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EAST BAY PLAIN SUBBASIN GROUNDWATER SUSTAINABILITY PLAN
CHAPTER 4 – PROJECTS AND MANAGEMENT ACTIONS

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4. SUBBASIN PROJECTS AND MANAGEMENT ACTIONS

(California Code of Regulations)[CCR] Title 23, Section 354.42)

This chapter describes the proposed projects and management actions necessary to maintain sustainability goals and measurable objectives while avoiding undesirable results for the East Bay Plain (EBP) Subbasin. The detailed discussion of SMC for each of the sustainability indicators in Chapter 3, including graphics for individual RMS wells in the appendices, demonstrates how undesirable results are avoided with implementation of the projects and management actions described in this chapter.

The project and management actions are described in accordance with of CCR Title 23 Sections 354.42 and 354.44, and are described separately for each GSA since each GSA will implement the projects and managements actions within the portion of the EBP Subbasin underlying its service area (see Chapter 1). A general description of anticipated projects and management actions and the associated costs are presented in **Tables 4-1 and 4-2,** while **Table 4-3** further summarizes the total gross benefits and costs of the projects developed for each GSA.

The GSAs are committed to maintaining sustainability within the EBP Subbasin, and the proposed projects and management actions reflect the GSA's desire to fill data gaps and let science-based decision-making drive the feasibility of additional future groundwater pumping.

4.1 EBMUD GSA Projects and Management Actions (CCR Title 23, Section 354.44)

The proposed projects and management actions within the EBP Subbasin underlying EBMUD's service area reflect EBMUD's desire to maintain sustainability with the EBP Subbasin, fill known data gaps, and let science-based decisions drive the feasibility and size of future groundwater projects. Consequently, only EBMUD's Bayside Phase 1 facility is proposed for implementation, while the proposed management actions will fill data gaps, monitor the EBP Subbasin, and allow EBMUD to evaluate whether three potential future projects (Additional Bayside Phase(s), Irrigation with Groundwater, and Chabot Recovery) are feasible. EBMUD's plans for financing proposed projects and management actions, along with coordination with other GSAs, is also presented.

4.1.1 EBMUD's Bayside Phase 1

Construction of the Bayside Groundwater Project Phase 1 facilities was completed in 2010 (**Figure 4-1**), with construction of a facility that enables EBMUD to inject potable drinking water into the deep aquifer of the EBP Subbasin during years with surplus water and also to extract, treat, and use groundwater as a supplemental supply during times of drought. The Phase 1 facility consists of an injection/extraction well, a water treatment plant and pipelines connecting the treatment plant to the well, a subsidence monitoring system, and a network of groundwater monitoring wells. The injection/extraction system uses an approximately 650-foot deep well located on property leased from the Oro Loma Sanitary District in San Leandro. When operated in injection mode, treated water from EBMUD's distribution system is directed through the injection/extraction well into the deep aquifer of the East Bay Plain Subbasin. The injection mode operation will take place during years when surplus water is available for storage. During droughts, water will be extracted and treated to meet all federal and state drinking water standards prior to distribution to customers.

Table 4-1. Existing and Potential Future Projects and Water Sources in the East Bay Plain Subbasin

GSA	Existing Facilities or Potential Future	Project Type	Estimated Average Annual Operating Cost ($/year)	Project Mechanism	Water Source			
					East Bay Hills Watershed	Tuolumne River Watershed	East Bay Plain Subbasin	Treated Wastewater
EBMUD	Existing	Bayside Phase 1 Injection	$30,000 to $40,000	Increase Recharge	X			
EBMUD	Potential Future	Bayside Phase 2 Injection[1]	TBD[2]	Increase Recharge	X			
EBMUD	Potential Future	Bayside Phase 3 Injection[1]	TBD	Increase Recharge	X			
EBMUD	Existing	Bayside Phase 1 Extraction	$30,000 to $200,000	Expand Dry-Year Water Supply Portfolio			X	
EBMUD	Potential Future	Bayside Phase 2 Extraction	TBD	Expand Dry-Year Water Supply Portfolio			X	
EBMUD	Potential Future	Bayside Phase 3 Extraction[1]	TBD	Expand Dry-Year Water Supply Portfolio			X	
Hayward	Existing	Extraction	$60,000 to $500,000	Emergency Water Supply			X	
Hayward	Potential Future	Extraction	TBD	Expand Dry-Year Water Supply Portfolio			X	
EBMUD	Existing	Recycled Water for Irrigation	See EBMUD Recycled Water Master Plan (2019)	Reduce SW Use and/or GW Pumping				X
EBMUD	Potential Future	Groundwater for Irrigation[1]	TBD	Reduce SW Use			X	
EBMUD	Potential Future	Groundwater for Supplemental Surface Water Flows[1]	TBD	Conserve Reservoir Storage			X	

[1] Implementation of this project will be based on science (i.e., collection of monitoring data with implementation of existing projects, filling data gaps, and additional data analysis)

[2] To Be Determined (TBD) if this potential future project is implemented.

Table 4-2. East Bay Plain Subbasin Management Actions

GSA	Action	First Year of Implementation	Completion Date	Number of Monitoring Stations	Minimum Frequency	Estimated Capital Cost	Estimated 5-Year Operating Costs
EBMUD	RMS[1] GW[2] Level Monitoring	2022	Ongoing	22	Semi-Annual	NA[3]	$72,500
EBMUD	Non-RMS GW Level Monitoring	2022	Ongoing		Semi-Annual	NA	$100,000
EBMUD	RMS GW Quality Monitoring	2022	Ongoing	22	Annual	NA	$110,000
EBMUD	Baseline GW Quality Sampling	2023	2024	22	Semi-Annual	NA	$88,000
EBMUD	Synoptic Stream Monitoring	2023	2030	NA[3]	NA[3]	NA	$75,000
EBMUD	Isotopic Sampling	2024	2024	NA	NA	NA	$100,000
EBMUD	Subsidence Monitoring	2022	Ongoing	2	Continuous	NA	$77,500
EBMUD	Baseline GDE[4]/Biologic Survey	2023	2023	NA	NA	NA	$150,000
EBMUD	Biological Surveys	2023	Ongoing	NA	Every 5 Years	NA	$50,000
EBMUD	Install Shallow RMS Wells Near Creeks	2023	2024	10	NA	$115,000	NA
EBMUD	Monitoring Shallow Wells for GW Levels	2024	Ongoing	10	Semi-Annual	NA	$21,000
EBMUD	Monitoring Shallow Wells for GW Quality	2024	Ongoing	10	Annual	NA	$30,000
EBMUD	Install New Nested Monitoring Wells	2023	2024	3	NA	$400,000	NA
EBMUD	Monitoring New Nested Wells for GW Levels	2024	Ongoing	9	Semi-Annual	NA	$21,000
EBMUD	Monitoring New Nested Wells for GW Quality	2024	Ongoing	9	Annual	NA	$30,000
EBMUD	Install Stream Gages	2024	2024	2	NA	$65,000	NA
EBMUD	Monitor Stream Gages	2024	Ongoing	2	Monthly	NA	$87,500
Hayward	RMS GW Level Monitoring	2022	Ongoing	8	Semi-Annual	NA	$27,500
Hayward	Non-RMS GW Level Monitoring	2022	Ongoing		Semi-Annual	NA	$25,000
Hayward	RMS GW Quality Monitoring	2022	Ongoing	8	Annual	NA	$40,000
Hayward	Baseline GW Quality Sampling	2023	2024	8	Semi-Annual	NA	$32,000
Both	Annual Reporting	2022	Ongoing	NA	Annual	NA	$275,000
Both	GSP Five-Year Updates	2027	Ongoing	NA	Every 5 Years	NA	$250,000
Both	DMS[5]	2022	Ongoing	NA	Annual	NA	$50,000
Both	Update Plume Info	2023	Ongoing	NA	Every 2 Years	NA	$20,000
Both	Fate/Transport Modeling	TBD	TBD	NA	TBD	NA	$100,000

[1] Representative Monitoring Site (RMS)

[2] Groundwater (GW)

[3] Not Applicable (NA), No capital costs associated with this project, or Number of Monitoring Stations/Frequency do not apply to this Action

[4] Groundwater Dependent Ecosystems (GDE)

[5] Data Management System (DMS)

[6] To Be Determined (TBD), need for fate/transport modeling is uncertain/unknown

Table 4-3. Summary of East Bay Plain Subbasin Projects by GSA			
GSA	Gross Average Annual Benefit at Full Implementation	Estimated Capital Cost	Estimated Average Annual Operating Cost
EBMUD	Recharge = 47 AFY; Extraction = 134 AFY; Net Extraction = 87 AFY; Average Annual over 50 years	$0[1]	$30,000 to $200,000[2]
Hayward	Extraction = 1,062 AFY (in years when operated)	$0[1]	$60,000 to $500,000
Total	**Recharge = 47 AFY; Extraction = 134 AFY + 1,062 AFY in Years Hayward Emergency wells operate[3]**		

[1] Project is already built and does not have additional future capital costs.

[2] Average estimated annual operating costs are $30,000/year with no injection/extraction operations; $40,000/year with injection operations; and $200,000/year with extraction operations.

[3] EBMUD recharge is 196 AFY in the years for which injection occurs or 47 AFY on average over 50 years based on an assumed 12 years of operation during that 50-year period; EBMUD extraction is 1,120 AFY in years for which extraction occurs or 134 AFY on average over 50 years based on an assumed 6 years of operation during that 50-year period; Hayward Emergency wells extraction is 1,062 AFY for years in which an emergency is declared and Hayward wells would operate.

4.1.1.1 Historical Operations

Bayside Phase 1 is operated in accordance with General Waste Discharge Requirements (WDR) of Order No. R2-2007-0038, adopted by the San Francisco Regional Water Quality Control Board (RWQCB) on May 9, 2007. In accordance with permit requirements, the annual reports include groundwater level and quality measurements and injection and extraction amounts each year.

The Bayside Phase 1 Well has an operational injection capacity of approximately 0.35 MGD and an extraction capacity of 2 MGD. Between 2009 – 2011, a total of about 29 million gallons of potable water was injected into the Deep Aquifer of the EBP Subbasin as part of startup testing of the facility (**Table 4-4**). Between 2017 - 2019, a total of about 18 million gallons of potable water was injected as shown in **Table 4-4**. Injection of water into the Bayside Phase 1 Well can only occur during years when surplus water is available, if pre-1914 water is available from the San Leandro Creek watershed, and if EBMUD's Upper San Leandro Water Treatment Plant is operational and in use at the time of injection. The extraction volumes from 2009 to 2020 were relatively minor, ranging from 4,545,000 to 113,000,000 gallons per year. However, as shown in **Table 4-4**, since conducting startup testing of the facility in 2009 and a pump test in 2010, no extraction has occurred except for groundwater sampling and maintenance operation. EBMUD still needs to obtain a drinking water permit before piloting extraction for use in EBMUD's distribution system.

Table 4-4. Summary of Historical Bayside Phase 1 Well Operations			
Year	Extraction (gallons)	Injection (gallons)	Comments
2009	4,545,000	445,000	Startup Testing
2010	113,000,000	0	Aquifer Test: Extraction from August 4 to September 29 associated with regional aquifer test at continuous pumping rate of 1,400 gpm (2.0 MGD).
2011	0	28,432,401	Startup testing injection occurred from June 1 to August 1; average rate of injection was 318 gpm (0.459 MGD).
2012	0	0	
2013	0	0	
2014	0	0	
2015	0	0	
2016	0	0	
2017	0	1,310,000	Injection occurred from February 10 to February 15 at rates ranging from 160 to 250 gpm (0.216 to 0.360 MGD).
2018	0	8,340,000	Injection occurred from October 9 to November 1 at an average rate of 252 gpm (0.363 MGD).
2019	0	8,390,000	Injection occurred from November 18 to December 11 at an average rate of 253 gpm (0.365 MGD).
2020	0	0	
Total	**117,545,000**	**46,917,401**	

4.1.1.2 Project Benefits, Planned Injection, and Planned Extraction Operations

For evaluation purposes in the GSP only, it was assumed EBMUD will begin implementing the Bayside Phase 1 project in 2022, where injection only occurs when surplus water is available, which for the purposes of this evaluation is assumed to occur for each year defined as a wet year, and extraction in the third (and any subsequent) year of a drought for a period of up to 6 months. EBMUD expects that the project will be operated in approximately one out of every three years on average for either injection or extraction over the long term (i.e., 50 years or more).

Injection wells provide groundwater benefits by recharging the EBP Subbasin when surface water is abundant. The estimated project benefits developed for the GSP are based on representative average hydrologic conditions. Based on a hydrologic and operations analysis covering the future 50-year period from 2022 to 2071, and the resulting frequency and rate of injection expected, the average annual net recharge benefit for the existing Bayside well would be 47 AFY as a 50-year annual average. The benefit in a year in which injection occurs is 196 AF. The reliability of source water is based on historical hydrology being a good projection of future hydrology. **Table 4-5** summarizes the estimated annual net recharge benefit, expected probability of water year type, and the weighted-average annual recharge for the injection well.

Table 4-5. EBMUD Bayside Phase 1 Well Average Injection Recharge			
Year Type	Total Annual Volume (AF)	% of Years	Weighted Average Volume (AFY)
Wet (Surplus water available)	196	24%	47
Average	0	40%	0
Drought	0	36%	0
Average Annual			**47**

Extraction will help make EBMUD's overall water supply portfolio during droughts more diversified and resilient. Based on a hydrologic and operations analysis covering the future 50-year period from 2022 to 2071 and the resulting frequency and rate of extraction expected, the average annual net extraction benefit for the existing Bayside well would be 134 AFY as a 50-year annual average. The benefit in a year in which extraction occurs is 1,120 AF. The reliability of source water is based on historical hydrology being a good projection of future hydrology. **Table 4-6** summarizes the estimated annual net extraction benefit, expected probability of water year type, and the weighted-average annual water supply from the extraction well.

The EBP Subbasin is not overdrafted, and current groundwater pumping is a relatively small fraction of estimated sustainable yield. Implementation of this project is consistent with meeting measurable objectives, avoiding the exceedance of minimum thresholds, and avoiding undesirable results for all six sustainability indicators. There will be notice provided to the public and other agencies regarding possible future implementation of other EBMUD GSP projects through GSA stakeholder outreach (e.g., website postings, meetings, press releases), and the California Environmental Quality Act (CEQA) process.

Table 4-6. EBMUD Bayside Phase 1 Well Average Extraction			
Year Type	Total Annual Volume (AF)	% of Years	Weighted Average Volume (AFY)
Wet (Surplus water available)	0	24%	0
Average	0	40%	0
First/Second Year in Drought	0	24%	0
Third Year or later in Drought	1,120	12%	134
Average Annual			**134**

4.1.1.3 Water Source

Water for injection during years when surplus water is available will be obtained from pre-1914 waters from San Leandro Creek watershed either through direct diversion or withdrawal from previously collected pre-1914 waters in Upper San Leandro Creek Reservoir. Water for extraction will be derived from the Deep Aquifer in the EBP Subbasin. Some of the water extracted from the Deep Aquifer will have been sourced from surface water supply from the San Leandro Creek watershed injected into the

Deep Aquifer. The remaining water extracted from the Deep Aquifer will be derived from native/local recharge in the EBP Subbasin.

4.1.1.4 Project Costs

Future costs relate only to ongoing annual maintenance and operation costs, which are estimated at $30,000 (years with no extraction) to $200,000 per year (years with extraction).

4.1.2 Management Actions

EBMUD GSP management actions (MA or actions) include a number of items to address sustainable groundwater management of EBP Subbasin. These actions can be grouped into broad categories that include monitoring, construction of new monitoring facilities, special studies, biological surveys, GSP reporting, and other actions. These actions will help fill existing data gaps and facilitate ongoing sustainable management in the EBP Subbasin in accordance with this GSP. These actions are described in more detail in this section.

4.1.2.1 Management Actions Overview

The MA to be conducted by EBMUD are summarized in **Table 4-7**, along with estimated capital costs and annual operating costs. In some cases (e.g., Five-Year GSP Update Report), costs are incurred in one year but are spread out over time to derive the reported average annual operating cost in **Table 4-7**. More detailed estimated costs by year are provided in **Appendix 4.B**.

4.1.2.1.1 *Monitoring*

The RMS wells in the groundwater level monitoring network are shown on **Figure 3-1**. The costs for RMS groundwater level monitoring includes both existing RMS wells and RMS wells planned for construction under a DWR Proposition 68 grant that are scheduled to be completed by mid-2022. Most of these wells have (or will have) transducers installed for automated water level monitoring, and semi-annual manual measurements and transducer downloads will be conducted as part of this action. In addition to RMS groundwater level monitoring wells, a broader network of groundwater level monitoring wells (non-RMS wells) is being investigated for inclusion in the overall monitoring network (**Appendix 3.G**). Non-RMS wells being investigated include current CASGEM wells that are not RMS wells, Port of Oakland monitoring wells, and EBMUD monitoring wells that are not currently CASGEM or RMS wells. The current status of Port of Oakland wells are unknown and will require further coordination and investigation with the Port of Oakland. It is anticipated that the initial network of non-RMS wells to be included in the broader GSP monitoring network will be established by 2023.

Table 4-7. EBMUD EBP Subbasin Management Actions						
Project	First Year of Implementation	Completion Date	Number of Monitoring Stations	Minimum Frequency	Estimated Capital Cost	Estimated Five-Year Costs
Monitoring Actions						
RMS[1] GW[2] Level Monitoring	2022	Ongoing	22	Semi-Annual	NA[3]	$72,500
Non-RMS GW Level Monitoring	2022	Ongoing	TBD[4]	Semi-Annual	NA	$100,000
RMS GW Quality Monitoring	2022	Ongoing	22	Annual	NA	$110,000
Baseline GW Quality Sampling	2023	2024	22	Semi-Annual	NA	$88,000
Subsidence Monitoring	2022	Ongoing	2	Daily	NA	$77,500
Synoptic Stream Monitoring	2023	2030	NA[5]	NA[5]	NA	$75,000
Construction of New Monitoring Facilities						
Install Shallow RMS Wells Near Creeks	2023	2024	10	NA	$115,000	$115,000
Monitoring Shallow Wells for GWL	2024	Ongoing	10	Semi-Annual	NA	$21,000
Monitoring Shallow Wells for GWQ	2024	Ongoing	10	Annual	NA	$30,000
Install Stream Gages	2024	2024	2	NA	$65,000	$65,000
Monitor Stream Gages	2024	Ongoing	2	Monthly	NA	$87,500
Install New Nested Monitoring Wells	2023	2024	3	NA	$400,000	$400,000
Monitoring New Nested Wells for GWL	2024	Ongoing	9	Semi-Annual	NA	$21,000
Monitoring New Nested Wells for GW Quality	2024	Ongoing	9	Annual	NA	$30,000
Special Studies						
Isotopic Sampling	2028	2028	NA	NA	NA	$100,000
GDE/Biological Monitoring						
Baseline GDE/Biological Surveys	2023	2023	NA	NA	NA	$150,000
Biological Surveys	2023	Ongoing	NA	Every 5 Years	NA	$50,000

Table 4-7. EBMUD EBP Subbasin Management Actions						
Project	First Year of Implementation	Completion Date	Number of Monitoring Stations	Minimum Frequency	Estimated Capital Cost	Estimated Five-Year Costs
Reporting						
Annual Reporting	2022	Ongoing	NA	Annual	NA	$178,750
GSP Five-Year Updates	2027	Ongoing	NA	Every 5 Years	NA	$162,500
Other						
DMS	2022	Ongoing	NA	Annual	NA	$25,000
Update Plume Info	2023	Ongoing	NA	Every 2 Years	NA	$13,000
Fate/Transport Modeling	TBD[6]	TBD	NA	TBD	NA	$65,000

[1] Representative Monitoring Site (RMS)

[2] Groundwater (GW)

[3] Not Applicable (NA); no associated capital costs

[4] To Be Determined (TBD); candidate non-RMS wells need further evaluation

[5] Not Applicable (NA), Number of Monitoring Stations/Frequency does not apply to this Action
6To Be Determined (TBD); Start Date, Completion Date, and Frequency are unknown at this time.

The RMS groundwater quality wells are the same group of wells as for RMS groundwater level monitoring (**Figure 3-11**). In the long-term, these wells will be sampled annually for arsenic, nitrate, chloride, and TDS; and a more comprehensive constituent analysis suite will occur every five years (e.g., full general mineral suite). In addition, baseline sampling of the groundwater quality RMS wells for key constituents is needed over the initial four years of GSP implementation to confirm the baseline for establishing MO and MT. Baseline sampling will include a minimum of four samples collected in both spring and fall over at least two different years, preferably different water year types (e.g., wet and dry). The non-RMS monitoring well network (**Appendix 3.G**) will be evaluated for supplemental water quality sampling for selected key constituents that may inform characterization of basin conditions (e.g., chloride samples in non-RMS wells along Bay margin that may be useful as sentinel wells for seawater intrusion).

Synoptic (also known as hydrometric) stream monitoring involves collecting stream discharge measurements along the course of a stream on the same day as close together in time as possible to improve understanding of gaining and losing reaches along a length of stream. Typically, stream discharge measurements will be collected at four or more locations along a stream for each synoptic event. Synoptic stream monitoring events during different seasons and different water year types enable a more comprehensive understanding of gaining and losing reaches. These stream synoptic monitoring events in EBP Subbasin will initially focus on San Pablo and San Leandro Creeks (**Figure 2-6**).

4.1.2.1.2 *Construction of New Monitoring Facilities*

New monitoring facility construction will largely correspond to streamflow measurement and understanding the interaction between streams and shallow groundwater levels. Ten new shallow single completion monitoring wells (likely 20 to 40 feet deep) will be installed at locations to be determined along major creeks and in potential GDE areas (**Figure 2-6 and 2-38**). Groundwater levels (with transducers installed) and groundwater quality will be monitored at these locations to establish baseline conditions, and then MT and MO will be assigned and incorporated into the RMS monitoring network. These wells are planned to address the surface water depletion sustainability indicator along with the chronic groundwater level decline sustainability indicator.

New monitoring facility construction will also include installation of two new stream gages; one will be located on San Pablo Creek and another on San Leandro Creek (**Figure 2-6**). The locations of the new gages remains to be determined; potential locations for the gages will be identified from which to select the optimal locations. Automated stream stage data collection equipment would then be installed, a rating curve established (between stream stage and stream discharge), and ongoing measurements collected. This stream gage will be used in conjunction with synoptic stream monitoring and shallow groundwater monitoring wells to better inform overall understanding of the surface water depletion sustainability indicator.

A third component of new construction will include drilling and installation of up to three new deep nested well monitoring sites with up to three different well depth completions at each site. One of these sites is planned to be located in north central Oakland to fill a data gap in that area. The two other locations remain to be determined following an updated assessment of data gap areas. Baseline water level and water quality sampling would be conducted at these new monitoring facilities for subsequent incorporation into the RMS monitoring network.

4.1.2.1.3 *Special Studies*

Periodic special studies are anticipated to fill data gaps and enhance the understanding of groundwater basin conditions. A special study is currently underway under a DWR Proposition 68 grant to conduct stream discharge and isotope sampling along San Pablo and San Leandro Creeks to improve the understanding of stream-aquifer interaction. Results from this ongoing isotopic study are expected in 2022, along with other GSP Implementation work related to streams. Additional studies using isotopes may be identified to further refine the understanding of stream-aquifer interaction. It is assumed one additional study may occur within the initial ten years of the GSP Implementation Period.

Another special study being conducted under the DWR Proposition 68 grant involves developing additional data related to the hydrogeologic boundary that occurs between EBP Subbasin and Niles Cone Subbasin. This special study involves a combination of long-term regional aquifer testing and collection of groundwater isotope data. It builds upon previous work conducted by USGS (2019), LSCE (2003), Fugro (2011), and the HCM for this GSP (Section 2). Other presently unidentified studies that support sustainable groundwater management may be conducted in the future.

4.1.2.1.4 *Biological Surveys*

Biological surveys planned to be conducted include a baseline field investigation to further characterize and validate potential GDEs, including identification of specific species at each location to allow more specific evaluation of rooting depths. Work conducted to date has included review of available GDE databases provided by TNC and others; however, no fieldwork has been conducted to further refine and validate potential GDE locations and species identification. The planned baseline field investigation would also establish current conditions for ecological health at each potential GDE location (**Figure 2-38**) to provide a basis for comparison for future surveys to be conducted every five years.

Following the baseline survey to be conducted within the initial five years of GSP implementation, there will be periodic biological surveys every five years prior to Five-Year Update Reports to allow for assessment of the ecological health of potential GDEs compared to the baseline survey. These GDE biological surveys will be analyzed in conjunction with groundwater level and quality data collected from the planned shallow monitoring wells. The Five-Year Update Report would describe the results of the GDE biological surveys along with discussion of shallow zone groundwater level fluctuations and groundwater quality.

4.1.2.1.5 *GSP Reporting*

The GSAs will prepare GSP Annual Reports in accordance with GSP regulations to document groundwater levels, groundwater storage change, basin water balance conditions, progress on implementation of projects and management actions, and comparisons to MT, IM, and MO. In addition, a Five-Year Update Report will be prepared beginning in 2027 and every five years thereafter. The Five-Year Update Reports will be more detailed than Annual Reports as these are key checkpoints during the GSP Implementation Period to report on groundwater basin status compared to Interim Milestones and to report the status of projects and management actions compared to the schedule presented in the GSP. A groundwater model update is also likely to occur at Five-Year intervals to incorporate new data, refine model structure as needed, and potentially recalibrate the model to recent water levels and streamflow data. In addition, the

Five-Year Update Report will include more detailed reporting on other data sets being collected such as groundwater quality data and subsidence (extensometer) data.

4.1.2.1.6 *Other Actions*

Other actions following submittal of the GSP include data input and maintenance of the DMS, periodic assessment of contaminant plumes that may be in proximity to GSA projects, and possible fate and transport modeling related to potential future groundwater quality issues.

4.1.2.2 Implementation

Implementation of management actions will begin in 2022 following GSP submittal. Certain actions will begin immediately (e.g., RMS groundwater level monitoring), while other activities will require additional time to identify and vet optimum construction locations (e.g., installation of shallow monitoring wells along creeks) and resolve other logistical issues (e.g., property access, permitting, consultant/contractor retention). The GSP implementation schedule is discussed in more detail in Chapter 5.

4.1.2.3 Management Action Operations and Monitoring

EBMUD will be responsible for MA operations and monitoring. EBMUD is already conducting groundwater level monitoring and groundwater quality sampling in selected wells. EBMUD will likely implement the various MA listed above using a combination of EBMUD staff, consultants to provide specific professional services, and outside contractors.

4.1.2.4 Management Action Benefits

The benefits of implementation the MA outlined above are primarily two-fold: 1) Allows for good groundwater basin management and meeting GSP/SGMA requirements; and 2) A significantly improved understanding of groundwater basin conditions, including stream-aquifer interaction. The MA are expected to greatly improve the spatial and vertical distribution of data needed to optimize groundwater basin management. Data gaps will be further evaluated as identified MA are implemented to determine if additional MA are warranted to further enhance the understanding of the EBP Subbasin and its management.

MA are also expected to provide substantial benefits towards tracking MO, IM, and MT, and assist with avoiding the occurrence of UR. Notification of the public and other agencies regarding implementation of MA will occur through EBMUD GSA stakeholder outreach, meetings, and press releases.

4.1.2.5 Management Action Costs

The estimated costs for EBMUD management actions are summarized in **Table 4-7**; with a more detailed year by year estimate provided in **Appendix 4.B**. The overall costs for the first ten years of the implementation period amount to an estimated $3,301,250, or an average of $330,125 on an annual basis.

4.1.3 Future EBMUD Projects Pending Data and Science

EBMUD has and will continue to look for opportunities to diversify its water supply portfolio to help improve resiliency to changing climate, regulations, and water supply needs. Consequently, EBMUD has identified three potential local groundwater projects that may be investigated in the future once data gaps are filled and there is sufficient information to evaluate their feasibility relative to maintaining sustainability within the EBP Subbasin while avoiding undesirable results. The three projects include:

- Future Phases of Bayside
- Irrigation with Groundwater
- Chabot Recovery

Each is briefly described below.

4.1.3.1 Future Phases of Bayside

Future phases of Bayside would involve constructing additional ASR wells. Data collected as part of the proposed management actions will be used to make science-based decisions regarding whether future phases are feasible. ASR well locations and diameter/depth of ASR wells would be selected to maximize recharge efficiency and benefits to the EBP Subbasin to maintain sustainability and avoid undesirable results.

If Bayside Phases 2 and 3 are developed, these projects will probably not occur until late in the GSP Implementation Period or during the Sustainability Period after 2042. Studies for Phase 2 and/or Phase 3 ASR facilities would include: identify sites that are good locations and conduct feasibility studies for construction of ASR wells, initiate permitting and environmental documentation, and identify and secure financing for construction. It can be anticipated that if additional ASR phases are developed in the future, the overall process will require about 10 years to complete for each phase.

4.1.3.2 Irrigation with Groundwater

This potential future project would use of groundwater in lieu of using imported surface water supplies to irrigate large parcels (e.g., parks, golf courses, cemeteries). Implementation of this project will depend on filling data gaps and will be based on science.

4.1.3.3 Chabot Recovery

This potential future project would use groundwater to supplement flows in San Leandro Creek. Implementation of this project will depend on filling data gaps and will be based on science.

4.1.4 EBMUD Project and Management Action Financing

Pursuant to CCR Title 23 Sections 354.44 and 354.6, EBMUD has evaluated the ability to cover project and management action costs. EBMUD may pursue available state and federal grants or loans to help with construction of new monitoring facilities and special studies. The remaining costs will be financed from revenues raised through water rates and/or fees and assessments. EBMUD will conduct the necessary

studies and decision processes (including Proposition 218 elections, if needed) to approve rates, fees, or assessments to provide the required funding.

4.1.5 Coordination with Other GSAs and Planning Agencies

As part of the EBP Subbasin GSP, EBMUD GSA will coordinate with Hayward GSA, as well as the neighboring GSAs in adjacent subbasins. Planning and coordination for various projects in the past have occurred between the GSAs (EBMUD and Hayward within EBP Subbasin, ACWD in Niles Cone Subbasin) and Alameda County. Coordination will continue among these and other agencies as needed to implement projects and management actions successfully. EBMUD GSA and Hayward GSA will work cooperatively to maximize the opportunities for recharge and groundwater extraction benefits for the southern portion of the EBP Subbasin. Coordination could potentially include pursuit of grant funding, additional injection/recharge opportunities, design and construction efforts, and additional special studies.

4.2 Hayward GSA Projects and Management Actions (CCR Title 23, Section 354.44)

The City of Hayward (Hayward) has identified one primary project to include in its implementation of the GSP. It involves use of the City's existing groundwater extraction wells for emergency supply purposes. Hayward has also specified other management actions to be implemented to meet sustainability objectives. The project description is based on information developed during the GSP process and previous studies. The project and management action operations and integration as part of the overall GSP are described in Chapter 5.

4.2.1 Extraction

Emergency supply wells are planned for use as extraction-only wells to provide supplemental water supply to Hayward in the event of a short-term emergency, such as may occur with an earthquake that interrupts surface water supplies. The size, location, and performance of each extraction well depends on site-specific characteristics that were assessed by Hayward for their existing emergency wells.

4.2.1.1 Project Overview

Hayward has already constructed five emergency extraction wells (in the 1990s) that are screened primarily in the Deep Aquifer (Well A has one screen section in the Intermediate Aquifer Zone). Three of the five emergency wells are located within the EBP Subbasin – Well A, Well D, and Well E (**Figure 4-1**). These wells are currently permitted as standby sources and thus can operate for 15 days over the course of one year; the GSP Project Scenario assumes these three emergency wells would operate for two months in a given year when needed. It is assumed that 15-day emergency use may be inadequate, and that the state would allow the wells to run beyond the initial 15 days in a true emergency where sufficient municipal water service is not restored in that period of time. The 60-day period is reflective of a San Francisco Public Utilities Commission (SFPUC) Regional Water System disruption scenario due to a large earthquake. Additional information regarding the Hayward emergency wells is provided in **Appendix 4.C**.

4.2.1.2 Implementation

Implementation has already begun with the three emergency supply wells, although they have not yet been used for extended periods of extraction. Hayward previously conducted feasibility studies for the emergency well system in the 1980s and early 1990s and developed the project for full operations by the late 1990s. The existing three emergency wells located within EBP Subbasin have extraction capacities of 1.73, 1.22, and 3.74 MGD for Wells A, D, and E, respectively. The future scenario in this GSP assumes that the three wells would each operate on schedules of 5 days on and 1 day off (i.e., the average pumping rate over the 60-day period is 16 percent less than stated well pumping capacities). Hayward will monitor extraction well performance and impacts from the existing emergency wells to inform the potential for expanded production in the future.

4.2.1.2.1 *Construction Activities and Requirements*

No new construction activities are anticipated to be needed to operate the existing emergency water supply wells.

4.2.1.2.2 *Water Source*

Water for extraction will be derived primarily from the Deep Aquifer in the EBP Subbasin (a portion of Well A production will be derived from the Intermediate Aquifer). The extracted water will be derived from native/local recharge in the EBP Subbasin.

4.2.1.2.3 *Conditions or Constraints on Implementation*

The Hayward emergency wells are an existing project for the GSP, and its implementation does not depend on the performance of other projects or activities. Hayward will continue to monitor conditions in the GSA and adjacent areas to determine the impacts of the extraction well during its operations. An expanded monitoring program being implemented for the GSP will provide additional information related to Hayward emergency well operations.

4.2.1.2.4 *Permitting Process and Agencies with Potential Permitting and Regulatory Control*

The Hayward emergency wells are operated in accordance with permits from the SWRCB Division of Drinking Water.

4.2.1.3 Project Operations and Monitoring

Hayward will be responsible for emergency supply well project operations and monitoring. Extractions will be metered, and transducers installed in production and monitoring wells where feasible to collect ongoing groundwater level data.

4.2.1.4 Project Benefits

The emergency extraction wells provide benefits to the Hayward water supply portfolio utilizing EBP Subbasin groundwater storage when surface water supplies are severely interrupted by a major emergency (e.g., an earthquake that interrupts surface water delivery to Hayward). The estimated project benefits developed for the GSP are based on representative average hydrologic conditions. The emergency use of water supply wells by Hayward is not tied to hydrologic year type, because an emergency interruption could occur in any type of water year (i.e., wet, average, or drought). Therefore, the GSP future scenario (described in **Appendices 4.C and 6.E**) is designed to allow for evaluation of Hayward emergency well operations in different water year types and under different GSA project operation conditions (e.g., with and without EBMUD Bayside Well operations). In any given year that the Hayward emergency wells would operate, extraction from the three wells combined over two months is estimated to total 1,062 AF.

The EBP Subbasin is not overdrafted, and current groundwater pumping is a relatively small fraction of estimated sustainable yield. Implementation of this project is consistent with meeting measurable objectives, avoiding the exceedance of minimum thresholds, and avoiding undesirable results for all six sustainability indicators. There will be notice provided to the public and other agencies regarding possible future implementation of other Hayward GSP projects through GSA stakeholder outreach (e.g., website postings, meetings, press releases), and the CEQA process.

4.2.1.5 Project Costs

Hayward completed construction of the emergency well facilities between the late 1980s and late 1990s. Thus, the construction of the facilities was completed more than twenty years ago and there are no additional capital costs. Future costs relate only to ongoing annual maintenance and operation costs, which are estimated to range from $60,000 in years wells are not operated for emergency supply to between $300,000 and $500,000 during years when the wells are operated for emergency purposes. If treatment facilities (e.g., for manganese) need to be built in the future, related capital costs for a treatment system at the existing well site(s) may be needed at that time. Additional development costs for a water treatment system may include project administration, legal, permitting, and environmental review. Given the uncertainty regarding whether water treatment facilities will be built by Hayward, no estimated costs for treatment facilities are presented in this GSP.

4.2.2 Management Actions

Hayward management actions include a number of items to address EBP Subbasin management. These actions can be grouped into broad categories including monitoring, special studies, GSP reporting, and other actions. These actions will help address existing data gaps and sustainably manage the EBP Subbasin. These actions are described in more detail in this section.

4.2.2.1 Management Actions Overview

The management actions planned by Hayward are summarized in **Table 4-8**, along with estimated annual operating costs. In some cases (e.g., Five-Year GSP Update Report), costs are incurred in a single year but are spread out over time to derive the reported average annual cost in **Table 4-8**. More detailed estimated costs by year are provided in **Appendix 4.D**.

Table 4-8. Hayward EBP Subbasin Management Actions						
Project	First Year of Implementation	Completion Date	Number of Monitoring Stations	Minimum Frequency	Estimated Capital Cost	Estimated Five-Year Costs
Monitoring Actions						
RMS[1] GW[2] Level Monitoring	2022	Ongoing	8	Semi-Annual	NA[3]	$27,500
Non-RMS GW Level Monitoring	2022	Ongoing	TBD[4]	Semi-Annual	NA	$25,000
RMS GW Quality Monitoring	2022	Ongoing	8	Annual	NA	$40,000
Baseline GW Quality Sampling	2023	2024	8	Semi-Annual	NA	$32,000
Special Studies						
Isotopic Sampling	TBD	TBD	NA[5]	NA[5]	NA	?[6]
Reporting						
Annual Reporting	2022	Ongoing	NA	Annual	NA	$96,250
GSP Five-Year Updates	2027	Ongoing	NA	Every 5 Years	NA	$87,500
Other						
DMS	2022	Ongoing	NA	Annual	NA	$25,000
Update Plume Info	2023	Ongoing	NA	Every 2 Years	NA	$7,000
Fate/Transport Modeling	TBD[7]	TBD	NA	TBD	NA	$35,000

[1] Representative Monitoring Site (RMS)

[2] Groundwater (GW)

[3] Not Applicable (NA); no associated capital costs

[4] To Be Determined (TBD); candidate non-RMS wells need further evaluation

[5] Not Applicable (NA), Number of Monitoring Stations/Frequency does not apply to this Action

[6] It is uncertain if additional isotopic studies will be needed; no cost is provided at this time

[7] To Be Determined (TBD); Start Date, Completion Date, and Frequency are unknown at this time

4.2.2.1.1 *Monitoring*

RMS wells in the groundwater level monitoring network are shown on **Figure 3-1**. The costs for RMS groundwater level monitoring include both existing RMS wells and RMS wells planned for construction under a DWR Proposition 68 grant that is scheduled to be completed by mid-2022. Most of these wells have (or will have) transducers installed for automated water level monitoring, and semi-annual manual measurements and transducer downloads will be conducted as part of this action. In addition to RMS groundwater level monitoring wells, a broader network of groundwater level monitoring wells (non-RMS wells) is being investigated for inclusion into the overall monitoring network. Non-RMS wells being investigated include Hayward wells not included as RMS wells (**Appendix 3.G**). The initial network of non-RMS wells in the broader GSP monitoring network is anticipated to be established by 2023.

The RMS groundwater quality wells are the same group of wells as for RMS groundwater level monitoring (**Figure 3-11**). In the long-term, these wells will be sampled annually for arsenic, nitrate, chloride, and TDS; and a more comprehensive sampling would occur every five years (e.g., full general mineral suite). Baseline sampling of the RMS groundwater quality wells for key constituents is needed over the initial four years of GSP implementation to confirm the basis for establishing MO and MT. Baseline sampling will include a minimum of four samples collected in both spring and fall over at least two different years, preferably different water year types (e.g., wet, and dry). The non-RMS monitoring well network (**Appendix 3.G**) will be evaluated for supplemental water quality sampling for selected key constituents to characterize basin conditions (e.g., chloride samples in non-RMS wells along Bay margin that may be useful as sentinel wells for seawater intrusion).

4.2.2.1.2 *Special Studies*

A special study currently (in 2021 and 2022) being conducted under the DWR Proposition 68 grant involves developing additional data and information related to the hydrogeologic boundary between the EBP and the Niles Cone Subbasin's. This special study involves a combination of long-term regional aquifer testing and collection of groundwater isotope data. It builds upon previous work conducted by USGS (2019), LSCE (2003), Fugro (2011), and the HCM for this GSP (Section 2). Other unidentified special studies may be conducted in the future.

4.2.2.1.3 *GSP Reporting*

The GSAs will prepare annual GSP reports each year documenting groundwater levels, groundwater storage change, basin water balance conditions, progress on implementation of projects and management actions, and comparisons to MT, IM, and MO. In addition, a Five-Year Update Report will be prepared beginning in 2027, and every five years thereafter. The Five-Year Update Reports will be more detailed than Annual Reports as these are key checkpoints during the GSP Implementation Period to report on groundwater basin status compared to Interim Milestones and to report status of project and management action implementation compared to the schedule presented in the GSP. A periodic groundwater model update is likely to incorporate new data, refine model structure as needed, and potentially recalibrate to recent water levels and streamflow data. In addition, the Five-Year Update

Report will include more detailed reporting on other data sets being collected such as groundwater quality data.

4.2.2.1.4 *Other Actions*

Other actions following submittal of the GSP include data input and maintenance of the DMS, periodic assessment of contaminant plumes that may be in proximity to GSA projects, and fate and transport modeling related to potential future groundwater quality issues.

4.2.2.2 Implementation

Implementation of management actions will begin in 2022 following submittal of the GSP. The implementation schedule is provided in Section 5.

4.2.2.3 Management Action Operations and Monitoring

Hayward will be responsible for management action operations and monitoring. Hayward will conduct groundwater level monitoring and groundwater quality sampling in selected RMS wells and other wells within Hayward GSA included in the broader monitoring network. Hayward will likely implement the various management actions listed above using a combination of Hayward staff, consultants to provide specific professional services, and outside contractors.

4.2.2.4 Management Action Benefits

The benefits of management action implementation outlined above are primarily two-fold: 1) Allows for good groundwater basin management and meeting GSP/SGMA requirements; and 2) improves understanding of groundwater basin conditions. The management actions are expected to greatly improve the spatial and vertical distribution of data needed to optimize groundwater basin management. Data gaps will be further evaluated as identified management actions are implemented to determine if additional management actions are warranted to advance the understanding of the EBP Subbasin and its sustainable management.

Management actions are also expected to provide substantial benefits towards tracking MO, IM, and MT, and assist with avoiding the occurrence of UR. Notification of the public and other agencies regarding implementation of MA will occur through Hayward GSA stakeholder outreach and meetings.

4.2.2.5 Management Action Costs

The estimated costs for Hayward management actions are summarized in **Table 4-8**; a more detailed year by year estimate is provided in **Appendix 4.D**. The overall costs for the first ten years of the implementation period amount to an estimated $713,250, or an average of $71,325 on an annual basis.

4.2.3 Hayward Project Financing

Pursuant to CCR Time 23 Sections 354.44 and §354.6, Hayward has evaluated the ability to cover project and MA costs. The project and management action costs will be financed from revenues raised through water rates and/or fees and assessments. Hayward will conduct the necessary studies and decision

processes (including Proposition 218 elections, if needed) to approve rates, fees, or assessments to provide the required funding.

4.2.4 Coordination with Other GSAs and Planning Agencies

As part of the EBP Subbasin GSP, Hayward GSA will coordinate with EBMUD GSA, as well as the neighboring GSA (ACWD) in the Niles Cone Subbasin. Planning and coordination for previous projects have occurred between the GSAs (Hayward and EBMUD within EBP Subbasin, ACWD in Niles Cone Subbasin) and Alameda County. Coordination will continue among these and other agencies as needed to implement projects and management actions successfully. Hayward GSA and EBMUD GSA will work cooperatively to maximize the opportunities for recharge and groundwater extraction benefits for the southern portion of the EBP Subbasin. Coordination could potentially include pursuit of grant funding, additional injection/recharge opportunities, design and construction efforts, and additional special studies.

4.3 References

East Bay Municipal Utility District, *East Bay Municipal Utility District Bayside Groundwater Project, 2009 Annual Report, Order No. R2-2007-0038*, March 2010.

Woodard & Curran, Brown and Caldwell, and M.Cubed, *Recycled Water Master Plan Update, East Bay Municipal Utility District, Final Interim Report*, December 2018.

Woodard & Curran and Brown and Caldwell, *East Bay Municipal Utility District, Updated Recycled Water Master Plan*, February 2019.

FIGURES

LSCE TEAM

Map of Project Locations for East Bay Plain Subbasin GSAs

Figure 4-1

East Bay Plain Subbasin
Groundwater Sustainability Plan