Appendix D.

Assessment of Take of Covered Species from United Water Conservation District's Conjunctive Use Projects and Related Activities

Freeman Diversion

Multiple Species Habitat Conservation Plan

Prepared by:

United Water
CONSERVATION DISTRICT

"Conserving Water Since 1927"

June 2020

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1 INTRODUCTION

The purpose of this appendix is to identify and describe the conjunctive-use and related activities conducted by United Water Conservation District (United), and make an assessment of their potential to result in incidental take of steelhead (Oncorhynchus mykiss) and pacific lamprey (Entosphenus tridentatus) based on effects of the activities to Santa Clara River flows. United determined that no other covered species have potential to be affected by the activities described in this appendix. In addition to its surface-water diversion, artificial recharge, and maintenance activities as described in Chapters 3 and 5 of the Multiple Species Habitat Conservation Plan (HCP), United has constructed and operated three conjunctive-use projects over the past 63 years for the purpose of mitigating environmental impacts (i.e., water quality degradation) caused by seawater intrusion in the aquifers of the Oxnard subbasin of the Santa Clara River basin (abbreviated herein to "Oxnard basin"). These three projects are: 1) the Oxnard-Hueneme (O-H) Pipeline project, 2) the Pleasant Valley Pipeline (PVP) project, and 3) the Pumping Trough Pipeline (PTP) project. Locations of these projects are shown on Figure 1. Each of these projects includes several components, including headworks, artificial recharge facilities, water-supply wells, and conveyance infrastructure, that are operated by United in a comprehensive, systematic manner in order to achieve their intended benefits. It should be noted that United's surface-water diversion and maintenance activities at the Freeman diversion, headworks, and downstream conveyance infrastructure are also components of the PVP, PTP, and O-H Pipeline projects; however, those activities and an assessment of their potential for incidental take are described in Chapters 3, 5, and 7 of the HCP, which are not repeated in this appendix. It should also be noted that the distribution systems located downstream from United's turnouts on the O-H Pipeline, PTP, and PVP are neither owned nor operated by United and are not discussed in the HCP or this appendix. Much of the water recharged by United for these conjunctive-use projects remains in the Oxnard basin, helping to sustain groundwater levels and mitigating seawater intrusion, but a portion of this stored water is pumped back out at United's facilities and distributed to coastal areas in order to decrease pumping in key areas, providing further benefit to the basin and more effectively managing water levels in coastal areas where onshore gradients (which drive seawater intrusion) persist. Although United currently has no plans to modify operation of these conjunctive-use projects, United and the Fox Canyon Groundwater Management Agency (FCGMA) have recognized that, at least conceptually, operational adjustments to these conjunctive-use projects could further optimize their beneficial impacts on groundwater quality and sustainable yield of the Oxnard and Pleasant Valley basins. Such optimization efforts are currently envisioned to consist of modifying the timing and volume of surface water deliveries to coastal areas of the basins, so that groundwater extractions in these areas can be reduced.

As defined by the California Department of Water Resources (DWR), "Conjunctive management or conjunctive use refers to the coordinated and planned use and management of both surface water and groundwater resources to maximize the availability and reliability of water supplies in a region to meet various management objectives" (DWR 2016). The PVP and PTP both meet this definition of conjunctive-use projects, as they deliver diverted surface water for agricultural water supply when surface water is available, supplemented with groundwater during months when surface water is not available for diversion, or as otherwise needed. As will be described in more detail in subsequent sections of this appendix, these surface-water deliveries associated with the PVP and PTP reduce the need for groundwater pumping in areas of the Oxnard basin where seawater intrusion threatens groundwater quality.

A more expansive definition of conjunctive use has been used by the U.S. Department of the Interior: "Many conjunctive-use systems involve artificial recharge of surface water (whether potable, reclaimed, or waste-stream discharge) into the subsurface for purposes of augmenting or restoring the quantity of water stored in developed aquifers" (Peltier 2006). This definition more aptly fits the methods and objectives of the O-H Pipeline project, which does not include direct delivery of surface water to users. Rather, the O-H Pipeline project includes recharge of diverted surface water at the El Rio recharge basins for short-term (e.g., a few weeks) to long-term (e.g., a year or longer) storage and natural filtering in the aquifer prior to extraction, treatment, and conveyance to primarily municipal and industrial (M&I) purveyors and a few agricultural users along the O-H Pipeline (including an extension referred to as the Oceanview Pipeline). The primary goal of the O-H Pipeline system is to provide a source of water to coastal communities in the Oxnard basin (e.g., Oxnard and Port Hueneme) that reduces their reliance on groundwater extraction close to the coastline, where such extractions would exacerbate seawater intrusion. An important secondary benefit of the O-H Pipeline project has been improving groundwater quality in the Forebay area of the Oxnard basin, where many of the small mutual water companies providing water to the disadvantaged community of El Rio are solely dependent on groundwater for municipal supply.

2 DESCRIPTION OF UNITED'S CONJUNCTIVE USE PROJECTS AND RELATED ACTIVITIES

2.1 OXNARD-HUENEME PIPELINE PROJECT

The O-H Pipeline project was designed and constructed in the mid-1950s in response to increasing concerns raised by DWR and United investigators regarding groundwater quality degradation caused by seawater intrusion in the Port Hueneme area. Operation of this project began in 1957 and continues today. The goal of this project was to reduce groundwater pumping near the coast, primarily by municipal water suppliers but also including a few agricultural users, that was exacerbating seawater intrusion, and replace that pumping with groundwater extracted from the El Rio area, about 7 miles inland from the area of seawater intrusion. Pumping at an inland area, such as El Rio, reduces landward hydraulic gradients near the coast that can exacerbate seawater intrusion. Artificial recharge at the El Rio recharge basins has been applied at rates that, over the long term, equal or exceed groundwater extractions for the O-H Pipeline project. However, as discussed in more detail below, during some months recharge rates at El Rio are less than extractions for the O-H Pipeline project; most of these months occur during drought years.

The O-H Pipeline project includes a pipeline from United's Saticoy recharge facility for conveyance of surface water diverted from the Freeman Diversion to the El Rio recharge facility, recharge basins, extraction wells, a water treatment plant (required for municipal water supply), and the O-H Pipeline that conveys extracted groundwater from El Rio to turnouts for the Cities of Oxnard and Port Hueneme, as well as several mutual water companies and farms. Figure 1 shows the locations of the salient features of the O-H Pipeline project, including the El Rio recharge basins, El Rio well field, and O-H pipeline (including the Oceanview and Mugu Lateral extensions of the O-H Pipeline). The artificial recharge applied at El Rio percolates downward to the Oxnard Aquifer, which is the uppermost aquifer pumped for water-supply in the Oxnard basin and one of the hydrostratigraphic units that compose the regional Upper Aquifer System (UAS). Groundwater for the O-H Pipeline project is pumped from 12 United-operated water-supply wells located at El Rio (the El Rio well field); nine of these wells are screened in the UAS and three are screened in the Lower Aquifer System (LAS). The LAS wells are rarely used, except when the UAS wells produce groundwater with high nitrate concentrations, as can occur during droughts as a result of declining groundwater elevations in the Forebay area of the Oxnard basin (Figure 1). For example, the LAS wells were used extensively in 2016 and 2017, due to exceptional drought conditions in the area from 2012 through 2017.

Annual volumes of recharge at the El Rio recharge basins throughout its history of operation are shown on Figure 2. The average annual recharge rate at the El Rio recharge basins from 1991, when the Freeman Diversion was constructed, through 2019, the most recent complete water year, was 23,776 acre-feet per year (AF/yr.). Annual groundwater withdrawals from United's El Rio well field are also shown on Figure 2. The average annual extraction rate from the El Rio well field for the period from 1991 through 2019 was 13,505 AF/yr. As is apparent from these average groundwater recharge and extraction rates, and as illustrated on Figure 2, artificial recharge in the El Rio area substantially exceeds groundwater extractions during most years.

2.2 PLEASANT VALLEY PIPELINE PROJECT

The PVP project was designed and constructed in the 1950s for the purpose of reducing groundwater pumping in the western Pleasant Valley basin and eastern Oxnard basin, where declining groundwater levels and groundwater quality were concerns. As a secondary benefit of the PVP project, it is recognized that by preventing excessive groundwater drawdown in the Pleasant Valley basin, the potential for seawater intrusion in aquifers underlying farmland in the southern Oxnard and Pleasant Valley basins is also reduced.

The PVP project includes a pipeline from United's Saticoy recharge facility for conveyance of diverted surface water from Freeman Diversion to the Pleasant Valley Reservoir, located east of the Camarillo Airport near the City of Camarillo. The delivery of diverted Santa Clara River water to Pleasant Valley County Water District (PVCWD) offsets pumping of irrigation wells in the area. PVCWD operates the Pleasant Valley Reservoir, together with downstream distribution pipelines, to deliver water from the PVP project to farmers in the Pleasant Valley basin and eastern Oxnard basin. Figure 1 shows the locations of the salient features of the PVP project that are owned by United, including the PVP and Pleasant Valley Reservoir (PVCWD operates the Pleasant Valley Reservoir). Downstream from the Pleasant Valley Reservoir, PVCWD owns and operates distribution pipelines, water-supply wells (screened in the LAS), and turnouts, which deliver surface water and groundwater to farms within PVCWD's service area. Those facilities downstream from the Pleasant Valley Reservoir are neither owned nor operated by United. As noted previously, all of United's surface-water diversions, including those that are directed to the PVP for conveyance to PVCWD, are described and assessed in Chapters 3, 5, and 7 of the HCP.

Unlike the O-H Pipeline project described above, United does not own or operate an extraction well field that is dedicated exclusively to supplying groundwater to the PVP. However, from May 2006 through September 2013, an average of 978 AF/yr of water was extracted from United's Saticoy well field (Figure 1) and conveyed to PVCWD via the PVP. The wells of the Saticoy well field are located approximately 3,000 to 5,000 feet southeast of the Santa Clara River, and United's Saticoy recharge facility lies between the well field and the river. The Saticoy well field was constructed in 2003 and first operated in 2007. Annual total withdrawals from United's Saticoy wells for delivery to PVCWD via the PVP are shown on Figure 3, together with withdrawals from the Saticoy well field that are conveyed to the PTP project (as described in Section 2.3, below). All groundwater withdrawals from United's Saticoy well field are shown on Figure 3, and are much smaller than the quantity of water recharged at Saticoy.

United's pumping allocation for its Saticoy well field has been limited by the Fox Canyon Groundwater Management Agency (FCGMA) since 2011. The water extracted at the Saticoy well field for delivery to the PVP project (and the PTP project, as discussed below) is considered temporarily stored surface water, as it consists of surface water from Lake Piru that has been conveyed down the Santa Clara River to Freeman Diversion, where it is diverted and artificially recharged for storage at the Saticoy recharge facility (in addition to United's normal diversion and recharge of surface water from the Santa Clara River). Extractions from the Saticoy well field must conform with FCGMA Resolution 11-2 (FCGMA 2011), referred to as the Saticoy Well Field Storage Program. FCGMA Resolution 11-2 specifies that "After two (2) years, any unrecovered stored water (that was recharged under this Resolution) will no longer be eligible for extraction under this Storage Program." Lake Piru water that is stored and later extracted from the Saticoy well field under this program is directed to both the PVP and the PTP (the PTP project is described in Section 2.3 of this appendix). The total volume of Lake Piru water artificially recharged and temporarily stored under the Saticoy Well Field Storage Program was 33,400 AF, with a total of 11,616 AF extracted for delivery to the PVP and PTP projects during the program's period of operation. Therefore, approximately 22,000 AF more Lake Piru water was recharged than was extracted by United under the Saticoy Well Field Storage Program (a component of both the PVP and PTP projects). In the future, volumes of Lake Piru water recharged at Saticoy will continue to equal or exceed volumes extracted and conveyed to the PTP and PVP under the Saticoy Well Field Storage Program, as required under FCGMA Resolution 11-2, resulting in a neutral to net positive benefit to groundwater levels in the Oxnard Basin.

2.3 PUMPING TROUGH PIPELINE PROJECT

Both the O-H Pipeline and PVP projects (described above) succeeded in reducing groundwater extractions in areas of the Oxnard and Pleasant Valley basins where declining groundwater levels were negatively affecting groundwater quality. However, by the 1970s it was recognized that a major pumping depression or "trough" persisted in the UAS in the agricultural area immediately east of the City of Oxnard. Concerns that seawater could advance as far inland as the Oxnard Forebay prompted the State Water Resources Control Board in 1979 to threaten adjudication of the basin unless local interests could make meaningful progress towards mitigating the persistent overdraft and seawater intrusion problem. In response, United partnered with Ventura County to design and construct the PTP project. The PTP project was designed and constructed in the early 1980s to reduce groundwater pumping from the UAS pumping trough area by delivering surface water directly to farmers in-lieu of them pumping groundwater, similar to the PVP project. For times when surface water supplies are insufficient to meet demand, five LAS wells (the PTP well field) were constructed and are operated by United to supply groundwater for irrigation without pumping from the UAS, which has a more direct impact on seawater intrusion.

The PTP project includes a pipeline from United's Saticoy recharge facility to convey diverted surface water from Freeman Diversion to the pumping trough area, five LAS extraction wells that provide supplemental groundwater when needed, and turnouts for delivering the surface and groundwater to distribution systems owned and operated by agricultural users. The PTP well field is located approximately 4 to 5 miles southeast from the Santa Clara River. In addition, modest volumes of groundwater were supplied to the PTP project by United's Saticoy well field from 2006 through 2013, under the Saticoy Well Field Storage Program, as described in more detail in Section 2.2, above. Figure 1 shows the location of the salient features of the PTP project, including the United's pipeline, and LAS wells, together with the Saticoy recharge basins and well field.

Annual groundwater withdrawals from United's PTP wells are shown on Figure 4. The average annual extraction rate from the PTP wells for the period from 1991 through 2019 was 2,572 AF/yr. Past artificial recharge volumes at the Saticoy recharge facility, together with the modest quantities of groundwater extractions from the Saticoy well field that have been directed to the PTP (under the Saticoy Well Field Storage Program from 2006 through 2013) are summarized in Section 2.2 and shown on Figure 3. In the future, volumes of Lake Piru water recharged at Saticoy will continue to equal or exceed volumes extracted and conveyed to the PTP and PVP under the Saticoy Well Field Storage Program, as required under FCGMA Resolution 11-2, resulting in a neutral to net positive benefit to groundwater levels in the Oxnard Basin.

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3 EFFECTS ASSESSMENT OF UNITED'S CONJUNCTIVE USE PROJECTS AND RELATED ACTIVITIES ON SURFACE WATER CONDITIONS

3.1 GENERAL CONSIDERATIONS

Overall, United artificially recharges far more groundwater than it extracts in the Oxnard and Pleasant Valley basins, where all of its conjunctive use and related activities occur. Figure 5 compares the annual totals for United's artificial recharge to its groundwater pumping in the Oxnard basin since 1955, just before United's first conjunctive-use project began operation (United has never conducted artificial recharge or groundwater pumping activities in the adjacent Mound, Las Posas, or Pleasant Valley basins, and has not conducted such operations in the adjacent Santa Paula basin since 1941). Therefore, the net effect of United's conjunctive-use projects and related activities has been to improve the groundwater balance, which has maintained groundwater elevations in the Oxnard and adjacent basins at higher levels, on average, than would have occurred without these projects. Other beneficial effects of United's conjunctive use projects and related activities include, but are not limited to, improvement of groundwater quality in the Forebay area and in the Pleasant Valley basin, and mitigation of seawater intrusion in the Oxnard basin. If each of United's conjunctive use projects is considered independently, more water has been artificially recharged at the El Rio and Saticoy recharge facilities for the O-H Pipeline and PVP projects than groundwater has been extracted from the associated El Rio and Saticoy well fields. Additionally, although there is not a specific volume of artificial recharge explicitly credited toward groundwater withdrawals for the PTP project, United's total annual average recharge rate in the Forebay area is approximately 10 times greater than the annual average extraction rate from the PTP wells.

From a simple conceptual perspective, it might seem that the net effect of United's operations (greater artificial recharge than groundwater extractions, thus maintaining higher groundwater elevations than would occur otherwise) would tend to increase groundwater discharge to the Santa Clara River. However, except during uncommon periods when multiple years of above-average rainfall and artificial recharge occur with few intervening dry or average years, there is no direct hydraulic connection between the Oxnard Aquifer—which is the uppermost aquifer that receives United's artificial recharge (also the uppermost aquifer that is pumped)—and water flowing in the river. Specifically, the Oxnard Aquifer is decoupled from the river the vast majority of the time. And the other aquifers used for water supply in the Oxnard basin are screened in deeper aquifers that do not intersect the Santa Clara River bed. Groundwater discharge to a river can only occur where the saturated zone of an underlying aquifer intersects the riverbed, without an intervening unsaturated zone. In areas where an unsaturated zone of significant thickness occurs between a river and the water table, the interaction is indirect and effectively one-way—surface water can percolate downward to the aquifer, but groundwater does not reach land surface to add to surface flows. Accordingly, direct hydraulic interaction usually occurs in surface water bodies that are predominantly perennial in nature, whereas ephemeral streams are predominantly decoupled from underlying aquifers because of the presence of an unsaturated zone between the stream channel and the water table, and thus flow only in response to storms (or sometimes artificial influx from sources such as drainage systems and wastewater discharges). The occurrence of coupled versus decoupled stream/aquifer systems fundamentally defines where the potential for impacts to streamflow can arise from upward or downward movement of the water table; perennial reaches are the only stream reaches that receive sustained groundwater discharge over long time periods. Furthermore, if a surface-water body is separated from an aquifer by one or more intervening aquitards and aquifers, then effects of groundwater recharge or pumping in that aquifer on surface flows will be attenuated.

Within the Oxnard basin, the Santa Clara River is perennial only in the reach extending downstream of the Forebay area, from approximately one-quarter mile upstream from U.S. Highway 101 to the mouth of the river (Figure 1). Historical observations from the 1800s indicate that the reach of the Santa Clara River along the north side of the Forebay of the Oxnard basin has always been ephemeral (Beller et al. 2011), except during uncommon periods when multiple high-rainfall years occur in close succession. The locations of the perennial and ephemeral reaches correspond to the presence and absence, respectively, of a semi-perched aquifer and an underlying confining unit known as the Clay Cap, which are present downstream from the Forebay area of the Oxnard basin and in the adjacent Mound basin. The semi-perched aquifer and Clay Cap separate the Oxnard Aquifer from the Santa Clara River by a vertical distance of 100 to 150 feet. In the Forebay area, where the semi-perched aquifer and Clay Cap are absent, the Oxnard Aquifer water table is vertically separated from the Santa Clara River channel by an unsaturated zone that is typically 30 to 90 feet thick (and sometimes as much as 150 feet thick), with groundwater elevations from 10 to 70 feet above mean sea level. In both the Mound basin and the Forebay, the Oxnard Aquifer is decoupled from the Santa Clara River, except during those uncommon periods with multiple high-rainfall years occurring in close succession (as described above), when the Oxnard Aquifer may discharge directly to the Santa Clara River in the Forebay. Therefore, the fact that United recharges more water than it pumps in the Oxnard basin has a negligible, if any, direct impact on streamflow in the Santa Clara River or any other streams in the region, even if conceptually it might seem as if the net excess of recharge should result in increased streamflow.

Along the lower reach of the Santa Clara River where it overlies the confined Oxnard basin, the higher groundwater elevations in the Oxnard Aquifer resulting from United's recharge operations theoretically could reduce the long-term rate of downward leakance of groundwater from the semi-perched aquifer (which is directly hydraulically connected to the Santa Clara River downstream from the Forebay area) to a small degree. Potentially, this effect could slightly raise groundwater elevations in the semi-perched aquifer, and thus increase discharge of groundwater to the Santa Clara River in this reach to a small degree. However, available data show that groundwater elevations in the semi-perched aquifer rise and fall independently of groundwater elevations in the UAS, indicating that the widespread positive effect of United's conjunctive use and related activities on basin groundwater levels does not have a direct or measurable impact on surface water conditions in the Santa Clara River in the Oxnard or adjacent basins, except during those uncommon extremely wet periods when United's artificial recharge may add somewhat to surface flows. Figure 6 compares groundwater elevations measured at shallow wells screened in the semi-perched aquifer near the perennial reach of the Santa Clara River downstream of the Forebay area (Stillwater Sciences 2017) with groundwater elevations measured in a nearby well screened in the Oxnard Aquifer, illustrating this point.

3.2 OXNARD-HUENEME PIPELINE PROJECT

As described in Section 2.1, the total volume of water recharged to the groundwater basin (i.e., the Oxnard Aquifer) in the El Rio area for the O-H Pipeline project has been significantly greater than the total volume of groundwater pumped by United from the basin for the O-H Pipeline project. This excess of recharge compared to extraction results in higher long-term-average groundwater elevations in the Oxnard Aquifer (and, to a lesser extent, deeper aquifers), with or without pumping from the El Rio well field. Recharge of greater quantities of water than are pumped by United for the O-H Pipeline project will continue into the future, as the El Rio recharge basins are United's highest priority for receiving surface-water diversions, and the O-H Pipeline project is a major source of supply for the Cities of Oxnard and Port Hueneme, as well as several other municipal and agricultural users. Applying artificial recharge in the El Rio area is required to maintain suitable groundwater quality for public health at the El Rio well field (United 2008) and other municipal supply wells in the area (operated by entities other than United), and to maintain groundwater elevations at sufficiently high levels to allow the O-H system to operate as designed (e.g., prevent wells from going dry).

Despite the fact that recharge for the O-H Pipeline project exceeds pumping over the long term, during summer and fall, and for a period of 6 years during the exceptional drought beginning in 2012 (Figure 2), United's groundwater withdrawals at the El Rio well field can exceed recharge rates at the El Rio recharge facility. These short-term "deficits" could cause temporary groundwater-level declines that theoretically might exceed those that would have occurred if the O-H Pipeline project had never existed. This hypothetical comparison cannot be directly observed or readily modeled, as the O-H Pipeline has been in operation since 1957 and has impacted pumping patterns by other users in the basin to a significant degree over the past 63 years. However, as discussed in Section 3.1, neither artificial recharge nor pumping from the Oxnard Aquifer (or deeper aquifers) can be expected to have a direct or measurable impact on surface water conditions in the Santa Clara River in the Oxnard or adjacent basins, except during unusually wet periods when groundwater elevations may rise sufficiently high in the Forebay area to intersect the river bed in part due to United's artificial recharge activities. During these periods, the excess recharge at El Rio may contribute slightly to groundwater mounding in the Saticoy area, which can result in some artificially recharged water under the Saticoy recharge basins to immediately flow back into the Santa Clara River.

In addition to comparing annual recharge and pumping at El Rio, as shown on Figure 2, United reviewed pumping and recharge data on a monthly basis from January 1990 (prior to completion of construction of Freeman Diversion) through December 2019 for the El Rio recharge facility and well field, to provide greater temporal resolution of when pumping at El Rio may have exceeded recharge. Months when pumping at El Rio exceeded recharge were compared to months when groundwater elevations at well 02N22W12E04S (the Vulcan well) exceeded 72 feet above mean sea level (msl), which has been conservatively estimated as the minimum groundwater elevation at which groundwater in the Oxnard Aquifer potentially has some degree of interconnection with surface water in the Santa Clara River in the upper (northeast) portion of the Forebay (R2 Resources Consultants, Inc., 2015). As groundwater elevations rise above 72 feet msl at the Vulcan well, the degree of potential interconnection between surface water and groundwater increases and extends southwestward farther into the Forebay below Freeman Diversion. Monthly data for pumping at the El Rio well field are not available in electronic format in United's database prior to January 1990, and expanding the analysis to years prior to construction of Freeman Diversion would not provide relevant information with regard to current conditions on the Santa Clara River; therefore, this analysis only includes the 30-year period from January 1990 through December 2019. Table 1 summarizes the months that groundwater extractions exceeded artificial recharge at United's El Rio facility (and at United's Saticoy facility) while a hydraulic connection between surface water and groundwater potentially existed in the Forebay area, based on groundwater elevations at the Vulcan well. Of the 360 months (30 years) evaluated, groundwater extractions at El Rio exceeded recharge at El Rio during 40 months (11 percent of the total number of months evaluated) when surface water and groundwater were potentially connected. Most of these months occurred during the first, second, or third year after high-rainfall years associated with "El Nino" conditions in the Pacific Ocean (notable El Nino-related high-rainfall years in Ventura County occurred in 1992, 1993 1995, 1998, 2001, and 2005). During these high-rainfall years, groundwater recharge at El Rio was abundant while demand for extracted groundwater was low; therefore, months when groundwater extractions exceeded recharge were uncommon. During most years with average to below-average rainfall, and particularly during extended droughts (e.g., 2012 through 2016), groundwater elevations in the Forebay were generally well below the level at which groundwater and surface water were potentially interconnected; therefore, even if United's monthly groundwater extractions at El Rio exceeded recharge, they could not have impacted surface flows in the Forebay reach of the Santa Clara River. This leaves the 1 to 3 years following high-rainfall years (the "El Nino" years listed above) as the most common years that include months when groundwater extractions at El Rio exceeded recharge and a potential connection existed between surface water and groundwater in the Forebay. Groundwater levels remained high enough in these years to maintain a potential groundwater-surface water connection into spring, while the demand for groundwater on the Oxnard Plain returned to "average-year" rates.

Also shown on Table 1 are the net quantities of recharge (in exceedance of extractions) at El Rio in the season preceding those months when extractions exceeded recharge ("prior wet-season recharge in excess of pumping"). For this analysis, the "prior wet-season" is defined as the period when recharge exceeded recharge every month at El Rio without interruption, up to 12 months. As shown on Table 1, in all but one year, prior wet-season recharge exceeded total extractions in excess of recharge at El Rio by a large margin, typically 10,000 to 30,000 AF. The sum of extractions exceeding recharge at El Rio in each of those years (typically 2,000 to 3,000 AF) can be expected to have a minor impact on groundwater levels in the Oxnard

Aquifer below the Santa Clara River (and, therefore, surface-water flows) compared to these much larger quantities of recharge. In addition, prior wet-season recharge in excess of pumping at Saticoy has typically resulted in an additional 11,000 to 34,000 AF of recharge in the Forebay during years when groundwater is potentially connected with surface water. In 2008, prior wet-season recharge in excess of pumping at El Rio was only 2,061 AF, while pumping at El Rio during February, May, June, and July of 2008 exceeded recharge by 3,977 AF. These 4 months represent just 1 percent of the total (360) months evaluated, thus are highly atypical for operation of the El Rio facility and O-H Pipeline project. Furthermore, this atypical "recharge deficit" at El Rio was countered by a surplus of recharge at Saticoy, which exceeded pumping at the El Rio and Saticoy well fields combined by nearly 3,000 AF. This net excess of recharge compared to pumping by United in 2008 would have raised groundwater elevations in the Oxnard Aquifer in the Forebay area to a much greater extent than the net excess of pumping at El Rio that year would have caused them to decline, yielding a net increase to flows in the Santa Clara River compared to those that would be expected if United's conjunctive-use operations did not exist.

In summary, the net effect on surface flows in the Forebay reach of the Santa Clara River resulting from United recharging more water annually than it extracts at El Rio is, overall, to potentially increase those surface flows to a modest degree, but only when groundwater levels in the Oxnard Aquifer in the Forebay are high enough to intersect land surface. A thick unsaturated zone exists below the Santa Clara River in the Oxnard basin the majority of the time—there is no direct hydraulic connection between the Santa Clara River and the aquifers that are recharged and pumped by United during such times, and United's conjunctive-use operations would not affect surface flows.

3.3 PLEASANT VALLEY PIPELINE PROJECT

As noted in Section 2.2, groundwater recharge and pumping by United (through the Saticoy Well Field Storage Program) are minor components of the PVP project, providing a modest supplement from 2006 through 2013 to the much larger quantities of diverted surface water delivered via the PVP project. Also, as noted in Section 2.2, recharge exceeds pumping for the Saticoy Well Field Storage Program, and this excess of recharge compared to extraction produces long-term-average higher groundwater elevations in the Oxnard Aquifer (and, to a lesser extent, deeper aquifers) than would occur if the Saticoy Well Field Storage Program had never existed, or was halted in the future.

As discussed in Section 3.1, neither artificial recharge nor pumping from the Oxnard Aquifer (or deeper aquifers) can be expected to have a direct or measurable impact on surface water conditions in the Santa Clara River in the Oxnard or adjacent basins, except during unusually wet periods when groundwater elevations may rise sufficiently in the Forebay area to intersect the river bed due to extensive artificial recharge. During these unusually wet periods, it is possible that recharge in the Saticoy area associated with the Saticoy Well Field Storage Project could contribute to groundwater elevations rising in the Oxnard Aquifer under the Forebay reach of the Santa Clara River such that the water table intersects the river bed, contributing a minor amount of additional streamflow. Much larger quantities of groundwater (an order of magnitude or more) that are not associated with the Saticoy Well Field Storage Project would also typically be recharged by United at Saticoy during these wet periods. Therefore, it can be expected that the effects on streamflow resulting from recharge and pumping at Saticoy that contribute to the PVP program would be negligible compared to United's other recharge activities.

Similar to the month-by-month evaluation of recharge and pumping conducted for the El Rio facility, in Section 3.2 above, United reviewed pumping and recharge data for the Saticoy recharge facility and well field on a monthly basis from 2003 (when the Saticoy well field was constructed) through 2019. Months when pumping at Saticoy exceeded recharge were compared to months when groundwater elevations at well 02N22W12E04S (the Vulcan well) exceeded 72 feet msl, which is the minimum groundwater elevation at which groundwater in the Oxnard Aquifer has the potential to have some degree of potential interconnection with surface water in the Santa Clara River in the upper (northeast) portion of the Forebay (R2 Resources

Consultants, Inc., 2015). Table 1 summarizes the months that groundwater extractions exceed artificial recharge at United's Saticoy facility (and at United's El Rio facility) while a potential hydraulic connection between surface water and groundwater exists in the Forebay area. Of the 152 months between the first use of the Saticoy well field (May 2007) through December 2019, groundwater extractions at Saticoy exceeded recharge during just 6 months (4 percent of the total number of months) when surface water and groundwater were potentially interconnected; all of these months occurred in 2007, 2008, and 2011. It should be remembered, however, that the Saticoy well field is only used to pump Lake Piru water that is temporarily "stored" in the Saticoy recharge facility. This water is not natural Santa Clara River surface water. Furthermore, less of this Lake Piru "stored" water is extracted than recharged, resulting in a net total benefit to the aquifer. Finally, during each of years 2007, 2008, and 2011 the total volume of prior wet-season recharge (including both surface water and Lake Piru water) in excess of pumping at Saticoy was approximately 21,000, 35,000, and 32,000 AF on an annual basis.

3.4 PUMPING TROUGH PIPELINE PROJECT

As noted in Section 2.3, groundwater pumping from the LAS by United is a significant component of the PTP project, as a supplement to surface-water deliveries and to reduce pumping by private landowners from the UAS. Because the aquifers of the LAS are not in direct hydraulic communication with the Santa Clara River in the Oxnard basin at any location or time, there is no reason to believe that pumping from United's PTP wells could directly affect surface water in the river. It is theoretically possible, however, that groundwater level drawdown in the LAS could induce downward groundwater movement from the UAS to the LAS, which in turn could provide a weaker inducement for downward groundwater movement from the semi-perched aquifer to the Oxnard Aquifer downstream from the Forebay area. This assumed downward movement from the semi-perched aquifer to the UAS could result in slightly lower groundwater levels in the semi-perched aquifer that could affect streamflow in the perennial reach of the Santa Clara River downstream from the Forebay area. However, groundwater elevation data summarized for the semi-perched aquifer in Section 3.1 indicate that groundwater elevations in the semi-perched aquifer near the Santa Clara River are not discernibly affected by changes in groundwater elevation in the underlying Oxnard Aquifer. The lack of response in the semi-perched aquifer to changes in groundwater elevation in the underlying Oxnard Aquifer indicates that the hydraulic effects of pumping from the LAS by the PTP well field (which is located 5 to 7 miles southeast of the Santa Clara River) are not transmitted through the intervening Mugu, Oxnard, and semi-perched aquifers to a significant degree, and are highly unlikely to affect flow in the Santa Clara River downstream from the Forebay area (where the river is in hydraulic communication with the semi-perched aquifer). Additional pumping and recharge in the Saticoy area as part of the Saticoy Well Field Storage Program have contributed a much smaller volume of water to the PTP project compared to pumping from the PTP well field. Effects of the Saticoy Well Field Storage Program are assessed in Section 3.3, and are not discussed further in this section.

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4 INCIDENTAL TAKE ASSESSMENT

As discussed in Section 3, above, the three conjunctive-use projects and related activities by United in the Oxnard basin are neither known nor expected to have a direct or measurable impact on surface water conditions in the Santa Clara River in the Oxnard or adjacent basins, except during unusually wet periods when groundwater elevations may rise sufficiently high in the Forebay area to intersect the river bed. During these periods, the net excess of United's recharge compared to its extractions may contribute slightly to groundwater mounding in the Saticoy area, which can result in some artificially recharged water under the Saticoy recharge basins discharging back into the Santa Clara River.

The determination of effects weighs several factors which, in the case of United's conjunctive-use projects, focuses on the contribution to surface flows in the affected reach. As described above, the Oxnard Aquifer is most commonly decoupled from the river. This portion of the affected reach is characterized as a losing reach, resulting in dry conditions for substantial portions of the year, beginning approximately 1 mile downstream of the Freeman Diversion and continuing to approximately one-quarter mile upstream of the Highway 101 bridge. The losing reach is a well-documented natural condition of the river, which has always been ephemeral except during uncommon periods when multiple high-rainfall years occur in close succession (Section 3.1). During such uncommon periods, there may be a hydraulic connection between surface flows in the river and the Oxnard Aquifer due to United's artificial recharge activities. However, the resulting groundwater discharge back to the river likely results in, at most, minor changes to surface flows (United 2010). The subsequent extraction of mounded groundwater is not likely to result in quantifiable reductions in surface flows and, as displayed in Table 1, recharge volumes greatly exceed extractions during these periods of groundwater mounding. Therefore, while United's conjunctive-use projects can, during uncommon periods, result in groundwater recharge, which can artificially contribute to surface flows, these inputs are relatively minor and do not constitute an effect to steelhead and lamprey. As noted in Section 1, United determined that no other covered species have potential to be affected by the conjunctive use projects. Based on the conclusions presented in the previous sections related to a net excess of recharge, the effects to riparian habitat are presumed to be positive (i.e., more water available for riparian vegetation). However, due to the typical decoupled state of the Oxnard Aquifer from the river, and the historically ephemeral condition of the critical reach, the conjunctive use projects are presumed to have no measurable effect, positive or negative, on other species.

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5 CONCLUSION

United is not seeking incidental take coverage for on-going conjunctive-use projects. The O-H Pipeline project, the PVP project, and the PTP project each contribute to the groundwater elevations through recharge and extractions. In the context of this assessment, the influence of these operations on surface flows in the river is the primary factor in determining the potential effects to covered species. As detailed in Section 3.4, the PTP project is highly unlikely to influence surface flows in the river due to the PTP well field. The influence of the Saticoy well field from the PTP and PVP projects, as detailed in Section 3.3, on surface flows in the river is limited to unusually wet periods when groundwater elevations may rise sufficiently in the Forebay area to intersect the river bed. While surface flows in the affected reach may be influenced by recharge and pumping activities during these periods, these interactions contribute a minor amount of total surface flows, and a goal of the Saticoy Well Field Storage Program (Section 2.2) is to reduce, and ideally eliminate, the excessive mounding in the Saticoy area that artificially influences surface flows. Therefore, the overall effects from the PVP and PTP projects from the Saticoy well field on surface flows in the Santa Clara River are considered to be negligible. Similarly, the recharge and pumping associated with the O-H Pipeline project from the El Rio well field may influence surface flows during the unusually wet periods described above for the PVP and PTP projects when the recharge at El Rio may contribute slightly to surface flows in the Saticoy area. However, as noted above for the PVP and PTP projects, the effects of recharge at El Rio associated with the O-H Pipeline project on surface flows in the Saticoy area are considered to be negligible.

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6 REFERENCES

Beller, E.E., R.M. Grossinger, M.N. Salomon, S.J. Dark, E.D. Stein, B.K. Orr, P.W. Downs, T.R. Longcore, G.C. Coffman, A.A. Whipple, R.A. Askevold, B. Stanford, and J.R. Beagle. 2011. Historical Ecology of the Lower Santa Clara River, Ventura River, and Oxnard Plain: An Analysis of Terrestrial, Riverine, and Coastal Habitats, prepared for the State Coastal Conservancy, a report of SFEI's Historical Ecology Program, SFEI Publication #641, San Francisco Estuary Institute, Oakland, CA (report and GIS layers are available on SFEI's website, at: www.sfei.org/projects/VenturaHE).

California Department of Water Resources. 2016. Conjunctive Management and Groundwater Storage—A Resource Management Strategy of the California Water Plan. July.

Fox Canyon Groundwater Management Agency. 2011. Resolution 2011-02 of the Fox Canyon Groundwater Management Agency: A Resolution Creating the United Water Conservation District Saticoy Well Field Storage Program. April.

Fox Canyon Groundwater Management Agency. 2019. Groundwater Sustainability Plan for the Oxnard Subbasin. December.

R2 Resources Consultants, Inc. 2015. Freeman Operations Model Documentation. February.

Stillwater Sciences. 2017. Draft Report, City of Ventura Special Studies—Phase 3: Assessment of the Physical and Biological Conditions of the Santa Clara River Estuary, Ventura County, California. November.

United Water Conservation District. 2008. Nitrate Observations in the Oxnard Forebay and Vicinity, 1995-2006. July.

United Water Conservation District. 2010. Saticoy Recharge Mound Study. March.

United Water Conservation District. 2018. Ventura Regional Groundwater Flow Model and Updated Hydrogeologic Conceptual Model: Oxnard Plain, Oxnard Forebay, Pleasant Valley, West Las Posas, and Mound Basins, United Water Conservation District Open-File Report 2018-02. July.

U.S. Dept. of the Interior. 2006. Conjunctive Water Management: A Solution to the West's Growing Water Demand? (testimony of Jason Peltier, Deputy Assistant Secretary for Water and Science, U.S. Dept. of the Interior before the U.S. House of Representatives Committee on Government Reform Subcommittee on Energy and Resources. April.

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7 FIGURES

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Figure 1 Location Map, Showing United Conjunctive-Use Project Facilities in Oxnard Basin

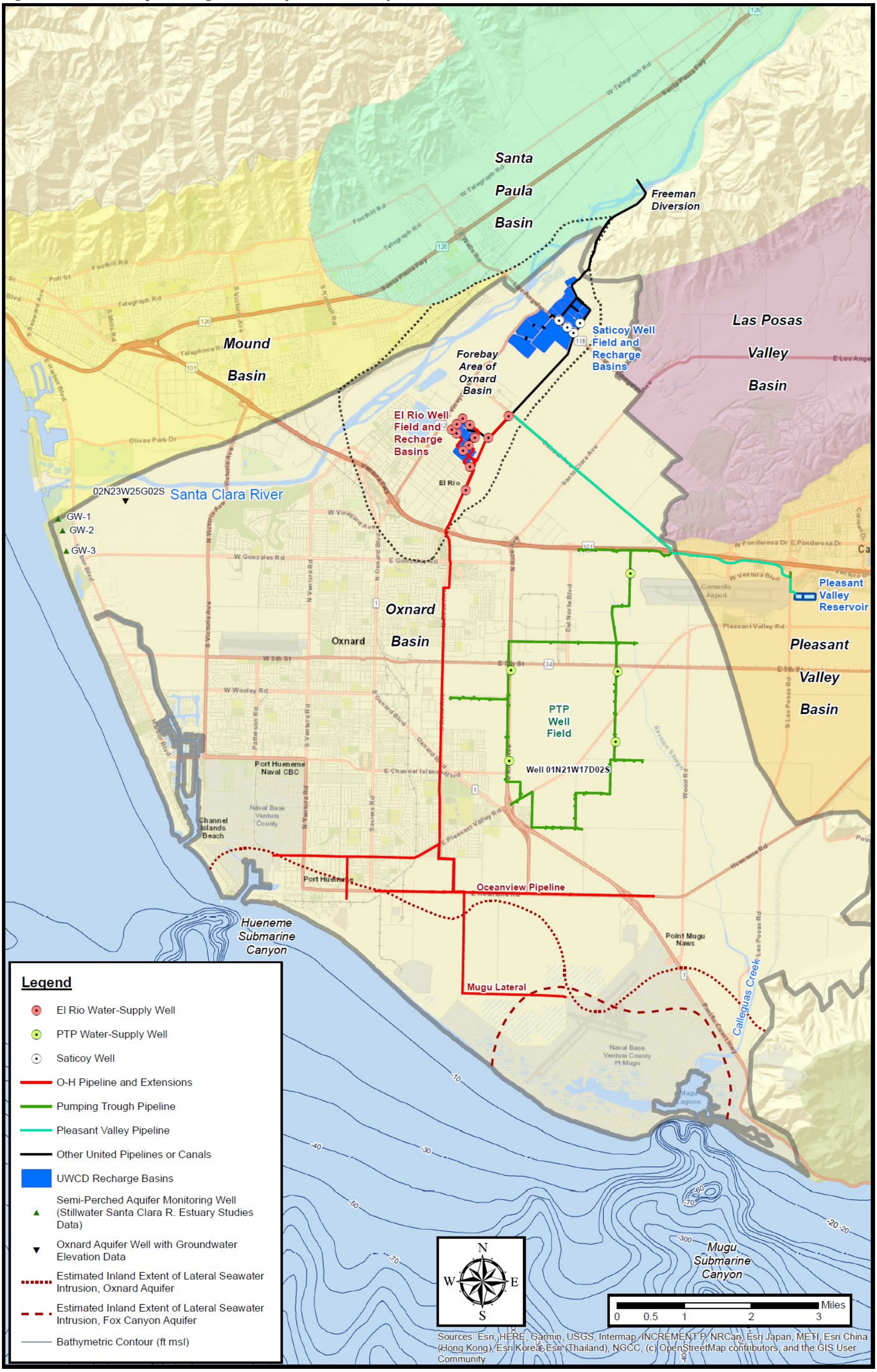

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Figure 2 Groundwater Pumping and Artificial Recharge at United's El Rio Facility for O-H Pipeline Project

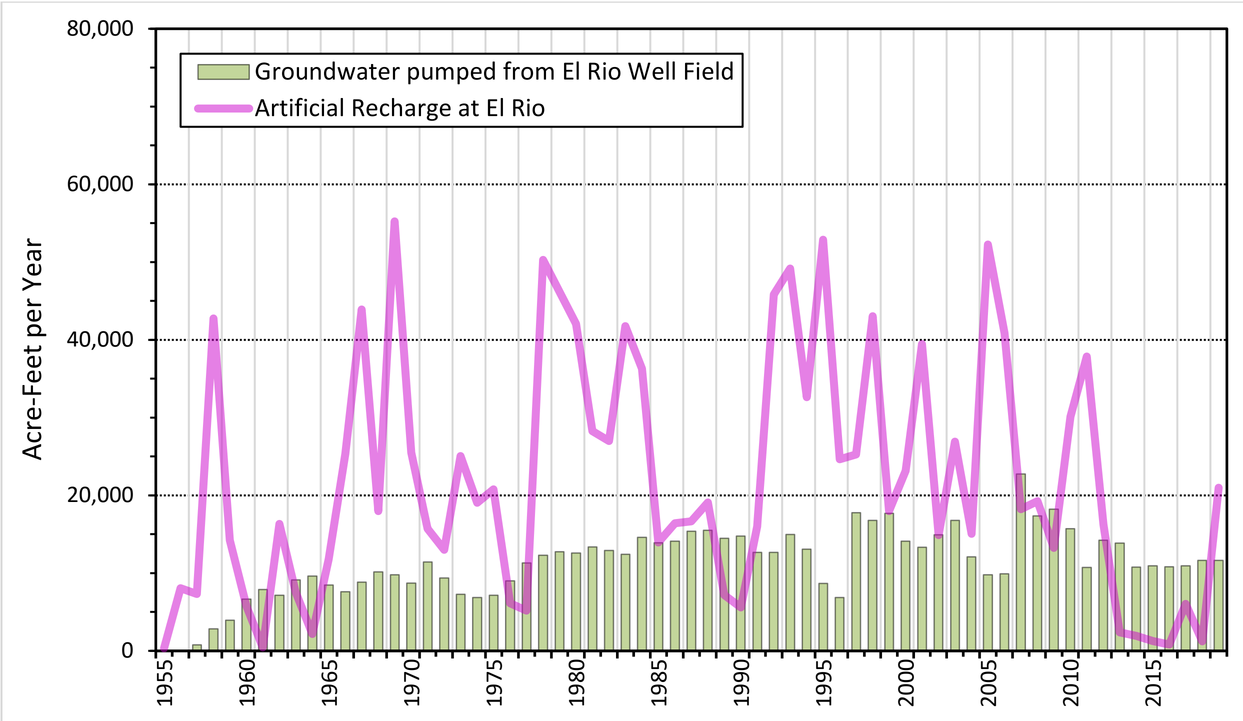


Figure 3 Groundwater Pumping and Artificial Recharge at United's Saticoy Facility for PVP and PTP Projects

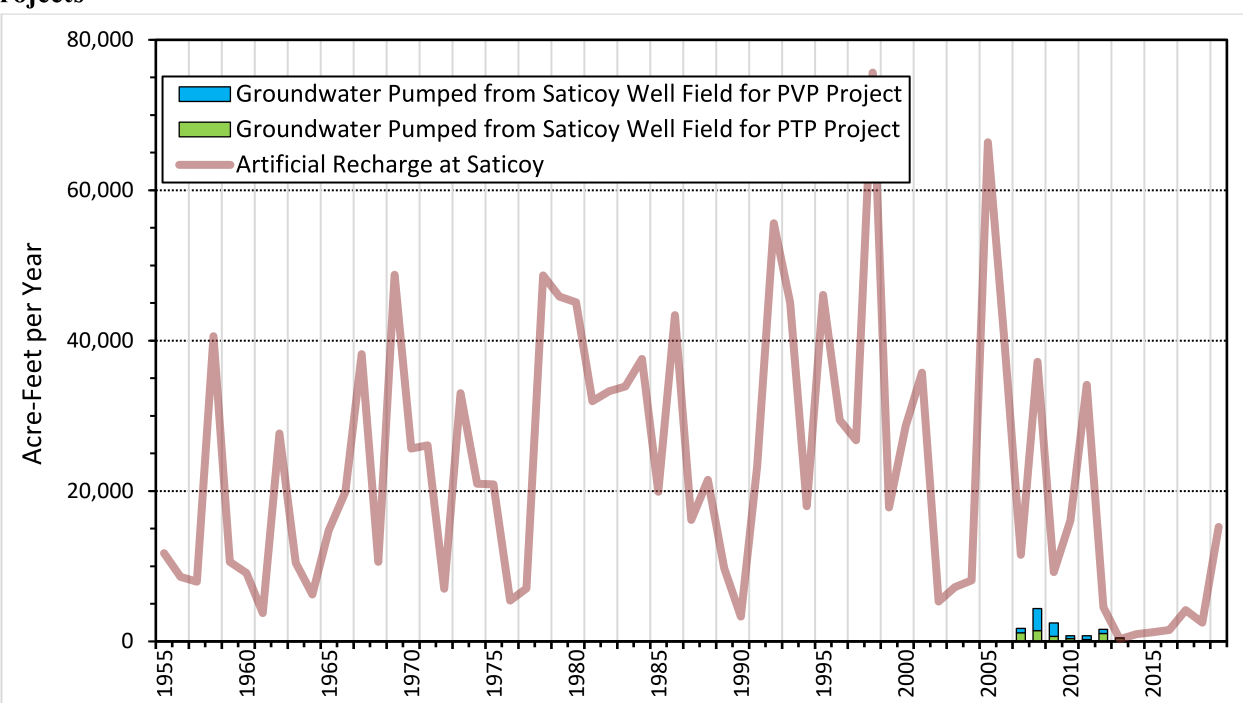


Figure 4 Groundwater Pumping from United's PTP Well Field

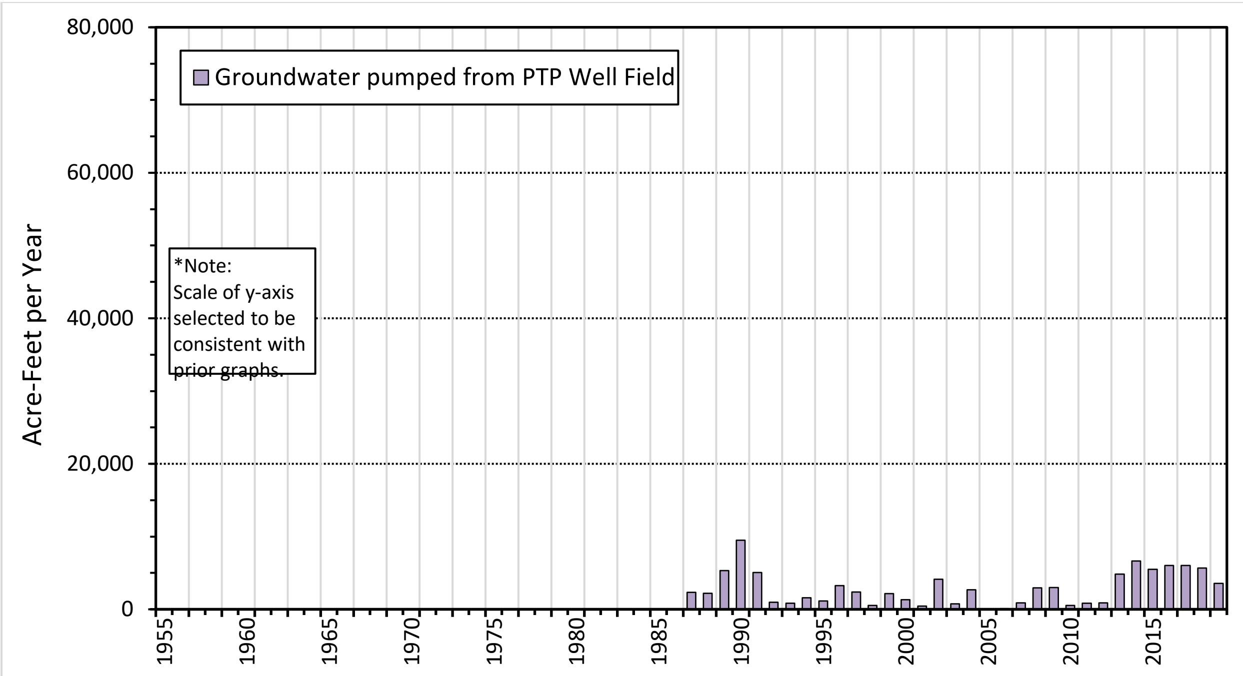


Figure 5 Total United Groundwater Pumping and Artificial Recharge in Oxnard Basin

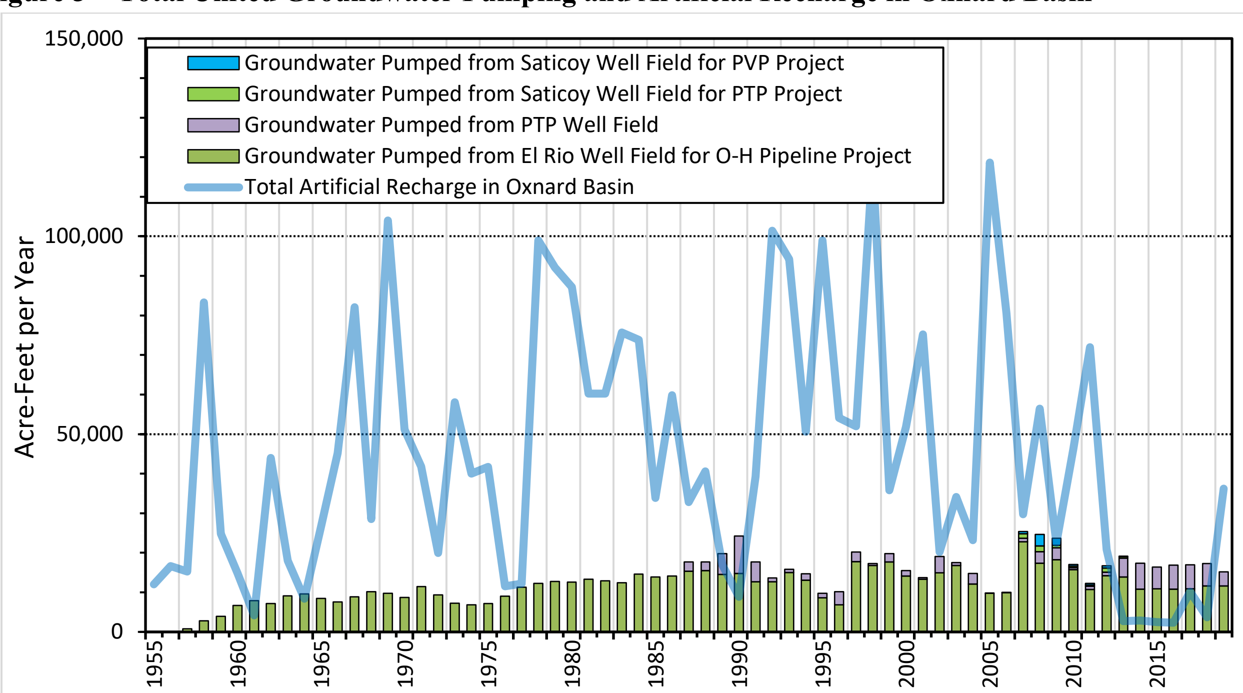
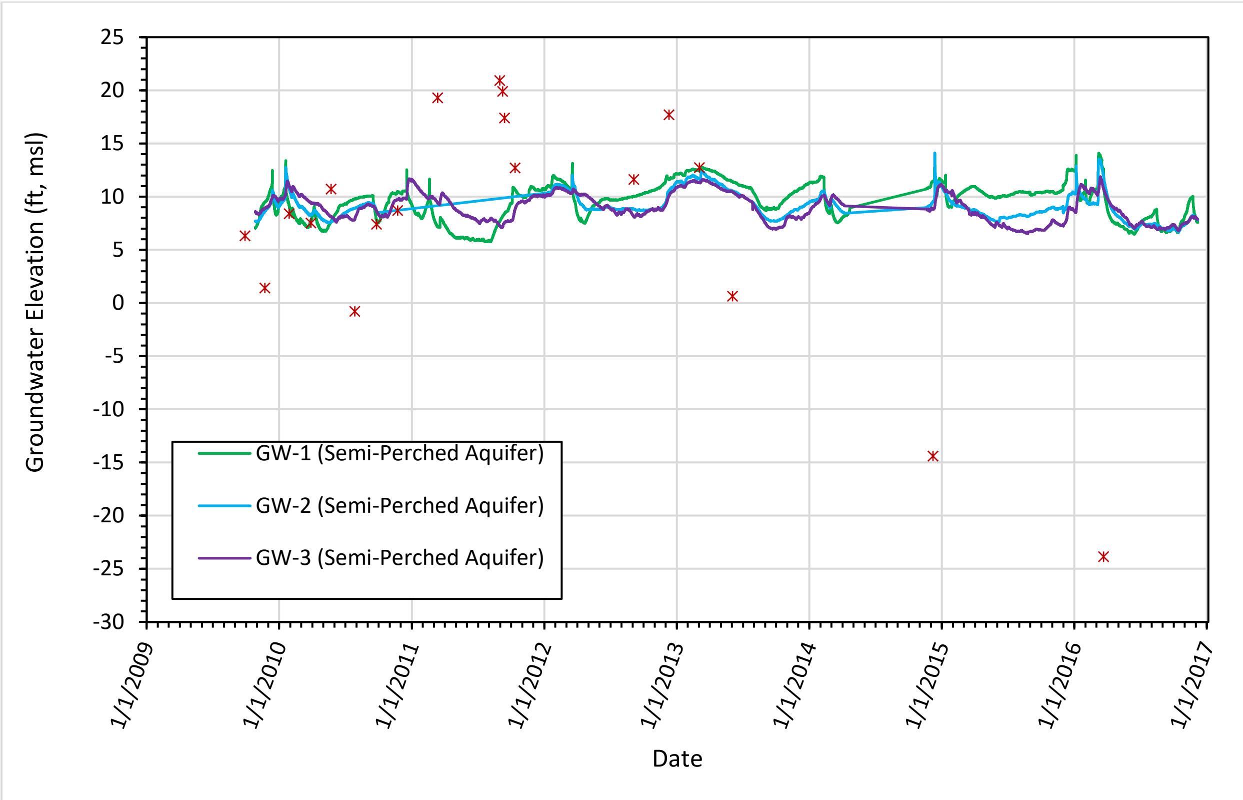


Figure 6 Groundwater Elevations in Semi-Perched Aquifer versus Oxnard Aquifer Below Lower Santa Clara River



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8 TABLE

Table 1. Months When Groundwater Extractions from United's Saticoy and El Rio Well Fields Exceeded Recharge at the Saticoy and El Rio Recharge Facilities, Respectively, and a Hydraulic Connection Existed between the Oxnard Aquifer and the Santa Clara River in the Forebay Area (since 1990)

Month and Year	Saticoy Groundwater Extractions in Excess of Recharge (acre-feet)	Prior Wet Season Recharge in Excess of Pumping at Saticoy (acre-feet)	El Rio Groundwater Extractions in Excess of Recharge (acre-feet)	Prior Wet Season Recharge in Excess of Pumping at El Rio (acre-feet)
Jul 1993	N/A	N/A	1,434	34,326
May 1994	N/A	N/A	247	26,811
Jun 1994	N/A		1,151	
Jul 1994	N/A		1,253	
Aug 1994	N/A		956	
Jun 1996	N/A	N/A	605	40,736
Jul 1996	N/A		659	
Aug 1996	N/A		679	
Sep 1996	N/A		629	
Apr 1997	N/A	N/A	990	15,234
May 1997	N/A		1,569	
Jun 1997	N/A		1,515	
Jul 1997	N/A		1,696	
Aug 1997	N/A		114	
Aug 1998	N/A	N/A	42	21,214
Jun 1999	N/A	N/A	549	17,506
Jul 1999	N/A		1,447	
Aug 1999	N/A		1,600	
Oct 1999	N/A		109	
Nov 1999	N/A		1,185	
Dec 1999	N/A		1,563	
Jan 2000	N/A	N/A	983	8,699
Jul 2000	N/A		1,488	
Aug 2000	N/A		1,350	
Dec 2000	N/A		833	
Jul 2001	N/A	N/A	953	14,663
Aug 2001	N/A		1,215	
Mar 2002	N/A	N/A	484	17,026
Apr 2002	N/A		844	
May 2002	N/A		994	
Jun 2002	N/A		878	
Mar 2007	none	20,800	219	29,754
Apr 2007	none		592	
May 2007	70		1,689	

Month and Year	Saticoy Groundwater Extractions in Excess of Recharge (acre-feet)	Prior Wet Season Recharge in Excess of Pumping at Saticoy (acre-feet)	El Rio Groundwater Extractions in Excess of Recharge (acre-feet)	Prior Wet Season Recharge in Excess of Pumping at El Rio (acre-feet)
Feb 2008	none	34,571	798	2,061
May 2008	108		290	
Jun 2008	714		1,246	
Jul 2008	839		1,643	
Apr 2009	none	11,071	204	9,857
Jul 2011	3	31,996	none	29,756
Aug 2011	none		955	
Dec 2011	19		none	

Notes:

- N/A = Not applicable (Saticoy well field was constructed in 2003)
- "Prior Wet Season Recharge in Excess of Pumping" is calculated as the sum of recharge minus pumping in each of the preceding months when recharge exceeded pumping, up to the first preceding month where pumping exceeded recharge or a maximum of 12 months (if more than 12 months existed with recharge exceeding pumping), whichever occurred first.