 0	6.5.97 0
6.5.98 NET ANNUAL CHANGE IN GROUNDWATER STORAGE		6.5.99 -1,632	6.5.100 5	6.5.101 30	6.5.102 72

6.5.103 Notes:

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

6.5.105 Positive values indicate a net inflow and negative values indicate a net outflow.

6.5.106



6.5.107

6.5.108 Figure 6-11. Comparison of Groundwater Elevation Changes Under Marina-Ord Water Augmentation "Project" Scenario with Various Boundary Conditions and 2030 Climate Condition, Marina-Ord Area WBZ

6.5.109

6.5.1106.5.6 Historical, Current, and Projected Overdraft and Sustainable Yield

SGMA defines sustainable yield as "the maximum quantity of water, calculated over a base period representative of long-term conditions in the Subbasin and including any temporary surplus, that can be withdrawn annually from a groundwater supply without causing an undesirable result" (CWC §10721(w)). DWR's Water Budget BMP (DWR, 2016b) further states that "Water budget accounting information should directly support the estimate of sustainable yield for the Subbasin and include an explanation of how the estimate of sustainable yield will allow the Subbasin to be operated to avoid locally defined undesirable results. The explanation should include a discussion of the relationship or linkage between the estimated sustainable yield for the Subbasin and local determination of the sustainable management criteria (sustainability goal, undesirable results, minimum thresholds, and measurable objectives)."

A key part of the codified definition and the BMP statement is the avoidance of undesirable results, defined as "significant and unreasonable" effects for any of the six SGMA sustainability indicators. For example, declining levels during a drought do not constitute an Undesirable Result for chronic lowering of groundwater levels if extractions and groundwater recharge are managed as necessary to ensure that reduction in groundwater levels or storage during a period of drought are offset by increases in groundwater levels or storage during other periods (CWC §10721(x)(1)). Therefore, while the water budget should provide support for sustainable yield, determination of the sustainable yield for the Subbasin ultimately depends upon whether undesirable results are avoided within the timeframes required by SGMA.

The sustainable yield of the Monterey Subbasin is significantly affected by recharge, pumping, and conditions in adjacent subbasins. As such, the sustainable yield established based on historical overdraft has significant uncertainty and does not address all undesirable results. Groundwater conditions in adjacent subbasins are projected to change as these subbasins move toward sustainability. A first-order estimate of the sustainable yield is estimated by subtracting overdraft from extraction; however, since sustainable management criteria were not established historically, the historical sustainable yield does not reflect sustainability as it is defined in this GSP. Projected water budget results have been used to estimate the projected sustainable yield. The sustainable yield has been evaluated by Management Area (i.e., water budget zone) as conditions vary and independent SMCs have been established for each area.

~~6.5.110.1~~6.5.6.1 *Marina-Ord Area WBZ*

An estimate of the three sustainable yields of the groundwater system underlying the Marina-Ord Area WBZ can be made on the basis of the water budget data presented in Table 6-2, and the “No Project” water budget results presented in Section 6.4.2.

The simplifying assumption for estimating historical sustainable yield is that a first-order estimate can be developed by subtracting the historical average overdraft from the historical average extractions. Data in Table 6-2 show that the historical pumping in the Marina-Ord Area WBZ was 4,346 AFY, and the historical overdraft was 1,632 AFY. This calculation leads to an estimated historical sustainable yield in the WBZ of 2,714 AFY.

Data in Table 6-2 additionally show that the average annual pumping in the current time period is 3,503 AFY, and average annual overdraft in the current time period is 209 AFY. This calculation leads to an estimated current sustainable yield in the WBZ of 3,294 AFY. The current time period represents only a few years~~,~~ and is not indicative of long-term groundwater conditions. Therefore, the current sustainable yield and overdraft estimates should not be used for developing long-term groundwater management strategies.

The projected water budget for the “No project” scenario results in a positive net increase in storage over the 50-year analog period, under all identified boundary conditions and climate condition scenarios. Further, projected groundwater level data presented in Section 6.5.4 indicate that groundwater levels stabilize within the first ten years of GSP implementation and are constant over the 30-year post-GSP implementation period under all identified boundary and climate conditions. Annual rates of groundwater extraction during this 30-year post-GSP implementation period average 9,870 AFY. As such, these projected water budget results support the conclusion that 9,870 AFY can be pumped from the Marina-Ord Area WBZ with no long-term loss in storage, and provide the first-order estimate of the sustainable yield of the Marina-Ord

Area WBZ. They also support the conclusion that the Marina-Ord Area WBZ will not be in overdraft in the future if adjacent subbasins are managed sustainably. and, in addition, the 180/400-Foot Aquifer Subbasin reaches its groundwater level MOs.

These calculations provide only first-order estimates of the magnitude of the Marina-Ord Area WBZ sustainable yield. The historical and current sustainable yield estimates are for information only and do not guide groundwater management activities in this GSP. The projected sustainable yield provides a first-order estimate of anticipated sustainable pumping if no projects are implemented. However, simply reducing pumping to within the sustainable yield is not proof of sustainability under SGMA, which must be demonstrated by avoiding undesirable results for all six sustainability indicators.

Comparison of projected groundwater levels within the Marina-Ord Area WBZ under the "no project" and "project" scenarios presented in Section 9.6 with established groundwater level MTs and MOs provides significant insight regarding the projected sustainable yield as defined under SGMA. As discussed above, the attainment of MTs and MOs, which are established to avoid undesirable results and achieve basin sustainability, should be considered in the estimation of sustainable yield under SGMA. As discussed in Sections 6.5.4, 9.6, and 9.6.1, projected groundwater level data indicate that:

- Under the "no project" scenario, groundwater levels in RMS wells stabilize and are generally higher than groundwater level MTs during non-drought periods under all identified boundary conditions and climate scenarios and reach groundwater level MOs if SWI Protective Boundary Conditions[42] are achieved in adjacent subbasins.
- Under the "Project" scenario, groundwater levels stabilize and are higher than groundwater level MTs and reach groundwater level MOs in RMS wells within the Marina-Ord Area WBZ, if MT and MO boundary conditions are achieved in adjacent subbasins, respectively.

These results indicate that the projected sustainable yield of the Marina-Ord Area WBZ ranges from approximately 4,400[43] AFY if adjacent subbasins are managed to their groundwater level MTs and adjudication goals as defined in their respective groundwater planning documents, to approximately 9,900[44] AFY if adjacent subbasins are managed to SWI protective groundwater

[42] In the absence of the installation of a seawater intrusion extraction or injection barrier, SWI Protective Boundary Conditions will be required to achieve seawater intrusion MTs in the 180/400-Foot Aquifer Subbasin.

[43] Groundwater levels stabilize above groundwater level MTs and MOs in the Marina-Ord Area when annual rates of pumping during the 30-year GSP implementation period average 4,376 AFY for the "project" scenario under MT and MO Boundary Condition Scenarios, respectively.

[44] Groundwater levels stabilize above groundwater level MTs and MOs when annual rates of pumping during the 30-year GSP implementation period average 9,870 AFY for the "no project" scenario under SWI Protective Boundary Conditions.

levels[45]. As such, the actual sustainable yield of the Marina-Ord area will be impacted by the groundwater levelss achieved and methods used to address address seawater intrusion and meet seawater intrusion MTs within adjacent subbasins, e.g., groundwater recharge, seawater intrusion extraction or injection barrier, or a combination of methods. Therefore, a coordinated approach will be required to reach sustainability within the Monterey subbasin and adjacent subbasins. Further, These results indicate that the future projected sustainable yield of the Marina-Ord Area WBZ ranges between approximately 4,400 AFY[46] and 9,900[47] AFY if adjacent subbasins are managed sustainably by achieving sustainably and the 180/400-Foot Aquifer Subbasin reaches its SMCsto seawater intrusion and groundwater level MTs and their sustainabilityMT and adjudication goals as defined in their respective groundwater planning documents. The actual sustainable yield will be dependent upon groundwater levels achieved and methods used to address seawater intrusion within adjacent subbasins, e.g., groundwater recharge, seawater intrusion extraction or injection barrier, or a combination of methods.

although these projected budget results provide potential insight into the sustainable yield of the Marina-Ord Area, confirmation that these quantities could be extracted without inducing seawater intrusion has to be verified.

6.5.110.26.5.6.2 Corral de Tierra Area WBZ

Information regarding the sustainable yield of the groundwater system underlying the Corral de Tierra Area WBZ can be garnered based on the projected water budget for the historical water budget data presented in Table 6-3 and the “No Project” scenario presented in Section 6.5.4.

The simplifying assumption for estimating historical sustainable yield is that a first-order estimate can be developed by subtracting the historical average overdraft from the historical average extractions. Data in Table 6-3 show that the historical pumping in the Corral de Tierra Area WBZ was 1,296 AFY, and the historical overdraft was 2,803 AFY. This calculation leads to an estimated sustainable yield in the WBZ of -1,507 AFY. While this is only a rough first-order estimate, the negative sustainable yield suggests that no amount of pumping reduction in the WBZ could have historically brought the area into balance. The outflows to adjacent subbasins and the Marina-Ord Area WBZ result in an overdraft independent of the WBZ pumping. Using the same method to estimate the current sustainable yield, the annual pumping during the current period in the Corral de Tierra Area WBZ was 1,771 AFY, and the historical overdraft was 1,818 AFY. This leads to an estimated sustainable yield in the WBZ of -47 AFY.

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[45] In the absence of the installation of a seawater intrusion extraction or injection barrier, SWI Protective Boundary Conditions will be required to achieve seawater intrusion MTs in the 180/400-Foot Aquifer Subbasin.

[46] Groundwater levels stabilize and annual rates of pumping during the 30-year GSP implementation period average 4,376 AFY for the “project” scenario.

[47] Groundwater levels stabilize and annual rates of pumping during the 30-year GSP implementation period average 9,870 AFY for the “no project” scenario.

The baseline projected water budget, which includes no projects, with boundary conditions set at measurable objectives in adjacent subbasins results in an annual average storage decrease of 89 AFY over the 30-year of the analog period that represents stabilized boundary conditions. Under the "No Project" scenario, annual rates of groundwater extraction over the 30-year analog period average 2,188 AFY. Subtracting the average annual overdraft from the average annual pumping yields a long-term sustainable yield of the Corral de Tierra Area WBZ of 2,100 AFY. This is a first-order estimate, and further analysis is needed to assess if this sustainable yield avoids all undesirable results.

This estimate of sustainable yield is the sustainable yield to hold groundwater levels where they are after the first 20 years of GSP implementation if there are no projects undertaken. Since groundwater levels are declining, this groundwater level would be significantly below current groundwater levels and below groundwater level MTs. Therefore, this sustainable yield estimate of 2,100 AFY is likely an overestimate of the true sustainable yield where all undesirable results are avoided.

The historical and current sustainable yield estimates are for information only and do not guide groundwater management activities in this GSP. The projected sustainable yield provides a first-order estimate of anticipated sustainable pumping if no projects are implemented. However, simply reducing pumping to within the sustainable yield is not proof of sustainability, which must be demonstrated by avoiding undesirable results for all six sustainability indicators. Further analysis is necessary to refine estimates of where pumping should be reduced to address all sustainability indicators.

6.6 Water Budget Uncertainty and Limitations

Models are mathematical representations of physical systems. They have limitations in their ability to represent physical systems exactly and due to limitations in the data inputs used. There is also inherent uncertainty in groundwater flow modeling itself since mathematical (or numerical) models can only approximate physical systems and have limitations in computing data. However, DWR (2018) recognizes that although models are not exact representations of physical systems because mathematical depictions are imperfect, they are powerful tools that can provide useful insights. As mentioned in Section 6.1 and described in detail in Appendix 6-B, the MBGWFM was developed using established scientific practices and principles for groundwater flow simulation, and calibrated using the best available data within the Subbasin. Inputs to the models are carefully selected using the best available data, the model's calculations represent established science for groundwater flow, and the model calibration error is within acceptable bounds. Therefore, the models are the best available tools for estimating water budgets and simulating projected groundwater conditions. As demonstrated by the calibration error statistics summarized in Section 6.1 and presented in detail in Appendix 6-B, the MBGWFM reasonably represents historical groundwater conditions within the Subbasin.

As is the case with any numerical groundwater flow model, the MBGWFM is subject to uncertainties and data gaps in hydrogeologic conceptualization (e.g., depth and extent of principal aquifer units), model parameterization (e.g., aquifer transmitting and storage properties) and calibration data (i.e., historical water level monitoring data), and simulated stresses (e.g., recharge, pumping, and boundary conditions). Here, "uncertainty" refers to the incomplete understanding of the physical setting, characteristics, and current conditions that significantly affect the calculation of the water budgets presented above. "Data gaps" refer to limitations in the spatial coverage of measured data or periods of time when no data are available. Each of these main categories of uncertainty and/or data gaps contribute to the overall uncertainty in the water budget outputs from MBGWFM.

The following list groups water budget components in increasing order of uncertainty.

(a) Measured: metered municipal, agricultural, and some small water system pumping

(b) Estimated: domestic pumping, including depth, rate, and location

(c) Simulated primarily based on climate data: precipitation, evapotranspiration, irrigation pumping

(d) Simulated based on calibrated model: all other water budget components

Simulated components based on calibrated model have the most uncertainty because those simulated results encompass uncertainty of other water budget components used in the model in addition to model calibration error.

As part of MBGWFM development and calibration, model uncertainty was evaluated by performing a sensitivity analysis on simulated stresses and aquifer parameters. A detailed description of the model sensitivity and uncertainty analysis is provided in Appendix 6-B. A summary of the main limitations of the model and corresponding water budgets identified from this analysis is provided below.

- Uncertainty in Simulated Boundary Conditions. As described in Section 6.2.2, inter-basin cross-boundary flows were simulated at the 180/400-Foot Aquifer Subbasin boundary based on historical groundwater elevation measurements from nearby wells, at the Seaside Area Subbasin boundary based on outputs from the historical Seaside Basin Groundwater Flow Model (Hydrometrics 2009 & 2018), and at the Monterey Coast based on freshwater equivalent sea levels. The datasets and assumptions used to model boundary conditions at each Subbasin boundary are subject to their own uncertainties, data gaps, and limitations, including:
    - *Lack of Deep Aquifer wells with historical data in the 180/400-Foot Aquifer Subbasin.* Only a small number of wells exist in the Deep Aquifers within the 180/400-Foot Aquifer Subbasin with observed water level data spanning the full duration of the Historical Period. As such, simulated Deep Aquifers heads along the northern model boundary are subject to the limitations in available data to

the north of the boundary, which may impact resulting calculations of 180/400-Foot Aquifer Subbasin exchanges within the water budget.

- *Incomplete conceptualization of Principal Aquifer units in the Seaside Basin Groundwater Flow Model.* The Seaside model does not explicitly simulate groundwater flow from each principal aquifer unit defined in the Monterey Subbasin GSP, but rather uses a unique conceptualization of aquifer units that is primarily based on the main geologic formations encountered in the Seaside Subbasin (i.e., the Aromas Sands, Paso Robles Formation, and Santa Margarita/Purisima Formations). As such, there is considerable uncertainty surrounding the assumptions employed to link outputs from the Seaside model to individual layers of the MBGWFM[48], which may impact resulting calculations of Seaside Area Subbasin exchanges within the water budget. Further analysis of potential inflows and outflows with respect to the model layers and principal aquifers along the Seaside sSubbasin boundary is proposed as part of proposed future modeling efforts identified in implementation action Future Modeling of Seawater Intrusion and Projects, Section 9.5.6.
- *Uncertainty in freshwater equivalent head calculations at the Monterey Coast.* As discussed in Section 6.2, freshwater equivalent sea levels at the Monterey Coastline are calculated based on the equivalent freshwater head formula presented in the USGS 2002 Report (USGS, 2002)~~Ghyben-Herzberg Relation~~. The depths and distances at which principal aquifer units outcrop along the seafloor were estimated to inform corresponding freshwater equivalent heads at the aquifer-seafloor interface. There is considerable uncertainty surrounding the depths and distances at which each principal aquifer unit comes in contact with the seafloor, which may impact resulting calculations of Ocean exchanges within the water budget.

- Uncertainty in Pumping Estimates within the Corral de Tierra (CDT) Management Area. Very limited historical groundwater pumping data are available for the CDT Management Area. As such, CDT groundwater pumping demands were estimated for small water systems and domestic wells by the Wallace Group ~~SVBGSA~~using extraction reported to MCWRA and SWRCB where available and approximated based on the number of households to account for small water systems connections and *de minimis* pumpers. Therefore, the accuracy of CDT groundwater pumping estimates included in the water budget is limited by the lack of available pumping data and uncertainty in the CDT pumping estimates provided by SVBGSA.

[48] See Appendix 6-B for further details.

- Uncertainty in Deep Aquifers Representation. Groundwater elevation data collected from the Deep Aquifers and the El Toro Primary Aquifer System (both represented by model Layer 8) show heterogeneous conditions in the upper and lower portions of these aquifers. As discussed in Section 5.1.4 and shown on Figure 5-12, a vertical gradient exists between the Paso Robles and Santa Margarita formations of the El Toro Primary Aquifer System. In addition, heterogeneous groundwater elevations were observed in the shallow and deep screens of Deep Aquifer well clusters, as shown on Figure 5-14. However, currently, there is not enough spatial coverage of data to characterize the upper and lower portions of these aquifers as separate aquifers. Refining representation of the Deep Aquifers and the El Toro Primary Aquifer System will facilitate connectivity between the MBGWFM and the Seaside Subbasin Model, and therefore refine the calculation of inter-basin flows. Additional data is needed within both (a) the Monterey Subbasin to characterize and calibrate upper and lower portions of these aquifers and (b) the adjacent subbasins to establish improved boundary conditions.~~to establish boundary conditions.~~

- Lack of Water Level Calibration Data. Though the MCWD service area, former Fort Ord Site, and CWS/Cal Am water service areas within CDT are well monitored, very limited historical groundwater elevation data exist in other portions of the Subbasin, including near the Reservation Rd area, in the Fort Ord Hills, and within the Deep Aquifer unit. As such, MBGWFM calibration in these areas is limited by the lack of available calibration data to quantify model error and inform localized adjustments to model parameterization.

- Climate Change Uncertainty. As described in Section 6.5.1., climate change scenarios were developed based on DWR's 2030 and 2070 Central Tendency climate modeling scenarios (DWR, 2020). These climate scenarios provide a standard framework for defining what might be considered the most likely future climate conditions within the Subbasin; however, they are inherently subject to considerable uncertainty. As stated in DWR (2018):

    - *"Although it is not possible to predict future hydrology and water use with certainty, the models, data, and tools provided [by DWR] are considered current best available* science *and, when used appropriately should provide GSAs with a reasonable* point *of reference for future planning.*

    - *All models have limitations in their interpretation of the physical system and the types of data inputs used and outputs generated, as well as the interpretation of outputs. The climate models used to generate the climate and hydrologic data for use in water budget development were recommended by [the DWR Climate Change Technical Advisory Group] for their applicability to California water resources planning."*

- Uncertainty in Aquifer Parameters. As mentioned above and described in detail in Appendix 6-B, a sensitivity analysis was performed to identify the most sensitive aquifer parameters that will impact model-calculated water levels, and was subsequently used to direct further calibration efforts. In general, it was discovered that the model was most sensitive to specific storage and lateral hydraulic conductivity parameters in each principal aquifer unit. These aquifer parameters were further calibrated using a combination of *Model-Independent Parameter Estimation and Uncertainty Analysis* (PEST) calibration procedures and professional judgement. As described in Appendix 6-B, all final calibrated aquifer parameters fell within their respective ranges reported in available pumping test data collected from wells within the Subbasin.

As discussed in Chapter 10, MCWD GSA and SVBGSA are planning data gap filling activities and monitoring network expansion within the Monterey Subbasin and in the adjacent 180/400-Foot Aquifer Subbasin. These activities are informed by the uncertainties and data gaps identified above and include:

- Monitoring network expansion and aquifer investigations in the 400-Foot Aquifer and Deep Aquifers near the Seaside Subbasin boundary;
- Monitoring network expansion and aquifer investigations in the Corral de Tierra Area near the 180/400-Foot Aquifer Subbasin boundary, including the Reservation Road portion and CWS/Cal Am service areas; and
- GEMS expansion and enhancement as well as a well registration program that intends to cover the entire Monterey Subbasin.

As additional groundwater elevation, aquifer properties, and groundwater extraction data become available, they will be used to refine representation of these aquifers as part of future modeling efforts during the first 5-years of GSP implementation.

7 MONITORING NETWORKS

This chapter describes the monitoring networks within the Monterey Subbasin that will be used to assess sustainable management criteria (SMCs) explained further in Chapter 8. This description of monitoring networks has been prepared in accordance with the Groundwater Sustainability Plan (GSP) Regulations §354.32 to include monitoring objectives, monitoring protocols, and data reporting requirements.

In addition to the monitoring networks within the Monterey Subbasin, the Marina Coast Water District (MCWD) Groundwater Sustainability Agency (GSA) and the Salinas Valley Basin Groundwater Sustainability Agency (SVBGSA) will include data from wells in the adjacent subbasins as part of the monitoring network and will continue their collaboration with agencies in adjacent subbasins. Further information on the wells in the adjacent subbasins cancould be found in theirthe 180/400-Foot Aquifer Subbasin GSP and the Basin Management Action Plan for the Seaside SubbasinSeaside Basin Management Plan.

7.1 Introduction

7.1.1 Monitoring Network Objectives

SGMA requires monitoring networks to collect data of sufficient quality, frequency, and distribution to characterize groundwater and related surface water conditions in the Subbasin, and to evaluate changing conditions that occur as the Plan is implemented. The monitoring networks are intended to:

- Monitor changes in groundwater conditions relative to measurable objectives and minimum thresholds;
- Demonstrate progress toward achieving measurable objectives;
- Monitor impacts to the beneficial uses or users of groundwater; and
- Quantify annual changes in water budget components.

7.1.2 Approach to Monitoring Networks

Monitoring networks are developed for each of the six sustainability indicators that are relevant to the Subbasin:

- Chronic lowering of groundwater levels
- Reduction in groundwater storage
- Seawater intrusion
- Degraded water quality
- Land subsidence

- Depletion of interconnected surface water

~~In accordance with GSP Regulations, the monitoring networks are primarily based on existing monitoring sites.~~ Representative Monitoring Sites (RMS) are a subset of the monitoring network and are focused on monitoring changes in groundwater conditions relative to Undesirable Results described further in Chapter 8. These are also limited to sites with data that are publicly available and not confidential.

MCWD GSA and SVBGSA established the density of monitoring sites and the frequency of measurements to demonstrate short-term, seasonal, and long-term trends. If the monitoring site density is determined to be inadequate, MCWD GSA and SVBGSA will expand monitoring networks as needed during GSP implementation. Filling data gaps and developing more extensive and complete monitoring networks will improve MCWD GSA and SVBGSA's ability to demonstrate sustainability and refine the existing conceptual and numerical hydrogeologic models. Chapter 10 provides a plan and schedule for resolving data gaps. MCWD GSA and SVBGSA will review the monitoring network in each five-year assessment. This review will include an evaluation of uncertainty and assess remaining data gaps that could affect the ability of the GSP to achieve the sustainability goal for the Subbasin.

7.1.3 Management Areas

If Management Areas are established, GSP Emergency Regulations require that the quantity and density of monitoring sites in those areas shall be sufficient to evaluate conditions of the Basin Setting and sustainable management criteria specific to that area.

As introduced in Section 1.4, this GSP establishes two Management Areas within the Subbasin including the Marina-Ord Area and the Corral de Tierra Area. These Management Areas have been developed to facilitate GSP implementation in these areas. As such, an adequate number of representative monitoring sites for each sustainability indicator has been identified for each Management Area. In Chapter 8, a basin-wide approach is taken for establishing Undesirable Results, however, where the drivers of Undesirable Results are different between Management Areas, SMCs are developed separately for each Management Area. Therefore, Management Area-specific monitoring networks are identified in this Chapter.

7.2 Representative Monitoring Sites

Representative monitoring sites (RMS) are defined in the GSP Emergency Regulations as a subset of monitoring sites that are representative of conditions in the Subbasin and will be used to establish Sustainable Management Criteria (SMCs). The sections below discuss the existing monitoring sites in the Subbasin as well as the RMS networks for each sustainability indicator. The monitoring networks for chronic lowering of groundwater levels and seawater intrusion will be used as a proxy to monitor the reduction in groundwater storage, as described in Chapter 8.

7.3 Groundwater Elevation Monitoring Network

The sustainability indicator for chronic lowering of groundwater levels is evaluated by monitoring groundwater elevations in designated monitoring wells. The GSP Emergency Regulations require a network of monitoring wells sufficient to demonstrate groundwater occurrence, flow directions, and hydraulic gradients between principal aquifers and surface water features.

Management Area-specific groundwater elevation monitoring networks are identified for monitoring of chronic lowering of groundwater levels within the Subbasin. The groundwater elevation monitoring network comprises over 390 wells monitored by U.S. Army, MCWRA, or MPMWD in the Marina-Ord Area; and 18 wells monitored by MCWRA in the Corral de Tierra Area. Of these wells that are actively monitored by a local agency, 35 are selected as groundwater elevation RMS wells in the Marina-Ord Area and 13~~4~~ are selected as groundwater elevation RMS wells in the Corral de Tierra Area. Figure 7-1 through Figure 7-6 show the locations of the groundwater elevation monitoring network and wells selected for the RMS network within the Marina-Ord Area and the Corral De Tiera Area.

The groundwater elevation monitoring network and RMS network for each management area are broken out by principal aquifer. However, as discussed in Chapters 4 and 5, the 180-Foot Aquifer is separated into an “upper” and a “lower” portion by a thin clay layer in the coastal areas of the Marina-Ord Area. In these areas, groundwater elevation and seawater intrusion conditions in the upper 180-Foot Aquifer are distinct from those in the lower 180-Foot Aquifer, while conditions in the lower 180-Foot Aquifer are consistent with those observed in the 400-Foot Aquifer. Therefore, the monitoring network and RMS network are selected to additionally distinguish the upper 180-Foot Aquifer and the lower 180-Foot Aquifer. Known seawater intrusion conditions in the lower 180-Foot and 400-Foot Aquifers are included on Figure 7-7 to demonstrate the selected groundwater elevation and seawater intrusion RMS network.

The RMS wells within each Management Area have been selected to facilitate monitoring of significant and unreasonable groundwater conditions identified in Chapter 8. The groundwater elevation RMS network in the Marina-Ord area has been coordinated with the seawater intrusion RMS network (Section 7.5). Groundwater elevation data will be utilized in conjunction with salinity data from these wells to monitor the potential expansion of the seawater intrusion front. Criteria for selecting wells as part of the RMS network include:

- RMS wells should facilitate monitoring of groundwater elevations within each principal aquifer;
- RMS wells should cover areas of the Subbasin where beneficial uses of groundwater are occurring (e.g., groundwater extraction, groundwater dependent ecosystems, etc.);
- RMS wells should facilitate monitoring along the existing seawater intrusion front to verify that water levels in these areas are not declining and increasing the risk of seawater intrusion.

- RMS wells that could be included in both the groundwater elevation and seawater intrusion RMS networks are preferred;
- RMS wells should be located on public parcels or on properties where access agreements have been negotiated;
- RMS wells must have known depths and well completion data;
- RMS wells should have relatively long periods of historical data (i.e., greater than 10 years and/or 50 water level measurements) and exhibit high-quality groundwater elevation data;
- RMS well hydrographs should be visually representative of the hydrographs from surrounding wells; and
- RMS wells should not be influenced by nearby infiltration, groundwater pumping, or groundwater remediation activities at Fort Ord.

Data from RMS wells will be considered public and will be used for groundwater elevation maps and analyses unless the owner of the RMS well opts out through correspondence with MCWD GSA or SVBGSA.[49]

Visual inspection of the geographic distribution of the monitoring network indicates there are no wells in the south-eastern portion of the Marina-Ord Area (i.e., the Fort Ord hills). However, no monitoring of groundwater levels is needed in this area because:

- It is undeveloped and overseen by the Bureau of Land Management (BLM) and has no current or likely future groundwater use or extraction.
- It is far from the ocean and therefore not subject to seawater intrusion.
- It is part of the Federal land area not subject to SGMA.

The RMS wells included in the groundwater level monitoring network are listed by Management Area in Table 7-1. The need for any additional wells is discussed in Section 7.3.2. Appendix 8-A presents well construction information and historical hydrographs for each RMS well. As previously discussed in Chapter 7, MCWD GSA will include wells in the adjacent subbasins as part of the groundwater level monitoring network and consider their data in groundwater management~~, including the Laguna Seca Monitoring wells in the Seaside Subbasin~~. However, those wells are not included as ~~the~~ RMS wells in the Monterey Subbasin.~~, whose detailed information could be found in their respective GSPs.~~

[49] If an owner opts out of public data reporting, another well will be identified for RMS monitoring.

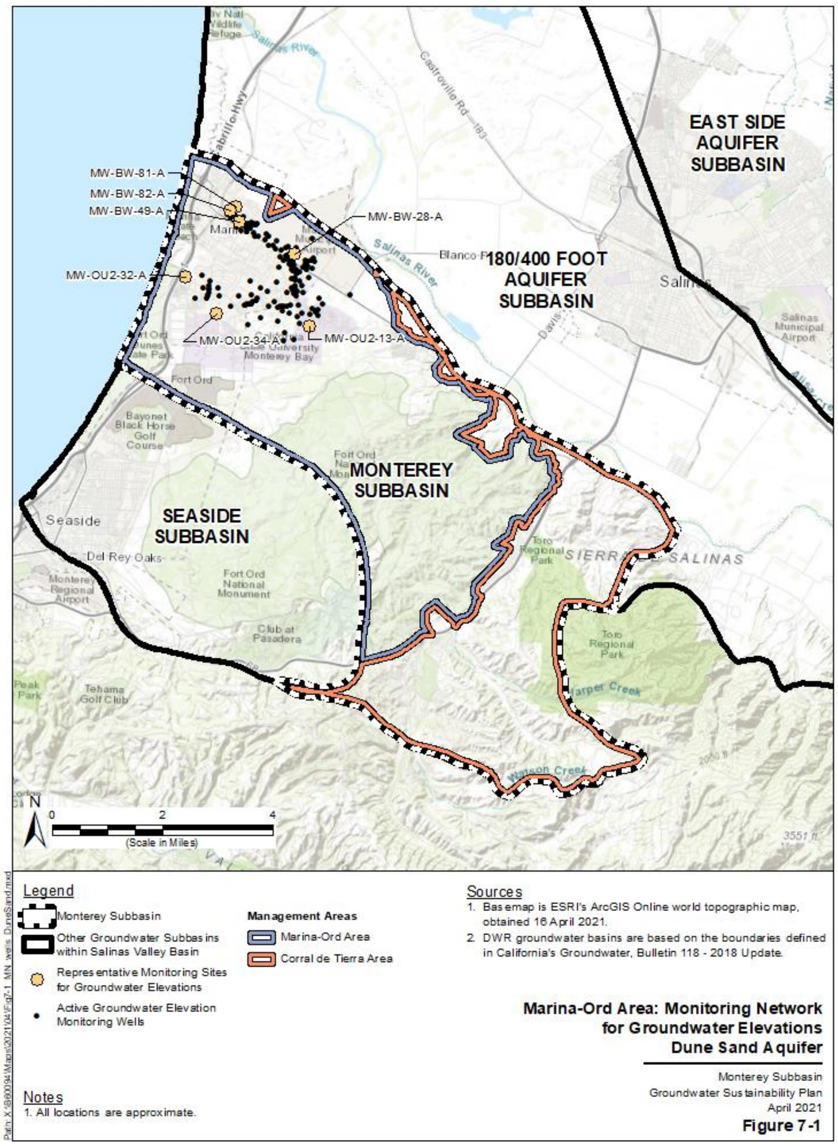


Figure 7-1. Marina-Ord Area: Monitoring Network for Groundwater Elevations, Dune Sand Aquifer

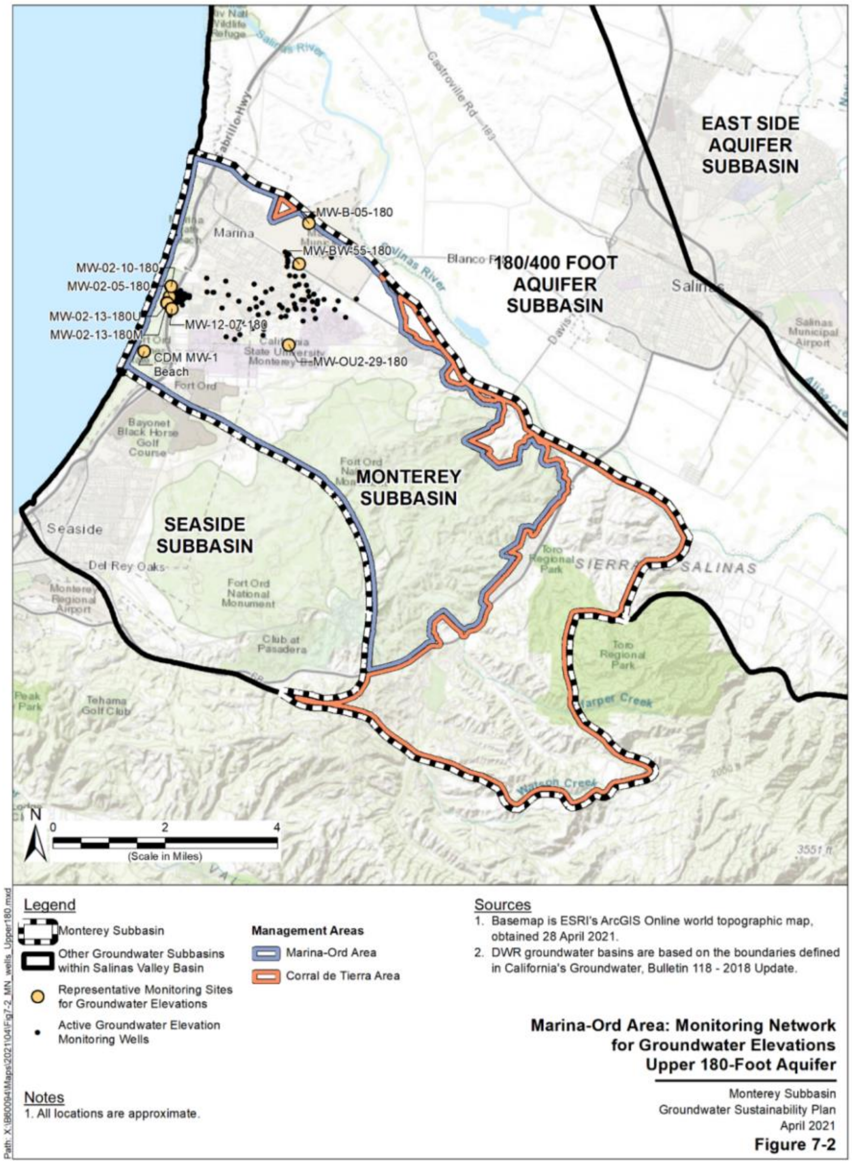


Figure 7-2. Marina-Ord Area: Monitoring Network for Groundwater Elevations, Upper 180-Foot Aquifer

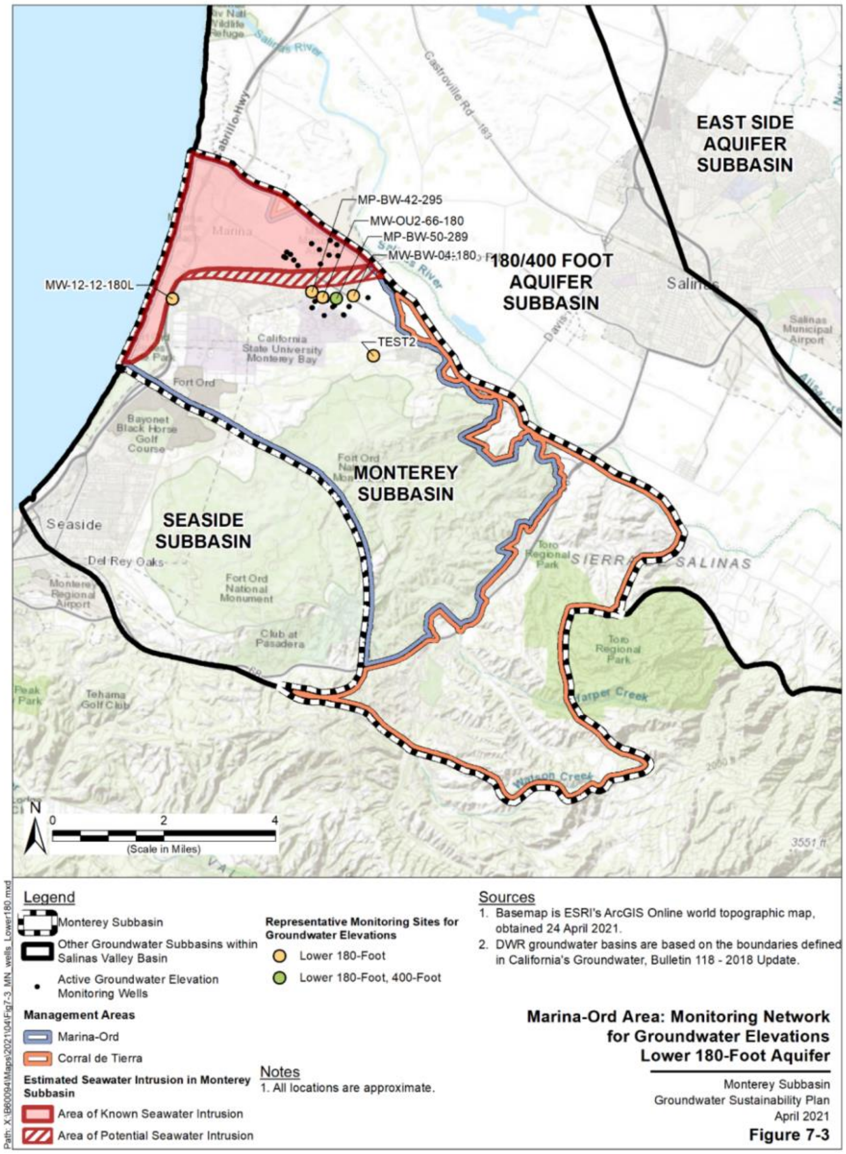


Figure 7-3. Marina-Ord Area: Monitoring Network for Groundwater Elevations, Lower 180-Foot Aquifer

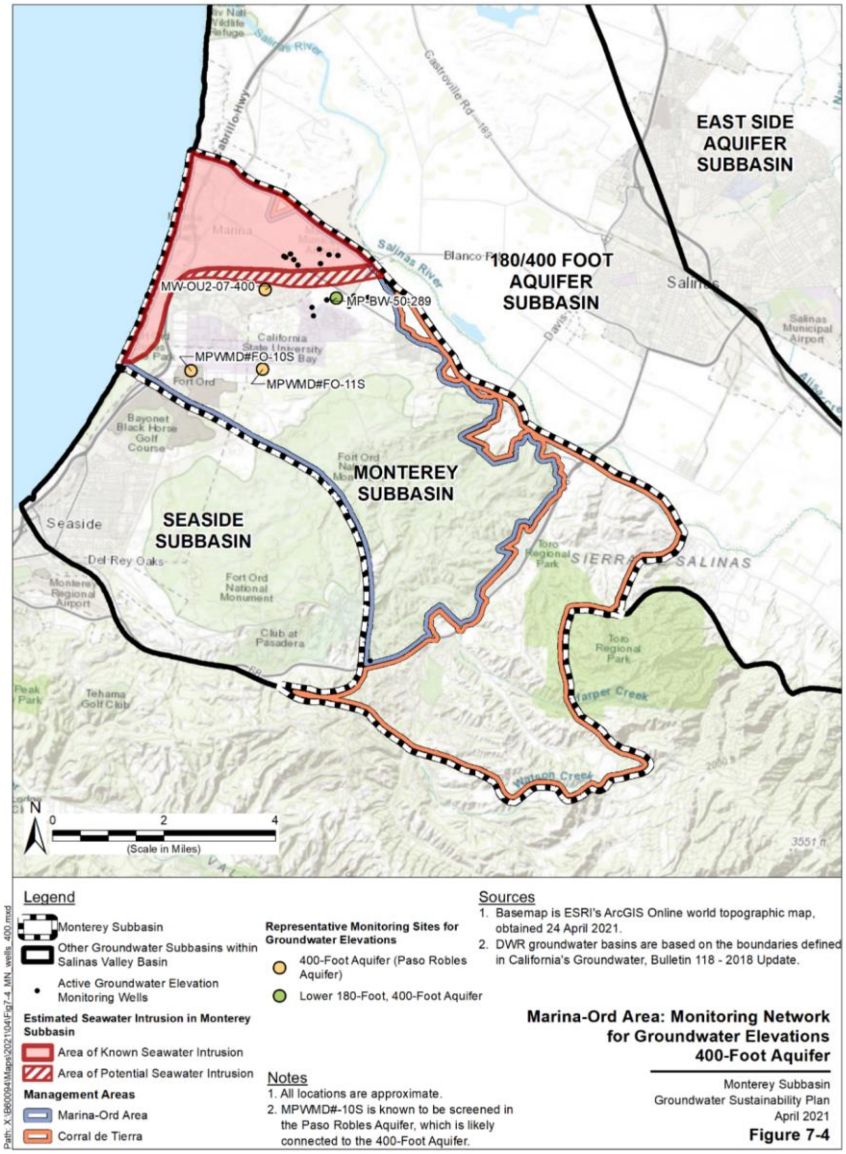


Figure 7-4. Marina-Ord Area: Monitoring Network for Groundwater Elevations, 400-Foot Aquifer

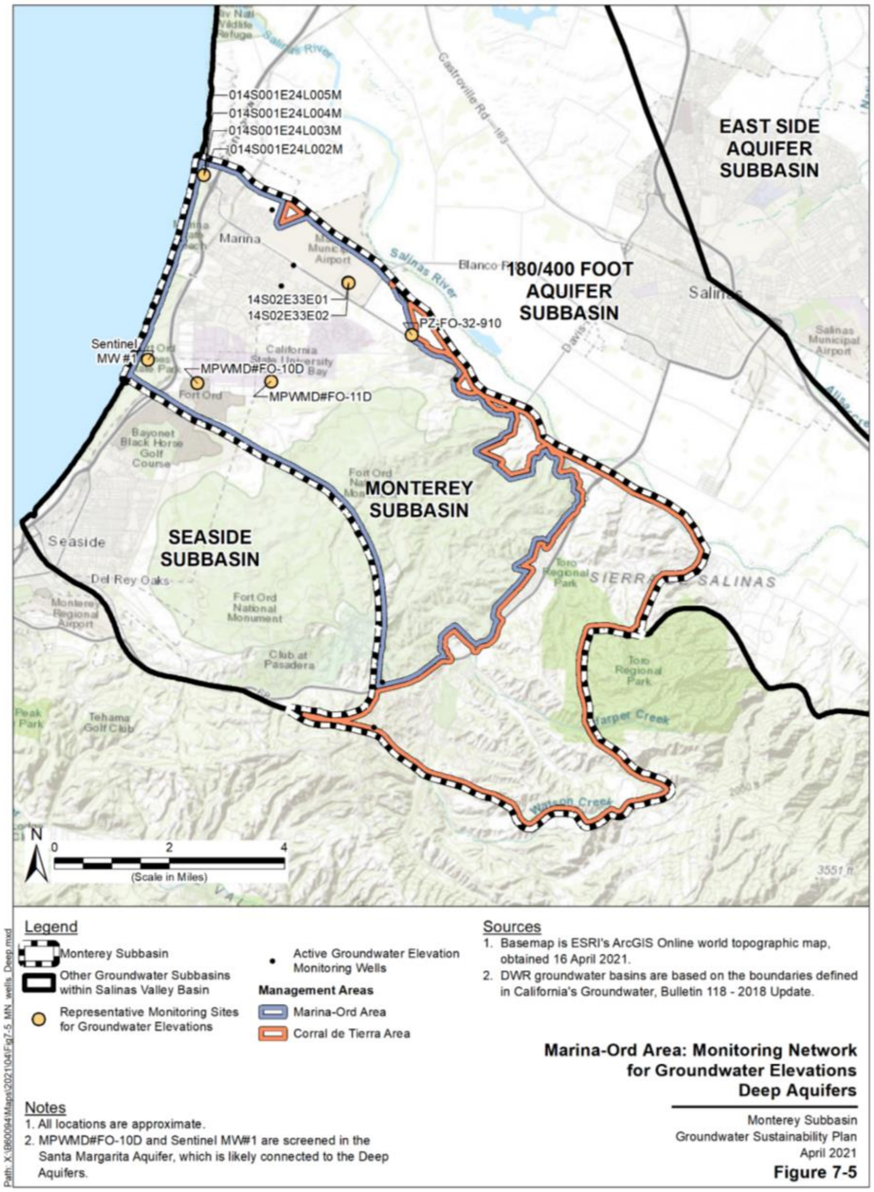


Figure 7-5. Marina-Ord Area: Monitoring Network for Groundwater Elevations, Deep Aquifers

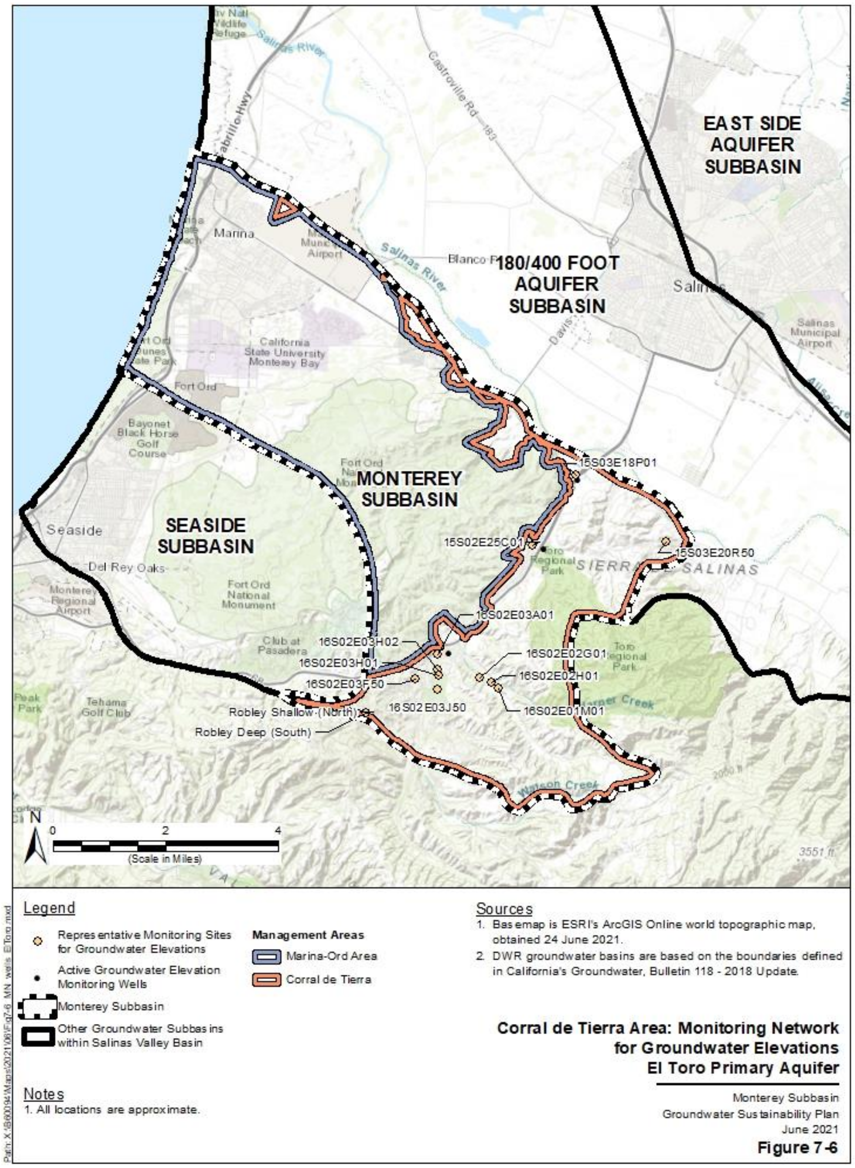


Figure 7-6. Corral de Tierra Area: Monitoring Network for Groundwater Elevations

Table 7-1. Monterey Subbasin Groundwater Elevation Representative Monitoring Sites

Site Name	Aquifer	CASGEM Well Number (c)	Local Well Designation	Well Use	Total Well Depth (ft)	Latitude (NAD 83)	Longitude (NAD 83)	Period of WL Record (years)
Marina/Ord Area								
MW-BW-28-A	Dune Sand Aquifer	--	--	Monitoring	104	36.6775	-121.7744	19
MW-BW-49-A	Dune Sand Aquifer	--	--	Monitoring	62	36.6854	-121.7928	18
MW-BW-81-A	Dune Sand Aquifer	--	--	Monitoring	82	36.6893	-121.7942	12
MW-BW-82-A	Dune Sand Aquifer	--	--	Monitoring	74	36.6886	-121.7961	12
MW-OU2-13-A	Dune Sand Aquifer	--	--	Monitoring	146	36.6584	-121.7689	32
MW-OU2-32-A	Dune Sand Aquifer	--	--	Monitoring	140	36.6705	-121.8098	27
MW-OU2-34-A	Dune Sand Aquifer	--	--	Monitoring	166	36.6613	-121.7993	27
CDM MW-1 Beach	Upper 180-Foot Aquifer (a)	366521N1218236W001	MW-1 Beach	Monitoring	140	36.6521	-121.8236	13
MW-02-05-180	Upper 180-Foot Aquifer (a)	--	--	Monitoring	69	36.6664	-121.8159	27
MW-02-10-180	Upper 180-Foot Aquifer (a)	--	--	Monitoring	64	36.6691	-121.8155	25
MW-02-13-180M	Upper 180-Foot Aquifer (a)	--	--	Monitoring	137	36.6648	-121.8167	21
MW-02-13-180U	Upper 180-Foot Aquifer (a)	--	--	Monitoring	78	36.6648	-121.8166	21
MW-12-07-180	Upper 180-Foot Aquifer (a)	--	--	Monitoring	96	36.6633	-121.8152	25
MW-B-05-180	Upper 180-Foot Aquifer (a)	--	--	Monitoring	210	36.6865	-121.7719	27
MW-BW-55-180	Upper 180-Foot Aquifer (a)	--	--	Monitoring	202	36.6758	-121.7747	16
MW-OU2-29-180	Upper 180-Foot Aquifer (a)	--	--	Monitoring	286	36.6548	-121.7772	27
MP-BW-42-295	Lower 180-Foot Aquifer (a)	--	--	Monitoring	467	36.6682	-121.7695	16
MW-12-12-180L	Lower 180-Foot Aquifer (a)	--	--	Monitoring	179	36.6652	-121.8146	21
MW-BW-04-180	Lower 180-Foot Aquifer (a)	--	--	Monitoring	364	36.6674	-121.7560	20
MW-OU2-66-180	Lower 180-Foot Aquifer (a)	--	--	Monitoring	339	36.6667	-121.7661	20
TEST2	Lower 180-Foot Aquifer (a)	--	--	Monitoring	425	36.6519	-121.7490	18
MP-BW-50-289	Lower 180-Foot, 400-Foot Aquifer (a)	--	--	Monitoring	397	36.6666	-121.7616	8
MPWMD#FO-10S	400-Foot Aquifer (a) (b)	366466N1218079W001	Fort Ord 10 - Shallow	Monitoring	650	36.6466	-121.8079	22
MPWMD#FO-11S	400-Foot Aquifer (a)	366474N1217847W002	FO-11-Shallow	Monitoring	740	36.6474	-121.7847	22

Site Name	Aquifer	CASGEM Well Number (c)	Local Well Designation	Well Use	Total Well Depth (ft)	Latitude (NAD 83)	Longitude (NAD 83)	Period of WL Record (years)
MW-OU2-07-400	400-Foot Aquifer (a)	--	--	Monitoring	580	36.6683	-121.7847	32
014S001E24L002M	Deep Aquifers	--	USGS DMW1--1	Monitoring	1880	36.6993	-121.8077	22
014S001E24L003M	Deep Aquifers	--	USGS DMW1--2	Monitoring	1430	36.6993	-121.8077	22
014S001E24L004M	Deep Aquifers	--	USGS DMW1--3	Monitoring	1080	36.6993	-121.8077	22
014S001E24L005M	Deep Aquifers	--	USGS DMW1--4	Monitoring	970	36.6993	-121.8077	22
14S02E33E01	Deep Aquifers	--	Airport Well 2" Shallow	Monitoring	1095	36.6730	-121.7615	17
14S02E33E02	Deep Aquifers	--	Airport Well 3" DEEP	Monitoring	1760	36.6730	-121.7614	17
PZ-FO-32-910	Deep Aquifers	--	MCWRA_21356	Monitoring	910	36.6604	-121.7413	13
MPWMD#FO-10D	Deep Aquifers (b)	366466N1218079W002	MPWMD #FO-10-Deep	Monitoring	1420	36.6466	-121.8079	22
MPWMD#FO-11D	Deep Aquifers	366474N1217847W001	FO-11-Deep	Monitoring	1130	36.6474	-121.7847	22
Sentinel MW #1	Deep Aquifers (b)	366521N1218236W002	SGB--MW #1	Monitoring	1500	36.6521	-121.8236	13
Corral de Tierra Area								
16S/02E-01M01	El Toro Primary Aquifer System	365680N1217073W001	16797	Residential	294	36.5680	-121.7072	58
16S/02E-02G01	El Toro Primary Aquifer System	365705N1217134W001	16820	Residential	440	36.5704	-121.7132	58
Robley Deep (South)	El Toro Primary Aquifer System	365608N1217494W001	Robley Deep (South)	Monitoring	820	36.5608	-121.7494	30
Robley Shallow (North)	El Toro Primary Aquifer System	365608N1217494W002	Robley Shallow (North)	Monitoring	430	36.5608	-121.7494	30
15S/02E-25C01	El Toro Primary Aquifer System	--	1840	Residential	680	36.6053	-121.6974	14
15S/03E-18P01	El Toro Primary Aquifer System	--	1804	Monitoring	810	36.6235	-121.6845	14
16S/02E-02H01	El Toro Primary Aquifer System	--	16823	Residential	204	36.5696	-121.7094	56
16S/02E-03H02	El Toro Primary Aquifer System	--	20813	Irrigation	920	36.5724	-121.7267	14
15S/03E-20R50	El Toro Primary Aquifer System	--	22683	Public Supply	680	36.6070	-121.6548	10
16S/02E-03A01	El Toro Primary Aquifer System	--	16842	Irrigation	134	36.5763	-121.7271	58
16S/02E-03F50	El Toro Primary Aquifer System	--	21073	Residential	510	36.5700	-121.7339	21
16S/02E-03H01	El Toro Primary Aquifer System	--	16877	Irrigation	948	36.5710	-121.7264	55
16S/02E-03J50	El Toro Primary Aquifer System	--	16862	Irrigation	810	36.5672	-121.7266	14

Notes:

(a) The RMS network is selected to additionally distinguish the upper 180-Foot Aquifer and the lower 180-Foot Aquifer, since conditions in the upper 180-Foot are distinct from those in the lower 180-Foot Aquifer, as described in Chapter 5.

(b) Wells MPWMD#FO-10S, MPWMD#FO-10D, and Sentinel MW#1 are monitored by MPWMD on behalf of the Seaside Watermaster. MPWMD#FO-10S is known to be screened in the Paso Robles Aquifer, which is likely connected to the 400-Foot Aquifer; MPWMD#FO-10D and Sentinel MW#1 are screened in the Santa Margarita Aquifer, which is likely connected to the Deep Aquifers.

(c) CASGEM well numbers are provided for existing CASGEM wells. It is the GSAs' understanding that the SGMA monitoring program will supersede the CASGEM program once the GSP is adopted and SGMA monitoring is in effect.

7.3.1 Groundwater Elevation Monitoring Protocols

Groundwater elevation measurements will be collected pursuant to the protocols identified in the following documents. These monitoring plans are included in Appendices 7-A through 7-C.

- Chapter 4 of the MCWRA CASGEM monitoring plan includes a description of existing MCWRA CASGEM groundwater elevation monitoring procedures (MCWRA, 2015b). Groundwater elevation measurements will be collected at least two times per year to represent seasonal low and seasonal high groundwater conditions. The monitoring protocols described in Appendix 7-A cover multiple monitoring methods for collecting data by hand and by automated pressure transducers.
- MPWMD CASGEM monitoring plan (Appendix 7-B) describes groundwater elevation monitoring procedures implemented by MPWMD (MPMWD, 2012). Groundwater elevation measurements will be collected twice a year, once at the end of September and once at the end of March. Groundwater elevation measurements will be taken by electric measuring tape to the nearest hundredth of a foot.
- Appendix A of the Quality Assurance Project Plan (QAPP; Appendix 7-C) for the former Fort Ord includes a description of groundwater monitoring procedures at the former Fort Ord (U.S. Army, 2019). Groundwater elevation measurements will be collected at least semi-annually, subject to future monitoring program revisions, and in accordance with applicable Standard Operating Procedures covered in the QAPP.

These protocols are consistent with data and reporting standards described in GSP Emergency Regulations §352.4.

7.3.2 Groundwater Elevation Monitoring Network Data Gaps

Based on the GSP Emergency Regulations and BMPs published by DWR on monitoring networks (DWR, 2016b), a visual analysis of the existing monitoring network was performed. This analysis was conducted using professional judgment to evaluate whether there are data gaps in the groundwater elevation monitoring network based upon potential significant and unreasonable conditions within the Subbasin.

While there is no definitive requirement on monitoring well density, the BMP cites several studies (Heath, 1976; Sophocleous, 1983; Hopkins, 1984) that recommend 0.2 to 10 wells per 100 square miles. The BMP notes that professional judgment should be used to design the monitoring network to account for high-pumping areas, proposed projects, and other subbasin-specific factors.

The Monterey Subbasin encompasses a total of 48.2 square miles. The Marina-Ord Area covers approximately 30.2 square miles and the Corral de Tierra Area covers approximately 18.0 square miles. If BMP guidance recommendations are applied to each of the areas, the monitoring network should include between 1 and 3 wells in the Marina-Ord Area and between one and two wells in the Corral de Tierra Area. The current RMS network includes 35 wells in the Marina-Ord Area (2 to 6 wells per principal aquifer) and 134 wells in the Corral de Tierra Area. In addition, the monitoring network includes over 390 wells in the Marina-Ord Area and 17 wells in the Corral de Tierra Area that are regularly monitored by local agencies. Data from wells in the monitoring network will be used by the GSAs to assess groundwater conditions and inform SGMA implementation. The number of groundwater elevation monitoring wells in Monterey Subbasin therefore exceed the number recommended in BMP guidance.

As discussed above, although no wells exist in the south-eastern portion of Marina-Ord Area (i.e., the Fort Ord hills), no monitoring of groundwater levels is needed in this area because it is part of a federal land area and has no current and future planned groundwater extraction. However, additional wells are necessary to provide additional groundwater elevation data near the ocean in areas subject to seawater intrusion.

For the Corral de Tierra Area, visual inspection of the geographic distribution of the monitoring network indicates that additional wells are necessary to monitor groundwater levels and characterize the Area. A higher density of monitoring wells is recommended near residential areas or other locations where groundwater withdrawal is significant.

The generalized locations for proposed new monitoring wells were based on addressing the criteria listed in the monitoring BMP including:

- Providing adequate data to produce seasonal potentiometric maps;
- Providing adequate data to map groundwater depressions and recharge areas;
- Providing adequate data to estimate the change in groundwater storage; and
- Demonstrating conditions at Subbasin boundaries.

Figure 7-7 through Figure 7-9. show the locations of existing groundwater elevation monitoring wells and the generalized locations where additional monitoring wells are needed in the Monterey Subbasin. These areas include:

- Within the Lower 180-Foot, 400-Foot Aquifer in the Marina-Ord Area to address a lack of coverage near the central coastline;
- Within the Deep Aquifers in the Marina-Ord Area to address a lack of coverage near the central coastline; and
- Within the El Toro Primary Aquifer in the Corral de Tierra Area to address lack of coverage near areas with substantial groundwater withdrawal.

In the Marina-Ord Area, additional wells are also needed in the identified areas to augment the seawater intrusion monitoring network as discussed in Section 7.5.2. The data gap areas shown on Figure 7-7 through Figure 7-9. will be addressed during GSP implementation by either identifying an existing well in each area that meets the criteria for a valid monitoring well, or drilling a new well in each area, as further described in Chapter 10.

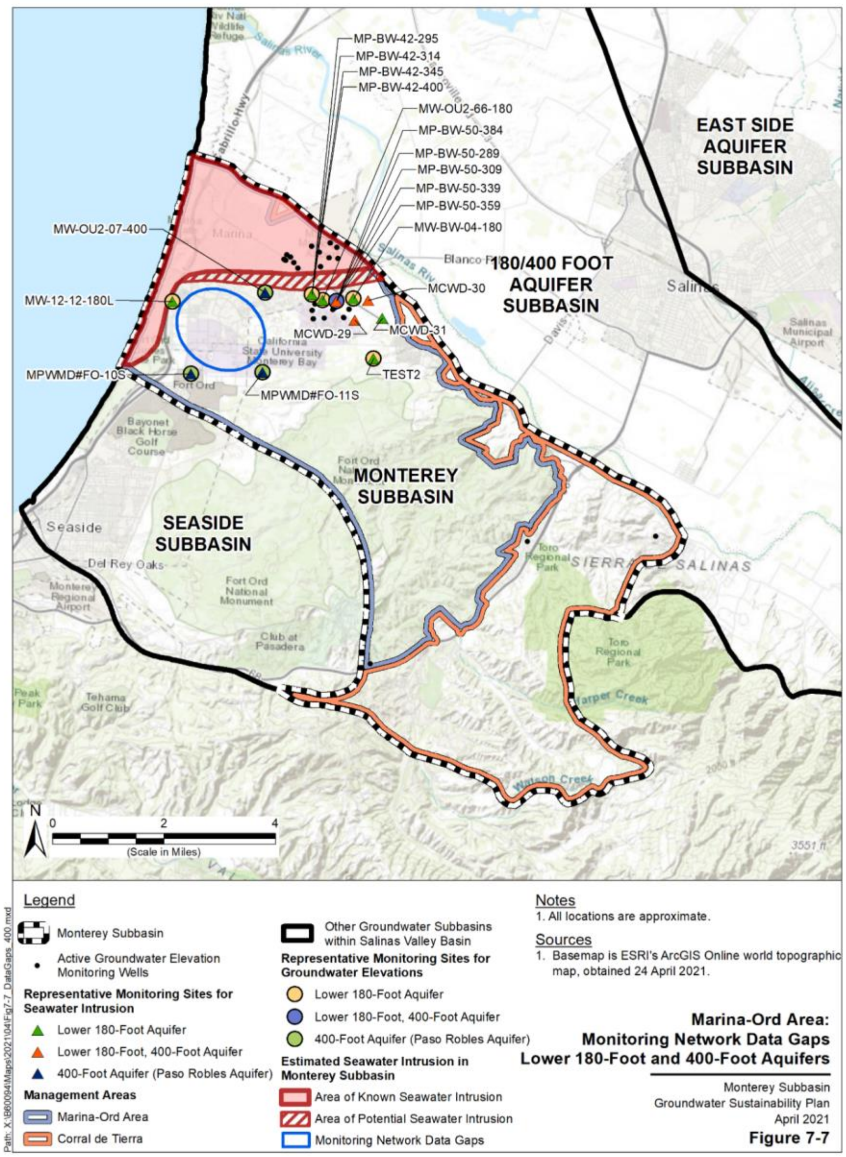


Figure 7-7. Marina-Ord Area: Monitoring Network Data Gaps, Lower 180-Foot and 400-Foot Aquifers

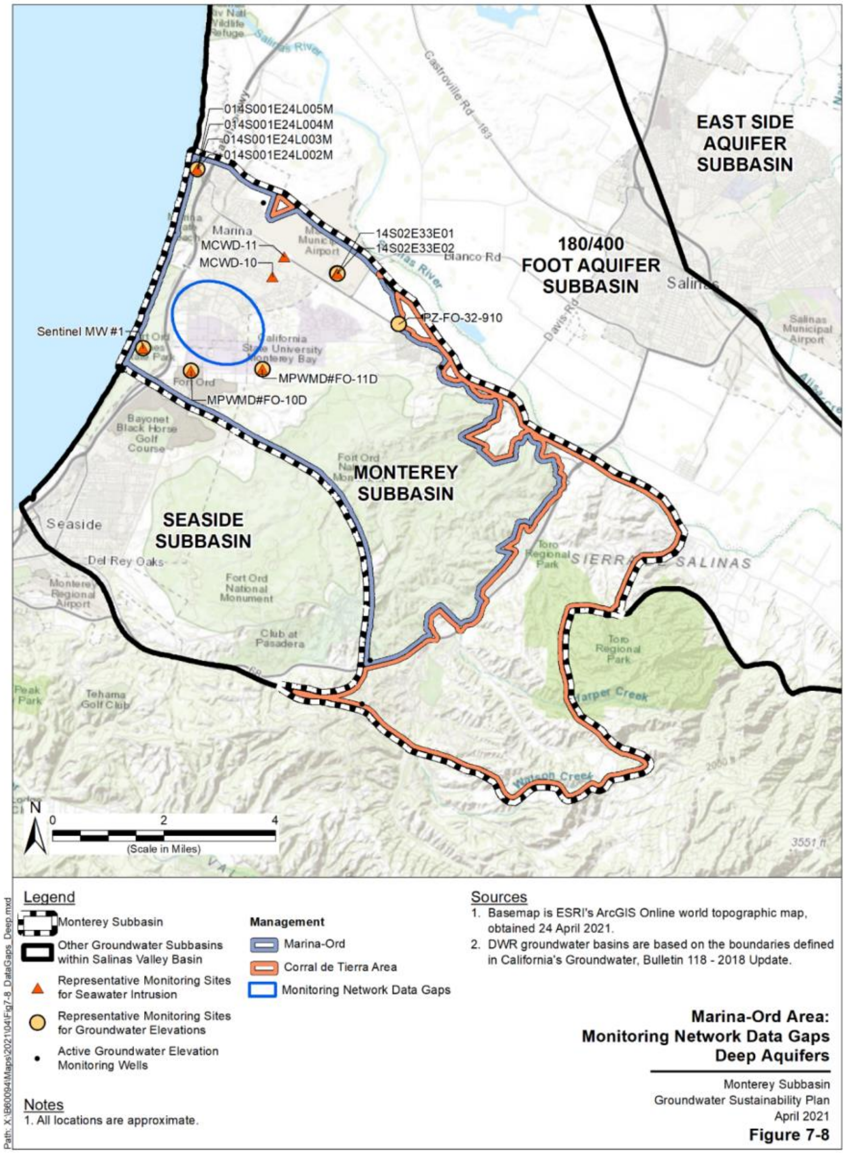


Figure 7-8. Marina-Ord Area: Monitoring Network Data Gaps, Deep Aquifers

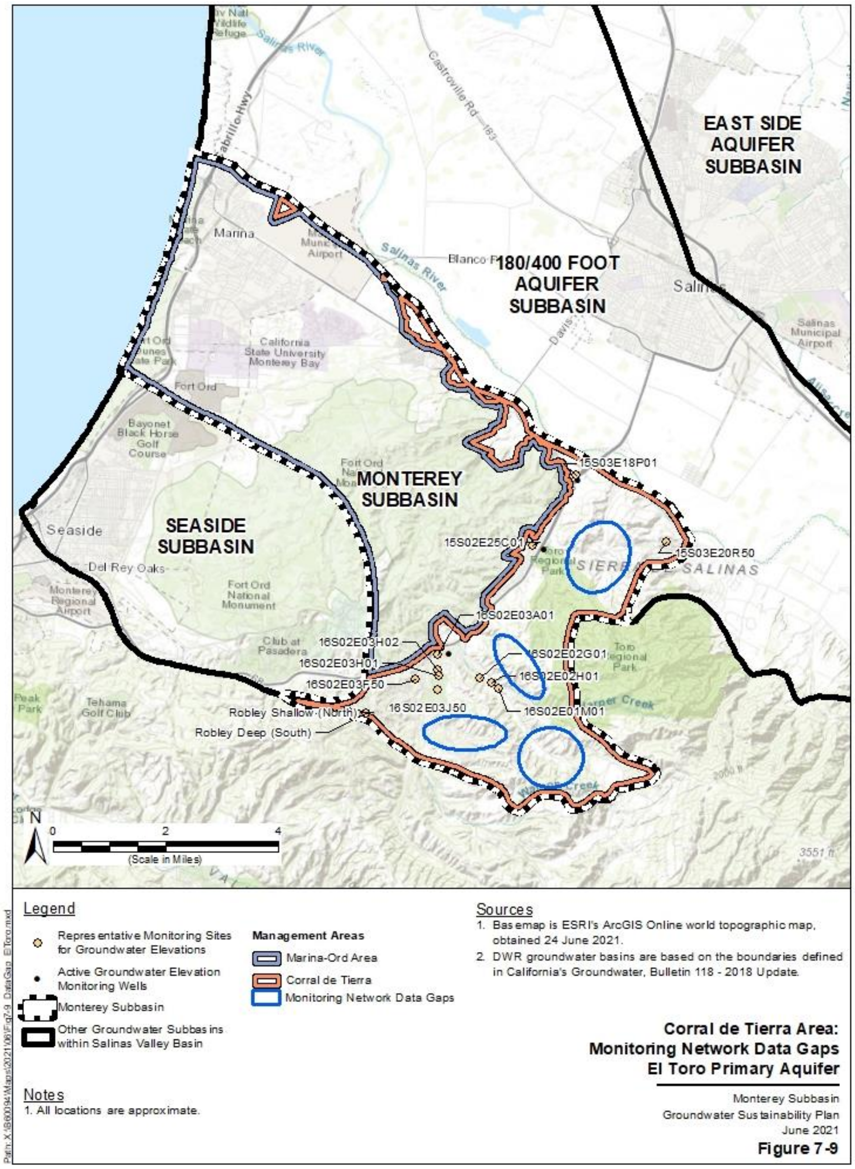


Figure 7-9. Corral de Tierra Area: Monitoring Network Data Gaps, El Toro Primary Aquifer

7.3.3 Protective Groundwater Gradient Monitoring

As discussed in Section 5.3.4, the hydraulic gradient and groundwater flow direction within the seawater intruded lower 180-Foot, 400-Foot Aquifer in the Marina-Ord Area is parallel to the current seawater intrusion front. It appears that, under the current hydraulic gradient and groundwater flow direction, there is minimal migration of seawater intrusion to inland areas of the Monterey Subbasin and that the lateral extent of seawater intrusion within the Subbasin has been relatively stable over the past two decades.

To ensure groundwater use within the Subbasin will not create groundwater gradients that actively draw intruding seawater inland within the Monterey Subbasin or into any adjacent subbasins, the MCWD GSA will also regularly evaluate the magnitude and direction of the hydraulic gradient from selected wells within the lower 180-Foot, 400-Foot Aquifer near the southern extent of the seawater intruded front. Specifically, selected wells will be assigned to groups of three. The magnitude and direction of the hydraulic gradient will be calculated for each group of wells. MCWD GSA will use this information to verify that the direction of the hydraulic gradient does not shift further to the south than has been measured over the last 10 years. This monitoring is conducted in addition to monitoring of groundwater elevations in the lower 180-Foot, 400-Foot Aquifer RMS located south of the seawater intruded front and ensure they meet the identified SMCs.

The wells selected for inland seawater intrusion protective groundwater gradient monitoring are listed in Table 7-2 and shown on Figure 7-10. These wells are located near the seawater intrusion front where it is closest to current groundwater production in the Marina-Ord Area. The magnitude and direction of hydraulic gradient measured in the Fall of 2017 based on these wells are listed in Table 7-3 and illustrated on Figure 7-11. As shown in Table 7-3, the magnitude and direction of the hydraulic gradient were approximately 0.0015 ft/ft and 64 degrees due north, respectively.

These protective groundwater gradients focus on limiting the expansion of the seawater intrusion extent in the Lower 180-Foot, 400-Foot Aquifer within the Monterey Subbasin and in the adjacent Seaside Subbasin, consistent with seawater intrusion minimum thresholds and measurable objectives established in Chapter 8.

Table 7-2. Wells Selected for Protective Groundwater Gradient Monitoring

Site Name	X (ft NAD83 State Plane IV)	Y (ft NAD83 State Plane IV)	2017 Fall Groundwater Elevation (ft NAVD 88)
MP-BW-30-317	5747078.37	2141302.81	-9.064
MP-BW-34-292	5750371.95	2140709.06	-13.061
MW-OU2-66-180	5750538.4265	2137520.5686	-11.221
MW-BW-04-180	5753483.211	2137660.1282	-15.321

Table 7-3. Fall 2017 Hydraulic Gradient and Flow Direction

Group	Sites	Hydraulic Gradient (L/L)	Direction (deg)
Group 1	MP-BW-30-317 MP-BW-34-292 MW-OU2-66-180	0.001479	64.08
Group 2	MP-BW-34-292 MW-OU2-66-180 MW-BW-04-180	0.001508	64.54

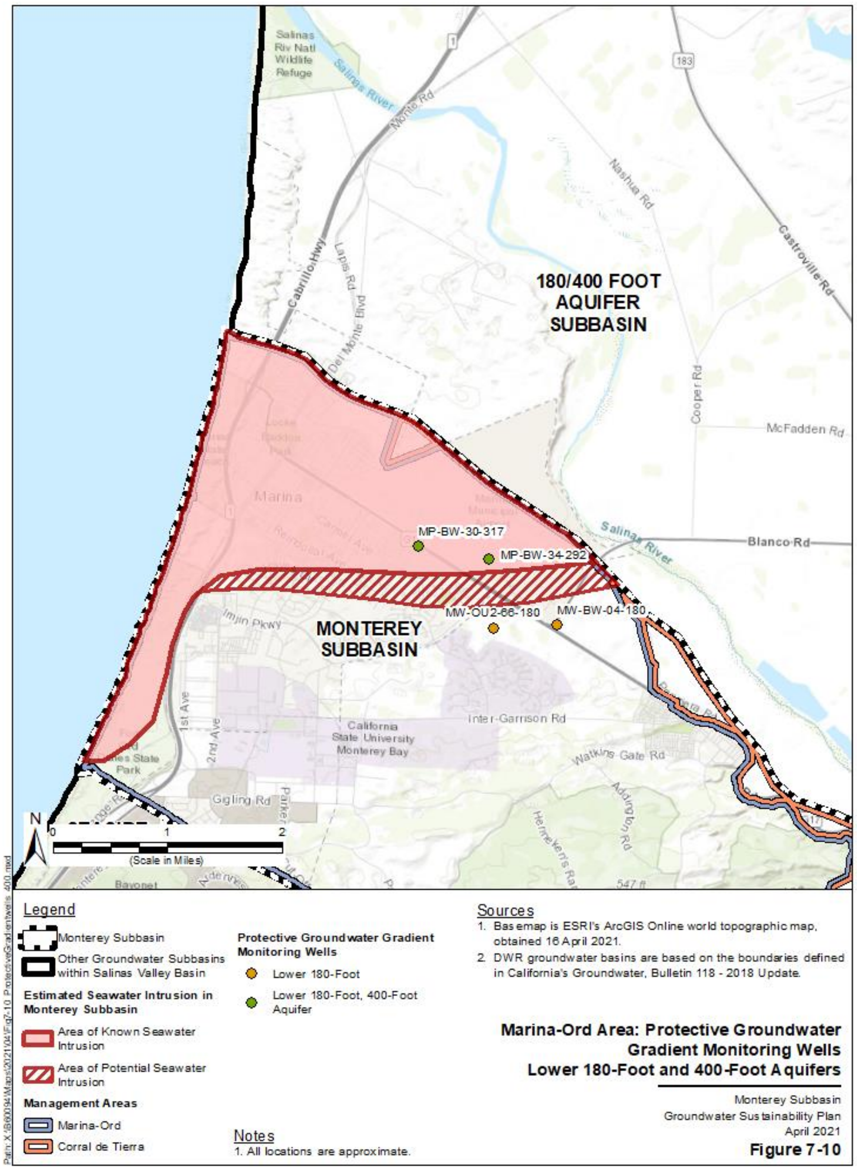
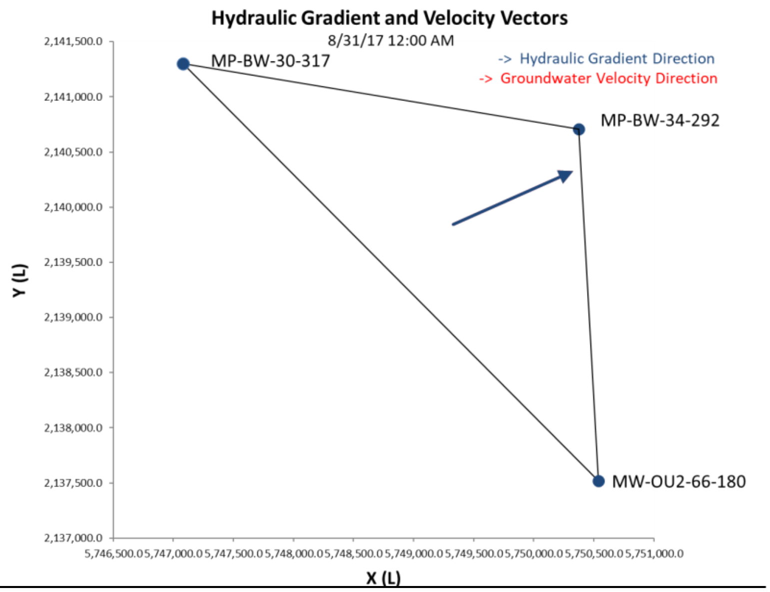
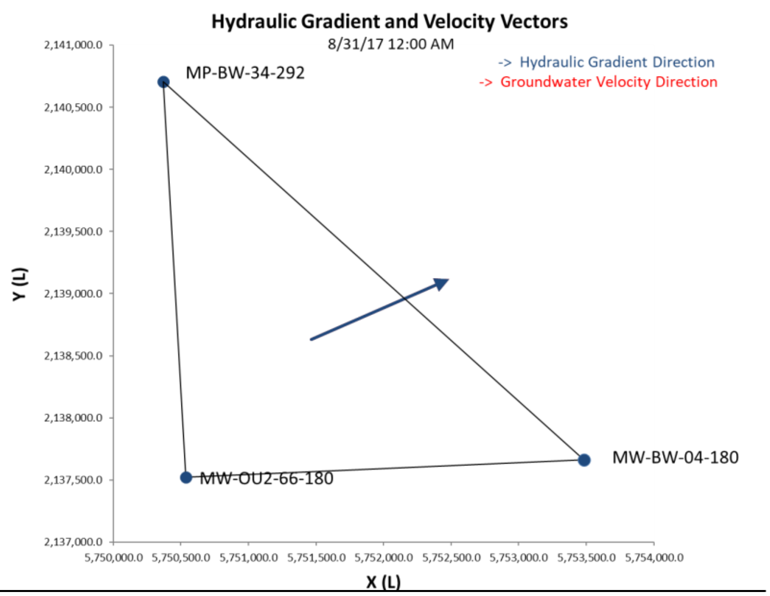


Figure 7-10. Marina-Ord Area: Protective Groundwater Gradient Monitoring Wells, Lower 180-Foot and 400-Foot Aquifers

Figure 7-11. Fall 2017 Hydraulic Gradient and Flow Direction





7.4 Groundwater Storage Monitoring Network

Data and minimum thresholds used to define undesirable results for chronic lowering of groundwater levels and seawater intrusion will also be used to assess reduction of groundwater storage (see Chapter 8). As such, the reduction of groundwater storage monitoring network will consist of the same RMS wells as described in Sections 7.3 and 7.5. Minimum thresholds for chronic lowering of groundwater levels and seawater intrusion are sufficiently protective to ensure prevention of significant and unreasonable occurrences of reduction in groundwater storage.

7.5 Seawater Intrusion Monitoring Network

Pursuant to §354.34 of the GSP Emergency Regulations, seawater intrusion should be monitored "using chloride concentrations, or other measurements convertible to chloride concentrations, so that the current and projected rate and extent of seawater intrusion for each applicable principal aquifer may be calculated". The sustainability indicator for seawater intrusion is evaluated using the location of the 500 milligrams per liter (mg/L) chloride isoconcentration contour that is based on chloride concentrations, equivalent total dissolved solids (TDS) concentrations, and/or specific conductivity measurements (Figure 5-23).

The seawater intrusion monitoring network comprises 42 RMS wells monitored by MCWD, U.S. Army, MCWRA, MPMWD, and the Seaside Groundwater Basin Watermaster in the Marina-Ord Area (see Figure 7-12 through Figure 7-16). All monitoring wells that are currently monitored for seawater intrusion in the Subbasin are included as part of the RMS network. Additional sites are added to the RMS network to facilitate monitoring of significant and unreasonable groundwater conditions identified in Chapter 8.

The seawater intrusion RMS network in the Marina-Ord area has been coordinated with the groundwater elevation RMS network (Section 7.3). Groundwater elevation data will be utilized in conjunction with chloride data from these wells to monitor potential expansion of the seawater intrusion front. The RMS wells within each management area have been selected to facilitate monitoring of significant and unreasonable groundwater conditions identified in Chapter 8. Criteria for selecting wells as part of the seawater intrusion RMS network include:

- RMS wells should facilitate monitoring seawater intrusion within all principal aquifers;
- RMS wells should be located near the coast in aquifer zones where seawater intrusion has not been identified (i.e., the Dune Sand Aquifer, the upper 180-Foot Aquifer, and the Deep Aquifers);
- RMS wells should be located near the coast and at the extent of the 500 mg/L chloride isoconcentration contour in aquifers where seawater intrusion has already occurred (i.e., the Lower 180-Foot/400-Foot Aquifer);

- RMS wells that could be included in both the groundwater elevation and seawater intrusion RMS networks are preferred;
- RMS wells should be located on public parcels or on properties where access agreements have been negotiated;
- RMS wells must have known depths and well completion data;
- RMS wells should not be influenced by nearby infiltration or groundwater remediation activities;
- RMS wells with available historical chloride and groundwater elevation data are preferred, but wells without this information may be used where alternate wells are not available; and
- Available chloride and/or water level data for seawater intrusion RMS wells should be representative of similar data from nearby surrounding wells.

Data from seawater intrusion RMS wells will be considered public and will be used for seawater intrusion maps and analyses unless the owner of the well opts out through correspondence with MCWDGSA or SVBGSA.[50]

The RMS wells currently in the seawater intrusion monitoring network are listed in Table 7-4. The need for any additional wells is discussed in Section 7.5.2.

[50] If an owner opts out of public data reporting, another well will be identified for SWI monitoring.

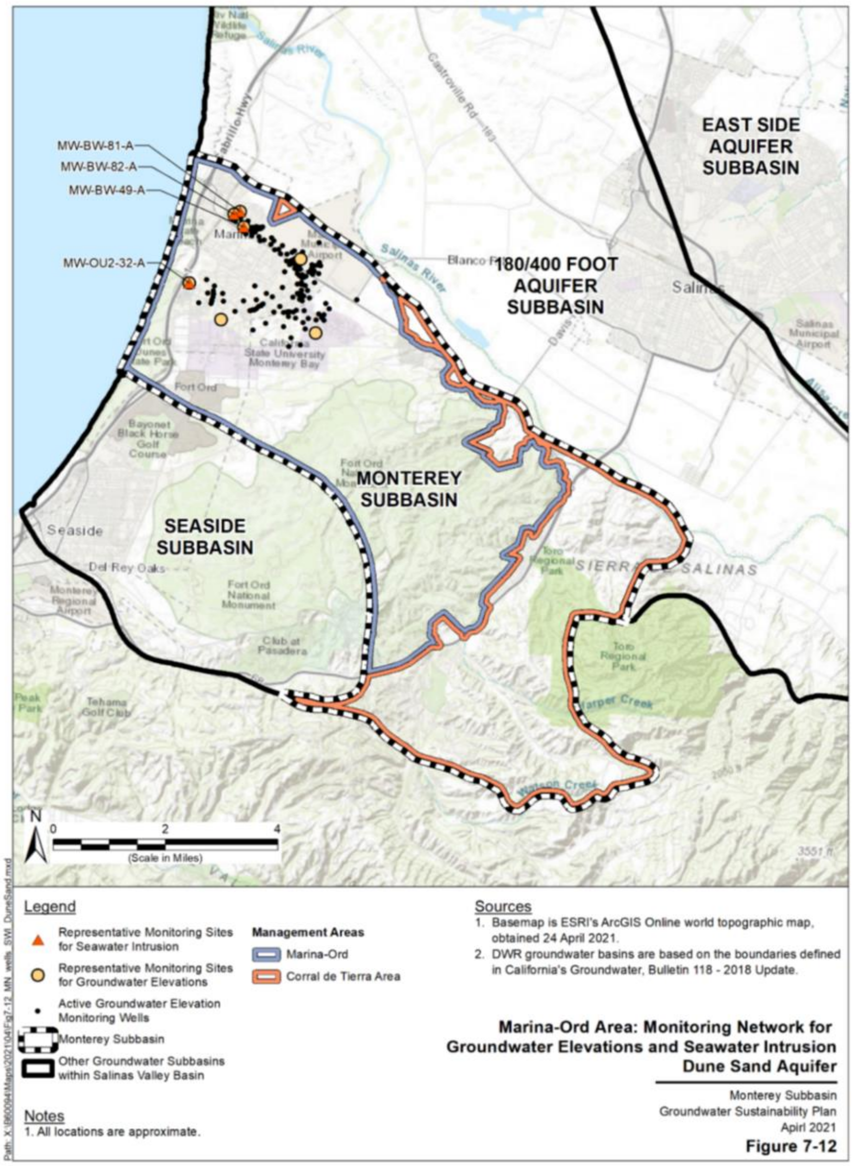


Figure 7-12. Marina-Ord Area: Monitoring Network for Groundwater Elevations and Seawater Intrusion, Dune Sand Aquifer

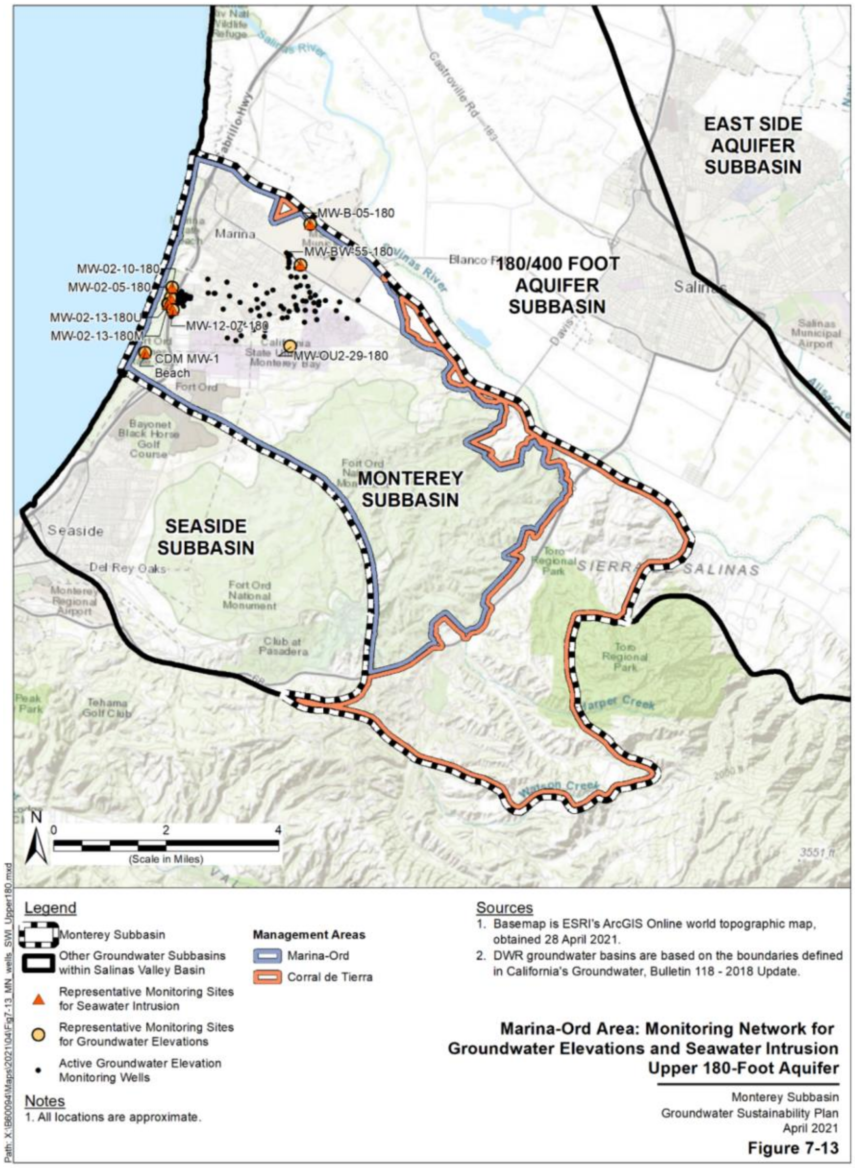


Figure 7-13. Marina-Ord Area: Monitoring Network for Groundwater Elevations and Seawater Intrusion, Upper 180-Foot Aquifer

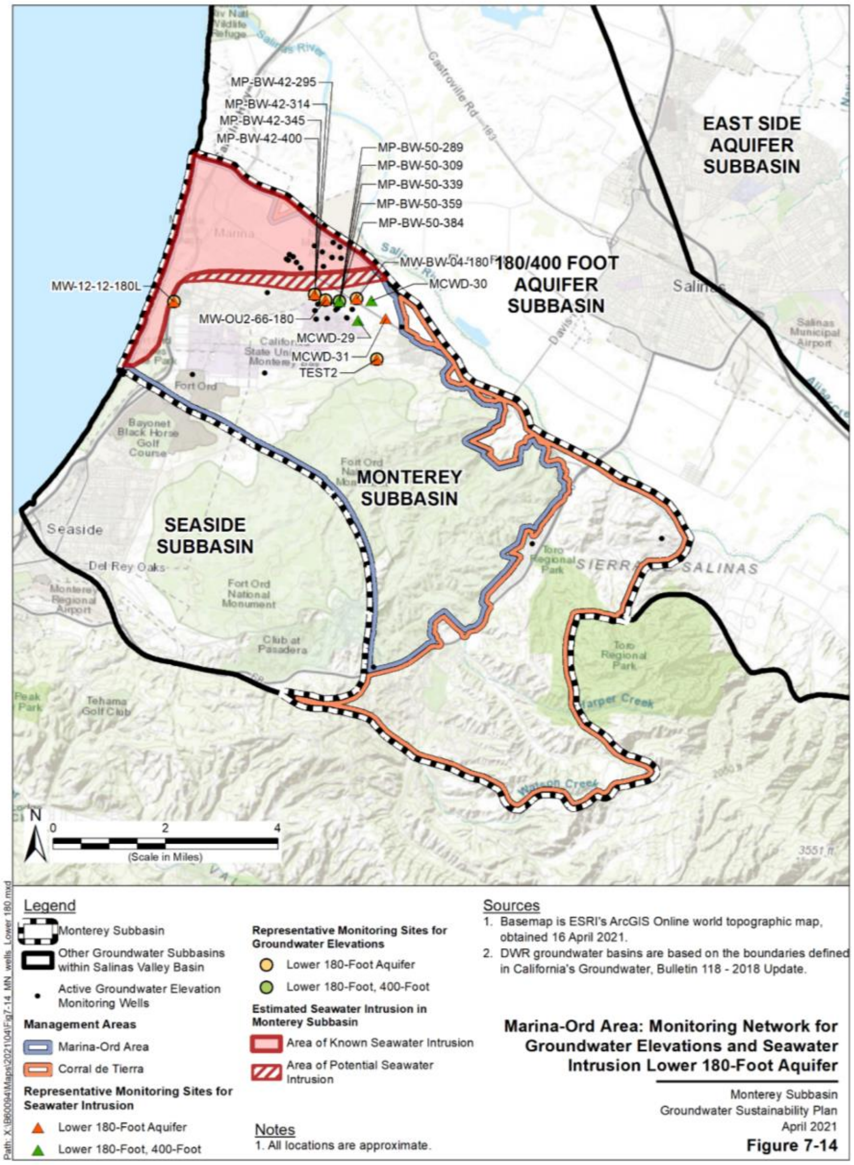


Figure 7-14. Marina-Ord Area: Monitoring Network for Groundwater Elevations and Seawater Intrusion, Lower 180-Foot Aquifer

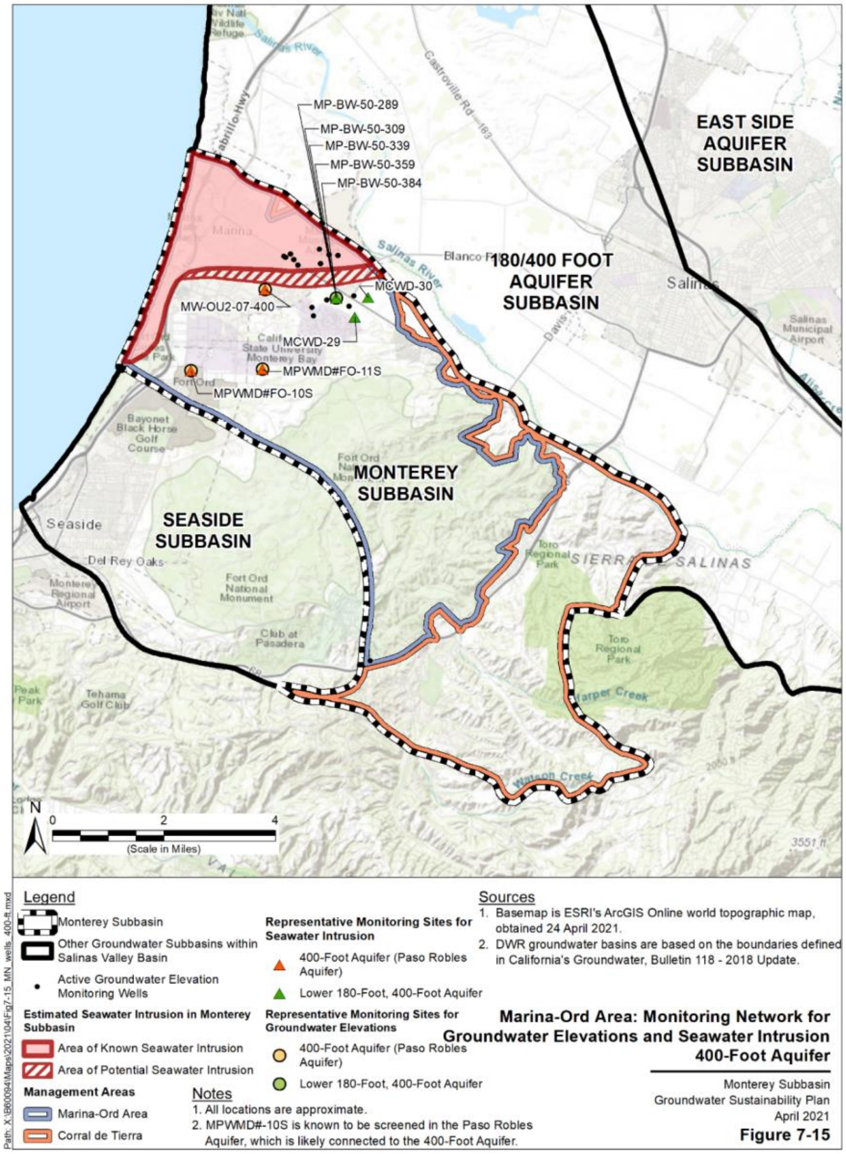


Figure 7-15. Marina-Ord Area: Monitoring Network for Groundwater Elevations and Seawater Intrusion, 400-Foot Aquifer

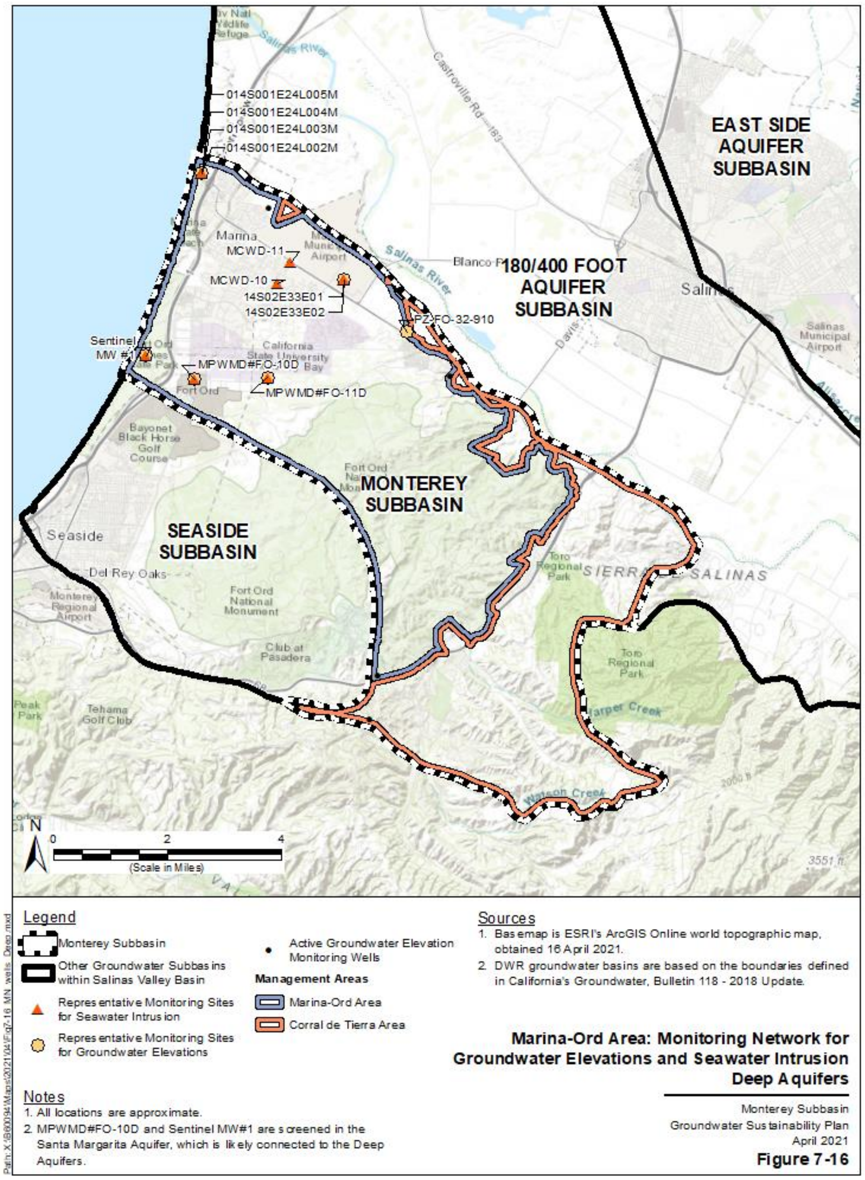


Figure 7-16. Marina-Ord Area: Monitoring Network for Groundwater Elevations and Seawater Intrusion, Deep Aquifers

Table 7-4. Monterey Subbasin Seawater Intrusion Representative Monitoring Sites

Site Name	Aquifer	CASGEM Well Number	Local Well Designation	Well Use	Total Well Depth (ft)	Latitude (NAD 83)	Longitude (NAD 83)	Period of TDS/Cl Record (years)
MW-BW-49-A	Dune Sand Aquifer	--	--	Monitoring	62	36.6854	-121.7928	1
MW-BW-81-A	Dune Sand Aquifer	--	--	Monitoring	82	36.6893	-121.7942	NA
MW-BW-82-A	Dune Sand Aquifer	--	--	Monitoring	74	36.6886	-121.7961	NA
MW-OU2-32-A	Dune Sand Aquifer	--	--	Monitoring	140	36.6705	-121.8098	6
CDM MW-1 Beach	Upper 180-Foot Aquifer (a)	366521N1218236W001	MW-1 Beach	Monitoring	140	36.6521	-121.8236	NA
MW-02-05-180	Upper 180-Foot Aquifer (a)	--	--	Monitoring	69	36.6664	-121.8159	27
MW-02-10-180	Upper 180-Foot Aquifer (a)	--	--	Monitoring	64	36.6691	-121.8155	17
MW-02-13-180M	Upper 180-Foot Aquifer (a)	--	--	Monitoring	137	36.6648	-121.8167	22
MW-02-13-180U	Upper 180-Foot Aquifer (a)	--	--	Monitoring	78	36.6648	-121.8166	5
MW-12-07-180	Upper 180-Foot Aquifer (a)	--	--	Monitoring	96	36.6633	-121.8152	19
MW-B-05-180	Upper 180-Foot Aquifer (a)	--	--	Monitoring	210	36.6865	-121.7719	6
MW-BW-55-180	Upper 180-Foot Aquifer (a)	--	--	Monitoring	202	36.6758	-121.7747	1
MCWD-31	Lower 180-Foot Aquifer (a)	--	Well 31	Public Supply	490	36.6625	-121.7465	36
MP-BW-42-295	Lower 180-Foot Aquifer (a)	--	--	Monitoring	467	36.6682	-121.7695	6
MP-BW-42-314	Lower 180-Foot Aquifer (a)	--	--	Monitoring	467	36.6682	-121.7695	6
MP-BW-42-345	Lower 180-Foot Aquifer (a)	--	--	Monitoring	467	36.6682	-121.7695	6
MP-BW-42-400	Lower 180-Foot Aquifer (a)	--	--	Monitoring	467	36.6682	-121.7695	6
MW-12-12-180L	Lower 180-Foot Aquifer (a)	--	--	Monitoring	179	36.6652	-121.8146	9
MW-BW-04-180	Lower 180-Foot Aquifer (a)	--	--	Monitoring	364	36.6674	-121.7560	9
MW-OU2-66-180	Lower 180-Foot Aquifer (a)	--	--	Monitoring	339	36.6667	-121.7661	9

Site Name	Aquifer	CASGEM Well Number	Local Well Designation	Well Use	Total Well Depth (ft)	Latitude (NAD 83)	Longitude (NAD 83)	Period of TDS/Cl Record (years)
TEST2	Lower 180-Foot Aquifer (a)	--	--	Monitoring	425	36.6519	-121.7490	NA
MCWD-29	Lower 180-Foot, 400-Foot Aquifer (a)	--	Well 29	Public Supply	557	36.6618	-121.7553	36
MCWD-30	Lower 180-Foot, 400-Foot Aquifer (a)	--	--	Public Supply	552	36.6670	-121.7513	36
MP-BW-50-289	Lower 180-Foot, 400-Foot Aquifer (a)	--	--	Monitoring	397	36.6666	-121.7616	1
MP-BW-50-309	Lower 180-Foot, 400-Foot Aquifer (a)	--	--	Monitoring	397	36.6666	-121.7616	1
MP-BW-50-339	Lower 180-Foot, 400-Foot Aquifer (a)	--	--	Monitoring	397	36.6666	-121.7616	1
MP-BW-50-359	Lower 180-Foot, 400-Foot Aquifer (a)	--	--	Monitoring	397	36.6666	-121.7616	1
MP-BW-50-384	Lower 180-Foot, 400-Foot Aquifer (a)	--	--	Monitoring	397	36.6666	-121.7616	1
MPWMD#FO-10S	400-Foot Aquifer (a) (b)	366466N1218079W001	Fort Ord 10 - Shallow	Monitoring	650	36.6466	-121.8079	24
MPWMD#FO-11S	400-Foot Aquifer (a)	366474N1217847W002	FO-11-Shallow	Monitoring	740	36.6474	-121.7847	1
MW-OU2-07-400	400-Foot Aquifer (a)	--	--	Monitoring	580	36.6683	-121.7847	16
014S001E24L002M	Deep Aquifers	--	USGS DMW1--1	Monitoring	1880	36.6993	-121.8077	4
014S001E24L003M	Deep Aquifers	--	USGS DMW1--2	Monitoring	1430	36.6993	-121.8077	4
014S001E24L004M	Deep Aquifers	--	USGS DMW1--3	Monitoring	1080	36.6993	-121.8077	4
014S001E24L005M	Deep Aquifers	--	USGS DMW1--4	Monitoring	970	36.6993	-121.8077	4
14S02E33E01	Deep Aquifers	--	Airport Well 2'' Shallow	Monitoring	1095	36.6730	-121.7615	NA
14S02E33E02	Deep Aquifers	--	Airport Well 3" DEEP	Monitoring	1760	36.6730	-121.7614	NA
MCWD-10	Deep Aquifers	--	Marina 10	Public Supply	1550	36.6717	-121.7824	36
MCWD-11	Deep Aquifers	--	Marina 11	Public Supply	1660	36.6770	-121.7788	35
MPWMD#FO-10D	Deep Aquifers (b)	366466N1218079W002	MPWMD #FO-10-Deep	Monitoring	1420	36.6466	-121.8079	13
MPWMD#FO-11D	Deep Aquifers	366474N1217847W001	FO-11-Deep	Monitoring	1130	36.6474	-121.7847	NA

Site Name	Aquifer	CASGEM Well Number	Local Well Designation	Well Use	Total Well Depth (ft)	Latitude (NAD 83)	Longitude (NAD 83)	Period of TDS/Cl Record (years)
Sentinel MW #1	Deep Aquifers (b)	366521N1218 236W002	SGB--MW #1	Monitoring	1500	36.6521	-121.8236	NA

Notes:

(a) The RMS network is selected to distinguish the upper 180-Foot Aquifer and the lower 180-Foot Aquifer, since conditions in the upper 180-Foot are distinct from those in the lower 180-Foot Aquifer, as described in Chapter 5.

(b) Wells MPWMD#FO-10S, MPWMD#FO-10D, and Sentinel MW#1 are monitored by MPWMD on behalf of the Seaside Watermaster. MPWMD#FO-10S is known to be screened in the Paso Robles Aquifer, which is likely connected to the 400-Foot Aquifer; MPWMD#FO-10D, and Sentinel MW#1 are screened in the Santa Margarita Aquifer, which is likely connected to the Deep Aquifers.

7.5.1 Seawater Intrusion Monitoring Protocols

Groundwater quality data or specific conductivity measurements will be collected pursuant to the following protocols as applicable to the monitoring agency of each well. These monitoring plans are included in appendices hereto.

- The Monterey County Quality Assurance Project Plan (QAPP; Appendix 7-D) describes existing MCWRA groundwater quality data monitoring protocols.
- The Seaside Basin Watermaster Monitoring and Management Program (SBWMMP, revision date September 5, 2006; Appendix 7-E) describes MPMWD groundwater monitoring protocols conducted on behalf of the Seaside Watermaster. Groundwater quality measurements for wells within the Monterey Subbasin are collected annually. Sentinel MW#1 is also monitored by the Seaside Watermaster via induction logging and more frequent transducer and datalogger based groundwater elevation monitoring.
- Appendix A of the Quality Assurance Project Plan (QAPP; Appendix 7-C) for the former Fort Ord includes a description of groundwater monitoring procedures at the former Fort Ord (U.S. Army, 2019). Groundwater quality or specific conductivity measurements will be collected annually and in accordance with applicable Standard Operating Procedures covered in the QAPP.

Additionally, groundwater quality data will be collected from MCWD production wells pursuant to Title 22 Drinking Water Program requirements.

These protocols are consistent with data and reporting standards described in GSP Emergency Regulations §352.4.

7.5.2 Seawater Intrusion Monitoring Network Data Gaps

There is no definitive requirement regarding seawater intrusion monitoring well density. The current network includes 2 to 10 seawater intrusion monitoring wells in the aquifers with no evidence of seawater intrusion and a total of 13 seawater intrusion monitoring wells in the lower 180-Foot, 400-Foot Aquifer where seawater intrusion has occurred. Additional seawater intrusion monitoring wells may be appropriate at the following locations:

- Within the 400-Foot Aquifer to address lack of coverage near the central coastline between wells MCWD-09 and MPWMD#FO-10S; and
- Within the Deep aquifers to address a lack of coverage near the central coastline between MCWD-10 and MPWMD#FO-10D.

These locations are consistent with data gap locations identified as part of the groundwater elevation monitoring network within the Marina-Ord area, which also focuses on preventing seawater intrusion as shown on Figure 7-7 and Figure 7-8 above.

The data gap areas shown on Figure 7-7 and Figure 7-8 will be addressed during GSP implementation by either identifying an existing well in each area that meets the criteria for a valid monitoring well, or drilling a new well in each area, as further described in Chapter 10.

7.6 Water Quality Monitoring Network

The sustainability indicator for degraded water quality is evaluated by monitoring groundwater quality at a network of existing water supply wells. The GSP Emergency Regulations require sufficient spatial and temporal data from each applicable principal aquifer to determine groundwater quality trends for water quality indicators to address known water quality issues.

As described in Chapter 8, separate minimum thresholds are set for the constituents of concern for public water system supply wells, on-farm domestic wells, and irrigation supply wells. Therefore, although there is a single groundwater quality monitoring network, different wells in the network are reviewed for different constituents. Constituents of concern for drinking water are assessed at public water supply wells and on-farm domestic wells, and constituents of concern for crop health are assessed at agricultural supply wells. The constituents of concern for the three sets of wells are listed in Chapter 5.

The municipal public water system supply wells included in the monitoring network were identified by reviewing data from the State Water Resources Control Board (SWRCB) Division of Drinking Water (DDW). The SWRCB collects data for municipal systems; community water systems; non-transient, non-community water systems; and non-community water systems that provide drinking water to at least 15 service connections or serve an average of at least 25 people for at least 60 days a year. The RMS network consists of eight DDW wells in the RMS network in the Ord Area and 24 wells in the Corral de Tierra Area. These wells are shown on Figure 7-17. and listed in Appendix 7-F.

All on-farm domestic wells and agricultural supply wells have been sampled through the CCRWQCB's Irrigated Lands Regulatory Program. Under the existing Ag Order, there are 10 ILRP wells in the Corral de Tierra Area that have been sampled through the CCRWQCB's IRLP are included in the RMS network. The locations of these wells are shown on Figure 7-17. and listed in Appendix 7-F. No active ILRP wells exist within the Fort Ord Area. The MCWDGSA and SVBGSA assume that Ag Order 4.0 will have a similar representative geographic distribution of wells within the Subbasin. The agricultural groundwater quality monitoring network will be revisited and revised when the Ag Order 4.0 monitoring network is finalized.

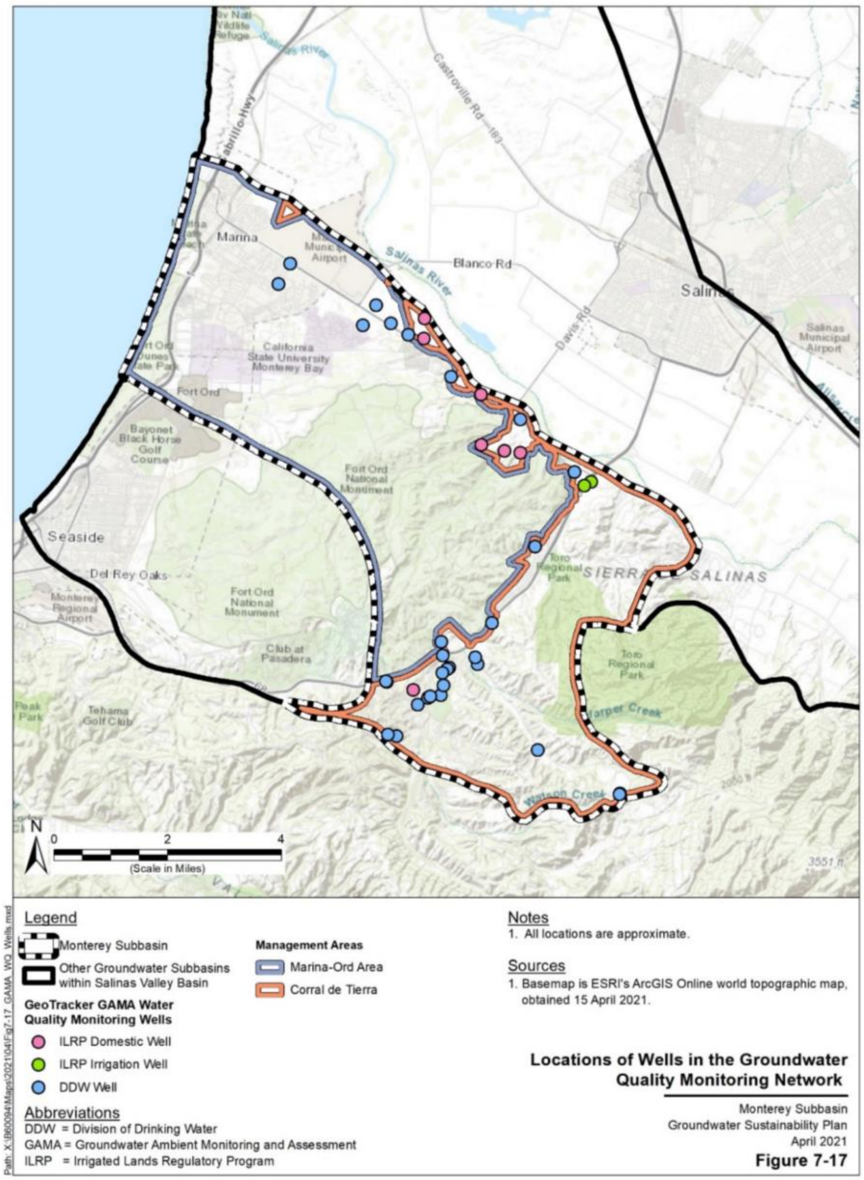


Figure 7-17. Locations of Wells in the Groundwater Quality Monitoring Network

7.6.1 Groundwater Quality Monitoring Protocols

Water quality data from public water systems are collected, analyzed, and reported in accordance with protocols that are reviewed and approved by the SWRCB, DDW, in accordance with the state and federal Safe Drinking Water Acts. Monitoring protocols may vary by agency.

ILRP data are currently collected under CCRWQCB Ag Order 3.0. ILRP samples are collected under the Tier 1, Tier 2, or Tier 3 monitoring and reporting programs. Under Ag Order 4.0, ILRP data will be collected in 3 phases and each groundwater basin within the Central Coast Region has been assigned to one or more of these phases. The designated phase for each ILRP well is provided in SWRCB's GeoTracker database and is publicly accessible at: https://geotracker.waterboards.ca.gov/. Ag Order 4.0 will take effect in the Subbasin beginning in 2027. Copies of the Ag Orders 3.0 and 4.0 monitoring and reporting programs are included in Appendix 7-G and are incorporated into this GSP. These protocols are consistent with data and reporting standards described in GSP Emergency Regulations §352.4.

~~ILRP data are currently collected under Central Coast RWQCB Ag Order 3.0. ILRP samples are collected under the Tier 1, Tier 2, or Tier 3 monitoring and reporting programs. Copies of these monitoring and reporting programs are included in Appendix 7D and are incorporated into this GSP. These protocols are consistent with data and reporting standards described in GSP Emergency Regulations §352.4.~~

7.6.2 Groundwater Quality Monitoring Data Gaps

There is adequate spatial coverage to assess impacts to beneficial uses and users for the DDW monitoring program. MCWDGSA nor SVBGSA plan on expanding the monitoring network at this time because the monitoring network relies on existing supply wells and neither MCWDGSA nor SVBGSA plan to independently sample wells for any COC. As new domestic and agricultural supply wells are added to Ag Order 4.0 and/or the County makes water quality data from small systems easily available, they will be added to this monitoring program.

7.7 Land Subsidence Monitoring Network

As described in Section 5.5, DWR collects land subsidence data using InSAR satellite data, and makes these data available to GSAs. This subsidence dataset represents the best available data for the Monterey Subbasin and is therefore used as the subsidence monitoring network.~~DWR has, and will be, collecting land subsidence data using InSAR satellite data, and will make these data available to GSAs. This subsidence dataset represents the best available data for the Monterey Subbasin and will therefore be used as the subsidence monitoring network.~~

7.7.1 Land Subsidence Monitoring Protocols

The land subsidence monitoring protocols are the ones used by DWR for InSAR measurements and interpretation. If the annual monitoring indicates subsidence is occurring at a rate greater than the minimum thresholds, then additional investigation and monitoring may be warranted.

In particular, the GSAs will implement a study to assess if the observed subsidence can be correlated to declining groundwater elevations, and whether a reasonable causality can be established. These protocols are consistent with data and reporting standards described in GSP Emergency Regulations §352.4.

7.7.2 Land Subsidence Data Gaps

There are no data gaps associated with the subsidence monitoring network.

7.8 Interconnected Surface Water Monitoring Network

As detailed in Chapter 8, shallow groundwater elevations near locations of interconnected surface water will be used as a proxy metric for this indicator. As such, the interconnected surface water monitoring network will be comprised of RMS sites adjacent to potential interconnected surface waters where minimum thresholds and measurable objectives based on shallow groundwater levels are developed for depletion of interconnected surface water.

As described in Section 5.6 of this GSP, potential interconnected surface water locations identified within the Subbasin are (1) the ponds and lakes located within the City of Marina (Figure 5-35), (2) the lower reaches of the El Toro Creek where groundwater within 20 feet of land surface has been recorded (Figure 5-36), (3) two locations along the Salinas River near the Monterey-180/400-Foot Aquifer Subbasin boundary. These areas may require additional evaluation of potential hydraulic interaction between surface water elevations and groundwater extractions.

The primary tool for assessing depletions of interconnected surface water will be shallow monitoring wells adjacent to the Subbasin's interconnected surface water locations. Groundwater elevations measured in shallow wells adjacent to interconnected surface water bodies will serve as the primary approach for monitoring depletion of surface water.

One RMS well is included in the interconnected surface water monitoring network in the Marina-Ord Area, as shown in Table 7-5 and on Figure 7-18. As discussed in Chapter 8, given the stable groundwater patterns in the Dune Sand Aquifer, there is no significant and unreasonable depletion of interconnected surface water under current conditions. In the event that future groundwater activities in the Subbasin or the adjacent 180/400-Foot Aquifer Subbasin may influence the condition of the Marina vernal ponds and/or the Dune Sand Aquifer, the GSAs will work with project proponents to install additional shallow groundwater monitoring wells.

There are currently no RMS wells included in the interconnected surface water monitoring network near the El Toro Creek or Salinas River. As described in Section 5.6, the level of interconnection between the El Toro Creek to the principal aquifer is unclear. As shown on Figure 7-19, an analysis of shallow groundwater levels is used to identify areas of potential interconnection between surface water and groundwater. Additionally, the SVBGSA plans to install one shallow well near El Toro Creek into the interconnected surface water monitoring network and may work with the United States Geological Survey (USGS) to reactivate the stream gauge along Toro Creek. ~~and will work with the United States Geological Survey (USGS) to reactivate the stream gauge along Toro Creek.~~ The conjunctive data collection will help correlate the potential seasonal flows with shallow groundwater and assess both the interconnectivity as well as the relationship with deeper wells in the area.

Table 7-5. Monterey Subbasin Interconnected Surface Water Representative Monitoring Sites

State Well Number	Aquifer	Well Use	Total Well Depth (ft)	Latitude (NAD 83)	Longitude (NAD 83)
Marina-Ord Area					
MW-BW-82-A	Dune Sand Aquifer	Monitoring	74	36.6886	-121.7961

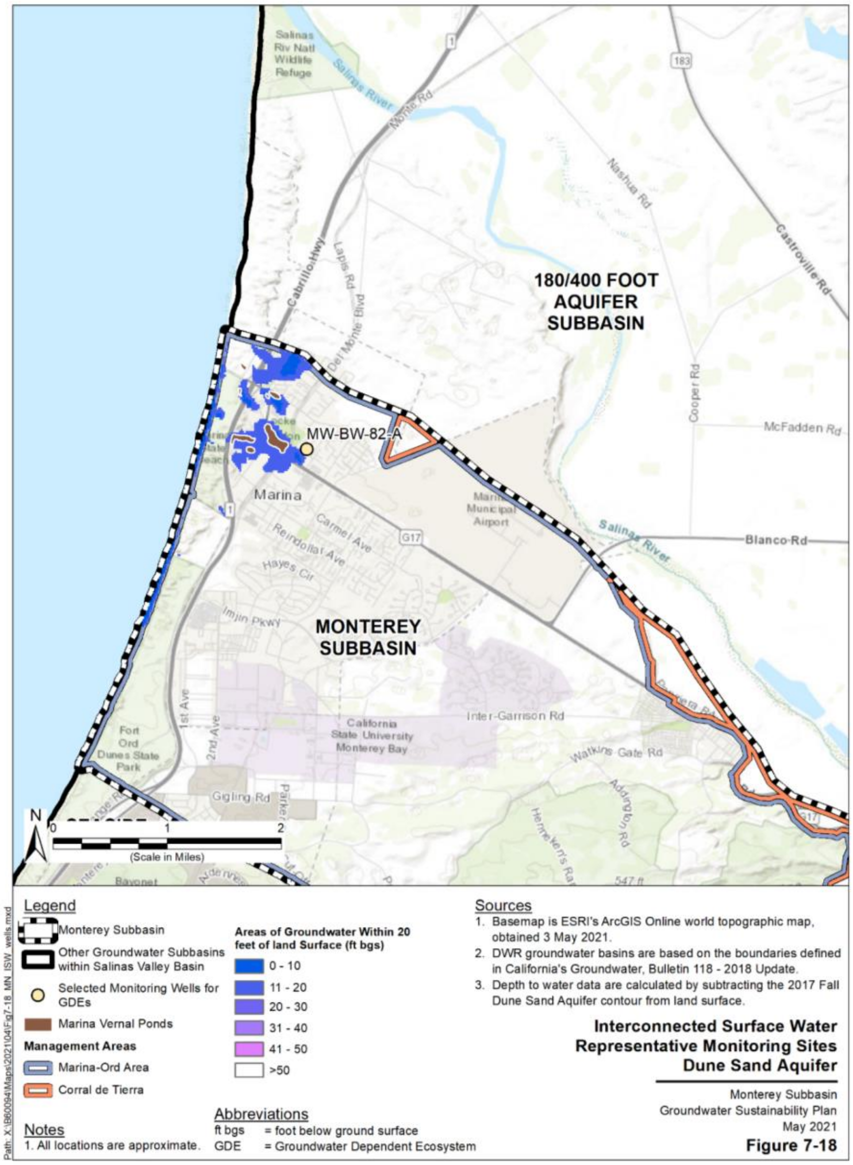


Figure 7-18. Interconnected Surface Water Representative Monitoring Sites, Dune Sand Aquifer

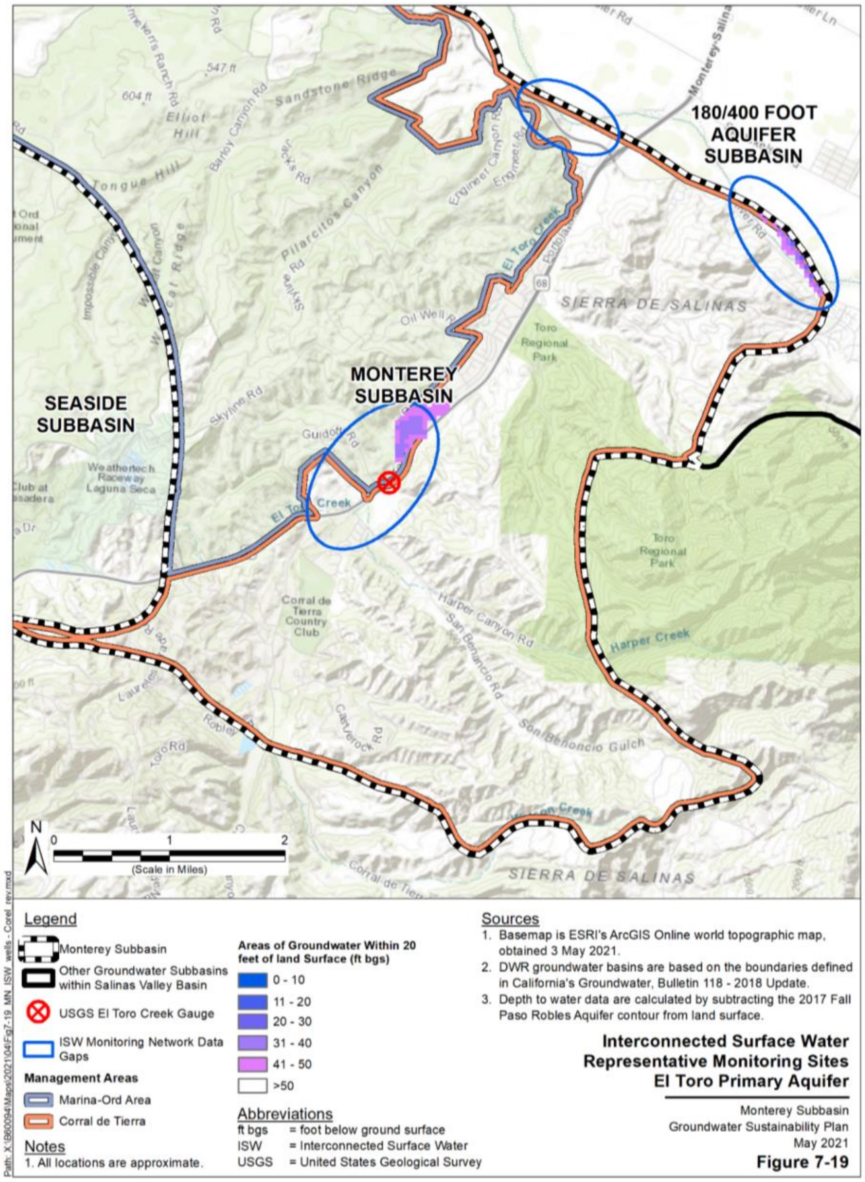


Figure 7-19. Interconnected Surface Water Representative Monitoring Sites, El Toro Primary Aquifer

7.9 Other Monitoring Networks

7.9.1 Groundwater Extraction Monitoring Network

Under Monterey County Ordinance No. 3717 and No. 3718, public water systems and agricultural pumpers using wells with an internal discharge pipe greater than 3 inches within Zones 2, 2A, and 2B report extractions annually to MCWRA's GEMS. Extraction is self-reported by well owners or operators. Agricultural wells report their data based on MCWRA's reporting year that runs from November 1 through October 31. Urban and industrial wells report extraction on a calendar year basis. When extraction data are summarized annually, MCWRA combines industrial and urban extractions into a single urban water use. However, these zones do not provide sufficient coverage of the Corral de Tierra Area. This data gap is further discussed in Section 7.9.1.2.

GEMS data is used where available, and groundwater withdrawn outside of Zones 2, 2A, and 2B in the Corral de Tierra Area is estimated following the approach taken by the Wallace Group. Their analysis was based on municipal pumping that is estimated using reported pumping data for public drinking water systems, as well as estimates based on land use type, acreage, parcels, and de minimis use. Pumping data for public water systems is reported annually to SWRCB's DDW Electronic Annual Report database, publicly accessible at: https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/eardata.html. An analysis of aerial imagery, parcel size analysis, and engineering judgment was used to estimate extraction by private wells was done for the parcels that are not part of a public drinking water system.

7.9.1.1 Groundwater Extraction Monitoring Protocols

Groundwater extraction monitoring uses existing monitoring programs performed by MCWD and other agencies. This includes MCWRA's GEMS program and the annual public drinking water system pumping reported to SWRCB by public water systems including MCWD. These monitoring protocols are consistent with data and reporting standards described in GSP Emergency Regulations §352.4.

7.9.1.2 Groundwater Extraction Monitoring Data Gaps

An accurate assessment of the amount of pumping requires an accurate count of the number of municipal, agricultural, and domestic wells in the GSP area. This information exists within the Marina-Ord Area, however, is more limited in the Corral de Tierra Area. As proposed in Chapter 9, SVBGSA will undertake well registration during implementation to develop a database of existing and active groundwater wells. This database will draw from the existing MCWRA database, DWR's OSWCR database, and the Monterey County Health Department database of state small and local small water systems. As part of the assessment, SVBGSA will verify well completion information and location and whether the well is active, abandoned, or destroyed, as is discussed further in Chapter 9.

SVBGSA will also expand and enhance the GEMS program to address groundwater extraction monitoring data gaps. The current GEMS program only covers a small southern portion of the Corral de Tierra Area resulting in a data gap. In addition, the accuracy and reliability of groundwater pumping reported through GEMS is~~are~~ constantly being updated. SVBGSA will work with MCWRA to address these data gaps during GSP implementation by expanding the GEMS program and considering other potential enhancements as described in Chapter 9.

7.9.2 Salinas River Watershed Diversions

Salinas River watershed monthly diversion data are collected annually in the SWRCB's eWRIMS, used to track information of water rights in the state, publicly accessible at: https://ciwqs.waterboards.ca.gov/ciwqs/ewrims/reportingDiversionDownloadPublicSetup.do. These data also include diversions from tributaries of the Salinas River.

7.9.2.1 Salinas River Watershed Diversions Monitoring Protocols

Salinas River watershed diversion monitoring protocols are those that the SWRCB has established for the collection of water right information. These protocols are consistent with data and reporting standards described in GSP Emergency Regulations §352.4.

7.9.2.2 Salinas River Watershed Diversions Monitoring Data Gaps

These data are lagged by a year because the reporting period does not begin until February of the following year.

7.10 Data Management System and Data Reporting

Data collected from the SGMA Monitoring Network will be uploaded to a Data Management System to be established and managed for the Monterey Subbasin and reported to the DWR in accordance with the Monitoring Protocols developed for the Subbasin, as described in the appendices hereto. Additional data collected as part of the Subbasin's other monitoring programs may be used in conjunction with data collected from the SGMA Monitoring Network to meet compliance with requirements regarding annual reporting (GSP Emergency Regulations §356.2) or as otherwise deemed necessary by the GSAs.

8 SUSTAINABLE MANAGEMENT CRITERIA

This chapter defines the conditions that constitute sustainable groundwater management; and establishes minimum thresholds, measurable objectives, and undesirable results for each sustainability indicator. This chapter includes adequate data to explain how sustainable management criteria (SMCs) were developed and how they influence all beneficial uses and users.

The chapter is structured to address all the GSP Emergency Regulations regarding SMCs. To retain an organized approach, the SMCs are grouped by sustainability indicators. The discussion of each sustainability indicator follows a consistent format that contains all information required by §354.22 et. seq of the GSP Emergency Regulations, and as further clarified in the SMCs BMP (DWR, 2017; CCR, 2016).

~~The chapter is structured to address all the Sustainable Groundwater Management Act (SGMA) regulations regarding SMCs. To retain an organized approach, the SMCs are grouped by sustainability indicator. The discussion of each sustainability indicator follows a consistent format that contains all information required by Section 354.22 *et. seq* of the regulations, and as further clarified in the SMCs BMP (DWR, 2017; CCR, 2016).~~

8.1 Definitions

The SGMA legislation and GSP Emergency Regulations contain terms relevant to SMCs. The definitions included in the GSP Emergency Regulations are repeated below. Where appropriate, additional explanatory text is added in italics. This explanatory text is not part of the official definitions of these terms.

- **Sustainability indicator** refers to any of the effects caused by groundwater conditions occurring throughout the Subbasin that, when significant and unreasonable, cause undesirable results, as described in California Water Code §10721(x).

  The six sustainability indicators relevant to this subbasin include chronic lowering of groundwater levels; reduction of groundwater storage; degraded water quality; land subsidence; seawater intrusion; and depletion of interconnected surface waters.

- **Undesirable Results** occur when significant and unreasonable effects for any of the sustainability indicators are caused by groundwater conditions occurring throughout the Subbasin.

  The GSP Emergency Regulations requires that the description of undesirable results include (1) the cause of groundwater conditions that would lead to or has led to undesirable results; (2) a quantitative description of the combination of minimum threshold exceedances that cause significant and unreasonable effects in the Subbasin (i.e., the undesirable result criteria); and (3) potential effects that may occur or are *occurring from undesirable results. An example undesirable result criteria could be defined as: more than 10% of the measured groundwater elevations being lower than the minimum thresholds.*

- **Significant and Unreasonable Conditions**

  Significant and unreasonable is not defined in the Regulations. However, the definition of undesirable results states, "Undesirable results occur when significant and unreasonable effects … are caused by groundwater conditions…". The SGMA BMP states that "the GSAs must consider and document the conditions at which each of the six sustainability indicators become significant and unreasonable, including reasons for justifying each particular threshold selected." Therefore, this GSP adopts the phrase significant and unreasonable conditions to be the qualitative description of conditions used to justify selected minimum thresholds and undesirable results criteria.

- **Measurable objectives** refer to specific, quantifiable goals for the maintenance or improvement of specified groundwater conditions that have been included in an adopted Plan to achieve the sustainability goal for the Subbasin.

  Measurable objectives are goals that the GSP is designed to achieve.

- **Minimum threshold** refers to a numeric value for each sustainability indicator used to define undesirable results.

  Minimum thresholds are quantitative indicators of an unreasonable condition.

- **Interim milestone** refers to a target value representing measurable groundwater conditions, in increments of five years, set by an Agency as part of a Plan.

  Interim milestones are targets such as groundwater elevations that will be achieved every five years to demonstrate progress towards sustainability.

8.2 Sustainability Goal

The sustainability goal of the Monterey Subbasin is to manage groundwater resources for long-term community, financial, and environmental benefits to the Subbasin's residents and businesses. The goal of this GSP is to ensure long-term viable water supplies to local communities at a reasonable cost. In addition, because the Subbasin is hydrologically connected with other Salinas Valley Basin Subbasins, this GSP aims to develop a coordinated approach to groundwater management within this Subbasin and neighboring Subbasins. The Subbasin will achieve long-term sustainability through the implementation of inter- and intra-basin coordination as well as projects and management actions.

Several projects and management actions are included in this GSP and detailed in Chapter 9. These projects and management actions will diversify the Subbasin's water supply portfolio, increase supply reliability, and protect the Subbasin's groundwater resources against seawater intrusion. The Subbasin's historical efforts to invest in water conservation will continue under SGMA.

These management actions and project types include:

- Multi-basin Projects
  - ~~Winter~~Seasonal Release with ASR and Direct Delivery
  - Regional Municipal Supply
  - Multi-benefit Stream Channel Improvements
- Marina-Ord Area Local Projects and Management Actions
  - MCWD Demand Management Measures
  - Stormwater Recharge Management
  - Recycled Water Reuse Through Landscape Irrigation and Indirect Potable Reuse
  - Monitoring Well(s)
- Corral de Tierra Area Local Projects and Management Actions
  - Pumping Allocation and Control
  - Check Dams
  - Recharge from Surface Water Diversions
  - Wastewater Recycling for Reuse
  - Decentralized Residential In-Lieu Recharge Projects
  - Decentralized Stormwater Recharge Projects
  - Increase Groundwater Production in the Upper Corral de Tierra Valley for Distribution to Lower Corral de Tierra Valley (Artesian Well)
- Implementation Actions
  - Support Implementation of the 180/400-Foot Aquifer Subbasin GSP and Seaside Watermaster Actions
  - Deep Aquifers Investigation
  - Support Restrictions on Additional Wells in the Deep Aquifers
  - Adopt 2022/2023 Priority Actions for Deep Aquifers in Absence of New Well Construction Ordinance if Conditions Threaten Sustainability in Near Term
  - Seawater Intrusion Working Group
  - Seawater Intrusion Modeling

- Incorporate Monterey Subbasin Model into the Salinas Valley Integrated Hydrologic Model (SVIHM)
- Well Registration
- Groundwater Extraction Management System (GEMS) Expansion and Enhancement
- Dry Well Notification System
- Water Quality Partnership
- Land Use Jurisdiction Coordination Program
- Arsenic Implementation Action

~~Management Actions:~~

- ~~[LIST TO BE ADDED AFTER CHAPTER 9 IS DEVELOPED]~~

~~Projects:~~

- ~~[LIST TO BE ADDED AFTER CHAPTER 9 IS DEVELOPED]~~

8.3 Achieving Long-Term Sustainability

The GSP addresses long-term groundwater sustainability. Correspondingly, the Subbasin GSAs intend to develop SMCs to avoid undesirable results under future hydrogeologic conditions with long-term, deliberate management of groundwater. The Subbasin GSAs' best understanding of future conditions is based on historical precipitation, evapotranspiration, streamflow, and reasonably anticipated climate change and sea-level rise, which have been estimated based on the best available climate science (DWR, 2018). These parameters underpin the estimated future water budget over the planning horizon (see Section 6.5). Groundwater conditions that are the result of extreme climatic conditions, which are worse than those anticipated based on the best available climate science, do not constitute an undesirable result. As such, SMCs may be modified in the future to reflect observed future climate conditions.

The GSAs will track hydrologic conditions during GSP implementation. These observed hydrologic conditions will be compared to predicted future hydrologic conditions for the Subbasin as presented in this GSP. This information will be used to interpret the Subbasin's performance against SMCs.

Further, since the GSP addresses long-term groundwater sustainability, exceedance of some SMCs during an individual year does not constitute an undesirable result. Pursuant to SGMA Regulations (California Water Code §10721(w)(1)), "Overdraft during a period of drought is not sufficient to establish a chronic lowering of groundwater levels if extractions and groundwater recharge are managed as necessary to ensure that reductions in groundwater levels or storage during a period of drought are offset by increases in groundwater levels or storage during other periods." Therefore, groundwater levels may temporarily exceed minimum thresholds during prolonged droughts, which could be more extreme than those anticipated based on historical data and expected climate change conditions. Such temporary exceedances do not constitute an undesirable result.

The SMCs presented in this current draft Chapter 8 have been developed based on historically observed hydrologic conditions and, in most cases, reasonably anticipated climate change. These SMCs may be updated in future drafts to reflect changes in anticipated climate conditions and climate change based upon groundwater modeling results.

8.4 Management Areas

As introduced in Section 1.4, this GSP establishes two Management Areas within the Subbasin including the Marina-Ord Area and the Corral de Tierra Area. These Management Areas have been developed to facilitate GSP implementation considering the differences in jurisdiction, water use sector, and principal aquifer characteristics described in Chapters 3 through 5.

Per GSP Emergency Regulations §354.20(a), "[m]anagement areas may define different minimum thresholds and be operated to different measurable objectives than the basin at large, provided that undesirable results are defined consistently throughout the basin"; and §354.20 (b) "A basin that includes one or more Management Areas shall describe the following in the Plan… (2) The minimum thresholds and measurable objectives established for each management area and an explanation of the rationale for selecting those values, if different from the basin at large."

This chapter takes a basin-wide approach for establishing undesirable results and identifies the drivers of undesirable results within each management area. The drivers for undesirable results often differ between the Management Areas, which warrant selection of different minimum thresholds and measurable objectives. For example, the primary concern of groundwater management in the Marina-Ord Area is seawater intrusion. Due to the land use characteristics and groundwater conditions in this area, effects that are typically associated with chronic lowering of groundwater levels, such as dewatering of wells, are not likely to occur. However, groundwater elevation SMCs in the Marina-Ord Area need to be established at levels that can control seawater intrusion. The Corral de Tierra Area is generally located further inland, where seawater intrusion not likely to occur. However, the area supports groundwater use by numerous municipal water systems, small water users, and domestic users where chronic lowering of groundwater levels may cause dewatering of wells, increased pumping costs, or reductions in storage that are significant and unreasonable. Therefore, groundwater elevation SMCs in the Corral de Tierra Area need to be established at levels that protect the ability to pump from domestic and small water system wells.

Minimum thresholds and measurable objectives defined in this chapter are developed through close coordination between the two subbasin GSAs to ensure the criteria within one management area do not cause undesirable results in the other. In addition, SMCs identified in this chapter consider SMCs and conditions identified in adjacent subbasins, which are in direct hydraulic communication with the Monterey Subbasin as described in Chapters 4 and 5. Due to the interconnectivity between the Monterey Subbasin and adjacent subbasins, the Monterey Subbasin groundwater elevation minimum thresholds are intended to be consistent with adjacent subbasins and are based on the assumption that SMCs and sustainability goals will be met in the adjacent subbasins. Therefore, continued coordination of SMCs and sustainability goals is critical, as each subbasin's ability to achieve sustainability is affected by the adjacent subbasins' ability to manage their groundwater sustainably. Through implementation, continued monitoring, data collection, additional analysis, and modeling will be used to validate the impact of the SMCs on the Monterey Subbasin and adjacent subbasins to inform the GSAs of compliance and needed adjustments.

Chapter 7 identifies the management area-specific monitoring networks that facilitate monitoring of SMCs defined in this chapter.

8.5 General Process for Establishing Sustainable Management Criteria

MCWD GSA and SVBGSA established a Technical Committee and a Steering Committee for the Monterey Subbasin to facilitate coordination between the two GSAs in development of this GSP. These Committees are established in accordance with the GSAs' Framework Agreement. The Technical Committee consists of GSA staff and consultants, and meets on a biweekly basis. The Technical Committee is the platform for coordinating technical analysis, data sharing, and communication in development of the GSP. The Steering Committee consists of one Board Member and the General Manager of each GSA. The purpose of the Steering Committee is to resolve any issues raised by the Technical Committee and reach consensus between the GSAs.

The SMCs presented in this chapter were developed using publicly available information, hydrogeologic analysis, feedback gathered during public meetings, and coordination between MCWD GSA and SVBGSA via the Monterey Subbasin Technical and Steering Committees.

The general process included:

- Establishing a procedure to SMCs development in the Technical Committee;
- Gathering input and developing preferences for establishing SMCs for each GSA's respective management area, including consultation with stakeholders and discussions within GSA staff;
- Reconciling management area-level input in the Technical Committee;
- Presenting proposed SMCs to GSA governing bodies and stakeholder groups;
- Modifying SMCs based on input from the public, GSA staff, and Board Members.

8.6 Sustainable Management Criteria Summary

Table 8-1 provides a summary of the SMCs for each of the six sustainability indicators. Measurable objectives are the goals that reflect the Subbasin's desired groundwater conditions for each sustainability indicator. These provide operational flexibility above the minimum thresholds. The minimum thresholds are quantitative indicators of the Subbasin's locally defined significant and unreasonable conditions. The undesirable result is a combination of minimum threshold exceedances that show a significant and unreasonable condition across the Subbasin as a whole. This GSP is designed to not only avoid undesirable results, but to achieve the sustainability goals within 20 years, along with interim milestones every 5 years that show progress. The management actions and projects provide sufficient options for reaching the measurable objectives within 20 years and maintaining those conditions for 30 years for all 6 sustainability indicators. The rationale and background for developing these criteria are described in detail in the following sections. The SMCs presented in Table 8-1 are part of the GSA's 50-year management plan: SGMA allows for 20 years to reach sustainability and requires the Subbasin have no undesirable results for the subsequent 30 years.

Table 8-1. Sustainable Management Criteria Summary

Sustainability Indicator	Measurement	Minimum Threshold	Measurable Objective	Undesirable Result	Interim Milestones
Chronic lowering of groundwater levels	Measured through the groundwater elevation representative monitoring well network within each management area	**Marina-Ord Area:** Minimum groundwater elevations historically observed between 1995 and 2015 in the Dune Sand, 180-Foot, 400-Foot, and Deep Aquifers.	**Marina-Ord Area:** Groundwater elevations observed in 2004 in the Dune Sand, 180-Foot, 400-Foot, and Deep Aquifers.	Over the course of any one year, exceedance of more than 20% of groundwater level minimum thresholds 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.	**Whole Subbasin:** Interim milestones are described in Table 8-3 for each RMS well that is defined in Chapter 7.
		Corral de Tierra Area: Groundwater elevations observed in 2015 in the El Toro Primary Aquifer System.	**Corral de Tierra Area:** Groundwater elevations observed in 2008 in the El Toro Primary Aquifer System.		

Sustainability Indicator	Measurement	Minimum Threshold	Measurable Objective	Undesirable Result	Interim Milestones
Reduction in groundwater storage	Measured through the groundwater elevation and seawater intrusion representative monitoring well networks.	**Whole Subbasin:** Minimum thresholds for chronic lowering of groundwater levels and seawater intrusion will be used as a proxy for reduction of groundwater storage minimum threshold.	**Whole Subbasin:** Measurable objectives for chronic lowering of groundwater levels and seawater intrusion will be used as a proxy for reduction of groundwater storage measurable objective.	Over the course of any one year, (1) exceedance of more than 20% of groundwater level minimum thresholds 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 minimum thresholds.	**Whole Subbasin:** Groundwater elevation and seawater intrusion interim milestones described respectively in Table 8-3 and Section 8.9.4.2 will serve as a proxy for reduction of groundwater storage interim milestones.

Sustainability Indicator	Measurement	Minimum Threshold	Measurable Objective	Undesirable Result	Interim Milestones
Seawater intrusion	Measured through seawater intrusion representative monitoring well network.	**Whole Subbasin:** The approximate location in 2015 of the 500 mg/L chloride concentration isocontour in the lower 180-Foot and 400-Foot Aquifers; Approximately 3,500 feet from the coast in the Dune Sand Aquifer, upper 180-Foot Aquifer and Deep Aquifers. This distance is generally consistent with the location of Highway 1 in the Monterey Subbasin and seaward of groundwater extraction wells in the Subbasin. No seawater intrusion in the El Toro Primary Aquifer System.	**Whole Subbasin:** Measurable objective is identical to the minimum threshold.	Any exceedance of the minimum threshold is considered as an undesirable result.	**Whole Subbasin:** Identical to minimum thresholds and measurable objectives. No seawater intrusion above 500 mg/L chloride in RMS wells.

Sustainability Indicator	Measurement	Minimum Threshold	Measurable Objective	Undesirable Result	Interim Milestones
Degraded groundwater quality	Groundwater quality data downloaded annually from state sources.	**Whole Subbasin:** 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. See Table 8-5 for the list of constituents.	**Whole Subbasin:** Measurable objective is identical to the minimum threshold.	Any exceedances of minimum thresholds during any one year as a direct result of projects or management actions conducted pursuant to GSP implementation is considered as an undesirable result.	**Whole Subbasin:** Identical to minimum thresholds and measurable objectives, which represent current conditions
Subsidence	Measured using DWR-provided InSAR data.	**Whole Subbasin:** 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.	**Whole Subbasin:** Measurable objective is identical to the minimum threshold.	Any exceedances of minimum thresholds during any one year due to lowered groundwater elevations is considered as an undesirable result.	**Whole Subbasin:** Identical to minimum thresholds and measurable objectives, which represent current conditions.

Sustainability Indicator	Measurement	Minimum Threshold	Measurable Objective	Undesirable Result	Interim Milestones
Depletion of interconnected surface water (ISW)	Measured through shallow groundwater elevations as a proxy near potential locations of ISW in the ISW representative monitoring well network.	**Whole Subbasin:** Minimum shallow groundwater elevations historically observed between 1995 and 2015 near locations of interconnected surface water.	**Whole Subbasin:** Identical to minimum threshold shallow groundwater elevations.	Any minimum threshold exceeded in a shallow groundwater well near any location of ISW for more than two consecutive years.	**Whole Subbasin:** Identical to minimum thresholds and measurable objectives, which represent current conditions.

8.7 Chronic Lowering of Groundwater Levels SMCs

Chronic lowering of groundwater levels is arguably the most fundamental Sustainability Indicator, as it influences several other key sustainability indicators, including seawater intrusion, reduction of groundwater storage, land subsidence, and interconnected surface water. Groundwater levels are also some of the most readily available and measurable metrics of groundwater conditions, which allows for a systematic, data-driven approach to the development of Sustainable Management Criteria.

8.7.1 Locally Defined Significant and Unreasonable Conditions

Locally defined significant and unreasonable groundwater elevations in the Marina-Ord and Corral de Tierra Areas are identified as follows.

Marina-Ord Area

Significant and unreasonable groundwater elevations in the Marina-Ord Area include:

- Groundwater elevations below those historically observed prior to 2015[51]:
    - Near the coast in the Dune Sand, 180-Foot, and 400-Foot Aquifers (where seawater intrusion was not observed),
    - Near the seawater intrusion front in the lower 180-Foot and 400-Foot Aquifers, and
    - Throughout the Deep Aquifers, because such groundwater elevations could cause lateral or vertical expansion of the existing seawater intrusion extent and/or eventual migration of saline water into Deep Aquifer wells.

As discussed in Section 3.1.6, groundwater use within the Marina-Ord Area is almost exclusively limited to generation of municipal supplies by MCWD. Groundwater elevations are significantly higher than municipal production well screen elevations in all aquifers in the Marina-Ord Area, and there is limited concern regarding the potential dewatering of groundwater production wells. Therefore, groundwater levels that could cause undesirable results associated with other locally relevant sustainability indicators, such as the lateral or vertical expansion of the existing seawater intrusion extent and/or eventual migration of saline water into Deep Aquifer wells, have been used to define groundwater level minimum thresholds in the Marina-Ord Area.

Corral de Tierra Area

Significant and unreasonable groundwater elevations in the Corral de Tierra Area include:

[51] Based upon the historical period (Water Year 2003 through 2017)

- Groundwater elevations at or below those observed in 2015. Lower groundwater elevations could lead to inadequate water production in a significant number of domestic and small water system wells, not only in the Corral de Tierra Area but also in the Laguna Seca subarea of the adjacent Seaside sSubbasin..
- Groundwater elevations that cause undesirable results associated with other locally relevant sustainability indicators, including interconnected surface water and groundwater quality, as described in Section 8.12the sections below.

These significant and unreasonable conditions were determined based on input collected during MCWD stakeholder meetings, SVBGSA Subbasin Planning Committee meetings, and discussions with GSA staff during Subbasin Technical Committee meetings.

8.7.2 Undesirable Results

Undesirable results have been defined within each management area. However, pursuant to the GSP Emergency Regulations, which state that Undesirable Results are to be defined consistently throughout the Subbasin (23 CCR §354.20), the definitions of undesirable results have been coordinated between Management Areas by subbasin GSAs and are described below.

8.7.2.1 Criteria for Determining Undesirable Results

The chronic lowering of groundwater levels undesirable result is a quantitative combination of groundwater level minimum threshold exceedances. For the Subbasin, the undesirable result for chronic lowering of groundwater levels occurs when

> *Over the course of any one year, exceedance of more than 20% of the groundwater level minimum thresholds in either:*
>
> *a. both the Dune Sand Aquifer and Upper 180-Foot Aquifer, or*
> *b. both the Lower 180 Foot and 400 Foot aquifer, or*
> *c. the Deep Aquifers, or*
> *d. the El Toro Primary Aquifer System.*

Since the GSP addresses long-term groundwater sustainability, exceedances of groundwater levels minimum thresholds during a drought do not constitute an undesirable result. Pursuant to GSP SGMA Regulations (California Water Code §10721(w)(1)), "Overdraft during a period of drought is not sufficient to establish a chronic lowering of groundwater levels if extractions and groundwater recharge are managed as necessary to ensure that reductions in groundwater levels or storage during a period of drought are offset by increases in groundwater levels or storage during other periods." Therefore, groundwater levels may temporarily exceed minimum thresholds during droughts, and do not constitute an undesirable result, as long as groundwater levels rebound.

Setting undesirable results based on an allowable percentage of minimum threshold exceedances provides flexibility in defining sustainability. Increasing the percentage of allowed minimum threshold exceedances allows for greater localized fluctuations in water levels but may lead to significant and unreasonable conditions for some beneficial users. Reducing the percentage of allowed minimum threshold exceedances ensures strict adherence to minimum thresholds but reduces operational flexibility due to unanticipated hydrogeologic conditions. The undesirable result is set at 20% within each principal aquifer or group of principal aquifers. The percentages balance the interests of beneficial users with the practical aspects of groundwater management under uncertainty and apply to both Management Areas.

This undesirable result definition refers to and relies on minimum thresholds established for each principal aquifer, or group of principal aquifers. As discussed further below and in Chapter 7, minimum thresholds for groundwater levels are set at 35 Representative Monitoring Sites in the Marina-Ord Area and 13 Representative Monitoring Sites in the Corral de Tierra Area. Within the Marina-Ord Area and the Reservation Road portion of the Corral de Tierra Area where the hydrogeological setting is similar, it is considered an undesirable result for chronic lowering of groundwater levels if minimum thresholds are exceeded in 20% or more of the Representative Monitoring Sites within either (a) the Dune Sand and Upper 180-Foot Aquifer, or (b) the Lower 180-Foot and 400-Foot Aquifers, or (c) the Deep Aquifers. Undesirable results for chronic lowering of water levels within the Marina-Ord Area and the Reservation Road portion of the Corral de Tierra Area are set based on minimum thresholds within these groups of aquifers, because of how they are hydraulicly connected near the coast where the greatest potential for additional seawater intrusion exists and the RMS networks are primarily focused. For example, groundwater levels within the Dune Sand Aquifer and Upper 180-Foot are very similar in coastal wells due to the pinching out of the Fort Ord Salinas Valley Aquitard (FO-SVA)[52]. Similarly, groundwater elevations in the lower 180-Foot Aquifer are similar to those measured in the 400-Foot Aquifer across much of the Marina-Ord Area.

The 20% limit on minimum threshold exceedances in the undesirable result allows for:

(a) A total of 3 exceedance out of the 16 existing RMS wells within the Dune Sand Aquifer and upper 180-Foot Aquifer,

(b) A total of 2 exceedances out of the 9 existing RMS wells within the Lower 180-Foot Aquifer and 400-Foot Aquifer,

(c) A total of 2 exceedances out of the 10 existing RMS wells within the Deep Aquifer, and

(d) A total of 3 exceedances out of the 13 existing RMS wells within the El Toro Primary Aquifer System.

[52] See discussion in Chapter 5

This number of exceedances is considered reasonable given the hydrogeologic uncertainty of the Subbasin. As the monitoring system grows, additional exceedances will be allowed. One additional exceedance will be allowed for approximately every five new monitoring wells.

8.7.2.2 Potential Causes of Undesirable Results

Conditions that may lead to an undesirable result include the following:

- **Unsustainable groundwater management in adjacent subbasins**. Due to the hydrologic connectivity between the Subbasin and other Salinas Valley Basin Subbasins, increased groundwater extraction or reduced recharge in either the Subbasin or the greater Salinas Valley Basin may lead to undesirable results.
- **Localized pumping clusters**. Even if regional pumping is maintained within the sustainable yield, clusters of high-capacity wells may cause excessive localized drawdowns that lead to undesirable results.
- **Expansion of *de minimis* pumping**. Individual *de minimis* pumpers do not have a significant impact on groundwater elevations. However, many *de minimis* pumpers are often clustered in specific residential areas. Pumping by these *de minimis* users is not regulated under this GSP. Adding additional domestic *de minimis* pumpers in these areas may result in excessive localized drawdowns and undesirable results.
- **Expansion of municipal or agricultural pumping**. Additional extractions for municipal or agricultural purposes, without an offsetting increase in recharge, cross-boundary flows and/or projects will reduce groundwater elevations.
- **Departure from the GSP's climatic assumptions, including extensive, unanticipated drought**. Minimum thresholds were established based on historical groundwater elevations and reasonable estimates of future climatic conditions and groundwater elevations. Departure from the GSP's climatic assumptions or extensive, unanticipated droughts may lead to excessively low groundwater elevations and undesirable results.

An undesirable result for chronic lowering of groundwater levels currently exists because during recent fall 2020 monitoring, or 2019 if fall 2020 was not available:

(1) groundwater elevations within the Marina-Ord Area exceeded minimum thresholds in

a. 2 out of 9 existing RMS wells (22%) in the lower 180-Foot Aquifer, 400-Foot Aquifer, and

b. 7 out of 10 existing RMS wells (70%) in the Deep Aquifers; and

(2) Groundwater elevations within the Corral de Tierra Area exceeded minimum thresholds in 78 out of 13 existing RMS wells (5461%).

8.7.2.3 Effects on Beneficial Users and Land Uses

As discussed in Section 3.1.6, groundwater use within the Marina-Ord Area is almost exclusively limited to generation of municipal supplies by MCWD. There is one recognized disadvantaged community (DACs) within the subbasin as shown on Figure 2-1. There are several recognized disadvantaged communities (DACs) within the Subbasin within the urban areas of the City of Marina. Thisese communityies reliesy on water services provided by MCWD.

As discussed above, undesirable results caused by chronic lowering of groundwater levels in the Marina-Ord Area are primarily associated with the expansion of seawater intrusion and other locally relevant sustainability indicators. These sustainability indicators have been considered when defining groundwater level minimum thresholds in the Marina-Ord Area.

The primary potential effects of undesirable results caused by chronic lowering of groundwater levels in the Corral de Tierra Area include dewatering of domestic and small water system wells, increased energy costs, or interference with other locally relevant sustainability indicators, which have been used to define groundwater level minimum thresholds in the Corral de Tierra Area. Similar results could occur in the adjacent Laguna Seca subarea from chronic lowering of groundwater levels in the Corral de Tierra Asubarea. Allowing multiple exceedances can have detrimental effects on beneficial users if more than one exceedance take place in a small geographic area. Allowing 20% exceedances in the Corral de Tierra Area are only reasonable if the exceedances are spread out across the management area, and as long as any one well does not regularly exceed its minimum threshold. If the exceedances are clustered in a small area, it will indicate that significant and unreasonable effects are being born by a localized group of landowners and water users and should be evaluated.

8.7.3 Minimum Thresholds

Minimum thresholds for chronic lowering of groundwater levels ("groundwater elevation minimum thresholds") in the **Marina-Ord Area** are defined as follows:

> *Minimum groundwater elevations historically observed between 1995 and 2015 in the Dune Sand, 180-Foot, 400-Foot, and Deep Aquifers.*

Groundwater elevation minimum thresholds in the **Corral de Tierra Area** are defined as follows:

> *Groundwater elevation observed in 2015 in the El Toro Primary Aquifer System.*

Groundwater elevation measurements collected during the fourth quarter (i.e., October, November, December) are used to establish minimum thresholds and measurable objectives in the Subbasin and will be used in the future for comparison to these thresholds. This methodology is (1) consistent with the methodology used in the adjacent 180/400-Foot Aquifer Subbasin; and (2) considers the existing monitoring schedule for the majority of RMS wells. The U.S. Army monitors 26 of the RMS wells once every quarter; MCWRA monitors 19 of the RMS wells between November and December as part of its annual groundwater elevation monitoring program; and the Seaside Watermaster has eight of the RMS wells monitored on a quarterly or more frequent basis.

Minimum thresholds for each well within the groundwater elevation representative monitoring network are provided in Table 8-2. Maps showing minimum thresholds and measurable objectives for each RMS are included in Appendix 8-A.

Table 8-2. Chronic Lowering of Groundwater Elevations Minimum Thresholds and Measurable Objectives

Monitoring Site	Aquifer	Minimum Threshold (ft NAVD88)	Measurable Objective (ft NAVD88)
Marina-Ord Area			
MW-BW-28-A	Dune Sand Aquifer	63.7	70.3
MW-BW-49-A	Dune Sand Aquifer	8.9	11.3
MW-BW-81-A	Dune Sand Aquifer	8.2	10.0
MW-BW-82-A	Dune Sand Aquifer	7.9	9.5
MW-OU2-13-A	Dune Sand Aquifer	89.6	94.4
MW-OU2-32-A	Dune Sand Aquifer	7.2	8.1
MW-OU2-34-A	Dune Sand Aquifer	4.7	6.6
CDM MW-1 Beach	Upper 180-Foot Aquifer	3.3	3.3
MW-02-05-180	Upper 180-Foot Aquifer	6.5	8.4
MW-02-10-180	Upper 180-Foot Aquifer	6.5	7.3
MW-02-13-180M	Upper 180-Foot Aquifer	6.0	6.8
MW-02-13-180U	Upper 180-Foot Aquifer	6.8	7.3
MW-12-07-180	Upper 180-Foot Aquifer	6.1	7.0
MW-B-05-180	Upper 180-Foot Aquifer	-8.0	-3.4
MW-BW-55-180	Upper 180-Foot Aquifer	-6.4	-5.7
MW-OU2-29-180	Upper 180-Foot Aquifer	-9.0	-7.2
MW-12-12-180L	Lower 180-Foot Aquifer	3.3	3.8
MW-BW-04-180	Lower 180-Foot Aquifer	-11.0	-11.0
MW-OU2-66-180	Lower 180-Foot Aquifer	-10.0	-9.2
TEST2	Lower 180-Foot Aquifer	-11.9	-10.6
MP-BW-42-295	Lower 180-Foot, 400-Foot Aquifer	-~~13.3~~8.9	-8.1
MP-BW-50-289	Lower 180-Foot, 400-Foot Aquifer	-8.4	-7.1
MPWMD#FO-10S	400-Foot Aquifer	-10.3	~~-0.1~~-3.0

Monitoring Site	Aquifer	Minimum Threshold (ft NAVD88)	Measurable Objective (ft NAVD88)
MPWMD#FO-11S	400-Foot Aquifer	-25.9	-6~~3~~.4
MW-OU2-07-400	400-Foot Aquifer	-6.6	-4.2
014S001E24L002M	Deep Aquifers	-29.6	-20.8
014S001E24L003M	Deep Aquifers	-6.8	3.5
014S001E24L004M	Deep Aquifers	-34.7	-21.1
014S001E24L005M	Deep Aquifers	-26.6	-6.0
14S02E33E01	Deep Aquifers	-43.8	-29.3
14S02E33E02	Deep Aquifers	-21.1	-13.9
MPWMD#FO-10D	Deep Aquifers	-10.6	-~~0.9~~3.8
MPWMD#FO-11D	Deep Aquifers	-4.8	~~6.2~~3.3
PZ-FO-32-910	Deep Aquifers	-44.1	-19.7
Sentinel MW #1	Deep Aquifers	-25.4	-18.8
Corral de Tierra Area			
15S/02E-25C01	El Toro Primary Aquifer System	23.0	33.0
15S/03E-18P01	El Toro Primary Aquifer System	-46.4	-28.4
15S/03E-20R50	El Toro Primary Aquifer System	29.0	39.0
16S/02E-01M01	El Toro Primary Aquifer System	291.5	301.5
16S/02E-02G01	El Toro Primary Aquifer System	294.9	304.9
16S/02E-02H01	El Toro Primary Aquifer System	278.9	288.9
16S/02E-03A01	El Toro Primary Aquifer System	227.0	232.0
16S/02E-03F50	El Toro Primary Aquifer System	220.7	225.7
16S/02E-03H01	El Toro Primary Aquifer System	210.1	220.1
16S/02E-03H02	El Toro Primary Aquifer System	221.5	226.5
16S/02E-03J50	El Toro Primary Aquifer System	193.3	210.1
Robley Deep (South)	El Toro Primary Aquifer System	169.8	183.5
Robley Shallow (North)	El Toro Primary Aquifer System	245.2	255.2

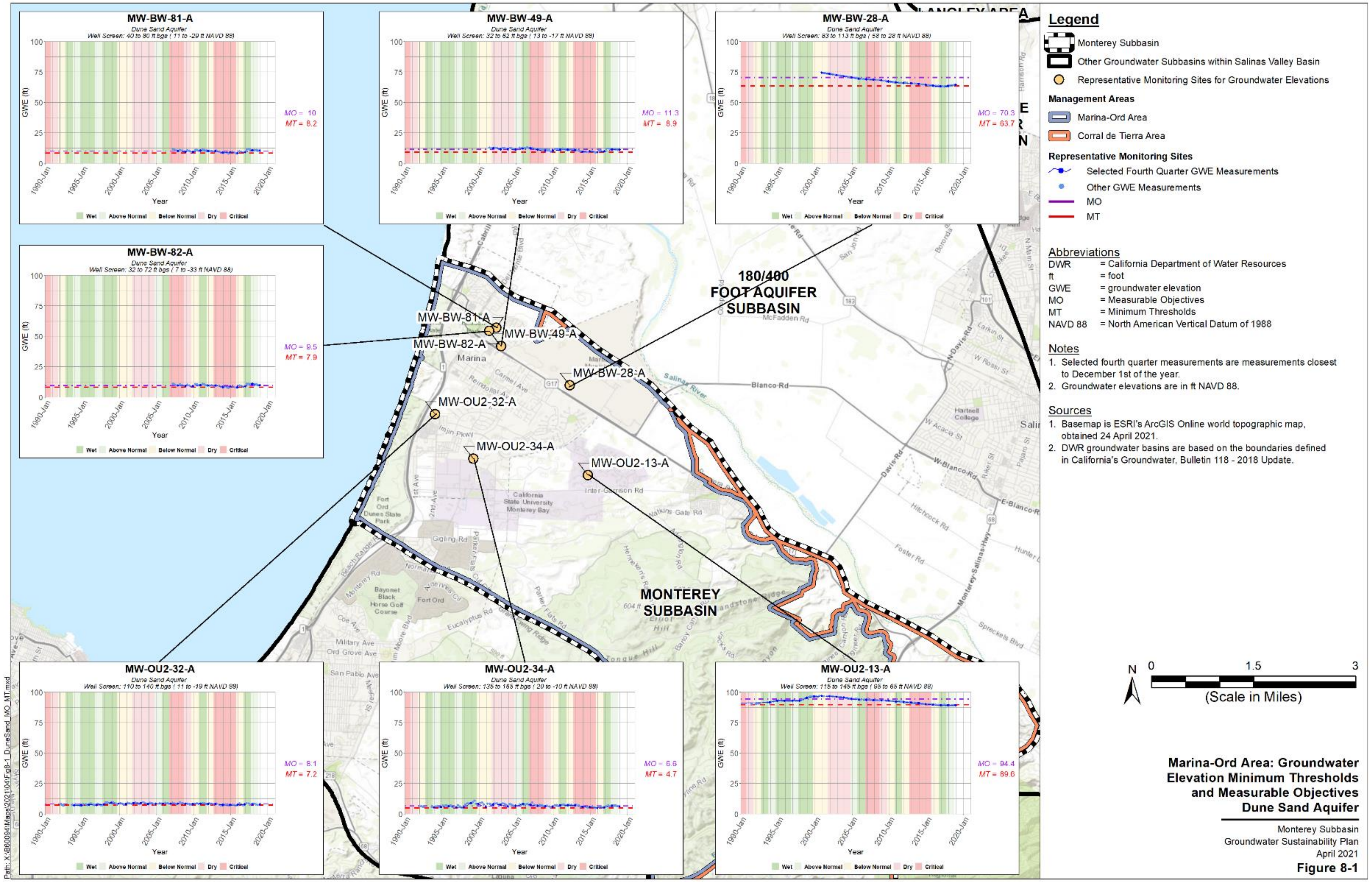


Figure 8-1. Marina-Ord Area: Groundwater Elevation Minimum Thresholds and Measurable Objectives Dune Sand Aquifer

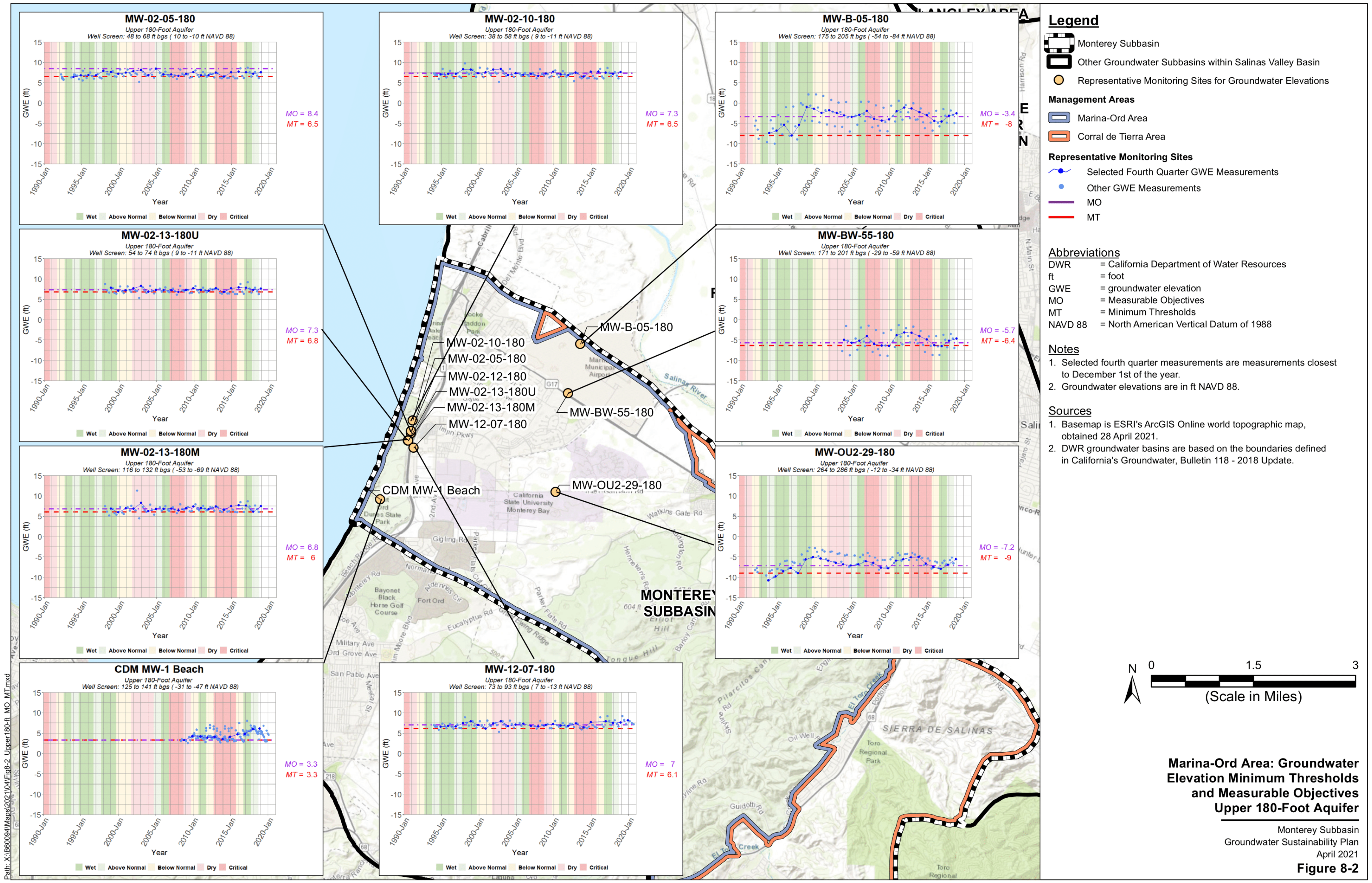


Figure 8-2. Marina-Ord Area: Groundwater Elevation Minimum Thresholds and Measurable Objectives, Upper 180-Foot Aquifer

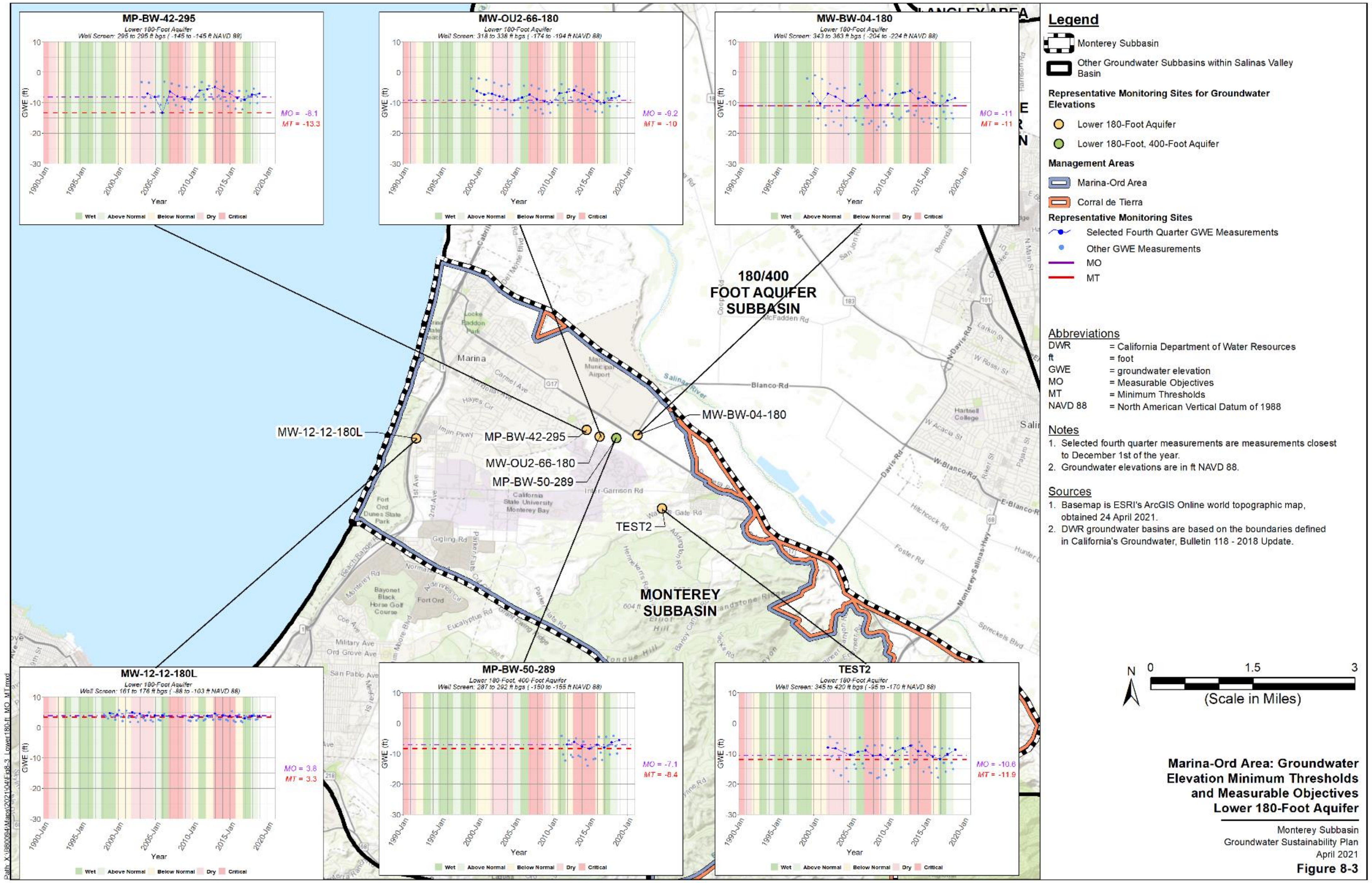


Figure 8-3. Marina-Ord Area: Groundwater Elevation Minimum Thresholds and Measurable Objectives, Lower 180-Foot Aquifer

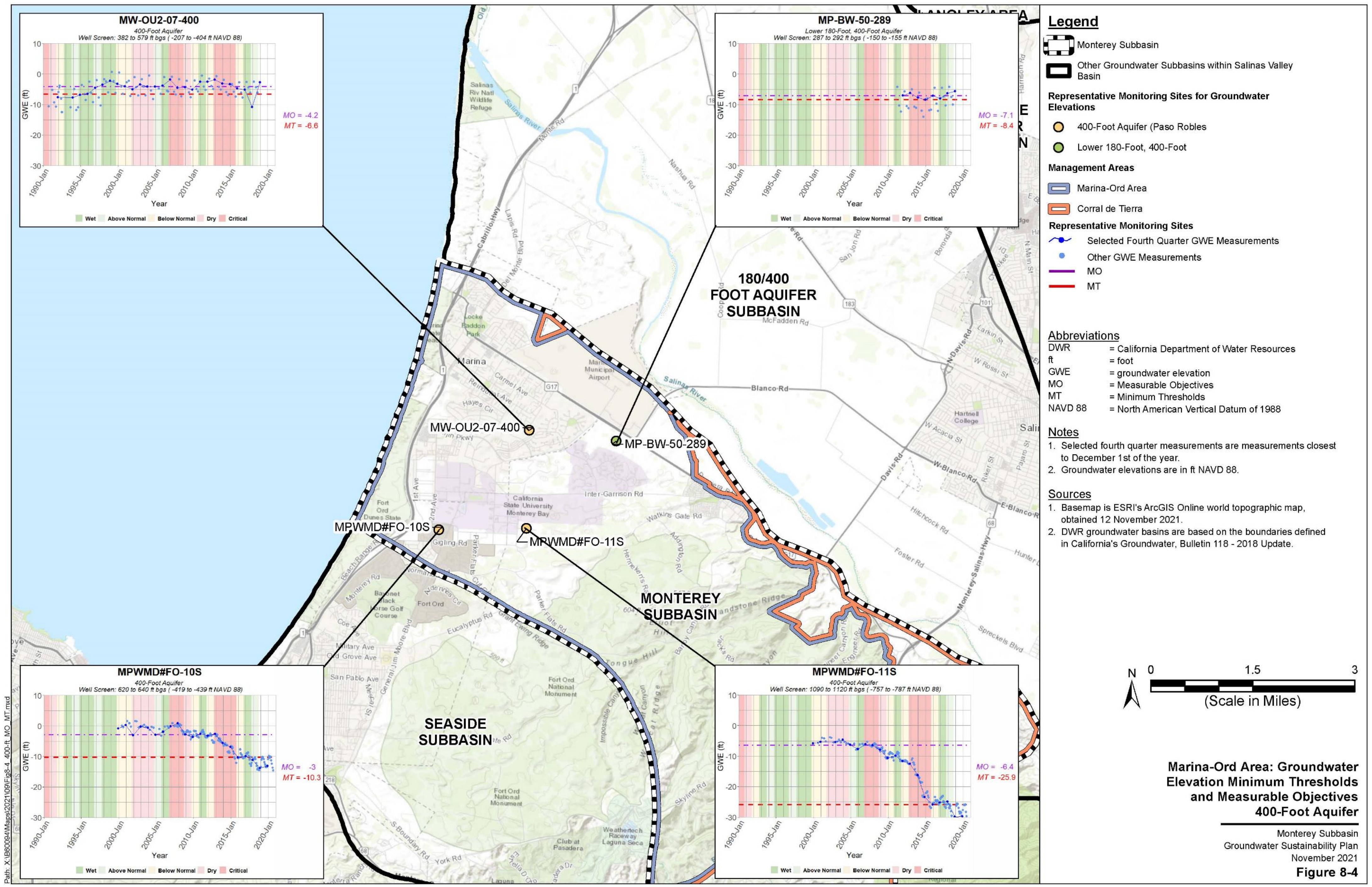


Figure 8-4. Marina-Ord Area: Groundwater Elevation Minimum Thresholds and Measurable Objectives, 400-Foot Aquifer

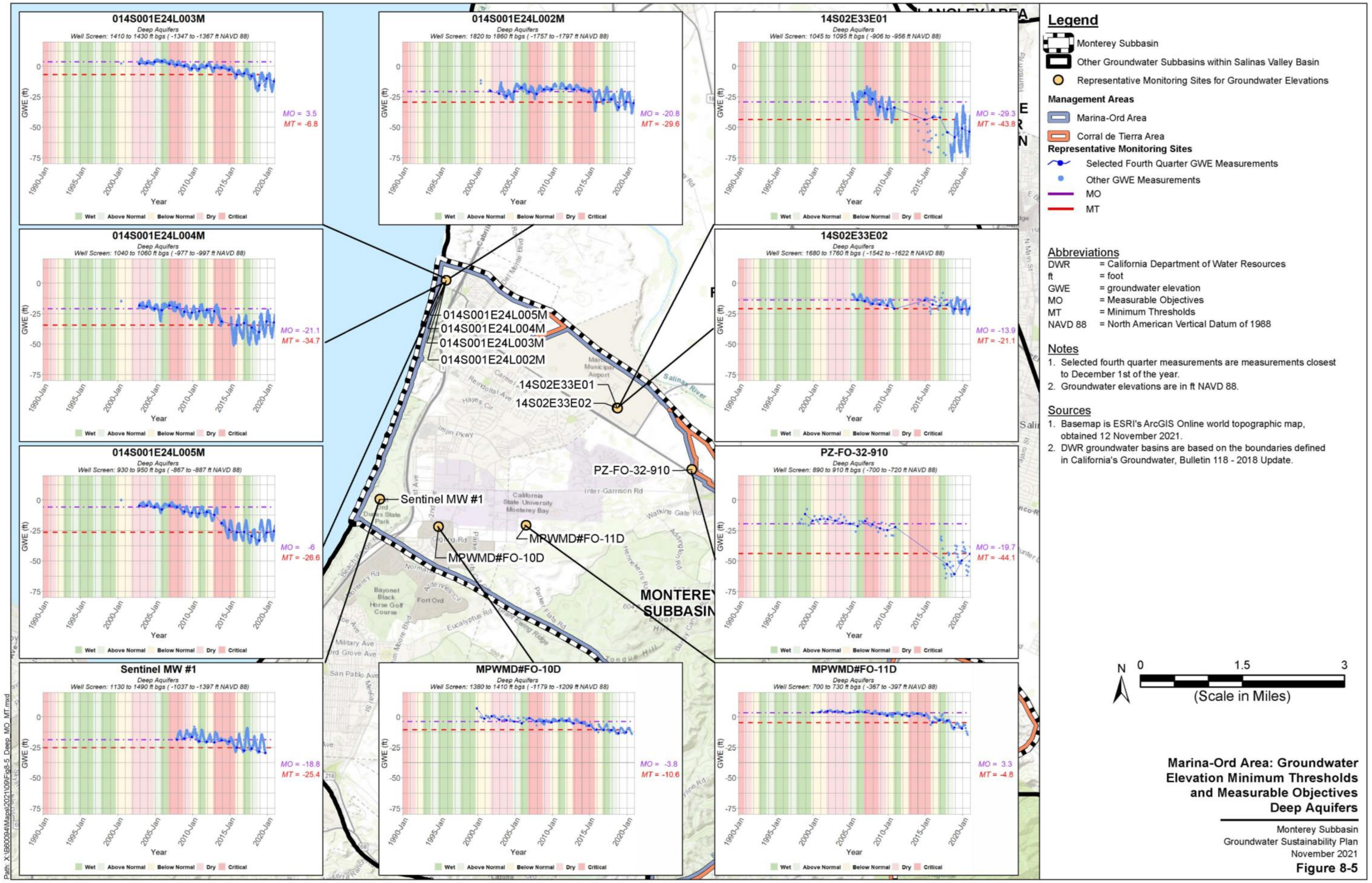


Figure 8-5. Marina-Ord Area: Groundwater Elevation Minimum Thresholds and Measurable Objectives, Deep Aquifers

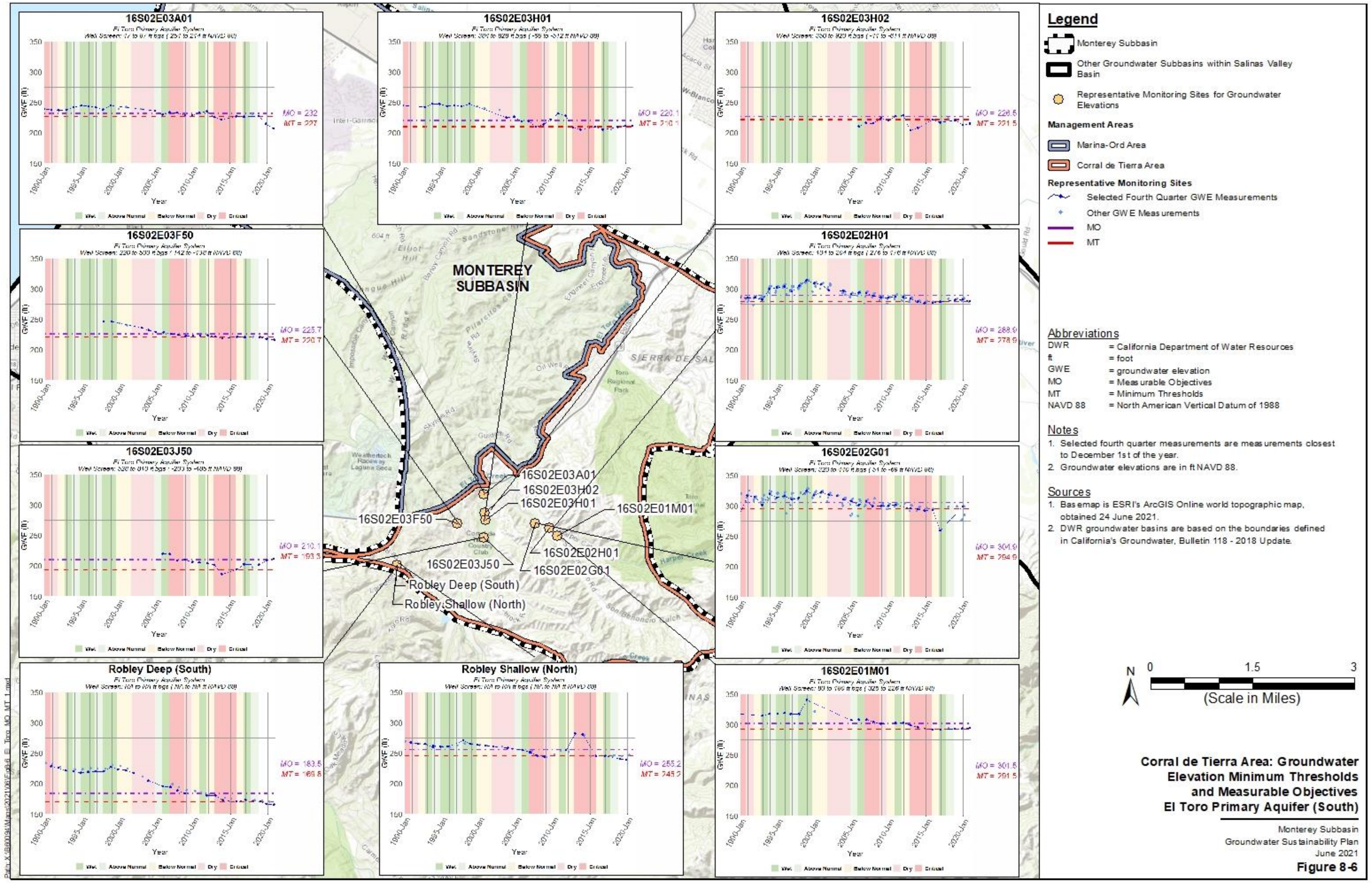


Figure 8-6. Corral de Tierra Area: Groundwater Elevation Minimum Thresholds and Measurable Objectives, El Toro Primary Aquifer (South)

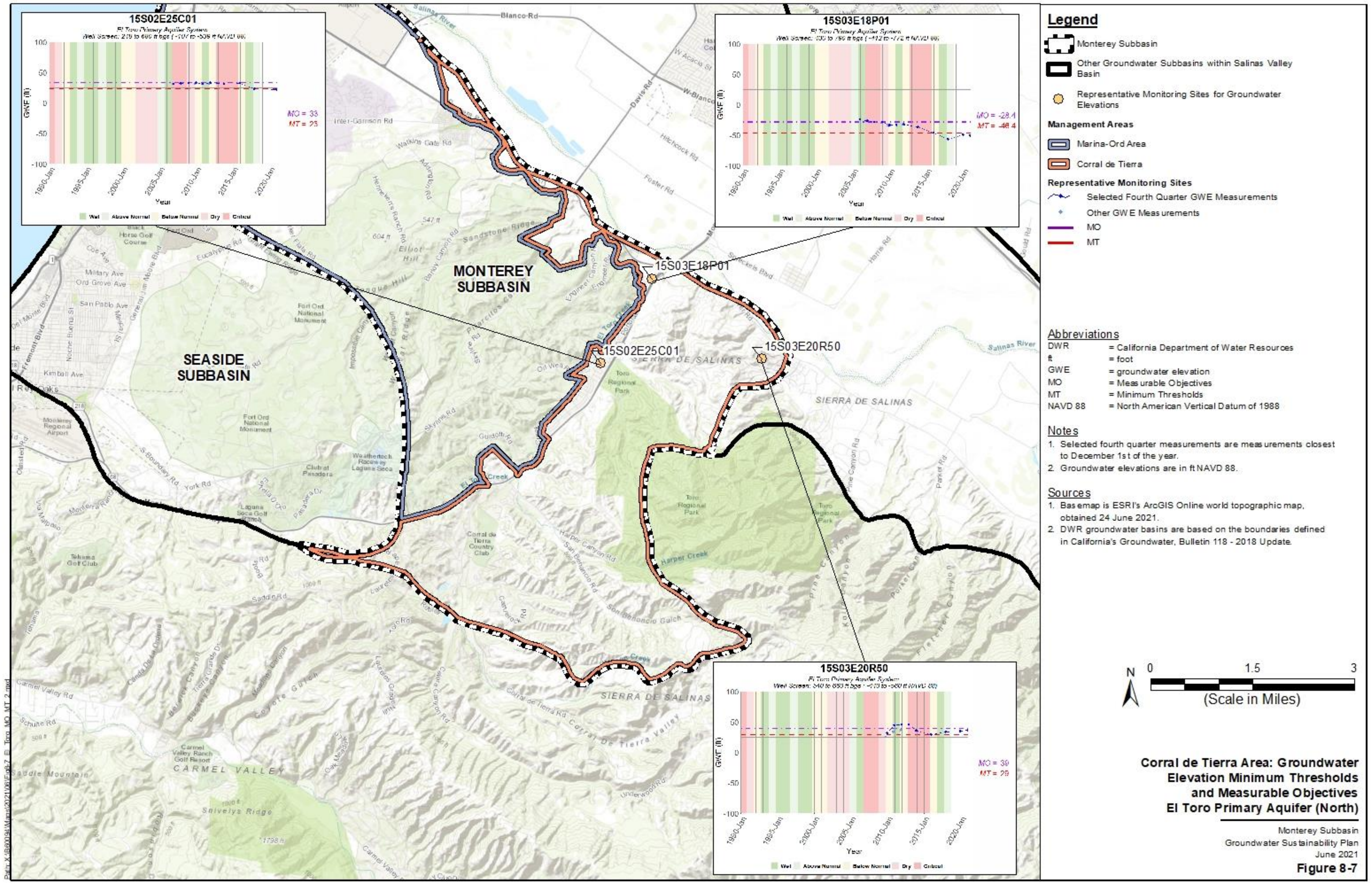


Figure 8-7. Corral de Tierra Area: Groundwater Elevation Minimum Thresholds and Measurable Objectives, El Toro Primary Aquifer (North)

8.7.3.1 Information and Methodology Used to Establish Minimum Thresholds and Measurable Objectives

A similar process is used to develop minimum thresholds and measurable objectives for each Management Area.

Consistent with the GSP Emergency Regulations §354.28(c), the definition of groundwater elevation minimum thresholds is based on considerations of historical groundwater elevation trends, water year types, projected water use in Management Areas, and relationships with other sustainability indicators.

The information and criteria relied on to establish minimum thresholds and measurable objectives in the Marina-Ord Area include:

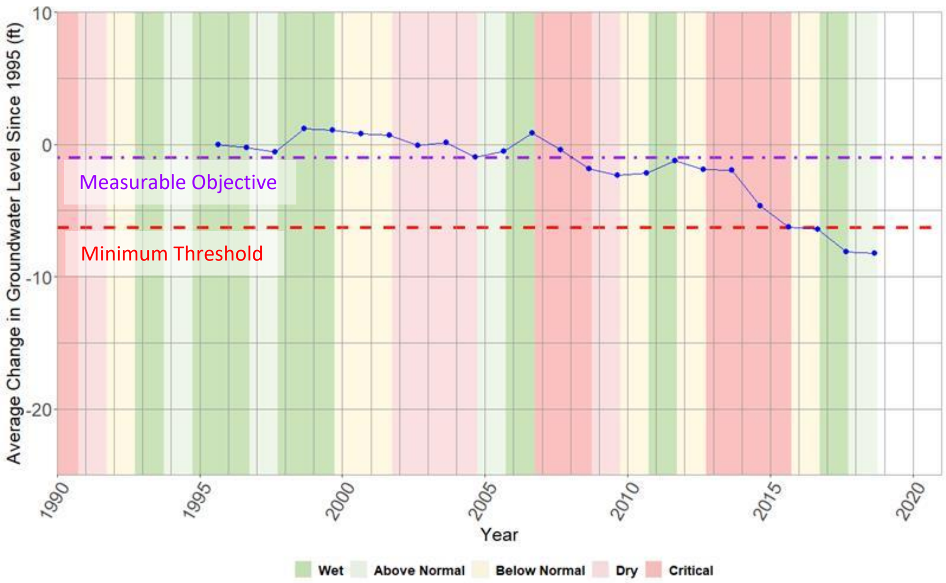
- Historical water level data from the selected RMS wells, each of which has a long-term historical water level record;
- Proximity to the seawater intrusion extent for consideration of seawater intrusion impacts;
- Minimum thresholds or levels of management established in the adjacent subbasins; and
- Well construction information.

As discussed in the preceding sections, the potential effects of undesirable results caused by chronic lowering of groundwater levels in the Marina-Ord Area are primarily associated with the expansion of seawater intrusion. The observed lateral extent of seawater intrusion within the Subbasin appears to have been generally stable within the 180- and 400-Foot Aquifers between 1995 and 2015. As such, minimum thresholds have been set based upon minimum groundwater elevations observed between 1995 and 2015 in the 180- and 400 Foot aquifers. Seawater intrusion is additionally monitored and managed pursuant to seawater intrusion SMCs (Section 8.9 below) to verify seawater intrusion does expand within the Subbasin due to sea-level rise and/or changes in the groundwater gradient.

Seawater intrusion has not been observed in the Deep Aquifer to date. However, groundwater elevations have been declining and are significantly below sea level. As discussed in Section 5.1.3.1, the declining groundwater elevations in the Deep Aquifer may be causing groundwater elevations to fall within the 400-Foot Aquifer in the southwestern portion of the Marina-Ord Area (i.e., near wells MPWMD#FO-10S and MPWMD#FO-11S. However, as stated in Section 5.1.3.1, the actual cause could not be confirmed due to the absence of adequate groundwater level and groundwater quality data in this area, which has been identified as a data gap ~~in that area which~~ and will be filled during GSP implementation~~.~~. Although there is some uncertainty whether the Deep Aquifer is subject to seawater intrusion from the ocean, continued decline of groundwater elevations in the Deep Aquifers could increase the risk of seawater intrusion and may eventually cause vertical migration of saline water from overlying aquifers into the Deep Aquifers. As such, minimum thresholds for the Deep Aquifers are set to historically observed minimum groundwater elevations between 1995 and 2015, which are equivalent to the groundwater elevations observed in 2015 for most Deep Aquifer wells.

In order to evaluate the reasonableness of the proposed minimum thresholds and measurable objectives, the GSAs plotted these values on monitoring well hydrographs. They visually inspected each hydrograph to check if the minimum thresholds and measurable objectives are appropriate. If an RMS well did not have measurements from 1995 through 2015, the SMCs were established considering groundwater elevation trends in the principal aquifers and the closest year when groundwater elevation data is available.

Figure 8-8 shows the cumulative average change in groundwater levels for all RMS wells in the Marina-Ord Area since 1995. Given that groundwater elevations have been steady in the shallower aquifers since 1995, averaged downward groundwater elevations trends in the Marina-Ord Area are primarily driven by downward elevation trends in the Deep Aquifers' wells as well as MPWMD#FO-10S and MPWMD#FO-11S located in the southwestern portion of the Marina-Ord Area that are potentially connected to the Deep Aquifers.



Note: Water year type designation based on PRISM climate data for the Monterey Subbasin, obtained from https://prism.oregonstate.edu/.

Figure 8-8. Cumulative Average Groundwater Elevation Change Since 1995 with Measurable Objective and Minimum Threshold for the Marina-Ord Area

As discussed in Chapter 5, conditions in the Deep Aquifers are closely connected to those in the adjacent 180/400-Foot Aquifer Subbasin where new production wells have been installed immediately north of the Marina-Ord Area. Rates of groundwater extraction from the Deep Aquifers by MCWD have generally been consistent since extraction from this aquifer was initiated in the late 1980s. After an initial drop in groundwater elevations within the Deep Aquifers at the initiation of groundwater extraction by MCWD, groundwater elevations in this aquifer stabilized within the Monterey Subbasin through approximately 2004. However, increases in the total rate of groundwater extraction from the Deep Aquifers since 2004 have caused groundwater elevations in the Deep Aquifers to decline.

Due to the interconnectivity between the Marina-Ord Area and the 180/400-Foot Aquifer Subbasin principal aquifers, each subbasin's ability to achieve sustainability is also affected by the adjacent subbasins' ability to manage to their respective established minimum thresholds, measurable objectives, and groundwater sustainability goals. Therefore, the Subbasins have taken a coordinated approach to SMCs development. However, no monitoring wells are currently identified in the Deep Aquifers immediately north of the Marina-Ord Area in the 180/400-Foot Aquifer GSP. SVBGSA is working to fill this data gap. As it does so, the minimum thresholds for additional Deep Aquifer monitoring sites should consider conditions and SMCs in the Monterey Subbasin. In addition, the direction of groundwater gradient along the seawater intrusion front in the Marina-Ord Area will be monitored and evaluated annually (see methodology in Chapter 7). Future modification of SMCs may be required in order for both subbasins to achieve sustainability.

The information and criteria relied on to establish the minimum thresholds and measurable objectives in the Corral de Tierra Area include:

- Feedback from discussions with the Subbasin Committee on challenges and goals
- Historical groundwater elevation data and hydrographs from wells monitored by the Monterey County Water Resources Agency (MCWRA) and Seaside Basin Watermaster
- Maps of current and historical groundwater elevation data
- Analysis of the impact of groundwater elevations on domestic wells

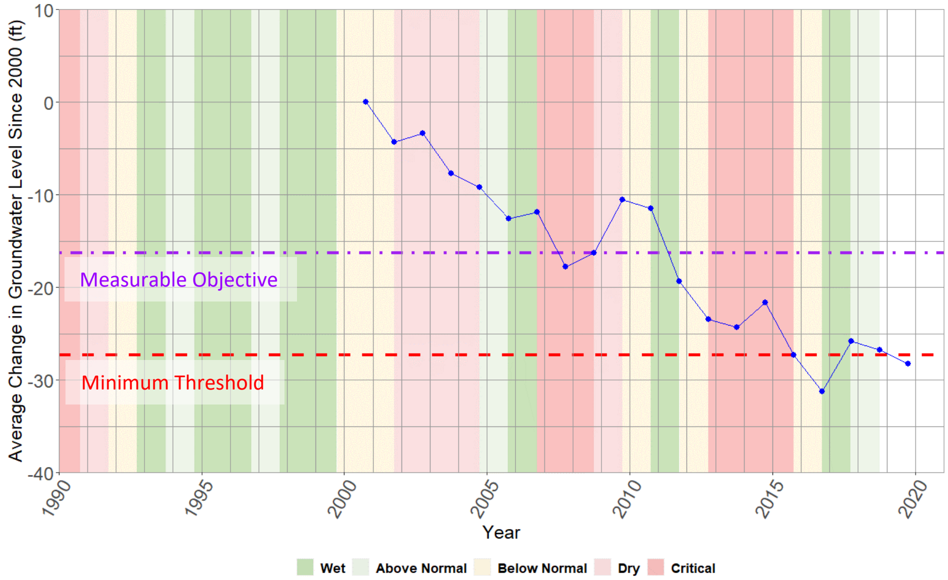
The general steps for developing minimum thresholds and measurable objectives were:

1. The Subbasin Planning Committee selected an approach and criteria for setting the groundwater elevation minimum thresholds and measurable objectives.
2. SVBGSA developed an average groundwater elevation change hydrograph to select representative years that could define minimum thresholds and measurable objectives for the Corral de Tierra Area. Groundwater elevations like those experienced during the representative climatic cycle between 2000 and 2015 were used to identify minimum thresholds and measurable objectives to ensure that they were achievable under reasonably expected climatic conditions.

The average groundwater elevation change hydrograph with minimum threshold and measurable objectives lines for the Corral de Tierra Area are shown on Figure 8-9. The average 2015 groundwater elevations in the Corral de Tierra Area are considered significant and unreasonable. When looking at the cumulative groundwater elevation changes within the representative climatic cycle (Figure 8-9), the historical lowest elevations occurred in 2016, not in 2015. To avoid this extreme low, the minimum thresholds were therefore set to 2015 groundwater elevations. The measurable objective is set to 2008 groundwater elevations, which is an achievable goal for the Subbasin under reasonably expected climatic conditions.

SVBGSA identified the appropriate minimum thresholds and measurable objectives on the respective monitoring well hydrographs. Each hydrograph was visually inspected to check if the minimum threshold and measurable objective were reasonable. If an RMS did not have measurements from the minimum threshold or measurable objective years, the SMCs were interpolated from the groundwater elevation contours. The RMS location was intersected with groundwater elevation contour maps to estimate the minimum thresholds and measurable objectives. Moreover, if the SMCs seemed unreasonable for an RMS, they were adjusted based on historical water levels and groundwater elevation trends seen in surrounding wells. The interpolated or adjusted minimum thresholds and measurable objectives are indicated by an asterisk in Table 8-2.

The minimum threshold contour map, along with the monitoring network wells, are shown on Figure 8-10 for the Corral de Tierra Area.



Note: Water year type designation based on PRISM climate data for the Monterey Subbasin, obtained from https://prism.oregonstate.edu/.

Figure 8-9. Cumulative Average Groundwater Elevation Change Since 2000 with Measurable Objective and Minimum Threshold for the Corral de Tierra Area

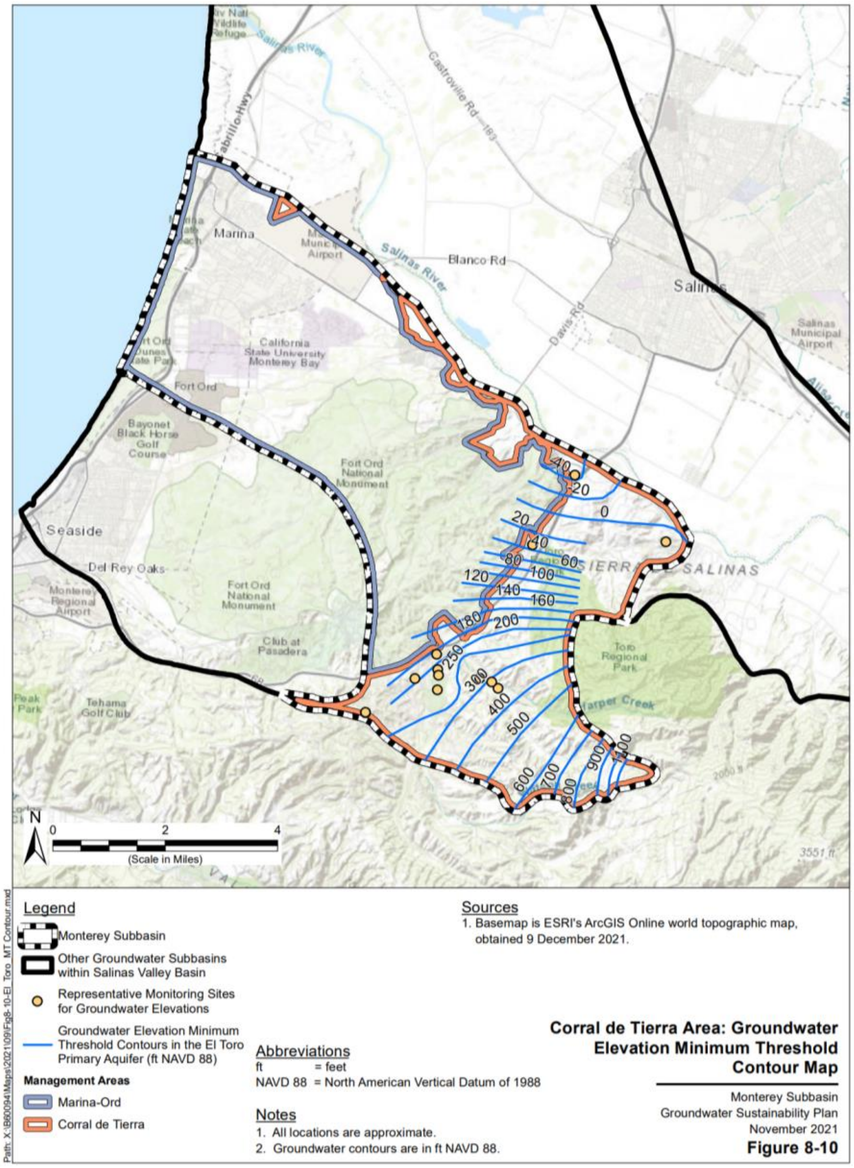


Figure 8-10. Corral de Tierra Area Groundwater Elevation Minimum Threshold Contour Map

8.7.3.2 Minimum Thresholds Impact on Domestic Wells

There is no known domestic use in the Marina-Ord Area. Land uses in this area are either urban, where well construction restrictions are imposed by the City of Marina and Monterey County, or open space. Additionally, groundwater elevation minimum thresholds in the shallower Dune Sand and 180-Foot Aquifers have been defined within their historical range of groundwater elevations, which has been steady for more than two decades. Therefore, minimum thresholds for groundwater elevation in the Marina-Ord Area are unlikely to impact domestic wells which are typically completed at shallower depths.

In the Corral de Tierra Area, groundwater elevation minimum thresholds are compared to the range of domestic well depths using DWR's Online System for Well Completion Reports (OSWCR) database. This check was done to assure that the minimum thresholds maintain operability in a reasonable percentage of domestic wells. The proposed minimum thresholds for groundwater elevation do not necessarily protect all domestic wells because it is impractical to manage a groundwater basin in a manner that fully protects the shallowest wells. The average computed depth of domestic wells in the Subbasin is 391.8 feet using data from the OSWCR database.

While this approach is reasonable, there are some errors that add inaccuracy to the analysis. These include:

- The OSWCR database may include wells that have been abandoned or destroyed, and therefore will have no detrimental impacts from lowered groundwater elevations.
- Domestic wells drilled prior to 1995 may no longer be in use, particularly if residents switched to small water systems.
- Some domestic wells may draw water from shallow, perched groundwater that is not managed in this GSP.
- Some wells in the OSWCR database are not accurately located, and therefore the estimated depth to water may not be accurate.
- The depth to water is derived from a smoothly interpolated groundwater elevation contour map. Errors in the map may result in errors in groundwater elevation at the selected domestic wells.

Given the limitations listed above, the analysis included 19 wells that had accurate locations and were drilled after 1994 out of the total 169 domestic wells in the OSWCR database for this area. In the Corral de Tierra Area, 100% of the domestic wells should have at least 25 feet of water in them to remain operable if groundwater elevations are at minimum thresholds. Therefore, the minimum thresholds appear to be reasonably protective for domestic users.

8.7.3.3 Relationship to Other Sustainability Indicators

Groundwater elevation minimum thresholds can influence other sustainability indicators. The Subbasin GSAs reviewed the relationship between groundwater level minimum thresholds and the other sustainability indicators and verified that these minimum thresholds will limit undesirable results for other sustainability indicators. As discussed above, the groundwater level minimum thresholds have primarily been established to limit seawater intrusion and maintain adequate groundwater storage within the Subbasin. These groundwater level minimum thresholds are also consistent with minimum thresholds established for:

- depletion of interconnected surface waters in wells proximate to such areas, and
- subsidence, as they are set above historical groundwater levels.

In this subbasin, there is no clear correlation between groundwater levels and groundwater quality.

8.7.3.4 Effects of Minimum Threshold between Management Areas

The minimum thresholds for each management area have been developed in a coordinated matter through discussions within the Subbasin Technical Committee. Because the minimum thresholds in each management area are defined at levels generally representative of 2015 conditions in all areas where water levels are declining, they will not cause undesirable results in the other management area.

8.7.3.5 Effect of Minimum Thresholds on Neighboring Basins and Subbasins

The Monterey Subbasin has two neighboring subbasins within the Salinas Valley Groundwater Basin:

- The 180/400-Foot Aquifer Subbasin to the north; and
- The Seaside Subbasin to the south.

The GSAs coordinating the Monterey Subbasin GSP are the same GSAs covering the adjacent 180/400-Foot Aquifer Subbasin. The GSAs have been coordinating the development of minimum thresholds and measurable objectives for the 180-Foot Aquifer and the 400-Foot Aquifer within the 180/400-Foot Aquifer Subbasin GSP, which was submitted to DWR in January 2020. Due to the interconnectivity between the Marina-Ord Area and the 180/400-Foot Aquifer Subbasin principal aquifers, the groundwater elevation minimum thresholds for the Marina-Ord Area are established to be consistent with the 180/400-Foot Aquifer Subbasin GSP and are based on the assumption that SMCs will be met in the adjacent subbasin. However, the 180/400-Foot Aquifer Subbasin GSP does not establish minimum thresholds or measurable objectives for the Deep Aquifers. The establishment of SMCs for the Deep Aquifers will be conducted following the completion of a Deep Aquifers Study. The impact of the Monterey Subbasin's minimum thresholds on the Deep Aquifers in the 180/400-Foot Aquifer Subbasin will be assessed after the Deep Aquifer SMCs are established. Continued GSA coordination of these SMCs is critical, as each subbasin's ability to achieve sustainability is affected by the adjacent subbasins' minimum thresholds, measurable objectives, and the ability to manage towards these SMCs.

The Seaside Subbasin is an adjudicated basin and not subject to SGMA. The Subbasin GSAs have and will continue to coordinate closely with the Seaside Watermaster to ensure that the Monterey Subbasin minimum thresholds do not prevent the Seaside Subbasin from meeting its adjudication requirements, .including the occurrence of "Material Injury" (as defined in the Seaside Basin adjudication decision) in the Laguna Seca subarea due to lowered groundwater Llevels.

8.7.3.6 *Effects on Beneficial Users and Land Uses*

The groundwater elevation minimum thresholds may have several effects on beneficial users and land uses in the Subbasin and adjacent subbasins.

Urban land uses and users. The groundwater elevation minimum thresholds may reduce the amount of groundwater pumping in the Subbasin or adjacent subbasins, or result in obtaining alternative sources of water within the Monterey Subbasin or through regional efforts. This may result in higher water costs for water users.

Domestic land uses and users. The groundwater elevation minimum thresholds are intended to protect most domestic wells along with small state and small local system wells. Therefore, the minimum thresholds will likely have an overall beneficial effect on existing domestic land uses by protecting the ability to pump from domestic wells or be supplied by small systems. However, extremely shallow domestic wells may become dry as many have during extended dry periods, requiring owners to drill deeper wells. Additionally, the groundwater elevation minimum thresholds may limit the number of new domestic wells or small state and small local system wells that can be drilled to limit future declines in groundwater elevations as a result of additional pumping that would come into production. Further, higher minimum thresholds would require additional projects and management actions to raise groundwater levels, and therefore it would place an even higher financial burden on domestic users to contribute to projects.

Agricultural land uses and users. The groundwater elevation minimum thresholds prevent continued lowering of groundwater elevations in the Subbasin. This may have the effect of limiting the amount of groundwater pumping in the Subbasin. Limiting the amount of groundwater pumping may limit the amount and type of crops that can be grown in the Subbasin. The groundwater elevation minimum thresholds could therefore limit the expansion of the Subbasin's agricultural economy. This could have various effects on beneficial users and land uses:

- Agricultural land currently under irrigation may become more valuable as bringing new lands into irrigation becomes more difficult and expensive.
- Agricultural land not currently under irrigation may become less valuable because it may be too difficult and expensive to irrigate.

Ecological land uses and users. Groundwater elevation minimum thresholds may limit the amount of groundwater pumping in the Subbasin and may limit both urban and agricultural growth. This outcome may benefit ecological land uses and users by curtailing the conversion of native vegetation to agricultural or domestic uses, and by reducing pressure on existing ecological land caused by declining groundwater elevations.

8.7.3.7 Relevant Federal, State, or Local Standards

No federal, state, or local standards exist for chronic lowering of groundwater elevations.

8.7.3.8 Method for Quantitative Measurement of Minimum Thresholds

Groundwater elevation minimum thresholds will be directly measured from the RMS network in accordance with the monitoring plans outlined in Chapter 7. Furthermore, groundwater elevation monitoring will meet the requirements of the technical and reporting standards included in the GSP Emergency Regulations.

As noted in Chapter 7, the current groundwater elevation RMS network in the Subbasin across aquifers includes 35 wells. Data gaps were identified in Chapter 7 and will be resolved during implementation of this GSP.

8.7.4 Measurable Objectives

The measurable objectives for chronic lowering of groundwater levels ("groundwater elevation measurable objectives") represent target groundwater elevations that are higher than the minimum thresholds. These measurable objectives provide operational flexibility to ensure that the Subbasin can be managed sustainably over a reasonable range of hydrologic and climatic variability. Groundwater elevation measurable objectives are summarized in Table 8-2. The measurable objectives are also shown on the maps for each RMS in Appendix 8-A and Figures 8-1 through 8-7 above.

8.7.4.1 Methodology for Setting Measurable Objectives

In the Marina-Ord Area, groundwater elevation measurable objectives are defined as follows:

> *Groundwater elevations observed in 2004 in the Dune Sand, 180-Foot, 400-Foot, and Deep Aquifers, prior to the decline of groundwater levels in the southwestern portion of the Marina-Ord Area.*

In the Marina-Ord Area, these measurable objectives are primarily set to further limit the potential for seawater intrusion within the Subbasin. Data collected by the Seaside Watermaster has shown a recent increase in chloride concentrations in MPWMD#FO-10S in the Monterey Subbasin, and MPWMD#FO-09S, a coastal Paso Robles Aquifer well located within the Seaside Subbasin[53]. These recent increases in chloride concentration indicate that groundwater

[53] ~~Chloride concentration measured from MPMWD#FO-10S and MPMWD#FO-09S in September 2020 were 89.9 mg/L and 90.4 mg/L, respectively. As of April 2021, the Seaside Watermaster is investigating whether increase in chloride concentrations in these wells are due to leakage in well casing. As part of GSP implementation, the Subbasin~~

elevations in the southwestern portion of the Marina-Ord Area may induce seawater intrusion in the 400-Foot and/or Deep Aquifers of the Monterey Subbasin and the Paso Robles Aquifer of the Seaside Subbasin. As discussed earlier in Chapters 4 and 5, there is uncertainty regarding hydrostratigraphy and the cause of groundwater elevation declines within this area. However, for this GSP, the representative year of 2004 is selected for measurable objectives, which is prior to recent groundwater declines in the Marina-Ord Area as shown on Figure 8-8.

These measurable objectives are generally consistent with those set for the 180- and 400-foot aquifers in the neighboring 180/400-Foot Aquifer Subbasin. Measurable objectives in the 180/400-Foot Aquifer Subbasin are set at 2003 levels. Measurable objectives for the Deep Aquifers have not been established within the 180/400-Foot Aquifer Subbasin.

In the Corral de Tierra Area, groundwater elevations from 2008 were selected as the measurable objectives to ensure that the objectives are achievable. Therefore, groundwater elevation measurable objectives in the Corral de Tierra Area are defined as follows:

Groundwater elevations observed in 2008 in the El Toro Primary Aquifer System.

The measurable objective contour maps along with the monitoring network wells are shown on Figure 8-11 for the Corral de Tierra Area.

~~GSAs intend to investigate possible seawater intrusion near the southwestern portion of the Marina-Ord Area in collaboration of the Seaside Watermaster.~~Chloride concentration measured from MPWMD#FO-10S and MPWMD#FO-09S in September 2020 were 89.9 mg/L and 90.4 mg/L, respectively. However, ~~A~~an investigation performed by MPWMD into the cause of this in mid-2021 concluded that there was leakage in the upper portion of the casing ~~that was allowing salty shallow dune sand water to flow downward in this well, thus~~ causing ~~these~~ increases in chloride readings in MPWMD#FO-09S. As part of GSP implementation, the Subbasin GSAs ~~intend to~~will investigate possible seawater intrusion near MPWMD#FO-10S ~~the southwestern portion of the Marina-Ord Area~~ in collaboration with~~of~~ the Seaside Watermaster.

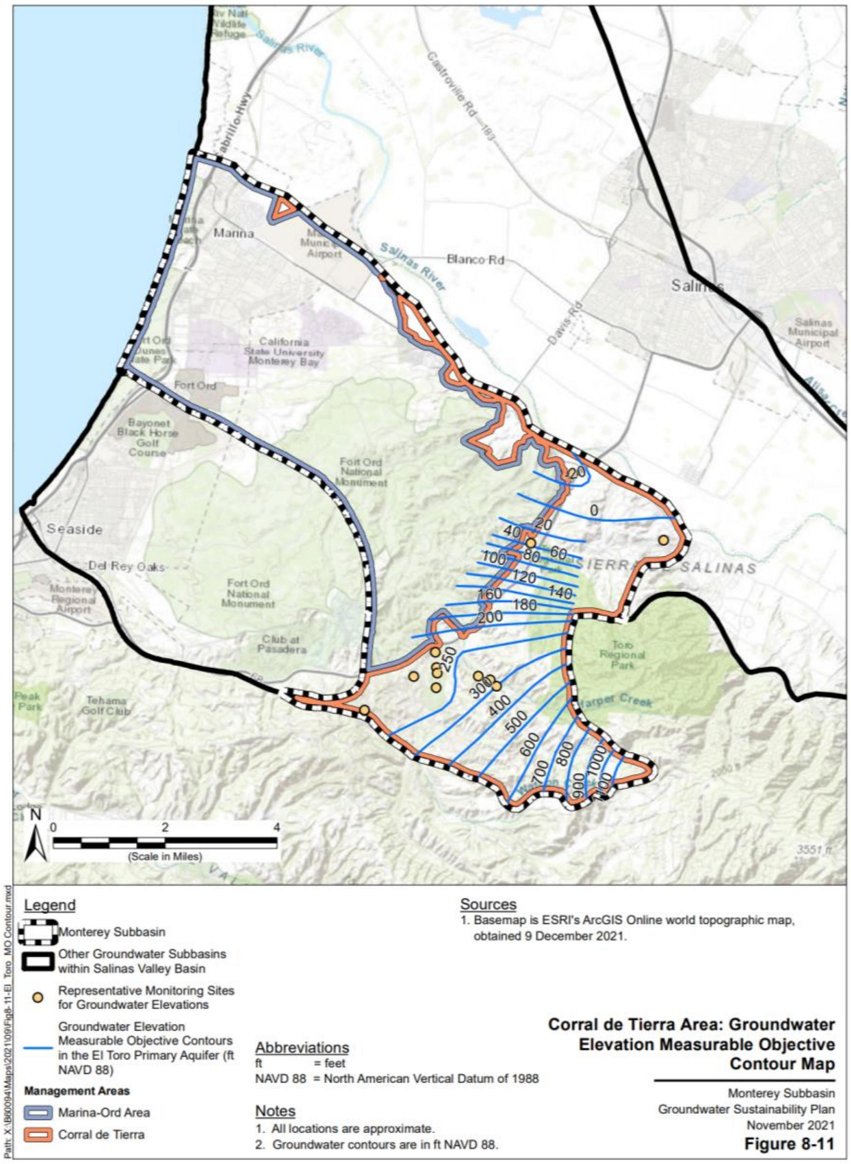


Figure 8-11. Corral de Tierra Area Groundwater Elevation Measurable Objective Contour Map

8.7.4.2 Interim Milestones

Chapter 9 identifies projects and management actions to address the Subbasin's overdraft conditions and meet measurable objectives established herein. These projects and management actions are early in their planning phases and will require coordination with adjacent subbasins and collaborating partners. As such, time will be required to implement these projects and management actions, and begin monitoring for the expected benefits. Groundwater interim milestones are established to reflect the timeline for project implementation, and realization of project benefits over time.

Within the Monterey Subbasin, for wells in the 400-Foot Aquifer, Deep, and El Toro Primary Aquifer System Aquifers where groundwater levels have been declining, groundwater elevation interim milestones are defined based on a trajectory informed by current (fourth quarter of 2020) groundwater levels, historical groundwater elevation trends[54], and measurable objectives. This trajectory allows for and assumes a continuation of historical groundwater elevation trends during the first 5-year period of GSP implementation, a deviation from that trend over the second 5-year period, and a recovery towards the measurable objectives in the third and fourth (last) 5-year period. An example of the trajectory is shown on Figure 8-12 with a Marina-Ord well. As discussed below in Section 8.8.3.1, there are large volumes of freshwater in the Subbasin that provide additional time and flexibility to reach identified SMCs while projects and management actions are implemented. The temporary use of stored groundwater in the 400-Foot Aquifer, Deep, and El Toro Primary Aquifer Systems Aquifers are reflected in these groundwater elevation interim milestones.

Groundwater elevation interim milestones for wells in the Dune Sand, 180-Foot, and 400-Foot Aquifers, with stable groundwater elevations, are set at their respective measurable objectives. Groundwater elevation interim milestones for wells that have already exceeded their measurable objective also use the measurable objective in place of the interim milestones.

Interim milestones for groundwater elevations are shown in Table 8-3. Hydrographs showing minimum thresholds, measurable objectives, and interim milestones for each RMS are included in Appendix 8-B.

[54] Calculated based on fourth quarter measurements over the historical period (i.e., 2004 to 2018).

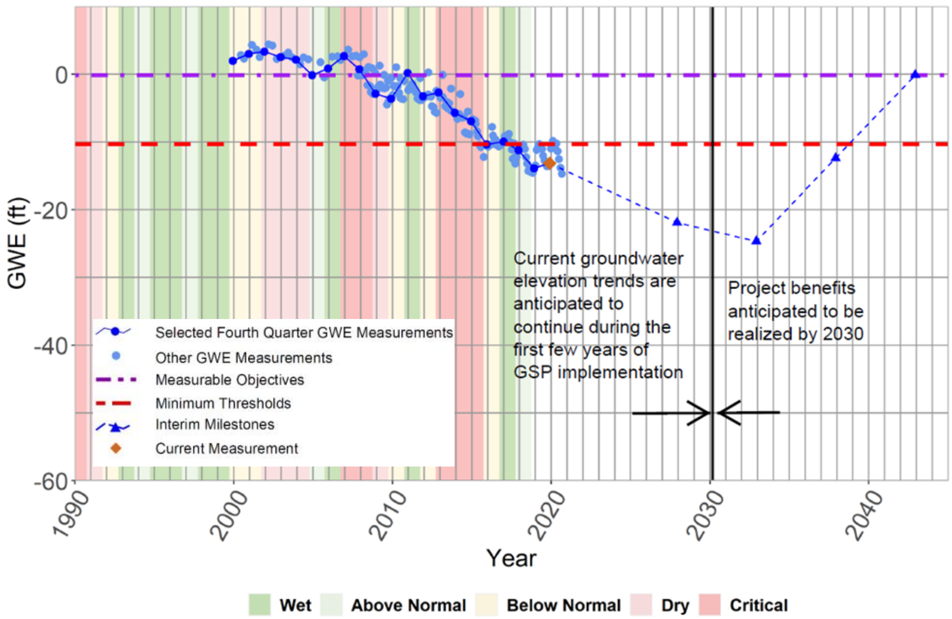


Figure 8-12. Example Trajectory for Groundwater Elevation Interim Milestones

Table 8-3. Groundwater Elevation Interim Milestones

Monitoring Site	Aquifer	Current Groundwater Elevation ft NAVD88 (assume at 2020)	Interim Milestone at Year 2027 (ft NAVD88)	Interim Milestone at Year 2032 (ft NAVD88)	Interim Milestone at Year 2037 (ft NAVD88)	Measurable Objective (ft NAVD88) (goal to reach at 2042)
Marina-Ord Area						
MW-BW-28-A	Dune Sand Aquifer	64.4 (a)	70.3	70.3	70.3	70.3
MW-BW-49-A	Dune Sand Aquifer	11.9 (a)	11.3	11.3	11.3	11.3
MW-BW-81-A	Dune Sand Aquifer	11 (a)	10.0	10.0	10.0	10
MW-BW-82-A	Dune Sand Aquifer	10.5 (a)	9.5	9.5	9.5	9.5

Monitoring Site	Aquifer	Current Groundwater Elevation ft NAVD88 (assume at 2020)	Interim Milestone at Year 2027 (ft NAVD88)	Interim Milestone at Year 2032 (ft NAVD88)	Interim Milestone at Year 2037 (ft NAVD88)	Measurable Objective (ft NAVD88) (goal to reach at 2042)
MW-OU2-13-A	Dune Sand Aquifer	89.3 (a)	94.4	94.4	94.4	94.4
MW-OU2-32-A	Dune Sand Aquifer	8.1 (a)	8.1	8.1	8.1	8.1
MW-OU2-34-A	Dune Sand Aquifer	7.1 (a)	6.6	6.6	6.6	6.6
CDM MW-1 Beach	Upper 180-Foot Aquifer	4.8 (a)	3.3	3.3	3.3	3.3
MW-02-05-180	Upper 180-Foot Aquifer	7.5 (a)	8.4	8.4	8.4	8.4
MW-02-10-180	Upper 180-Foot Aquifer	7.6 (a)	7.3	7.3	7.3	7.3
MW-02-13-180M	Upper 180-Foot Aquifer	7.5 (a)	6.8	6.8	6.8	6.8
MW-02-13-180U	Upper 180-Foot Aquifer	7.7 (a)	7.3	7.3	7.3	7.3
MW-12-07-180	Upper 180-Foot Aquifer	8.1 (a)	7.0	7.0	7.0	7
MW-B-05-180	Upper 180-Foot Aquifer	-2.3 (a)	-3.4	-3.4	-3.4	-3.4
MW-BW-55-180	Upper 180-Foot Aquifer	-4.2 (a)	-5.7	-5.7	-5.7	-5.7
MW-OU2-29-180	Upper 180-Foot Aquifer	-6.3 (a)	-7.2	-7.2	-7.2	-7.2
MW-12-12-180L	Lower 180-Foot Aquifer	4 (a)	3.8	3.8	3.8	3.8
MW-BW-04-180	Lower 180-Foot Aquifer	-8.2 (a)	-11.0	-11.0	-11.0	-11
MW-OU2-66-180	Lower 180-Foot Aquifer	-7.3 (a)	-9.2	-9.2	-9.2	-9.2
TEST2	Lower 180-Foot Aquifer	-8.5 (a)	-10.6	-10.6	-10.6	-10.6
MP-BW-42-295	Lower 180-Foot, 400-Foot Aquifer	-6.9 (a)	-8.1	-8.1	-8.1	-8.1
MP-BW-50-289	Lower 180-Foot, 400-Foot Aquifer	-7.9 (a)	-7.1	-7.1	-7.1	-7.1
MPWMD#FO-10S	400-Foot Aquifer	-13.1 (a)	-20.4 ~~-21.9~~	-22.7 ~~-24.7~~	-12.9 ~~-12.4~~	-3.0 ~~-0.1~~

Monitoring Site	Aquifer	Current Groundwater Elevation ft NAVD88 (assume at 2020)	Interim Milestone at Year 2027 (ft NAVD88)	Interim Milestone at Year 2032 (ft NAVD88)	Interim Milestone at Year 2037 (ft NAVD88)	Measurable Objective (ft NAVD88) (goal to reach at 2042)
MPWMD#FO-11S	400-Foot Aquifer	-29.8 (a)	-44.4~~-45.9~~	-49.0~~-50.9~~	-27.7~~-27.2~~	-6.4~~-3.4~~
MW-OU2-07-400	400-Foot Aquifer	-3.1 (a)	-4.2	-4.2	-4.2	-4.2
014S001E24L002M	Deep Aquifers	-30.3	-34.9	-36.6	-28.7	-20.8
014S001E24L003M	Deep Aquifers	-12.3	-18.9	-21.2	-8.9	3.5
014S001E24L004M	Deep Aquifers	-32.3	-41.6	-44.9	-33.0	-21.1
014S001E24L005M	Deep Aquifers	-25.6	-39.7	-44.8	-25.4	-6.0
14S02E33E01	Deep Aquifers	-53.7	-69.9	-75.6	-52.5	-29.3
14S02E33E02	Deep Aquifers	-20.8	-22.6	-23.3	-18.6	-13.9
MPWMD#FO-10D	Deep Aquifers	-12.7 (a)	-18.7~~-20.1~~	-20.5~~-22.5~~	-12.2~~-11.7~~	-3.8~~-0.9~~
MPWMD#FO-11D	Deep Aquifers	-9.7 (a)	-15.7~~-17.2~~	-17.6~~-19.5~~	-7.2~~-6.6~~	3.3~~6.2~~
PZ-FO-32-910	Deep Aquifers	-44.3	-65.6	-73.2	-46.4	-19.7
Sentinel MW #1	Deep Aquifers	-29.9 (a)	-37.8	-40.3	-29.5	-18.8
Corral de Tierra Area						
15S/02E-25C01	El Toro Primary Aquifer System	22	21	21	26	33.0
15S/03E-18P01	El Toro Primary Aquifer System	-50.4	-53	-53	-42.9	-28.4
15S/03E-20R50	El Toro Primary Aquifer System	36.5	37	37.5	38	39.0
16S/02E-01M01	El Toro Primary Aquifer System	293.6	295.3	297.2	299	301.5
16S/02E-02G01	El Toro Primary Aquifer System	298.5	299.2	300.8	302.6	304.9
16S/02E-02H01	El Toro Primary Aquifer System	279.5	282	284	286.1	288.9
16S/02E-03A01	El Toro Primary Aquifer System	206.9	188	188	206.3	232
16S/02E-03F50	El Toro Primary Aquifer System	215.9	211	211	217.2	225.7
16S/02E-03H01	El Toro Primary Aquifer System	211.7	213.6	215.5	217.4	220.1
16S/02E-03H02	El Toro Primary Aquifer System	215	205	205	214	226.5
16S/02E-03J50	El Toro Primary Aquifer System	211.8	210.1	210.1	210.1	210.1

Monitoring Site	Aquifer	Current Groundwater Elevation ft NAVD88 (assume at 2020)	Interim Milestone at Year 2027 (ft NAVD88)	Interim Milestone at Year 2032 (ft NAVD88)	Interim Milestone at Year 2037 (ft NAVD88)	Measurable Objective (ft NAVD88) (goal to reach at 2042)
Robley Deep (South)	El Toro Primary Aquifer System	165.13	160.5	160.5	170	183.5
Robley Shallow (North)	El Toro Primary Aquifer System	238.64	230.7	230.7	240.8	255.2
(a) These current groundwater levels were taken in the fourth quarter of 2019 due to the lack of measurements in fourth quarter of 2020.						

8.8 Reduction in Groundwater Storage SMC

8.8.1 Locally Defined Significant and Unreasonable Conditions

Locally defined significant and unreasonable conditions in groundwater storage in the Subbasin are those that:

- Lead to chronic, long-term reduction in groundwater storage, or
- Interfere with other sustainability indicators

These significant and unreasonable conditions were determined based on input collected during MCWD stakeholder meetings, SVBGSA Subbasin Committee meetings, and discussions with GSA staff during Subbasin Technical Committee meetings.

8.8.2 Undesirable Results

8.8.2.1 Criteria for Defining Reduction in Groundwater Storage Undesirable Results

The criteria used to define undesirable results for reduction of groundwater storage are based on minimum thresholds established for chronic lowering of groundwater levels and seawater intrusion.

The undesirable result for reduction of groundwater storage is defined to be consistent with groundwater elevation and seawater intrusion undesirable results, as identified below:

> *Over the course of any one year, exceedance of more than 20% of the groundwater level minimum thresholds in either:*
>
> *a. both the Dune Sand Aquifer and Upper 180-Foot Aquifer, or*
> *b. both the Lower 180 Foot and 400 Foot aquifer, or*
> *c. the Deep Aquifers, or*

d. the El Toro Primary Aquifer System.

OR

a. Exceedance of seawater intrusion minimum thresholds.

Since the GSP addresses long-term groundwater sustainability, exceedances of groundwater level~~s~~ minimum thresholds during a drought do not constitute an undesirable result. Pursuant to SGMA Regulations (California Water Code §10721(w)(1)), "Overdraft during a period of drought is not sufficient to establish a chronic lowering of groundwater levels if extractions and groundwater recharge are managed as necessary to ensure that reductions in groundwater levels or storage during a period of drought are offset by increases in groundwater levels or storage during other periods." Therefore, groundwater levels may temporarily exceed minimum thresholds during droughts, and do not constitute an undesirable result, as long as groundwater levels rebound.

Within the Subbasin, groundwater elevations are typically well above production well screen elevations and therefore there is limited concern regarding available groundwater storage to withstand future droughts. The critical limiting factor associated with groundwater availability in the Subbasin is further seawater intrusion and chronic decline in groundwater levels that can lead to seawater intrusion. As such, it is not necessary to define unique SMCs for reduction of groundwater storage.

There is adequate fresh groundwater in storage for beneficial uses and users within the Subbasin to withstand droughts when:

(a) groundwater elevations are equivalent to minimum thresholds established for chronic lowering of groundwater levels, and

(b) the extent of seawater intrusion, defined by the 500 mg/L chloride concentration isocontour, is equivalent to established seawater intrusion minimum thresholds.

Therefore, SMCs established for (a) chronic lowering of groundwater levels and (b) seawater intrusion are reasonable proxies for protection of groundwater storage.

8.8.2.2 Potential Causes of Undesirable Results

Reduction of groundwater storage is directly correlated to chronic lowering of groundwater levels and seawater intrusion. Therefore, the potential causes of undesirable results due to reduction of groundwater storage are the same as the potential causes listed for undesirable results due to chronic lowering of groundwater levels and seawater intrusion in Sections 8.7.2.2 and 8.9.2.2, respectively. As such, an undesirable result for reduction of groundwater storage will not occur as long as undesirable results are avoided with regard to the chronic lowering of groundwater levels and seawater intrusion indicators.

8.8.2.3 Effects on Beneficial Users and Land Use

The undesirable result is designed to avoid dropping below the level of groundwater in storage during 2015 for long-term use. Therefore, the primary potential effect of this undesirable result is generally beneficial for the groundwater uses and users in the Subbasin.

8.8.3 Minimum Thresholds

The undesirable results definition for reduction of groundwater storage refers to a decrease in storage caused by (1) water levels declining below groundwater elevation minimum thresholds or (2) high salinity groundwater migrating beyond seawater intrusion minimum thresholds. It is logical to tie these sustainability indicators together, because the amount of groundwater in storage is directly related to groundwater elevations and the extent of seawater intrusion. The minimum thresholds for chronic lowering of groundwater level and seawater intrusion, therefore, will be used as proxies for reduction of groundwater storage.

8.8.3.1 Information and Methodology Used to Establish Minimum Thresholds

Pursuant to the GSP Emergency Regulations and as further described in the DWR Sustainable Management Criteria BMP (DWR, 2017), minimum thresholds for reduction of groundwater storage may be set by using groundwater levels as a proxy if it is demonstrated that a correlation exists between the two metrics. One approach to using groundwater levels as a proxy, described in the DWR Sustainable Management Criteria BMP, is to demonstrate that minimum thresholds for chronic lowering of groundwater levels are sufficiently protective to ensure prevention of significant and unreasonable occurrences of the Sustainability Indicator in question.

This GSP has adopted and extended this approach to use minimum thresholds defined for both the chronic lowering of groundwater level indicator and the seawater intrusion indicator as a proxy. As discussed above, the amount of groundwater in storage is directly related to groundwater elevations and the extent of seawater intrusion. As demonstrated in the calculation below, groundwater elevation and seawater intrusion minimum thresholds are sufficiently protective of the groundwater storage indicator. As shown in Table 8-4, the estimated fresh groundwater storage volume is calculated based on:

- The area of each principal aquifer outside its seawater intrusion minimum threshold;
- The saturated thickness of each principal aquifer[55];
- An estimated specific yield ranging between 0.1 and 0.2, based on typical values for sandy aquifers.

[55] Saturated thickness is estimated by either (1) the difference between groundwater elevations in Fall 2015 and the bottom of the aquifer, or (2) the thickness of the aquifer, whichever is smaller. This method conservatively assumes that the confined storage within each aquifer is negligible compared to the drainable porosity.

Table 8-4. Estimated Fresh Groundwater Storage in the Marina-Ord Area

Principal Aquifer	Estimated Fresh Groundwater Storage (AF)	
	Lower Range (Specific Yield at 0.1)	Upper Range (Specific Yield at 0.2)
Marina-Ord Area		
Dune Sand Aquifer	30,000	60,000
Upper 180-Foot Aquifer	50,000	100,000
Lower 180-Foot Aquifer	44,000	88,000
400-Foot Aquifer	134,000	268,000
Deep Aquifers	1,544,000	3,088,000

This calculation represents a theoretical estimate of the total volume of fresh groundwater that exists within the principal aquifers within the Subbasin. It should be noted, however, that not all fresh groundwater in storage can be practically accessed or used. Chronic declines in groundwater levels and the potential for increased seawater intrusion are the critical limiting factors associated with usable groundwater storage in the Subbasin. As such, minimum thresholds established for seawater intrusion and groundwater elevations are appropriate proxies for this sustainability indicator. However, the existence of such groundwater storage within the Subbasin provides additional time and flexibility to reach identified SMCs for chronic lowering of groundwater levels. Groundwater can temporarily be removed from storage until local and/or regional projects and/or management actions can be implemented. The temporary use of stored groundwater is reflected in interim milestones established for chronic lowering of groundwater levels within the Deep Aquifers, where no seawater intrusion has yet been identified. However, there is currently insufficient data to determine the vertical or lateral (i.e., seaward) location of the seawater intrusion front within the Deep Aquifers. This information has been identified as a data gap within Section 5.3.3 of the GSP, and will ultimately be used to determine the extent to which such temporary withdrawals of groundwater from storage can continue and water level elevation SMCs must be achieved.

8.8.3.2 Relationship to Other Sustainability Indicators

As discussed above, the groundwater storage minimum thresholds are set at a level consistent with groundwater elevation and seawater intrusion minimum thresholds, which are also consistent with other sustainability indicators, as described in Sections 8.7.3.3 and 8.9.3.2.

8.8.3.3 Effects of Minimum Threshold between Management Areas

The minimum thresholds for each management area have been developed in a coordinated manner through discussions within the Subbasin Technical Committee. Because the minimum thresholds in each management area are defined similarly based on groundwater elevation and seawater intrusion minimum thresholds, they will not cause undesirable results in the other management area.

8.8.3.4 Effect of Minimum Thresholds on Neighboring Basins and Subbasins

The Monterey Subbasin has two neighboring subbasins within the Salinas Valley Groundwater Basin:

- The 180/400-Foot Aquifer Subbasin to the north;
- The Seaside Subbasin to the south

The GSAs coordinating the Monterey Subbasin GSP are the same GSAs covering the adjacent 180/400-Foot Aquifer Subbasin. The GSAs have been coordinating the development of the minimum thresholds and measurable objectives within the 180/400-Foot Aquifer Subbasin GSP, which was submitted to DWR in January 2020. Because the minimum thresholds in both the Monterey Subbasin and 180/400-Foot Aquifer Subbasin have been developed by the same GSAs in a coordinated fashion, the minimum thresholds do not conflict with each other.

The Seaside Subbasin is an adjudicated basin and not subject to the Sustainable Groundwater Management Act's minimum threshold requirements. Because the minimum thresholds are set to avoid dropping below recent levels of storage, it is likely that the minimum thresholds will not prevent the Seaside Subbasin from meeting its adjudication requirements. The Subbasin GSAs have and will continue to coordinate closely with the Seaside Watermaster to ensure that the Monterey Subbasin minimum thresholds do not prevent the Seaside Subbasin from meeting its adjudication requirements.

8.8.3.5 Effect on Beneficial Uses and Users

Because the groundwater storage minimum thresholds are defined based on groundwater elevation and seawater intrusion minimum thresholds, the effects of groundwater storage minimum threshold on beneficial uses and users are similar to those described in Sections 8.7.3.6 and 8.9.3.4.

8.8.3.6 Relation to State, Federal, or Local Standards

No federal, state, or local standards exist for reductions in groundwater storage.

8.8.3.7 Method for Quantitative Measurement of Minimum Threshold

Because the groundwater elevation and seawater intrusion minimum thresholds will be used as a proxy for reduction of groundwater storage, the measurement of change in groundwater storage will be measured directly from the groundwater elevation and seawater intrusion monitoring networks described in Chapter 7.

8.8.4 Measurable Objectives

Because the close relationship between the reduction of groundwater storage and the chronic lowering of groundwater level and seawater intrusion sustainability indicators, the groundwater elevation and seawater intrusion measurable objectives serve as proxies for reduction of groundwater storage.

8.8.4.1 Method for Setting Measurable Objectives

This methodology is designed to represent groundwater in storage when groundwater elevations and the seawater intrusion extent are maintained at their respective measurable objectives. As stated above, the measurable objectives for chronic lowering of groundwater levels and seawater intrusion provide an adequate margin of operational flexibility.

8.8.4.2 Interim Milestones

The groundwater elevation and seawater intrusion interim milestones described respectively in Table 8-3 and Section 8.9.4.2 will serve as a proxy for reduction of groundwater storage.

8.9 Seawater Intrusion SMC

8.9.1 Locally Defined Significant and Unreasonable Conditions

Locally defined significant and unreasonable seawater intrusion in the Subbasin is defined as follows:

- Expansion of the 2015 seawater intruded area in the Subbasin, identified based upon the 500 mg/L chloride concentration isocontour.

The seawater intrusion SMCs apply to the whole Subbasin, as shown in Figure 8-13 and Figure 8-14.

These significant and unreasonable conditions were determined based on input collected during MCWD stakeholder meetings, SVBGSA Subbasin Committee meetings, and discussions with GSA staff during Subbasin Technical Committee meetings.

8.9.2 Undesirable Results

8.9.2.1 Criteria for Defining Seawater Intrusion Undesirable Results

The seawater intrusion undesirable result is a quantitative combination of chloride concentrations minimum threshold exceedances. As discussed below, there is one minimum threshold for each of the four principal aquifers within the Marina-Ord Area and Reservation Road portion of the Corral de Tierra Area where the hydrogeologic setting is the same as the Marina-Ord Area. Because even localized expansion of the seawater intrusion front is not acceptable, the undesirable result of seawater intrusion is:

Any exceedance of the minimum threshold is considered as an undesirable result.

This undesirable result may be modified as the projects and actions to address seawater intrusion are refined during implementation of this GSP.

8.9.2.2 Potential Causes of Undesirable Results

Conditions that may lead to an undesirable result for seawater intrusion include the following:

- **Decreases in groundwater levels near the coast in Monterey Subbasin and/or adjacent coastal subbasins (the adjudicated Seaside Subbasin and 180/400-Foot Aquifer Subbasin).** Decreases in groundwater levels near the coast could lead to further migration of seawater inland into the Monterey Subbasin.
- **Sea level rise**. Increase in sea level increases the driving force for seawater intrusion and can lead to further migration of seawater inland.

8.9.2.3 Effects on Beneficial Users and Land Use

The primary detrimental effect on beneficial users and land uses from allowing seawater intrusion to continue or occur in the future is that the pumped groundwater may become saltier and thus impact groundwater supply wells (i.e., MCWD production wells or agricultural wells) and associated land uses. This may force production wells to move to further inland or to deeper aquifers, which will cause increased groundwater production costs, and reduce water supply reliability.

Allowing seawater intrusion to continue or occur in the future may also impact agriculture. Chloride moves readily within soil and water and is taken up by the roots of plants. It is then transported to the stems and leaves. Sensitive berry rootstocks can tolerate only up to 120 mg/L of chloride, while grapes can tolerate up to 700 mg/L or more (University of California Agriculture and Natural Resources, 2002).

Limiting seawater intrusion will benefit groundwater users because it will protect groundwater production wells within the Marina-Ord Area and Reservation Road portion of the Corral de Tierra Area, and maintain adequate storage in the Subbasin. However, limitations on groundwater extraction and/or development of alternative water supplies may be required to achieve minimum thresholds, which will cause increased water production costs or a reduction in water supplies.

8.9.3 Minimum Thresholds

Pursuant to GSP Emergency Regulations §354.28, the seawater intrusion minimum threshold is defined by a chloride concentration isocontour for each principal aquifer.

Because further expansion of the seawater intruded area is significant and unreasonable, the seawater intrusion minimum threshold is defined as:

> *The approximate location in 2015 of the 500 mg/L chloride concentration isocontour in the lower 180-Foot and 400-Foot Aquifers;*
>
> *Approximately 3,500 feet from the coast in the Dune Sand Aquifer, upper 180-Foot Aquifer and Deep Aquifers. This distance is generally consistent with the location of Highway 1 in the Monterey Subbasin and seaward of groundwater extraction in the Subbasin.*

The approximate line of Highway 1 is determined as the seawater intrusion minimum threshold in the Dune Sand Aquifer, upper 180-Foot Aquifer and Deep Aquifers, as there is very limited seawater intrusion observed in these aquifers currently. The intent of this is minimum threshold is to limit seawater from intruding into these aquifers. Such seawater intrusion could occur from the ocean and/or through vertical migrations from underlying or overlying aquifers which are currently seawater intruded.

Figure 8-13 presents the minimum threshold for seawater intrusion in the lower 180-Foot and 400-Foot Aquifers. Figure 8-14 presents the minimum threshold for seawater intrusion in the Dune Sand, upper 180-Foot, and Deep Aquifers.

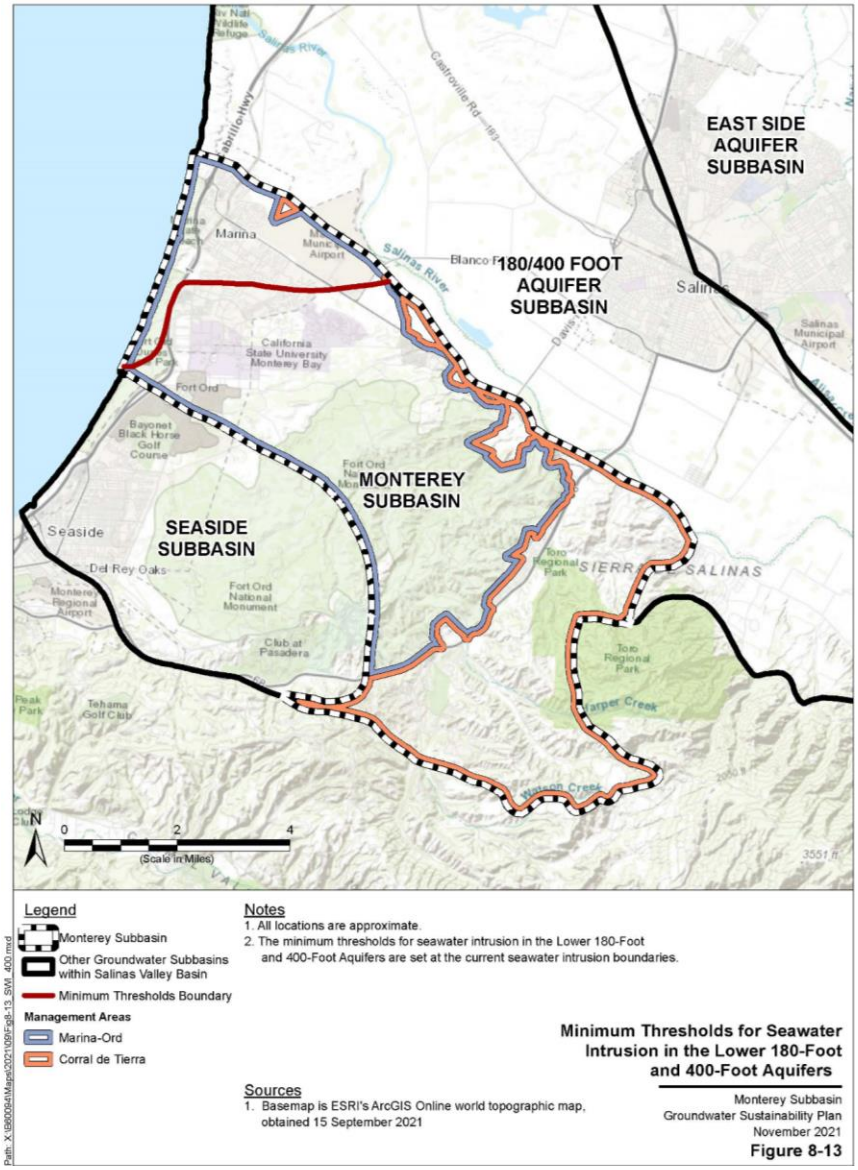


Figure 8-13. Minimum Thresholds for Seawater Intrusion in the Lower 180-Foot and 400-Foot Aquifer

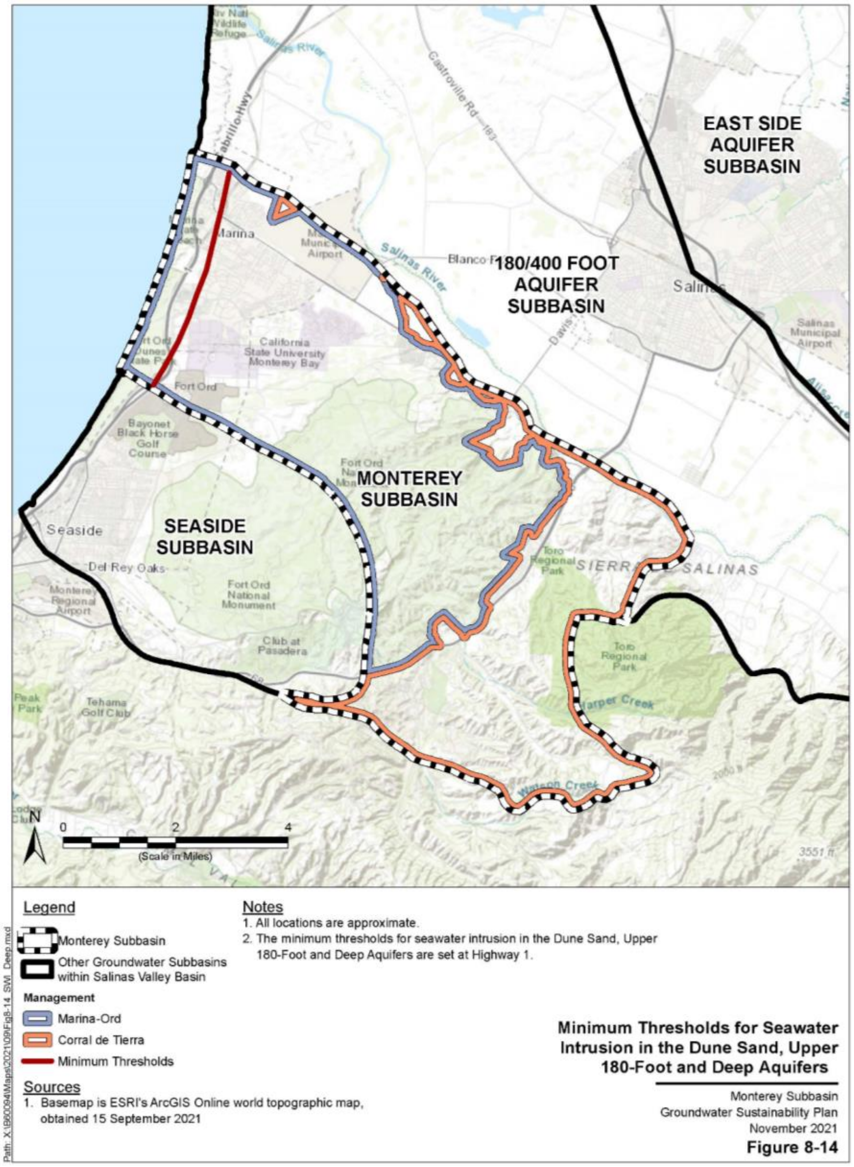


Figure 8-14. Minimum Thresholds for Seawater Intrusion in the Dune Sand, Upper 180-Foot, and Deep Aquifers

8.9.3.1 Information and Methodology Used to Establish Minimum Thresholds and Measurable Objectives

Consistent with GSP Emergency Regulations §354.28 (c), the definition of minimum thresholds for seawater intrusion is based on maps and cross-sections of the chloride concentration isocontour and how minimum thresholds will be affected by current and projected sea levels.

The seawater intrusion minimum thresholds are developed based on seawater intrusion maps and cross-sections included in Chapter 5 of this GSP. The maps identify the extent of seawater intrusion as the estimated location of the 500 mg/L chloride concentration isocontour line. The maps are developed through analysis of TDS and chloride measurements collected from monitoring wells near the coast, geophysical data, and the hydrogeological setting.

8.9.3.2 Relationship to Other Sustainability Indicators

As discussed above, minimum thresholds for seawater intrusion have been considered in the development of SMCs for related sustainability indicators including:

- groundwater level elevations SMCs, and
- depletion of groundwater storage SMCs.

Seawater intrusion is the primary driver used to set SMCs for these other sustainability indicators, which are also consistent with minimum thresholds established for:

- depletion of interconnected surface waters in wells proximate to such areas, and
- subsidence, as they are set above historical groundwater levels.

No conflict exists between seawater intrusion and degraded groundwater quality SMCs, beyond that caused by seawater intrusion itself, which increases chloride, sodium and TDS concentrations in groundwater wells (e.g., chloride, TDS).

8.9.3.3 Effect of Minimum Threshold on Neighboring Basins and Subbasin

The Monterey Subbasin has two neighboring subbasins within the Salinas Valley Groundwater Basin:

- The 180/400-Foot Aquifer Subbasin to the north;
- The Seaside Subbasin to the south

The GSAs coordinating the Monterey Subbasin GSP are the same GSAs covering the adjacent 180/400-Foot Aquifer Subbasin. The GSAs have been coordinating the development of the minimum thresholds and measurable objectives within the 180/400-Foot Aquifer Subbasin GSP, which was submitted to DWR in January 2020. Minimum thresholds for seawater intrusion are established consistent with the 180/400-Foot Aquifer Subbasin GSP.

The Seaside Subbasin is an adjudicated basin and not subject to SGMA. Because the minimum thresholds in the Monterey Subbasin are established to prevent expansion of the seawater intruded area in the Subbasin, it is likely that the minimum thresholds will not prevent the Seaside Subbasin from meeting its adjudication requirements. The Subbasin GSAs have and will continue to coordinate closely with the Seaside Watermaster to ensure that the Monterey Subbasin minimum thresholds do not prevent the Seaside Subbasin from meeting its adjudication requirements.

8.9.3.4 Effects on Beneficial Users and Land Uses

Urban land uses and users. The seawater intrusion minimum thresholds will prevent high salinity levels from impacting the water supply of urban land uses and users, along with agricultural uses and users. However, the seawater intrusion minimum threshold may (a) reduce the amount of allowable groundwater pumping within the Subbasin, or (b) require implementation of local or regional projects and/or management actions to augment existing water supplies within the Subbasin. This may result in higher water costs for water users.

Agricultural land uses and users. The seawater intrusion minimum thresholds generally provide positive benefits to the Subbasin's agricultural water users. Preventing additional seawater intrusion ensures that a supply of usable groundwater will exist for beneficial agricultural use.

On-farm domestic land uses and users. There are no known on-farm domestic groundwater users in the Marina-Ord Area, where SMCs are developed for seawater intrusion.

Ecological land uses and users. Although the seawater intrusion minimum threshold does not directly benefit ecological uses, it can be inferred that the seawater intrusion minimum thresholds generally provide positive benefits to the Subbasin's ecological water uses. Preventing seawater intrusion into the Subbasin will help prevent unwanted high salinity levels from impacting ecological groundwater uses.

8.9.3.5 Relevant Federal, State, or Local Standards

No federal, state, or local standards exist for seawater intrusion.

8.9.3.6 Method for Quantitative Measurement of Minimum Threshold

Chloride concentrations are measured in groundwater samples collected from the seawater intrusion monitoring network identified in Chapter 7. These samples are used to develop the approximate location of the 500 mg/L chloride isocontour. The methodology and protocols for collecting samples and developing the 500 mg/L concentration isocontour are detailed in Appendix 7-C through Appendix 7-E.

8.9.4 Measurable Objectives

In the Monterey Subbasin, the measurable objectives for the seawater intrusion are the same as the minimum thresholds:

> *The approximate location in 2015 of the 500 mg/L chloride concentration isocontour in the lower 180-Foot and 400-Foot Aquifers;*

> *Approximately 3,500 feet from the coast in the Dune Sand Aquifer, upper 180-Foot Aquifer and Deep Aquifers. This distance is generally consistent with the location of Highway 1 in the Monterey Subbasin and seaward of groundwater extraction wells in the Subbasin.*

8.9.4.1 Method for Setting Measurable Objectives

As described above, measurable objectives are set to be identical to the minimum thresholds for the respective principal aquifers and therefore follow the same method as detailed in Section 8.9.3.1.

8.9.4.2 Interim Milestones

The interim milestones for seawater intrusion are the same as the measurable objective.

8.10 Degraded Water Quality SMC

8.10.1 Locally Defined Significant and Unreasonable Conditions

Locally defined significant and unreasonable changes in groundwater quality resulting from direct GSA action in the Subbasin are increases in a chemical constituent that either:

- Increase in number of potable supply wells in which concentrations of constituents of concern exceed Title 22 California Code of Regulations (Title 22) drinking water standards (i.e., maximum contaminant levels (MCLs) or secondary maximum contaminant levels (SMCLs), or
- Increase in the number of agricultural supply wells in which constituents of concern exceed concentrations that may lead to reduced crop production.

These significant and unreasonable conditions were determined based on input collected during MCWD stakeholder meetings, SVBGSA Subbasin Committee meetings, and discussions with GSA staff during Subbasin Technical Committee meetings.

8.10.2 Undesirable Results

8.10.2.1 Criteria for Defining Undesirable Results

The degradation of groundwater quality becomes an undesirable result when a quantitative combination of groundwater quality minimum thresholds is exceeded. For the Subbasin, the exceedance of minimum thresholds is unacceptable as a direct result of GSP implementation. Some groundwater quality changes are expected to occur independent of SGMA activities; because these changes are not related to SGMA activities, nor GSA management, they do not constitute an undesirable result. Additionally, SGMA states that GSAs are not responsible for addressing water quality degradation that was present before January 1, 2015 (California Water

Code §10727.2(b)(4)). Therefore, the degradation of groundwater quality reaches an undesirable result when:

> *Future or new minimum thresholds exceedances are caused by a direct result of GSA groundwater management action(s), including projects or management actions and regulation of groundwater extraction.*

The groundwater level SMC is designed and intended to help protect groundwater quality. Setting the groundwater level minimum thresholds at or above historical lows assures that no new depth dependent constituents of water quality concern are mobilized. The GSAs may pursue projects or management actions to ensure that groundwater levels do not fall below groundwater levels minimum thresholds.

This undesirable result recognizes there is an existing regulatory framework in the form of the California Porter Cologne Act and the federal Clean Water Act that addresses water quality management; and considers existing federal, state, and local groundwater quality standards, which were used in the development of minimum thresholds in the GSP. The GSAs~~SVBGSA is~~ are not responsible for enforcing drinking water requirements or for remediating violations of those requirements that were caused by others (Moran and Belin, 2019). The existing regulatory regime does not require nor obligate the SVBGSA or MCWD GSA to take any affirmative actions to manage or control existing groundwater quality. However, SVBGSA and MCWD GSA are committed to monitoring and disclosing changes in groundwater quality and ensuring its groundwater management actions do not cause drinking water or irrigation water to be unusable.

SVBGSA and MCWD GSA will work closely with the Central Coast Regional Water Quality Control Board and other entities that have regulatory authority over water quality. SVBGSA will lead the Water Quality Coordination Group, as described in Chapter 9, which includes meeting annually with these partner agencies to review the status of water quality data and discuss any action needed to address water quality degradation.

If the GSAs have not implemented any groundwater management actions in the Subbasin, including projects, management actions, or pumping management, no such management actions constitute an undesirable result. If minimum thresholds are exceeded after the GSAs have implemented actions in the Subbasin, the GSAs will review groundwater quality and groundwater gradients in and around the project areas to assess if the exceedance resulted from GSAs actions to address sustainability indicators, or was independent of GSAs activities. Both the implementation of actions and assessment of exceedances will occur throughout the GSP timeframe of 50 years as required by SGMA. The general approach to assess if a minimum threshold exceedance is due to GSAs action will include:

- If no projects, management actions, or other GSP implementation actions have been initiated in a subbasin, or near the groundwater quality impact, then the impact was not caused by any GSAs action.

- Many projects will likely include a new monitoring network. If data from the project-specific monitoring network do not show groundwater quality impacts, this will suggest that the impact was not caused by any GSAs actions.
- If a GSA undertakes a project that changes groundwater gradients, moves existing constituents, or results in the exceedance of minimum thresholds, SVBGSA and MCWD GSA will undertake a more rigorous technical study to assess local, historical groundwater quality distributions, and the impact of the GSAs activity on that distribution.

For SGMA compliance, undesirable results for groundwater quality are not caused by (1) lack of action; (2) GSA required reductions in pumping; (3) exceedances in groundwater quality minimum thresholds that occur, if there are fewer exceedances than if there had been a lack of management; (4) exceedances in groundwater quality minimum thresholds that would have occurred independent of projects or management actions implemented by the GSAs; (5) past harm.

In the Corral de Tierra Area specifically, arsenic is a naturally occurring constituent. Elevated arsenic levels in drinking water are a concern for local stakeholders, especially if they relate to declining groundwater elevations. Currently, there is not sufficient data that shows a relationship between declining groundwater elevations and elevated arsenic levels. During GSP implementation, SVBGSA will work to collect and analyze data to better understand if such a relationship exists described further in Chapter 9.

The degradation of groundwater quality becomes an undesirable result when a quantitative The degradation of groundwater quality becomes an undesirable result when a quantitative combination of groundwater quality minimum thresholds is exceeded. For the Subbasin, the exceedance of minimum thresholds is unacceptable as a direct result of GSP implementation. Some groundwater quality changes are expected to occur independent of SGMA activities; because these changes are not related to SGMA activities, nor GSA management, they do not constitute an undesirable result. Additionally, SGMA states that GSAs are not responsible for addressing water quality degradation that was present before January 1, 2015 (California Water Code §

10727.2(b)(4)). Therefore, the degradation of groundwater quality reaches an undesirable result when:

- *Future or new minimum thresholds exceedances are caused by a direct result of GSA groundwater management action(s), including projects or management actions and regulation of groundwater extraction.*

- *The groundwater level SMC is designed and intended to help protect groundwater quality. Setting the groundwater level minimum thresholds at or above historical lows assures that no new depth dependent constituents of water quality concern are mobilized. The GSAs may pursue projects or management actions to ensure that groundwater levels do not fall below groundwater levels minimum thresholds.*

- *This undesirable result recognizes there is an existing regulatory framework in the form of the California Porter Cologne Act and the federal Clean Water Act that addresses water quality management; and considers existing federal, state, and local groundwater quality standards, which were used in the development of minimum thresholds in the GSP. SVBGSA is not responsible for enforcing drinking water requirements or for remediating violations of those requirements that were caused by others (Moran and Belin, 2019). The existing regulatory regime does not require nor obligate the SVBGSA or MCWD GSA to take any affirmative actions to manage or control existing groundwater quality. However, SVBGSA and MCWD GSA are committed to monitoring and disclosing changes in groundwater quality and ensuring its groundwater management actions do not cause drinking water or irrigation water to be unusable.*

- *SVBGSA and MCWD GSA will work closely with the Central Coast Regional Water Quality Control Board and other entities that have regulatory authority over water quality. SVBGSA will lead the Water Quality Coordination Group, as described in Chapter 9, which includes meeting annually with these partner agencies to review the status of water quality data and discuss any action needed to address water quality degradation.*

- *If the GSAs have not implemented any groundwater management actions in the Subbasin, including projects, management actions, or pumping management, no such management actions constitute an undesirable result. If minimum thresholds are exceeded after the GSAs have implemented actions in the Subbasin, the GSAs will review groundwater quality and groundwater gradients in and around the project areas to assess if the exceedance resulted from GSAs actions to address sustainability indicators, or was independent of GSAs activities. Both the implementation of actions and* *assessment of exceedances will occur throughout the GSP timeframe of 50 years as required by SGMA. The general approach to assess if a minimum threshold exceedance is due to GSAs action will include:*

If no projects, management actions, or other GSP implementation actions have been initiated in a subbasin, or near the groundwater quality impact, then the impact was not caused by any GSAs action.

Many projects will likely include a new monitoring network. If data from the project-specific monitoring network do not show groundwater quality impacts, this will suggest that the impact was not caused by any GSAs actions.

If a GSAs undertakes a project that changes groundwater gradients, moves existing constituents, or results in the exceedance of minimum thresholds, SVBGSA and MCWD GSA will undertake a more rigorous technical study to assess local, historical groundwater quality distributions, and the impact of the GSAs activity on that distribution.

For SGMA compliance, undesirable results for groundwater quality are not caused by (1) lack of action; (2) GSA required reductions in pumping; (3) exceedances in groundwater quality minimum thresholds that occur, if there are fewer exceedances than if there had been a lack of management; (4) exceedances in groundwater quality minimum thresholds that would have occurred independent of projects or management actions implemented by the GSAs; (5) past harm.

In the Corral de Tierra area specifically, arsenic is a naturally occurring constituent. Elevated arsenic levels in drinking water are a concern for local stakeholders, especially if they relate to declining groundwater elevations. Currently, there is not sufficient data that shows a relationship between declining groundwater elevations and elevated arsenic levels. During GSP implementation, SVBGSA will work to collect and analyze data to better understand if such a relationship exists described further in Chapter 9.

8.10.2.2 For the Subbasin, any groundwater quality degradation that leads to an exceedance of MCLs or SMCLs in potable water supply wells or a reduction in crop production in agricultural wells that is a direct result of GSP implementation is unacceptable. Some groundwater quality changes are expected to occur independent of SGMA activities; because these changes are not related to SGMA activities they do not constitute an *undesirable result. Therefore, the degradation of groundwater quality undesirable result is:*

8.10.2.3 Any exceedances of minimum thresholds during any one year as a direct result of projects or management actions conducted pursuant to GSP implementation is considered as an undesirable result.

8.10.2.48.10.2.2 Potential Causes of Undesirable Results

As shown in Chapter 5, the known groundwater quality issues within the Marina-Ord Area are caused by legacy Fort Ord contamination. To date, no constituents of concern are detected above drinking water standards in any Marina-Ord Area groundwater supply wells (i.e., MCWD production wells). The U.S. Army is responsible for remediation of groundwater contamination associated with historical releases at the former Army base. This remediation is being conducted under the oversight of the US Armed Forces, US EPA, and the CCRWQCB.

High arsenic concentrations are known to occur within the El Toro Primary Aquifer System within the Corral de Tierra Area; these concentrations are naturally occurring. There is also no clear correlation that can be established between groundwater levels and groundwater quality at this time.

The potential for harming water quality will be considered in the process to select projects and management actions. If needed, additional project-specific groundwater quality monitoring networks may be established to ensure projects do not harm water quality. Conditions that may lead to an undesirable result in the Marina-Ord-Area or the Corral de Tierra Area include the following:

- **Required Changes to Subbasin Pumping**. If the location and rates of groundwater pumping change as a result of projects implemented under the GSP, these changes could alter hydraulic gradients and associated flow directions, and cause movement of constituents of concern towards a supply well at concentrations that exceed relevant standards. However, as noted above, quality changes from GSA-required reductions in pumping do not constitute an undesirable result.
- **Groundwater Recharge**. Active recharge of imported water or captured runoff could modify groundwater gradients and move constituents of concern towards a supply well in concentrations that exceed relevant limits.
- **Recharge of Poor-Quality Water**. Recharging the Subbasin with water that exceeds an MCL, SMCL, or level that reduces crop production could lead to an undesirable result.

County Ordinance No. 04011 (see Section 3.4) restricts well construction in areas that may interfere with contamination plumes at the former Fort Ord. Therefore, the potential for GSP projects to impact legacy contamination at Fort Ord within the Marina-Ord Area is unlikely.

~~8.10.2.5~~8.10.2.3 *Effects on Beneficial Users and Land Use*

Avoiding groundwater quality degradation at potable and agricultural wells due to actions directly resulting from GSP implementation will positively affect beneficial users as it will limit the need for potential groundwater treatment. However, this SMC will limit implementation of selected projects and in the vicinity of Fort Ord until legacy contaminants have been remediated. Remediation of legacy Ford Ord contamination is required pursuant to the Records of Decision, entered into by the Army and overseeing regulatory agencies.

8.10.3 Minimum Thresholds

The minimum threshold for degraded water quality ("water quality minimum threshold") for the Monterey Subbasin is defined as:

> *No additional exceedances of Title 22 drinking water standards in potable supply wells or Basin Plan water quality objectives in agricultural supply wells as a result of GSP implementation.*

Minimum thresholds for DDW public water system supply wells and ILRP on-farm domestic wells are based on Title 22 drinking water standards (i.e., MCLs and SMCLs). Minimum thresholds for agricultural supply wells are based on the water quality objectives listed in the Basin Plan (CCRWQCB, 2019) (Agricultural Water Quality Objectives). These drinking water and agricultural water quality criteria are jointly defined herein as "Regulatory Water Quality Standards". The minimum threshold values for constituents of concern identified for each management area are provided in Table 8-5. The selection criteria for constituents of concern are detailed in Section 8.10.3.1.

Because the minimum thresholds reflect no additional exceedances of Regulatory Water Quality Standards, the minimum thresholds are set to the number of existing exceedances. Surpassing the number of existing exceedances of Regulatory Water Quality Standards for any of the listed constituents as a result of GSP implementation will lead to an undesirable result. There are no current exceedances of Title 22 drinking water standards in Marina-Ord Area water supply wells. Additionally, as shown in Table 8-5, no constituents of concern exceed Agricultural Water Quality Objectives in agricultural supply wells in the Corral de Tierra Area. The Subbasin GSAs will continue to monitor water quality in the water quality monitoring network to ensure future exceedances are not due to GSP implementation. Not all wells in the monitoring network are sampled for every constituent of concern.

Table 8-5. Groundwater Quality Minimum Thresholds and Measurable Objectives

Constituent of Concern	Minimum Threshold/ Measurable Objective – Number of Wells Exceeding Regulatory Water Quality Standard (based on most recent sample)
Marina-Ord Area	
DDW Public Water System Supply Wells	
Carbon Tetrachloride	0
Trichloroethane	0
Corral de Tierra Area	
DDW Public Water System Supply Wells	
Arsenic	7
Benzo(a)Pyrene	1
Chromium	2
1,2 Dibromo-3-chloropropane	2
Dinoseb	3
Iron	13
Hexachlorobenzene	1
Manganese	11
Nickel	1
Specific Conductance	2
1,2,3-Trichloropropane	1
Total Dissolved Solids	2
Vinyl Chloride	3
Zinc	1
ILRP On-Farm Domestic Wells	
Total Dissolved Solids	1

8.10.3.1 Information and Methodology Used to Establish Water Quality Minimum Thresholds and Measurable Objectives

The powers granted to GSAs to effect sustainable groundwater management under SGMA generally revolve around managing the quantity, location, and timing of groundwater pumping. SGMA does not empower GSAs to develop or enforce water quality standards; that authority rests with the SWRCB Division of Drinking Water and Monterey County, because of the limited purview of GSAs with respect to water quality, and the rightful emphasis on those constituents that may be related to groundwater quantity management activities.

Therefore, this GSP is designed to avoid taking any action that may inadvertently move groundwater constituents already in the Subbasin in such a way that the constituents have a significant and unreasonable impact that would not otherwise occur. Constituents of concern must meet two criteria:

1. They must have a Regulatory Water Quality Standard.
2. They must have been detected in groundwater within the Subbasin at levels above the Regulatory Water Quality Standard.

Based on the review of groundwater quality data discussed in Chapter 5, the constituents of concern that exceed Title 22 drinking water standards and may affect drinking water supply wells in the Marina-Ord Area include:

- Trichloroethylene (TCE)
- Carbon Tetrachloride (CT)
- TDS
- Chloride

TCE and CT are being remediated by the Army at the former Fort Ord. Although currently not detected above their respective MCLs within Marina-Ord Area water supply wells, these compounds are identified as constituents of concern because they are detected above their respective MCLs in groundwater monitoring wells in the vicinity of water supply wells. TDS and chloride are also detected in groundwater above their respective SMCLs in the Marina-Ord Area primarily as a result of seawater intrusion.

Minimum thresholds are established so that no exceedance of Title 22 drinking water standards for these constituents of concern in water supply wells occur as a result of GSP implementation.

Other constituents and associated beneficial uses within the Marina-Ord Area are managed through existing management and regulatory programs under the U.S. Army, CCRWQCB, and SWRCB. New projects and management actions that could impact groundwater quality will require associated monitoring and permitting by the SWRCB and RWQCB.

There are no domestic or agricultural wells within the Marina Ord-Area. However, there is one ILRP on-farm domestic well with a TDS concentration that exceeded Title 22 drinking water standards between 2013-2019 in the Reservation Road portion of the Corral de Tierra Area, which is in the same hydrogeologic setting as the Marina-Ord Area. There were no exceedances of Agricultural Water Quality Objectives in ILRP irrigation wells in this area.

Based on the review of groundwater quality in Chapter 5 the constituents of concern (COCs) that may affect drinking water supply wells in the Corral de Tierra Area include (Table 8-5):

- Arsenic
- Benzo(a)Pyrene
- Chromium

- 1,2 Dibromo-3-chloropropane
- Dinoseb
- Iron
- Hexachlorobenzene
- Manganese
- Nickel
- Specific Conductance
- 1,2,3-Trichloropropane
- Total Dissolved Solids
- Vinyl Chloride
- Zinc

As discussed in Chapter 7, wells for three separate water quality monitoring networks were reviewed and used for developing SMCs:

- Public water system supply wells regulated by the SWRCB Division of Drinking Water.
- On-Farm Domestic wells monitored as part of ILRP. This dataset was obtained from the SWRCB through the GeoTracker GAMA online portal. The ILRP data were separated into two data sets, one for domestic wells and the other for agricultural wells (discussed below) for purposes of developing initial draft minimum thresholds and measurable objectives for each type of well. The monitoring well network for the ILRP will change in 2020 once monitoring is established and results are published under Ag Order 4.0. At that time, the new ILRP on-farm domestic monitoring network will be incorporated into this GSP, replacing the current network, for water quality monitoring.
- Irrigation supply wells monitored as part of ILRP. As mentioned above, this dataset was obtained from the SWRCB through the GeoTracker GAMA online portal. Like the on-farm domestic well dataset, the IRLP irrigation monitoring well network will change with the finalization of Ag Order 4.0.

Each of these well networks are monitored for a different set of water quality parameters. Furthermore, some groundwater quality impacts are detrimental to only certain networks. For example, high nitrates are detrimental to public water system supply wells and domestic wells but are not detrimental to agricultural irrigation wells. The constituents monitored in each well network are indicated by an X in Table 8-6. An X does not necessarily indicate that the constituents have been found above the Regulatory Water Quality Standard for that monitoring network.

Table 8-6. Monitored Constituents in Monitoring Well Networks

Constituent	Public Water System Supply	On-Farm Domestic[1]	Agricultural Supply
Chloride	X	X	X
Nitrate + Nitrite (sum as nitrogen)		X	X
Sulfate	X	X	X
Total Dissolved Solids	X	X	X
Nitrite	X	X	
Nitrate (as nitrogen)	X	X	
Specific Conductance	X	X	
Silver	X		
Aluminum	X		
Alachlor	X		
Arsenic	X		
Atrazine	X		
Boron	X		
Barium	X		
Beryllium	X		
Lindane	X		
Di(2-ethylhexyl)phthalate	X		
Bentazon	X		
Benzene	X		
Benzo(a)Pyrene	X		
Toluene	X		
Cadmium	X		
Chlordane	X		
Chlorobenzene	X		
Cyanide	X		
Chromium	X		
Carbofuran	X		
Carbon Tetrachloride	X		
Copper	X		
Dalapon	X		
1,2 Dibromo-3-chloropropane	X		
1,1-Dichloroethane	X		
1,2-Dichloroethane	X		
1,2-Dichlorobenzene	X		
1,4-Dichlorobenzene	X		
1,1-Dichloroethylene	X		
cis-1,2-Dichloroethylene	X		

Constituent	Public Water System Supply	On-Farm Domestic[1]	Agricultural Supply
trans-1,2-Dichloroethylene	X		
Dichloromethane (a.k.a. methylene chloride)	X		
1,2-Dichloropropane	X		
Dinoseb	X		
Diquat	X		
Di(2-ethylhexyl)adipate	X		
Ethylbenzene	X		
Endrin	X		
Fluoride	X		
Trichlorofluoromethane	X		
1,1,2-Trichloro-1,2,2-Trifluoroethane	X		
Iron	X		
Foaming Agents (MBAS)	X		
Glyphosate	X		
Hexachlorocyclopentadiene	X		
Hexachlorobenzene	X		
Heptachlor	X		
Mercury	X		
Manganese	X		
Molinate	X		
Methyl-tert-butyl ether (MTBE)	X		
Methoxychlor	X		
Nickel	X		
Oxamyl	X		
1,1,2,2-Tetrachloroethane	X		
Perchlorate	X		
Polychlorinated Biphenyls	X		
Tetrachloroethene	X		
Pentachlorophenol	X		
Picloram	X		
Antimony	X		
Selenium	X		
2,4,5-TP (Silvex)	X		
Simazine	X		
Styrene	X		
1,1,1-Trichloroethane	X		
1,1,2-Trichloroethane	X		
1,2,4-Trichlorobenzene	X		
Trichloroethene	X		

Constituent	Public Water System Supply	On-Farm Domestic[1]	Agricultural Supply
1,2,3-Trichloropropane	X		
Thiobencarb	X		
Thallium	X		
Toxaphene	X		
Vinyl Chloride	X		
Xylenes	X		
Zinc	X		

[1]Basin plan states domestic wells are monitored for Title 22 constituents; however, GeoTracker GAMA only provides data for the constituents listed above.

8.10.3.2 Relationship to Other Sustainability Indicators

Preventing degradation of groundwater quality may affect other sustainability indicators or may Preventing migration of groundwater of poor water quality may limit activities needed to avoid exceeding minimum thresholds for other sustainability indicators. For example, groundwater quality minimum thresholds could influence the types and locations of projects needed to attain groundwater elevation minimum thresholds and seawater intrusion minimum thresholds by

- limiting the types of water that can be used for recharge to raise groundwater elevations, and
- limiting the locations where such recharge can occur due to legacy Fort Ord contamination.

8.10.3.3 Effect of Minimum Thresholds on Neighboring Basins and Subbasins

The anticipated effect of the degraded groundwater quality minimum thresholds on each of the neighboring subbasins is addressed below.

The Monterey Subbasin has two neighboring subbasins within the Salinas Valley Groundwater Basin:

- The 180/400-Foot Aquifer Subbasin to the north;
- The Seaside Subbasin to the south

The GSAs coordinating the Monterey Subbasin GSP are the same GSAs covering the adjacent 180/400-Foot Aquifer Subbasin. The GSAs have been coordinating the development of the minimum thresholds and measurable objectives within the 180/400-Foot Aquifer Subbasin GSP, which was submitted to DWR in January 2020. The groundwater quality minimum threshold defined herein are consistent with the minimum threshold defined in the 180/400-Foot Aquifer Subbasin GSP.

The Seaside Subbasin is an adjudicated basin and not subject to SGMA. Because the minimum threshold in the Monterey Subbasin is no additional exceedance of regulatory standards, it is likely that the minimum thresholds will not prevent the Seaside Subbasin from meeting its adjudication requirements. The Subbasin GSAs have and will continue to coordinate closely with the Seaside Watermaster to ensure that the Monterey Subbasin minimum thresholds do not prevent the Seaside Subbasin from meeting its adjudication requirements.

8.10.3.4 Effect on Beneficial Uses and Users

Urban land uses and users. The groundwater quality minimum thresholds generally provide positive benefits to the Subbasin's urban water users. Preventing any GSA actions that would result in additional drinking water supply wells exceeding MCLs or SMCLs ensures adequate groundwater quality for public water system supplies.

Agricultural land uses and users. The groundwater quality minimum thresholds generally provide positive benefits to the Subbasin's agricultural water users. Preventing any GSA actions that would result in additional agricultural supply wells from exceeding levels that could reduce crop production ensures that a supply of usable groundwater will exist for beneficial agricultural use.

Domestic land uses and users. The groundwater quality minimum thresholds generally provide positive benefits to the Subbasin's domestic water users. Preventing any GSA actions that would result in constituents of concern in additional drinking water supply wells from exceeding MCLs or SMCLs ensures adequate groundwater quality for domestic supplies.

Ecological land uses and users. Although the groundwater quality minimum thresholds do not directly benefit ecological uses, it can be inferred that the degradation of groundwater quality minimum thresholds provide generally positive benefits to the Subbasin's ecological water uses. Preventing any GSA actions that would result in constituents of concern from migrating will prevent unwanted contaminants from impacting ecological groundwater uses.

8.10.3.5 Relation to State, Federal, or Local Standards

The groundwater quality minimum thresholds are set at the Subbasin's water supply wells and specifically incorporate state and federal standards for drinking water.

8.10.3.6 Method for Quantitative Measurement of Minimum Thresholds

Degradation of groundwater quality minimum thresholds will be directly measured from existing public water system supply wells, domestic wells, or agricultural supply wells. Groundwater quality will be measured through existing monitoring programs.

- Exceedances of MCLs and SMCLs in public water system wells will be monitored from annual water quality reports submitted to the California Division of Drinking Water and the County of Monterey.

- Exceedances of MCLs and SMCLs in on-farm domestic wells will be monitored from the ILRP data as discussed in Chapter 7. Exceedances of Agricultural Water Quality Objectives for crop production will be monitored from the ILRP data as discussed in Chapter 7.

Initially, a review of data relative to MCLs, SMCLs, and Agricultural Water Quality Objectives will be centered around the constituents of concern identified above. If during the review of the water quality data additional constituents appear to exceed MCLs, SMCLs, or Agricultural Water Quality Objectives minimum thresholds and measurable objectives will be developed for these additional constituents.

8.10.4 Measurable Objectives

The measurable objectives for degradation of groundwater quality represent target groundwater quality distributions in the Subbasin. SGMA does not mandate the improvement of groundwater quality. Therefore, measurable objectives have been set to be identical to the minimum thresholds, as defined in Table 8-5.

8.10.4.1 Method for Setting Measurable Objectives

As described above, measurable objectives are set to be identical to the minimum thresholds and therefore follow the same method as detailed in Section 8.10.3.1.

8.10.4.2 Interim Milestones

Interim milestones show how the GSAs anticipate the Subbasin will gradually move from current conditions to meeting the measurable objectives over the next 20 years of implementation. Interim milestones are set for each five-year interval following GSP adoption.

There is no anticipated degradation of groundwater quality during GSP implementation that results from the implementation of projects and actions as described in Chapter 9. Therefore, the expected interim milestones are identical to minimum thresholds and measurable objectives, which represent current conditions.

8.11 Subsidence SMC

8.11.1 Locally Defined Significant and Unreasonable Conditions

Locally defined significant and unreasonable subsidence in the Subbasin is defined as follows:

- Any inelastic land subsidence that is caused by lowering of groundwater elevations occurring in the Subbasin is significant and unreasonable.

Subsidence can be elastic or inelastic. Elastic subsidence is the small, reversible lowering and raising of the ground surface. Inelastic subsidence is generally irreversible. This set of SMCs only concerns inelastic subsidence.

8.11.2 Undesirable Results

8.11.2.1 Criteria for Defining Undesirable Results

By regulation, the ground surface subsidence undesirable result is a quantitative combination of subsidence minimum threshold exceedances. For the Monterey Subbasin, no long-term subsidence is acceptable. Therefore, the ground surface subsidence undesirable result is:

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

As discussed below, the subsidence minimum thresholds allow for measurement error in the InSAR data of 0.1 foot per year. Should potential subsidence be observed, the Subbasin GSAs will first assess whether the subsidence may be due to elastic subsidence. If the subsidence is not elastic, the GSAs will undertake a program to assess whether the subsidence is caused by lowered groundwater elevations. The first step in the assessment will be to check if groundwater elevations have dropped below historical lows. If groundwater elevations remain above historical lows, the GSAs shall assume that any observed subsidence was not caused by lowered groundwater levels. If groundwater levels have dropped below historical lows, the GSAs will attempt to correlate the observed subsidence with measured groundwater elevations.

8.11.2.2 Potential Causes of Undesirable Results

As shown in Chapter 5, no land subsidence has been observed within the Subbasin. It is unlikely that land subsidence will occur within the Subbasin because of its proximity to the ocean. However, the GSAs have established SMCs for this sustainability indicator and will continue to monitor InSAR data.

8.11.2.3 Effects on Beneficial Users and Land Use

The undesirable result for subsidence does not allow any subsidence to occur in the Subbasin. Therefore, there is no negative effect on any beneficial uses and users.

8.11.3 Minimum Thresholds

The minimum threshold for subsidence is defined as:

> *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.*

8.11.3.1 Information Used and Methodology for Establishing Subsidence Minimum Thresholds

The minimum threshold was established using InSAR data available from DWR. The minimum threshold is no long-term irreversible subsidence in the Subbasin. The InSAR data provided by DWR, however, is subject to measurement error. DWR stated that, on a statewide level, for the total vertical displacement measurements between June 2015 and June 2019, the errors are as follows (Brezing, personal communication):

1. The error between InSAR data and continuous GPS data is 16 mm (0.052 feet) with a 95% confidence level.
2. The measurement accuracy when converting from the raw InSAR data to the maps provided by DWR is 0.048 feet with a 95% confidence level.

By adding errors 1 and 2, the combined error is 0.1 foot. While this methodology is not a robust statistical analysis, it does provide an estimate of the potential error in the InSAR maps provided by DWR.

Additionally, the InSAR data provided by DWR reflects both elastic and inelastic subsidence. While it is difficult to compensate for elastic subsidence, visual inspection of monthly changes in ground elevations suggests that elastic subsidence is largely seasonal. To minimize the influence of elastic subsidence on the assessment of long-term, permanent subsidence, changes in ground level will only be measured annually from June of one year to June of the following year.

8.11.3.2 Relationship between Individual Minimum Thresholds and Relationship to Other Sustainability Indicators

The subsidence minimum threshold has little or no impact on other minimum thresholds as there has been no observed subsidence observed to date. Therefore, the SMCs for subsidence should not trigger greater extraction or the implementation of any projects and/or management actions in the Subbasin which could affect other sustainability indicators.

8.11.3.3 Effect of Minimum Thresholds on Neighboring Basins and Subbasins

The Monterey Subbasin has two neighboring subbasins within the Salinas Valley Groundwater Basin:

- The 180/400-Foot Aquifer Subbasin to the north;
- The Seaside Subbasin to the south

The GSAs coordinating the Monterey Subbasin GSP are the same GSAs covering the adjacent 180/400-Foot Aquifer Subbasin. The GSAs have been coordinating the development of the minimum thresholds and measurable objectives within the 180/400-Foot Aquifer Subbasin GSP, which was submitted to DWR in January 2020. The land subsidence minimum threshold defined herein is consistent with the minimum threshold defined in the 180/400-Foot Aquifer Subbasin GSP.

The Seaside Subbasin is adjudicated not subject to SGMA. Because the minimum threshold in the Monterey Subbasin is zero subsidence, it is likely that the minimum thresholds will not prevent the Seaside Subbasin from meeting its adjudication requirements. The Subbasin GSAs have and will continue to coordinate closely with the Seaside Watermaster to ensure that the Monterey

Subbasin minimum thresholds do not prevent the Seaside Subbasin from meeting its adjudication requirements.

8.11.3.4 Effects on Beneficial Uses and Users

The subsidence minimum threshold is set to prevent any long-term inelastic subsidence. Available data indicate that there is currently no long-term subsidence occurring in the Subbasin, and pumping limits are already required by minimum thresholds for other sustainability indicators. Therefore, the subsidence minimum threshold does not require any additional reductions in pumping and there is no negative impact on any beneficial user.

8.11.3.5 Relation to State, Federal, or Local Standards

There are no federal, state, or local regulations related to subsidence.

8.11.3.6 Method for Quantitative Measurement of Minimum Threshold

Minimum thresholds will be assessed using DWR-supplied InSAR data.

8.11.4 Measurable Objectives

The measurable objective for ground surface subsidence represents target subsidence rates in the Subbasin. Because the minimum threshold of zero net long-term subsidence is the best achievable outcome, the measurable objective is identical to the minimum threshold.

8.11.4.1 Method for Setting Measurable Objectives

The measurable objective will be assessed using DWR-supplied InSAR data.

8.11.4.2 Interim Milestones

The subsidence measurable objective is set at zero net long-term subsidence, which is consistent with current conditions. Therefore, there is no change between current conditions and sustainable conditions and interim milestones are identical to current conditions.

8.12 Depletion of Interconnected Surface Water SMC

Areas with interconnected surface water occur where shallow groundwater may be connected to the surface water system. This set of SMCs only applies to locations of potential interconnected surface water, as shown on Figure 5-35 and Figure 5-36.

8.12.1 Locally Defined Significant and Unreasonable Conditions

The Monterey Subbasin generally does not have large areas where interconnected surface water occurs. As shown in Chapter 5, four potential locations of interconnected surface water are identified in the Subbasin: the Marina vernal ponds, the lower reaches of El Toro Creek, and two stretches of the Salinas River. The Salinas River supports surface water rights holders and has ecological flow requirements. Additionally, all surface water bodies identified are located within areas of potential groundwater dependent ecosystems (GDEs). Therefore, the management of interconnected surface water within the Monterey Subbasin is also focused on managing groundwater impacts on GDEs.

Locally defined significant and unreasonable depletion of interconnected surface water in the Subbasin is defined as:

- Depletions that would result in an unreasonable impact on other beneficial uses and users of surface water, such as groundwater dependent ecosystems.

These significant and unreasonable conditions were determined based on input collected during MCWD stakeholder meetings, SVBGSA Subbasin Committee meetings, and discussions with GSA staff during Subbasin Technical Committee meetings.

8.12.2 Undesirable Results

8.12.2.1 Criteria for Defining Undesirable Results

By regulation, the depletion of interconnected surface water undesirable result is a quantitative combination of minimum threshold exceedances. Shallow groundwater elevations near the locations of potentially interconnected surface water will be used as a proxy for minimum thresholds and measurable objectives. Since there is likely to be a limited number of shallow groundwater wells by each location of interconnected surface water, more than one minimum threshold exceedance by a location of interconnected surface water would cause an undesirable result.

Therefore, for the Monterey Subbasin, the undesirable result for depletion of interconnected surface water is:

> *Any minimum threshold exceeded in a shallow groundwater well near any location of interconnected surface water for more than two consecutive years.*

The undesirable result is established based on historically observed hydrologic conditions observed between 1995 and 2015 during which period no significant or unreasonable depletion of interconnected surface water had occurred.

Within this subbasin, there are only a few instances of potential ISW: the Marina Ponds, the two locations of the Salinas River, and Lower Toro Creek. Currently, tThere is no extraction near the Marina Ponds, and thus no cause for concern for extraction-induced depletion. There is uncertainty regarding the connectivity to the principal aquifer in the two areas where the Salinas River dips into the Subbasin, as it may or may not be underlain by the Salinas Valley Aquitard. There is the potential for interconnection along Lower Toro Creek, which is considered a perennial stream, as described in Chapter 4. However, the flows recorded at the USGS gage from 1961 to 2001 indicate flow only occurred in 60% of the years of record. During the other 30% of the time, surface water users saw no flow, as is typical for this creek. Therefore, one year of no flow is not reflective of an undesirable result for this surface water body and the undesirable result consists of two consecutive years of minimum threshold exceedance. Thus, this undesirable result is reasonable and reflective of this Subbasin.

Future climate change and extreme droughts may cause shallow groundwater elevation declines and further depletions of interconnected surface water irrespective of groundwater pumping. The exceedance of minimum thresholds near locations of interconnected surface water due to naturally occurring, extreme drought conditions may not be considered an undesirable result. Additionally, the GSAs will continue to evaluate the effects of future climate change on groundwater conditions and may reevaluate SMCs when more information is available.~~However, future climate change and extreme droughts may cause shallow groundwater elevation declines and further depletions of interconnected surface water irrespective of groundwater pumping. The exceedance of minimum thresholds near locations of interconnected surface water due to naturally occurring, extreme drought conditions may not be considered an undesirable result. This methodology aligns with the SMCs BMP (DWR, 2017) which states, "Overdraft during a period of drought is not sufficient to establish a chronic lowering of groundwater levels if extractions and groundwater recharge are managed as necessary to ensure that reductions in groundwater levels or storage during a period of drought are offset by increases in groundwater levels or storage during other periods." Additionally, the GSAs will continue to evaluate the effects of future climate change on groundwater conditions and may reevaluate SMCs when more information is available.~~

8.12.2.2 Potential Causes of Undesirable Results

Depletion of interconnected surface water is generally correlated to chronic lowering of groundwater levels in an interconnected groundwater aquifer system.

Conditions that may lead to an undesirable result for the depletion of interconnected surface waters in the Marina-Ord Area include the following:

- **Potential projects that would create groundwater declines in shallow groundwater.** There is currently no groundwater extraction in the Dune Sand Aquifer or the underlying 180-Foot Aquifer near locations of interconnected surface water within the Marina-Ord Area However, future projects near interconnected surface water bodies within the Monterey Subbasin or adjacent subbasins could reduce shallow groundwater elevations.

Conditions that may lead to an undesirable result for the depletion of interconnected surface waters in the Corral de Tierra Area include the following:

- **Localized pumping increases**. Even if the Subbasin is adequately managed at the Subbasin scale, increases in localized pumping of shallow groundwater near interconnected surface water bodies could reduce shallow groundwater elevations.
- **Expansion of riparian water rights**. Riparian water rights holders often pump from wells adjacent to streams. Pumping by these riparian water rights holder users is not regulated

under this GSP. Additional riparian pumpers near interconnected reaches of rivers and streams may result in excessive localized surface water depletion.

- **Departure from the GSP's climatic assumptions, including extensive, unanticipated drought**. Minimum thresholds were established based on anticipated future climatic conditions. Departure from the GSP's climatic assumptions or extensive, unanticipated droughts may lead to excessively low groundwater elevations that increase surface water depletion rates.
- **Changes in Nacimiento and San Antonio Reservoir Releases.** Since the Salinas River is dependent on reservoir releases for sustained summer flows, when diversions are at the highest level, any decrease in reservoir flows during that time could affect interconnected surface waters by increases in depletions and could cause undesirable results to beneficial users.

8.12.2.3 Effects on Beneficial Users and Land Use

Potential effects of undesirable results of depletion of interconnected surface water in the Marina-Ord Area may include reduced surface water to support GDEs.

Potential effects of undesirable results of depletion of interconnected surface water in the Corral de Tierra may include reduced surface water flows to support downstream or in-stream uses, and to support riparian habitat or associated GDEs.

The depletion of interconnected surface water undesirable result is to have no net change in surface water depletion during average hydrologic conditions and over the long-term, as determined by shallow groundwater elevations. Therefore, during average long-term hydrologic conditions, the undesirable result will not have a negative effect on the beneficial users and uses of groundwater. However, pumping of shallow groundwater during dry years could temporarily increase rates of surface water depletions. Therefore, there could be short-term impacts on all beneficial users and uses of the surface water during dry years.

8.12.3 Minimum Thresholds

The minimum threshold for depletion of interconnected surface water is set to:

> *Minimum shallow groundwater elevations historically observed between 1995 and 2015 near locations of interconnected surface water.*

Figure 8-15 shows locations of interconnected surface water and shallow groundwater level minimum thresholds established in the Marina-Ord Area. As mentioned in Chapter 7, SVBGSA is planning to install a new interconnected surface water monitoring well in the Corral de Tierra Area along El Toro Creek. SMCs for the new well will be determined using interpolated values from the groundwater elevation contour maps.

~~potentially interconnected surface water and shallow groundwater level minimum thresholds established in the Marina-Ord Area.~~

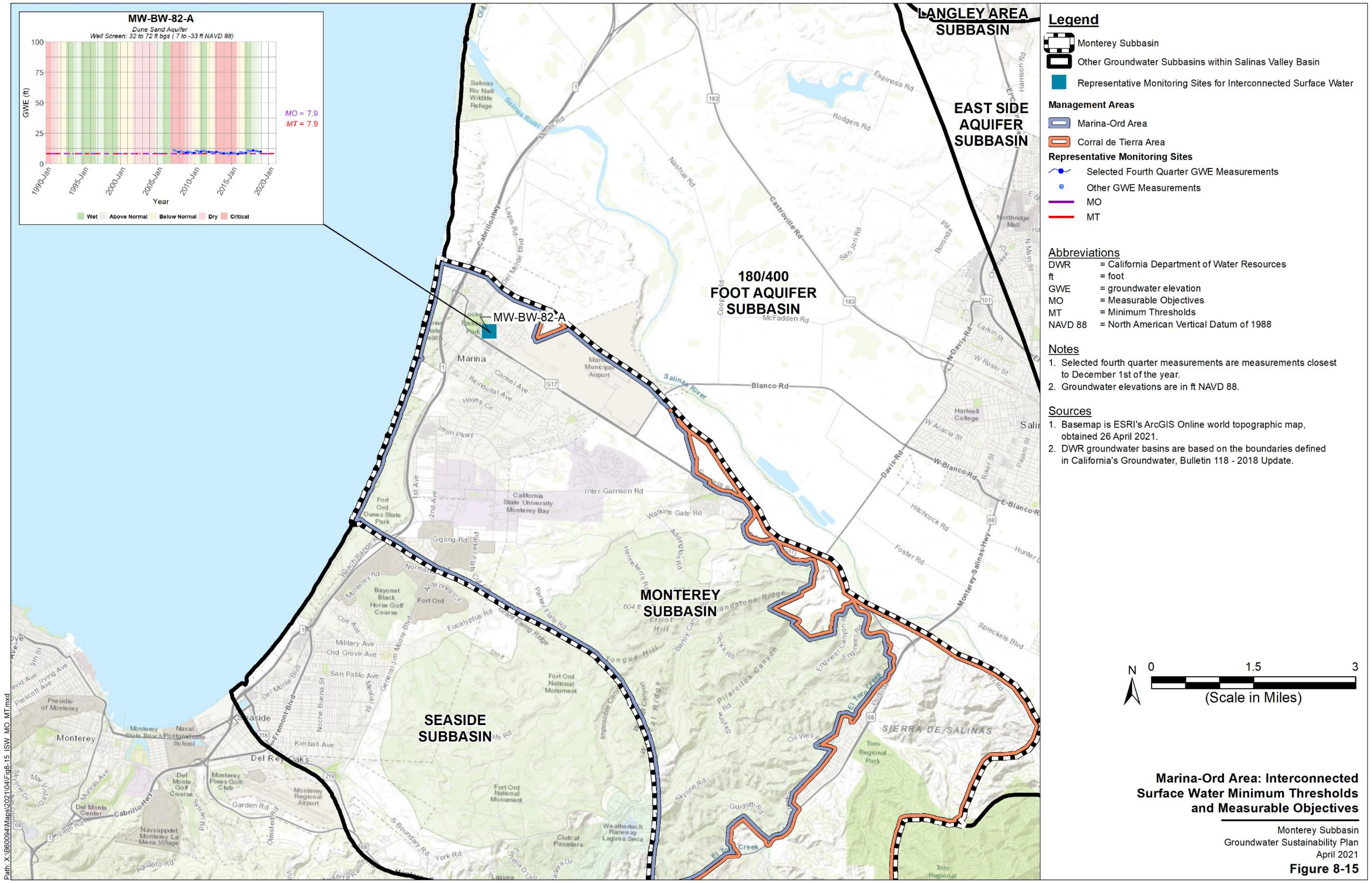


Figure 8-15. Marina-Ord Area: Interconnected Surface Water Minimum Thresholds and Measurable Objectives

8.12.3.1 Information Used and Methodology for Establishing Depletion of Interconnected Surface Water Minimum Thresholds

8.12.3.1.1 Establishing Groundwater Elevations as Proxies

The GSP Emergency Regulations §354.28(d) states that: "an Agency may establish a representative minimum threshold for groundwater elevation to serve as the value for multiple sustainability indicators, where the Agency can demonstrate that the representative value is a reasonable proxy for multiple individual minimum thresholds as supported by adequate evidence."

The evaluation of ISW in the Salinas Valley Groundwater Basin is based on an approach recommended by the Environmental Defense Fund (EDF, 2018) that uses groundwater elevations as surrogates for streamflow depletion rates caused by groundwater use. Basic hydraulic principles state that groundwater flow is proportional to the difference between groundwater elevations at different locations along a flow path. Using this basic principle, groundwater flow to a stream, or conversely seepage from a stream to the underlying aquifer, is proportional to the difference between water elevation in the stream and groundwater elevations at locations away from the stream. Assuming the elevation in the stream is relatively stable, changes in interconnectivity between the stream and the underlying aquifer are determined by changes in groundwater levels in the aquifer. Thus, the change in hydraulic gradient between stream elevation and surrounding groundwater elevations is representative of change in interconnection between surface water and groundwater. Monitoring the hydraulic gradient in the aquifer adjacent to the stream monitors the interconnectivity between stream and aquifer. Therefore, the gradient can be monitored by measuring and evaluating groundwater elevations at selected shallow monitoring wells near streams. No existing estimations of the quantity and timing of depletions of ISW exist, nor data available to make estimations, so the hydraulic principles provide the best available information.

8.12.3.1.2 Review of Beneficial Uses and Users of Surface Water

The various beneficial uses and users of surface waters were addressed when setting interconnected surface water depletion minimum thresholds. The classes of beneficial uses and users that were reviewed include riparian rights holders, appropriative rights holders, ecological surface water users, and recreational surface water users. This evaluation is not a formal analysis of public trust doctrine, but provides a reasonable review of all uses and users in an attempt to balance all interests. This evaluation does not assess what constitutes a reasonable beneficial use under Article X, Section 2 of the California Constitution.

The minimum thresholds for depletion of interconnected surface waters are developed using the definition of significant and unreasonable conditions described above, public information about critical habitat, public information about water rights described below, and the Subbasin water budget analysis.

Riparian water rights holders

There are no active riparian water rights holders within the Subbasin, including riparian water rights holders for the sections of the Salinas River where it enters the Subbasin. The diversion data were obtained from queries of the SWRCB eWRIMS water rights management system.

The SVBGSA is not aware of any current riparian water rights litigation or water rights enforcement acts along the Salinas River in the Subbasin. Therefore, SVBGSA assumes that the current level of depletion has not injured any riparian water rights holders in the Subbasin.

Appropriative water rights holders

There are no appropriative water rights holders within the Subbasin.

Ecological surface water users

Within the Marina-Ord Area, groundwater elevations within the shallow-most aquifer, the Dune Sand Aquifer, have been stable for over two decades. In 2020, the City of Marina determined that the groundwater dependent ecosystems associated with the Marina vernal ponds are in "good condition". Given the stable groundwater patterns in the Dune Sand Aquifer and the good condition of the groundwater dependent ecosystems, there is no significant and unreasonable depletion of interconnected surface water under current conditions.

There are no known flow prescriptions on the El Toro Creek or any tributaries in the Corral de Tierra Area. Therefore, the current level of depletion has not violated any ecological flow requirements. This conclusion is not meant to imply that depletions do not impact potential species living in or near surface water bodies in the Corral de Tierra Area. However, any impacts that may be occurring have not risen to a level that triggers regulatory intervention. Therefore, the impacts from current rates of depletion on ecological surface water users adjacent to the El Toro Creek are not unreasonable.

A review of MCWRA's Nacimiento Dam Operation Policy and MCWRA's water rights indicates MCWRA operates the Dam in a manner that meets downstream Salinas River demands and considers ecological surface water users. Since the reservoir operations consider ecological surface water users and reflect reasonable existing surface water depletion rates, this GSP infers that stream depletion from existing groundwater pumping is not unreasonable. If further river management guidelines are developed to protect ecological surface water users, the SMC in this GSP will be revisited.

Recreational surface water users

No recreational activities such as boating regularly occur on surface water bodies in the Subbasin.

As shown by the analysis above, the current rate of surface water depletion is not having an unreasonable impact on the various surface water uses and other users in the Subbasin. Therefore, the minimum thresholds are set based on historical minimum groundwater elevations observed between 1995 and 2005.

8.12.3.2 Relationship between Individual Minimum Thresholds and Relationship to Other Sustainability Indicators

The minimum threshold for depletion of surface water is set near the locations of interconnected surface water above historical and current groundwater elevations. The minimum thresholds reference the same historical years with consideration of fluctuations in aquifers that has steady groundwater elevations over the past two decades. Therefore, no conflict exists between minimum thresholds measured at various locations within the Subbasin.

As discussed above, SMCs for depletion of interconnected surface water minimum threshold are consistent with those established for chronic lowering of groundwater levels, change in groundwater storage, and seawater intrusion SMCs. There is no known relationship between these SMCs and groundwater quality or subsidence.

8.12.3.3 Effect of Minimum Thresholds on Neighboring Basins and Subbasins

The Monterey Subbasin has two neighboring subbasins within the Salinas Valley Groundwater Basin:

- The 180/400-Foot Aquifer Subbasin to the north;
- The Seaside Subbasin to the south

The GSAs coordinating the Monterey Subbasin GSP are the same GSAs covering the adjacent 180/400-Foot Aquifer Subbasin. The GSAs have been coordinating the development of the minimum thresholds and measurable objectives within the 180/400-Foot Aquifer Subbasin GSP, which was submitted to DWR in January 2020. Because the minimum thresholds in both the Monterey Subbasin and 180/400-Foot Aquifer Subbasin have been developed by the same GSAs in a coordinated fashion, the minimum thresholds do not conflict with each other.

The Seaside Subbasin is an adjudicated basin and not subject to SGMA. Because there are no interconnected surface water bodies that cross the Monterey and the Seaside Subbasin, it is likely that the minimum thresholds will not prevent the Seaside Subbasin from meeting its adjudication requirements. The Subbasin GSAs have and will continue to coordinate closely with the Seaside Watermaster to ensure that the Monterey Subbasin minimum thresholds do not prevent the Seaside Subbasin from meeting its adjudication requirements.

8.12.3.4 Effect on Beneficial Uses and Users

Table 3-9 of the Salinas River Long-Term Management Plan (MCWRA, 2019) includes a list of 18 different designated beneficial uses on certain reaches of the river. In general, the major beneficial uses on the Salinas River are:

- Surface water diversions for agricultural, urban/industrial and domestic supply
- Groundwater pumping from recharged surface water

- Freshwater habitat
- Rare, threatened or endangered species, such as the Steelhead Trout
- CSIP diversions

The depletion of surface water minimum thresholds may have varied effects on beneficial users and land uses in the Subbasin.

Urban land uses and users. The depletion of surface water minimum threshold prevents lowering of shallow groundwater elevations adjacent to groundwater dependent ecosystems and certain parts of streams. This may limit the amount of urban pumping near these areas, which could limit urban growth in these areas and implementation of projects that extract groundwater from these shallow aquifers. Also, if pumping is limited, municipalities may have to obtain alternative sources of water to achieve urban growth goals. If this occurs, this may result in higher water costs for municipal water users.

Domestic land uses and users. The depletion of surface water minimum threshold may benefit existing domestic land users and uses by maintaining shallow groundwater elevations near streams and groundwater dependent ecosystems protecting the operability of relatively shallow domestic wells. However, these minimum thresholds may limit the number of new domestic wells that can be installed near such areas to limit the additional drawdown from the new wells.

Agricultural land uses and users. The depletion of surface water minimum threshold prevents lowering of shallow groundwater elevations adjacent to certain parts of streams and groundwater dependent ecosystems. This has the effect of limiting the amount of groundwater pumping in these areas. Limiting the amount of groundwater pumping may limit the quantity and type of crops that can be grown in these adjacent to streams and rivers.

Ecological land uses and users. The depletion of surface water minimum thresholds likely benefits ecological uses and users by preventing further degradation of ecological impacts from groundwater pumping. Additionally, by setting future groundwater levels at or above recent lows, there should be less impact to GDEs than has been seen to date. Therefore, GDEs are protected from future significant and unreasonable impacts due to low groundwater levels, regardless of the GDE location.

8.12.3.5 Relation to State, Federal, or Local Standards

The minimum thresholds are developed in accordance with NMFS streamflow requirements. There are no NMFS streamflow requirements and known water rights litigation and enforcement complaints for the non-Salinas River surface water bodies within the Monterey Subbasin.

8.12.3.6 Method for Quantitative Measurement of Minimum Threshold

Groundwater elevations measured in shallow wells adjacent to potentially interconnected surface water bodies will serve as the primary approach for monitoring depletion of surface water. The Monterey Subbasin Model will serve as the secondary approach for monitoring depletion of surface water when it becomes available. At a minimum, the model will be updated every 5 years and the amount of surface water depletion that occurred in the previous 5 years will be estimated.

As discussed in Chapter 7, one shallow groundwater well is included in the monitoring network within the Marina-Ord Area. In the event that future groundwater activities in the Subbasin or the adjacent 180/400-Foot Aquifer Subbasin may influence the condition of these vernal ponds, the GSAs will work with project proponents to install additional shallow groundwater monitoring well. New projects or management actions that could impact groundwater conditions near the coastal areas of the City of Marina will require associated permitting by the City of Marina, the County of Monterey, and the California Coastal Commission per land use restrictions discussed in Chapter 3.

No shallow groundwater wells are currently identified in the Corral de Tierra Area. As discussed in Chapter 7, SVBGSA will incorporate one existing shallow well along Toro Creek near the USGS gauge into the interconnected surface water monitoring network and will work with USGS to reactivate the stream gauge along Toro Creek during GSP implementation for conjunctive data collection.

8.12.4 Measurable Objectives

The measurable objective for depletion of interconnected surface water is the same as the minimum threshold.

8.12.4.1 Method for Setting Measurable Objectives

Depletion of interconnected surface water measurable objectives are set at conditions identified with the historical minimum shallow groundwater elevations between 1995 and 2015. Therefore, there is no need to set a measurable objective different than the minimum threshold.

Discussions with GSA staff and stakeholders suggested that stakeholders acknowledge El Toro Creek is the mainstream that drains into the neighboring 180/400-Foot Aquifer Subbasin. The Corral de Tierra Area generally does not have large areas where interconnected surface water potentially occurs; however, further analyses and model results are needed to establish this relationship. Therefore, there is no need to set a measurable objective different than the minimum threshold.

Salinas River flows are meant in part to intentionally recharge the groundwater basin. Therefore, there is no need to set a measurable objective different than the minimum threshold.

8.12.4.2 Interim Milestones

Depletion of interconnected surface water minimum thresholds and measurable objectives are set at conditions identified with the historical minimum shallow groundwater elevations between 1995 and 2015; there is no anticipated increase or decrease in surface water depletion during GSP implementation. The expected interim milestones are identical to the minimum threshold and measurable objectives shown on Figure 8-15. Figure 8-15 shows the identified historical minimum shallow groundwater elevations observed between 1995 and 2015.

9 PROJECTS AND MANAGEMENT ACTIONS

This chapter describes the projects and management actions that will allow the Subbasin to attain sustainability in accordance with §354.42 and §354.44 of the Groundwater Sustainability Plan (GSP) Regulations.

The term "projects" generally refers to activities that require infrastructure or physical changes to the environment to support groundwater sustainability. The term "groundwater management actions" generally refers to activities that support groundwater sustainability without infrastructure.

The Salinas Valley Basin Groundwater Sustainability Agency (SVBGSA) and Marina Coast Water District (MCWD) are developing an Implementation Agreement that is anticipated to be adopted before completion of this Groundwater Sustainability Plan (GSP). The Implementation Agreement will address the responsibilities of each agency and identify coordination mechanisms to facilitate GSP implementation, including the filling of data gaps, monitoring, and implementation of projects and management actions identified in the GSP. It is anticipated that MCWD will lead the planning and implementation of projects within the Marina-Ord Area, and that SVBGSA will lead the planning and implementation of projects in the Corral de Tierra Area. Several projects identified in this chapter will require multi-basin coordination and will be facilitated by MCWD, SVBGSA, and other relevant parties.

9.1 Goals and Objectives of Projects and Management Actions

Per the GSP Emergency Regulations, GSPs must include projects and management actions to address any existing or potential future undesirable results for the identified relevant sustainability indicators. Therefore, the goal of the projects and management actions discussed herein is to address significant and unreasonable results related to the relevant sustainability indicators in each management area. As discussed in Chapter 8, existing and potential future undesirable results in the Subbasin are identified for the (1) chronic lowering of groundwater levels sustainability indicator in the Marina-Ord and Corral de Tierra Management Areas, and (2) seawater intrusion sustainability indicator in the Marina-Ord Area. In addition, the reduction of groundwater storage indicator is directly correlated with groundwater elevations and seawater intrusion.

Earlier chapters of this GSP highlighted the hydraulic connection between the Monterey Subbasin and both the adjacent critically overdrafted 180/400-Foot Aquifer Subbasin and Seaside Subbasin. Reaching sustainability and achieving measurable objectives within the Monterey Subbasin will be affected by groundwater conditions and management within these adjacent subbasins and the greater Salinas Valley Basin. Therefore, projects, management actions, and implementation actions will need to be coordinated between subbasins to achieve sustainability. Regional coordination projects and multi-subbasin projects are included when they have the potential to directly benefit this Subbasin. Therefore, the Subbasin Groundwater Sustainability

Agencies (GSAs) have developed a California Sustainable Groundwater Management Act (SGMA) implementation approach that includes regional coordination actions, participating in regional, multi-basin projects, in addition to implementing local projects and management actions.

This GSP is developed as part of an integrated effort to achieve groundwater sustainability in all six subbasins of the Salinas Valley. Therefore, the projects and actions included in this GSP are part of a larger set of integrated projects and actions for the entire Valley.

9.1.1 Process for Developing Projects and Management Actions

Projects and management actions presented in this chapter were developed through reviews of publicly available information, gathering feedback during public meetings, conducting hydrogeologic analysis, consulting with MCWD and SVBGSA staff, coordinating through the MCWD/SVBGSA Subbasin Technical Committee and the SVBGSA Monterey Subbasin Planning Committee, and meeting with each GSA's governing body members.

Developing projects and management actions for this GSP involved building on, revising, and adding to the projects and management actions developed for the entire Valley as part of the 180/400-Foot Aquifer Subbasin GSP and other draft 2022 Salinas Valley Basin GSPs. The initial list of projects in the 180/400-Foot Aquifer Subbasin GSP was developed with stakeholder input, including a brainstorming workshop for stakeholders to propose and discuss their ideas. The list of projects and actions were then narrowed down for inclusion in the 180/400-Foot Aquifer Subbasin GSP based on feasibility, likelihood of stakeholder acceptance, and ability to address groundwater conditions.

Building off the previously identified projects, the GSAs undertook an iterative process at the Subbasin level to develop the projects and management actions in this GSP.

Within the Marina-Ord Area, project planning was built on foundational supply planning efforts conducted by MCWD prior to GSP development. A list of local projects for the Marina-Ord Area were developed by consulting with MCWD staff and reviewing prior MCWD feasibility assessments of water supply augmentation and recharge projects. Inclusion of multi-subbasin projects in this GSP was developed through the Subbasin Technical Committee. MCWD and SVBGSA staff assessed multi-subbasin projects included in the 180/400-Foot Aquifer Subbasin GSP and other draft 2022 Salinas Valley Basin GSPs that could potentially provide supply augmentation to the Monterey Subbasin and tailored those projects for this GSP. After the initial list of local and multi-basin projects were developed, the identified projects and management actions were presented during stakeholder workshops, MCWD Board Meetings, and were discussed with stakeholders.

Within the Corral de Tierra Area, an overview of the purpose and types of projects and management actions was presented by SVBGSA to the Subbasin Planning Committee, and initial ideas were solicited. Committee members completed a survey for feedback and further solicitation of ideas. After these ideas were gathered, a list of potential projects and management actions specific to the management area was presented to the Subbasin Committee and discussed.

Special workshops and meetings were held with the purpose of considering pumping reductions. Potential projects and management actions were also discussed in terms of meeting the Sustainable Management Criteria (SMCs) outlined in Chapter 8.

9.1.2 Conditions and Assumptions

The projects and management actions included in this chapter outline a framework for achieving sustainability, however, many details must be negotiated before any of the projects and management actions can be implemented. Project costs will be additional to the agreed-upon funding to sustain the operational costs of Subbasin GSAs, and funding needed for monitoring and reporting.

The projects and management actions are based on existing infrastructure and assume continued operation of that infrastructure at current capacity. If current infrastructure is operated differently or other projects are implemented within the Valley that affect groundwater conditions, the GSAs will adapt their consideration of projects and management actions accordingly.

Discussions and decisions regarding specific projects will continue throughout GSP implementation and be part of the adaptive management of the Subbasin. Members of the GSAs and stakeholders in the Subbasin should view these projects and management actions as a starting point for more detailed discussions. Where appropriate, details that must be agreed upon are identified for each project or management action.

The specific design for implementing management actions and projects will provide individual landowners and public entities flexibility in how they manage water and how the Subbasin achieves groundwater sustainability. Not all projects and management actions necessarily need to be implemented. The GSAs will work collaboratively as detailed in the Implementation Agreement to determine which projects and management actions to implement in order to attain sustainability in the Monterey Subbasin.

9.2 Overview of Projects and Management Actions

354.44 (a)(1) A list of projects and management actions proposed in the Plan with a description of the measurable objective that is expected to benefit from the project or management action. The list shall include projects and management actions that may be utilized to meet interim milestones, the exceedance of minimum thresholds, or where undesirable results have occurred or are imminent.

The projects and management actions for this GSP are summarized in Table 9-1 and include these major categories based on the leading agency and focused area:

- **Multi-subbasin Projects** – Projects that provide supply augmentation to the Monterey Subbasin that require infrastructure or rely on a supply source outside the Monterey

Subbasin. These projects are generally identified in multiple Salinas Valley Subbasin GSPs and expand upon how the project would be applied in the Monterey Subbasin.

- **Marina-Ord Area Local Projects and Management Actions** – Projects and management actions to be led by MCWD (or Marina-Ord Area agencies) that will primarily benefit the Marina-Ord Area.
- **Corral de Tierra Area Local Projects and Management Actions** – Projects and management actions to be led by SVBGSA that will primarily benefit the Corral de Tierra Area.

This GSP focuses on the projects that have direct benefits to the Subbasin's water supply or groundwater conditions. However, implementation actions that support GSP implementation in other Salinas Valley subbasins that may benefit the Monterey Subbasin and reduce the need for additional Subbasin specific projects and management actions are also identified in Section 9.5.

Table 9-1. Summary of Projects and Management Actions

P/MA #	Name	Project Type / Water Supply	Description	Project Benefits / Quantification of Benefits	Cost
Multi-basin Projects					
R1	Seasonal Release with ASR and Direct Delivery	Direct delivery to Marina Ord	Release flows from reservoirs during the winter/spring when there's less water loss to the stream channels. Divert these flows and any additional Permit 11043 water available for diversion at the SRDF during winter/spring months. Flows released during winter/spring will be treated and then injected into the 180/400-Foot Aquifer Subbasin for CSIP users' extraction during the peak irrigation season and/or delivered for direct municipal use.	Reduced pumping in the principal aquifers resulting in an in-lieu recharge benefit. Potential direct benefit to Marina Ord/ Monterey Subbasin ranges from **1,600 acre-feet per year (AFY) currently up to 4,500 AFY by 2040** based on existing and projected MCWD winter/spring water demands (6 months).	Multi-subbasin Capital Cost: **$181 million** Unit Cost for 12,900 AFY ASR: **$1,450/ acre-foot (AF)** Unit Cost for 3,600 AFY direct delivery: **$1,100/AF** *(distribution of benefits across subbasins will be determined through a benefits assessment)*
R2	Regional Municipal Supply	Direct delivery to Marina-Ord and Corral de Tierra	Build a regional desalination plant that would treat brackish water extracted from the seawater intrusion barrier and supply drinking water to municipalities in the	Estimated regional production at **15,000 AFY** that will augment groundwater supplies. Portion of this benefiting the Marina-Ord/Monterey Subbasin has yet to be determined.	Multi-subbasin capital cost: **$385 million** Unit cost for 15,000 AFY production: **$2,900/AF** *(capital and unit costs do not include cost of the extraction*

P/MA #	Name	Project Type / Water Supply	Description	Project Benefits / Quantification of Benefits	Cost
			Monterey Subbasin and other subbasins.		*barrier itself, which adds another **$1,200/AF**)*
R3	Multi-benefit Stream Channel Improvements	Direct recharge to Corral de Tierra	Prune native vegetation and remove non-native vegetation, manage sediment, and enhance floodplains for recharge. Includes 3 components: 1. Stream Maintenance Program 2. Invasive Species Eradication 3. Floodplain Enhancement and Recharge	Component 1: Multi-subbasin benefits not quantified Component 2: Multi-subbasin benefit of **2,790 to 20,880 AFY** of increased recharge Component 3: Multi-subbasin benefit of **1,000 AFY** from 10 recharge basins	Component 1 Multi-subbasin Cost: **$150,000** for annual administration and **$95,000** for occasional certification; **$780,000** for the first year of treatment on 650 acres, and **$455,000** for annual retreatment of all acres Component 2 Multi-subbasin Average Cost: **$16,500,000** Unit Cost: **$60 to $600/AF** Component 3 Multi-subbasin Cost: **$11,160,000** Unit Cost: **$930/AF**
Marina-Ord Area Local Projects and Management Actions					
M1	MCWD Demand Management Measures	Management Action	Provides in-lieu recharge through reducing groundwater demands.	Equivalent to a 2,500 AFY in-lieu recharge benefit at the current population.	$350,000 to $450,000 annually
M2	Stormwater Recharge Management	Direct recharge	Existing policies will facilitate and result in additional stormwater catchment and infiltration over time as redevelopment occurs	Under the existing urban development footprint approximately 550 AFY of stormwater is generated and infiltrated west of Highway 1. Groundwater modeling indicates that stormwater recharge catchment and recharge will increase to 1,100 AFY on average as further projected	No additional cost to implement

P/MA #	Name	Project Type / Water Supply	Description	Project Benefits / Quantification of Benefits	Cost
				development occurs which will increase net subbasin infiltration rates by 200 AFY to 500 AFY.	
M3	Recycled Water Reuse Through Landscape Irrigation and Indirect Potable Reuse	Direct and in-lieu recharge	Direct non-potable irrigation use and/or injection of advanced treated water from Monterey One Water (M1W) and extraction using existing MCWD wells or new production wells.	Approximately 2,200 AFY to 5,500 AFY advance treated recycled water available to MCWD based on current and projected wastewater flows.	Investments have already been made to deliver 1,427 AFY~~600 AFY~~ for landscape irrigation~~ by 2022~~. ~~Addition 827 AFY for landscape irrigation~~ ~~Capital cost: **$5,600,000**~~ Unit cost~~ for~~: **$~~1,600~~2,400/AF** Approximately 2,400 AFY recharge through IPR: Capital cost: **$65 million** Unit cost: ~~for~~ **$3,300/AF** Costs per AF would likely decrease at higher production capacities due to economies of scale.
M4	Monitoring Well(s)	Data Gaps Filling	Installation of 400-Foot Aquifer and Deep Aquifer monitoring wells near the Seaside Subbasin boundary.	Would fill critical data gaps on hydrostratigraphy, seawater intrusion, and groundwater recharge mechanisms for the 400-Foot Aquifer and Deep Aquifers. It would also provide critical information for the design of recycled water reuse through IPR as described in M3.	Approximately $1,100,000 includes cost of collection of soil cores and performance of hydraulic and geochemical analyses and bench scale pilot testing associated with the recycled water reuse through IPR as described in M3.

P/MA #	Name	Project Type / Water Supply	Description	Project Benefits / Quantification of Benefits	Cost
Corral de Tierra Area Local Projects and Management Actions					
C1	Pumping Allocation and Control	Management Action	Proactively determine how extraction should be fairly divided and controlled	Decreased extraction; range of potential benefits	$500,000 for establishment of pumping allocations and controls
C2	Check Dams	Direct recharge	Construct check dams to slow surface water to increase recharge	On average, 150 AFY of streamflow recharged	Capital Cost: **$5,143,000** Unit Cost: **$2,830/AF**
C3	Recharge from Surface Water Diversions	Direct recharge	Build a diversion facility(ies) that would divert water for recharge when streamflow is high	On average, 160 AFY of excess streamflow available for recharge.	Capital Cost: **$5,950,000** Unit Cost: **$3,050/AF**
C4	Wastewater Recycling for Reuse	In-lieu recharge	Upgrade existing wastewater treatment plant and pipelines to expand beneficial reuse through irrigation and recharge	232 AFY	Capital Cost: **$28,635,000** Unit Cost: **$11,750/AF**, with potential additional cost savings
C5	Decentralized Residential In-Lieu Recharge Projects	In-lieu recharge	Small-scale projects initiated by homeowners and business owners, including rooftop rainwater harvesting, rain gardens, and graywater systems	If 75 households install 5000-gallon rain barrels, up to 5.3 AFY rainwater harvested, and 0.97 AFY from graywater systems installed by 75 houses	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
C6	Decentralized Stormwater Recharge Projects	Direct recharge	Medium scale bioswales and recharge basins on non-agricultural land	If 1% of the Subbasin is converted from an area of runoff to an area of recharge, 182 AFY	Cost to GSA (not for implementation or incentives): $150,000 - $200,000 to encourage projects through outreach,

P/MA #	Name	Project Type / Water Supply	Description	Project Benefits / Quantification of Benefits	Cost
					site assessments, and assistance with planning
C7	Increase Groundwater Production in the Upper Corral de Tierra Valley for Distribution to Lower Corral de Tierra Valley (Artesian Well)	Direct delivery	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.	160 AFY	Capital Cost: **$13,275,000** Unit Cost: **$6,550/AF**
Implementation Actions					
I1	Support Implementation of the 180/400-Foot Aquifer Subbasin GSP and Seaside Watermaster Actions	Implementation Action			Not estimated at this time
I2	Deep Aquifers Investigation	Data Gaps Filling	Support completion of study of the Deep Aquifers to enable better management of groundwater and seawater intrusion.	Increased understanding of Deep Aquifers	$1,000,000[56]
I3	Support Restrictions on Additional Wells	Implementation Action	Collaborate and provide input to Monterey County as it finalizes	Reduce rates of groundwater elevation decline in the Deep Aquifers and prevent potential seawater intrusion	Not estimated at this time

[56] Reflects total multi-basin cost.

P/MA #	Name	Project Type / Water Supply	Description	Project Benefits / Quantification of Benefits	Cost
	in the Deep Aquifers		proposed modifications to the well construction ordinance.		
I4	Adopt 2022/2023 Priority Actions for Deep Aquifers in Absence of New Well Construction Ordinance if Conditions Threaten Sustainability in Near Term	Implementation Action	To be determined (TBD). Priority actions will be developed based on findings reported from the Deep Aquifers study.	Reduce rates of groundwater elevation decline in the Deep Aquifers and prevent potential seawater intrusion	Not estimated at this time
I5	Seawater Intrusion Working Group	Implementation Action	Participate in working group that is pulling together the best available science, data, and understanding of local seawater intrusion causes and potential resolutions.	An agreed-to approach for managing seawater intrusion	$50,000 - $75,000[57] per year
I6	Seawater Intrusion Modeling	Implementation Action	Develop seawater intrusion model for the Monterey Subbasin.	Increased ability to understand impact of potential projects and management actions on seawater intrusion	Not estimated at this time
I7	Incorporate Monterey Subbasin Model into the Salinas	Implementation Action	Refine construction and calibration of the SVIHM in the Monterey Subbasin using inputs developed	Produce an analytical tool that is capable of analyzing benefits and impacts of multi-subbasin projects	Not estimated at this time

[57] Reflects total multi-basin cost.

P/MA #	Name	Project Type / Water Supply	Description	Project Benefits / Quantification of Benefits	Cost
	Valley Integrated Hydrologic Model (SVIHM)		for the Monterey Subbasin Model.		
I7	Well Registration	Implementation Action	Register all production wells, including domestic wells.	Better informed decisions, more management options	Not estimated at this time
I8	Groundwater Extraction Management System (GEMS) Expansion and Enhancement	Data Gaps Filling	Update current GEMS program by collecting groundwater extraction data from wells in areas not currently covered by GEMS and improving data collection.	Better informed decisions	Not estimated at this time
I9	Dry Well Notification System	Implementation Action	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.	Support affected well owners with analysis of groundwater elevation decline	Not estimated at this time
I10	Water Quality Coordination Group	Implementation Action	Form a working group for agencies and organizations to collaborate on addressing water quality concerns.	Improve water quality	Not estimated at this time
I11	Land Use Jurisdiction Coordination Program	Implementation Action	Review land use plans and efforts to coordinate with land use planning agencies to assess activities that potentially	Join land use planning with water use planning	Not estimated at this time

P/MA #	Name	Project Type / Water Supply	Description	Project Benefits / Quantification of Benefits	Cost
			create risks to groundwater quality or quantity.		
I12	Arsenic Implementation Action	Implementation Action	Provides for additional analysis on the relationship between arsenic and groundwater conditions in the Corral de Tierra Area.	Affirm relationship between groundwater elevations and arsenic in the El Toro Primary Aquifer System.	Not estimated at this time

9.3 General Provisions

This section summarizes general provisions that are applicable to all proposed projects. These general provisions include certain permitting and regulatory processes and public noticing requirements. This section also identifies the methodology used in the GSP to evaluate project benefits and estimate costs. Further project specific details are included within each project description in Section 9.4.

9.3.1 Permitting and Regulatory Processes

Permitting and regulatory requirements vary for the different projects and management actions depending on whether they are infrastructure projects, recharge projects, or demand reduction management actions.

Projects of a magnitude capable of having a demonstrable impact on groundwater within the Monterey Subbasin will require a California Environmental Quality Act (CEQA) environmental review process. Projects will require either an Environmental Impact Report, Negative Declaration, or a Mitigated Negative Declaration. Additionally, any project that coordinates with federal facilities or agencies may require NEPA documentation.

Projects that utilize alternative sources of water to augment groundwater supply may require new permits or changes to existing surface water rights permits (e.g., Permit 11043) administered by the State Water Resources Control Board or by the Central Coast Regional Board regarding stormwater capture or recharge, recycled water use, and waste discharge.

Projects that are related to operations on the Salinas River will require conforming with California Division of Safety of Dams regulations, flow restrictions, and the County's Habitat Conservation Plan (HCP).

There will be a number of local, county and state permits, right of ways, and easements required depending on pipeline alignments, stream crossings, and project type.

Projects with wells will require a Monterey County Department of Health well construction permit.

Specific currently-identified permitting and regulatory requirements for projects and management actions are described in each project description in Section 9.4. Upon implementation, the regulatory and permitting requirements of the project or management action will be re-examined.

9.3.2 Public Noticing

Public notice requirements vary for the different projects and management actions listed above. Some projects that involve infrastructure improvements may not require specific public noticing (other than that related to CEQA and construction). Certain other management actions that involve, for example, imposition of fees by Subbasin GSAs, may require public noticing pursuant to Proposition 218 or Proposition 26. In general, projects and management actions being considered for implementation will be discussed during regular Board Meetings which are open to the public. Additional stakeholder outreach efforts will be conducted prior to and during project implementation, as required by law.

9.3.3 Evaluation of Benefits

The primary expected benefit of projects and management actions identified herein relate to water quantity, e.g., AFY. The way in which a project or management action benefits are evaluated/quantified depends on its type. The following are the major types of projects and management actions that are included herein to supplement the Monterey Subbasin's groundwater supplies:

- Direct recharge through recharge basins or injection/dry wells
- In-lieu recharge through direct delivery of non-potable or potable water to replace groundwater pumping
- Demand management
- Reoperation of reservoir releases to achieve greater or more regular surface water flows available for recharge or direct delivery

For those projects that involve direct recharge or delivery, the benefit is quantified directly through measurement of those flows. For projects that involve indirect recharge or supply augmentation through, for example, reoperation of reservoir releases and delivery flexibility, quantification of the benefit will require a comparison of the observed water supply condition (e.g., total delivered water) against a hypothetical condition where the project was not in place. For management actions that involve water demand reduction, the benefit will be evaluated by comparison of the observed water demand condition (e.g., reported pumping by municipal systems) against a hypothetical condition where the management action was not in place. Because it is not possible to determine with certainty what the condition without the project or management action would be like, quantification of the benefits is inherently uncertain.~~The potential projects and management actions described herein are laid out to mitigate overdraft under a range of future conditions. [Will complete this section upon completion of projected water budget evaluations]As discussed in Chapter 6, current and historical rates of groundwater extraction within the Subbasin are within the Subbasins estimated recharge, however significant groundwater outflows are occurring to adjacent subbasins. It is projected that the Subbasin will be in overdraft throughout the GSP planning horizon unless projects and management actions are implemented in the Monterey Subbasin and in the larger Salinas Valley Basin.~~

~~The amount of supply augmentation and/or demand reduction required to mitigate overdraft within the Monterey Subbasin has been assessed based on a range of potential future conditions in the Monterey Subbasin and adjacent Subbasins. In all cases, it has been assumed that:~~

the adjacent 180/400 foot Subbasin will reach sustainability as described in its GSP, which has been approved by DWR, and that minimum thresholds will be achieved.

The adjacent Seaside Basin will meet adjudication requirements established in Monterey Superior Court's March 27, 2006 ruling in California American Water v. City of Seaside, et al., Case No. M66343 (Seaside Basin Adjudication).

The goals and objectives of projects and management actions implementation are not necessarily to achieve a certain water budget outcome, but rather to ensure that undesirable results for relevant sustainability indicators are avoided by the end of the SGMA implementation period (i.e., by 2042). For this reason, ultimately the success of the collective implementation of projects and management actions will be determined by whether the SMCs are achieved, which will be monitored through the monitoring networks described in Chapter 7.

9.3.4 Cost assumptions used in developing projects

Assumptions used to develop projects and cost estimates are provided in Appendix 9-A. Assumptions and issues for each project need to be carefully reviewed and revised during the pre-design phase of each project. Project designs, and therefore costs, could change considerably as more information is gathered.

The cost estimates included for each project are order of magnitude estimates. These estimates were made with little to no detailed engineering data. The expected accuracy range for such an estimate is within +50 percent or -30 percent. The cost estimates are based on the GSAs' perception of current conditions at the project location. They reflect our professional opinion of costs at this time and are subject to change as project designs mature.

The capital costs of infrastructure projects include major infrastructure components, such as pipelines, pump stations, customer connections, turnouts, injection wells, recharge basins, and storage tanks. Capital costs also include a 30% contingency for plumbing appurtenances, 15% increase for general conditions, 15% for contractor overhead and profit, and 9.25% for sales tax. Engineering, legal, administrative, and project contingencies were assumed as 30% of the total construction cost and included within the capital cost. Land acquisition at $45,000/acre was also included within capital costs.

Annual operations and maintenance (O&M) fees include the costs to operate and maintain new project infrastructure. O&M costs also include any pumping costs associated with new infrastructure. O&M costs do not include O&M or pumping costs associated with existing infrastructure, such as existing Salinas Valley Reclamation Plant (SVRP) costs, because these are assumed to be part of water purchase costs. Water purchase costs are assumed to include repayment of loans for existing infrastructure; however, these purchase costs will need to be negotiated. The terms of such a negotiation could vary widely.

Capital costs were annualized over 25 years and added with annual O&M costs and water purchase costs to determine an annualized dollar per acre-foot $/AF) cost for each project. The cost per acre-foot is the amortized cost of the project divided by the annual yield. It provides a means to compare projects, however, it is not the cost of irrigation nor the domestic cost of drinking water for households on water systems. More refined cost analyses and future benefit analyses will be completed during GSP implementation.

9.4 Projects Descriptions

The projects and management actions that are planned to reach sustainability were the most reliable, implementable, cost-effective, and acceptable to stakeholders. Descriptions of these project and management actions are included below and are not in order of priority. Generalized costs are also included for planning purposes. Components of these projects and actions may change in future analyses, including facility locations, recharge mechanisms, and other details. Therefore, each of the projects and management actions described in this GSP should be treated as a generalized project representative of a range of potential project configurations. Projects and management actions are to be implemented consistent with the Implementation Agreement between the GSAs.

Multi-subbasin Projects

9.4.1 R1 – Winter Seasonal Releases from Reservoirs

This project entails modifying reservoir releases for the MCWRA's Conservation Program and Salinas River Diversion Facility (SRDF) diversions to maximize annual diversions at the SRDF. Winter SeasonalReservoir release water will be diverted at the SRDF during winter/spring, treated at a new water treatment plant, and (1) injected through Aquifer Storage and Recovery (ASR) injection wells in the winter off-irrigation seasonwhen not needed for irrigation, and later extracted during peak irrigation season demands for use through the CSIP system and/or (2) delivered directly to municipalities as supply augmentation. The winter/spring release and storage will reduce or eliminate the need for Conservation Program summer releases for CSIP and increase annual carryover in the reservoirs, allowing for more consistent winter seasonalannual releases. However, a benefits assessment will be prepared to assess different levels of benefits.

Some potential project constraints exist including: clarifying water rights, establishing compliant reservoir operation rules, altering the permit from the Division of Safety of Dams to allow the SRDF diversion structure to operate outside its current window of April-October, and possibly modifying the diversion infrastructure to operating during higher flow events. The SRDF is funded by a Proposition 218 Special Assessment that identified special benefits. This zone of benefit covers the majority of the Monterey Subbasin (see Zone 2C under Section 3.2.2.2). Lands within MCWD have been paying Zones 2, 2A and now 2C assessments since the 1990s. Use of this structure will require additional analysis of rights and technical operations.

ASR in the 180/400-Foot Aquifer Subbasin

Under the ASR component, water released from Nacimiento and San Antonio Reservoirs will be diverted from the Salinas River using the existing SRDF at a maximum flow rate of 36 cubic feet per second (cfs) during ~~winter~~ off-irrigatioin months. Water will then be pumped to a 23 million gallons per day (MGD) surface water treatment plant where it will be treated during ~~winter~~ off-irrigation months to meet the water quality standards necessary for groundwater injection, and conveyed to new injection wells in the 180/400-Foot Aquifer Subbasin. If operated at full capacity for 6 months such a plant could generate up to 12,900 AFY. The existing SRDF facilities have a maximum diversion flow of 36 cfs, or 16,000 gpm. Based on an injection rate of 1,000 gpm per injection well, 16 new injection wells will be installed. New injection well facilities will include wells completed in both the 180- and 400-Foot Aquifers, back-flush facilities including back wash pumps and percolation basins for water disposal into the vadose zone, electrical and power distribution, and motor control facilities.

Direct Delivery for Municipal Use

In addition to an ASR component, ~~winter~~ seasonal releases could be used for direct delivery for municipal supply. Under direct delivery use, this water would act as in-lieu recharge by reducing the need for winter/spring pumping from municipal wells, resulting in less winter/spring groundwater demand. The water not pumped by municipal wells during ~~the winter~~this season and left in the aquifers through this in-lieu recharge would aid the Monterey Subbasin and other subbasins in achieving SMCs. As with ASR injection, ~~winter~~ seasonally released surface water would need to be treated prior to delivery for municipal uses. However, direct delivery of ~~winter~~ seasonal releases would likely be a less expensive option to utilize surface water because no construction or operation of injection or extraction wells would be necessary.

A more expansive version of this direct delivery for municipal use option was described in MCWRA's 2008 filing by its attorneys, Downey Brand, with the SWRCB seeking an extension of the time to put water under Permit 11043 to beneficial use (RMC, 2008). MCWD now owns the vacant parcel on the Armstrong Ranch property within one mile of the SRDF, where a regional surface water treatment plant could be constructed to treat ~~winter~~ seasonal release water and any additional Permit 11043 water available for diversion at the SRDF. Treated water would be conveyed through pipelines to the municipal users, e.g., MCWD, Castroville and the City of Salinas. This treatment plant could serve as a joint treatment plant for both ASR and direct delivery operations. Based on existing and projected water demands, approximately 1,600 to 4,500 AFY of MCWD's water demand between January and June could be met through direct delivery.

9.4.1.1 Relevant Measurable Objectives

Relevant measurable objectives benefiting from this project include:

- **Groundwater elevation measurable objective** - The project releases more water in dry years than under current reservoir operations. These dry-year releases will add more water to the shared principal aquifers in the Monterey and 180/400-Foot Aquifer Subbasins, and help maintain adequate groundwater elevations during dry years.

- **Groundwater storage measurable objective** - The project releases more water in dry years than under current reservoir operations. These dry-year releases will add more water to the principal aquifers in dry years, increasing the amount of groundwater in storage throughout the greater Salinas Valley Basin. In-lieu recharge and/or injection through ASR wells will directly increase storage in the shared principal aquifers as well.
- **Seawater intrusion measurable objective** – Increasing both groundwater elevations and groundwater storage will help re-establish natural hydraulic gradients and reduce or reverse seawater intrusion.
- **Interconnected surface water measurable objective** - Increasing winter/spring releases from the reservoirs will be adding more surface water in the river during the winter/spring, when environmental flow needs are the greatest. While it may not decrease the annual rate of ISW depletion from groundwater extraction, the additional winter surface water flows will better support environmental surface water users during the periods of the year when they need water.

9.4.1.2 Expected Benefits and Evaluation of Benefits

Groundwater storage benefits are in the process of being estimated for the Monterey Subbasin using the Salinas Valley Integrated Hydrologic Model (SVIHM). Subbasin-specific estimates will be refined during the preparation of the Habitat Conservation Plan (HCP). While the HCP is not scoped to estimate groundwater recharge, this project does need to work in accordance with the HCP.

The main groundwater-related benefits for the Monterey Subbasin include:

- Reduced pumping in the principal aquifers including the 180-Foot, 400-Foot, and Deep Aquifers. This reduced pumping will leave more water in the aquifers, thereby reducing the decline of groundwater elevations and storage.

In addition, this project provides regional groundwater improvements for the 180-Foot, 400-Foot, and Deep Aquifers such as:

- Improve the ability to maximize annual diversions at the SRDF. Diversions at the SRDF no longer rely on large peak irrigation season~~summer~~ reservoir releases, of which less than 10% get to the SRDF. Winter/spring releases can be coordinated with environmental releases.
- More water available for CSIP and/or other beneficial users. The consistent diversions under the ASR component provide a more reliable supply to CSIP. Under the direct delivery component, reduced municipal pumping during the winter/spring should benefit CSIP pumping during the peak irrigation season~~summer~~ from the same principal aquifers.

- A reduction in, or reversal of, seawater intrusion. Providing more water for extractors reduces seawater intrusion. The groundwater from natural recharge that occurs in addition to the injection and/or in-lieu recharge may be able to mitigate seawater intrusion by minimizing native groundwater extraction and altering the hydraulic gradients to reverse inland flow of saline waters.

The main groundwater-related expected benefits for the greater Salinas Valley Basin include:

- Increased annual carryover in the reservoirs, allowing for more consistent ~~winter seasonal~~annual releases. Eliminating most peak-irrigation season~~summer~~ reservoir releases will allow more water to be retained in Nacimiento and San Antonio reservoirs. This increased amount of water in the reservoirs can be used to ensure more consistent annual ~~winter seasonal~~ releases during droughts, with higher volume releases as a result of increased storage.
- Reduced ~~summer~~ peak-irrigation season water supporting invasive species in riparian zones. Eliminating most peak-irrigation season ~~summer~~ reservoir releases will result in less shallow water supporting invasive species such as arundo or tamarisk.

The intended benefit of this project for the Salinas Valley Basin is reservoir reoperation that allows for more regular, annual releases, including during dry years. Initial simulations are being run to quantify the regular annual releases and their respective groundwater recharge benefits to the Basin as well as the Monterey Subbasin. This simulation reduces peak-irrigation season ~~summer~~ releases in order to increase carryover in the reservoirs for subsequent regular ~~winter seasonal~~annual releases.

Benefits will be measured using the monitoring networks described in Chapter 7. Groundwater levels will be measured with a network of wells that is monitored by MCWRA. Land subsidence will be measured using InSAR data provided by the Department of Water Resources. When data gaps are filled, interconnected surface waters will be measured through shallow groundwater wells and river flow.

9.4.1.3 Circumstances for Implementation

If selected, this project will be implemented in coordination with MCWRA and will require agreements between MCWRA and SVBGSA under the ASR component and between MCWRA and the municipal water agencies under the direct delivery component.

This project will likely be subject to new flow restrictions and reservoir operations resulting from the planned HCP. This project will not proceed until the water rights and flow prescriptions from the HCP have been determined.

9.4.1.4 Permitting and Regulatory Process

This project requires close coordination with the MCWRA to modify reservoir releases and SRDF diversions. Permits that might be required for diverting winter/spring reservoir releases at the SRDF include:

> ***State Water Resources Control Board (SWRCB)*** –A modification to MCWRA's existing water right or re-diversion permit may be necessary. MCWRA's Licenses 7543 and 12624 and Permit 21089, storage water rights, were amended in 2008 to authorize Zone 2C as the authorized place of use, to add Underground Storage, and to add the SRDF as an authorized point of rediversion. However, MCWRA's Permit 11043 is a direct diversion right on the Salinas River. MCWRA could petition the SWRCB to add the SRDF as an additional point of diversion, to designate the entire Zone 2C as the authorized place of use of water, and to authorize underground storage under the permit. Water used under Permit 11043 for diversion at the SRDF could be made subordinate to the two existing projects described in the permit. However, diversion of water at the SRDF under Permit 11043 if implemented first would enable MCWRA to show the SWRCB that it is putting water under Permit 11043 to beneficial use to avoid revocation of the permit.
>
> ***Division of Safety of Dams (DOSD)*** – The existing DOSD permit may need to be modified to allow the SRDF diversion structure to operate outside its current window of April-October.
>
> ***National Marine Fisheries Service (NMFS)*** – Projects that potentially affect flows in any surface water under NMFS jurisdiction must get approval from NMFS. NMFS may set conditions that will be included in the State Water Resources Control Board water rights.
>
> ***California Department of Fish and Wildlife (CDFW)*** – Any project that diverts water from a river, stream, or lake, or that has the potential to affect fish and wildlife resources, must obtain a Land and Streambed Alteration Agreement from CDFW.

The project will require a CEQA review process. Additionally, any project that coordinates with federal facilities or agencies may require NEPA documentation.

There will be a number of local, county, and state permits, right of ways, and easements required depending on pipeline alignments, stream crossings, and project type, such as:

> ***State Water Resources Control Board (SWRCB)*** – Construction that disturbs one acre of more of land and that discharges stormwater requires a General Construction Stormwater Permit (Water Quality Order No. 2009-0009-DWQ)
>
> ***City of Marina*** – An encroachment permit is required when working within the City of Marina right-of-way or on City of Marina property. This may be needed if pipelines are required in roadways to connect to MCWD's distribution system.

ASR in the 180/400-Foot Aquifer Subbasin

Permits that might be required for the ASR component include:

Environmental Protection Agency (EPA) – All ASR projects must register with the EPA's Underground Injection Control program.

State Water Resources Control Board (SWRCB) – All ASR projects must submit an Underground Storage Supplement as part of the application to receive either a Temporary Permit, a Standard Permit, or a Streamlined Permit from SWRCB.

Regional Water Quality Control Board (RWQCB) – General Waste Discharge Requirements paperwork must be filed with RWQCB to comply with its General Order that governs the injection of water to recharge aquifers.

Monterey County Health Department (MCHD) – Well construction permits must be obtained from MCHD.

Direct Delivery for Municipal Use

Permits that might be required for the direct delivery component include:

State Water Resources Control Board (SWRCB) – A permit to operate a public water system is required from SWRCB's Division of Drinking Water. For existing water systems, such the MCWD public water system, an amendment to the existing permit is required for addition of a new water source.

9.4.1.5 *Implementation Schedule*

If this project is selected, the annual implementation schedule after initial agency agreements and any permitting or water rights alterations is presented on Figure 9-1.

Task Description	Year 1	Year 2	Year 3	Year 4	Year 5	Annually
Phase I – Agreements, CEQA, Permitting	■	■	■			
Phase II – Treatment Facilities, Pipeline, and/or ASR well Construction			■	■	■	
Phase III – ~~Winter~~ Seasonal Releases						■

Figure 9-1. Implementation Schedule for Seasonal Releases from Reservoirs

9.4.1.6 *Legal Authority*

The GSA has the right to divert and store water once it has the right to utilize the appropriate water rights. Section 10726.2 (b) of the California Water Code (CWC) provides GSAs the authority to, "Appropriate and acquire surface water or groundwater and surface water or groundwater rights, import surface water or groundwater into the agency, and conserve and store within or outside the agency" (CWC, 2014). MCWRA is the legal authority for some of this project's facilities, therefore the GSAs will work collaboratively to use existing structures and water rights.

MCWRA operates the dams at Nacimiento and San Antonio pursuant to the terms and conditions of the permits and licenses for the two dams, and the flow prescriptions required by NMFS.

9.4.1.7 Estimated Cost

Costs for the injection and/or direct delivery of seasonal flows from the SRDF were estimated based upon the assumption that the diversion will take advantage of the existing SRDF facilities at an original calculated rate of 12,900 AFY.

ASR in the 180/400-Foot Aquifer Subbasin

Capital costs are estimated to be $181,134,000 for the construction of an ASR injection well field consisting of 16 wells, construction of a 4-mile conveyance pipeline between the SRDF site and the injection well system, and a surface water treatment plant that includes filtration and disinfection. These costs include engineering, overhead, and contingencies. Most of the costs associated with the ASR component are for the construction of the injection wells.

Annual O&M costs are estimated at $5,223,000 for the operation of the surface water treatment plant and the ASR injection well field, including a 20% contingency. Total annualized cost is $19,393,000. Based on the calculated project yield of 12,900 AFY, the unit cost of water for ASR is $1,500/AF. This unit cost does not include additional benefits received from recharge from the Salinas River within the Salinas Valley. This unit cost is not the cost of the project to stakeholders in the Monterey Subbasin as it focuses on the delivery of water to CSIP water users within the 180/400 Foot Subbasin. As part of this project, benefits analysis will be undertaken to determine the zones of benefit and assessments.

Direct Delivery for Municipal Use

For cost estimating purposes, it is assumed that approximately 3,600 AFY of the project capacity will be delivered to MCWD to meet winter/spring municipal demands. Unit capital and operating costs of surface water treatment for direct delivery are assumed to be similar to those estimated for the ASR option above. A conveyance pipeline between the SRDF site and the treatment plant, and a conveyance pipeline between the treatment plant and the MCWD water distribution system will be constructed. Should, for example, the City of Salinas and Castroville participate in the project, then cost for the conveyance pipelines needed to serve them would be determined.

Capital plus soft costs for direct delivery at an assumed 3,600 AFY of delivery to MCWD are estimated to be approximately $42,700,000. Annual O&M costs are estimated at $500,000. Based on the assumed delivery to MCWD, the unit cost of water for direct delivery is $1,100/AFY. These costs include engineering, overhead, and contingencies. Depending upon the municipal participants, this Project would directly benefit water users within the 180/400-Foot Aquifer Subbasin and the Monterey Subbasin. As part of this project, benefits analysis will be undertaken to determine the zones of benefit and assessments.

9.4.1.8 Public Noticing

Stakeholder engagement is a critical aspect of developing a successful and implementable project. Key coordinating agencies and stakeholders for this project include the MCWRA, CSIP water users, municipalities receiving water from the project, as well as the public. The MCWD GSA and SVBGSA intend to engage stakeholders early in project development.

Before any project initiates construction, it will go through a public notice process to ensure that all groundwater users and other stakeholders have ample opportunity to comment on projects before they are built. The general steps in the public notice process will include the following:

- SVBGSA staff will bring an assessment of the need for the project to the SVBGSA Board and the MCWRA Board in publicly noticed meetings. This assessment will include:
    - A description of the undesirable result(s) that may occur if action is not taken
    - A description of the proposed project
    - An estimated cost and schedule for the proposed project
    - Any alternatives to the proposed project
- The SVBGSA Board will notify stakeholders in the area of the proposed project and allow at least 30 days for public response.
- After the 30-day public response period, the SVBGSA Board will vote whether or not to approve design and construction of the project and to approve an agreement with MCWRA on the use of MCWRA's water rights and SRDF, and notify the public if approved via an announcement on the SVBGSA website and mailing lists. The boards will work cooperatively moving forward with this project.

The permitting and implementation of change to releases from the reservoirs will require notification of stakeholders, beneficiaries, water providers, member lands adjacent to the river, and subbasin committee members as well as all permit and regulatory holding agencies such as DWR, CEQA, NOAA, USACE, and others.

9.4.2 R2 – Regional Municipal Supply Project

This project is not a stand-alone project but rather a potential supplement to the seawater intrusion extraction barrier project. This project would construct a regional desalination plant to treat the brackish water extracted from the proposed seawater intrusion barrier in the 180/400-Foot Aquifer Subbasin (Priority Project 6 in Chapter 9 of the 180/400-Foot Aquifer GSP). It delivers water for direct potable use to municipal systems in the Monterey Subbasin and other subbasins within Salinas Valley. This project provides in-lieu recharge to the groundwater system through reduced extraction by municipal systems. If the plant produced more water than could be used for direct potable use, excess water could be used for irrigation or reinjected into the 180-Foot or 400-Foot Aquifer. This water will be available year-round.

Further analysis and scoping are needed to determine the exact location of the desalination plant, end uses, and desalination technology. Depending on the desalination plant selected, the source water pipeline would consist of approximately 11 miles of source water pipeline to convey up to 22,000 gpm (32 mgd or 35,500 AFY) of flow to the plant from the seawater intrusion extraction barrier. The pipeline would range from 18” to 36” in diameter. The plant will produce approximately 15,000 AFY of potable water for use. The distribution of that water is yet to be determined. Rough estimates of piping and needed pump stations to provide water to the main municipal areas are included in the cost estimate and will be refined during GSP implementation.

9.4.2.1 Relevant Measurable Objectives

The measurable objectives benefiting from the desalination plant include:

- **Groundwater elevation measurable objective** - By reducing groundwater extraction through in-lieu recharge, there will be more water left in the principal aquifers. This will either raise groundwater elevations or reduce the rate of groundwater elevation decline over time.
- **Groundwater storage measurable objective** - Using desalinated water reduces groundwater extraction, which will either increase groundwater storage or reduce the rate of storage loss.
- **Land subsidence measurable objective** - Increasing both groundwater elevations and groundwater storage will have the benefit of reducing any potential for land subsidence caused by groundwater depletion.
- **Seawater intrusion measurable objective** – Seawater intrusion has advanced a few miles inland in the Monterey Subbasin. Providing water for in-lieu use will reduce the pumping-induced gradient that drives seawater intrusion.

9.4.2.2 Expected Benefits and Evaluation of Benefits

The proposed plant would produce up to 15,000 AFY of desalinated water for the Salinas Valley. A portion of that would go to the Monterey Subbasin. This would reduce groundwater extraction by that amount, increase the Subbasin’s groundwater storage (or lessen the decline), and reduce the risk of seawater intrusion. This will benefit all groundwater users in the Subbasin to some degree. If desalinated water is delivered to the City of Marina, the pumping reductions and groundwater elevation benefits would occur in the locations of MCWD’s production wells. Specific quantification of the groundwater benefit for the Monterey Subbasin is unable to be determined prior to determining the distribution of available desalinated water.

Benefits will be measured using the monitoring networks described in Chapter 7. Groundwater elevations will be measured with a network of wells that is monitored by MCWRA. Benefits to groundwater storage will be monitored using delivery volumes measurements as well as calculations with groundwater elevations measurements. Land subsidence will be measured using InSAR data provided by the Department of Water Resources. Seawater intrusion will be measured using select Representative Monitoring Sites wells. A direct correlation between providing desalinated water to the Subbasin and changes in groundwater levels, subsidence, or seawater intrusion will depend in part on the suite of management actions and projects implemented concurrently in the Subbasin.

9.4.2.3 Circumstances for Implementation

This project is not a stand-alone project, but is a potential supplement to the seawater intrusion extraction barrier project. This project will only be implemented if and when a brackish water extraction barrier is built to control seawater intrusion. A more detailed cost/benefit analysis will be completed before any work begins on this project. Further analysis and comparison of desalination technologies, stakeholder deliberations on the distribution of desalinated water, and identification of project sites still need to be completed. This project will only be implemented if it is cost-effective and politically feasible when compared to other projects.

9.4.2.4 Permitting and Regulatory Process

Permits from the following government organizations that may be required for this project include:

- ***Monterey Bay National Marine Sanctuary (MBNMS)*** – All Regional Water Quality Control Board (RWQCB) 404 permits, Section 10 permits, and National Pollutant Discharge Elimination System (NPDES) permits must be reviewed by MBNMS.
- ***United States Fish and Wildlife Service (USFWS)*** – A Migratory Bird Treaty Act Permit (16 U.S. Code §703-711) may be required from the USFWS. Other federal agencies involved in the permitting process for this project may need to consult with USFWS in compliance with Section 7 of the Endangered Species Act. Interagency coordination is also required by the Fish and Wildlife Coordination Act (16 U.S. Code §661-667e).
- ***National Oceanic & Atmospheric Administration (NOAA)*** – Section 7 of the Endangered Species Act requires other federal agencies to consult with NOAA's National Marine Fisheries Service (NMFS) if threatened or endangered species could be affected by this project. NMFS also monitors compliance with Section 305b of the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S. Code §1855b) which protects essential fish habitats.
- ***United States Army Corps of Engineers (USACE) –*** Under the Rivers and Harbor Act, a Section 10 permit (33 U.S. Code §403) is required for the construction of any structure in or over any navigable water of the United States. Under the Clean Water Act, a Section 404 permit (33 U.S. Code §1341) is required to discharge dredge or fill materials into "waters of the United States".

- ***State Water Resources Control Board (SWRCB)*** – A permit to operate a public water system is required from SWRCB's Division of Drinking Water. Construction that disturbs one acre or more of land and that discharges stormwater requires a General Construction Stormwater Permit (Water Quality Order No. 2009-0009-DWQ). Certification to discharge dredged or fill material is required by Section 401 of the Clean Water Act and by the Porter-Cologne Water Quality Control Act (California Water Code §13000 et seq.). Discharge of brine or other pollutants requires a National Pollutant Discharge Elimination System (NPDES) permit under Section 402 of the Clean Water Act (33 U.S. Code §1342).
- ***California Department of Fish and Wildlife (CDFW)*** – Projects that may result in the take of a threatened or endangered species require an Incidental Take Permit (California Endangered Species Act Title 14, §783.2). A Streambed Alteration Agreement (California Fish and Game Code Section 1602) is required if the project may substantially adversely affect fish and wildlife resources.
- ***California Coastal Commission (CCC)*** – Construction within the Coastal Zone requires a Coastal Development Permit (Public Resources Code 30000 et seq.). Under the Coastal Zone Management Act (16 U.S.C. §1456), the CCC will ensure that federal authorized work is consistent with the enforceable policies of California's Coastal Management Program. Consistency between federal and state laws in coastal areas is also required by the Federal Consistency Regulations (15 Code of Federal Regulations, Part 930, Subpart D). The County may have initial jurisdiction to issue any required permit, but that would be appealable to the full Commission.
- ***California Department of Transportation (Caltrans)*** – Work that may obstruct a State highway requires an Encroachment Permit.
- ***California Department of Toxic Substances Control (DTSC)*** – If the project encroaches into the Fort Ord area, there will be hazardous waste management and disposal requirements concerning Soluble Threshold Limit Concentrations and Total Threshold Limit Concentrations (22 California Code of Regulations §66261.24).
- ***California State Lands Commission (CSLC)*** – A New Land Use Lease is required for the subsurface slant wells located below mean high tide and an Amended Land Use Lease for use of the Monterey One Water outfall and diffuser (California Public Resources Code §1900).
- ***California Department of Parks and Recreation*** – If the project encroaches into Fort Ord Dunes State Park, an easement, right of entry, and/or lease negotiation is required. Federal agencies involved in this project are required to consult with the Department of Parks and Recreation's State Historic Preservation Officer in accordance with Section 106 of the National Historic Preservation Act (16 U.S. Code §470).

- ***California Public Utilities Commission (CPUC)*** – A Certificate of Public Convenience and Necessity (California Public Utilities Code §1001 et seq.) is required to show that the project will benefit society.
- ***Various Entities with Jurisdiction on the Former Fort Ord*** – If the project encroaches into the Fort Ord area, it must comply with any applicable land use regulations of the entities with jurisdiction on the former Fort Ord.
- ***Monterey County*** – If the project encroaches onto any county-maintained road, an Encroachment Permit (Monterey County Code Chapter 14.04) is required from the County. Removal of 3 or fewer trees can be handled by a standalone Tree Removal Permit (Monterey County Code Chapter 16.60). Removal of more than 3 trees should be included in a County Use Permit and/or Coastal Development Permit.
- ***Monterey County Health Department*** – If there will be 55 gallons (liquid), 500 pounds (solid), or 200 cubic feet (compressed gas) of hazardous materials onsite at any one time, a Hazardous Materials Business Plan and a Hazardous Materials Inventory Statement (California Health and Safety Code Chapter 6.95) must be submitted to the Monterey County Health Department's Environmental Health Bureau. Other required permits include a Well Construction Permit (Monterey County Code Chapter 15.08) and permits to construct and operate a desalination treatment facility (Monterey County Code Chapter 10.72).
- ***Monterey County Department of Planning and Building Services*** – The project will require a Coastal Development Permit, which may be submitted to Monterey County Department of Planning and Building Services. If the project will extend inland beyond the Coastal Zone, a Use Permit (Monterey County Code (MCC) Chapter 21.72 Title 21) is also required. A Grading Permit (MCC Code Chapter 16.08) is required if total disturbance onsite equals or exceeds 100 cubic yards. If the project encroaches on the Fort Ord area, an excavation permit is required for disturbances that equal or exceed 10 cubic yards (Monterey County Code Chapter 16.10). An erosion control plan (Monterey County Code Chapter 16.12) is required if there is a risk of accelerated (human-induced) erosion that could lead to degradation of water quality, loss of fish habitat, damage to property, loss of topsoil or vegetation cover, disruption of water supply, or increased danger from flooding.
- ***Monterey One Water*** – A Sewer Connection Permit is required to connect to the regional sewer system.
- ***Monterey Bay Air Resources District (MBARD)*** – If the project may release or control air pollutants, an Authority to Construct and Permit to Operate is required (MBARD Rule 200).
- ***Monterey Peninsula Water Management District (MPWMD)*** – An expansion/extension permit is required to expand the current water system (MPWMD Ordinance 96).

- ***Cal Am, CalWater, Alco, and other local water agencies*** – The project will require contracts with local water agencies that plan to buy and deliver the desalinated water.
- ***Transportation Agency for Monterey County (TAMC)***– An easement for access to and use of the project site may need to be negotiated with TAMC.
- ***Seaside Groundwater Basin Watermaster*** – A permit may be needed to inject and/or extract groundwater.
- ***Local jurisdictions*** – Permits may also be required by a local jurisdiction depending on location of desalination plant, including but not limited to: land use permits, building permits, public health permits, public works permits, tree removal permits, and encroachment permits.

9.4.2.5 Implementation Schedule

If this project is selected, the implementation schedule is presented on Figure 9-2. This project would take approximately 11 years to implement, assuming the seawater intrusion barrier is already in place.

Task Description	Year: 1	2	3	4	5	6	7	8	9	10	11
Agreements/ROW											
CEQA											
Permitting											
Design											
Bid/Construct											

Figure 9-2. Implementation Schedule for Regional Municipal Supply Project

9.4.2.6 Legal Authority

Pursuant to California Water Code sections 10726.2 (a) and (b), the SVBGSA has the right to acquire and hold real property, appropriate and acquire surface water or groundwater, acquire water rights, and to divert and store water once it has acquired any necessary real property or appropriative water rights. Some rights in real property (whether fee title, easement, license, leasehold or other) may be required to implement the project.

9.4.2.7 Estimated Cost

An initial estimate analyzed the cost to treat 15,000 AFY and deliver that desalinated water to municipalities throughout the coastal region of the Salinas Valley Basin, including the Monterey Subbasin. The estimated capital cost for the pipeline from the wells to the desalination plant and desalination plant is $309,387,000. The estimated capital cost for the distribution network ranges from $65,257,000 to $84,315,000 depending on how many communities receive water. It currently is only scoped to provide water to the portion of the Corral de Tierra adjacent to the 180/400-Foot Aquifer Subbasin; however, it could be expanded with additional piping and pumping which would increase the cost. Annual operations and maintenance are projected to cost about $13,300,000. If the total cost of the project is annualized over a 25-year term, and if production is 15,000 AFY, the unit cost for the desalination plant and distribution network is approximately $2,900/AF.

It should be noted that this cost does not include cost of constructing and operating the seawater extraction barrier, which is a precursor to this project. The cost of the seawater extraction barrier is equivalent to $1,200/AF when divided by this project's estimated capacity at 15,000 AFY.

9.4.2.8 Public Noticing

Before SVBGSA initiates construction on this project, it will go through a public notice process to ensure that all groundwater users and other stakeholders have ample opportunity to comment on projects before they are built. The general steps in the public notice process will include the following:

- SVBGSA staff will bring an assessment of the need for the project to the SVBGSA Board in a publicly noticed meeting. This assessment will include:
    - A description of the undesirable result(s) that may occur if action is not taken
    - A description of the proposed project
    - An estimated cost and schedule for the proposed project
    - Any alternatives to the proposed project
- The SVBGSA Board will notice stakeholders in the area of the proposed project and allow at least 30 days for public response.
- After the 30-day public response period, the SVBGSA Board will vote whether or not to approve design and construction of the project.

In addition to the public noticing detailed above, all projects will follow the public noticing requirements required by CEQA. In addition to the public noticing detailed above, all projects will follow the public noticing requirements per CEQA.

After approval, SVBGSA will provide annual notification via an announcement on the SVBGSA website and mailing lists.

9.4.3 R3 – Multi-benefit Stream Channel Improvements

Over the past half a century, the Salinas River has been impacted by the construction of the San Antonio and Nacimiento Dams and flood control levees intended to move water away from agricultural fields. These have changed natural river geomorphology, resulting in sediment build up and vegetation encroachment on the historically dynamic channels of the Salinas River. This alteration of natural floodplains and geomorphology has increased flood risk, decreased direct groundwater recharge, and contributed to increased evapotranspiration through vegetation build-up. Targeted, geomorphically-informed stream maintenance and floodplain enhancement can improve stream function both morphologically and biologically.

This project takes a three-pronged approach to stream channel improvements. First it removes dense vegetation and reduces the height of sediment bars that impede streamflow in designated maintenance channels. Second, the project removes the invasive species *Arundo donax* (arundo) and *Tamarix sp.* (tamarisk) throughout the Salinas River watershed. Third, it enhances the recharge potential of floodplains along the Salians River.

This three-pronged approach increases flow by removing dense native and non-native vegetation, provides vegetation-free channel bottom areas for infiltration, stabilizes stream banks and earthen levees by reducing downstream velocities, and reduces flood risk. This program's activities also benefit native species throughout the river ecosystem by removing competition from encroached non-native species. Invasive species such as arundo can take up to four times as much water as native riparian species thereby negatively impacting both river flows as well as infiltration into the subsurface through the streambed (Cal-IPC, 2011). Infiltration through the streambed accounts for a significant portion of the groundwater budget (Cal-IPC, 2011). River maintenance activities enhance groundwater recharge efforts through the streambed by providing additional open channel bed for infiltration, and floodplain enhancement can further recharge potential of high flows. By improving geomorphological function through vegetation and sediment removal activities, the coordinated efforts allow native species to reestablish in areas where invasive species have become dominant.

Surface water flows, and notably flood flows, can be impacted by the density of vegetation and whether the vegetation is comprised of native or non-native species. Native riparian species allow for dynamic action that scours the riverbed and resorts sediment in a manner that encourages natural infiltration and conveyance of floodwaters in the broader active flood terraces in the river. This wider use of the floodplain by floodwaters slows velocities and distributes floodwaters over a broader spatial area of the river channel.

Stream channel vegetation removes water from the river through evapotranspiration (ET). Water loss through ET from invasive species such as arundo can take up between 3.1 and 23.2 AFY per acre, whereas ET from native vegetation can take up to 4 AFY per acre (Melton and Hang, 2021; Cal-IPC, 2011). This illustrates the difference in water consumption between vegetation types and how these water consumptions can have major impacts on water in the river (Cal-IPC, 2011). The Salinas River is characterized by a braided channel in some areas of the floodplain and a confined channel in other areas. Plants can take root in channel locations that adversely impact the flow of water, resulting in either a channelized river or in creating directional velocities that can cause localized damages including levee failure. Poorly functioning sedimentation can also negatively impact water flow in drought and flood conditions, as well as impeded proper infiltration to the subsurface. Geomorphological processes are important to managing a natural riverbed and floodplain to enhance recharge, groundwater levels, and groundwater storage.

This program is not meant to restore the Salinas River to historical conditions, but rather to enhance geomorphological function through targeted maintenance sites for flood risk reduction and floodplain enhancement for increased recharge. The Monterey County Water Resources Agency (MCWRA) has developed a science-based approach to river management that recognizes the value of critical habitat, environmental resources, cost to landowners, and coordination among stakeholders (MCWRA, 2016). A key feature of this modified management approach is providing protection for critical habitats and water quality (MCWRA, 2016). One of the important functions of a river is to provide habitat for native species. In a poorly functioning river, invasive species have more opportunities to crowd out native species and in turn, further degrade the river conditions. Therefore, this program will result in flood risk reduction, increased recharge, and a multitude of benefits that address critical functions of the Salinas River.

This program includes four main types of tasks: vegetation maintenance, non-native vegetation removal, sediment management, and floodplain enhancement and recharge.

- **Vegetation Maintenance** – Vegetation, both native and non-native, will be removed within designated maintenance areas using a scraper, mower, bulldozer, excavator, truck or similar equipment to remove the vegetation above the ground and finishing by ripping roots to further mobilize the channel bottom. Vegetation maintenance includes pruning up to 25 percent of canopy cover and removing dead mass. Maintenance activities will not include disturbance of emergent wetland vegetation that provides suitable habitat for threatened California red-legged frogs or for the endangered tidewater gobies. In instances where native vegetation needs to be removed for site-specific conditions or tie-ins, these impacts can be compensated with replanting and revegetation in other areas as a form of mitigation offset for stream channel maintenance. Native trees will be planted during the rainy season to enhance their rate of success.

- **Non-Native Vegetation Removal –** Non-native vegetation removal primarily focuses on the arundo present in the region but may include tamarisk shrubs as well. Arundo is a grass that was introduced to the Americas in the 1800s for construction material and for erosion control purposes (Cal-IPC, 2011). In 2011, the California Invasive Plant Council determined that the Salinas Watershed had the second largest invasion with approximately 1500 infested acres. While arundo thrives near water, such as wetlands and rivers, it grows in many habitats and soil types. It requires a substantial amount of water, previously estimated making it one of the thirstier plants in a given region and outpacing the water demands of native vegetation. To manage this invasive species, arundo biomass is typically sprayed, sometimes mowed or hand cut if needed, and then treated with multiple applications of herbicide over several years. Permits allow arundo removal in the entire riparian corridor, including along the low-flow channel.
- **Sediment Management** – Sediment management includes channel bed grading and sediment removal. Sediment grading and removal may occur exclusively, or after vegetation maintenance activities described above. Sediment removal and grading activities help reestablish proper gradients to allow for improved drainage downstream, encourage preferential flow into and through secondary channels, and minimize resistance to flow (until dunes form) (MCWRA, 2016). Sediment removal will follow best practices to protect native species while producing maximum benefit for flood reduction and groundwater recharge.
- **Floodplain Enhancement and Recharge** – Floodplain enhancement restores areas along the River, creeks, and floodplains to slow and sink high flows and encourage groundwater recharge. Restored floodplain and riparian habitat can slow down the velocity of the River and creeks and encourage greater infiltration. Due to agricultural and urban encroachment, streams have become more highly channelized, and flow has increased in velocity, particularly during storm events. This flow has resulted in greater erosion and loss of functional floodplains. Floodplain restoration efforts could be focused on lands directly adjacent to creeks, so as to not interfere with active farming. In addition, efforts to restore creeks and floodplains could be extended to the foothills to slow water closer to its source.

Program Components

This multi-benefit stream channel improvements program is implemented through various program components. These build off existing programs and permits to undertake the four main types of tasks. During GSP implementation, these components may be modified as needed to most efficiently accomplish the program goals.

Component 1: Stream Maintenance Program

The first component continues the Salinas River Stream Maintenance Program (SMP), which maintains the river corridor to reduce flood risk and minimize bank and levee erosion, while maintaining and improving ecological conditions for fish and wildlife consistent with other priorities for the Salinas River (MCWRA, 2016). It is a coordinated Stream Maintenance Program that includes MCWRA, the Resource Conservation District of Monterey County (RCDMC), and the Salinas River Management Unit Association currently representing approximately 50 landowner members along the river corridor. Project benefits include increased water availability, flood risk reduction, reduced velocities during high flows to lessen bank and levee erosion, and enhanced infiltration by managing vegetation and sediment throughout the river and its tributaries.

The Salinas River Stream Maintenance Program occurs along the area of the Salinas in Monterey County. The 92-miles of the river in Monterey County is broken into seven River Management Units from San Ardo in the south to Highway 1 in the north. The management activities are focused on the secondary channels of the Salinas River located outside of the primary low flow channel and are preferentially aligned with low-lying undeveloped areas that are active during times of higher flow (MCWRA, 2016). The SMP includes three main activities as part of stream maintenance: vegetation maintenance, non-native vegetation removal, and sediment management.

Component 2: Invasive Species Eradication

The second Component supports and/or undertakes removal of arundo and tamarisk done by the Resource Conservation District of Monterey County (RCDMC). RCDMC is the lead agency on an estimated 15 to 20-year effort to fully eradicate arundo from the Salinas River Watershed, working in a complementary manner with the SMP. This project focuses on removal of woody invasive species such as arundo, tamarisk, and tree tobacco (Nicotiana glauca) along the Salinas River, as well as retreatments needed to keep it from coming back. It includes three distinct phases: initial treatment, re-treatment, and ongoing monitoring and maintenance treatments. As of April 2021, estimated arundo under treatment was 850 acres. Original mapped acreage had expanded by 20%, leaving 900 arundo acres remaining to be treated. The initial treatment phase includes mechanical and/or chemical treatment in all areas of the river that have yet to be treated. The re-treatment phase includes re-treatment of the approximately 850 acres that have already had an initial treatment and re-treatment of the remaining 900 acres done in stages, with each area treated over a three-to-five-year period following initial treatment. The final phase is the ongoing monitoring and maintenance treatment phase. This phase requires monitoring for regrowth of the invasive species or new invasive species and chemical treatment every three to five years.

Component 3: Floodplain Enhancement and Recharge

The third component complements the first two by enhancing and restoring floodplains to enable high flows to be slowed and directed toward areas where it can infiltrate into the ground. For this component, SVBGSA will partner with the Integrated Regional Water Management (IRWM) Group, Central Coast Wetlands Group, and other organizations that are already undertaking creek and floodplain restoration efforts and encourage inclusion of features that would enhance recharge.

Restored floodplain and riparian habitat along creeks can slow down the velocity of creeks and encourage greater infiltration. Due to agricultural and urban encroachment, streams have become more highly channelized, and flow has increased in velocity, particularly during storm events. This flow has resulted in greater erosion and loss of functional floodplains.

9.4.3.1 Relevant Measurable Objectives

Relevant measurable objectives benefiting from this project include:

- **Groundwater elevation measurable objective -** Removing the invasive species, better managing streams, and directing high flows into restored floodplains will facilitate more water infiltrating and percolating into the subsurface to raise groundwater elevations. This has the effect of adding water to the principal aquifers. Adding water to the principal aquifers will ultimately increase groundwater elevations or decrease their decline.
- **Groundwater storage measurable objective -** Adding water to the principal aquifers will ultimately have the effect of increasing groundwater in storage.
- **Land subsidence measurable objective -** Increasing both groundwater elevations and groundwater storage will have the added benefit of preventing any potential land subsidence. Maintaining and adding water in the subsurface will keep pore spaces saturated with positive pressure and inhibit land surface collapse associated with groundwater depletion.
- **Interconnected surface water measurable objective -** By removing vegetation pathways for evapotranspiration, less interconnected groundwater and less surface water will be depleted, leaving more water available in the river for flows as well as for connection to the principal aquifers.

9.4.3.2 Expected Benefits and Evaluation of Benefits

The groundwater-related expected benefits are increased groundwater elevations in the vicinity of the river channel due to increased infiltration and percolation to the principal aquifers, increased groundwater in storage, decreased depletion of interconnected surface water, and protection against any potential land subsidence due to groundwater extractions. In addition, the project reduces flood risk.

Increased storage of floodwaters can increase groundwater elevations in the vicinity of the Salinas River. This typically will be seen as groundwater mounding subparallel to the river corridor. However, as more water infiltrates into the subsurface, more water will flow laterally, thereby expanding the zone of influence from the river outward and raising groundwater elevations laterally. Additionally, water stored underground is not subject to evapotranspiration in the same way water stored above ground is. With the annual removal of arundo, evapotranspiration will decrease over time, allowing for more water to remain in the system. Arundo removal is coupled with identified native species removal where native species have encroached in high flow channels where they may not typically grow; however, there is significant uncertainty in the recharge benefits, as arundo and many native species draw both surface and groundwater.

Removal of arundo on 900 acres along the Salinas River will decrease evapotranspiration by 2,790 to 20,880 AFY throughout the Salinas Valley. This will enhance recharge from the Salinas River within its reach in the Monterey Subbasin and leave more water in the River to get down to the Castroville Seawater Intrusion Project, where surface water is used in lieu of groundwater to help address seawater intrusion and declining groundwater elevations. With this reduction of non-productive water consumption, less water may be released from the reservoirs to get the same amount of water downstream, which results in indirect recharge as removal reduces groundwater use by the plants. It also increases the Valley's overall sustainable yield and drought resilience.

Component 3 of this project includes various floodplain enhancement features and restoration activities. Preliminary project scoping includes the development of 10 recharge basins within the greater Salinas Valley Basin, each with a recharge capacity of about 100 AFY. However, greater analysis is needed to determine the exact number, size, and type of features. The combined benefit of the four recharge basins is expected to be 1,000 AFY in increased recharge.

This program will also enhance streamflow by returning patterns of flow to a more natural state. Arundo infestation decreases the natural channel migration and complexity of sandy-bottomed streams by confining the channel to an armored, single stem with faster flowing water, which then becomes susceptible to erosion and incision. A narrowing channel with reduced capacity also heightens flood risk. Removing arundo will allow greater normalization of natural geomorphic processes and sediment transport by de-armoring low-flow channel banks and adjacent floodplain areas to enable channel migration and braiding.

Stream channel improvements will provide many additional ecosystem benefits, including:

Habitat restoration: This project will help restore riparian habitat. Results from four years of plant community monitoring of arundo sites initially treated in 2016 show that diversity and abundance of native plants have increased over this time period and this trend is expected to continue. Field biologists conducting pre-activity surveys have also observed increased wildlife activity post-arundo removal.

Increased connectivity for wildlife: Within the Central Coast region there are several mountain ranges, coastal areas, valley floors, and upland habitats that need to be connected to allow for the wildlife movement necessary for gene flow and healthy populations (Thorne *et al.*, 2002). The Salinas River riparian area is an important linkage for wildlife movement between upland habitat via tributaries. Removal of dense arundo stands will reduce physical impediments to movement for wildlife species such as mountain lion, bobcat, deer, and American badger. RCDMC has documented this through wildlife camera monitoring, which has shown increased detections of large mammals such as deer, bobcat, and coyote after arundo removal. This project will promote habitat use and movement of wildlife by increasing availability of food and nesting resources.

Flood risk reduction: Stream maintenance has the societal benefit of reducing flood risk to neighboring lands, which are mostly agricultural fields. Arundo's dense structure creates increased surface roughness, thus backing up water and causing flooding during high flow events. When agricultural fields are flooded with river water, farmers lose crops and thus considerable income, and must leave their fields fallow for months after flooding due to food safety concerns. Flooding can also damage levees which then have to be repaired and bring weed seeds and propagules (including arundo) into fields which then have to be controlled.

Enhanced Conveyance and Infrastructure Protection: The work conducted in the SMP improves conveyance of storm, flood, and nuisance waters by keeping water in the stream channel and flowing freely rather than being blocked by the invasive species. The SMP protects city infrastructure by keeping water more in the channel rather than blocked and rerouted by arundo, which reduces the cost of infrastructure repairs to nearby cities.

Project benefits will be measured using the monitoring networks described in Chapter 7. Groundwater levels will be measured with a network of wells that is monitored by MCWRA. Land subsidence will be measured using InSAR data provided by the Department of Water Resources. When data gaps are filled, interconnected surface waters will be measured through shallow groundwater wells and river flow.

The expected benefits to groundwater in the Monterey Subbasin will be defined through further investigation.

9.4.3.3 Circumstances for Implementation

The SMP and invasive species eradication are ongoing projects with MCWRA, the RCDMC, and the Salinas River Management Unit Association. Program administration is provided by the RCDMC and the Salinas River Management Unit Association. Landowners currently pay for all maintenance activities in the maintenance channels and for associated biological monitoring and reporting. SVBGSA could support the program, become an administrative partner in the program with other program partners, or fund maintenance and monitoring activities.

Floodplain enhancement will be implemented if additional water is required to reach sustainability. A number of agreements and rights must be secured before individual projects are implemented. Primarily, a more formal cost/benefit analysis must be completed to determine how many site options are preferable. Water diversion rights may need to be secured to divert stormwater, which may take many years.

9.4.3.4 Permitting and Regulatory Process

For Components 1 and 2, the permitting process has already been initiated by MCWRA and RCDMC and permits are in place until 2025 for the program. Invasive species eradication will be continued under existing permits. All participants in the SMP must enter into an agreement with MCWRA and comply with all terms, conditions, and requirements of the permits and Program Guidelines.

Component 3 may require a CEQA environmental review process, and may require an Environmental Impact Report or a Mitigated Negative Declaration (the review could also result in a Negative Declaration or Notice of Exemption). Additionally, permits from a variety of state and federal agencies may be necessary, and any project that coordinates with federal facilities or agencies may require National Environmental Policy Act (NEPA) documentation.

Permits for all 3 components are detailed below.

Component 1 Permits:

- **U.S. Army Corps of Engineers (USACE) -** The Department of the Army Regional General Permit (RGP) 20 for the Salinas River Stream Maintenance Program, Corps File No. 22309S, was executed on September 28, 2016 by the USACE. The RGP is authorized under Section 404 of the Clean Water Act (33 U.S.C. Section 1344) through November 15, 2021. The National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS) concurred with the USACE determination that the project was not likely to adversely affect the federally endangered San Joaquin kit fox (Vulpes macrotis mutica) and the federally threatened California tiger salamander (Ambystoma californiense), Monterey spineflower (Chorizanthe pungens var. pungens) and its critical habitat, the yellow-billed cuckoo (Coccyzus americanus), and the South-Central Coast (S-CCC) steelhead (Oncorhynchus mykiss). The USFWS issued a Biological Opinion on August 22, 2016 for the federally endangered least Bell's vireo (Vireo bellii pusillus) and tidewater goby (Eucyclogobius newberryi) and its critical habitat and the federally threatened California red-legged frog (Rana draytonii).
- **National Oceanic and Atmospheric Administration (NOAA) –** The RCDMC also has a letter of concurrence in which NOAA supports USACE's decision that the SMP "is not likely to adversely affect species listed as threatened or endangered or critical habitats designated under the Endangered Species Act."

- **State of California Regional Water Quality Control Board -** The Clean Water Act Section 401 Water Quality Certification for Discharge of Dredged and/or Fill Materials, Certification No. 32716WQ02, was approved on August 31, 2016, and is set to expire on November 30, 2025. The Central Coast Water Board staff will assess the implementation and effectiveness of the SMP after five years and consider modifications to this Certification for the second five years of the permit term.
- **California Department of Fish & Wildlife -** The SMP is authorized under a Routine Maintenance Agreement (RMA) 1600-2016-0016-R4, approved October 14, 2016, and held by the RCDMC. The RMA was amended and restated on June 16, 2017 and subsequently amended on April 10, 2018. The RMA covers all impacts under the program from the original date of approval through December 31, 2026.
- **California Natural Resources Agency –** An Environmental Impact Report was completed in compliance with the CEQA.

Component 2 Permits:

- ***California Department of Fish & Wildlife*** – The invasive species eradication is authorized under a Routine Maintenance Agreement (RMA) 1600-2012-0154-R4, approved April 11, 2014 and held by the RCDMC. The RMA was amended on September 30, 2014. It covers all impacts under the program from the original date of approval through April 10, 2026.
- ***Environmental Protection Agency*** – National Pollutant Discharge Elimination System (NPDES) permit CAG990005 allows the Salinas River Arundo Control Program to apply pesticides to waterways.
- In addition, the Salinas River Arundo Control Program filed a CEQA Mitigated Negative Declaration, received a technical assistance letter from NOAA NMFS, completed a U.S. Fish and Wildlife Service No Take Request, and received a technical assistance letter from U.S. Fish and Wildlife Service.

Component 3 Permits that may be required for floodplain enhancement include:

- **United States Army Corps of Engineers (USACE) –** A Regional General Permit may be required if there are impacts to wetlands or connections to waters of the United States.
- **California Department of Fish and Wildlife (CDFW) –** A Standard Agreement is required if the project could impact a species of concern.
- **Environmental Protection Agency (EPA) Region 9 –** National Environmental Policy Act (NEPA) documentation must be submitted for any project that coordinates with federal facilities or agencies. Additional permits may be required if there is an outlet or connection to waters of the United States.

- **National Marine Fisheries Service (NMFS) –** A project may require authorization for incidental take, or another protected resources permit or authorization from NMFS.
- **California Natural Resources Agency –** Projects of a magnitude capable of having a demonstrable impact on the environment will require a CEQA environmental review process. Projects will require either an Environmental Impact Report, Negative Declaration, or a Mitigated Negative Declaration.

9.4.3.5 Implementation Schedule

The components of this program may be implemented on different schedules. The annual implementation schedule for Component 1 is outlined on Figure 9-3. About 40 new acres could be added to the program each year, taking about 10 years to add the remaining acres. Annual maintenance needs to be continued indefinitely. For Component 2, up to 100 of the remaining 900 acres of uncontrolled arundo can begin treatment each year, as shown on Figure 9-4. For Component 3, it is contingent on the first two components, but may be initiated shortly after Component 2. This schedule is shown on Figure 9-5.

Task Description	Dec 1	Mar 31	Sep 1	Nov 30
Phase I – Annual RMU report, Work Plan, and noticing				
Phase II – Pre-maintenance surveys				
Phase III – Maintenance activities				

Figure 9-3. Annual Implementation Schedule for Stream Maintenance

	Year												
Task Description	1	2	3	4	5	6	7	8	9	10	11	12	13
Treat and retreat first 100 acres													
Treat and retreat second 100 acres													
Treat and retreat third 100 acres													
Treat and retreat fourth 100 acres													
Treat and retreat fifth 100 acres													
Treat and retreat sixth 100 acres													
Treat and retreat seventh 100 acres													
Treat and retreat eighth 100 acres													
Treat and retreat ninth 100 acres													

Figure 9-4. Implementation Schedule for Invasive Species Eradication

	Year				
Task Description	1	2	3	4	5
Studies/Preliminary Engineering Analysis					
Agreements/Right of Way (ROW)					
CEQA					
Permitting					
Design					
Bid/Construct					

Figure 9-5. Implementation Schedule for Floodplain Enhancement and Recharge

9.4.3.6 Legal Authority

MCWRA has legal authority over the Component 1 SMP for program administration and permitting. Private landowners and local cities who conduct maintenance in the permitted work areas must agree to permit conditions and execute an agreement annually with each agency. Private landowners and local cities currently pay for all maintenance activities including heavy equipment work and biological monitoring and reporting.

For Component 2 invasive species removal, the RCDMC has legal authority for program administration and permitting. The RCDMC obtains Landowner Access Agreements with property owners or managers (tenants) to allow them to do the work or to allow the RCDMC to oversee landowner-conducted work.

For floodplain restoration activities, the SVBGSA has the right to divert and store water once it has access to the appropriate water rights. Section 10726.2 (b) of the California Water Code provides GSAs the authority to, "Appropriate and acquire surface water or groundwater and surface water or groundwater rights, import surface water or groundwater into the agency, and conserve and store within or outside the agency" (CWC, 2014).

9.4.3.7 Estimated Cost

Component 1 program permits have been completed and are operational through 2026. Renewal of the 401 Certification with the Central Coast Regional Water Control Board will include a cost of $95,000 in the timeframe of 2024 to 2026. The annual administrative cost of Component 1 of this program is approximately $150,000. This cost does not include stream maintenance activities, required biological monitoring, and reporting, which are currently paid by program participants. These costs vary from year to year based on the number of participants and work site conditions. This program could cover the costs of stream maintenance activities, biological monitoring, and/or reporting in order to reach higher participation rates from landowners and therefore increased project benefit. The cost for the vegetation management is approximately $1,200/acre for the first year and $700/acre for annual maintenance thereafter. This does not include the cost of sediment management, which can be costly. The cost estimate for stream maintenance activities, required biological monitoring, and reporting is included in Appendix 9-A, which may continue to be paid by participants, be funded by the GSA, or be funded through a different source. The table shows the cost estimates for the primary subbasins where the Salinas River flows. The presence of two reaches of Salinas River in the Monterey Subbasin may adjust this table with further analysis.

Table 9-2. Cost Estimate of Vegetation Management

	Acres	First year of vegetation management ($1,200/acre)	Subsequent years of vegetation management ($700/acre)
Already treated	254	-	$177,800
Upper Valley	250	$300,000	$175,000
Forebay	263	$315,600	$184,100
180/400-Foot Aquifer and Monterey Subbasins	137	$164,400	$95,900
Subtotal		**$780,000**	**$632,800**

For Component 2, the estimated capital cost is estimated at between $14,536,943 and $18,871,239. Annual O&M costs are anticipated to be approximately $165,200. The indirect projected yield for the invasive species eradication project is estimated at between 3.1 AFY and 23.2 AFY per acre of invasive species removed. With the range of costs and range of project benefits, the amortized cost of water for this project is estimated to range between $60/AF and $740/AF. See Appendix 9-A for cost estimate.

Component 3 includes the construction of 10 recharge basins near the Salinas River in the greater Salinas Valley Basin, each with an expected benefit of 100 AFY and a capital cost of $1,116,000 each, for a total of $4,464,000. Spread over 25 years and assuming a 6% discount rate, the annualized cost is $83,300 per recharge basin, including annual maintenance. The unit cost is $930/AF. These costs were estimated assuming that only one recharge basin would be built, but there may be economies of scale that lower the cost if more are built. These costs are approximate; exact costs will depend onsite specifics.

9.4.3.8 Public Noticing

Component 1 implementation and permitting require annual notification of potential program participants and this notification is announced via direct mail to program participants as well as announced on the MCWRA website. Program-related annual reporting as required and is published on the MCWRA website.

Component 2 public noticing practices and requirements of the existing RCDMC invasive species eradication programs will be continued as part of this project. This includes reaching out to specific landowners and tenants in areas of potential work and completing annual permit reports that are posted to the RCDMC website.

Component 3 public noticing will be conducted prior to any project initiates construction to ensure that all groundwater users and other stakeholders have ample opportunity to comment on projects before they are built. The general steps in the public notice process will include the following:

- SVBGSA staff will bring an assessment of the need for the project to the SVBGSA Board in a publicly noticed meeting. This assessment will include:
    - A description of the undesirable result(s) that may occur if action is not taken
    - A description of the proposed project
    - An estimated cost and schedule for the proposed project
    - Any alternatives to the proposed project
- The SVBGSA Board will notify stakeholders in the area of the proposed project and allow at least 30 days for public response.
- After the 30-day public response period, the SVBGSA Board will vote whether or not to approve design and construction of the project, and notify the public if approved via an announcement on the SVBGSA website and mailing lists.

In addition to the process detailed above, all projects will follow the public noticing requirements per CEQA or NEPA.

Marina-Ord Area Local Projects & Management Actions

9.4.4 M1 – MCWD Demand Management Measures

In the past two decades, MCWD has made significant strides in reducing its per capita potable water demand above and beyond targets delineated by the Water Conservation Act. Conservation reductions have come primarily from water conservation retrofits as well as from behavioral changes driven by increasing water rates, drought awareness, and public education programs. During the twenty-year period of 1999 through 2020, per capita water demand within the MCWD service area decreased from 144 gallons per capita per day (GPCD) to 80 GPCD, a decrease of approximately 44% (Schaaf & Wheeler, 2021). At the current population of 30,480 served by MCWD, this decrease in per capita water use provides an approximately 2,500 AFY of in-lieu recharge benefits[58].

Following the 2014-2016 drought, the State of California developed the “Making Water Conservation a California Way of Life” framework to address the long-term water use efficiency requirements called for in executive orders issued by Governor Brown. In May of 2018, Assembly

[58] Without these decreases in per capita water use, water demand for MCWD’s current population at 30,480 would be approximately 2,500 AFY higher than its current water demand. This reduced demand on groundwater extraction by MCWD creates an in-lieu recharge benefit to the Monterey Subbasin.

Bill (AB) 1668 and Senate Bill (SB) 606 went into effect, which built upon the executive orders implementing new urban water use objectives for urban retail water suppliers.

SB 606 and AB 1668 establish guidelines for efficient water use and a framework for the implementation and oversight of the new standards, which must be in place by 2022. The bills call for creation of new urban efficiency standards for indoor use, outdoor use, and water loss, as well as any appropriate variances for unique local conditions. These water use standards will be adopted by the State Water Resources Control Board (SWRCB) by regulation no later than June 30, 2022. Using the adopted standards, each urban retail water agency will annually, beginning January 1, 2024, calculate its own objective.

MCWD plans to continue to implement conservation efforts within its service area to meet and exceed new legislative requirements as part of the “Making Water Conservation a California Way of Life” framework. Potable water demand reductions will be achieved through the following strategies.

- MCWD has adopted design standards and guidelines for new construction that exceed the State’s plumbing code requirements for water-conserving features, codified in Section 3.36 of the District Ordinances.
- MCWD will implement demand management measures discussed in Section 7 of its 2020 UWMP.
- Phased redevelopment of the Ord Community will include the replacement of a significant amount of water distribution system that is over 50-years old. These replacements should reduce system water losses.

In addition, MCWD plans on using recycled water to offset non-potable uses or augment groundwater production (see Project M3: M3 – Recycled Water Reuse Through Landscape Irrigation and Indirect Potable Reuse in Section 9.4.6).

9.4.4.1 Relevant Measurable Objectives

The measurable objective benefiting from demand management measures includes:

- **Groundwater elevation measurable objective –** demand management measures will result in less demand on groundwater pumping and higher groundwater levels, particularly near the location of production wells.
- **Groundwater storage measurable objective –** Reducing pumping from the principal aquifers will ultimately have the effect of increasing groundwater in storage.
- **Seawater intrusion measurable objective –** Seawater intrusion has advanced a few miles inland in Monterey Subbasin. Increasing groundwater storage and groundwater elevation will support the natural hydraulic gradient that pushes back against the intruding seawater.

9.4.4.2 Expected Benefits and Evaluation of Benefits

Continued implementation and expansion of demand management efforts will reduce demand on groundwater resources from the Monterey Subbasin and provide in-lieu recharge to the Subbasin. As described above, the decrease in per capita water use historically provided up to 2,500 AFY of in-lieu recharge benefits. As the population expands, these in-lieu recharge benefits will increase.

Pursuant to Section 7.3 of MCWD's 2020 UWMP:

> *The District will continue to track per capita demand rates to assess overall savings, in addition to comparing water consumption of new residential development against older households and households which have been retrofitted with conservation devices. The District will continually reassess rebate programs to address saturation rates and emerging technologies.*

9.4.4.3 Circumstances for implementation

Implementation of demand management measures is ongoing. No additional circumstances for implementation are necessary.

9.4.4.4 Public Noticing

MCWD's UWMP is updated every five years and documents historical and planned implementation of demand management measures. The plan is adopted by MCWD following a public hearing and is publicly available.

Beginning January 1, 2024, MCWD is anticipated to calculate its urban water use objectives pursuant to SB 606 and AB 1668 and report its water use according to the water use objectives.

9.4.4.5 Permitting and Regulatory Process

As detailed above, MCWD is implementing demand management measures to meet and/or exceed the following legislative requirements:

- **Water Conservation Act -** With the adoption of the Water Conservation Act of 2009, also known as SB x7-7, the state is required to reduce urban water use by 20% by the year 2020. Each urban retail water supplier was required to develop a baseline daily per capita water use ("baseline water use") in their 2010 Urban Water Management Plan (UWMP) and establish per capita water use targets for 2015 and 2020 to help the state achieve the 20% reduction. Per the 2020 UWMP, MCWD's 2020 per capital water demand (or 80 GPCD) was approximately 32% lower than its per capita water use target for 2020 (117 GPCD).
- **SB 606 and AB 1668 water use objectives -** Following the 2014-2016 drought, the State of California developed the "Making Water Conservation a California Way of Life"

framework to address the long-term water use efficiency requirements called for in executive orders issued by Governor Brown. In May of 2018, AB 1668 and SB 606 went into effect, which built upon the executive orders implementing new urban water use objectives for urban retail water suppliers.

SB 606 and AB 1668 establish guidelines for efficient water use and a framework for the implementation and oversight of the new standards, which must be in place by 2022. The bills call for creation of new urban efficiency standards for indoor use, outdoor use, and water loss, as well as any appropriate variances for unique local conditions. These water use standards will be adopted by the State Water Resources Control Board (SWRCB) by regulation no later than June 30, 2022. Using the adopted standards, each urban retail water agency will annually, beginning January 1, 2024, calculate its own objective.

- **California plumbing code and design standards -** As discussed above, MCWD has adopted design standards and guidelines for new construction that exceed the State's requirements, including the California Green (CALGreen) Building Code Standards and Model Water Efficient Landscape Ordinance (MWELO).

  CALGreen requires installation of water-efficient fixtures and equipment in new buildings and retrofits. CalGreen includes prescriptive indoor provisions for maximum water consumption of plumbing fixtures and fittings in new and renovated properties. It also allows for an optional performance path to compliance, which requires an overall aggregate 20% reduction in indoor water use from a calculated baseline using a set of worksheets provided with the CalGreen guidelines.

  The MWELO establishes a structure for planning, designing, installing, maintaining and managing water-efficient landscapes in new construction and rehabilitated projects. It promotes low-water use landscaping through more efficient irrigation systems, greywater usage, onsite stormwater capture, and limiting the portion of landscapes that can be covered in turf.

9.4.4.6 Legal Authority

This action is implemented pursuant to MCWD's authority as a public water system. Plumbing standards are adopted in Section 7 of the Marina Coast Water District Code.

9.4.4.7 Implementation Schedule

Implementation of demand management measures is ongoing and will be carried throughout GSP implementation.

9.4.4.8 Estimated Cost

MCWD has increased its conservation program budget in recent years, from a total expense of $336,553 in fiscal year 2018-19 to an estimated budget of $438,000 for fiscal year 2021-22[59]. The major change in conservation program budget over the past five years reflects increases in MCWD's educational outreach efforts and resultant demand for rebates and retrofits. It is anticipated that MCWD will maintain its current level of conservation spending.

9.4.5 M2 – Stormwater Recharge Management

The Cities of Marina and Seaside, the two major municipalities within the Marina-Ord Area, have policies that will facilitate additional stormwater catchment and infiltration beyond existing efforts as development and redevelopment occurs.

The City of Marina has historically relied on onsite infiltration as a means of stormwater management and continues to implement policies for onsite infiltration. The City of Marina storm drain design standards specify retention of stormwater runoff from new development or redevelopment sites and require that no runoff from a project site to flow to public streets.

The portion of the City of Seaside within the Monterey Subbasin similarly relies on onsite infiltration of stormwater. Although the City of Seaside historically had not required onsite infiltration of stormwater, the city manages stormwater runoff in accordance with its National Pollutant Discharge Elimination System (NPDES) permit, which is through requirement of Best Management Practices that encourages onsite infiltration or other methods of reducing stormwater runoff. Furthermore, the City of Seaside's recent General Plan update includes policies to promote groundwater recharge by implementing stormwater infiltration.

As discussed in Section 3.5.1.4, redevelopment at the former Fort Ord was governed by the Fort Ord Base Reuse Plan, which was later incorporated into each individual jurisdictional area's land use plans. The 1997 Fort Ord Base Reuse Plan called for eliminating all ocean stormwater discharges and infiltrating all stormwater runoff east of Highway 1. Pursuant to this Plan, most stormwater outfall pipes that historically extended into Monterey Bay has been removed and several percolation basins were constructed west of Highway 1. In addition, the US Army Garrison Presidio of Monterey (USAGPOM) is currently developing plans to decommission a 66-inch diameter stormwater outfall located within the Fort Ord Dunes State Park, anticipated to occur by 2025. The percolation basins were considered temporary with the long-term objective to percolate all storm-water on the east side of Highway 1 as part of the redevelopment of the former Fort Ord. The Fort Ord Storm Water Master Plan (Creegan + D'Angelo, 2005) was prepared to provide guidelines for meeting the obligation for onsite infiltration.

The current and planned urbanized areas within the Marina-Ord Area overlies well-drained, highly permeable dune sands. Infiltration basins or subsurface infiltration systems are effective

[59] MCWD, 2020. Budget Summary of the FY 2020–2021 Draft Budget Memorandum, dated 15 June 2020.

stormwater disposal methods. It is anticipated that as future development and redevelopment within the Marina-Ord Area occur, additional stormwater from urbanized areas and construction sites will be captured and infiltrated, providing recharge to the groundwater basin.

9.4.5.1 Relevant Measurable Objectives

The measurable objective benefiting from demand management measures includes:

- **Groundwater elevation measurable objective** – Promoting and requiring stormwater infiltration will percolate more water into the subsurface, which will raise groundwater elevations and add water to the principal aquifer(s).
- **Groundwater storage measurable objective** – Adding water to the groundwater system will ultimately have the effect of increasing groundwater in storage.
- **Seawater intrusion measurable objective** – Increasing groundwater storage and groundwater elevations will support the creation of seaward hydraulic gradients that push back against the intruding seawater.

9.4.5.2 Expected Benefits and Evaluation of Benefits

Managed stormwater recharge is expected to increase sustainable yield and groundwater elevations. Runoff occurs when the rate of rainfall exceeds the soil infiltration rate. This project captures and infiltrates this runoff, which would otherwise flow to the ocean, and facilitates recharge to principal aquifer(s). Based on land use, stormwater catchment area, and precipitation data gathered for the Monterey Subbasin Groundwater Flow Model (MBGWFM), it estimated that approximately 540 AFY of stormwater runoff is generated within the current urbanized areas in the Marina-Ord Area. A significant portion of this volume is infiltrated via existing stormwater catchment facilities. The MBGWFM indicates the amount of runoff capture and re-infiltration will ~~likely~~ increase to approximately 1,100 AFY over time as future development occurs under the existing guidelines. The MBGWFM indicates that net infiltration rates[60] within ~~the subbasin~~the Subbasin will increase by approximately 200 AFY to 500 AFY as a result of stormwater catchment and re-infiltration within ~~the subbasin~~the Subbasin.

Benefits of stormwater recharge on attaining applicable measurable objectives will be measured using the monitoring networks described in Chapter 7.

9.4.5.3 Circumstances for implementation

Stormwater management policies implemented by the Cities of Marina and Seaside are ongoing. No additional circumstances for implementation are necessary.

[60] Net infiltration is the difference between infiltration that occurs as a result of urban catchment and re-infiltration and naturally occurring infiltration under non-urban conditions.

9.4.5.4 Public Noticing

No additional public noticing is required.

9.4.5.5 Permitting and Regulatory Process

The Cities of Marina and Seaside comply with the Central Coast Regional Water Quality Control Board's Regional Municipal Stormwater Permit (i.e., Phase II NPDES Permit for Small MS4 systems). Both cities are member entities of the Monterey Regional Stormwater Management Program (MRSWMP). The regional program was developed to respond to SWRCB's implementation of the Phase II NPDES Stormwater Program. The purpose of the Phase II NPDES Stormwater Program is to implement and enforce Best Management Practices (BMPs) to reduce the discharge of pollutants from municipal separate storm sewer systems. The municipalities are responsible for conducting their stormwater management program in accordance with the terms of the regional program.

No additional permitting or regulatory process is required of this action.

9.4.5.6 Legal Authority

This action is implemented by local municipalities. Chapter 8.46 of the City of Marina's municipal code and Chapter 8.46 of the City of Seaside's municipal code respectively provide these municipalities the legal authority to manage stormwater discharge within their jurisdictional limits.

9.4.5.7 Implementation Schedule

Implementation of stormwater recharge management is ongoing and will be carried throughout GSP implementation.

9.4.5.8 Estimated Cost

There are no additional costs to implement this project.

9.4.6 M3 – Recycled Water Reuse Through Landscape Irrigation and Indirect Potable Reuse

The project consists of recycled water reuse through landscape irrigation and/or indirect potable reuse (IPR) within MCWD's service area. As described below, the source water for both of these options is recycled water from the Monterey One Water (M1W) Regional Treatment Plant (RTP), which would undergo advanced treatment to meet criteria under Title 22 of the California Code Regulations (CCR) for subsurface applications of recycled water. Advanced treated recycled water is non-potable. Reuse of this water through IPR involves injection into a groundwater aquifer and recovery through an appropriately permitted Groundwater Replenishment Reuse Project (GRRP), which provides seasonal storage and generates potable water that can meet a larger portion of MCWD's water demand beyond irrigation and non-potable needs.

Recycled Water Generation, Collection and Treatment

MCWD operates two wastewater collection systems serving the City of Marina and the Ord Community (i.e., communities within the former Fort Ord). Wastewater is conveyed to the Monterey One Water (M1W) Regional Treatment Plant (RTP) north of Marina. The RTP treats wastewater collected from multiple communities in Monterey County, from Pacific Grove to Moss Landing along the coast and inland to the City of Salinas. In 2020, municipal wastewater flows to the RTP were 19,000 AF, with MCWD contributing 2,170 AF, or 11%. Wastewater is treated to secondary treatment standards at the RTP facilities. That water not designated for further treatment and recycling is discharged via an ocean outfall. Water designated for further treatment is conveyed to either the Salinas Valley Reclamation Plant (SVRP) or the Advanced Water Purification Facility (AWPF), as discussed below.

The SVRP is capable of producing an average of 33,000 AFY of tertiary-treated recycled water. It currently produces about 14,000 AFY of tertiary-treated recycled water meeting the standards of unrestricted reuse under Title 22 of the California Code of Regulations. The majority of the recycled water is delivered to the Castroville Seawater Intrusion Project (CSIP), irrigating farmland in the greater Castroville area and reducing demands on Salinas Valley groundwater. As agricultural demands are seasonal, this capacity cannot be fully utilized year-round.

In 2020, M1W completed the AWPF with a capacity to supply advanced treated water to the Seaside Subbasin for IPR and to meet MCWD's recycled water demand.~~In 2020, M1W completed the AWPF with capacity of 5.0 million gallons per day (MGD). The 5.0 MGD AWPF can treat and produce 5,600 AFY of advanced treated water, sufficient to supply 3,700 AFY to the Seaside Subbasin for IPR use as part of M1W's Pure Water Monterey project as well as provide 1,427 AFY to MCWDthat has the capacity to produce 4,300 AFY of advanced treated water. Of this water produced, 3,700 AFY is conveyed to Seaside Subbasin for IPR use as part of M1W's Pure Water Monterey project, and 600 AFY is available to MCWD. Based on current plans, the AWPF will be expanded further to produce an additional 2,250 AFY of purified water for M1W and 827 AFY for MCWD~~[61]~~.~~

In 1989, MCWD entered into an annexation agreement with Monterey Regional Water Pollution Control Agency (MRWPCA; now M1W) for wastewater treatment. This agreement established MCWD's first right to receive tertiary treated wastewater from the SVRP. MCWD has the right to obtain treated wastewater from M1W's RTP equal in volume to that of the volume of MCWD wastewater treated by M1W and additional quantities not otherwise committed to other uses. MCWD's sewer flows will increase over time as MCWD's water demand increases and could be used as source water for a MCWD expansion of the AWPF. Based on MCWD's projected 2040

[61] MCWD has the right to utilize up to and including a net 1,427 AFY of the AWPF treatment capacity to serve the Ord Community to implement the recycled water portion of the Regional Urban Water Augmentation Program (RUWAP). The wastewater stream for the MCWD portion of the project is MCWD's own municipal wastewater, which was originally slated for tertiary treatment, in addition to a 650 AFY contribution to RUWAP by MCWRA through M1W during May through August.

water demand of 9,574 AFY, it is anticipated that 6,130 AFY of sewer flows will be generated within MCWD's service area. Such wastewater flows could provide 5,500 AFY of net advanced treated water from MCWD[62].

Landscape Irrigation

On April 8, 2016, MCWD and M1W entered into the Pure Water Delivery and Supply Project Agreement, as amended by the 2017 First Amendment, wherein the Product Water Conveyance Facilities were designed, constructed, owned, and operated by MCWD with a capacity sufficient to convey a minimum of 5,127 AFY of advanced treated water, including the 3,700 AFY capacity for M1W and a total of 1,427 AFY capacity for MCWD. Both the 2016 Agreement and the 2017 Amendment are provided in Appendix 9-B. The Product Water Conveyance Facilities include a regional advanced treated water transmission line through Marina, the Ord Community, and into the City of Seaside and allow delivery of advanced treated water from the AWPF for landscape irrigation within these communities and IPR in the Seaside Subbasin.

The regional transmission line was completed in 2019 and placed in operation in 2020 as part of the Pure Water Monterey Project. With completion of the ~~Phase I~~ AWPF and the transmission line, MCWD is currently constructing a recycled water distribution system to allow delivery of its 600 AFY of advanced treated water for landscape irrigation by 2022 (RBF, 2003). This distribution system could increase deliveries for landscape irrigation to as much as 1,427 AFY or more in the future through expansion of the AWPF. MCWD's right to purchase recycled water has a contractual upper limit in the summer months, so providing 1,427 AFY of recycled water supply requires the commitment of summertime flows from M1W and MCWRA. The recycled water distribution system currently under construction and the regional transmission line are shown on Figure 9-7.

Landscape irrigation use of recycled water reduces groundwater demand and thus functions as an in-lieu groundwater recharge project.

IPR in Monterey Subbasin

MCWD conducted a joint, regional three-party study with FORA and M1W for water supply planning for redevelopment of the former Fort Ord (2020 Water Supply Augmentation Study) (EKI, 2020). The 2020 Water Supply Augmentation Study conceptualized various groundwater augmentation and direct supply options for screening and systematic evaluation. The recommended option under the Study was IPR through expansion of the AWPF, injection of advanced treated water into 180/400 Foot Aquifers and/or the Deep Aquifers, and extraction with new and existing MCWD production wells (EKI, 2020).

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[62] During 2020, MCWD generated approximately 2,170 AF of wastewater, which represents approximately 64% of MCWD's total water production of 3,367 AF in 2020. Assuming a similar wastewater flow to water production ratio, MCWD's projected water demand of 9,574 AFY by 2040 would generate approximately 6,130 AFY of wastewater. A total of 6,650 gross sewer flow is available from MCWD for treatment at the AWPF with the additional 650 AFY of gross wastewater flow contributed by MCWRA and M1W.

Advanced treated recycled water is non-potable unless it is injected into a groundwater aquifer and recovered as part of an appropriately permitted Groundwater Replenishment Reuse Project (GRRP). A GRRP provides seasonal storage capacity and generates potable water that can meet a larger portion of MCWD's water demand beyond irrigation and non-potable needs.

As described above, MCWD's sewer flows will increase over time as MCWD's water demand increases and could be used as source water for a MCWD expansion of the AWPF. As described above, based upon projected water demands and sewer flows, approximately 5,500 AFY of net advanced treated water could be generated for IPR by MCWD (minus that used directly for landscape irrigation) by 2040. The majority of this water is more likely to be available during ~~winter~~ winter/spring months when CSIP is not operational and therefore is more compatible with IPR than landscape irrigation.

The recommended water supply alternative in the 2020 Water Supply Augmentation Study identified three options for IPR injection/extraction of the advanced treated water. These options include:

- Injection into and extraction from the 180/400-Foot Aquifers near existing MCWD 180/400-Foot Aquifer production wells;
- Combined injection/extraction from both 180/400-Foot Aquifer and Deep Aquifer; and
- Injection into and extraction from the Deep Aquifer, near existing MCWD Deep Aquifer wells

The current operation frequency of MCWD's production wells generally ranges from 10% to 40%. These operation frequencies are low and, barring other constraints (e.g., concerns regarding seawater intrusion), could likely be increased to an operational frequency of up to 70% to capture injected water. Additional production wells might need to be constructed to provide additional extraction capacity, depending on the volume and rate of injection. The 2020 Water Supply Augmentation Study evaluated two potential production capacities for the IPR project including 973 AFY and 2,400 AFY. The project could be readily expanded to facilitate injection of additional advanced treated water as it becomes available.

9.4.6.1 Relevant Measurable Objectives

The measurable objective benefiting from recycled water use through landscape irrigation or a IPR project includes:

- **Groundwater elevation measurable objective** – The project provides either in-lieu groundwater recharge by eliminating irrigation demand and direct recharge through IPR. This has the effect of adding water to the principal aquifer(s). Adding water to the principal aquifer will ultimately increase groundwater elevations or decrease their decline.

- **Groundwater storage measurable objective** – Adding water to the groundwater system will ultimately have the effect of increasing groundwater in storage.
- **Seawater intrusion measurable objective** – Increasing groundwater storage and groundwater elevations will support the natural hydraulic gradient that pushes back against the intruding seawater. The option of injection/extraction into the 180/400-Foot Aquifer may provide additional benefits of creating a barrier near MCWD's existing production wells against seawater intrusion.

9.4.6.2 *Expected benefits and evaluation of benefits*

The primary benefit from recycled water use is to provide an alternative water supply to address the current overdraft in the Subbasin and supply future redevelopment of the former Fort Ord. Using recycled water for landscape irrigation reduces groundwater demand, which provides an in-lieu recharge benefit and is expected to increase groundwater elevations near groundwater productions. IPR application directly recharges the groundwater aquifers, thereby increasing the Subbasin's sustainable yield and groundwater elevations. Based on current and projected wastewater flows, approximately 2,200 AFY to 5,500 AFY advanced treated water may be available to MCWD for landscape irrigation and/or IPR.

The option of injection/extraction into the 180/400-Foot Aquifer may provide additional benefits of protecting MCWD's existing production wells from seawater intrusion and contaminant migration from the former Fort Ord. However, siting of this location is constrained by Fort Ord's Groundwater Protection Zone. Additional modeling and long-term monitoring are required to assess impacts on contaminants migration and seawater intrusion.

Project deliveries will be quantified directly through volumetric measurements of delivered or injected advanced treated water. Benefits towards attaining applicable measurable objectives will be measured using the monitoring networks described in Chapter 7.

9.4.6.3 *Circumstances for implementation*

As discussed above, MCWD is currently constructing its recycled water distribution system to allow delivery of 600 AFY of recycled water for landscape irrigation by 2023. No additional circumstances for implementation are necessary.

Project planning for AWPF expansion for IPR use is currently ongoing. Permitting, design, and construction efforts will be initiated as soon as funds become available.

9.4.6.4 *Public Noticing*

Stakeholder engagement is a critical aspect of developing a successful and implementable project. Key stakeholders include the U.S. Army, local governments and adjacent municipalities, as well as the public. MCWD intends to engage stakeholders early in project development.

Before any project initiates construction, it will go through a public notice process to ensure that all groundwater users and other stakeholders have ample opportunity to comment on projects before they are built.

In addition to the public noticing detailed above, all projects will follow the public noticing requirements per CEQA.

9.4.6.5 Permitting and Regulatory Process

Landscape Irrigation

The regulatory requirements for recycled water use for landscape irrigation are defined in California Code of Regulations, Title 22, Article 3. M1W and MCWD have existing permits with the RWQCB to produce, transmit, and distribute advanced treated water for landscape irrigation.

Production of disinfected, advanced treated recycled water at M1W facilities is regulated under Waste Discharge Requirements (WDR) permit Order No. R3-2017-0003. Transmission and distribution of advanced treated water from the M1W AWPF are regulated under Order No. WQ 2016-0068-DDW (General Permit). The General Permit allows MCWD's distribution of advanced treated recycled water for non-residential irrigation use in accordance with its Title 22 Engineering Report approved by the SWRCB in April 2020. The report detailed specific uses and the use area requirements for the advanced treated recycled water produced by M1W. The General Permit will need to be modified if significant changes are made to the transmission, distribution, storage, or use, and/or the volume or character of the recycled water applied within MCWD's service area.

IPR in Monterey Subbasin

Major permitting processes required for an Advanced Water Treatment Plant (AWTP) expansion and IPR use include CEQA, SWRCB permitting, and RWQCB permitting.

- **California Environmental Quality Act (CEQA) Compliance:** The project will be required to comply with CEQA requirements likely by preparing an environmental impact report (EIR). It is assumed that the EIR would build upon the Pure Water Monterey EIR, and thus may take the form of a supplemental EIR, rather than a standalone EIR.
- **State Water Resources Control Board (SWRCB) Permitting:** Regulations for subsurface application of recycled water are included in CCR Title 22, Division 4, Chapter 3, Article 5.2. These regulations include minimum treatment requirements for full advanced treatment at the AWPF, as well as requirements to demonstrate adequate retention time within the aquifer. The SWRCB Division of Drinking Water (DDW) oversees permitting of such a project.

  Detailed descriptions of all regulatory requirements for the advanced treatment of wastewater as well as implementation of a GRRP are included in Section 2 of the Pure Water Monterey Final Engineering Report (Nellor et. Al., 2017).

- **Regional Water Quality Control Board (RWQCB) permitting:** The Regional Water Quality Control Board is responsible for waste discharge requirements and water recycling requirements for wastewater treatment plants and thus oversees the general water quality effects of discharging treated wastewater into groundwater basins.

  M1W has an existing WDR permit for the Pure Water Monterey project, which applies to both the AWPF, as well as injection of the purified recycled water into the Seaside Subbasin. In order for MCWD to inject the purified recycled water into the Monterey Subbasin, the Pure Water Monterey WDR would either need to be modified to explicitly include this use, or a new WDR would need to be issued by the Central Coast RWQCB.

Additional construction permits are required prior to construction, including but not limited to, City of Marina encroachment permit, grading permit, and building permit, and County approval of use permitting, grading permit, and well construction permit.

9.4.6.6 Legal Authority

This project will be implemented pursuant to MCWD's authority as a water district.

9.4.6.7 Implementation Schedule

Landscape Irrigation

MCWD owns and operates the regional transmission line from the AWPF and is currently constructing a recycled water distribution system that will allow distribution of up to 1,427 AFY to customers. MCWD anticipating delivering its current 600 AFY of advanced treated water available to customers by 2022. MCWD's 2020 UWMP estimates that 950 AFY of landscape irrigation demand can be met by recycled water by 2030 and 1,270 AFY by 2040.

IPR in Monterey Subbasin

MCWD is currently conducting a Recycled Water Feasibility Study to further assess the possibility of implementing an IPR project. The Recycled Water Feasibility Study includes analysis of IPR alternatives using a groundwater flow model and the development of a conceptual design. MCWD anticipates conducting preliminary investigations recommended in the Water Supply Augmentation Study during the first or second year of GSP implementation.

If selected, the IPR project is likely to take between 5 and 7 years from the initiation of additional groundwater investigations through completion of tracer study that is required to be performed within the first year of GRRP operations (Figure 9-6).

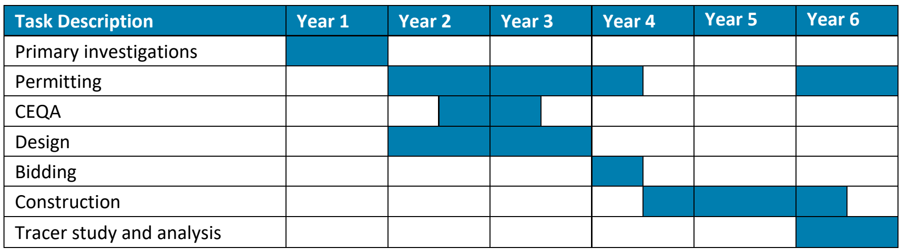

Figure 9-6. Implementation Schedule for MCWD Indirect Potable Reuse

9.4.6.8 Estimated Cost

Landscape Irrigation

Infrastructure needed to treat and deliver 1,427 AFY of advanced treated water for landscape and other non-potable uses within MCWD has already been constructed and funded with State Revolving Fund loans and various grants. The estimated unit cost to MCWD of the advanced treated water is approximately $2,400/AFY. ~~No additional capital funding is needed. M1W has already constructed a 5.0 million gallons per day (MGD) advanced water purification facility (AWPF) for the Pure Water Monterey Project. The 5.0 MGD AWPF can treat and produce 5,600 AFY of advanced treated water, sufficient to provide 1,427 AFY to MCWD. The unit cost of water for MCWD's share of the AWPF's capacity is approximately $ 2,400/AFY. Infrastructure required for delivering the initial 600 AFY of recycled water for landscape irrigation within MCWD is already under construction and does not require additional investment. The additional capital costs associated with providing recycled water up to 1,427 AFY (i.e., an additional 827 AFY) is~~ are ~~primarily associated with expansion of the AWPF. It is assumed that this expansion will be planned concurrently with the future phases of the Pure Water Monterey project or a MCWD expansion for IPR uses for economies of scale.~~

~~Capital plus soft costs (planning environmental, permitting, engineering, legal, mitigation etc.) costs are estimated to be $5,600,000 for an MCWD-contributed AWPF expansion to provide an 827 AFY of recycled water for landscape irrigation. Annual O&M costs are estimated at $810,000 for operation of the AWPF expansion and the recycled water system. Total annualized cost is therefore $1,250,000 and the unit cost of water is $1,600/AFY. Detailed cost estimates and assumptions are included as Appendix 9-A.~~

IPR in Monterey Subbasin

Conceptual costs for the IPR option are evaluated as part of the Water Supply Augmentation Study (EKI, 2020) and adjusted to conform with GSP cost assumptions as described in Section 9.3.4. The project includes an AWPF expansion and a new transmission main from M1W to a small injection wellfield in Marina (Figure 9-7). The water would be injected using new wells and extracted using new and existing MCWD production wells. Property or pipeline easement acquisition costs were not included in these estimates. It is assumed that the source water and finished water are available and rights to these sources can be obtained.

Capital plus soft costs (planning environmental, permitting, engineering, legal, mitigation etc.) for IPR use at an assumed 2,400 AFY project capacity are estimated to be approximately $65 million. Annual O&M costs are estimated at $3,110,000 for operation of the AWPF, injection wells, and additional production wells. Total annualized cost is $7,820,000. Based on the assumed project capacity of 2,400 AFY, the unit cost of water is $3,300/AF. Project per unit cost may decrease with economies of scale. Detailed cost estimates and assumptions are included as Appendix 9-A.

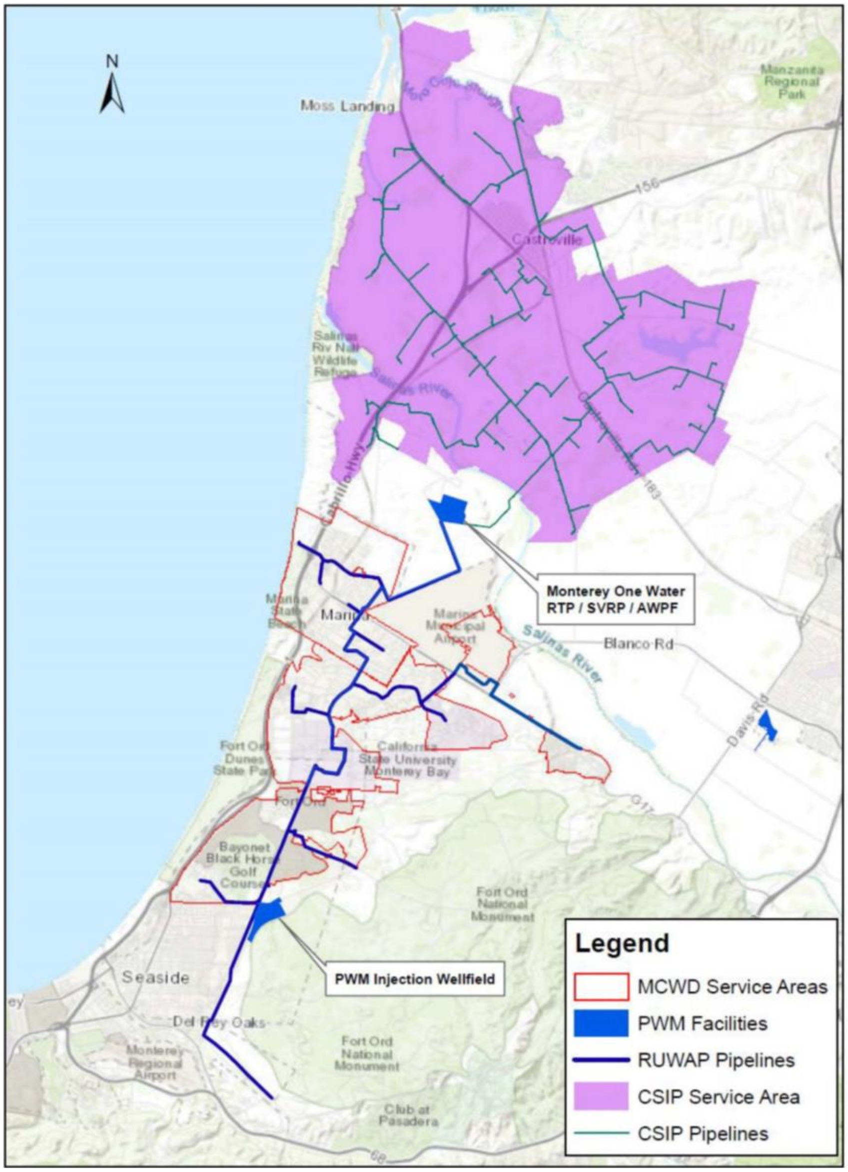

Figure 9-7. MCWD Recycled Water System

9.4.7 M4 – Drill and Construct Monitoring Wells

This project includes drilling and construction of monitoring wells screened in the 400-Foot Aquifer and the Deep Aquifers near the southwestern portion of the Subbasin. Additional monitoring wells are needed to fulfill monitoring network data gaps identified in Chapter 7 (Figures 7-7 and 7-8), and investigate several data gaps related to groundwater conditions identified in this area, including

1) Extent of seawater intrusion in the 400-Foot Aquifer and Deep Aquifers,
2) Connectivity between the 400-Foot Aquifer and the Deep Aquifers;
3) The cause of the groundwater depression observed in monitoring wells MPWMD#FO-10S and MPWMD#FO-11S; and
4) The source of elevated chloride detections in monitoring well MPWMD#FO-10S.

The project is assumed to include three monitoring wells in two locations: one cluster of two wells north of monitoring well MPWMD#FO-10, with separate wells in the 400-ft Aquifer and the Deep Aquifers, and one well near the coast screened in the 400-ft Aquifer.

During well drilling and construction, MCWD will collect geological information at the well sites including soil cores and water samples at selected depths, as well as borehole geophysical logs. Collected data will be analyzed to evaluate the quality and movement of groundwater in the 400-Foot and Deep Aquifers in this area. Findings of the hydrogeological analyses will be integrated into future updates of this GSP. Annual induction logging of the Deep Aquifer monitoring well will also provide additional information regarding potential vertical migration of seawater in this area.

In addition, the project may include geochemical analysis and pilot testing of core and groundwater samples to aid in the design of recycled water injection into the southwestern portion of the Subbasin. As discussed in Project M3 M3 – Recycled Water Reuse Through Landscape Irrigation and Indirect Potable Reuse (Section 9.4.6), MCWD is planning to expand its recycled water use for injection into the 400-foot Aquifer and/or Deep Aquifers. The monitoring wells proposed herein are located seaward of production wells in Monterey and Seaside Subbasins. Therefore, groundwater injection in this area may have the additional benefit of protecting production wells in both Subbasins from seawater intrusion. The geochemical work will inform future feasibility studies and site selection of the recycled water project.

General steps for the Project would include:

- Preparation of project scope;
- Identification of field locations and (if needed) negotiation for long-term access to the planned well locations;

- Preparation of bid specifications and a request for proposals ("RFP"); a bid walk with potential drilling contractors; and eventually selection of a drilling contractor and negotiation of contracts;
- Preparation and permitting for drilling and well construction with the local agency (Monterey County Health Department); health and safety planning for the project;
- Site walk with the drilling contractor to identify layout, hazards, traffic, and particular constraints such as the need for sound walls or other mitigation measures at each well location; marking and clearing for buried utilities and other hazards;
- Preliminary well and annular materials design;
- Mobilization of the rig and crew to the wellsite, borehole drilling, collection of soil cores and water samples at selected depths, sampling and logging of drilled materials, and downhole geophysical logging (e.g., induction logging, spinner tests);
- Laboratory analysis of soil hydraulic, mineralogical, and potential contaminant leaching properties;
- Laboratory analysis of water quality constituents,;
- Geochemical compatibility modeling/bench scale pilot studies of potential water quality impacts from recycled water injection;
- Final design of each well and filter pack based on encountered conditions, interpreted geology, and geophysical data, including indications of general water quality and saline conditions;
- Well construction, including casing, filter pack, transition seal, grout, and surface completion;
- Surveying to determine coordinates and elevation of the wells and water level measurement reference points; and
- Development of the wells after at least 72 hours for grout curing; and
- Sampling and water-level gauging of the wells.

9.4.7.1 <u>Relevant Measurable Objectives</u>

Relevant measurable objectives benefiting from construction of new monitoring wells described herein include:

- **Groundwater elevation measurable objective –** The proposed monitoring wells will be added to the Subbasin's groundwater elevation monitoring network. After a period of initial monitoring, the GSAs will establish groundwater elevation SMCs at these wells that are consistent with the Subbasin's sustainable goal. Data collected from these wells will inform groundwater elevation measurable objectives in their vicinity and within the Subbasin.

- **Groundwater storage measurable objective –** The proposed monitoring wells will be added to the Subbasin's groundwater storage monitoring network. Groundwater storage SMCs are defined in this Subbasin using groundwater elevation and seawater intrusion measurements as proxies.
- **Seawater intrusion measurable objective –** The proposed monitoring wells will be added to the Subbasin's seawater intrusion monitoring network. Data collected from this project will fill the existing data gap of seawater intrusion extent near the Monterey-Seaside Subbasin boundary. The GSAs will evaluate initial water quality data collected from these wells and establish additional seawater intrusion SMCs. Annual induction logging will also be performed in the Deep Monitoring well to assess potential vertical migration of the seawater intrusion front. Data collected from these wells will provide additional data regarding seawater intrusion in their vicinity and within the Subbasin.

9.4.7.2 Expected Benefits and Evaluation of Benefits

This project would fill critical data gaps regarding hydrostratigraphy, seawater intrusion, and groundwater recharge mechanisms for the 400-Foot Aquifer and Deep Aquifers that would benefit management towards the abovementioned measurable objectives. The hydrogeologic investigations conducted as part of this project will be incorporated into the hydrogeologic conceptual model of future GSP updates. Data from these monitoring wells will help inform the need, placement, and performance of projects to address potential seawater intrusion into the Monterey Subbasin and the northern Seaside Subbasin.

The proposed monitoring wells will be added to the Subbasin's groundwater elevation, groundwater storage, and seawater intrusion monitoring networks. The GSAs intend to establish additional SMCs at these locations after an initial period of monitoring. Progress towards attaining measurable objectives at these locations will be evaluated pursuant to protocols described in Chapter 7.

9.4.7.3 Circumstances for Implementation

This project will be implemented immediately upon GSP adoption and as soon as easements or right-of-way for access are secured.

9.4.7.4 Permitting and Regulatory Process

Drilling permits from Monterey County Health Department (MCHD) will be required for the project. Final Well Construction Reports after completion of the well must be submitted to the California Department of Water Resources (DWR).

9.4.7.5 *Implementation Schedule*

After approval and access to the well sites are obtained, project implementation may require 6 - 12 months to complete.

9.4.7.6 *Legal Authority*

Legal access to the well sites may require negotiation if the sites are on private land. An easement or right-of-way may be required to ensure access to the wells over the timeframe required by SGMA of at least 20 years.

9.4.7.7 *Estimated Cost*

Based on monitoring well construction and geological analysis conducted for the Pure Water Monterey project the Seaside Subbasin, estimated capital costs of this project are approximately $1,100,000. This cost includes constructing three monitoring wells at two locations as well as geochemical analysis and modeling to evaluate groundwater impacts from injecting AWPF treated water into areas near the monitoring wells.

9.4.7.8 *Public Noticing*

As with all SGMA projects and management actions, stakeholder input and involvement are crucial for long-term success in sustainable management of groundwater. Normal notification and updates to the project schedule will be implemented as part of regular public meetings and publications.

Corral de Tierra Area Local Projects & Management Actions

9.4.8 C1 – Pumping Allocations and Controls

Pumping allocations are one demand-side approach to managing and controlling pumping. Given limited supply-side options in the Monterey Subbasin, pumping allocations provide a management action to proactively determine how extraction should be fairly divided and controlled if needed.

Pumping allocations divide up the sustainable yield among beneficial users. Pumping allocations are not water rights and cannot determine water rights. Instead, they are a way to determine each extractor's pro-rata share of groundwater extraction and regulate groundwater extraction. They can be used to:

- Underpin management actions that manage pumping
- Generate funding for projects and management actions
- Incentivize water conservation and/or recharge projects

Pumping allocations can take many forms if it is needed now or in the future. Allocations can be developed based on various criteria. After a Valley-wide workshop on pumping allocations, Subbasin committee members and other stakeholders completed a survey on their preferences for a pumping allocation structure. At the January and both March 2021 Monterey Subbasin Planning Committee meetings, members discussed whether and what type of pumping allocation structure would be appropriate in the Corral de Tierra Area portion of the Monterey Subbasin. Subbasin committee members passed a motion for an allocations-based demand management, and the criteria that form the basis for the Subbasin's allocations structure would be based on a per connection allocation for small parcels and a per acreage for large parcels. This provides a starting point for the development of an allocation structure within GSP implementation; however, a different allocation structure could be selected at that point.

The hybrid per connection/per acreage allocation structure estimates *de minimis* extraction and subtracts it from the overall sustainable yield. Under this allocation structure, extractors with parcels larger than 5 acres receive an allocation based on acreage, and extractors with parcels smaller than 5 acres receive an allocation on a per connection basis, assuming one connection per parcel. Allocations for municipal water systems would be on a per connection basis. To reduce pumping to meet the sustainable yield, all users would reduce water usage by the same percentage, except for *de minimis* users. ~~If pumping needs to be reduced to meet the sustainable yield, all users would reduce water usage by the same percentage, except for *de minimis* users.~~ Unless *de minimis* users are incorporated into the allocation structure, the total amount estimated for *de minimis* use would be preset and remain the same, thus increasing the portion of the sustainable yield used by *de minimis* users.

Including pumping allocations in the GSP shows that allocations are a management tool that can be further developed during implementation, but it will not establish pumping allocations nor pumping controls. During GSP implementation period, a full stakeholder engagement process and in-depth analysis needs to be undertaken into potential impacts and additional data that needs to be collected. Stakeholder engagement will include outreach to water systems, homeowners, and landowners so that those interested can participate in the establishment of the selected allocation structure.

Developing the selected allocations structure in order to be feasible and effective requires good groundwater extraction data. Two implementation actions that can help are GEMS Expansion and Well Registration.

Pumping allocations could also be used as the basis for pumping fees, which could raise funds for projects and management actions. For example, a fee structure could be defined such that each extractor has a pumping allowance that is based on their allocation, and a penalty or disincentive fee is charged for extraction over that amount. If the sustainable yield is lower than current extraction, a transitional pumping allowance could be developed to transition from a groundwater user's actual historical pumping amounts (estimated or measured) to their allowance based on the sustainable yield. The purpose of this transitional allowance is to ensure that no pumper is required to immediately reduce their pumping, but rather pumpers have an opportunity to reduce their pumping over a set period. Transitional pumping allowances could then be phased out until total pumping allowances in each subbasin are less than or equal to the calculated sustainable yield.

9.4.8.1 Relevant Measurable Objectives

The measurable objectives benefiting from pumping allowance and controls include:

- **Groundwater elevation measurable objective -** Pumping allocations and controls that promote less pumping that will result in higher groundwater levels.
- **Groundwater storage measurable objective -** Reducing pumping from the principal aquifers will ultimately have the effect of increasing groundwater in storage.
- **Land subsidence measurable objective -** Pumping allocations and controls that reduce the pumping stress on the principal aquifers and thereby reduce any potential for groundwater reduction-induced subsidence.
- **Seawater intrusion measurable objective -** Seawater intrusion has advanced a few miles inland in Monterey Subbasin. Conserving groundwater through an allocations structure will support the natural hydraulic gradient that pushes back against the intruding seawater.

9.4.8.2 Expected Benefits and Evaluation of Benefits

The primary benefit expected for this project is that it is another demand-side management tool that would help manage the sustainable yield and help reduce further decline of groundwater elevations. Working within a groundwater budget allows the Subbasin to bring extraction in line with the sustainable yield and mitigate overdraft.

Benefits will be measured using the monitoring networks described in Chapter 7. Groundwater elevations will be measured with a network of wells that is monitored by MCWRA. Groundwater storage will be monitored using groundwater extraction measurements. Land subsidence will be measured using InSAR data provided by the Department of Water Resources. Seawater intrusion will be measured using selected Representative Monitoring Sites wells.

9.4.8.3 Circumstances for implementation

SVBGSA will work with the Subbasin stakeholders to collect data needed to establish pumping allocations and undertake additional stakeholder outreach prior to establishing pumping allocations. As part of establishing pumping allocations, SVBGSA will determine whether to implement pumping controls immediately or to establish a trigger based on groundwater conditions, after which controls are implemented.

9.4.8.4 *Permitting and Regulatory Process*

The GSA Board of Directors will need to authorize the establishment of pumping allocations and controls. The development and implementation of pumping controls is a regulatory activity and would be embodied in a GSA regulation. The regulation could be established to provide for automatic implementation upon existence of specific criteria or to require the vote of the Board to implement.

9.4.8.5 *Legal Authority*

California Water Code §10726.4(a)(2) provides GSAs the authorities to control groundwater extractions by regulating, limiting, or suspending extractions from individual groundwater wells or extractions from groundwater wells in the aggregate (CWC, 2014). Imposition of pumping allocations and controls will require a supermajority plus vote of the SVBGSA Board of Directors.

9.4.8.6 *Implementation Schedule*

If selected, the proposed implementation schedule is shown on Figure 9-8. After the establishment of pumping allocations is initiated for the Monterey Subbasin, pumping controls will be implemented only when needed.

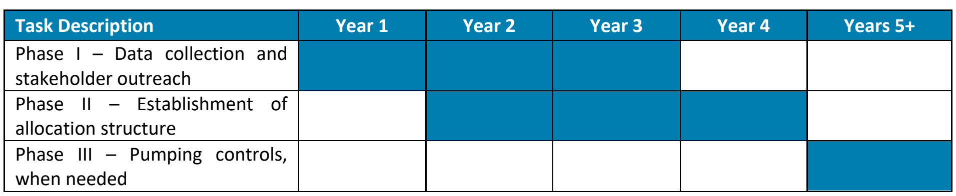

Figure 9-8. Implementation Schedule for Pumping Management

9.4.8.7 *Estimated Cost*

Development of a pumping allocation structure and pumping controls is approximately $400,000. This includes outreach meetings to engage stakeholders, analysis of potential allocation structures, facilitation of stakeholder dialogues, refinement according to specific situations, and legal analysis. When pumping controls are enacted, there will be additional administrative costs associated with implementation.

9.4.8.8 *Public Noticing*

As part of the approval of the establishment of pumping allocations in the Monterey, it will go through a public notice process to ensure that all groundwater users and other stakeholders have ample opportunity to comment on it. The general steps in the public notice process will include the following:

- GSA staff will bring an assessment of the need for allocations to the SVBGSA Board in a publicly noticed meeting. This assessment will include:
    - A description of the undesirable result(s) that may occur if action is not taken
    - A description of the proposed management action
    - An estimated cost and schedule for the proposed management action
    - Any alternatives to the proposed management action
- The SVBGSA Board will notify stakeholders in the area of the proposed project and allow at least 30 days for public response.
- After the 30-day public response period, the SVBGSA Board will vote whether or not to approve design and construction of the project, and notify the public if approved via an announcement on the SVBGSA website and mailing lists.

Imposition of pumping allocations and controls may also require a CEQA review process and may require an Environmental Impact Report or a Mitigated Negative Declaration (the review could also result in a Negative Declaration or Notice of Exemption). All projects will follow the public noticing requirements per CEQA or NEPA.

9.4.9 C2 – Check Dams

Check dams are small, sometimes temporary dams constructed across streams or rivers to reduce or slow flow. Especially when streambeds have high recharge potential, check dams can increase recharge by holding back water while infiltration occurs, rather than running off in the stream. Most streams in the Corral de Tierra Area are intermittent, flowing less than 25% of the year as a result of generally high infiltration rates and low precipitation rates. A check dam will slow this flow down in order to facilitate the additional infiltration of water and increase recharge to the principal aquifer. Two potential sites for this project have been identified downstream of the confluence of Watson Creek and Calera Canyon. The headwaters of Watson Creek at this location are part of a subwatershed that is approximately 20.5 square miles; this subwatershed is part of the larger El Toro Creek Subwatershed, which drains north to the Salinas River. Alternative sites could be identified during GSP implementation.

At the assumed location along Watson Creek, the creek bed is relatively wide (approximately 50-60 feet) and has significant bank erosion. For the purposes of the cost estimate, an inflatable rubber dam is assumed to serve as a check dam. An inflatable rubber dam has the advantage of remote, automatic control of the dam height promoting operational safety and passage of higher streamflows. A similar, but larger, inflatable dam system is installed along the Salinas River as part of the Salinas River Diversion Facility. Alternative types of check dams, such as more permanent structures built of rock or other materials, may be possible and will be analyzed as part of project design if this project is selected for implementation.

The scoped check dam will be approximately 70 feet in length and approximately 7.5 feet at maximum height. The rubber dam will require a concrete structure that includes both a foundation and transition walls. Housing a compressed air system, power supply and controls will require a control building nearby. Rock slope protection will be installed both upstream and downstream of the facility to address existing areas of eroded streambank and ensure long-term stability. This project also includes a stilling basin and fish passage for the rubber dam for preliminary consideration. This project assumes acquiring ten acres of land for construction of the check dam structure and associated control facilities.

The check dam will detain low streamflows and create a detention volume of approximately 3 AF when runoff is present. The 2-year return interval flow rate for this point of the creek is approximately 218 cfs based on the flow gage measurements from the (United States Geological Survey) USGS gauge that collected data through 2006 (USGS, 2012). The runoff volume for a 2-year, 24-hour rainfall event is estimated to be approximately 250 AF.

The benefit of this project is dependent on the recharge rate from the creek bed into the underlying aquifers. There is hydraulic connectivity between the alluvial sediments in the stream beds and the underlying El Toro Primary Aquifer System. However, the extent of this connectivity is currently unquantified and may be inconsistent with the presence of clay deposits in the subsurface.

9.4.9.1 Relevant Measurable Objectives

The measurable objectives benefiting from outreach and education include:

- **Groundwater elevation measurable objective** - By slowing stormwater and runoff in designated areas along the streambed, there will be more water added to the principal aquifer. This water will be slowed down and allowed to infiltrate, which has the effect of addition water to the aquifer. Adding water into the principal aquifer will raise groundwater elevations over time.
- **Groundwater storage measurable objective** - Furthermore, adding water to the principal aquifer will ultimately have the effect of increasing groundwater in storage. Groundwater storage is also calculated from measured groundwater elevations. By raising groundwater elevations, the calculation of change in storage will be less negative, or even positive over time.
- **Land subsidence measurable objective** - Increasing both groundwater elevations and groundwater storage will have the added benefit of preventing any potential land subsidence. Maintaining and adding water in the subsurface will keep pore spaces saturated with positive pressure and inhibit land surface collapse associated with groundwater depletion.

9.4.9.2 Expected Benefits and Evaluation of Benefits

This project will increase sustainable yield and groundwater elevations through enhanced recharge of stormwater and runoff. Runoff occurs when the rate of rainfall exceeds the soil infiltration rate. This runoff then flows over the land surface before accumulating into washes and streams as measurable streamflow. In the initial phases of overland flow, this water often infiltrates into the soils, which enhances soil moisture and can recharge the aquifer. The benefits to increased soil moisture go beyond increased opportunity for recharge. The primary benefit from this project is increased groundwater elevations and storage that results from increased infiltration of stormwater and runoff. The project benefit is anticipated to be 150 AFY

Benefits will be measured using the monitoring networks described in Chapter 7. Groundwater elevations will be measured with a network of wells that is monitored by MCWRA. Various volumetric measurement methods may be installed with this facility to assist in calculating increases in groundwater storage. Land subsidence will be measured using InSAR data provided by the Department of Water Resources.

9.4.9.3 Circumstances for Implementation

The check dam project will be implemented if stakeholders determine it is necessary to reach or maintain sustainability. A number of agreements and rights must be secured before the project is implemented. In particular, access agreements and surface water rights will be pivotal to the project implementation, as detailed below. A more formal cost/benefit analysis must be completed to determine if the check dam will provide quantifiable benefits to the principal aquifer. Site specific analyses will help determine the potential recharge benefit.

9.4.9.4 Permitting and Regulatory Process

Projects described in this section may require a CEQA review process and may require an Environmental Impact Report or a Mitigated Negative Declaration (the review could also result in a Negative Declaration or Notice of Exemption). Additionally, permits from a variety of state and federal agencies may be necessary, and any project that coordinates with federal facilities or agencies may require National Environmental Policy Act (NEPA) documentation.

In addition, permits from the following government organizations that may be required for the check dam project include:

- ***Monterey Bay National Marine Sanctuary (MBNMS)*** – All Regional Water Quality Control Board (RWQCB) 404 permits, Section 10 permits, and National Pollutant Discharge Elimination System (NPDES) permits must be reviewed by MBNMS.
- ***United States Fish and Wildlife Service (USFWS)*** – Federal agencies involved in the permitting process for this project may need to consult with USFWS in compliance with Section 7 of the Endangered Species Act. Interagency coordination is also required by the

Fish and Wildlife Coordination Act (16 U.S. Code §661-667e; the Act of March 10, 1934; ch. 55; 48 stat. 401).

- ***National Oceanic & Atmospheric Administration, Fisheries (NOAA)*** – Federal agencies involved in the permitting process for this project may need to consult with USFWS in compliance with Section 7 of the Endangered Species Act.
- ***United States Army Corps of Engineers (USACE) –*** Under the Rivers and Harbor Act, a Section 10 permit (33 U.S. Code §403) is required for the construction of any structure in or over any navigable water of the United States. Under the Clean Water Act, a Section 404 permit (33 U.S. Code §1341) is required to discharge dredge or fill materials into waters of the United States.
- ***State Water Resources Control Board (SWRCB)*** – Construction that disturbs one acre or more of land and that discharges stormwater requires a General Construction Stormwater Permit (Water Quality Order No. 2009-0009-DWQ). Water quality certification may be required by Section 401 of the Clean Water Act and by the Porter-Cologne Water Quality Control Act (California Water Code §13000 et seq.). Diversion and use require an appropriative water right permit per Water Code §1200 et seq.
- ***California Department of Fish and Wildlife (CDFW)*** – Projects that may result in the taking of a threatened or endangered species require an Incidental Take Permit (California Endangered Species Act Title 14, §783.2). A Streambed Alteration Agreement (California Fish and Game Code Section 1602) is required if the project may substantially adversely affect fish and wildlife resources.
- ***Monterey County*** – If the project encroaches onto any county-maintained road, an Encroachment Permit (Monterey County Code Chapter 14.04) is required from the County. Removal of 3 or fewer trees can be handled by a standalone Tree Removal Permit (Monterey County Code Chapter 16.60). Removal of more than 3 trees should be included in a County Use Permit and/or Coastal Development Permit.
- ***Monterey County Health Department*** – Other required permits include a Well Construction Permit (Monterey County Code Chapter 15.08), permits to construct and operate a desalination treatment facility (Monterey County Code Chapter 10.72), and a variation on Monterey County Noise Ordinance (MCC 10.60.030).
- ***Monterey County Department of Planning and Building Services*** – This project will require a Use Permit (MCC Chapter 21.72 Title 21). A Grading Permit (Monterey County Code Chapter 16.08) is required if total disturbance onsite equals or exceeds 100 cubic yards. An erosion control plan (Monterey County Code Chapter 16.12) is required if there is risk of accelerated (human-induced) erosion that could lead to degradation of water quality, loss of fish habitat, damage to property, loss of topsoil or vegetation cover, disruption of water supply, or increased danger from flooding.

- ***Local jurisdictions*** – Permits may also be required by a local jurisdiction depending on location, including but not limited to: land use permits, building permits, public health permits, public works permits, tree removal permits, and encroachment permits
- ***Landowners*** –Land lease/sale, easements, and/or encroachment agreements may be required.

9.4.9.5 Implementation Schedule

If selected, it will follow the implementation schedule presented on Figure 9-9. The schedule begins after any SWRCB permits are secured. The schedule may vary if a different type of check dam is implemented.

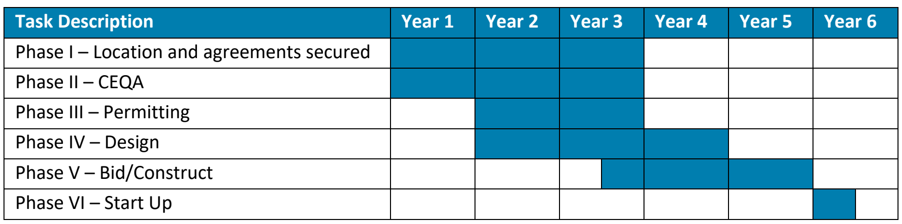

Figure 9-9. Implementation Schedule for Check Dams

9.4.9.6 Legal Authority

The SVBGSA will use the legal authority and partnerships for this modified project contained in existing distribution, irrigation, and partnership programs. California Water Code §10726.2 provides GSAs the authority to purchase, among other things, land, water rights, and privileges. This project would be developed in accordance with all applicable groundwater laws and respect all groundwater rights. Section 10726.2 (b) of the California Water Code provides GSAs the authority to, "Appropriate and acquire surface water or groundwater and surface water or groundwater rights, import surface water or groundwater into the agency, and conserve and store within or outside the agency" (CWC, 2014).

The County also has the power to impose charges on a parcel or acreage basis under the County Service Area provisions of the Government Code (beginning with Section 25210). These provisions give the County the authority to provide extended services within a specified area, which may be countywide, and to fix and collect charges for such extended services. Miscellaneous extended service for which county service areas can be established include "water service, including the acquisition, construction, operation, replacement, maintenance, and repair of water supply and distribution systems, including land, easements, rights-of-way, and water rights."

9.4.9.7 *Estimated Cost*

Capital costs were estimated at $5,143,000. On an annualized basis, assuming a 6% discount rate, and 25-year term, this amounts to $402,300. Including an annual operations and maintenance cost of $22,000 generates a total annualized cost of $424,300. Assuming a yield of 150 AFY, the unit cost for water stored is estimated at $2,830/AFY

9.4.9.8 *Public Noticing*

Before SVBGSA initiates construction on this project, it will go through a public notice process to ensure that all groundwater users and other stakeholders have ample opportunity to comment on projects before they are built. The general steps in the public notice process will include the following:

- SVBGSA staff will bring an assessment of the need for the project to the SVBGSA Board and the MCWRA Board in publicly noticed meetings. This assessment will include:
    - A description of the undesirable result(s) that may occur if action is not taken
    - A description of the proposed project
    - An estimated cost and schedule for the proposed project
    - Any alternatives to the proposed project
- The SVBGSA Board and the MCWRA Board will notify stakeholders in the area of the proposed project and allow at least 30 days for public response.
- After the 30-day public response period, the SVBGSA Board will vote whether or not to approve design and construction of the project and notify the public if approved via an announcement on the SVBGSA website and mailing lists.

The permitting and implementation of the check dam will require notification of stakeholders, beneficiaries, water providers, member lands adjacent to the river, and subbasin committee members as well as all permit and regulatory holding agencies such as DWR, NOAA, USACE, and others. In addition to the public noticing detailed above, all projects will follow the public noticing requirements per CEQA or NEPA.

9.4.10 C3 – Recharge Basins from Surface Water Diversions

Surface water in the El Toro Creek watershed can be diverted from the small tributaries, and rerouted to recharge basins to enhance storage, infiltration, and recharge opportunities in this management area. While many of the streambeds have high recharge potential, the topographic relief of the many canyons is too steep and flow in these smaller streams is too intermitted to allow for more storage or recharge. Diverting runoff from these smaller tributaries to recharge basins may allow for increased recharge of the principal aquifer system by increasing the time the water is in contact with permeable sediments in a more stable location.

Four potential locations for recharge basins were identified. El Toro Lake was selected for the development of the cost analysis; however, the other locations, as well as additional locations not yet identified, remain viable options for this project. This project diverts water from Watson Creek downstream of its confluence with Calera Canyon and conveys it to a recharge basin located at El Toro Lake.

El Toro Lake is located in a 0.6 square mile watershed, separate from the watershed for Watson Creek, which drains 20.5 square miles and contributes to El Toro Creek. In this watershed, the two-year, 24-hour storm event with a rainfall depth of 2.31 inches yields a runoff volume of 7.4 AF. However, El Toro Lake has reportedly not filled to its capacity during recent wet weather seasons. Therefore, the watershed contribution is neglected for the initial cost estimate, and it is assumed that diversion and associated pipeline infrastructure from Watson Creek will be required to deliver water to the recharge basin for it to reach storage capacity.

Based on LIDAR topographical data, the storage capacity of El Toro Lake is approximately 32 AF assuming a maximum depth of 4.5 feet and allowing a minimum of 2 feet of freeboard around the perimeter of the lake (NOAA, 2010). Additional surface runoff captured from the Toro Lake subwatershed, or other subwatersheds nearby and retained in the Toro Lake recharge basin may lessen the quantity of water required to be diverted from Watson Creek to maintain a fuller capacity.

The project will require construction of a diversion structure and pump station located downstream of the confluence of Calera Canyon and Watson Creeks, and accessible from Corral de Tierra Road via a new access drive. The diversion structure will include a concrete weir structure set at an elevation to divert flows above a designated flow rate. This structure will include a debris screen, concrete weir, sluice gate, and a gravity pipeline for conveying water to a pump station that will be sized for pumping at a rate of 1,500 gpm (approximately 3.5 cfs). The two-year return interval flow rate for this point of the creek is approximately 218 cfs. The pump station will include a control building for power supply and controls. Water will be conveyed 3,200 linear feet from the diversion pump station to the El Toro Lake recharge basin. The cost estimate also includes a new inlet structure at El Toro Lake for water discharged from the conveyance pipeline.

This project will also acquire 15.7 acres of land that includes El Toro Lake. Easements will be established to allow installation of the new diversion structure and construction of the conveyance pipeline.

9.4.10.1 Relevant Measurable Objectives

The measurable objectives benefiting from outreach and education include:

- **Groundwater elevation measurable objective** - By routing stormwater and runoff into El Toro Lake, there will be more water added to the principal aquifer. This water will be stored in the recharge basin and allowed to infiltrate, which has the effect of addition water to the aquifer. Adding water into the principal aquifer will raise groundwater elevations over time.

- **Groundwater storage measurable objective** - Furthermore, adding water to the principal aquifer will ultimately have the effect of increasing groundwater in storage. Groundwater storage is also calculated from measured groundwater elevations. By raising groundwater elevations, the calculation of change in storage will be positive.
- **Land subsidence measurable objective** - Increasing both groundwater elevations and groundwater storage will have the added benefit of preventing any potential land subsidence. Maintaining and adding water in the subsurface will keep pore spaces saturated with positive pressure and inhibit land surface collapse associated with groundwater depletion.

9.4.10.2 Expected Benefits and Evaluation of Benefits

This project will increase sustainable yield and groundwater elevations through enhanced infiltration of diverted stormwater and runoff. Runoff occurs when the rate of rainfall exceeds the soil infiltration rate. This runoff then flows over the land surface before accumulating into washes and streams as measurable streamflow. The benefits to increased soil moisture go beyond increased opportunity for recharge. The primary benefit from this project is increased groundwater elevations and storage that results from increased infiltration of stormwater and runoff. The project benefit is anticipated to be 250 AFY.

Benefits will be measured using the monitoring networks described in Chapter 7. Groundwater elevations will be measured with a network of wells that is monitored by MCWRA. Various volumetric measurement methods may be installed with this facility to assist in calculating increases to groundwater storage. Land subsidence will be measured using InSAR data provided by the Department of Water Resources.

9.4.10.3 Circumstances for Implementation

If selected, the creek diversion project will be implemented if stakeholders determine it is necessary to reach or maintain sustainability. A number of agreements and rights must be secured before the project is implemented. Primarily, a more formal cost/benefit analysis must be completed to determine if the creek diversion will provide quantifiable benefits to the principal aquifer. Site specific analyses will help determine the potential recharge benefit.

9.4.10.4 Permitting and Regulatory Process

Projects described in this section may require a CEQA review process and may require an Environmental Impact Report or a Mitigated Negative Declaration (the review could also result in a Negative Declaration or Notice of Exemption). Additionally, permits from a variety of state and federal agencies may be necessary, and any project that coordinates with federal facilities or agencies may require National Environmental Policy Act (NEPA) documentation.

In addition, permits from the following government organizations that may be required for the recharge from surface water diversion project include:

- ***United States Army Corps of Engineers (USACE)*** – A Regional General Permit may be required if there are impacts to wetlands or connections to waters of the United States.
- ***California Department of Fish and Wildlife (CDFW)*** – A Standard Agreement is required if the project could impact a species of concern.
- ***Environmental Protection Agency (EPA) Region 9*** – National Environmental Policy Act (NEPA) documentation must be submitted for any project that coordinates with federal facilities or agencies. Additional permits may be required if there is an outlet or connection to waters of the United States.
- ***National Marine Fisheries Service (NMFS)*** – A project may require authorization for incidental take, or another protected resources permit or authorization from NMFS.
- ***State Water Board Stormwater Pollution Prevention Plan (SWPPP)*** – A General Permit to Discharge Stormwater may be required depending on how stormwater is rerouted.
- ***California Department of Transportation (Caltrans)*** – An Encroachment Permit is required if any state highway will be obstructed.
- ***Monterey County*** – A Use Permit may be required. A Grading Permit is required if 100 cubic yards or more of soil materials are imported, moved, or exported. An Encroachment Permit is required if objects will be placed in, on, under, or over any County highway.
- ***Landowners*** –Land lease/sale, easements, and/or encroachment agreements may be required.

9.4.10.5 Implementation Schedule

If selected, this project will follow the implementation schedule that is presented on Figure 9-10. Implementation Schedule for Surface Water Diversions, after any SWRCB permits are secured.

Task Description	Year 1	Year 2	Year 3	Year 4	Year 5
Studies/Preliminary Engineering Analysis	■				
Agreements/ROW	■	■			
CEQA		■	■		
Permitting		■	■		
Design			■	■	
Bid/Construct				■	■

Figure 9-10. Implementation Schedule for Surface Water Diversions

9.4.10.6 Legal Authority

Pursuant to California Water Code sections 10726.2 (a) and (b), the SVBGSA has the right to acquire and hold real property, and to divert and store water once it has acquired any necessary real property or appropriative water rights. Some rights in real property (whether fee title, easement, license, leasehold or other) may be required to implement a recharge project. A diversion permit or a SWRCB 5-year temporary permit is required for the authority to divert water.

9.4.10.7 Estimated Cost

Capital costs were estimated at $5,477,000. On an annualized basis, assuming a 6% discount rate, and 25-year term, this amounts to $428,500. Including an annual operations and maintenance cost of $21,000 generates a total annualized cost of $449,500. Assuming a yield of 250 AFY, based on operation 40 days of the year the unit cost for water stored is estimated at $1,800/AFY.

9.4.10.8 Public Noticing

Before SVBGSA initiates construction on this project, it will go through a public notice process to ensure that all groundwater users and other stakeholders have ample opportunity to comment on projects before they are built. The general steps in the public notice process will include the following:

- SVBGSA staff will bring an assessment of the need for the project to the SVBGSA Board and the MCWRA Board in publicly noticed meetings. This assessment will include:
    - A description of the undesirable result(s) that may occur if action is not taken
    - A description of the proposed project
    - An estimated cost and schedule for the proposed project
    - Any alternatives to the proposed project
- The SVBGSA Board and the MCWRA Board will notify stakeholders in the area of the proposed project and allow at least 30 days for public response.
- After the 30-day public response period, the SVBGSA Board will vote whether or not to approve design and construction of the project and notify the public if approved via an announcement on the SVBGSA website and mailing lists.

The permitting and implementation of the diversion will require notification of stakeholders, beneficiaries, water providers, member lands adjacent to the river, and subbasin committee members as well as all permit and regulatory holding agencies such as DWR, NOAA, USACE, and others. In addition to the public noticing detailed above, all projects will follow the public noticing requirements per CEQA or NEPA.

9.4.11 C4 – Wastewater Recycling for Indirect Potable Use

This project will reclaim up to 232 AFY of treated wastewater. This water will be disinfected at tertiary levels for beneficial reuse within the Corral de Tierra Planning Area. Wastewater flow volumes totaling 232 AFY from the California Utility Service (CUS) wastewater treatment plant are available to serve the Toro Park Subdivision and parts of Corral de Tierra Area, as well as potential non-irrigation water uses not served by public water purveyors.

An estimated annual demand of 168.5 AFY from the local golf course and 23.3 AFY from area parks, amount to an approximate total demand of 192 AFY This assumes the golf course's full demand would be utilized by recycled water, which may be an over assumption as golf courses may not utilize recycled water to irrigate their greens. An additional 40 AFY to 80 AFY of demand will need to be identified to completely allocate the treated wastewater for beneficial reuse; there may be additional demand within the community's landscaped open spaces found in the public right of way, private developments, or schools not considered at this time. However, this project assumes the project benefit is equivalent to the entire 232 AFY.

The project assumes construction of a tertiary filtration and disinfection system at the CUS-owned wastewater treatment plant (WWTP). The plant is rated for a design flow of 0.30 MGD and sends its secondary-treated effluent to approximately 112 acres for disposal.

This project will retrofit the existing treatment plant to produce tertiary-disinfected recycled water. A new membrane bioreactor system and ultraviolet (UV) disinfection system is needed, and treatment costs may be lessened depending on the degree to which the existing unit processes may be retained and/or retrofitted. Treated water will be stored within a 300,000-gallon treated water storage tank and ultimately conveyed to the southwest toward open space parks and the golf course located in Corral de Tierra Area. A recycled water pump station rated for a peak flow of 1 MGD will be installed at the plant and 30,900 linear feet (LF) of 10" pipe will deliver the water to the reuse sites. No changes to the plant headworks or equalization storage were assumed for the retrofit.

Project costs associated with onsite storage could be reduced if alternative storage is identified offsite at reuse sites, such as at golf course ponds or recharge basins, which allows the plant to pump recycled water as it is produced to those sites. There may also be an opportunity to re-purpose one of the wet-weather storage ponds at the WWTP as a treated effluent storage pond. The feasibility of each of the different treated water storage alternatives would have to be refined in subsequent planning and design phases.

The pipelines will be installed in the public right-of-way where feasible. Otherwise, temporary construction and permanent access easements will be recorded where the pipelines cross private lands. This project will require easements on 3.25 acres of land. Costs to retrofit the irrigation piping at the parks and golf course to accommodate the recycled water and a small equalization tank and pump station at the golf course are not included at this time. At this conceptual planning stage, the costs for pipeline installation are generic, and do not delineate varying costs for paved and unpaved areas or areas inside or outside the public right of way. In the next phase of planning, pipeline costs can be further reduced by analyzing alignment routes in unpaved and undeveloped areas where costs associated with traffic control, utility crossings, pavement demolition and restoration, and other installation considerations would be reduced. Because the project retrofits existing facilities for treatment and reuse, and proposed pipelines will largely remain in the public right of way, the associated environmental permitting costs for this project may be lower than those for other green field projects. An adjustment to reflect these lower environmental permitting costs may be warranted in future cost estimates for this project.

9.4.11.1 Relevant Measurable Objectives

The measurable objectives benefiting from outreach and education include:

- **Groundwater elevation measurable objective -** By using recycled water instead of pumping groundwater, there will be more water maintained in the principal aquifer. This has the effect of adding water to the principal aquifer. Adding water into the principal aquifer will either raise groundwater elevations or reduce the rate of groundwater elevation decline. Furthermore, using recycled water instead of pumped groundwater passively increases the groundwater elevations by not diminishing them.
- **Groundwater storage measurable objective -** Furthermore, adding water to the principal aquifer will ultimately have the effect of increasing groundwater in storage. Groundwater storage is also calculated from measured groundwater elevations. By raising groundwater elevations, the calculation of change in storage will be positive.
- **Land subsidence measurable objective -** Increasing both groundwater elevations and groundwater storage will have the added benefit of preventing any potential land subsidence. Maintaining and adding water in the subsurface will keep pore spaces saturated with positive pressure and inhibit land surface collapse associated with groundwater depletion.

9.4.11.2 Expected Benefits and Evaluation of Benefits

The primary benefit from this project is increased groundwater elevations and storage that results from reduced groundwater extraction. The existing treatment plant will produce approximately 232 AF/yr. of tertiary recycled water for distribution, and therefore, up to that amount of reduced groundwater extraction will be reduced assuming the timing of water delivery aligned with irrigation needs. The exact location of groundwater elevation impacts would depend on where current extraction is reduced, which would need to be determined during the project design phase.

Benefits will be measured using the monitoring networks described in Chapter 7. Groundwater elevations will be measured with a network of wells that is monitored by MCWRA. Land subsidence will be measured using InSAR data provided by the Department of Water Resources. Seawater intrusion will be measured using select Representative Monitoring Sites wells.

9.4.11.3 Circumstances for Implementation

If selected, the Toro WWTP project will be implemented if stakeholders determine it is necessary to reach or maintain sustainability. This project retrofits existing facilities for treatment and reuse, and proposed pipelines will largely remain in the public right of way, the associated environmental permitting costs for this project may be lower than those for other green field projects. The upgrades need to be designed, permits and CEQA completed, and recycled water recipients identified before this project can be funded and implemented.

9.4.11.4 Permitting and Regulatory Process

Projects described in this section may require a CEQA review process and may require an Environmental Impact Report or a Mitigated Negative Declaration (the review could also result in a Negative Declaration or Notice of Exemption). Additionally, permits from a variety of state and federal agencies may be necessary, and any project that coordinates with federal facilities or agencies may require National Environmental Policy Act (NEPA) documentation.

In addition, permits from the following government organizations that may be required for the check dam project include:

- ***United States Fish and Wildlife Service (USFWS)*** – A Migratory Bird Treaty Act Permit (16 U.S. Code §703-711) may be required from the USFWS. Other federal agencies involved in the permitting process for this project may need to consult with USFWS in compliance with Section 7 of the Endangered Species Act. Interagency coordination is also required by the Fish and Wildlife Coordination Act (16 U.S. Code §661-667e).
- ***State Water Resources Control Board (SWRCB)*** – A permit to operate a public water system is required from SWRCB’s Division of Drinking Water. Construction that disturbs one acre or more of land and that discharges stormwater requires a General Construction Stormwater Permit (Water Quality Order No. 2009-0009-DWQ).
- ***California Department of Fish and Wildlife (CDFW)*** – Projects that may result in the taking of a threatened or endangered species require an Incidental Take Permit (California Endangered Species Act Title 14, §783.2).
- ***California Department of Transportation (Caltrans)*** – Work that may obstruct a State highway requires an Encroachment Permit.
- ***California Public Utilities Commission (CPUC)*** – A Certificate of Public Convenience and Necessity (California Public Utilities Code §1001 et seq.) is required to show that the project will benefit society.

- ***Monterey County*** – If the project encroaches onto any county-maintained road, an Encroachment Permit (Monterey County Code Chapter 14.04) is required from the County. Removal of 3 or fewer trees can be handled by a standalone Tree Removal Permit (Monterey County Code Chapter 16.60). Removal of more than 3 trees should be included in a Use Permit (see Monterey County Department of Planning and Building Services).
- ***Monterey County Health Department*** – If there will be 55 gallons (liquid), 500 pounds (solid), or 200 cubic feet (compressed gas) of hazardous materials onsite at any one time, a Hazardous Materials Business Plan and a Hazardous Materials Inventory Statement (California Health and Safety Code Chapter 6.95) must be submitted to the Monterey County Health Department's Environmental Health Bureau.
- ***Monterey County Department of Planning and Building Services*** – This project will require a Use Permit (MCC Chapter 21.72 Title 21). A Grading Permit (Monterey County Code Chapter 16.08) is required if total disturbance onsite equals or exceeds 100 cubic yards. An erosion control plan (Monterey County Code Chapter 16.12) is required if there is risk of accelerated (human-induced) erosion that could lead to degradation of water quality, loss of fish habitat, damage to property, loss of topsoil or vegetation cover, disruption of water supply, or increased danger from flooding.
- ***Monterey One Water*** – A Sewer Connection Permit is required to connect to the regional sewer system.
- ***Monterey Bay Air Resources District (MBARD)*** – If the project may release or control air pollutants, an Authority to Construct and Permit to Operate is required (MBARD Rule 200).
- ***Monterey Peninsula Water Management District (MPWMD)*** – An expansion/extension permit is required to expand the current water system (MPWMD Ordinance 96).
- ***Transportation Agency for Monterey County (TAMC)***– An easement for access to and use of the project site may need to be negotiated with TAMC.
- ***Local jurisdictions*** – Permits may also be required by a local jurisdiction depending on location of scalping plant, including but not limited to: land use permits, building permits, public health permits, public works permits, tree removal permits, and encroachment permits.

9.4.11.5 Implementation Schedule

The annual implementation schedule is presented on Figure 9-11.

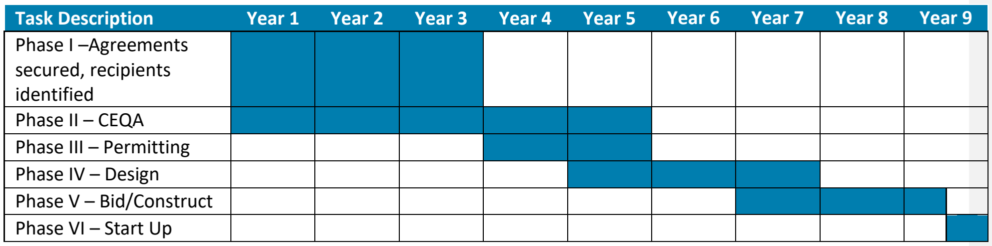

Figure 9-11. Implementation Schedule for Toro WWTP

9.4.11.6 <u>Legal Authority</u>

The SVBGSA will use the legal authority and partnerships for this modified project contained in existing distribution, irrigation, and partnership programs. California Water Code §10726.2 provides GSAs the authority to purchase, among other things, land, water rights, and privileges. This project would be developed in accordance with all applicable groundwater laws and respect all groundwater rights. Section 10726.2 (b) of the California Water Code provides GSAs the authority to, “Appropriate and acquire surface water or groundwater and surface water or groundwater rights, import surface water or groundwater into the agency, and conserve and store within or outside the agency” (CWC, 2014).

The County also has the power to impose charges on a parcel or acreage basis under the County Service Area provisions of the Government Code (beginning with Section 25210). These provisions give the County the authority to provide extended services within a specified area, which may be countywide, and to fix and collect charges for such extended services. Miscellaneous extended service for which county service areas can be established include "water service, including the acquisition, construction, operation, replacement, maintenance, and repair of water supply and distribution systems, including land, easements, rights-of-way, and water rights."

9.4.11.7 <u>Estimated Cost</u>

Capital costs were estimated at $28,635,000. On an annualized basis, assuming a 6% discount rate, and 25-year term, this amounts to $2,240,100. Including an annual operations and maintenance cost of $486,000 generates a total annualized cost of $2,726,100. Assuming a yield of 232 AFY, the unit cost for water delivered is estimated at $11,750/AF.

These costs do not include the wastewater collection system or the distribution system for treated water to be delivered.

9.4.11.8 <u>Public Noticing</u>

Before SVBGSA initiates construction on this project, it will go through a public notice process to ensure that all groundwater users and other stakeholders have ample opportunity to comment on projects before they are built. The general steps in the public notice process will include the following:

- SVBGSA staff will bring an assessment of the need for the project to the SVBGSA Board and the MCWRA Board in publicly noticed meetings. This assessment will include:
    - A description of the undesirable result(s) that may occur if action is not taken
    - A description of the proposed project
    - An estimated cost and schedule for the proposed project
    - Any alternatives to the proposed project
- The SVBGSA Board and the MCWRA Board will notify stakeholders in the area of the proposed project and allow at least 30 days for public response.
- After the 30-day public response period, the SVBGSA Board will vote whether or not to approve design and construction of the project and notify the public if approved via an announcement on the SVBGSA website and mailing lists.

The permitting and implementation of the diversion will require notification of stakeholders, beneficiaries, water providers, member lands adjacent to the river, and subbasin committee members as well as all permit and regulatory holding agencies such as DWR, CEQA, NOAA, USACE, and others. In addition to the public noticing detailed above, all projects will follow the public noticing requirements per CEQA or NEPA.

9.4.12 C5 – Decentralized Residential In-Lieu Recharge Projects

This project is a set of initiatives that incentivize homeowners to install decentralized in lieu recharge projects, such as rainwater harvesting, graywater reuse, and recharge features on their properties. Harvested rainwater can be used for residential landscaping and domestic animal water purposes and reduce groundwater pumping, thereby functioning as in-lieu recharge. The two main types of in-lieu recharge are rooftop rainwater harvesting and graywater reuse. Decentralized rainwater capture at the residential scale, or graywater use from a laundry-to-landscape system, can assist property owners with outdoor landscaping watering needs, which is typically a significant portion of an individual household's water use. By substituting rainwater or graywater for outdoor irrigation, less groundwater will be pumped and the Corral de Tierra Area benefits from in-lieu recharge. Water used for landscaping is mostly lost to evapotranspiration and is not available to be returned to the groundwater system. Alternatively, rain gardens can be designed to capture rainwater.

This project will engage property owners through outreach, help identify opportunities for residential-scale rainwater harvesting or graywater reuse systems. This project primarily includes workshops to do outreach and education for homeowners, but could also help install or incentivize installation in the future. For example, it could also include the development of a fund to provide financial incentives to help bring down individual costs associated with rainwater harvesting or graywater systems. This could also be expanded to include other residential-scale conservation efforts, such as xeriscaping or lawn buy-back efforts.

Rain Barrels and Cisterns

Residential rainwater harvesting in rain barrels or cisterns can provide water for outdoor irrigation, and offset the pumping, treatment of, and delivery of groundwater. Appropriately sized cisterns for 2,500 square foot rooftops range from approximately 600 gallons up to 5,000 gallons. Since more of the rain falls in the winter months, having enough storage to last over the summer months is an important factor in sizing cisterns for outdoor irrigation purposes. Use of rainwater for landscaping typically does not require pumping, treatment, or complex delivery systems. Rainwater harvesting at the residential level could be further enhanced with drip-irrigation systems and timers included with the cistern installations.

Rain Gardens

Rainwater could be captured in small, residential rain gardens to enhance use of rainwater to irrigate landscapes rather than groundwater. Rain gardens are vegetated basins installed at residences to capture and detain rainfall runoff while providing an aesthetic landscaping benefit to landowners. The rain garden temporarily holds water, thereby allowing it to infiltrate the soil and provide moisture for plant roots. Rain gardens include grassed swales, rock lined swales (dry creek beds), and bioswales. Bioswales are typically sized for larger catchments than residential scale. Grassed and rock-lined swales, which are shallow channels designed to convey, filter, and infiltrate runoff, are more often used at the residential scale.

Rain gardens are installed at natural low points on the property and are typically planted with native, water-tolerant plants that are able to thrive in saturated soil conditions. They can be installed in a variety of soils, from clays to sands, but are best suited for soils with high infiltration capacities.

Graywater Systems

Graywater reuse systems can provide additional residential in-lieu water use. These systems direct gently used water from showers or laundry onto landscapes to water plants instead of extracted groundwater. For example, Laundry to Landscape systems and are often installed with dual drainage plumbing that enables the water to be directed to either the landscape or wastewater system. Monterey County has developed and approved its own set of graywater guidelines for discharging graywater onto landscapes.

9.4.12.1 Relevant Measurable Objectives

Relevant measurable objectives benefiting from this project include:

- **Groundwater elevation measurable objective** – Rainwater harvesting, rain gardens, and graywater reuse will increase rainwater used for irrigation in lieu of pumped groundwater, thereby decreasing groundwater extraction. By pumping less water, it has a similar effect of adding water to the principal aquifer. Adding water into the principal aquifer, it will raise groundwater elevations over time.

- **Groundwater storage measurable objective** – Adding water to the principal aquifer will ultimately have the effect of increasing groundwater in storage.

9.4.12.2 Expected Benefits and Evaluation of Benefits

The primary benefit from this project is increased use of rainwater in lieu of groundwater. The Corral de Tierra Area of the Monterey Subbasin is generally characterized by low density or rural density development, covering approximately 11,500 acres with around 3,100 dwellings. A very simplified calculation of potential benefits is applied to the number of dwellings based on a satellite imagery and parcel analysis: there are roughly 2,000 square feet per rooftop receiving 19 inches of rain per year yielding approximately 225 AFY of water potentially available for capture and use. If 75 households implemented rooftop rainwater harvesting, this would yield approximately 5.3 AFY of in-lieu recharge. However, this quantity may be less if rain barrels fill up only once per year in the rainy season. Expected benefits resulting from rain garden installations would be in addition to those described above for rooftop rainwater harvesting. More detailed analyses of land cover and runoff generation are required for refining the evaluation of both rooftop rainwater harvesting systems and rain gardens. During the implementation period, these numbers will be refined that will demonstrate the variation between dry, wet, and normal years. Additionally, these numbers will be refined as more residents implement rainwater capture infrastructure over time.

Increased capture of rainwater will potentially increase groundwater elevations by reducing the amount of residential demand for water for outdoor irrigation. This in-lieu use will yield dividends over a longer period as more residents install rainwater harvesting features, and subsequently use less groundwater for landscaping purposes.

Implementing a laundry-to-landscape program has an expected annual benefit of 0.97 AFY if 75 households in the Corral de Tierra Area installed systems. This is based on an expected water availability of approximately 4,100 gallons per household per April through October season. These values come from assuming a 4-person household, a high efficiency washer that uses 15 gallons per load, and that laundry to landscape water replaces all irrigation water used. Since water for outdoor irrigation takes up a large portion of a household’s water use, this would present a significant in-lieu water savings during the hottest and driest months. If the laundry to landscape system was used year-round, the benefits would be higher.

Benefits will be measured using the monitoring networks described in Chapter 7. Groundwater levels will be measured with a network of wells that is monitored by MCWRA. A direct correlation between groundwater recharge and changes in groundwater levels is unlikely to be observed unless many individual projects are implemented in the same area; however, the program will ask workshop participants about the projects they have implemented and will use that information to estimate reduced extraction.

9.4.12.3 Circumstances for Implementation

Decentralized residential recharge projects can be initiated at any time. Agencies and organizations in the region are already engaged in efforts to promote rainwater harvesting, rain gardens, and graywater reuse systems, and their efforts could be leveraged to expand these projects throughout the Subbasin.

9.4.12.4 Permitting and Regulatory Process

Individuals implementing residential recharge projects are responsible for any required permitting. Due to the small-scale and decentralized nature of these projects, it is not anticipated that these projects are of a magnitude capable of having a demonstrable impact on the environment that would require a California Environmental Quality Assurance (CEQA) review process; however, an applicable permit process will make that determination. Any storage tank sized 5,000 gallons or more will require a permit (WAC, 2021).

For the installation of greywater systems, California Code allows for greywater use from showers, bathtubs, and washing machines, but not from kitchen sinks or dishwashers. The California Plumbing Code Chapter 15 facilitates water conservation, relieves stress on private septic systems, makes legal compliance easily achievable, and provides guidelines for avoiding potentially unhealthful conditions. The Code requires a construction permit for greywater systems that make changes to a home's drain/waste plumbing connected to clothes washers, showers, bathtubs, and bathroom sinks. The Code allows residential greywater landscape irrigation from washing machines to be installed without a construction permit if the system meets all performance guidelines in the Code. For such systems in the unincorporated area of Monterey County on properties containing wells and/or septic systems, residents should apply at the Monterey County Planning Department using the graywater permit template. Applications will be routed to the Monterey County Environmental Health Bureau's Environmental Health Review Services (EHRS) for review to ensure that the graywater system observes required setbacks from onsite wastewater treatment system and wells, if present. City and unincorporated County residents that do not use a well or septic system should contact their Building Department to apply for a graywater permit using the graywater permit template (Central Coast Greywater Alliance, 2020).

9.4.12.5 Implementation Schedule

If this project is selected, the implementation schedule is presented on Figure 9-12. It is anticipated that Phase I will take 2 years. Phase II will overlap with Phase I and take 2 years and be extendable if the project is expanded. Phase III and IV, implementation and ongoing maintenance by residents, will begin in Year 2 and continue into the future.

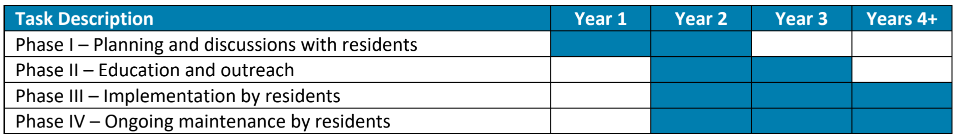

Figure 9-12. Implementation Schedule for Recharge of Rainwater Initiatives

9.4.12.6 Legal Authority

No legal authority is needed to promote decentralized residential in-lieu recharge projects.

9.4.12.7 Estimated Cost

The success of this project depends on homeowner participation. An important first step is education and outreach. The GSA will host 5 workshops on rainwater harvesting and 5 workshops on graywater reuse for a total cost of $50,000.

Construction costs will be the responsibility of the homeowners with possible incentives from the GSA. A complete rainwater harvesting system for a typical single-family home will generally cost between $4,000 and $10,000, with the largest cost being the storage tank (WAC, 2021). Many of the other costs are the gutters, downspouts, and irrigation distribution systems. At $10,000 for a 5,000- gallon tank and respective system, that equates to an annual cost of $800 and a unit cost of $8,800/AF.

For laundry-to-landscape systems, the costs include dual drainage plumbing, labor, materials, and the irrigation distribution system. These costs are shown in Table 9-3. If each household system costs $2,100 and yields 4,100 gallons from April to October, this equates to an annual cost of $200 and a unit cost of $9,180/AF.

Table 9-3. Costs of a Laundry to Landscape System for one Household

Item	Cost
Dual drainage plumbing	$500
2-3 hours of labor	$400
Materials	$200
Irrigation distribution system	$1,000
Total	**$2,100**

9.4.12.8 Public Noticing

As part of the approval of the program, it will go through a public notice process to ensure that all groundwater users and other stakeholders have ample opportunity to comment on it. The general steps in the public notice process will include the following:

- SVBGSA staff will bring an assessment of the need for the project to the SVBGSA Board in a publicly noticed meeting. This assessment will include:
  - A description of the undesirable result(s) that may occur if action is not taken
  - A description of the proposed project
  - An estimated cost and schedule for the proposed project
  - Any alternatives to the proposed project
- The SVBGSA Board will notice stakeholders in the area of the proposed project and allow at least 30 days for public response.
- After the 30-day public response period, the SVBGSA Board will vote on whether to approve design and construction of the project.

In addition to the public noticing detailed above, if CEQA is applicable, the public noticing requirements will be followed.

9.4.13 C6 – Decentralized Stormwater Recharge Projects

This project promotes the installation of stormwater collection features in neighborhood locations downstream of typical flooding spots for the purpose of groundwater recharge. These projects are typically larger than the household-scale projects and have greater potential for the water to reach the local principal aquifers because as more water is captured, larger basins are more able to harness the power of gravity to saturate the subsurface all the way to the aquifer. Secondary benefits are potential improvement to surface water quality and flood hazard mitigation.

Anticipated climate change may bring more frequent and extreme precipitation events to this subbasin. When rainfall is concentrated in a short time period rather than spread out, more stormwater runs off rather than infiltrates, which reduces recharge to the principal aquifers. Runoff flows out of the Subbasin, but recharge features can capture and recharge a portion of the stormwater. By using proactive stormwater diversion, collection, and infiltration management techniques, groundwater conditions can improve in this Subbasin.

For this project, SVBGSA will engage in outreach, identify opportunities for neighborhood-scale stormwater routing and collection features, and potentially establish a fund to provide financial incentives to encourage their installation in residential areas. For new urban developments, Monterey County has adopted Post-Construction Requirements that require projects to implement low impact development techniques to better enable water infiltration before it becomes runoff. SVBGSA's efforts could be done in conjunction with other rainwater and floodwater efforts scaled to and applied at different locations for a variety of benefits and recharge impacts.

These decentralized stormwater recharge projects include a range of features, such as bioswales, small surface recharge basins, drywells, or other specific capture structures for enhanced infiltration and recharge purposes. This water can also be captured and used for irrigation in lieu of groundwater. Projects may require additional infrastructure and/or maintenance costs.

Bioswales

The routed stormwater could be collected in a series of swales, or into a small recharge basin, or a combination of both depending on land availability and permissions from landowners and neighborhood groups. The 3 primary types of swales are grassed swales, rock lined swales (dry creek beds), and bioswales. Vegetation in the swales slows stormwater, allows sediments to filter out, and can help remove nutrients. Bioswales are vegetated swales that use engineered media beneath the swale to reduce runoff volume and peak runoff rates. Bioswales have a greater capacity for water retention, nutrient removal, and pollutant removal.

Small Surface Recharge Basins

Stormwater could be diverted and captured in small, surface retention basins where it can infiltrate and provide decentralized, indirect recharge opportunities. These small basins can help reduce peak flooding on streets and prevent erosion or damage to the roadways from storms.

Soils greatly influence the extent of groundwater recharge and where recharge projects would be most beneficial. Infiltration of precipitation into the subsurface is dependent on a number of factors such as soil texture, soil organic content, slope, root zone depth, and salinity. High slopes through much of the Subbasin increase run-off and decrease infiltration. According to the Soil Survey Geographic Database (SSURGO), the Corral de Tierra Area has a roughly even mix of high and low infiltration rate soils. The soils with the highest designated recharge potential are generally located near the center of the Corral de Tierra Area, and along canyon bottoms where alluvial sediments have accumulated (Figure 4-7).

Dry Wells

Recharge basins can be coupled with dry wells that direct water into the subsurface, thus helping water infiltrate into the unsaturated region above the water table. Dry wells can also help circumvent locations with a lot of clay near the surface by providing screens in more permeable sediments. Site-specific analyses would be required to properly design and install these features for maximum benefit to the principal aquifer.

In Lieu Reuse

Stormwater can also be routed for retention and reuse to irrigate common areas within residential communities, medians, parks, and large building landscaping. This functions as in-lieu recharge, as it reduces the amount of groundwater needed for irrigation.

9.4.13.1 <u>Relevant Measurable Objectives</u>

Relevant measurable objectives benefiting from this project include:

- **Groundwater elevation measurable objective** - Using decentralized stormwater projects will increase water that recharges the principal aquifer, or if used in lieu of pumped groundwater for irrigation will decrease groundwater extraction. By pumping less water, it has a similar effect of adding water to the principal aquifer. Adding water into the principal aquifer through direct recharge or in-lieu use will raise groundwater elevations over time.

- **Groundwater storage measurable objective** - Adding water to the principal aquifer will ultimately have the effect of increasing groundwater in storage.

9.4.13.2 Expected Benefits and Evaluation of Benefits

The primary benefit from this project is increased groundwater recharge. The Corral de Tierra Area covers an area of approximately 11,500 acres, with multiple small drainages interspersed throughout. The number of small drainages is unknown; however, if 1% of the acreage of the management area is utilized for stormwater capture, that would allow for 115 acres receiving roughly 19 inches of precipitation annually to generate 182 AFY of stormwater runoff to be routed and captured, assuming the applications are large enough to capture all stormwater during rain events. This water can be routed and captured in small neighborhood bioswales, basins, drywells, or even sent directly to agricultural lands. During the implementation period, these numbers will be refined with flood studies that are more location specific and accurate; that will demonstrate the variation between dry, wet, and normal years. Additionally, these numbers will be refined as various neighborhoods implement stormwater capture infrastructure over time.

Increased storage of runoff will potentially increase groundwater elevations in the vicinity of the stormwater capture facilities. This typically will be seen as groundwater mounding. However, as more water is emplaced in the subsurface, more water will flow laterally, thereby expanding the zone of influence from each stormwater capture basin outward and raising groundwater elevations laterally. Additionally, proper maintenance can minimize recharge system losses, and maximize potential infiltration and subsequent storage.

Changes in groundwater elevation will be measured with the groundwater level monitoring program detailed in Chapter 7. A direct correlation between floodwater recharge and changes in groundwater elevations may be possible if located close enough to existing monitoring wells. Additionally, various volumetric measurement methods will be installed along with either recharge basins or dry wells to assist in calculating increases to groundwater storage.

9.4.13.3 Circumstances for Implementation

Decentralized stormwater recharge projects can be initiated at any time. Agencies and organizations in the region are already engaged in efforts to promote stormwater recharge, and their efforts could be leveraged. Among other organizations, the Monterey County Public Works Department (MCPWD) are both engaged in efforts to manage runoff and have set the stage for consideration integrated solutions of runoff and infiltration in these watersheds. Site specific analyses are required to determine the potential recharge benefit.

9.4.13.4 *Permitting and Regulatory Process*

Projects described in this section may require a CEQA review process and may require an Environmental Impact Report or a Mitigated Negative Declaration (the review could also result in a Negative Declaration or Notice of Exemption). Additionally, permits from a variety of state and federal agencies may be necessary, and any project that coordinates with federal facilities or agencies may require National Environmental Policy Act (NEPA) documentation.

There may be a number of local, county, and state permits, rights of way, and easements required depending on bioswale or conveyance alignments and retention basins. Projects with dry wells will require a well construction permit.

9.4.13.5 *Implementation Schedule*

If this project is selected, it will follow the implementation schedule presented on Figure 9-13. It is anticipated that Phase I will take 2 years. Phase II will overlap with Phase I and take 2 years. Phase III, site selection and construction, will occur in years 3 and 4. Ongoing maintenance will continue in Year 4 and beyond.

Task Description	Year 1	Year 2	Year 3	Year 4	Years 5+
Phase I - Planning and discussions with neighborhoods	■	■			
Phase II - Surveying of top selected sites		■	■		
Phase III - Site selection and construction			■	■	
Phase IV - Ongoing maintenance				■	■

Figure 9-13. Implementation Schedule for Recharge of Stormwater Capture Initiatives

9.4.13.6 *Legal Authority*

No legal authority is needed to promote decentralized stormwater recharge projects. For the implementation of projects, pursuant to California Water Code sections 10726.2 (a) and (b), the SVBGSA has the right to acquire and hold real property, and to divert and store water once it has acquired any necessary real property or appropriative water rights. Some rights in real property (whether fee title, easement, license, leasehold or other) may be required to implement a recharge project. A permit to appropriate water may not needed to infiltrate stormwater if constructed on a parcel without a USGS blue line stream. If a blue line stream crosses the parcel, SVBGSA will evaluate whether a permit is needed. SVBGSA recognizes that this process takes several years to complete. If a permit is needed, SVBGSA will pursue a SWRCB 5-year temporary permit under the Streamlined Permit Process while it applies for the diversion permit.

9.4.13.7 *Estimated Cost*

The construction cost for the decentralized stormwater recharge projects is unable to be estimated until specific projects are scoped. This project is designed as a program that encourages developers, municipalities, homeowners' associations, and landowners to install stormwater recharge projects and assists with initial planning costs. The program costs approximately $150,000-$200,000 for strategic outreach, assistance with site assessments, assessment of recharge potential, and help securing grant funds. This amount would fund cone penetration tests to assess recharge potential for 4 to 6 sites. If needed to increase implementation of stormwater recharge projects, SVBGSA could provide monetary incentives or fund and implement the projects themselves. Each site-specific project will have its own associated costs based on the level of complexity of the stormwater capture technique. These span from non-vegetated basin to capture and infiltrate stormwater to recharge basins coupled with dry wells. The project-specific construction costs will be estimated based on initial site assessments and feasibility studies.

9.4.13.8 Public Noticing

Before SVBGSA initiates construction on any project, it will go through a public notice process to ensure that all groundwater users and other stakeholders have ample opportunity to comment on projects before they are built. The general steps in the public notice process will include the following:

- SVBGSA staff will bring an assessment of the need for the project to the SVBGSA Board in a publicly noticed meeting. This assessment will include:
  - A description of the undesirable result(s) that may occur if action is not taken
  - A description of the proposed project
  - An estimated cost and schedule for the proposed project
  - Any alternatives to the proposed project
- The SVBGSA Board will notice stakeholders in the area of the proposed project and allow at least 30 days for public response.
- After the 30-day public response period, the SVBGSA Board will vote on whether to approve design and construction of the project.

In addition to the public noticing detailed above, all projects will follow any public noticing requirements required by CEQA. If projects are undertaken by other public agencies or private entities or persons, the implementing agency or private entity or person will be responsible for obtaining the appropriate permit (if any) and undertaking required public noticing.

9.4.14 C7 – Increase Groundwater Production in the Upper Corral de Tierra Valley for Distribution to Lower Corral de Tierra Valley

This project undertakes additional groundwater production in the Upper Corral de Tierra Valley for distribution in the Lower Corral de Tierra Valley for supplementary water supply. Although additional sites may be identified in the future, this project is scoped for locating the extraction at the artesian well in Watson Creek, with delivery to El Toro Lake, where it can be picked up by a water system to be used in lieu of groundwater extraction or recharged. The existing artesian well supplies water to local water systems in the near vicinity, and reportedly can supply more than the existing demand. However, well yield data is not available. This project includes the construction of a new extraction well at the artesian well location and a conveyance pipeline to El Toro Lake, approximately 3.4 miles to the northwest of the site. Water systems may connect to the conveyance pipeline at El Toro Lake, or the water could be temporarily stored there and recharged, depending on the recharge potential.

Although further site scoping and project design are needed, this project would likely require a surge tank, conveyance pipeline, and connection to water systems that would treat the water prior to use. Due to artesian well conditions, a pump was excluded from the conceptual estimate. Easements may be needed to allow for the installation of the new well, construction of the conveyance pipeline, and storage or recharge site.

9.4.14.1 Relevant Measurable Objectives

The measurable objectives benefiting from outreach and education include:

- **Groundwater elevation measurable objective** - By routing excess artesian groundwater from one location to a recharge basin, there will be more water added to the El Toro Primary Aquifer System nearby areas of groundwater elevation decline. This water will be used in lieu of pumping or allowed to infiltrate at Toro Lake, both of which have the effect of adding water to the aquifer. Adding water into the principal aquifer will raise groundwater elevations over time.
- **Groundwater storage measurable objective** - Furthermore, adding water to the principal aquifer will ultimately have the effect of increasing groundwater in storage. Groundwater storage is also calculated from measured groundwater elevations. By raising groundwater elevations, the calculation of change in storage will be positive.
- **Land subsidence measurable objective** - Increasing both groundwater elevations and groundwater storage will have the added benefit of preventing any potential land subsidence. Maintaining and adding water in the subsurface will keep pore spaces saturated with positive pressure and inhibit land surface collapse associated with groundwater depletion.

9.4.14.2 Expected Benefits and Evaluation of Benefits

This project will increase sustainable yield and groundwater elevations through capturing and routing excess artesian groundwater to Lower Corral de Tierra Valley. Artesian conditions occur when the pressure of groundwater is greater than the ground surface elevation, and this groundwater is allowed to easily find the surface. Utilizing excess artesian groundwater presents an opportunity to offset groundwater pumping elsewhere without negatively impacting the current demands on the artesian source. The primary benefit from this project is increased groundwater elevations and storage in the Lower Corral de Tierra Valley that results from in lieu use or increased infiltration of this excess artesian groundwater in El Toro Lake. The project benefit is anticipated to be 160 AFY.

Benefits will be measured using the monitoring networks described in Chapter 7. Groundwater elevations will be measured with a network of wells that is monitored by MCWRA. Various volumetric measurement methods may be installed with this facility to assist in calculating increases to groundwater storage. Land subsidence will be measured using InSAR data provided by the Department of Water Resources.

9.4.14.3 Circumstances for Implementation

If selected, the artesian well project will be implemented if stakeholders determine it is necessary to reach or maintain sustainability. A number of agreements and rights must be secured before the project is implemented. Primarily, a more formal cost/benefit analysis must be completed to determine if the artesian well will provide quantifiable benefits to the principal aquifer. Site specific analyses will help determine the potential recharge benefit.

9.4.14.4 Permitting and Regulatory Process

Permits from the following government organizations that may be required for this project include:

- ***United States Fish and Wildlife Service (USFWS)*** – Federal agencies involved in the permitting process for this project may need to consult with USFWS in compliance with Section 7 of the Endangered Species Act. Interagency coordination is also required by the Fish and Wildlife Coordination Act (16 U.S. Code §661-667e).
- ***National Oceanic & Atmospheric Administration, Fisheries (NOAA)*** – Federal agencies involved in the permitting process for this project may need to consult with USFWS in compliance with Section 7 of the Endangered Species Act.
- ***State Water Resources Control Board (SWRCB)*** – A permit to operate a public water system is required from SWRCB's Division of Drinking Water (California Health and Safety Code §116525). Construction that disturbs one acre or more of land and that discharges stormwater requires a General Construction Stormwater Permit (Water Quality Order No. 2009-0009-DWQ). Diversion and use require an appropriative water right permit per Water Code §1200 et seq.
- ***California Department of Parks and Recreation*** – Federal agencies involved in this project are required to consult with the Department of Parks and Recreation's State Historic Preservation Officer in accordance with Section 106 of the National Historic Preservation Act (16 U.S. Code §470).
- ***California Public Utilities Commission (CPUC)*** – A Certificate of Public Convenience and Necessity (California Public Utilities Code §1001 et seq.) is required to show that the project will benefit society.
- ***Monterey County Health Department*** – If there will be 55 gallons (liquid), 500 pounds (solid), or 200 cubic feet (compressed gas) of hazardous materials onsite at any one time,

a Hazardous Materials Business Plan and a Hazardous Materials Inventory Statement (California Health and Safety Code Chapter 6.95) must be submitted to the Monterey County Health Department's Environmental Health Bureau. Other required permits include a Well Construction Permit (Monterey County Code Chapter 15.08) and a variation on Monterey County Noise Ordinance (Monterey County Code 10.60.030).

- ***Monterey County Department of Planning and Building Services*** – This project will require a Use Permit (Monterey County Code Chapter 21.72 Title 21). A Grading Permit (Monterey County Code Chapter 16.08) is required if total disturbance onsite equals or exceeds 100 cubic yards. An erosion control plan (Monterey County Code Chapter 16.12) is required if there is risk of accelerated (human-induced) erosion that could lead to degradation of water quality, loss of fish habitat, damage to property, loss of topsoil or vegetation cover, disruption of water supply, or increased danger from flooding.
- ***Monterey County*** – If the project encroaches onto any county-maintained road, an Encroachment Permit (Monterey County Code Chapter 14.04) is required from Monterey County's Public Works & Facilities division. Removal of 3 or fewer trees can be handled by a standalone Tree Removal Permit (Monterey County Code Chapter 16.60). Removal of more than 3 trees should be included in a Use Permit (see Monterey County Department of Planning and Building Services).
- ***Monterey County Water Resource Agency (MCWRA)*** – Participation/ easements/ purchase agreements
- ***Transportation Agency for Monterey County (TAMC)***– An easement for access to and use of the project site may need to be negotiated with TAMC.
- ***Local jurisdictions*** – Permits may also be required by a local jurisdiction depending on location of scalping plant, including but not limited to: land use permits, building permits, public health permits, public works permits, tree removal permits, and encroachment permits
- ***Landowners*** –Land lease/sale, easements, and/or encroachment agreements may be required.

9.4.14.5 Implementation Schedule

The annual implementation schedule is presented on Figure 9-14.

Task Description	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9
Phase I – Source water identification and agreements secured	■	■	■						
Phase II – CEQA	■	■	■	■	■				
Phase III – Permitting				■	■				
Phase IV – Design				■	■	■			
Phase V – Bid/Construct							■	■	■
Phase VI – Start Up									■

Figure 9-14. Implementation Schedule for Artesian Well

9.4.14.6 Legal Authority

The SVBGSA will use the legal authority and partnerships for this modified project contained in existing distribution, irrigation, and partnership programs. California Water Code §10726.2 provides GSAs the authority to purchase, among other things, land, water rights, and privileges. This project would be developed in accordance with all applicable groundwater laws and respect all groundwater rights. Section 10726.2 (b) of the California Water Code provides GSAs the authority to, "Appropriate and acquire surface water or groundwater and surface water or groundwater rights, import surface water or groundwater into the agency, and conserve and store within or outside the agency" (CWC, 2014). Some rights in real property (whether fee title, easement, license, leasehold or other) may be required to implement the project.

The County also has the power to impose charges on a parcel or acreage basis under the County Service Area provisions of the Government Code (beginning with Section 25210). These provisions give the County the authority to provide extended services within a specified area, which may be countywide, and to fix and collect charges for such extended services. Miscellaneous extended service for which county service areas can be established include "water service, including the acquisition, construction, operation, replacement, maintenance, and repair of water supply and distribution systems, including land, easements, rights-of-way, and water rights."

9.4.14.7 Estimated Cost

Capital costs were estimated at $13,275,000. On an annualized basis, assuming a 6% discount rate, and 25-year term, this amounts to $1,038,500. Including an annual operations and maintenance cost of $9,000 generates a total annualized cost of $1,047,500. Assuming a yield of 160 AFY, the unit cost for water stored is estimated at $6,550/AFY.

9.4.14.8 Public Noticing

Before SVBGSA initiates construction on this project, it will go through a public notice process to ensure that all groundwater users and other stakeholders have ample opportunity to comment on projects before they are built. The general steps in the public notice process will include the following:

- SVBGSA staff will bring an assessment of the need for the project to the SVBGSA Board and the MCWRA Board in publicly noticed meetings. This assessment will include:
  - A description of the undesirable result(s) that may occur if action is not taken
  - A description of the proposed project
  - An estimated cost and schedule for the proposed project
  - Any alternatives to the proposed project
- The SVBGSA Board and the MCWRA Board will notify stakeholders in the area of the proposed project and allow at least 30 days for public response.
- After the 30-day public response period, the SVBGSA Board will vote whether or not to approve design and construction of the project and notify the public if approved via an announcement on the SVBGSA website and mailing lists.

The permitting and implementation of the diversion will require notification of stakeholders, beneficiaries, water providers, member lands adjacent to the river, and subbasin committee members as well as all permit and regulatory holding agencies such as DWR, NOAA, USACE, and others. In addition to the public noticing detailed above, all projects will follow the public noticing requirements per CEQA or NEPA.

9.5 Implementation Actions

Implementation actions include actions that contribute to groundwater management and GSP implementation but do not directly help the Subbasin reach or maintain sustainability.

9.5.1 I1 – 180/400-Foot Aquifer Subbasin GSP Implementation and Seaside Watermaster Actions

Due to the interconnectivity between the Monterey Subbasin and the adjacent critically overdrafted 180/400-Foot Aquifer Subbasin, sustainable groundwater management will need to be achieved jointly within these subbasins. The 180/400-Foot Aquifer Subbasin GSP establishes minimum thresholds, measurable objectives, and groundwater sustainability goals for this subbasin. The primary goal of this implementation action is to assist attaining sustainable management of the Monterey Subbasin through support of regional planning and project implementation efforts that have been selected for the 180/400-Foot Aquifer Subbasin.

This action includes MCWD's continued support of projects implemented in the 180/400 Subbasin and in the larger Salinas Valley Basin, particularly those that address regional seawater intrusion, provides recharge or alternative water supplies to coastal areas, and/or improve Deep Aquifer conditions near the Monterey-180/400 Subbasin boundary. Such projects are identified in the 180/400 Subbasin GSP including:

- CSIP Optimization
- M1W Winter Modification
- CSIP Expansion
- Maximum State Disaster Response Fund (SDRF) Diversion

As mentioned in Chapter 8, the Subbasin GSAs are working to fill monitoring network data gaps in the Deep Aquifers immediately north of the Marina-Ord Area. As it does so, SMCs for minimum thresholds for additional Deep Aquifer monitoring sites will be established. MCWD will work with SVBGSA to take a coordinated approach to SMCs development and project implementation that considers conditions and management goals in both of these subbasins.

In addition to SGMA implementation efforts, the Subbasin's water users support regional water planning conducted the MCWRA through contribution to zones of benefit. The majority of the Subbasin is included in MCWRA Zones 2C, 2Y, and 2Z as discussed in Section 3.2.2.2.

The Seaside Subbasin is an adjudicated basin not subject to SGMA, and as such does not follow the same management structure or goals as the Monterey Subbasin. However, the two subbasins are hydrologically connected, and actions to meet adjudication goals in the Seaside Subbasin will have an impact on the Monterey Subbasin. The Seaside Watermaster Board is currently discussing adding protective groundwater elevations to their original pumping reductions goals in an effort to move towards a more sustainable management approach. These conversations are ongoing and will include the active collaboration with the GSAs in order to decide on protective elevations that are analogous to the established groundwater elevation SMCs outlined in Chapter 8 of this GSP.

9.5.2 I2 – Deep Aquifers Investigation

The Deep Aquifers underlying portions of the Salinas Valley Basin are a critical groundwater resource that is highly valued but minimally understood. Over the decades, as seawater intrusion has advanced into the 180-Foot and 400-Foot aquifers of the 180/400-Foot Aquifer Subbasin, agricultural landowners and drinking water providers have drilled wells deeper to access freshwater. The need for additional studies about the Deep Aquifers has been identified in the context of stopping seawater intrusion and effectively managing groundwater sustainability.

The 180/400-Foot Aquifer Subbasin GSP Section 9.3.6 Priority Management Action 5: Support and Strengthen Monterey County Restrictions on Additional Wells in the Deep Aquifers, calls for the SVBGSA to support the County extending ordinance 5303 to prevent any new wells from being drilled into the Deep Aquifers until more information is known about the Deep Aquifers' sustainable yield. The plan was to complete the study of the Deep Aquifers over the subsequent years, when funding became available. While the ordinance has expired, the plan for the study of the Deep Aquifers has developed.

To address seawater intrusion in the 180/400-Foot Aquifer, the SVBGSA created the Seawater Intrusion Working Group (SWIG), as detailed in Section 9.5.5 below. The SWIG membership comprises nine agencies and municipalities and multiple stakeholders to develop consensus on the current understanding of seawater intrusion in the Subbasin and adjacent subbasins subject to seawater intrusion, identify data gaps, and develop a broad-based plan for controlling seawater intrusion. Working together with a Technical Advisory Committee (TAC), the SWIG identified key tasks that could be included in the Deep Aquifers Study. GSA staff began to meet with stakeholders and partner agencies to determine if there was a reasonable and equitable path forward for securing funding to initiate this study.

A Cooperative Funding Proposal has been developed for the Deep Aquifers Study. The Study will focus on describing the geology, hydrogeology, and extents of the Deep Aquifers, the Deep Aquifers water budgets, and addressing the economic and administrative constraints on extracting from the Deep Aquifers. The study will include guidance on management issues and also propose and initiate a Deep Aquifers Monitoring Program. The Study is expected to begin in 2022 and take one to two years to complete. The GSAs will incorporate findings of the Deep Aquifers Study into future GSP updates to ensure that the study and the development of future regulations will promote groundwater sustainability of the Deep Aquifers as defined in this GSP.

Particularly within the Monterey Subbasin, MCWD GSA and SVBGSA will facilitate data collection and share information during the study process. Such data collection efforts and information will include:

- Deep Aquifer information collected to date within the Monterey Subbasin, such as lithologic, geophysical, groundwater elevation, and water quality data;
- Completion of additional Deep Aquifer groundwater monitoring wells to address data gaps in the southwestern portion of the Monterey Subbasin (see Project M4: M4 – Drill and Construct Monitoring Wells in Section 9.4.7);
- Annual induction logging of Deep Aquifer wells in the Monterey Subbasin;
- Participating in the Seawater Intrusion Working Group (see Section 9.5.5),
- Attending coordination meetings stakeholders, providing comments to draft study work products, and incorporating its findings into understanding of Basin Setting in the Monterey Subbasin.

9.5.3 I3 – Support Monterey County's Final Well Construction Ordinance to Protect Deep Aquifers

Due to identified concerns regarding the risk of seawater intrusion into the Deep Aquifers the Monterey County Board of Supervisors adopted Ordinance No. 5302 in May 2018, pursuant to Government Code Section 65858. The ordinance was an Interim Urgency Ordinance, which took effect immediately upon adoption. The ordinance prohibited the acceptance or processing of any applications for new Deep Aquifers Wells beneath areas impacted by seawater intrusion, with stated exceptions including municipal wells and replacement wells. The ordinance was originally only effective for 45 days, but at the June 26, 2018 Monterey County Board of Supervisors meeting, the Board of Supervisors extended the ordinance to May 21, 2020, by adoption of Ordinance No. 5303. The Ordinance also required that all new wells in the Deep Aquifers meter groundwater extractions, monitor groundwater elevations and quality, and submit all data to MCWRA and the Groundwater Sustainability Agency with jurisdiction.

A new County Ordinance that placed a 90-day moratorium on new well construction permit applications was adopted in December 2020. The moratorium was adopted so the County could study the impact of the California Supreme Court's decision on August 27, 2020 in the case Protecting Our Water and Environmental Resources et al., v. County of Stanislaus, et al., (10 Cal.5th 479 (2020); "Protecting Our Water"). The decision may require environmental review, pursuant to CEQA, when the County considers applications to construct, repair, or destroy water wells if the decision to issue the permit involves the exercise of discretion by the decision-making authority. The County has not yet completed proposed modifications to the well construction ordinance and the moratorium on well construction permit applications has expired since March 2021. Well construction applications for the Deep Aquifers are currently being reviewed and permitted on a case-by-case basis.

As shown in Chapter 5, dramatic groundwater elevation declines of over five feet per year have been observed in MCWD's Deep Aquifers wells and in the Cooper & Nashua Road area in the 180/400 Subbasin. These declines are due to increases in production from the Deep Aquifers. Deep Aquifers groundwater elevations in MCWD wells and Cooper & Nashua Road area are 50 to 100 feet below sea level. They are also 50 to 100 feet below groundwater elevations in the 400-Foot Aquifer, leading to a significant risk of vertical migration of seawater intrusion from this aquifer to the Deep Aquifer. This indicates that current levels of pumping in the Deep Aquifers have already created the conditions which result in undesirable groundwater elevations as defined in Chapter 8, and may also result in undesirable seawater intrusion in the future. SVBGSA and MCWD will continue to collaborate and provide input to Monterey County as they finalize the proposed modifications to the well construction ordinance.

9.5.4 I4 – Adopt 2022/2023 Priority Actions for Deep Aquifers in Absence of New Well Construction Ordinance if Conditions Threaten Sustainability in Near Term

Priority management actions for the Deep Aquifersies will be developed based on findings reported from the Deep Aquifers study. Resulting priority management actions will promote groundwater sustainability as defined in this GSP. [TO BE FURTHER DEVELOPED]

9.5.5 I5 – Seawater Intrusion Working Group

SVBGSA established a Seawater Intrusion Working Group (SWIG) as part of GSP implementation in the 180/400-Foot Aquifer Subbasin. The SWIG membership comprises nine agencies and municipalities and multiple stakeholders to develop consensus on the current understanding of seawater intrusion in the Subbasin and adjacent subbasins subject to seawater intrusion, identify data gaps, and develop a broad-based plan for controlling seawater intrusion. Additionally, the SWIG provides a platform for understanding Deep Aquifers issues that accompanies seawater intrusion in the coastal Subbasins. The SWIG advises SVBGSA staff and is not a legislative body subject to the Brown Act open meeting law.

The SWIG and its Technical Advisory Committee (TAC) were established by SVBGSA in August 2020. The purpose of the TAC is to provide technical information in support of the SWIG's policy direction and decision-making. SVBGSA and MCWD have been participating in the SWIG and SWIG TAC, each meeting monthly.

As part of GSP implementation, the Subbasin GSAs will continue convening and participating in the SWIG and SWIG TAC, to work towards the ultimate goal of developing a path to address seawater intrusion. See discussion under Section 9.5.1 above.

9.5.6 I6 – Future Modeling of Seawater Intrusion and Projects

Neither the SVIHM nor the Monterey Subbasin Groundwater Flow Model (Monterey Subbasin Model or MBGWFM) is variable density flow models, which is needed to adequately simulate seawater intrusion and model the impacts of proposed projects. Addressing seawater intrusion is a critical piece of sustainable groundwater management in the Monterey Subbasin, and a model that can project how it will change in response to projects and management actions is needed to identify a strategy to reduce seawater intrusion impacts. Upon completion of the Monterey Subbasin model, SVBGSA will develop a variable density flow model for the Monterey Subbasin, working together with MCWD and MCWRA. The model will use three-dimensional variable density modeling code that is compatible with the MODFLOW modeling platform, such as SEAWAT or MODFLOW-USG. Development of this model will include compiling all the concentration data available and mapping it to determine initial conditions and boundary conditions, calibrating to water levels and concentration (i.e., seawater intrusion), and developing predictive scenarios. It is anticipated that this model may be expanded to include the coastal area of the 180/400 Foot Subbasin and will aid in evaluating the potential effects of regional projects on seawater intrusion and groundwater levels in the Monterey Subbasin.

A number of multi-subbasin projects has been proposed as part of integrated management in the Salinas Valley Basin, including those identified in Section 9.4 above as well as projects proposed in the 180/400-Foot Aquifer Subbasin GSP that may affect subbasin boundary conditions. As part of project planning, the anticipated benefits and impacts of these projects will need to be assessed with a numerical model that covers multiple subbasins.

Neither the SVIHM nor the Monterey Subbasin Model is currently capable of simulating conditions across the Monterey and adjacent subbasins. The Monterey Subbasin Model, which was used to develop water budget information in this GSP, has a model area that focuses primarily on the Monterey Subbasin. The SVIHM encompasses the entire Salinas Valley Groundwater Basin. However, the SVIHM does not accurately reflect hydrologic conditions within the Monterey Subbasin or the Seaside Subbasin[63].

The MCWD GSA and SVBGSA will incorporate information from the Monterey Subbasin Model into the SVIHM and/or the seawater intrusion model so that projects can be modeled for the entire Salinas Valley Groundwater Basin, inclusive of the Monterey Subbasin. This action was envisioned during development of the Monterey Subbasin Model, as the model was developed from the MODFLOW family of groundwater model software tools to ensure that it will be compatible with the regional SVIHM.

9.5.7 I7 – Well Registration

All groundwater production wells, including wells used by *de minimis* pumpers, will be required to be registered with the SVBGSA. Well registration is intended to establish a relatively accurate count of all the active wells in the Subbasin. This implementation action will help gain a better understanding of the wells in active use, verses those that have been decommissioned. Well registration will collect information on active wells, such as type of well meter, depth of well, and screen interval depth. Well metering is intended to improve estimates of the amount of groundwater extracted from the Subbasin. A GSA may not require *de minimis* users (as defined) to meter or otherwise report annual extraction data. Other public agencies such as the County or Water Resources Agency may have such authority. ~~SGMA does not allow metering of *de minimis* well users, and therefore well metering is limited to non-*de minimis* wells.~~ The details of the well registration program, and how it integrates with existing ordinances and requirements, will be developed during the first 2 years of GSP implementation.

9.5.8 I8 – GEMS Expansion and Enhancement

SGMA requires Groundwater Sustainability Agencies to manage groundwater extractions within a basin's sustainable yield. Accurate extraction data is fundamental to this management. The MCWRA GEMS collects groundwater extraction data from certain areas in the Salinas Valley. The

[63] A detailed discussion of the models' current construction and calibration results can be found in technical memorandum presented to the SVBGSA Advisory Committee on April 2, 2021.

system was enacted in 1993 under Ordinance 3663 and was later modified by Ordinances 3717 and 3718. The MCWRA provides the SVBGSA annual GEMS data that can be used for groundwater management.

Most of the Monterey Subbasin's estimated groundwater extraction data is derived from MCWRA's GEMS Program, which is only implemented in Zones 2, 2A, and 2B[64]. There are limited data on groundwater extraction within the Corral de Tierra Area outside of MCWRA Zones 2, 2A and 2B.

SVBGSA will work with MCWRA to expand the existing GEMS Program to cover the entire Monterey Subbasin, which would capture all wells that have at least a 3-inch internal diameter discharge pipe. Program revisions will consider and not contradict related state regulations. Alternatively, SVBGSA could implement a new groundwater extraction reporting program that collects data outside of MCWRA Zones 2, 2A, and 2B. The groundwater extraction information will be used to report total annual extractions in the Subbasin and assess progress on the groundwater storage SMCs as described in Chapter 8. Additional improvements to the existing MCWRA groundwater extraction reporting system may include some subset of the following:

- Developing a comprehensive database of extraction wells
- Expanding reporting requirements to all areas of the Salinas Valley Groundwater Basin
- Including all wells with a 2-inch discharge or greater
- Requiring automatically reporting flow meters
- Comparing flow meter data to remote sensing data to identify potential errors and irrigation inefficiencies.

9.5.9 <u>I9 – Dry Well Notification System</u>

The GSAs could develop or support the development of a program to assist well owners (domestic or state small and local small water systems) whose wells go dry due to declining groundwater elevations. The program could include a notification system whereby well owners can notify the GSAs or relevant partner agencies if their well goes dry, such as the Household Water Supply Shortage System (DWR, 2021). The information collected through this portal is intended to inform state and local agencies on drought impacts on household water supplies. It could also include referral to assistance with short-term supply solutions, technical assistance to assess why it went dry, and/or long-term supply solutions. For example, the GSAs could set up a trigger system whereby it would convene a working group to assess the groundwater situation if the number of wells that go dry in a specific area cross a specified threshold. A smaller area trigger system would initiate action independent of monitoring related to the groundwater level SMCs. The GSAs could also support public outreach and education.

[64] Zones 2 and 2A were later superseded by Zone 2C, see Chapter 3 Section 3.2.2.2.

9.5.10 I10 – Water Quality Coordination Group

The Water Quality Coordination Group will include the CCRWQCB, local agencies and organizations, water providers, domestic well owners, technical experts, and other stakeholders. The purpose of the Coordination Group is to coordinate amongst and between agencies that regulate water quality directly and the GSAs, which have an indirect role to monitor water quality and ensure their management does not cause undesirable water quality results.

Numerous agencies at the local and state levels are involved in various aspects of water quality. The SWRCB and CCRWQCBs are the principal state agencies with primary responsibility for the coordination and control of water quality for the health, safety, and welfare of the people of the state pursuant to the Porter-Cologne Water Quality Control Act 1969 (California Water Code Division 7 Section 13001). There are many efforts to address water quality by the SWRCB. For example, at the State level, the Department of Drinking Water's Safe and Affordable Funding for Equity and Resilience (SAFER) program is designed to meet the goal of safe drinking water for all Californians. In addition, at the local level, the County of Monterey Health Department Drinking Water Protection Service is designed to regulate and monitor water systems and tests water quality for new building permits for systems with over 2 connections.

Locally based GSAs established pursuant to SGMA are required to develop and implement GSPs to avoid undesirable results (including an undesirable result related to water quality) and mitigate overdraft in the groundwater basin within 20 years. MCWDGSA and SVBGSA will coordinate with the appropriate water quality regulatory programs and agencies in the Subbasin to understand and develop a process for determining when groundwater management and extraction are resulting in degraded water quality in the Subbasin.

Both the State and Monterey County have committed to a Human Right to Safe Drinking Water. SGMA outlines a specific role for GSAs related to beneficial users of groundwater including drinking water, which is to manage groundwater according to the 6 sustainability indicators. The Coordination Group will help define the unique role for the GSAs, not related to specific sustainability metrics. Under this implementation action, the GSAs will play a convening role by developing and coordinating a Water Quality Coordination Group.

The Coordination Group will review water quality data, identify data gaps, and coordinate agency communication. The Coordination Group will convene at least annually to share groundwater quality conditions, as assessed for the GSP annual reports, and assesses whether groundwater management actions are resulting in unsustainable conditions. The goal of the Coordination Group will include documenting agencies' actions that address water quality concerns including outlining each agency's responsibilities. An annual update to the GSAs' BOD will be provided regarding Coordination Group efforts and convenings.

This Coordination Group will also serve to collaborate with agencies on local regulations that could affect groundwater contamination, such as county or city groundwater requirements that relate to regulation of septic systems, well drilling, capping and destruction, wellhead protection and storage and/or leaking of hazardous materials.

~~Drinking water access and quality is a critical issue throughout the Monterey Subbasin. Numerous agencies at the local and State levels are involved in various aspects of water quality. The SWRCB and RWQCBs are the principal state agencies with primary responsibility for the coordination and control of water quality for the health, safety, and welfare of the people of the state pursuant to the Porter-Cologne Water Quality Control Act 1969 (California Water Code Division 7 Section 13001). The locally based Groundwater Sustainability Agencies established by the SGMA are required to develop and implement GSPs to avoid undesirable results (one related to water quality) and mitigate overdraft within 20 years. SVBGSA and MCWD GSA will coordinate with the appropriate water quality regulatory programs and agencies in the Subbasin to understand and develop a process for determining when groundwater management and extraction are resulting in degraded water quality in the Subbasin.~~

~~Both the State and the County have committed to a Human Right to Safe Drinking Water. SGMA outlines a specific role for GSAs related to beneficial users of groundwater, including drinking water. This implementation action will help define the unique role for the GSAs, not related to specific sustainability metrics. Under this implementation action, the GSAs will play a convening role by developing and coordinating a water quality partnership (Partnership). There are many efforts to address water quality occurring simultaneously and the GSAs acknowledge this developing set of policy and implementation actions by the SWRCB. For example, at the State level, the DDW's Safe and Affordable Funding for Equity and Resilience (SAFER) program is designed to meet the goal of safe drinking water for all Californians. At the local level, the County of Monterey Health Department Drinking Water Protection Service is designed to regulate and monitor water systems and tests water quality for new building permits for private wells.~~

~~The Partnership will review water quality data, identify data gaps, and coordinate agency communication. The Partnership will include the RWQCB, local agencies and organizations, water providers, domestic well owners, technical experts, and other stakeholders including the U.S. Army, which is responsible for implementing remedial efforts to address legacy groundwater contamination at Fort Ord. The Partnership will convene at least annually. The goal of the Partnership will include documenting agency actions to address water quality concerns. An annual update to the GSAs' board of directors will be provided regarding Partnership efforts and convenings.~~

9.5.11 I11 – Land Use Jurisdiction Coordination Program

The Land Use Jurisdiction Coordination Program outlines how the SVBGSA and MCWDGSA review land use plans and efforts to coordinate with land use planning agencies to assess activities that potentially create risks to groundwater quality or quantity. The goal is to ensure that GSAs and Land Use Jurisdiction efforts are aligned. Examples of these activities include the application of the B-8 Zoning district by the County of Monterey in areas with water supply, water quality and other constraints on development, and the consideration of recharge potential for new developments. While the SVBGSA does not have land use authority, and the Land Use Jurisdictions retain all such authority, the Coordination Program also describes how local agencies should consider adopted GSPs when revising or adopting policies, such as adopting and amending general plans and approving land use entitlements, regulations, or criteria, or when issuing orders or determinations, where pertinent. The Coordination Program will be developed immediately upon implementation of this GSP.

9.5.12 I12 – Arsenic Implementation Action

This implementation action provides for additional analysis on the relationship between arsenic and groundwater conditions in the Corral de Tierra ~~Management~~ Area. While arsenic is naturally occurring and often increases with depth, the 2007 *El Toro Groundwater Study Monterey County, California* (GeoSyntec, 2007) found that in this area, arsenic concentrations are higher in the Paso Robles Formation, which is closer to the ground surface, than in the deeper Santa Margarita Formation. Additionally, municipal water providers show a wide range and lack of trends of arsenic concentrations with respect to reported extraction (GeoSyntec, 2007). However, the available data and published reports for the Corral de Tierra Area do not have sufficient data to affirm or invalidate a relationship between arsenic, groundwater levels, and/or extraction without additional analysis.

This implementation action ~~[[has been added to meet the concerns raised during discussions with stakeholders, and]]~~ will provide for further analysis of the relationship between arsenic concentrations, groundwater levels, and extraction at specific locations within the Corral de Tierra. SVBGSA will work with the Monterey County Health Department and small water systems to gather existing information with which to undertake this analysis. This will help refine the groundwater management with respect to arsenic concentrations, should the data affirm a relationship with groundwater levels and extraction.

9.6 Project-Based Water Budget and Groundwater Elevation Analysis

Using the Monterey Subbasin Model, the GSAs developed two project-based scenarios to assess the effectiveness of potential water supply augmentation projects on the Subbasin's sustainable yield and groundwater elevations. The two project-based scenarios provided include:

- Marina-Ord Water Augmentation "Project" Scenario with Variable Boundary Conditions: This scenario assumes that a portion of MCWD's projected water demand will be satisfied through some form of water supply augmentation. For evaluation purposes, this projected water budget assumes that all recycled water generated by MCWD will be used to augment water supplies within its service area. This project is consistent with the *Recycled Water Reuse Through Landscape Irrigation and Indirect Potable Reuse* project described in Section 9.4.6, project M3. It simulates an incremental increase in augmented water supplies beginning at 600 AFY in 2023 and up to 5,495 AFY by 2040. The impacts of this Project are evaluated under variable boundary conditions along the 180/400-Foot Aquifer Subbasin, consistent with those identified in Section 6.5. These boundary conditions include:

- Minimum Threshold (MT) Boundary Conditions
- Measurable Objective (MO) Boundary Conditions, and
- Seawater Intrusion (SWI) Protective Boundary Conditions.

Each of these boundary condition scenarios is predicated on the assumption that the 180/400-Foot Aquifer Subbasin will be managed to its SMCs over the 50-year projected model, as described further in Chapter 6 period. In addition, boundary conditions for the Seaside Subbasin, which is an adjudicated subbasin, are assumed to remain stable at 2017 levels[65].

- Corral de Tierra Water Augmentation "Project" Scenario with MO Boundary Conditions: This scenario analyzes a hypothetical and extreme condition where all of Corral de Tierra Area projected water demand is met by some form of water supply augmentation. The scenario assumes Measurable Objective (MO) Boundary Conditions are achieved at the 180/400-Foot Aquifer Subbasin boundary and water levels along the Seaside Subbasin boundary remain stable at 2017 levels[66]. This scenario has been evaluated to provide insights regarding the pumping reductions that would be required to raise groundwater elevations and achieve SMCs within the Corral de Tierra Area.

For the purposes of this high-level evaluation, these augmented water supplies are modeled as "in-lieu" groundwater supplies, where direct, proportional reductions in groundwater pumping from existing wells relative to the "no project" pumping demands described in Chapter 6 (Sections 6.5.1.1 and 6.5.2.1)) are assumed.

An overview of projected water budget results and groundwater elevation trends is provided below. Additional details regarding climate and boundary condition assumptions are provided in Section 6.5.1.

9.6.1 Marina-Ord Area "Project" Scenario Results

Table 9-4**Error! Reference source not found.** summarizes projected water budget results for the Marina-Ord Water Augmentation "Project" scenario with variable boundary conditions. The project scenario, as described above, results in an average annual pumping rate over the 50-year analog period of 4,488 AFY within the Marina-Ord Area WBZ. This average annual pumping rate is below the estimated average annual recharge within the Subbasin under all projected climate scenarios, which ranges between (6,356 AFY and 7,509 AFY)[67]. This average annual pumping rate

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[65] Or at the established MTs (i.e., based on 2015 water levels) in the Corral de Tierra Area wherever they were below MTs at the end of the Historical Period (see discussion in Appendix 6-B Section 2.4.2.2.2).
[66] Or at the established MTs (i.e., based on 2015 water levels) in the Corral de Tierra Area wherever they were below MTs at the end of the Historical Period (see discussion in Appendix 6-B Section 2.4.2.2.2).
[67] See Tables 6A-4 and 6A-5 in Appendix 6-A.

represents a 4,279 AFY reduction in projected pumping from the "No Project" scenario (see Table 6-5).

The project scenario does not however result in a similar net annual increase in groundwater storage over the "No Project" scenario (see Section 6.5.5). Net annual changes in groundwater storage for this project only average 200 AFY more than the "No Project" scenario. The limited increase in net groundwater storage is the result of projected increases in net outflows to the 180/400-Foot Aquifer Subbasin and decreases in net inflows from the Seaside Subbasin and ocean under this "Project" scenario.

Consistent with the "No Project" scenario the projected water budget for this "Project" scenario results in a positive net increase in storage over the 50-year analog period, under all identified boundary condition and climate condition scenarios. These projected water budget results indicate that this management area will not be in overdraft under this "Project" scenario if adjacent subbasins are managed sustainably ~~sustainably,~~ and seawater intrusion groundwater level MTs are achieved in ~~with the groundwater level measurable objective being reached in~~ the 180/400-Foot Aquifer Subbasin ~~and SMCs are achieved~~. This "Project" scenario also results in a decrease in inflows from the ocean and from the 180/400-Foot Aquifer Subbasin in the lower 180-Foot and 400-Foot Aquifers, which are seawater intruded. Therefore this "Project" scenario reduces the risk of expansion of the seawater intrusion front over the "No Project" scenario.

Figure 9-15 depicts (a) average projected changes in groundwater elevations at RMS wells in the Marina-Ord Area WBZ under the "Project" scenario with variable boundary conditions and (b) average change in water levels required to reach MTs and MOs at RMS wells in the Marina-Ord Area WBZ. As shown on this Figure, projected groundwater elevations under this "Project" scenario stabilize within the first 10 years of GSP implementation for all boundary conditions and are constant over the 30-year post-GSP implementation period during which groundwater rates of extraction are 4,376 AFY. However, the resulting average groundwater elevation varies significantly between the various boundary scenarios. The results indicate that under the "Project" scenario groundwater elevations in RMS wells within the Marina-Ord Area WBZ will:

- reach groundwater level MTs if MT Boundary Conditions are met in the 180/400-Foot Aquifer Subbasin,
- reach groundwater level MOs and MTs if MO Boundary Conditions are met in the 180/400-Foot Aquifer Subbasin; and
- reach groundwater level MOs and MTs if SWI Protective boundary conditions are met in the 180/400-Foot Aquifer Subbasin.

These results suggest, however, that even under this "Project" scenario, groundwater elevations in RMS wells will not meet MOs in the Marina-Ord Area WBZ if MO boundary conditions are not achieved in adjacent subbasins, unless additional projects are undertaken. As described in

Section 8.7.4, such conditions could lead to increases in seawater intrusion within the Monterey Subbasin and lead to undesirable results. As such, a coordinated approach to sustainable groundwater management will be required between subbasins within the Salinas Valley Basin.

As discussed in Section 6.6.1, comparison of projected groundwater levels within the Marina-Ord Area WBZ under the "No Project" scenario (Section 6.5.5) and "Project" scenario with established MTs and MOs provides significant insight regarding the projected sustainable yield as defined under SGMA. As discussed above, the attainment of MTs and MOs, which are established to avoid undesirable results and achieve subbasin sustainability, should be considered in the estimation of sustainable yield under SGMA. As discussed in Section 6.6 and above, projected groundwater level data indicate that:

- Under the "no project" scenario groundwater levels in RMS wells stabilize and are generally higher than groundwater level MTs during non-drought periods under all identified boundary conditions and climate scenarios, and reach groundwater level MOs if SWI protective boundary conditions are achieved in adjacent subbasins.

- Under the "Project" scenario, groundwater levels stabilize and are higher than groundwater level MTs and reach groundwater level MOs in RMS wells within the Marina-Ord Area WBZ, if MT and MO boundary conditions are achieved in adjacent subbasins, respectively.

These results indicate that SMCs can likely be attained in the Subbasin under this "Pproject" scenario if the 180/400-Foot Aquifer Subbasin reaches its groundwater level SMCs and the Seaside Subbasin is managed consistent with itsadjacent basins subbasins are managed to their respective sustainabilityMT and adjudication goals.are managed sustainably and the 180/400-Foot Aquifer Subbasin reaches its SMCs.

However, further monitoring, and modeling will be required to determine how such a project can best be implemented to confirm that SMCs can be achieved. Project implementation will also require coordination with projects and management actions implemented in adjacent subbasins.

Table 9-4. Projected Water Budget Results Under Marina-Ord Area Water Augmentation "Project" Scenario with Variable Boundary Conditions and 2030 Climate Condition

Net Annual Groundwater Flows (a) (AFY)	Projected Annual Inflows/Outflows (b) 2030 Climate Conditions		
	Minimum Threshold Boundary Conditions	Measurable Objective Boundary Conditions	Seawater Intrusion Protective Boundary Conditions
Recharge			
• Rainfall, leakage, irrigation	**6,823**	**6,823**	**6,823**

Well Pumping			
● Well Pumping (c)	**-4,488**	**-4,488**	**-4,488**
Net Inter-Basin Flow			
● Seaside Subbasin	1,776	612	-1,115
● 180/400-Foot Aquifer Subbasin	-6,833	-4,901	-1,788
● Ocean (Presumed Freshwater)	-738	-764	-806
● Ocean (Presumed Seawater)	2,617	2,047	989
	-3,178	**-3,006**	**-2,721**
Net Intra-basin Flow			
● Corral de Tierra Area (Water Budget Zone)	**898**	**1,001**	**958**
Net Surface Water Exchange			
● Salinas River Exchange	**0**	**0**	**0**
NET ANNUAL CHANGE IN GROUNDWATER STORAGE	**55**	**330**	**572**

Notes:

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

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

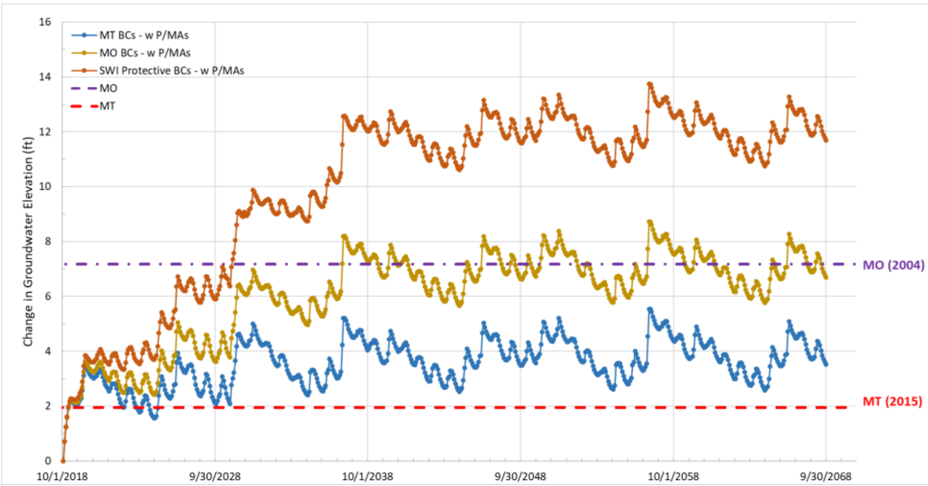

Figure 9-15. Comparison of Groundwater Elevation Changes Under Marina-Ord Water Augmentation "Project" Scenario with Various Boundary Conditions and 2030 Climate Condition, Marina-Ord Area WBZ

9.6.2 Corral de Tierra "Project" Scenario Results

Table 9-5 summarizes projected water budget results for the Corral de Tierra Water Augmentation "Project" scenario under MO Boundary Conditions. The project scenario, as described above, analyzes a hypothetical and extreme condition where all of Corral de Tierra Area projected future water demand (i.e., 2,188 AFY) is met by some form of water supply augmentation. The scenario assumes groundwater level Measurable Objective (MO) Boundary Conditions are achieved at the 180/400-Foot Aquifer Subbasin boundary and water levels along the Seaside Subbasin boundary remain stable at 2017 levels[68]. However, it should be noted that the 180/400-Foot Aquifer Subbasin only needs to reach its groundwater level MTs to avoid undesirable results if projects (e.g., extraction and/or injection barriers) are implemented to achieve seawater intrusion MTs.

Although this "Project" scenario reduces groundwater extraction by 2,188 AFY from the "No Project Scenario" (see Table 6-6), it only results in a net annual change in groundwater storage of 295 AFY over the No Project Scenario (see Table 9-5). This limited increase in net groundwater

[68] Or at the established MTs (i.e., based on 2015 water levels) in the Corral de Tierra Area wherever they were below MTs at the end of the Historical Period (see discussion in Appendix 6-B Section 2.4.2.2.2)

storage is the result of projected increases in net inter-basin outflows to the 180/400-Foot Aquifer Subbasin and the Seaside Subbasin.

The "Project" scenario results show that the Corral de Tierra Area WBZ is projected to remain in slight overdraft over the 50-year analog period even if the 180/400-Foot Aquifer Subbasin is managed to its water level MOs and significant investments in alternative water suppliers are made.

Figure 9-16 compares (a) average projected changes in groundwater elevations at RMS wells in the Corral de Tierra Area WBZ under the "No Project" and "Project" scenarios (with MO Boundary Conditions and 2030 Climate Scenario) and (b) the average change in water levels required to reach groundwater level MTs and MOs at RMS wells in the Corral de Tierra Area WBZ under these conditions.

As shown on Figure 9-16, groundwater elevations in RMS wells within the Corral de Tierra Area WBZ appear to stabilize at levels that are approximately 15 feet higher under the "Project" scenario than under the "No Project" scenario. However, groundwater elevations under the "Project" scenario are still approximately 5 feet lower than groundwater elevation MTs and 15 feet lower than groundwater elevation MOs.

This project scenario shows that even if all pumping wereas replaced with alternative supplies and pumping was eliminated in the Corral de Tierra Area, the Corral de Tierra Area would still need recharge projects to reach sustainability. This project scenario shows one potential path forward to help reach sustainability; however, different sets of projects and management actions could be undertaken. Projects and management actions will be prioritized and selected early during GSP implementation.

Table 9-5. Projected Groundwater Water Budget Results under Corral de Tierra Area Water Supply Augmentation "Project" Scenario with MO Boundary Condition and 2030 Climate Condition

Net Annual Groundwater Flows (AFY) (b)	Projected Annual Inflows/Outflows Measurable Objective Boundary Conditions
Recharge	
• Rainfall, leakage, irrigation	**4,105**
Well Pumping	
• El Toro Primary Aquifer System	**0**
Net Inter-Basin Flow (Presumed Freshwater) (c)	
• Seaside Subbasin	-381
• 180/400-Foot Aquifer Subbasin	-2,728
• Ocean	0
	-3,109
Net Intra-basin Flow	
• From Marina-Ord Area WBZ	**-1,352**
Net Surface Water Exchange	
• Salinas River Exchange	**207**
NET ANNUAL CHANGE IN GROUNDWATER STORAGE	**-148**

Notes:

(a) The Corral de Tierra Area Zone Budget does not include inflows to and outflows from the portion of Corral de Tierra Area that is north of Reservation Rd.
(b) Positive values indicate a net inflow and negative values indicate a net outflow.
(c) Net cross boundary flows are reflective of 100% freshwater as no seawater inflows to the Subbasin reach the Corral de Tierra Area.
~~(c)~~(d) Stream gauge data was unavailable from El Toro Creek for the historical period, and thus El Toro Creek was not directly simulated in the model. See further discussion in Section 6.4.1.1.3.

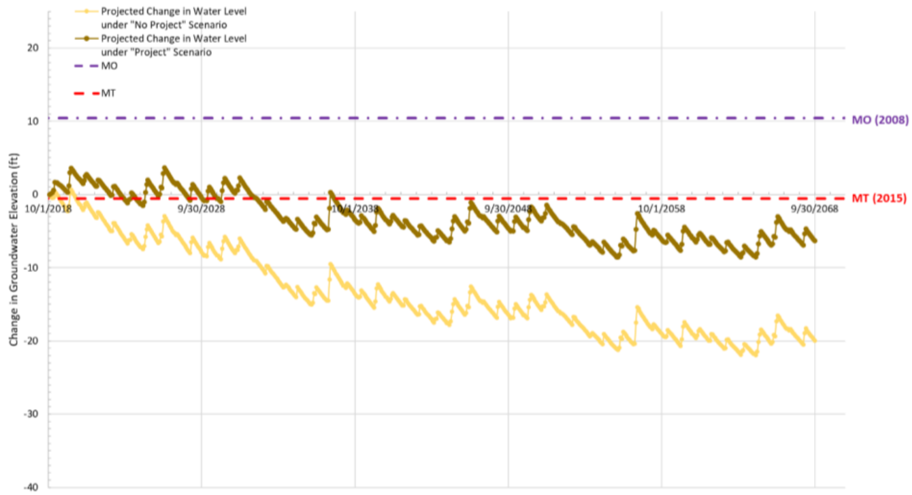

Figure 9-16. Comparison of Groundwater Elevation Changes Under Marina-Ord Water Augmentation "Project" Scenario and "No Project" Scenario, with MO Boundary Condition and 2030 Climate Condition

9.7 Addressing Overdraft Conditions

As discussed in Chapter 6 and in Section 9.6 above, projected water budget results indicate that if adjacent subbasins are managed to their respective sustainability and adjudication goals~~sustainably and the~~ 180/400-Foot Aquifer Subbasin~~ reaches SMCs:~~

- The Marina-Ord Area WBZ will not be in overdraft during the 30-year post-GSP implementation period, and
- The Corral de Tierra Area WBZ will be in minor overdraft (i.e., 89 AFY) during the 30-year post-GSP implementation period.

However, projected water level results indicate that further analysis and implementation of projects and/or management actions may be required to reach SMCs in the Marina-Ord Area WBZ and the Corral de Tierra WBZ, depending upon boundary conditions achieved in adjacent subbasins.

The potential projects presented in Chapter 9, if implemented in aggregate, are adequate to supply the entirety of the Marina-Ord Management Area's projected groundwater demand, and significantly impact the projected demand in the Corral de Tierra Area.

The MCWD GSA and SVBGSA are the same GSAs covering the adjacent 180/400-Foot Aquifer Subbasin and will be directly leading joint efforts to achieve sustainability and mitigate any residual overdraft. As described herein, regional, or multi-subbasin projects and management actions will need to be coordinated. For example, in the event that a seawater intrusion extraction barrier is constructed in the 180/400-Foot Aquifer Subbasin, impacts to groundwater levels, seawater intrusion, and cross-boundary flows will need to be assessed.

To demonstrate this future coordination, Implementation Action 1 (180/400-Foot Aquifer Subbasin GSP Implementation and Seaside Watermaster Actions) describes the GSAs' plan to support projects and actions in adjacent subbasins, particularly those that will improve groundwater conditions near Monterey Subbasin boundaries and reduce the potential for seawater intrusion and decrease cross-boundary outflows from the Monterey Subbasin. During the first five years of GSP implementation, the GSAs will perform various studies and analyses to refine project concepts into actionable projects. As part of this process, the GSAs will implement Implementation Action 6 (SVIHM Calibration and Refinement) to develop a numerical tool capable of quantifying the benefits and impacts of these projects on the Monterey Subbasin.

10 PLAN IMPLEMENTATION

This section describes the activities that will be performed by Marina Coast Water District (MCWD) and Salinas Valley Basin Groundwater Sustainability Agency (SVBGSA) as part of Groundwater Sustainability Plan (GSP) implementation within the Monterey Subbasin. The activities described herein focus on the first five years of GSP implementation (i.e., through 2027). Key GSP implementation activities to be undertaken by the Subbasin Groundwater Sustainability Agencies (GSAs) over the next five years include:

- Data collection, monitoring, and reporting;
    - Annual monitoring and reporting
    - Updating the Data Management System
    - Improving monitoring networks
    - Addressing identified data gaps in the Hydrogeologic Conceptual Model (HCM)
- Conducting intra-basin and inter-basin coordination;
- Continuing communication and stakeholder engagement;
- Conducting periodic evaluations of the GSP;
- Implementing projects and management actions and preparing grant applications; and
- Developing a funding strategy.

Each of these activities is discussed in more detail below. The implementation plan is based on the best data available regarding groundwater conditions in the Subbasin and potential management actions and projects described in Chapter 9. This plan considers management actions defined by the MCWD GSA and SVBGSA in their respective Management Areas, as well as coordinated management of the Subbasin as a whole. The level of understanding regarding subbasin conditions and proposed project and management actions will evolve over time based on future data collection, model development, and input from Subbasin stakeholders.

10.1 Implementation Agreement

MCWD GSA and SVBGSA intend to coordinate implementation of the GSP, through anthe Implementation Agreement. MCWD GSA will implement the GSP within the Marina-Ord Management Area and the SVBGSA will implement the GSP within the Corral de Tierra Management area. These efforts may overlap with regard to regional projects and implementation actions, and in places where Management Areas are very hydrogeologically linked such as the Reservation Road portion of the Corral de Tierra Area.

10.2 Data Collection, Monitoring, and Reporting

Successful sustainable groundwater management relies on a foundation of data to support decision making. As such, collection of data within the Subbasin will be a key part of GSP implementation. These data collection efforts include monitoring of each Sustainability Indicator from the Sustainable Groundwater Management Act (SGMA) monitoring network, as well as other data and information required for management and reporting under the SGMA, as described below.

Beginning in the first year of GSP implementation, SGMA requires submittal of annual monitoring data and development of an annual report. This annual process tracks groundwater conditions with respect to the Sustainable Management Criteria (SMCs) established in Chapter 8. The GSAs will hire consultant(s), form agreements with agencies, and/or hire staff to implement the monitoring and reporting functions. Monitoring of the six sustainability indicators will begin upon adoption of the GSP. The GSAs will coordinate on monitoring data collection and reporting.

Chapter 7 discusses the SGMA monitoring network, associated Representative Monitoring Sites (RMS) wells, and protocols that will be used in the Subbasin. Those protocols will be followed as part of GSP implementation. Most of the monitoring networks described in Chapter 7 rely on existing monitoring programs, which include quarterly or monthly monitoring of groundwater elevations and annual monitoring of seawater intrusion indicators (e.g., water quality sampling and geophysical surveying). Where possible, MCWD and SVBGSA will leverage data collection and analysis completed by existing water management agencies (e.g., Monterey County Water Resources Agency (MCWRA), Monterey Peninsula Water Management District (MPWMD), Seaside Basin Watermaster, and the U.S. Army[69]) to avoid duplication of efforts.

Data collected will be incorporated into the Subbasin's Data Management System (DMS) and will be used to support Annual Reporting (see Section 10.2.2 below). Furthermore, monitoring results will be evaluated against applicable Sustainable Management Criteria (SMCs; i.e., undesirable results, minimum thresholds, and measurable objectives) to support groundwater management decisions on management actions and projects in the Subbasin.

10.2.1 Annual Monitoring and Reporting

The GSAs anticipate that within the first five years of GSP implementation (i.e., in the 2022 to 2027 timeframe), the following monitoring related efforts will be performed:

[69] It is anticipated that groundwater monitoring will continue to be conducted by the U.S. Army within the former Fort Ord for the near future. MCWD plans to obtain ownership of RWS wells and potential additional wells for continued monitoring once the Army's remediation efforts terminate.

- Collection and/or compilation of water level data at least on a quarterly basis at groundwater elevation RMS wells, with the potential for monitoring of additional well site(s);
- Collection and/or compilation of water quality data at least on an annual basis at seawater intrusion RMS wells, with the potential for monitoring of additional well site(s);
- Water quality data compilation from the State Water Resources Control Board's (SWRCB) GeoTracker Groundwater Ambient Monitoring and Assessment (GAMA) groundwater information system for Division of Drinking Water (DDW) and Irrigated Lands Regulatory Program (ILRP) wells;
- InSAR data compilation from the California Department of Water Resources (DWR) SGMA Data View to assess land subsidence;
- Collection and/or compilation of quarterly water level data at the shallow RMS wells for interconnected surface waters to inform groundwater conditions near groundwater dependent ecosystems (GDEs);
- Quality assurance and quality control (QA/QC) checks;
- Data Management System (DMS) importation; and
- Data gap filling as it pertains to the monitoring network (see Section 10.2.5 below).

10.2.2 Annual Reporting

SGMA requires completion of annual reports to document Subbasin conditions relative to the SMC presented in Chapter 8. Starting on April 1, 2022, MCWD and SVBGSA will submit annual reports for the Monterey Subbasin to DWR and make them publicly available. The purpose of the reports is to provide monitoring, groundwater extraction, and total water use data to DWR, compare monitoring data to the SMCs, and adaptively manage actions and projects implemented to achieve sustainability.

Chapter 7 outlines the data collected through the monitoring programs that will be used to complete annual reports. Where possible, the GSAs will leverage data collection and analysis completed by MCWRA and Seaside Basin Watermaster to avoid duplication of efforts.

Annual reports will include, but not be limited to, the following:

- Groundwater elevation contour maps for both Spring and Fall conditions;
- Hydrographs of groundwater elevations in the groundwater elevation and interconnected surface water RMS wells;
- Seawater intrusion isocontour maps drawn using data collected in seawater intrusion RMS wells;
- Annual change in subsidence maps based on InSAR data;

- Annual groundwater extraction volumes by water use sector for the entire Basin, an explanation as to how groundwater extraction volumes were estimated, an accounting of accuracy, and an explanation as to how accuracy was determined;
- Estimates of annual change in groundwater storage. The Monterey Subbasin Groundwater Model will be updated to include new groundwater elevation data, groundwater extraction volumes, and hydrology datasets (i.e., precipitation and evapotranspiration) to estimate the annual change in groundwater storage.

10.2.3 Updating the Data Management System

The MCWD and SVBGSA have developed a DMS that is used to store, review, and upload data collected from the monitoring programs outlined above, as described in Chapter 7. A web application that reports these data is available on the SVBGSA's website for stakeholders to view. The DMS will be updated as new information is collected for annual reports, developed as part of GSP implementation, and provided by stakeholders. New data that will be added to the DMS includes, but is not limited to, the following:

- Water level data at groundwater elevation RMS wells and other potential additional monitoring well site(s);
- Groundwater water quality data at seawater intrusion RMS wells and other potential additional monitoring well site(s);
- Groundwater water quality data from the SWRCB's GeoTracker GAMA groundwater information system for DDW and ILRP wells;
- InSAR data from the DWR SGMA Data View, which will be used to assess land subsidence; and
- Water level data at shallow RMS wells for interconnected surface waters to inform groundwater conditions near groundwater dependent ecosystems (GDEs).

10.2.4 Improving Monitoring Networks

As discussed in Chapter 7, data gaps have been identified in the groundwater elevation, seawater intrusion, and interconnected surface water monitoring networks.

10.2.4.1 Groundwater Elevations

Chapter 7 identifies spatial data gaps in the groundwater level monitoring network in both the Marina-Ord Area and the Corral de Tierra Area as shown on Figures 7-7 through 7-9.

In the Marina-Ord Area, additional groundwater elevation monitoring is necessary near the ocean and subject to seawater intrusion, particularly along the central coastline in the 400-Foot and Deep Aquifers. As a first phase, MCWD plans to install two 400-Foot Aquifer monitoring wells and one Deep Aquifer monitoring well in this area to fill this data gap.

In the Corral de Tierra Area, additional groundwater monitoring is needed near areas where substantial groundwater withdrawals occur in the upper El Toro Creek area. There are four general data gaps in the groundwater level monitoring network shown on Figure 7-9 that would require at least three new monitoring wells to fill. If possible, SVBGSA will first incorporate existing wells into the monitoring network to fill this data gap. SVBGSA will contact well owners to gain permission and secure access agreements to incorporate their wells into the groundwater elevation monitoring network. All existing wells that are candidates for incorporation into the monitoring network will be inspected to (a) ensure they are adequate for monitoring, and (b) determine depth, perforated intervals, and assign an aquifer designation. If an existing well cannot be identified to fill a data gap or permission to use data from an existing well cannot be secured, then a new monitoring well will be drilled and added to the monitoring network. The GSAs will obtain required permits and access agreements before drilling new wells. The GSAs will retain the services of licensed geologists or engineers and qualified drilling companies for drilling new wells. To the extent possible, grant funds and technical assistance support services through DWR or other entities will be used for installation of new wells. Once drilled, the new wells will be tested as necessary and equipped with dedicated data loggers for monitoring. All new monitoring wells identified as RMS locations will be added to MCWRA's monitoring network for continuity and consistency in data collection.

Additionally, the SVBGSA is coordinating closely with MCWRA to expand and enhance the Groundwater Extraction Management System (GEMS) network as detailed in Chapter 9. Expanding the GEMS network will add more wells into the monitoring network, and potentially fill in currently identified data gaps.

10.2.4.2 Seawater Intrusion

Spatial data gaps within the seawater intrusion monitoring network in the Marina-Ord Area are located in the same general area as the data gaps identified within the groundwater elevation network. Therefore, the aforementioned new monitoring wells to be constructed in the Marina-Ord Area will be monitored for both groundwater elevation and seawater intrusion.

10.2.4.3 Interconnected Surface Water (ISW)

Depletion of interconnected surface water will be monitored through shallow wells adjacent to locations of interconnected surface water. There is no entity that currently monitors ISW within the Corral de Tierra Area and no existing shallow wells that can be added to the ISW monitoring network. Thus, SVBGSA plans to install a new shallow well where preliminary analysis indicate there may be interconnected surface water near El Toro Creek as shown in Figure 5-36. The ISW monitoring wells will be incorporated into MCWRA's existing monitoring network and MCWRA will make these data available to SVBGSA. A monitoring well may be paired with USGS stream gauges to evaluate groundwater gradient and effects of groundwater levels on surface water depletion. These wells will be added to MCWRA's groundwater elevation monitoring programs. This information will also help determine the extent of interconnection.

10.2.4.4 Groundwater Extraction Information

Accurate extraction data is necessary to meet SGMA requirements for reporting annual groundwater extractions within the Subbasin. The area encompassed by the current GEMS includes Zones 2, 2A, and 2B; and provides sufficient coverage of the Marina-Ord Area. However, GEMS does not cover the entire Corral de Tierra Area. The GSAs and MCWRA will work together to potentially improve the existing GEMS Program outside of these areas as outlined in Chapter 9.

As described in Chapter 9, accurate extraction data is necessary to meet SGMA requirements to manage groundwater extractions within the Subbasin's sustainable yield.

The existing publicly reported data from water systems within the Corral de Tierra Area will continue to be used until the GEMs program can be expanded, or more small systems and private wells can be included in extraction monitoring programs.

10.2.4.5 Inter-basin Monitoring Programs

Beyond filling data gaps in the SGMA monitoring network, the Subbasin GSAs will support monitoring network improvement efforts within the adjacent 180/400-Foot Aquifer and Seaside Subbasins. Although monitoring wells outside the Monterey Subbasin cannot be included as a Representative Monitoring Site (RMS) and evaluated against SMCs, data collected from these adjacent subbasins will inform groundwater elevation and seawater intrusion analyses in Annual Reports and Periodic GSP Updates, as well as multi-basin planning of projects and management actions.

Within the Seaside Subbasin, monitoring well FO-09 Shallow where casing leakage has been identified is likely to be replaced. The monitoring well is located near the coastline just south of the Seaside-Monterey Subbasin boundary. It is used to (a) monitor groundwater levels relative to seawater intrusion protective groundwater elevations and (b) monitor water quality in groundwater to detect occurrences of seawater intrusion into both Subbasins. MCWD GSA recognizes the importance of monitoring at this location and is in discussions to participate in a cost-share arrangement to destroy and replace this well per request of the Seaside Watermaster. The Subbasin GSAs will continue to evaluate and partner to improve monitoring in adjacent subbasins to the extent that such efforts benefit multi-basin groundwater management.

10.2.5 Address Identified Data Gaps in the Basin Setting

MCWD GSA and SVBGSA will prioritize and begin to fill the key data gaps identified in this GSP related to the hydrogeological conceptual model, groundwater conditions, water budgets (numerical modeling), among other things. Filling these data gaps would allow the GSAs to improve understanding of the Basin Setting and thus, the characterization of the Subbasin and the principal aquifers. Earlier chapters of this GSP have identified the following data gaps:

- Location and magnitude of recharge to the Deep Aquifers, including the connectivity with the ocean, adjacent subbasins, upper principal aquifers, and current and potential seawater intrusion;
- Limited subsurface information in the southern Marina-Ord Area, including groundwater elevation and water quality data to characterize the extent of groundwater elevation decline and seawater intrusion near MPWMD#FO-10 and MPWMD#FO-11;
- Limited subsurface information in the Corral de Tierra Area along the 180/400-Foot Aquifer Subbasin boundary;
- Limited subsurface information in the eastern Fort Ord hills area to characterize the hydrostratigraphy and the connectivity between Marina-Ord Area and the Corral de Tierra Area principal aquifers;
- Location of seawater intrusion between the front and MCWD production wells. As discussed in Section 5.3.3, no additional total dissolved solids (TDS) measurements exist between MCWD production well MCWD-30 and the cluster of wells located northwest of MCWD's production wells, where TDS concentrations exceed 10,000 mg/L.

During the first five years of GSP implementation, the GSAs will prioritize and fill key data gaps that have been identified, including:

- Installation of new 400-Foot Aquifer and Deep Aquifers monitoring wells in the southern Marina-Ord Area. A geochemical analysis and coring of the deep aquifer may be conducted concurrently with construction of the new deep monitoring well to better characterize these two aquifers and their connectivity with the Seaside Subbasin.
- Implementation of the multi-party Deep Aquifers Investigation, which will be managed by SVBGSA. As described in Section 9.5.2, the primary tasks of the study include describing the hydrogeology and extents of the multi-subbasin Deep Aquifers, completing a water budget, and initiating a Deep Aquifers monitoring program.
- Establishment of an annual induction logging program of Deep Aquifers monitoring well clusters. There are currently five monitoring well clusters within the Subbasin. Induction logging provides an effective way to profile water quality changes and signs of vertical migration of seawater intrusion into the Deep Aquifer.
- Installation of monitoring wells in the Corral de Tierra Area along the 180/400-Foot Aquifer Subbasin boundary, in northern portion along Highway 68 north of the USGS gauge, and along the boundary with the Seaside Subbasin. Data from these monitoring wells will better characterize inter-basin flows and help refine the Subbasin's water budget.
- Conducting pumping tests in the aforementioned areas to collect aquifer property information and refine groundwater modeling efforts.

- Collecting well registration and groundwater extraction information (as described in Sections 9.5.7 and 9.5.8) in the Corral de Tierra Area to refine groundwater modeling efforts and the water budget;
- Assisting DWR's airborne electromagnetic (AEM) study within the Salinas Valley and utilizing these results to refine the hydrogeological conceptual model in the eastern Fort Ord hills area.

10.3 Intra- and Inter-basin Coordination

Both intra- and inter-basin coordination will continue to be conducted between MCWD GSA and SVBGSA, which covers the Monterey Subbasin and the adjacent 180/400-Foot Aquifer Subbasin. In addition, the Subbasin GSAs have and will continue to coordinate with other entities (including the Seaside Basin Watermaster) on water management efforts that involve the larger Salinas Valley Basin.

Intra- and inter-basin coordination efforts between MCWD and SVBGSA are anticipated to include continued technical committee meetings. It is anticipated that such meetings will be held approximately monthly to facilitate regional projects planning (Section 9.4) and implementation activities (Section 9.5) and will incorporate Implementation Agreement requirements as described in Section 10.1.

10.4 Communications and Engagement

The GSAs will routinely report information to the public about GSP implementation and progress towards sustainability and the need to use groundwater efficiently, as described in Chapter 2. The GSAs' websites will be maintained as a communication tool for posting data, reports, and meeting information. An interactive mapping function for viewing Salinas Valley Groundwater Basin-wide data that were used during GSP development is hosted on the SVBGSA website.

MCWD and SVBGSA's Stakeholder Communication and Engagement Plans (SCEPs) will continue to be refined, updated, and executed during GSP implementation. Anticipated stakeholder engagement activities include, but are not limited to:

- Public meetings including GSA Board meetings, Advisory Committee meetings, subbasin planning committee meetings, and stakeholder workshops;
- One-on-one stakeholder communications;
- Posting of relevant announcements and information on the respective websites (mcwd.org and svbgsa.org) and other direct mailings, as needed;
- Interested parties list maintenance; and
- Stakeholder Communication and Engagement Plan (SCEP) evaluation and updates.

The GSAs will continue to inform the public on GSP implementation progress and implementation of projects through the stakeholder engagement activities identified above. In addition, each project or management action may be subject to specific public noticing requirements as detailed in their respective project descriptions in Chapter 9. The Annual Reports to be prepared by April 1 each year will assess progress towards sustainability and will provide an important opportunity to reengage subbasin stakeholders in its review.

10.5 Project and Management Action Implementation

To prevent potential Undesirable Results, projects and management actions are planned as part of GSP implementation. As described in Chapter 9, a portfolio of projects and management actions has been developed with the goal of proactively addressing relevant sustainability indicators.

Implementation Actions

Several of the implementation actions described in Chapter 9 involve regional coordination that are currently ongoing and will continue to be implemented post GSP adoption. These actions include supporting groundwater management in adjacent subbasins, as well as supporting the Deep Aquifer Investigation, the Seawater Intrusion Working Group, and the Deep Aquifer Well Moratorium.

A numerical modeling tool needs to be developed that can assess the impacts of proposed projects that address seawater intrusion over multiple subbasins. The SVBGSA will finish the development of a variable density flow model during the first year of GSP implementation that can be extended to cover multiple coastal subbasins of the Salinas Valley Basin. This modeling construction effort will build upon the existing Monterey Subbasin Groundwater Flow Model and be coordinated with the Salinas Valley Integrated Hydrologic Model (SVIHM) developed by the USGS and the Seaside Basin Watermaster's Seaside Basin Model.

Data collection and analysis are critical for the implementation of all GSPs. These actions, as highlighted in the sections above, are a top priority to be able to better understand the groundwater conditions and necessity of projects and management actions. Along with the expansion of monitoring networks, including updating and enhancing GEMS to improve the collection of extraction data, SVBGSA will consider registering wells to gain more information on active wells, especially de minimis users. In addition, it will begin establishing up the Dry Well Notification System within the first 2 years of GSP implementation, which will assist well owners whose access is jeopardized through declining groundwater elevations. SVBGSA plans to undertake the development of these actions within the first 2 years after GSP submittal, and fully implement them through years 3 and 4 through actively reaching out to well owners, visiting and checking wells, and inputting data.

The Water Quality Coordination Group is also a critical implementation action to coordinate with other agencies that have responsibilities affecting domestic water quality and access. After undertaking preliminary planning work in the first 2 years after implementation, SVBGSA plans to establish the Partnership in years 3 and 4.

New Water Supply and Regional Municipal Supply Projects

Chapter 9 describes projects that involve new water supplies for recharge (injection) or direct use in-lieu of groundwater extraction. These projects include:

- Two of the proposed regional projects, the Seasonal Release for Aquifer Storage and Recovery (ASR) and Direct Use project and the Regional Municipal Supply project,
- One of the proposed projects in the Marina-Ord Area (Recycled Water Reuse), and
- All six proposed projects in the Corral de Tierra Area.

Chapter 9 outlines the estimated cost and benefit for each project; however, more detailed scoping and analysis needs to be undertaken.

During the first 2 years of GSP implementation, the GSAs will undertake further scoping and analysis of potential project benefits and feasibility. The GSAs will evaluate if water rights permits are needed and take that into consideration in project selection and planning. Multiple projects may be needed to mitigate overdraft. With stakeholder input, the GSAs will determine (a) which projects to move forward first, (b) which projects to implement if the first set of projects do not reach sustainability goals, and (c) which projects should not be prioritized for implementation. After initial project selection, more detailed analyses and potential discussions with landowners will need to occur to determine project specifics, such as locations of recharge and distribution systems. During years 3 and 4, GSAs will secure access agreements, undertake permitting and CEQA, and develop funding mechanisms for projects that are selected. The GSAs will continue an iterative, ongoing process to evaluate the effectiveness of projects post implementation, including assessment of groundwater conditions, and the need for additional projects.

Other Marina-Ord Area Projects and Management Actions

Two local ongoing management actions within the Marina-Ord Area will continue to be implemented after GSP submittal. These management actions include MCWD Demand Management Measures and Stormwater Recharge Management.

The local project entitled: Drilling and Installation of Monitoring Wells is critical for filling data gaps and informing project selection and design in the southern Marina-Ord Area. MCWD GSA plans to initiate the project immediately after GSP submittal and anticipates the project will be completed within the first 2 years of GSP implementation.

Other Corral de Tierra Management Actions

Demand management provides options since supply-side projects are likely not sufficient to reach sustainability. During GSP development, the SVBGSA Monterey Subbasin Planning Committee prioritized pumping allocations and control as the top project or management action within the Corral de Tierra Area. SVBGSA will begin establishment of pumping allocations and controls immediately following GSP implementation. The establishment of pumping allocations will involve robust stakeholder input to ensure appropriate planning timelines and landowner engagement. At that time, stakeholders could also evaluate potential funding mechanisms or incentives that could be developed as part of a pumping allocations program.

The implementation of all projects and management actions will be a dynamic, adaptive process. Refinement of the projects and actions will occur simultaneously with adjustment of the funding mechanism that supports the projects and actions. A start-up budget that covers required actions such as data, monitoring, and reporting could also cover pre-financing stages of project selection and design. Projects and management actions will be approved by the respective Board of Directors and will be implemented in a coordinated manner across the entire Salinas Valley.

10.6 Periodic Evaluations of GSP

Per the GSP Emergency Regulations (23-CCR §356.4), the Subbasin GSAs will conduct a periodic evaluation of its GSP, at least every five years, and will modify the GSP as necessary to ensure that the Sustainability Goal for the Subbasin is achieved. The GSP elements that will be covered in the periodic evaluation are described below.

The 5-year update will include updating the Monterey Subbasin Groundwater Flow Model (MBGWFM) with newly collected data. Section 6.7 discussed several limitations with the MBGWFM while recognizing that the model was developed using the best available data at this time. As additional groundwater elevation, aquifer properties, and groundwater extraction data becomes available, the GSAs anticipate refining and recalibrating the MBGWFM as part of the 5-year update. Additionally, model scenarios will be updated to reflect both the additional data and refinements in project design or assumptions. It will also include a reevaluation of climate change to ensure assumptions in the GSP are still valid.

10.6.1 Sustainability Evaluation

This section will evaluate the current groundwater conditions for each sustainability indicator, including progress toward achieving interim milestones and measurable objectives.

10.6.2 Plan Implementation Progress

This section will evaluate the current implementation status of projects and management actions, along with an updated implementation schedule and any new projects and management that are not included in this GSP.

10.6.3 Reconsideration of GSP Elements

Per 23-CCR §356.4(c), elements of the GSP, including the Basin Setting, SMCs, and projects and management actions sections will be reviewed and revised if necessary.

10.6.4 Monitoring Network Description

This section will provide a description of the SGMA monitoring network, including identification of data gaps, assessment of monitoring network function with an analysis of data collected to date, identification of actions that are necessary to improve the monitoring network, and development of plans or programs to fill data gaps.

10.6.5 New Information

This section will provide a description of significant new information that has been made available since the adoption or amendment of the GSP, or the last five-year assessment, including data obtained to fill identified data gaps. As discussed above under *Reconsideration of GSP Elements*, if evaluation of the Basin Setting or SMCs definitions warrant changes to any aspect of the GSP, this new information would also be included.

10.6.6 Regulations or Ordinances

The Subbasin GSAs possess the legal authority to implement regulations or ordinances related to the GSP. This section will provide a description of relevant actions taken by the GSAs, including a summary of related regulations or ordinances, as appropriate.

10.6.7 Legal or Enforcement Actions

This section will summarize legal or enforcement actions taken by the GSA in relation to the GSP, along with how such actions support sustainability in the Subbasin.

10.6.8 Plan Amendments

This section will provide a description of proposed or complete amendments to the GSP.

10.7 Plan Implementation Costs

Per the GSP Emergency Regulations (23-CCR §354.6(e) and 354.44(b)(8)), this section provides estimates of the costs to implement this GSP and potential sources of funding to meet those costs.

Costs herein are estimated and discussed for each GSA. A presumed contribution from each GSA is estimated for certain activities that will be carried out via collaboration, such as preparation of annual reports, DMS hosting and maintenance, and preparing the 5-year GSP update. These costs may shift during GSP implementation depending on how the GSAs decide to undertake each specific task.

10.7.1 MCWD GSA Start-up Budget and Funding to Meet Costs

Table 10-1 summarizes the conceptual planning-level costs for the initial 5 years of GSP implementation (i.e., 2022-2027) by MCWD GSA within the Monterey Subbasin. These costs are developed for Subbasin specific activities, including

- Monitoring and data collection beyond tasks already undertaken by other agencies;
- Annual analysis and reporting of sustainability conditions;
- GSA staff overhead and legal support;
- Continued stakeholder outreach and coordination;
- Periodic evaluation and five-year update of the GSP, including updates to the MBGWFM;
- Improvements to the monitoring networks and hydrogeologic investigations to address data gaps;
- Refinement and implementation of projects and management actions, as well as implementation actions.

These planning level costs include implementation actions envisioned to occur within the first 5 years of GSP implementation. It does not include funding for development or implementation of projects and management actions; however, it does include some funding for refinement and selection of projects and management actions. When projects and management actions move forward with implementation, they will require additional funding for project feasibility and design studies, environmental permitting, and landowner outreach. These are initial estimates of costs and will likely change as more data become available.

As shown in Table 10-1, direct costs for GSP implementation are estimated to be a total of $3,745,000 over the next five years, including GSA staff time. The MCWD GSA will likely meet the estimated costs through a combination of contributions through rate payers and from grant funding, if available.

Table 10-1. MCWD GSA Monterey Subbasin Specific Estimated Planning-Level Costs for First 5 Years of Implementation

Activity	MCWD Estimated Annual Cost	Total MCWD Cost for 5 years or Lump Sum	Assumptions
Annual Monitoring and Reporting		**$400,000**	
Monitoring	$25,000	$125,000	Includes efforts supplemental to existing Fort Ord, MCWRA, and Seaside monitoring programs
Induction Logging	TBD	TBD	Anticipated to be conducted as part of the SVB-wide Deep Aquifer Study and proposed Monitoring Program
Voluntary monitoring of non-RMS wells	$5,000	$25,000	Additional specific conductivity monitoring
Reporting	$50,000	$250,000	Assumed contribution to subbasin cost shared between GSAs
Data Management System		**$35,000**	
Establish a basin-wide DMS	-	$10,000	One-time cost to import existing RMS data into a basin-wide DMS
DMS Hosting and Maintenance	$2,000	$10,000	Assumed contribution to subbasin cost shared between GSAs; includes hosting fee and updating information
Upload Marina-Ord Area data to DMS	$3,000	$15,000	Obtain data from local agencies, process, and upload
Administration and Legal		**$1,125,000**	
Administration	$200,000	$1,000,000	-
Legal	$25,000	$125,000	-
Coordination and Outreach		**$270,000**	
Stakeholder engagement	$30,000	$150,000	Ad hoc meetings and workshops, website maintenance
Intra- and Inter-basin coordination	$24,000	$120,000	Attending meetings, regular communication, etc.

Activity	MCWD Estimated Annual Cost	Total MCWD Cost for 5 years or Lump Sum	Assumptions
Required Five-year Update Incl. Model Update	-	**$500,000**	
MBGWFM refinement and recalibration for the Marina-Ord Area	-	$150,000	-
Gather and Input new data into model	-	$30,000	-
Reevaluate climate change	-	$10,000	-
Update future scenarios	-	$60,000	-
Stakeholder engagement	-	$50,000	-
Coordination with SVBGSA	-	$50,000	-
Analysis and report-writing	-	$150,000	Assumed contribution to subbasin cost shared between GSAs
Implementation Actions		**$165,000**	
Support adjacent subbasins	TBD	TBD	Not estimated at this time
Deep Aquifer Study	-	$50,000	MCWD funding contributions
Support Deep Well Moratorium / 2022/23 Actions	-	$35,000	-
Seawater Intrusion Working Group	-	$80,000	MCWD cost for participating in the SWIG and SWIG TAC for the first two years, level of effort beyond year 2 TBD
Future Modeling of Seawater Intrusion and Projects	TBD	TBD	Not estimated at this time
Improving Monitoring Networks (see Projects)			
Refine and Implement Projects and Management Actions (1)		**$1,250,000**	
Coordinate Regional Projects (R1 and R2)	-	$100,000	-
Refine Recycled Water Reuse Project (M3)	-	$150,000	Assumes completion of the Recycled Water Feasibility Study
Install Monitoring Wells and Conduct Hydraulic and Geochemical Testing for Recycled Water Injection (M4)	-	$1,000,000	-
Total (2)		**$3,745,000**	

Notes:

(1) This is initial funding for these activities but are not likely to fully cover these activities for all potential projects and management actions.

(2) Costs estimated herein do include MCWD GSA staff time.

10.7.2 SVBGSA Start-up Budget and Funding to Meet Costs

10.7.2.1 SVBGSA Operational Fee

SVBGSA established a Valley-wide Operational Fee to fund the typical annual operational costs of its regulatory program authorized by SGMA, including regulatory activities of management groundwater to sustainability (such as GSP development), day-to-day administrative operations costs, and prudent reserves. The Operational Fee funds GSA operational costs, and therefore covers any tasks undertaken by staff, such as planning, technical review, partnership development, communication, stakeholder engagement, and support for the selection, development and implementation of projects and management actions. The fee is a regulatory fee with the purpose of ensuring that groundwater use is managed sustainably so that adequate supplies remain for all users. The Operational Fee is also used as local cost share for grants.

The Operational Fee is based on the 2018 Regulatory Fee Study (Hansford Economic Consulting, 2019) commissioned by SVBGSA. The SVBGSA has the authority to charge fees, as set forth in the California Water Code §10730, 10730.1, and 10730.2. The Operational Fee is a regulatory fee authorized under California Water Code §10730 and is exempt from voter approval, as it is not a tax pursuant to California Constitution Article XIIIC (Proposition 26, Section 1(e)(3)). As the fee must be proportional and related to the benefits of the program, this study analyzed options and proposed a regulatory fee structure whereby agricultural beneficiaries are responsible for 90% of the cost and all other beneficiaries are responsible for 10% of the cost. The SVBGSA Board of Directors approved this fee in March 2019.

The Monterey Subbasin urban and agricultural groundwater users within the Corral de Tierra Area are charged the Operational Fee by domestic connection or irrigated acreage by land use code. The Operational Fee funds Valley-wide activities, including initial GSP development; however, additional funding is needed for meeting future requirements, GSP implementation, and projects and management actions.

10.7.2.2 SVBGSA Start-up Budget

Table 10-2 summarizes the conceptual planning-level costs for the initial 5 years of SVBGSA's GSP implementation for the Monterey Subbasin. This table does not include SVBGSA's Valley-wide costs for routine administrative operations and other Valley-wide costs funded through the SVBGSA operational fee outlined in 10.5.1. The Subbasin specific costs, shown in Table 10-2, include data collection and analysis focusing on the Corral de Tierra Area beyond tasks already undertaken by other agencies. These tasks could be undertaken by staff, consultants, or partner agencies. The costs comprise of annual analysis and reporting of sustainability conditions; improvements to the monitoring networks, including installation of three new monitor wells; and supplemental hydrogeologic investigations to address data gaps.

The start-up budget includes implementation actions envisioned to occur within the first 5 years of GSP implementation. It does not include funding for development or implementation of projects, management actions, and implementation actions; however, does include some funding for refinement, selection, and preliminary scoping of projects and management actions. Costs included will include listed activities, but are not anticipated to cover all feasibility studies, project design, and permitting associated will all potential projects and management actions. When projects, management actions, and implementation actions move forward with implementation, they will require additional funding for project feasibility and design studies, environmental permitting, and landowner outreach. These are initial estimates of costs and will likely change as more data become available.

These costs are independent of fees currently collected by MCWRA; no fees will be collected by SVBGSA that duplicate fees already being collected by MCWRA.

For components of this GSP being developed in coordination with other GSPs in the Salinas Valley, SVBGSA's establishment costs are split between subbasins, and initial implementation costs are estimated based on the direct costs to the Monterey Subbasin. These are initial estimates; however, the final cost and division between subbasins will be reviewed and revised as necessary prior to implementation and per approval of the SVBGSA Board.

Table 10-2. SVBGSA Monterey Subbasin Specific Estimated Planning-Level Costs for First 5 Years of Implementation

Activity	SVBGSA Estimated Annual Cost	SVBGSA Total Cost for 5 years or Lump Sum	Assumptions
Data Collection, Monitoring, and Reporting		**$160,000**	
Annual Monitoring and Reporting	$30,000	$150,000	-
Updating the Data Management System	$2,000	$10,000	Assumed contribution to subbasin cost shared between GSAs; includes hosting fee and updating information
Improving Monitoring Networks		**$36752,000**	
Install up to 4 wells for groundwater elevation monitoring	-	$225,000	Assume average depth 600' @ $125/ft = $75,000 x 3 wells total = $225,000
Development of GEMS expansion ordinance	-	$7,000	SVBGSA-wide cost split equally between subbasins; includes hosting fee and updating information
Implementation of GEMS expansion	-	$100,000	Estimate for implementation in the Corral de Tierra
Install up to 1 shallow wells for monitoring ISW	-	$15,000	-
Add Seaside wells to monitoring GWL network	-	$5,000	-
Additional groundwater level monitoring	3,000	$15,000	
Addressing Identified Data Gaps in the HCM		**$16,000**	
Aquifer properties assessment	-	$16,000	For three aquifer properties tests
Coordination and Outreach		**$130,000**	
Coordination with MCWRA	-	$10,000	Setting up a shared system; MCWRA time
Inter- and Intra-subbasin Coordination	$24,000	$120,000	-
Required Five-year Update		**$250,000**	
Coordination on model updates	-	$25,000	-
Coordination with MCWD	-	$50,000	-
Stakeholder engagement	-	$50,000	-
Analysis and report-writing	-	$125,000	Assumed contribution to subbasin cost shared between GSAs

Activity	SVBGSA Estimated Annual Cost	SVBGSA Total Cost for 5 years or Lump Sum	Assumptions
Refine and Scope Projects, Management Actions, and Implementation Actions (1)	**-**	**$500,000**	**Depends on projects and management actions pursued; Could be grant or project match**
Engineering feasibility studies and project design	-	-	-
Permitting and environmental review	-	-	-
Cost-benefit analyses	-	-	-
Total (2)	**-**	**$1,423~~398~~,000**	-

Notes:

1. (1) This is initial funding for these activities but are not likely to fully cover these activities for all potential projects and management actions.
2. (2) Costs estimated herein do **not** include SVBGSA and member agency staff time.

10.7.3 Funding for Projects and Management Actions

The start-up budget does not include funding for specific projects and management actions. Projects and management actions implemented by other agencies and organizations that contribute to groundwater sustainability will follow the funding strategies developed by those respective agencies and organizations. For projects funded by the Subbasin GSAs or funding the GSAs raise to contribute to the implementation of projects, the GSAs will evaluate the most appropriate funding mechanisms and engage stakeholders and the respective Board of Directors in this analysis. These include:

Grant funding – The GSAs will pursue grants to the extent possible to fund projects and management actions.

Contributions from local jurisdictions, partner agencies, organizations, and companies – Where appropriate, the GSAs will work with partners to solicit contributions to jointly implement a project or management action.

Benefit assessment (218 vote) – For projects with considerable capital cost or that benefit multiple subbasins, the GSAs will consider holding a 218 vote to levy an assessment based upon the special benefits conferred from a specific project. Before doing so, the GSAs will undertake an analysis to identify the special benefit of the conferred project, the cost of the benefit, the zone of benefit, and method of calculating the assessments to be levied. This requires a public hearing and is subject to a majority protest.

Fee – Fees may be collected for a variety of purposes, such as funding a regulatory program or providing a product or service. Fees are not subject to a vote or protest proceeding, but they cannot exceed the cost of running the program or providing the product or service. Some regulatory programs need to be implemented via ordinance.

Fines and Penalties – With the establishment of an ordinance, the GSAs have the authority to impose fines and penalties, such as may be associated with a regulatory program. Imposition of a fine or penalty must provide due process, usually a hearing after notice/citation and before assessment of the fine or penalty, and funds must be put back into the program.

Special tax – The GSAs have the authority to levy a special tax for a specific purpose, such as a parcel tax or some sales tax components. This requires a two-thirds vote of the electorate.

The GSAs acknowledge that the costs associated with projects and management actions will need to be funded through mechanisms such as these. It will work with funding agencies and local partners to do so.

10.8 Plan Implementation Schedule

Implementing the Monterey Subbasin GSP will be coordinated with the implementation of the five other GSPs in the Salinas Valley. The implementation schedule reflects the significant integration and coordination needed to implement all Salinas Valley Basin GSPs in a unified manner.

In the Marina-Ord Area, the implementation schedule reflects evaluating and prioritizing projects and management actions during the first 2 to 3 years. In the Corral de Tierra Area, the initial focus of project and management action efforts will be to begin development of pumping allocations and controls immediately and to evaluate and prioritize supply-side projects.

A general schedule showing the major tasks and estimated timeline during the first 5 years of GSP implementation is provided on Figure 10-1.

MCWDGSA and SVBGSA will adaptively manage groundwater and the implementation of the GSP. The work of the GSAs and stakeholders to complete this GSP provides a solid base to guide groundwater management; however, certain conditions may provide the need to adapt and change management as envisioned in this plan. For example, if existing conditions change, such as a prolonged drought that affects groundwater conditions, or additional funding for specific projects becomes available, MCWDGSA and SVBGSA may adapt their management strategy. If that occurs, the GSAs will work through an open and transparent process with stakeholders, partner agencies, and DWR to ensure it continues to meet regulatory requirements and reaches sustainability.

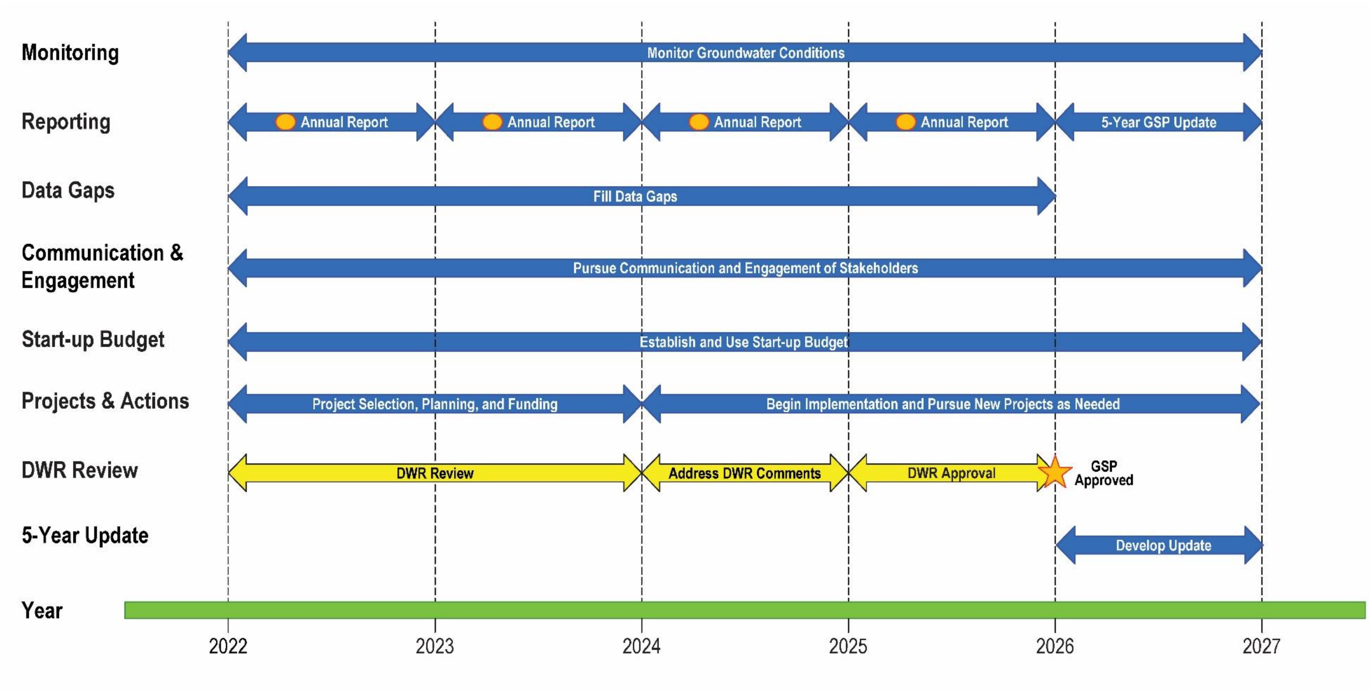

Figure 10-1. General Schedule During First Five-Years of GSP Implementation

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