Groundwater Sustainability Plan for the Pleasant Valley Basin

Fox Canyon Groundwater Management Agency
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Board of Directors
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Subject: Groundwater Sustainability Plan for the Pleasant Valley Basin

Dear Board of Directors:

Dudek is pleased to submit this Groundwater Sustainability Plan (GSP) for the Pleasant Valley Basin to the Fox Canyon Groundwater Management Agency. This GSP was prepared this in accordance with California Code of Regulations, Title 23. Water, Division 2. Department of Water Resources, Chapter 1.5. Groundwater Management, Subchapter 2. Groundwater Sustainability Plans.

Respectfully Submitted,

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ACRONYMS AND ABBREVIATIONS

Acronym/Abbreviation	Definition
AF	acre-feet
AFY	acre-feet per year
AHA	Adjusted Historical Allocation
ASRVB	Arroyo Santa Rosa Valley Basin
BMO	Basin Management Objective
CEQA	California Environmental Quality Act
cfs	cubic feet per second
CIMIS	California Irrigation Management Information System
CMWD	Calleguas Municipal Water District
COCs	constituents of concern
CWD	Camrosa Water District
CWRF	Camrosa Water Reclamation Facility
DBS&A	Daniel B. Stephens & Associates Inc.
DPWM	Distributed Parameter Watershed Model
DWR	California Department of Water Resources
EPVMA	East Pleasant Valley Management Area
ET	evapotranspiration
FCA	Fox Canyon Aquifer
FCGMA	Fox Canyon Groundwater Management Agency
GCA	Grimes Canyon Aquifer
GDE	groundwater-dependent ecosystem
gpm	gallons per minute
GREAT	Groundwater Recovery Enhancement and Treatment
GSA	Groundwater Sustainability Agency
GSP	Groundwater Sustainability Plan
LAS	Lower Aquifer System
LPVB	Las Posas Valley Basin
M&I	municipal and industrial
mg/L	milligrams per liter
msl	above mean sea level
MWC	Mutual Water Company
MWTP	Moorpark Wastewater Treatment Plant
NPVMA	North Pleasant Valley Management Area
PVB	Pleasant Valley Basin
PVCWD	Pleasant Valley County Water District
PVMWC	Pleasant Valley Mutual Water Company
PVP	Pleasant Valley Pipeline
PVPDMA	Pleasant Valley Pumping Depression Management Area
RMSE	root-mean-squared error
SCAG	Southern California Association of Governments
SGMA	Sustainable Groundwater Management Act

Acronym/Abbreviation	Definition
SOAR	Save Open Space and Agricultural Resources
SWP	State Water Project
TAG	Technical Advisory Group
TDS	total dissolved solids
TMDL	total maximum daily load
UAS	Upper Aquifer System
UWCD	United Water Conservation District
UWMP	urban water management plan
WLPMA	West Las Posas Management Area
WQO	Water Quality Objective
WRP	Water Reclamation Plant
WWTP	wastewater treatment plant

EXECUTIVE SUMMARY

The Fox Canyon Groundwater Management Agency (FCGMA, or the Agency) has developed this Groundwater Sustainability Plan (GSP) for the Pleasant Valley Basin (PVB; DWR Basin 4-006), in compliance with the 2014 Sustainable Groundwater Management Act (SGMA) (California Water Code, Section 10720 et seq.). FCGMA is one of three Groundwater Sustainability Agencies (GSAs) in the PVB. The other two GSAs are the Camrosa Water District–Pleasant Valley GSA and the Pleasant Valley Outlying Areas GSA. This GSP is the sole GSP prepared for the PVB, and covers the entire PVB, including all areas of the PVB outside of FCGMA's jurisdiction. The purpose of this GSP is to define the conditions under which the groundwater resources of the entire PVB, which support agricultural, municipal and industrial, and environmental uses, will be managed sustainably in the future.

The PVB shares a boundary and is in hydraulic communication with Oxnard Subbasin (Subbasin; DWR Basin 4-004.02) to the west. The boundary between the PVB and the Oxnard Subbasin is associated with a change in character of recent and older alluvial deposits. In the PVB, these deposits are finer grained and are, in general, less suitable for groundwater production than the coarser-grained sediments of the same age in the Oxnard Subbasin. There is no corresponding change in character in the deeper aquifers, including the Fox Canyon Aquifer, which are continuous across the boundary between the PVB and the Oxnard Subbasin. Groundwater production from wells on either side of the boundary between the PVB and the Oxnard Subbasin influences groundwater elevations and the direction of groundwater flow across this boundary.

Historical groundwater production from the PVB and Oxnard Subbasin combined has resulted in seawater intrusion in the aquifers of the Subbasin. In the PVB, the average rate of groundwater production between 2015 and 2017 was approximately 13,200 acre-feet per year (AFY). In 2015, approximately 53% of the production from the Lower Aquifer System, which comprises the Hueneme, Fox Canyon, and Grimes Canyon Aquifers, and 47% of the production from the Upper Aquifer System, which comprises the older alluvium in the PVB, and the Oxnard and Mugu Aquifers in the Oxnard Subbasin. Numerical groundwater simulations indicate that if these production rates were carried into the future, groundwater elevations in the PVB would not recover during multi-year cycles of drought and recovery, and seawater intrusion would continue in the Oxnard Subbasin. The landward extent of the area in the Subbasin currently impacted by concentrations of chloride greater than 500 milligrams per liter is referred to as the "saline water impact front."[1]

Combinations of projects and management actions were explored to estimate the rate of groundwater production that would allow groundwater elevations in the PVB to recover during multi-year cycles

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1 Sources of water high in chloride in the Oxnard Subbasin include modern seawater as well as non-marine brines and connate water in fine-grained sediments. Therefore, the area of the Subbasin impacted by concentrations of chloride greater than 500 milligrams per liter is referred to as the *saline water impact area*, rather than the *seawater intrusion impact area*, to reflect all the potential sources of chloride to the aquifers in this area.

of drought and recovery, and prevent future landward migration of the saline water impact front. This rate of groundwater production is referred to as the sustainable yield. With the currently available projects and management actions, the sustainable yield of the PVB was estimated to be approximately 11,600 AFY, with an uncertainty of ± 1,200 AFY. At the upper bound of the uncertainty estimate (12,600 AFY), the estimated sustainable yield of the PVB is 600 AFY lower than the 2015–2017 average production rate.

Adoption of this GSP represents the first step in achieving groundwater sustainability within the PVB by 2040, as required by SGMA. Evaluation of this GSP is required at a minimum of every 5 years following submittal to the California Department of Water Resources (DWR). As part of the 5-year evaluation process, the sustainable yield will be refined and adjusted. These refinements will be based on new data, additional studies undertaken to fill data gaps, and groundwater modeling. Refinements and adjustments will also be made to the minimum threshold groundwater levels developed to avoid undesirable results, the measurable objective groundwater levels that account for the need to continue groundwater production during drought cycles and the associated interim milestones to help gauge progress toward sustainability over the next 20 years.

In order to minimize the pumping reductions required to achieve sustainable management of the PVB, investment in projects to increase water supply, provide the infrastructure to redistribute pumping, and/or directly control seawater intrusion in the Oxnard Subbasin should be investigated. Inter-basin optimization studies, groundwater modeling, and project feasibility studies are recommended over the next 5 years to explore practicable processes and approaches to increasing the sustainable yield of the PVB.

ES.1 INTRODUCTION

The PVB is an alluvial groundwater basin, located in Ventura County, California. The climate is typical of coastal Southern California, with average daily temperatures ranging generally from 43°F to 80°F in summer and from 41°F to 74°F in winter. The PVB ranges in elevation from approximately 30 to 680 feet above mean sea level. Land use overlying the PVB is divided between agricultural and urban uses, with agricultural use covering approximately 40% of the land within Pleasant Valley, and residential and urban use covering approximately 50% of the land. The remaining 10% is open space. DWR has designated the 77-square-mile PVB as a high priority basin and subject to critical conditions of overdraft.

The PVB is bounded to the north by the Camarillo Hills and the Somis Gap, to the east by the Arroyo Santa Rosa Valley Groundwater Basin (DWR Groundwater Basin 4-007) and Conejo Mountain, to the southeast by the Santa Monica Mountains, and to the west and southwest by the Oxnard Subbasin. The Bailey Fault bisects the PVB, running northeast/southwest from the boundary of the Arroyo Santa Rosa Valley Groundwater Basin on the east to the boundary with the Oxnard Subbasin on the west. To the southeast of the Bailey Fault, the Fox Canyon Aquifer is absent in the subsurface. This area of the PVB has been designated as the East Pleasant Valley Management Area (EPVMA). The Camrosa Water District–Pleasant Valley GSA jurisdictional area coincides with the portion of the Camrosa Water District Service area in the EPVMA. The PVB Outlying Areas GSA covers the remaining portions of the EPVMA not within Camrosa Water District–Pleasant Valley GSA jurisdiction. Additionally, the PVB Outlying Areas GSA covers an approximately 3.6 acre area of the PVB on the boundary between the PVB and the Las Posas Valley Basin to the north. With the exception of the 3.6 acres in the jurisdiction of the PVB Outlying Areas GSA, the area northwest of the Bailey Fault lies within the jurisdictional boundaries of FCGMA.

FCGMA is an independent special district formed in 1982 by the California Legislature to manage and protect the aquifers within its jurisdiction for the common benefit of the public and all groundwater users (FCGMA et al. 2007). Extractors within FCGMA jurisdiction are subject to the Agency's GSPs, ordinances, and policies created for the sustainable management of groundwater.

Public participation and stakeholder feedback have played a critical role in the development of this GSP. The FCGMA maintains a list of stakeholders interested in the GSP process, known as the *List of Interested Parties*. A monthly newsletter, meeting notices, and notices of GSP documents available for review were sent electronically to those on the List of Interested Parties. Public workshops were held to inform stakeholders and the general public on the contents of the GSP and to solicit feedback on that content. To further facilitate stakeholder understanding, the FCGMA Board of Directors (Board) approved release of a preliminary draft GSP for public comment in November 2017. Additionally, the FCGMA Board formed a Technical Advisory Group, which generally held monthly public meetings throughout the GSP development process, beginning in July 2015 and ending in February 2019. In addition, updates on the development of the GSP were given at meetings of the FCGMA Board, beginning in April 2015. All FCGMA Board meetings, Technical Advisory Group meetings, Board-appointed committee meetings, and Board special workshops are noticed in accordance with the Brown Act, and opportunities for public comment were provided at all FCGMA Board meetings, Technical Advisory Group meetings, Board-appointed committee meetings, and workshops.

ES.2 SUMMARY OF BASIN SETTING AND CONDITIONS

There are five commonly recognized hydrostratigraphic units in the PVB: the Shallow Alluvial Aquifer, older alluvium, the Upper San Pedro Formation, the Fox Canyon Aquifer, and the Grimes Canyon Aquifer. The boundary between the PVB and the Oxnard Subbasin is associated with a change in character of recent and older alluvial deposits. The Fox Canyon Aquifer and Grimes Canyon Aquifer are continuous across the boundary with the Oxnard Subbasin to the west. The majority of the PVB aquifers, except the Shallow Alluvial Aquifer, are confined. In northern PVB, the Shallow Alluvial Aquifer rests directly on the folded, faulted, and eroded surface of the Fox Canyon Aquifer. Water that recharges the Shallow Alluvial Aquifer via flow in Arroyo Las Posas is able to migrate to the Fox Canyon Aquifer in this area; however, migration of recharge to the Fox Canyon Aquifer and Grimes Canyon Aquifer from Arroyo Las Posas to other parts of the PVB may be limited by extensive faulting and folding.

Groundwater elevations and flow directions have varied historically in the PVB. In general, groundwater elevations are higher in the northeastern part of the PVB and are lower adjacent to the Oxnard Subbasin boundary, and the groundwater gradient drives flow from east to west in the PVB. Groundwater elevations and the direction of flow are poorly constrained in the EPVMA, which lacks monitoring wells and historical groundwater elevation data. Historical groundwater elevation data document rising groundwater levels in the older alluvium and the Fox Canyon Aquifer throughout the 1990s. These rising groundwater levels were driven by increased surface water recharge to the PVB as discharge from upstream wastewater treatment plants and shallow dewatering wells in Simi Valley produced perennial flow in Arroyo Las Posas. The effects of this increased flow reached the PVB in the early 1990s as both direct surface water flow and increased subsurface inflow from the Las Posas Valley Basin to the north. Perennial surface water flows no longer reach the PVB, and groundwater elevations have declined in response to the combined effects of the diminished recharge and the drought that began in 2011.

As the PVB began to receive additional recharge from perennial flows in Arroyo Las Posas, groundwater concentrations of total dissolved solids (TDS) began to increase in northern PVB. Increased concentrations of TDS have been observed in both the older alluvium and the Fox Canyon Aquifer. TDS concentrations have impaired municipal use of groundwater in the northern PVB.

In addition to groundwater quality concerns related to infiltrating surface water, brine migration along the Bailey Fault is also a concern in the PVB. Degradation of groundwater quality may occur in the PVB if groundwater levels fall below threshold elevations that maintain sufficient hydrostatic pressure to prevent upwelling of brines along the Bailey Fault and from the geologic formations underlying the PVB. However, a direct correlation between groundwater elevation and degraded water quality has not been established.

The water budget for the PVB provides an accounting and assessment of the average annual volume of groundwater and surface water entering (i.e., inflow) and leaving (i.e., outflow) the PVB and enables an accounting of the cumulative change in groundwater in storage over time. The United Water Conservation District developed the Ventura Regional Groundwater Flow Model, a MODFLOW numerical groundwater flow model, for the PVB, the Oxnard Subbasin, the western part of the Las Posas Valley Basin, and the Mound Basin. A peer review study of the United Water Conservation District model was conducted for this GSP. The historical groundwater budget for the PVB is based on the United Water Conservation District model, which had a historical base period from 1985 to 2015. During average conditions, which are defined as water years in which the precipitation in the PVB was between 75% and 150% of the average annual precipitation, the net change in groundwater storage for the older alluvium was an increase of 1,758 AFY and the net change in storage in the Lower Aquifer System was an increase of 860 AFY. This increase reflects the increased recharge along Arroyo Las Posas, and does not take into consideration the ongoing seawater intrusion in the Oxnard Subbasin during these years. Groundwater pumping during these years averaged 999 AFY in the older alluvium and 7,145 AFY in the Lower Aquifer System.

Several model scenarios were developed to assess the future sustainable yield of the PVB and the adjacent Oxnard Subbasin. Each future scenario covered a 50-year timeframe, from 2020 to 2069. In two scenarios the 2015–2017 average groundwater extraction rate was continued throughout the 50-year model period. The results of each of these scenarios indicated that continuing the 2015–2017 extraction rate would allow for net seawater intrusion in both the Upper Aquifer System and the Lower Aquifer System in the Oxnard Subbasin. In three additional scenarios, the groundwater production rate was decreased gradually over the first 20 years. These model scenarios indicated that reduced groundwater production can eliminate net seawater intrusion in the Oxnard Subbasin over periods of drought and recovery. Based on the suite of model scenarios, the sustainable yield of the PVB was calculated to be approximately 12,600 AFY, with an uncertainty of ± 1,000 AFY.

It is anticipated that the analysis for the 5-year update to the GSP will focus on developing new water supply projects, as well as examining the potential impacts of differential extractions on the coast and inland, particularly in the Lower Aquifer System. Additional modeling is recommended for the 5-year update process to understand how changes in pumping patterns and the addition of new water supply projects can increase the overall sustainable yield of the PVB. As this understanding improves, projects to support increases in the overall sustainable yield can be developed.

To reflect the current understanding of the hydrogeologic characteristics of the PVB, and in anticipation of future management strategies the PVB has been divided into three management areas. These areas are the EPVMA, the North Pleasant Valley Management Area, and the Pleasant Valley Pumping Depression Management Area. The Pleasant Valley Pumping Depression Management Area is adjacent to the Oxnard Subbasin, north of the EPVMA. The North Pleasant Valley Management Area is east of the Pleasant Valley Pumping Depression Management Area and north of the EPVMA. These areas are distinguished by differing hydrogeologic and water quality characteristics.

ES.3 OVERVIEW OF SUSTAINABILITY CRITERIA

The primary sustainability goal in the PVB is to maintain a sufficient volume of groundwater in storage in the older alluvium and the Lower Aquifer System so that there is no net decline in groundwater elevation or storage over wet and dry climatic cycles. Further, groundwater levels in the PVB should be maintained at elevations that are high enough to not inhibit the ability of the Oxnard Subbasin to prevent net landward migration of the saline water impact front after 2040.

Under SGMA, undesirable results occur when the effects caused by groundwater conditions occurring throughout the PVB cause significant and unreasonable impacts to any of the six sustainability indicators:

- Chronic lowering of groundwater levels
- Reduction of groundwater storage
- Seawater intrusion
- Degraded water quality
- Land subsidence
- Depletions of interconnected surface water

Of the six sustainability indicators, chronic lowering of groundwater levels, reduction of groundwater storage, degraded water quality, and land subsidence are applicable to the PVB. The PVB does not experience direct seawater intrusion, but groundwater elevations in the PVB affect seawater intrusion in the Oxnard Subbasin. Depletion of interconnected surface water is also not occurring within the PVB, where surface water bodies are ephemeral, losing streams, with groundwater elevations below the bottom of the stream channels. Minimum thresholds and measurable objectives, which are quantitative metrics of groundwater conditions in the PVB, were established for the sustainability indicators determined to be a current and/or potential future undesirable result. Groundwater elevations were used as a proxy for other sustainability indicators in establishing the minimum thresholds and measurable objectives.

The measurable objective groundwater levels for the PVB are the groundwater levels throughout the PVB, at which there is neither seawater flow into nor freshwater flow out of the Upper Aquifer System or the Lower Aquifer System in the Oxnard Subbasin. If groundwater levels in the PVB remained at the measurable objective in perpetuity, no groundwater would flow from the aquifer systems into the Pacific Ocean, and no ocean water would flow into the aquifer systems. To allow for operational flexibility during drought periods, groundwater levels in the PVB are allowed to fall below the measurable objective. In order to prevent net seawater intrusion over periods of drought and recovery, the periods during which groundwater elevations are below the measurable objective must be offset by periods when the groundwater elevations are higher than the measurable objective.

The minimum thresholds for the four applicable sustainability indicators are groundwater levels that were selected to allow declines in groundwater elevations during periods of future drought to be offset by recoveries during future periods of above-average rainfall in the PVB. These groundwater elevations also limit seawater intrusion in the Oxnard Subbasin. The minimum thresholds were tested with future groundwater model simulations that suggest the Oxnard Subbasin is likely to experience net landward migration of the 2015 saline water impact front after 2040 if groundwater levels fall below the minimum threshold elevations. These minimum thresholds are anticipated to improve the beneficial uses of the PVB by preventing chronic lowering of groundwater levels. This allows for long-term use of groundwater supplies in the PVB without ongoing loss of storage.

Although exceedance of a minimum threshold at any given well in the PVB may indicate an undesirable result is occurring in the PVB, a single exceedance is not necessarily sufficient to indicate PVB-wide conditions are causing undesirable results. To define the conditions under which undesirable results will occur in the PVB, three criteria were developed. The PVB would be determined to be experiencing an undesirable result if:

- In any single monitoring event, groundwater levels in four of nine identified key wells are below their respective minimum thresholds.
- The groundwater elevation at any individual key well is below the historical low groundwater level for that well.
- The groundwater level in any individual key well is below the minimum threshold for either three consecutive monitoring events or three of five consecutive monitoring events, which occur in the spring and fall of each year.

ES.4 OVERVIEW OF THE SUBBASIN MONITORING NETWORK

The overall objective of the monitoring network in the PVB is to track and monitor parameters that demonstrate progress toward meeting the sustainability goals. In order to accomplish this objective, the monitoring network in the PVB must be capable of the following:

- Monitoring changes in groundwater conditions (in four sustainability indicator categories)
- Monitoring progress toward minimum thresholds and measurable objectives
- Quantifying annual changes in water budget components

The existing network of groundwater wells includes both monitoring wells and production wells. This network is capable of delineating the groundwater conditions in the PVB and has been used for this purpose in the past. The current groundwater well network will be used to monitor groundwater conditions moving forward, in order to continue to assess long-term trends in groundwater elevation and groundwater quality in the PVB.

Although the current monitoring network is adequate to monitor groundwater conditions in the PVB, several improvements can be made to the network as funding becomes available. FCGMA has applied for funding through a DWR Technical Support Services (TSS) monitor well funding grant to add a monitoring well south of 5th Street to better constrain aquifer-specific groundwater elevations adjacent to the boundary with the Oxnard Subbasin. Additionally, there are no dedicated monitoring wells in either the North Pleasant Valley Management Area or the EPVMA. Adding a monitoring well to these management areas would provide for aquifer-specific water levels that would improve the understanding of groundwater gradients throughout the PVB. Lastly, to fill an existing data gap and to assist with understanding the potential connectivity between shallow groundwater and potential groundwater-dependent ecosystems, the monitoring network can be improved by installing shallow dedicated monitoring wells within the boundaries of the potential groundwater-dependent ecosystem along Arroyo Las Posas, Conejo Creek, and Calleguas Creek.

As funding becomes available, pressure transducers should be added to wells in the groundwater monitoring network. Pressure transducer records provide the high-temporal-resolution data that allows for a better understanding of water level dynamics in the wells related to groundwater production, groundwater management activities, and climatic influence.

In addition to supplementing the existing monitoring network with new wells, monitoring can also be improved in the future by coordination of monitoring schedules to ensure that groundwater monitoring activities occur over a 2-week window during the key reporting periods and mid-March and mid-October.

In the future, to the extent possible, additional dedicated monitoring wells will be incorporated into the existing monitoring network. These wells will provide information on groundwater conditions in geographic locations where data gaps have been identified, or where a dedicated monitoring well would better represent conditions in the aquifers than a production well currently used for monitoring.

ES.5 PROJECTS AND MANAGEMENT ACTIONS

Future projects and management actions have been identified to address potential impacts to beneficial uses and users of groundwater in the PVB resulting from groundwater production in excess of the current sustainable yield. One project was included in this GSP. This project was suggested by stakeholders and was reviewed by the FCGMA Board. The inclusion of this project does not constitute a commitment by the FCGMA Board to construct or fund it, but rather signals that it was sufficiently detailed to be included in groundwater modeling efforts that examined the quantitative impacts of the projects on groundwater elevations and the sustainable yield of the PVB. Projects included in the GSP or any amendment thereof that increase the available supply of groundwater are necessary to meet the sustainability goal for the basin in a manner that avoids adverse impacts to beneficial uses and users of groundwater within the basin.

Project No. 1 – Temporary Agricultural Land Fallowing

The Temporary Agricultural Land Fallowing Project will decrease groundwater production in the Pleasant Valley Pumping Depression Management Area, adjacent to the Oxnard Subbasin. This project will benefit the PVB by lessening pumping reductions for agricultural users of the PVB, while providing compensation for agricultural users who choose to fallow parcels of land.

Management Action No. 1 – Reduction in Groundwater Production

The primary management action proposed under this GSP is a reduction in groundwater production from the PVB. FCGMA has had the authority to monitor and regulate groundwater production in the portion of the PVB within its boundaries since 1983. The primary benefits related to reduction in groundwater production is recovery of groundwater elevations that have historically allowed for seawater intrusion in the Oxnard Subbasin. Reduction in groundwater production can be used to close any differential between groundwater elevations that can be obtained through implementation of projects and the groundwater elevations necessary to meet the sustainability goals for the PVB.

FCGMA approved an ordinance to establish an allocation system for the Oxnard Subbasin and PVB on October 23, 2019. The purpose of this ordinance is to facilitate adoption and implementation of the GSP and to ensure that the Oxnard Subbasin and PVB are operated within their sustainable yields. It is not the purpose of the ordinance to determine or alter water right entitlements, including those that may be asserted pursuant to California Water Code Sections 1005.1, 1005.2, or 1005.4.

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