APPENDIX D

City of Fresno Metro Plan Update Phase 2 Modeling

CITY OF FRESNO METRO PLAN UPDATE PHASE 2 MODELING

Prepared for the City of Fresno
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CITY OF FRESNO METRO PLAN UPDATE PHASE 2 MODELING

INTRODUCTION

This memorandum discusses the approach and assumptions used in the technical analysis to evaluate the impacts and benefits to the groundwater for the City of Fresno (City) Metropolitan Water Resources Management Plan update (Metro Plan) under "Baseline" and the "With Project" scenarios.

The Kings Basin Integrated Groundwater Surface Water Model (Kings IGSM) was used to evaluate the groundwater impacts of the land use changes that would occur under projected urban growth from 2005 to 2060. The Kings IGSM model analysis will help the City to:

- Determine the effects of future growth;
- 2. Determine the effects of new water supply facilities; and
- 3. Provide a basis for comparing the impacts and benefits of the "With Project" alternative.

In this memorandum, information on the Kings IGSM model is provided, the assumptions for areas outside the City are documented, and the results of the modeling are described.

APPROACH AND METHOD OF ANALYSIS- KINGS IGSM

The City overlies only a portion of the Kings Groundwater Basin (Kings Basin). The geographic extent of the Kings IGSM is the entire Kings Basin. The groundwater basin is interconnected and activities within the Kings Basin can affect the City. The land use and growth within the City may also affect the surrounding area. It is thus important to define the assumptions for land use, water demand and water supplies for both the City and the areas surrounding the City.

The Kings IGSM model was developed to support both the City and the Upper Kings Basin Water Forum (Water Forum) with an integrated analytical tool to evaluate the hydrologic and hydrogeologic conditions within the Kings Groundwater Basin (Kings Basin). The Water Forum includes representatives from the overlying water districts, counties, incorporated cities, and environmental and other community interest groups. The Water Forum's Technical Analysis and Data Work Group provided oversight and direction during the development and calibration of the Kings IGSM. The Kings IGSM Model Development and Calibration report (WRIME, 2007) is available online at http://project.wrime.com/krcd/krcd_igsm.htm.

The model was used to evaluate the effects on groundwater of future land uses for the City and surrounding area. This is important because under current water supply conditions in the City, when land is converted from agricultural uses to urban uses, the water supply generally shifts from agricultural irrigation with Kings River or Central Valley Project surface water, to



groundwater. This shift to exclusive use of groundwater occurs in all areas except developing urban areas that are to be provided treated surface water from the existing drinking water treatment plants located in the City and Clovis.

The Kings IGSM model represents the existing land use and water supply, the existing surface water treatment plants, the existing or approved groundwater recharge facilities (Leaky Acres, Waldron Pond, Fresno/Fresno Metropolitan Flood Control District ponds); and the increased volumes of wastewater that are treated and percolated at the City's Regional Wastewater Reclamation Facility (RWRF).

MODELING ASSUMPTIONS AND INPUT SUMMARY

The Kings IGSM model was used to evaluate two conditions based on future growth without project condition (Baseline) and a projected growth with new water supply projects and water conservation efforts (With Project). The model input files for the two conditions were developed using projected data from the cities or water purveyors, and based on assumptions listed in Table 1. The model assumptions cover the City, the districts within City's Sphere of Influence (SOI), the immediate area outside the City which includes the 2060 Growth Fringe, and the City of Clovis. Figure 1 shows the City's sphere-of-influence, the Southeast Growth Area, and the 2060-Growth Fringe areas. Some of the pertinent data inputs to the model that may have an influence on the groundwater budget are: hydrology, surface water deliveries, land use, water use, groundwater pumping, and groundwater recharge.

In addition, assumptions on the initial conditions include values for groundwater levels, soil moisture, unsaturated soil moisture and small watershed soil moisture conditions and are set at the average groundwater levels in 2005 (Figure 2).

LAND USE

Growth in the City results in land use conversion from open space or agriculture to urban. The City land use information within the SOI and 2060 Growth Fringe was provided by West Yost Associates (West Yost) for the years 2005, 2010, 2025, and 2060 are shown in Figures 3a, 3b, 3c, and 3d, respectively. The land use conditions were interpolated linearly for the other years to develop the model input files. For the Baseline conditions, it was assumed that there are no new water resources projects or supplies.

Three other water producing agencies exist within the SOI: Pinedale Water District (Pinedale), Bakman Water Company (Bakman) and California State University Fresno (CSUF). Little or no growth is expected within these areas. The City is assumed to develop outside of its current SOI into the Southeast Growth Area and the 2060 Growth Fringe. The 2060 Growth Fringe overlies portions of other subregions in the Kings IGSM model within the Fresno Irrigation District and Consolidated Irrigation District. Urban development is not solely due to



Table 1. Kings IGSM Dynamic Model Assumptions

City of Fresno City of Clovis / Non Fresno							
	Baseline City of	With Project	City of Clovis / Non Fresno				
	Daseine	with Project					
Land Use	Land use for 2005, 2010, 20252060 provided by West Yost;	Same	Land use linearly interpolated from 2005 to 2030 then held constant at 2030 conditions.				
Agricultural Water Demand	Based on: - 2005-2060 Land Use and Crop Acreage - 1964-2004 Repeated Hydrology	Same	Based on: - 2005 & 2030 Land Use and Crop Acreage - 1964-2004 Hydrology				
Crop Acreage	2005, 2010,2060 Crop Acreage; Inbetween years linearly interpolated	Same	2030 Crop Acreage (2004 crop acreage minus agricultural areas converted to urban)				
Urban Water Demand	2005, 2010,,2060 Urban Demand Estimate by West Yost	2005, 2010,,2060 Urban Demand with conservation efforts provided by West Yost	2005 to 2030 Urban Demand based on UWMP or other public documents				
Recharge @ Leaky Acres	- For 1973-2004 use historical recharge rates - For 1964-2004 use 1973-2004 recharge rates based on San Joaquin Hydrology Index	Same	N/A				
Recharge @ Existing FMFCD Ponds	For 1994-2004 use historical recharge rates For 1964-1993 use 1994-2004 recharge rates based on San Joaquin Hydrology Index Use ponds that are active in 2004 Use 2000-2004 average recharge ratios for distribution of total recharge to individual ponds	Same	Same as Fresno (N/A for Non Fresno)				
Recharge @ Future FMFCD Ponds	For 2025 to 2060 recharge estimates based on land use/area within 11 Divisions in the Growth Fringe	Same	N/A				
Recharge @ other ponds	Use 2004 conditions	Same	Use Clovis Estimates (Non Fresno) 2004 Conditions plus Waldron Ponds (FID)& Harter Ponds (CID)				
Recharge @ creeks and streams		Use 2004 conditions					
Surface Water Treatment Plant	Use Full Capacity Rates by 2010 (30 TAF)	Increase capacity for existing SWTP to (60 TAF) New SE SWTP (60 TAF)	Use 2005 Monthly Flow Ratios up to Use 2030 Rates (30 MGD) (N/A for Non Fresno)				
Wastewater Treatment Plant Total Flows	RWRF effluent flows to: Percolation Ponds; FID Canals; On-site irrigation (See Table 3-13 of Metro Plan Update Phase 1) Linear Interpolation for values in between Use 2004 conditions x (95,400)/(78,400) for 2010 Use 2004 conditions x (127,700)/(78,400) for 2025	Decrease inflow and percolation due to water conservation	(Clovis Satelite Treatment Plant (tertiary treatment) - 2,900 AF/yr increased to '- 7,600 AF/yr for 2010 and 2030, respectively - Plant outflow to be used for landscape irrigation in Clovis and CSUF (Non Fresno) Use 2004 conditions for: Selma-Kingsburg-Fowler (SKF) WWTP & Other non-Fresno WWTP				
Municipal Wells Pumping	Well location and schedule provided by West Yost for Fresno SOI, SEGA and Growth Fringe	New Well location and schedule based on water conservation and decreased water pumping; provided by West Yost for Fresno SOI, SEGA and Growth Fringe	Use 2004 Pumping Rates minus Surface Water Plant's 2030 Flows - Proportionally reduce pumping rate of each well Flows remain constant from 2030 to 2060 (Non Fresno) Municipal pumping by element				
Hydrology		Repeated 41-year hydrologic cycle\					
San Joaquin River Boundary Conditions		Seepage from the river: 50% into the basin Subsurface boundary flow along the SJ river: -No flow condition east of highway 99 -General head boundary conditions west of highway 99					
Surface Water Deliveries - Kings River	Historical deliveries and diversions revised for capture of flood flows at Waldron/Harter ponds - Adjust for SWTP flows	Historical deliveries and diversions revised for capture of flood flows at Waldron/Harter ponds - Adjust for increase capacity SWTP flows	(Non Fresno) Historical deliveries and diversions revised for capture of flood flows at Waldron/Harter ponds				
Surface Water Deliveries - Friant-Kern & CVP to Non-Fresno/Clovis Areas	West Yost estimates of deliveries to FID & Fresno (60 TAF/yr, 17.9 TAF/yr for critically dry years) - Adjust for SWTP flows	West Yost estimates of deliveries to FID & Fresno (60 TAF/yr, 17.9 TAF/yr for critically dry years) - Adjust for SWTP flows	(Non Fresno) Historical deliveries and diversions				
Land Use, Demand, Supply for Backman, Pinedale, and CSUF	2004 conditions	2004 conditions	N/A				
Pine Flat Reservoir Operations		Historical releases and flows					
Initial Conditions	- Use En	nd of Sep 2004 values for GW levels, soil moisture, unsaturated soil moisture, and small wa	tershed soil moisture				

conversion of agricultural land, but may also be due to urbanization of native, or other vacant land.

The land use for the area beyond the SOI and 2060-Growth Fringe are assumed to expand or grow based on projected growth found within general plans or other public documents. The land use projections were for the years 2005 to 2030. The land use projection beyond 2030 for all non-Fresno areas are assumed to remain constant, with no change from 2030 to 2060.

HYDROLOGY

Since future rainfall and streamflow conditions are not known, a representative hydrologic period was selected using the historical conditions to represent likely future water supply conditions. The Kings IGSM model uses the hydrology and surface water deliveries that occurred during the calibration period, from 1964 to 2004, to represent future conditions for 2005 to 2060. It is assumed that the hydrologic conditions observed over the past 41-years for Kings River and San Joaquin streamflows and diversions would occur over the next 41 years. Since the 41-year calibration period does not cover the entire projection period, it was assumed that the 41-year hydrology would be repeated from the first year. In other words, years 2005 to 2045 would coincide with the 41-year hydrology period of 1964 to 2004, and then the same cycle would be repeated for the following 15 years, 2046 to 2060. The 1964 to 2004 calibration period contained both wet and dry periods and appropriate hydrologic variability to represent a range of conditions, shown in Figure 3e.

Streamflow and Boundary Condition

The northern boundary of the Kings IGSM model is the San Joaquin River which separates Fresno and Madera Counties. Groundwater subsurface flow across the northern boundary and seepage from the San Joaquin River is impacted by the conditions of groundwater hydraulic head and the level of future development. Development north of the City across the San Joaquin River within Madera County is unknown; it is assumed that efforts made by the City will also be made by others to maintain groundwater level north of the San Joaquin River as development progresses. This implies that groundwater extraction and recharge will be concurrent north and south of the San Joaquin River. This assumption applies to both the Baseline and With Project scenarios. This would result in similar groundwater level conditions north and south of the San Joaquin River. It is thus assumed that half of the seepage from the San Joaquin River will recharge the groundwater within Fresno County and the other half will recharge in Madera County. This assumption will be along the entire length of the northern boundary of the Kings IGSM model.

The boundary condition along the northern boundary of the model operates under a no-flow condition across the San Joaquin River. This means that groundwater will not migrate across the border between the City of Fresno and Madera County. This assumption helps reduce the



impacts for the unknown development in Madera County. The no-flow condition is applied along the San Joaquin River east of Highway 99 where development is predominantly occurring or is likely to occur near the northern boundary of the model within Fresno and Madera Counties. West of Highway 99, the boundary condition is set to a general hydraulic head boundary condition. The Kings IGSM model calibration applied the general head boundary condition to simulate historical groundwater levels. Under the general head boundary condition, groundwater flows along the hydraulic gradient from north to south providing groundwater recharge to the western Kings Basin. It is assumed that the western region of basin will not undergo a significant change in the land use and water use conditions.

WATER USE

The sources of water for the City are groundwater and surface water diverted from the Kings River and the San Joaquin River via Friant-Kern Canal. The groundwater is used to meet the agricultural and urban water demands that are not met by surface water. The assumptions for surface water use under Baseline conditions are that the existing 30 million gallon per day (MGD) Surface Water Treatment Facility (SWTF) produced 15.8 TAF per year in 2005 and will increase to its maximum rate of 32.5 TAF per year (30 MGD) by 2010. The increase in surface water uses reduces groundwater extraction within City of Fresno. The quantity of treated surface water produced is approximately 30.8 TAF instead of 32.5 TAF to allow for 1 month of downtime for maintenance each year. Under Baseline conditions, the additional water demand from 2010 to 2060 is met exclusively by groundwater. Groundwater pumping in 2005 is 141 TAF increasing to 349 TAF per year by 2060 under Baseline conditions.

The With Project conditions implement a change in groundwater demands with a 10% reduction in water consumption due to water conservation, increased treated surface water production, and utilizing recycled water in-lieu of groundwater pumping. The water conservation includes a 5% reduction by all customers by 2010 and an additional 5% reduction in 2020. Water conservation efforts will equate to a savings in water use by 38 TAF per year by 2060. The second strategy included in the model is to reduce groundwater extraction by increased use of treated surface water. The With Project condition includes development of a new 60 MGD SWTF in the southeast portion of Fresno and the expansion of 30 MGD to the northeast plant. A new 60 MGD SWTF will be set to begin production in 2015. The expansion of the existing 30 MGD SWTF in the northeast will increase capacity to 60 MGD by 2020. The increased capacity of treated surface water is a total of 123 TAF per year. The With Project conditions reduced groundwater pumping from 141 TAF per year in 2005 to 82 TAF per year in 2020 when the maximum water conservation efforts and the expansion of the SWTFs come online. Groundwater extraction is reduced in 2025 with the use of 25 TAF per year of recycled water in-lieu of pumping.



A summary of the projected water use is found in Figure 2-3 in the Metro Plan Update Phase 2 Report (West Yost, 2008). A map of the groundwater well locations and the pumping distribution pattern and capacity for the Baseline and With Project conditions are found in Figures 4a and 4b, respectively.

RECHARGE

FMFCD Existing and Future Ponds

The data available for recharge was limited to recent years when most of the ponds were in operation. Observed data was available from the Fresno Metropolitan Flood Control District (FMFCD) only for the period from 1980 to 2004. To evaluate potential future conditions a synthetic recharge schedule was developed using the average monthly recharge distribution and the San Joaquin River hydrologic index. The synthetic schedule was used to approximate the total recharge within the cities of Fresno and Clovis that will occur in future scenarios. The average annual water recharged in the existing FMFCD ponds is 18 TAF per year.

An estimate for future ponding acreage in the areas to be developed was also needed to evaluate future conditions. Annual water recharged and monthly distribution assumptions for the 2060 Growth Fringe were provided by the FMFCD. The 2060 Growth Fringe was divided into 11 subgroups, Division 1 to 11 shown in Figure 4c. Each division assumed a percolation rate ranging from 0.2 to 0.5 feet per day and the ponding acreage required to support mixed urban development as provided by West Yost. Impacts on total recharge for low water years, maintenance, excavation and other unknowns were taken into account in the estimated and calculated average annual recharge. The future recharge schedule was used as part of the input files for 2025 and 2060 Baseline Conditions. The average annual water recharged in the existing FMFCD ponds is 10 TAF per year.

Project Recharge Ponds

Figure 4c shows the location of the three project pond locations (i.e., regional recharge basins). Deliveries of surface water to groundwater recharge ponds begin in 2025 with 26.1 TAF per year into Pond 1. An additional 48.8 TAF per year into Pond 2 by 2030 and 37.4 TAF per year by 2037 of groundwater recharge into Pond 2. A total of 112.3 TAF per year was added to the groundwater storage. The water supply will in part come from additional Kings River water deliveries and a new source of surface water of 35 TAF per year beginning in 2035 increasing to 55 TAF per year by 2050.

MODEL RESULTS

This section provides the summary of the Kings IGSM modeling results for the City of Fresno Baseline and With Project scenarios. The groundwater response is depicted by the groundwater



level contour maps, well hydrographs and changes in groundwater storage calculations for the Fresno area for the 2005 to 2060 period.

GROUNDWATER ELEVATION

The change in groundwater elevation associated with Baseline and With Project conditions is shown in a series of contour maps showing the groundwater elevation above mean sea level (MSL). The Baseline groundwater levels in Figures 5a through 5g, show the average annual groundwater elevation for the years 2010 through 2060, respectively. Figures 6a through 6g show the average annual groundwater levels for the With Project conditions for the years 2010 through 2060, respectively. The 2005 groundwater elevation map, Figure 2, is used as the same common starting point.

The initial groundwater elevations are set at the year 2005 levels. The groundwater surface elevation range from 270 to 300 feet MSL in the northern and eastern portions of the SOI to 180 to 190 feet MSL in the southwest. The existing groundwater gradient is from the northeast, with higher groundwater surface elevation, to the southwest. The gradient is relatively flat within the central portion of the SOI but begins to decline in the southwestern area outside of the SOI in the 2060 Growth Fringe section near the Regional Wastewater Reclamation Facility (RWRF) where the groundwater levels continue to drop below 150 feet MSL. The groundwater level contours show some mounding effects of the percolation of wastewater near the RWRF. A 10-foot groundwater depression is estimated near the center of the SOI, north of downtown, with an elevation of 170 to 180 feet MSL. A second groundwater depression is estimated in the eastern section of the SOI in the Bakman Water District (Bakman), also at 170 to 180 feet MSL.

Groundwater Levels Under Baseline Conditions

The groundwater levels, under Baseline conditions, drop 10 feet from 2005 to 2010, increasing the depression throughout most of the western SOI. By 2025, the groundwater levels at the central portion of the City continue to decline to 140 to 150 feet MSL. The second depression at Bakman continues to spread to a larger region toward the west. By 2060, the groundwater levels dropped below 110 feet in most of the City and Bakman. The mound is evident at the RWRF.

Figure 7a shows the change in groundwater level that occurred from 2005 to 2060. A negative value represents a drop, or decrease, in groundwater level as compared to the level in 2005. By the end of the modeling simulation, the groundwater levels are simulated to drop 70 to 85 feet along Highway 99. The depression is projected to be relatively evenly spread along the highway with two valleys in the groundwater depression located in the northwest and southeast Fresno area. These valleys are most likely the result of pumping distribution patterns shown previously in Figure 4a. The groundwater levels throughout the area are projected to drop; there are some areas where mounding, relative to the surrounding groundwater levels,



are noticed. The mound in the southwest located beneath the RWRF is a result of the wastewater percolation. The groundwater levels drop by 70 to 75 feet in the surrounding area but only 65 feet at the RWRF. The groundwater mounding northeast of Highway 180, with a drop of only 40 feet, and in the northeast portion along Big Dry Creek, with a gain of 10 feet, is due to hydrology and soil conditions. The difference in hydrology between 2005 and 2060 is that more surface water is available to flow in the canals in 2060 as compared to 2005. The two areas of mounding are areas of high conductivity or infiltration rates, meaning the water within the canals recharge the groundwater faster in these areas.

Groundwater Levels Under With Project Conditions

Under With Project conditions the groundwater follows a similar trend from 2005 to 2010 with a drop in groundwater levels by 10 feet in the western SOI. From 2010 to 2020 the depression in the center of the City has been reduced and groundwater levels increased to 180 to 200 feet MSL. The increase in groundwater levels was the result of water conservation and increased treated surface water production. The groundwater levels in the eastern portion of the SOI increased with a depression present at Bakman 10 feet below the surrounding area. Since Bakman is supported exclusively by groundwater extraction, a depression is likely to continue in this area.

At the end of simulation, 2060, the groundwater in the center of the City is at 200 to 210 feet MSL, an increase of 25 to 30 feet from 2005, shown in Figure 7b. Along Highway 99, the groundwater levels range from 0 feet to 15 feet, indicating no change to an increase by 15 feet compared to 2005. There are areas of mounding in the northeast SOI and the City of Clovis. The mounding in the City of Clovis results from the benefits of groundwater recharge in the Marion basin near Dry Creek canal. This mounding effect is amplified by the gains in groundwater level within the SOI due to the increased capacity in the Northeast SWTF and reduction in groundwater pumpage. Other areas where beneficial groundwater mounding is evident is at the project ponds sites. The groundwater recharged in these areas shows an improvement to the surrounding groundwater by 5 to 10 feet compared to 2005.

Areas outside of the Fresno area that are affected by the project conditions are the groundwater depression southwest of the City and the eastern portion of the Fresno Irrigation District. The area southwest of Highway 99 continues to lose groundwater down gradient from the northeast to the southwest. The gradient is caused by a groundwater depression in the western portion of the Kings Basin located near Raisin City. The groundwater depression formed east of the City is a result of the increased groundwater pumping to meet agricultural demands. The surface water from the Kings River was diverted and reallocated to meet the City's water use requirements, either for the surface water treatment or recharge. The remaining water was used to support the crop water demand in the surrounding areas.



Baseline and With Project Groundwater Level Comparison

A comparison of the changes in groundwater levels, under Baseline and With Project conditions, are shown using a contour map and well hydrographs. The contour map, Figure 8, shows difference in groundwater levels at 2060 (With Project minus Baseline). Near the center of the SOI, the simulated groundwater difference is 105 feet. This is an increase in groundwater level relative to 2060 Baseline condition. Alternatively, the increase in groundwater level in this figure represents the benefit of the projects implemented under the With Project condition when compared to the Baseline condition at the end of the model simulation.

The changes in groundwater levels from 2005 to 2060 are shown using eight representative well hydrographs and three simulated hydrographs at the project pond sites. The well hydrographs show historical observed groundwater levels, for comparative purposes, represented by red diamonds along with a red line for the simulated groundwater levels for the Baseline conditions and a black line for the With Project conditions. The peaks and valleys in the lines show the changes in groundwater level at different time periods of the year (e.g., spring and fall). The hydrographs that have an exaggerated variance indicate an area with higher areas of water permeability like agricultural areas. The hydrographs at the pond location do not include historical observed level since these are only simulated and wells do not existing at these locations. The well and pond locations are shown in Figure 9a and the simulated well 9hydrographs in Figure 9b and 8c.

Figure 9a shows Well 35, located in the southwest portion within the 2060 Growth Fringe, near the regional wastewater treatment plant. The historical data shows a decline in groundwater elevation of approximately 25 feet. The Baseline condition shows an additional 70 feet decline from 2005 to 2060. The With Project condition shows a decline of groundwater elevation of 25 feet by 2060. There are three notable inflections that occur in the With Project groundwater level line: 1. New/Expanded SWTF in 2015 to 2020 cause an upward trend; 2. Use of recycled water for irrigation reducing wastewater percolation produces a downward trend; and 3. Additional surface water supply (New) for recharge shown by an upward trend in 2030 and 2050.

A similar effect can be seen in the pond location hydrographs. In the Pond 2 hydrograph, the With Project groundwater levels begin to deviate from the Baseline beginning at 2010 which coincides with the 5% water conservation efforts. Most noticeably is the dramatic increase of 25 feet in groundwater in 2030 when the pond begins to receive water to recharge the groundwater. The groundwater simulation ends in 2060 with the With Project groundwater level at 195 feet and the Baseline at 110 feet. The difference of 85 feet in groundwater levels shows the benefits realized of the projects implemented versus doing nothing (Baseline condition).



Table 2. Well Hydrograph Summary

		2005	2060	2060 - 2005	Project
Loc	cation	GWL (feet)	GWL (feet)	Change in GWL (feet)	minus Baseline (feet)
	Project		160	-25	
Well 35	Baseline	185	110	-75	50
	Project		195	0	
Well 45	Baseline	195	105	-90	90
	Project		230	35	
Well 47	Baseline	195	140	-55	90
	Project		210	15	
Well 58	Baseline	195	110	-85	100
	Project		186	0	
Well 60	Baseline	186	105	-81	81
	Project		300	-15	
Well 70	Baseline	315	270	-45	30
	Project		217	27	
Well 239	Baseline	190	123	-67	94
	Project		240	35	
Well 240	Baseline	205	170	-35	70
	Project		178	-10	
Pond 1	Baseline	188	110	-78	68
	Project		195	0	
Pond 2	Baseline	195	110	-85	85
	Project		257	12	
Pond 3	Baseline	245	165	-80	92

Table 2 is a comparative summary of groundwater level at the well and pond locations between the Baseline and With Project conditions. The column for "With Project minus Baseline" shows the amount of groundwater stored from the projects implemented, under With Project conditions, versus no actions taken. The benefits range from 30 to 100 feet of potential gains in groundwater.

CHANGE IN GROUNDWATER STORAGE SUMMARY

The Baseline condition results in a decline in groundwater storage from 2005 to 2060 at a rate of 20 TAF per year within the SOI. The overdraft causes a drop of 80 feet in groundwater levels from 180 MSL to 100 MSL by 2060 in the approximate center of the City north of downtown. The decline under Baseline conditions in water level and depletion of groundwater storage are associated with the increased urban development and the increased urban reliance on groundwater.

Under With Project conditions there is an average annual surplus of groundwater of 4 TAF per year and an increase in groundwater level from 180 MSL to 200 MSL from 2005 to 2060. The projects implemented in this scenario allowed for increased use of surface and recycled water in-lieu of groundwater pumping and allow for greater opportunity to capture surface for storage in the project ponds. The difference in groundwater storage under various hydrologic conditions, Table 3, shows the benefit of the ability to recharge more groundwater, improve conservation efforts and reduce groundwater pumping. Detailed groundwater budgets for the Baseline and With Project conditions are included in Tables 4 and 5, respectively.

Table 3. Change in Groundwater Storage within SOI by Hydrologic Period

MODEL RUNS	2005-2060 Annual Average	2018 Dry Year	2024 Wet Year	2028-2033 Multiple Dry Years	2036-2039 Multiple Wet Years	
Baseline Conditions (TAF)	-20	-76	50	-43	17	
With Project Conditions (TAF)	4	-39	73	-3	38	

In the dry hydrologic periods, the With Project scenario counters the dependence on groundwater by a reduction of pumping. During the dry year period in 2018, the groundwater storage will decline 76 TAF under Baseline conditions. In the With Project scenario, the groundwater storage will decline 39 TAF. The savings in groundwater, in this time period, is due to the new 60 MGD SWTF and 5% water conservation, and results in a savings of 37 TAF of groundwater. In the multiple dry years, 2028 to 2033, the 40 TAF reduction in groundwater loss is attributed to the 25 TAF of recycled water being used in-lieu of groundwater extraction.

The benefits of increased groundwater storage capacity with the project recharge ponds (i.e., regional recharge basins) and a reduction in groundwater pumping are seen during the wet hydrologic periods. In 2024, an additional 23 TAF of groundwater storage results from



Table 4. Average Annual Groundwater Budget, Baseline

Groundwater Budget for the City of Fresno Sphere of Influence - Baseline Simulation (General Head west of Hwy 99, 50% SJ River Flux east of Hwy 99)

All Units in Acre-Feet

Percolation Seepage and Recharge Total Percolation Seepage From Collection Seepage F		T						All Units in Acre-Fe	et						
Note Process										Outflow					
Percolation San Joseph Northwest Southwest S					Boundary Inflow	1		See	page and Recha	arge	Total	Pum	nping	Total	
Value Yan From Rain and San Joseph Northeast Southwest Northeast Southwest Northeast Southwest Northeast															
Waser Vess Applied Water River Seepage Northwest Northwest Southwest Southwe								l							Change in
2006 31,152 25,477 11,590 2,218 16,585 50,916 13,909 97,382 0 164,468 111,513 25,677 277,182 20,000 33,167 22,355 11,580 2,218 15,229 25,228 25,272 22,872 20,000 130,468 130,477 75,685 22,161,182 20,000 33,167 22,165 11,381 22,777 13,584 58,431 16,165 44,100 0 175,586 138,455 67,600 221,195 221,195 22,160 23,167 23,165 23	M/			Manthusast	Cath	Manthaaat	C				Tatal Inflam		Other Demonstrat	Tatal Outland	•
2006 31.561 22.558 11.569 2.516 19.022 59.263 22.762 0 198.666 130.417 79.665 216.132															Storage
2007 31.074 22.066 11.319 2.277 18.684 58.433 16.99 45.150 0 175.506 134.686 87.200 222.066 220.															-58,503
DOIS 20.008															-29,827 -45,813
2009 30,986 21,341 -10,309 -2,728 18,500 65,264 16,776 -2,465 0 -12,588 17,460 82,769 210,249 -2,029 15,608 60,0145 -2,422 -4,175 0 -2,020,000 -12,538 62,500 -2,041,18 -2,020 -															12,207
2010															-27,963
2011 37,165 19,740 -9,438 -1,270 77,474 66,226 36,550 43,151 0 214,328 19,570 81,252 207,000															44,465
2012 30.075															7,211
2014 36,619 34,245 16,453 10,153 16,009 50,001 20,314 40,800 0 20,552 135,256 74,601 200,857 20,100	2012	30,975								0					-19,181
2015 33,397 29,037 113,973 4,183 19,570 63,3398 26,483 46,766 0 291,034 138,469 72,030 210,489 2016 27,097 10,450 0,332 3,949 20,881 64,296 26,104 6,688 0 189,225 141,685 72,446 24,4101 2017 27,103 28,330 113,807 7,188 10,818 64,296 26,104 6,688 0 189,225 144,685 75,720 220,576 220,576 20,207 27,005 28,330 13,807 7,188 10,818 59,781 34,688 47,138 0 169,225 144,685 75,720 220,576 220,576 20,207	2013	27,765	22,862	-11,112	-9,023	17,895	58,167	15,698	42,069	0		132,056	77,244	209,300	-45,204
2016 77,657 19,450 9,332 3,989 20,881 64,249 25,164 45,488 0 189,829 141,655 72,446 214,101										0					-8,036
2017 27,168 28,302 -13,607 -7,168 19,810 56,302 17,196 39,449 0 166,202 144,850 75,777 226,577															-9,431
2018 24,645 30,532 115,116 -11,082 19,042 50,356 12,193 37,619 0 149,188 149,186 77,020 225,208 225,209 33,203 30,131 -14,590 -19,044 22,416 63,550 27,429 47,606 0 209,042 151,649 65,550 220,209 220,209 220,209 23,203 30,131 -14,590 -19,044 22,416 63,550 22,209 220,209															-24,229
2019															-52,540
2020															-76,094
2021 33,437 \$2,056 24,900 1.1,053 22,740 65,390 25,321 49,902 0 223,540 156,992 62,039 221,031															-3,880 -12,092
2022 29,086 24,900 -12,010 591 23,849 66,674 29,342 44,427 0 201,164 183,732 55,151 222,247 2024 22,133 32,2461 66,074 29,084 44,612 0 214,761 186,391 53,252 222,164 2024 41,512 81,510 -38,257 5,267 23,985 71,101 39,870 0 277,264 173,115 43,169 222,248 2025 33,004 44,110 -21,019 6,696 24,188 68,100 33,386 65,861 0 274,694 173,115 43,699 221,382 2027 30,002 44,618 -21,773 6,664 24,696 67,621 21,423 47,471 0 212,246 173,966 42,536 222,379 2029 23,306 28,701 -13,884 181 23,744 59,971 18,040 180,978 179,461 46,588 222,429 2030 24,536 29,967															2,513
2023 26,133 42,6692 -20,448 423 22,461 66,074 29,604 44,612 0 214,781 168,391 53,252 221,643															-21,076
2024															-6,764
2026 26,333 23,831 -11,408 6,172 25,335 67,655 21,876 49,149 0 200,003 178,914 42,348 221,262 2028 27,790 24,267 -11,682 -5.28 23,807 62,599 18,141 44,330 0 188,725 179,107 44,632 223,739 2030 223,966 28,701 -13,894 181 23,784 59,971 18,040 41,079 0 181,678 179,461 45,968 225,429 2030 24,536 22,967 -14,659 1,304 22,806 57,284 18,040 41,079 0 181,678 179,461 45,968 225,429 2030 24,536 22,967 -14,659 1,304 22,806 57,284 18,049 43,120 0 162,447 179,597 46,614 226,211 23,784 46,143 226,241 23,784 46,144 23,728 46,144 226,211 23,784 46,144 23,677 2031 24,971 33,278 36,319 -17,988 41,921 21,560 52,422 44,744 40,342 0 202,013 180,117 49,718 229,835 2032 26,535 36,319 17,988 41,921 21,560 52,422 44,744 40,342 0 202,013 180,117 49,718 229,835 2034 34,602 44,006 -21,584 6,739 24,637 57,282 22,271 49,122 0 223,275 180,430 52,097 232,527 2035 34,538 62,633 -29,928 13,151 26,799 63,320 34,458 62,633 -29,928 13,151 26,799 63,320 34,484 43,186 0 246,182 181,023 53,883 234,916 2037 31,761 44,098 -21,544 40,074 20,784 43,186 0 246,182 181,023 53,883 234,916 2037 31,761 44,098 -21,544 40,074 28,677 66,935 27,485 46,649 0 244,746 181,767 45,651 235,777 2038 35,651 54,150 55,862 21,046 28,104 69,277 31,523 45,150 0 249,946 36,739 36,835 36,947 31,523 45,150 0 249,946 36,747 31,523 36,841 31,547 36,841 31,547 37,548 36,841 31,547 31,548 36,841 31,548 36,841 31,548 36,841 31,548 36,841 31,548 36,841 31,548 36,841 31,548 36,841 31,548 36,841 31,548 36,841 31,548 36,841 31,548 36,841 31,548 36,841 31,548 36,841 31,548 36,841 31,548 36,841 31,548 36,841 31,548 36,841 31,548 36,8	2024									0					50,037
2027 30,902 45,818 22,1778 1,894 24,689 67,821 21,423 47,471 0 218,240 178,986 42,525 223,807 22,029 23,906 28,701 11,892 42,287 11,814 44,330 0 188,725 179,107 44,632 223,739 2029 23,906 28,701 1.13,984 181 22,784 59,971 18,040 41,079 0 181,678 179,461 45,686 223,479 2031 24,553 29,967 1.14,669 1,018 23,477 52,613 13,481 37,280 0 187,474 179,686 48,168 228,016 2032 26,535 36,319 1.79,881 1,921 21,550 52,422 22,988 52,615 19,188 41,940 0 202,013 130,117 49,718 222,835 22,817 18,040 52,022 13,179 18,020 186,275 180,026 50,513 23,1179 180,020 186,275 180,026 50,313 <td>2025</td> <td>31,004</td> <td>44,110</td> <td>-21,019</td> <td></td> <td></td> <td>69,810</td> <td>33,356</td> <td>52,581</td> <td>0</td> <td>240,636</td> <td>177,784</td> <td>43,609</td> <td>221,393</td> <td>19,132</td>	2025	31,004	44,110	-21,019			69,810	33,356	52,581	0	240,636	177,784	43,609	221,393	19,132
2028 27,790 24,267 -11,682 -528 23,807 62,599 18,141 44,330 0 188,725 179,107 44,532 223,739 2030 22,506 28,701 -13,384 181 23,744 59,971 18,040 41,079 0 181,678 179,617 45,568 225,429 2031 24,536 29,967 -14,659 1,304 22,806 57,284 18,099 43,120 0 162,477 179,957 46,614 226,016 2032 26,535 36,319 -17,988 -1,921 21,560 52,422 44,744 40,342 0 202,013 180,117 49,718 228,835 2034 34,602 44,005 -21,584 6,739 24,837 57,282 28,271 49,122 0 223,275 180,430 52,097 233,456 2036 34,588 62,633 -29,928 13,151 26,066 62,320 32,484 43,186 0 245,182 181,023 <td></td> <td>-12,293</td>															-12,293
2029 23,906 28,701 -13,894 181 23,784 59,971 18,040 41,079 0 181,678 177,961 45,688 225,429 2030 24,538 29,967 -14,669 1,018 23,477 52,613 13,481 37,280 0 167,674 179,585 48,158 228,016 2032 26,535 36,319 -16,6408 -1,018 23,477 52,613 13,481 37,280 0 167,674 179,885 48,158 228,8016 2033 28,614 36,861 -18,196 2,284 22,988 52,615 19,168 41,980 0 186,275 180,266 50,913 231,179 2035 28,875 37,087 -18,326 11,416 26,205 60,237 180,93 41,460 0 205,648 180,780 53,676 234,456 2037 31,761 44,098 21,544 20,764 28,577 66,935 27,485 46,649 0 244,746 181,176<															-3,250
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2032 26,535 36,319 -17,388 -1,921 21,560 52,422 47,744 40,342 0 202,013 180,117 49,718 229,835 2033 28,614 36,851 -18,196 2,224 22,958 52,615 19,168 41,990 0 186,275 180,286 50,913 231,179 2034 34,602 44,005 -21,584 6,739 24,837 57,282 28,271 49,122 0 223,275 180,430 52,097 232,527 2035 28,875 37,007 -18,336 11,416 26,025 60,237 18,093 41,460 0 205,048 180,780 53,676 2036 34,538 62,633 -29,928 13,151 26,798 62,320 32,484 43,186 0 245,182 181,023 53,893 224,456 2037 31,751 44,098 -21,544 20,794 28,577 69,955 27,485 46,649 0 244,746 181,176 54,551 235,727 2038 35,581 54,150 -25,982 21,046 28,104 69,287 31,523 45,158 0 258,867 181,360 55,252 236,612 2039 38,052 66,157 -31,328 20,685 27,997 68,130 32,091 41,927 0 263,724 181,637 54,669 226,298 2040 30,707 44,818 -20,506 22,989 29,125 67,020 23,638 45,159 0 239,900 181,832 55,401 237,233 2042 30,104 33,533 -18,763 18,104 26,019 68,288 42,865 43,884 0 239,299 181,820 57,766 237,773 2043 27,057 37,233 -18,441 14,455 26,239 61,385 22,266 41,832 0 241,7345 182,255 56,003 228,348 2044 26,161 37,695 -18,713 13,526 26,522 36,510 20,675 41,632 0 205,788 182,255 56,003 228,348 2046 24,515 25,138 -12,285 12,383 25,299 64,966 23,622 36,566 0 173,525 182,255 56,003 228,344 2046 24,515 25,138 -12,285 12,383 25,299 64,966 23,432 36,847 0 2417,335 182,255 56,003 228,348 2046 24,515 25,138 -12,285 12,383 25,299 64,966 23,432 36,847 0 2417,345 182,243 56,401 228,334 2046 24,515 25,138 -12,285 12,383 26,229 36,560 20,675 41,632 0 205,788 180,997 183,495 57,476 240,017 2047 26,699 23,447 -11,394 14,710 28,513 52,766 60,277 30,8															-43,731 -60.431
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2034 34,602 44,005 -21,584 6,739 24,837 57,282 28,271 49,122 0 223,275 180,430 52,097 223,527 2036 28,875 37,087 -18,326 11,416 26,205 60,237 18,093 41,460 0 205,048 180,709 53,576 224,456 2036 34,538 62,633 -29,928 13,151 26,799 62,320 32,484 43,186 0 245,182 181,023 53,893 224,916 2037 31,761 44,098 -21,544 20,784 28,577 66,395 27,485 46,649 0 244,746 181,176 54,561 235,727 2038 35,561 54,150 -25,892 21,046 28,104 69,287 31,523 45,158 0 256,867 181,300 52,36612 2039 38,062 66,157 -31,326 20,685 27,997 68,130 32,091 41,927 0 263,724 181,367 54,															-44,949
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2039 38.062 66.157 -31.326 20.685 27.997 68.130 32.091 41.927 0 263.724 181.637 54.659 236.296 2040 30,707 41.818 -20.506 22,959 29.125 67.020 23.638 45,139 0 239,900 181.832 55,401 237,233 2041 31,530 38,333 -18,763 18.104 26,019 68.288 42,865 43,894 0 250,269 182,007 55,766 237,773 2042 30,104 38,523 -19,008 15,333 25,299 64,966 23,432 36,687 0 217,335 182,255 56,093 238,348 2043 27,067 37,233 -18,411 14,455 26,239 61,885 22,866 41,949 0 217,335 182,255 56,093 238,348 2044 26,161 37,879 -18,511 13,526 26,322 58,890 20,675 41,632 0 205,788 182,										0					9,096
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2051 38,897 62,950 -30,301 17,623 25,812 59,179 62,708 45,200 0 282,068 184,444 58,416 242,860 2052 33,195 20,227 -9,643 25,395 29,757 63,304 23,447 41,051 0 226,733 184,547 58,484 243,031 2053 28,225 16,575 -7,874 22,556 30,426 60,272 12,625 37,848 0 206,553 184,675 58,471 243,146 2054 25,133 21,496 -10,443 20,242 30,613 56,678 9,137 36,103 0 188,959 184,780 58,671 243,1461 2055 30,763 34,571 -16,855 18,199 29,553 62,259 28,443 42,593 0 229,527 184,930 58,625 243,555 2056 30,525 29,242 -14,269 21,848 30,472 65,407 23,641 41,453 0 228,320 185,10			47,106		17,531	28,161	58,495	36,918	43,948	0	237,559	184,066		241,809	-4,051
2052 33,195 20,227 -9,643 25,395 29,757 63,304 23,447 41,051 0 226,733 184,547 58,484 243,031 2053 28,225 16,575 -7,874 22,556 30,426 60,272 12,625 37,848 0 200,653 184,675 58,471 243,146 2054 25,133 21,496 -10,443 20,242 30,613 56,678 9,137 36,103 0 188,959 184,780 58,671 243,451 2055 30,763 34,571 -16,855 18,199 29,553 62,259 28,443 42,593 0 229,527 184,930 58,625 243,555 2056 30,525 29,242 -14,269 21,848 30,472 65,407 23,641 41,453 0 228,320 185,102 58,405 243,507 2057 26,570 18,848 -9,037 23,266 31,267 61,019 14,985 40,339 0 207,258 185,273<															-46,365
2053 28,225 16,575 -7,874 22,556 30,426 60,272 12,625 37,848 0 200,653 184,675 58,471 243,146 2054 25,133 21,496 -10,443 20,242 30,613 56,678 9,137 36,103 0 188,959 184,780 58,671 243,451 2055 30,763 34,571 -16,855 18,199 29,553 62,259 28,443 42,593 0 229,527 184,930 58,625 243,555 2056 30,525 29,242 -14,269 21,848 30,472 65,407 23,641 41,453 0 228,320 185,102 58,405 243,507 2057 26,570 18,848 -9,037 23,266 31,267 61,019 14,985 40,339 0 227,258 185,273 58,469 243,742 2058 25,543 26,492 -12,967 19,585 30,381 56,207 11,392 35,116 0 191,749 185,350										-					39,352
2054 25,133 21,496 -10,443 20,242 30,613 56,678 9,137 36,103 0 188,959 184,780 58,671 243,451 2055 30,763 34,571 -16,855 18,199 29,553 62,259 28,443 42,593 0 229,527 184,930 58,625 243,555 2056 30,525 29,242 -14,269 21,848 30,472 65,407 23,641 41,453 0 228,320 185,102 58,405 243,507 2057 26,570 18,848 -9,037 23,266 31,267 61,019 14,985 40,339 0 207,258 185,273 58,469 243,742 2058 25,543 26,492 -12,967 19,585 30,381 56,207 11,392 35,116 0 191,749 185,350 58,557 243,907 2059 23,830 28,519 -14,022 15,450 30,146 50,582 7,838 34,837 0 177,180 185,553															-16,299
2055 30,763 34,571 -16,855 18,199 29,553 62,259 28,443 42,593 0 229,527 184,930 58,625 243,555 2056 30,525 29,242 -14,269 21,848 30,472 65,407 23,641 41,453 0 228,320 185,102 58,405 243,507 2057 26,570 18,848 -9,037 23,266 31,267 61,019 14,985 40,339 0 207,258 185,273 58,469 243,742 2058 25,543 26,492 -12,967 19,585 30,381 56,207 11,392 35,116 0 191,749 185,350 58,557 243,907 2059 23,830 28,519 -14,022 15,450 30,146 50,582 7,838 34,837 0 177,180 185,553 58,553 244,106 2060 30,813 55,520 -27,315 16,159 29,665 57,732 38,211 43,242 0 244,027 185,75															-42,510
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2057 26,570 18,848 -9,037 23,266 31,267 61,019 14,985 40,339 0 207,258 185,273 58,469 243,742 2058 25,543 26,492 -12,967 19,585 30,381 56,207 11,392 35,116 0 191,749 185,350 58,557 243,907 2059 23,830 28,519 -14,022 15,450 30,146 50,582 7,838 34,837 0 177,180 185,553 58,553 244,106 2060 30,813 55,520 -27,315 16,159 29,665 57,732 38,211 43,242 0 244,027 185,753 58,662 244,415															-13,884 -15,151
2058 25,543 26,492 -12,967 19,585 30,381 56,207 11,392 35,116 0 191,749 185,350 58,557 243,907 2059 23,830 28,519 -14,022 15,450 30,146 50,582 7,838 34,837 0 177,180 185,553 58,553 244,106 2060 30,813 55,520 -27,315 16,159 29,665 57,732 38,211 43,242 0 244,027 185,753 58,662 244,415															-15,151 -36.493
2059 23,830 28,519 -14,022 15,450 30,146 50,582 7,838 34,837 0 177,180 185,553 58,553 244,106 2060 30,813 55,520 -27,315 16,159 29,665 57,732 38,211 43,242 0 244,027 185,753 58,662 244,415															-50,493
2060 30,813 55,520 -27,315 16,159 29,665 57,732 38,211 43,242 0 244,027 185,753 58,662 244,415															-67,045
															-210
Average 30,419 35,340 -17,089 7,330 24,447 60,857 24,801 42,939 0 209,043 168,335 60.872 229.207 1	Average	30,419	35,340	-17,089	7,330	24,447	60,857	24,801	42,939	0	209,043	168,335	60,872	229,207	-20,081

Table 5. Average Annual Groundwater Budget, With Project

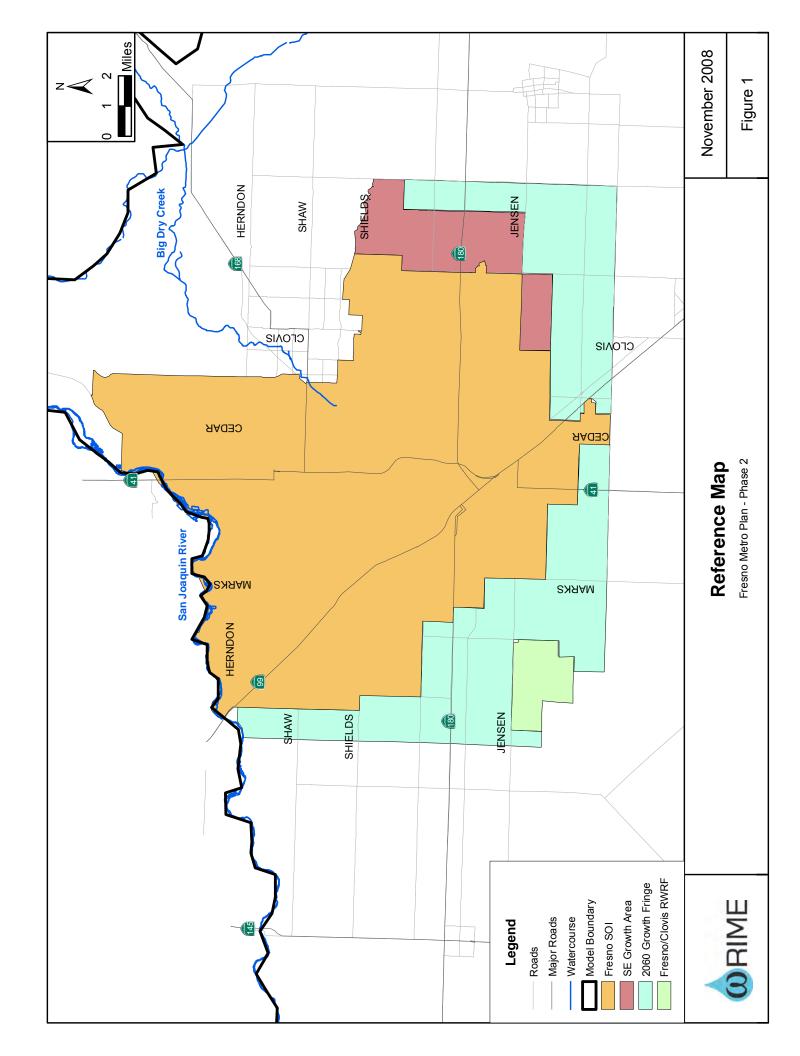
Groundwater Budget for the City of Fresno Sphere of Influence - With Project Simulation (General Head west of Hwy 99, 50% SJ River Flux east of Hwy 99)

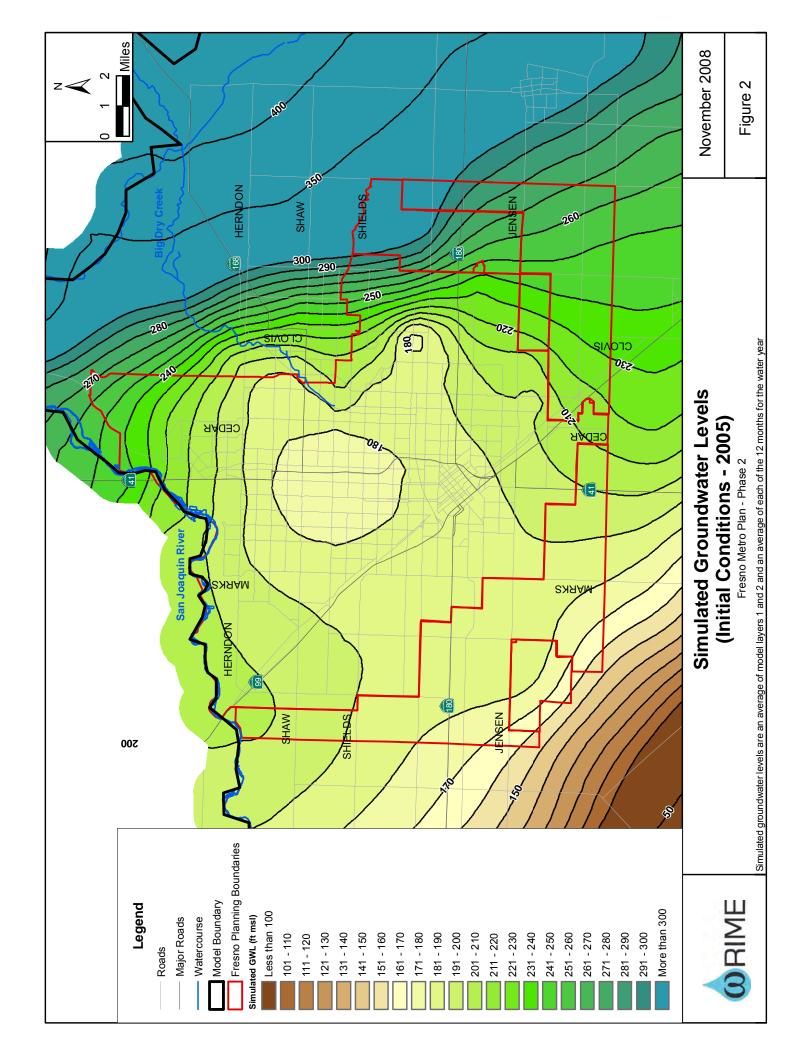
All Units in Acre-Feet

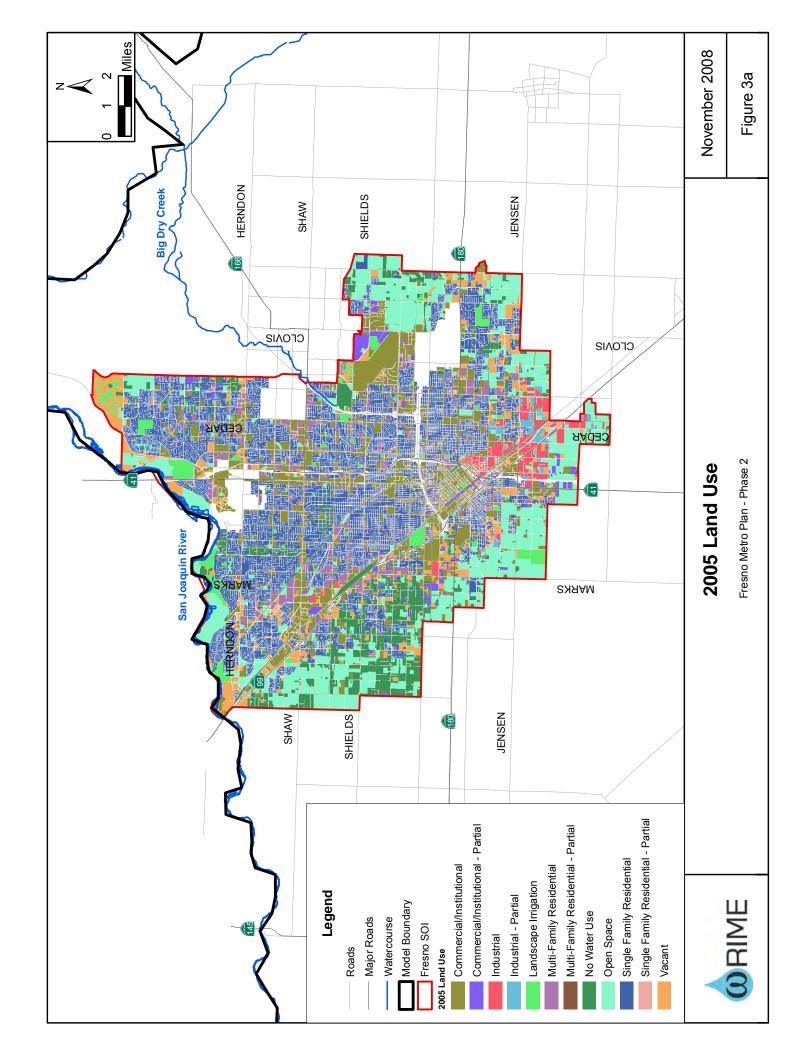
Percentation Perc								All Units in Acre-Fe	et						
Processor Processor Project										Outflow					
New York September New York New					Boundary Inflow	1		See	page and Recha	arge	Total	Pum	ping	Total	
Value Total Project Water Novel Southwest															
Water Van Applied Water Applied Water New Seepage Northwest Southwest Southw			l					l							Change in
2006 31.101 29.409 -12.500 -1.859 16.202 96.606 15.804 37.382 0 166.506 141.700 20.533 224.339 45.500 20.5	M-4 W			Manthusast	Cath	Manthaaat	C				Tatal Inflam		Other Demonstra	Tatal Outland	•
DOCK 31,975 23,967 -11,156 -2,447 16,958 -9,174 -2,777 -2,267 -0 -18,189 -18,277 -7,141 -7,141 -2,172 -2,267 -2,267 -2,267 -2,267 -2,267 -2,267 -2,267 -2,267 -2,267 -2,267 -2,267 -2,267 -2,267 -2,268 -2,273 -2,274 -2,2															Storage
2007 31.203 25.000 11.310 2.864 16.972 07.641 16.779 4.150 0 275.680 15.647 77.441 21.669 07.203 20.8770 15.203 20.8770 15.203 20.8770 15.203 20.8770 15.203 20.8770 15.203 20.8770 15.203 20.8770 15.203 20.8770 15.203 20.8770 15.203 20.8770 20.877															-55,703
Dec															-29,200 -37,994
2009 30,064 21,374 11,0309 7,404 15,511 5,404 17,624 15,511 5,511 5,511 15,511															15,800
2010 40,280 57,818 26,949 7,040 15,031 59,161 54,440 44,777 0 246,449 127,725 07,627 195,552 59,201 2011 30,375 16,389 24,927 16,399 24,877															-22,306
Dec-11 36.475 19.700															50,944
2013 27,240 22,967 -11,112 -13,022 16,233 61,232 16,177 42,246 0 150,900 10,1513 88,496 173,008 -14,271 2014 36,530 32,600 28,8															20,201
2014 30,330 34,047 16,453 15,965 13,948 53,988 32,956 49,999 0 188,941 30,544 68,123 146,047 170,097 13,136 13,048 13,04	2012	30,372								0					898
2015 32,889 28,380 -13,973 -10,980 15,200 57,968 27,133 49,703 0 183,048 88,481 81,616 170,097 13, 2017 22, 27, 22 11,142 -13,807 -20,978 -13,807 -14,408 56,859 -25,096 44,777 0 184,528 85,163 69,078 155,139 -20,007	2013	27,240	22,967	-11,112	-13,022	15,203	54,232	16,177	42,245	0	153,930	104,513	68,495	173,008	-19,079
2016 77,002 19,502 -9,332 -14,044 14,706 56,650 26,006 44,737 0 164,536 86,163 69,376 155,139 9, 2017 2018 22,975 30,459 -15,116 -46,500 11,376 40,641 11,485 37,214 0 131,656 82,641 71,561 154,202 18,000 27,2566 122,446 -39,000 12,377 30,459 -15,116 -46,500 11,376 40,641 11,485 37,214 0 0 131,656 80,002 72,566 122,446 -39,000										0					24,168
2017 26.472 26.114															13,549
2018 23,675 30,489 -15,116 -20,790 11,376 40,841 11,485 37,214 0 113,185 80,082 72,566 152,648 39, 2019 31,646 275,547 72,125 140,672 27,200 31,646 23,407 24,407															9,398
2019 34,673 59,381 24,891 24,812 10,883 45,891 37,877 44,686 0 1174,546 77,547 72,125 149,672 24, 24, 24, 24, 24, 24, 25, 22, 2166 11,853 51,766 27,981 46,089 0 10,2221 75,089 62,989 137,766 24, 24, 24, 24, 24, 24, 25, 25, 24, 24, 24, 25, 25, 24, 24, 24, 25, 25, 24, 24, 25, 25, 24, 24, 24, 25, 25, 24, 24, 24, 25, 25, 24, 24, 24, 25, 25, 24, 24, 24, 25, 25, 24, 24, 24, 25, 25, 24, 24, 24, 25, 25, 24, 24, 24, 25, 25, 24, 24, 24, 24, 24, 24, 24, 24, 24, 24															-18,606
2020															-39,463 24,874
2021 32.962 48.821 24.755 19.780 12.389 53.708 27.014 46.485 0 176.444 75.105 79.448 194.553 21.															24,074
2022 26,887 24,379 -12,010 -23,744 11,925 53,901 23,372 24,065 0 147,525 76,557 58,471 135,028 12, 2024 40,724 75,283 -36,577 -22,694 10,792 53,539 46,651 43,651 0 155,562 77,962 54,722 12,664 22,22 2024 40,724 75,283 -36,577 -22,694 10,792 53,539 46,651 43,678 0 205,566 79,387 57,366 136,753 72, 20,204 40,724 75,283 -36,577 -22,694 10,792 53,539 46,651 43,678 0 205,566 79,387 57,366 136,753 72, 20,204 22,207 23,619 24,224 21,324 2															21,891
2023															12,496
2024 40,274 75,283 38,287 22,2694 10,792 53,389 46,651 43,678 0 209,566 79,387 57,366 136,753 72, 2025 27,480 40,655 21,019 13,746 13,746 13,421 54,229 37,553 47,440 0 186,014 80,883 73,351 154,234 31, 2026 23,587 22,977 11,1408 144,901 13,519 53,415 23,944 46,272 0 157,506 81,702 68,195 149,987 77, 2027 26,549 22,277 11,862 2-2,653 12,205 50,383 15,705 40,744 0 161,197 81,880 67,633 148,913 12,205 22,205 22,207 22,207 23,247 11,862 2-2,653 12,205 50,383 15,705 40,252 0 131,466 81,970 64,291 146,261 144,203 12,205															22,877
2026 22,587 22,977 .11,408 .14,801 13,519 53,415 23,944 46,272 0 157,506 81,702 88,195 149,987 77,	2024									0					72,814
2027 28,949 42,243 21,778 -19,806 13,198 53,778 21,539 43,074 0 161,197 81,880 67,033 148,913 12,205 25,009 23,217 -11,882 -23,863 12,205 50,393 15,705 40,252 0 131,446 81,970 64,291 146,261 -14,2009 21,323 27,386 -13,984 -29,947 9,841 45,599 20,132 39,423 0 119,742 82,058 48,784 130,842 -11,2030 22,586 28,853 -14,869 -43,264 -5,004 37,923 167,78 38,508 41,829 133,228 82,147 46,201 123,348 44,2031 -2031 22,919 31,296 -16,408 -48,463 5,136 31,812 10,262 36,185 41,829 114,579 82,237 47,440 129,677 -15,203 -	2025	27,480	40,655	-21,019	-13,746	13,421	54,229	37,553	47,440	0	186,014	80,883	73,351	154,234	31,779
2028 25,009 23,217 11,682 22,8653 12,205 50,393 15,705 40,252 0 131,446 81,970 64,291 146,281 -14 2030 22,586 26,523 -14,659 43,264 5,004 37,923 16,778 36,008 41,829 133,228 82,147 46,201 128,348 41, 20,341 22,941 31,226 16,408 48,463 5,136 31,812 10,262 30,185 41,829 113,428 82,237 46,201 128,548 41, 20,322 25,108 33,883 -17,988 -50,122 31,151 27,293 51,636 40,134 41,829 154,903 82,236 48,581 130,907 23, 20,320 25,108 33,883 -17,988 -50,122 31,151 27,293 51,636 40,134 41,829 154,903 82,236 48,581 130,907 23, 20,334 33,444 40,056 -21,584 -47,218 3,825 33,505 32,093 41,930 41,829 157,930 82,208 50,142 132,650 25, 223 33,894 40,056 -21,584 -47,218 3,825 33,505 32,093 41,930 41,829 157,930 82,508 50,142 132,650 25, 20,338 33,300 55,777 29,928 -44,992 4,519 35,588 34,879 40,859 41,829 171,850 82,614 52,393 43,497 40,286 33,320 55,777 29,928 -44,992 4,519 35,588 34,879 40,859 41,829 177,658 82,614 52,383 314,997 33,643 33,605 47,414 22,592 42,156 4,510 38,847 36,939 41,920 177,658 82,615 53,269 155,874 41,829 120,404 41,829 177,899 82,615 53,269 155,874 41,829 120,404 41,829 177,698 82,615 53,269 155,874 41,829 120,404 41,829 177,698 82,615 53,269 155,674 41,829 120,404 41,829 177,698 82,615 53,269 155,674 41,829 120,404 41,829 177,698 82,615 53,269 155,674 41,829 120,404 41,829 177,698 82,615 53,269 155,674 41,829 120,404 41,829 177,698 82,615 53,269 155,674 41,829 120,404 41,829 120,404 41,829 120,404 41,829 120,404 41,829 120,404 41,829 120,404 41,829 120,404 41,829 120,404 41,829 120,404 41,829 120,404 41,829 120,404 41,829 120,404 41,829 120,404 41,829 120,404 41,829 120,404 41,8															7,518
2029 21,332 27,338 -13,984 -29,947 9,841 45,569 20,132 39,423 0 119,742 82,058 48,784 130,842 -11 2030 22,516 28,523 14,659 +43,264 5,004 37,923 36,165 41,829 114,579 82,237 47,440 122,647 -15 2032 22,108 33,863 11,988 50,122 3,151 27,233 51,636 41,829 114,579 82,237 47,440 122,647 -15 2033 26,792 34,226 -18,196 -48,863 3,096 28,738 19,854 37,627 41,829 125,102 82,417 49,336 131,803 -6,223 2034 33,494 41,829 13,284 44,182 33,804 18,326 +44,185 5,009 34,983 18,797 38,741 41,829 15,646 80,614 61,746 134,320 23,720 23,844 49,324 41,919 44,1829 17,689 82,614															12,283
2030 22,586 28,523 -114,659 -43,224 5,004 37,923 16,778 38,508 41,829 133,228 82,147 46,201 128,348 44, 2031 22,919 31,296 16,408 -48,483 5,136 31,815 12,229 36,185 41,829 114,579 82,237 47,440 129,677 -15 2032 25,108 33,863 -17,988 50,122 3,151 27,293 51,636 40,134 41,829 154,903 82,236 48,881 130,907 23, 2034 33,494 40,056 -21,584 47,218 38,255 33,505 32,093 41,930 41,829 157,930 82,508 50,142 132,650 25, 2034 23,3494 40,056 -21,584 47,218 38,255 33,505 32,093 41,930 41,829 157,930 82,508 50,142 132,650 25, 2036 33,330 55,777 -29,928 -44,992 4,519 35,588 34,879 40,859 41,829 174,850 82,514 51,706 134,320 37, 2037 28,812 39,062 -21,584 40,226 5,564 39,727 30,483 43,632 41,829 167,389 82,614 51,208 134,997 32, 2038 33,695 47,414 -25,592 42,136 43,017 4,494 37,783 34,934 41,829 177,058 82,614 51,706 134,320 37, 2037 28,812 39,062 -21,584 40,226 43,519 36,847 36,979 41,902 41,829 177,058 82,615 52,902 135,517 42,004 26,348 36,033 -20,556 44,04 40,44 37,783 34,936 34,936 39,895 41,829 177,989 82,615 52,902 135,584 41,020 42,040 26,348 36,033 -20,556 41,055 6,274 39,062 21,154 41,061 41,062 41,0															-14,814
2031 22,919 31,296 -16,408 -48,453 5,136 31,812 10,262 36,185 41,829 114,579 32,236 43,858 119,907 23,236 26,518 13,9097 23,236 26,518 13,9097 23,236 43,858 13,9097 23,232 26,792 34,226 -18,196 48,863 3,096 28,738 119,854 37,627 41,829 125,102 82,417 49,386 131,803 -6,233 43,239 41,829 125,102 82,417 49,386 131,803 -6,238 20,335 25,722 33,894 -16,326 -44,185 5,009 34,983 18,797 38,741 41,829 136,463 82,566 51,471 134,067 2,237 2037 28,812 39,002 -21,544 40,286 5,654 39,727 30,483 43,632 41,829 171,658 82,614 52,389 134,979 32,242 14,829 177,058 82,615 53,389 134,979 32,483 43,632 41,829 177,058															-11,100
2032 25.108 33.863 -17.988 5.01.22 31.51 27.293 51.636 40.134 41.829 15.102 82.417 49.386 130.907 23. 2033 26.792 34.226 -18.196 448.863 3.096 28.738 19.854 37.627 41.829 15.102 82.417 49.386 131.803 5-6. 2034 33.494 40.056 -21.584 47.218 3.825 33.505 32.093 41.930 41.829 157.930 82.508 50.142 132.650 25. 2035 25.722 33.894 -18.326 44.185 5.009 34.993 18.797 38.741 41.829 136.463 82.596 50.142 132.650 25. 2036 33.320 55.777 -29.928 44.992 45.19 39.727 30.483 34.852 41.829 177.880 82.614 51.706 134.320 37. 2037 28.812 39.092 -21.544 40.286 5.654 39.727 30.483 40.859 41.829 167.389 82.614 51.706 134.320 37. 2038 33.895 47.414 -25.982 42.136 45.10 38.847 36.579 41.902 41.829 177.088 82.614 52.383 134.997 22. 2039 36.410 57.046 -31.326 43.0177 4.494 37.783 34.938 39.895 41.829 177.088 82.615 52.992 135.844 44. 2040 28.348 36.033 -20.506 -41.055 6.274 39.052 21.135 41.991 41.829 157.077.898 82.615 52.992 135.551 42.204 22.824 33.854 13.8565 -18.763 48.679 2.2555 32.720 54.763 44.455 41.829 170.977.82 82.615 52.902 135.678 42.004 28.843 33.654 -18.763 48.679 2.2555 32.720 54.763 44.455 41.829 170.977.82 82.615 52.004 136.789 136.789 14.902 44.1829 170.977.88 82.617 53.674 136.289 14.204 22.824 22.825 23.720 54.763 44.455 41.829 170.977.88 82.617 54.515 136.789 14.829 12.204 28.873 33.572 19.008 49.897 16.18 30.512 28.853 37.603 41.829 170.977 82.616 54.511 136.788 14.829 12.004 28.843 33.654 18.763 48.697 16.18 30.512 28.853 37.603 41.829 170.977 82.616 55.457 137.748 -5. 2041 28.243 28.243 33.572 19.008 49.8997 16.18 30.512 28.853 37.603 41.829 170.977 82.618 55.457 137.748 -5. 2042 28.6723 33.197 18.713 51.477 2.266 27.970 21.875 39.722 44.1829 120.040 82.618 55.457 137.748 -5. 2046 21.255 22.074 41.2285 50.523 3.800 24.680 7.664 35.564 41.829 120.040 82.618 55.457 139.041 138.649 14.829 120.040 82.618 55.457 139.041 138.649 14.829 120.040 82.618 55.457 139.041 138.649 14.829 120.040 82.618 55.457 139.041 138.649 14.829 120.040 82.618 55.457 139.041 138.040 14.829 120.040 82.618 55.457 139.041 14.829 120.040 82.618															4,880 -15.098
2033 26,792 34,226 -18,196 -48,863 3,096 22,738 19,854 37,627 41,829 157,930 82,508 50,142 132,550 25 2035 25,722 33,894 -41,856 5,009 34,933 18,797 38,741 41,829 157,930 82,598 50,142 132,650 25 2036 25,722 33,894 -48,185 5,009 34,933 18,797 48,899 41,829 177,850 82,614 51,706 134,430 22,812 39,002 -21,544 -40,286 5,654 38,727 30,483 43,632 41,829 167,389 82,614 51,706 134,397 33,340 41,829 167,389 82,614 52,833 134,997 32,28 2038 33,685 47,414 -25,882 -42,136 4,510 38,847 36,879 41,829 177,938 82,615 52,202 135,517 29,938 44,002 86,747 43,849 37,723 34,833 43,836 39,885															23,996
2034 33,494 40,056 -21,584 -47,218 3,825 33,505 32,093 41,930 41,829 157,390 82,508 50,142 132,650 25. 2035 25,722 33,894 -16,326 -44,185 5,009 34,993 18,797 33,741 41,829 136,463 82,598 51,471 134,067 2,2 2036 33,320 55,777 -29,928 -44,992 4,519 35,588 34,879 40,859 41,829 171,850 82,614 51,706 134,320 37. 22,812 39,082 -21,544 -40,286 5,684 39,727 30,483 43,632 41,829 177,850 82,614 52,383 134,997 32. 2038 33,695 47,414 -25,982 -42,136 4,510 38,847 36,979 41,902 41,829 177,058 82,615 53,329 135,884 41. 2039 36,410 57,046 -31,326 -43,077 4,494 37,793 34,936 39,885 41,829 177,058 82,615 52,902 135,517 42. 2040 26,348 36,033 -20,506 -41,055 6,274 39,052 21,135 41,961 41,829 151,072 82,615 53,864 136,289 14,924 12,944 12,9															-6,700
2035 25,722 33,894 -18,326 -44,185 5,009 34,983 18,797 38,741 41,829 136,463 82,596 51,471 134,067 2,2037 28,812 39,082 -21,544 -40,286 5,654 39,727 30,483 43,632 41,829 171,898 82,614 51,706 134,329 37,72 30,483 34,985 41,829 177,098 82,614 52,383 134,997 32,383 38,985 41,829 177,098 82,615 53,269 135,844 41,220 37,343 41,829 41,															25,280
2036 33,320 55,777 -29,928 -44,992 4,519 35,588 34,879 40,859 41,829 171,850 82,614 51,706 134,320 37, 22,812 39,982 -21,544 40,286 5,554 39,727 30,483 43,632 41,829 167,389 82,614 52,383 134,997 32, 20,383 33,695 47,414 -25,982 -42,136 4,510 38,847 36,979 41,902 41,829 177,058 82,615 53,269 135,884 41, 20,39 36,410 57,046 -31,326 -43,077 4,494 37,783 34,936 39,895 41,829 177,989 82,615 52,902 135,517 42, 20,40 25,346 36,033 -20,506 41,055 6,274 39,052 21,135 41,961 41,829 151,072 82,615 53,674 136,289 14, 20,41 29,843 33,654 -18,763 46,879 2,355 32,720 54,763 41,855 41,829 170,977 82,617 54,151 136,768 34, 20,41 29,843 33,654 -18,763 46,879 2,355 32,720 54,763 41,455 41,829 170,977 82,617 54,151 136,768 34, 20,42 26,723 33,572 19,008 49,597 1,618 30,312 28,853 37,603 41,829 131,905 82,618 54,700 137,318 -5, 20,43 23,801 23,321 33,197 18,713 51,477 2,266 27,970 21,875 39,722 41,829 120,040 82,618 55,125 137,743 -11 2,045 24,686 32,765 18,516 48,665 3,376 30,087 17,898 39,166 41,829 122,625 82,618 56,031 138,649 -16 20,46 21,255 23,014 12,285 50,523 3,880 24,690 7,654 35,564 41,829 114,566 82,620 57,408 140,091 20,44 23,372 21,377 21,827 -11,394 -46,533 6,062 29,088 11,489 38,061 41,829 114,566 82,620 57,401 139,044 -20,42 20,42 20,42 20,43 22,601 13,602 -10,196 40,099 7,206 36,631 7,703 35,924 41,829 114,566 82,620 57,401 140,091 22,205 29,013 41,226 20,523 41,829 114,566 82,620 57,401 140,091 22,206 22,907 44,095 5,032 33,803 40,439 39,339 41,829 114,566 82,620 57,401 140,091 22,206 22,907 44,095 5,032 33,803 40,439 39,339 41,829 114,566 82,620 57,401 140,091 22,206 22,907 44,095 5,032 33,803 40,439 39,339 41,829 114,566 82,620 57,401 140,091 22,206 22,907 44,095 5,032 33,803 40,439 39,339 41,829 114,566 82,620 57,401 140,091 22,206 22,907 44,095 5,032 33,803 40,439 39,339 41,829 114,566 82,620 57,401 140,091 22,206 22,907 44,206 -20,007 44,309 6,644 35,944 7,723 35,996 41,829 114,566 82,620 57,401 140,091 42,206 22,007 44,203 32,404 43,803 6,987 41,829 114,829 114,529 124,800 82,600 59,043 141,691 42,206 22,6															2,395
2038 33,695 47,414 -25,982 -42,136 4,510 38,847 36,979 41,902 41,829 177,058 82,615 53,269 135,884 41,22 2039 36,410 57,046 -31,326 -43,077 4,494 37,783 34,936 39,895 41,829 177,989 82,615 52,202 135,517 42 2040 26,348 36,033 -20,506 -41,055 6,274 39,052 21,135 41,961 41,829 151,072 82,615 53,674 136,289 14, 2041 29,643 33,654 -16,763 -46,879 2,355 32,720 54,763 41,829 179,977 32,617 54,151 136,768 34, 2043 23,601 32,583 -18,441 -50,819 2,021 28,839 27,490 39,518 41,829 126,630 82,618 55,425 137,743 -11 2045 24,886 32,765 -18,516 -48,666 3,376 30,087															37,530
2039 36,410 57,046 -31,326 -43,077 4,494 37,783 34,936 39,895 41,829 177,999 82,615 52,902 135,517 42, 2040 26,348 36,033 -20,506 -41,055 6,274 39,052 21,135 41,961 41,829 151,072 82,615 53,674 136,289 14, 2041 29,843 33,654 -18,763 -46,879 2,355 32,720 54,763 41,455 41,829 170,977 82,617 54,151 136,768 34, 2042 26,723 33,572 -19,008 -49,597 1,618 30,312 28,853 37,603 41,829 131,905 82,618 54,700 137,318 -5, 2043 23,601 32,593 -18,411 -50,819 2,021 28,839 27,490 39,518 41,829 131,905 82,618 55,125 137,743 -11 2044 23,372 33,197 -18,713 -51,477 2,266 27,970 21,875 39,722 41,829 120,040 82,618 55,487 138,105 -18 2045 24,686 32,765 -18,516 -48,665 3,376 30,087 17,888 39,166 41,829 122,625 82,618 56,487 138,105 -18 2046 21,255 23,074 -12,285 -50,523 3,880 24,690 7,654 35,564 41,829 95,137 82,620 56,441 139,061 -43 2047 24,137 21,827 -11,394 -46,533 6,062 29,088 11,489 38,061 41,829 114,566 82,620 56,771 139,337 -24 2049 27,009 42,206 -23,037 -44,995 5,032 33,803 40,439 39,339 41,829 114,566 82,620 56,717 139,337 -24 2049 27,009 42,206 -23,037 -44,995 5,032 33,803 40,439 39,339 41,829 114,566 82,620 56,711 140,031 22,2050 23,841 19,602 -10,196 -40,059 7,206 36,631 7,703 35,924 41,829 114,566 82,620 58,91 140,712 -18 2051 40,279 54,789 -30,301 -45,114 3,358 28,412 71,922 41,964 41,829 207,139 82,620 58,91 140,711 66,205 23,831 18,813 -9,643 -40,197 -40,835 37,704 25,092 37,959 41,829 115,809 82,620 58,91 140,711 66,205 23,631 24,759 15,662 -7,674 -41,826 7,002 37,949 10,171 37,151 41,829 114,829 114,829 114,829 114,829 114,829 114,829 114,829 114,829 114,829 114,829 114,829		28,812	39,082						43,632		167,389				32,392
2040 26,348 36,033 -20,506 -41,055 6,274 39,052 21,135 41,961 41,829 151,072 82,615 53,674 136,289 14 2041 29,843 33,654 -18,763 -46,879 2,355 32,720 54,763 41,455 41,829 170,977 82,617 54,151 136,768 34,204 26,723 33,572 -19,008 -49,597 1,618 30,312 28,853 37,603 41,829 131,905 82,618 54,700 137,318 -5,204 20,301 32,593 -18,441 -50,819 2,021 28,839 27,490 39,518 41,829 120,040 82,618 55,125 137,743 -11 2044 23,372 33,197 -18,516 -48,665 3,376 30,087 17,898 39,166 41,829 120,040 82,618 56,031 138,059 -16 2046 21,255 23,074 -12,285 -30,043 -44,865 3,376 30,087 17,898 39,166 41,829															41,175
2041 29,843 33,654 -18,763 -46,879 2,355 32,720 54,763 41,455 41,829 170,977 82,617 54,151 136,768 34,202 2042 26,723 33,572 -19,008 -49,597 1,618 30,312 28,853 37,603 41,829 126,630 82,618 54,700 137,318 -5,204 2043 23,601 32,593 -18,441 -50,819 2,021 28,839 27,490 39,518 41,829 126,630 82,618 55,125 137,743 -11 2044 23,372 33,197 -18,713 -51,477 2,266 27,970 21,875 39,722 41,829 120,604 82,618 56,031 138,105 -18 2045 24,686 32,765 -18,516 -48,665 3,376 30,087 17,898 39,166 41,829 120,605 82,618 56,031 138,069 -16 2046 21,255 23,074 -12,285 -50,523 3,880															42,473
2042 26,723 33,572 -19,008 -49,597 1,618 30,312 28,853 37,603 41,829 131,905 82,618 54,700 137,318 -5,203 2043 23,601 32,593 -18,441 -50,819 2,021 28,839 27,490 39,518 41,829 126,630 82,618 55,125 137,743 -11 2044 23,372 33,197 -18,173 -51,477 2,266 27,970 21,875 39,722 41,829 120,040 82,618 55,487 138,105 -18 2045 24,686 32,765 -18,616 -48,665 3,376 30,087 17,898 39,166 41,829 122,625 82,618 56,031 138,649 -16 2047 24,137 21,827 -11,394 -46,533 3,880 24,690 7,654 35,564 41,829 95,137 38,664 14,829 2043 23,623 21,219 -11,029 -44,330 6,769 32,877 8,558															14,783
2043 23,601 32,593 -18,441 -50,819 2,021 28,839 27,490 39,518 41,829 126,630 82,618 55,125 137,743 -11 2044 23,372 33,197 -18,713 -51,477 2,266 27,970 21,875 39,722 41,829 120,040 82,618 55,487 138,105 -18 2045 24,686 52,765 -18,516 -48,665 33,376 30,087 17,898 39,166 41,829 122,625 82,618 56,031 138,649 -16 2046 21,255 23,074 -12,285 -50,523 3,880 24,690 7,654 35,564 41,829 95,137 82,620 56,441 139,061 -43 2047 24,137 21,827 -11,394 -46,533 6,062 29,088 11,489 38,061 41,829 114,566 82,620 56,717 139,337 -24 2048 23,623 21,219 -11,029 -44,330 6,769 32,877 8,558 37,673 41,829 117,188 82,620 57,408 140,028 -22 2049 27,009 42,206 -23,037 -44,095 5,032 33,803 40,439 39,339 41,829 162,524 82,620 57,411 140,031 22, 2050 23,841 19,602 -10,196 -40,059 7,206 36,631 7,703 35,924 41,829 122,480 82,620 58,091 140,711 66, 2051 40,279 54,789 -30,301 -45,114 3,358 28,412 71,922 41,964 41,829 122,480 82,620 58,272 140,892 5, 2053 24,579 15,682 -7,874 -41,826 7,002 37,949 10,171 37,151 41,829 115,869 82,617 58,692 141,309 -25 2055 22,891 18,813 9,643 -40,197 5,851 37,704 25,092 37,959 41,829 116,662 82,618 58,372 140,990 -25 2055 20,54 22,080 20,179 -10,443 -43,803 6,964 35,944 7,723 35,396 41,829 115,869 82,617 58,692 141,309 -25 2055 22,899 18,236 -9,037 -41,850 -43,836 39,857 39,277 41,829 115,869 82,617 58,692 141,309 -25 2055 22,899 18,236 -9,037 -41,250 -43,836 39,850 11,480 38,850 11,480 38,192 41,829 115,869 82,617 58,692 141,309 -25 2056 22,899 18,236 -9,037 -44,655 5,981 35,501 10,281 34,987 41,829 115,849 115,869 82,617 58,692 141,309 -25 2056 22,899 18,236 -9,037 -44,655 5,981 35,501 10,281 34,987 41,829 117,423 82,608 59,043 141,651 -24 2056 20,805 26,577 14,022 49,811 5,591 31,210 6,960 34,716 41,829 117,423 82,608 59,043 141,651 -24 2059 20,805 26,577 14,022 49,811 5,591 31,210 6,960 34,716 41,829 110,855 82,607 59,223 141,800 -37 2060 31,935 49,792 -27,315 -50,042 4,203 32,430 43,545 38,832 41,829 165,509 82,606 58,946 141,155 23,800 32,400 32,400 32,400 32,400 32,400 32,400 34,545 38,832 41,829 165,509 82,606 5															34,208
2044 23,372 33,197 -18,713 -51,477 2,266 27,970 21,875 39,722 41,829 120,040 82,618 55,487 138,105 -18 2045 24,686 32,765 -18,516 -48,665 3,376 30,087 17,898 39,166 41,829 122,625 82,618 56,031 138,649 -16 2046 21,255 23,074 -12,285 -50,523 3,880 24,690 7,654 35,564 41,829 95,137 82,620 56,441 139,061 -43 2047 24,137 21,827 -11,394 -46,533 6,062 29,088 11,489 38,061 41,829 114,566 82,620 56,717 139,337 -24 2048 23,623 21,219 -11,029 -44,330 6,769 32,877 8,558 37,673 41,829 117,188 82,620 57,408 140,028 -22 2049 27,009 42,206 -23,037 -44,095 5,032 33,803 40,439 39,339 41,829 162,524 82,620 57,411 140,031 22 2050 23,841 19,602 -10,196 -40,059 7,206 36,631 7,703 35,924 41,829 122,480 82,620 58,092 140,712 -18 2051 40,279 54,789 -30,301 -45,114 3,358 28,412 71,922 41,964 41,829 207,139 82,620 58,091 140,711 66, 2052 29,013 18,813 -9,643 -40,197 5,851 37,704 25,092 37,959 41,829 115,869 82,617 58,692 141,309 -25 2053 24,579 15,682 -7,874 -41,826 7,002 37,949 10,171 37,151 41,829 124,662 82,618 58,372 140,990 -16 2054 22,080 20,179 -10,443 -43,803 6,964 35,944 7,723 35,396 41,829 115,869 82,617 58,692 141,309 -25 2056 27,627 26,932 -14,269 -43,533 5,657 39,562 21,030 39,857 41,829 158,119 82,617 58,692 141,309 -25 2058 23,115 24,762 -12,967 -46,065 5,981 35,501 10,281 34,987 41,829 117,849 117,849 82,606 58,946 141,552 23, 2060 31,935 49,792 -27,315 -50,042 4,203 32,430 43,545 38,832 41,829 165,209 82,606 58,946 141,552 23,															-5,412 -11,112
2045 24,686 32,765 -18,516 -48,665 3,376 30,087 17,898 39,166 41,829 122,625 82,618 56,031 138,649 -16 2046 21,255 23,074 -12,285 -50,523 3,880 24,690 7,654 35,564 41,829 95,137 82,620 56,441 139,061 -43,20 24,137 21,827 -11,394 -46,533 6,062 29,088 11,489 38,061 41,829 95,137 82,620 56,717 139,337 -24 2048 23,623 21,219 -11,029 -44,330 6,769 32,877 8,558 37,673 41,829 117,188 82,620 57,408 140,028 -22 2049 27,009 42,206 -23,037 -44,095 5,032 33,803 40,439 39,339 41,829 117,188 82,620 57,411 140,031 22,200 23,841 19,602 -10,196 -40,059 7,206 36,631 7,703 35,924 41,829 <td< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>-11,112</td></td<>															-11,112
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2047 24,137 21,827 -11,394 -46,533 6,062 29,088 11,489 38,061 41,829 114,566 82,620 56,717 139,337 -24 2048 23,623 21,219 -11,029 -44,330 6,769 32,877 8,558 37,673 41,829 117,188 82,620 57,408 140,028 -22 2049 27,009 42,206 -23,037 -44,095 5,032 33,803 40,439 39,339 41,829 117,188 82,620 57,408 140,028 -22 2050 23,841 19,602 -10,196 -40,059 7,206 36,631 7,703 35,924 41,829 122,480 82,620 58,092 140,712 -18 2051 40,279 54,789 -30,301 -45,114 3,358 28,412 71,922 41,964 41,829 207,139 82,620 58,091 140,711 66 2052 29,013 18,813 -9,643 -40,197 5,851 <td< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>-43,923</td></td<>															-43,923
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2049 27,009 42,206 -23,037 -44,095 5,032 33,803 40,439 39,339 41,829 162,524 82,620 57,411 140,031 22,050 2050 23,841 19,602 -10,196 -40,059 7,206 36,631 7,703 35,924 41,829 122,480 82,620 58,092 140,712 -18 2051 40,279 54,789 -30,301 -45,114 3,358 28,412 71,922 41,964 41,829 207,139 82,620 58,091 140,711 66, 2052 29,013 18,813 -9,643 -40,197 5,851 37,704 25,092 37,959 41,829 146,422 82,620 58,272 140,892 59,203 24,579 15,682 -7,874 -41,826 7,002 37,949 10,171 37,151 41,829 124,662 82,618 58,372 140,899 -16 2054 22,080 20,179 -10,443 -43,803 6,964 35,944 7,723 35,36	2048	23,623	21,219	-11,029	-44,330	6,769	32,877	8,558	37,673	41,829	117,188	82,620	57,408	140,028	-22,840
2051 40,279 54,789 -30,301 -45,114 3,358 28,412 71,922 41,964 41,829 207,139 82,620 58,091 140,711 66, 2052 29,013 18,813 -9,643 -40,197 5,851 37,704 25,092 37,959 41,829 146,422 82,620 58,272 140,892 5, 2053 24,579 15,682 -7,874 -41,826 7,002 37,949 10,171 37,151 41,829 124,662 82,618 58,772 140,990 -16 2054 22,080 20,179 -10,443 -43,803 6,964 35,944 7,723 35,396 41,829 115,869 82,617 58,692 141,309 -25 2055 30,586 31,690 -16,855 -47,232 4,071 34,896 39,857 39,277 41,829 158,119 82,617 58,762 141,379 16, 2056 27,627 26,932 -14,269 -43,533 5,657 <td< td=""><td></td><td>27,009</td><td>42,206</td><td>-23,037</td><td>-44,095</td><td>5,032</td><td>33,803</td><td>40,439</td><td>39,339</td><td>41,829</td><td>162,524</td><td>82,620</td><td>57,411</td><td>140,031</td><td>22,493</td></td<>		27,009	42,206	-23,037	-44,095	5,032	33,803	40,439	39,339	41,829	162,524	82,620	57,411	140,031	22,493
2052 29,013 18,813 -9,643 -40,197 5,851 37,704 25,092 37,959 41,829 146,422 82,620 58,272 140,892 5,1 2053 24,579 15,682 -7,874 -41,826 7,002 37,949 10,171 37,151 41,829 124,662 82,618 58,372 140,990 -16 2054 22,080 20,179 -10,443 -43,803 6,964 35,944 7,723 35,396 41,829 115,869 82,617 58,692 141,309 -25 2055 30,586 31,690 -16,855 -47,232 4,071 34,896 39,857 39,277 41,829 158,119 82,617 58,7692 141,379 -16 2056 27,627 26,932 -14,269 -43,533 5,657 39,562 21,030 39,092 41,829 143,927 82,614 58,737 141,351 2,4 2057 22,899 18,236 -9,037 -41,950 7,348 <t< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>-18,230</td></t<>															-18,230
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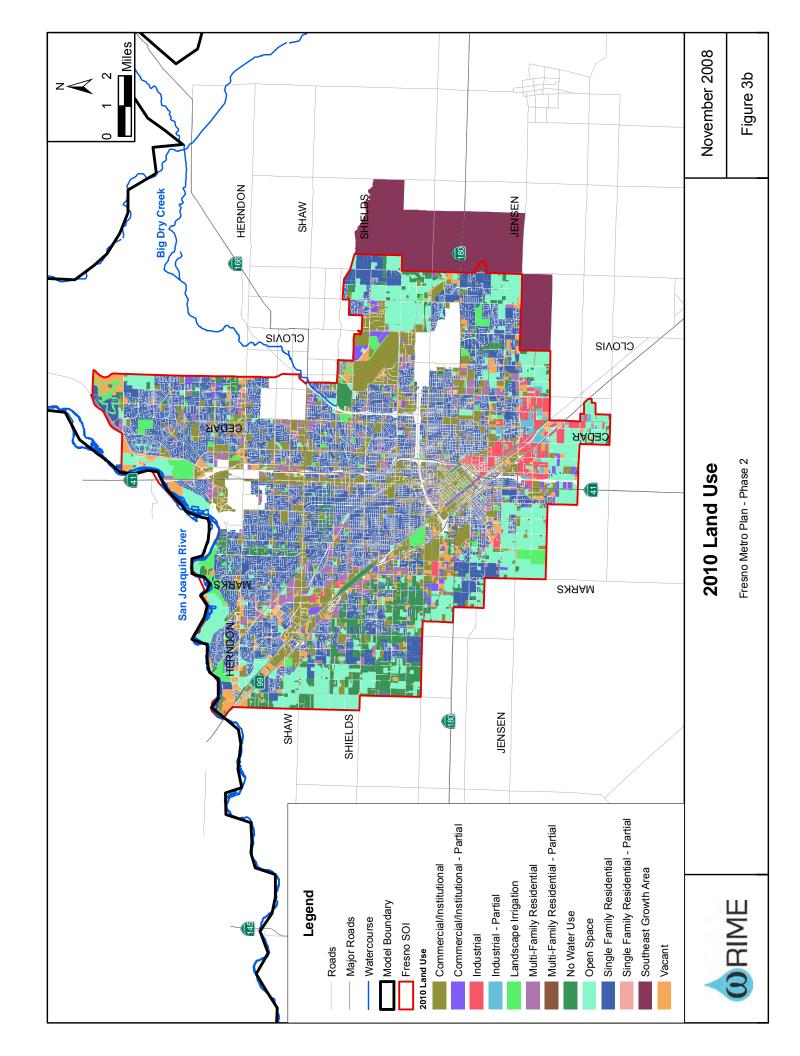
increased capacity of 30 MGD in the northeast SWTF and 10% water conservation implementation. In the multiple wet years period increased groundwater recharge of new water supply of 35 TAF results in a 21 TAF of additional storage over baseline conditions. The projects implemented produced a sustainable balanced groundwater table under increasing urban water demands from 2005 to 2060.

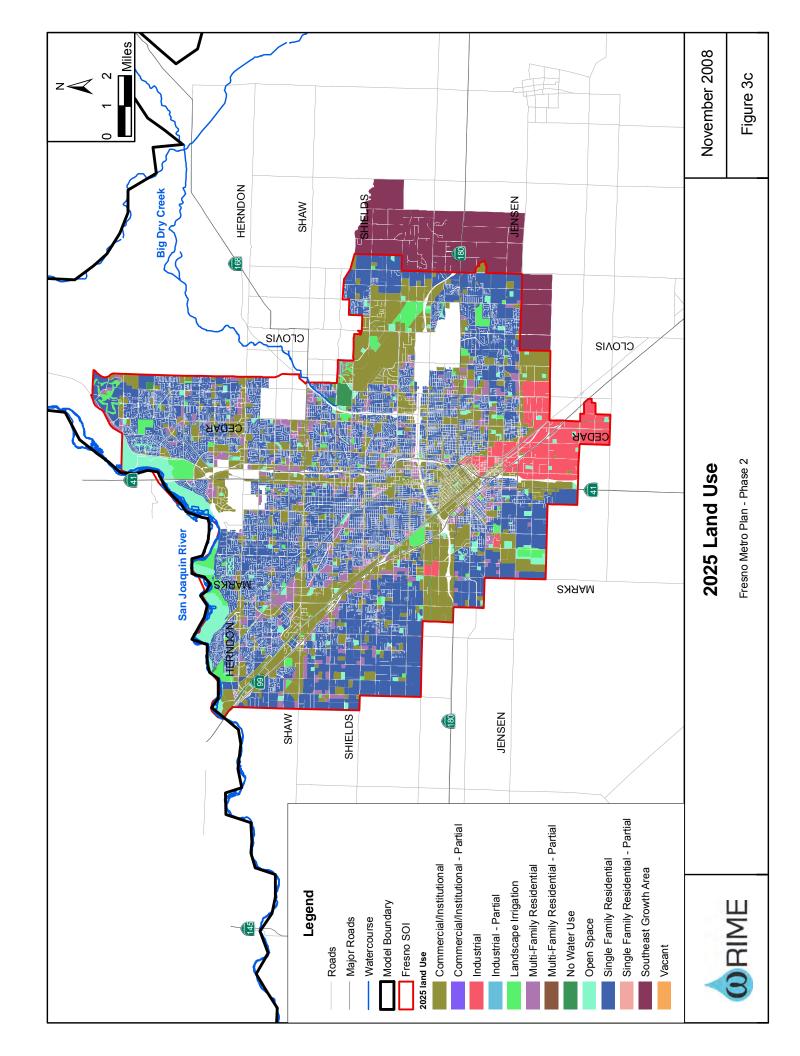


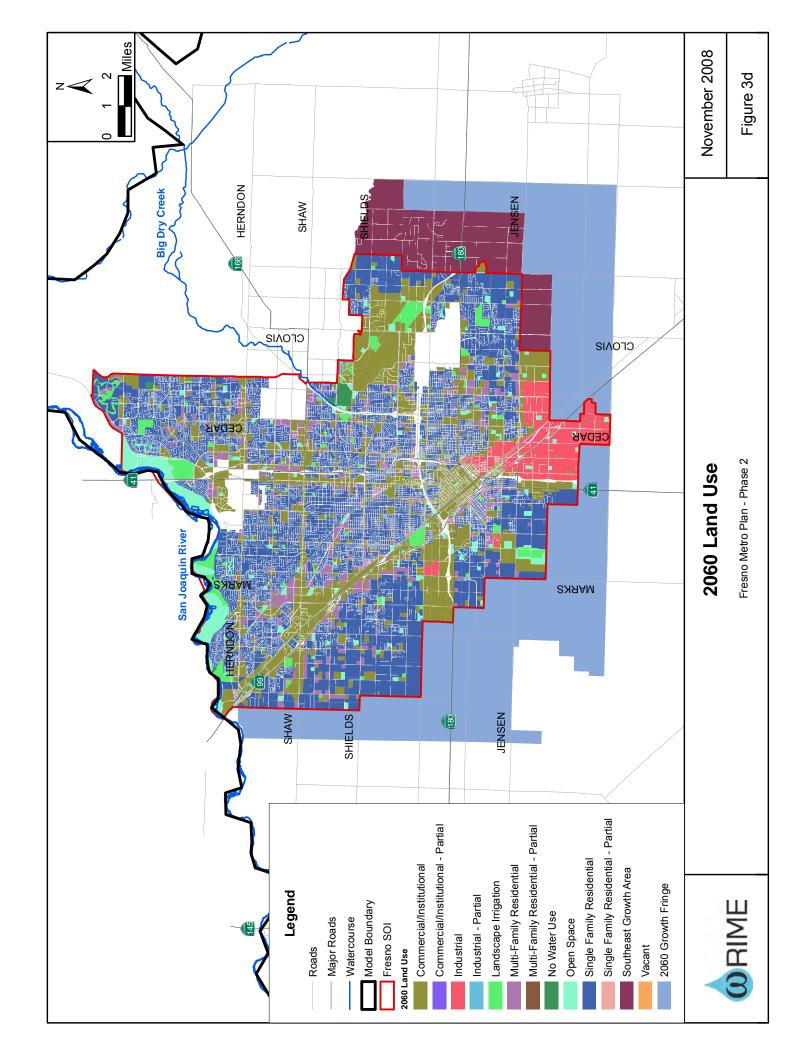


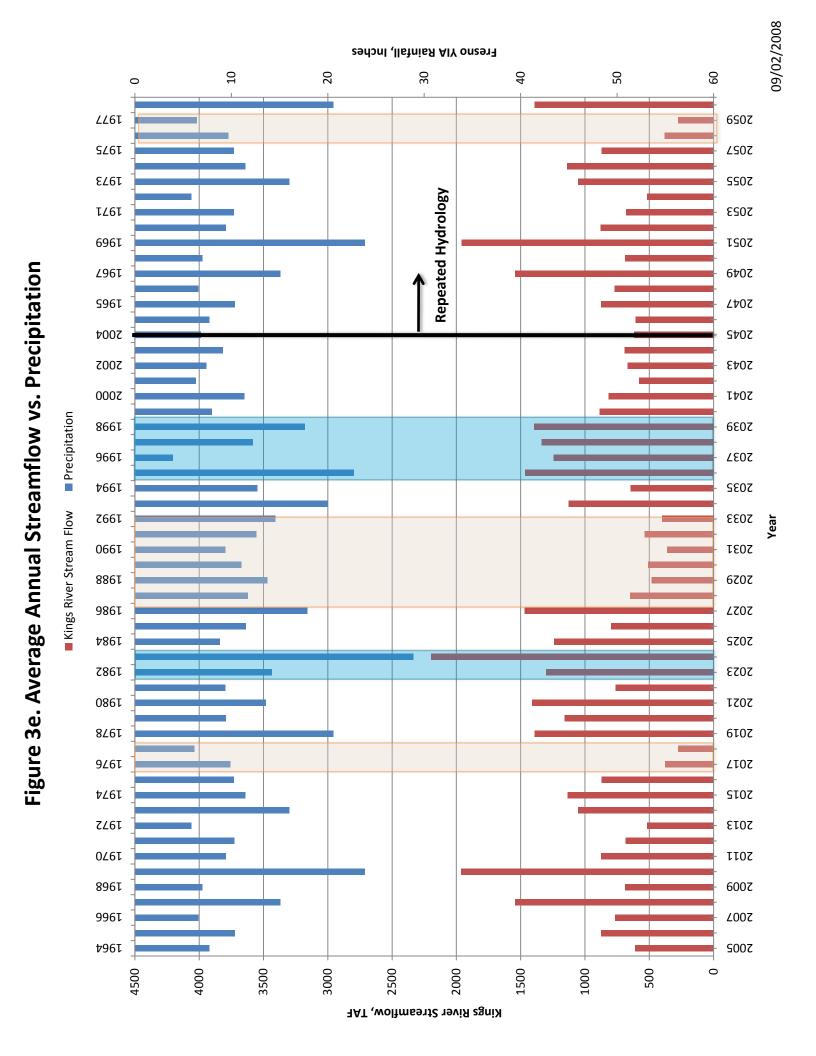


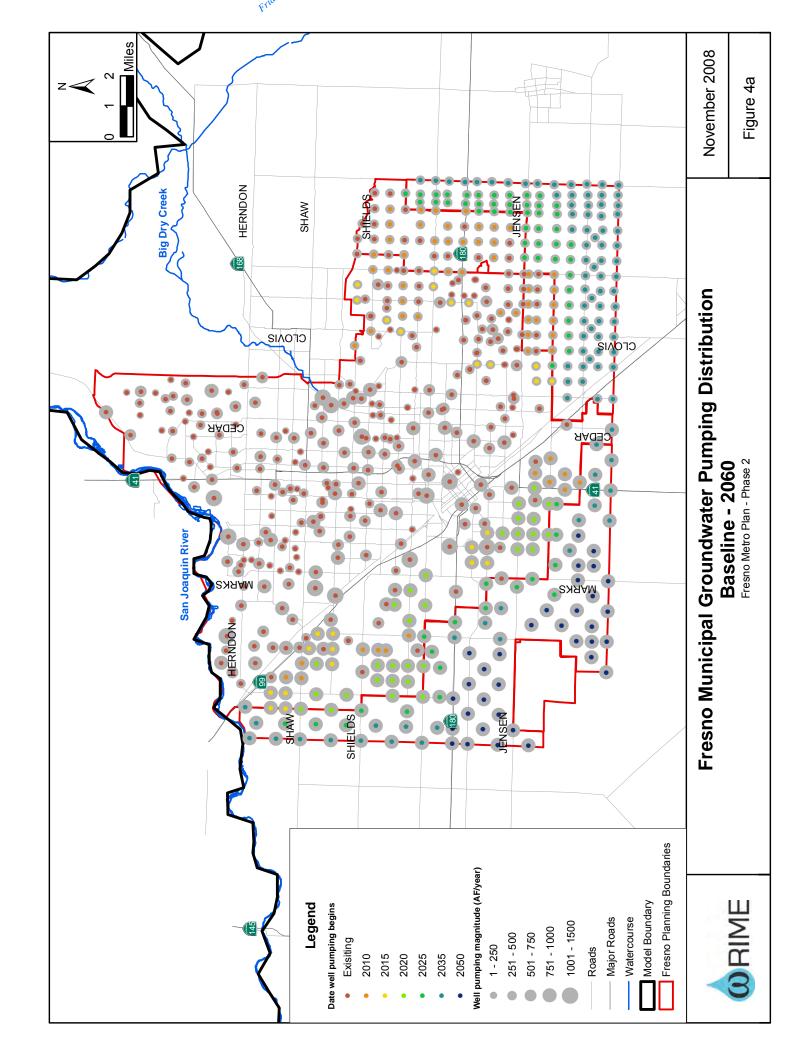


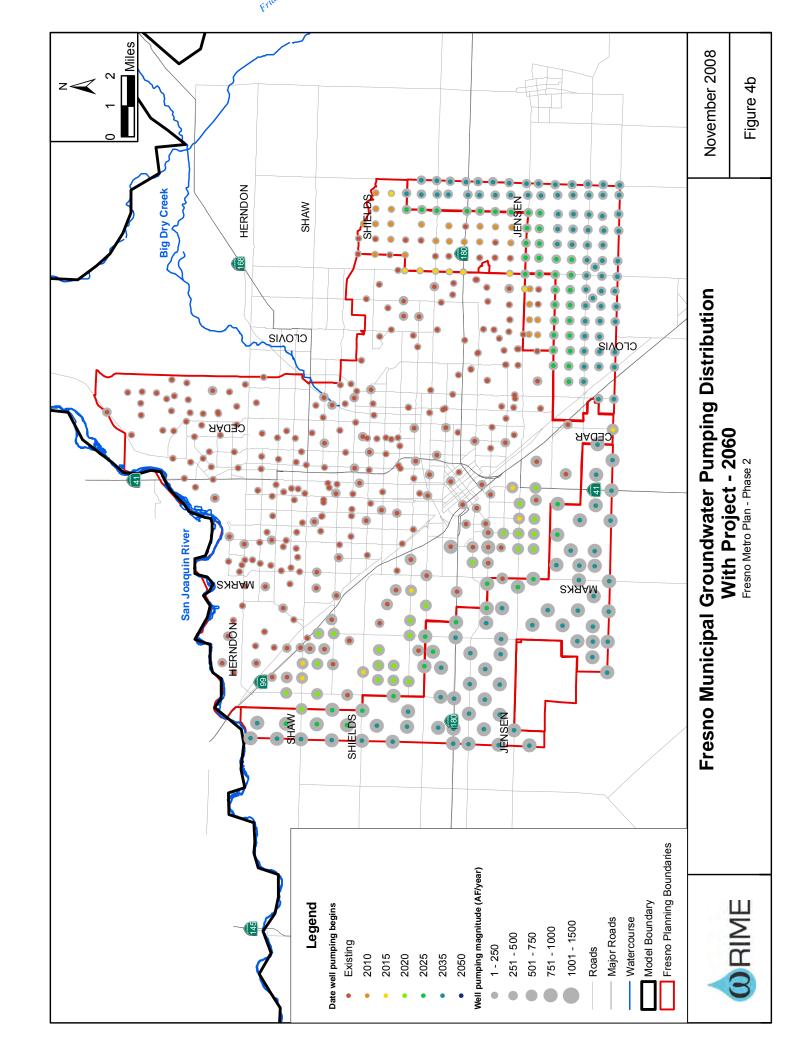


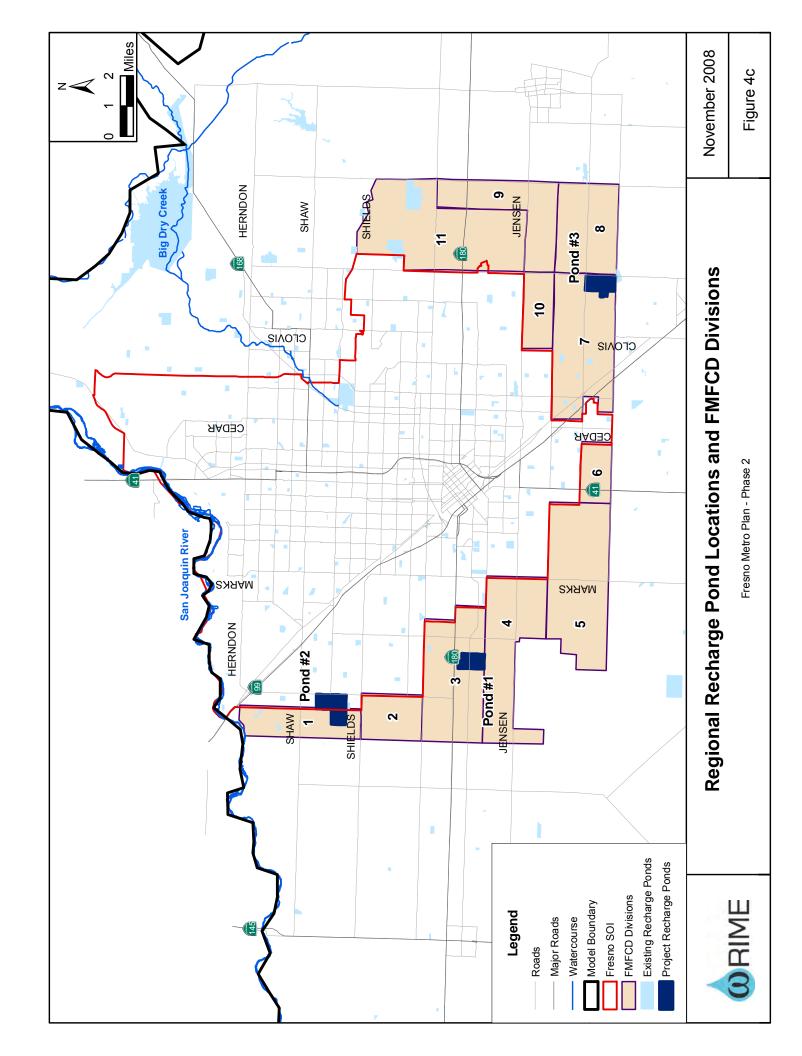


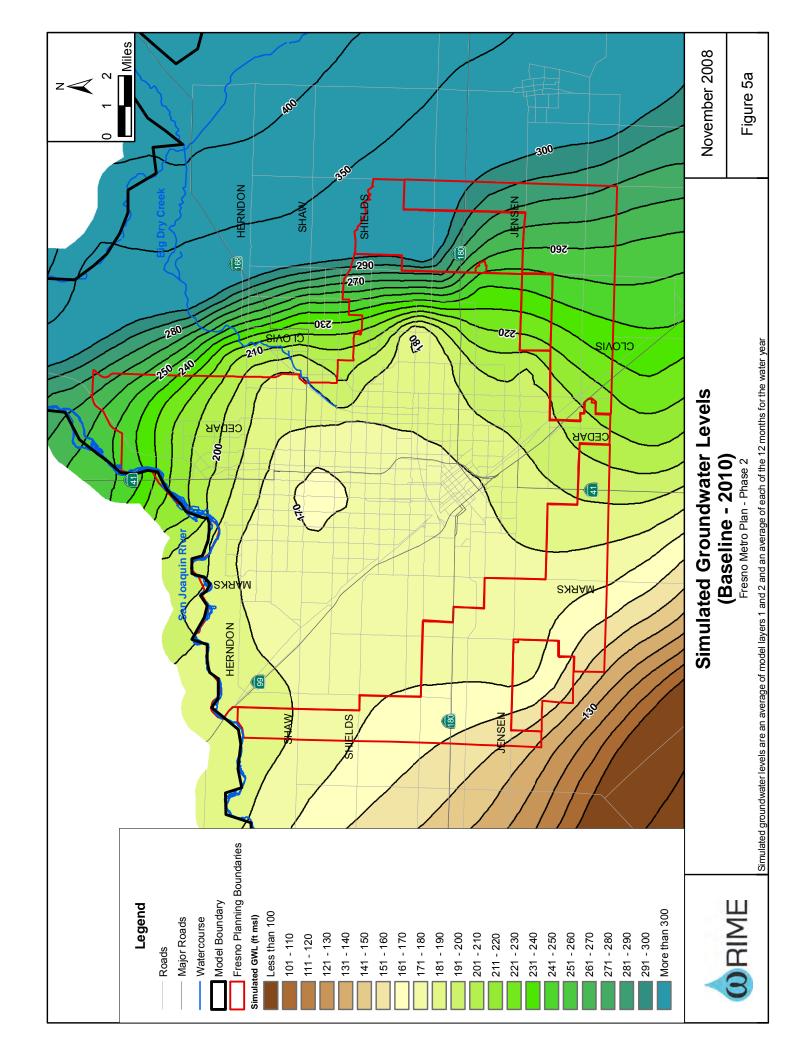


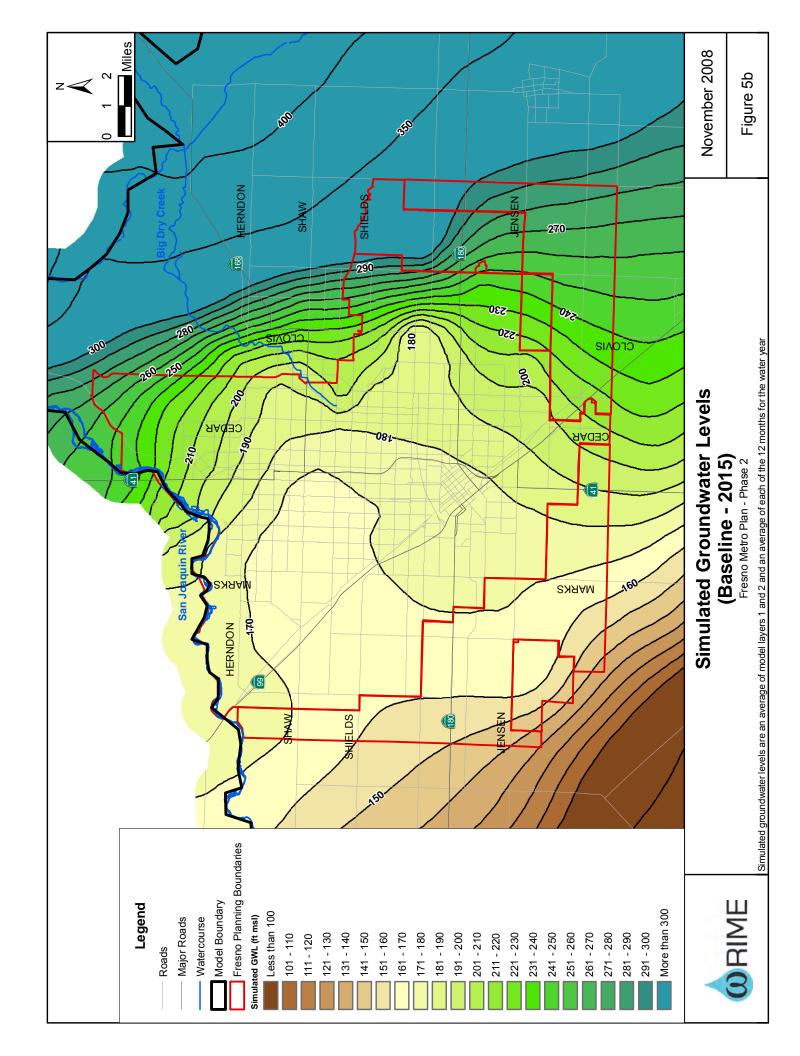


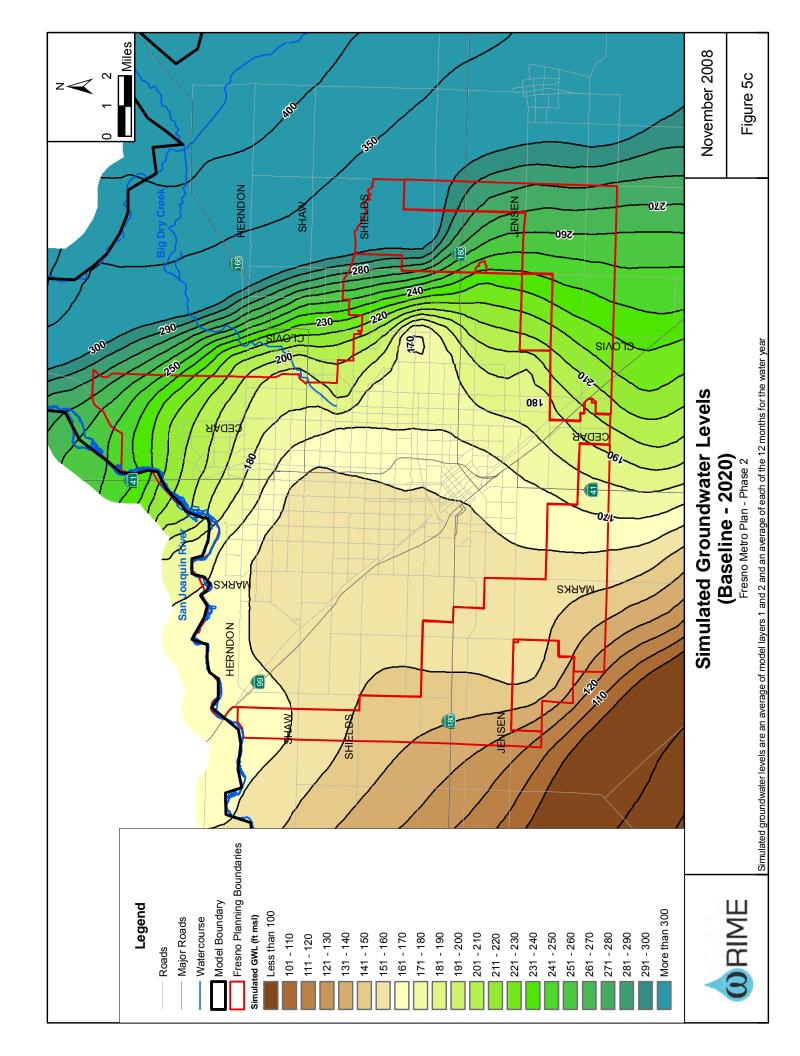


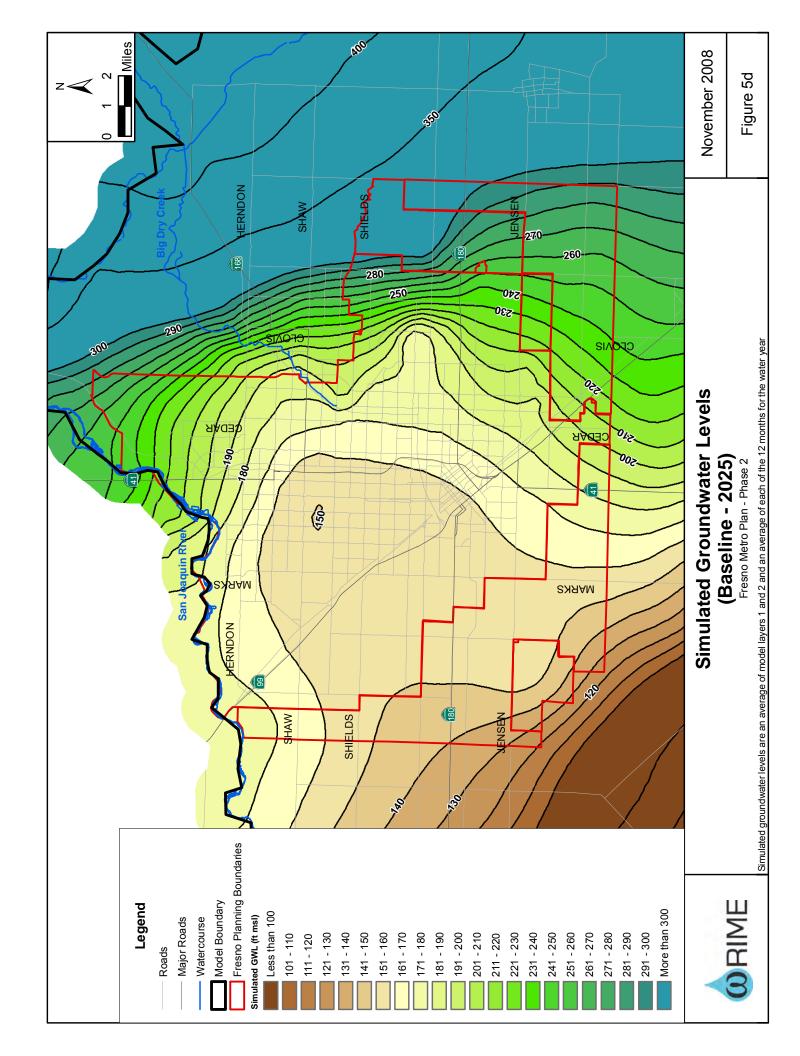


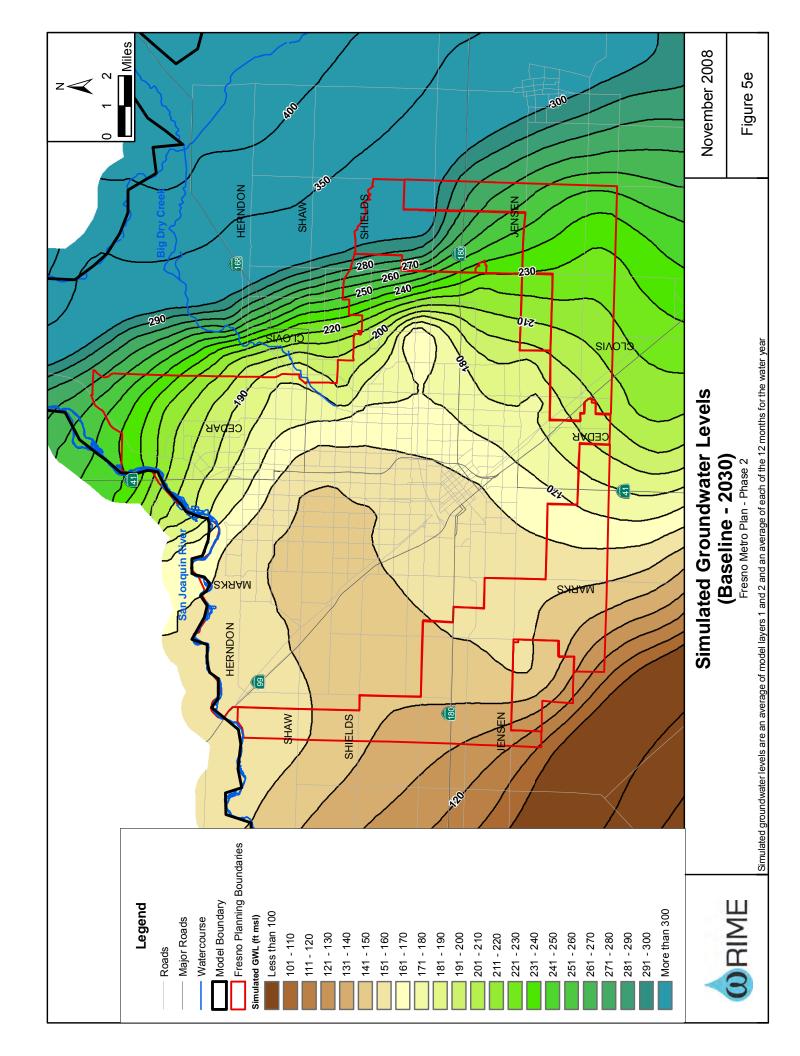


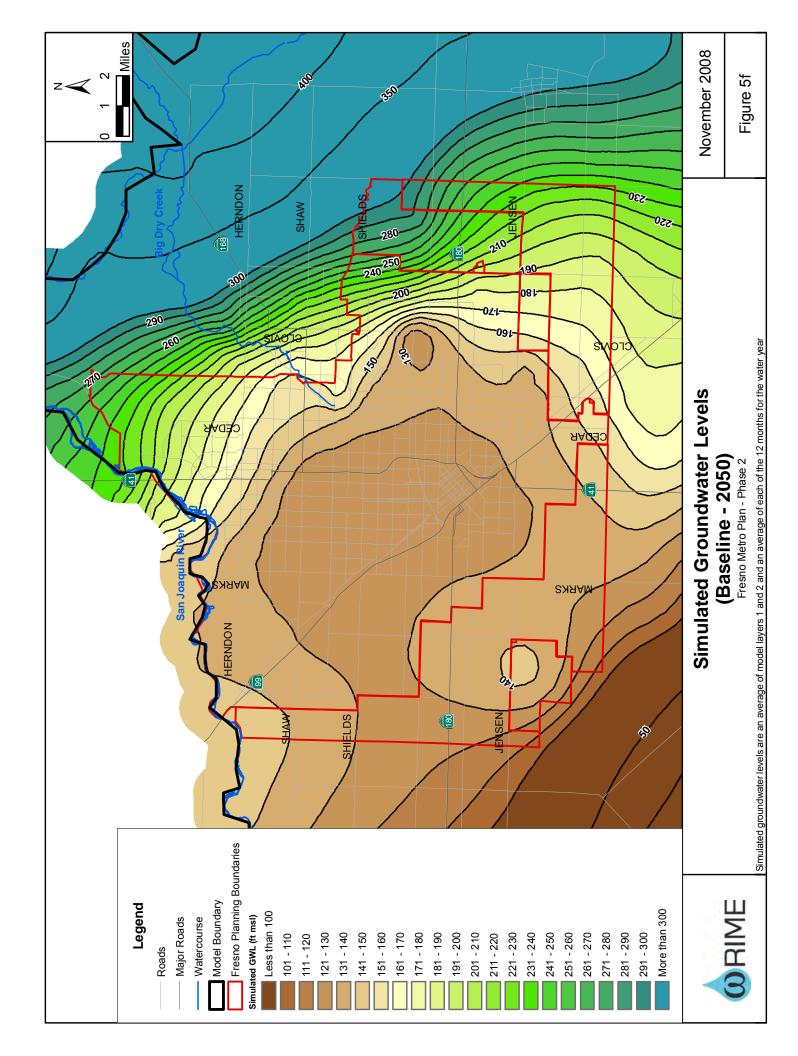


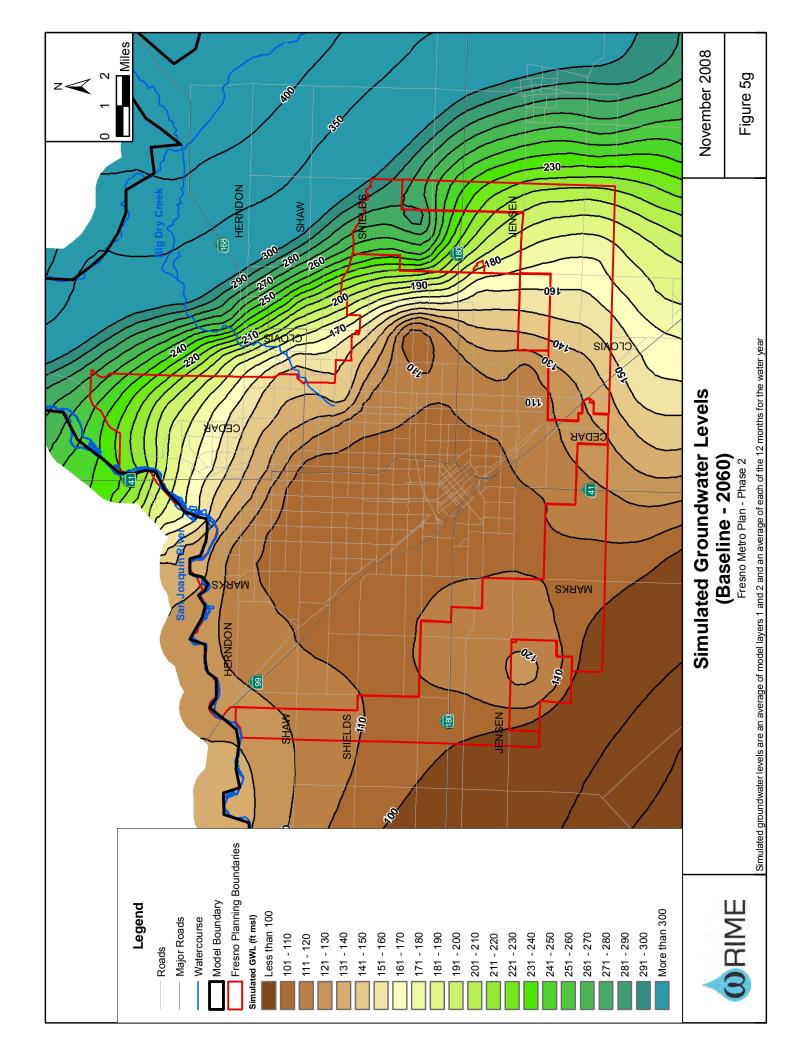


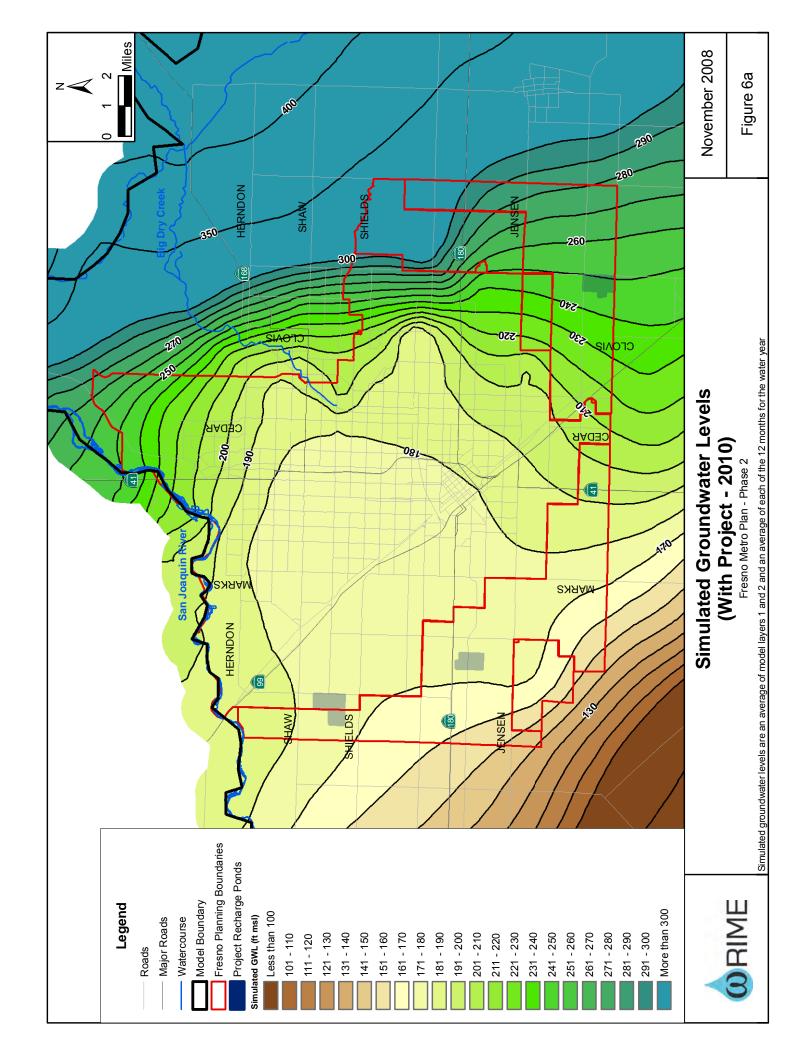


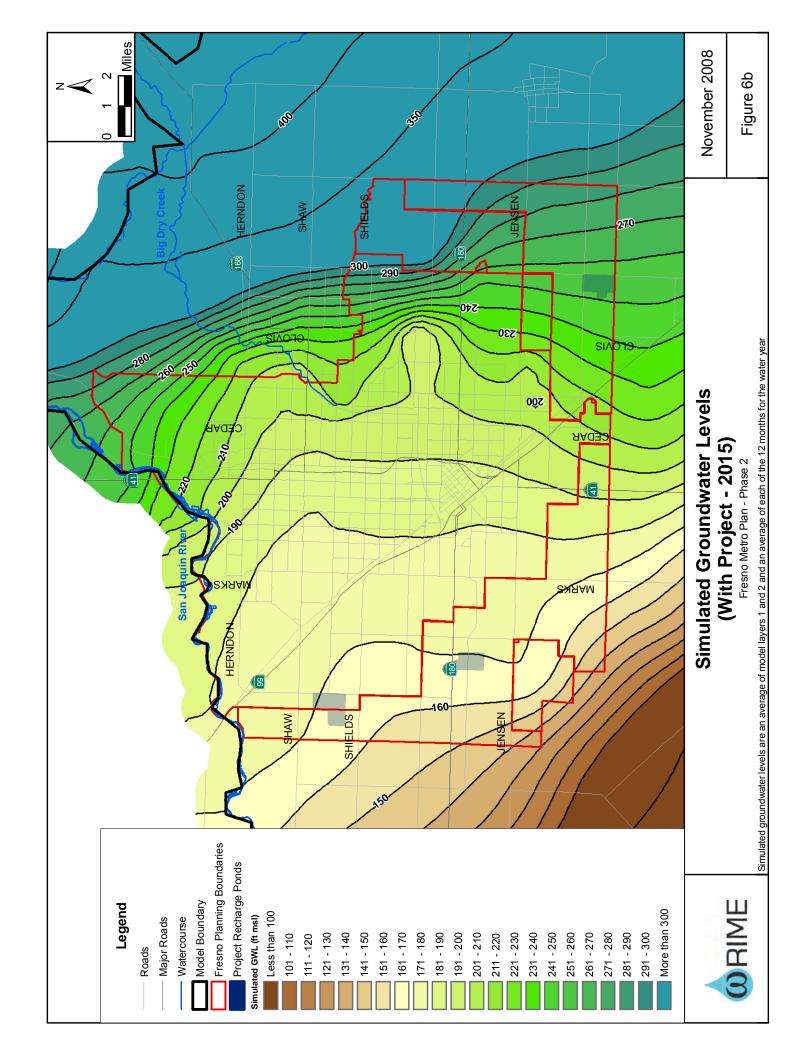


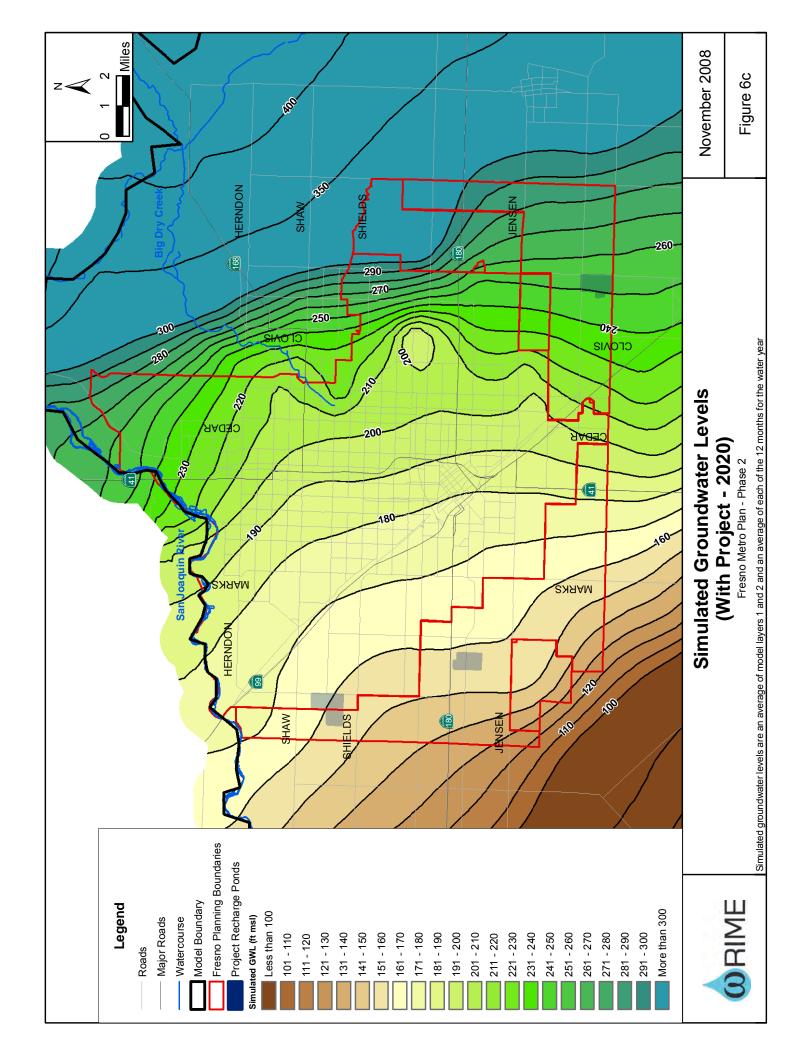


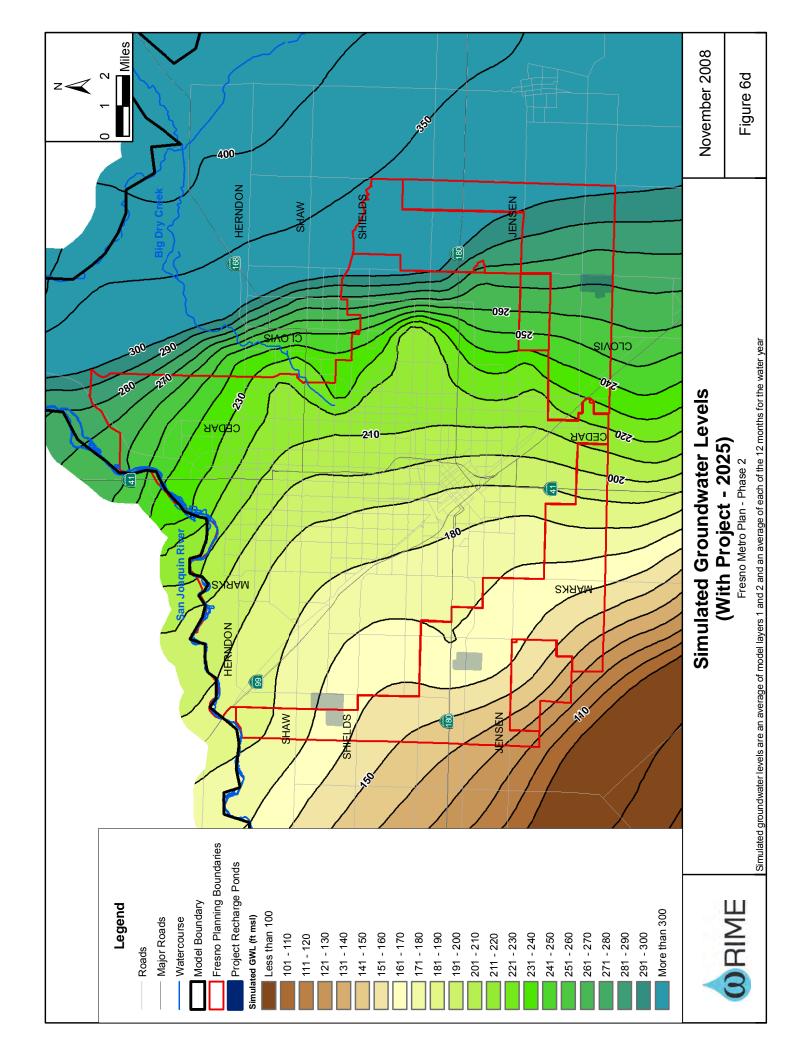


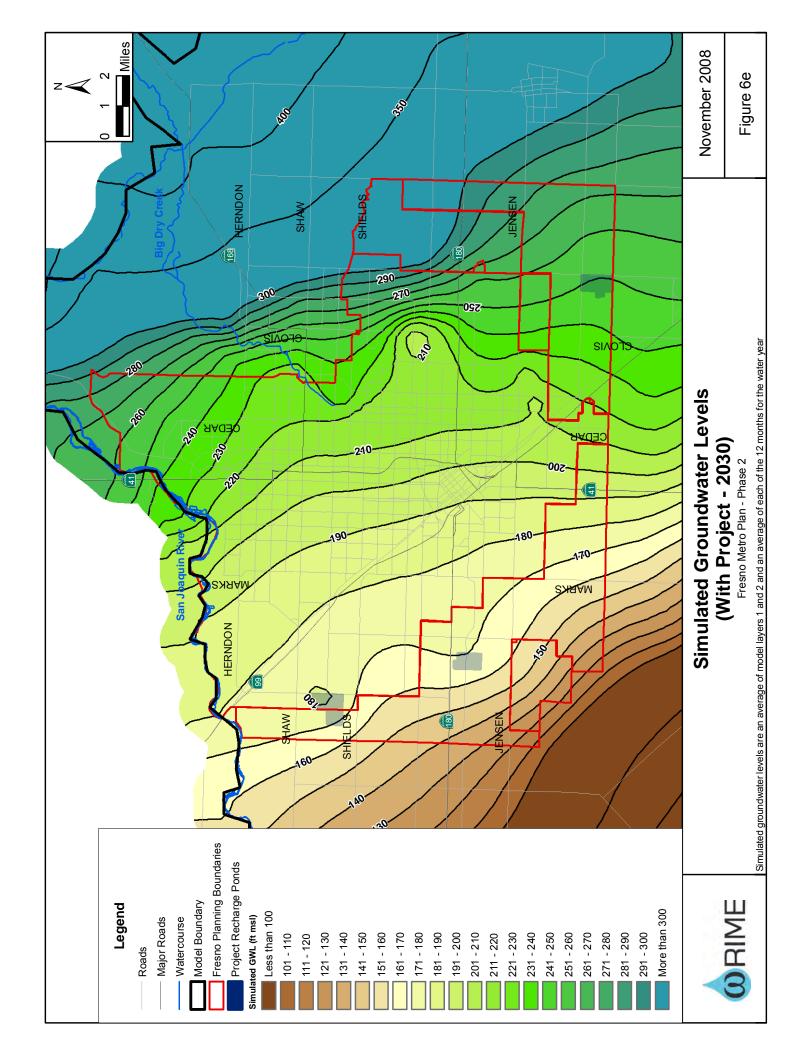


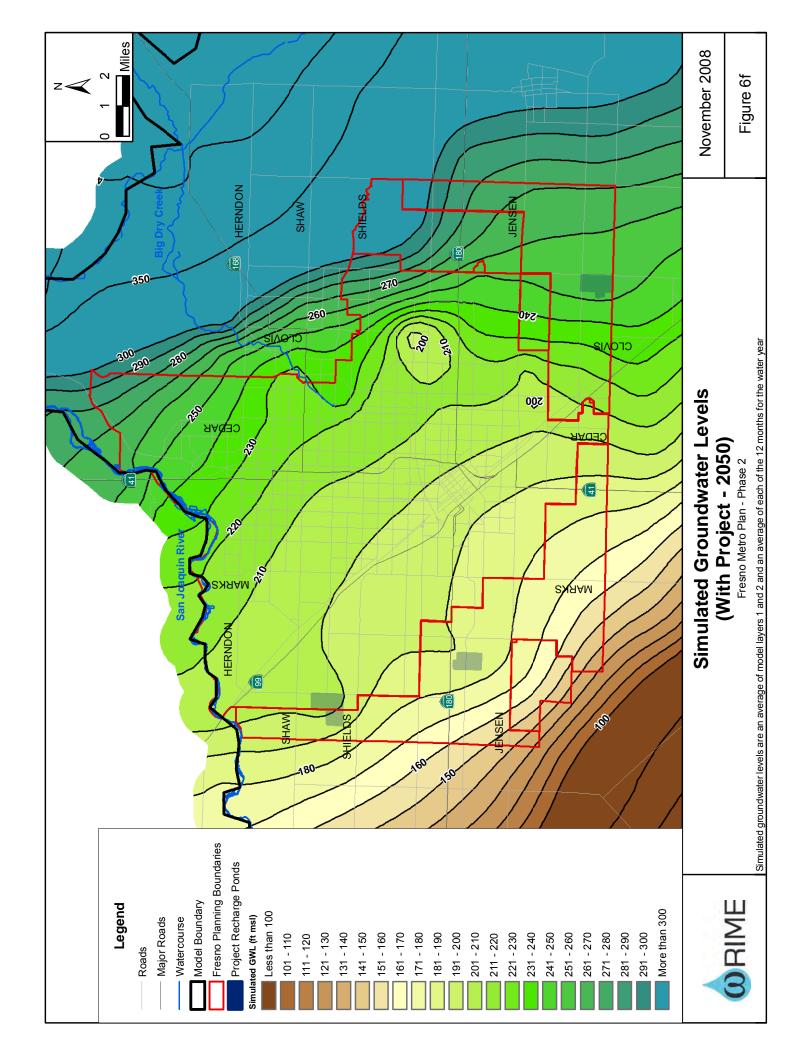


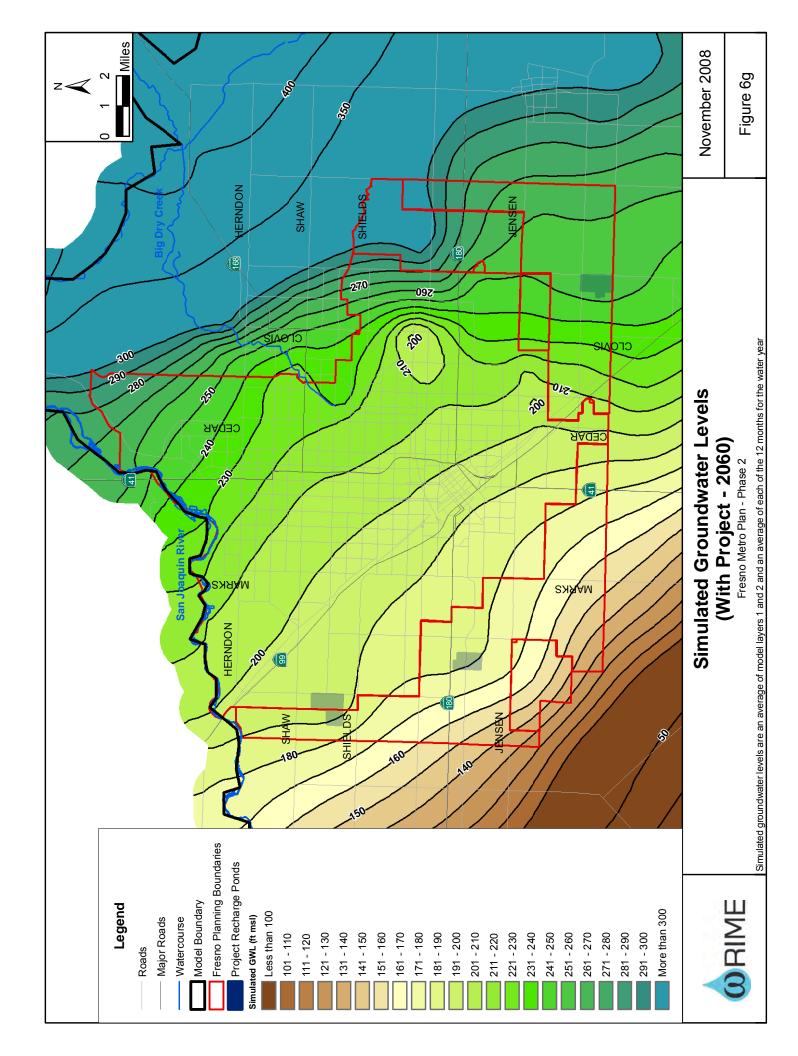


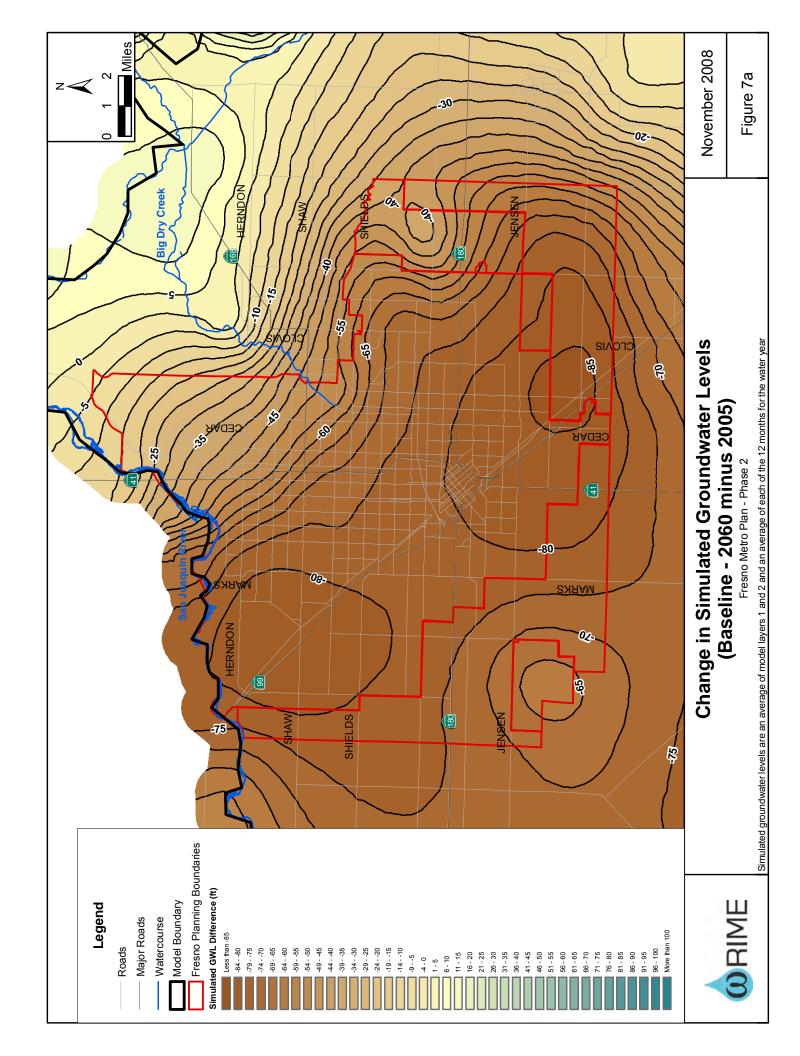


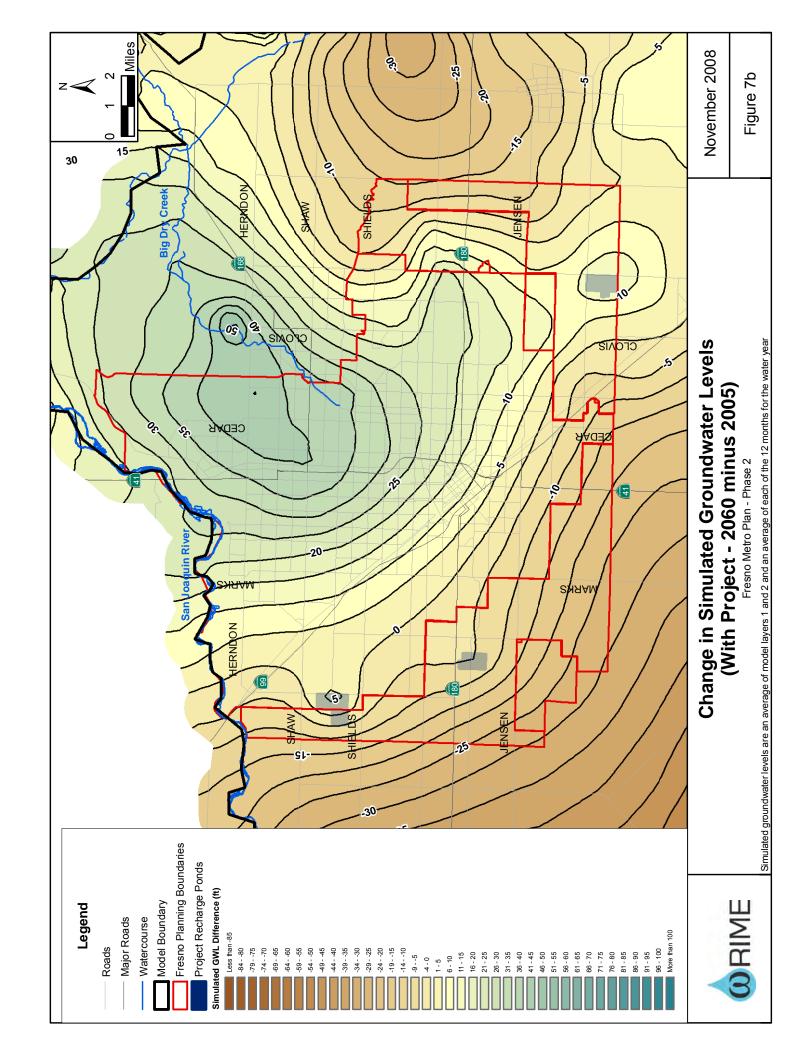


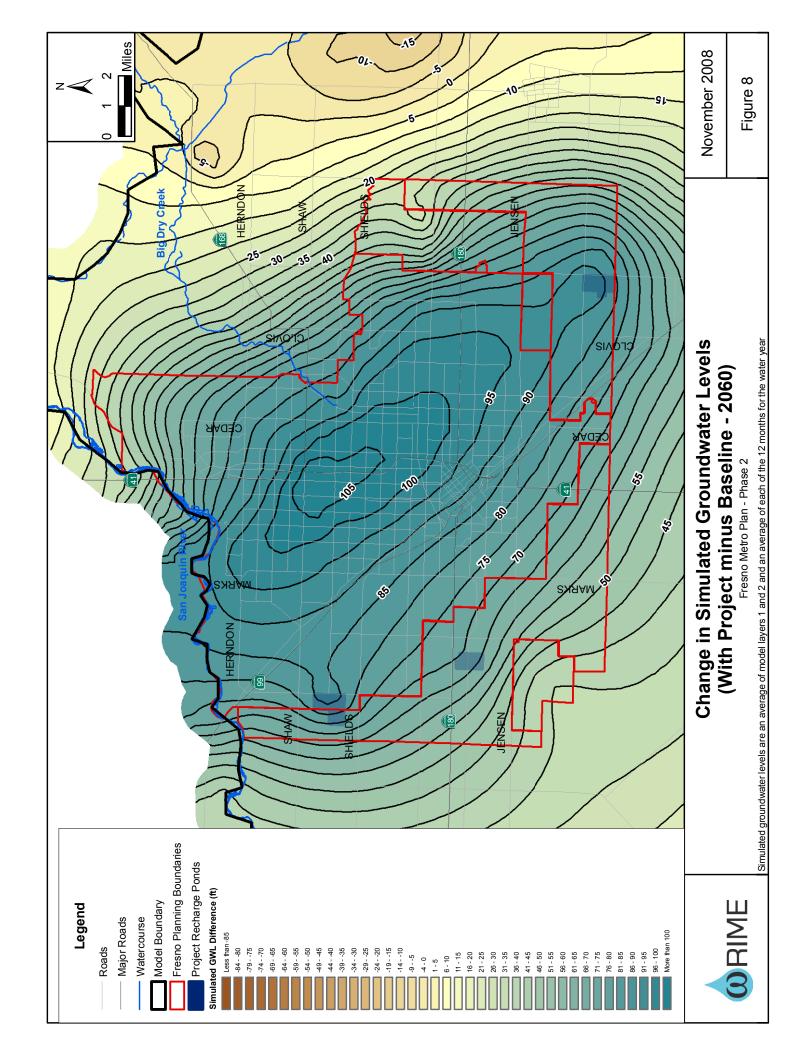












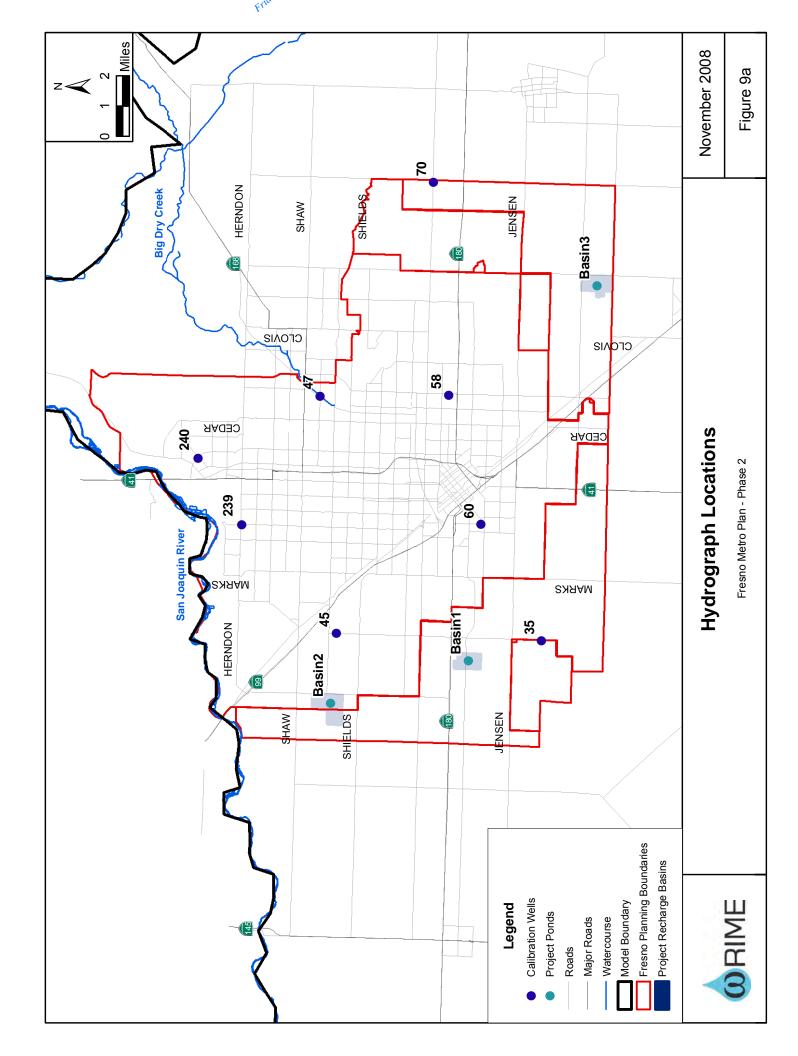


Figure 9b. Simulated Well Hydrographs

✓ ◆ Observed GWL
✓ ─ With Project GWL
✓ Baseline GWL

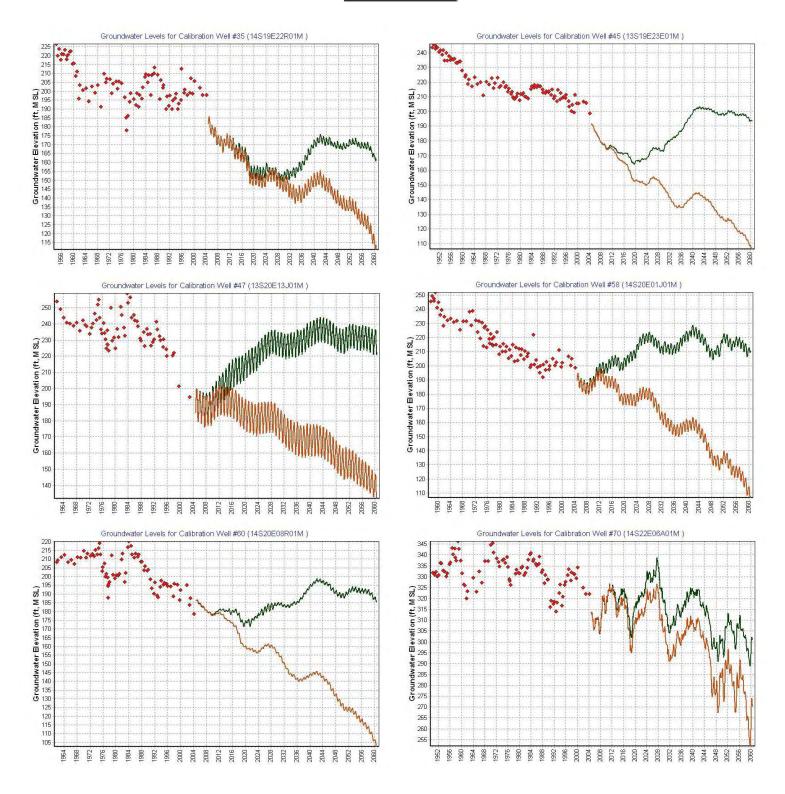


Figure 9c. Simulated Well Hydrographs

✓ ◆ Observed GWL
✓ ── With Project GWL
✓ ── Baseline GWL

