APPENDIX D

GROUND WATER MODEL

PERMIT 15000 FEASIBILITY STUDY

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APPENDIX D: GROUND-WATER MODEL

D.1 INTRODUCTION

A ground-water flow model (Model) was developed to simulate the impacts to the ground-water basin due to historical hydrology and water management practices that affects the hydrologic condition of the Upper Ysidora, Chappo, and Lower Ysidora sub-basins. The Model also provides the necessary tool to measure the changes in ground-water conditions and the potential affect to riparian vegetation and streamflow in the study area, as various stresses are applied in relationship with development of Permit 15000. Changes in ground-water pumping, streamflow, diversions, and wastewater production are simulated so that each of these stresses can be reviewed to estimate their potential impact to the condition and health of the Santa Margarita River and the sub-basins. The impacts of these stresses were measured as changes in the overall water budget, changes in ground-water levels, and changes in evapotranspiration (ET) demands.

The Model described in this appendix is used to estimate the impact of each of four different project alternatives that could be constructed to perfect Permit 15000 and expand the Base’s diversion of water from the Santa Margarita River. Equally important, the Model described in this report may also be used in the future as a management tool to determine the best location for ground-water pumping, effects of adding or removing sources of water from the basin, and use in negotiations with local, state and federal regulators. A particle tracking or contaminant transport package may also be added to the Model to estimate the impacts of pumping and hydrologic conditions on the transport and movement of organic and inorganic compounds in each of the three sub-basins. The Model is the compilation of all environmental, wastewater, and water supply data on the Base and should be managed and maintained into the future in order to maximize water supply and minimize impact to the environment.

D.2 PREVIOUS STUDIES

Two previous modeling studies were considered for compilation of the Model used to address concerns for Permit 15000's impact to ground water. The original base data for the Chappo and Upper Ysidora ground-water model was constructed from LAW/Crandall's work for the Department of the Navy, Southwest Division (1995). A ground-water model was later developed by IT Corporation to simulate the movement of volatile organic compounds (VOC) in the Chappo sub-basin (IT Corporation, 1996). In September 2000, Stetson Engineers extended the boundary of the original LAW/Crandall ground-water model to include the Lower Ysidora sub-basin and all contributions made by wastewater discharge to the Lower Santa Margarita River Basin (The Environmental Company, 2000).

Both LAW/Crandall and IT Corporation conducted aquifer pumping tests to obtain hydraulic properties of the sub-basins, which were summarized in their reports and used to develop their respective models. IT Corporation's contaminant modeling work was used to verify hydrogeologic conditions within the Chappo sub-basin and placement of proposed production wells.

The ground-water model constructed for Camp Pendleton by Law/Crandall, Inc. (1995) was used to evaluate the potential effect of production wells on contaminant migration within the Chappo sub-basin. A MODFLOW™ flow model was coupled with MODPATH™, a particle tracking model, to simulate flow within the drinking water supply basins. The MODFLOW™ river package was used to simulate recharge from the river to the ground-water aquifer. The river was simulated as a loosing stream throughout the model domain. The model was based on annual time-steps and assumed a continuous, steady source of water in the river. Hydraulic properties obtained from aquifer pumping tests were used in the model and summarized in their report. Their study was based upon average monthly pumping at the Upper Ysidora and Chappo production wells, and considered the effects of four proposed production wells. LAW/Crandall's study concluded that construction of a new well in the Lower Chappo might increase the potential for contaminants to be drawn into existing wells, and proposed three new production wells to be located in the Upper Ysidora.

A ground-water flow and contaminant transport model was used to study migration of VOC (volatile organic compounds) impacted ground water in the Chappo sub-basin as part of the draft Remedial Investigation and Feasibility Study for Operable Unit 2 (IT Corporation, 1996). The model was constructed to evaluate different remedial alternatives with respect to the VOCs located in the 22/23 Area of Camp Pendleton. The options included no action, pump and treat, and pumping/injecting scenarios. Given the highly porous media of the Chappo and the effects of dilution and dispersion, it was estimated that the impacted ground water would return to background conditions by natural attenuation within 10 years, and therefore no further action was recommended.

The two models described in this section represent the numerical ground-water modeling efforts previously performed on the Lower Santa Margarita Basin. In addition to these numerical models, development of analytical and spreadsheet models that account for the interaction between surface and ground water have been conducted by The Environmental Company (September 2000), Fallbrook Public Utility District (Fallbrook PUD, 1994) and Camp Pendleton (Leedshill, 1989).

The selected numerical model, MODFLOW™ (McDonald and Harbaugh, 1988) is a three-dimensional ground-water flow model developed by the USGS. MODFLOW™ uses mathematical expressions to represent the ground-water flow system, including initial conditions, boundary conditions, hydrogeologic attributes of the aquifer, and simplifying assumptions that capture the heterogeneities of the subsurface.

D.3 GROUND-WATER MODEL CONSTRUCTION

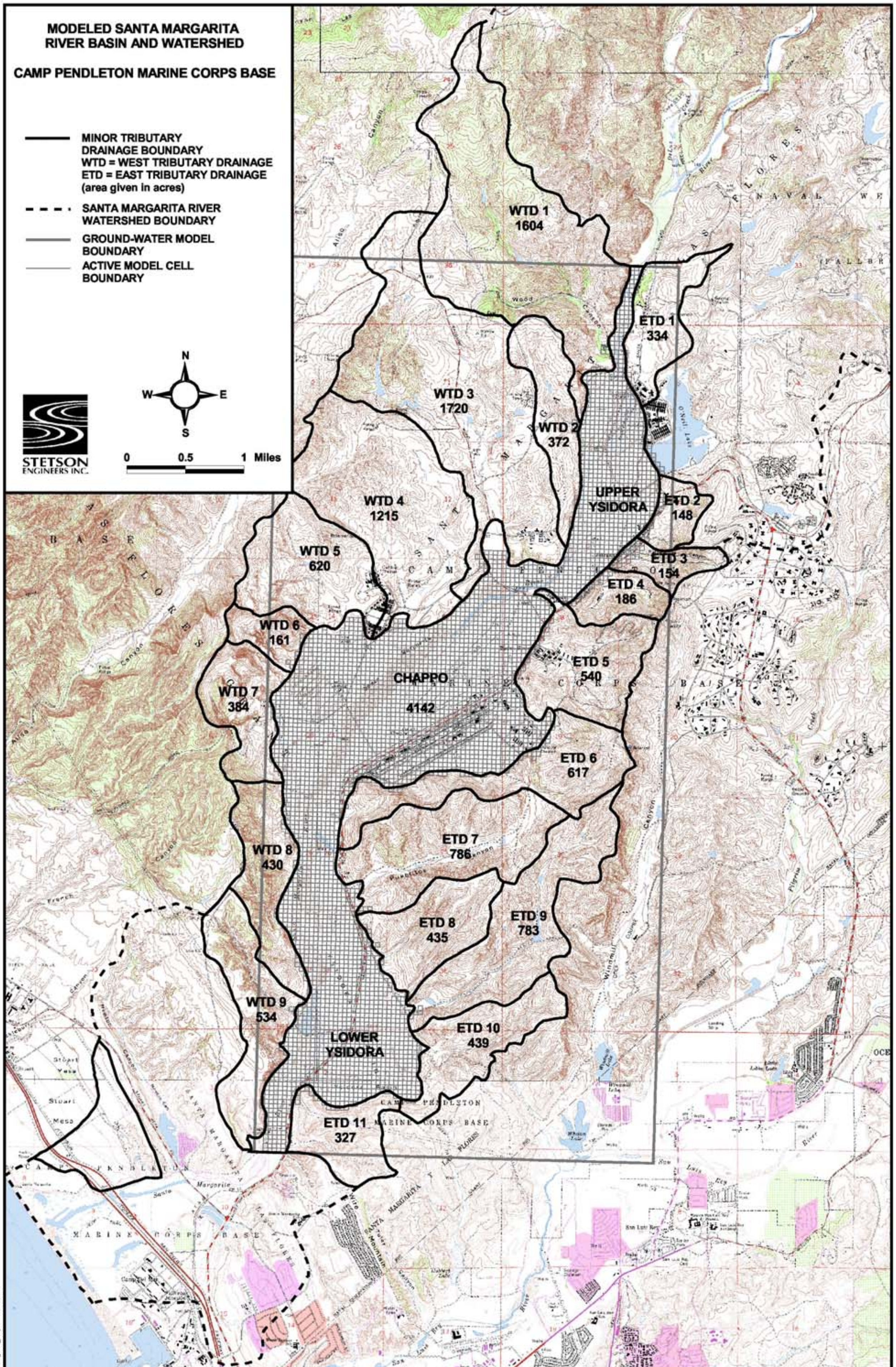
The selected numerical model, MODFLOW™ (McDonald and Harbaugh, 1988) is a three-dimensional finite-difference ground-water flow model code developed by the USGS. This computer code was chosen because of its flexibility in the type and number of hydrogeologic components that can be used to properly simulate the ground-water basin. The Santa Margarita River Basin model was developed using the streamflow, evapotranspiration, recharge, pumping, and general head boundary modules (or packages) of MODFLOW™. The data development for these different model input parameters are described in this section of the appendix.

The Model consists of 2 layers, 202 rows, 90 columns, and 7,390 active cells. A 20-year calibration period from water year (WY) 1980 through 1999 was established to simulate extended wet and dry periods. Monthly stress periods were simulated to capture the seasonal variations observed in existing water level and stream gage data. The Santa Margarita River was simulated to have the flexibility to be a gaining, loosing, or dry stream at different stream reaches or with different seasonal variations.

D.3.1 MODEL AREA AND GRID LAYOUT

The model area extends from the bedrock narrows just north of the Naval hospital to the narrows just south of the Lower Ysidora. The areal extent is comprised of the Upper Ysidora, Chappo, and Lower Ysidora alluvial sub-basins (Figure D-1). The northeast model boundary was located approximately 3,600 feet north of the existing diversion structure to minimize boundary effects at the diversion weir and channel. The southwest model boundary was established just north of the estuary and does not consider any tidal influence. The active modeled area of the three sub-basins is approximately 4,100 acres, and the surrounding watershed drainage area is approximately 11,800 acres.

The Model was constructed with two layers representing the Upper and Lower Alluvium of the Santa Margarita River Basin. The Lower Alluvium is generally more coarse-grained than the Upper Alluvium, except in the Upper Ysidora sub-basin where the entire section consists of coarse sand and gravel. These two units are the main ground-water bearing formations. The total thickness of the alluvium increases downstream from about 120 feet at the De Luz Creek confluence to about 200 feet near the coast. Each layer was discretized into 202 rows and 90 columns with 200-foot by 200-foot spacing.



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Top elevations at active model cells were assigned from a 5-foot contour interval topographical survey provided by the Base (MCB-CP, 1999) as GIS coverage. The surrounding no-flow model cells were based on 20 foot contour intervals from USGS topographical maps (1968 Morro Hill; 1975 Oceanside, 1975 San Luis Rey, and 1968 Las Pulgas Canyon). Two layers were chosen to represent the alluvial aquifer in all three sub-basins. Well logs and cross sections of the Lower Santa Margarita River ground-water basin (Worts and Boss, 1954; Slemon, 1978) show a coarser (cobbles, gravel, and sand) lower alluvium beneath a finer (gravel, sand, silt, and clay) upper alluvium. Though the ground-water basin is considered to be one aquifer, the two layers allow for the simulation of variable materials. Well logs and geologic cross sections were used to determine the elevations of the interface of the upper and lower alluvium and the depth to bedrock (Figure D-2; Worts and Boss, 1954). There is a general downward slope of the interface between the two layers from the northeast edge (south of the De Luz confluence) of the model domain toward the southwest edge (Lower Ysidora Narrows). The finite-difference grid was constructed to account for the changes in elevations and downward slope of the surface and contacts from northeast to southwest.

D.3.2 MODELED TIME PERIODS

Water years 1980 through 1999 were chosen for the calibration period. This interval of time was selected because it contained consecutive years with below normal and above normal hydrogeologic conditions (precipitation and streamflow) and continuous field data for model input. The data reviewed included USGS streamflow gage records, precipitation databases, production well records, and historical Water Master Reports for Lake O'Neill release/spill and river diversion information.

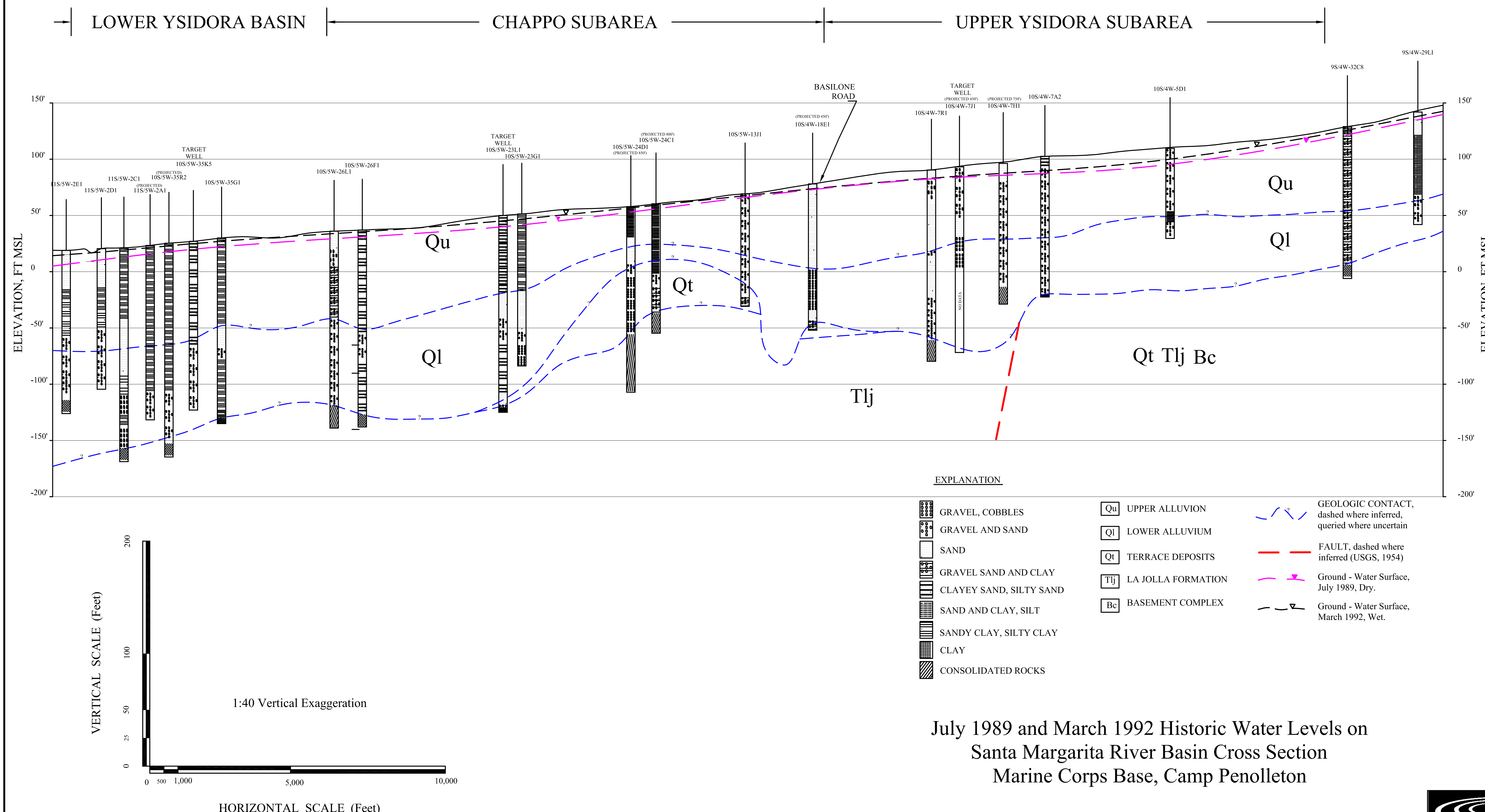
The steady-state Model was constructed with monthly stress periods. During each stress period, streamflow, recharge, evapotranspiration, pumping rates, etc. remained constant. Average values for each month were used as input into the Model for each of these parameters, such that the Model simulates average constant conditions throughout each month. The average monthly values accounted for variation in the seasonal natural system with the highest streamflows and precipitation occurring during the winter season and a dry climate occurring during the summer and autumn.

D.3.3 INITIAL AND BOUNDARY CONDITIONS

D.3.3.1 No-Flow and Active Cells

The bedrock units to the east and west of the river’s alluvial sub-basins were simulated as no-flow boundaries and considered as inactive cells without contributing to ground-water flow. Although there is some subsurface flow though the bedrock, it is generally considered to be non-water-bearing due to very low permeability. Figure D-3 displays the active and no flow cells for

FIGURE D-2



July 1989 and March 1992 Historic Water Levels on
Santa Margarita River Basin Cross Section
Marine Corps Base, Camp Penolleton

SOURCES: LAW/CRANDALL, INC. 1995
WORTS & BOSS, 1954

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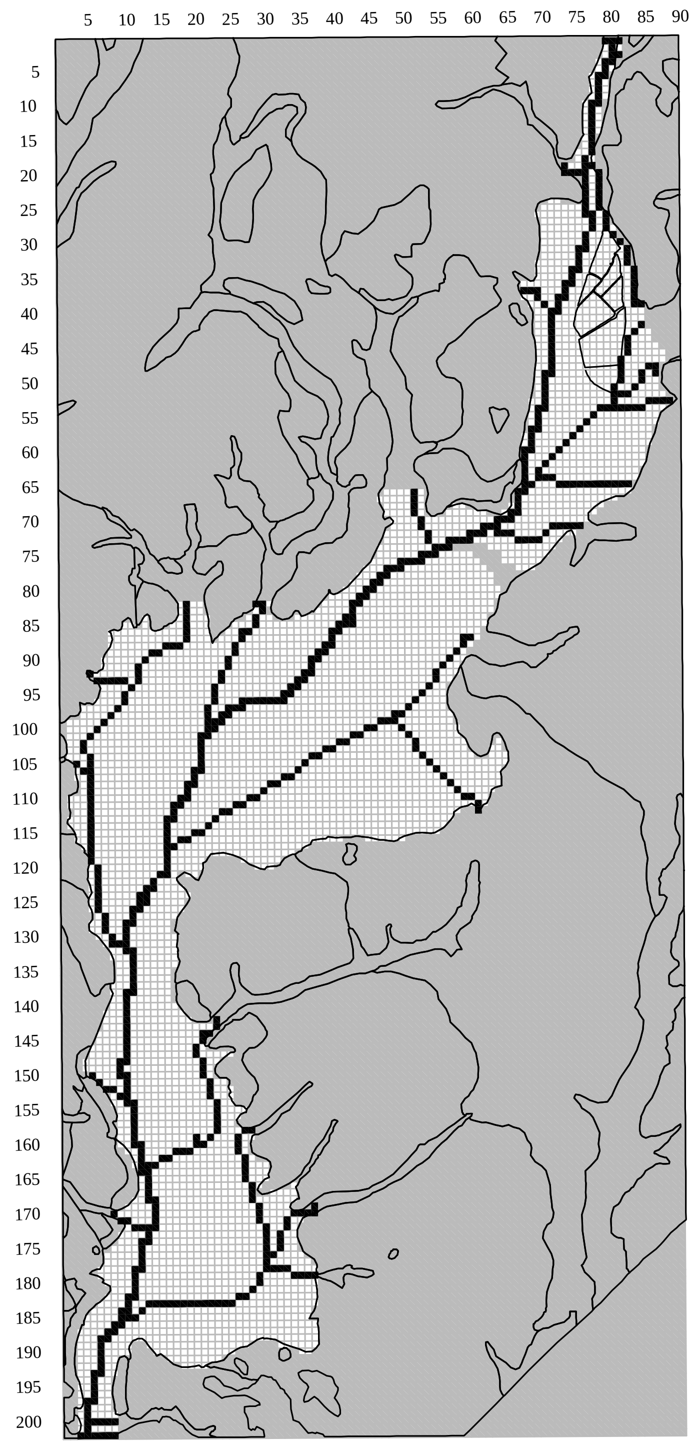
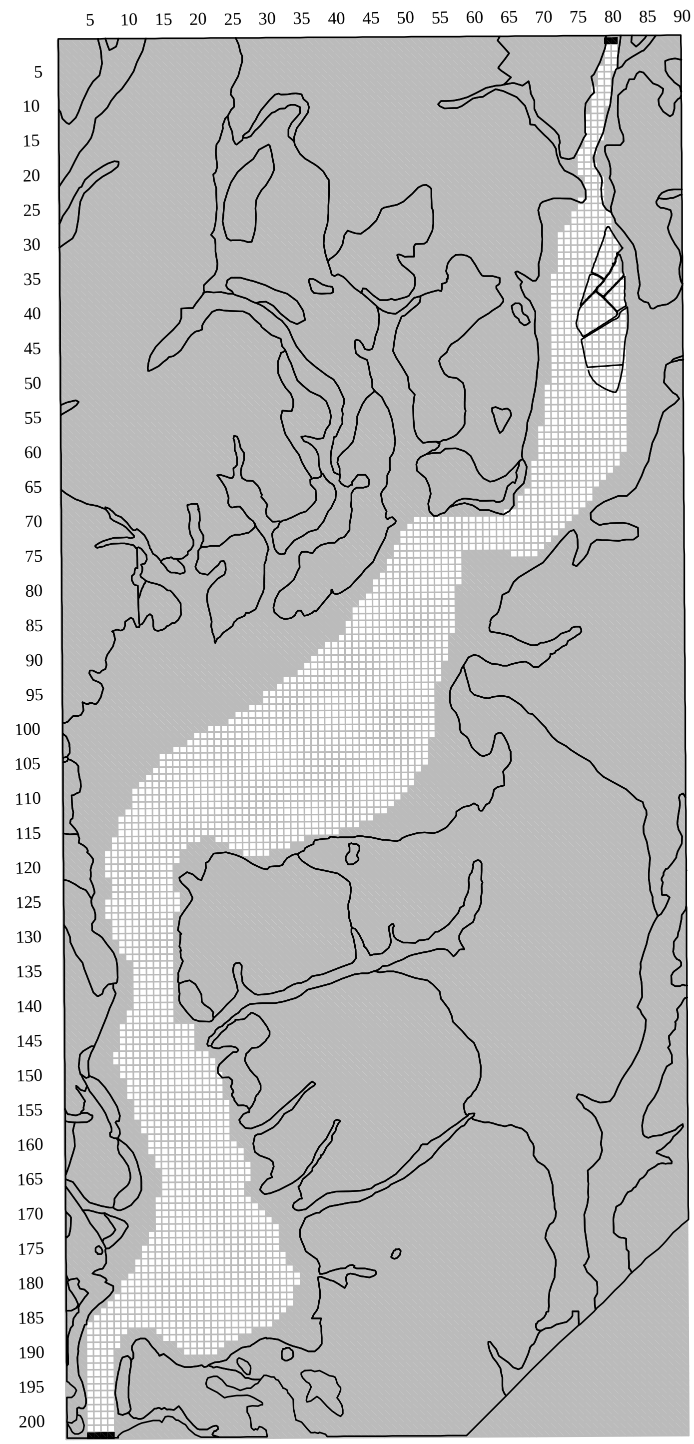


Ground-Water Model
Layer 1



Ground-Water Model
Layer 2

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- ■ STREAM CELL
- ▩ NO FLOW CELL
- □ ACTIVE CELL
- ～ OUTLINE OF GEOLOGIC UNITS
- ■ GENERAL HEAD BOUNDARY CELL
- ⋕ FINITE DIFFERENCE GRID (200 ft. x 200ft.)

GROUND- WATER MODEL
BOUNDARY CONDITIONS AND
ACTIVE CELLS

the two Model layers. Layers 1 and 2 contain approximately 4,600 and 2,800 active model cells, respectively. Table D-1 summarizes the active cell area for the three sub-basins.

TABLE D - 1 ACTIVE MODEL CELLS

Sub-Basin	# Active Cells		Active Cell Area (ac)		Average Active Cell Thickness (ft)	
	Layer 1	Layer 2	Layer 1	Layer 2	Layer 1	Layer 2
Upper Ysidora	916	618	840	570	56	81
Chappo	2,353	1,290	2,160	1,180	60	90
Lower Ysidora	1,310	903	1,200	830	89	133
Total	4,579	2,811	4,200	2,580	n/a	n/a

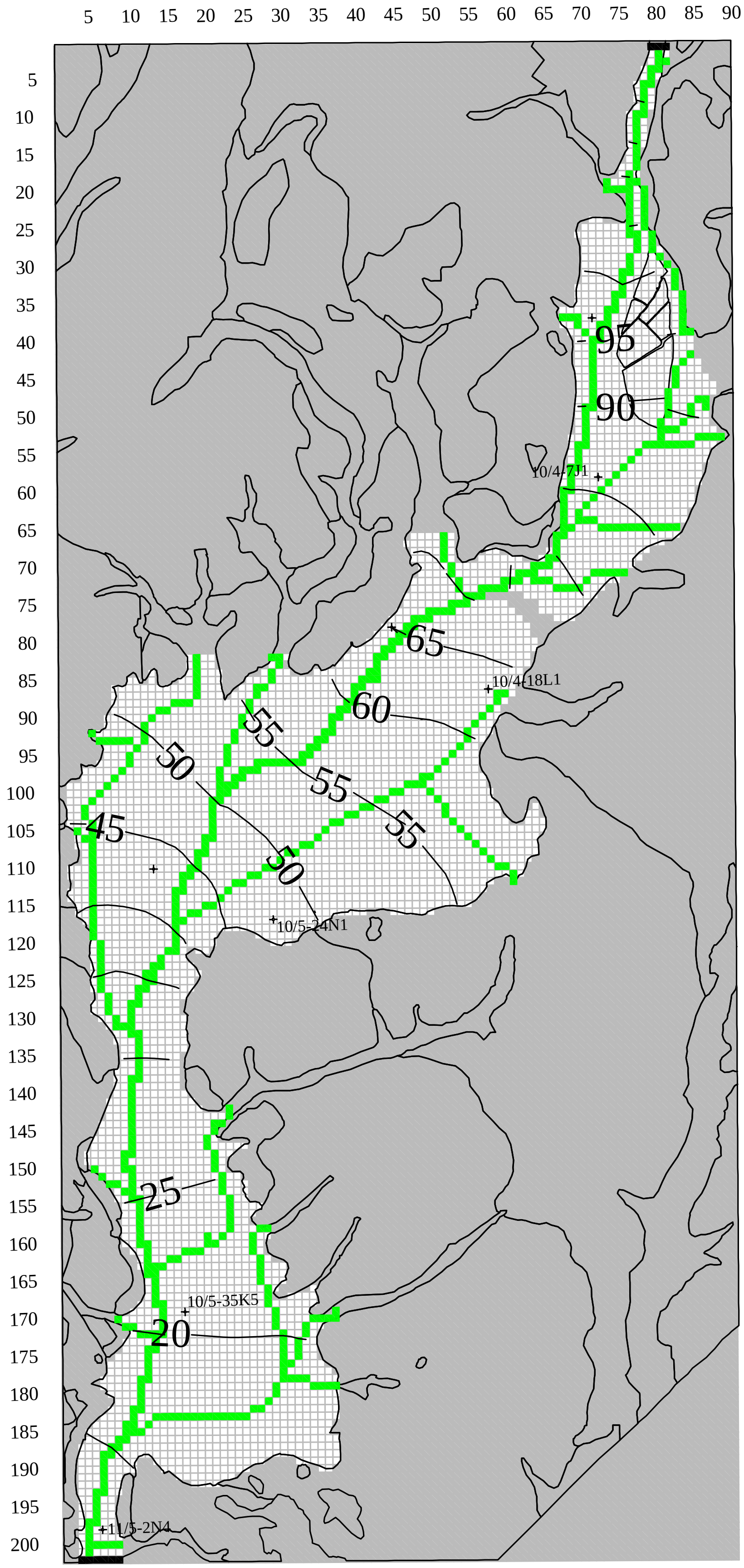
D.3.3.2 Initial Water Levels (Ground-Water Head)

Through an interative process, beginning with WY 1980 average water levels and ending with simulated October 1979 water levels, initial water level conditions were established for the Model. Available measured water level data at 5 monitoring wells during this first simulated month were used to confirm these initial conditions. Table D-2 compares simulated initial ground-water levels with October 1979 measured and the WY 1980 average annual values. Figure D-4 shows the initial ground-water level contours.

TABLE D - 2 OCTOBER 1979 MEASURED AND SIMULATED WATER LEVELS (FEET, MSL)

Monitoring Well	Sub-Basin	WY 1980 Average Annual Water Level	Oct 1979 Measured Water Level	Simulated Initial Water Level
10/4-7J1	Upper Ysidora	87	85	85
10/4-18L1	Chappo	67	65	64
10/5-24N1	Chappo	50	47	48
10/5-35K5	Lower Ysidora	22	21	21
11/5-2N4	Lower Ysidora	11	10	11

FIGURE D-4



-o- Target Water Level Well

Initial Ground-Water Level Countours (feet,msl)

Lower Santa Margarita River

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D.3.3.3 Modeled General Head Boundaries and Underflow

General head boundaries were established at the upgradient (northeast) and downgradient (southwest) active cells in both layers to simulate subsurface underflow. Underflow into and out of the Model domain is controlled by the general head boundary and the simulated ground-water head within the aquifer. A general head boundary has more flexibility than a constant head boundary by establishing a theoretical reservoir head at a certain distance from the Model boundary that the model can draw upon for underflow into the Model domain. This allows for some seasonal water level fluctuations at the boundaries. The following table summarizes the parameters were used in establishing the general head boundaries within the different layers at the upgradient and downgradient active cells. Conductance (C) across an active cell surface is calculated by the following equation:

$C = K_b (A/B)$ where: K_b = hydraulic conductivity of the boundary material (L/T)
A = area of the boundary (L^2); and
B = thickness or width of boundary (L).

TABLE D - 3 GENERAL HEAD BOUNDARY PARAMETERS

Parameter	Northeast Upgradient GHB		Southwest Downgradient GHB	
	Layer 1	Layer 2	Layer 1	Layer 2
Head @ Boundary	132.18 ft, msl	132.18 ft, msl	9.82 ft, msl	9.82 ft, msl
Avg Saturated Thickness of Cell	35 feet	65 ft	74 ft	84 ft
Width of Cell	200 ft	200 ft	200 ft	200 ft
Gradient from Model Domain to Boundary	.00218 ft/ft (11.5 ft / mile)*	.00218 ft/ft (11.5 ft / mile)*	.00218 ft/ft (11.5 ft / mile)*	.00218 ft/ft (11.5 ft / mile)*
Distance to Boundary	1000 ft	1000 ft	1000 ft	1000 ft
Hydraulic Conductivity	338 ft/day	451 ft/day	37 ft/day	338 ft/day
Avg Calculated Conductance	2400 ft^2/day	5700 ft^2/day	550 ft^2/day	5700 ft^2/day
Estimated Underflow	18 af/m	18 af/m	5 af/m	35 af/m

* from Troxell and Hofmann, 1954

D.3.3.4 Modeled Streamflow

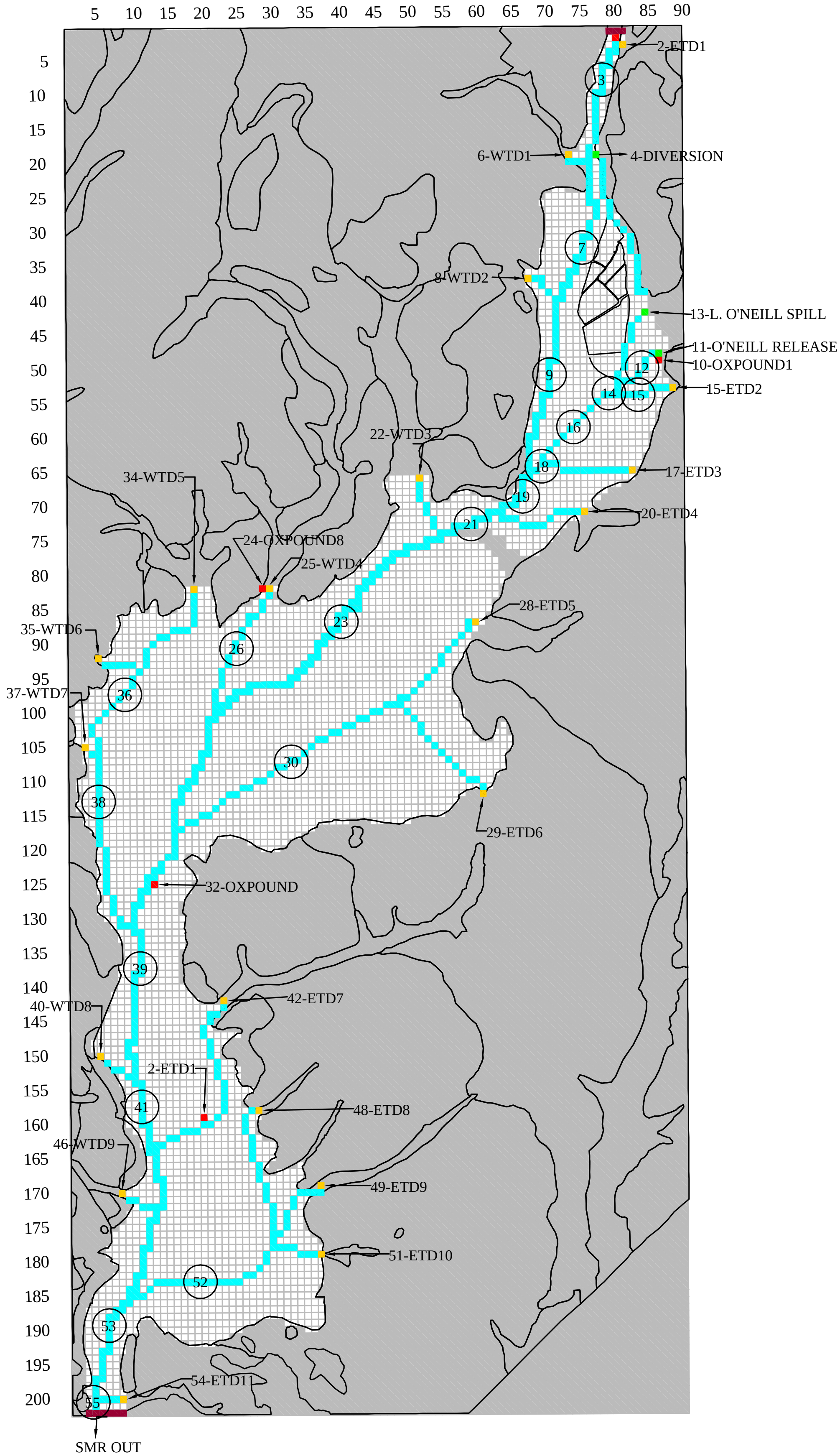
The MODFLOW™ streamflow package was used to simulate the flow of the Santa Margarita River, including minor tributary drainages, historical oxidation pond discharges, diversions, Lake O'Neill spills and releases, and the river system's interaction with the alluvial aquifer. The streamflow package is able to account for flow in the river and whether a river reach is gaining water from or losing water to the aquifer. The USGS developed the Streamflow Package to account for intermittent rivers typical in the southwestern United States, like the

Santa Margarita River. It permits rivers to go dry and then re-wet if ground water becomes available further downstream. The major inflows to the river that were simulated are: surface flow into the top of the Model domain, ground-water discharge into the river, wastewater discharge from Oxidation Ponds 1, 2, 3, 8, and 13 (after evaporation and infiltration to ground-water), recoverable runoff from minor side tributary drainages (Figure D-5), and spills and releases from Lake O'Neill. The major outflows from the river that were simulated include surface flow leaving the southern end of the model domain, infiltration to ground water, and diversions to the recharge ponds and Lake O'Neill. Table D-4 summarizes the Model input streamflow data on an annual basis throughout the 20 year simulated time period. Table D-5 presents the same information summarized by average annual monthly volumes. The average monthly streamflow volumes demonstrates the seasonal nature of the hydrologic conceptual site model .

TABLE D - 4 MODEL INPUT: AVERAGE ANNUAL STREAMFLOW (AF/WY)

AF/WY	SMR	Lake O'Neill Spill	Lake O'Neill Release	Ox Ponds	Minor Tribs	Active Cell Runoff	Subtotal	Div	Balance
1980	175,417	3,961	700	2,307	5,755	1,790	189,930	0	189,930
1981	21,149	0	700	2,142	732	0	24,724	0	24,724
1982	57,715	330	700	1,956	3,125	418	64,244	0	64,244
1983	82,811	1,658	700	2,195	3,153	535	91,052	7,845	83,207
1984	22,888	1,009	700	2,122	1,131	180	28,030	1,990	26,041
1985	20,450	473	700	2,360	897	314	25,194	3,261	21,932
1986	46,545	1,727	700	1,961	3,509	411	54,853	7,937	46,916
1987	12,246	1,296	700	2,695	603	0	17,540	2,371	15,169
1988	32,493	1,251	700	3,153	2,353	113	40,063	3,029	37,034
1989	16,267	1,150	700	2,486	1,131	260	21,994	3,641	18,353
1990	9,256	186	700	2,365	579	0	13,086	3,623	9,463
1991	53,443	1,840	700	1,972	1,837	286	60,078	6,136	53,942
1992	32,780	840	700	2,061	2,593	296	39,271	6,163	33,108
1993	224,666	5,680	700	2,422	3,822	1,233	238,522	697	237,825
1994	16,866	0	700	970	529	0	19,065	3,759	15,306
1995	99,762	2,742	700	933	3,157	1,080	108,374	1,602	106,772
1996	11,910	0	700	856	244	0	13,709	1,099	12,610
1997	21,060	0	700	949	2,059	486	25,254	3,633	21,621
1998	100,677	2,363	700	917	1,275	745	106,676	4,659	102,017
1999	9,365	0	700	902	453	0	11,421	2,955	8,466
Average	53,388	1,325	700	1,886	1,947	407	59,654	3,220	56,434
Median	27,690	1,079	700	2,092	1,556	291	33,651	3,145	30,505
20 Yr Total	1,067,765	26,505	14,000	37,726	38,938	8,146	1,193,080	64,400	1,128,680

FIGURE D-5



6-WTD1	Stream Segment # - Stream Segment ID (arrow direction indicates direction of flow at cell)		
	WTD	=	West Tributary Drainage
	ETD	=	East Tributary Drainage
	OXPOUND	=	Discharge at Waste Water Oxidation Pound
38	Continuation of Santa Margarita River, or of side drainage		

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Ground-Water Model Stream Construction

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TABLE D - 5 MODEL INPUT: AVERAGE MONTHLY STREAMFLOW (AF/WY)

Avg AF/M	SMR	Lake O'Neill Spill	Lake O'Neill Release	Ox Ponds	Minor Tribs	Active Cell Runoff	Subtotal	Div	Balance
Oct	960	6	0	149	48	0	1,163	17	1,147
Nov	2,286	36	700	155	198	17	3,392	38	3,353
Dec	2,778	4	0	167	227	49	3,225	144	3,081
Jan	11,887	174	0	175	644	207	13,089	409	12,680
Feb	15,750	456	0	169	323	84	16,782	784	15,999
Mar	11,893	473	0	174	381	50	12,972	823	12,149
Apr	3,273	115	0	151	74	0	3,614	561	3,053
May	1,856	49	0	151	1	0	2,057	337	1,720
Jun	945	5	0	149	1	0	1,099	79	1,020
Jul	569	2	0	151	10	0	733	15	718
Aug	429	0	0	152	0	0	580	7	573
Sep	762	4	0	143	39	0	949	6	942
Avg Mo.	4,449	110	58	157	162	34	4,971	268	4,703
Med Mo.	2,071	21	0	151	61	0	2,641	111	2,529
Ttl Avg Anl	53,388	1,325	700	1,886	1,947	407	59,654	3,220	56,434

Simulated Stream Geometry and Conductance

Stream geometry encompasses the location of the river within the basin, streambed width and length within a Model cell, and the streambed thickness. The following two reports were used to establish these parameters for the Model:

- Santa Margarita River Sedimentation Study; Phase I: Preliminary Hydraulic and Sediment Transport Analyses. Northwest Hydraulic Consultants (NCH); February 1997

- Draft Report: Santa Margarita River Hydrology, Hydraulics and Sedimentation Study. WEST Consultants Inc. (WEST); September 1999.

Changes in the river's low-flow channel location have been recorded since 1879 (NHC, 1997). The most recent change occurred during the flood event of January 1993, within the timeframe of the Model. Figure D-5 shows the location established in the Model for the stream and minor tributaries, diversion, and canals. Streambed conductance (C_{str}) values for each stream cell representing the Santa Margarita River were calculated from WEST's stream geometry profiles, using the following equation:

$$C_{str} = K_z \, (A/b)$$

where:
- K_Z = hydraulic conductivity of streambed material (L/T)
- A = area of the stream cell: length x width (L^2); and
- b = thickness of the streambed (L).

The length of each stream cell was 200 feet and the width varied from 80 feet to 1,060 feet (WEST, 1999). Streambed thickness ranged from 6 to 12 feet. The streambed conductance for each Model stream cell was held constant throughout all stress periods of the model run. This simplifying assumption does not account for the seasonal change in the width of the streambed as the river widens and narrows with available water. For minor tributary drainages, the conductance was set to 500 ft/d, whereas conductance of the Santa Margarita River stream cells was estimated to range from 400 to 8800 ft/day. The conductance of the diversion channel was set to 5 ft/d to avoid any double counting of recharge volume at the ponds. Attachment 1 following this appendix shows the MODFLOW™ Streamflow Package, including the stream elevation and streambed conductance for all stream segments and reaches. The stream segment order, side tributaries, diversions and canals, and oxidation pond discharges to the river are shown in Figure D-5.

Santa Margarita River Streamflow from WY 1980 through 1999

The Santa Margarita River has a dominating influence on the hydrogeologic conditions within the Model domain. The Santa Margarita River is often dry for several months of the year in parts of the Chappo and Lower Ysidora sub-basins. In extremely dry years, there has been no flow at all reaching the ocean. In extremely wet years, the average daily flow has reached as high as 19,500 cfs and the peak daily flow has exceeded 44,000 cfs (January 1993). The hydrologic variability of the Santa Margarita River makes it both a powerful and vulnerable source of water for its many users (Figure D-6). As shown in Table D-5, the average monthly streamflow during the calibration period at the top of the Model boundary is 4,450 af of water, ranging from a 20 year average of 430 af/m in August to 15,750 af/m in February.

Diversions from the Santa Margarita River from WY 1980 through 1999

River water was diverted for ground-water recharge in percolation basins and to fill Lake O'Neill. Attachment 2 contains the simulated monthly historical diversions from the Santa Margarita River from WY 1980 through 1999. The diversion structure and ponds were under maintenance an repair during the first part of the simulated time period. The river over-banked and by-passed the ground-water recharge basins during the 1993 flood event. Average annual diversions from WY 1980 through 1999 to Lake O'Neill was 490 af/wy, ranging from 0 to 1,340 af/wy.

Lake O'Neill Spill and Release from WY 1980 through 1999

Historically, Lake O'Neill receives surface diversions from the Santa Margarita River, inflow from the surrounding watershed (including Fallbrook Creek), and direct precipitation. A spreadsheet analysis was performed to proportion the available water on a monthly basis to

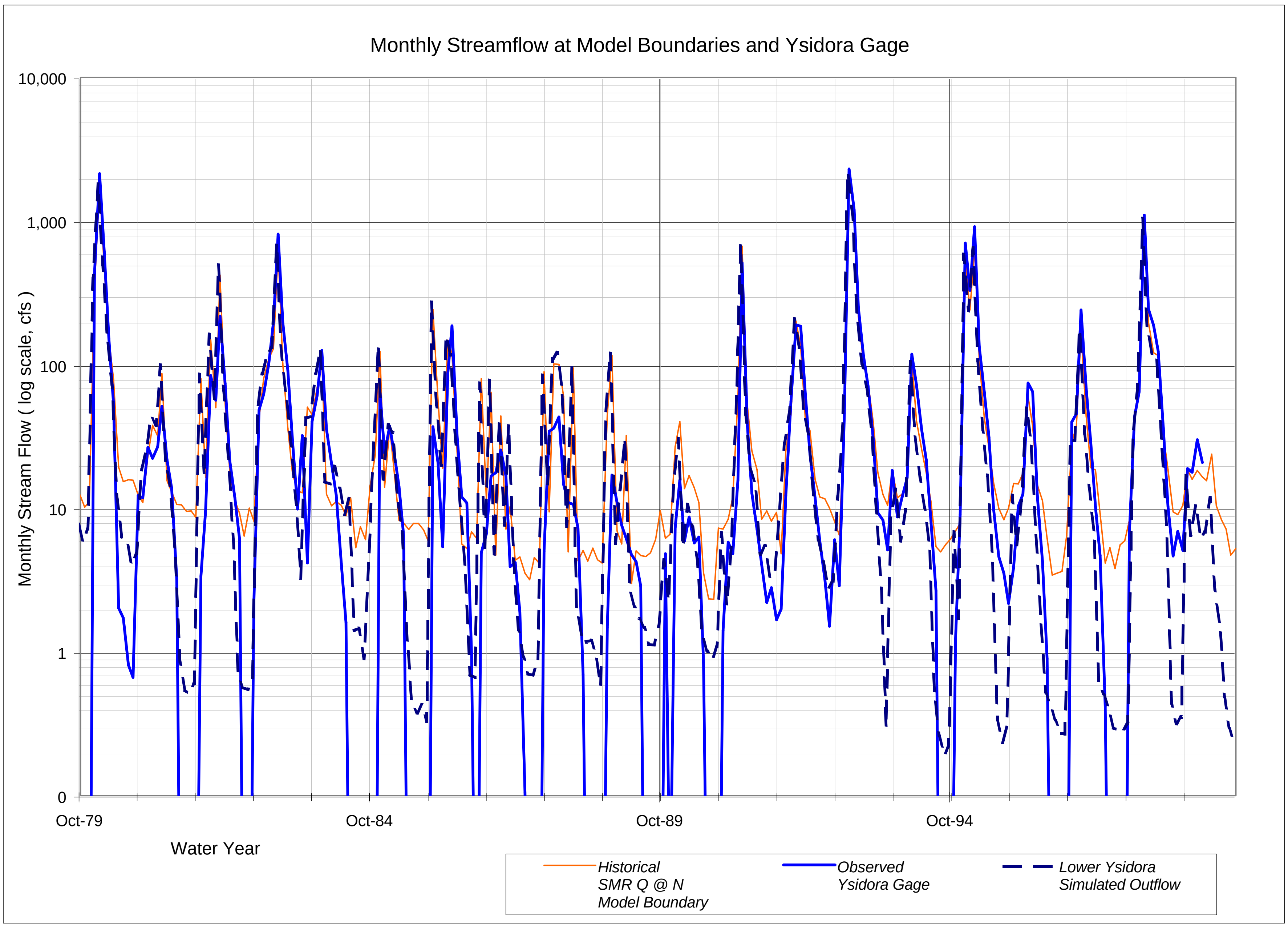

Monthly Streamflow at Model Boundaries and Ysidora Gage
Monthly Stream Flow (log scale, cfs)
10,000
1,000
100
10
1
0
Oct-79
Oct-84
Oct-89
Oct-94
Water Year
Historical SMR Q @ N Model Boundary
Observed Ysidora Gage
Lower Ysidora Simulated Outflow

Figure D - 6

evaporation off of the lake surface, spills at the spillway, and the annual November release. Spills and releases from Lake O'Neill were estimated from Annual Watermaster Reports, and Fallbrook Creek streamflow was used from the USGS stream gage on Fallbrook Creek. Table D-4 and 5 show the estimated annual summary for each of these inflows and outflows for the calibration period, WY 1980 through WY 1999. Appendix E describes the surface water analysis for full diversions to Lake O'Neill under the pre-1914 water right and proposed Permit 15000 diversions to Lake O'Neill.

Minor Tributary Drainage and Surface Runoff from WY 1980 through 1999

Precipitation runoff into the model domain is estimated to comprise approximately 3.6% of the Santa Margarita River surface flow in the three sub-basin. Local runoff generated by precipitation events is dependent on soil characteristics, land slopes, existing soil moisture, storm intensity, and storm duration. Due to these factors, the runoff varies greatly from year to year, month to month, and location to location. Within the alluvial floodplain on Camp Pendleton, runoff is generally minimal due to the flatness of topography, undeveloped characteristic of the area, and sandy soil. In the foothills and mountainous areas dominated by bedrock formations, runoff may be significant during large precipitation events. The minor tributary runoff was calculated as part of the stream analysis in Appendix E.

The watershed drainage area for the active model cells is shown in Figure D-1. Tables D-6 below shows each of the 20 minor tributary drainage areas and the alluvium surface area of the valley floor, along with the water runoff volume proportioned to each. Table D-7 shows the same information as average monthly volumes and demonstrates the seasonal distribution of runoff.

TABLE D - 6 WY 1980 - 1999 MINOR TRIBUTARY AND ALLUVIUM SIMULATED RUNOFF

Stream Segment	Minor Tributary Drainage	Area (acre)	Average (af/wy)	Median (af/wy)	Total (af/ 20 wy)
2	E Trib 1	330	60	60	1,150
6	W Trib 1	1,600	260	200	5,150
8	W Trib 2	370	60	50	1,190
15	E Trib 2	150	30	20	510
17	E Trib 3	150	190	120	3,890
20	E Trib 4	190	30	30	640
22	W Trib 3	1,720	220	150	4,430
25	W Trib 4	1,220	130	90	2,610
28	E Trib 5	540	90	90	1,860
29	E Trib 6	620	110	100	2,122
34	W Trib 5	620	50	30	990
35	W Trib 6	160	50	40	1,000
37	W Trib 7	380	70	50	1,330
40	W Trib 8	430	80	70	1,610
42	E Trib 7	790	140	130	2,700
46	W Trib 9	530	50	30	920
48	E Trib 8	440	70	70	1,500
49	E Trib 9	780	130	130	2,690
51	E Trib 10	440	80	70	1,510
54	E Trib 11	330	60	50	1,130
	Total Side Trib	11,790	1,950	1,580	38,940
	Q alluvium	4,140	410	290	8,150

TABLE D - 7 AVERAGE MONTHLY MINOR TRIBUTARY AND ALLUVIUM RUNOFF

Month	**Precipitation (Oceanside)** (12.01 in/yr avg) (avg in/m)	**11 East Side Minor Tributary Drainages** 7,510 acres (avg af/m)	**9 West Side Minor Tributary Drainages** 4,280 acres (avg af/m)	**Q al (Alluvium)** 4,140 acres (avg af/m)	**Total Runoff** 15,930 (avg af/m)
Oct	0.45	20	20	0	50
Nov	1.26	100	100	20	220
Dec	1.59	120	110	50	280
Jan	2.95	340	310	210	850
Feb	2.35	160	170	80	410
Mar	2.01	180	200	50	430
Apr	0.75	40	30	0	70
May	0.11	0	0	0	0
Jun	0.11	0	0	0	0
Jul	0.10	0	0	0	0
Aug	0.05	0	0	0	0
Sep	0.31	20	20	0	40
Total (af/y)		980	960	410	2,350

Wastewater Discharge from WY 1980 - 1999

Wastewater from Sewage Treatment Plants (STP) 1, 2, 3, 8, and 13 was discharged into oxidation ponds and then released into the Santa Margarita River during the calibration period. This inflow was proportioned to streamflow and to ground-water recharge. The streamflow portion is discussed in this section. The following wastewater flow assumptions were made:

- The oxidation pond associated with STP 1 is located outside of the model domain and does not appear to contribute to the basin's ground-water recharge, therefore only the discharge to the stream, located near the Lake O'Neill release point, was modeled.

- The flow path for wastewater releases from STP 2 include: oxidation pond 2, to golf course irrigation or oxidation pond 3, then to a river discharge point near oxidation pond 13 in the Lower Ysidora. Only STP 2 water discharged to the river is considered in the model because oxidation ponds 2 and 3 are outside of the modeled active cells.

- Wastewater from STP 3 flows to an oxidation pond in the south end of Chappo, just north of the narrows. It is assumed that approximately 10% of the water in the oxidation pond recharges the ground water beneath the pond and the remaining 90% is released to the Santa Margarita River during the calibration period. Monthly precipitation and potential evaporation are accounted for prior to calculating available ground-water recharge and release to the stream.

- Oxidation pond 8 is located in the Chappo on the west side of the river, within the active model cells. It is assumed that approximately 10% of the water in the oxidation pond recharges the ground water beneath the pond and the remaining 90% is released to the Santa Margarita River. Monthly precipitation and potential evaporation are accounted for prior to calculating available ground-water recharge and release to the stream.

- The largest oxidation ponds, located in the Lower Ysidora, were associated with STP 13. The use of these ponds was discontinued after they were damaged during the 1993 flooding. During their operation, it is assumed that approximately 10% of the water in the oxidation ponds recharged the ground water beneath the pond and the remaining 90% is released to the Santa Margarita River. Monthly precipitation and potential evaporation are accounted for prior to calculating available ground-water recharge and release to the stream.

Attachment 2, Table D-A2-2, summarizes the average annual and average monthly STP releases to the oxidation ponds and the discharges to the Santa Margarita River that were incorporated into the modeled calibration period. The waste discharge has a small seasonal variation compared to other stream inflow parameters.

D.3.3.5 Modeled Production Wells

During the model calibration period of WY 1980 through WY 1999, Camp Pendleton operated five production wells in the Upper Ysidora, nine production wells in the Chappo, and three irrigation wells in the Ysidora Narrows and Lower Ysidora. Attachment 3 summarizes the ground-water production in the three sub-basins, showing the effects of the seasonal summer demand, increased demand of ground water following dryer than normal winters, and the 1995 base expansion. Table D-8 lists the production wells, screen intervals, period of operation during the model calibration period, and average annual pumping volumes during the pumping period. Figure D-7 shows the location of modeled production wells.

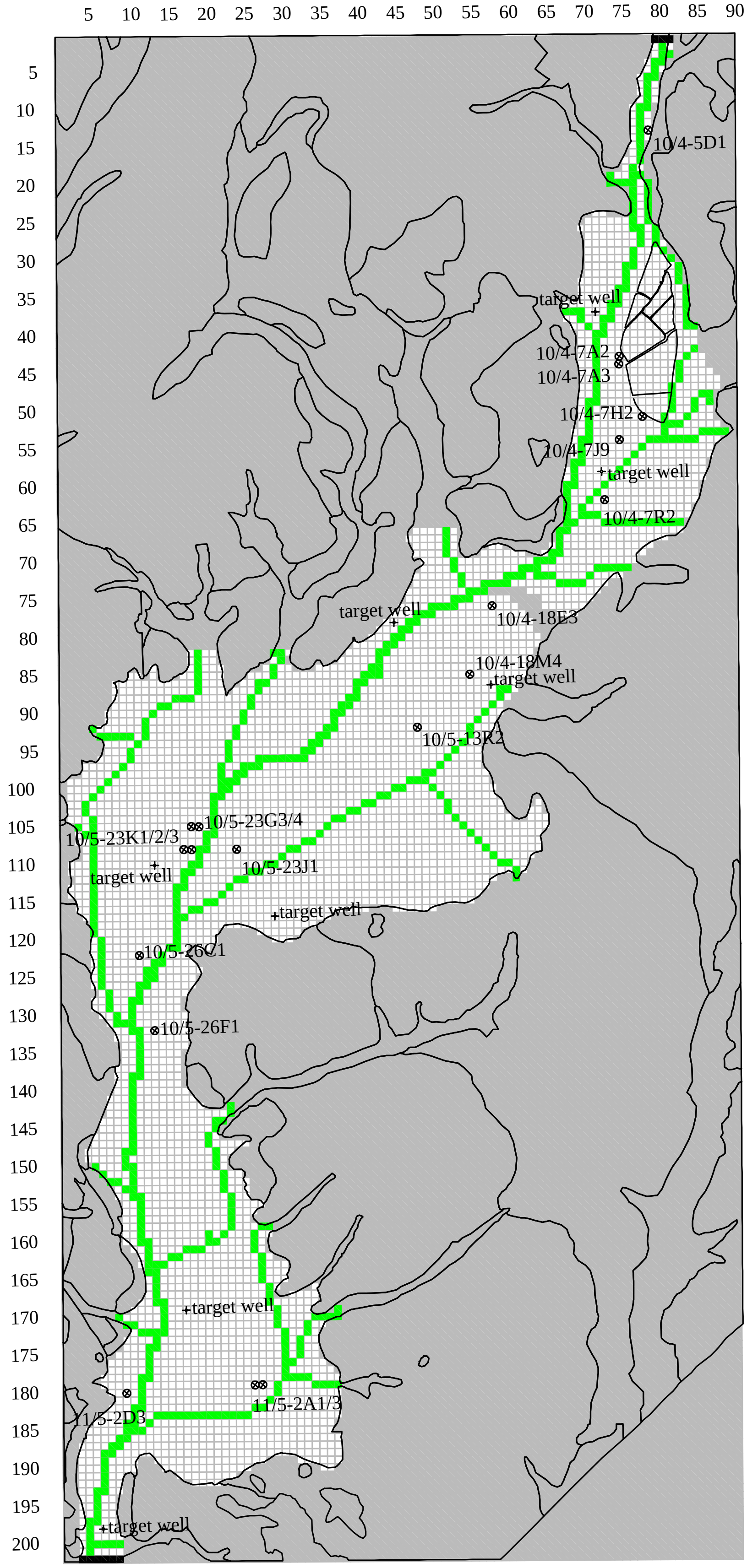
TABLE D - 8 PRODUCTION WELL INVENTORY

Well ID	Bldg No.	Year Drilled	Operation (feet, bgs)	Average AF/WY (feet, msl)	Screen Interval	Ground Surface
Upper Ysidora Sub-basin						
10/4-5D1	27911	1943	1981-1987	384	28-70	110
10/4-7R2	2603	1955	1980-1999	461	n/a	(7R1) 90
10/4-7A2	2673	1956	1980-1999	622	n/a	(7A1) 103
10/4-7A3	n/a	1999	1999	16	n/a	(7A1) 103
10/4-7H2	2671	1956	1980-1999	293	n/a	(7H1) 98
Chappo Sub-basin						
10/5-13R2	2363	1956	1980-1982	461	68-132	66
			1990-1999	506	n/a	n/a
10/4-18E3	2393	1965	1981-1999	465	89-109	78
10/4-18M4	2373	1960	1980-1999	442	84-224	76
10/5-23J1	2301	1950	1980-1999	742	107-137	52
10/5-23G3	33926	1976	7 years	44	17-118	54
10/5-23G4	n/a	n/a	1999	326	n/a	n/a
10/5-23K2	33924	n/a	11 years	238	n/a	50
10/5-23K3	n/a	n/a	1999	336	n/a	n/a
10/5-26C1	2201	1959	1980-1999	808	96-162	44
Ysidora Narrows and Lower Ysidora Sub-basin (irrigation wells)						
10/5-26F1	2200	n/a	1980-1999	941	88-170	39
11/5-2D3	n/a	n/a	1986-1999	148	n/a	n/a
11/5-2A3/1	19122	n/a	1980-1989	95	n/a	n/a

Note: n/a indicates unknown or unavailable data; bgs is 'below ground surface'; msl is 'mean sea level'

D.3.4 GROUND-WATER FLOW MODEL PROPERTIES

The ground-water flow model parameters were developed based on the conceptual site model. A numerical model inherently requires simplifying assumptions when defining a problem domain. Each volume element (a block defined by a row, a column, and a layer in the grid) is assigned a unique set of hydraulic parameters influencing the calculations depicting flow of ground water at the center of that particular block. Hydraulic properties shaped by the



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⊗ Production Well
+ Target Water Level Well

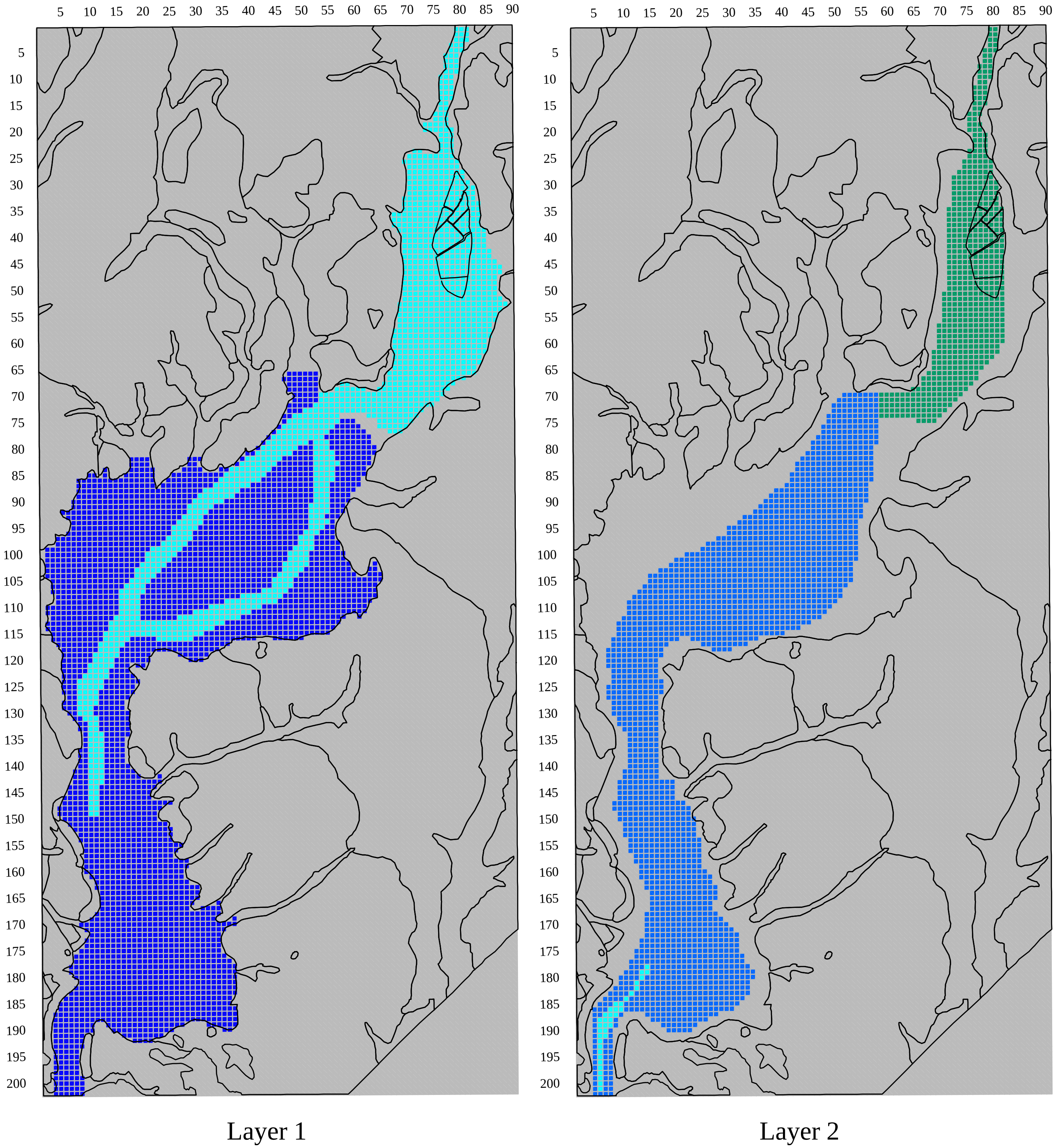
Well Locations within the Model Area

geologic substrate that the ground water flows through include hydraulic conductivity (horizontal and vertical), effective porosity, specific yield, and storativity. Aquifer transmissivity was obtained by multiplying hydraulic conductivity by the thickness of the layer at that grid block. Other cell properties influenced by climatic conditions include recharge, and evapotranspiration.

Two layers were chosen to represent the alluvial aquifer in all three sub-basins. Well logs and cross sections of the Lower Santa Margarita River ground-water basin (Worts and Boss, 1954; Slemon, 1978) show a coarser (cobbles, gravel, and sand) lower alluvium beneath a finer (gravel, sand, silt, and clay) upper alluvium. Though the ground-water basin is considered to be one aquifer, the two layers allow for the simulation of variable materials. The Model was constructed with two layers representing the two Quaternary alluvial units of the Santa Margarita River Basin. The upper layer was assigned properties of an unconfined layer to capture the water table aquifer characteristics of the upper alluvium. The bottom layer of the Model was assigned an aquifer type of an unconfined unit with variable transmissivity, allowing for variability in the saturated thickness of the lower alluvium.

D.3.4.1 Modeled Hydraulic Properties

Aquifer hydraulic characteristics were assigned based on aquifer pumping tests conducted by IT Corporation and previous model results (LAW/Crandall, 1995). Horizontal conductivities ranged from 0.8 and 37 ft/day in the silts and silty sands of the Chappo and Lower Ysidora sub-basins to approximately 300 to 450 ft/day in the gravels and sands of the lower alluvium in the Chappo and Upper Ysidora (LAW, 1995). Specific yield ranged from 0.05 in silts to 0.2 in sands and gravels (LAW, 1995). Storativity was estimated at 0.00002 to 0.00008 depending on soil type. Effective porosity was assigned values from 0.22 for sand and gravel units to 0.40 for silt/clay units. This model was constructed by combining layers 1, 2, and 3 of the Law/Crandall model as a new layer 1; and layers 4 and 5 of the LAW/Crandall model as a new layer 2. The following table summarizes the hydraulic properties used in this Model (adjusted from the LAW/Crandall model, 1995). Figure D-8 shows the extent of these property zones for layers 1 and 2.



Hydraulic Conductivity Zone	Value
1	37.00
2	192.0
3	300.0
4	388.0
5	451.0
6	494.0

Ground-Water Model Hydraulic Conductivity

Lower Santa Margarita River

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TABLE D - 9 MODELED HYDRAULIC PARAMETERS

	K_{xy}/K_z (ft/day)	Storativity (1/ft)	Specific Yield (ft^3/ft^3)	Porosity (fraction)
Upper Ysidora Sub-Basin				
Layer 1 sand/gravel	338, 68	0.00002	0.2	0.22
Layer 2 sand/gravel	494, 99	0.000046	0.2	0.22
Chappo Sub-Basin				
Layer 1 near SMR	338, 68	0.00002	0.2	0.22
Layer 1 silt/sand	192, 38	0.00002	0.2	0.22
Layer 1 sand beneath Supply Depot	300, 68	0.00002	0.2	0.22
Layer 2 sand/gravel	300, 68	0.00002	0.2	0.22
Lower Ysidora Sub-Basin				
Layer 1 near SMR	338, 68	0.00002	0.2	0.22
Layer 1 silts w/ sand	192, 38	0.00002	0.2	0.22
Layer 2 sand/gravel	300, 68	0.00002	0.2	0.22

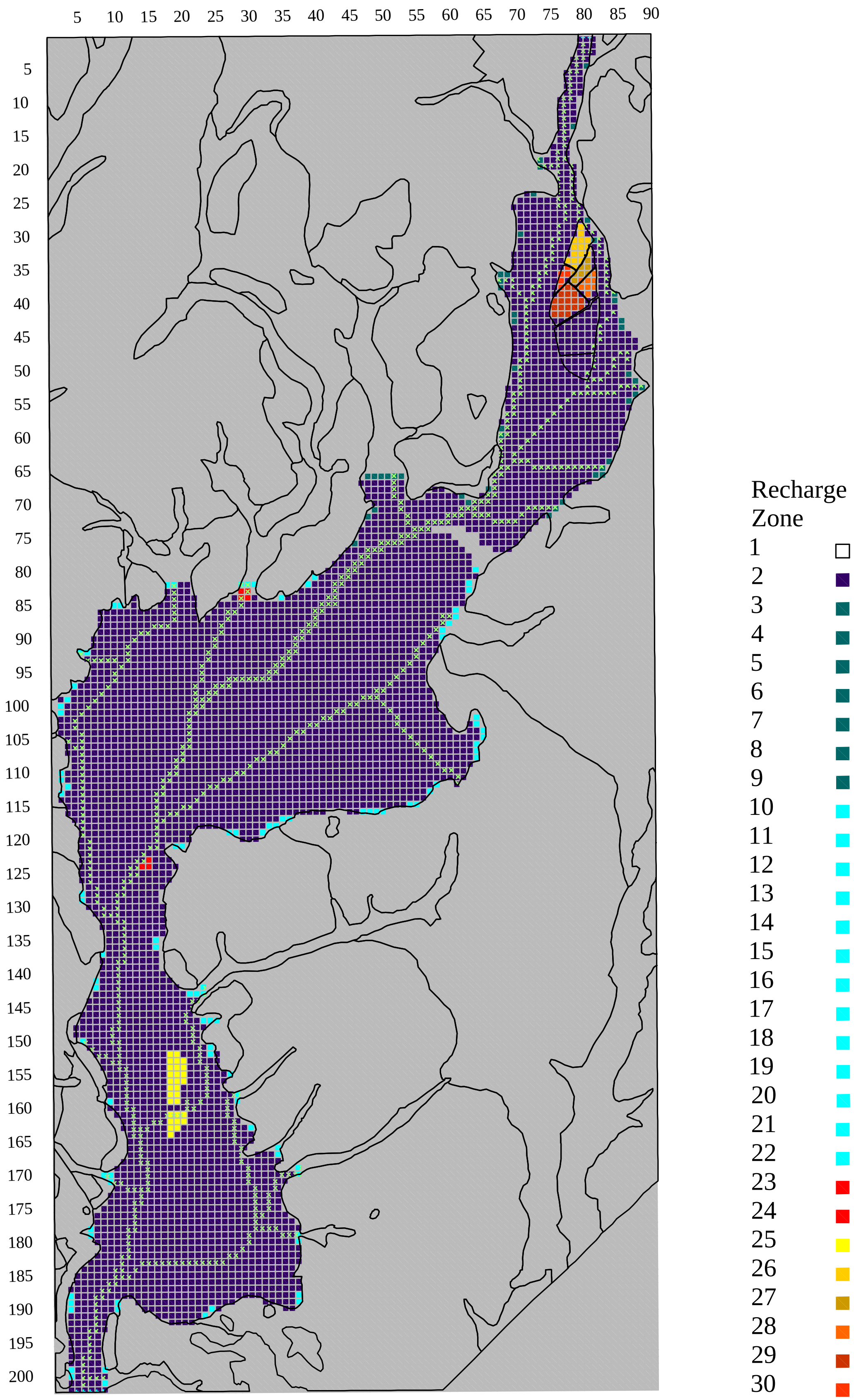
D.3.4.2 Modeled Recharge

Recharge from direct precipitation, side tributary underflow, oxidation ponds, and the recharge basins was simulated in layer 1 of the active model cells (Figure D-9). Attachment 2, Table D-A2-3 contains average annual and average monthly recharge within the model domain.

Recoverable water by runoff and infiltration from rainfall was considered to be approximately 17% of measured precipitation (Crippen, 1965), typical of a Southern California coastal climate. This recoverable water was assigned to the upper model layer as recharge and side tributary runoff. The median annual precipitation from water years 1980 through 1999 was 12.0 in/yr, ranging from 3.6 in/yr in WY 1986-87 to 25.9 in/yr in WY 1979-80. Figure D-9 shows the different recharge zones assigned within layer 1 active model cells.

Using the historical diversion data (OWR, 2000), infiltration rates at the Upper Ysidora recharge basins were calibrated with the ground-water model. The ground-water recharge pond infiltration rates were modeled with a seasonal variation ranging from 0.2 ft/day to 1.8 feet/day to account for percolation of the water diverted from the Santa Margarita River.

FIGURE D-9



Ground-Water Model Recharge Zones

Lower Santa Margarita River

STETSON ENGINEERS INC.

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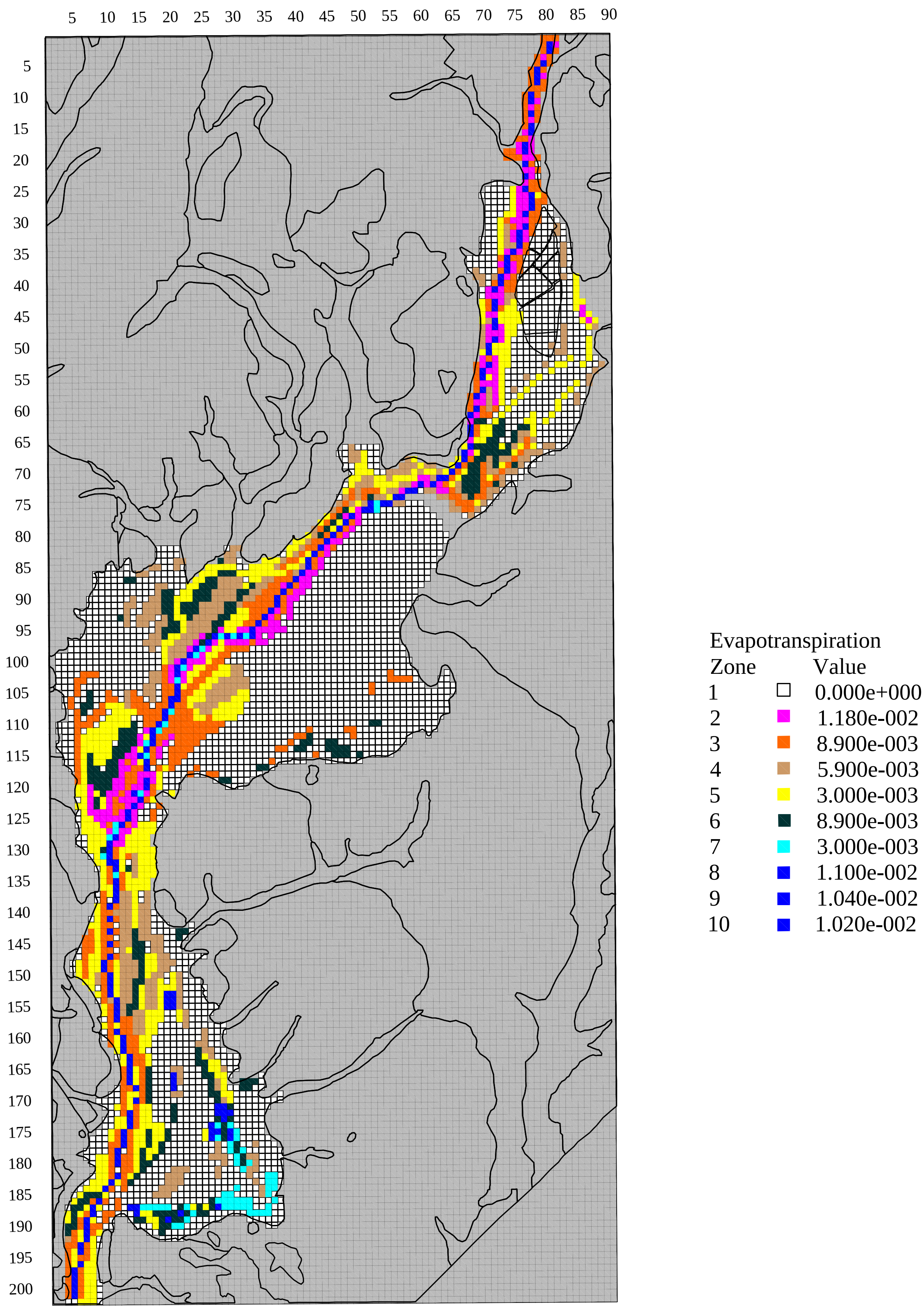
It was estimated that 10% of water stored in Oxidation Ponds 3, 8, and 13 was recharged into the ground-water aquifer (minus evaporation, plus rainfall) and included in the Model for the appropriate years of operation (Carlson, 2000, personal communication). Table D-A2-2 shows the average annual and average monthly recharge from Oxidation Ponds within the model domain

D.3.4.3 Modeled Evapotranspiration

Phreatophyte location and density of coverage was estimated from infrared and aerial photos taken in 1980, 1982, 1989, 1993 and 1997 and a riparian vegetation survey conducted in 1997 (MCB-CP, 2000) to determine ground water consumption by evapotranspiration. Dense cottonwood and willow riparian trees were assigned an ET rate of approximately 60 in/yr and an extinction depth of 20 feet. Dense wetland plants were assigned an ET rate of approximately 45 in/yr with an extinction depth of 8 feet. Different densities of phreatophytes were assigned values proportional to these values. Table D-10 shows the simulated ET zones and densities assigned to layer 1 of the model active cells, and Figure D-10 shows where these zones are located.

TABLE D - 10 MODEL INPUT: ET DENSITIES AND AERIAL COVERAGE BY SUB-BASIN

ET Zone	Vegetative Cover	ET Rate (ft/day)	Extinction Depth (ft)
1	No ET	0.00	20
2	Dense Riparian Trees	0.0118	20
3	75% Riparian Trees	0.0089	20
4	50% Riparian Trees	0.0059	20
5	25% Riparian Trees	0.0030	20
6	Dense Wetlands	0.0089	8
7	30% Wetlands	0.0030	8
8	UY open water	0.0110	3
9	CH open water	0.0104	3
10	LY open water	0.0102	3



Ground-Water Model ET Zones

Lower Santa Margarita River

STETSON ENGINEERS INC.

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D.4 CALIBRATION PROCESS

Data for streamflow, precipitation, and various diversions and releases were compiled from the Base's records for the 20-year period from water year 1980 through water year 1999. This calibration period included the wastewater contributions from Oxidation Ponds 1, 2, 3, 8, and 13. Average input parameters were first used to establish a steady state model, followed by an annual average 20-year transient model calibration period. The final calibration was completed on a 20-year period of monthly time steps. The Ysidora stream gage, which has been monitored by the USGS at its current location near Basilone Road since December 19, 1980, was used as a calibration point for the Santa Margarita River in the ground-water flow model. Ground-water levels from eight monitoring wells were used for calibration of water contour intervals. Adjustments were made to the model until the stream flow results from the model closely matched the measured stream flow from 1980 through 1999, showing the expected response between wet and dry years. Model calibration also included matching ground water levels in eight monitoring wells.

D.4.1 WATER LEVEL DATA

Historical water levels from two monitoring wells in the Upper Ysidora, four monitoring wells in the Chappo, and two monitoring wells in the Lower Ysidora were used for model calibration because of the continuity of the recorded data at these wells. Figure D-7 shows the location of these wells (marked target wells) and Table D-11 shows the annual average water level at these wells.

TABLE D - 11 MONITORING WELL WATER LEVEL DATA

Well ID	Period of Record	Average Annual Water Level (ft,msl)	Measuring Point Elevation (ft,msl)
Upper Ysidora Sub-Basin			
10/4-6R1	1983-1995	93	105
10/4-7J1	1980-1999	86	92
Chappo Sub-Basin			
10/4-18L1	1980-1999	65	74
10/5-13G1	1996-1999	66	124
10/5-24N1	1989-1999	48	57
10/5-23L1	1985-1995	41	50
Lower Ysidora Sub-Basin			
10/5-35K5	1980-1993	22	25
11/5-2N4	1980-1993	12	16

Three monitoring wells, 10/4-7J1, 10/5-23L1, and 10/5-35K5, located near the south central part of the Upper Ysidora, Chappo, and Lower Ysidora respectively, were used as indicator wells for water level changes in the aquifer. The historical calibration of the Model, as well as impacts from future model runs, use these three "target" wells to identify potential impacts to the streamflow and ground-water sub-basins.

The lowest water level during the calibration period occurred during July 1989, and the highest water level occurred during March 1992. Figure D-2 shows a cross section through the sub-basins and the range in water levels observed during the calibration period. The available data shows that water levels appear to mound North of the narrows near Basilone Road. Each of the three target monitoring wells for the three sub-basins are also shown on this cross section. Figure D-11 shows observed water level data compared to modeled simulated results for all three sub-basins.

D.4.2 YSIDORA STREAM GAGE

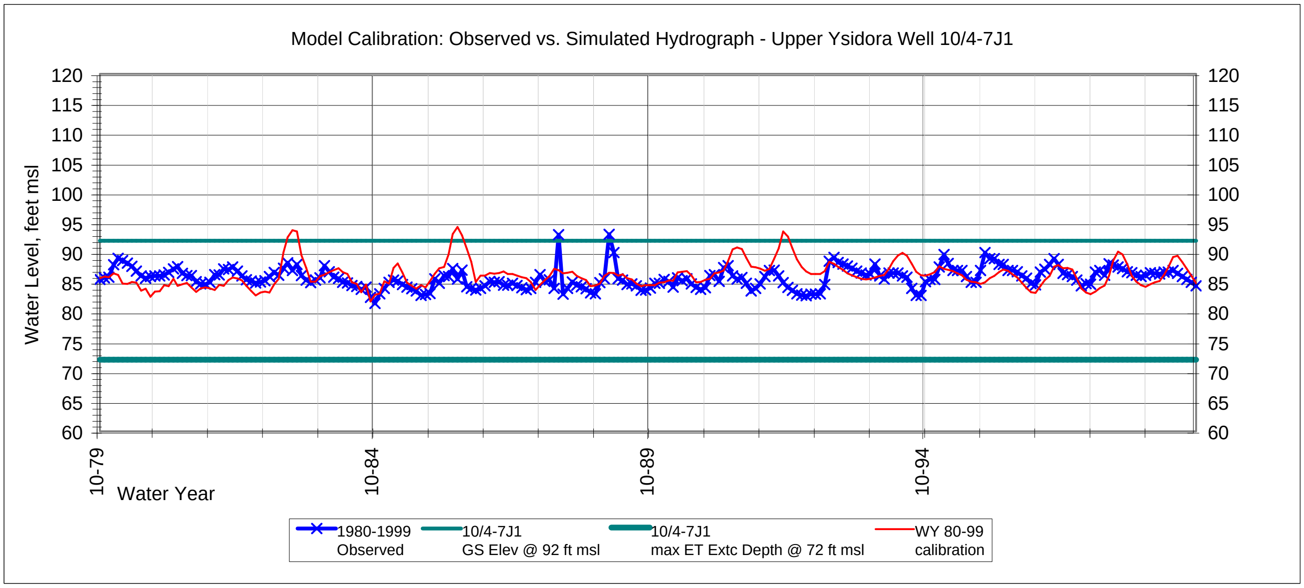
The Ysidora stream gage has been operating at its current location near Basilone Road since December 1989. Prior to time, during the first half of the calibration period, the Ysidora gage was operated at the southern end of the Lower Ysidora sub-basin. Figure D-12 shows a graph of the measured and simulated flows near the present location of the Ysidora gage.

D.5 MODEL OUTPUT

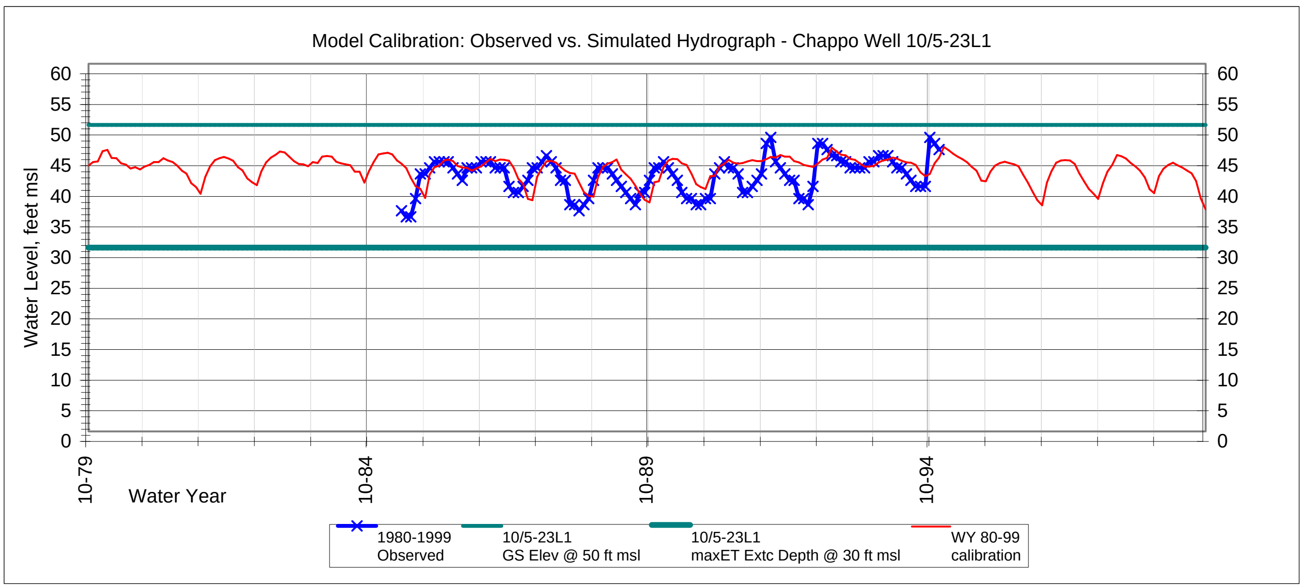
The *MODFLOWä stream* package was chosen for this Model because of its ability to simulate loosing, dry, and gaining stream reaches during different stress periods. This matches the natural behavior of the Santa Margarita River. Figure D-13 shows the different gaining and loosing reaches during a dry monthly stress period (July 1989), and contrasts this with the simulated results during a wet period (March 1992).

Monthly flows observed at the Ysidora gage are shown in Figure D-12, along with simulated flows at the Ysidora gage and surface flow out of the Model boundary in the Lower Ysidora sub-basin. The Model simulates a wetter river during winter months of the dry period (WY 1987 - 1989), which could be an effect of averaging the river flow over the whole month instead of the daily peaks. The simulated river flow does go to 0 cfs during the observed summer months of these same dry years.

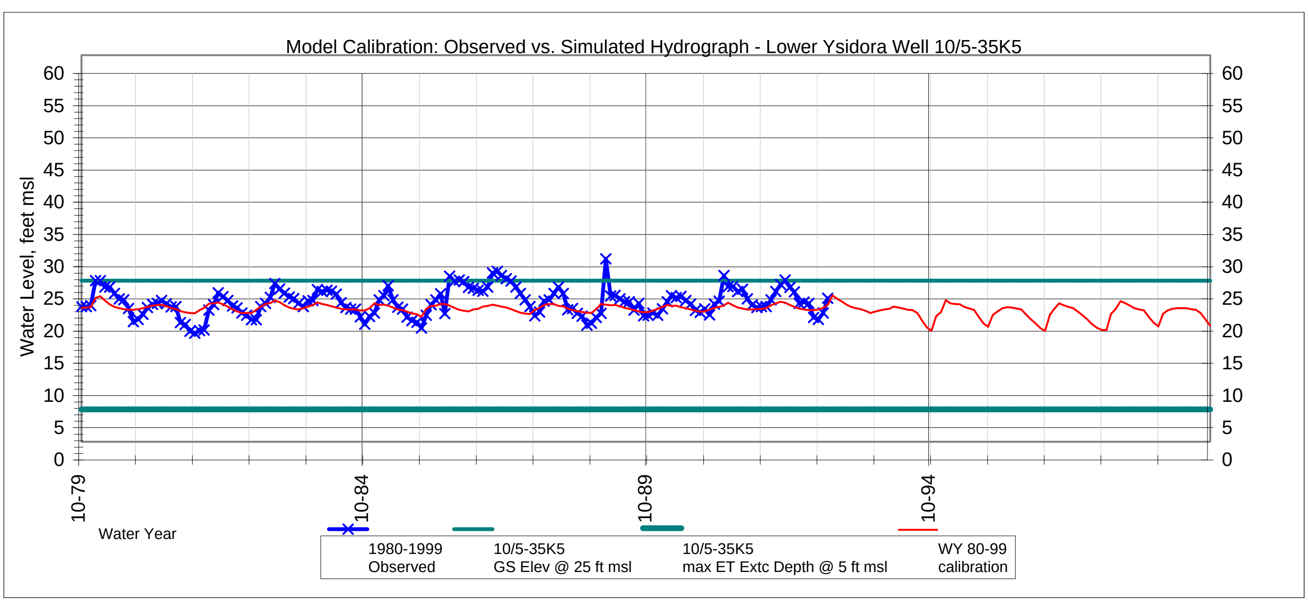
Each water level graph shows the ground surface elevation and the maximum estimated ET extinction depth for riparian vegetation (20 feet). Water levels near the ground surface are an indication of mounding, especially in the Upper Ysidora sub-basin near the recharge ponds. Water levels near the maximum ET extinction depth are considered critical during the summer months, but less critical during the winter months as long as there is no prolonged period of low



Model Calibration: Observed vs. Simulated Hydrograph - Upper Ysidora Well 10/4-7J1
Water Level, feet msl
120
115
110
105
100
95
90
85
80
75
70
65
60
10-79
10-84
10-89
10-94
Water Year
1980-1999 Observed
10/4-7J1 GS Elev @ 92 ft msl
10/4-7J1 max ET Extc Depth @ 72 ft msl
WY 80-99 calibration



Model Calibration: Observed vs. Simulated Hydrograph - Chappo Well 10/5-23L1
Water Level, feet msl
60
55
50
45
40
35
30
25
20
15
10
5
0
10-79
10-84
10-89
10-94
Water Year
1980-1999 Observed
10/5-23L1 GS Elev @ 50 ft msl
10/5-23L1 maxET Extc Depth @ 30 ft msl
WY 80-99 calibration



Model Calibration: Observed vs. Simulated Hydrograph - Lower Ysidora Well 10/5-35K5
Water Level, feet msl
60
55
50
45
40
35
30
25
20
15
10
5
0
10-79
10-84
10-89
10-94
Water Year
1980-1999 Observed
10/5-35K5 GS Elev @ 25 ft msl
10/5-35K5 max ET Extc Depth @ 5 ft msl
WY 80-99 calibration

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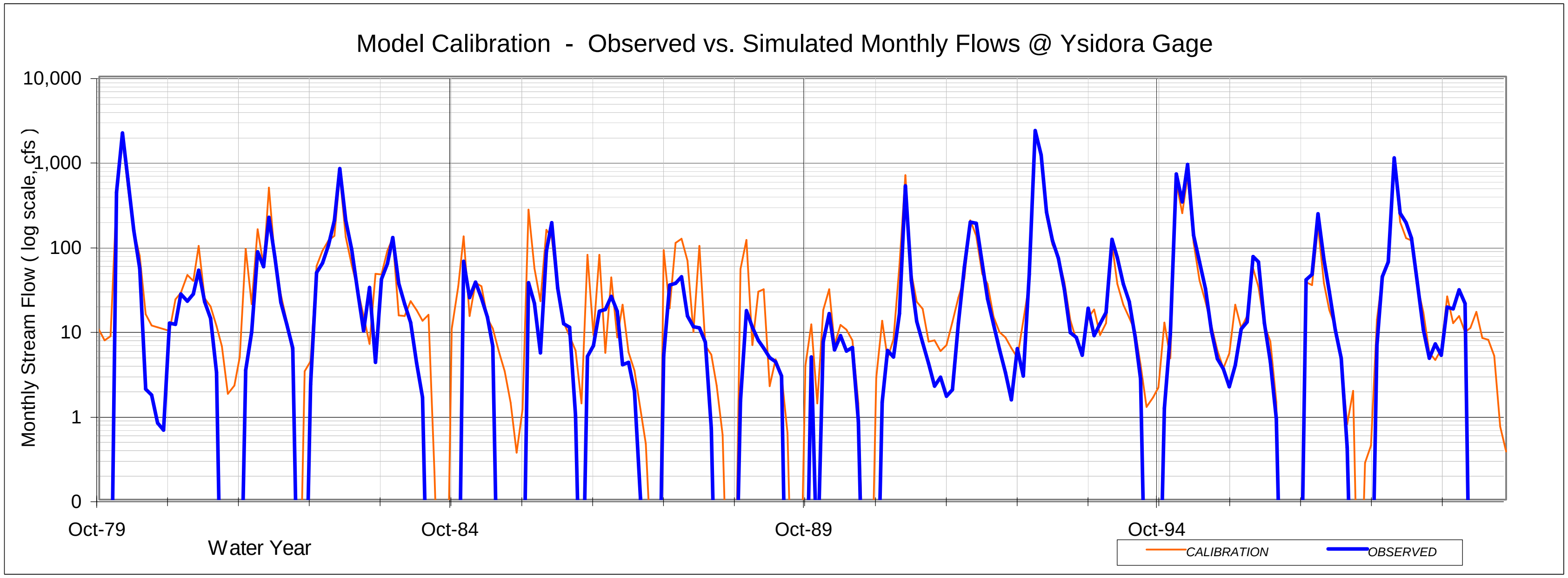
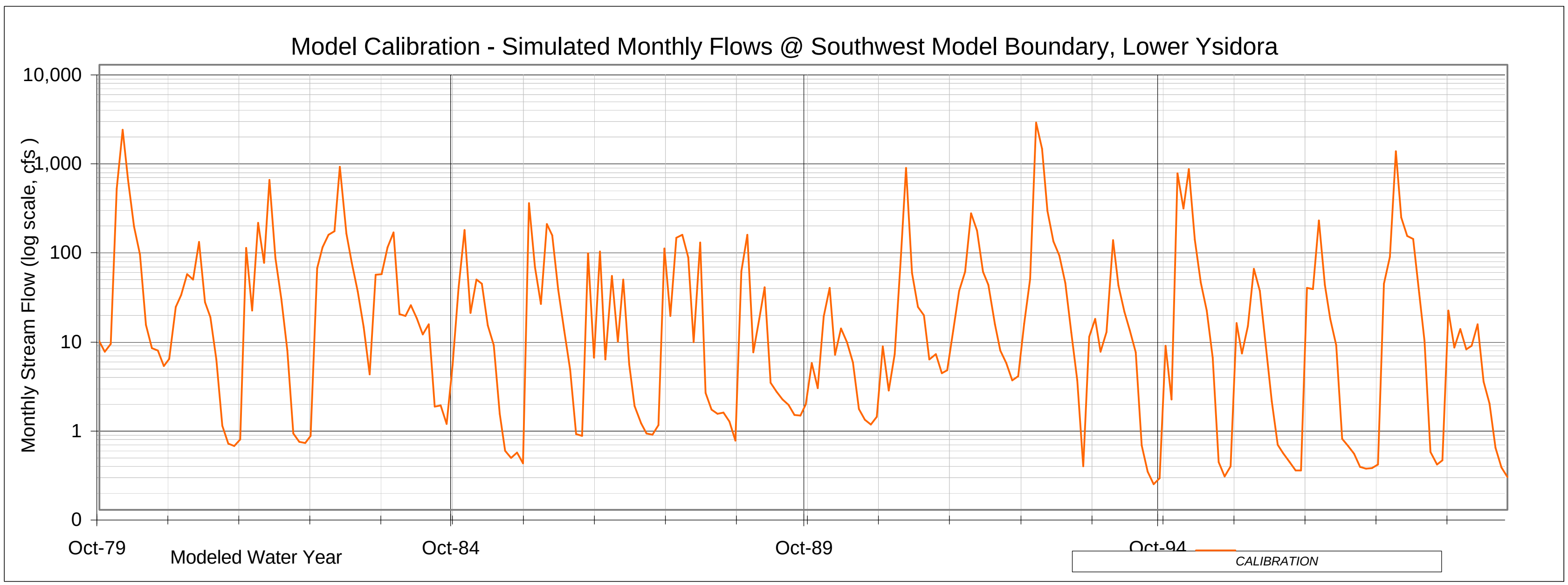
March 23, 2001

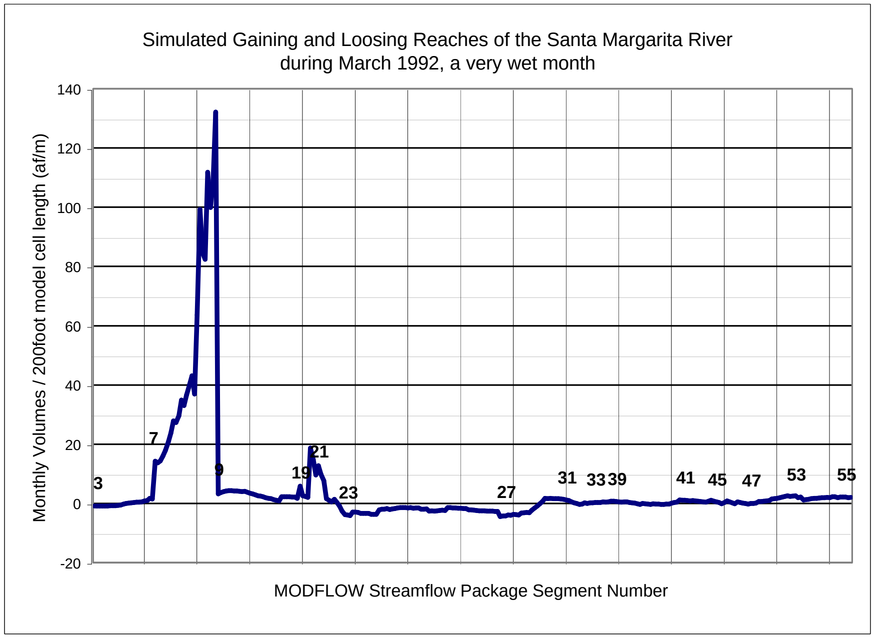


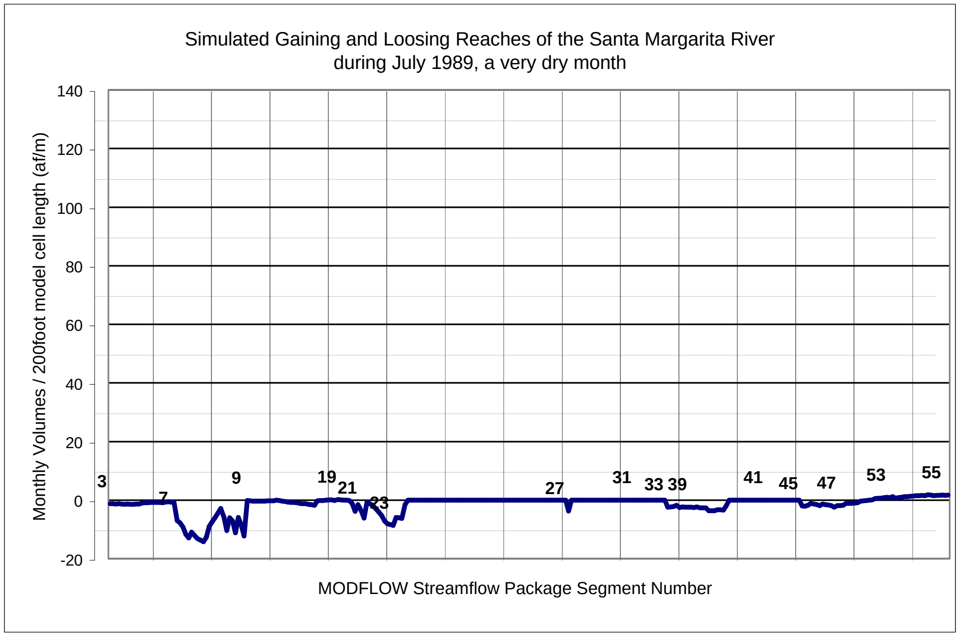


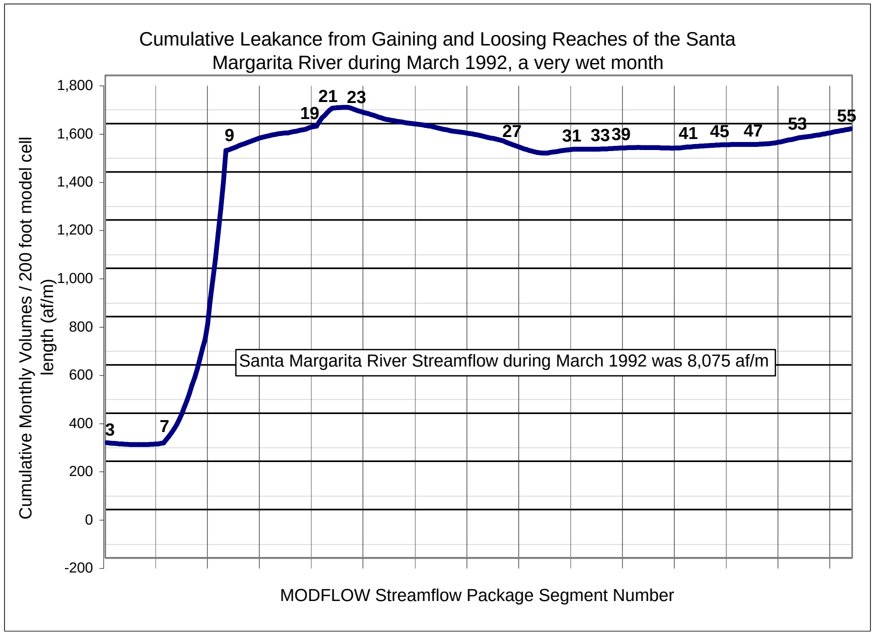
Permit 15000 Analysis

Project Feasibility Study

Figure D-12


Simulated Gaining and Loosing Reaches of the Santa Margarita River
during March 1992, a very wet month
Monthly Volumes / 200foot model cell length (af/m)
MODFLOW Streamflow Package Segment Number
140
120
100
80
60
40
20
0
-20
3
7
9
19
21
23
27
31
33
39
41
45
47
53
55


Simulated Gaining and Loosing Reaches of the Santa Margarita River
during July 1989, a very dry month
Monthly Volumes / 200foot model cell length (af/m)
MODFLOW Streamflow Package Segment Number
140
120
100
80
60
40
20
0
-20
3
7
9
19
21
23
27
31
33 39
41
45
47
53
55


Cumulative Leakance from Gaining and Loosing Reaches of the Santa
Margarita River during March 1992, a very wet month
Cumulative Monthly Volumes / 200 foot model cell length (af/m)
MODFLOW Streamflow Package Segment Number
Santa Margarita River Streamflow during March 1992 was 8,075 af/m
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
-200
3
7
9
19
21
23
27
31
33
39
41
45
47
53
55

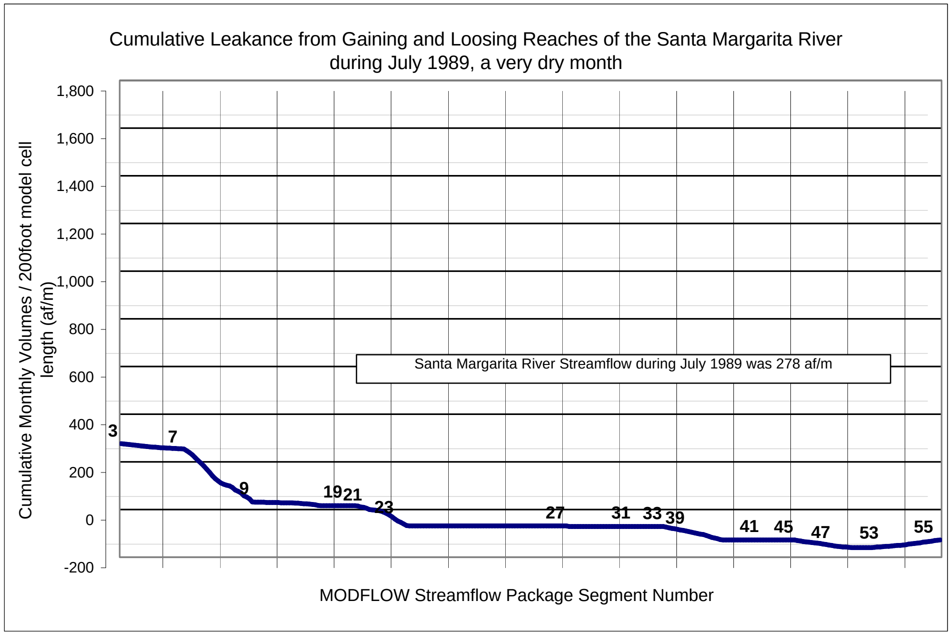

Cumulative Leakance from Gaining and Loosing Reaches of the Santa Margarita River
during July 1989, a very dry month
Cumulative Monthly Volumes / 200foot model cell length (af/m)
MODFLOW Streamflow Package Segment Number
Santa Margarita River Streamflow during July 1989 was 278 af/m
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
-200
3
7
9
19
21
23
27
31
33
39
41
45
47
53
55

Figure D-13

water levels. Water levels below the maximum ET extinction depth are considered potentially harmful to riparian vegetation. The location of the monitoring wells are an indication of water levels in the sub-basin, but are not located near the river where stream bed recharge is expected to yield a higher water level.

D.6 WATER BUDGET

The major influence on the ground-water budget is the Santa Margarita River, which provides approximately 60- 65% of the total recharge to the ground-water basins. Of the major outflows from the ground-water aquifer, pumping of ground-water production wells account for approximately 50% and ET removes an additional 30%. Other influences on the ground-water budget include recharge from precipitation, percolation/oxidation ponds, and side tributary runoff. The Model was developed to account for the inflows and outflows of the river, and the impacts they have on the three ground-water sub-basins.

The calibrated model run is summarized in the water budget presented in Table D-12. The Model boundary is the area for which the water budget is calculated. The ground-water model provides calculated numbers for underflow, streamflow out of the model area, and evapotranspiration. Measured and estimated model input data provides values for streamflow into the model domain, diversion to and release/spill from Lake O'Neill, ground-water pumping, and recoverable water from precipitation.

TABLE D - 12 MODEL CALIBRATION -- AVERAGE ANNUAL WATER BUDGET FOR 1980-1999

		Average Annual (af/y)	Median Annual (af/y)
Inflow:	Subsurface Underflow	850	820
	Santa Margarita River Inflow	53,340	27,690
	Lake O'Neill Spill and Release	1,990	1,780
	Minor Tributary Drainages	2,120	1,720
	Waste Water Discharge	2,030	2,260
	Direct Precipitation	690	500
	Total Inflow:	61,020	34,770
Outflow:	Subsurface Underflow	240	240
	Santa Margarita River Outflow	52,380	25,460
	Ground-Water Pumping	5,560	5,870
	Evapotranspiration	2,880	2,830
	Diversions to Lake O'Neill	490	430
	Total Outflow:	61,570	34,830
	Net change in Storage:	790	160
Exchange of Water within Model Domain			
	Diversions to Recharge Ponds	2,850	2,480
	Stream Recharge to Ground Water	4,280	4,700

D.7 MODEL SCENARIOS OF ANTICIPATED BASIN CHANGES

The calibrated Model was used as a predictive tool to ascertain the potential effect of various stresses and changes to the ground-water system that are expected to occur in the future. These anticipated changes include: removal of wastewater from the Santa Margarita River basin, augmentation to streamflow due to settlement with the RCWD, and increase in ground water pumping. Table D-13 below summarizes the model runs that were performed to estimate the impact of these future changes to the ground-water system on the Base.

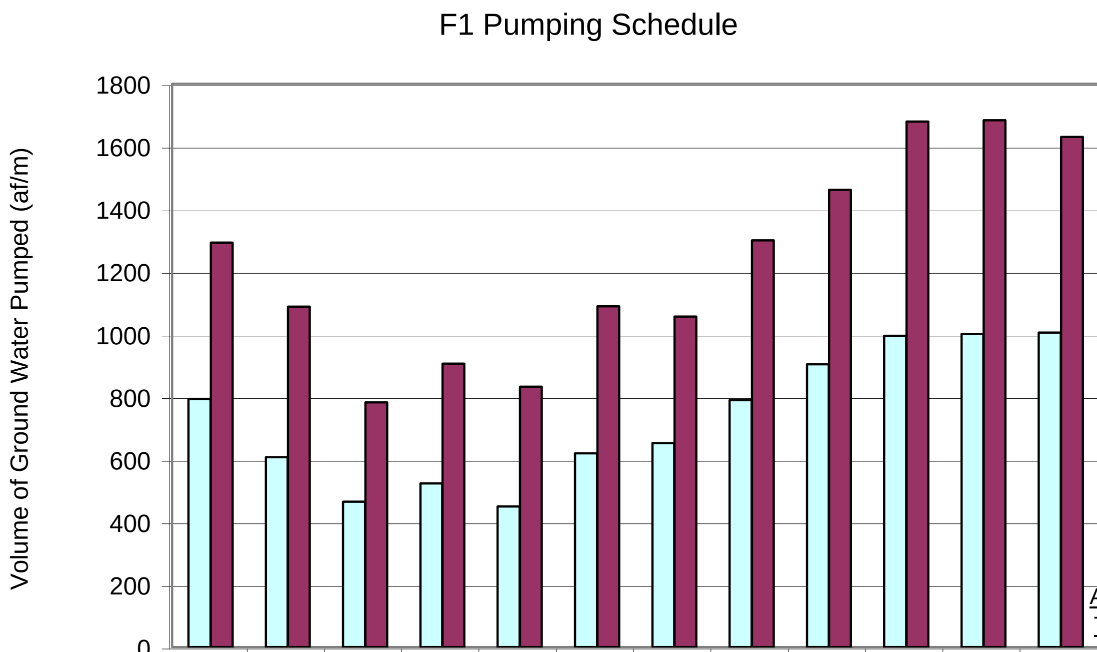
TABLE D - 13 SUMMARY OF MODEL SCENARIOS FOR ANTICIPATED BASIN CHANGES

Run #	SMR Flow	Ground-Water Pumping	Wastewater Release	Comment
1	H	H	Yes	Calibration Run
2	H	H	No	Effect of no Wastewater Release
3	A	H	Yes	Effect of Augmented Flows
5	A	F2	No	Effect of F2 Pumping
6	A	F3	No	Effect of F3 Pumping
7	H	F3	No	Effect of F3 Pumping with no Augmentation or Wastewater Flows

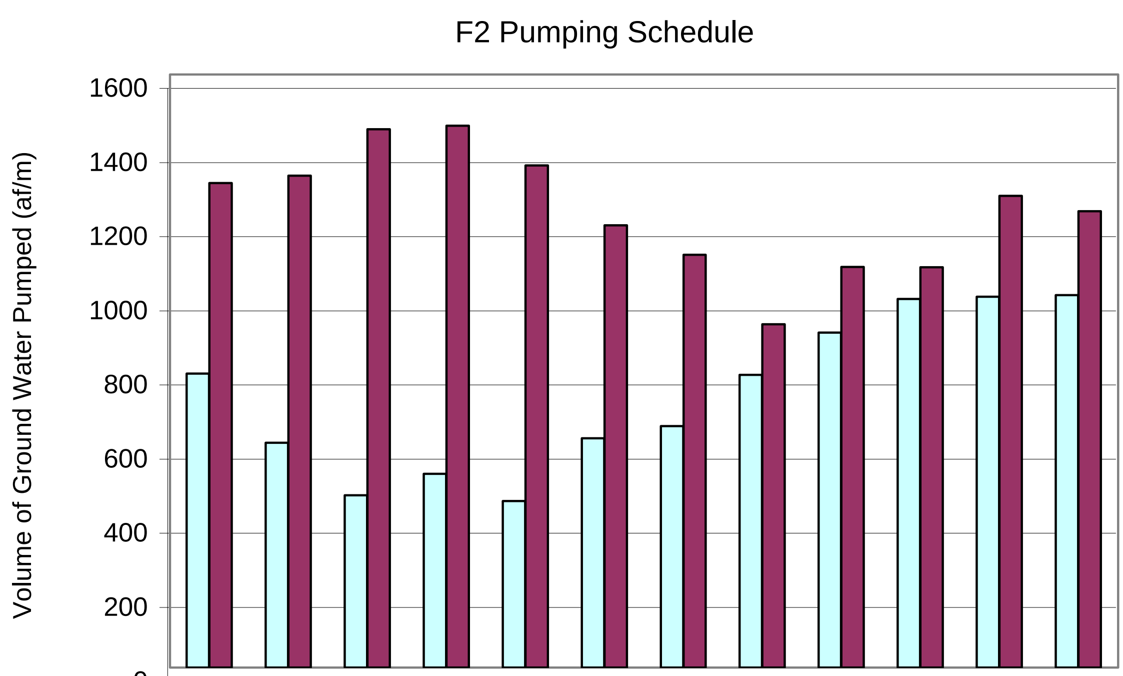
Notes: H indicates 1980 to 1999 historical value
A indicates Augmented streamflow due to the RCWD Settlement
F1 indicates 14,800 AFY ground-water pumping
F2 indicates 14,800 AFY conjunctive use ground-water pumping
F3 indicates 14,050 AFY conjunctive use ground-water pumping

Different pumping scenarios were analyzed to determine optimal ground-water pumping management practices during seasonal changes as well as extended dry periods. The existing average annual ground-water well production rate for WY 1980 through 1999 is 5,555 afy, ranging from 3,724 af in WY 1991 to 6,705 af in WY 1981. The F1 pumping schedule was developed from the average historical (WY 1980 - 1999) monthly distribution of production with historical maximum production occurring in July and August of each year and minimum production occurring during the winter months. This pumping schedule (Figure D-14) includes 6 new production wells and increases the average annual production to 14,800 afy in a direct proportion to the historical demand, independent of management for drought or wet years. Model locations for the 6 proposed wells (designated by "PW-") are shown in Figure D-15.

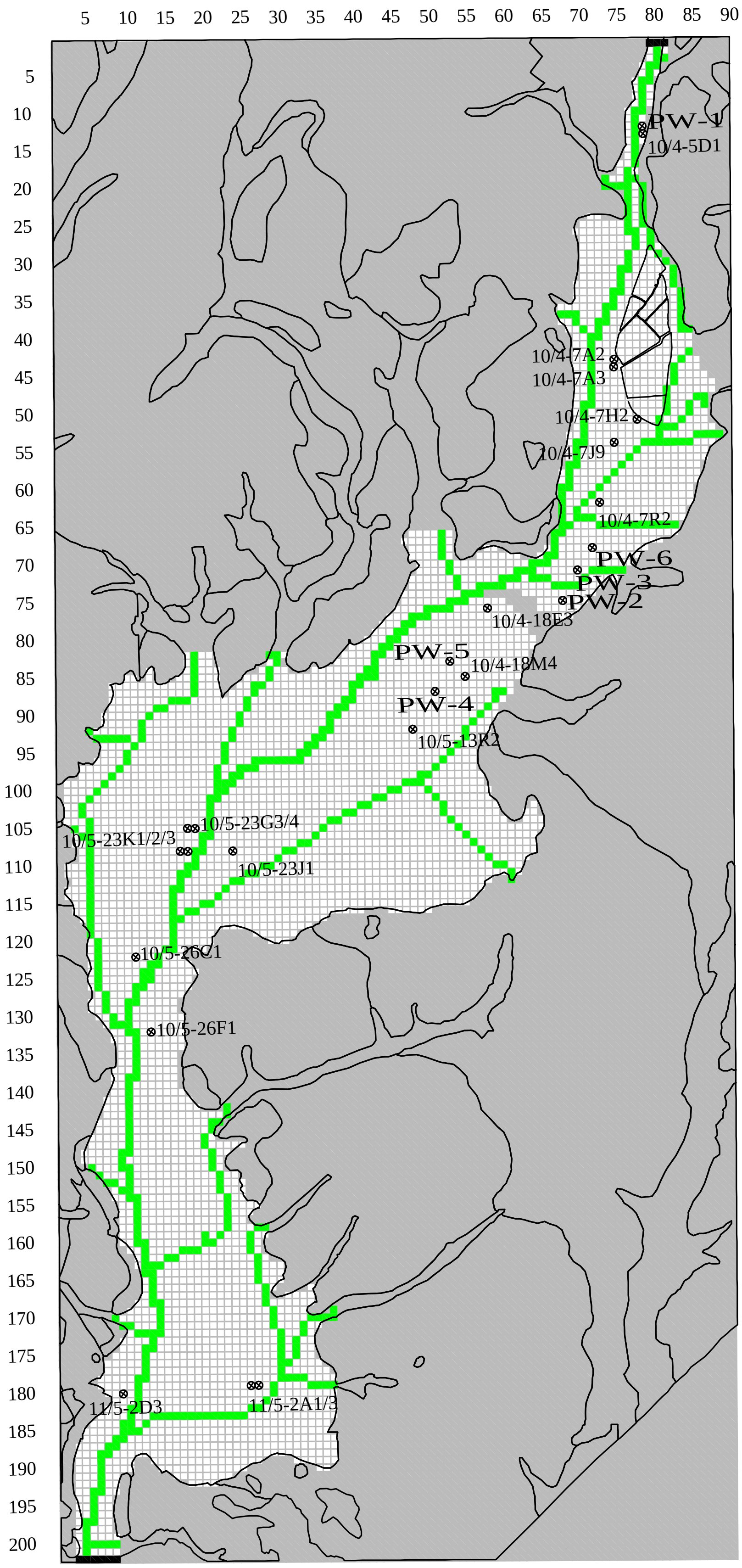
Figure D-14



	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Annual Totals
Buildout	793	607	465	523	449	619	651	789	903	994	1,001	1,005	8,800
F1	1,293	1,088	782	905	832	1,089	1,056	1,300	1,462	1,680	1,683	1,630	14,800



	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Annual Totals
Buildout	793	607	465	523	449	619	651	789	903	994	1,001	1,005	8,800
F2	1,307	1,327	1,452	1,462	1,355	1,193	1,114	926	1,081	1,080	1,273	1,231	14,800



⊗ Production Well Location
PW- Proposed Well Location

Existing and Proposed Well Locations within the Model Area

STETSON ENGINEERS INC.

F:\DATA\1828\REPORT\GWMODEL\DFX\PropWell_Loc_D-15.DWG

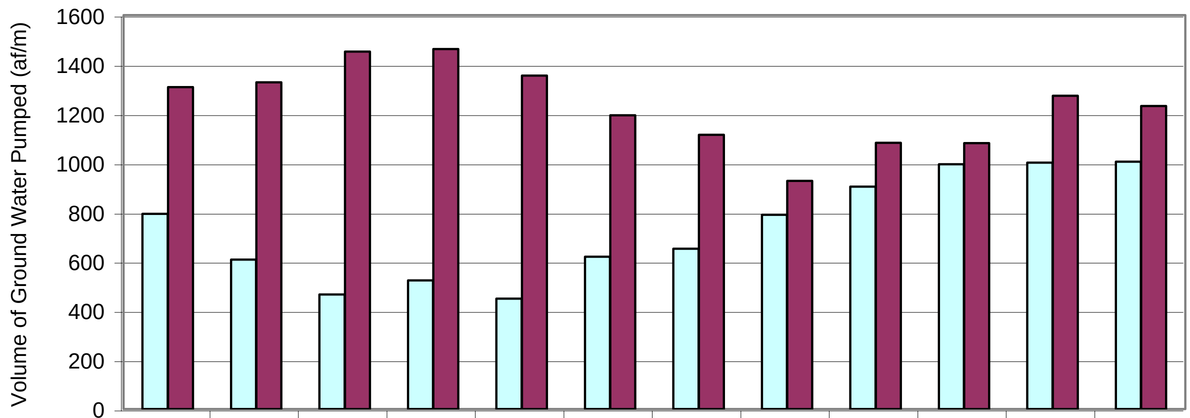
The F2 (Figure D-14) pumping schedule also maximizes annual ground-water production of 14,800 afy, but shifts the maximum production rates to the winter months. Figure D-14 compares the average historical monthly pumping with average monthly pumping under the F1 and F2 ground-water production schedules. The F3 pumping schedule is similar to F2 with the maximum production in winter months, but includes management practices that reduce ground-water production by 3,000 afy starting during the summer months following the second below normal winter/spring streamflow. If the below normal streamflow continues through a third consecutive winter/spring, ground-water production will be curtailed by an additional 3,000 afy until normal or above normal streamflow conditions return. Figure D-16 compares the different monthly F3 pumping schedules during these different conditions. Reduced percentages of F3 pumping were also considered to minimize impacts to riparian habitat during dry years and increase diversions from the Santa Margarita River. The following table summarizes the average annual pumping volumes and number of wells for the pumping schedules studied.

TABLE D - 14 SUMMARY OF GROUND-WATER PRODUCTION SCHEDULES

Pumping Schedule	Average Annual Ground-Water Production (afy)	# of Proposed Wells (pw)	Comment
F1	14,800	6	Increase proportional to historical monthly pumping; maximum production in summer months.
F2	14,800	6	Increase proportional to historical annual pumping; maximum production in winter months.
F3	14,050	6	Identical to F2 pumping with dry year management reduction of 3,000 afy during second dry summer; reduction of 6,000 afy during third dry summer until next year that normal stream flow occurs.
80% F3	11,240	4	80% of F3 production, installing 3 proposed wells in the Upper Ysidora and 1 proposed well in the Chappo.
90% F3	12,640	5	90% of F3 production, installing 3 proposed wells in the Upper Ysidora and 2 proposed well in the Chappo.
95 % F3	13,348	6	95% of F3 production, installing 4 proposed wells in the Upper Ysidora and 2 proposed well in the Chappo.

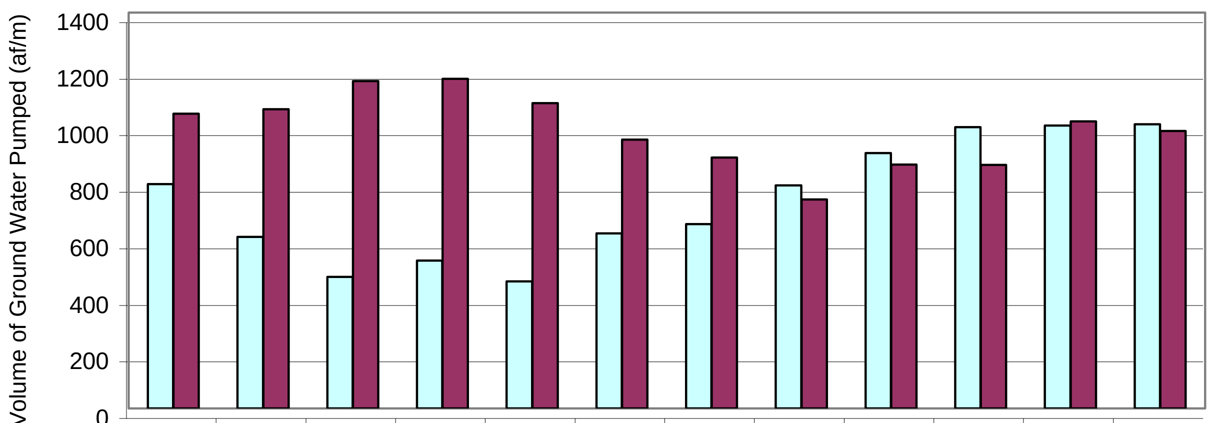
Elimination of wastewater discharge to the river and oxidation pond infiltration shows decreases in evapotranspiration and streamflow out of the Lower Ysidora. As would be expected from the conceptual model, the Model predicts the impact to be greater during consecutive years of below normal streamflow and precipitation. The modeled effects of augmented flows under historical conditions of pumping and wastewater discharge shows an increase in streamflow out

F3 Pumping during Normal Streamflow (af/m)



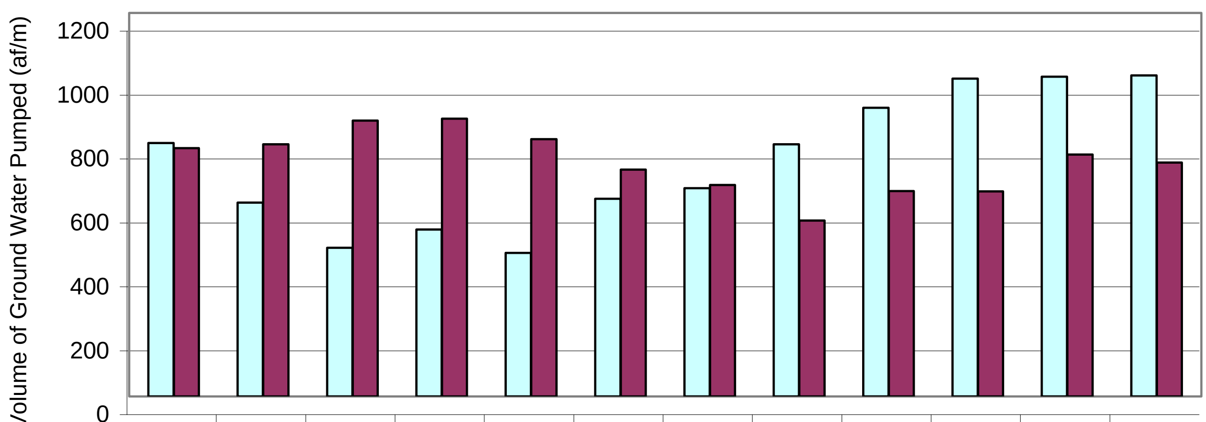
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Annual Total
Buildout	793	607	465	523	449	619	651	789	903	994	1,001	1,005	8,800
F3	1,307	1,327	1,452	1,462	1,355	1,193	1,114	926	1,081	1,080	1,273	1,231	14,800

F3 Pumping during Second Below Normal Winter (af/m)



	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Annual Total
Buildout	793	607	465	523	449	619	651	789	903	994	1,001	1,005	8,800
F3-3K	1,042	1,058	1,158	1,165	1,080	951	888	739	862	861	1,015	981	11,800

F3 Pumping Following Third Below Normal Winter



	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Annual Total
Buildout	793	607	465	523	449	619	651	789	903	994	1,001	1,005	8,800
F3-6K	777	789	863	869	805	709	662	551	643	642	757	732	8,800

of the model area. The Model showed reduced evapotranspiration with the addition of a management plan of reduced pumping during continued dry years with F3 pumping, compared with F2 maximum pumping. Table D-15 quantifies and compares the results from these anticipated basin changes with the calibrated Model run.

TABLE D - 15 ANTICIPATED BASIN CHANGES -- AVERAGE ANNUAL WATER BUDGET (AF/WY)

	Run # 1	**Run # 2**	**Run # 3**	**Run # 5**	**Run # 6**
SMR Streamflow:	H	H	A	A	A
Ground-Water Pumping:	H	H	H	F2	F3
Wastewater Release:	yes	no	yes	no	no
Inflow:					
Subsurface Underflow	850	840	840	1,460	1,420
Santa Margarita River Inflow	53,340	53,340	55,860	55,860	55,860
Lake O'Neill Spill and Release	1,990	1,990	1,990	1,990	1,990
Minor Tributary Drainages	2,120	2,120	2,120	2,120	2,120
Waste Water Discharge	2,030	0	2,030	0	0
Direct Precipitation	690	710	690	710	710
Total Inflow:	61,020	59,000	63,530	62,140	62,100
Outflow:					
Subsurface Underflow	240	230	240	200	220
Santa Margarita River Outflow	52,380	50,290	54,660	45,590	46,090
Ground-Water Pumping	5,560	5,560	5,560	14,800	14,050
Evapotranspiration	2,900	2,810	2,960	1,950	2,120
Diversions to Lake O'Neill	490	490	490	490	490
Total Outflow:	61,570	59,380	63,910	63,030	62,970
Net change in Storage:	790	380	380	890	870
Water Exchange within Model Domain					
Net Infiltration from Recharge Ponds	2,850	2,850	2,850	2,850	2,850
Net Stream Recharge to GW	4,280	4,330	4,370	11,910	11,380

Attachment 1: Stream Package for Calibration Run, Stress Period 1

	Row		Segment	Reach	Flow	Stage	Conductance	Btm Elev	Top Elev	
	645		55	2	1	0	1	-1	50	
	645		0							

Layer	Row	Column	Segment	Reach	Flow	Stage	Conductance	Btm Elev	Top Elev	Description
1	2	81	1	1	1070150	130.45	400	124	130	**Santa Margarita River**
1	3	82	2	1	5312	128.35	500	127	128	**East Tributary 1**
1	3	81	3	1	-1	129.82	400	123	129.38	**SMR cont**
1	4	81	3	2	0	129.2	400	122	128.75	
1	4	80	3	3	0	128.57	400	122	128.13	
1	5	80	3	4	0	127.95	400	121	127.5	
1	6	80	3	5	0	127.32	400	120	126.88	
1	6	79	3	6	0	126.7	400	120	126.25	
1	7	79	3	7	0	126.07	400	119	125.63	
1	8	79	3	8	0	125.45	400	119	125	
1	9	79	3	9	0	124.2	400	117	123.75	
1	10	79	3	10	0	122.95	400	116	122.5	
1	10	78	3	11	0	121.7	400	115	121.25	
1	11	78	3	12	0	120.45	400	114	120	
1	12	78	3	13	0	119.45	400	113	119	
1	13	78	3	14	0	118.45	400	112	118	
1	14	78	3	15	0	117.45	400	111	117	
1	15	78	3	16	0	116.45	400	110	116	
1	16	78	3	17	0	115.45	400	109	115	
1	17	78	3	18	0	114.45	400	108	114	
1	18	77	3	19	0	112.45	400	106	112	
1	19	77	3	20	0	111.45	400	105	111	
1	19	78	4	1	0	110.33	5	103	109.89	**Div to ponds/O'Neill**
1	20	79	4	2	0	110.22	5	103	109.77	
1	21	79	4	3	0	110.11	5	103	109.66	
1	22	79	4	4	0	109.99	5	103	109.55	
1	23	79	4	5	0	109.88	5	103	109.44	
1	24	79	4	6	0	109.77	5	103	109.32	
1	25	79	4	7	0	109.65	5	103	109.21	
1	26	80	4	8	0	109.54	5	103	109.1	
1	27	80	4	9	0	109.43	5	102	108.98	
1	28	80	4	10	0	109.32	5	102	108.87	
1	29	81	4	11	0	109.11	5	102	108.67	
1	30	82	4	12	0	108.91	5	102	108.46	
1	31	83	4	13	0	108.7	5	102	108.26	
1	32	83	4	14	0	108.5	5	102	108.05	
1	33	83	4	15	0	108.29	5	101	107.85	
1	34	84	4	16	0	108.09	5	101	107.64	
1	35	84	4	17	0	107.88	5	101	107.44	
1	36	84	4	18	0	107.68	5	101	107.23	
1	38	84	4	20	0	107.27	5	100	106.82	
1	39	84	4	21	0	109.76	5	108.41	109.41	
1	39	85	4	22	0	113.35	5	112	113	
1	37	84	4	29	0	107.47	5	101	107.03	
1	20	77	5	1	-1	110.07	600	103	109.62	**SMR cont**
1	19	74	6	1	25479	118.35	500	117	118	**West Tributary 1,**
1	20	74	6	2	0	128.35	500	127	128	**Wood Canyon**
1	20	75	6	3	0	118.35	500	117	118	
1	20	76	6	4	0	113.35	500	112	113	
1	21	77	7	1	-1	109.68	600	103	109.23	**SMR cont**
1	22	77	7	2	0	108.91	6000	102	108.46	
1	23	77	7	3	0	108.53	6000	102	108.08	
1	24	77	7	4	0	108.14	6000	101	107.69	
1	25	77	7	5	0	107.76	6000	101	107.31	
1	26	77	7	6	0	107.37	6000	100	106.92	
1	26	78	7	7	0	106.99	6000	100	106.54	
1	27	78	7	8	0	106.6	6000	100	106.15	
1	28	78	7	9	0	106.22	6000	99	105.77	
1	29	77	7	10	0	105.83	6000	99	105.38	
1	30	77	7	11	0	105.45	6000	99	105	
1	31	77	7	12	0	104.45	6000	98	104	
1	31	76	7	13	0	103.45	6000	97	103	

Layer	Row	Column	Segment	Reach	Flow	Stage	Conductance	Btm Elev	Top Elev	Description
1	32	76	7	14	0	102.45	6000	96	102	
1	33	76	7	15	0	101.45	6000	95	101	
1	34	76	7	16	0	100.45	6000	94	100	
1	34	75	7	17	0	100.03	6000	93	99.58	
1	35	75	7	18	0	99.62	6000	93	99.17	
1	36	75	7	19	0	99.2	6000	92	98.75	
1	36	74	7	20	0	98.78	6000	92	98.33	
1	37	74	7	21	0	98.37	6000	91	97.92	
1	38	74	7	22	0	97.95	6000	91	97.5	
1	38	73	7	23	0	97.53	6000	91	97.08	
1	39	73	7	24	0	97.12	6000	90	96.67	
1	40	73	7	25	0	96.7	6000	90	96.25	
1	37	68	**8**	**1**	**5904**	118.35	500	117	118	**West Tributary 2**
1	37	69	8	2	0	113.35	500	112	113	
1	37	70	8	3	0	113.35	500	112	113	
1	38	70	8	4	0	108.35	500	107	108	
1	39	71	8	5	0	106.35	500	105	106	
1	40	72	**9**	**1**	**-1**	96.28	500	89	95.83	**SMR cont**
1	41	72	9	2	0	95.87	500	89	95.42	
1	42	72	9	3	0	95.45	500	89	95	
1	43	72	9	4	0	94.83	500	88	94.38	
1	44	72	9	5	0	94.2	500	87	93.75	
1	45	72	9	6	0	93.58	500	87	93.13	
1	46	72	9	7	0	92.95	500	86	92.5	
1	47	72	9	8	0	92.33	500	85	91.88	
1	48	72	9	9	0	91.7	500	85	91.25	
1	49	72	9	10	0	91.08	500	84	90.63	
1	49	71	9	11	0	90.45	500	84	90	
1	50	71	9	12	0	90.41	500	83	89.96	
1	51	71	9	13	0	90.36	500	83	89.91	
1	52	71	9	14	0	90.32	500	83	89.87	
1	53	71	9	15	0	90.27	500	82	89.82	
1	54	71	9	16	0	90.23	500	82	89.78	
1	54	70	9	17	0	90.19	500	82	89.74	
1	55	70	9	18	0	90.14	500	82	89.69	
1	56	70	9	19	0	90.1	500	81	89.65	
1	57	70	9	20	0	90.06	500	81	89.61	
1	57	69	9	21	0	90.01	500	81	89.56	
1	58	69	9	22	0	89.97	500	80	89.52	
1	59	69	9	23	0	89.92	500	80	89.47	
1	60	69	9	24	0	89.88	500	80	89.43	
1	60	68	9	25	0	85.45	500	75	85	
1	61	68	9	26	0	84.74	500	74	84.29	
1	62	68	9	27	0	84.02	500	73	83.57	
1	63	68	9	28	0	83.31	500	72	82.86	
1	64	68	9	29	0	82.59	500	71	82.14	
1	65	68	9	30	0	81.88	500	70	81.43	
1	66	67	9	31	0	81.16	500	69	80.71	
1	49	87	**10**	**1**	**106600**	100.45	50	94	100	**Oxidation Pond 1**
1	48	87	**11**	**1**	**0**	100.45	50	94	100	**Lake O'Neill Release**
1	48	86	**12**	**1**	**-1**	100.45	50	94	100	**Release Canal**
1	49	85	12	2	0	102.67	50	101.32	102.32	
1	50	85	12	3	0	97.45	50	91	97	
1	51	84	12	4	0	95.95	50	89	95.5	
1	52	83	12	5	0	94.45	50	87	94	
1	42	85	**13**	**1**	**0**	108.35	50	107	108	**Lake O'Neill Spill**
1	43	84	13	2	0	103.35	50	102	103	
1	44	83	13	3	0	103.35	50	102	103	
1	45	83	13	4	0	103.35	50	102	103	
1	46	83	13	5	0	103.35	50	102	103	
1	47	82	13	6	0	103.35	50	102	103	
1	48	82	13	7	0	103.35	50	102	103	
1	49	82	13	8	0	103.35	50	102	103	
1	50	82	13	9	0	93.35	50	92	93	
1	51	81	13	10	0	93.35	50	92	93	
1	52	81	13	11	0	93.35	50	92	93	

Layer	Row	Column	Segment	Reach	Flow	Stage	Conductance	Btm Elev	Top Elev	Description
1	52	82	**14**	**1**	**-1**	92.95	50	85	92.5	**Release Canal cont**
1	53	81	14	2	0	91.45	50	84	91	
1	53	89	**15**	**1**	**2354**	113.35	500	112	113	**East Tributary 2**
1	53	88	15	2	0	108.35	500	107	108	
1	53	87	15	3	0	103.35	500	102	103	
1	53	86	15	4	0	103.35	500	102	103	
1	54	85	15	5	0	103.35	500	102	103	
1	54	84	15	6	0	103.35	500	102	103	
1	54	83	15	7	0	103.35	500	102	103	
1	54	82	15	8	0	103.35	500	102	103	
1	54	81	15	9	0	93.35	500	92	93	
1	54	80	**16**	**1**	**-1**	89.95	50	82	89.5	**Release Canal cont**
1	54	79	16	2	0	88.45	50	80	88	
1	55	78	16	3	0	86.95	50	78	86.5	
1	56	77	16	4	0	85.45	50	77	85	
1	57	76	16	5	0	85	50	76	84.55	
1	58	75	16	6	0	84.54	50	75	84.09	
1	59	74	16	7	0	84.09	50	74	83.64	
1	60	73	16	8	0	83.63	50	73	83.18	
1	61	72	16	9	0	83.18	50	73	82.73	
1	62	71	16	10	0	82.72	50	72	82.27	
1	63	70	16	11	0	82.27	50	71	81.82	
1	65	83	**17**	**1**	**2441**	128.35	500	127	128	**East Tributary 3,**
1	65	82	17	2	0	108.35	500	107	108	**Rattlesnake Canyon**
1	65	81	17	3	0	103.35	500	102	103	
1	65	80	17	4	0	103.35	500	102	103	
1	65	79	17	5	0	93.35	500	92	93	
1	65	78	17	6	0	88.35	500	87	88	
1	65	77	17	7	0	88.35	500	87	88	
1	65	76	17	8	0	88.35	500	87	88	
1	65	75	17	9	0	88.35	500	87	88	
1	65	74	17	10	0	88.35	500	87	88	
1	65	73	17	11	0	89.55	500	88.2	89.2	
1	64	72	17	12	0	93.35	500	92	93	
1	64	71	17	13	0	88.35	500	87	88	
1	64	70	**18**	**1**	**-1**	81.81	50	70	81.36	**Release Canal cont**
1	65	69	18	2	0	81.36	50	69	80.91	
1	66	68	18	3	0	80.9	50	69	80.45	
1	67	67	**19**	**1**	**-1**	80.35	1723	68	79.9	**SMR cont**
1	68	67	19	2	0	79.75	838	67	79.3	
1	69	67	19	3	0	79.25	833	66	78.8	
1	69	66	19	4	0	78.75	833	66	78.3	
1	70	66	19	5	0	78.25	8865	65	77.8	
1	70	65	19	6	0	77.75	8865	65	77.3	
1	70	64	19	7	0	77.25	8865	64	76.8	
1	71	76	**20**	**1**	**2954**	93.35	500	92	93	**East Tributary 4,**
1	71	75	20	2	0	93.35	500	92	93	**near General's House**
1	71	74	20	3	0	93.35	500	92	93	
1	71	73	20	4	0	88.35	500	87	88	
1	71	72	20	5	0	88.35	500	87	88	
1	72	71	20	6	0	88.35	500	87	88	
1	73	70	20	7	0	88.35	500	87	88	
1	73	69	20	8	0	83.35	500	82	83	
1	73	68	20	9	0	83.35	500	82	83	
1	73	67	20	10	0	88.35	500	87	88	
1	72	66	20	11	0	83.35	500	82	83	
1	72	65	20	12	0	83.35	500	82	83	
1	72	64	20	13	0	83.35	500	82	83	
1	71	64	**21**	**1**	**-1**	76.75	8865	64	76.3	**SMR cont**
1	71	63	21	2	0	76.25	8865	63	75.8	
1	71	62	21	3	0	75.75	8865	63	75.3	
1	72	62	21	4	0	75.45	1250	63	75	
1	72	61	21	5	0	75.2	1250	62	74.75	
1	72	60	21	6	0	74.95	1250	62	74.5	
1	73	60	21	7	0	74.7	2373	62	74.25	
1	73	59	21	8	0	74.45	2373	62	74	

Layer	Row	Column	Segment	Reach	Flow	Stage	Conductance	Btm Elev	Top Elev	Description
1	73	58	21	9	0	74.2	2373	61	73.75	
1	73	57	21	10	0	73.95	2373	61	73.5	
1	74	57	21	11	0	73.7	2155	61	73.25	
1	74	56	21	12	0	73.45	2155	61	73	
1	66	52	**22**	**1**	**27321**	88.35	500	87	88	**West Tributary 3,**
1	67	52	22	2	0	83.35	500	82	83	**Basilone Road**
1	68	52	22	3	0	80.35	500	79	80	
1	69	52	22	4	0	80.35	500	79	80	
1	70	53	22	5	0	80.35	500	79	80	
1	71	53	22	6	0	80.35	500	79	80	
1	72	54	22	7	0	83.35	500	82	83	
1	73	54	22	8	0	78.35	500	77	78	
1	74	55	**23**	**1**	**-1**	73.2	2155	61	72.75	**SMR cont**
1	75	55	23	2	0	72.95	1316	61	72.5	
1	75	54	23	3	0	72.7	1316	60	72.25	
1	75	53	23	4	0	72.45	1316	60	72	
1	76	53	23	5	0	72.2	1339	60	71.75	
1	76	52	23	6	0	71.95	1339	60	71.5	
1	76	51	23	7	0	71.7	1339	60	71.25	
1	76	50	23	8	0	71.45	1339	59	71	
1	77	50	23	9	0	71.2	1364	59	70.75	
1	77	49	23	10	0	70.95	1364	59	70.5	
1	77	48	23	11	0	70.7	1364	59	70.25	
1	78	48	23	12	0	70.45	741	59	70	
1	78	47	23	13	0	69.83	741	58	69.38	
1	79	47	23	14	0	69.2	755	58	68.75	
1	79	46	23	15	0	68.58	755	57	68.13	
1	80	46	23	16	0	67.95	962	57	67.5	
1	80	45	23	17	0	67.33	962	56	66.88	
1	81	45	23	18	0	66.7	980	56	66.25	
1	81	44	23	19	0	66.08	980	55	65.63	
1	82	44	23	20	0	65.45	1000	55	65	
1	82	43	23	21	0	65.16	1000	54	64.71	
1	83	43	23	22	0	64.86	1020	54	64.41	
1	84	43	23	23	0	64.57	1042	54	64.12	
1	84	42	23	24	0	64.27	1042	54	63.82	
1	85	43	23	25	0	63.98	1277	54	63.53	
1	85	42	23	26	0	63.69	1277	53	63.24	
1	85	41	23	27	0	63.39	1277	53	62.94	
1	86	41	23	28	0	63.1	1739	53	62.65	
1	86	40	23	29	0	62.8	1739	53	62.35	
1	87	40	23	30	0	62.51	1778	53	62.06	
1	88	40	23	31	0	62.21	2500	52	61.76	
1	88	39	23	32	0	61.92	2500	52	61.47	
1	89	39	23	33	0	61.63	2558	52	61.18	
1	89	38	23	34	0	61.33	2558	52	60.88	
1	90	38	23	35	0	61.04	2381	52	60.59	
1	90	37	23	36	0	60.74	2381	51	60.29	
1	91	37	23	37	0	60.45	2439	51	60	
1	92	37	23	38	0	60.2	1250	51	59.75	
1	92	36	23	39	0	59.95	1250	51	59.5	
1	93	36	23	40	0	59.7	1282	51	59.25	
1	93	35	23	41	0	59.45	1282	51	59	
1	94	35	23	42	0	59.2	1316	51	58.75	
1	94	34	23	43	0	58.95	1316	50	58.5	
1	95	34	23	44	0	58.7	1351	50	58.25	
1	95	33	23	45	0	58.45	1351	50	58	
1	96	33	23	46	0	58.2	1667	50	57.75	
1	96	32	23	47	0	57.95	1667	50	57.5	
1	96	31	23	48	0	57.7	1667	50	57.25	
1	96	30	23	49	0	57.45	1667	49	57	
1	96	29	23	50	0	57.2	1667	49	56.75	
1	96	28	23	51	0	56.95	1667	49	56.5	
1	96	27	23	52	0	56.7	1667	49	56.25	
1	97	27	23	53	0	56.45	1714	49	56	
1	97	26	23	54	0	56.2	1714	48	55.75	

Layer	Row	Column	Segment	Reach	Flow	Stage	Conductance	Btm Elev	Top Elev	Description
1	97	25	23	55	0	55.95	1714	48	55.5	
1	98	25	23	56	0	55.7	1765	48	55.25	
1	98	24	23	57	0	55.45	1765	48	55	
1	99	24	23	58	0	55.03	3030	47	54.58	
1	99	23	23	59	0	54.62	3030	47	54.17	
1	100	23	23	60	0	54.2	3125	47	53.75	
1	82	29	**24**	**1**	**25270**	68.35	500	67	68	**Oxidation Pond 8**
1	82	30	**25**	**1**	**19304**	73.07	500	71.72	72.72	**West Tributary 4**
1	83	30	**26**	**1**	**-1**	63.35	500	62	63	**to river**
1	84	29	26	2	0	63.35	500	62	63	
1	85	29	26	3	0	63.35	500	62	63	
1	86	28	26	4	0	63.35	500	62	63	
1	86	27	26	5	0	63.35	500	62	63	
1	87	27	26	6	0	62.16	500	60.81	61.81	
1	88	26	26	7	0	60.87	500	59.52	60.52	
1	89	26	26	8	0	59.59	500	58.24	59.24	
1	90	25	26	9	0	59.59	500	58.24	59.24	
1	91	25	26	10	0	58.35	500	57	58	
1	92	24	26	11	0	56.38	500	55.03	56.03	
1	93	24	26	12	0	56.38	500	55.03	56.03	
1	94	23	26	13	0	57.34	500	55.99	56.99	
1	95	23	26	14	0	56.06	500	54.71	55.71	
1	96	23	26	15	0	56.06	500	54.71	55.71	
1	97	22	26	16	0	55.41	500	54.06	55.06	
1	98	22	26	17	0	55.41	500	54.06	55.06	
1	99	22	26	18	0	55.41	500	54.06	55.06	
1	100	22	**27**	**1**	**-1**	53.78	3125	46	53.33	
1	101	22	27	2	0	53.37	3226	46	52.92	
1	101	21	27	3	0	52.95	3226	46	52.5	
1	102	21	27	4	0	52.53	3333	46	52.08	
1	103	21	27	5	0	52.12	3448	45	51.67	
1	104	21	27	6	0	51.7	2941	44	51.25	
1	105	21	27	7	0	51.28	2941	44	50.83	
1	106	21	27	8	0	50.87	2941	43	50.42	
1	106	20	27	9	0	50.45	2941	43	50	
1	107	20	27	10	0	49.62	2941	42	49.17	
1	108	20	27	11	0	48.78	2941	41	48.33	
1	108	19	27	12	0	47.95	2941	40	47.5	
1	109	19	27	13	0	47.12	2941	39	46.67	
1	110	19	27	14	0	46.28	2941	39	45.83	
1	110	18	27	15	0	45.45	2941	38	45	
1	111	18	27	16	0	45.07	2941	37	44.62	
1	111	17	27	17	0	44.68	2941	37	44.23	
1	112	17	27	18	0	44.3	2941	37	43.85	
1	113	17	27	19	0	43.91	2941	36	43.46	
1	113	16	27	20	0	43.53	2941	36	43.08	
1	114	16	27	21	0	43.14	2941	35	42.69	
1	115	16	27	22	0	42.76	2941	35	42.31	
1	116	16	27	23	0	42.37	2941	35	41.92	
1	87	60	**28**	**1**	**8575**	78.35	500	77	78	**East Tributary 5**
1	87	59	28	2	0	76.29	500	74.94	75.94	
1	88	59	28	3	0	74.35	500	73	74	
1	89	58	28	4	0	68.35	500	67	68	
1	90	57	28	5	0	68.35	500	67	68	
1	91	56	28	6	0	74.35	500	73	74	
1	92	55	28	7	0	68.35	500	67	68	
1	93	55	28	8	0	68.35	500	67	68	
1	94	54	28	9	0	68.35	500	67	68	
1	95	53	28	10	0	65.69	500	64.34	65.34	
1	96	52	28	11	0	63.35	500	62	63	
1	97	51	28	12	0	63.35	500	62	63	
1	98	50	28	13	0	63.35	500	62	63	
1	98	49	28	14	0	63.35	500	62	63	
1	112	61	**29**	**1**	**9803**	143.35	50	142	143	**East Tributary 6**
1	111	61	29	2	0	133.35	50	132	133	
1	110	60	29	3	0	93.35	50	92	93	

Layer	Row	Column	Segment	Reach	Flow	Stage	Conductance	Btm Elev	Top Elev	Description
1	110	59	29	4	0	93.35	50	92	93	
1	109	58	29	5	0	73.07	50	71.72	72.72	
1	108	57	29	6	0	69.54	50	68.19	69.19	
1	107	56	29	7	0	69.54	50	68.19	69.19	
1	106	55	29	8	0	68.35	50	67	68	
1	105	54	29	9	0	63.35	50	62	63	
1	104	53	29	10	0	63.35	50	62	63	
1	103	52	29	11	0	63.35	50	62	63	
1	102	52	29	12	0	63.35	50	62	63	
1	101	51	29	13	0	63.35	50	62	63	
1	100	50	29	14	0	63.35	50	62	63	
1	99	49	**30**	**1**	**-1**	63.35	5	62	63	**MCAS Ditch**
1	99	48	30	2	0	63.35	5	62	63	
1	99	47	30	3	0	63.35	5	62	63	
1	100	46	30	4	0	63.35	5	62	63	
1	100	45	30	5	0	63.35	5	62	63	
1	101	44	30	6	0	63.35	5	62	63	
1	101	43	30	7	0	58.35	5	57	58	
1	102	42	30	8	0	53.35	5	52	53	
1	102	41	30	9	0	58.35	5	57	58	
1	103	40	30	10	0	53.35	5	52	53	
1	103	39	30	11	0	58.35	5	57	58	
1	104	38	30	12	0	53.35	5	52	53	
1	104	37	30	13	0	58.35	5	57	58	
1	105	36	30	14	0	58.35	5	57	58	
1	106	35	30	15	0	53.35	5	52	53	
1	107	34	30	16	0	53.35	5	52	53	
1	107	33	30	17	0	53.35	5	52	53	
1	108	32	30	18	0	53.35	5	52	53	
1	108	31	30	19	0	53.35	5	52	53	
1	109	30	30	20	0	53.35	5	52	53	
1	110	29	30	21	0	53.35	5	52	53	
1	110	28	30	22	0	56.06	5	54.71	55.71	
1	111	27	30	23	0	53.35	5	52	53	
1	111	26	30	24	0	53.35	5	52	53	
1	112	25	30	25	0	53.35	5	52	53	
1	112	24	30	26	0	53.35	5	52	53	
1	113	23	30	27	0	53.35	5	52	53	
1	114	22	30	28	0	53.35	5	52	53	
1	115	21	30	29	0	53.35	5	52	53	
1	115	20	30	30	0	52.2	5	50.85	51.85	
1	116	19	30	31	0	58.35	5	57	58	
1	116	18	30	32	0	53.35	5	52	53	
1	117	17	30	33	0	43.35	5	42	43	
1	117	16	**31**	**1**	**-1**	41.99	2941	34	41.54	**SMR cont**
1	118	16	31	2	0	41.6	2353	34	41.15	
1	119	16	31	3	0	41.22	1176	33	40.77	
1	120	16	31	4	0	40.83	1176	33	40.38	
1	121	16	31	5	0	40.45	1176	33	40	
1	121	15	31	6	0	40.03	1176	32	39.58	
1	122	14	31	7	0	38.78	1324	31	38.33	
1	123	14	31	8	0	38.37	1103	31	37.92	
1	123	13	31	9	0	37.95	1103	30	37.5	
1	124	13	31	10	0	37.53	882	30	37.08	
1	124	12	31	11	0	37.12	882	29	36.67	
1	125	13	**32**	**1**	**51017**	43.35	500	42	43	**Oxidation Pond 3**
1	125	12	**33**	**1**	**-1**	36.7	882	29	36.25	**SMR cont**
1	126	12	33	2	0	36.28	882	29	35.83	
1	126	11	33	3	0	35.87	882	28	35.42	
1	127	11	33	4	0	35.45	735	28	35	
1	128	11	33	5	0	35.14	1029	27	34.69	
1	128	10	33	6	0	34.83	1029	27	34.38	
1	129	10	33	7	0	34.51	1029	27	34.06	
1	130	10	33	8	0	34.2	1029	26	33.75	
1	82	19	**34**	**1**	**9844**	78.35	500	77	78	**West Tributary 5**
1	83	19	34	2	0	78.35	500	77	78	

Layer	Row	Column	Segment	Reach	Flow	Stage	Conductance	Btm Elev	Top Elev	Description
1	84	19	34	3	0	73.07	500	71.72	72.72	
1	85	19	34	4	0	68.35	500	67	68	
1	86	19	34	5	0	63.35	500	62	63	
1	87	19	34	6	0	63.35	500	62	63	
1	88	18	34	7	0	58.35	500	57	58	
1	88	17	34	8	0	58.35	500	57	58	
1	88	16	34	9	0	58.35	500	57	58	
1	89	15	34	10	0	55.35	500	54	55	
1	89	14	34	11	0	55.35	500	54	55	
1	90	13	34	12	0	55.35	500	54	55	
1	91	12	34	13	0	57.34	500	55.99	56.99	
1	92	12	34	14	0	58.35	500	57	58	
1	93	12	34	15	0	58.35	500	57	58	
1	92	5	**35**	**1**	**2562**	118.35	500	117	118	**West Tributary 6**
1	93	6	35	2	0	103.35	500	102	103	
1	93	7	35	3	0	88.35	500	87	88	
1	93	8	35	4	0	83.35	500	82	83	
1	93	9	35	5	0	68.35	500	67	68	
1	93	10	35	6	0	60.35	500	59	60	
1	94	11	**36**	**1**	**-1**	58.35	500	57	58	**West Tributaries 5 & 6**
1	95	10	36	2	0	58.35	500	57	58	
1	96	10	36	3	0	53.35	500	52	53	
1	97	9	36	4	0	53.35	500	52	53	
1	98	8	36	5	0	53.35	500	52	53	
1	99	7	36	6	0	53.35	500	52	53	
1	100	6	36	7	0	52.2	500	50.85	51.85	
1	101	5	36	8	0	52.2	500	50.85	51.85	
1	102	4	36	9	0	52.2	500	50.85	51.85	
1	103	4	36	10	0	53.35	500	52	53	
1	104	5	36	11	0	44.41	500	43.06	44.06	
1	105	5	36	12	0	44.41	500	43.06	44.06	
1	105	3	**37**	**1**	**6096**	53.35	500	52	53	**West Tributary 7**
1	106	4	37	2	0	43.35	500	42	43	
1	106	5	**38**	**1**	**-1**	43.35	500	42	43	**West Tributaries 5, 6 & 7**
1	107	5	38	2	0	43.35	500	42	43	
1	108	5	38	3	0	43.35	500	42	43	
1	109	5	38	4	0	43.35	500	42	43	
1	110	5	38	5	0	43.35	500	42	43	
1	111	5	38	6	0	43.35	500	42	43	
1	112	5	38	7	0	41.04	500	39.69	40.69	
1	113	5	38	8	0	41.04	500	39.69	40.69	
1	114	5	38	9	0	41.04	500	39.69	40.69	
1	115	5	38	10	0	38.35	500	37	38	
1	116	5	38	11	0	38.35	500	37	38	
1	117	5	38	12	0	38.35	500	37	38	
1	118	5	38	13	0	38.35	500	37	38	
1	119	5	38	14	0	38.35	500	37	38	
1	120	6	38	15	0	39.35	500	38	39	
1	121	6	38	16	0	41.04	500	39.69	40.69	
1	122	6	38	17	0	42.16	500	40.81	41.81	
1	123	6	38	18	0	42.16	500	40.81	41.81	
1	124	6	38	19	0	38.35	500	37	38	
1	125	6	38	20	0	38.35	500	37	38	
1	126	6	38	21	0	38.35	500	37	38	
1	127	7	38	22	0	43.35	500	42	43	
1	128	7	38	23	0	43.35	500	42	43	
1	129	7	38	24	0	43.35	500	42	43	
1	130	8	38	25	0	38.35	500	37	38	
1	131	8	38	26	0	38.35	500	37	38	
1	131	9	38	27	0	38.82	500	37.47	38.47	
1	131	10	**39**	**1**	**-1**	33.89	1029	26	33.44	**SMR cont**
1	132	10	39	2	0	33.58	1029	26	33.13	
1	132	11	39	3	0	33.26	1029	26	32.81	
1	133	11	39	4	0	32.95	1176	25	32.5	
1	134	11	39	5	0	32.64	1176	25	32.19	
1	135	11	39	6	0	32.33	1176	25	31.88	

Layer	Row	Column	Segment	Reach	Flow	Stage	Conductance	Btm Elev	Top Elev	Description
1	136	11	39	7	0	32.01	1618	24	31.56	
1	137	11	39	8	0	31.7	1618	24	31.25	
1	138	11	39	9	0	31.39	1618	24	30.94	
1	138	10	39	10	0	31.08	1618	23	30.63	
1	139	10	39	11	0	30.76	1618	23	30.31	
1	140	10	39	12	0	30.45	1618	23	30	
1	141	10	39	13	0	30.14	1618	22	29.69	
1	142	10	39	14	0	29.83	735	22	29.38	
1	143	10	39	15	0	29.51	735	22	29.06	
1	144	10	39	16	0	29.2	735	21	28.75	
1	145	10	39	17	0	28.89	1324	21	28.44	
1	146	10	39	18	0	28.58	1324	21	28.13	
1	147	10	39	19	0	28.26	1324	21	27.81	
1	148	10	39	20	0	27.95	1397	20	27.5	
1	148	9	39	21	0	27.64	1397	20	27.19	
1	149	9	39	22	0	27.33	3676	20	26.88	
1	150	9	39	23	0	27.01	3676	19	26.56	
1	150	10	39	24	0	26.7	3676	19	26.25	
1	151	10	39	25	0	26.39	3676	19	25.94	
1	152	10	39	26	0	26.08	3676	18	25.63	
1	150	5	**40**	**1**	**6831**	34.62	500	33.27	34.27	**West Tributary 8**
1	151	6	40	2	0	34.62	500	33.27	34.27	
1	152	7	40	3	0	33.35	500	32	33	
1	152	8	40	4	0	33.35	500	32	33	
1	153	9	40	5	0	28.35	500	27	28	
1	153	10	**41**	**1**	**-1**	25.45	1912	18	25	**SMR cont**
1	154	10	41	2	0	25.26	1912	18	24.81	
1	154	11	41	3	0	25.07	1912	17	24.62	
1	155	11	41	4	0	24.87	1912	17	24.42	
1	156	11	41	5	0	24.68	1912	17	24.23	
1	157	11	41	6	0	24.49	1912	17	24.04	
1	158	11	41	7	0	24.3	1912	17	23.85	
1	159	11	41	8	0	24.1	1912	16	23.65	
1	160	11	41	9	0	23.91	4412	16	23.46	
1	160	12	41	10	0	23.72	4412	16	23.27	
1	161	12	41	11	0	23.53	3676	16	23.08	
1	162	12	41	12	0	23.33	3676	16	22.88	
1	142	23	**42**	**1**	**12488**	53.35	500	52	53	**East Tributary 7**
1	143	23	42	2	0	52.35	500	51	52	
1	144	22	42	3	0	51.35	500	50	51	
1	144	21	42	4	0	50.35	500	49	50	
1	145	21	42	5	0	48.35	500	46	48	
1	146	20	42	6	0	43.35	500	42	43	
1	147	20	42	7	0	40.35	500	39	40	
1	148	21	42	8	0	37.35	500	36	37	
1	149	21	42	9	0	32.35	500	31	32	
1	150	21	42	10	0	28.35	500	27	28	
1	151	22	42	11	0	28.35	500	27	28	
1	152	22	42	12	0	28.35	500	27	28	
1	153	22	42	13	0	28.35	500	27	28	
1	154	23	42	14	0	28.35	500	27	28	
1	155	23	42	15	0	28.35	500	27	28	
1	156	23	42	16	0	28.35	500	27	28	
1	157	23	42	17	0	28.35	500	27	28	
1	158	23	42	18	0	28.35	500	27	28	
1	159	22	42	19	0	28.35	500	27	28	
1	160	21	42	20	0	28.35	500	27	28	
1	159	20	**43**	**1**	**83264**	28.35	500	27	28	**Oxidation Pond 13 and 2**
1	160	20	**44**	**1**	**-1**	28.35	500	27	28	**East Trib r/o cont**
1	161	19	44	2	0	28.35	500	27	28	
1	161	18	44	3	0	28.35	500	27	28	
1	161	17	44	4	0	28.35	500	27	28	
1	162	16	44	5	0	28.35	500	27	28	
1	162	15	44	6	0	28.35	500	27	28	
1	163	14	44	7	0	28.35	500	27	28	
1	163	13	44	8	0	28.35	500	27	28	

Layer	Row	Column	Segment	Reach	Flow	Stage	Conductance	Btm Elev	Top Elev	Description
1	163	12	**45**	**1**	**-1**	23.14	3676	15	22.69	**SMR cont**
1	164	12	45	2	0	22.95	3676	15	22.5	
1	164	13	45	3	0	22.76	3676	15	22.31	
1	165	13	45	4	0	22.18	3676	14	21.73	
1	166	13	45	5	0	21.99	3676	14	21.54	
1	167	13	45	6	0	21.8	3676	14	21.35	
1	168	13	45	7	0	21.6	3676	14	21.15	
1	168	14	45	8	0	21.41	3676	14	20.96	
1	169	14	45	9	0	21.22	3676	13	20.77	
1	170	14	45	10	0	21.03	3676	13	20.58	
1	171	14	45	11	0	20.83	3676	13	20.38	
1	172	14	45	12	0	20.64	4412	13	20.19	
1	172	13	45	13	0	20.45	4412	13	20	
1	170	8	**46**	**1**	**8491**	38.35	500	37	38	**West Tributary 9**
1	171	9	46	2	0	28.35	500	27	28	
1	171	10	46	3	0	22.27	500	20.92	21.92	
1	172	11	46	4	0	22.27	500	20.92	21.92	
1	172	12	46	5	0	22.27	500	20.92	21.92	
1	173	13	**47**	**1**	**-1**	20.16	4412	12	19.71	**SMR cont**
1	174	13	47	2	0	19.86	4412	12	19.41	
1	174	12	47	3	0	19.57	4412	12	19.12	
1	175	12	47	4	0	19.27	4412	12	18.82	
1	176	12	47	5	0	18.98	4412	11	18.53	
1	177	12	47	6	0	18.69	4412	11	18.24	
1	178	12	47	7	0	18.39	4412	11	17.94	
1	178	11	47	8	0	18.1	4412	10	17.65	
1	179	11	47	9	0	17.8	4412	10	17.35	
1	180	11	47	10	0	17.51	4412	10	17.06	
1	181	11	47	11	0	17.21	4412	9	16.76	
1	182	11	47	12	0	16.92	4412	9	16.47	
1	182	10	47	13	0	16.63	4412	9	16.18	
1	183	10	47	14	0	16.33	4412	9	15.88	
1	184	10	47	15	0	16.04	3676	8	15.59	
1	184	9	47	16	0	15.74	3676	8	15.29	
1	185	9	47	17	0	15.45	3676	8	15	
1	158	28	**48**	**1**	**6912**	53.35	500	52	53	**East Tributary 8**
1	158	27	48	2	0	43.35	500	42	43	
1	159	26	48	3	0	33.35	500	32	33	
1	160	26	48	4	0	28.35	500	27	28	
1	161	26	48	5	0	28.35	500	27	28	
1	162	27	48	6	0	28.35	500	27	28	
1	163	27	48	7	0	27.35	500	26	27	
1	164	27	48	8	0	27.35	500	26	27	
1	165	27	48	9	0	27.35	500	26	27	
1	166	28	48	10	0	28.35	500	27	28	
1	167	28	48	11	0	28.35	500	27	28	
1	168	28	48	12	0	27.35	500	26	27	
1	169	29	48	13	0	26.35	500	25	26	
1	170	29	48	14	0	25.35	500	24	25	
1	171	29	48	15	0	25.35	500	24	25	
1	172	30	48	16	0	25.35	500	24	25	
1	173	30	48	17	0	25.35	500	24	25	
1	174	30	48	18	0	24.35	500	23	24	
1	175	30	48	19	0	24.35	500	23	24	
1	169	37	**49**	**1**	**12443**	83.35	500	82	83	**East Tributary 9**
1	170	37	49	2	0	93.35	500	92	93	
1	170	36	49	3	0	88.35	500	87	88	
1	170	35	49	4	0	43.35	500	42	43	
1	170	34	49	5	0	38.35	500	37	38	
1	171	33	49	6	0	38.35	500	37	38	
1	172	33	49	7	0	38.35	500	37	38	
1	173	32	49	8	0	27.35	500	26	27	
1	174	32	49	9	0	27.35	500	26	27	
1	175	32	49	10	0	27.35	500	26	27	
1	176	31	49	11	0	24.35	500	23	24	
1	176	30	**50**	**1**	**-1**	24.35	500	23	24	**East Tib r/o cont**

Layer	Row	Column	Segment	Reach	Flow	Stage	Conductance	Btm Elev	Top Elev	Description
1	177	30	50	2	0	24.35	500	23	24	
1	179	37	**51**	**1**	**6970**	43.35	500	42	43	**East Tributary 10**
1	179	36	51	2	0	38.35	500	37	38	
1	179	35	51	3	0	33.35	500	32	33	
1	179	34	51	4	0	27.35	500	26	27	
1	178	33	51	5	0	25.35	500	24	25	
1	178	32	51	6	0	25.35	500	24	25	
1	178	31	51	7	0	24.35	500	23	24	
1	178	30	**52**	**1**	**-1**	24.35	500	23	24	**East Tib r/o cont**
1	179	29	52	2	0	23.32	500	21.97	22.97	
1	180	29	52	3	0	23.32	500	21.97	22.97	
1	181	28	52	4	0	23.32	500	21.97	22.97	
1	182	27	52	5	0	22.27	500	20.92	21.92	
1	182	26	52	6	0	22.27	500	20.92	21.92	
1	183	25	52	7	0	22.27	500	20.92	21.92	
1	183	24	52	8	0	22.27	500	20.92	21.92	
1	183	23	52	9	0	22.27	500	20.92	21.92	
1	183	22	52	10	0	22.27	500	20.92	21.92	
1	183	21	52	11	0	22.27	500	20.92	21.92	
1	183	20	52	12	0	20.17	500	18.82	19.82	
1	183	19	52	13	0	21.22	500	19.87	20.87	
1	183	18	52	14	0	20.35	500	19	20	
1	183	17	52	15	0	20.35	500	19	20	
1	183	16	52	16	0	19.38	500	18.03	19.03	
1	183	15	52	17	0	19.38	500	18.03	19.03	
1	183	14	52	18	0	18.35	500	17	18	
1	183	13	52	19	0	19.12	500	17.77	18.77	
1	184	12	52	20	0	18.35	500	17	18	
1	185	11	52	21	0	18.35	500	17	18	
1	185	10	52	22	0	19.12	500	17.77	18.77	
1	186	9	**53**	**1**	**-1**	15	2206	7	14.55	**SMR cont**
1	186	8	53	2	0	14.54	2206	7	14.09	
1	187	8	53	3	0	14.09	1000	4	13.64	
1	187	7	53	4	0	13.63	1000	4	13.18	
1	188	7	53	5	0	13.18	1000	3	12.73	
1	188	6	53	6	0	12.72	1000	3	12.27	
1	189	6	53	7	0	12.27	1000	2	11.82	
1	190	6	53	8	0	11.81	1000	2	11.36	
1	191	6	53	9	0	11.36	1000	1	10.91	
1	192	6	53	10	0	10.9	1000	1	10.45	
1	193	6	53	11	0	10.45	1000	1	10	
1	193	5	53	12	0	10.25	1000	0	9.8	
1	194	5	53	13	0	10.05	1000	0	9.6	
1	195	5	53	14	0	9.85	1222	0	9.4	
1	196	5	53	15	0	9.65	1222	0	9.2	
1	197	5	53	16	0	9.45	1111	0	9	
1	197	4	53	17	0	9.25	1111	0	8.8	
1	198	4	53	18	0	9.05	1111	0	8.6	
1	199	4	53	19	0	8.85	1111	0	8.4	
1	200	8	**54**	**1**	**5198**	18.35	500	12	13	**East Tributary 11**
1	200	7	54	2	0	18.35	500	17	18	
1	200	6	54	3	0	13.35	500	12	13	
1	200	5	54	4	0	13.35	500	12	13	
1	200	4	**55**	**1**	**-1**	8.65	1000	0	8.2	**SMR cont**
1	201	4	55	2	0	8.45	1000	0	8	

Trib	Trib	Description
0	0	Trib = Stream Tributary
0	0	
1	2	**Str Seg 1+2 -> 3**
0	0	
3	0	**Str Seg 3 -> 5**
0	0	
5	6	**Str Seg 5+6 ->7**
0	0	
7	8	**Str Seg 7+8 -> 9**

Layer	Row	Column	Segment	Reach	Flow	Stage	Conductance	Btm Elev	Top Elev	Description
0	0									
0	0									
10	11									**Str Seg 10+11 -> 12**
0	0									
12	13									**Str Seg 12+13 -> 14**
0	0									
14	15									**Str Seg 14+15 -> 16**
0	0									
16	17									**Str Seg 16+17 -> 18**
9	18									**Str Seg 9+18 -> 19**
0	0									
19	20									**Str Seg 19+20 -> 21**
0	0									
21	22									**Str Seg 21+22 -> 23**
0	0									
0	0									
24	25									**Str Seg 24+25 -> 26**
23	26									**Str Seg 23+26 -> 27**
0	0									
0	0									
28	29									**Str Seg 28+29 -> 30**
27	30									**Str Seg 27+30 -> 31**
0	0									
31	32									**Str Seg 31+32 -> 33**
0	0									
0	0									
34	35									**Str Seg 34+35 -> 36**
0	0									
36	37									**Str Seg 36+37 -> 38**
33	38									**Str Seg 33+38 -> 39**
0	0									
39	40									**Str Seg 39+40 -> 41**
0	0									
0	0									
42	43									**Str Seg 42+43 -> 44**
41	44									**Str Seg 41+44 -> 45**
0	0									
45	46									**Str Seg 45+46 -> 47**
0	0									
0	0									
48	49									**Str Seg 48+49 -> 50**
0	0									
50	51									**Str Seg 50+51 -> 52**
47	52									**Str Seg 47+52 -> 53**
0	0									
53	54									**Str Seg 53+54 -> 55**

Div	Description
	Div = Stream Diversion
0	
0	no div into Str Seg 2
0	no div into Str Seg 3
3	**Div from Str 3 -> 4**
0	no div into Str Seg 5
. . . .	no div in downstream segs

Attachment 2; Table D-A2-1: Simulated Diversions from the Santa Margarita River

see Appendix E for calculation of SMR Flow at Model Boundary
Pond Diversions from Camp Pendelton records
Lake O'Neill Diversions estimated from Water Master Reports

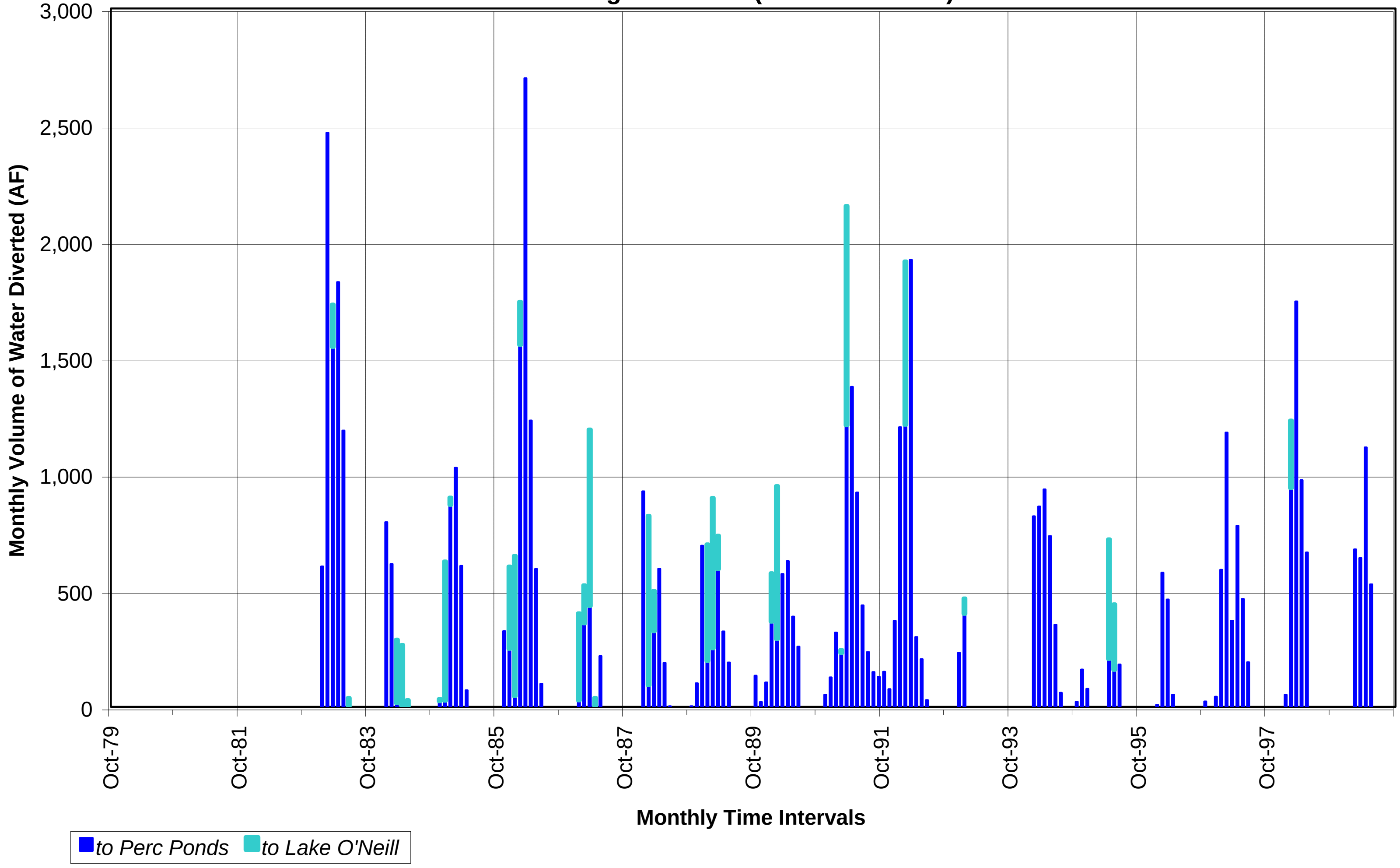
					CF/D Input Ground Water Flow Model	
mo-yr	**Precip in/mo**	**SMR Flow at Model Boundary**	**Pond Diversions af**	**L. O'Neill Diversions af**	Stress Period	All Diversions cf/d
Oct-79	0.80	748	0	0	1	0
Nov-79	0.90	615	0	0	2	0
Dec-79	0.40	671	0	0	3	0
Jan-80	10.10	20,303	0	0	4	0
Feb-80	7.50	106,429	0	0	5	0
Mar-80	5.10	28,604	0	0	6	0
Apr-80	0.90	9,256	0	0	7	0
May-80	0.10	4,787	0	0	8	0
Jun-80	0.00	1,171	0	0	9	0
Jul-80	0.00	928	0	0	10	0
Aug-80	0.10	956	0	0	11	0
Sep-80	0.00	950	0	0	12	0
Oct-80	0.50	746	0	0	13	0
Nov-80	0.00	661	0	0	14	0
Dec-80	1.20	1,395	0	0	15	0
Jan-81	1.70	2,289	0	0	16	0
Feb-81	1.90	1,925	0	0	17	0
Mar-81	3.00	5,242	0	0	18	0
Apr-81	0.60	944	0	0	19	0
May-81	0.00	786	0	0	20	0
Jun-81	0.00	642	0	0	21	0
Jul-81	0.00	638	0	0	22	0
Aug-81	0.00	576	0	0	23	0
Sep-81	0.00	579	0	0	24	0
Oct-81	0.10	521	0	0	25	0
Nov-81	2.20	4,798	0	0	26	0
Dec-81	0.90	993	0	0	27	0
Jan-82	4.20	8,983	0	0	28	0
Feb-82	1.20	3,037	0	0	29	0
Mar-82	5.30	25,368	0	0	30	0
Apr-82	0.90	3,269	0	0	31	0
May-82	0.10	1,091	0	0	32	0
Jun-82	0.10	685	0	0	33	0
Jul-82	0.00	560	0	0	34	0
Aug-82	0.00	388	0	0	35	0
Sep-82	1.10	606	0	0	36	0
Oct-82	0.10	492	0	0	37	0
Nov-82	2.30	2,558	0	0	38	0
Dec-82	2.10	4,853	0	0	39	0
Jan-83	3.00	6,643	603	0	40	862,871
Feb-83	3.10	7,828	2,466	0	41	3,528,907
Mar-83	7.20	37,674	1,545	183	42	2,473,006
Apr-83	2.80	6,157	1,824	0	43	2,610,251
May-83	0.30	2,172	1,186	0	44	1,697,849
Jun-83	0.00	1,055	0	38	45	54,383
Jul-83	0.00	801	0	0	46	0
Aug-83	0.30	773	0	0	47	0
Sep-83	1.60	3,065	0	0	48	0
Oct-83	1.10	2,707	0	0	49	0
Nov-83	2.90	4,188	0	0	50	0
Dec-83	3.30	6,652	0	0	51	0
Jan-84	0.00	756	793	0	52	1,134,184
Feb-84	0.20	628	613	0	53	877,883
Mar-84	0.00	670	15	274	54	413,053
Apr-84	0.30	635	0	266	55	380,680
May-84	0.00	536	0	29	56	41,503

mo-yr	Precip in/mo	SMR Flow at Model Boundary	Pond Diversions af	L. O'Neill Diversions af	Stress Period	All Diversions cf/d
Jun-84	0.10	714	0	0	57	0
Jul-84	0.00	321	0	0	58	0
Aug-84	0.00	448	0	0	59	0
Sep-84	0.00	365	0	0	60	0
Oct-84	0.50	867	0	0	61	0
Nov-84	1.50	1,426	23	11	62	48,687
Dec-84	4.50	7,491	25	599	63	893,540
Jan-85	0.90	846	866	33	64	1,286,456
Feb-85	1.30	2,213	1,027	0	65	1,469,713
Mar-85	0.40	1,062	606	0	66	866,892
Apr-85	0.20	499	71	0	67	102,183
May-85	0.00	477	0	0	68	0
Jun-85	0.00	430	0	0	69	0
Jul-85	0.00	472	0	0	70	0
Aug-85	0.00	472	0	0	71	0
Sep-85	0.10	425	0	0	72	0
Oct-85	0.20	357	0	0	73	0
Nov-85	5.00	14,659	324	0	74	464,258
Dec-85	1.60	3,400	248	355	75	862,828
Jan-86	1.00	1,154	44	604	76	927,773
Feb-86	3.70	8,919	1,554	187	77	2,490,981
Mar-86	3.50	7,192	2,701	0	78	3,864,822
Apr-86	1.00	1,490	1,230	0	79	1,760,260
May-86	0.00	341	592	0	80	847,343
Jun-86	0.00	317	99	0	81	141,023
Jul-86	0.00	414	0	0	82	0
Aug-86	0.00	373	0	0	83	0
Sep-86	2.30	4,812	0	0	84	0
Oct-86	0.70	693	0	0	85	0
Nov-86	1.50	3,873	0	0	86	0
Dec-86	0.00	284	0	0	87	0
Jan-87	1.00	2,650	27	375	88	575,314
Feb-87	0.10	433	358	164	89	747,050
Mar-87	0.00	620	432	759	90	1,704,475
Apr-87	0.00	263	0	38	91	54,383
May-87	0.00	276	218	0	92	311,986
Jun-87	0.00	214	0	0	93	0
Jul-87	0.20	192	0	0	94	0
Aug-87	0.10	275	0	0	95	0
Sep-87	0.00	250	0	0	96	0
Oct-87	2.80	5,401	0	0	97	0
Nov-87	0.70	570	0	0	98	0
Dec-87	3.00	6,098	0	0	99	0
Jan-88	1.70	6,064	926	0	100	1,324,582
Feb-88	1.40	3,622	91	729	101	1,174,056
Mar-88	0.00	299	324	175	102	713,819
Apr-88	2.90	5,733	593	0	103	849,261
May-88	0.10	261	189	0	104	271,056
Jun-88	0.00	307	2	0	105	2,476
Jul-88	0.00	260	0	0	106	0
Aug-88	0.40	319	0	0	107	0
Sep-88	0.00	266	0	0	108	0
Oct-88	0.00	252	3	0	109	3,893
Nov-88	1.90	2,698	101	0	110	144,172
Dec-88	4.10	6,997	692	0	111	989,841
Jan-89	0.50	421	196	502	112	999,415
Feb-89	0.90	342	250	648	113	1,284,739
Mar-89	1.10	1,932	591	145	114	1,052,596
Apr-89	0.00	181	324	0	115	463,428
May-89	0.30	306	190	0	116	272,473
Jun-89	0.00	282	0	0	117	0
Jul-89	0.00	278	0	0	118	0
Aug-89	0.00	295	0	0	119	0

mo-yr	Precip in/mo	SMR Flow at Model Boundary	Pond Diversions af	L. O'Neill Diversions af	Stress Period	All Diversions cf/d
Sep-89	0.31	368	0	0	120	0
Oct-89	0.35	585	133	0	121	190,340
Nov-89	0.20	373	20	0	122	28,623
Dec-89	0.00	399	105	0	123	150,269
Jan-90	1.80	1,618	365	209	124	821,468
Feb-90	1.80	2,432	290	658	125	1,356,711
Mar-90	0.40	828	570	0	126	815,744
Apr-90	1.30	1,020	626	0	127	895,887
May-90	0.60	843	388	0	128	555,278
Jun-90	0.60	663	259	0	129	370,663
Jul-90	0.00	215	0	0	130	0
Aug-90	0.00	141	0	0	131	0
Sep-90	0.00	140	0	0	132	0
Oct-90	0.00	440	0	0	133	0
Nov-90	0.30	434	52	0	134	74,419
Dec-90	0.10	507	126	0	135	180,322
Jan-91	1.00	722	319	0	136	456,530
Feb-91	2.40	3,540	230	14	137	349,196
Mar-91	6.20	40,356	1,208	944	138	3,079,790
Apr-91	0.00	3,229	1,374	0	139	1,966,372
May-91	0.00	1,515	920	0	140	1,316,639
Jun-91	0.00	1,125	436	0	141	623,972
Jul-91	**0.10**	508	235	0	142	336,315
Aug-91	**0.00**	577	149	0	143	213,238
Sep-91	**0.00**	490	129	0	144	184,616
Oct-91	**0.40**	567	150	0	145	214,669
Nov-91	**0.00**	292	76	0	146	108,766
Dec-91	**2.40**	1,519	370	0	147	529,518
Jan-92	**2.80**	2,690	1,201	0	148	1,718,786
Feb-92	**4.40**	12,049	1,211	702	149	2,737,750
Mar-92	**3.20**	8,075	1,919	0	150	2,746,337
Apr-92	**0.10**	2,507	300	0	151	429,339
May-92	**0.20**	2,091	205	0	152	293,382
Jun-92	**0.00**	959	29	0	153	41,503
Jul-92	**0.10**	723	0	0	154	0
Aug-92	**0.00**	702	0	0	155	0
Sep-92	**0.00**	603	0	0	156	0
Oct-92	**0.20**	489	0	0	157	0
Nov-92	**0.00**	394	0	0	158	0
Dec-92	**2.40**	2,279	231	0	159	330,591
Jan-93	**11.30**	126,916	398	68	160	666,906
Feb-93	**2.10**	65,980	0	0	161	0
Mar-93	**1.40**	13,105	0	0	162	0
Apr-93	**0.00**	6,122	0	0	163	0
May-93	**0.00**	4,514	0	0	164	0
Jun-93	**0.50**	2,410	0	0	165	0
Jul-93	0.00	1,068	0	0	166	0
Aug-93	0.00	754	0	0	167	0
Sep-93	0.00	635	0	0	168	0
Oct-93	0.00	1,128	0	0	169	0
Nov-93	0.00	714	0	0	170	0
Dec-93	0.39	758	0	0	171	0
Jan-94	0.42	956	0	0	172	0
Feb-94	2.90	6,585	818	0	173	1,170,664
Mar-94	0.00	2,453	861	0	174	1,232,202
Apr-94	0.50	1,560	934	0	175	1,336,675
May-94	0.10	1,069	733	0	176	1,049,018
Jun-94	0.00	678	353	0	177	505,189
Jul-94	0.00	326	60	0	178	85,868
Aug-94	0.10	302	0	0	179	0
Sep-94	0.00	339	0	0	180	0
Oct-94	0.00	367	22	0	181	31,485
Nov-94	0.00	420	160	0	182	228,981

mo-yr	Precip in/mo	SMR Flow at Model Boundary	Pond Diversions af	L. O'Neill Diversions af	Stress Period	All Diversions cf/d
Dec-94	0.20	474	77	0	183	110,197
Jan-95	10.40	32,754	0	0	184	0
Feb-95	0.50	14,525	0	0	185	0
Mar-95	2.50	38,465	0	0	186	0
Apr-95	1.80	6,613	205	515	187	1,030,413
May-95	0.10	2,555	158	283	188	631,128
Jun-95	0.40	1,579	182	0	189	260,466
Jul-95	***0.10***	904	0	0	190	0
Aug-95	***0.00***	604	0	0	191	0
Sep-95	***0.00***	502	0	0	192	0
Oct-95	***0.00***	607	0	0	193	0
Nov-95	***0.00***	897	0	0	194	0
Dec-95	***0.40***	895	0	0	195	0
Jan-96	***1.70***	1,061	9	0	196	12,880
Feb-96	***1.90***	3,628	577	0	197	825,762
Mar-96	***0.80***	2,250	461	0	198	659,751
Apr-96	***0.20***	878	52	0	199	74,419
May-96	0.00	683	0	0	200	0
Jun-96	0.00	372	0	0	201	0
Jul-96	0.00	206	0	0	202	0
Aug-96	0.00	214	0	0	203	0
Sep-96	0.00	220	0	0	204	0
Oct-96	0.90	390	23	0	205	32,916
Nov-96	2.60	1,739	0	0	206	0
Dec-96	2.70	2,252	43	0	207	61,539
Jan-97	5.40	10,057	588	0	208	841,504
Feb-97	0.40	2,656	1,178	0	209	1,685,870
Mar-97	0.00	1,161	370	0	210	529,518
Apr-97	0.20	1,113	777	0	211	1,111,988
May-97	0.00	554	463	0	212	662,613
Jun-97	0.00	251	191	0	213	273,346
Jul-97	0.00	320	0	0	214	0
Aug-97	0.00	230	0	0	215	0
Sep-97	0.80	337	0	0	216	0
Oct-97	0.00	359	0	0	217	0
Nov-97	1.90	500	0	0	218	0
Dec-97	1.60	2,790	0	0	219	0
Jan-98	0.00	4,061	52	0	220	74,419
Feb-98	8.50	62,608	939	291	221	1,760,289
Mar-98	0.00	11,851	1,741	0	222	2,491,596
Apr-98	0.00	7,315	973	0	223	1,392,489
May-98	0.20	6,984	663	0	224	948,839
Jun-98	0.00	1,968	0	0	225	0
Jul-98	0.10	1,124	0	0	226	0
Aug-98	0.00	570	0	0	227	0
Sep-98	0.00	546	0	0	228	0
Oct-98	0.30	633	0	0	229	0
Nov-98	1.20	1,116	0	0	230	0
Dec-98	0.60	961	0	0	231	0
Jan-99	0.00	1,111	0	0	232	0
Feb-99	0.80	995	676	0	233	967,443
Mar-99	0.00	943	639	0	234	914,492
Apr-99	1.20	1,442	1,114	0	235	1,594,278
May-99	0.00	630	526	0	236	752,774
Jun-99	0.40	502	0	0	237	0
Jul-99	1.40	431	0	0	238	0
Aug-99	0.00	285	0	0	239	0
Sep-99	0.00	317	0	0	240	0
	20 yr total	**1,028,298**	**54,602**	**9,798**		

Simulated Historical Monthly Diversions from Santa Margarita River (WY 1980 - 1999)



Attachment 2, Table D-A2-2: Simulated Discharge to Santa Margarita River and Infiltration to Ground Water from Waste Water Oxidation Po

Note: Volume of water discharged to the Santa Margarita River or infiltrated to ground water is after precipitation and evaporation are accounted for.
Ox Ponds 1, 3, 8, and 13 -- flow to SMR accounts for [(WWQ from STP) - Evap + Precip] * 90% -- (the 90% accounts for 10% infiltration to ground water)
Ox Pond 1 -- flow to SMR accounts for (WWQ from STP) - Evap -- (no infiltration to ground water)
Note: if potential evaporation for the month is > STP discharge to the pond, discharge to SMR =0
OxPonds post STP 1,3,8,and13 assume 10% infiltration into gw; note OX Pond 1 is not within model domain
STP: Sewage Treatment Plant
STP 2: * estimated flow volume at USGS gage location from col AC of worksheet STPdata.xls / stp2 flow toward Pond 2
** discharge from STP 2 to SMR takes the following course: Horse Lake, div to irrigate golf course, USGS gage, ox ponds 2 & 3, invert pipe to SMR
** STP2 discharge to the SMR accounts for reuse of water as irrigation to the golf course, and evap from oxidation ponds 2 and 3 (post Brood Mare Lake
** assume no infiltration to ground water from ponds post STP2 plant discharge

90% Discharge to Santa Margarita River

AF/WY	Ox Pond 1 STP 1	outflow near Ox Pond 13 STP 2 **	Ox Pond 3 STP 3	Ox Pond 8 STP 8	Ox Pond 13 STP 13	Total
1980	807	191	449	199	660	2,307
1981	649	146	466	201	681	2,142
1982	572	139	363	179	703	1,956
1983	528	89	603	182	793	2,195
1984	438	57	625	226	775	2,122
1985	519	137	577	360	767	2,360
1986	394	82	478	314	692	1,961
1987	731	76	347	448	1,094	2,695
1988	784	233	712	319	1,105	3,153
1989	422	148	678	154	1,085	2,486
1990	408	43	662	148	1,104	2,365
1991	360	99	567	52	894	1,972
1992	410	91	445	54	1,061	2,061
1993	401	81	538	70	1,332	2,422
1994	366	105	496	108	-	1,076
1995	393	109	460	81	-	1,042
1996	346	63	443	67	-	918
1997	400	65	486	63	-	1,014
1998	416	66	419	81	-	983
1999	438	160	400	64	-	1,062
Average	489	109	511	169	637	1,915
Median	419	95	482	151	735	2,092
Total	9,785	2,181	10,211	3,370	12,746	38,294

avg AF/M	STP 1	STP 2**	STP 3	STP 8	STP 13	Total
Oct	40	1	39	15	55	150
Nov	39	12	37	15	55	158
Dec	40	22	42	15	54	172
Jan	42	21	43	16	59	180
Feb	40	28	43	14	51	177
Mar	44	19	46	15	55	179
Apr	40	5	42	14	51	153
May	43	1	43	13	51	152
Jun	41	-	44	14	51	149
Jul	41	-	45	13	51	151
Aug	42	-	45	13	52	152
Sep	38	0	42	11	52	143
Avg Mnthly	41	9	43	14	53	
Med Mnthly	41	3	43	14	52	
Avg Ttl=Anl	489	109	511	169	637	1,915

10% Infiltration to Ground Water

AF/WY	Total	Ox Pond 3 STP 3	Ox Pond 8 STP 8	Ox Pond 13 STP 13
1980	145	50	22	73
1981	150	52	22	76
1982	138	40	20	78
1983	175	67	20	88
1984	181	69	25	86
1985	189	64	40	85
1986	165	53	35	77
1987	210	39	50	122
1988	237	79	35	123
1989	213	75	17	121
1990	213	74	16	123
1991	168	63	6	99
1992	173	49	6	118
1993	216	60	8	148
1994	67	55	12	-
1995	60	51	9	-
1996	57	49	7	-
1997	61	54	7	-
1998	56	47	9	-
1999	52	44	7	-
Average	146	57	19	71
Median	166	54	17	82
Total	2,925	1,135	374	1,416

avg AF/M	Total	STP 3	STP 8	STP 13
Oct	12	4	2	6
Nov	12	4	2	6
Dec	12	5	2	6
Jan	13	5	2	7
Feb	12	5	2	6
Mar	13	5	2	6
Apr	12	5	2	6
May	12	5	1	6
Jun	12	5	2	6
Jul	12	5	1	6
Aug	12	5	1	6
Sep	12	5	1	6
Avg Monthly	12	5	2	6
Med Monthly	12	5	2	6
Avg Total=Anl	146	57	19	71

Attachment 2; Table D-A2-3: Simulated Recharge Package Summary

Model Rch Zone #:		2	3	4	5	6	7	8	9	10	11	12	13	14	15
Area (acres):		4,142	1,604	334	372	148	154	1,720	186	540	1,215	617	620	161	384
# Model Cells:		4,543	4	6	9	5	4	12	3	8	6	24	2	4	8
AF/W-Yr	**Precip**	Qal	W Trib 1	E Trib 1	W Trib 2	E Trib 2	E Trib 3	W Trib 3	E Trib 4	E Trib 5	W Trib 4	E Trib 6	W Trib 5	W Trib 6	W Trib 7
Year	in/yr	af/yr	af/yr	af/yr	af/yr	af/yr	af/yr	af/yr	af/yr	af/yr	af/yr	af/yr	af/yr	af/yr	af/yr
1980	25.90	1,315	52	11	12	5	5	56	6	17	39	20	20	5	12
1981	8.90	-	18	4	4	2	2	19	2	6	14	7	7	2	4
1982	16.10	307	32	7	7	3	3	35	4	11	24	12	12	3	8
1983	22.80	393	46	10	11	4	4	49	5	15	35	18	18	5	11
1984	7.90	132	16	3	4	1	2	17	2	5	12	6	6	2	4
1985	9.40	230	19	4	4	2	2	20	2	6	14	7	7	2	5
1986	18.30	302	37	8	9	3	4	39	4	12	28	14	14	4	9
1987	3.60	-	7	2	2	1	1	8	1	2	5	3	3	1	2
1988	13.00	83	26	5	6	2	2	28	3	9	20	10	10	3	6
1989	9.11	191	18	4	4	2	2	20	2	6	14	7	7	2	4
1990	7.05	-	14	3	3	1	1	15	2	5	11	5	5	1	3
1991	10.10	210	20	4	5	2	2	22	2	7	15	8	8	2	5
1992	13.60	218	27	6	6	3	3	29	3	9	21	10	11	3	7
1993	17.90	906	36	7	8	3	3	38	4	12	27	14	14	4	9
1994	4.41	-	9	2	2	1	1	9	1	3	7	3	3	1	2
1995	16.00	793	32	7	7	3	3	34	4	11	24	12	12	3	8
1996	5.00	-	10	2	2	1	1	11	1	3	8	4	4	1	2
1997	13.00	357	26	5	6	2	2	28	3	9	20	10	10	3	6
1998	12.30	547	25	5	6	2	2	26	3	8	19	9	10	2	6
1999	5.90	-	12	2	3	1	1	13	1	4	9	5	5	1	3
Average	12.01	299	24	5	6	2	2	26	3	8	18	9	9	2	6
Median	11.20	214	22	5	5	2	2	24	3	8	17	9	9	2	5
Total	240	5,983	482	100	112	45	46	516	56	162	365	185	186	48	115

Avg AF/M	**Precip**	Qal	W Trib 1	E Trib 1	W Trib 2	E Trib 2	E Trib 3	W Trib 3	E Trib 4	E Trib 5	W Trib 4	E Trib 6	W Trib 5	W Trib 6	W Trib 7
month	in/mo	avg af/m	avg af/m	avg af/m	avg af/m	avg af/m	avg af/m	avg af/m	avg af/m	avg af/m	avg af/m	avg af/m	avg af/m	avg af/m	avg af/m
Oct	0.45	0.0	391.7	11.3	9.3	2.7	3.6	150.1	7.0	22.2	149.9	9.7	116.9	4.0	11.2
Nov	1.26	12.2	1098.5	31.8	26.2	7.5	10.1	421.0	19.7	62.2	420.4	27.1	328.0	11.1	31.4
Dec	1.59	35.8	1395.6	40.4	33.3	9.5	12.8	534.9	25.0	79.0	534.1	34.4	416.7	14.1	39.9
Jan	2.95	151.0	2578.6	74.7	61.5	17.6	23.7	988.3	46.2	146.0	986.8	63.6	769.8	26.1	73.8
Feb	2.35	61.3	2056.9	59.6	49.1	14.0	18.9	788.3	36.9	116.5	787.2	50.8	614.1	20.8	58.9
Mar	2.01	36.8	1755.0	50.9	41.9	12.0	16.1	672.6	31.4	99.4	671.6	43.3	523.9	17.8	50.2
Apr	0.75	0.0	652.1	18.9	15.6	4.5	6.0	249.9	11.7	36.9	249.5	16.1	194.7	6.6	18.7
May	0.11	0.0	91.9	2.7	2.2	0.6	0.8	35.2	1.6	5.2	35.2	2.3	27.4	0.9	2.6
Jun	0.11	0.0	91.9	2.7	2.2	0.6	0.8	35.2	1.6	5.2	35.2	2.3	27.4	0.9	2.6
Jul	0.10	0.0	87.5	2.5	2.1	0.6	0.8	33.5	1.6	5.0	33.5	2.2	26.1	0.9	2.5
Aug	0.05	0.0	43.8	1.3	1.0	0.3	0.4	16.8	0.8	2.5	16.7	1.1	13.1	0.4	1.3
Sep	0.31	0.0	271.8	7.9	6.5	1.9	2.5	104.2	4.9	15.4	104.0	6.7	81.1	2.7	7.8
Avg Mo	1.00	25	876.3	25.4	20.9	6.0	8.0	335.8	15.7	49.6	335.3	21.6	261.6	8.9	25.1
Med Mo	0.60	0	521.9	15.1	12.5	3.6	4.8	200.0	9.4	29.6	199.7	12.9	155.8	5.3	14.9
Avg Ttl=Anl	12.01	297	10515	305	251	72	97	4030	188	596	4024	259	3139	106	301

Rch Zone #:	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Area (acres):	786	430	435	783	534	439	327	4	3	27	14	7	7	16	5
# Model Cells:	9	7	8	2	10	4	6	4	3	29	15	7	8	18	5
AF/W-Yr	E Trib 7	W Trib 8	E Trib 8	E Trib 9	W Trib 9	E Trib 10	E Trib 11	OxPond 8	OxPond 3	OxPond 13	Perc 1	Perc 2	Perc 3	Perc 4	Perc 5
Year	af/yr	af/yr	af/yr	af/yr	af/yr	af/yr	af/yr	af/yr	af/yr	af/yr	af/yr	af/yr	af/yr	af/yr	af/yr
1980	25	14	14	25	17	14	11	50	22	73	16	8	8	18	5
1981	9	5	5	9	6	5	4	52	22	76	-	-	-	-	-
1982	16	9	9	16	11	9	7	40	20	78	4	2	2	4	1
1983	22	12	12	22	15	13	9	67	20	88	2,233	1,119	1,192	2,667	572
1984	8	4	4	8	5	4	3	69	25	86	1,236	254	1	2	1
1985	9	5	5	9	6	5	4	64	40	85	1,806	790	153	3	1
1986	18	10	10	18	12	10	7	53	35	77	2,342	1,156	1,175	1,713	269
1987	4	2	2	4	2	2	1	39	50	122	1,019	-	-	-	-
1988	13	7	7	13	9	7	5	79	35	123	1,598	591	12	1	0
1989	9	5	5	9	6	5	4	75	17	121	1,928	479	38	3	1
1990	7	4	4	7	5	4	3	74	16	123	2,030	828	83	-	-
1991	10	5	5	10	7	6	4	63	6	99	2,074	1,330	1,052	1,085	1
1992	13	7	7	13	9	7	6	49	6	118	2,741	1,080	1,033	928	5
1993	18	10	10	18	12	10	7	60	8	148	640	5	5	13	4
1994	4	2	2	4	3	2	2	55	12	-	1,777	1,212	774	274	-
1995	16	9	9	16	11	9	7	51	9	-	728	92	5	11	3
1996	5	3	3	5	3	3	2	49	7	-	1,088	-	-	-	-
1997	13	7	7	13	9	7	5	54	7	-	2,319	982	511	5	1
1998	12	7	7	12	8	7	5	47	9	-	1,690	1,108	889	972	2
1999	6	3	3	6	4	3	2	44	7	-	1,641	787	426	289	-
Average	12	6	7	12	8	7	5	57	19	71	1445	591	368	399	43
Median	11	6	6	11	7	6	5	54	17	82	1666	689	60	8	1
Total	236	129	131	235	161	132	98	1,135	374	1,416	28908	11821	7359	7989	866

Avg AF/M	E Trib 7	W Trib 8	E Trib 8	E Trib 9	W Trib 9	E Trib 10	E Trib 11	OxPond 8	OxPond 3	OxPond 13	Perc 1	Perc 2	Perc 3	Perc 4	Perc 5
month	avg af/m	avg af/m	avg af/m	avg af/m	avg af/m	avg af/m	avg af/m	avg af/m	avg af/m	avg af/m	avg af/m	avg af/m	avg af/m	avg af/m	avg af/m
Oct	41.8	16.1	14.4	186.8	17.4	29.3	10.9	4.3	1.6	6.1	10.4	7.7	0.0	0.0	0.0
Nov	117.3	45.1	40.4	523.9	48.8	82.2	30.5	4.2	1.6	6.1	41.6	0.1	0.1	0.2	0.0
Dec	149.0	57.3	51.4	665.7	62.0	104.4	38.7	4.7	1.6	6.0	77.2	19.4	2.0	0.5	0.1
Jan	275.3	105.9	94.9	1229.9	114.6	193.0	71.6	4.8	1.7	6.5	253.5	63.2	16.8	2.1	0.6
Feb	219.6	84.5	75.7	981.1	91.4	153.9	57.1	4.9	1.6	5.6	361.4	125.2	70.8	61.9	13.2
Mar	187.4	72.1	64.6	837.1	78.0	131.3	48.7	5.1	1.7	6.1	318.7	129.4	88.6	160.3	14.1
Apr	69.6	26.8	24.0	311.0	29.0	48.8	18.1	4.7	1.5	5.6	205.5	127.4	86.2	115.4	9.3
May	9.8	3.8	3.4	43.8	4.1	6.9	2.6	4.8	1.5	5.7	134.7	98.2	65.7	53.7	6.6
Jun	9.8	3.8	3.4	43.8	4.1	6.9	2.6	4.9	1.5	5.6	32.0	51.6	20.2	3.7	0.0
Jul	9.3	3.6	3.2	41.7	3.9	6.6	2.4	5.1	1.5	5.7	15.0	12.8	1.7	0.0	0.0
Aug	4.7	1.8	1.6	20.9	1.9	3.3	1.2	5.0	1.4	5.8	4.3	5.6	0.0	0.0	0.0
Sep	29.0	11.2	10.0	129.6	12.1	20.3	7.5	4.7	1.2	5.8	4.3	4.1	0.0	0.0	0.0
Avg Mo	93.6	36.0	32.2	418.0	38.9	65.6	24.3	4.8	1.5	5.9	121.6	53.7	29.3	33.1	3.7
Med Mo	55.7	21.4	19.2	248.9	23.2	39.1	14.5	4.8	1.5	5.8	59.4	35.5	9.4	1.3	0.1
Avg Ttl=Anl	1123	432	387	5015	467	787	292	57	18	71	1459	645	352	398	44

Attachment 3: Production Well Pumping Schedules

Historical Pumping Well Summary (af)

monthly pumping data from Camp Pendelton

Well ID	Basin	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
10/4-5D1	UY	-	258	466	398	402	524	385	254	0	-
10/4-7A2	UY	613	475	531	172	328	850	608	515	650	766
10/4-7A3	UY	-	-	-	-	-	-	-	-	-	-
10/4-7H2	UY	586	401	290	479	480	0	148	438	182	190
10/4-7J9	UY	-	-	-	-	-	-	-	-	-	-
10/4-7R2	UY	788	779	805	848	577	964	117	127	449	622
10/4-18E3	CH	-	128	540	592	783	835	1,150	643	293	476
10/4-18M4	CH	381	945	914	901	476	-	204	979	536	949
10/5-13R2	CH	1,082	793	350	-	-	-	-	-	-	-
10/5-23G3	CH	265	346	32	-	-	-	84	1	20	-
10/5-23G4	CH	-	-	-	-	-	-	-	-	-	-
10/5-23J1	CH	528	502	0	122	1,155	834	617	458	1,585	1,210
10/5-23K1	CH	228	-	-	-	-	-	-	-	-	-
10/5-23K2	CH	-	-	-	-	-	-	275	370	242	296
10/5-23K3	CH	-	-	-	-	-	-	-	-	-	-
10/5-26C1	CH	911	611	1,042	703	299	463	1,088	914	574	510
10/5-26F1	LY N	835	1,464	1,447	942	1,078	1,069	731	1,098	1,109	805
11/5-2D3	LY	-	-	-	-	-	-	222	-	115	52
11/5-2A1	LY	-	-	-	-	-	-	-	-	-	24
11/5-2A3	LY	114	1	53	2	-	294	134	139	192	-
	UY	1,986	1,914	2,093	1,897	1,787	2,338	1,257	1,334	1,280	1,578
	CH	3,395	3,326	2,878	2,317	2,713	2,132	3,417	3,365	3,249	3,442
	LY	949	1,466	1,500	944	1,078	1,362	1,086	1,237	1,415	880
		6,331	6,705	6,471	5,158	5,579	5,833	5,760	5,936	5,944	5,900

Sub Basin:	UY	UY	UY	UY	UY	UY	CH	CH	CH	CH	CH
Average	10/4-	10/4-	10/4-	10/4-	10/4-	10/4-	10/4-	10/4-	10/5-	10/5-	10/5-
AF/M	5D1	7A2	7A3	7H2	7J9	7R2	18E3	18M4	13R2	23G3	23G4
Oct	11	58	-	24	-	39	36	50	32	4	-
Nov	7	40	-	29	-	39	31	39	21	2	-
Dec	5	32	-	21	-	24	30	41	22	4	-
Jan	8	33	-	23	-	36	34	35	25	2	-
Feb	8	31	-	19	-	30	29	29	23	1	-
Mar	9	42	-	26	-	41	40	48	28	3	-
Apr	9	42	-	23	-	34	37	46	22	5	-
May	13	58	1	25	-	34	39	46	29	7	1
Jun	18	69	2	24	-	38	36	68	38	8	3
Jul	19	76	3	29	-	48	42	70	36	5	6
Aug	12	79	4	26	-	47	42	73	29	3	6
Sep	14	68	3	24	-	51	46	64	31	3	6
Avg Monthly	11	52	1	24	-	38	37	51	28	4	2
Med Monthly	10	50	0	24	0	38	37	47	28	3	0
Avg Total=Anl	134	627	12	293	0	461	442	608	334	44	22

Historical Pumping Well Summary (af)

monthly pumping data from Camp Pendelton

Well ID	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**
10/4-5D1	-	-	-	-	-	-	-	-	-	-
10/4-7A2	557	387	709	740	1,106	619	1,160	902	-	854
10/4-7A3	-	-	-	-	-	-	-	-	-	235
10/4-7H2	370	75	-	375	310	283	354	260	384	246
10/4-7J9	-	-	-	-	-	-	-	-	-	-
10/4-7R2	575	350	139	0	-	185	80	499	1,016	302
10/4-18E3	703	394	7	96	365	478	290	464	326	273
10/4-18M4	633	276	753	537	-	459	723	1,057	1,444	-
10/5-13R2	114	312	450	259	-	808	637	815	1,047	20
10/5-23G3	-	4	33	29	69	0	-	-	-	-
10/5-23G4	-	-	-	-	-	-	-	-	-	444
10/5-23J1	471	475	105	116	83	440	544	40	-	1,138
10/5-23K1	-	-	-	-	-	-	-	-	-	-
10/5-23K2	162	160	184	214	-	-	-	-	160	343
10/5-23K3	-	-	-	-	-	-	-	-	-	461
10/5-26C1	642	716	860	612	1,217	504	1,412	1,201	1,091	739
10/5-26F1	790	501	695	844	1,153	797	926	969	856	898
11/5-2D3	65	72	203	223	317	182	74	97	170	167
11/5-2A1	-	-	-	-	-	-	-	-	-	-
11/5-2A3	-	-	-	-	-	-	-	-	-	-
	1,502	812	847	1,115	1,416	1,087	1,593	1,661	1,400	1,636
	2,725	2,338	2,393	1,865	1,734	2,688	3,605	3,577	4,068	3,418
	855	573	898	1,067	1,471	979	1,000	1,066	1,026	1,065
	5,083	3,724	4,138	4,046	4,621	4,754	6,199	6,304	6,494	6,119

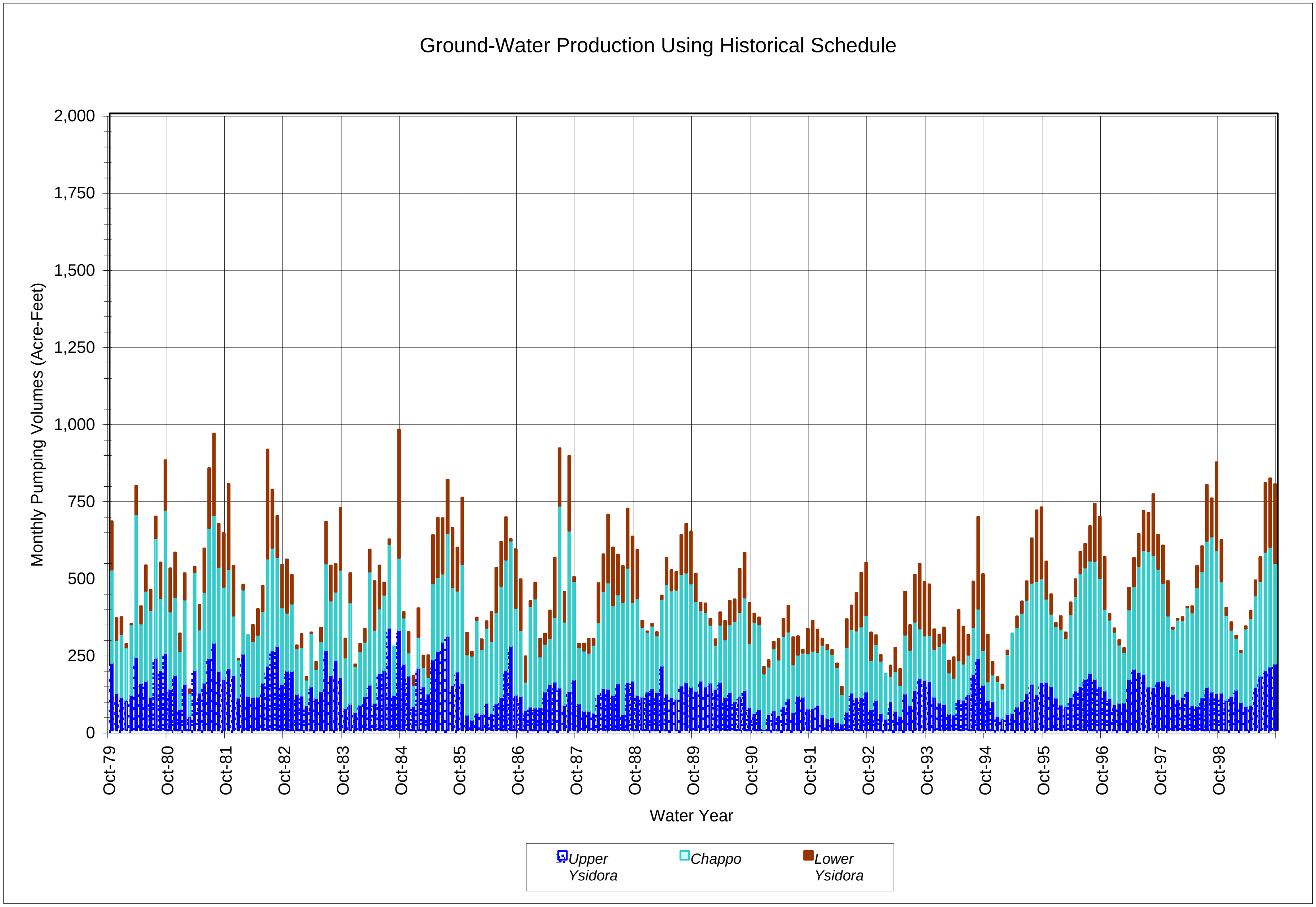
Sub Basin:	CH	CH	CH	CH	CH	LY N	LY	LY	LY
Average	10/5-	10/5-	10/5-	10/5-	10/5-	10/5-	11/5-	11/5-	11/5-
AF/M	23J1	23K1	23K2	23K3	26C1	26F1	2D3	2A1	2A3
Oct	40	2	11	-	67	111	13	1	3
Nov	42	1	9	-	59	58	6	-	2
Dec	32	1	9	-	53	16	5	-	1
Jan	39	1	10	-	55	22	2	-	4
Feb	34	1	7	-	44	22	2	-	2
Mar	39	3	10	-	56	38	1	-	6
Apr	47	1	12	-	51	75	1	-	6
May	38	1	13	1	85	96	5	-	6
Jun	53	0	12	3	83	104	5	-	7
Jul	59	-	8	6	85	126	6	-	4
Aug	53	-	10	7	88	128	23	-	3
Sep	45	-	9	6	79	155	29	-	2
Avg Monthly	43	1	10	2	67	79	8	0	4
Med Monthly	41	1	10	0	63	85	5	0	4
Avg Total=Anl	521	11	120	23	805	950	98	1	46

Historical Pumping Well Summary (af)

monthly pumping data from Camp Pendelton

Well ID	WY of Operation	# of WY of Operation	Avg AFY of Operation	Average	Median	20 Yr Total
10/4-5D1	1981-87	7	380	134	-	2,686
10/4-7A2	1980-99	20	630	627	616	12,542
10/4-7A3	1999	1	240	12	-	235
10/4-7H2	1980-99	20	290	293	300	5,850
10/4-7J9		0		-	-	-
10/4-7R2	1980-99	20	460	461	474	9,221
10/4-18E3	1981-99	19	470	442	429	8,836
10/4-18M4	1980-1998	19	640	608	585	12,168
10/5-13R2	1980-82 + 90-99	13	510	334	187	6,687
10/5-23G3	7 years	7	130	44	1	884
10/5-23G4	1999	1	440	22	-	444
10/5-23J1	1980-99	20	520	521	473	10,424
10/5-23K1	1980	1	230	11	-	228
10/5-23K2	10 years	10	240	120	80	2,405
10/5-23K3	1999	1	460	23	-	461
10/5-26C1	1980-99	20	810	805	728	16,109
10/5-26F1	1980-99	20	950	950	912	19,007
11/5-2D3	1986-99	14	140	98	73	1,958
11/5-2A1	1989	1	20	1	-	24
11/5-2A3	1980-88	9	100	46	-	929
			UY	1,527	1,540	30,535
			CH	2,932	3,064	58,646
			LY	1,096	1,065	21,918
				5,555	5,866	111,098

	Monthly Total	% of Total Pumping	Buildout Pumping / well
Oct	501	9.0%	793
Nov	383	6.9%	607
Dec	293	5.3%	465
Jan	330	5.9%	523
Feb	283	5.1%	449
Mar	391	7.0%	619
Apr	411	7.4%	651
May	498	9.0%	789
Jun	570	10.3%	903
Jul	628	11.3%	994
Aug	632	11.4%	1,001
Sep	634	11.4%	1,005
	5,555	100.0%	8,800



Appendix D, Attachment 3, Figure D - A3 - 1