APPENDIX L

UWCD GSP Model Documentation

TECHNICAL MEMORANDUM

IMPLEMENTATION OF GROUNDWATER MODEL INPUTS FOR SIMULATIONS IN SUPPORT OF GROUNDWATER SUSTAINABILITY PLAN DEVELOPMENT BY THE FOX CANYON GROUNDWATER MANAGEMENT AGENCY

UNITED WATER CONSERVATION DISTRICT

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This Technical Memorandum was prepared at the request of the Fox Canyon Groundwater Management Agency (FCGMA). This document describes selected modeling stresses and assumptions used by United Water Conservation District to conduct simulations for the Groundwater Sustainability Plans (GSPs) prepared by FCGMA and its consultant, DUDEK, that may not be described in the GSPs.

Contents Page

List of Tables

List of Figures

1 INTRODUCTION

The Fox Canyon Groundwater Management Agency (FCGMA) with the assistance of its consultant, DUDEK, developed the Groundwater Sustainability Plans (GSPs) for the Oxnard subbasin, Pleasant Valley (PV) basin, and Las Posas Valley (LPV) basin (DUDEK, 2019; FCGMA, 2019) in compliance with the 2014 Sustainability Groundwater Management Act (SGMA). The United Water Conservation District (UWCD) supported the analysis of the GSPs for the Oxnard subbasin, PV basin, and West Las Posas (WLP) Management Area of the Las Posas Valley basin by using its MODFLOW-based groundwater model (UWCD, 2018a).

In response to a request from FCGMA, this document details the implementation of selected modeling stresses used for the GSP simulations. The document contains two main sections which describe selected processes and assumptions used in the simulations by UWCD to conduct simulations for the Groundwater Sustainability Plans: Section 2) Groundwater Flow Modeling Inputs and Section 3) Surface Water Hydrology Modeling. Section 3 details the modeling of several surface water hydrology spreadsheet models that provide input data to the groundwater modeling. The UWCD Model documentation (UWCD, 2018a) covered historical climate and therefore did not need to forecast surface-water inputs to the groundwater modeling. Specific to the GSP modeling presented here, this document provides additional detail regarding how the surface-water and groundwater forecasting for the future runs requested by FCGMA was implemented into the groundwater model.

2 GROUNDWATER FLOW MODELING INPUTS

This section describes the various data inputs that were required for simulations by the UWCD Model in support of the GSP analysis in cooperation with FCGMA and their consultants DUDEK. Some of these components have previously been described within the UWCD Model documentation (UWCD, 2018a), while some are specific to the scenarios simulated for the GSP development.

2.1 WEATHER DATA

The California Department of Water Resources (DWR) issued the guidelines on four sets of 50-year weather data for the preparation of GSPs (DWR, 2018a). Dudek selected four weather datasets based on two historical climate cycles (1930-1979 and 1940-1989). Each of the two historical climate cycles were adjusted by two DWR climate factors corresponding to the DWR recommended central tendency scenarios for each climate periods for the near future (2030) and the late future (2070). This resulted in a total of four 50-year climate datasets to be used for model simulations.

Monthly precipitation was calculated by UWCD based on the historical precipitation and the climate factor per DWR's guidelines for GSP development (DWR, 2018a). Notably, of the four datasets used for the model simulations, the 1930-1979 weather data with the 2070 DWR Climate Factor was found to be the most conservative for Oxnard, PV and WLP basins.

2.2 RECHARGE

The UWCD Model was used to analyze groundwater recharge resulting from various sources and uses of surface water, as described below. The recharge from different sources and/or uses were summed as total recharge in the recharge package (RCH) in the UWCD Model. The groundwater recharge from various sources and/or usages of surface water is detailed in the following subsections. The recharge rates used were based on the calibration result of the UWCD Model (UWCD, 2018a).

2.2.1 PRECIPITATION

Monthly evapotranspiration (ET) was assumed to be 0.75 inch. If the monthly precipitation was less than 0.75 inch, no recharge from the precipitation was simulated. If the monthly precipitation was greater than 0.75 inch, the recharge was assumed to increase linearly, proportional to the monthly precipitation, with a maximum recharge rate of 30 percent. The recharge from precipitation was implemented as follows:

- If monthly precipitation was less than 0.75 inch, then no recharge was assigned in that area;
- If monthly precipitation was 0.75 to 1 inch, then recharge was assigned from 0 to 10 percent of precipitation (on a sliding scale);
- If monthly precipitation was 1 to 3 inches, then recharge was assigned from 10 to 30 percent of precipitation
- If monthly precipitation was greater than 3 inches, then recharge was assigned as 30 percent of precipitation.

2.2.2 EXTRACTED WATER FROM WELLS

The extracted groundwater from wells serves agricultural need as well as municipal and industrial (M&I) use. The extracted groundwater for agriculture was assumed to have higher recharge rate than M&I use.

The agricultural water recharge rate was assumed to be 25% for Oxnard subbasin and 20% for both PV and WLP basins. If the precipitation recharge rate was higher than the assumed agricultural water recharge rate (20% or 25%) particularly during wet months, the agricultural water recharge rate was replaced by the higher precipitation recharge rate. The M&I water recharge rate was assumed to be 5% (of delivered water) for all basins.

2.2.3 Applied Water

Cities and local water agencies deliver water to users. The sources of the water range from State Water Project (imported by Calleguas Municipal Water District (CMWD)), extracted water transported from other basins, and extracted groundwater from local wells. The recharge rates for agricultural and M&I uses were calculated in the same manner as described in Section 2.2.2 *Extracted Water from Wells*, above.

2.2.4 UWCD Recharge Activities and Surface Water Deliveries

UWCD diverts stream flow from the Santa Clara River for artificial recharge within its spreading basins and delivers a portion of diverted SCR water via pipelines to Pumping Trough Pipeline (PTP) users and Pleasant Valley County Water District (PVCWD) users for agricultural irrigation. Additionally, Camrosa Water District (Camrosa) diverts water from Conejo Creek to supply PVCWD users. The recharge resulting from surface water deliveries from the water diverted and delivered water by UWCD and Camrosa was calculated as agricultural return flow in the same manner as described in Section 2.2.2 *Extracted Water from Wells*, above. The recharge occurring in UWCD's spreading basins was calculated without loss based on a series of surface water hydrology and operational models, as detailed in *Section 3 Surface Water Hydrology Modeling*.

2.3 MOUNTAIN FRONT RECHARGE

There are areas that are outside of the UWCD Model but are part of surface watersheds associated with Oxnard subbasin, PV, WLP, and Mound groundwater basins. The precipitation that falls on these areas may contribute mountain front recharge to the aquifers. The precipitation is calculated based on the surface watershed areas outside of the UWCD Model. The sum of precipitation is multiplied by the same precipitation recharge ratio used in calculating the precipitation recharge detailed in Section 2.2.1 *Precipitation*, which is presented above.

2.4 STREAMFLOW, DIVERSION, DISCHARGE AND INTER-BASIN SUBSURFACE FLOW

The UWCD Model simulated flows in the Santa Clara River, Conejo Creek, Arroyo Las Posas, and Calleguas Creek. The stream flowrates at the Freeman Diversion were calculated as detailed in Section 3.3 *Upper Basins Surface Water Model*, below. UWCD simulated SCR flow from downstream of the Freeman Diversion to the ocean. The SCR streamflow downstream of the Freeman Diversion was calculated as the streamflow at Freeman Diversion minus the diverted flows.

The streamflow in Conejo Creek entering the UWCD Model was provided by the FCGMA's consultant, DUDEK. The discharge to Conejo Creek by Camarillo Sanitation District was included in the Stream (STR) package, as was the flow diversion by Camrosa.

The streamflow in Arroyo Las Posas enters the UWCD Model from East Las Posas. There was also an inter-basin flow between East Las Posas and the PV basin in the form of subsurface flow (groundwater flux) beneath Arroyo Las Posas. The streamflow and inter-basin flow between East Las Posas and PV were simulated by a groundwater model developed by CMWD's consultant, INTERA. The streamflow and inter-basin flow used by the UWCD Model were provided by INTERA.

2.5 PUMPING

When FCGMA was contemplating the pumping rates for the GSPs, FCGMA staff calculated the annual average of 2015 to 2017 pumping records as the baseline annual extraction rates for the GSP simulation. FCGMA proposed different pumping reductions in each basin (Oxnard, PV, and LPV) based on the baseline extraction rates and different projects (fallowing or imported water) considered in order to reduce the extraction rates. In addition, FCGMA considered the surface water delivery by UWCD and water from the Conejo Creek diversion to further reduce the baseline extraction rates by an equal amount of delivered surface water.

Two projects approved by the FCGMA were included in all the GSPs as existing projects: the Northern PV Desalter and the pumping of credits associated with Conejo Creek water deliveries. These two projects add additional pumping to the baseline extraction rates.

Based on the GSP scenario description from FCGMA, UWCD adjusted the extraction rates for each basin based on some or all the following conditions:

1. Pumping Reduction: A reduction percentage for each basin was applied to the extraction wells within each basin
2. UWCD Surface Water Deliveries: UWCD predicted a monthly surface water delivery to PTP and PVCWD users from 2020 to 2069 based on the UWCD Oxnard Plain Surface Water Distribution Model (*Section 3.5 Oxnard Plain Surface Water Distribution Model*). The extractions within the PTP and PVCWD service areas were reduced by an amount equal to surface water deliveries in the PTP and PVCWD service areas.
3. Conejo Creek Diversion for PVCWD: extractions in the PVCWD service area were reduced by the predicted Conejo Creek diversions (4,500 acre-ft per year per Camrosa Water District). Conejo Creek diversions to PVCWD were routed through the Oxnard Plain Surface Water Distribution Model.
4. Fallowing: As described in the GSP for Oxnard subbasin, an area in the Oxnard subbasin was selected for fallowing to reduce extraction by 504 acre-ft per year. Similarly, as described in the GSP for the PV basin, an area in the PV basin was selected for fallowing in order to reduce groundwater extractions by 2,407 acre-ft per year.
5. In-Lieu Delivery: Additional imported water delivered by CMWD to the WLP basin was assumed to reduce the pumping within WLP by an amount equal to the imported water entering the basin.
6. Northern PV Desalter: An annual extraction of 4,500 acre-ft was applied to 2 wells (02M20W19F04S and 02N20W19L05S) from August 2020 to July 2045, and zero pumping thereafter.

7. Conejo Creek Credit Recovery: An annual extraction of 4,500 acre-ft was applied to 3 wells (02N20W29C01S, 02N20W29B02S, and 02N20W21M01S). It should be noted that the UWCD Model predicts that the Conejo Creek Credit Pumping is not sustainable at 4,500 acre-ft annually and averaged 2,800 acre-feet per year over the simulation period.
8. Groundwater Recovery Enhancement and Treatment (GREAT) Program by City of Oxnard:
   - Phase I: The treated wastewater, 4,600 acre-ft per year, was assumed to reduce the agricultural extraction within Oxnard subbasin annually by an equal amount of 4,600 acre-ft per year.
   - Credit Pumping: The accrued credits from the delivery of GREAT program water was recovered at two existing City of Oxnard wells, 02N22W23C05S and 02N22W23F07S.

Through implementing the pumping rate adjustments, UWCD found that the allocated extraction rates in certain areas may be less than the diverted surface water or the reduced water by fallowing during some months of wet years. During these wet months, the extraction rates were set to zero in those areas.

Wells in other basins (Mound basin and areas outside of Oxnard, PV, and WLP basins) used the average pumping rates from 2013 to 2015 as baseline pumping applied to all GSP simulations.

3 SURFACE WATER HYDROLOGY MODELING

A series of linked spreadsheet models were used to model surface water hydrology in the Piru, Fillmore and Santa Paula basins (including Lake Piru) to the Freeman Diversion. These surface water models were then coupled with the groundwater flow model. To illustrate the connection between the various models described herein, Figure 1 provides a simplified schematic of the model integration employed for the GSP supporting work. Natural surface flow inputs to these models used historic hydrology for the two historical climate cycles, with adjustments for climate change according to the DWR Guidance Document for the Sustainable Management of Groundwater. The hydrologic historic records for inputs that depend predominantly on human activities (e.g., reservoir operations, wastewater discharges) were adjusted to better reflect anticipated future conditions. All spreadsheet models were calculated and calibrated in daily time steps, using Microsoft Excel. A brief description of the models and major assumptions are presented here. More detailed information is available in other published reports, as referenced.

3.1 LAKE PIRU RESERVOIR MODEL

The Lake Piru reservoir model is a water balance model calculating water levels and storage in Lake Piru based on historic data or assumed scenarios for inputs and outputs. Water inputs include inflows from the Middle Piru Creek watershed (natural flows, State Water imports, releases from Pyramid Lake) and rainfall; outputs include releases through the Santa Felicia Dam (SFD) outlet works (conservation releases, migration releases, habitat releases), spills and evaporation.

Important assumptions and inputs include:

- A 2015 bathymetry survey was used for calculating Lake Piru surface area and storage volume. Total storage capacity was based on a 2006 bathymetry survey (83,244 AF). Lake Piru storage capacity decreased to 82,000 AF, based on a 2015 bathymetry survey, which was not incorporated in the model. The recent decrease in storage capacity will somewhat increase the volume of spills over SFD, but is not expected to significantly alter the findings of this study.
- Historic inflows from Middle Piru Creek includes periods when Pyramid Lake operations were different from current operations.
- UWCD has a State Water Project Table A allocation of 3,150 AF. Annual allocations of Table A water were based on DWR's modeling of the State Water Project's existing delivery capability, which includes current flow regulations and adjusted to account for land-use changes (DWR, 2018b). It was assumed that UWCD would not purchase Table A water during wet years, consistent with current operations.

Habitat and migration releases are performed according to the Santa Felicia Water Release Plan (UWCD, 2012).

3.2 SURFACE FLOW INPUTS UNDER CLIMATE CHANGE SCENARIOS

The series of linked spreadsheet models require daily surface flow inputs for all major tributaries in the Santa Clara River (SCR) watershed. The flows were adjusted for climate change effects for the 2030 and 2070 future conditions. The following historic records were used:

- Middle Piru Creek (inflows to Lake Piru). Historic records are from USGS gage 11110000 Piru Creek near Piru CA and USGS gage 11109600 Piru Creek above Lake Piru CA.
- Santa Clara River near Piru. Historic records are from USGS gage 11109000 Santa Clara River near Piru CA. To include simulated discharges from the Valencia Water Reclamation Plant, flows prior to 1969 (before construction of the facility) were increased by 15 cfs.
- Hopper Creek. Historic records from USGS gage 11110500 Hopper Creek near Piru CA, and VCWPD Station 701 Hopper Creek at Hwy 126 near Piru.
- Sespe Creek. Historic records are from USGS gage 11113000 Sespe Creek near Fillmore.
- Santa Paula Creek. Historic records are from USGS gage 11113500 Santa Paula Creek near Santa Paula.

Daily historic flow records were adjusted to 2030 and 2070 future conditions using the HUC8_18070102 annual and monthly change factors provided by the DWR, using the methodology for application of time series change factor data described in the Guidance Document for Climate Change Data Use during Groundwater Sustainability Plan Development (DWR, 2018a). The methodology was applied to the daily flow data using the same methods as recommended for monthly data.

3.3 UPPER BASINS SURFACE WATER MODEL

The Upper Basins Surface Water Model calculates surface flows, recharge to groundwater and rising groundwater for the reaches of the Santa Clara River overlying the Piru, Fillmore and Santa Paula basins (Figure 2). Model inputs include releases from Lake Piru (via Piru Creek; obtained from the Lake Piru reservoir model), Santa Clara River flows from Los Angeles County, tributary flows (Hopper Creek, Sespe Creek, Santa Paula Creek), and historic available storage in Piru and Fillmore basins. Model outputs include available storage in the Piru and Fillmore basins for model scenarios, and river flows at the Freeman Diversion. Empirical relationships are used to model the following processes: recharge to groundwater in the Piru and Fillmore basins, rising groundwater at the Piru/Fillmore and Fillmore/Santa Paula basin boundaries, underflow between Piru and Fillmore basins, and losses in surface flows across Santa Paula basin. The model essentially calculates the change in available storage in Piru and Fillmore basins for a scenario compared to historic trends (based on a water mass balance for each basin), and subsequently adjusts fluxes for recharge, rising groundwater and underflow for the scenario based on the calculated available storage and the established empirical relationships.

The influxes and outfluxes calculated for each reach are summarized in Table 1. Important assumptions include:

- Modeled Santa Clara River flows from LA County assume the current rate of discharge from the Valencia Water Reclamation Plant. Therefore, flows prior to 1968 (before construction of facility) were adjusted to simulate wastewater discharge of 15 cfs.

A correction factor of 1.2 was applied to gaged stream flows from major tributaries (Hopper Creek, Sespe Creek, and Santa Paula Creek) to improve model calibration. The correction factor accounts for inflows from other minor tributaries and bank storage.

3.4 DIVERSIONS AT FREEMAN DIVERSION FACILITY

Diversions are calculated based on total river flows entering the Freeman Diversion facility (imported from the Upper Basins Surface Water Model), and operational simulations using the Hydrological Operations Simulation System (HOSS) model.

The HOSS is a hydrology-based operations model that simulates diversions and flow magnitudes in the Santa Clara River downstream of the Freeman Diversion, and the amount of water that is lost or gained to/from groundwater in the “critical reach” of the SCR in the Oxnard Forebay. The HOSS is based upon several decades of historical flow gage data, groundwater conditions in the Forebay, and diversion flow rates, and has been peer-reviewed by R2 Resource consultants (R2 Resource Consultants, 2016).

For groundwater modeling for GSP development, diversion operations follow Scenario 6, as proposed by UWCD in its Administrative Draft Multiple Species Habitat Conservation Plan (UWCD, 2018b). Scenario 6 operations are designed to provide adequate bypass flows for fish migration while minimizing reductions in diversions, and represents a realistic scenario for future diversion operations.

3.5 OXNARD PLAIN SURFACE WATER DISTRIBUTION MODEL

The Oxnard Plain Surface Water Distribution Model was used to calculate the amounts of artificial recharge at UWCD’s facilities and surface water deliveries to the PTP and the PVWCD surface water delivery systems. The Oxnard Plain Surface Water Distribution model is a water routing model that simulates amounts of groundwater recharge and surface water deliveries based on a series of adjustable hydrologic inputs (e.g. total river flow, diversions, obtained from the HOSS model) and operational assumptions. Since some modeled operations in the Surface Water Distribution Model depend on groundwater levels, iterative runs were performed where outputs from the Surface Water Distribution Model (spreading at recharge basins and calculated groundwater extractions) were used in the groundwater model, and groundwater level outputs from the groundwater model run (forecasted groundwater elevations at three wells were used to determine available storage in the Oxnard Forebay and groundwater mounding in the Saticoy Facility) were then used to re-run the same scenario in the Surface Water Distribution Model. The analyses were repeated until monthly fluxes for surface water deliveries and recharge converged to within 100 – 200 AF between consecutive runs, which was considered sufficient accuracy for this study. The water distribution model was also used to calculate pumping demands in the PTP and PV service areas, based on the difference between surface water deliveries and total agricultural demands within the respective service areas. Total agricultural demands were reduced by specified percentages over a 20-year period for model run scenarios that included pumping reductions.

Water resource inputs to the Surface Water Distribution Model include diversion amounts, pumping from Saticoy wells and Conejo Creek diversions. Operational assumptions govern how the distribution of surface water is prioritized among recharge basins and surface water deliveries, and change based on season and hydrologic conditions (dry, normal or wet years). The following assumptions were made regarding water inputs:

- Surface water from the Freeman Diversion can supply all recharge basins and surface water delivery systems, while water occasionally pumped from UWCD's Saticoy well field is restricted to the PTP and PVCWD surface water delivery pipelines. Surface water from Conejo Creek diversions are restricted to the PVWCD's delivery pipeline.
- Diversions calculated in the HOSS were reduced by 10% for days when bypass flows were provided to account for inefficiencies in diversion operations due to flushing, maintenance and other reasons.
- The Saticoy well field is used to pump down the groundwater mound that sometimes develops beneath the Saticoy recharge basins in wet years. The production capacity of the Saticoy well field is dependent upon groundwater elevation. The well field does operate during periods of significant spreading in the recharge basins.
- Surface water deliveries from the Conejo Creek diversion to PVWCD were estimated at 4,500 AF/year by Camrosa Water District.

Water routing prioritization indicates the order in which recharge basins and surface water delivery systems receive available water. A priority of 1 is the highest priority. Facilities assigned a priority of 3 or greater often receive no water, as all water has been used by higher-priority facilities. Prioritization rules for water routing are summarized in Table 2, and depend on the following factors:

- Water year hydrology is defined as low, moderate or high, based on stream flow magnitude (R2 Resource Consultants, 2016).
- Season: summer is defined as July 1st to the first significant storm event of the winter (equal to first turn-out of the season); winter is the remaining period. During summer dry and normal conditions, the highest priorities for surface water routing are El Rio, PTP and PV (percentages to each facility are detailed in Table 2). During winter season and wet summers, the highest priority is surface water deliveries (equally divided between PTP and PV), followed by El Rio and then other recharge basins.
- Forebay available storage is the estimated volume of groundwater that could be stored in the Forebay, and is calculated based on groundwater elevations in two key wells. Conditions with available storage > 70,000 AF indicate dry conditions with increased priority for recharge in El Rio.

- Suspended sediment concentrations: when sediment levels in the river exceed 3,000 NTUs, diversions are routed to Noble recharge basin first, to avoid clogging of the surface layer in the Saticoy recharge basins. Sediment levels in the river were estimated based on the historical empirical correlation between average daily streamflow and sediment concentration.

Instantaneous conveyance capacity limits for facilities are the following: 225 cfs for Saticoy, 80 cfs for Noble, 30 cfs for Rose, 100 cfs for Ferro, 120 cfs for El Rio, 65 cfs for PTP and PV systems individually, and 75 cfs for PTP and PV systems combined. In addition, cumulative restrictions on supply to the Saticoy and El Rio recharge basins were applied to reflect reduced infiltration rates during period of high recharge (Table 3). These rates only applied when the storage capacities for Saticoy (576 AF) or El Rio (700 AF) were exceeded.

4 REFERENCES

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5 TABLES

Table 1. Model reaches and influxes/outfluxes for the Santa Clara River Upper Basins Surface Water Model.

Reach No.	Reach Description	Influxes	Outfluxes
1	Piru Creek SFD dam to SCR confluence	- Flows from SFD (from Lake Piru model)	- Piru Creek diversions - Percolation Piru Creek - Piru Creek flow upstream SCR confluence
2	SCR Newhall to Torrey	- Piru Creek flow upstream SCR confluence - SCR flow USGS gage at Countyline/near Piru	- Percolation Newhall to Torrey - SCR flow Torrey
3	SCR Torrey to Piru/Fillmore basin boundary	- SCR flow Torrey - Hopper Creek flow - Piru basin rising groundwater	- Percolation Torrey to Piru basin boundary - Percolation Hopper Creek - SCR flow Cavin
4	SCR Piru/Fillmore basin boundary to Sespe confluence	- SCR flow Cavin	- Percolation Cavin to Sespe - SCR flow upstream Sespe confluence
5	SCR Sespe confluence to Fillmore/Santa Paula basin boundary	- SCR flow upstream Sespe confluence - Sespe Creek flow - Fillmore basin rising groundwater	- Percolation Sespe Creek - Percolation SCR downstream Sespe - SCR flow at Fillmore basin boundary
6	SCR Fillmore/ Santa Paula basin boundary to Freeman diversion	- SCR flow at Fillmore basin boundary - Santa Paula Creek	- Percolation Santa Paula Creek - Santa Paula basin losses (percolation and diversions) - SCR flows at Freeman

Table 2. Prioritization order for water resources supply to recharge basins and PTP/PV systems. *When facilities are assigned identical priorities, the percentages of supply received for each facility are included in parentheses.*

Facility	Summer (low – moderate)	Summer (high), winter	Forebay storage > 70,000 AF	NTU > 3,000
El Rio basin	1 (50%)	2	1	5
PTP system	1 (25%)	1 (50%)	2 (50%)	6 (50%)
PV system	1 (25%)	1 (50%)	2 (50%)	6 (50%)
Saticoy basin	2	3	3	4
Noble basin	3	4	4	1
Rose basin	4	5	5	2
Ferro basin	5	6	6	3

Table 3. Maximum infiltration rates for Saticoy and El Rio recharge basins.

Cumulative diversions to basin (AF)	Saticoy max. rate (cfs)	El Rio max. rate (cfs)
< 35,000	375	100
35,000 – 45,000	320	90
45,000 – 50,000	300/280*	80
50,000 – 55,000	275/240*	70
> 55,000	240	60

* Rates marked with asterisk apply when available storage in the Forebay remained below 20,000 AF during the 100 days prior. The correlation was developed by observed percolation rates in both facilities.

6 FIGURES

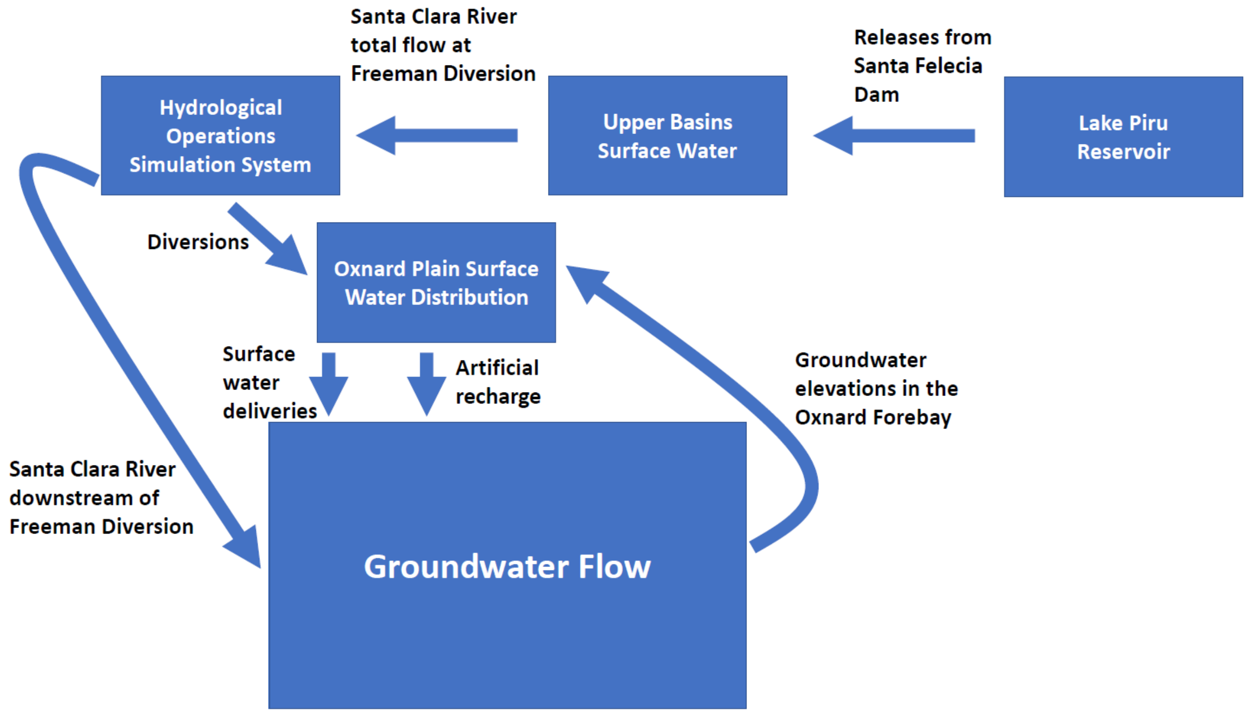

Figure 1. Schematic of the Surface Water Models used to inform the Groundwater Flow Model. *All models are depicted as the blue boxes with white lettering; information connecting the models is presented with the black lettering beside the blue arrows between the models.*

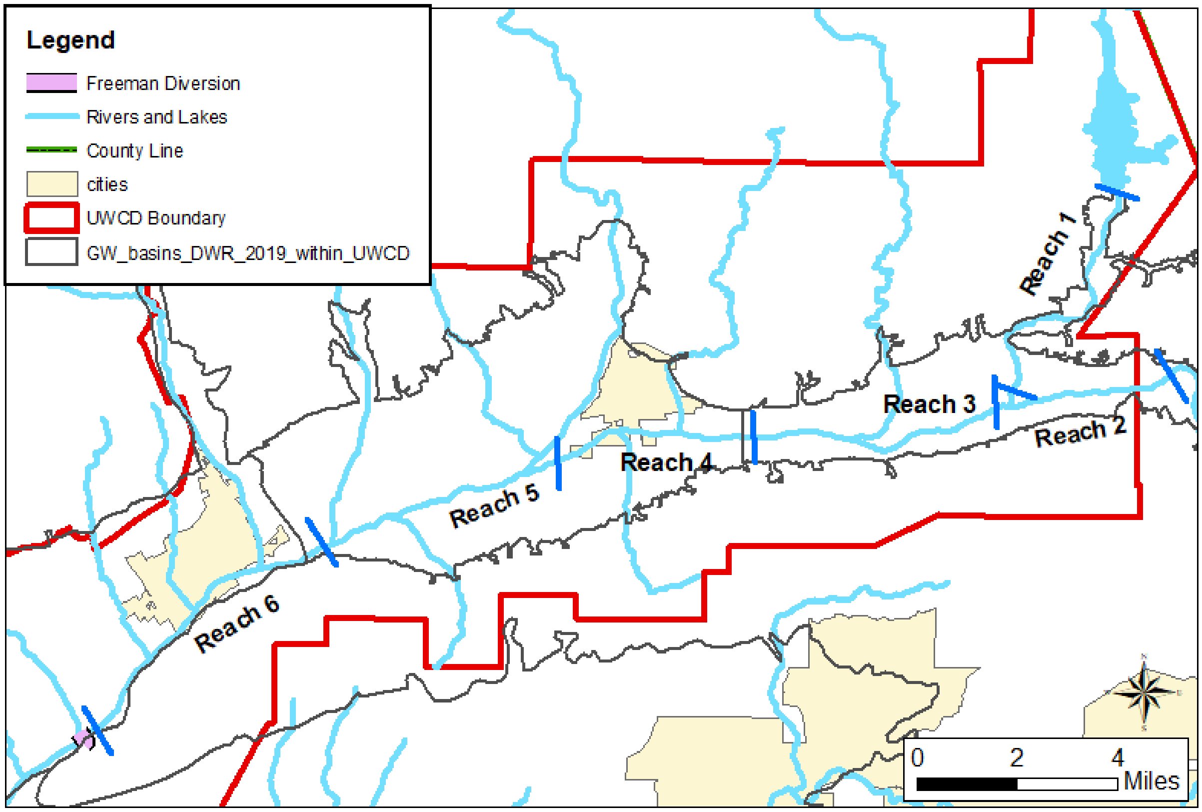

Figure 2. Model reaches for the Santa Clara River Upper Basins Surface Water Model. *Reaches are numbered and separated by blue lines.*