

MONTEREY SUBBASIN GSP STAKEHOLDER MEETING

27 OCTOBER 2021

GROUNDWATER SUSTAINABILITY PLAN (GSP)

- Developed pursuant Sustainable Groundwater Management Act (SGMA) passed in 2014
- SGMA requires governments and water agencies of high and medium priority basins to halt overdraft and bring groundwater basins into balanced levels of pumping and recharge.
- Under SGMA, these basins should reach sustainability within 20 years of adopting their sustainability plans.
- GSP for Monterey Subbasin (Medium Priority Subbasin) due for submittal to DWR on 31 January 2022

PRESENTATION OUTLINE

- Monterey Subbasin Groundwater Sustainability Plan (GSP)
 - Download Link/Comment Portal
 - Stakeholder Meetings/Comment Period/Adoption Schedule
- Overview of Groundwater Sustainability Plan Chapters I through 10
- Comments and Questions

GSP CHAPTER OUTLINE/AVAILABILITY

1. Introduction and Agency Information
2. Plan Area
3. Stakeholder Engagement and Communication
4. Hydrogeological Conceptual Model (HCM)
5. Groundwater Conditions Assessment
6. Water Budget
7. Monitoring Network
8. Sustainable Management Criteria (SMCs)
9. Projects & Management Actions (P&MAs)
10. GSP Implementation

All Draft Chapters (1 through 10)
Released for Stakeholder Review
20 September 2021

(Chapters 1, 2, 4, 5, 7, 8, were previously released
following earlier Stakeholder meetings)

Available at

MCWD: https://www.mcwd.org/gsa_gsp.html

SVBGSA: <https://svbgsa.org/monterey-subbasin/>

* 23-CCR Sections 354.16-20;

www.water.ca.gov/groundwater/sgm/gsp.cfm

MCWD PUBLIC MEETINGS DURING GSP DEVELOPMENT

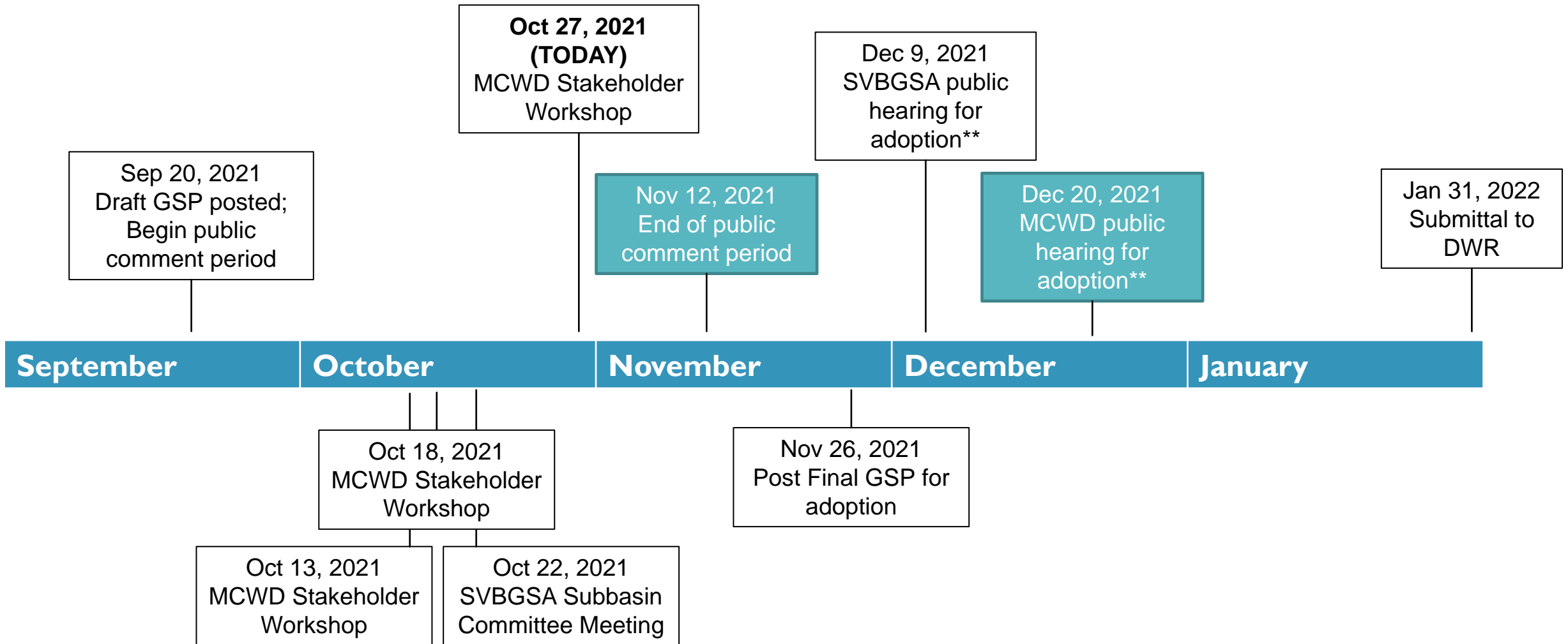
Five MCWD Stakeholder Workshops

- August 25, 2020 (Chapt. 1-4)
- November 17, 2020 (Chapt. 5)
- March 11, 2021 (Chapt 7 & 8)
- October 13, 2021 (Chapt. 6, 9, 10)
- October 27, 2021 (today)

Six MCWD Board Meeting Updates

- March 19, 2018
- April 16, 2018
- May 20, 2019
- February 16, 2021
- August 16, 2021
- October 18, 2021

GSP PUBLIC REVIEW AND ADOPTION SCHEDULE



** SVBGSA Subbasin Committee & Advisory Committee meetings to consider the final GSP will be held between Nov 29 and Dec 3, 2021.
 ** May be continued during January board meetings if necessary.

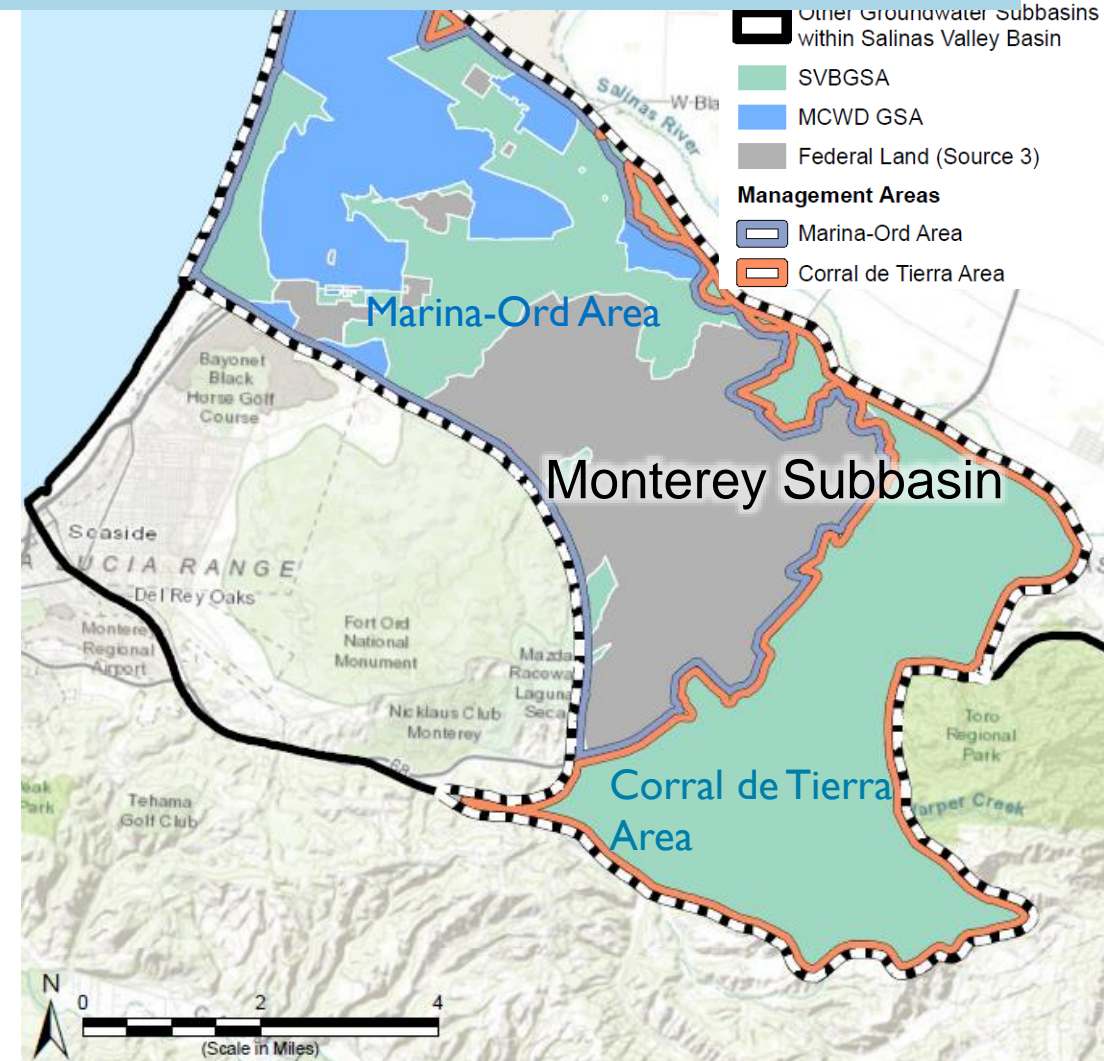
COMMENTS / QUESTIONS?



OVERVIEW OF GSP CHAPTERS 1-10

CHAPTER 1: INTRODUCTION AND AGENCY INFORMATION

- Provides an overview of the plan
- Describes administrative information and legal authority of the plan preparation GSAs
 - One GSP covering the entire basin has been developed and subject for adoption by SVBGSA and MCWD GSA (MCWD)
- GSP development subdivided by Management Area:
 - MCWD: Marina-Ord Area
 - SVBGSA: Corral de Tierra Area








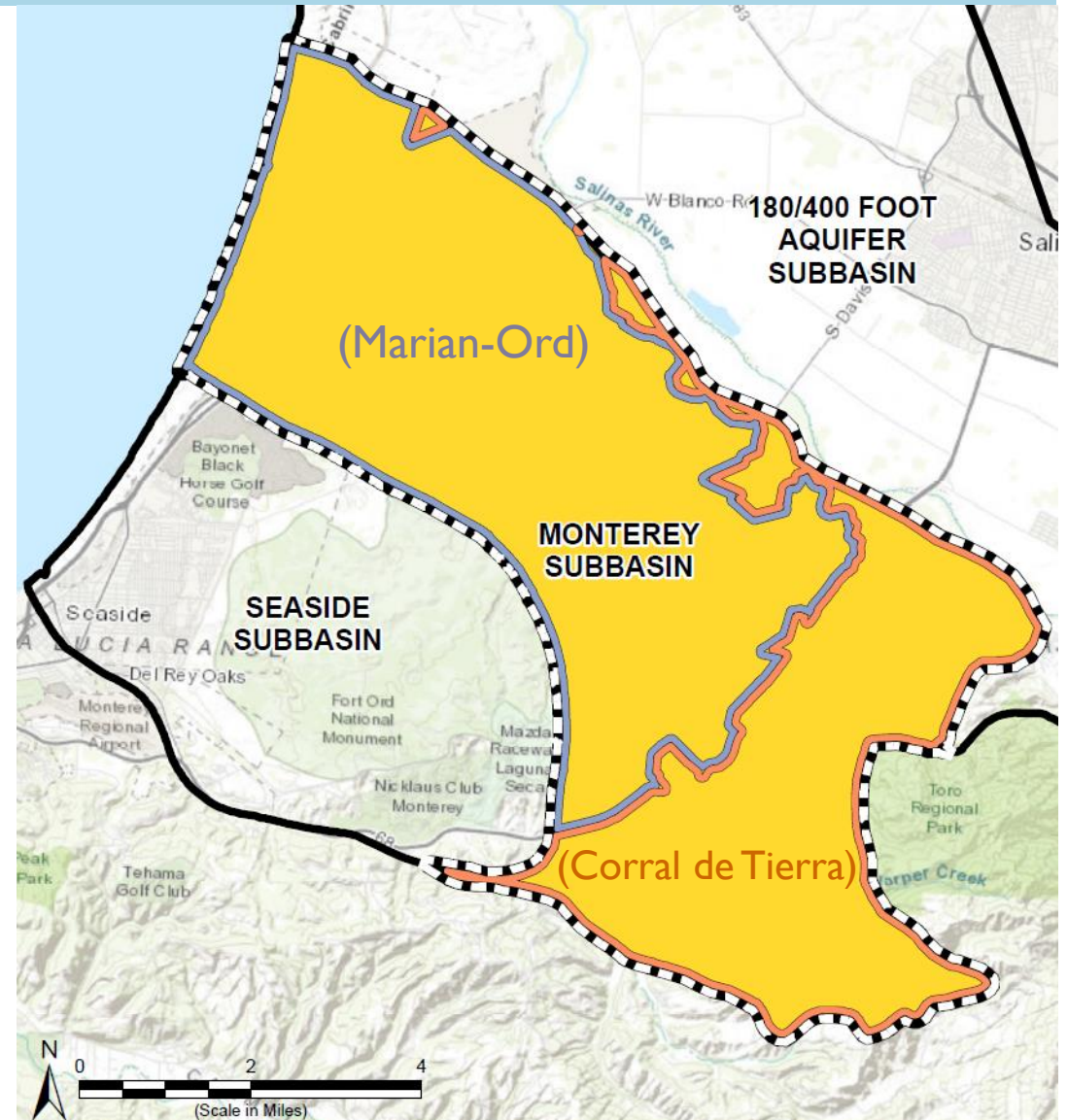
CHAPTER 2: PLAN AREA

- Describes area covered by GSP including a summary of jurisdictional areas
- Describes existing water resources management programs and land use elements
- Identifies Management Areas and Neighboring Subbasins

“Each Plan shall include a description of covered”

Legend





-  Monterey Subbasin
-  Other Groundwater Subbasins within Salinas Valley Basin
-  Plan Area
- Management Areas**
-  Marina-Ord
-  Corral de Tierra

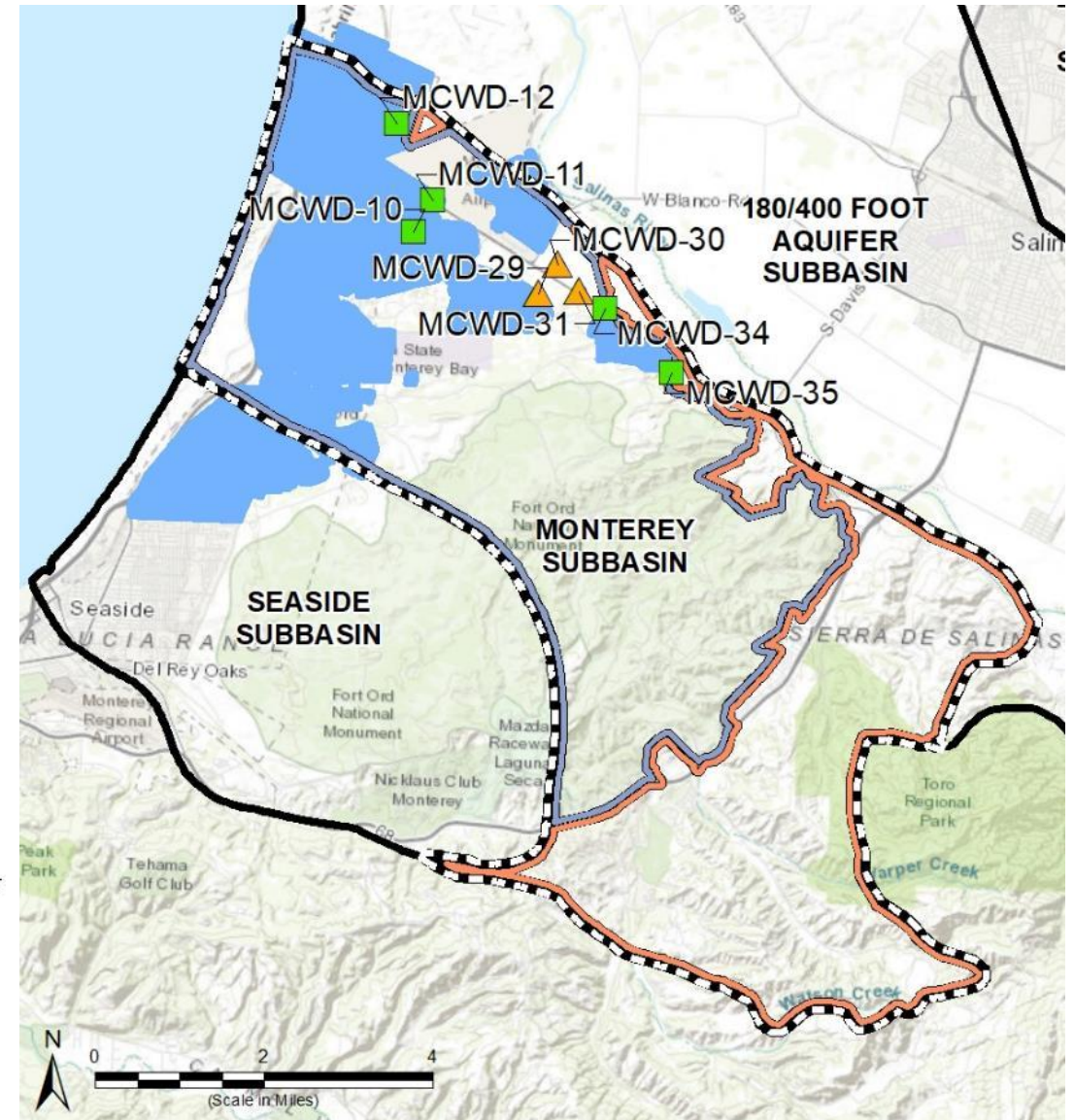


MCWD IS THE ONLY WATER SUPPLIER IN MARINA-ORD AREA

- MCWD Serves 3,200 to 4,200 acre-feet per year to its customers
- Groundwater is the sole source of water supply

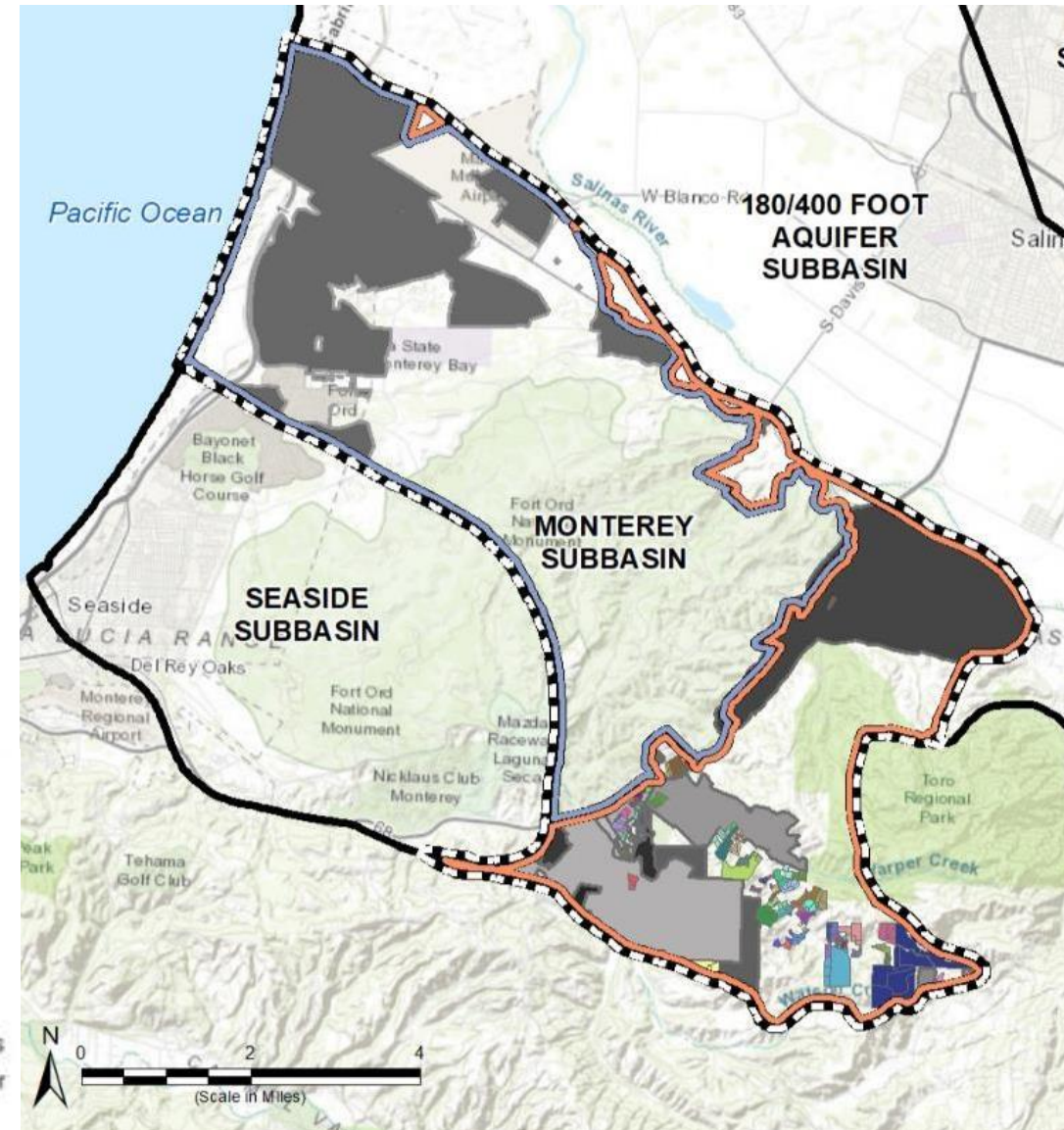
Legend

-  Monterey Subbasin
 -  Other Groundwater Subbasins within Salinas Valley Basin
 -  MCWD Service Area
 -  Lower 180-Foot, 400-Foot Aquifer Production Wells
 -  Deep Aquifer Production Wells
- ### Management
-  Marina-Ord
 -  Corral de Tierra



CORRAL DE TIERRA AREA WATER USERS

- Total groundwater use is approximately 2,500 AFY (Wallace Group, 2020)
 - Five large drinking water systems (200+ connections)
 - 17 small drinking water systems (15-199 connections)
 - 66 small state and local water systems (2-14 connections)
- Domestic wells
- Golf course
- 2 parks
- 110 acres of agriculture

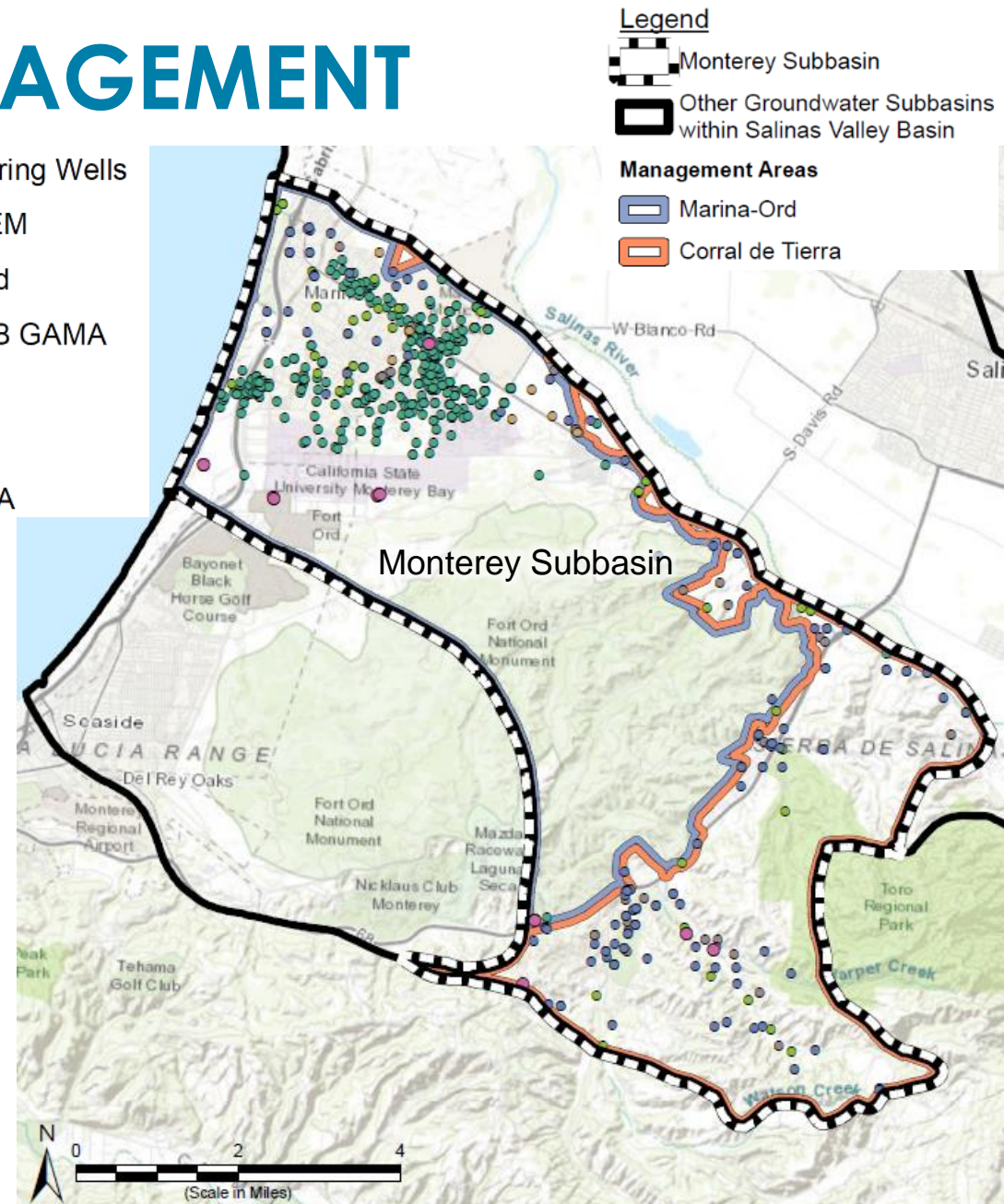


DATA GATHERING AND MANAGEMENT

- Gathered data from local management and monitoring entities
 - MCWRA & MPWMD / Seaside Basin Watermaster
 - Fort Ord (U.S.Army Corps of Engineers)
 - MCWD
- Include extensive data from Fort Ord
 - >700 wells with water level & water quality records
- Exchanged data between SVBGSA and MCWD
- Constructed Data Management System
 - >100,000 water level & water quality records from >1,000 wells
 - Lithology & well construction from >2,000 wells
 - MCWD production well data (20 years)
 - Airborne Electromagnetic Surveys (2017-2019)
 - Numerous publicly available field studies, water level/quality data, hydrogeologic investigations, etc.

Public Monitoring Wells

- CASGEM
- Fort Ord
- SWRCB GAMA
- USGS
- MCWD
- MCWRA



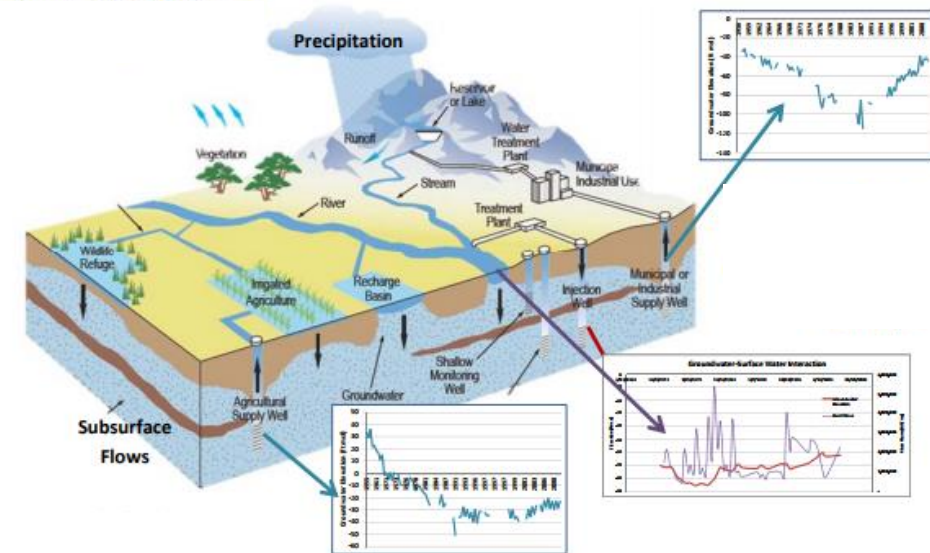
CHAPTER 3 – STAKEHOLDER ENGAGEMENT AND COMMUNICATIONS

- Describes the GSAs' decision-making processes and public engagement strategies
- Describes the beneficial uses and users of groundwater in the subbasin
- Documents stakeholder communication conducted by the GSAs including public meetings held and comments received



CHAPTER 4 – HYDROGEOLOGIC CONCEPTUAL MODEL

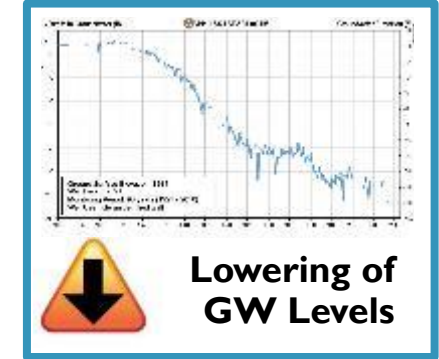
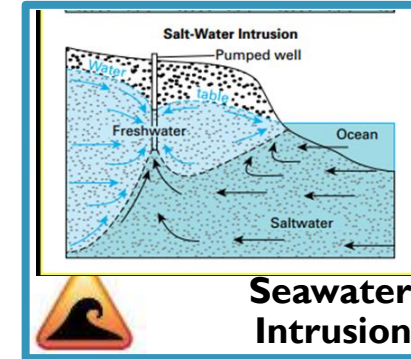
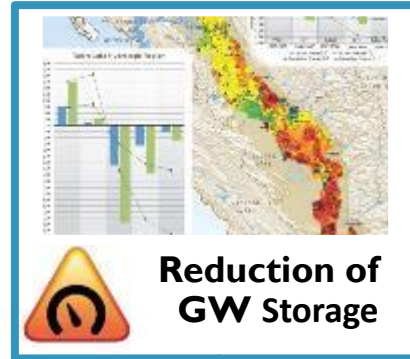
- Defines the geology and hydrology of the Basin, including the definition of the “Principal Aquifer”
- Includes graphical information (maps and cross-sections)



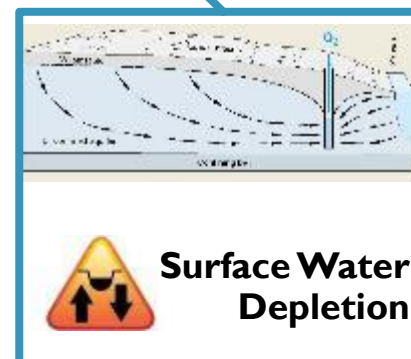
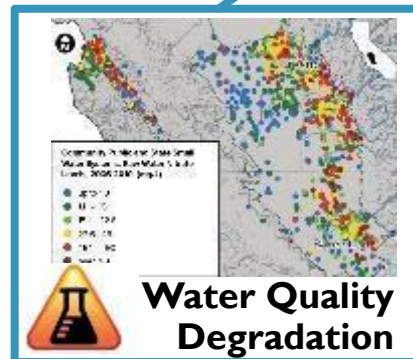
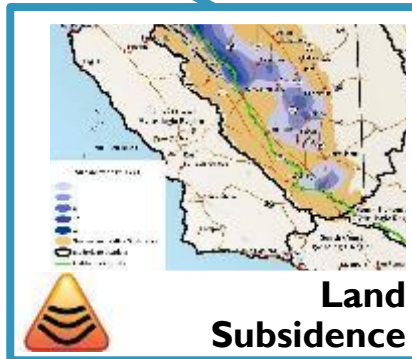
PRINCIPAL AQUIFERS AND AQUITARDS

Principal Aquifers and Aquitards	
Marina-Ord Area	Corral de Tierra Area
Dune Sand Aquifer	--
Salinas Valley Aquitard	
180-Foot Aquifer	
Middle Aquitard	
400-Foot Aquifer	El Toro Primary Aquifer
Deep Aquitard	
Deep Aquifers	

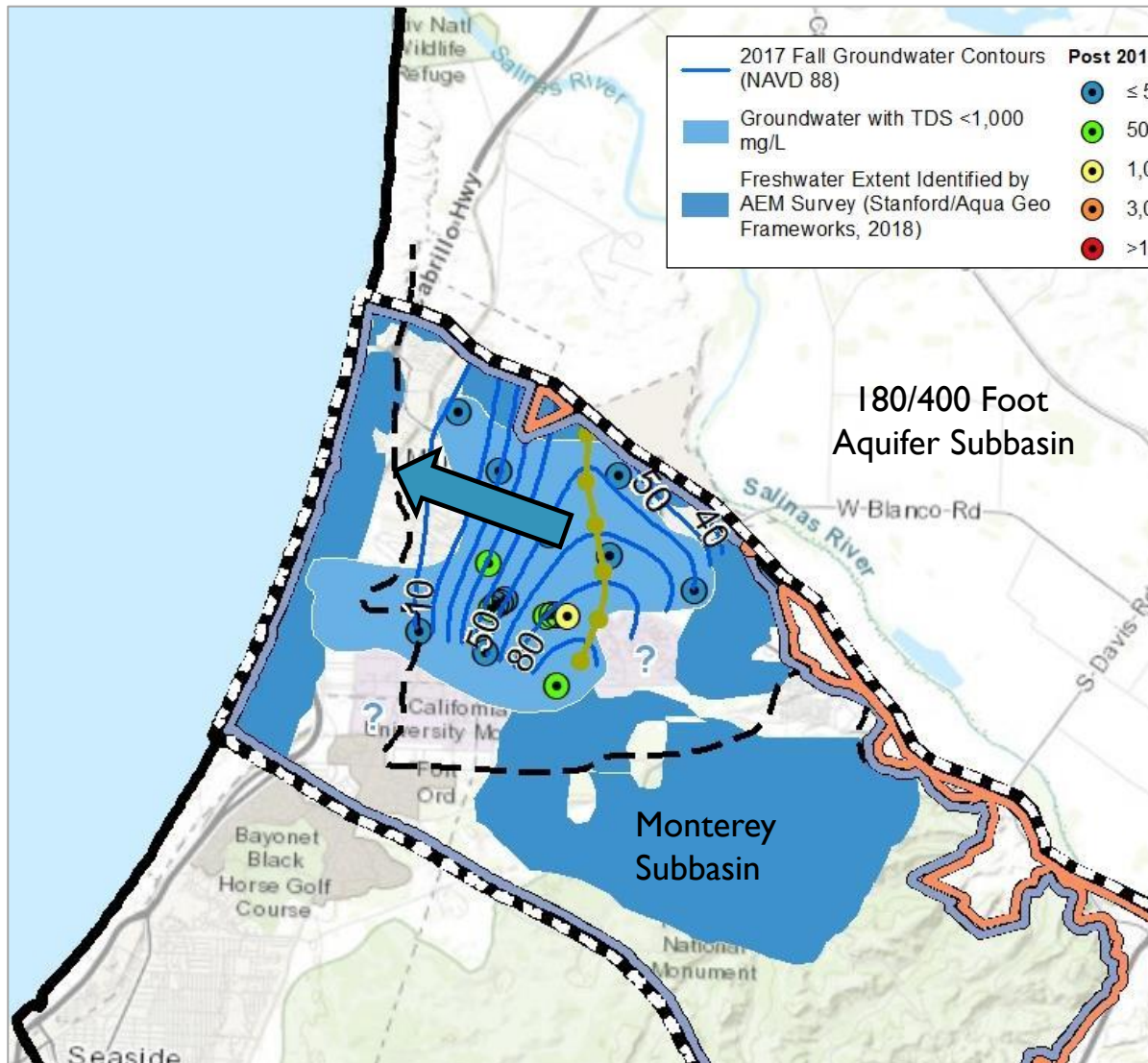
CHAPTER 5 – GROUNDWATER CONDITIONS



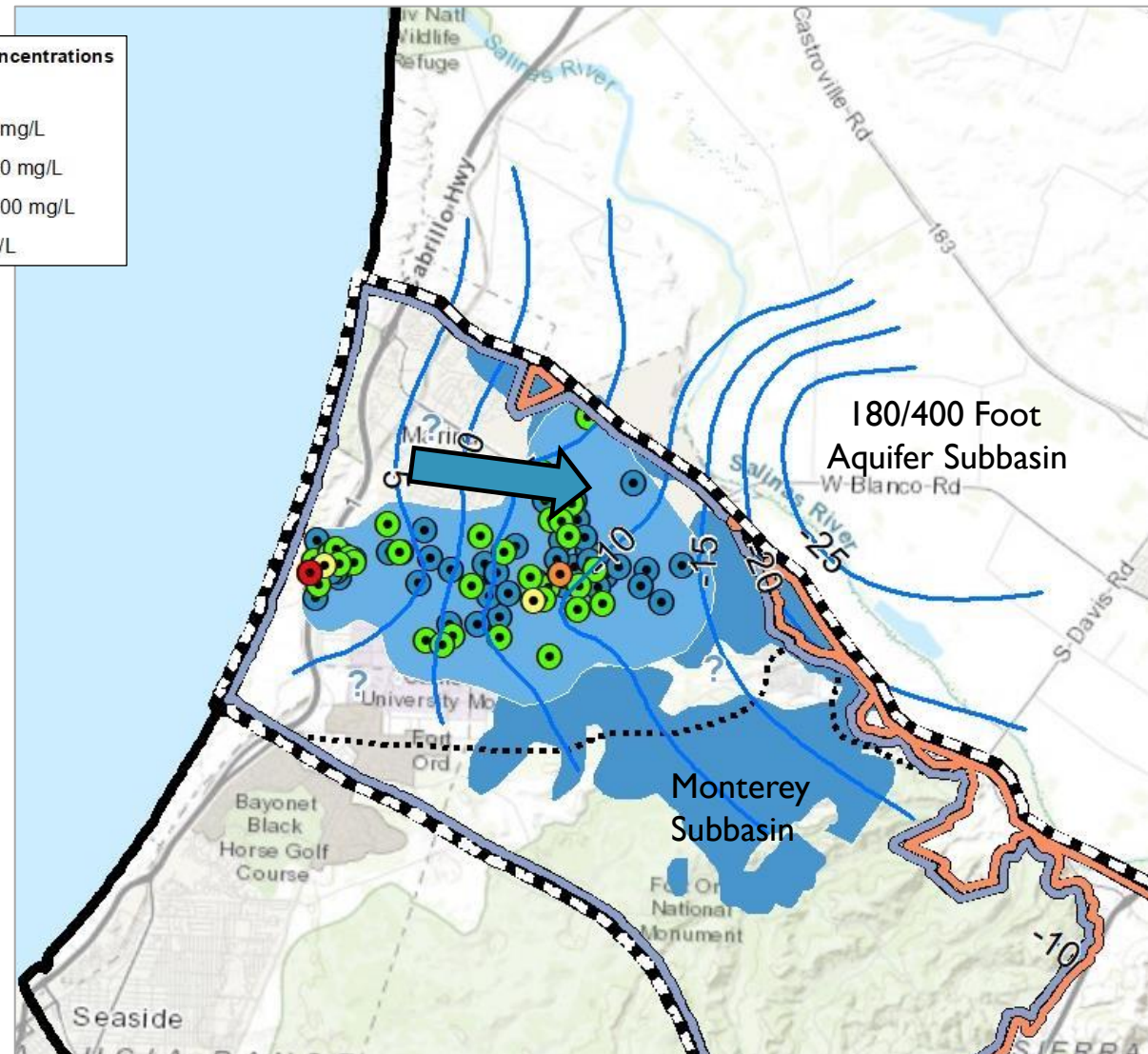
Primary Issues in Monterey Subbasin



GROUNDWATER ELEVATIONS/SEAWATER INTRUSION (MARINA-ORD AREA)

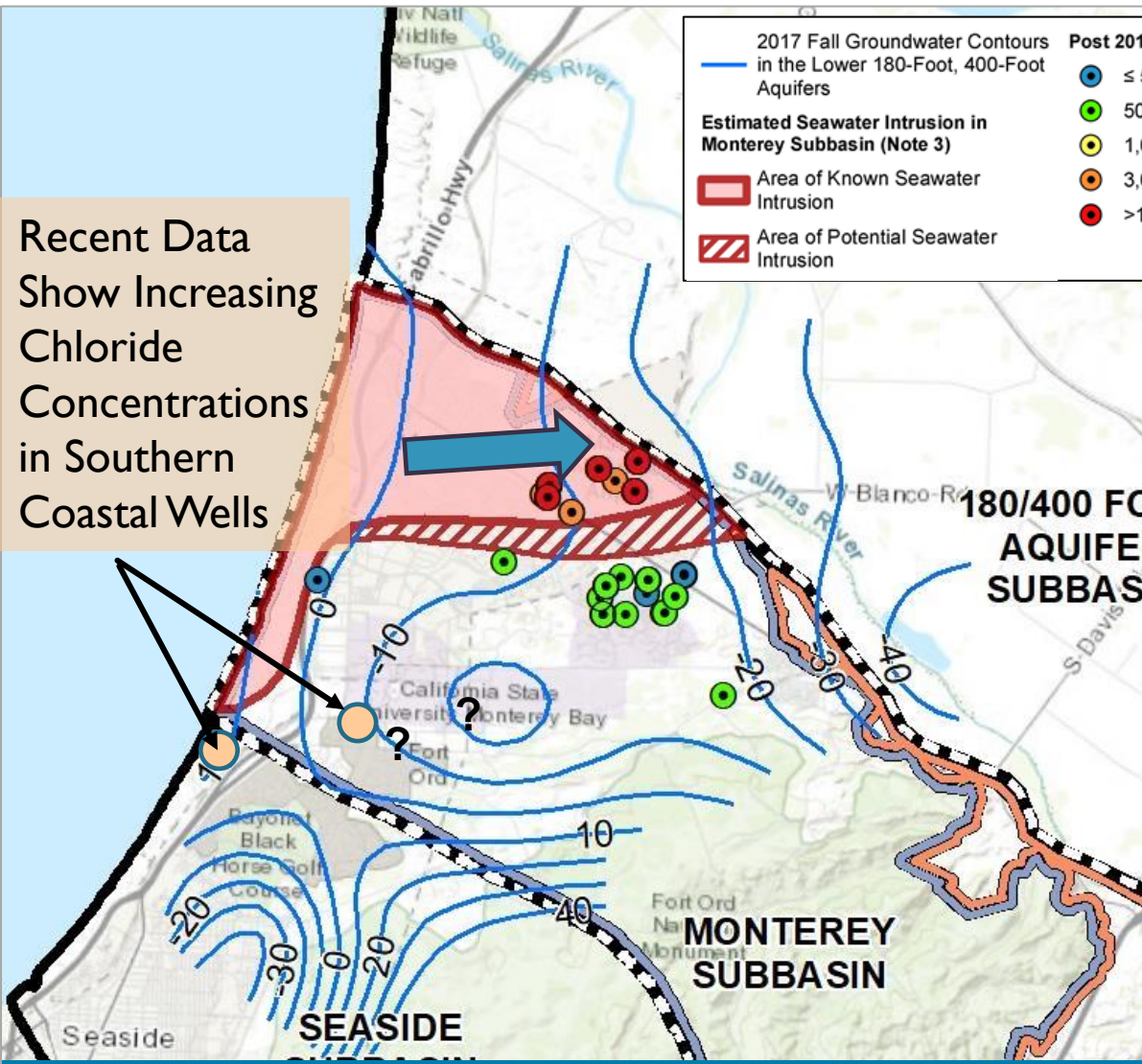


Dune Sand Aquifer

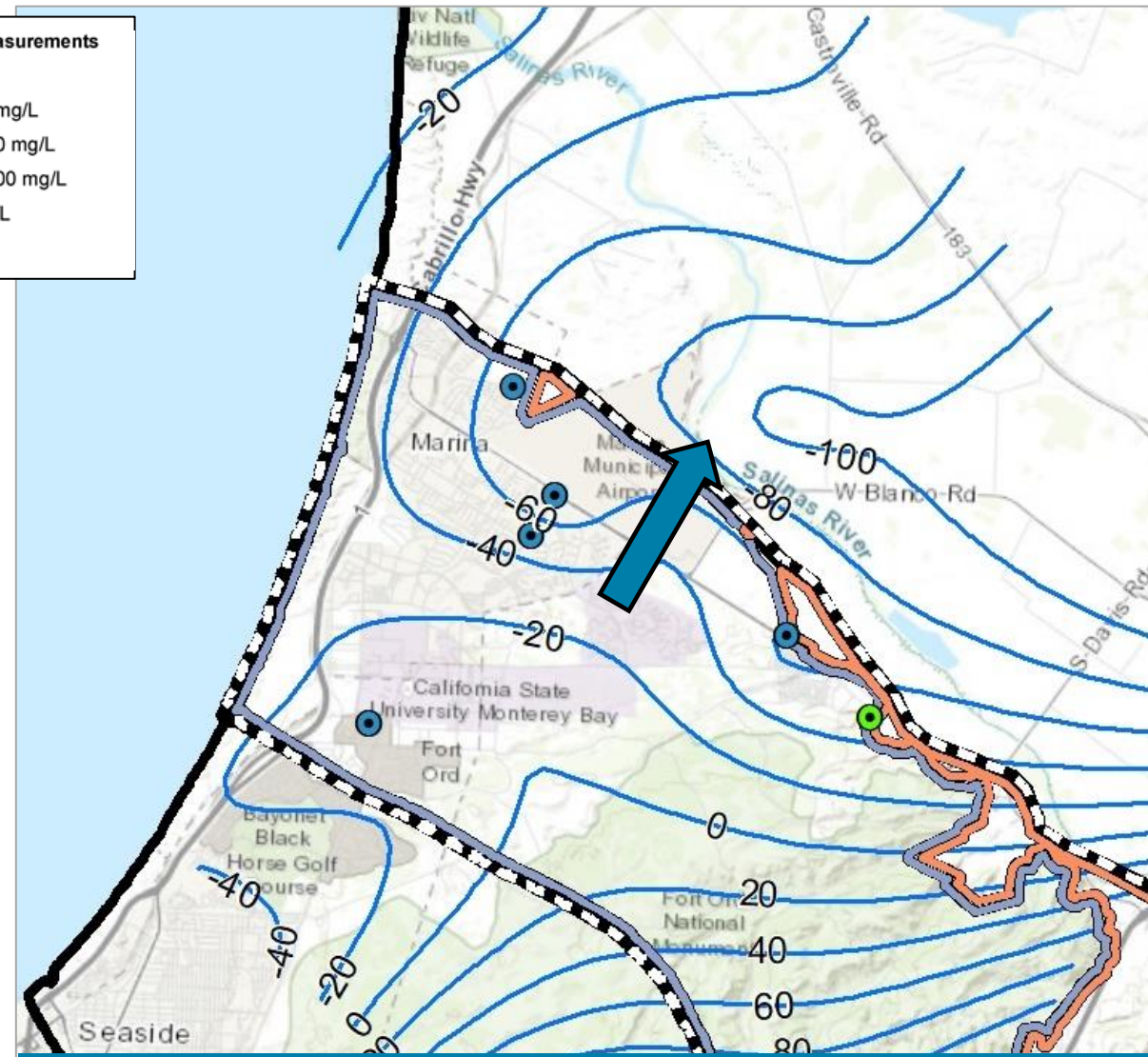


Upper 180-Foot Aquifer

GROUNDWATER ELEVATIONS/SEAWATER INTRUSION (MARINA ORD AREA)



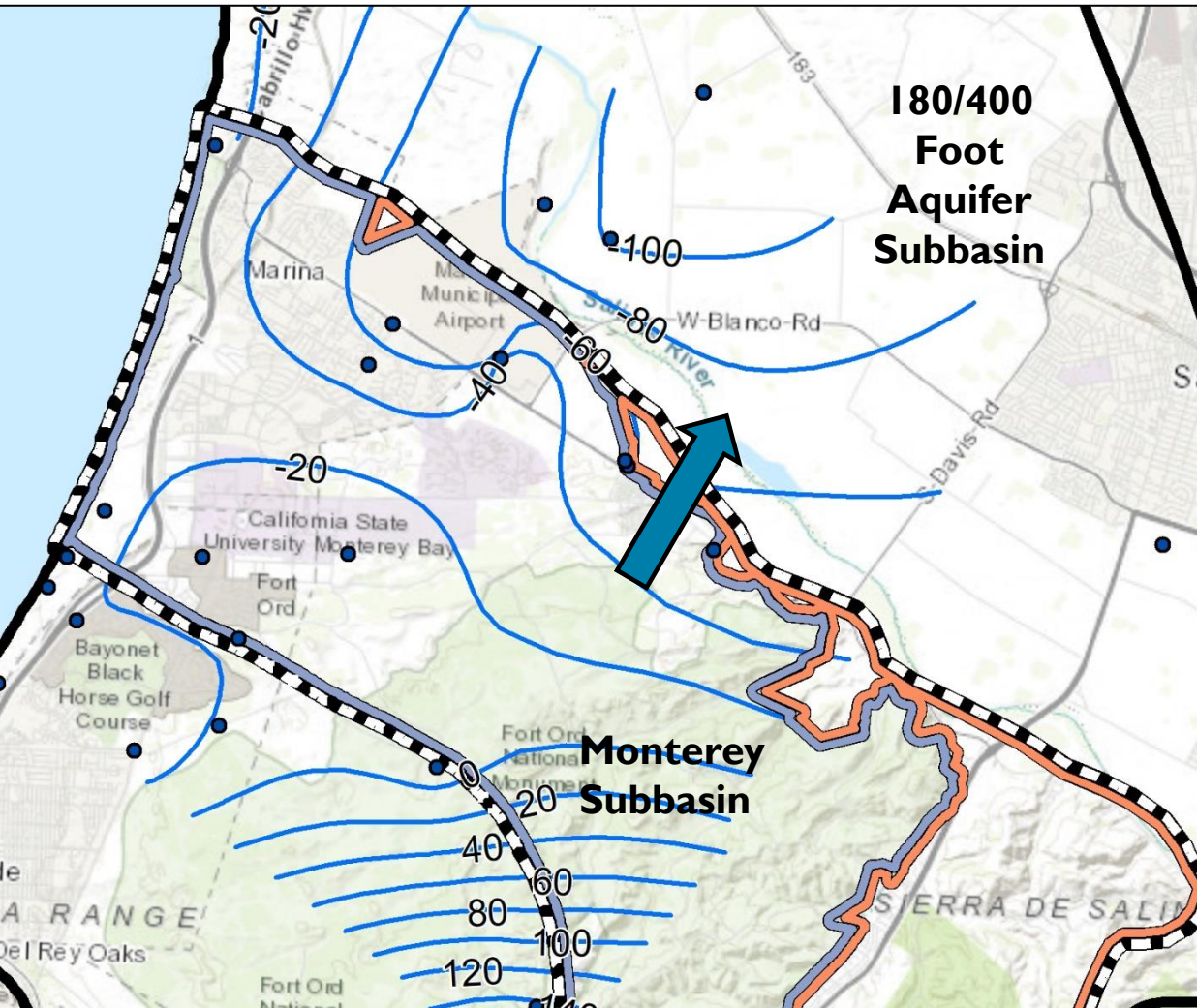
400-Foot Aquifer



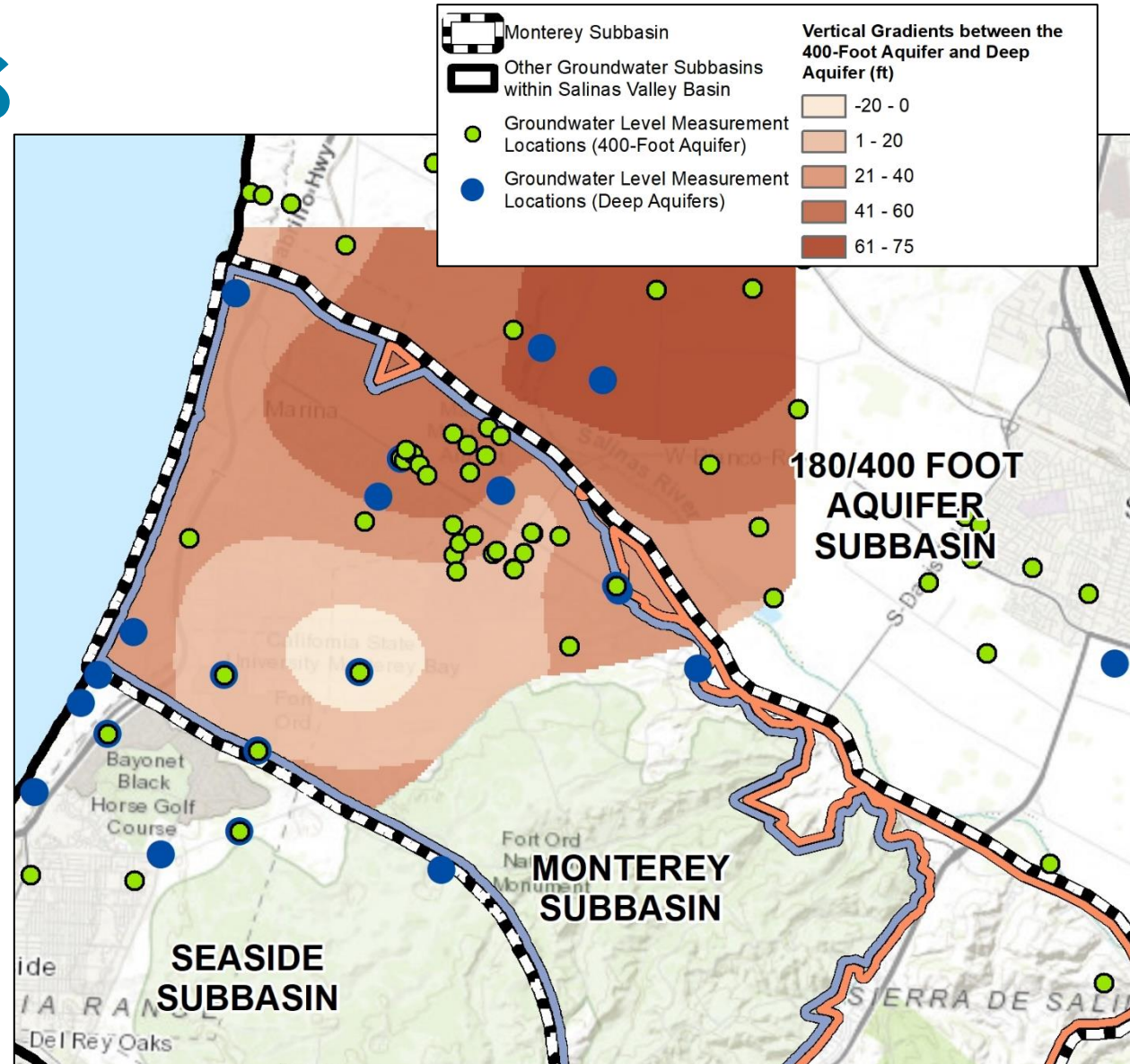
Deep Aquifer

Recent Data Show Increasing Chloride Concentrations in Southern Coastal Wells

DEEP AQUIFER GRADIENTS

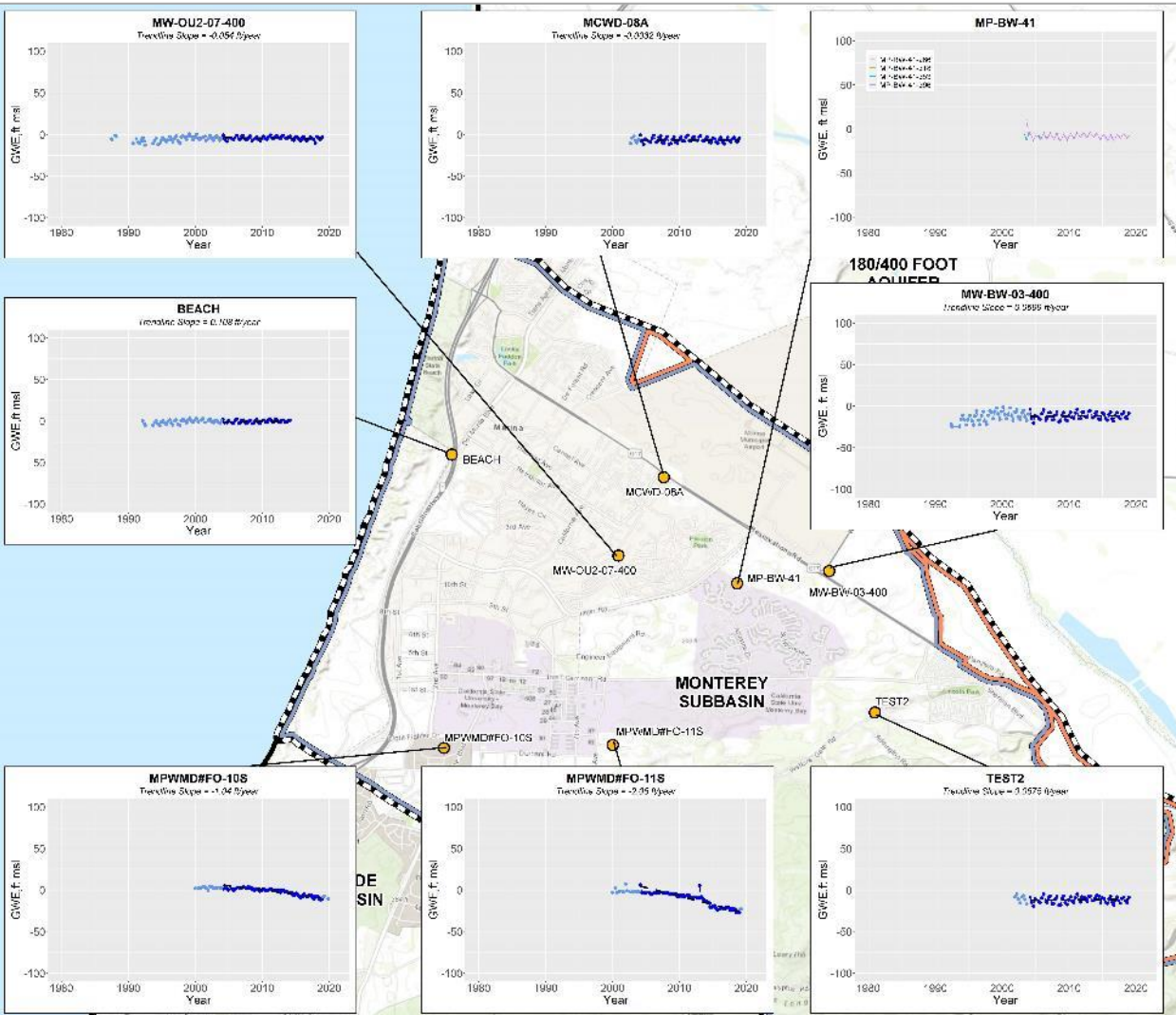


**Lateral Groundwater Gradients
Deep Aquifer**

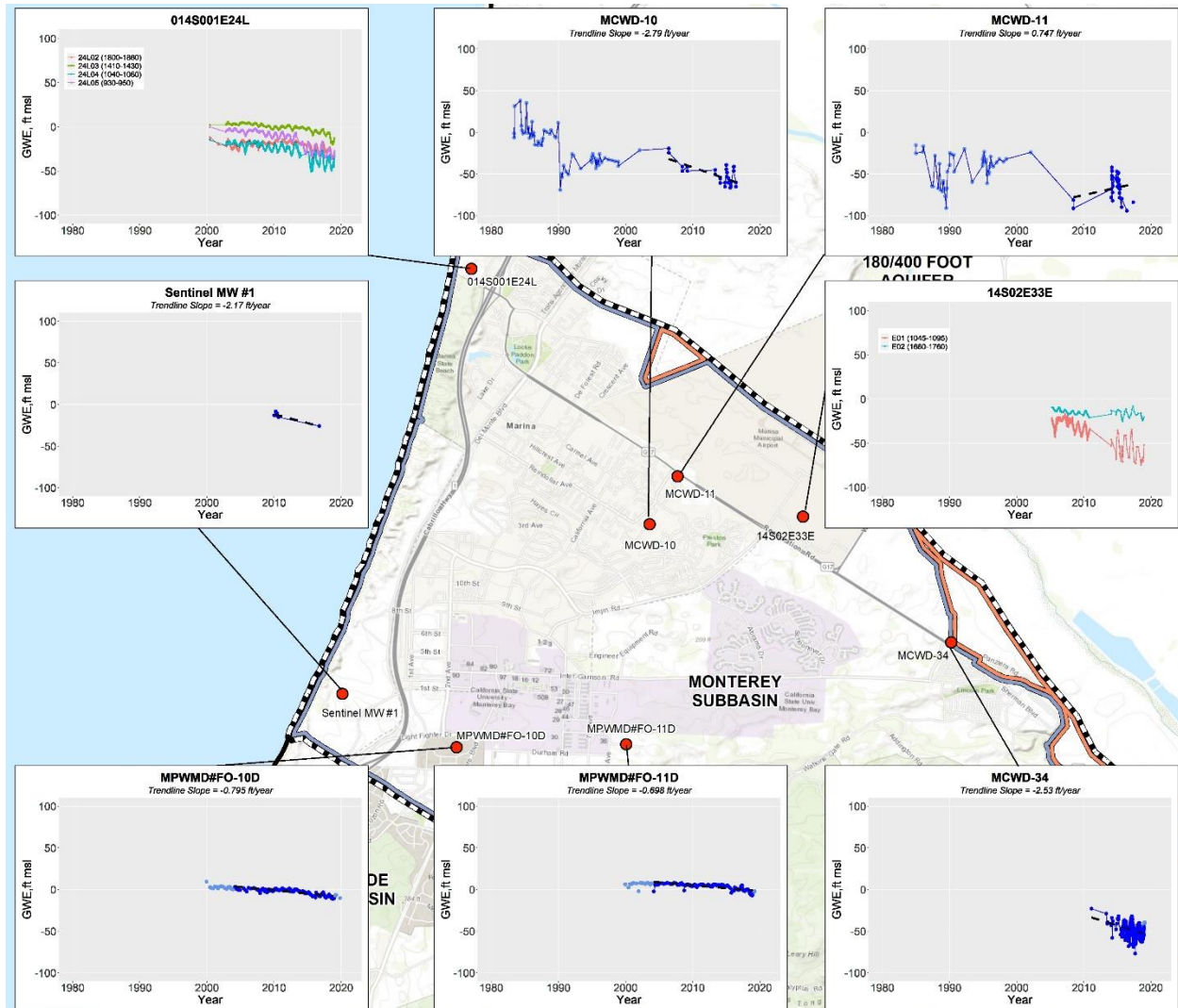


**Vertical Gradients Between
400-Foot and Deep Aquifers**

GROUNDWATER ELEVATION TRENDS



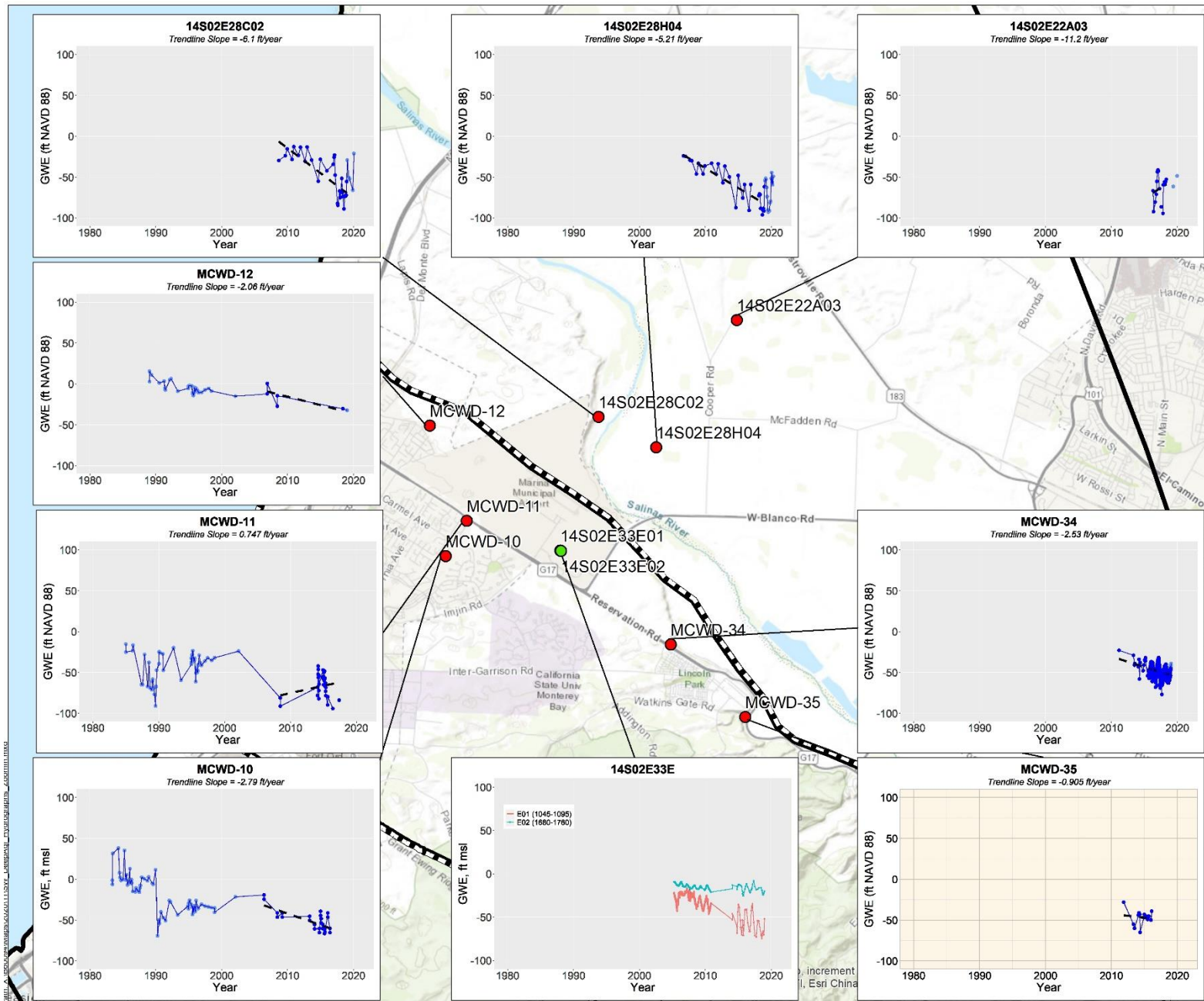
400-Foot Aquifer



Deep Aquifer

DEEP AQUIFER GROUNDWATER ELEVATION TRENDS

MONTEREY SUBBASIN AND 180/400 FOOT AQUIFER SUBBASIN



DEEP AQUIFER PRODUCTION INCREASING SINCE 2008

MCWRA-MCWD 1996 ANNEXATION AGREEMENT¹

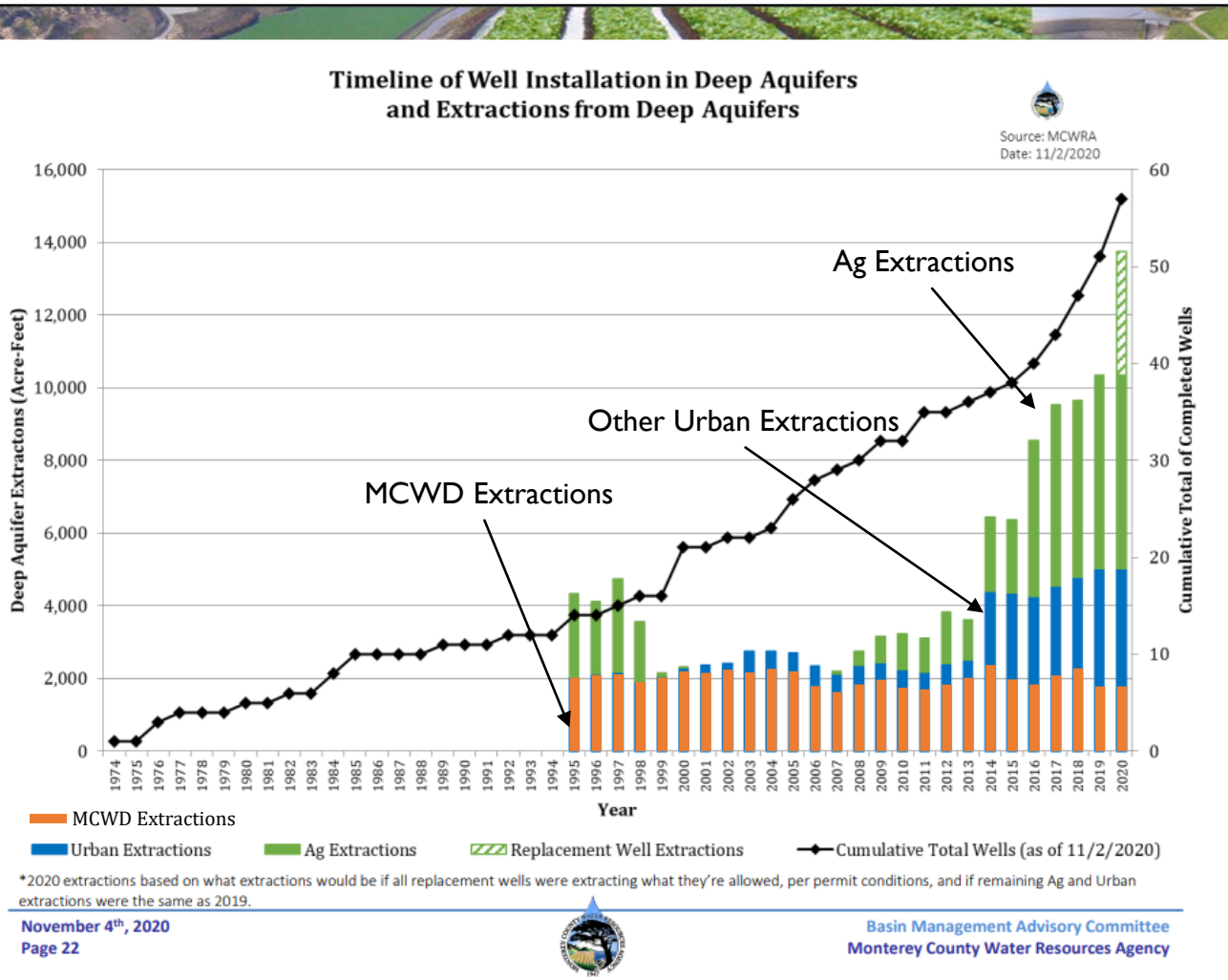
Section 5.3 Management of the 900-Foot Aquifer

“The Parties agree that the ‘900-foot’ 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.”

Section 5.9 Annexation Fee

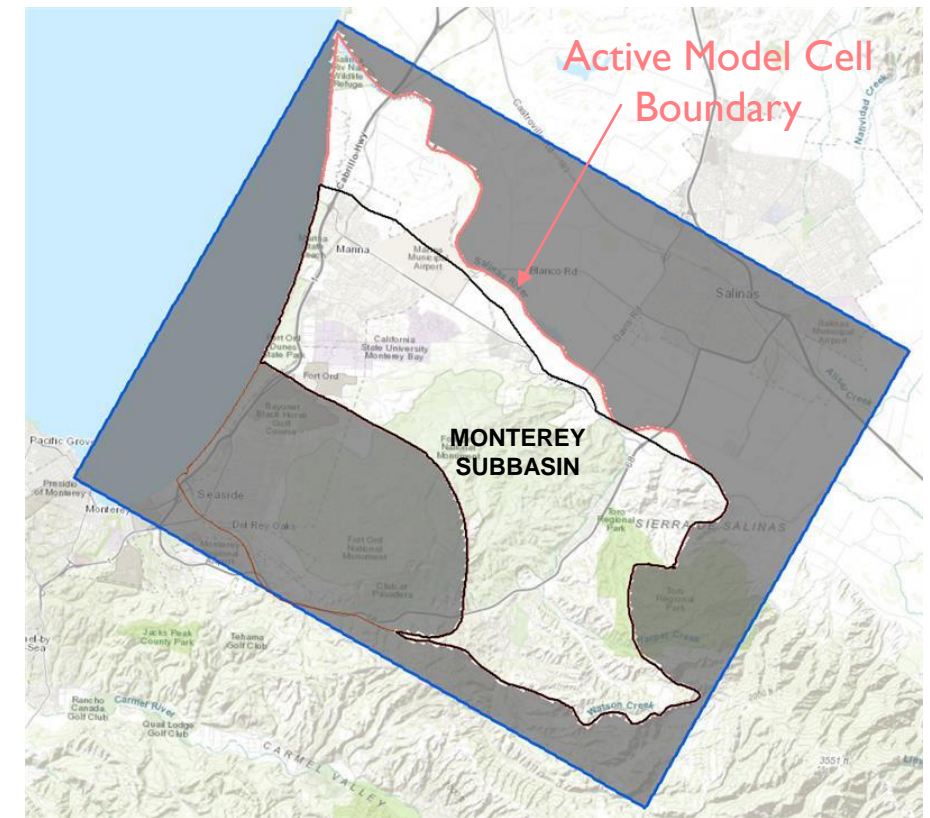
Annexation fees paid by MCWD “shall also be used for management protection of the ‘900-ft’ aquifer.”

1. MCWRA; MCWD, 1996. Annexation Agreement and Groundwater Mitigation Framework for Marina Area Lands.



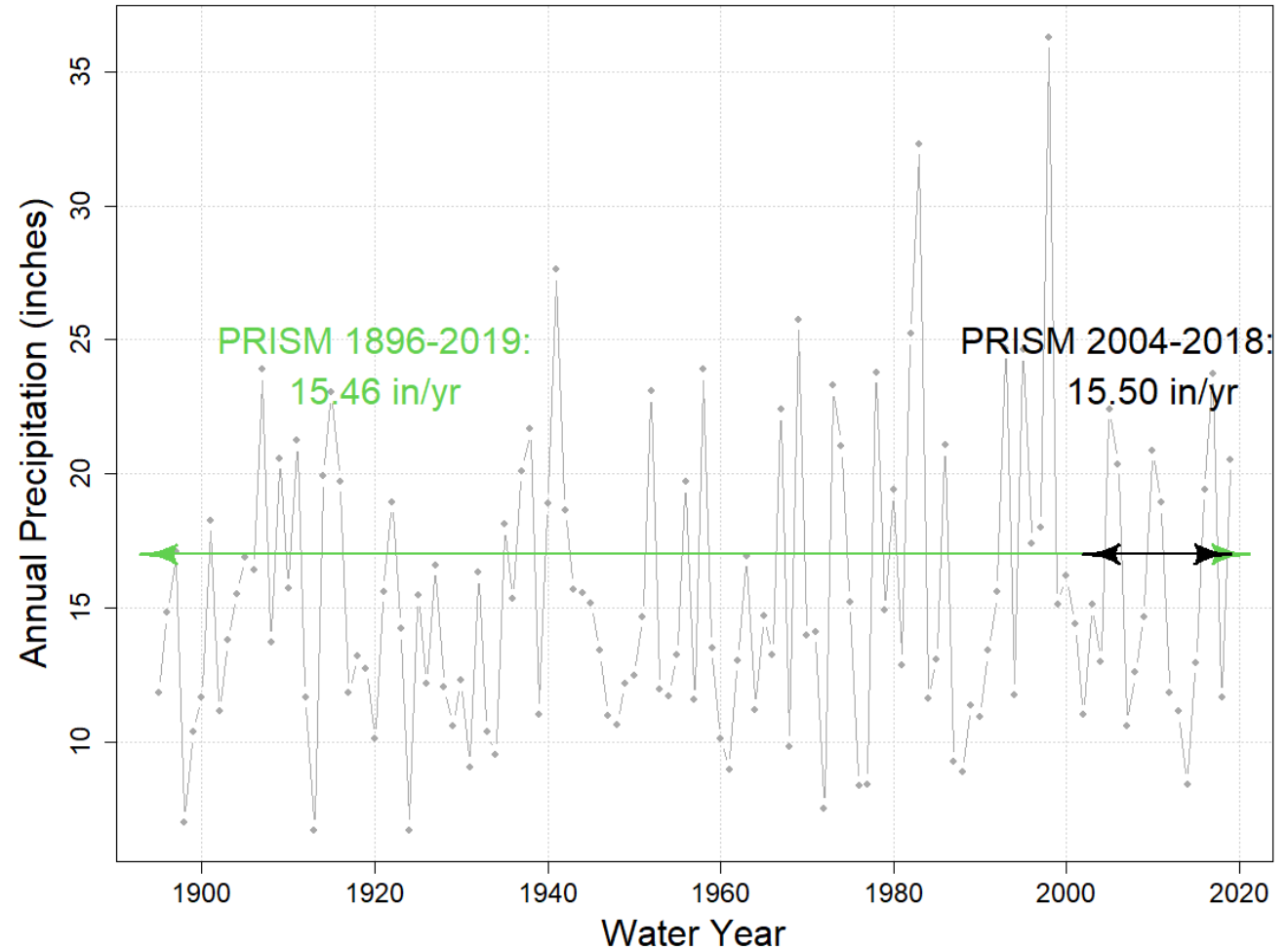
CHAPTER 6 – WATER BUDGET

- Water budget results in the Monterey Subbasin are based on the Monterey Subbasin Groundwater Model
 - Prepared by MCWD in coordination with SVBGSA
 - Incorporates observed boundary conditions with the adjoining Seaside and I80/400-Foot Aquifer Subbasins
- Monterey Subbasin model is anticipated to eventually be coordinated with SVHIM and/or other SGMA regional model(s)
- SVIHM was not calibrated within the Monterey Subbasin and therefore could not be used for this subbasin



SGMA WATER BUDGET ANALYSIS REQUIREMENTS

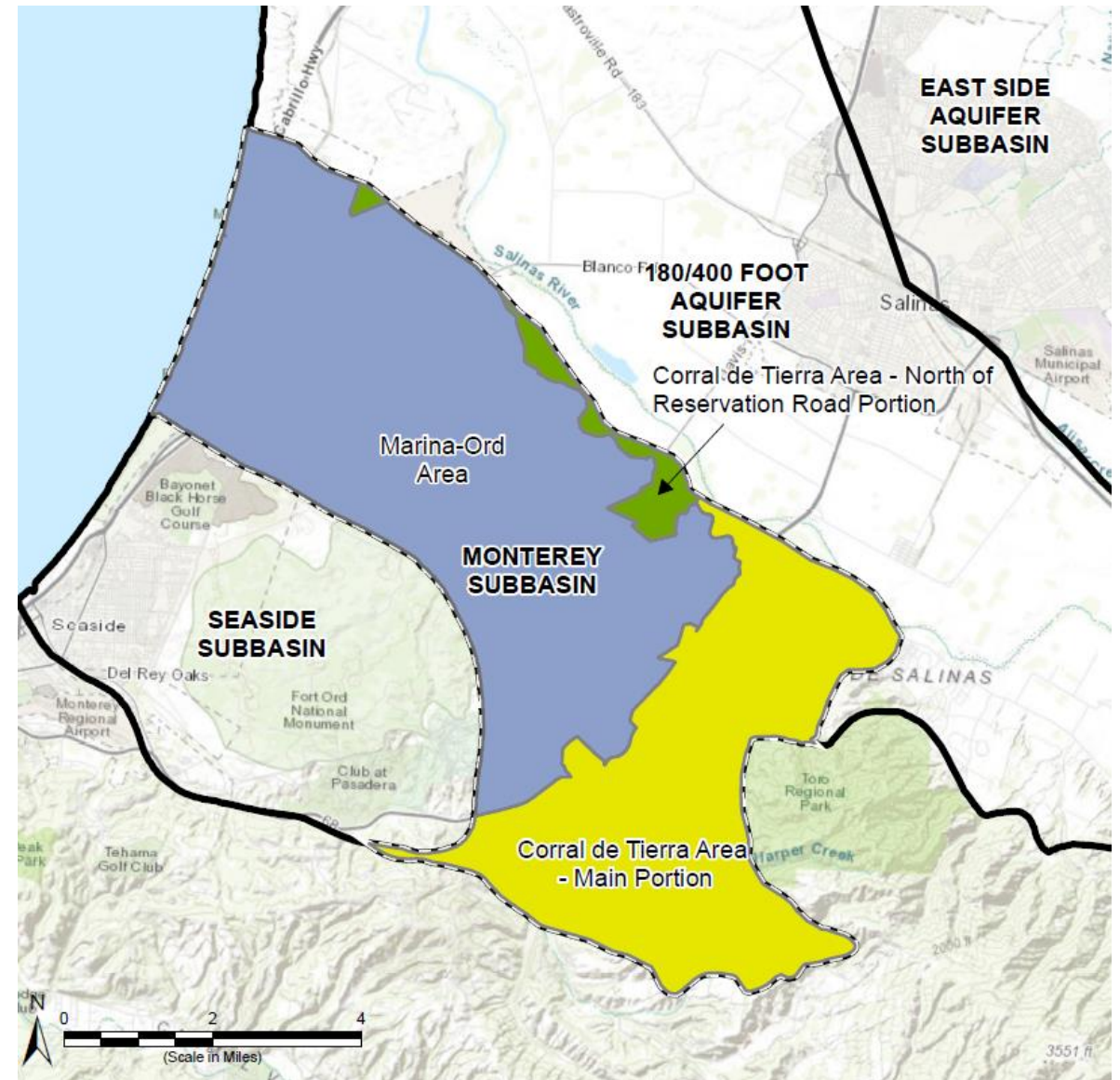
- Historical water budget
 - Water Years 2004 through 2018 (Oct 2003 to Sep 2018)
 - Average precipitation aligns with long-term record during WY 1986 through 2019
- Projected water budget (simulated 50-year period)
 - (WY 2019 through 2068)



WATER BUDGET ZONES (WBZ)

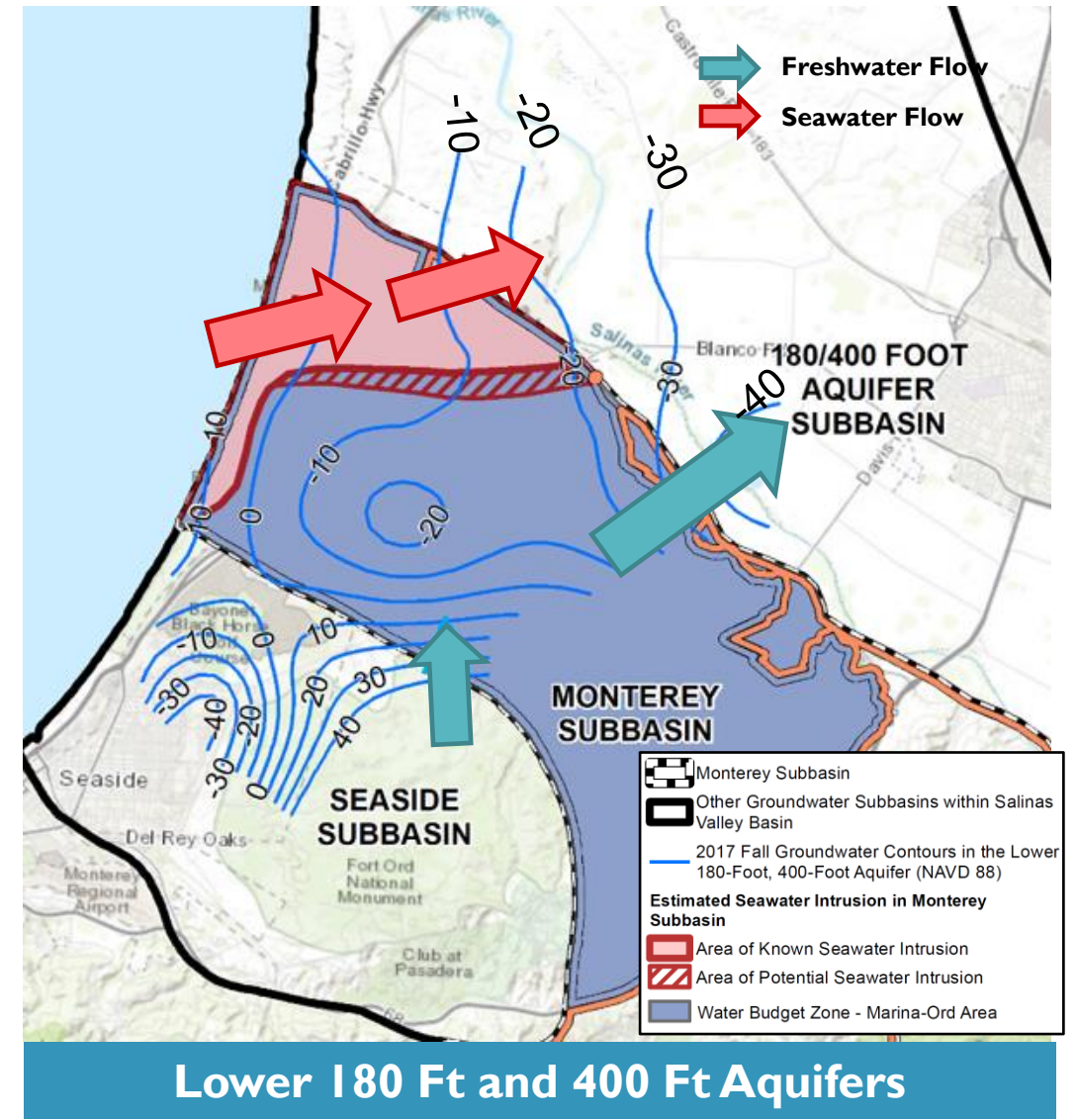
1. Marina Ord Area (WBZ)
 - Marina-Ord Area, plus
 - Reservation Road portion of the Corral de Tierra Area
2. Corral de Tierra Area (WBZ)
 - Remainder of the Corral de Tierra Area

Note: The Reservation Road portion is a “flow-through” between the Marina-Ord Area and the 180/400-Foot Aquifer Subbasin. Has similar hydrostratigraphy as the Marina-Ord Area



HISTORICAL WATER BUDGET (2004-2018): MARINA-ORD AREA WBZ

Net Annual Groundwater Flows (AFY)	Net Inflows (+) Net Outflows (-)
Recharge	
● Rainfall, Irrigation, etc.	+6,144
Well Pumping	
● MCWD (180-Foot and 400-Foot Aquifers)	-1,797
● MCWD (Deep Aquifers)	-2,262
● Reservation Road Portion	-287
	<hr/>
	-4,346
Net Inter-Basin Flow (Presumed Freshwater)	
● Seaside Subbasin	+1,310
● 180/400 Foot Aquifer Subbasin	-5,761
● Outflow to Ocean	-524
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	-4,975
Net Inter-Basin Flow (Presumed Seawater)	
● 180/400 Foot Aquifer Subbasin	-2,872
● Ocean Inflow	+2,872
	<hr/>
	0
Net Intra-basin Flow	
● Corral de Tierra Area (Water Budget Zone)	+1,544
NET ANNUAL CHANGE IN GROUNDWATER STORAGE	-1,633



PROJECTED WATER BUDGET DEVELOPMENT

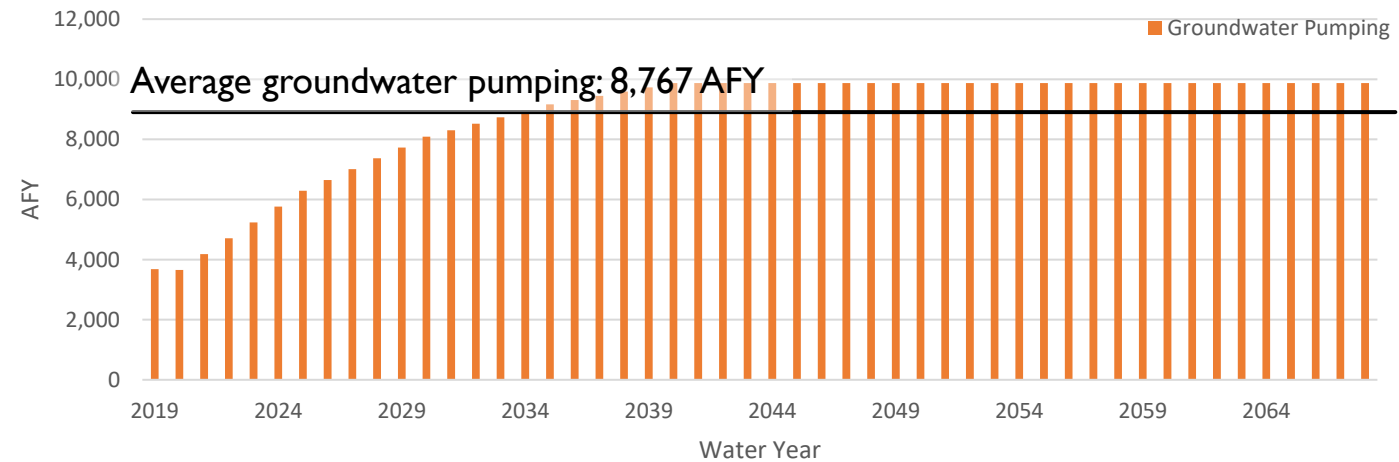
(WY 2019 THROUGH 2068)

- Projected water budget calculations consider
 - Climate change
 - Projected Future land use changes in Monterey Subbasin (through 2040)
 - Projected groundwater extraction in Monterey Subbasin (through 2040 per 2020 UWMP)
 - Several scenarios to simulate changes in boundary conditions as 180/400 Foot Aquifer subbasin and Seaside subbasin (as these basins reach sustainability)
- Results show:
 - Monterey Subbasin conditions are strongly dependent upon conditions in adjacent Subbasins
 - Future climate/recharge rates in Monterey Subbasin increase based on DWR Climate model

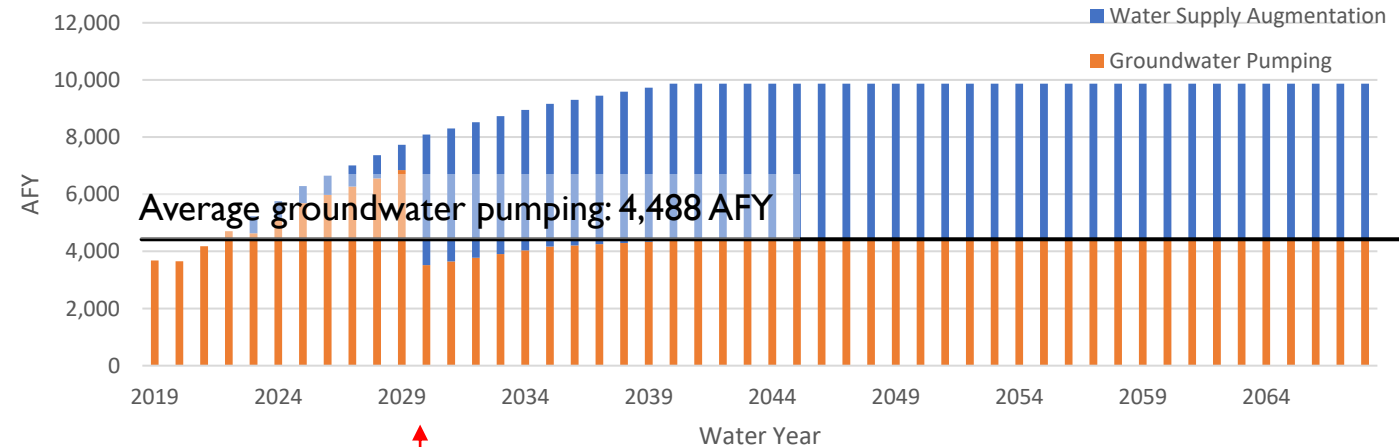
PROJECTED FUTURE GROUNDWATER DEMANDS

- MCWD future groundwater pumping based on 2020 UWMP projections
 - “No Projects” assumes 100% of projected future demands met by groundwater
 - “Water Augmentation Project” assumes future recycled water availability and/or other supply augmentation projects will offset a portion of the projected groundwater demands
- All other pumping, deliveries assumed constant based on WY 2018 data

"No Projects": Marina-Ord WBZ Projected Water Supply



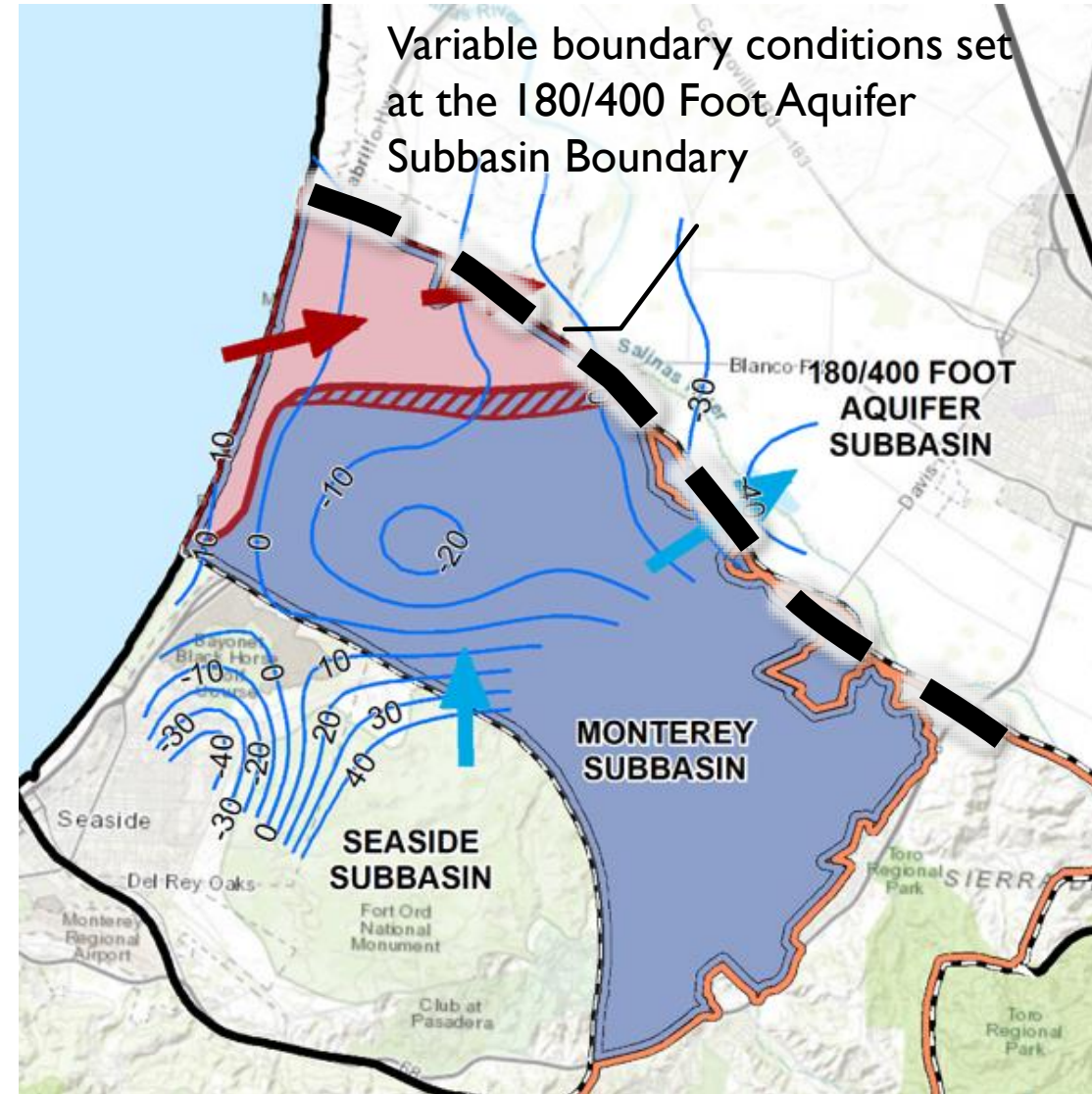
"Water Augmentation Project": Marina-Ord WBZ Projected Water Supply



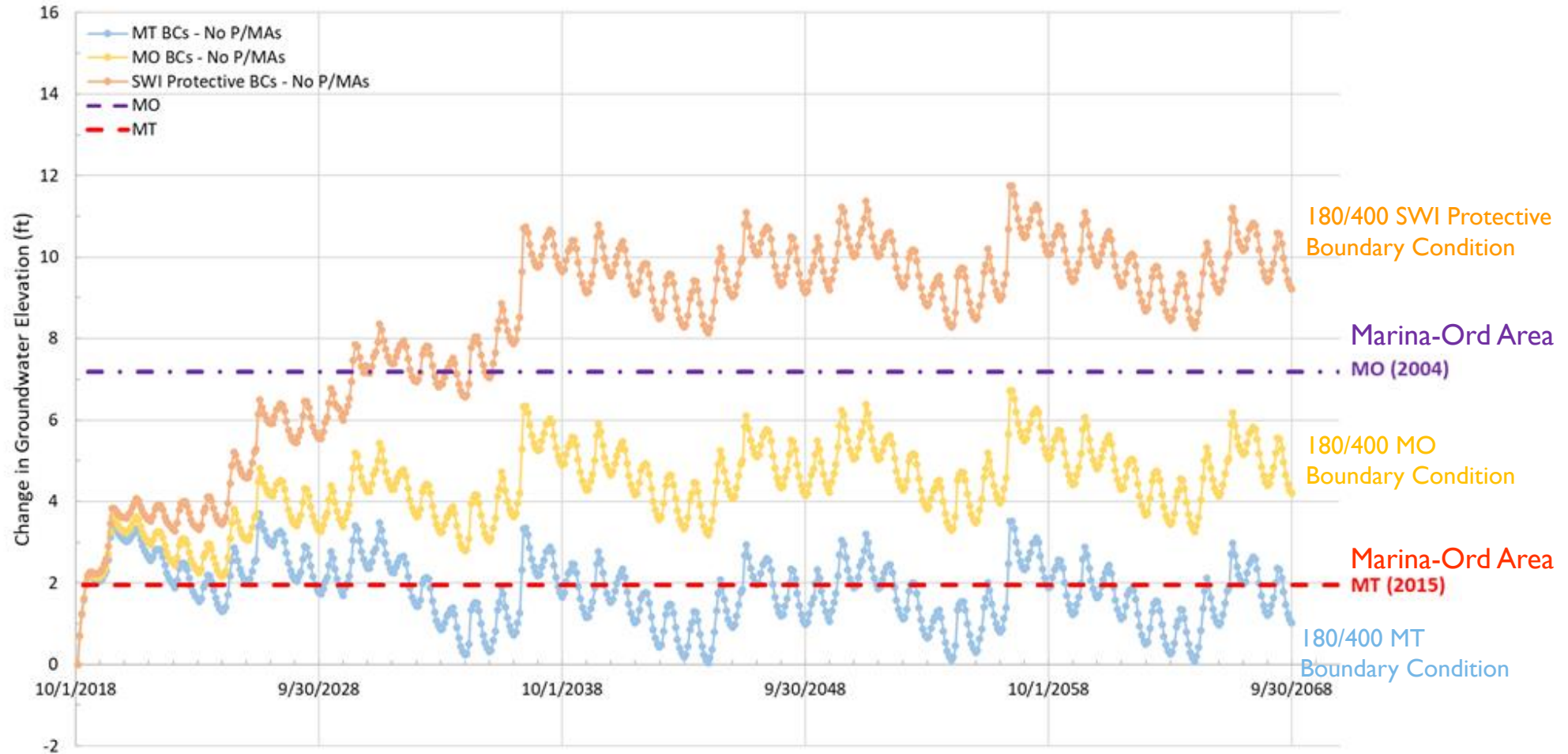
↑ assumes IPR (other supply augmentation) project will come online in 2030

“NO PROJECTS” PROJECTED WATER BUDGET: MARINA-ORD WBZ (VARIABLE BOUNDARY CONDITIONS IN 180/400 FOOT AQUIFER SUBBASIN)

Net Annual Groundwater Flows (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, Irrigation, etc.	+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
● Outflow to Ocean (Presumed Freshwater)	-524	-725	-752	-794
● Ocean Inflow (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	-1,633	-143	+133	+379

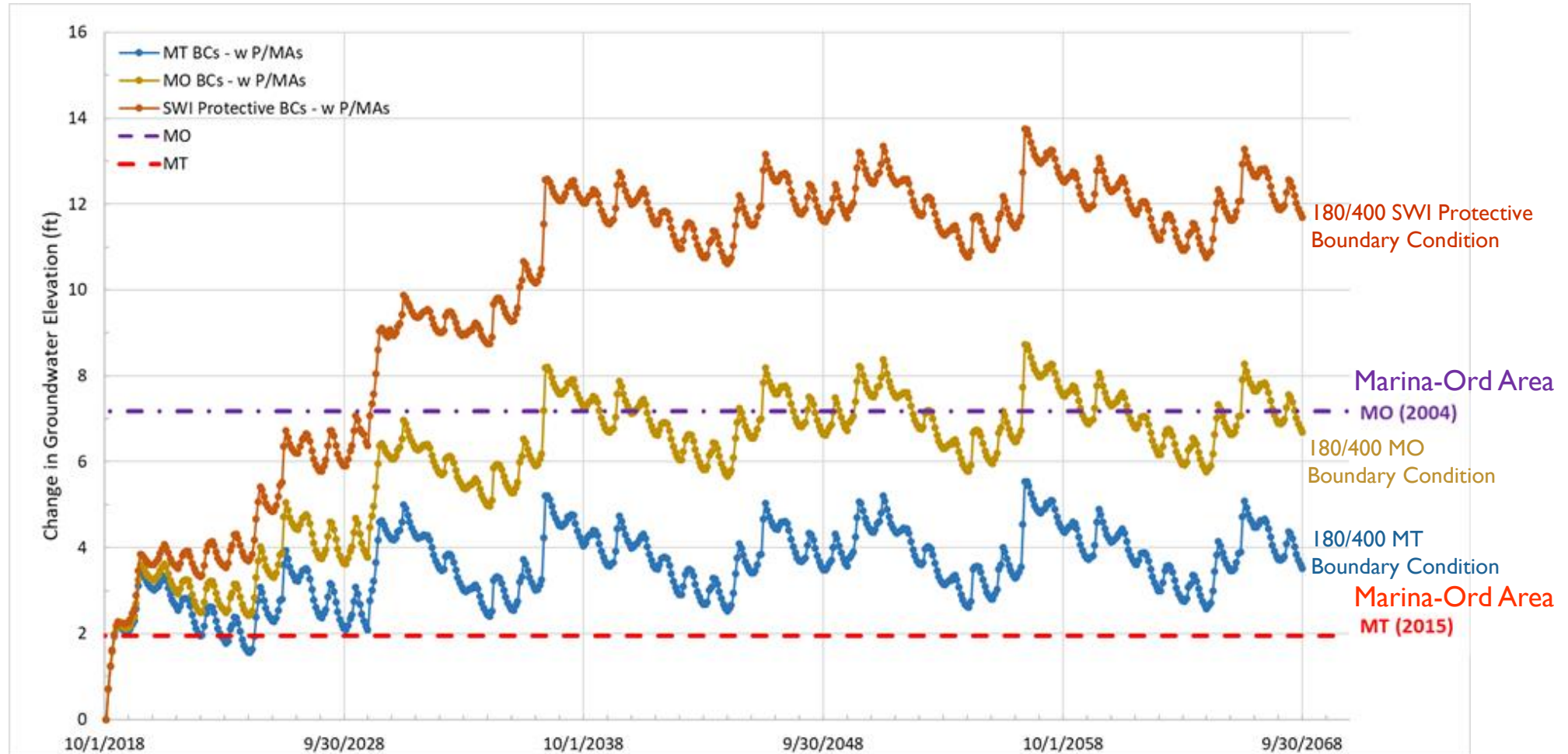


“NO PROJECT” PROJECTED WATER BUDGET: MARINA-ORD WBZ (VARIABLE BOUNDARY CONDITIONS IN 180/400 FOOT AQUIFER SUBBASIN)



Projected Change in Groundwater Levels in RMS Wells

“WATER AUGMENTATION PROJECT”: PROJECTED WATER BUDGET: MARINA-ORD AREA (VARIABLE BOUNDARY CONDITIONS IN 180/400 FOOT AQUIFER SUBBASIN)



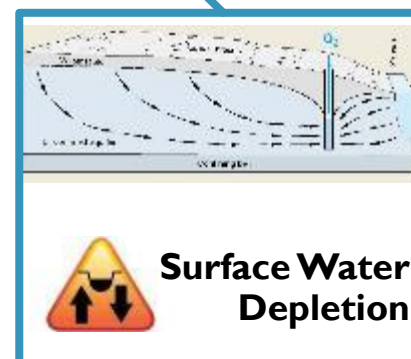
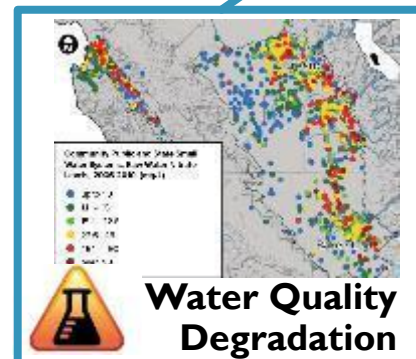
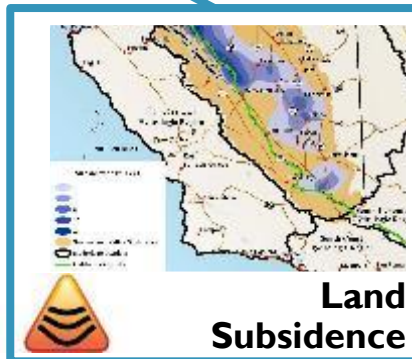
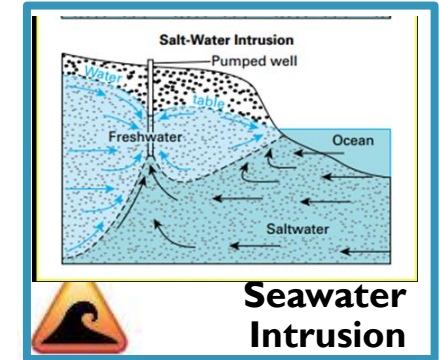
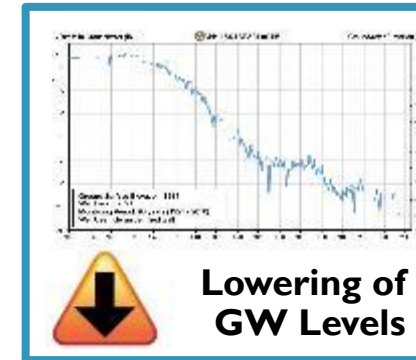
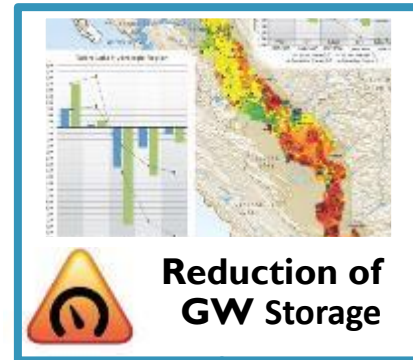
Projected Change in Groundwater Levels in RMS Wells

PROJECTED WATER BUDGET CONCLUSIONS

- Future climate/recharge rates in Monterey Subbasin increase slightly based on DWR Climate model
- Monterey Subbasin conditions are strongly dependent upon conditions in adjacent Subbasins
 - If 180/400 Foot Aquifer Subbasin reaches water level SMCs (MT: 2015 water levels MO: ~2003 water levels) and Seaside subbasin groundwater levels stabilize at 2018 levels Marina Ord should stabilize
 - Projects will still likely be required to reach SMCs in Monterey Subbasin given projected increases in water demands in the Marina Ord Area and continued projected declines in groundwater levels in the Corral De Tierra area.
- Sustainability will take coordinated actions between subbasins

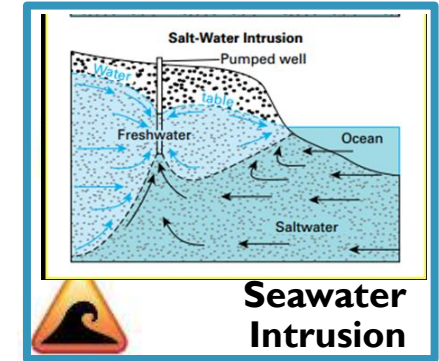
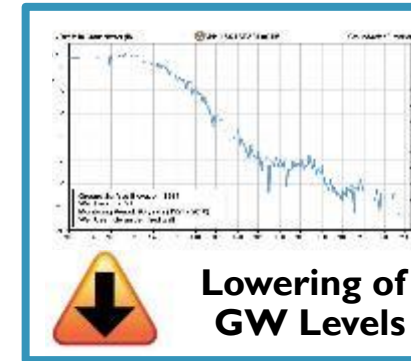
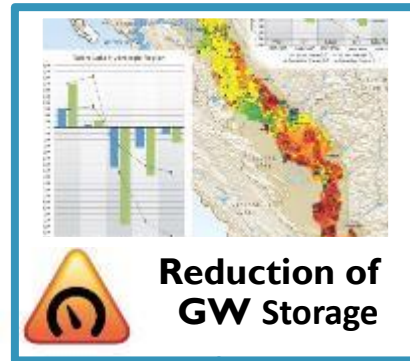
CHAPTERS 7 & 8 –SUSTAINABLE MANAGEMENT CRITERIA & MONITORING NETWORK

“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.”

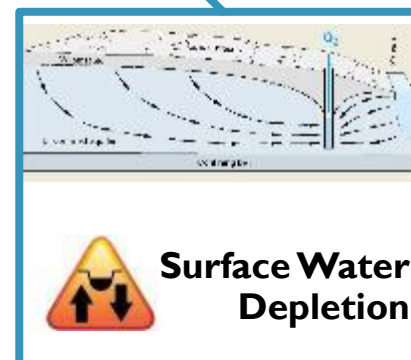
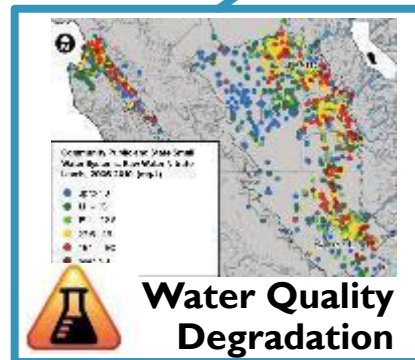
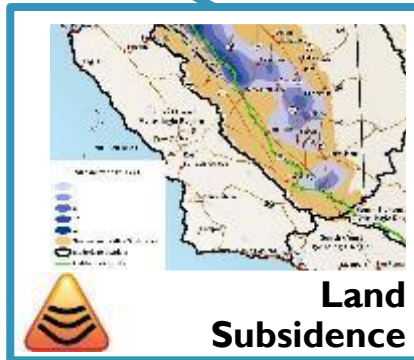


CHAPTERS 7 & 8 –SUSTAINABLE MANAGEMENT CRITERIA & MONITORING NETWORK

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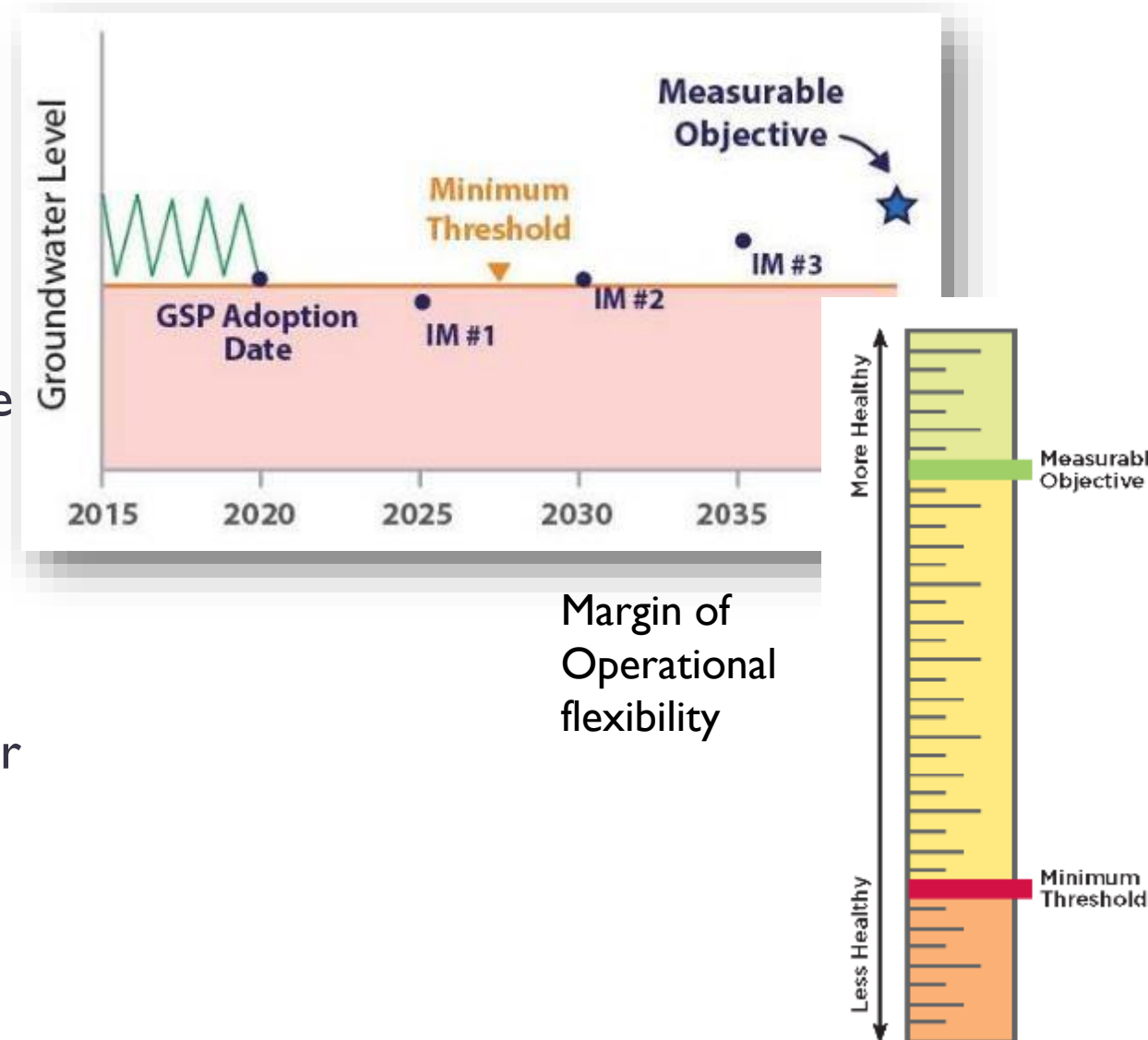


Presentation Today Focuses on Key SMCs in Monterey Subbasin



SGMA REQUIRES SETTING SMCS AND AVOIDING UNDESIRABLE RESULTS⁽¹⁾

- **Sustainability indicators** (SIs) are the six effects that, when **significant and unreasonable**, become undesirable results
- **Minimum thresholds** (MTs) are the quantitative values representing groundwater conditions at a representative monitoring site that, when exceeded, may cause an undesirable result(s)
- **Measurable Objectives** (MOs) are quantitative goals that reflect the basin's desired groundwater conditions and allow the GSA to achieve the sustainability goal within 20 years



CRITICAL DRIVERS TO AVOID UNDESIRABLE RESULTS

(BASIS FOR DEVELOPMENT OF MINIMUM THRESHOLDS)

Marina-Ord Area

- Limit further advancement of Seawater Intrusion
- Stabilize Groundwater Levels in the 400 Foot and Deep Aquifers *(at 2015 levels)*
- Make sure that Projects do not:
 - Cause shallow Groundwater Levels to decline in vicinity of groundwater dependent ecosystems
 - Cause legacy Fort Ord Contamination to migrate further

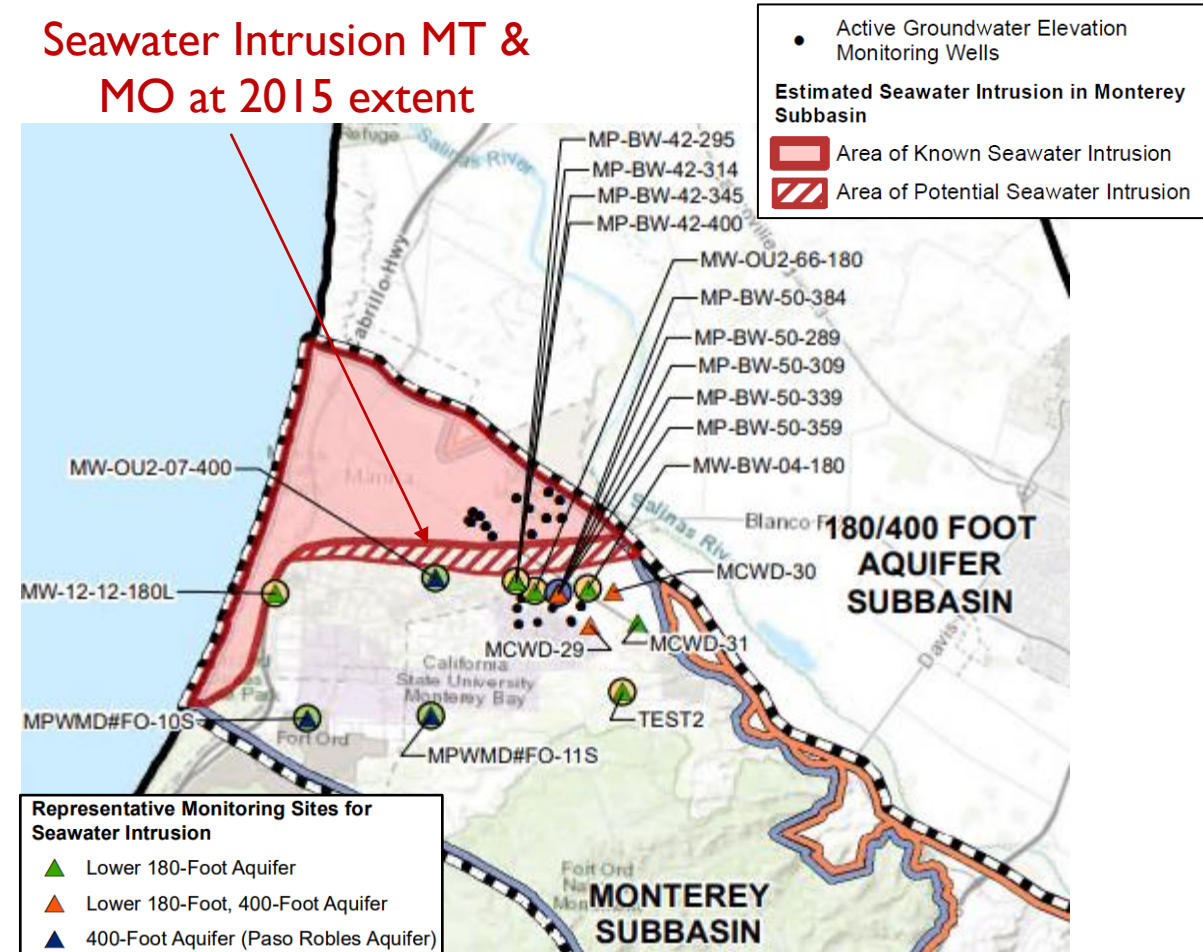
Corral de Tierra Area

- Stabilize Groundwater Levels *(at 2015 levels)* to
 - Protect domestic and small water system supply wells
 - Maintain current (reasonable) levels of Surface water depletion
- Pump within the sustainable yield

SEAWATER INTRUSION SMCS

- **Measured:**
 - Through Representative Monitoring Wells (RMWVs)
- **Minimum Threshold (MT) & Measurable Objective (MO):**
 - Lower-180 & 400 Foot Aquifers:
 - Location in 2015 of the 500 mg/L isocontour
 - Dune Sand, upper 180-Foot Aquifer and Deep Aquifers
 - ~ 3500 Feet from Coast (near Highway I)
- **Undesirable Result:**
 - Any exceedance of MT

Seawater Intrusion MT & MO at 2015 extent

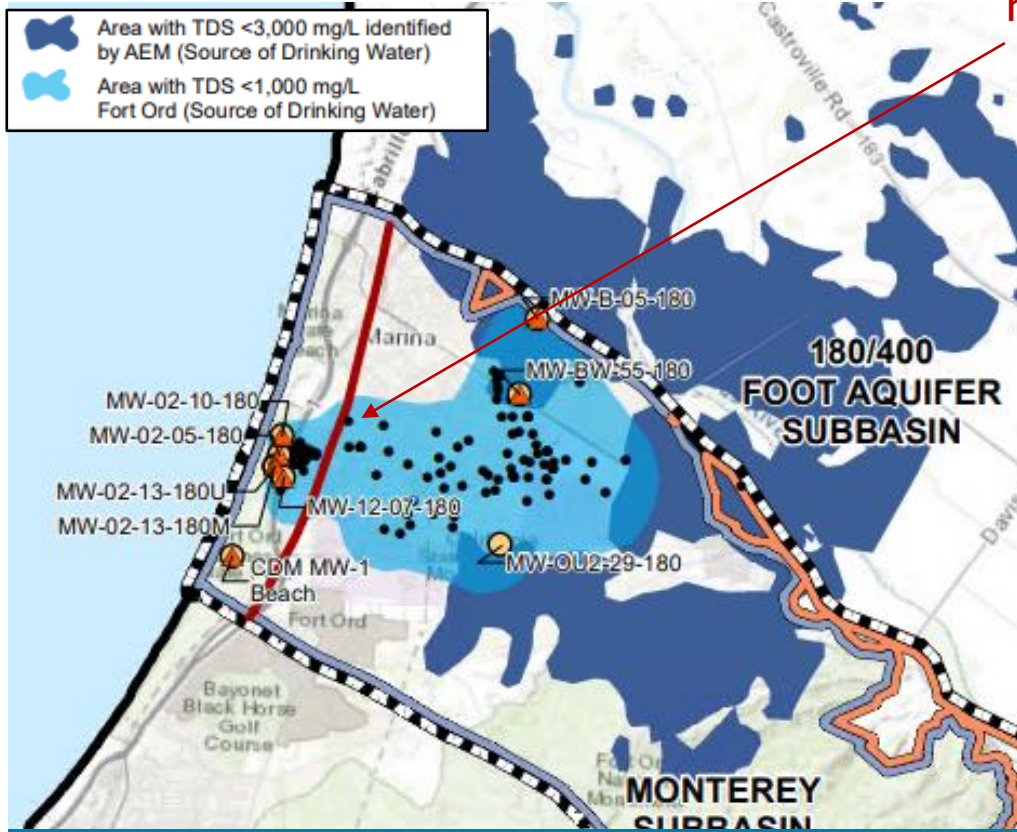


Lower 180-Foot and 400-Foot Aquifers

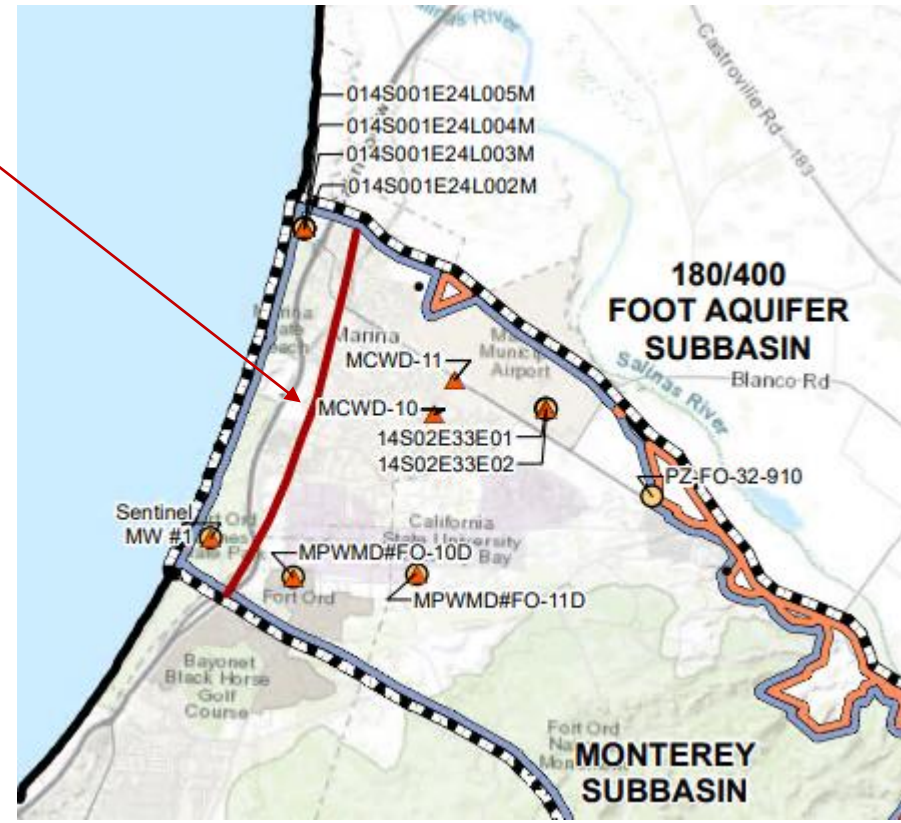
SEAWATER INTRUSION SMCS

Seawater Intrusion MT & MO
 ~3,500 feet from coast
 near Highway I

-  Representative Monitoring Sites for Seawater Intrusion
-  Representative Monitoring Sites for Groundwater Elevations
-  Active Groundwater Elevation Monitoring Wells
-  Minimum Thresholds Boundary



Upper 180-Foot Aquifer



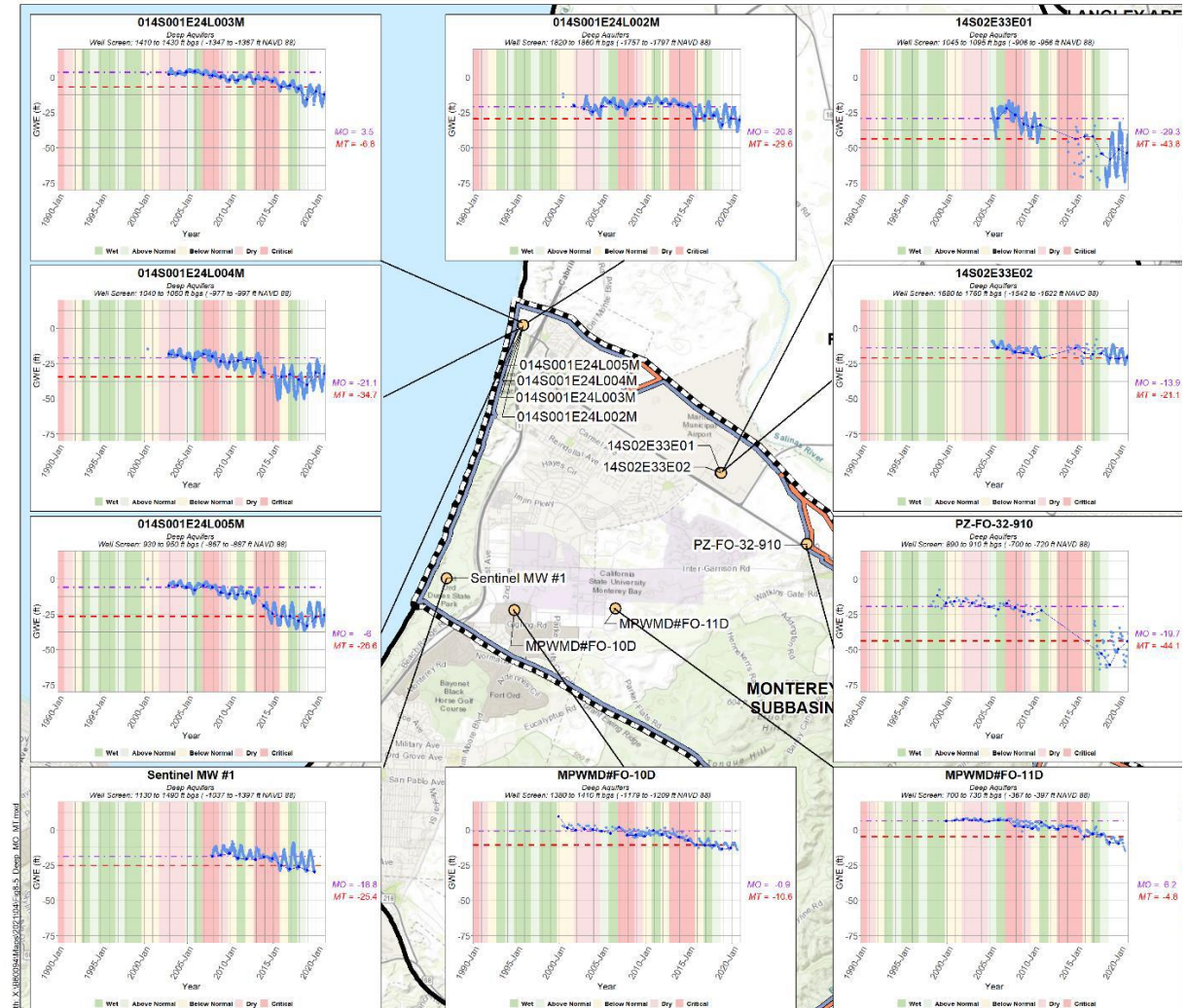
Deep Aquifers

CHRONIC LOWERING OF GROUNDWATER LEVEL SMCS

- **Measured:**
 - Through Representative Monitoring Wells (RMWs)
- **Minimum Threshold (MT) (in all principal aquifers):**
 - Marina Ord: Minimum GW elevation between 1995-2015
 - Corral de Tierra: GW elevation in 2015
- **Measurable Objective (in all principal aquifers):**
 - Marina Ord: GW elevation in 2004
 - Corral de Tierra: GW elevation in 2008
- **Undesirable Result:**

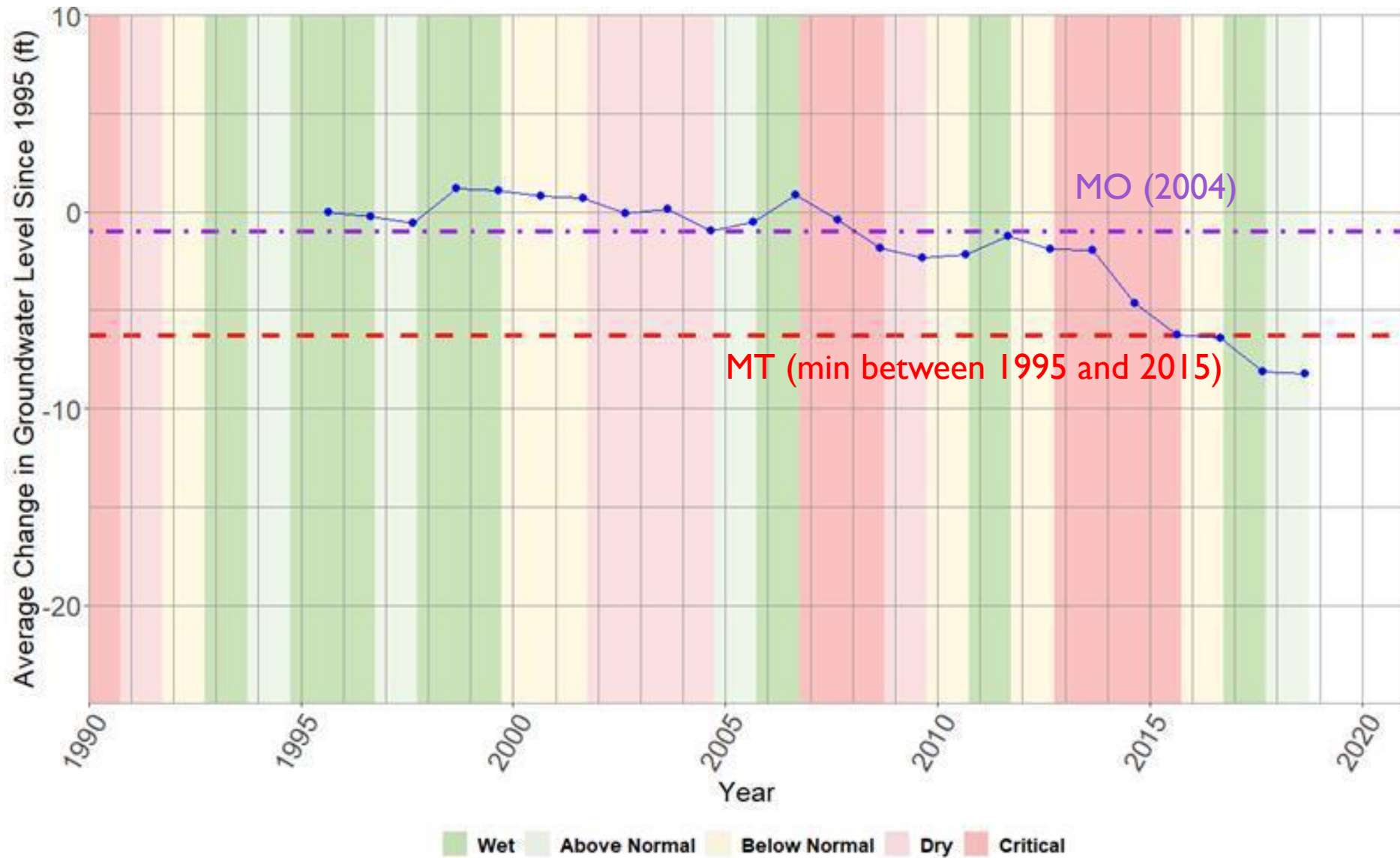
Over the course of any one year, exceedance of more than 20% of groundwater level minimum thresholds in **either**

 - both the Dune Sand and upper 180-Foot Aquifers, or
 - both the lower 180-Foot and 400-Foot Aquifers, or
 - the Deep Aquifers, or
 - the El Toro Primary Aquifer System.

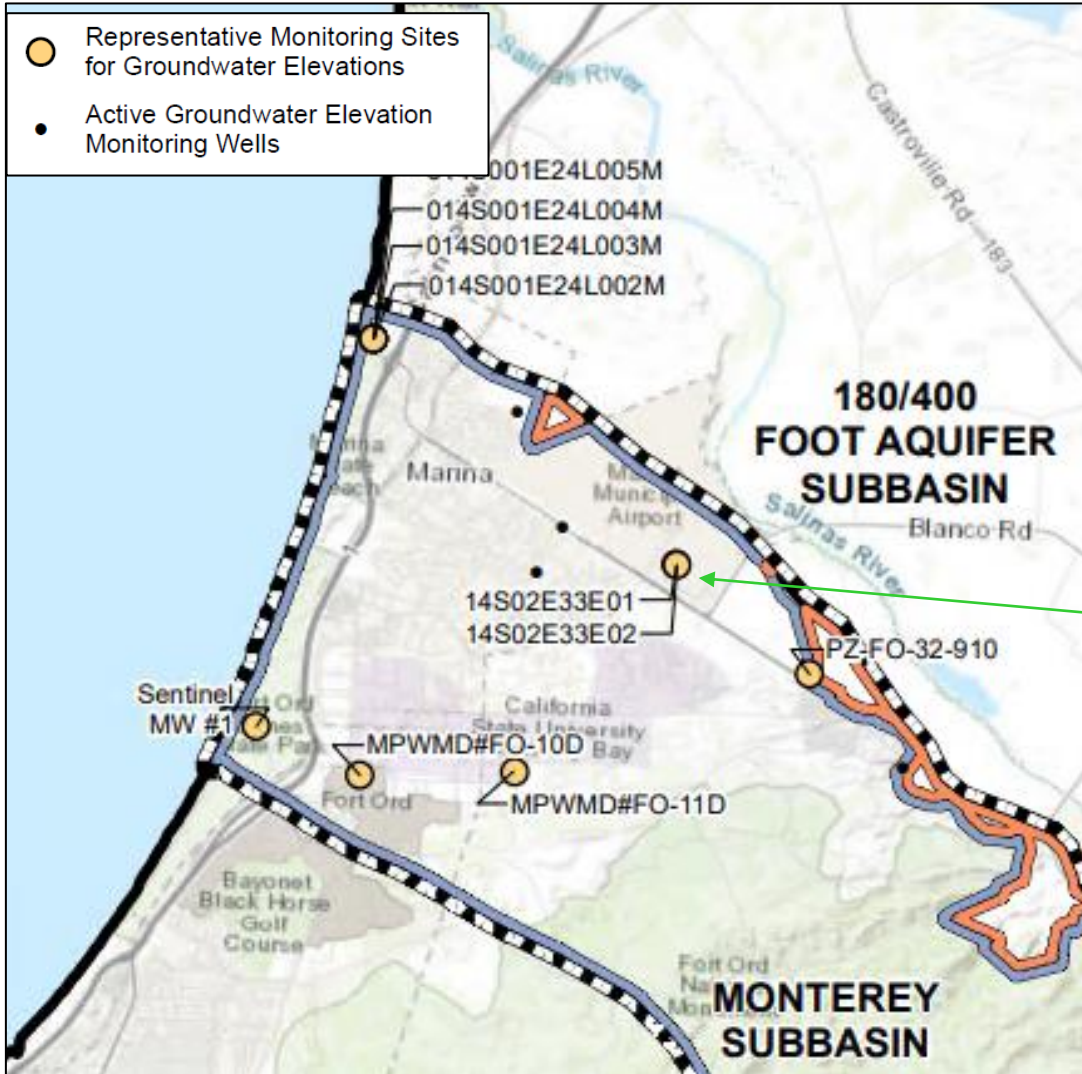


Deep Aquifers

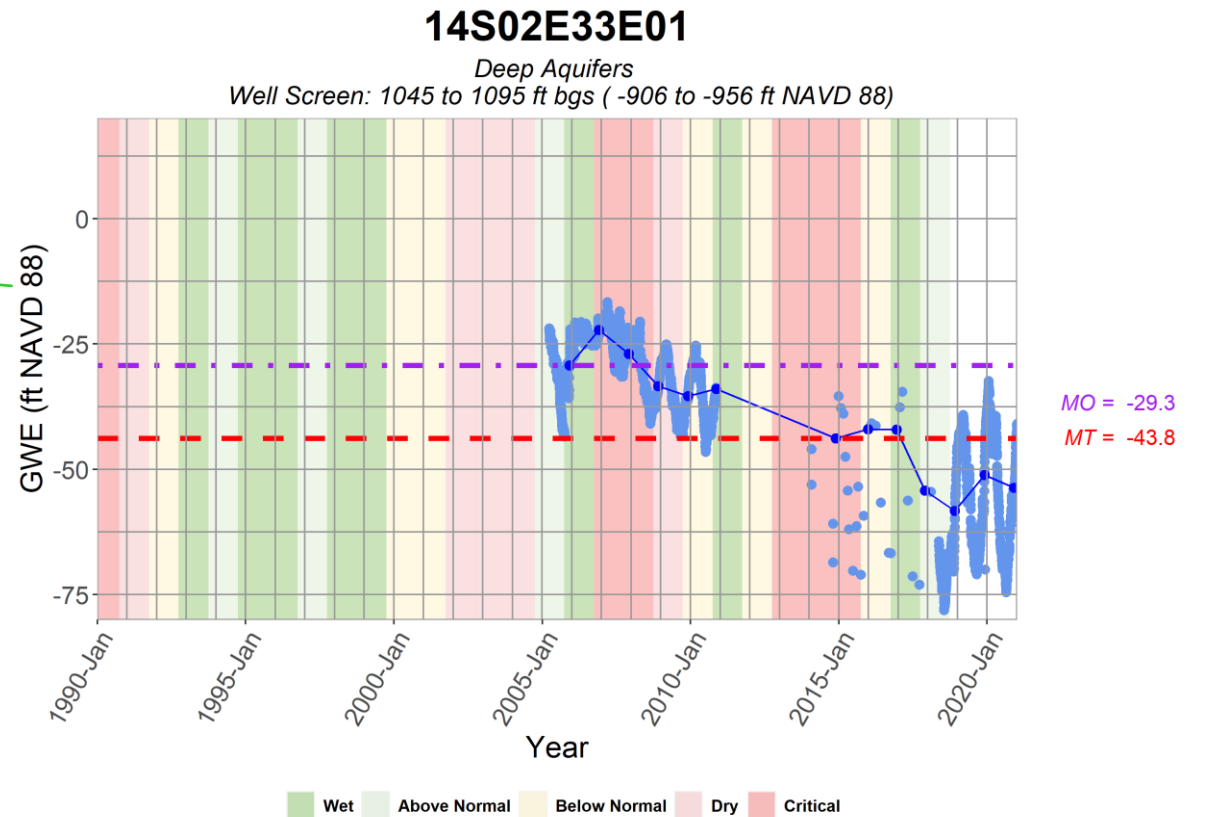
MARINA ORD AREA: CUMULATIVE AVERAGE GROUNDWATER ELEVATION CHANGE SINCE 1995



DEEP AQUIFERS

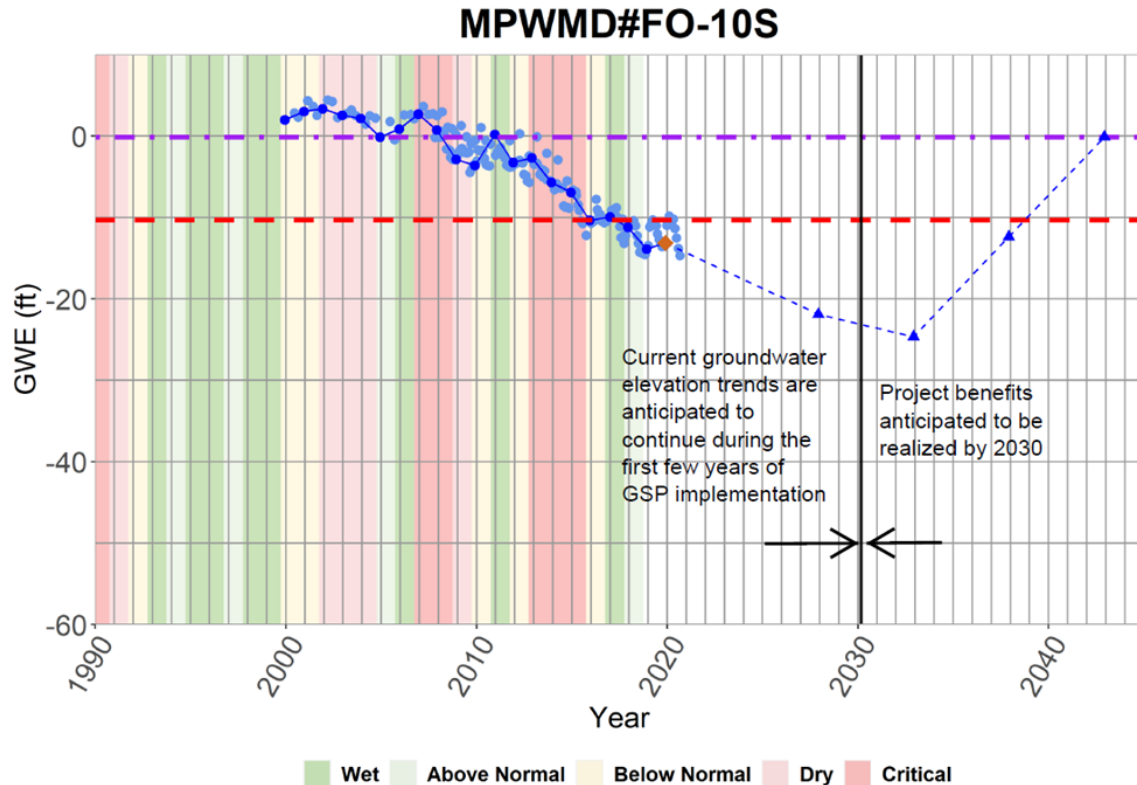


Deep Aquifers

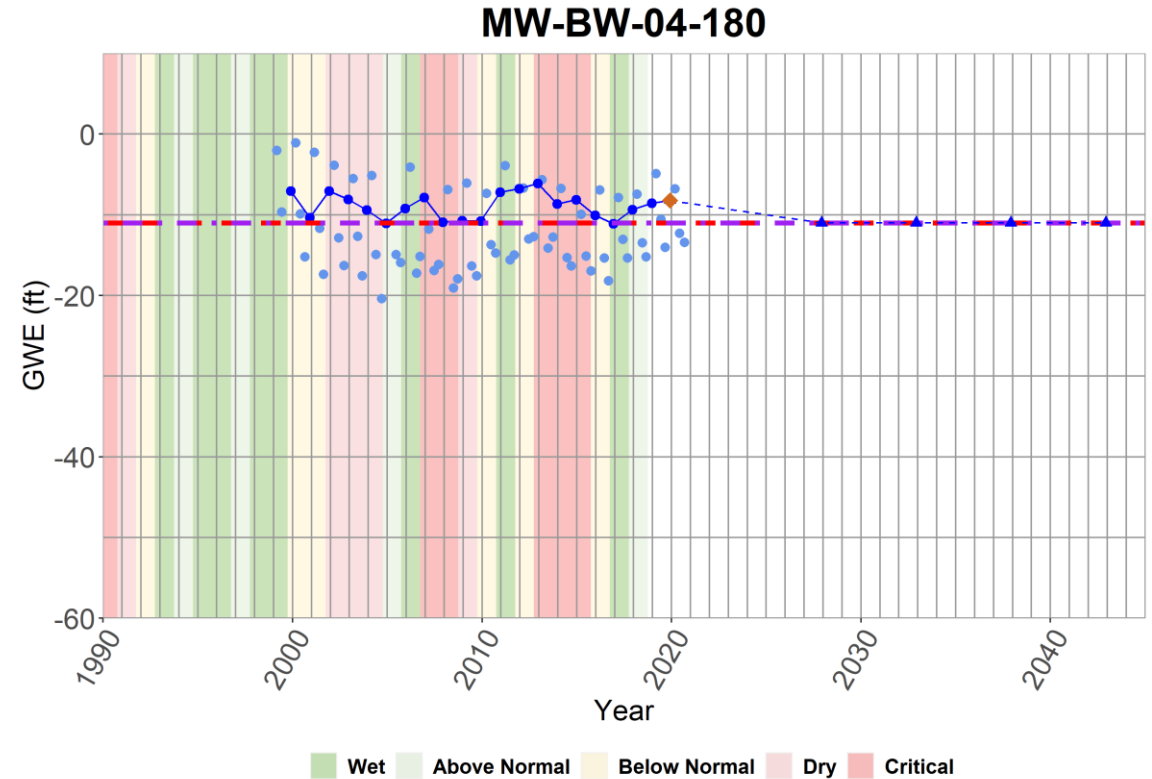


INTERIM MILESTONES

In Deep Aquifer and 400 Foot Aquifer near Seaside Basin where water levels are declining



In Dune Sand, 180- and 400-Foot Aquifers near seawater intrusion front.



Example Trajectory for Groundwater Elevation Interim Milestones

CHAPTERS 9 AND 10: PROJECTS/MANAGEMENT ACTIONS AND GSP IMPLEMENTATION

MARINA ORD AREA Projects/Management Actions

- MCWD Demand Management Measures – Continued Conservation
- Stormwater Recharge Management
- Recycled Water Reuse through Landscape Irrigation and Indirect Potable Reuse
- Monitoring Wells
- Regional Projects
 - Winter Release from Reservoirs with ASR and Direct Delivery
 - Regional Municipal Supply through brackish water desalination extracted from seawater intrusion barrier

IMPLEMENTATION ACTIONS

- MCWD actions that contribute to groundwater management that may indirectly benefit the Subbasin
- Focuses on regional coordination
 - Support for groundwater management and project planning in adjacent subbasins
 - Support for the Deep Aquifer Study and Monterey County's final well ordinance to protect the Deep Aquifers
 - Future modeling of seawater intrusion and projects using a regional model

CHAPTER 10 – GSP IMPLEMENTATION

■ **SGMA Monitoring and Reporting**

- Conduct SGMA and voluntary monitoring: groundwater elevation, water quality, induction logging, etc.
- Document basin conditions and report annually to DWR
- Improve monitoring networks and address data gaps
- Conduct periodic evaluations of GSP and prepare five-year updates

■ **Coordination and Stakeholder Engagement**

- Continue intra- and inter-basin coordination
- Continue stakeholder engagement and communication

■ **Projects and Implementation Costs**

- Refine projects during the first two years and begin implementation
- Identify plan implementation costs

SUSTAINABILITY GOAL MONTEREY SUBBASIN

- Manage groundwater resources for long-term community, financial, and environmental benefits to the Subbasin's residents and businesses
- Develop a coordinated approach to groundwater management within this Subbasin and neighboring Subbasins to achieve long-term sustainability through:
 - Inter- and intra-basin coordination and
 - Implementation of projects and management actions.

⁽¹⁾ DWR, 2018.

<https://water.ca.gov/Programs/Groundwater-Management/SGMA-Groundwater-Management>

COMMENTS / QUESTIONS?

“WATER AUGMENTATION PROJECT”: PROJECTED WATER BUDGET: MARINA-ORD AREA (VARIABLE BOUNDARY CONDITIONS IN 180/400 FOOT AQUIFER SUBBASIN)

Net Annual Groundwater Flows (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, Irrigation, etc.	+6,144	+6,823	+6,823	+6,823
Well Pumping				
● Well Pumping	-4,346	-4,488	-4,488	-4,488
Net Inter-Basin Flow				
● Seaside Subbasin	+1,310	+1,776	+612	-1,115
● 180/400 Foot Aquifer Subbasin	-8,633	-6,833	-4,901	-1,788
● Outflow to Ocean (Presumed Freshwater)	-524	-738	-764	-806
● Ocean Inflow (Presumed Seawater)	+2,872	+2,617	+2,047	+989
	<hr/> -4,975	<hr/> -3,178	<hr/> -3,006	<hr/> -2,720
Net Intra-basin Flow				
● Corral de Tierra Area (Water Budget Zone)	+1,544	+898	+1,001	+958
Net Surface Water Exchange				
● Salinas River Exchange	0	0	0	0
NET ANNUAL CHANGE IN GROUNDWATER STORAGE	-1,633	+55	+330	+573

“NO PROJECTS” PROJECTED WATER BUDGET: MONTEREY SUBBASIN (VARIABLE CLIMATE CONDITIONS)

Net Annual Groundwater Flows (AFY)	Historical Annual Inflows (+) / Outflows (-) (WY 2004-2018)	Projected Annual Inflows (+) / Outflows (-) Measurable Objective Boundary Conditions		
		Baseline Climate Conditions	2030 Climate Conditions	2070 Climate Conditions
Recharge				
● Rainfall, irrigation, etc.	+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
● Outflow to Ocean (Presumed Freshwater)	-524	-721	-752	-804
● Ocean Inflow (Presumed Seawater)	+2,872	+2,288	+2,369	+2,534
	<hr style="width: 50%; margin: 0 auto;"/> -8,999	<hr style="width: 50%; margin: 0 auto;"/> +23	<hr style="width: 50%; margin: 0 auto;"/> -537	<hr style="width: 50%; margin: 0 auto;"/> -1,286
Net Surface Water Exchange				
● Salinas River Exchange	+151	+259	+254	+249
NET ANNUAL CHANGE IN GROUNDWATER STORAGE	-4,434	-521	-310	-40

“NO PROJECTS” PROJECTED WATER BUDGET: MONTEREY SUBBASIN

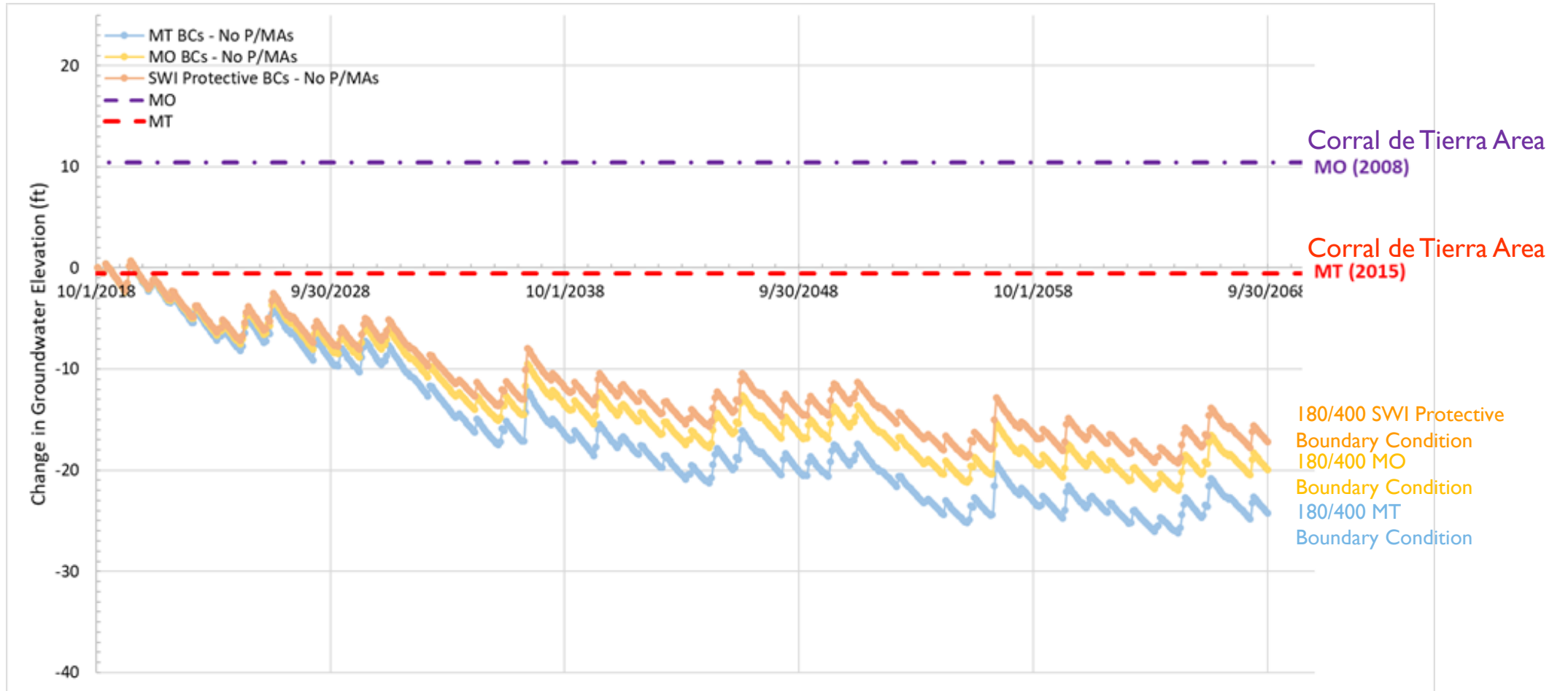
(VARIABLE BOUNDARY CONDITIONS IN 180/400 FOOT AQUIFER SUBBASIN)

Net Annual Groundwater Flows (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, irrigation, etc.	+10,055	+10,928	+10,928	+10,928
	+10,055	+10,928	+10,928	+10,928
Well Pumping				
● Well Pumping	-5,641	-10,955	-10,955	-10,955
	-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
● Outflow to Ocean (Presumed Freshwater)	-524	-725	-752	-794
● Ocean Inflow (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
	+151	+261	+254	+279
NET ANNUAL CHANGE IN GROUNDWATER STORAGE	-4,434	-721	-310	+18

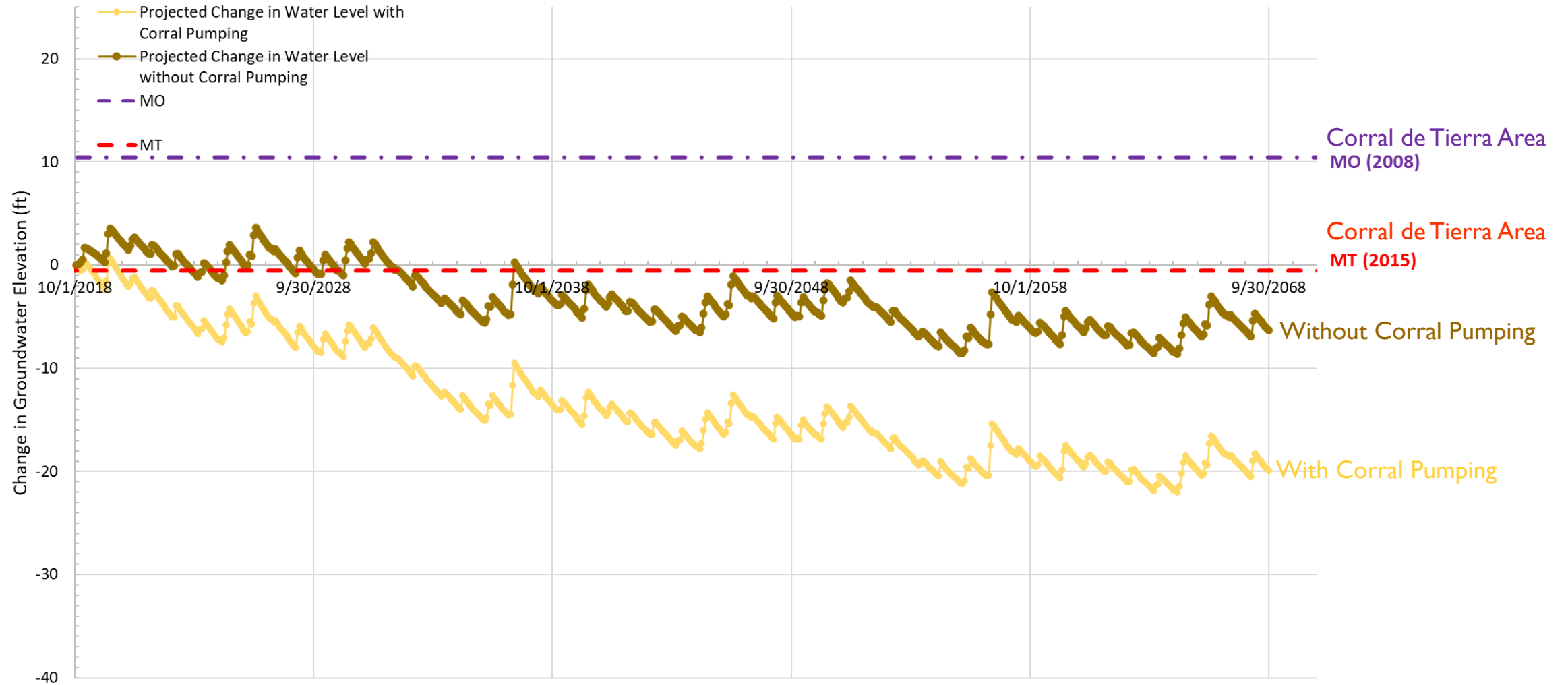
“NO PROJECTS” PROJECTED WATER BUDGET: CORRAL DE TIERRA WBZ (VARIABLE BOUNDARY CONDITIONS IN 180/400 FOOT AQUIFER SUBBASIN)

Net Annual Groundwater Flows (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, irrigation, etc.	+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

“NO PROJECTS” PROJECTED WATER BUDGET: CORRAL DE TIERRA WBZ (VARIABLE BOUNDARY CONDITIONS IN 180/400 FOOT AQUIFER SUBBASIN)



PROJECTED WATER BUDGET: CORRAL DE TIERRA AREA (WITH AND WITHOUT PUMPING IN THE CORRAL DE TIERRA AREA)



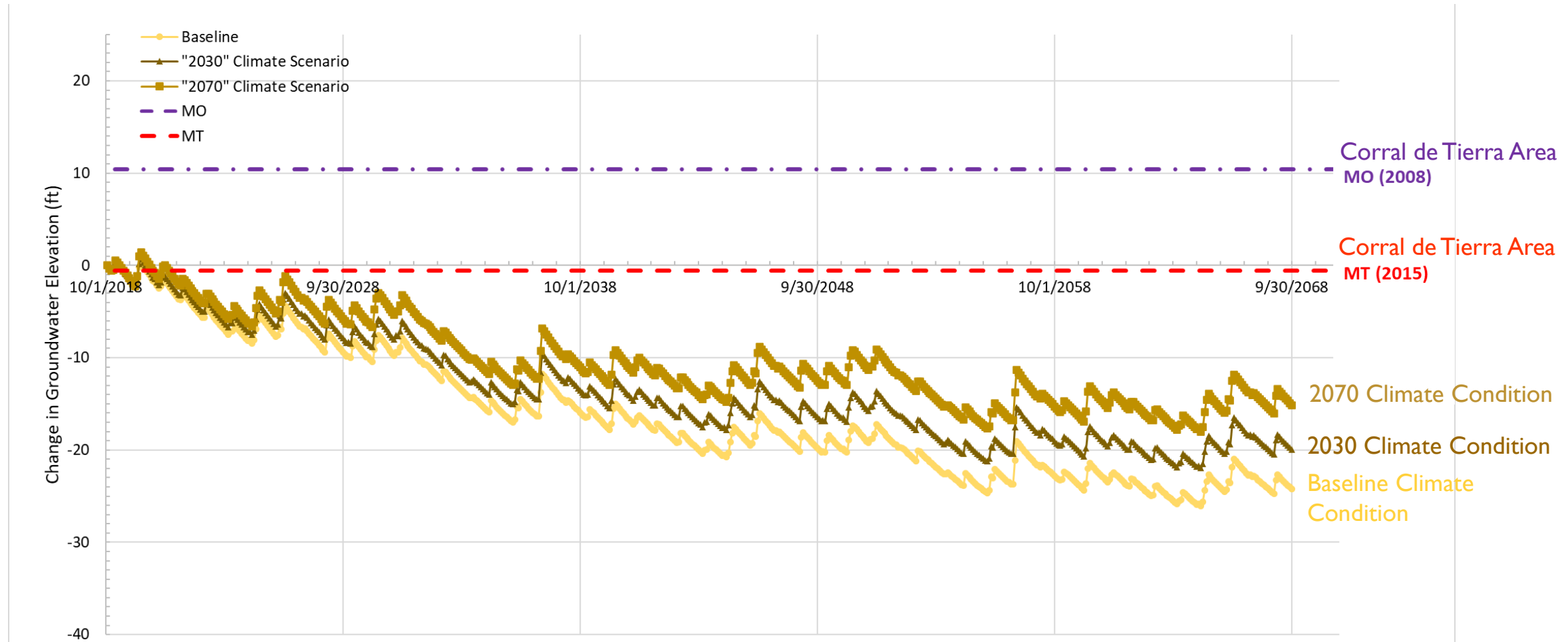
PROJECTED WATER BUDGET: CORRAL DE TIERRA AREA

(WITH AND WITHOUT PUMPING IN THE CORRAL DE TIERRA AREA)

2030 Climate and Measurable Objective Boundary Conditions

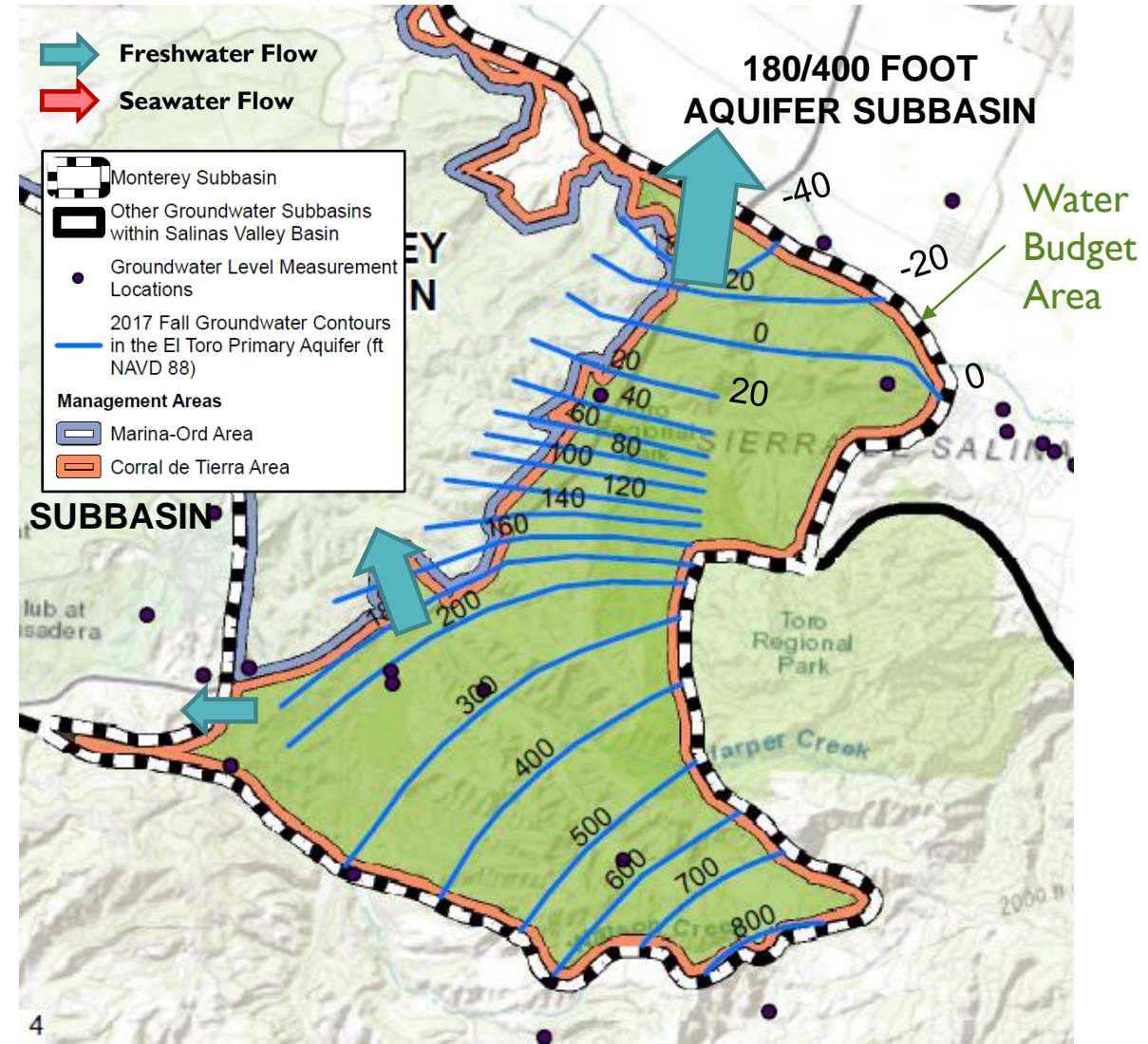
Net Annual Groundwater Flows (AFY)	Historical Annual Inflows (+) / Outflows (-) (WY 2004-2018)	Projected Annual Inflows (+) / Outflows (-) Measurable Objective Boundary Conditions	
		With Corral Pumping	No Corral Pumping
Recharge			
● Rainfall, Irrigation, etc.	+3,910	+4,105	+4,105
Well Pumping			
● El Toro Primary Aquifer System	-1,296	-2,188	0
Net Inter-Basin Flow (Presumed Freshwater)			
● Seaside Subbasin	-392	-103	-381
● 180/400 Foot Aquifer Subbasin	-3,632	-1,485	-2,728
● Ocean Net Flow	0	0	0
	-4,024	-1,588	-3,109
Net Intra-basin Flow			
● Marina-Ord Area (Water Budget Zone)	-1,544	-1,026	-1,352
Net Surface Water Exchange			
● Salinas River Exchange	+151	+254	+207
NET ANNUAL CHANGE IN GROUNDWATER STORAGE	-2,803	-443	-149

“NO PROJECTS” PROJECTED WATER BUDGET: CORRAL DE TIERRA WBZ (VARIABLE CLIMATE SCENARIOS)



HISTORICAL WATER BUDGET (2004-2018): CORRAL DE TIERRA WBZ

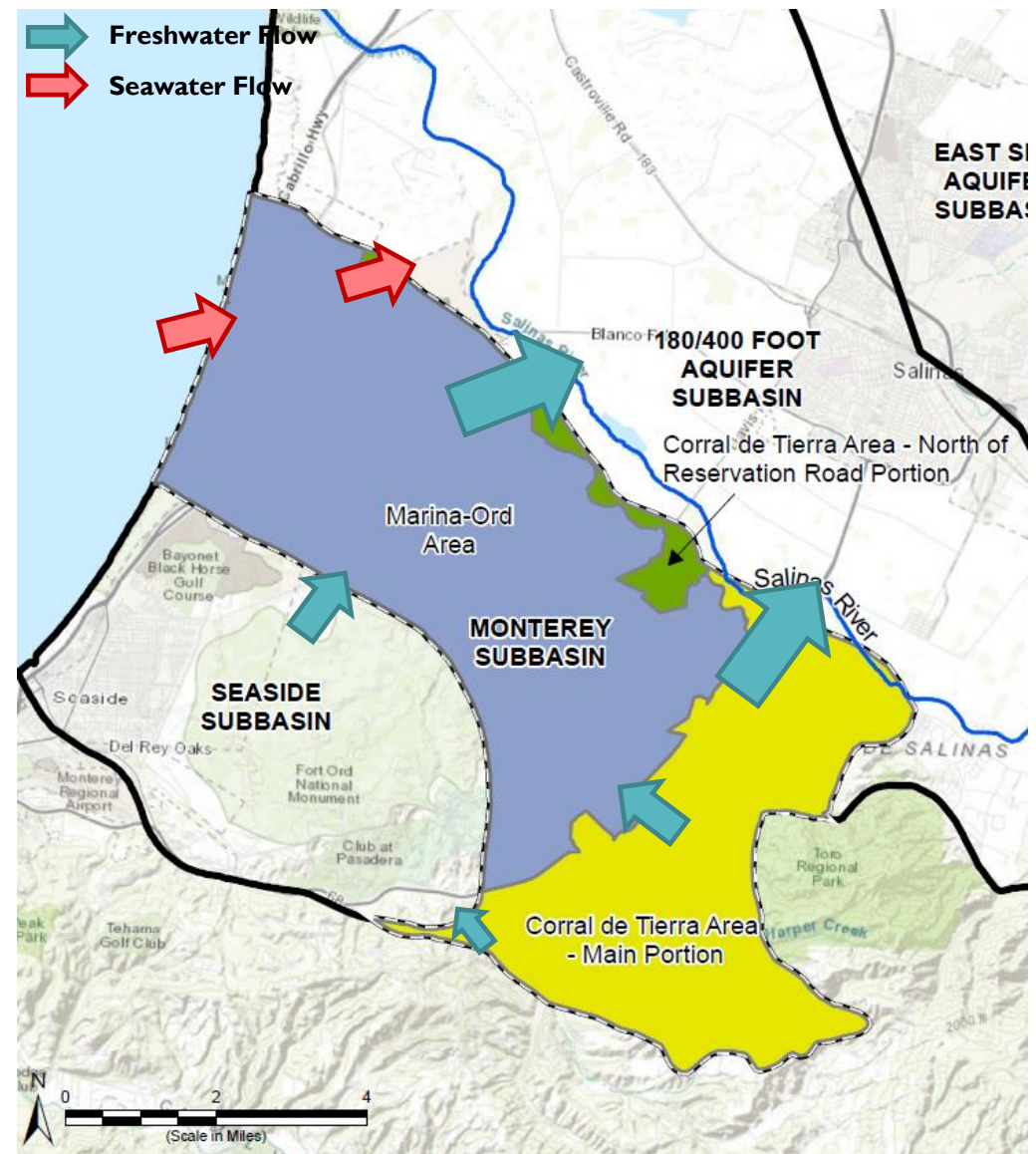
Net Annual Groundwater Flows (AFY)	Net Inflows (+) Net Outflows (-)
Recharge	
● Rainfall, Irrigation, etc.	+3,910
Well Pumping	
● El Toro Primary Aquifer System	-1,296
Net Inter-Basin Flow (Presumed Freshwater)	
● Seaside Subbasin	-392
● 180/400 Foot Aquifer Subbasin	-3,632
● Ocean Net Flow	0
	<hr/>
	-4,024
Net Intra-basin Flow	
● Marina-Ord Area (Water Budget Zone)	-1,544
Net Surface Water Exchange	
● Salinas River Exchange	+151
NET ANNUAL CHANGE IN GROUNDWATER STORAGE	-2,803



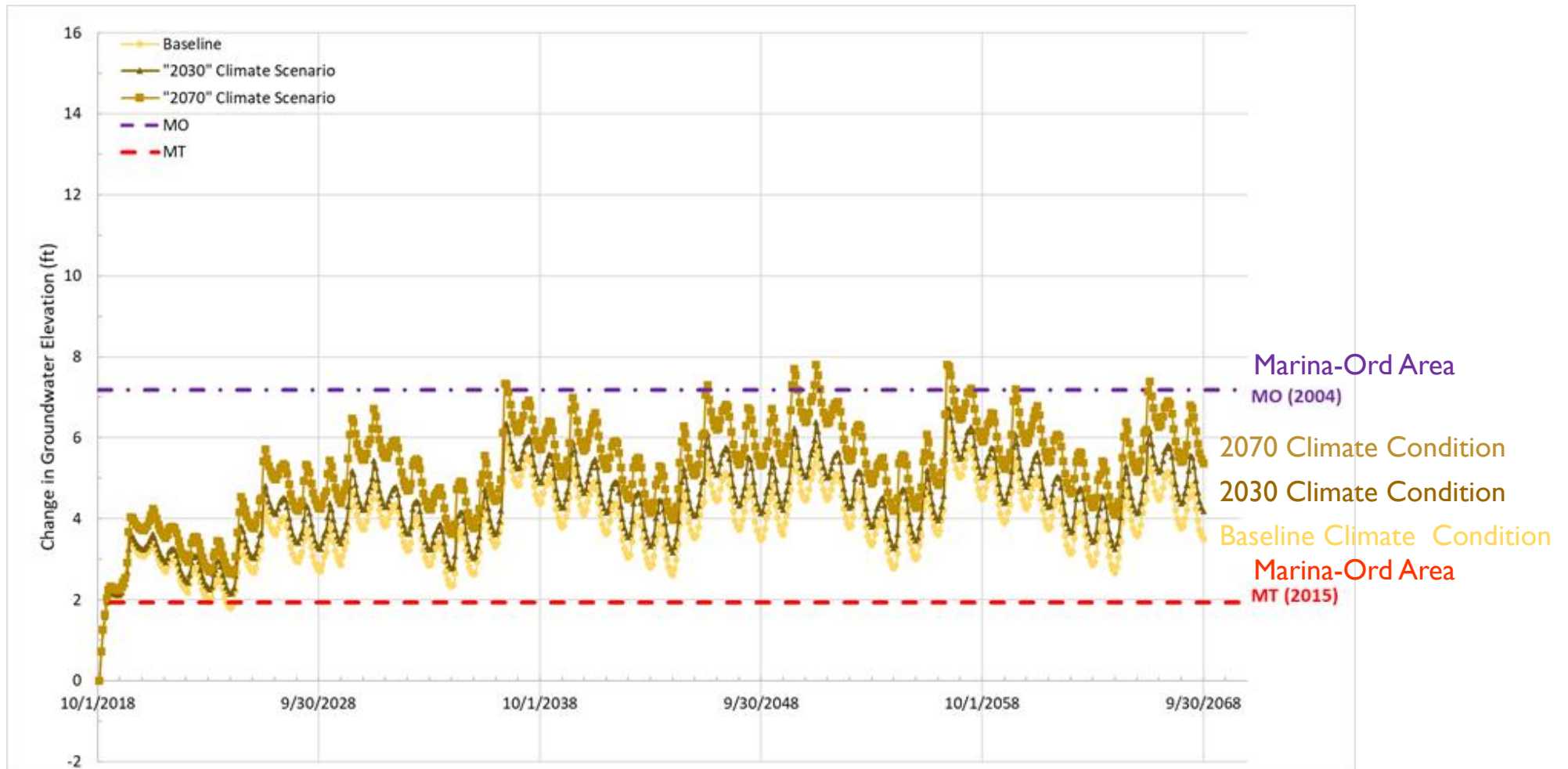
El Toro Primary Aquifer System

HISTORICAL WATER BUDGET (2004-2018): MONTEREY SUBBASIN

Net Annual Groundwater Flows (AFY)	Net Inflows (+) Net Outflows (-)
Recharge	
● Rainfall, Irrigation, etc.	+10,055
Well Pumping	
● Well Pumping	-5,641
Net Inter-Basin Flow (Presumed Freshwater)	
● Seaside Subbasin	+918
● 180/400 Foot Aquifer Subbasin	-9,393
● Outflow to Ocean	-524
	-8,999
Net Inter-Basin Flow (Presumed Seawater)	
● 180/400 Foot Aquifer Subbasin	-2,872
● Ocean Inflow	+2,872
	0
Net Surface Water Exchange	
● Salinas River Exchange	+151
NET ANNUAL CHANGE IN GROUNDWATER STORAGE	-4,434



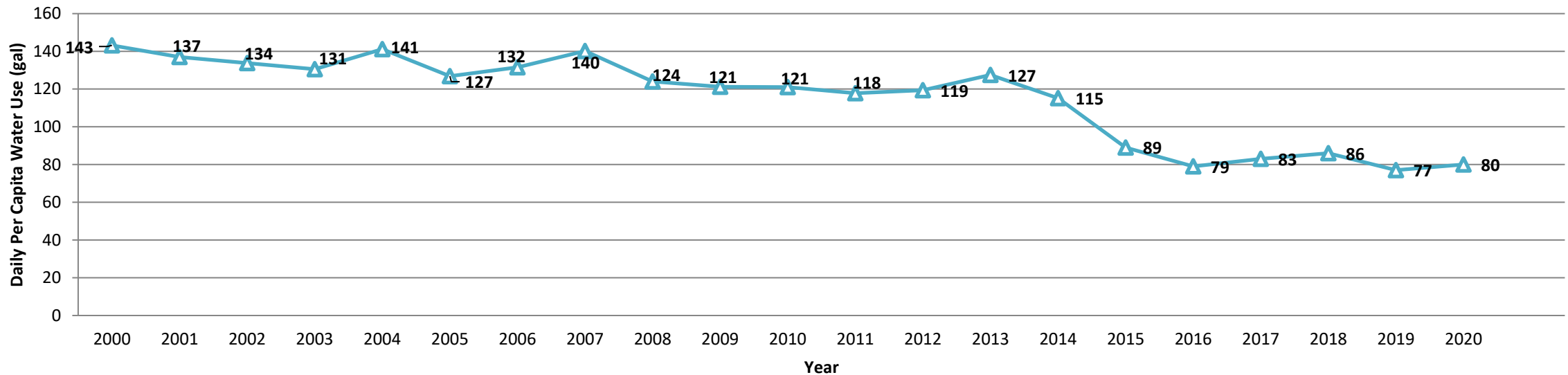
“NO PROJECT” PROJECTED WATER BUDGET: MARINA-ORD WBZ (180/400 FOOT AQUIFER MO BOUNDARY CONDITION: VARIABLE CLIMATE SCENARIOS)



Projected Change in Groundwater levels in RMS Wells

MCWD DEMAND MANAGEMENT MEASURES CONTINUED WATER CONSERVATION

MCWD Daily Per Capita Water Use
2000-2020



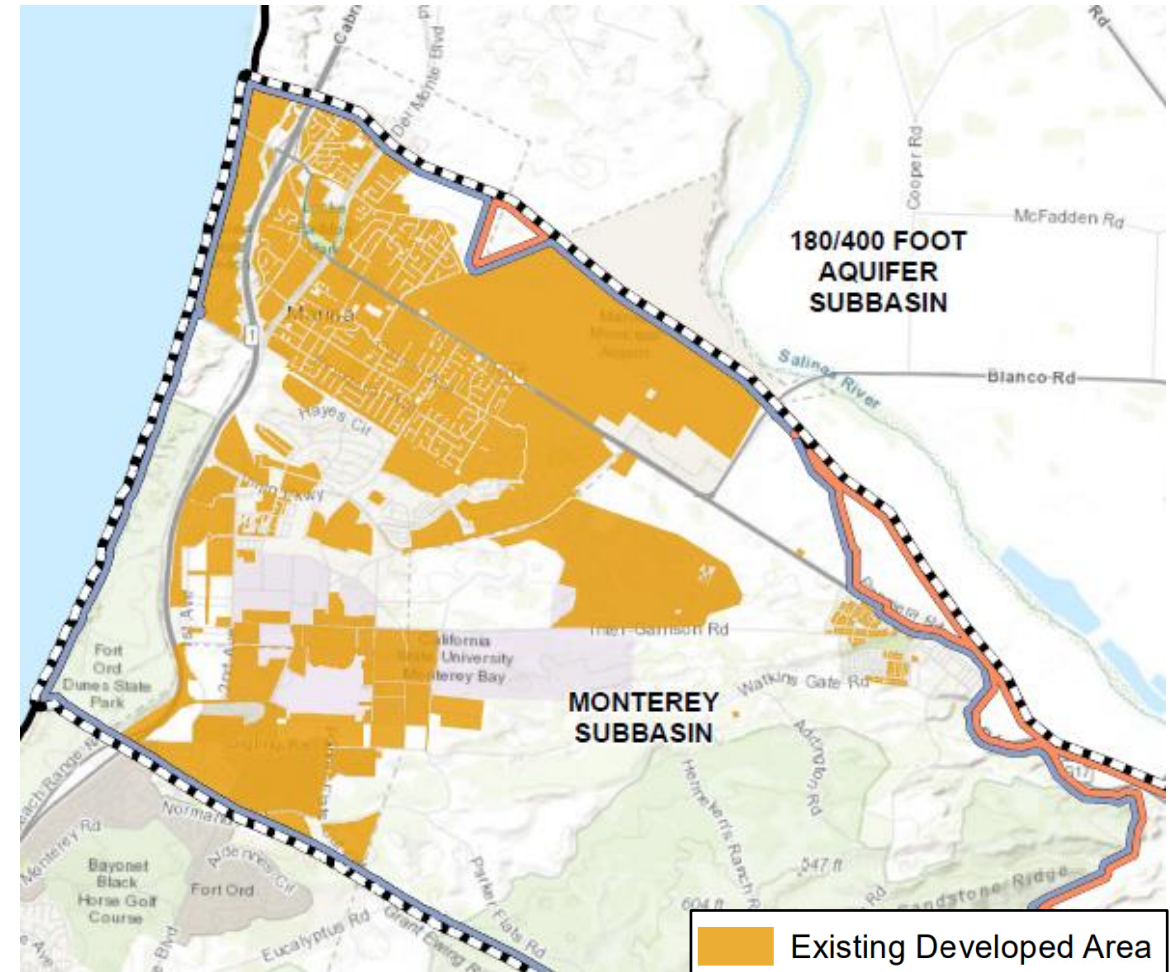
Description: Provides in-lieu recharge through reducing groundwater demands. Project includes existing and potentially new conservation programs to decrease MCWD Per Capita Water Use

Project Benefit: Equivalent to a **2,500 AFY** in-lieu recharge benefit at the current population.

Project Cost: \$350,000 to \$450,000 annually

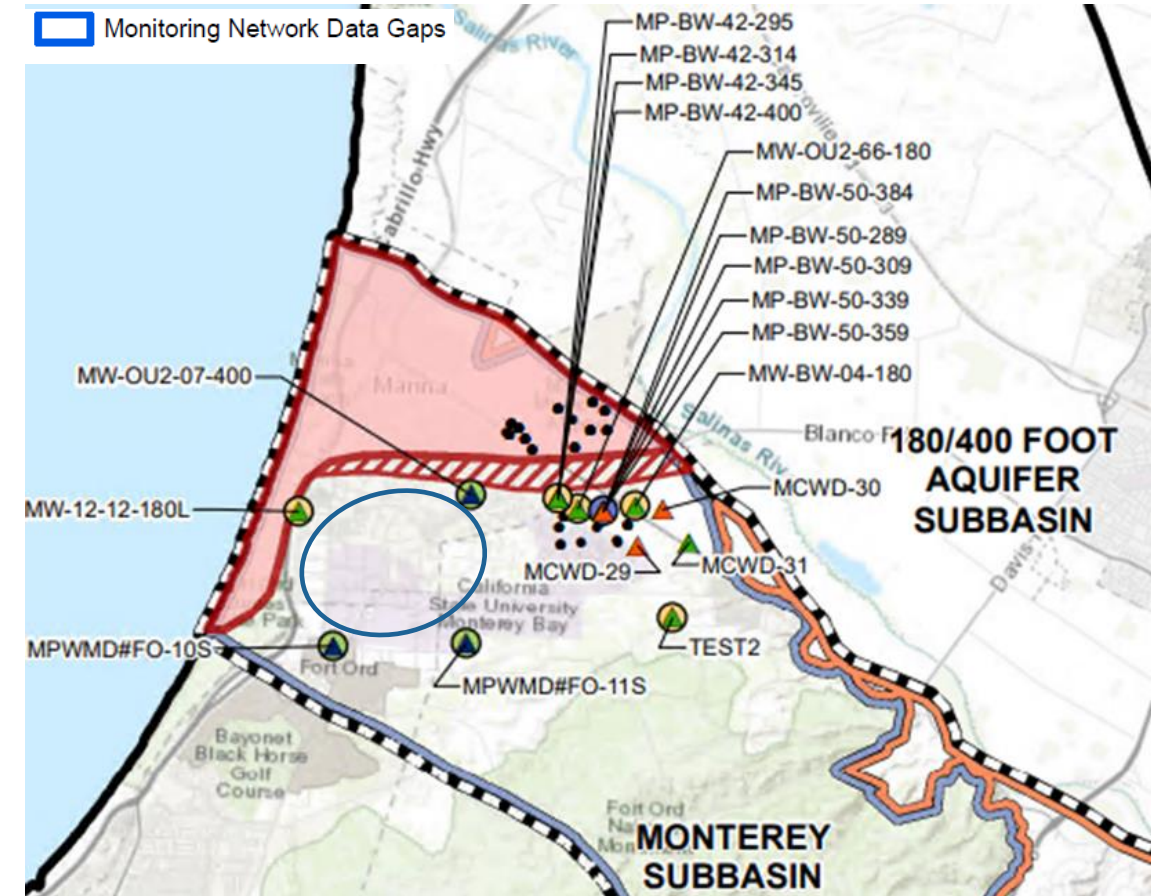
STORMWATER RECHARGE MANAGEMENT

- **Description:**
 - Existing policies facilitate and result in stormwater catchment and infiltration in urban areas
- **Project Benefit:**
 - Groundwater modeling indicates that: approximately 550 AFY is currently captured and reinfiltreated east of Highway 1, and 1,100 AFY of stormwater is projected to be captured and reinfiltreated within the total future development area even further east of Highway 1.
 - Estimated net additional recharge 200 to 500 AFY.
- **Cost Estimate:**
 - No additional cost to implement



GROUNDWATER MONITORING WELLS (400 FOOT AND DEEP AQUIFERS)

- **Description:**
 - Install 400-Foot Aquifer and Deep Aquifer monitoring wells near coastal Seaside Subbasin boundary.
- **Project Benefit:**
 - Will fill critical data gaps on hydrostratigraphy, seawater intrusion, and groundwater recharge mechanisms for the 400-Foot Aquifer and Deep Aquifers.
 - Will provide critical information for design of recycled water reuse through Injection.
- **Conceptual Cost Estimate:**
 - Capital Cost: \$1.1 Million



RECYCLED WATER REUSE THROUGH LANDSCAPE IRRIGATION AND INDIRECT POTABLE REUSE (INJECTION)

■ Description:

- Direct non-potable irrigation use and/or injection of advanced treated water from Monterey One Water (MIW) and extraction using existing MCWD wells or new production wells

■ Project Benefit:

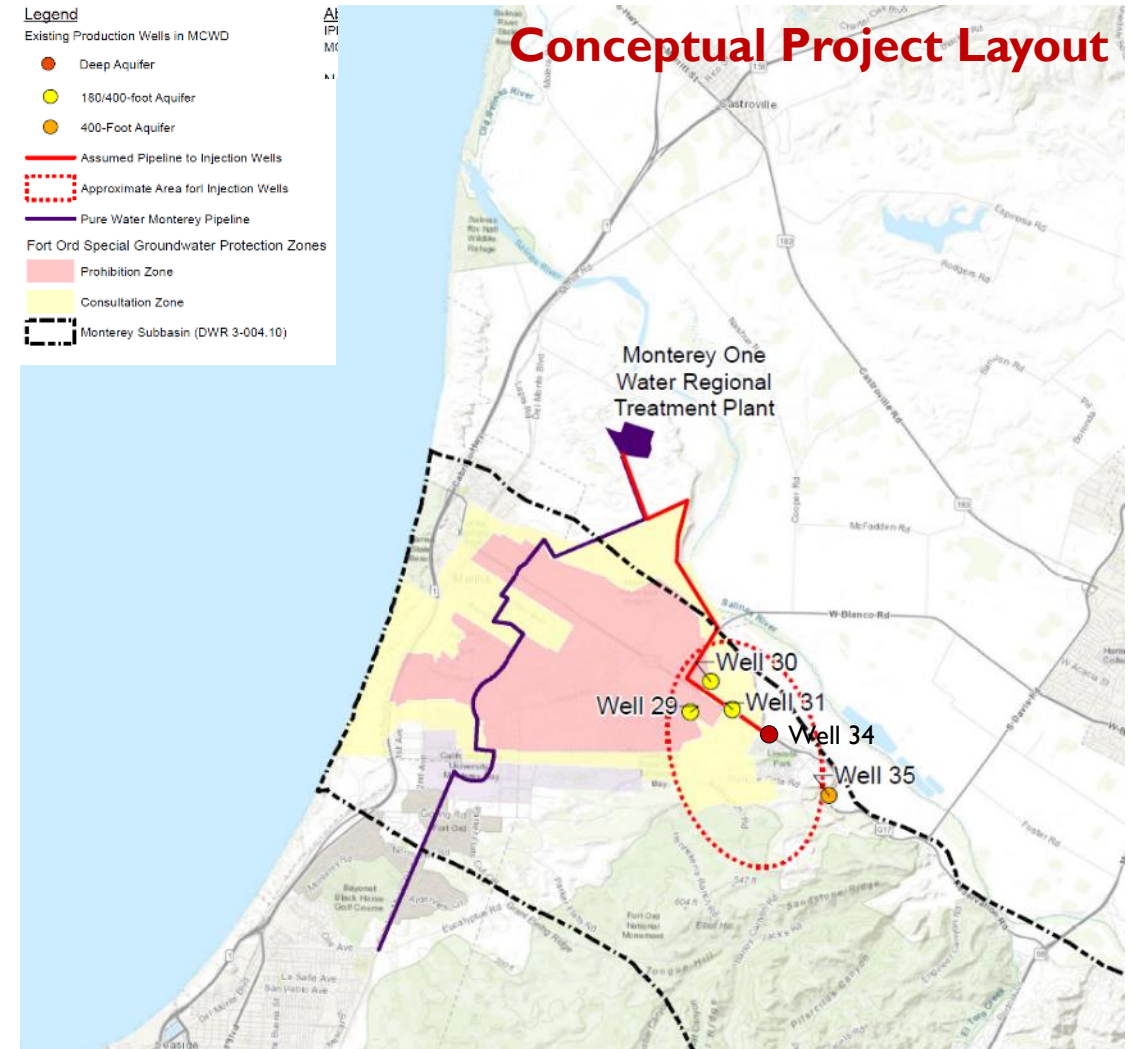
- ~2,200 AFY to 5,500 AFY advance treated recycled water available to MCWD based on current and projected wastewater flows

■ Conceptual Cost Estimate:

- Investments have already been made to deliver 600 AFY for landscape irrigation by 2022.
- Capital Cost Landscape Irrigation (additional 827 AFY): \$5,600,000
- Unit Cost Landscape Irrigation for additional 827 AFY: **\$1,600/AF**
- Capital Cost IPR (2,400 AFY): \$65 Million
- Unit Cost IPR (2,400 AFY): **\$3,300/AF**

Notes:

1. Per acre foot cost based on 25-year average (6% interest)
2. Capital Unit cost for Landscape irrigation based upon 827 AFY expansion
3. Capital and unit costs for IPR based on 2400 AFY of production. lower costs per AF with increased yield

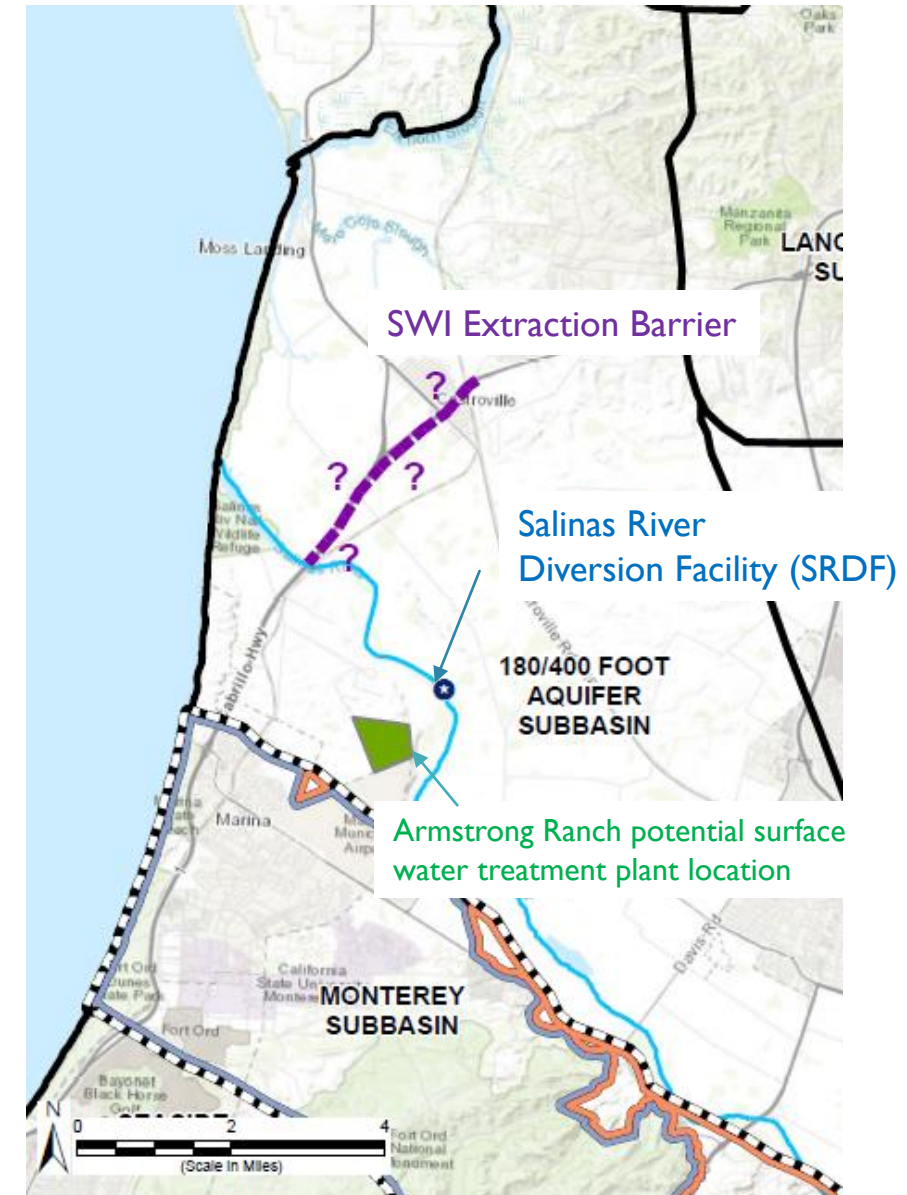


REGIONAL PROJECTS

- **Winter Release with ASR and Direct Delivery:**
 - Release flows from reservoirs during the winter 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 months.
 - Treat and inject flows into the 180/400-Foot Aquifer Subbasin for CSIP users' extraction during the summer and divert for direct municipal use.
- **Potential Direct Project Benefit to Marina-Ord:**
 - **1,600 AFY currently** and up to **4,500 AFY by 2040** (based on existing and projected winter water demands)
- **Conceptual Cost Estimate¹:**
 - Multi-subbasin Capital Cost: \$172 Million²
 - Unit Cost for ASR: \$1,450/AF³
 - Unit Cost for Direct Delivery: **\$1,100/AF⁴**

Notes:

1. Per acre foot cost based on 25-year average (6% interest)
2. Distribution of benefits across subbasins will be determined through a benefits assessment
3. Unit cost for ASR based on 12,900 AFY benefit
4. Unit cost for direct delivery based on 3,600 AFY delivery to MCWD lower costs per AF with increased yield
Assumes no additional diversion structure needed



REGIONAL PROJECTS

- **Regional Municipal Supply (brackish desal):**
 - Build regional desalination plant to treat brackish water extracted from the seawater intrusion extraction barrier
 - Supply drinking water to municipalities in the Monterey Subbasin and other subbasins
- **Potential Regional Production: 15,000 AFY**
- **Conceptual Cost Estimate¹:**
 - Multi-subbasin Capital Cost: \$385 Million²
 - Unit Cost for production and delivery: \$2,900/AF³
 - Capital and unit costs do not include cost of the extraction barrier itself, which adds another \$1,200/AF

Notes:

1. Per acre foot cost based on 25-year average (6% interest) lower costs per AF with increased yield
2. Distribution of benefits across subbasins will be determined through a benefits assessment

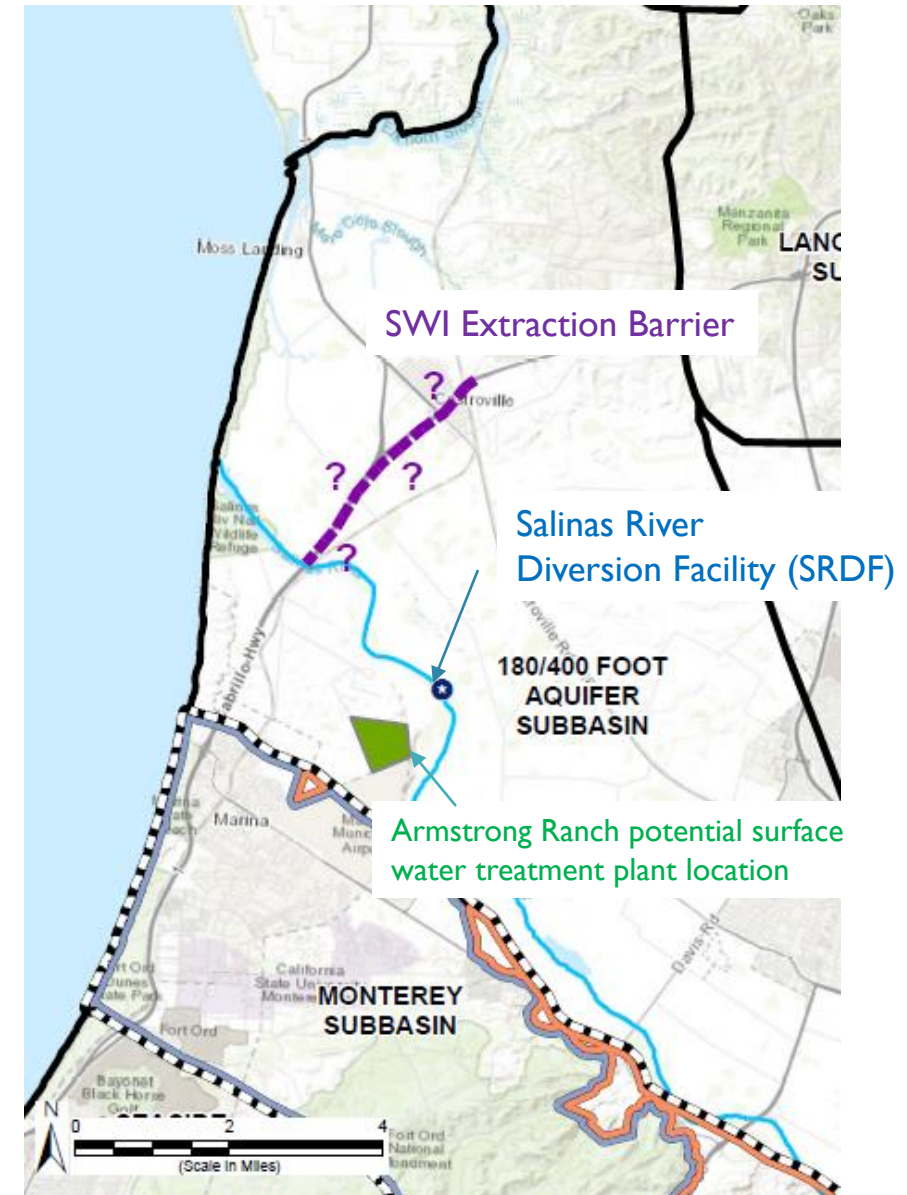


Table 10-1. MCWD GSA Monterey Subbasin Specific Estimated Planning-Level Costs for First 5 Years of Implementation

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.

Table 10-1. MCWD GSA Monterey Subbasin Specific Estimated Planning-Level Costs for First 5 Years of Implementation (Continued)

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.