APPENDIX C

Sutter Pointe Water Supply Assessment

SUTTER COUNTY

SUTTER POINTE SPECIFIC PLAN
SB 610 WATER SUPPLY ASSESSMENT

December 2008

Sutter Pointe Specific Plan
SB 610 Water Supply Assessment

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SECTION 1 – INTRODUCTION

1.1 INTRODUCTION

Enacted in 2001 (effective January 1, 2002), Senate Bill 610 added section 21151.9 to the Public Resources Code requiring that any proposed "project," as defined in section 10912 of the Water Code, comply with Water Code section 10910, et seq. Commonly referred to as a "SB 610 Water Supply Assessment," Water Code section 10910 outlines the necessary information and analysis that must be included in an environmental impact report (EIR) to ensure that proposed land developments have a sufficient water supply to meet existing and planned water demands over a 20-year projection.

Proposed "projects" requiring the preparation of a SB 610 water supply assessment include, among others, residential developments of more than 500 dwelling units, shopping centers or business establishments employing more than 1,000 persons or having more than 500,000 square feet of floor space, commercial office buildings employing more than 1,000 persons or having more than 250,000 square feet of floor space and projects that would demand an amount of water equivalent to, or greater than, the amount of water required by a 500 dwelling unit project. Water Code § 10912, subdivision (a).

The Environmental Impact Report (EIR) analyzes the Sutter Pointe Specific Plan (Sutter Pointe or SPSP) on a programmatic level and Phases 1 and A of Sutter Pointe on a project level. This assessment will include projected water demands for all phases of Sutter Pointe. Individually and collectively, all phases of Sutter Pointe are proposed to exceed more than one of the thresholds stated above requiring preparation of a SB 610 water supply assessment.

This SB 610 Water Supply Assessment has been prepared as part of the CEQA process to analyze the sufficiency of water supplies to meet projected water demands within Sutter Pointe through 2030 and is organized according to the following sections:

- Section 1: Introduction. This Section provides an overview of SB 610 Water Supply Assessment requirements, a description of the Sutter Pointe Specific Plan, descriptions of each of the phases of Sutter Pointe, and of past and proposed land uses within the Sutter Pointe Specific Plan, as well as a background of water supplied by the County of Sutter.
- Section 2: Projected Water Demands for the Sutter Pointe Specific Plan. This Section describes the methodology used for deriving water demands for Sutter Pointe and provides a description of planned land uses and associated water demand projections for Sutter Pointe through 2030.

- Section 3: Water Supplies. This Section provides information regarding existing and planned water supplies for Sutter Pointe along with their planned uses under the Proposed Water Supply Program as well as two alternative water supply programs.
- Section 4: Groundwater Sufficiency Analysis. This Section provides the necessary information and analyses regarding groundwater supplies for Sutter Pointe. This Section also details and summarizes the analyses performed by Luhdorff & Scalmanini Consulting Engineers which shows that sufficient groundwater will be available to meet existing and planned land uses throughout the North American groundwater subbasin through 2030.
- Section 5: Conclusions. This Section summarizes the conclusion of this SB 610 Water Supply Assessment

The analyses and conclusions presented in this assessment incorporate a significant amount of information from the Sutter Pointe Specific Plan Water Supply Master Plan (SPSP Water Supply Master Plan) prepared by MacKay & Somps Civil Engineers (MSCE) and the Sutter Pointe Specific Plan Groundwater Supply Assessment (SPSP GSA) prepared by Luhdorff & Scalmanini Consulting Engineers (LSCE). The SPSP Water Supply Master Plan and SPSP GSA are included in this assessment as **Appendices A** and **B**, respectively.

1.2 THE SUTTER POINTE SPECIFIC PLAN

1.2.1 Introduction

Sutter Pointe is located in an unincorporated area of southeastern Sutter County and consists of 7,527.6 acres of land. This subsection will describe historic, current and proposed land uses within Sutter Pointe.

1.2.2 Historical and Current Land Uses

The existing land within Sutter Pointe has been primarily used for agriculture with rice being the predominant crop. Natomas Central Mutual Water Company (NCMWC) is a privately owned water company that supplies surface water to irrigate agricultural lands in the Natomas Basin. NCMWC shareholders own approximately 5,009.3 acres within Sutter Pointe. This land is irrigated with surface water from NCMWC's water rights and entitlements. The remaining 2,518.3 acres are not owned by NCMWC shareholders and are irrigated with NCMWC supplemental surface water and/or groundwater from the North American Groundwater Subbasin.

1.2.3 Proposed Land Uses

Sutter Pointe will be constructed in four independent residential and four commercial/industrial phases with the numbered phases corresponding to residential land uses and lettered phases corresponding to non-residential land uses. However, for purposes of this assessment, it has

been assumed that Phases 1 and A (Phase 1+A) will be built out during the same time period. The same is also assumed for Phases 2 and B (Phase 2+B), Phases 3 and C (Phase 3+C), and Phases 4 and D (Phase 4+D), respectively. Build-out land uses for each of the phases is described below in **Table 1-1**. Development of the four phases is assumed as follows:

- *Phase 1+A:* Construction beginning in 2011 with build out in seven years (2017);
- *Phase 2+B:* Construction beginning in 2018 with build out in five years (2022);
- *Phase 3+C:* Construction beginning in 2023 with build out in three years (2025);
- *Phase 4+D:* Construction beginning in 2026 with build out in five years (2030).

Table 1-1 – Sutter Pointe Build-Out Land Uses

		Phase 1+A	Phase 2+B	Phase 3+C	Phase 4+D	Build Out
Land Use		Acres	Acres	Acres	Acres	Acres
Residential	Low Density	121.0	316.3	0.0	75.5	512.8
	Medium Density	874.8	491.9	331.3	252.3	1,950.3
	High Density	91.4	0.0	57.8	38.5	187.7
	Residential Roads	127.2	48.4	40.1	28.5	244.2
	Residential Totals	**1,214.4**	**856.6**	**429.2**	**394.8**	**2,895.0**
Public Facilities	Community Parks	99.4	181.8	67.0	83.7	431.9
	Open Space - High	47.3	119.1	0.0	0.0	166.4
	Open Space - Medium	47.4	26.1	37.5	21.3	132.3
	Open Space - Low	21.1	38.3	13.9	22.8	96.1
	K-8 School	61.1	20.9	21.0	18.7	121.7
	High School	52.9	0.0	0.0	0.0	52.9
	Public Facilities Totals	**329.2**	**386.2**	**139.4**	**146.5**	**1,001.3**
Industrial	Employment 1	96.8	100.9	188.5	194.2	580.4
	Employment 2	380.3	611.4	506.2	492.6	1,990.5
	Employment Roads	73.9	63.1	67.3	99.5	303.8
	Commercial Retail	129.9	0.0	21.8	26.5	178.2
	Mixed Use	100.8	0.0	0.0	63.3	164.1
	Industrial Drainage Basins	50.6	116.3	145.0	102.4	414.3
	Industrial Totals	**832.3**	**891.7**	**928.8**	**978.5**	**3,631.3**
	Land Use Totals	**2,375.9**	**2,134.5**	**1,497.4**	**1,519.8**	**7,527.6**

1.2.4 Water Supply Plan

Water supplies for Sutter Pointe will consist of surface water to be obtained from NCMWC and groundwater to be pumped from new wells to be constructed in Sutter Pointe. Groundwater supplied from wells will be pumped from the North American Groundwater Subbasin (North American Subbasin), a portion of the Sacramento Valley Groundwater Basin as defined by the State of California Department of Water Resources.

As described in more detail in Section 3, the Sutter Pointe Specific Plan includes three alternatives for supplying water for the development. Under the Proposed Water Supply

Program as well as Alternative "A" and Alternative "B," groundwater is planned to be the sole supply of water until sometime in 2018 but will be sufficient to supply at least 52 percent of build-out demands. A combination of surface water and groundwater will then serve Sutter Pointe after the necessary infrastructure to deliver and treat surface water is completed. Development of the three water supply programs were guided by the following considerations:

1. The need to conserve water during single and multiple dry years;
2. Balancing of groundwater and surface water supplies in an effort to conserve both resources;
3. The existing availability of Bureau of Reclamation Settlement Contract water (surface water) only from April through October;
4. The need to limit the monthly and annual deliveries of Settlement Contract water to comply with dry-year provisions during critically-dry years; and
5. Preservation of the opportunity to adjust the final mix of surface and groundwater to optimize the overall operation of the system and conserve resources.

At build out, the Proposed Water Supply Program will supply water to Sutter Pointe with groundwater during the winter months (November through March), and a combination of groundwater and surface water during the remainder of the year (April through October). Approximately 2,518.3 acres of the 7,527.6 acres comprising Sutter Pointe are within NCMWC's service area but are not owned by NCMWC shareholders (Non-Shareholder Lands). As a result, groundwater will continue to be the sole supply for this 2,518.3-acre area after surface water supplies are available under the Proposed Water Supply Program.

At build out of Sutter Pointe, Alternative "A" would use only groundwater from November through March, only surface water from April through June, and a combination of groundwater and surface water from July through October to meet demands during normal years. Alternative "A" would use more surface water annually than the Proposed Water Supply Program and also contemplates use of NCMWC surface water supplies within Non-Shareholder Lands. At build out, Alternative "B" would use a combination of groundwater and surface water throughout the year. Alternative "B" would use the highest annual quantity of surface water and contemplates using NCMWC surface water supplies and a new, yet-to-be obtained winter diversion right to serve demands within Sutter Pointe

Section 4 of this assessment will analyze the sufficiency of groundwater and surface water under the Proposed Water Supply Program as well as under Alternatives "A" and "B." Because Alternatives "A" and "B" would require additional discretionary approvals from the United States Bureau of Reclamation (USBR) to change the place and/or timing of use of the NCMWC surface water supplies which have not yet been obtained, this Assessment will focus on the Proposed Water Supply Program. However, this Assessment also includes analyses for

Alternatives "A" and "B." Potential implementation of either Alternative "A" or Alternative "B" will rely on this Assessment to the extent it is consistent with Water Code § 10910, et seq.

1.3 WATER SERVICE FOR SUTTER POINTE

The County of Sutter currently operates one municipal well in the town of Robbins. Because this service area does not consist of 3,000 or more connections and is therefore not considered a public water system, an urban water management plan has never been prepared. There is no existing "public water system" (as defined by Water Code § 10912, subdivision (c)) on or adjacent to lands to be occupied by Sutter Pointe. There is also no entity serving domestic water supplies whose area includes Sutter Pointe.

Because planned land uses within Sutter Pointe will exceed 3,000 connections, this new service area will become a public water system. It is the expressed intent of the County of Sutter to provide M&I service within the SPSP planning area. Sutter County would initially provide groundwater for the early phases of development, and a combination of ground and surface water to meet the ultimate needs of the development. Surface water would be obtained from NCMWC which has the authority to serve municipal and industrial (M&I) water to shareholders and public agencies.

It is the intent of Sutter County to provide retail water service to the Sutter Pointe Specific Plan Area through a dependent or independent special district (i.e., a Community Services District, a County Service Area, or some other County agency). A domestic water system to deliver ground and surface water to the Sutter Pointe Specific Plan Area will be developed. Potable water will be provided in sufficient quantity and of acceptable quality to meet the needs of all M&I uses within the Sutter Pointe Specific Plan Area. The water system will include water supply and treatment facilities, storage reservoirs, booster pumps, transmission pipelines, and distribution pipelines to all customers within the planning area. The system will have the capability of providing adequate supplies during normal and critically-dry years to meet the domestic and fire protection needs of the plan area. More information regarding the proposed infrastructure for Sutter Pointe is detailed in the SPSP Water Supply Master Plan (see **Appendix A**).

Golden State Water Company (GSWC), through its parent company (American States Water Company), entered into an agreement with NCMWC on July 1, 2004 to provide M&I water service within the NCMWC service area. GSWC is an investor owned, California Public Utilities Commission (PUC) regulated, private water company. GSWC has expressed the intent to be the water service purveyor for the Sutter Pointe planning area and caused a Master Infrastructure Advance Planning Study (MIAPS) to be prepared (Wood Rodgers, April 24, 2006) setting forth their plan to provide ground and surface water to the development. The service plan outlined in the MIAPS is reasonably similar to the plan set forth in this master plan, albeit a higher level planning study as compared to the detailed study set forth in the Sutter Pointe Water Supply Master Plan. GSWC has applied to the PUC for permission to service the Sutter Pointe

planning area. Sutter County, however, has gone on record opposing that application. GSWC asserts that its contract with NCMWC authorizes it to be the exclusive M&I purveyor within the Natomas Basin utilizing NCMWC water rights and contractual entitlements under the Settlement Contract with the U.S. Bureau of Reclamation; the County asserts that the GSWC/NCMWC contract is not sufficient to assure GSWC's ability to control water supplies because the delivery of water by a mutual water company is appurtenant to the shares, and the shareholders have not pledged their shares to NCMWC or GSWC.

At this time it is uncertain that GSWC will gain the necessary PUC approvals to serve the development. Regardless of the entity that provides the service, though, the same sources of water supply would be used, therefore the analysis of the physical water availability would not change depending on which entity prevails.

SECTION 2 – PROJECTED WATER DEMANDS WITHIN SUTTER POINTE

2.1 INTRODUCTION

This section describes the methodology and resulting water demands for the Sutter Pointe Specific Plan beginning in 2010 through 2030 and includes a discussion of:

- Demand Projection Methodology – this section describes the methodology used to calculate water demands for Sutter Pointe;
- Unit Water Demand Factors – this section details the derivation of unit water demand factors based on water use observed in newly constructed residential developments and other water use data in the vicinity of Sutter Pointe.
- Projected Normal-Year Water Demands – this section provides an estimate of projected normal-year water demands associated with planned land uses within Sutter Pointe.
- Projected Single-Dry and Multiple-Dry Year Water Demands – this section provides an estimate of projected single-dry and multiple dry year water demands associated with planned land uses within Sutter Pointe.

2.2 DEMAND PROJECTION METHODOLOGY

This section presents the projected baseline water demands for Sutter Pointe. The analysis is based on first assessing baseline future demand by using land uses projected within Sutter Pointe multiplied by the developed unit water demand factors representing expected use characteristics. Land-use based projections are particularly useful for estimating water demand at build-out conditions and are generally believed by water use professionals to be more representative then using per-capita demand estimates.

Baseline projections of future demand for Sutter Pointe were estimated using land-use based projections of the number of acres of each land-use classification multiplied by unit demand factors that apply to each classification. For purposes of this assessment, full build out within Sutter Pointe Area Plan is anticipated by 2030. Baseline project-specific demand projections are assumed to remain constant thereafter.

2.3 UNIT WATER DEMAND FACTORS

2.3.1 Introduction

Baseline unit water demand factors – used to establish an acre-foot per acre per year demand for a particular type of land-use – were applied to planned land uses within Sutter Pointe to estimate water demands in five-year increments beginning in 2010 through 2030.

2.3.2 Unit Water Demand Factors

Unit water demand factors assumed for the various land uses are based on the amount of water use expected for the types of land uses within Sutter Pointe. Estimated unit water demand factors are also based on a review of water demand factors for several jurisdictions in and around south Sutter County and Sacramento County including:

- City of Sacramento – Panhandle Project
- Sacramento County Water Agency (SCWA) Zone 40 Water Supply Master Plan
- NCMWC – Integrated Water Resource Management Plan
- Arden-Cordova – Westborough Project

Tables 2-1 and **2-2** shows a comparison of water demand factors for Sutter Pointe and the other projects and jurisdictions listed above. The unit water demand factors assumed for Sutter Pointe are in the high range and represent a conservative approach to water supply planning.

Table 2-1 – Comparison of Residential Unit Water Demand Factors

	Sutter Pointe	City of Sacramento – Panhandle Project	SCWA Zone 40 Water Supply Master Plan	NCMWC – Integrated Water Resource Management Plan	Arden Cordova – Westborough Project
Residential Land Use Category	**Unit Water Demand Factor (af/ac/yr)**	**Unit Water Demand Factor (af/ac/yr)**	**Unit Water Demand Factor (af/ac/yr)**	**Unit Water Demand Factor (af/ac/yr)**	**Unit Water Demand Factor (af/ac/yr)**
Low Density	3.67	2.81	2.89	3.60	3.67
Medium Density	4.17	3.60	3.70	---	3.67
High Density	4.67	3.60	4.12	---	4.67

Table 2-2 – Comparison of Non-Residential Unit Water Demand Factors					
	Sutter Pointe	**City of Sacramento – Panhandle Project**	**SCWA Zone 40 Water Supply Master Plan**	**NCMWC – Integrated Water Resource Management Plan**	**Arden Cordova – Westborough Project**
Non-Residential Land Use Category	**Unit Water Demand Factor (af/ac/yr)**	**Unit Water Demand Factor (af/ac/yr)**	**Unit Water Demand Factor (af/ac/yr)**	**Unit Water Demand Factor (af/ac/yr)**	**Unit Water Demand Factor (af/ac/yr)**
Parks/Recreation	4.08	4.20	3.46	---	4.08
Open Space (High Water Use)	4.08	---	---	---	---
Open Space (Medium Water Use)	2.34	---	---	---	---
Open Space (Low Water Use)	0.60	---	---	---	0.00
Schools	3.67	2.50	3.46	---	3.67
Commercial Retail	3.00	3.00	2.75	---	3.00
Mixed Use	3.00	3.00	2.51	---	3.00
Industrial/Employment	3.00	4.00	2.71	---	3.00
Drainage Basins/Channels	0.60	---	---	---	0.40
Roadways	0.20	0.00	0.21	---	0.00

2.3.3 Unaccounted for Water

Unit demand factors do not account for inherent losses that occur in the distribution to customers, or unaccounted for water supplies such as fire hydrant flushing and construction water. To account for these factors in the overall demand requirements, the estimated demands are multiplied by an "unaccounted for water" percentage, which is then added to the projected end-user demand to generate an overall estimate for demand for treated water supplies.

For purposes of this assessment, unaccounted for water is assumed to be 7.5 percent of both residential and non-residential estimated demands. This is consistent with loss rates observed in newly-constructed developments using modern methods and materials of construction.

2.4 PROJECTED NORMAL-YEAR WATER DEMANDS

Unit water demand factors described above for Sutter Pointe are applied to the land uses within each phase of development to project annual water demands during normal years. Projected annual water demands at build out of each phase are shown in **Table 2-3**. **Table 2-4** shows projected water demands for Sutter Pointe in five-year increments beginning in 2010 through 2030.

Table 2-3 – Projected Normal-Year Water Demands by Phase

	Land Use	Unit Water Demand Factor (ac-ft/acre/year)	Phase 1+A		Phase 2+B		Phase 3+C		Phase 4+D		Build Out	
			Acres	Annual Water Demand (ac-ft/year)	Acres	Annual Water Demand (ac-ft/year)	Acres	Annual Water Demand (ac-ft/year)	Acres	Annual Water Demand (ac-ft/year)	Acres	Annual Water Demand (ac-ft/year)
Residential	Low Density	3.67	121.0	444	316.3	1,161	0.0	0	75.5	277	512.8	1,882
	Medium Density	4.17	874.8	3,648	491.9	2,051	331.3	1,382	252.3	1,052	1,950.3	8,133
	High Density	4.67	91.4	427	0.0	0	57.8	270	38.5	180	187.7	877
	Residential Roads	0.20	127.2	25	48.4	10	40.1	8	28.5	6	244.2	49
	Residential Total		**1,214.4**	**4,544**	**856.6**	**3,222**	**429.2**	**1,660**	**394.8**	**1,515**	**2,895.0**	**10,941**
Public Facilities	Community Parks	4.08	99.4	406	181.8	742	67.0	273	83.7	341	431.9	1,762
	Open Space - High	4.08	47.3	193	119.1	486	0.0	0	0.0	0	166.4	679
	Open Space - Medium	2.34	47.4	111	26.1	61	37.5	88	21.3	50	132.3	310
	Open Space - Low	0.60	21.1	13	38.3	23	13.9	8	22.8	14	96.1	58
	K-8 School	3.67	61.1	224	20.9	77	21.0	77	18.7	69	121.7	447
	High School	3.67	52.9	194	0.0	0	0.0	0	0.0	0	52.9	194
	Public Facilities Total		**329.2**	**1,141**	**386.2**	**1,389**	**139.4**	**446**	**146.5**	**474**	**1,001.3**	**3,450**
Industrial	Employment 1	3.00	96.8	290	100.9	303	188.5	566	194.2	583	580.4	1,742
	Employment 2	3.00	380.3	1,141	611.4	1,834	506.2	1,519	492.6	1,478	1,990.5	5,972
	Employment Roads	0.20	73.9	15	63.1	13	67.3	13	99.5	20	303.8	61
	Commercial Retail	3.00	129.9	390	0.0	0	21.8	65	26.5	80	178.2	535
	Mixed Use	3.00	100.8	302	0.0	0	0.0	0	63.3	190	164.1	492
	Industrial Drainage Basins	0.60	50.6	30	116.3	70	145.0	87	102.4	61	414.3	248
	Industrial Total		**832.3**	**2,168**	**891.7**	**2,220**	**928.8**	**2,250**	**978.5**	**2,412**	**3,631.3**	**9,050**
Subtotals			**2,375.9**	**7,853**	**2,134.5**	**6,831**	**1,497.4**	**4,356**	**1,519.8**	**4,401**	**7,527.6**	**23,441**
7.5% System Loss (ac-ft/year)			**589**		**512**		**327**		**330**		**1,758**	
Total Water Demand by Phase (ac-ft/year)			**8,442**		**7,343**		**4,683**		**4,731**		**25,199**	
Cumulative Water Demands (ac-ft/year)			**8,442**		**15,785**		**20,468**		**25,199**			

Table 2-4 – Projected Normal-Year Water Demands by Year

			2010		2015		2020		2025		2030	
Land Use		Unit Water Demand Factor (ac-ft/acre/year)	Acres	Annual Water Demand (ac-ft/year)	Acres	Annual Water Demand (ac-ft/year)	Acres	Annual Water Demand (ac-ft/year)	Acres	Annual Water Demand (ac-ft/year)	Acres	Annual Water Demand (ac-ft/year)
Residential	Low Density	3.67	0.0	0	86.4	317	310.8	1,141	437.3	1,605	512.8	1,882
	Medium Density	4.17	0.0	0	624.9	2,606	1,169.9	4,879	1,698.0	7,081	1,950.3	8,133
	High Density	4.67	0.0	0	65.3	305	91.4	427	149.2	697	187.7	877
	Residential Roads	0.20	0.0	0	90.9	18	156.2	31	215.7	43	244.2	49
	Residential Total		**0.0**	**0**	**867.4**	**3,246**	**1,728.4**	**6,478**	**2,500.2**	**9,426**	**2,895.0**	**10,941**
Public Facilities	Community Parks	4.08	0.0	0	71.0	290	208.5	851	348.2	1,421	431.9	1,762
	Open Space - High	4.08	0.0	0	33.8	138	118.8	485	166.4	679	166.4	679
	Open Space - Medium	2.34	0.0	0	33.9	79	63.1	148	111.0	260	132.3	310
	Open Space - Low	0.60	0.0	0	15.1	9	44.1	26	73.3	44	96.1	58
	K-8 School	3.67	0.0	0	43.6	160	73.6	270	103.0	378	121.7	447
	High School	3.67	0.0	0	37.8	139	52.9	194	52.9	194	52.9	194
	Public Facilities Total		**0.0**	**0**	**235.1**	**815**	**560.9**	**1,974**	**854.8**	**2,976**	**1,001.3**	**3,450**
Industrial	Employment 1	3.00	0.0	0	69.1	207	157.3	472	386.2	1,159	580.4	1,741
	Employment 2	3.00	0.0	0	271.6	815	747.1	2,241	1,497.9	4,494	1,990.5	5,972
	Employment Roads	0.20	0.0	0	52.8	11	111.8	22	204.3	41	303.8	61
	Commercial Retail	3.00	0.0	0	92.8	278	129.9	390	151.7	455	178.2	535
	Mixed Use	3.00	0.0	0	72.0	216	100.8	302	100.8	302	164.1	492
	Industrial Drainage Basins	0.60	0.0	0	36.1	22	120.4	72	311.9	187	414.3	249
	Industrial Total		**0.0**	**0**	**594.5**	**1,549**	**1,367.3**	**3,499**	**2,652.8**	**6,638**	**3,631.3**	**9,050**
Subtotals			**0.0**	**0**	**1,697.1**	**5,609**	**3,656.6**	**11,952**	**6,007.8**	**19,040**	**7,527.6**	**23,441**
7.5% System Loss (ac-ft/year)			**0**		**421**		**896**		**1,428**		**1,758**	
Total Water Demands (ac-ft/year)			**0**		**6,030**		**12,848**		**20,468**		**25,199**	

Total water demands within Sutter Pointe are projected to be 25,199 acre-feet per year (AFY) at build out. Water supplies used to meet these demands are described in Section 3.

2.5 PROJECTED DRY-YEAR AND MULTIPLE DRY-YEAR WATER DEMANDS

Water demands within Sutter Pointe are assumed to be reduced by 12.5% from normal-year levels during single and multiple dry year periods. **Table 2-5** shows water demands during dry year periods in 5-year increments.

Table 2-5 – Annual Dry-Year Water Demands

	2010	2015	2020	2025	2030
Annual Water Demand during Dry Years (acre-feet/year)	**0**	**4,908**	**10,457**	**16,658**	**20,510**
7.5% System Loss	**0**	**368**	**784**	**1,249**	**1,538**
Total Water Demands	**0**	**5,276**	**11,241**	**17,907**	**22,048**

It is widely understood that customer demands typically increase during dry years without implementing water conservation measures, principally to compensate for lower precipitation levels and the resulting increase in irrigation demands. As a result, a 12.5% reduction in normal year water demands would actually result in a decrease of 15%-20% compared to unregulated demands.

Despite this phenomenon, reductions of 12.5 percent from normal-year demands during dry-years are reasonable compared to what other water purveyors have achieved through either requests for voluntary reductions or enforced demand management measures. Below are summaries of dry-year demand reductions that have either been achieved or assumed for some water purveyors throughout central and northern California:

- *City of Stockton Municipal Utility District*: Between 1993 and 1999, the City of Stockton Municipal Utility District (COSMUD) utilized a program calling for a voluntary 10 percent reduction in water use through conservation, and achieved actual savings between 12 and 19 percent.[1] COSMUD's significant demand reductions that resulted after its request for voluntary demand management measures indicate that even without implementation of mandatory demand management measures, significant demand reductions can be achieved.
- *City of Folsom*: The City of Folsom – located in a similar climate to Sutter Pointe – anticipates a savings of greater than 7% of its overall demand based on implementation of

[1] Draft 2005 City of Stockton Urban Water Management Plan, p. 7-3.

its demand management measures under its municipal code in dry years. These demand management measures include mandatory water reduction measures associated with outdoor irrigation, water waste (including runoff from property and sidewalk or driveway cleaning), and bans on refilling swimming pools.

- *City of Clovis*: The City of Clovis – located in a climate that is generally hotter and drier than Sutter Pointe – anticipates a demand reduction savings between 18 percent and 35 percent by reducing outdoor irrigation to two or one days per week.[2] These savings are anticipated through calculations of reduced water application and consumption through outdoor irrigation.
- *City of Modesto*: The City of Modesto – located in a warmer and drier climate than Sutter Pointe – anticipates achieving a 10 to 20 percent conservation savings by implementing its Stage 1 actions as part of its demand management measures.
- *East Bay Municipal Utility District*: During the 1976-1977 drought – one of the most severe single drought years in the State's hydrologic record – EBMUD measured demand reductions at 39 percent of its overall demand.[3] EBMUD used numerous demand management measures including enforcing bans on outdoor irrigation and encouraging water supply efficiency with indoor uses.
- *City of San Francisco*: During the 1987-1992 drought, the City of San Francisco achieved a 25 percent reduction in overall demand by targeting a 10 percent reduction in indoor use and a 60 percent reduction in outdoor use.[4] Because the City of San Francisco has relatively low landscape demands due to its climate and high level of urbanization, a lower level of conservation may be more realistic for Sutter Pointe. However, a 12.5 percent reduction in normal-year water demands is still reasonable during dry years.
- *Zone 7 Water Agency*: In 2007, Zone 7 Water Agency's retail agencies – located in the Bay Area – were successful in reducing short-term water demand by almost 20 percent by asking residents to undertake "voluntary demand reduction measures" during the state curtailments of State Water Project water supplies. [5]
- *City of Napa*: The City of Napa, located in a climatic region that is wetter and cooler than Sutter Pointe, anticipates being able to achieve 10 percent conservation through a public awareness campaign, which is analogous to a voluntary conservation request.[6] This public awareness campaign operates as Stage 1 of the City of Napa's conservation plan, and thus the City anticipates relying upon more restrictive measures to achieve even greater conservation savings.

[2] City of Clovis 2005 Urban Water Management Plan at Table 35, p. 49.
[3] East Bay Municipal Utility District's 2005 Urban Water Management Plan at p. 3-2 and Table 6-1 on p. 6-2.
[4] City and County of San Francisco's 2005 Urban Water Management Plan at Appendix F, p. 3.
[5] Telephone Call with Karla Nemeth Environmental and Public Affairs Manager with Zone 7 Water Agency on July 16, 2007.
[6] City of Napa, Urban Water Management Plan: 2005 Update, p. 7-4.

Although a 12.5% reduction in normal-year demands within Sutter Pointe is reasonably attainable, Sutter County currently has no ordinance giving it authority to implement either a water shortage contingency plan or temporary demand management measures within Sutter Pointe. This is largely due to the fact that Sutter County supplies only small amounts of water to service areas and therefore has not been required to prepare an Urban Water Management Plan.

Because this authority will be necessary, the County plans to adopt a water shortage contingency plan applicable to Sutter Pointe prior to issuance of a written verification of sufficient water supply pursuant to Government Code Government Code § 66473, et seq. (SB 221 Written Verification). This water shortage contingency plan will include mandate reductions during dry years through staged measures that may include the following:

- Prohibition on water waste;
- Limitations on outdoor use; and
- Prohibitions on some types of water uses.

In addition to conservation measures, water rates are likely to be structured to promote conservation during normal years as well as penalize excess water use during periods of drought. Carefully designed quantity-based water rates will establish economic incentives to future customers to use water efficiently. These water rate structures would conform to the 2007 requirements of Best Management Practice 11 from the California Urban Water Conservation MOU (or later edition if applicable).

2.6 Reduced Potable Water Demands from Use of Non-Potable Sources

Wastewater generated within Sutter Pointe will be transported to and treated by Sacramento County Regional Sanitation District facilities. There are no immediate plans to use recycled water within Sutter Pointe. However, major open spaces and park areas within Sutter Pointe will be plumbed with purple pipe to facilitate future use of recycled water or other non-potable water supply sources. In addition, the opportunity exists to use other non-potable water for landscape irrigation within Sutter Pointe. These sources could include other water from NCMWC and groundwater.

2.7 Conclusions

Projected build-out water demands for Sutter Pointe during a normal year are 25,199 acre-feet per year. Projected build-out water demands during single-dry and multiple-dry years are expected to be reduced by conservation to 22,049 acre-feet per year.

SECTION 3 – SUTTER POINTE WATER SUPPLIES

3.1 INTRODUCTION

This section will describe existing and planned sources of water supply for Sutter Pointe along with their planned uses under the Proposed Water Supply Program as well as under Alternatives "A" and "B."

3.2 EXISTING WATER SUPPLIES (GROUNDWATER)

3.2.1 Introduction

Existing water supplies for Sutter Pointe consist of groundwater from the North American Subbasin. Under the Proposed Water Supply Program as well as under Alternatives "A" and "B," groundwater is planned to be the sole source of supply for the project until sometime in 2018. As analyzed and documented by Luhdorff & Scalmanini Consulting Engineers (LSCE) and detailed in Section 4, groundwater supplies will be sufficient to meet at least 52 percent of build-out demands of Sutter Pointe as well the needs of other existing and future planned groundwater uses throughout the North American Subbasin through 2030. The *Sutter Pointe Specific Plan Groundwater Supply Assessment* (SPSP GSA) prepared by LSCE is included in this assessment as **Appendix B**.

3.2.2 Projected Groundwater Supplies for Sutter Pointe

Under the Proposed Water Supply Program, groundwater is planned to be used to meet all demands within Sutter Pointe until sometime in 2018. Thereafter, infrastructure is planned to be in place allowing the use of surface water supplies during the summer months (April through October). Maximum annual groundwater use will be 13,071 acre-feet during normal years as shown in **Table 3-1**. During single and multiple-dry years, surface water supplies available to Sutter Pointe would be reduced by as much as 25% (see discussion of planned surface water supplies below) while water demands are projected to decrease 12.5% through implementation of temporary demand management measures. Maximum groundwater use during single and multiple dry years ("critical years") would be 12,948 acre-feet.[7]

[7] In approving small-lot tentative subdivision maps and prior to recordation of each final subdivision map, the County will require landowners to provide a permanent agreement, in recordable form, authorizing the County or other applicable water purveyor to act as the exclusive agent for exercising the overlying groundwater rights appurtenant to the land and prohibiting the landowner or its successor or assigns from extracting groundwater or otherwise exercising such rights on their own behalf.

Table 3-1 – Projected Annual Groundwater Use within Sutter Pointe (Proposed Water Supply Program)

Projected Groundwater Use (acre-feet/year)	2010	2015	2020	2025	2030
Normal Years	0	6,030	9,928	11,486	13,071
Single and Multiple-Dry Years	0	5,276	8,709	10,089	12,948

Because water supply Alternatives "A" and "B" would entail the use of increased quantities of surface water, annual groundwater use would be less than under the Proposed Water Supply Program during both normal and dry years at build out of Sutter Pointe. Under Alternative "A," the maximum normal-year groundwater use of 9,563 acre-feet would occur at build out. Maximum normal-year groundwater use under Alternative "B" of 6,579 acre-feet would also occur at build out. Maximum groundwater use during "critical years" for Alternatives "A" and "B" would be 12,432 acre-feet and 9,276 acre-feet, respectively. Because these alternatives would use less groundwater per year, analysis of the sufficiency of groundwater supplies presented in Section 4 will be based on the highest projected groundwater use which would occur under the Proposed Water Supply Program.

3.2.3 Planned Sutter Pointe Production Wells

The Proposed Water Supply Program and Alterative "A" would require two well fields to meet water demands at build out. Alternative "B" would only require one well field as this program would use more surface water per year.

3.3 PLANNED WATER SUPPLIES (SURFACE WATER)

3.3.1 Introduction

> California Water Code section 10911, subdivision (a):
>
> > If the city or county . . . concludes as a result of its assessment, that water supplies are, or will be, insufficient, the city or county shall include in its water supply assessment its plans for acquiring additional water supplies, setting forth the measures that are being undertaken to acquire and develop those water supplies.

Existing water supplies available for Sutter Pointe (groundwater) are sufficient to meet all demands of Phase 1+A and most demands of Phase 2+B. However, the County currently does

not have existing entitlements to surface water supplies for Sutter Pointe. Under the Proposed Water Supply Program as well as Alternatives "A" and "B," the County plans to obtain surface water from NCMWC. Under Alternative "B," the County also plans to apply for an additional wintertime diversion from the Sacramento River in order to supply surface water during the months of November through March. These surface water supplies are planned to be available for delivery to Sutter Pointe beginning sometime in 2018.

3.3.2 NCMWC Water Supplies

Surface water will be obtained from NCMWC, which currently serves the Sutter Pointe area with agricultural irrigation water. NCMWC does not currently supply water to any public water system. The surface water will be transferred from a diversion point along the Sacramento River and conveyed through an offsite water pipeline to the location of the proposed surface water treatment facility, approximately located between Powerline Road and SR 99/70, south of Riego Road.

NCMWC holds numerous water right licenses from the State Water Resources Control Board (SWRCB) to divert water from the Sacramento River. Licenses applicable to this assessment are shown in **Table 3-2**.

Table 3-2 – NCMWC Surface Water Licenses

License	Place of Use	Purposes of Use	Period of Diversion	Diversion Amount (cfs)	Diversion Limit (ac-ft/year)
License 1050	Bureau of Reclamation Settlement Contract Service Area ("Project Water") and NCMWC Place of Use Boundary ("Base Supply" and SWRCB Licenses/ Permits Place of Use)	Agricultural Irrigation and M&I Purposes	April 1 – October 1	42	Limited to 120,200 by Bureau of Reclamation Renewal Contract (see **Appendix C**)
License 2814			April 15 – October 15	38	
License 3109			May 1 – October 31	160	
License 3110			May 1 – October 1	120	
License 9794			April 1 – June 30	131	
License 9989			April 1 – June 30; September 1 – October 31	14	

Licenses 1050, 2814, 3109, 3110, and 9794 were originally authorized to be used for irrigation purposes only. In 1990, the SWRCB modified these licenses by approving the use of water for domestic and municipal and industrial (M&I) purposes with the approval of the SWRCB.

NCMWC entered into Contract No. 14-06-200-885A (Settlement Contract) with the USBR in 1964. The Settlement Contract is based on NCMWC's pre-existing licenses and permit to divert

water. The purpose of the Settlement Contract is to change the timing and pattern of those diversions to accommodate the Bureau of Reclamation's operation of the Central Valley Project. However, NCMWC's water rights exist independently of the Settlement Contract.

The Settlement Contract provides for delivery of water to NCMWC during the months of April through October. Effective on May 10, 2005, the Settlement Contract was renewed for a 40-year term (Renewal Contract). The Renewal Contract between NCMWC and the USBR is included in this assessment as **Appendix C**.

Under the Renewal Contract, NCMWC is entitled to divert up to 120,200 acre-feet per year in a normal year. This amount includes 98,200 acre-feet per year of "Base Supply" which can be diverted from April through October and an additional 22,000 acre-feet of "Project Water" which is available during July and August. Distribution of NCMWC's monthly diversion entitlements is shown in **Table 3-3**.[8] The Renewal Contract limits NCMWC's annual diversions of water from the Sacramento River to the quantities described in **Table 3-3** regardless of the entitlement pursuant to which the water is diverted.

Table 3-3 – Monthly Water Deliveries Under the NCMWC Renewal Contract

Month	Base Supply (ac-ft)	Project Water Supply (ac-ft)	Total Supply (ac-ft)
April	14,000	0	14,000
May	27,700	0	27,700
June	23,000	0	23,000
July	11,500	7,200	18,700
August	3,900	14,800	18,700
September	16,100	0	16,100
October	2,000	0	2,000
Total	**98,200**	**22,000**	**120,200**

In a memorandum decision issued in late November 2008, the United States Court for the Eastern District of California found that the Bureau of Reclamation had failed to complete adequate Endangered Species Act (ESA) consultations before entering into the Settlement

[8] While the USBR Settlement Contract does not set monthly limits on diversions from any particular diversion facility, it is important that the monthly M&I diversions do not exceed the historical schedule to the shareholder lands within the Sutter Pointe area. Nearly all of the shareholder lands within the Sutter Pointe area are currently served by the Northern Main Channel, which is principally fed from the Bennett Pumping Plant. Since the monthly M&I demands for these lands will be less than the corresponding monthly agricultural irrigation rate for the same lands, the monthly water deliveries in Table 3-3 of the SPSP Water Supply Master Plan (see **Appendix A**) should not conflict with the ability of NCMWC to deliver water to shareholder lands outside of the Sutter Pointe area under nearly all, if not all, cases. Should a conflict in delivery schedules arise, the system operator could adjust the mix of groundwater pumping and M&I surface water diversions to accommodate the irrigation needs of the neighboring farmers.

Contracts, including the NCMWC Settlement Contract. However, the court did not invalidate the Settlement Contracts. The court has ordered the parties to submit additional evidence on the question of whether the Settlement Contracts involved discretionary action sufficient to trigger the Bureau of Reclamation's duty to consult under the ESA. Notably, though, if the Settlement Contracts were to be invalidated by the court in some future legal proceeding, NCMWC and the other Settlement Contractors could continue to divert water under their water rights permits and licenses. If the Settlement Contracts are invalidated, the water that is generated by the CVP (Project Water), may not be available to the Settlement Contractors until after the Bureau of Reclamation completes a new ESA consultation. However, it is likely that if the long-term Settlement Contracts were invalidated, the parties would enter into interim contracts while the ESA consultation is pending, as the Bureau of Reclamation requires such agreements to properly manage operations of the Central Valley Project.

In order to assure that sufficient surface water supplies will be available to Sutter Pointe, the County will impose the following conditions pertaining to surface water supplies in approving any small-lot tentative subdivision map:

1. The County will require either the conveyance to the County, or to any other public entity responsible for providing wholesale or retail surface water to the affected property (e.g., a County Service Area), all shares the affected landowner(s) may hold in NCMWC that are associated with the land subject to the tentative subdivision map or, in lieu thereof, requiring, in exchange for voluntary retirement of all shares held by the affected landowner(s), execution of a contract between NCMWC and the County, or any other public entity responsible for providing wholesale or retail surface water to the affected property, providing a water supply equivalent to that available through such shares; and
2. The County will disallow non-agricultural development in Sutter Pointe absent such conveyance of shares or agreement with NCMWC providing a water supply or, alternatively, absent the conveyance of shares or agreement with NCMWC, proof of a right to use an alternate surface water source that is of sufficient quantity to serve the area and is as reliable as the surface water NCMWC uses pursuant to its water rights and/or its Settlement Contract with the USBR.

3.3.2.1 Reliability of NCMWC Surface Water Supplies

The nature of water diversions under the Renewal Contract provides a favorable entitlement to divert during dry years. The maximum reduction in NCMWC's diversions during any "critical year" is 25% of both Base Supplies and Project Water. Annual water deliveries from the USBR are determined on the basis of natural inflow to Shasta Lake (the Shasta Index). In a normal year when there is ample water in the Central Valley Project (CVP) system, NCMWC receives 100% of its Settlement Contract entitlement. During a "critical year," NCMWC receives no less than

75% of its normal year entitlement, or 90,150 acre-feet. A "critical year" means any year in which either of the following eventualities exist:

(1) The forecasted full natural inflow to Shasta Lake for the current Water Year (October 1 through September 30), as such forecast is made by the United States on or before February 15 and reviewed as frequently thereafter as conditions and information warrant, is equal to or less than 3.2 million acre-feet; or

(2) The total accumulated actual deficiencies below 4 million acre-feet in the immediately prior Water Year or series of successive prior Water Years each of which had inflows of less than 4 million acre-feet, together with the forecasted deficiency for the current Water Year, exceed 800,000 acre-feet.

"Critical years" occur relatively infrequently. Over the last 85 years of record (1921-2006), the Shasta Index has been (or would have been) triggered only nine times (1924, 1931, 1932, 1933, 1934, 1977, 1991, 1992, and 1994). This results in the occurrence of a critical year in less than one in nine years.

3.3.2.2 NCMWC Surface Water Supplies Available to Sutter Pointe

Owners of approximately 5,009.3 acres, or 67%, of the 7,527.6-acre project site own shares in the NCMWC. This area is irrigated with surface water from NCMWC's existing water rights and entitlements. The remaining 2,518.3 acres are within NCMWC's service area boundary; however, these lands are not owned by NCMWC shareholders nor have they been historically served by NCMWC. The non-shareholder lands are located along the eastern site boundary of the project site and are served by existing groundwater wells.

The Sutter Pointe Specific Plan area (7527.6± acres) represents approximately one-quarter (25%±) of the NCMWC's overall irrigation demand.[9] However, shareholder acres on the project site represent approximately 15.83%[10] of the total 31,652± shareholder acres within NCMWC.[11] Under the terms of NCMWC's Bylaws, then, the project area is entitled to receive up to 15.83% of NCMWC's total diversions. Non-shareholder lands within the planning area (2518.3± acres) are served by groundwater pumping, currently estimated to be in the magnitude of 8,367± acre-feet per year.[12]

NCMWC has a closed irrigation system wherein the tail water from irrigation is captured in Reclamation District No. 1000 local drainage ditches and is therefore available to be recycled to

[9] Cited from personal conversation with Dee E. Swearingen, General Manager, Natomas Central Mutual Water Company, June 13, 2007.
[10] Sutter Pointe percentage share of NCMWC Service Area calculated as follows: (5,009.3)/(31,652)*100%
[11] The NCMWC service area size is cited from personal conversation with Dee E. Swearingen, General Manager, Natomas Central Mutual Water Company, June 13, 2007.
[12] Source: Luhdorff & Scalmanini Consulting Engineers.

the highline ditches owned by NCMWC. Recycled irrigation water reduces the quantity of "new" water that needs to be diverted from the Sacramento River to meet the irrigation demands of NCMWC shareholder lands.

Additionally, runoff from urban areas in the developed portions of the Natomas Basin in Sacramento County augments the volume of water available within Reclamation District No. 1000 drainage ditches during the irrigation season, principally a result of summer time nuisance flows from lawn irrigation and the like.[13] Since these drainage ditches are inter-tied throughout the entirety of the Natomas Basin, these urban runoff waters are available for recycling by NCMWC shareholders for agricultural irrigation. Although recycling of urban runoff may be practiced by NCMWC, the use of this recaptured urban runoff is not assumed to be available as part of the water supply for Sutter Pointe.

To the extent that lands are converted from agricultural production to urban land uses within the SPSP area, the amount of tail water from irrigation that will enter Reclamation District No. 1000 ditches will be reduced. This would cause a net decrease in the quantity of recycled irrigation water available for agricultural irrigation of NCMWC shareholder lands. While data is not available on the quantity or the volume of tailwater used or generated by the irrigation of lands within the project site, it is not known if the conversion of these lands to urban uses will actually create a net reduction in the availability of tailwater within the NCMWC system.

NCMWC does not divert surface water from the Sacramento River for use by its shareholders for agricultural irrigation, on an acre-foot-by-acre-foot basis. Bureau of Reclamation records indicate the actual quantity of surface water diverted by NCMWC is in the magnitude of 88,000± acre-feet per year.[14] Historically, NCMWC has delivered approximately 30,000± acre-feet per year to the shareholder lands within the SPSP area.[15] The difference between the shareholder lands within the planning area representing one-quarter of the NCMWC's irrigation demand, but only comprising 15.83% of the shareholder acreage can be explained by the fact that, among others, some shareholders use more water than others. Thus, while the shareholders in the project area have been entitled to receive about 13,926 acre-feet per year of NCMWC's 88,000 acre-feet per year in diversions, they have historically been receiving an additional 16,074 acre-feet per year that were not needed for delivery to other NCMWC shareholders. However, if other NCMWC shareholder increase their demands in the future beyond that supported by existing diversions (88,000 acre-feet per year) but still within the amounts allowed under the Settlement

[13] The urbanized areas within Sacramento County are provided surface water from the City of Sacramento's water system.

[14] Source: Bureau of Reclamation records of deliveries and transfers of Sacramento River Water under USBR's Settlement Contract (14-06-200-885A) with NCMWC. The 88,000 acre-feet per year represents an average of 42 years of data (1965 – 2006).

[15] Amount of water delivered to the Shareholder Land within the NCMWC service area is cited from personal conversation with Dee E. Swearingen, General Manager, NCMWC, June 13, 2007. This figure has been substantiated in Table A of Appendix B of the SPSP Water Supply Master Plan (see **Appendix A**).

Contract and underlying water rights (120,000 acre-feet per year), some, if not all, of that increase could be met by increasing diversions under the USBR Settlement Contract or the NCMWC water rights without impacting the amount of water that is currently being received by the shareholders in the project area. Thus, since this analysis is based on the project area receiving only 15.83% of 88,000 acre-feet per year from NCMWC, it is a conservative approach that likely understates the water that will be available.

During normal years, NCMWC has a right to divert up to 120,200 acre-feet per year under its existing water rights and its recently renewed Settlement Contract with the USBR. In Critical Dry Years, NCMWC's Settlement Contract is cut back by 25% from 120,200 acre-feet per year to a maximum of 90,150 acre-feet per year. Assuming Sutter Pointe is able to continue to obtain water deliveries that exceed the amount it could demand to receive by virtue of its shares, the planning area would have access to approximately 30,050 acre-feet per year of surface water during normal years, and approximately 22,538 acre-feet per year of surface water during Critical Dry Years. If those years had been Critical Dry Years wherein the USBR would have instituted the 25% cutback provision of the Settlement Contract, and the proposed project is still able to obtain water deliveries in addition to the 15.83% its shares would entitle it to, sufficient surface water would remain available to meet 100% of the shareholder's water demands. (25% cutback results in a supply of 90,150 acre-feet per year; annual use by NCMWC has been 88,000 acre-feet per year; see above).

If agricultural irrigation demands were uniform throughout the NCMWC service area, the volume of diverted surface water delivered to shareholder lands lying within the planning area would be in the magnitude of 13,930± acre-feet per year during normal years (10,450± acre-feet per year during Critical Dry Years), based on these lands being 15.83% of the shareholder area within NCMWC. This obviously is not the case as 30,000± acre-feet per year have been delivered to Sutter Pointe shareholder lands.

This difference gives rise to the need to estimate the Sutter Pointe's entitlement of NCMWC's diversion rights under the USBR Settlement Contract. Three different approaches were developed to estimate Sutter Pointe's available supply:

1. Historical Use: As stated earlier, the shareholder lands within the Sutter Pointe planning area have historically used approximately 30,000 acre-feet per year of surface water during a 100% delivery year. Under this approach, Sutter Pointe's available supply would be approximately 34.09% of historical diversions under the USBR Settlement Contract (30,000 AFY/88,000 AFY x 100%).
2. Historical Diversions: Assuming the shareholder lands within the Sutter Pointe planning area represent one-quarter (25%) of the irrigation demand, shareholders could potentially divert a similar share of the actual amount of water that has been historically diverted under the Settlement Contract. The shareholder lands within

Sutter Pointe have unrestricted access to approximately 25% of the 88,000 acre-feet per year of surface water historically diverted to all shareholder land within NCMWC's service area, or approximately 22,000 acre-feet per year during a 100% delivery year and 16,500 acre-feet per year during a Critical Dry Year (25% reduction) under the USBR Settlement Contract. Sutter Pointe's entitlement would be approximately 25.0% of the historical diversions under the USBR Settlement Contract (22,000 AFY/88,000 AFY x 100%).

3. NCMWC Shares: Simply focusing on shares of stock in the NCMWC, the shareholders within Sutter Pointe, who control approximately 15.83% of the company's shares, should have access to NCMWC's water rights pro-rata to their share portion. Under this approach, the shareholder lands within the planning area would have access to approximately 13,930 acre-feet per year in a 100% delivery year (88,000 AFY x 0.1583) and 10,448 acre-feet per year in a Critical Dry Year under the USBR Settlement Contract.

Table 3-4 summarizes Sutter Pointe's available water supplies based on the percent of the Settlement Contract calculated using each of these three approaches.

Table 3-4 – Surface Water Supplies Available to Sutter Pointe under the USBR Settlement Contract during Normal and Critical Dry Years

Approach	Use	Normal Year Supplies (AFY)		Critical Dry Year Supplies (AFY)	
		Settlement Contract	Available Supplies	Settlement Contract	Available Supplies
Historical Use	34.09%	88,000	30,000	66,000	22,500
Historical Diversions	25.00%	88,000	22,000	66,000	16,500
NCMWC Shares	15.83%	88,000	13,930	66,000	10,448

Regardless of whether NCMWC supplies available to Sutter Pointe are based on historical use, historical diversions, or their percent ownership of NCMWC shares, the shareholder lands within Sutter Pointe have the right to use no less than 13,930± acre-feet per year of surface water from the Sacramento River during normal years and 10,448± acre-feet during Critical Dry Years to meet the M&I water demands within Sutter Pointe.[16, 17, 18, 19, 20, 21] Note that if the USBR

[16] Refer to Table C in Appendix B of the SPSP Water Supply Master Plan (see **Appendix A**) for calculations that verify the ability for the Proposed, Alternate "A" and Alternate "B" Water Supply Programs to serve the water demands of the project during both normal and critically dry years.

[17] The volume of Settlement Contract surface water needed to meet M&I demands within the SPSP area during normal and critical dry years is estimated in this report to be 12,128 AFY (normal year) and 9,100 AFY (critical dry year) for the Proposed Water Supply Program, 15,638 AFY (normal year) and 9,617 AFY (critical dry year) for the Alternate "A" Revised Water Supply Program, and to be 13,126 AFY (normal year) and 8,591 AFY (critical dry

Settlement Contracts are invalidated, there would be no requirement to reduce the diversions in Critical Dry Years, and at least 13,930 afy would be available to the project in *all* years.

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year) for the Alternate "B" Winter Diversion Water Supply Program. Alternate "B" requires the procurement of new winter diversion right (6,000 AFY).

[18] On December 13, 2007, NCMWC announced that it entered into an agreement to sell up to 10,000 acre-feet per year of its "Project Water" to the City of Folsom (the "Folsom Agreement"). NCMWC commissioned Wagner & Bonsignore Consulting Civil Engineers, Inc. ("Wagner & Bonsignore"), to evaluate the impacts to its shareholders of transferring up to 10,000 acre feet of Project Water. In making its decision, the NCMWC Board of Directors evaluated the impact of the proposed sale on the ability of NCMWC to meet the existing irrigation demands of its shareholders during the peak of the irrigation season. The October 31, 2007, report entitled, "Water Supply Evaluation of the Potential Transfer of 10,000 acre-feet of Project Water from USBR Contract" (the "Wagner & Bonsignore Report"), found that NCMWC had a surplus supply during the months of July and August, even during critically-dry years. Accordingly, the Wagner & Bonsignore Report concluded that "the transfer of 10,000 acre-feet of project water should not impair NCMWC's ability to continue to provide sufficient water for irrigation" of shareholders lands. A review of the analysis contained in the SPSP Water Supply Master Plan shows that the proposed sale of 3,723 acre-feet in July and 6,727 acre-feet in August during normal years would reduce the SPSP pro-rata share of NCMWC's remaining diversion rights under the Bureau Settlement Contract below the level of surface water demands required to serve this project in July and August during both normal and critical dry years (see **Appendix A** (Table C-3 in Appendix C of the SPSP Water Supply Master Plan)). However, while the magnitude of the monthly shortfall is relatively small on an annual basis, there still exists a surplus of surface water available to help meet the M&I demands of Sutter Pointe. The potential monthly surface water shortfalls in July and August can easily be eliminated by adjusting the mix between groundwater pumping and surface water diversions throughout the year. That is, increased surface water diversions during months of surplus surface water supplies with corresponding decreases in monthly ground water pumping during the same periods, and increased groundwater pumping in July and August when shortfalls in surface water supplies occur. The net result would be that overall annual groundwater and surface water quantities would not change under any of the alternative water supply programs. Accordingly, the findings and conclusions contained in this assessment would not be affected by the sale of water to the City of Folsom.

[19] See Section 3.3.7 of this Assessment. The volume of surface water needed to meet M&I demands within Sutter Pointe during normal and critical dry years is estimated to be 12,128 acre-feet per year (normal year) and 9,099 acre-feet per year (critically-dry year) for the Proposed Water Supply Program, 15,638 acre-feet per year (normal year) and 9,616 acre-feet per year (critically-dry year) for the Alternate "A" Revised Water Supply Program, and to be 13,126 acre-feet per year (normal year) and 8,590 acre-feet per year (critically-dry year) for the Alternate "B" Winter Diversion Water Supply Program.

[20] It is recognized that crop planting and associated water demands may change in the future and differ from historical usages. Additionally, the adequacy of meeting current irrigation demands needs to be compared to future M&I needs on a month-by-month basis rather than a comparison of annual demands. Further, these comparisons need to be made within the context of the monthly diversion limits contained within the USBR Settlement Contract. With regards to changing irrigation practices over time, NCMWC, as a part of their evaluation of the potential impacts of the sale to the City of Folsom, commissioned Wagner & Bonsignore to evaluate the potential impacts to its shareholders of transferring up to 10,000 acre feet of Project Water to the City of Folsom. The Wagner & Bonsignore Report evaluated historical crop patterns and the potential for future changes that might increase the overall agricultural irrigation demands within the NCMWC service area. That report found that the most recent years of record represented a reasonable approximation of the maximum irrigation demands that may occur in the future given all the various land use and development trends within the Natomas Basin. Evaluations of differences between agricultural irrigation and M&I demands on a month-by-month basis (including evaluation of monthly diversion limits in the USBR Settlement Contract) have been included elsewhere in the SPSP Water Supply Master Plan (see **Appendix A**).

[21] See **Table 3-5**. If available supplies are based on ownership of NCMWC shares, Alternative "A" would entail pumping an additional 1,708 acre-feet of groundwater pumping during a normal year.

Table 3-5 compares surface water demands under the three alternative water supply programs with the surface water supplies available to Sutter Pointe based on the three methods previously described and shown in **Table 3-4**. Surplus surface water supplies available to Sutter Pointe will be no less than 3,382 acre-feet per year in normal years and 4,649 acre-feet in critically-dry years.

Table 3-5 – Comparison of Surface Water Demands and Supplies Available to Sutter Pointe

		Historical Use		Historical Diversions		NCMWC Shares	
Water Supply Program	Surface Water Demand (ac-ft/year)	Supply (ac-ft/year)	Surplus (ac-ft/year)	Supply (ac-ft/year)	Surplus (ac-ft/year)	Supply (ac-ft/year)	Surplus (ac-ft/year)
Proposed Water Supply Program							
Normal Year	12,128	30,000	17,872	22,000	9,872	13,930	1,802
Critical Dry Year	9,099	22,500	13,401	16,500	7,401	10,448	1,349
Alternative "A" Water Supply Program							
Normal Year	15,638	30,000	14,362	22,000	6,362	13,930	(1,708)
Critical Dry Year	9,616	22,500	12,884	16,500	6,884	10,448	832
Alternative "B" Water Supply Program							
Normal Year	13,126	30,000	16,874	22,000	8,874	13,930	804
Critical Dry Year	8,591	22,500	13,909	16,500	7,909	10,448	1,857

3.3.3 New Wintertime Diversion for Alternative "B"

In addition to surface water supplies from NCMWC, Alternative "B" also relies on 5,496 acre-feet of winter-time diversions (November through March) from the Sacramento River during normal years and 4,182 acre-feet during dry years. This water supply has not yet been obtained and would require obtaining a new water right permit from the State Water Resources Control Board.

3.3.4 Surface Water Diversion Facilities

A reliable diversion facility will be required to deliver surface water to the project. It is envisioned that either the Bennett Pumping Plant, an existing agricultural diversion facility that may not have the reliability that is normal and customary for a municipal water diversion facility, will be improved to meet M&I reliability standards. Alternatively, the proposed NCMWC Sankey Diversion Facility would be constructed to accomplish this objective.

The Bennett Pumping Plant, in addition to being an aged and unscreened agricultural diversion facility, draws from the relatively shallow Natomas Cross Canal. During some water years, the level of the Sacramento River falls below the flowline of the cross canal requiring the installation of a temporary dam at the mouth of the canal and pumping of water from the river up into the canal to supply the Bennett Pumping Plant with sufficient water. It is envisioned that this practice will continue after upgrading the Bennett Pumping Plant to M&I standards. In addition to the lack of fish screens, there are concerns that predation is occurring in the deep scour holes

below the existing pump intakes where larger fish forage on smaller fish (especially juvenile Anadromous Salmonids). Additionally, due to the shallow nature of the Cross Canal, concerns have been raised about the practicality of installing fish screens and keeping adequate submergence over the pump bowls.

Upgrading of the existing Bennett Pumping Plant will need to address these design challenges. It is envisioned that a sunken and screened intake structure could be constructed that would provide the required submergence for proper operation of the pump intakes. This intake structure would include a self-cleaning trash rack that would be designed to allow sufficient flow to the screened pumps while keeping trash, debris, and predatory fish out of the pump forebay. Such an intake structure, along with redundant pumps, backup electrical power, and appropriate controls, would provide a modern and reliable diversion facility that would replace the existing Bennett Pumping Plant.[22]

Regulatory approvals required for this facility will be required from various local, state and federal agencies, including, but not limited to Reclamation District No. 1000, Sacramento Area Flood Control Authority (SAFCA), U.S. Army Corps of Engineers (COE), California Department of Fish and Game (DFG), U.S. Natural Marine Fisheries Service (NMFS), and the U.S. Fish and Wildlife Service (FWS). Fish screens would have to meet all the NMFS and DFG Fish Screening Criteria.

Notwithstanding the above discussion, the proposed upgrades to the Bennett Pumping Facility may not actually be necessary. In all likelihood, the proposed Sankey Diversion Facility, a state-of-the-art screened diversion facility that would meet M&I reliability standards, will be operational by the time surface water diversions are necessary to meet M&I water demands within Sutter Pointe. NCMWC is proposing to consolidate its five existing pumping plants into two new facilities with fish screens. If NCMWC is successful in gaining the necessary entitlements, permits and funding to consolidate its existing pumping plants, the Bennett Pumping Plant, along with other pumping facilities serving their Northern and Central Service Areas, would be abandoned once NCMWC's proposed Sankey Diversion Facility (435± cubic feet per second) is operational. NCMWC proposes to construct this new facility along the Sacramento River, at the foot of Sankey Road, immediately downstream of the confluence of the river with the Natomas Cross Canal.

[22] The total cost of upgrading the Bennett Pumping Plant is estimated to be approximately $39.2 million and would be shared with NCMWC, with the M&I customers contributing approximately 19%± to 22%± of the total cost to upgrade the facility depending upon which water supply program is actually implemented (M&I demand expressed as a percentage of the total pumping requirements of this facility (244± cfs)). NCMWC agricultural shareholders would be responsible for the remaining costs of the upgrade. The equivalent costs associated with upgrading of the existing Bennett Pumping Plant are presumed to be representative of the M&I share of the costs of the proposed Sankey Diversion Facility.

While it is uncertain whether NCMWC will actually construct the Sankey Diversion Facility, NCMWC has completed a joint EIR/EIS for which a Record of Decision was completed in July 2008 and construction of the new diversion facility could begin as early as the spring of 2009. If construction starts in the spring of 2009, then this facility could be completed and ready for operation in the fall of 2010. NCMWC is in the process of securing funding for the facility at this time. This timeline suggests that it is reasonably foreseeable that the Sankey Diversion Facility will be operational in time for delivery of surface water to Sutter Pointe by 2018. In all likelihood, the point of delivery of raw surface water for M&I uses within the planning area will occur at the new point of diversion, not at the location of the Bennett Pumping Plant.

From one standpoint, the question of whether surface water will be diverted from the Bennett Pumping Plant or the Sankey Diversion Facility is a comparatively unimportant issue, given that the same surface water supply would be diverted from either location. Compared with the process of obtaining water rights or water contracts allowing the diversion of surface water from a source such as the Sacramento River, the process of diverting such water is relatively straightforward, in that, assuming the availability of sufficient financial resources to construct such facilities, the design and construction of the facilities is simply a matter of sound engineering. Here, under either scenario, there is little doubt that, assuming available surface water supplies, adequate diversion capacity will be available.

3.3.5 Necessary Approvals for Use of Surface Water

3.3.5.1 NCMWC Surface Water Supplies

The SWRCB water right licenses allow the use of NCMWC's surface water supplies for domestic and M&I purposes with approval from the SWRCB. Accordingly, for NCMWC to supply water for M&I purposes in the proposed project site, NCMWC would need to obtain approval from the SWRCB to modify the purpose of use to allow M&I service under NCMWC's water right licenses. The process of obtaining this approval from the SWRCB includes submittal of a petition to change the purpose of use. This application would be reviewed by the staff of the SWRCB and by the general public via a public review period, before proceeding to a public hearing before the SWRCB for final consideration.

Although the NCMWC Renewal Contract with the USBR contemplates the use of water for M&I purposes, the Renewal Contract does not currently allow water diverted pursuant to the Renewal Contract to be used for M&I purposes within the Sutter Pointe planning area. Discretionary approval by the USBR is required before surface water supplies could be used for M&I purposes within Sutter Pointe. In addition to approvals from the SWRCB and the USBR, approvals may need to be obtained from the U.S. Fish and Wildlife Service, NOAA, and NMFS modify the purpose of use and place of use under the Settlement Contract.

The provision of NCMWC water to Non-Shareholder Lands would require approvals from NCMWC and the USBR and may require approvals from the State Water Resources Control

Board, and the California Department of Corporations. However, since the total M&I surface water used under any of the three water supply alternatives is significantly lower than current agricultural surface water irrigation use on the existing shareholder lands within the SPSP planning area, these approvals are not anticipated to be problematic.

For each of the three water supply programs, there will neither be a net increase in diversions under the Settlement Contract nor a negative impact on the existing NCMWC shareholders. The groundwater extracted under the Proposed Water Supply Program will be sufficient to meet the total annual needs of the Non-Shareholder Lands. As such, since the groundwater supply exceeds the demands of the Non-Shareholder Lands on an annual basis, none of the above mentioned regulatory approvals should be necessary as the surface supply usage can all be allocated to the shareholder lands.

Alternate "A" and Alternate "B" Water Supply Programs, however, have a lower dependence on groundwater pumping than does the Proposed Water Supply Program. Due to the lower magnitude of groundwater pumping, neither of these two water supply programs is capable of serving the total annual demands of the Non-Shareholder Lands solely with groundwater. Accordingly, these programs envision that some of the water diverted by NCMWC pursuant to the USBR Renewal Contract will be delivered to Non-Shareholder lands. For this reason, the above described approvals will or may be required for Alternate "A" and "B" Water Supply Programs.

As stated earlier, obtaining these approvals are not anticipated to be problematic since it can be conclusively proven that they will not increase above historic levels the amount of water diverted under the USBR Renewal Contract or impact the ability of NCMWC to serve their existing shareholders the amount of water equal to or greater than what they have received in the past.

3.3.5.2 New Wintertime Diversion for Alternative "B"

The new wintertime diversion from the Sacramento River to supply surface water to Sutter Pointe during the months of November through March would require filing and obtaining a water right permit from the State Water Resources Control Board.

3.3.6 Estimated Costs and Financing

The estimated cost of the Sutter Pointe M&I water system is projected to be approximately $239± million (including contingencies, engineering and inspection costs). The developers of Sutter Pointe propose to construct this system in phases as the development builds out over time. Economic and Planning Systems, Inc. (EPS), has prepared a financing plan to pay for the cost of the proposed water system. The financing plan contains mechanisms to fund the system improvements.

3.3.7 Planned Use of Surface Water Supplies

Under the Proposed Water Supply Program as well as Alternative "A," surface water will be used in conjunction with groundwater to meet demands within Sutter Pointe beginning sometime in 2018. **Table 3-6** and **Table 3-7** show planned surface water supplies for Sutter Pointe under the Proposed Water Supply Program and Alternative "A," respectively. Pursuant to the NCMWC Renewal Contract, surface water supplies could experience reductions of up to 25% during single and multiple-dry years ("critical years").

Table 3-6 – Planned Surface Water Supplies (Proposed Water Supply Program)

Projected Surface Water Use (ac-ft/year)	2010	2015	2020	2025	2030
Normal Years	0	0	2,920	8,982	12,128
Single and Multiple-Dry Years	0	0	2,531	7,818	9,099

Table 3-7 – Planned Surface Water Supplies (Alternative "A")

Projected Surface Water Use (ac-ft/year)	2010	2015	2020	2025	2030
Normal Years	0	0	6,485	13,924	15,638
Single and Multiple-Dry Years	0	0	4,138	8,302	9,616

Under Alternative "B," surface water would also be available for use within Sutter Pointe sometime in 2018. As shown in **Table 3-8**, Alternative "B" would use more surface water than either the Proposed Water Supply Program or Alternative "A." In addition to surface water supplies from NCMWC, Alternative B also relies on 5,496 acre-feet of winter-time diversions (November through March) from the Sacramento River during normal years and 4,182 acre-feet during dry years.

Table 3-8 – Planned Surface Water Supplies (Alternative "B")

Projected Surface Water Use (ac-ft/year)	2010	2015	2020	2025	2030
Normal Years	0	0	5,549	14,198	18,622
Single and Multiple-Dry Years	0	0	2,743	8,900	12,772

3.4 WATER SUPPLY PLANS

3.4.1 Introduction

The Sutter Pointe Specific Plan includes three alternatives for supplying water for the development. Under the Proposed Water Supply Program as well as Alternative "A" and Alternative "B," groundwater is planned to be the sole supply of water until sometime in 2018. A combination of surface water and groundwater would then serve Sutter Pointe after the necessary infrastructure to deliver and treat surface water is completed. Development of the three alternative water supply programs was guided by the following considerations:

1. The need to conserve water during single and multiple dry years;
2. Balancing of groundwater and surface water supplies in an effort to conserve both resources;
3. The existing availability of USBR Settlement Contract water (surface water) only from April through October assuming the Settlement Contract remains in effect;
4. The need to limit the monthly and annual deliveries of Settlement Contract water to comply with dry-year provisions during Critical Dry Years assuming the Settlement Contract remains in effect; and
5. Preservation of the opportunity to adjust the final mix of surface and groundwater to optimize the overall operation of the system and conserve resources.

The following subsections will integrate the use of planned surface water and groundwater supplies under the Proposed Water Supply Program as well as Alternatives "A" and "B" to show how these resources would be used to meet water demands within Sutter Pointe.

3.4.2 Proposed Water Supply Program

Under the Proposed Water Supply Program groundwater is planned to be the sole supply of water until sometime in 2018. A combination of surface water and groundwater would then serve Sutter Pointe after the necessary infrastructure to deliver and treat surface water is completed. At build out, the Proposed Water Supply Program would supply water to Sutter Pointe with groundwater during the winter months (November through March), and a combination of groundwater and surface water during the remainder of the year (April through

October). Approximately 2,518.3 acres of the 7,527.6 acres comprising Sutter Pointe are within NCMWC's service area but are not owned by NCMWC shareholders (Non-Shareholder Lands). As a result, groundwater would continue to be the sole supply for this 2,518.3-acre area after surface water supplies are available.

Table 3-9 shows projected monthly surface water and groundwater uses at build out of each phase of Sutter Pointe. **Table 3-10** shows projected monthly surface water and groundwater uses under the Proposed Water Supply Program from 2010 through 2030 in five-year increments.

Table 3-9 – Planned Normal-Year Water Supplies by Phase (Proposed Water Supply Program)[23]

	Planned Normal-Year Water Supplies (acre-feet)											
	Phase 1+A			Phase 2+B			Phase 3+C			Phase 4+D		
Month	Groundwater	Surface Water	Subtotal	Groundwater	Surface Water	Subtotal	Groundwater	Surface Water	Subtotal	Groundwater	Surface Water	Subtotal
January	371	0	371	695	0	695	901	0	901	1,109	0	1,109
February	338	0	338	631	0	631	819	0	819	1,008	0	1,008
March	405	0	405	758	0	758	982	0	982	1,210	0	1,210
April	574	0	574	772	301	1,073	505	887	1,392	505	1,209	1,714
May	802	0	802	990	510	1,500	706	1,238	1,944	706	1,688	2,394
June	962	0	962	1,024	775	1,799	847	1,486	2,333	847	2,026	2,873
July	1,157	0	1,157	1,066	1,097	2,163	1,018	1,786	2,804	1,018	2,434	3,452
August	1,148	0	1,148	1,056	1,091	2,147	1,011	1,773	2,784	1,011	2,416	3,427
September	971	0	971	1,034	781	1,815	855	1,499	2,354	855	2,043	2,898
October	802	0	802	1,188	312	1,500	1,632	312	1,944	2,082	312	2,394
November	507	0	507	947	0	947	1,228	0	1,228	1,512	0	1,512
December	405	0	405	758	0	758	982	0	982	1,210	0	1,210

	Phase 1+A			Phase 2+B			Phase 3+C			Phase 4+D		
Totals	Groundwater	Surface Water	Total	Groundwater	Surface Water	Total	Groundwater	Surface Water	Total	Groundwater	Surface Water	Total
	8,442	**0**	**8,442**	**10,919**	**4,867**	**15,786**	**11,486**	**8,981**	**20,467**	**13,073**	**12,128**	**25,201**

Table 3-10 – Planned Normal-Year Water Supplies by Year (Proposed Water Supply Program)

	Planned Normal-Year Water Supplies (acre-feet)											
	2010			2015			2020			2025		
Month	Groundwater	Surface Water	Subtotal	Groundwater	Surface Water	Subtotal	Groundwater	Surface Water	Subtotal	Groundwater	Surface Water	Subtotal
January	0	0	0	265	0	265	565	0	565	901	0	901
February	0	0	0	241	0	241	514	0	514	819	0	819
March	0	0	0	289	0	289	617	0	617	982	0	982
April	0	0	0	410	0	410	693	181	874	505	887	1,392
May	0	0	0	573	0	573	914	306	1,220	706	1,238	1,944
June	0	0	0	688	0	688	1,000	465	1,465	846	1,487	2,333
July	0	0	0	826	0	826	1,102	658	1,760	1,018	1,786	2,804
August	0	0	0	820	0	820	1,093	655	1,747	1,011	1,773	2,784
September	0	0	0	694	0	694	1,009	469	1,477	855	1,499	2,354
October	0	0	0	573	0	573	1,033	187	1,220	1,632	312	1,944
November	0	0	0	362	0	362	771	0	771	1,228	0	1,228
December	0	0	0	289	0	289	617	0	617	982	0	982

	2010			2015			2020			2025		
Totals	Groundwater	Surface Water	Total	Groundwater	Surface Water	Total	Groundwater	Surface Water	Total	Groundwater	Surface Water	Total
	0	**0**	**0**	**6,031**	**0**	**6,031**	**9,927**	**2,920**	**12,847**	**11,486**	**8,982**	**20,468**

[23] Water supplied as represented in Tables 3.8 and 3.9 may differ slightly from annual quantities presented in other sections because of rounding operations.

3.4.3 Alternative "A" Revised Water Supply Program

Similar to the Proposed Water Supply Program, groundwater is planned to be the sole supply of water until sometime in 2018 under Alternative "A." At build out of Sutter Pointe, Alternative "A" would use only groundwater from November through March, only surface water from April through June, and a combination of groundwater and surface water from July through October to meet demands during normal years. Alternative "A" would use more surface water annually than the Proposed Water Supply Program and also contemplates use of NCMWC surface water supplies within the 2,518.3 acres of Non-Shareholder Lands assuming that appropriate approvals from NCMWC can be obtained.[24]

Table 3-11 shows projected monthly surface water and groundwater uses at build out of each phase of Sutter Pointe under Alternative "A." **Table 3-12** shows projected monthly surface water and groundwater uses under Alternative "A" from 2010 through 2030 in five-year increments.

[24] If surface water supplies available to Sutter Pointe from NCMWC are determined based on the percentage of shares of NCMWC shares, a shortfall in surface water supplies would be approximately 1,708 acre-feet during normal years under Alternative "A." Additional groundwater in would be pumped to account for this potential shortfall. As detailed in Section 4, there will be sufficient groundwater supplies to meet groundwater demands of 13,073 acre-feet per year within Sutter Pointe under the Proposed Water Supply Program during normal years. Therefore, there will also be sufficient groundwater supplies to accommodate the potential increase in groundwater pumping from 9,563 acre-feet per year to 11,271 acre-feet per year under Alternative "A."

Table 3-11 – Planned Normal-Year Water Supplies by Phase (Alternative "A")[25]

	Planned Normal-Year Water Supplies (acre-feet)											
	Phase 1+A			Phase 2+B			Phase 3+C			Phase 4+D		
Month	Groundwater	Surface Water	Subtotal	Groundwater	Surface Water	Subtotal	Groundwater	Surface Water	Subtotal	Groundwater	Surface Water	Subtotal
January	371	0	371	695	0	695	901	0	901	1,109	0	1,109
February	338	0	338	631	0	631	819	0	819	1,008	0	1,008
March	405	0	405	758	0	758	982	0	982	1,210	0	1,210
April	574	0	574	0	1,073	1,073	0	1,392	1,392	0	1,714	1,714
May	802	0	802	0	1,500	1,500	0	1,944	1,944	0	2,394	2,394
June	962	0	962	0	1,799	1,799	0	2,333	2,333	0	2,873	2,873
July	1,157	0	1,157	0	2,163	2,163	0	2,804	2,804	535	2,917	3,452
August	1,148	0	1,148	0	2,147	2,147	0	2,784	2,784	510	2,917	3,427
September	971	0	971	0	1,815	1,815	0	2,354	2,354	387	2,511	2,898
October	802	0	802	1,188	312	1,500	1,632	312	1,944	2,082	312	2,394
November	507	0	507	947	0	947	1,228	0	1,228	1,512	0	1,512
December	405	0	405	758	0	758	982	0	982	1,210	0	1,210

	Phase 1+A			Phase 2+B			Phase 3+C			Phase 4+D		
Totals	Groundwater	Surface Water	Total	Groundwater	Surface Water	Total	Groundwater	Surface Water	Total	Groundwater	Surface Water	Total
	8,442	**0**	**8,442**	**4,977**	**10,809**	**15,786**	**6,544**	**13,923**	**20,467**	**9,563**	**15,638**	**25,201**

Table 3-12 – Planned Normal-Year Water Supplies by Year (Alternative "A")

	Planned Normal-Year Water Supplies (acre-feet)											
	2010			2015			2020			2025			2030		
Month	Groundwater	Surface Water	Subtotal	Groundwater	Surface Water	Subtotal	Groundwater	Surface Water	Subtotal	Groundwater	Surface Water	Subtotal	Groundwater	Surface Water	Subtotal
January	0	0	0	265	0	265	565	0	565	901		901	1,109	0	1,109
February	0	0	0	241	0	241	514	0	514	819		819	1,008	0	1,008
March	0	0	0	289	0	289	617	0	617	982		982	1,210	0	1,210
April	0	0	0	410	0	410	230	644	874	0	1,392	1,392	0	1,714	1,714
May	0	0	0	573	0	573	320	900	1,220	0	1,944	1,944	0	2,394	2,394
June	0	0	0	688	0	688	385	1,079	1,465	0	2,334	2,334	0	2,873	2,873
July	0	0	0	826	0	826	462	1,298	1,760	0	2,804	2,804	535	2,917	3,452
August	0	0	0	820	0	820	459	1,288	1,747	0	2,784	2,784	510	2,917	3,427
September	0	0	0	694	0	694	388	1,089	1,477	0	2,354	2,354	387	2,511	2,898
October	0	0	0	573	0	573	1,033	187	1,220	1,632	312	1,944	2,082	312	2,394
November	0	0	0	362	0	362	771	0	771	1,228		1,228	1,512	0	1,512
December	0	0	0	289	0	289	617	0	617	982		982	1,210	0	1,210

	2010			2015			2020			2025			2030		
Totals	Groundwater	Surface Water	Total	Groundwater	Surface Water	Total	Groundwater	Surface Water	Total	Groundwater	Surface Water	Total	Groundwater	Surface Water	Total
	0	**0**	**0**	**6,031**	**0**	**6,031**	**6,362**	**6,485**	**12,847**	**6,544**	**13,924**	**20,468**	**9,563**	**15,638**	**25,201**

[25] Water supplied as represented in Tables 3.10 and 3.11 may differ slightly from annual quantities presented in other sections because of rounding operations.

3.4.4 Alternative "B" Revised Water Supply Program

Under Alternative "B," groundwater would be the sole source of supply until sometime in 2018. At build out, Alternative "B" would use a combination of groundwater and surface water throughout the year. Alternative "B" would use the highest annual quantity of surface water and contemplates using NCMWC surface water supplies to serve demands throughout all of Sutter Pointe. In addition to surface water supplies from NCMWC, Alternative B also relies on 5,496 acre-feet of new winter-time diversions (November through March) from the Sacramento River during normal years and 4,182 acre-feet during dry years.

Table 3-13 shows projected monthly surface water and groundwater uses at build out of each phase of Sutter Pointe under Alternative "B." **Table 3-14** shows projected monthly surface water and groundwater uses under Alternative "B" from 2010 through 2030 in five-year increments.

Table 3-13 – Planned Normal-Year Water Supplies by Phase (Alternative "B")[26]

	Planned Normal-Year Water Supplies (acre-feet)											
	Phase 1+A			Phase 2+B			Phase 3+C			Phase 4+D		
Month	Groundwater	Surface Water	Subtotal	Groundwater	Surface Water	Subtotal	Groundwater	Surface Water	Subtotal	Groundwater	Surface Water	Subtotal
January	371	0	371	295	400	695	251	650	901	273	836	1,109
February	338	0	338	231	400	631	219	600	819	270	738	1,008
March	405	0	405	358	400	758	382	600	982	277	933	1,210
April	574	0	574	500	573	1,073	308	1,084	1,392	449	1,265	1,714
May	802	0	802	650	850	1,500	407	1,537	1,944	699	1,695	2,394
June	962	0	962	680	1,119	1,799	607	1,726	2,333	699	2,174	2,873
July	1,157	0	1,157	750	1,413	2,163	806	1,998	2,804	699	2,753	3,452
August	1,148	0	1,148	730	1,417	2,147	791	1,993	2,784	699	2,728	3,427
September	971	0	971	650	1,165	1,815	607	1,747	2,354	699	2,199	2,898
October	802	0	802	788	712	1,500	982	962	1,944	1,253	1,141	2,394
November	507	0	507	547	400	947	578	650	1,228	285	1,227	1,512
December	405	0	405	358	400	758	332	650	982	277	933	1,210

	Phase 1+A			Phase 2+B			Phase 3+C			Phase 4+D		
Totals	Groundwater	Surface Water	Total	Groundwater	Surface Water	Total	Groundwater	Surface Water	Total	Groundwater	Surface Water	Total
	8,442	**0**	**8,442**	**6,537**	**9,249**	**15,786**	**6,270**	**14,197**	**20,467**	**6,579**	**18,622**	**25,201**

Table 3-14 – Planned Normal-Year Water Supplies by Year (Alternative "B")

	Planned Normal-Year Water Supplies (acre-feet)											
	2010			2015			2020			2025		
Month	Groundwater	Surface Water	Subtotal	Groundwater	Surface Water	Subtotal	Groundwater	Surface Water	Subtotal	Groundwater	Surface Water	Subtotal
January	0	0	0	265	0	265	325	240	565	251	650	901
February	0	0	0	241	0	241	274	240	514	219	600	819
March	0	0	0	289	0	289	377	240	617	382	600	982
April	0	0	0	410	0	410	530	344	874	308	1,084	1,392
May	0	0	0	573	0	573	710	510	1,220	407	1,537	1,944
June	0	0	0	688	0	688	793	671	1,465	606	1,727	2,333
July	0	0	0	826	0	826	912	848	1,760	806	1,998	2,804
August	0	0	0	820	0	820	897	850	1,747	791	1,993	2,784
September	0	0	0	694	0	694	778	699	1,477	607	1,747	2,354
October	0	0	0	573	0	573	793	427	1,220	982	962	1,944
November	0	0	0	362	0	362	531	240	771	578	650	1,228
December	0	0	0	289	0	289	377	240	617	332	650	982

	2010			2015			2020			2025		
Totals	Groundwater	Surface Water	Total	Groundwater	Surface Water	Total	Groundwater	Surface Water	Total	Groundwater	Surface Water	Total
	0	**0**	**0**	**6,031**	**0**	**6,031**	**7,298**	**5,549**	**12,847**	**6,270**	**14,198**	**20,468**

	2030		
	Groundwater	Surface Water	Subtotal
January	273	836	1,109
February	270	738	1,008
March	277	933	1,210
April	449	1,265	1,714
May	699	1,695	2,394
June	699	2,174	2,873
July	699	2,753	3,452
August	699	2,728	3,427
September	699	2,199	2,898
October	1,253	1,141	2,394
November	285	1,227	1,512
December	277	933	1,210

	2030		
Totals	Groundwater	Surface Water	Total
	6,579	**18,622**	**25,201**

[26] Water supplied as represented in Tables 3.12 and 3.13 may differ slightly from annual quantities presented in other sections because of rounding operations.

3.5 NORMAL, SINGLE-DRY AND MULTIPLE-DRY YEAR INTEGRATION

Table 3-15 integrates water demands, surface water supplies, and groundwater supplies for Sutter Pointe in 5-year increments through 2030 during normal, single-dry and multiple-dry years under the Proposed Water Supply Program. Maximum annual surface water use will be 12,126 acre-feet and maximum annual groundwater use will be 13,073 acre-feet.

Table 3-15 – Sutter Pointe Water Demands and Supplies during Normal, Single-Dry and Multiple-Dry Years (Proposed Water Supply Program)

		Water Supplies					
Year	Projected Baseline Water Demand (ac-ft/year)	Groundwater	Surface Water			Total Available Water Supply (ac-ft/year)	Projected Surplus/ (Shortfall) (ac-ft/year)
		Available Water Supply (ac-ft/year)	Hydrologic Year Type		Available Water Supply (ac-ft/year)		
2010	0	---	Normal		---	---	---
	0	---	Single Dry		---	---	---
		---	Multiple Dry	Year 1	---	---	---
		---		Year 2	---	---	---
		---		Year 3	---	---	---
2015	6,030	6,030	Normal		0	6,030	0
	5,276	5,276	Single Dry		0	5,276	0
		5,276	Multiple Dry	Year 1	0	5,276	0
		5,276		Year 2	0	5,276	0
		5,276		Year 3	0	5,276	0
2020	12,848	9,928	Normal		2,920	12,848	0
	11,241	8,710	Single Dry		2,531	11,241	0
		8,710	Multiple Dry	Year 1	2,531	11,241	0
		8,710		Year 2	2,531	11,241	0
		8,710		Year 3	2,531	11,241	0
2025	20,468	11,486	Normal		8,982	20,468	0
	17,907	10,089	Single Dry		7,818	17,907	0
		10,089	Multiple Dry	Year 1	7,818	17,907	0
		10,089		Year 2	7,818	17,907	0
		10,089		Year 3	7,818	17,907	0
2030	25,199	13,071	Normal		12,128	25,199	0
	22,048	12,949	Single Dry		9,099	22,048	0
		12,949	Multiple Dry	Year 1	9,099	22,048	0
		12,949		Year 2	9,099	22,048	0
		12,949		Year 3	9,099	22,048	0

Table 3-16 and **Table 3-17** show water demands and supplies during normal, single-dry, and multiple-dry years for revised water supply programs Alternative "A" and Alternative "B," respectively. During normal years, maximum annual surface water use would be 15,636 acre-feet at build out and maximum annual groundwater use would be approximately 9,563 acre-feet at build out under Alternative "A." Under Alternative "B," maximum annual surface water use would be 18,620 acre-feet at build out and maximum annual groundwater use would be approximately 6,577 acre-feet at build out.

Table 3-16 – Sutter Pointe Water Demands and Supplies during Normal, Single-Dry and Multiple-Dry Years (Alternative "A")

Year	Projected Baseline Water Demand (ac-ft/year)	Water Supplies					Projected Surplus/ (Shortfall) (ac-ft/year)
		Groundwater	Surface Water			Total Available Water Supply (ac-ft/year)	
		Available Water Supply (ac-ft/year)	Hydrologic Year Type		Available Water Supply (ac-ft/year)		
2010	0	---	**Normal**		---	---	---
	0	---	**Single Dry**		---	---	---
		---	**Multiple Dry**	Year 1	---	---	---
		---		Year 2	---	---	---
		---		Year 3	---	---	---
2015	6,030	6,030	**Normal**		0	6,030	0
	5,276	5,276	**Single Dry**		0	5,276	0
		5,276	**Multiple Dry**	Year 1	0	5,276	0
		5,276		Year 2	0	5,276	0
		5,276		Year 3	0	5,276	0
2020	12,848	6,363	**Normal**		6,485	12,848	0
	11,241	7,103	**Single Dry**		4,138	11,241	0
		7,103	**Multiple Dry**	Year 1	4,138	11,241	0
		7,103		Year 2	4,138	11,241	0
		7,103		Year 3	4,138	11,241	0
2025	20,468	6,544	**Normal**		13,924	20,468	0
	17,907	9,605	**Single Dry**		8,302	17,907	0
		9,605	**Multiple Dry**	Year 1	8,302	17,907	0
		9,605		Year 2	8,302	17,907	0
		9,605		Year 3	8,302	17,907	0
2030	25,199	9,561	**Normal**		15,638	25,199	0
	22,048	12,432	**Single Dry**		9,616	22,048	0
		12,432	**Multiple Dry**	Year 1	9,616	22,048	0
		12,432		Year 2	9,616	22,048	0
		12,432		Year 3	9,616	22,048	0

Table 3-17 – Sutter Pointe Water Demands and Supplies during Normal, Single-Dry and Multiple-Dry Years (Alternative "B")

Year	Projected Baseline Water Demand (ac-ft/year)	Water Supplies					Projected Surplus/ (Shortfall) (ac-ft/year)
		Groundwater	Surface Water			Total Available Water Supply (ac-ft/year)	
		Available Water Supply (ac-ft/year)	Hydrologic Year Type		Available Water Supply (ac-ft/year)		
2010	0	---	**Normal**		---	---	---
	0	---	**Single Dry**		---	---	---
		---	**Multiple Dry**	Year 1	---	---	---
		---		Year 2	---	---	---
		---		Year 3	---	---	---
2015	6,030	6,030	**Normal**		0	6,030	0
	5,276	5,276	**Single Dry**		0	5,276	0
		5,276	**Multiple Dry**	Year 1	0	5,276	0
		5,276		Year 2	0	5,276	0
		5,276		Year 3	0	5,276	0
2020	12,848	7,299	**Normal**		5,549	12,848	0
	11,241	8,498	**Single Dry**		2,743	11,241	0
		8,498	**Multiple Dry**	Year 1	2,743	11,241	0
		8,498		Year 2	2,743	11,241	0
		8,498		Year 3	2,743	11,241	0
2025	20,468	6,270	**Normal**		14,198	20,468	0
	17,907	9,007	**Single Dry**		8,900	17,907	0
		9,007	**Multiple Dry**	Year 1	8,900	17,907	0
		9,007		Year 2	8,900	17,907	0
		9,007		Year 3	8,900	17,907	0
2030	25,199	6,577	**Normal**		18,622	25,199	0
	22,048	9,276	**Single Dry**		12,772	22,048	0
		9,276	**Multiple Dry**	Year 1	12,772	22,048	0
		9,276		Year 2	12,772	22,048	0
		9,276		Year 3	12,772	22,048	0

SECTION 4 – GROUNDWATER

4.1 INTRODUCTION

California Water Code section 10910, subdivisions (f)(1) and (f)(2):

> If a water supply for a proposed project includes groundwater, the following information shall be included in the water assessment:
>
> (1) A review of any information contained in the urban water management plan relevant to the identified water supply for the proposed project.
> (2) A description of any groundwater basin or basins from which the proposed project will be supplied. . . . For basins that have not been adjudicated, information as to whether the department has identified the basin or basins as overdrafted or has projected that the basin will become overdrafted if present management conditions continue, in the most current bulletin of the department that characterizes the condition of the groundwater basin, and a detailed description by the public water system, or the city of county if either is required to comply with this part pursuant to subdivision (b), of the efforts in the basin or basins to eliminate the long-term overdraft condition.

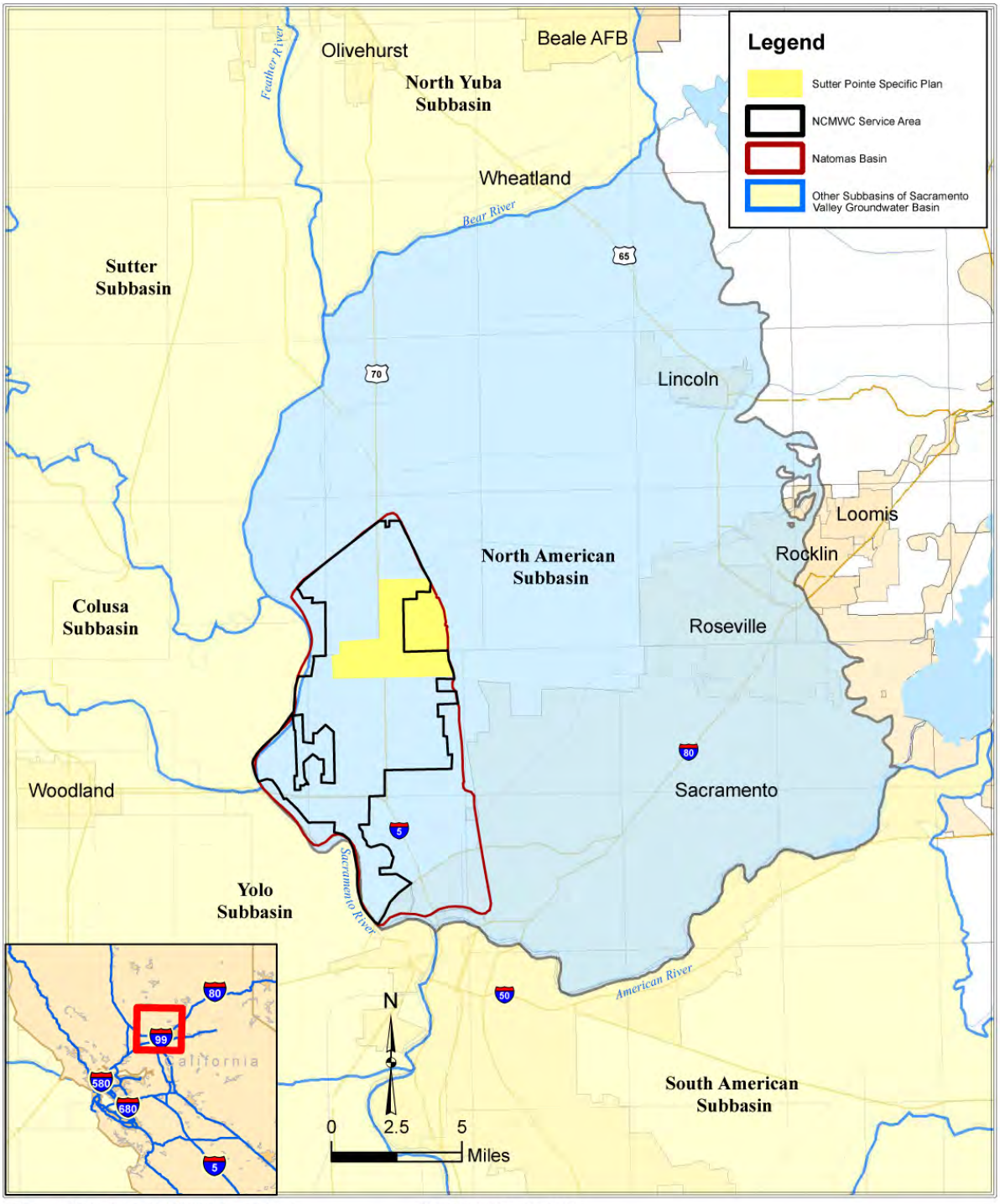
Under the Proposed Water Supply Program and Alternatives "A" and "B," groundwater will supply all water for Sutter Pointe until sometime in 2018. Thereafter, groundwater will be used in conjunction with surface water when infrastructure necessary for the delivery of surface water will be completed enabling use of surface water obtained from NCMWC. The maximum groundwater pumping for M&I use by the Sutter Pointe development at build out is projected to be 13,071 acre-feet during normal years under the Proposed Water Supply Program. Based on the information and analyses below, groundwater supplies are sufficient to supply at least 52 percent of build-out demands of Sutter Pointe as well as other existing and planned groundwater uses through 2030.[27]

[27] Combined maximum groundwater pumping for both M&I and agricultural use within the Sutter Pointe planning area is projected to be 15,477 acre-feet per year under Phase 2+B. Groundwater pumping within the Sutter Pointe planning area is then expected to decrease as agricultural land uses are replaced by urban land uses. This has been modeled by LSCE in the SPSP GSA.

The relevant groundwater basin for purposes of this assessment is the North American Groundwater Subbasin (North American Subbasin) as defined by the California Department of Water Resources (DWR). The North American Subbasin is part of the Sacramento Valley Groundwater Basin and overlies portions of Sutter County as shown below in **Figure 4-1** (included as Figure 1-1 of the *Sutter Pointe Specific Plan Groundwater Supply Assessment* prepared by Luhdorff & Scalmanini Consulting Engineers). Groundwater for Sutter Pointe will be supplied by wells pumping from the North American Subbasin.

The North American Subbasin has not been the subject of any proceeding to adjudicate rights to pump groundwater. The most recent DWR Bulletin 118 (2006) does not identify the North American Subbasin as overdrafted.

Figure 4-1 – Location of the North American Subbasin



LUHDORFF & SCALMANINI CONSULTING ENGINEERS

Figure 1-1
Location of Sutter Pointe Specific Plan Within North American Subbasin

4.2 THE NORTH AMERICAN GROUNDWATER SUBBASIN[28]

4.2.1 Groundwater Basin and Subbasin Descriptions

Sutter Pointe is located in the North American Subbasin of the Sacramento Valley Groundwater Basin (DWR Basin number 5-21). This groundwater basin is the second largest in California, and includes a total of 18 subbasins. The Sacramento Valley consists of a large northwest-trending, elongated, asymmetric structure trough that extends 150 miles north from the Sacramento-San Joaquin Delta to the City of Red Bluff. The valley is dominated by sedimentary water-bearing deposits that are thickest west of the valley axis. These deposits thin in the eastern portion of the valley where they overlie the crystalline rocks of the Sierra Nevada basement complex.

The North American Subbasin (Subbasin Number 5-21.64) is located along the eastern edge of the Sacramento River Valley and is described in the online version of DWR's Bulletin 118 update (DWR, 2006). The subbasin encompasses about 351,000 acres in Sutter, Placer, and Sacramento counties. The North American Subbasin is bounded by the Bear River on the North, the Feather River on the west, the Sacramento River on the south, and the approximate edge of the alluvial aquifer in the Sierra Nevada foothills on the east. The Sutter Pointe Specific Plan is located near the western edge of this subbasin.

4.2.2 Geology of the North American Subbasin

Prior to development, groundwater in the northern portion of the subbasin flowed to the west and southwest from the Sierra Nevada toward the Feather and Sacramento Rivers. Water bearing alluvial deposits range in thickness from a few hundred feet near the Sierra Nevada in the east to over 2,000 feet along the western edge of the subbasin. Most wells in the subbasin pump groundwater from either the volcanic Mehrten Formation or the overlying alluvial deposits. All of these formations have a westerly dip toward the axis of the valley. These water-bearing deposits are discussed in more detail below. The source for most of this discussion is the *Feasibility Report, American Basin Conjunctive Use Project* (DWR, 1997).

4.2.2.1 Mehrten Formation

The oldest major fresh water-bearing formation in the North American Subbasin is the Mehrten Formation of late Miocene to mid-Pliocene age. This formation is of volcanic origin and unconformably overlies marine sediments of Eocene age (Olmstead and Davis, 1961). It is exposed in a discontinuous band along the eastern edge of the subbasin and dips westward beneath the central and western portion of the subbasin. The top of the Mehrten Formation trends deeper from the north to the south beneath the subbasin.

[28] The description of the North American Groundwater Subbasin is taken from the SPSP GSA prepared by LSCE (see **Appendix B**).

The Mehrten Formation is often subdivided into two distinct units. One is a sedimentary unit consisting of gray to black andesitic sands, which are often reported by well drillers as "black sands." The black sands are fluvial deposits derived from andesitic source rock in the Sierra Nevada. Associated with the black sands are lenses of stream gravel deposits containing andesitic cobbles and boulders, sometimes measuring several feet in diameter. The sand and gravel lenses are interbedded with thicker blue and brown clay (DWR, 1974a). The black sand units in the Mehrten Formation are capable of yielding large quantities of groundwater to wells. In the northern portion of the subbasin, near Coon Creek, two wells completed in the Mehrten black sands are reported to produce 3,000 gallons per minute (gpm). In the southwest corner of the study area, one well completed primarily in the Mehrten black sands produced 3,200 gpm during development (DWR, 1997).

The second extensive Mehrten Formation unit is a dense, hard, gray tuff breccia, sometimes reported by well drillers as "lava." It is composed of angular pieces and blocks of andesite in a cemented ash matrix derived from volcanic eruptions in the Sierra Nevada. Where present, the tuff breccia acts as an aquitard and yields very little water to wells.

Based on data from DWR monitoring wells, the Mehrten Formation is at least 900 feet thick near the SIA. The dense, hard, gray tuff breccia is not present at this location.

4.2.2.2 Laguna and Turlock Lake Formations

The Laguna Formation of Pliocene age and the Turlock Lake Formation of early Pleistocene-age overlie the Mehrten Formation unconformably. Exposures of the Laguna are small, discontinuous, and limited to the northeastern corner of the subbasin. The Turlock Lake Formation outcrops in a wide band in the southeastern portion of the subbasin.

The Laguna and Turlock Lake formations are very similar in composition and are indistinguishable in the subsurface. They are differentiated in outcrop by the presence of a preserved clay soil horizon in the Turlock Lake Formation. The former soil profiles of the Laguna Formation have been stripped by erosion (Helley and Harwood, 1985). Both formations consist of a heterogeneous mixture of tan to brown interbedded silt, clay, and sand. They contain a few gravel lenses, which are poorly sorted and have relatively low permeability.

Sediments of these two formations are typically more fine-grained than overlying units, although it is difficult to determine subsurface boundaries from drillers' logs. Wells completed in clean Laguna Formation sands and gravels can produce significant quantities of groundwater. The combined thickness of the two units in the subbasin is probably less than 200 feet.

4.2.2.3 Riverbank and Modesto Formations

The Riverbank and Modesto formations of Pleistocene age are the most widely exposed geologic units in the subbasin. The easternmost exposures of the Riverbank and Modesto formations

unconformably overlie the Turlock Lake, Laguna, and Mehrten formations and pre-cretaceous metamorphic and igneous rocks. Like the Laguna and Turlock Lake formations, the Riverbank and Modesto formations are so similar as to be indistinguishable in drill cuttings. In outcrop, the Riverbank Formation has thicker argillic soil horizons and forms terraces that are topographically above Modesto terraces (Helley and Harwood, 1985).

The Riverbank and Modesto formations consist of a heterogeneous mixture of silt, sand, gravel and clay. The units exhibit large variability in grain size over short distances, both laterally and vertically. The maximum combined thickness of the two units is 50 to 75 feet in the subbasin. These units have moderate permeability on average but contain some coarser zones with high permeability (Olmstead and Davis, 1961).

4.2.2.4 Flood Basin Deposits and Alluvium

The youngest geologic units in the subbasin are flood basin deposits and alluvium. Laterally extensive exposures generally occur along the northern and western margins, adjacent to and within the active channels of the Bear, Feather, and Sacramento rivers. Smaller exposures occur adjacent to minor streams.

The flood basin deposits are predominantly fine-grained sediments that have accumulated in flood basins along the major rivers of the Sacramento Valley. In the subbasin, there are also a few smaller exposures north and east of Pleasant Grove. The flood basin deposits consist primarily of silt and clay, which yield little water to wells. The flood basin deposits contain local lenses of sand and gravel deposited by the migrating ancestral river channels. These lenses can yield large quantities of groundwater to wells. The thickness of the flood basin deposits in the subbasin ranges up to 100 feet (Olmstead and Davis, 1961).

The alluvium consists primarily of sand, gravel, and silt, with minor amounts of clay, deposited in recent geologic time (last 10,000 years) by active streams flowing through the study area. The most extensive deposits occur along the Bear, Feather, and Sacramento rivers. The thickness of the alluvium is estimated at 25 to 60 feet along the Bear River (Olmstead and Davis, 1961). Thinner deposits of alluvium are also exposed along the smaller streams draining the subbasin, including Coon Creek, Auburn Ravine, and Pleasant Grove Creek. Although the alluvium is highly permeable, it is too thin to represent a significant groundwater source. Most high-yield wells completed in the recent alluvium also draw groundwater from underlying formations.

4.2.3 Local Hydrogeology and Groundwater Production Zones

The thickness of the fresh water-bearing deposits beneath NCMWC increases from about 1,100 feet in the northeast to about 1,400 feet in the southwest portion of the Sutter Pointe area. These deposits can be divided into upper and lower aquifer systems. The division between the two aquifer systems is inexact due to data limitations and the difficulty in accurately determining formation contacts.

DWR (1997) indicates that the upper aquifer system consists of saturated Laguna Formation and younger sediments extend to a depth of 200 to 300 feet. Geologic data collected during construction of the Paulson production and monitoring wells and the Lauppe monitoring wells suggest the division between upper and lower zones should be deeper, probably on the order of 400 feet, at least in Sutter Pointe. Geologic conditions are generally similar in the upper 400 feet of the aquifer system, and the water level data also show that groundwater levels exhibit similar responses to a depth of about 400 feet. Therefore, for purposes of this study, the upper zone is defined as the upper 400 feet of the aquifer system, and the lower zone is assumed to extend from a depth of 400 feet to the base of fresh water.

In the Natomas Basin, the upper aquifer system generally appears to be semi-confined due to the presence of shallow clay and silt confining layers overlying the upper zone and deeper confining layers within the upper zone. Sands and gravels in the upper zone are generally thin and laterally discontinuous, and there are thick sequences of fine-grained strata between the more permeable aquifer materials. Wells completed in the upper 100 feet or so of the upper zone exhibit unconfined conditions in some areas.

The lower aquifer system consists of non-marine, Mehrten Formation deposits and includes a smaller percentage of coarse-grained sediments. However, individual coarse-grained zones in the lower aquifer are typically thicker than in the upper aquifer. In some areas, the lower aquifer is further divided into two distinct units. The upper unit is comprised of gray to black andesitic sand and associated lenses of stream gravel containing andesitic cobbles and boulders interbedded with thicker blue or brown clay. The lower unit has been described as a dense, hard, gray tuff breccia. It is composed of angular pieces and blocks of andesite in a cemented matrix of andesite, devitrified lapilli, and ash derived from volcanic eruptions in the Sierra Nevada. Based on information from DWR monitoring wells, the Mehrten Formation is at least 900 feet thick near the Sacramento Airport and the typical lower unit gray tuff does not occur at that location. The lower zone exhibits more confinement than the upper zone, but is still considered to be semi-confined. There is a delayed response to imposed stresses in the upper aquifer, indicating hydraulic interconnection between these water-bearing strata.

For the Sacramento River Basinwide Water Management Plan (BWMP), DWR reviewed drillers' logs in the NCMWC service area and reported that average well depths were 149 feet for domestic wells, 313 feet for irrigation wells, 378 feet for industrial wells, and 308 feet for municipal wells (DWR, 2003c). Therefore, the majority of the wells in NCMWC extract groundwater from the upper aquifer system as defined above.

4.2.3.1 Paulson Production and Monitoring Wells

A multiple-completion monitoring well and a production well were installed in the southeastern portion of Sutter Pointe in 2007. The primary purpose of installing the wells at this time was to determine groundwater quality in the SPSP area at different depths and allow an aquifer test to

be conducted so that aquifer characteristics could be determined. As discussed below, a 36-hour aquifer test was conducted using these wells in July 2007. The production well was designed to be used as a water supply well after development of the SPSP begins.

The two monitoring wells were constructed in April 2007 using 2-inch polyvinyl chloride (PVC) casing to depths of 250 and 400 feet, respectively. The screened intervals of the Paulson monitoring wells are 210- 220 and 230-240 feet for MW-250 and 360-370 and 380-390 feet for MW-400. The Paulson production well (PW-1) was constructed in June 2007 using 18.625-inch stainless steel casing to a depth of 408 feet. Paulson PW-1 has four separate screen sections: 185-225 feet, 265-285 feet, 325-339 feet, and 378-397 feet. A summary of well construction and testing is presented in the report, *Well Construction and Testing Summary of the Lennar Communities Paulson Production Well* (LSCE, 2007).

4.2.4 Well Yields and Aquifer Characteristics

Aquifer characteristics refer to the ability of aquifers to transmit and store groundwater. Calculations based on data from long-term, constant rate pumping tests are the preferred method for estimating aquifer characteristics. No aquifer test data for the Natomas Basin are available in the published literature, but the results of the aquifer test conducted for this study using the Paulson production and monitoring wells are summarized below.

4.2.4.1 Well Yields and Specific Capacities

Well yields and aquifer characteristics in the North American Subbasin were summarized by DWR (1997). A review of drillers' logs indicated that wells drilled in Sutter County since 1980 range in depth from less than a hundred to over 500 feet, with an average of 183 feet. In the Natomas Basin, DWR reviewed drillers' logs that contained well yield information. The yield of these wells generally ranges from 1,000 to 2,500 gpm, with an average of about 1,900 gpm. The Sacramento River BWMP (DWR, 2003c) indicates that drillers' logs for 27 irrigation wells in the NCMWC service area contained well yield information, and the average yield of these wells was 1,625 gpm.

NCMWC prepared a DWR Groundwater Storage Grant Application in 2003, which provided yield information for 13 irrigation wells, including five wells located in the SPSP. The yields of these wells ranged from 800 to 3,500 gpm, with an average of about 2,100 gpm. An industrial well in the SPSP area, the Sysco Well, has a smaller capacity than most irrigation wells (about 650 gpm). The new Paulson production well was tested at capacities ranging from 1,233 to 2,630 gpm. The test results suggest that the well will yield about 2,000 gpm on a long-term basis.

Specific capacity is the ratio of well yield to drawdown and provides a measure of productivity for both the aquifer and the well. Specific capacity is calculated as Q/s, where Q is the yield of

the well in gpm and s is the drawdown in feet. Because specific capacity changes with time, it is typically estimated based on a projected 24-hour pumping period.

Specific capacity data are only available for three wells in the SPSP area. The 24-hour specific capacities of the Bianchi-l and 2 agricultural wells are 37 and 25 gpm/ft, respectively. The 24-hour specific capacity of the Paulson production well is 23 gpm/ft.

4.2.4.2 Transmissivity and Hydraulic Conductivity

The ability of an aquifer to transmit water is measured by the transmissivity, which can be defined as the hydraulic conductivity (permeability) times the saturated thickness. Transmissivity is best estimated from aquifer test data. The test results were plotted on log-log plots and analyzed using the Theis (1935) method, which calculates aquifer properties based on drawdown data from wells completed in a confined aquifer. Although there are low permeability confining layers above and below the zone in which Paulson PW- 1 is completed, there is some vertical groundwater flow though these zones, which means that the aquifer is semi-confined. Although the Theis model simulates confined conditions, it produced the best curve matches because there was little evidence of vertical leakage until the end of the test. A longer test would be expected to show more indication of vertical leakage.

Transmissivity values estimated from the Paulson aquifer test data range from 43,800 to 64,700 gallons per day per foot (gpd/ft), with a mean of 56,600 gpd/ft (7,600 ft^2/day). Dividing the mean value by the screened interval of the Paulson production well yields a hydraulic conductivity of 36 ft/day.

Aquifer test data are not available for other wells in the area, but transmissivity was estimated from specific capacity using an empirical equation for a confined aquifer: T = Q/s * 2000, where T is the transmissivity in gpd/ft and Q/s is the specific capacity in gpm/ft. Transmissivities estimated from specific capacity Bianchi wells 1 and 2 are 74,000 and 50,000 gpd/ft, respectively.

DWR developed a groundwater flow model of the Sacramento Valley in the 1970s and estimated hydraulic conductivity for the model element that includes the SPSP area to be 51 ft/day for the 30-230 foot depth zone and 28 ft/day for the 230-500 foot depth zone (DWR, 1978). The estimate of 36 ft/day based on the Paulson aquifer test falls within this range, which is appropriate since the screened interval of the Paulson production well (185-397 feet) includes part of both layers simulated with the DWR model.

4.2.4.3 Storage Coefficient and Storage Capacity

The ability of an aquifer to store groundwater is measured by the storage coefficient, which is defined as the volume of water that is released from or added to storage per unit surface area and per unit change in hydraulic head. For unconfined aquifers, a change in hydraulic head means a

change in the elevation of the water table, and the storage coefficient is called the specific yield. Specific yields are lower for fine-grained aquifer materials, and range from about 3% for clay to 20% for unconsolidated sand or sand and gravel (Olmsted and Davis, 1961). In its online description of the North American Subbasin, DWR assumed a specific yield of 7% for the upper 200 feet of the aquifer system.

Storage coefficients in confined aquifers are much smaller, and accurate estimates are only possible based on aquifer tests in which drawdown is measured in an observation well located at some distance from the pumped well. Storage coefficients estimated from 8.6×10^{-4} to 1.2×10^{-3}, with a mean of 1.0×10^{-3}.

The DWR 2006 basin description contains an estimated groundwater storage capacity of 4.9 million acre-feet based on an assumed aquifer thickness of only 200 feet and a specific yield of 7%. The are no available estimates of the actual amount of groundwater in storage in the subbasin, but DWR (2003b) contains an estimate of groundwater in storage beneath the NCMWC service area from a depth of 15 feet to the base of fresh water (about 1,400 acre-feet). That estimate is 3.24 million acre-feet. Section 3.4.3 of the SPSP GSA describes DWR's estimate of the total volume of groundwater stored beneath the NCMWC area.

Although it has not been quantified by DWR, the total volume of groundwater in storage in the subbasin is very large. However, this volume does not indicate what portion of the storage can safely be extracted (the safe yield) to meet water demands in the subbasin. The volume of groundwater extraction cannot exceed the rate of groundwater recharge over a period of years without causing a depletion of aquifer storage. As discussed in Chapter 6 of the SPSP GSA and Section 4.5.5 below, the change in groundwater storage is positive for all project scenarios. This indicates that groundwater levels in the Natomas Basin are predicted to rise even with the proposed project, although the rate of increase in the project area will be slightly less due to increased pumping to supply the Sutter Pointe project. This means that future groundwater inflows to the Natomas Basin are expected to exceed outflows from the Basin.

4.2.4.4 Summary

Available data to determine aquifer characteristics in the North American Subbasin are limited, and the subsurface sediments are heterogeneous. Overall, the well yields, specific capacities, transmissivities, and storage coefficients calculated from the Paulson aquifer test and other data are indicative of a semi-confined aquifer containing relatively high-yielding formation materials.

4.2.5 Existing Groundwater Conditions

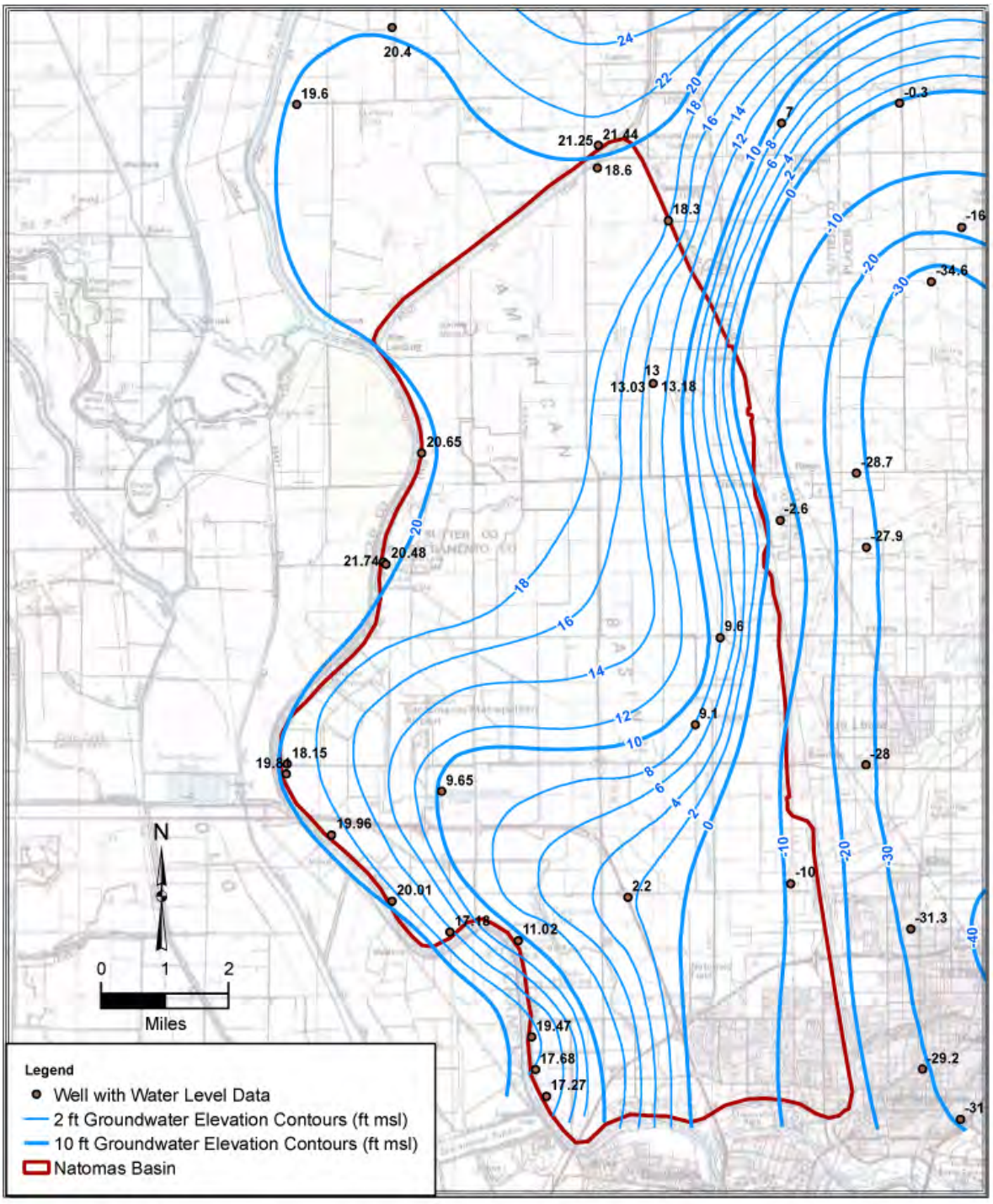
Groundwater conditions vary considerably across the North American Subbasin. Groundwater levels have been high and relatively stable in the northern and western portions of the subbasin. This is in contrast to groundwater level declines that have occurred in much of the central, eastern, and southern portions of the subbasin. Overdraft has occurred historically in the latter

areas and appears to still be occurring in the central portion of the subbasin east of the Sutter Pointe area and east of the Natomas Basin. In recent years, groundwater levels have stabilized in other areas where historical overdraft has been reported. This suggests that overdraft conditions have abated in most of the subbasin. Groundwater levels are generally higher in the upper zone, creating a downward gradient for vertical flow.

In the Natomas Basin, groundwater levels have generally been high and relatively stable in the northern and western portion but have declined in recent years in a few wells in the southern portion. Groundwater levels along the eastern edge of the Natomas Basin show historical declines followed by stabilization. Groundwater levels in this area are significantly affected by the cones of depression centered a few miles to the east. The direction of groundwater flow is easterly toward these pumping depressions, and the gradient for flow is relatively steep in this area.

Water level data are limited in the Sutter Pointe area, but groundwater levels appear to have been consistently high (generally within 10 feet of the ground surface in the spring) and relatively stable in recent years. Similar to the rest of the Natomas Basin, groundwater levels near the eastern edge of Sutter Pointe are significantly affected by the cone of depression centered about three miles to the east. Spring 2003 groundwater levels in the Natomas Basin and outlying areas are shown in **Figure 4-2** (Figure 4-11 in the SPSP GSA).

Figure 4-2 – Spring 2003 Groundwater Levels



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LUHDORFF & SCALMANINI CONSULTING ENGINEERS

Figure 4-11
Spring 2003 Groundwater Elevation Contours for Upper Zone Wells in Natomas Basin

4.3 ACTIVE GROUNDWATER AND INTEGRATED REGIONAL WATER MANAGEMENT PLANS WITHIN THE NORTH AMERICAN SUBBASIN

Although historical overdraft conditions have abated in most of the North American Subbasin, several efforts are either underway or have been completed to assess and manage groundwater resources within the subbasin. These efforts are listed and briefly described below:

- *Sacramento Valley Integrated Regional Water Management Plan*: The *Sacramento Valley Integrated Regional Water Management Plan* was completed in December 2006 by the Northern California Water Association (NCWA). Its primary purpose was to provide a framework for the management of water resources throughout the Sacramento Valley. Its planning area encompasses the portion of the Sacramento River Hydrologic Region (as defined in DWR's California Water Plan) from the Redding Groundwater Basin in the north to the Sacramento metropolitan area in the south. The Sacramento Valley IRWMP Region consists primarily of the Sacramento Valley floor area bounded by foothills in the east and west. This area also generally overlies the Redding and Sacramento Valley Groundwater Basins.
- *American River Basin Integrated Regional Water Management Plan*: The *American River Basin Integrated Regional Water Management Plan* was completed in May 2006 by the Regional Water Authority. It encompasses all of Sacramento County and most of Placer and El Dorado counties but does not include the Sutter County portion of the North American Subbasin. Its objectives are similar to the Sacramento Valley IRWMP, and there is considerable overlap between the two plan areas.
- *Sacramento River Basinwide Water Management Plan*: The *Sacramento River BWMP*, completed by DWR's Northern District in 2003, contains various information about groundwater conditions and utilization in NCMWC's service area. It indicates a total of 94 irrigation wells in NCMWC, ranging in depth from 76 to 1,025 feet, with an average of 313 feet. The BWMP estimates that 29,500 acres within NCMWC are irrigated with surface water, and 2,800 acres are irrigated with groundwater. Groundwater pumping was estimated to be 15,000 acre-feet per year based on DWR's 1990 and 1998 land use maps for Sutter and Sacramento counties, respectively.
- *Sacramento Groundwater Authority Groundwater Management Plan*: The *Sacramento Groundwater Authority Groundwater Management Plan* was adopted by the Sacramento Groundwater Authority in December 2003. The plan covers the Sacramento County portion of the North American Subbasin and, thus, includes the southern two-thirds of the Natomas Basin.
- *Western Placer County Groundwater Management Plan*: The *Western Placer County Groundwater Management Plan* was prepared by Montgomery Watson Harza (MWH) on behalf of the City of Roseville, City of Lincoln, Placer County Water Agency, and

California American Water. The Plan was adopted by the respective agencies during the summer and fall of 2007

4.4 SUTTER COUNTY GROUNDWATER PUMPING

California Water Code section 10910, subdivision (f)(3):

> If a water supply for a proposed project includes groundwater, the following information shall be included in the water assessment:
>
> (3) A detailed description and analysis of the amount and location of groundwater pumped by the public water system, or the city or county if either is required to comply with this part pursuant to subdivision (b), for the past five years from any groundwater basin from which the proposed project will be supplied. The description and analysis shall be based on information that is reasonably available, including, but not limited to, historic use records.

4.4.1 Historic Groundwater Pumping by the County of Sutter

Sutter County has not pumped any groundwater from the North American Subbasin. Sutter County has and continues to operate one well in the town of Robbins. However, Robbins is located outside of the North American Subbasin and is therefore not relevant to this assessment.

4.4.2 Projected Groundwater Pumping by the County of Sutter

California Water Code section 10910, subdivision (f)(4):

> If a water supply for a proposed project includes groundwater, the following information shall be included in the water assessment:
>
> (4) A detailed description and analysis of the amount and location of groundwater that is projected to be pumped by the public water system, or the city or county if either is required to comply with this part pursuant to subdivision (b), from any basin from which the proposed project will be supplied. The description and analysis shall be based on information that is reasonably available, including, but not limited to, historic use records.

Projected groundwater pumping by Sutter County from the North American Subbasin is based on three factors: (1) projected water demands of existing urban and rural residential areas served

with groundwater by Sutter County service areas; (2) projected water demands for Sutter Pointe; and (3) projected water demands of other proposed projects located in unincorporated areas of Sutter County to be served with groundwater by the County of Sutter.

Although groundwater will be pumped by other water users overlying the North American Subbasin, this section of the Water Code is asking for representation of only the quantity of water pumped by the intended purveyor for the Sutter Pointe Specific Plan, which is the County of Sutter.[29]

Existing Service Areas – As stated above, Sutter County does not operate any service areas located within the North American Subbasin.

Sutter Pointe Specific Plan – Projected groundwater pumping by Sutter Pointe under the Proposed Water Supply Program, Alternative A, and Alternative B during normal and dry years is shown in **Table 4-2**.

Table 4-2 – Projected Annual Groundwater Use within Sutter Pointe (Proposed Water Supply Program)

	Projected Groundwater Use (acre-feet/year)	2010	2015	2020	2025	2030
Proposed Water Supply Program	Normal Years	0	6,030	9,928	11,486	13,071
	Single and Multiple-Dry Years	0	5,276	8,709	10,089	12,948
Alternative A	Normal Years	0	6,030	6,363	6,544	9,561
	Single and Multiple-Dry Years	0	5,276	7,103	9,605	12,432
Alternative B	Normal Years	0	6,030	7,299	6,270	6,577
	Single and Multiple-Dry Years	0	5,276	8,498	9,007	9,276

[29] A pair of existing numerical groundwater flow models were used to evaluate the impacts of the Sutter Pointe project on groundwater conditions in the North American Subbasin (see Section 5.0 of the SPSP GSA and Section 4.5.2 below.). The two models (NARIGSM and SACISGM) were linked and used to simulate the effect of variations in the rate, timing, and location of Sutter Pointe pumping and also other pumping as identified for the model area for a 35-year horizon and under different water year types. As discussed Section 6.1.1 of the SPSP GSA, estimated pumpage in the entire subbasin was included in the simulation of the Existing and Future Conditions Baseline scenarios.

Other Proposed Projects – Other than Sutter Pointe, there are currently no other projects being planned within the North American Subbasin that will be served by groundwater pumped by Sutter County.

Summary of Groundwater Demands Projected to be Served by Sutter County – Total projected groundwater pumping by Sutter County in 2030 from the North American Subbasin includes only the groundwater demands associated with Sutter Pointe as described in **Table 3-7** above. Maximum groundwater pumping would occur under the Proposed Water Supply Program for all year types.

4.5 SUFFICIENCY OF GROUNDWATER SUPPLIES

4.5.1 Introduction

> California Water Code section 10910, subdivision (f)(5):
>
> > If a water supply for a proposed project includes groundwater, the following information shall be included in the water assessment:
> >
> > An analysis of the sufficiency of the groundwater from the basin or basins from which the proposed project will be supplied to meet the projected water demand associated with the proposed project.

As required by Water Code § 10910, the assessment needs to investigate the groundwater uses and aquifer conditions for an area broader than just the proposed project or the service area of the existing purveyor. For purposes of this assessment, a study area has been defined as the North American Subbasin in order to provide a broad representation of groundwater uses.

Analysis of the sufficiency of groundwater supplies available to meet the needs of Sutter Pointe and other groundwater users throughout the North American Subbasin was conducted by LSCE in the SPSP GSA. The SPSP GSA evaluates the water needs of Sutter Pointe until 2030 in relation to existing and future water demands and supplies within Sutter Pointe (especially the Natomas Basin that encompasses Sutter Pointe) and the North American Subbasin. This section summarizes the analyses performed by LSCE and the conclusions in the SPSP GSA.

4.5.2 Groundwater Models

A pair of existing numerical groundwater flow models were used to evaluate the impacts of the Sutter Pointe project on groundwater conditions in the North American Subbasin. The models are based on the Integrated Groundwater and Surface Water Models (IGSM) developed by Montgomery Watson Harza Global, Inc. (MWH) in the 1990s. The IGSM model for the

Sutter/Placer County portion of the North American Subbasin, which includes Sutter Pointe, is referred to as the North American River (NAR) IGSM and was originally developed by MWH in 1995. The NARIGSM was subsequently updated by DWR (1997) and MWH (2001). The SACIGSM and NARIGSM models cover the North American Subbasin and are the only calibrated groundwater flow models that encompass a large enough area to simulate all potential project-related groundwater and surface-water impacts. Although there are limitations to these models, they are well documented and generally accepted by local water purveyors and state agencies. More background on the SACIGSM and NARIGSM models is provided below.

For purposes of the Sutter Pointe evaluation of potential project pumping impacts, including locally and regionally in the North American Subbasin, WRIME linked the NARIGSM and SACIGSM models and used them to simulate the effect of variations in the rate, timing, and location of Sutter Pointe pumpage and also other pumpage as identified for the study area for a 35-year horizon and under different water year types.

WRIME, in coordination with LSCE, conducted the model calibration and simulations that involved linking the NARIGSM and SACIGSM models. IGSM Code Version 6.2 was used for the linked model simulations. The linked NARIGSM and SACIGSM models have been used to simulate the effect of variations in the rate, timing, and location of SPSP pumpage and also other pumpage as identified in the North American Subbasin, with emphasis on the Natomas Basin, for a 35-year horizon and under different water year types.

Since they were last calibrated (1995 for the NARIGSM and 2007 for the SACIGSM), a number of changes have been made to both models. A check of the calibration was performed in fall 2007 after the refinement of the hydraulic conductivity values in the Natomas Basin to match recent aquifer test data. This check showed that the calibration remained within guidelines established in the latest modeling reports. Further updates and refinements were made to the model through late 2007 and early 2008 to incorporate new and more detailed information for the Natomas area. While additional checks of the calibration were not performed, the changes were considered to have only a minor effect on the calibration. Although the calibration of the NARIGSM and SACIGSM models used for the Sutter Pointe evaluation exhibits heads that are somewhat overestimated or underestimated at some locations, the calibration is considered acceptable and the use of the models is reasonable for evaluating the impacts of the proposed project and project alternatives.

4.5.3 Modeling Scenarios

Two baseline (no-project) and six project scenarios were developed and simulated with the IGSM models. For each scenario, the model was run for a 35-year simulation period based on 1970-2004 hydrologic conditions.

The baseline scenarios include the Existing Conditions Baseline (ECB) and the Future Conditions Baseline (FCB). The ECB scenario generally represents existing conditions in the groundwater basin based on 1994 to 2004 data. The FCB simulates conditions in the groundwater basin in 2030.

The project scenarios simulate the Proposed Water Supply Program (Scenarios 1, 2A, and 2B), Alternative A (Scenario 3), and Alternative B (Scenarios 4 and 5) as described below:

- *Scenario 1*: Project Scenario 1 represents the Proposed Water Supply Program at partial development (Residential Phases 1 and 2, and Employment Phases A and B) and only the western well field. The Water Supply Master Plan determined that this stage of development of the project (approximately 12 years into the Sutter Pointe Project) represents the period of maximum groundwater pumping in the Sutter Pointe area since most of the above phases of development are projected to occur in areas historically irrigated by surface water from NCMWC rather than groundwater. Beyond Phases 1+A and 2+B of development, significant areas that have been irrigated with groundwater would be developed thereby decreasing the amount of groundwater pumping to meet agricultural irrigation demands.
- *Scenario 2A*: Project Scenario 2A represents the Proposed Water Supply Program at full build out of Sutter Pointe with both the western and eastern well fields when compared against the ECB. By this time, all agricultural land uses in the Sutter Pointe area would be replaced by M&I land uses.
- *Scenario 2B*: Project Scenario 2B represents the Proposed Water Supply Program at full build out of Sutter Pointe with both the western and eastern well fields when compared against the FCB. This scenario is otherwise identical to Scenario 2A.
- *Scenario 3*: Project Scenario 3 represents full build out of Sutter Pointe for Alternative A when compared against the FCB.
- *Project Scenarios 4 and 5*: Project Scenarios 4 and 5 represent full build out of Sutter Pointe for Alternative B against the FCB. Both Scenarios 4 and 5 assume that only one well field is constructed as the proposed wintertime diversion would eliminate the need for a second well field at full build out of Sutter Pointe. Scenario 4 assumes that the well field would be located in the southwestern portion of Sutter Pointe, while Scenario 5 assumes that the well field would be located in the eastern portion of Sutter Pointe. The SPSP GSA determined that the impacts on the aquifer vary depending on the location of the well field.

4.5.4 Simulated Groundwater Levels by Baseline Scenario

The ECB simulated water demand based on 1994 to 2004 data in the magnitude of about 87,800 acre-feet per year in the Sutter County portion of the Natomas Basin (including approximately 33,100 acre-feet per year in Sutter Pointe). The simulated water demand is about 100,700 acre-feet per year in the Sacramento County portion of the Natomas Basin, for a total of about 188,500 acre-feet per year. Over the entire simulation period, this demand was supplied by about 33,400 acre-feet per year of groundwater pumping and 155,200 acre-feet per year of surface and recycled water. The total simulated water supply for the ECB in the North American Subbasin includes 384,300 acre-feet per year of surface water (used only for water supply) and 389,800 acre-feet per year of groundwater (which includes some remediation pumping along with water supply pumping) (Jim Blanke, pers. comm., April 23, 2008). Details of the ECB are contained in the SPSP GSA.

The FCB simulates conditions in the groundwater basin in 2030. The simulated 2030 water demand in the Sutter County portion of the Natomas Basin (about 87,800 acre-feet per year) is the same as the ECB. The simulated water demand increases to about 116,800 acre-feet per year in the Sacramento County portion of the Natomas Basin, for a total of about 204,600 acre-feet per year. In this portion of Sacramento County, the agricultural demand decreased by about 6,300 acre-feet per year and the urban demand increased by about 22,300 acre-feet per year as compared to the ECB. In the Natomas Basin, these demands are supplied by about 25,300 acre-feet per year of groundwater pumping and 179,300 acre-feet per year of surface and recycled water.

For both the ECB and the FCB, the simulated surface water diversions are highest in normal years and lowest in wet years, and simulated groundwater pumping is lowest during wet years and highest during dry years. The average annual water supply for future conditions in the North American Subbasin is 535,800 acre-feet per year for surface water (used for water supply) and 328,000 acre-feet per year for groundwater (pumping includes minor amounts of remediation pumping along with water supply pumping) (Jim Blanke, WRIME, pers. comm., April 23, 2008).

For the FCB, future water supply conditions for northern Sacramento County were primarily based on UWMPs for each water district in the north area. As reported by WRIME (2007), all of the plans identified future demand projections and water supply sources to meet the demands. Most of the plans also indicate a significant transition from groundwater to surface-water utilization to meet municipal water demands.

Section 6.1.1 of the SPSP GSA explains the basis for future supply conditions, including the UWMPs for entities in northern Sacramento County that describe the planned transition to the use of more surface water and less groundwater by 2030. This section also summarizes the estimated groundwater utilization in Natomas Basin and consideration of new developments planned in Placer and Sacramento Counties, including Placer Vineyards, Placer Ranch, West

Roseville, Rio Linda-Elverta Community Water District (RL-ECWD) area, Greenbriar, Metro Air Park, and others. The specific plans for projects such as Placer Vineyards, Greenbriar, and Metro Air Park indicate surface water is planned to be the primary source of water supply, while the 2005 RL-ECWD UWMP indicates that new developments will be supplied primarily with groundwater supplemented by surface water and also some recycled water.

4.5.5 Simulated Groundwater Levels by Project Scenario

Predicted groundwater level impacts for all scenarios are discussed and depicted on contour maps in the SPSP GSA (see **Appendix B**). For purposes of this assessment, the analysis of groundwater sufficiency included evaluation of water needs of Sutter Pointe until the year 2030 in relation to existing and future water demands and supplies within the Natomas Basin and the North American Subbasin.

For all scenarios, simulated drawdowns are primarily localized in the Sutter Pointe area. Off-site drawdowns are greatest for the Proposed Project Water Supply Program (Scenarios 1, 2A, and 2B). As expected, Alternatives A and B result in smaller water level impacts. Predicted drawdowns are slightly smaller for Alternative A (Scenario 3) and much smaller for Alternative B (Scenarios 4 and 5).

The significant results of the six project scenarios (particularly Scenarios 1, 2A, and 2B which have the greatest potential groundwater level impacts) are summarized below:

1. Scenario 1:

   The maximum predicted off-site drawdowns are slightly more than 15 feet in Sutter County and about ten feet in Sacramento County. The ten-foot drawdown contour extends up to a mile away from the site to the northeast, but only about ½ mile from the site to the north and ¼ mile to the south. These off-site drawdowns are considered to be relatively small given that groundwater levels in the Natomas Basin have historically been high and are predicted to remain high in the future. In the area east of the Natomas Basin, where cones of depression already exist, the Proposed Project will have relatively small drawdown impacts of less than three feet.

   The heads in the Natomas Basin are generally stable over the entire simulation period, with no discernable upward or downward trend. Heads in the cones of depression east of the Natomas Basin are declining, although the additional decline due to the Proposed Project is considered to be negligible over that predicted in the ECB.

2. Scenario 2A

   This scenario has larger off-site drawdowns than Scenario 1 even though total pumpage in the Sutter Pointe area is less. This is the result of the well field location since

simulated drawdowns are smaller for scenarios that utilize the western well field due to a greater percentage of the water to supply the pumpage coming from the Sacramento River and the western model boundary (beneath the River).

The maximum predicted off-site drawdowns are slightly more than 15 feet in Sutter County and about ten feet in Sacramento County. The ten-foot drawdown contour extends up to a mile away from the site to the northeast, but only about ½ mile from the site to the north and ¼ mile to the south. These off-site drawdowns are considered to be relatively small given that groundwater levels in the Natomas Basin have historically been high and are predicted to remain high in the future. In the area east of the Natomas Basin, where cones of depression already exist, the Proposed Project will have relatively small drawdown impacts of less than four feet.

The heads in the Natomas Basin are generally stable over the entire simulation period, with no discernable upward or downward trend. Heads in the cones of depression east of the Natomas Basin are declining, although the additional decline due to the Proposed Project is considered to be negligible over that predicted in the ECB.

3. Scenario 2B

This scenario indicates that the maximum predicted off-site drawdowns are slightly more than 15 feet in Sutter County and about ten feet in Sacramento County. The ten-foot drawdown contour extends up to a mile away from the site to the northeast, but only about ½ mile from the site to the north and ¼ mile to the south. These off-site drawdowns are considered to be relatively small given that groundwater levels in the Natomas Basin have historically been high and are predicted to remain high in the future. In the area east of the Natomas Basin, where cones of depression already exist, the Proposed Project will have relatively small drawdown impacts of less than three feet. Spring groundwater elevations in and near the Natomas Basin are higher than for Scenario 2A due primarily to anticipated reductions in pumping east of the Natomas Basin.

Year-to-year head fluctuations due to wet and dry periods are magnified due to planned conjunctive use by the Sacramento Groundwater Authority and the Regional Water Authority member agencies (WRIME, 2007). These fluctuations are the result of increased use of surface water in wet years and increased groundwater pumping during dry years.

4. Scenario 3

Similar to Scenario 2B, the year-to-year head fluctuations due to wet and dry periods are magnified due to planned conjunctive use by the Sacramento Groundwater Authority and

the Regional Water Authority member agencies. These fluctuations are the result of increased use of surface water in wet years and increased groundwater pumping during dry years. The predicted drawdown for Scenario 3 (Alternative A) is less than for Scenario 2B. The cone of depression in the Sutter Pointe area is also smaller and not as deep, and the maximum drawdown near the western portion of the Sutter Pointe area is about ten feet.

5. Scenario 4

   Scenario 4 has the smallest off-site drawdowns due to the use of the western well field. The maximum drawdown for Scenario 4 is about five feet, and most of the drawdown is localized in the vicinity of the western well field. Year-to-year head fluctuations due to wet and dry periods are magnified due to planned conjunctive use by the Sacramento Groundwater Authority and the Regional Water Authority member agencies. These fluctuations are the result of increased use of surface water in wet years and increased groundwater pumping during dry years.

6. Scenario 5

   The maximum drawdown for Scenario 5 is about ten feet, and the five-foot drawdown contour covers a large area for this scenario. Year-to-year head fluctuations due to wet and dry periods are magnified due to planned conjunctive use by the Sacramento Groundwater Authority and the Regional Water Authority member agencies. These fluctuations are the result of increased use of surface water in wet years and increased groundwater pumping during dry years.

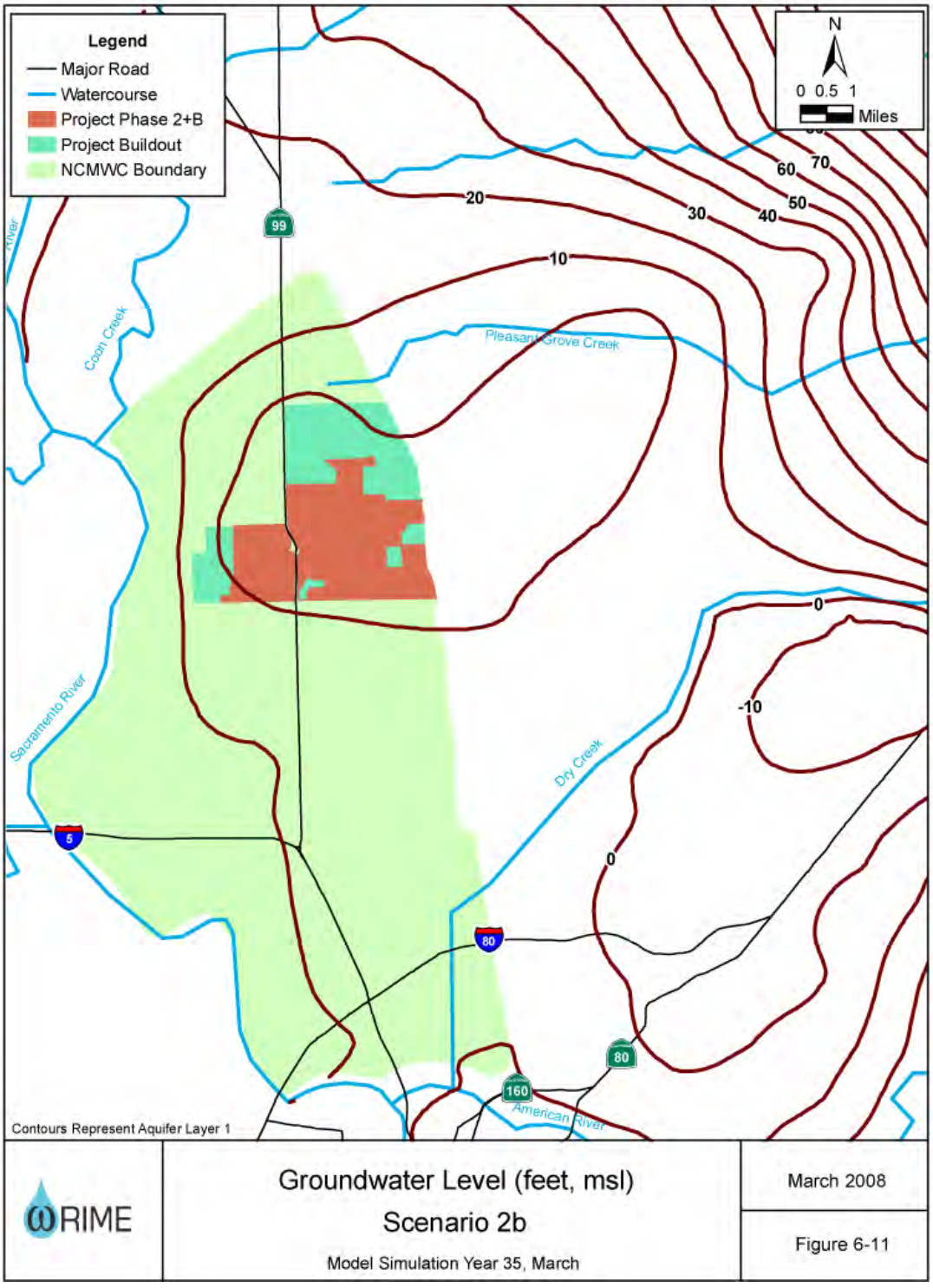
4.5.6 General Findings

All simulated groundwater elevation hydrographs included in the SPSP GSA show seasonal fluctuations and year-to-year changes in head due to wet and dry periods. Almost all hydrographs show increasing heads over the 35-year simulation period, including wells located in the cones of depression east of the Natomas Basin. Both the hydrographs and the head contour maps discussed above show that water level impacts caused by the Proposed Project, and for Alternatives A and B, are generally localized in and near the Sutter Pointe area.

The impacts of the Proposed Project and Alternatives A and B on groundwater conditions in the North American Subbasin are shown on water budget tables in Chapter 6 of the SPSP GSA. The water budgets show the change in groundwater inflow and outflow and the change in storage in the Natomas Basin due to each project scenario. The simulated change in groundwater storage is positive for all scenarios, which indicates that heads in the Natomas Basin are predicted to rise even with the Proposed Project, although the rate of increase in the project area will be slightly less due to increased groundwater pumping to supply the Sutter Pointe project. **Figure 4-3** shows projected groundwater levels for Scenario 2B. Scenario 2B represents the Proposed

Water Supply Program at full build out of Sutter Pointe, and comparing existing groundwater levels with those projected in **Table 4-3** shows the projected rise in regional groundwater levels with the Proposed Project.

Figure 4-3 – Scenario 2B Groundwater Levels



In summary, the groundwater supply anticipated for the project appears to be sustainable on a permanent basis, in that the amount of groundwater withdrawn by the project (under any of the project scenarios described above) and other foreseeable groundwater users going forward will be less than the amounts of natural replenishment over a period of years, during which water supply conditions approximate average conditions. Groundwater, then, is a viable long-term source of water for those portions of the project area planned to be served in whole or in part by groundwater.

4.5.7 Conclusion of Sufficiency of Groundwater Supplies

The results of the analyses conducted for the SPSP GSA led to the conclusion that groundwater supplies from the North American Subbasin are sufficient to serve the proposed Sutter Pointe project or project alternatives and other existing and projected uses through the year 2030 (and, presumably, on a permanent basis). The primary reasons for this conclusion are summarized below:

- In the Natomas Basin, groundwater levels have generally been high and relatively stable in the northern and western portions but have declined in recent years in a few wells in the southern portion. Groundwater levels along the eastern edge of the Natomas Basin show historical declines followed by stabilization. Groundwater levels in the eastern area are significantly affected by cones of depression centered a few miles to the east.
- Historical groundwater level declines have occurred in much of the central, eastern, and southern portions of the North American Subbasin. Overdraft has occurred historically in the latter areas and appears to still be occurring in the central portion of the subbasin east of Sutter Pointe. In recent years, groundwater levels have stabilized in other areas where historical overdraft has been reported. This suggests that overdraft conditions have abated in most of the subbasin.
- Water level data are limited in Sutter Pointe, but groundwater levels appear to have been consistently high (generally within ten feet of the ground surface in the spring) and relatively stable in recent years. Similar to the rest of the Natomas Basin, groundwater levels near the eastern edge of Sutter Pointe are significantly affected by the cone of depression centered about three miles to the east.
- Land use and water supplies were evaluated for current (2004) and future (2030) conditions in the Natomas Basin (SPSP GSA Chapter 2); this analysis shows total groundwater utilization in 2004 in the Natomas Basin. Estimated future pumpage with the project is 31,963 acre-feet per year and without the project is 27,258 acre-feet per year. Without the project, pumpage estimates for the Natomas Basin are similar for current (28,636 acre-feet per year) and future conditions (27,258 acre-feet per year). Groundwater pumping would increase by only 4,705 acre-feet per year with the project even though proposed pumping at build out (Phase 4+D) during a normal year is 13,072 acre-feet per year. This is due to the phasing out of pumping for agricultural land uses in the project area and also the shift from groundwater to surface-water utilization in other parts of the Natomas Basin.
- Future water demand and supply estimates for northern Sacramento County were primarily based on UWMPs for each water district. As reported by WRIME (2007), most of the plans indicate a significant transition from groundwater to surface water to meet future municipal water demands.

- Projected water demand and supply for the five Sutter Pointe project scenarios in normal and critically-dry years served as the basis for the analysis of potential pumping impacts and groundwater supply sufficiency**.** For the ECB, the total simulated water supply in the North American Subbasin includes 384,300 acre-feet per year of surface water (used only for water supply) and 389,800 acre-feet per year of groundwater (which includes some remediation pumping along with water supply pumping). For the FCB, the total simulated water supply in the North American Subbasin includes 535,800 acre-feet per year of surface water and 328,000 acre-feet per year of groundwater. On a subbasin scale, this represents a significant transition from groundwater to surface water to meet future water demands.
- Current pumpage in the Natomas Basin is somewhat less than the average annual rate of groundwater recharge. The ECB showed a small positive change in groundwater storage during the simulation period, which indicates that groundwater levels were stable to slightly rising. This is consistent with actual groundwater level data from the Natomas Basin discussed above.
- Future pumpage in the Natomas Basin, without the Sutter Pointe proposed project, is less than the current average annual pumping rate and also less than the average annual rate of groundwater recharge; the FCB showed a larger positive change in storage during the simulation period.
- Scenarios 1 and 2A simulated groundwater conditions at the end of Phase 2+B (about 12 years into the project) and Phase 4+D (Year 20), respectively. Although simulated heads are lower for these project scenarios compared to the ECB, the change in storage is still positive and groundwater levels are predicted to be stable to increasing in the Natomas Basin.
- Scenarios 2B, 3, 4, and 5 simulated full build out of Sutter Pointe for the proposed project and Alternatives A and B. All showed generally rising water levels in the Natomas Basin and a much larger increase in groundwater storage compared to Scenarios 1 and 2A. The predicted increase in storage is slightly smaller than for the FCB.

In summary, the analyses of observed and simulated groundwater levels and the water budget results demonstrate that groundwater supplies from the Natomas Basin and the North American Subbasin are sufficient to meet the demands of the Sutter Pointe proposed project and the project alternatives as well as other pumpage in the Natomas Basin and the North American Subbasin for more than a 20-year horizon. Groundwater supplies are indicated to be sufficient for the Sutter Pointe proposed project and project alternatives, as shown by the positive change in groundwater storage in the Natomas Basin and simulated groundwater levels for the North American Subbasin that are generally stable or increasing following the initial years of the 35-year simulation period.

SECTION 5 – CONCLUSIONS

Important conclusions based on the information and analyses presented in this assessment are as follows:

- It is the intent of Sutter County to provide retail water service to the Sutter Pointe Specific Plan Area through a dependent or independent special district (i.e., a Community Services District, a County Service Area, or some other County agency). The water system will include water supply and treatment facilities, storage reservoirs, booster pumps, transmission pipelines, and distribution pipelines to all customers within the planning area. The system will have the capability of providing adequate supplies during normal and critically-dry years to meet the domestic and fire protection needs of the plan area.
- Projected build-out water demands within Sutter Pointe are projected to be 25,199 acre-feet per year during normal years and 22,049 acre-feet per year during dry years. During critically-dry years, demands are assumed to be reduced by 12.5 percent from normal-year demands through implementation of a water shortage contingency plan that will be adopted prior to issuance of any SB 221 written verification of sufficient water supplies pursuant to pursuant to Government Code Government Code § 66473, et seq.
- The Sutter Pointe Specific Plan includes the following three alternative water supply programs:
    - *Proposed Water Supply Program*: At build out under the Proposed Water Supply program, annual demands would be met with 13,071 acre-feet of groundwater and 12,128 acre-feet of surface water from NCMWC during normal years, and 12,949 acre-feet of groundwater and 9,099 acre-feet of surface water from NCMWC during critically-dry years.
    - *Alternative "A"*: At build out under Alternative "A," annual demands would be met with 9,561 acre-feet of groundwater and 15,638 acre-feet of surface water from NCMWC during normal years, and 12,432 acre-feet of groundwater and 9,616 acre-feet of surface water from NCMWC during critically-dry years.[30]

[30] If surface water supplies available to Sutter Pointe from NCMWC are determined based on the percentage of shares of NCMWC shares, a shortfall in surface water supplies would be approximately 1,708 acre-feet during normal years under Alternative "A." Additional groundwater in would be pumped to account for this potential shortfall. As detailed in Section 4, there will be sufficient groundwater supplies to meet groundwater demands of 13,073 acre-feet per year within Sutter Pointe under the Proposed Water Supply Program during normal years. Therefore, there will also be sufficient groundwater supplies to accommodate the potential increase in groundwater pumping from 9,563 acre-feet per year to 11,271 acre-feet per year under Alternative "A."

- *Alternative "B"*: At build out under Alternative "B," annual demands would be met with 6,577 acre-feet of groundwater, 13,126 acre-feet of surface water from NCMWC, and 5,496 acre-feet of new surface water during normal years, and 12,722 acre-feet of groundwater, 8,590 acre-feet of surface water from NCMWC, and 4,182 acre-feet of new surface water during critically-dry years.

- Groundwater from the North American Subbasin is the only existing water supply available to Sutter Pointe at the present time. Maximum groundwater pumping within Sutter Pointe is planned to be 13,071 acre-feet per year. This would be able to meet at least 52 percent of build-out water demands and would supply water for development of all of Phases 1+A and 2+B.
- Based on analyses performed by Luhdorff & Scalmanini Consulting Engineers and documented in the SPSP GSA, sufficient groundwater will be available from the North American Subbasin to meet demands associated with Sutter Pointe under any of the alternative water supply programs as well as other exiting and future planned groundwater uses through 2030.
- Sutter County plans to obtain surface water from NCMWC which has the authority to serve municipal and industrial (M&I) water to shareholders and public agencies.
    - Pursuant to NCMWC's Renewal Contract with the USBR, NCMWC may divert up to 120,200 acre-feet of surface water per year. This amount includes 98,200 acre-feet per year of "Base Supply" which can be diverted from April through October and an additional 22,000 acre-feet of "Project Water" (Table 3-3), which is available during July and August.
    - Based on shares of NCMWC owned by landowners within Sutter Pointe NCMWC surface water supplies available for Sutter Pointe are no less than 19,030 acre-feet per year during normal years and 14,270 acre-feet per year during critically-dry years. Maximum use of NCMWC surface water supplies of 15,638 acre-feet would occur under Alternative "A."
    - During single and multiple dry years, NCMWC surface water deliveries may be reduced up to 25 percent pursuant to the Renewal Contract with the USBR. Such reductions have generally occurred in less than one in nine years.
    - Approval from the USBR will be required to allow NCMWC surface water supplies to be used for M&I purposes within the Sutter Pointe planning area.
    - The provision of NCMWC water to Non-Shareholder Lands would require approvals from NCMWC and the USBR and may require approvals from the State Water Resources Control Board and the California Department of Corporations.

- In order to assure that sufficient surface water supplies will be available to Sutter Pointe, the County will impose the following conditions in approving any small-lot tentative subdivision map:
    - The County will require either the conveyance to the County, or to any other public entity responsible for providing wholesale or retail surface water to the affected property (e.g., a County Service Area), all shares the affected landowner(s) may hold in NCMWC that are associated with the land subject to the tentative subdivision map or, in lieu thereof, requiring, in exchange for voluntary retirement of all shares held by the affected landowner(s), execution of a contract between NCMWC and the County, or any other public entity responsible for providing wholesale or retail surface water to the affected property, providing a water supply equivalent to that available through such shares; and
    - The County will disallow non-agricultural development in Sutter Pointe absent such conveyance of shares or agreement with NCMWC providing a water supply or, alternatively, absent the conveyance of shares or agreement with NCMWC, proof of a right to use an alternate surface water source that is of sufficient quantity to serve the area and is as reliable as the surface water NCMWC uses pursuant to its water rights and/or its Settlement Contract with the USBR.
- As planned, surface water supplies from NCMWC would be available sometime in 2018 for use within Sutter Pointe as described in the three alternative water supply programs.
- In addition to surface water supplies from NCMWC, Alternative "B" also relies on 5,496 acre-feet of winter-time diversions (November through March) from the Sacramento River during normal years and 4,182 acre-feet during critically-dry years. This water supply has not yet been obtained and would require obtaining a new water right permit from the SWRCB.

SECTION 6 – APPENDICES

Appendix A – Sutter Pointe Specific Plan Water Supply Master Plan, MacKay & Somps Civil Engineers, June 2008

Appendix B – Sutter Pointe Specific Plan Groundwater Supply Assessment, Luhdorff & Scalmanini Consulting Engineers, June 2008

Appendix C – Contract between the United States Bureau of Reclamation and the Natomas Central Mutual Water Company ("Renewal Contract"), May 10, 2005

APPENDIX A

SUTTER POINTE SPECIFIC PLAN WATER SUPPLY MASTER PLAN

Sutter Pointe Specific Plan
Water Supply Master Plan

Prepared by
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December 17, 2008

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Appendix C. H2ONET® Model Results
Appendix D. Engineer's Opinion of Costs
Appendix E. B.O.R. Settlement Contract

Abbreviations And Acronyms:

Ac	Acres
AFY	Acre-feet per year
Ac-ft/Yr/Ac	Acre-feet per year per Acre
ADF	Average day flow
AF	Acre-feet
Approx.	Approximately
CFS	Cubic feet per second
EPA	Environmental Protection Agency
FF	Fire Flow
Ft	Feet
GPM (gpm)	Gallons Per Minute
M&I	Municipal and Industrial
MDF	Maximum Daily Flow
MG	Million Gallons
MGD	Million Gallons per Day
NCMWC	Natomas Central Mutual Water Company
PHF	Peak Hour Flow
PSI (psi)	Pound per Square Inch
Project site	Sutter Pointe Specific Plan area
SPSP	Sutter Pointe Specific Plan
SWRCB	State Water Resources Control Board
WSMP	Water Supply Master Plan

1.0 Executive Summary

The Sutter Pointe Specific Plan (SPSP), consisting of approximately 7527.6± acres in South Sutter County, is proposing to be developed into a mixed-use urban community. The Measure M Group, consisting of landowners and developers for this area, is leading the planning process to urbanize this agricultural area. The availability of potable water for the SPSP area is a critical issue in the development of the planning area, as a reliable water supply is needed to meet the water demands of this new development. The possible water supply sources, conveyance methods, and facilities required have been explored in this Water Supply Master Plan (WSMP).

Presently, the Natomas Central Mutual Water Company (NCMWC) supplies irrigation water to the SPSP area through the surface water rights they hold for this area. NCMWC shareholder land comprises approximately 67%± of the SPSP project area (5009.3 ± acres) and is irrigated by surface water. The area of non-shareholder land (2518.3 ± acres) is irrigated by NCMWC supplemental surface water and existing ground water wells.

It is proposed that the future development within the SPSP area be served by the conversion of these surface water rights to meet Municipal and Industrial (M&I) demands for this area and the exercise of overlaying ground water rights to the aquifers lying below the planning area.

Since the M&I demands are generally lower than the irrigation demands, it is anticipated that sufficient surface water will be available for use in the Sutter Pointe community. However, the availability of the surface water sources for use in the SPSP may take a few years to develop. Until the surface water is available, ground water sources can be utilized[1].

[1] The Proposed Water Supply Program is capable of meeting 51.9% of the demand of the project from groundwater sources. Alternate "A" Revised Water Supply Program is capable of meeting 37.9% of the demand of the project from groundwater sources and Alternate "B" Winter Diversion Water Supply Program is capable of meeting approximately 26.1% of the demand of the project from groundwater sources.

Groundwater studies have verified the capacity of the aquifer to provide groundwater for all of the near term demands, as well as approximately one half of the long term needs of the community[2], on a sustainable basis. NCMWC currently delivers surface waters to the lands with the SPSP planning area for agricultural irrigation.

It is the expressed intent of the County of Sutter to provide M&I service within the SPSP planning area. Sutter County would initially provide groundwater for the early phases of development, and a combination of ground and surface water to meet the ultimate needs of the development. Surface water would be obtained from NCMWC which has the authority to serve M&I water to shareholders and public agencies. The existence of these surface waters is certain, as they are currently used to irrigate agricultural lands within the SPSP planning area.

It is the intent of Sutter County to provide retail water service to the Sutter Pointe Specific Plan Area through a dependent or independent special district (i.e., a Community Services District, a County Service Area, or some other County agency). A domestic water system to deliver ground and surface water to the Sutter Pointe Specific Plan Area will be developed. Potable water will be provided in sufficient quantity and of acceptable quality to meet the needs of all M&I uses within the Sutter Pointe Specific Plan Area. The water system will include water supply and treatment facilities, storage reservoirs, booster pumps, transmission pipelines, and distribution pipelines to all customers within the planning area. The system will have the capability of providing adequate supplies during normal and critical dry years to meet the domestic and fire protection needs of the plan area.

Golden State Water Company (GSWC), through its parent company (American States Water Company), entered into an agreement with NCMWC on July 1, 2004 to provide M&I water service within the NCMWC service area. GSWC is an

[2] Depending on the water supply scenario and the extent of well field development this percentage can vary from approximately 26.1% to 51.9% of normal year demands.

investor owned, California Public Utilities Commission (PUC) regulated, private water company. GSWC has expressed the intent to be the water service purveyor for the Sutter Pointe planning area and caused a Master Infrastructure Advance Planning Study (MIAPS) to be prepared (Wood Rodgers, April 24, 2006) setting forth their plan to provide ground and surface water to the development. The service plan outlined in the MIAPS is reasonably similar to the plan set forth in this master plan, albeit a higher level planning study as compared to the detailed study set forth in this master plan. GSWC has applied to the PUC for permission to service the Sutter Pointe planning area. Sutter County, however, has gone on record opposing that application. GSWC asserts its contract with NCMWC authorizes it to be the exclusive M&I purveyor within the Natomas Basin utilizing NCMWC water rights and contractual entitlements under the Settlement Contract with the U.S. Bureau of Reclamation; the County asserts that the GSWC/NCMWC contract is not sufficient to assure GSWC's ability to control water supplies because the delivery of water by a mutual water company is appurtenant to the shares, and the shareholders have not pledged their shares to NCMWC or GSWC.

At this time it is uncertain that GSWC will gain the necessary PUC approvals to serve the development. Regardless of the entity that provides the service, though, the same sources of water supply would be used; therefore the analysis of the physical water availability would not change depending on which entity prevails.

The 2008 Water Supply Master Plan for the Sutter Pointe Specific Plan (SPSP) area was prepared on a conceptual level and intended for planning and entitlement purposes only. Additional and more detailed Master Plans will need to be developed as the project moves closer and into the design stages of the development. It is the intent of this master plan to provide water facilities that meet generally accepted industry standards and that are comparable in features and quality to those provided in neighboring agencies with similar developments. For clarification, all future analysis and final design master plans will be

completed to comply with Sutter County Standards and will be subject to the review and approval of the Public Works Director of Sutter County.

2.0 Introduction

The Measure M Group is proposing to develop approx. 7527.6± acres in South Sutter County generally referred to as the Sutter Pointe Specific Plan (SPSP) area. As a part of the Sutter Pointe Specific Plan, new backbone water system facilities will be developed to meet the estimated demands for the proposed land uses.

This WSMP has been prepared to provide sources of water supply and demonstrate that a sufficient supply exists to support the proposed project. The objectives of this study are as follows:

- Identify water demands for the project area.
- Identify water supply sources (initial and build-out) for the project area.
- Identify onsite and offsite water infrastructure necessary for supply, treatment, storage, and distribution for the project.

Obviously, as the project is implemented the final land uses will be adjusted to reflect the current thinking and to respond to market forces, including the use density transfers. This master plan has been designed to provide the needed flexibility in terms of infrastructure. Over time, this master plan will need to be updated to keep pace with changes in the land use plan. Understandably, changes in land uses, if significant in nature, could result in changes to the projected water demands that might require changes in the proposed water system.

The total water demands to develop the Sutter Pointe Specific Plan Area and the requirements for transmission pipelines, distribution pipelines, and water storage facilities are presented in this study.

Surface water will be obtained from the Natomas Central Mutual Water Company (NCMWC) which currently serves SPSP area with agricultural irrigation water. The surface water will be transferred from a diversion point along the Sacramento River and conveyed through an offsite water pipeline to the location

of the proposed surface water treatment facility, approximately located between Powerline Road and SR 99/70, south of Riego Road. Additionally, a proposed well field will supply raw water to the location of the proposed ground water treatment facility, when surface water is in limited supply and/or not available, and also during the initial phase of the development.

This study evaluates three water supply programs for the SPSP area. The Proposed Water Supply Program will provide a base supply of surface water to meet the demands of the development throughout the summer months and a base supply of groundwater to meet the year round demands of the non-shareholders lands as well as supply the wintertime demands of the entire community when surface water is not available. The Alternate "A" Water Supply Program (the "Revised Water Supply Program") will provide a base supply of surface water to meet the demands of the development throughout the summer months and a base supply of groundwater to meet the demands in the winter. The Alternative "B" Water Supply Program (the "Winter Diversion Water Supply Program") will meet summer and winter demands through a supply comprised of groundwater pumping, summer surface water diversion, and the procurement of additional winter diversion rights from the Sacramento River.

The criteria used to evaluate each water supply program and the results for each program are presented herein. The proposed infrastructure, water supply, and hydraulic calculations provided within this study are preliminary and will be refined during design phase of the project.

2.1 Study Area Description

The SPSP area is located on the southeastern corner of Sutter County abutting Sacramento and Placer Counties (See Figure 1 Vicinity Map). State Route 99/70 (SR 99/70) traverses the site in a north-south fashion and Riego Road and Sankey Road runs east west through the project area. On the western side of SR 99/70 the project reaches out to Powerline Road and to the east the project reaches out to Natomas Road. The site is covered in four U.S. Geological Survey 7.5-minute series quadrangle maps (U.S. Geological Survey 1968),

namely Verona, Pleasant Grove, Taylor Monument and Rio Linda. The Sacramento River flows southerly about a mile west of the western boundary of the project area.

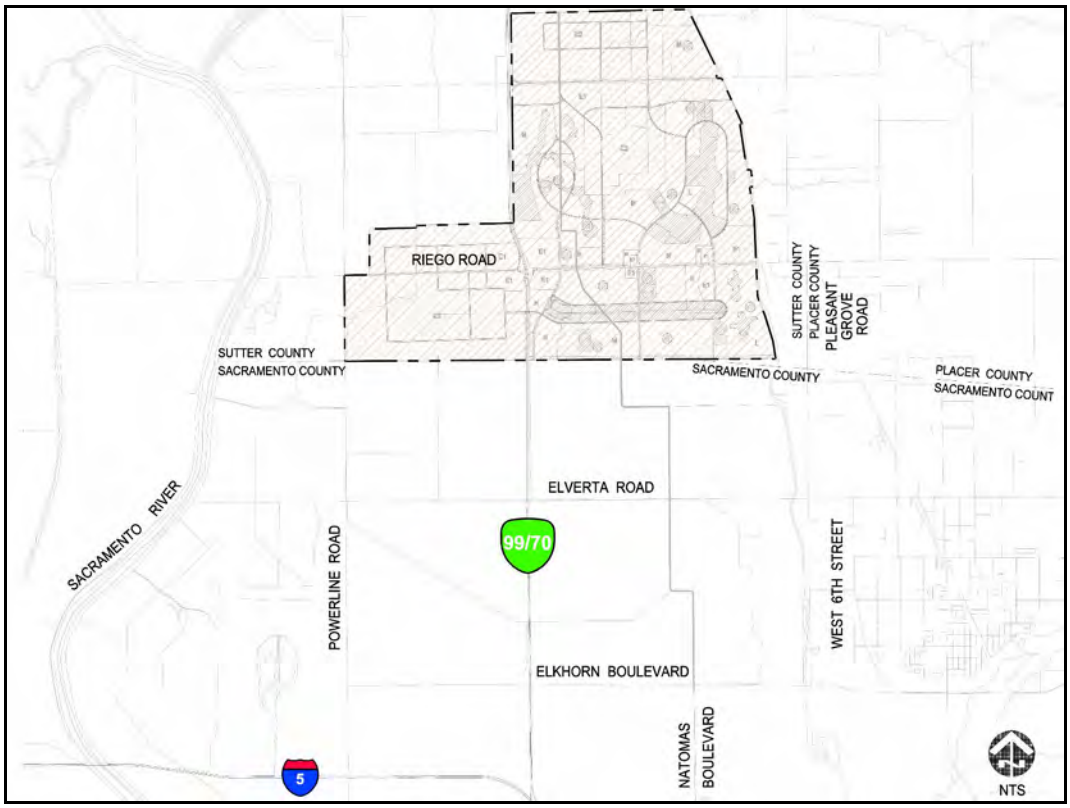


Figure 1 Vicinity Map

2.2 Topography

The site generally slopes towards SR 99/70 and southward. Elevations on the eastern end of the project site range from approximately 37 to 25 (NGVD 29). The western end of the project is relatively flat with elevations ranging from 22 to 19. The southern end of the project site reaches a low elevation of approximately 14. The Natomas East Main Drain is located along the eastern boundary of the plan area with levee elevations ranging from 44 to 30. At the southeast corner of the SPSP area elevations are at approximately 25 and slope in a southwesterly direction.

2.3 Land use and Zoning

The existing land within the SPSP area has been primarily used for agriculture with rice being the predominant crop. Numerous irrigation ditches traverse the entire plan area. Areas surrounding the project site are also being used for agricultural purposes.

The SPSP area is specified as an industrial/commercial reserve with the current zoning identified as agricultural (AG) in the Sutter County General Plan and Zoning Map dated April 06, 2006. Land surrounding the project area is also zoned as agricultural (AG). The proposed SPSP consists of a total of 7527.6± acres. It is made up of 2895.0± acres of Residential area, 1001.3± acres for Community facilities, and 3631.3± acres of Employment uses. The Sutter Pointe Specific Plan Land Use Plan is shown in Figure 2.

2.4 Development Phasing

The SPSP area will be developed in several phases. The proposed phases are divided into two categories, residential villages (Phases 1-4) and employment villages (Phases A-D). The phasing sequences were determined by analyzing the proposed infrastructure needs of the Sutter Pointe community, the potential impacts of the economy, surrounding regional growth, and proposed future changes in the surrounding infrastructure/public facilities. It is estimated that the residential villages (Phases 1-4) will be developed at an average rate of 1000 units per year, with ultimate build-out in approximately 20± years, however this could fluctuate depending on the economic strength of the housing industry.

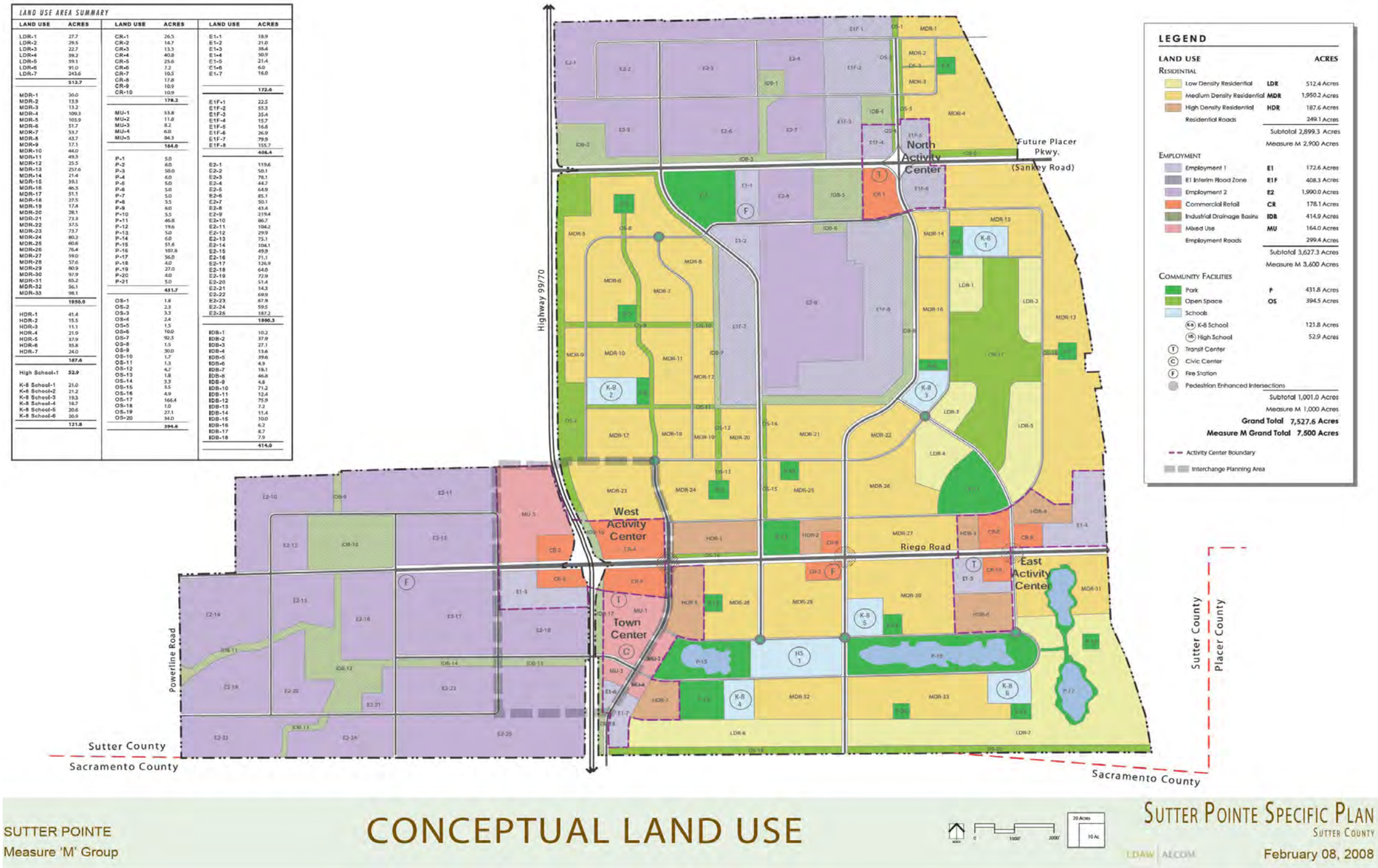
While it may be that the employment villages (Phases A-D) will develop concurrently with the residential villages (Phases 1-4), it is more reasonable to believe that this development rate will be much lower, with full build-out in approximately 40± years. Due to the development rate of the employment villages being affected by a multitude of social and economic factors, it is difficult to determine the total amount of the employment lands developing in any given year. From an engineering perspective, it is difficult to predict the water supply

needs of a new development where there are numerous variables as to the construction timing of the various phases. Therefore, for the purposes of this WSMP, a simplifying yet conservative approach was implemented, which assumes the development of the residential villages and employment villages achieve ultimate build-out in the same time frame. With this assumption in place and for simplicity of this analysis, the following build-out years for each phase have been established:

- Phase 1+A (build-out in approximately 7± years)
- Phase 2+B (build-out in approximately 5± years)
- Phase 3+C (build-out in approximately 3± years)
- Phase 4+D (build-out in approximately 5± years)

Given this breakdown of development phases, and for the purposes of this WSMP analysis, it is assumed that the ultimate build-out is achieved in approximately 20± years. The Sutter Pointe Specific Plan Conceptual Phasing Plan is shown in Appendix A, Exhibit 4.

Figure 2 Land Use Plan



3.0 Existing Irrigation System

Presently, there are no public municipal water supply facilities within the project area. The nominal amount of development that currently exists within the plan area is served by private wells with limited capacity. The predominant existing land use within the planning area is large agricultural operations; principally rice farming and some dry farms. Irrigation of these lands is provided by water diverted from the Sacramento River by the Natomas Central Mutual Water Company (NCMWC), a privately owned water purveyor within the Natomas Basin.

3.1 NCMWC System

During normal years NCMWC has the right to divert 120,200 acre-feet per year (AFY) under its existing surface water rights/licenses and its recently renewed Bureau of Reclamation Settlement Contract.[3] During critical dry years NCMWC's CVP Contract entitlement is cutback by 25% to a maximum of 90,150± AFY.

NCMWC owns and operates several surface water diversion facilities that divert surface water from the Sacramento River under their existing water rights, licenses, and contracts. Diverted water is pumped into a series of irrigation ditches that flow by gravity to deliver water to the fields. The farmers use lift pumps and/or gravity turnouts to deliver water to the fields themselves. Over time, as farming gives way to urbanization, the existing irrigation ditches within the plan area will be abandoned, and/or piped to accommodate the Sutter Pointe development and provide continued delivery of irrigation water to the agricultural lands within and outside the SPSP area.

NCMWC has a closed irrigation system wherein the tail water from irrigation is captured in Reclamation District No. 1000 local drainage ditches and is therefore available to be

[3] The renewed Bureau of Reclamation Settlement Contract is included in its entirety in Appendix E.

recycled to the highline ditches owned by NCMWC. Recycled irrigation water reduces the quantity of "new" water that needs to be diverted from the Sacramento River to meet the irrigation demands of NCMWC shareholder lands.

Additionally, runoff from urban areas in the developed portions of the Natomas Basin in Sacramento County augments the volume of water available within Reclamation District No. 1000 drainage ditches during the irrigation season, principally a result of summer time nuisance flows from lawn irrigation and the like.[4] Since these drainage ditches are inter-tied throughout the entirety of the Natomas Basin, these urban runoff waters are available for recycling by NCMWC shareholders for agricultural irrigation. Although recycling of urban runoff may be practiced by NCMWC, the use of this recaptured urban runoff is not acceptable, nor is it assumed, within this Master Plan to meet the projected M&I demands of the Sutter Pointe development.

To the extent that lands are converted from agricultural production to urban land uses within the SPSP area, the amount of tail water from irrigation that will enter Reclamation District No. 1000 ditches will be reduced. On the surface this would appear as a net decrease in the quantity of recycled irrigation water available for agricultural irrigation of non-SPSP area agricultural lands.

The volume of water available for irrigation of non-SPSP lands, however, will actually not change. This is due to the fact that those waters will continue to remain in the NCMWC system prorate since they will not be delivered to lands within the SPSP area for agricultural irrigation purposes. That is, if those waters aren't pulled out of the NCMWC system for irrigation within the SPSP area, then they will remain in the NCMWC system for use by others – a no net change situation.

While data is not available on the quantity or the volume of tailwater used or generated by the irrigation of lands within the SPSP area, it is not known if the conversion of these lands to urban uses will actually create a net reduction in the

[4] The urbanized areas within Sacramento County are provided surface water from the City of Sacramento's water system.

availability of tailwater within the NCMWC system. There is, however, no indication that the irrigation of lands with the SPSP area generates a higher volume or rate of tailwater than other lands within the NSMWC service area. Accordingly, there is no reason to suspect a net reduction in the availability of tailwater within the NCMWC system.

3.2 NCMWC Water Rights

NCMWC has the following water rights permits or licenses from the State Water Resources Control Board (SWRCB) – Refer to Table 1. As mentioned above, these licenses are controlled through the CVP Settlement Contract that limits NCMWC diversion right at 120,200 AFY. This amount includes 98,200 AFY of "Base Supply"[5] and an additional 22,000 AFY of "Project Water".[6] The total diversion rights held by NCMWC, including Permit 19400, which is not controlled by the settlement contract, totals 130,200 acre feet per annum. As the planning area is urbanized, these contracts and licenses will need to be amended to include M&I use of the water and to add the non-shareholder lands lying within in the planning area to the place of use of the above listed NCMWC water rights, licenses, and settlement contract.[7]

[5] "Base Supply" – Is defined as the diverted surface water from the Sacramento River as a result of the appropriative rights acquired under State law. The base supply may be diverted from the Sacramento River during the Agricultural growing season for irrigation purposes only.

[6] "Project Water" – Is defined as the diverted surface water from the Sacramento River as a result of the contract rights pursuant to a settlement agreement with the U.S. Bureau of Reclamation for water rights from the CVP. The CVP project water, by contract, is currently limited to use for irrigation during the growing season (April-October). However, the CVP water rights permits issued to the Bureau by the State Board include M&I as a permitted use.

[7] The provision of NCMWC water to non-shareholder lands would require approvals from NCMWC and the Bureau of Reclamation and may require approvals from the State Water Resources Control Board, and the California Department of Corporations. However, since the total M&I surface water used under any of the three water supply alternatives is significantly lower than current agricultural surface water irrigation use on the existing shareholder lands within the SPSP planning area, these approvals are not anticipated to be problematic. For each of the three water supply programs, there will neither be a net increase in diversions under the Settlement Contract nor a negative impact on the existing NCMWC shareholders. The groundwater extracted under the Proposed Water Supply Program will be sufficient to meet the total annual needs of the non-shareholder lands. As such, since the groundwater supply exceeds the demands of the non-shareholder lands on an annual basis, none of the above mentioned regulatory approvals should be necessary as the surface supply usage can all be allocated to the shareholder lands. Alternate "A" and Alternate "B" Water Supply Programs, however, have a lower dependence on groundwater pumping than does the Proposed Water Supply Program.

3.3 Settlement Contract Provisions

NCMWC entered into Contract No. 14-06-200-885A (Settlement Contract) with Reclamation in 1964. The CVP Settlement Contract is based on NCMWC's pre-existing licenses and permit to divert water. The purpose of the Settlement Contract is to change the timing and pattern of those diversions to accommodate the Bureau of Reclamation's operation of the Central Valley Project. However, NCMWC's water rights exist independently of the Settlement Contract.

The nature of water diversions under the Bureau's "settlement contract" provides an enhanced right to divert during dry years. While "normal, dry and multiple dry years" are typically utilized to determine the reliability of a community's water supply, in areas where the water supply is subject to a Bureau "settlement contract", it is customary to measure water supply reliability in terms of Normal and Critical Years. According to the "settlement" contract, the maximum 25% reduction in the NCMWC water supply will only occur in "critical years". Therefore, these rights are considered very reliable during dry years assuring the community of a highly dependable water supply, which will minimize the need to institute severe water conservation measures during drought events.

Due to the lower magnitude of groundwater pumping, neither of these two water supply programs are capable of serving the total annual demands of the non-shareholder lands solely with groundwater. Accordingly, these programs envision that some of the water diverted by NCMWC pursuant to the Bureau of Reclamation Settlement Contract will be delivered to non-shareholder lands. For this reason, the above described approvals will or may be required for Alternate "A" and "B" Water Supply Programs. As stated earlier, obtaining these approvals are not anticipated to be problematic since it can be conclusively proven that they will not increase above historic levels the amount of water diverted under the Bureau of Reclamation Contract or impact the ability of NCMWC to serve their existing shareholders amount of water equal to or greater than they have received in the past.

Table 1: SWRCB Permits/Licenses Summary

License/ Permit[8]	Place of Use	Purpose of Use	Period of Diversion	Diversion Amount (CFS)	Diversion Limit (AFY)
License 1050	Bureau of Reclamation Settlement Contract Service Area ("Project Water") and NCMWC Place of Use Boundary ("Base Supply" and SWRCB Licenses / Permits Place of Use (See Appendix E)	Agricultural Irrigation Purposes	April 1 - October 1	42	Limited to 120,200 by Bureau of Reclamation Settlement Contract (See Appendix E)
License 2814			March 15 - October 15	38	
License 3109			May 1 - October 31	160[9]	
License 3110			May 1 - October 1	120[10]	
License 9794			April 1 - June 30	131[11]	
License 9989			March 1 - June 30 & September 1 - October 31	14[12]	
Permit 19400	Sacramento International Airport & Metro Air Park (See Exhibits 6 & 7, Appendix A)	Domestic, Municipal and Industrial Purposes	October 1 - April 1	168	10,000

Annual water deliveries from the Bureau are determined on the basis of the natural inflow to Shasta Lake (the Shasta Index). In a normal Year[13], when there is ample water in the CVP system, CVP Settlement Contractors receive 100% of their Settlement Contract entitlements. During a "critical year", when the forecasted full natural inflow to Shasta Lake for the current Water Year is projected to be equal to or less than 3.2 million acre-feet, the CVP Settlement

[8] In July 1990, the State Water Resources Control Board issued an order allowing a change in the purpose of use to include M&I and domestic uses for these licenses and permit. The point of diversion for these uses is limited to the existing Elkhorn Diversion and restricted to a place of use that includes only the Sacramento International Airport and the Sacramento Airport Special Planning Area (Metro Air Park).
[9] The actual right under L3110 is 160 CFS, however the maximum amount diverted under L3109 & L3110 is limited to 270 CFS.
[10] The actual right under L3110 is 120 CFS, however the maximum amount diverted under L3109 & L3110 is limited to 270 CFS.
[11] The maximum amount of use under L9794 is limited to 11,846 AFA.
[12] The maximum amount of use under L9989 is limited to 2,627 AFA.
[13] A "Year" shall mean a calendar year.

Contractors receive 75% of their entitlement, resulting in a "cutback" of 25% of water deliveries. In "multiple dry year" events, when the total accumulated deficiencies are below 4 million acre-feet in the immediately prior Water Year[14] or series of successive prior Water Years each of which had inflows of less than 4 million acre-feet, together with the forecasted deficiency of the current Water Year, exceed 800,000 acre-feet, CVP Settlement Contractors receive 75% of their entitlement, resulting in a "cutback" of 25% of water deliveries.[15] In the occurrence of a single and multiple dry years, the Shasta Index is used to determine the magnitude of "cutbacks" in CVP water delivered to CVP Settlement Contractors.

Critical Years occur relatively infrequently. Over the last 85 years of record (1921 – 2006), the Shasta Index has been (or would have been) triggered only nine times (1924, 1931, 1932, 1933, 1934, 1977, 1991, 1992, and 1994).[16] This yields a recurrence interval of once every nine (9) years, or so, on average. Accordingly, these rights are very reliable during dry years thereby assuring the community of a highly dependable water supply, which will minimize the need to institute severe water conservation measures during drought events.

3.4 NCMWC Historic Diversions

NCMWC does not divert surface water from the Sacramento River for use by its shareholders for agricultural irrigation, on an acre-foot-by-acre-foot basis. Bureau of Reclamation records indicate the actual quantity of surface water diverted by NCMWC is in the magnitude of 88,000± AFY.[17] However, NCMWC historically has delivered approximately 30,000± AFY to the shareholder lands

[14] A" Water Year" shall mean the period commencing with October 1 of one year and extending through Septembers 30 of the next as described in the Contract between the United States and Natomas Central Mutual Water Company, Contract No. 14-06-200-885A-R-1.

[15] The Shasta Index, Single Dry Year & Multiple Dry Years definitions were taken from the Contract between the United States and Natomas Central Mutual Water Company, Contract No. 14-06-200-885A-R-1.

[16] Historical data for critical dry year events in which the Shasta Index has been triggered were obtain from the U.S. Department of Interior, Bureau of Reclamation.

[17] Source: Bureau of Reclamation records of deliveries and transfers of Sacramento River Water under USBR's Settlement Contract (14-06-200-885A) with NCMWC. The 88,000 AFY represents an average of 42 years of data (1965 – 2006).

within the planning area.[18] This indicates that the shareholder lands within the planning area have received an equivalent of approximately 34.09%± of the historic diversions.

These shareholder lands represent about 15.83%± of all shareholder lands within the service area of NCMWC.[19] This difference (34.09%± v. 15.83%±) clearly proves that NCMWC delivers varying quantities of surface water to different shareholder areas. NCMWC staff, however, indicates that during most recent irrigation years, if those years had been Critical Years wherein the Bureau would have instituted the 25% cutback provision of the Settlement Contract, there would have still been sufficient surface water available to meet 100% of its shareholder's water needs.[20]

3.5 Sutter Pointe Historical Use

Of the total 7527.6± acres that make up the Sutter Pointe Specific Plan area, only approximately 67%± (5009.3± acres) are shareholder lands lying within NCMWC's current service area or corporate boundary. As stated earlier, the SPSP planning area represents approximately one-quarter (25%±) of the NCMWC's overall irrigation demand[21], but only 15.83%± of the total 31,652± acres of shareholder lands within NCMWC.[22] Accordingly, assuming SPSP represents 25%± of the irrigation demand of NCMWC, the planning area has

[18] Cited from personal conversation with Dee E. Swearingen, General Manager, Natomas Central Mutual Water Company, June 13, 2007. Amount of water delivered to the Shareholder Land within the NCMWC service area is cited from personal conversation with Dee E. Swearingen, General Manager, Natomas Central Mutual Water Company, June 13, 2007. This figure has been substantiated in Table A of Appendix B.
[19] SPSP % share of NCMWC Service Area calculated as follows: (5,009.3)/(31,652)*100%
[20] Cited from personal conversation with Dee E. Swearingen, General Manager, Natomas Central Mutual Water Company, June 13, 2007.
[21] Cited from personal conversation with Dee E. Swearingen, General Manager, Natomas Central Mutual Water Company, June 13, 2007.
[22] The NCMWC Service area size is cited from personal conversation with Dee E. Swearingen, General Manager, Natomas Central Mutual Water Company, June 13, 2007.

access to approximately 30,050± AFY during normal years, and approximately 22,538± AFY during critically dry years. [23]

The difference between the shareholder lands within the planning area representing one-quarter of the NCMWC's irrigation demand, but only comprising 15.83%± of the shareholder acreage can be explained by the fact that, among others, some shareholders use more water than others. Historically, however, NCMWC has delivered approximately 30,000± AFY to the shareholder lands within the planning area. Non-shareholder lands within the planning area (2518.3± acres) are served by groundwater pumping, currently estimated to be in the magnitude of 8,367± AFY.[24]

3.6 Sutter Pointe Surface Water "Supplies"

If agricultural irrigation demands were uniform throughout the NCMWC service area, the volume of diverted surface water delivered to shareholder lands lying within the planning area would be in the magnitude of 13,930± AFY during normal years (10,450± AFY during critically dry years), based on these lands being 15.83%± of the shareholder area within NCMWC. This obviously is not the case as some 30,000± AFY have been delivered to SPSP shareholder lands. This difference gives rise to the need to estimate the SPSP's surface water "supplies" vis-à-vis NCMWC's diversion rights under the Bureau Settlement Contract. Three different approaches were developed to estimate the SPSP "supplies" amount:

1. **Historical Usage**: As stated earlier, the shareholder lands within the SPSP planning area have used a certain quantity of water to irrigate their 5009.3± acres of irrigated area historically served by NCMWC. Under this approach, the shareholder lands with the planning area enjoy unrestricted access to approximately 30,000± AFY. In this case the SPSP

[23] If one assumes the planning area represents 34.09%± of the historical diversions, the SPSP planning area has access to approximately 40,980± AFY during normal years and approximately 30,730± AFY in critically dry years.

[24] Source: Ludhorff & Scalmanini Consulting Engineers.

"supplies" is estimated at approximately 34.09%± of the historical diversions under the Settlement Contract (88,000 AFY).

2. **Historical Diversions**: Assuming the shareholder lands within the SPSP planning area represent one-quarter (25%) of the irrigation demand, they should enjoy a similar share of the actual amount of water that has been historically diverted under the Bureau Settlement Contract. Under this approach, the shareholder lands within the planning area enjoy unrestricted access to approximately one-quarter of 88,000± AFY, or approximately 22,000± AFY. In this case the SPSP "supplies" is estimated at approximately 25.00%± of the historical diversions under the Settlement Contract (88,000 AFY).

3. **NCMWC Shares**: Focusing on simply shares of stock in the NCMWC, the shareholders within the planning area, who control approximately 15.83%± of the company's shares, should have access to NCMWC's water rights pro-rata to their share portion. In this case the SPSP "supplies" are estimated at approximately 15.83%± of the historical diversions under the Settlement Contract. Under this approach, the SPSP "supplies" is estimated at approximately 13,930± AFY under the Settlement Contract (88,000± AFY). [25]

This "supplies" analysis can be summarized as follows:

[25] Based on the Settlement Contract diversion right of 122,200 AFY, this entitlement would be approximately 19,020 AFY.

Surface Water "Supplies" Estimates[26]

Settlement Contract Diversion Rights

Approach	Settlement Contract Historical Diversions	"Supplies" Percentage	"Supplies" Quantity
Historical Usage	88,000 AFY	34.09%±	30,000± AFY
Historical Diversions	88,000 AFY	25.00%±	22,000± AFY
NCMWC Shares	88,000 AFY	15.83%±	13,930± AFY

In any event, whether one looks at Historical Usage, Historical Diversions, or NCMWC Shares, the shareholder lands within the planning area have the privilege to use surface water from the Sacramento River in sufficient quantities to meet the M&I water demands for the SPSP area. [27, 28 , 29, 30, 31]

[26] A fourth approach could be developed predicated on the pro-rata share of waters historically delivered to SPSP shareholder lands (30,000± AFY) expressed as a percentage of the historical diversions (88,000± AFY), or 34.09%±. If one assumes the planning area represents 34.09%± of the historical diversions, the SPSP planning area "supplies" could also be determined to be approximately 40,980± AFY during normal years and approximately 30,730± AFY in critically dry years.

[27] Refer to Table C in Appendix B for calculations that verify the ability for the Proposed, Alternate "A" and Alternate "B" Water Supply Programs to serve the water demands of the project during both normal and critically dry years.

[28] The volume of Settlement Contract surface water needed to meet M&I demands within the SPSP area during normal and critical dry years is estimated in this report to be 12,128 AFY (normal year) and 9,099 AFY (critical dry year) for the Proposed Water Supply Program, 15,638 AFY (normal year) and 9,616 AFY (critical dry year) for the Alternate "A" Revised Water Supply Program, and to be 13,126 AFY (normal year) and 8,590 AFY (critical dry year) for the Alternate "B" Winter Diversion Water Supply Program. Alternate "B" requires the procurement of new winter diversion right (6,000 AFY).

[29] On December 13, 2007, NCMWC announced that it entered into an agreement to sell up to 10,000 AFY (consisting of an initial purchase of 8,000 AFY purchase with an option to purchase an additional 2,000 AFY) of its Bureau of Reclamation Settlement Contract "Project Water" to the City of Folsom (the" Folsom Agreement"). NCMWC commissioned Wagner & Bonsignore Consulting Civil Engineers, Inc. ("Wagner & Bonsignore"), to evaluate the impacts to its shareholders of transferring up to 10,000 acre feet of Project Water. In making its decision, the NCMWC Board of Directors evaluated the impact of the proposed sale on the ability of the Water Company to meet the existing irrigation demands of its shareholder members during the peak of the irrigation season. The Wagner & Bonsignore report (entitled "Water Supply Evaluation of the Potential Transfer of 10,000 acre-feet of Project Water from USBR Contract" dated October 31, 2007 – the "Wagner & Bonsignore Report") found that NCMWC had a surplus supply during the months of July and August, even during critical dry years. Accordingly, the Wagner & Bonsignore Report concluded "the transfer of 10,000 acre-feet of project water should not impair NCMWC's ability to continue to provide sufficient water for irrigation" of shareholders lands. A check of the analysis contained in this Master Plan revealed that the proposed sale of 10,000 acre-feet per

3.7Sutter Pointe Reserves

This Master Plan estimated the SPSP "supplies" to NCMWC surface water rights under the Settlement Contract and the projected demands thereof for the Proposed Water Supply Program, Alternate "A" Water Supply Program, and Alternate "B" Water Supply Program. Based on these estimates and projected

year (3,723 acre-feet in July and 6,727 acre-feet in August (during normal years)) would reduce the SPSP pro-rata share of NCMWC's remaining diversion rights under the Bureau Settlement Contract below the level of surface water demands required to serve this project in July and August during both normal and critical dry years – refer to Table C-3 in Appendix C. However, while the magnitude of the monthly shortfall is relatively small, on an annual basis, there still exists a surplus of surface water available to help meet the M&I demands of SPSP. The monthly surface water shortfalls in July and August can easily be eliminated by adjusting the mix between ground water pumping and surface water diversions throughout the year. That is, increased surface water diversions during months of surplus surface water supplies with corresponding decreases in monthly ground water pumping during the same periods, and increased ground water pumping in July and August when shortfalls in surface water supplies occur. The net result would have a zero sum effect on the overall water supply picture over a year's time since the total annual surface water diversions and ground water pumping would not change.
Accordingly, the findings and conclusions contained in this Master Plan are not affected by the Folsom Agreement (assuming that it is consummated). In summary, the shareholder lands within the SPSP area have a right to the same quantities of water they enjoyed prior to NCMWC entering into the Folsom Agreement.

[30] It is recognized that crop planting and associated water demands may change in the future and differ from historical usages. Additionally, the adequacy of meeting current irrigation demands needs to be compared to future M&I needs on a month-by-month basis rather than a comparison of annual demands. Further, these comparisons need to be made within the context of the monthly diversion limits contained within the Bureau Settlement Contract. With regards to changing irrigation practices over time, NCMWC, as a part of their evaluation of the potential impacts of the Folsom Agreement, commissioned Wagner & Bonsignore Consulting Civil Engineers, Inc. ("Wagner & Bonsignore") to evaluate the potential impacts to its shareholders of transferring up to 10,000 acre feet of Project Water to the City of Folsom (the "Folsom Agreement"). The Wagner & Bonsignore Report evaluated historical crop patterns and the potential for future changes that might increase the overall agricultural irrigation demands within the NCMWC service area. That report found that the most recent years of record represented a reasonable approximation of the maximum irrigation demands that may occur in the future given all the various land use and development trends within the Natomas Basin. Evaluations of differences between agricultural irrigation and M&I demands on a month-by-month basis (including evaluation of monthly diversion limits in the Settlement Contract) have been included elsewhere in this master plan.

[31] Assuming pumping of an additional 1,708 acre feet of groundwater pumping during a normal year under Alternate "A" Water Supply Program is justified given the results of the Groundwater Supply Assessment prepared for the project. The Proposed Water Supply Program has a groundwater demand of 13,071 AFY in normal years. The Sutter Pointe Groundwater Supply Assessment prepared by Luhdorff & Scalmanini Consulting Engineers found this magnitude of groundwater demand was sustainable on a long term basis. Therefore, an increase of 1,708 AFY over and above the projected groundwater demand under Alternate "A" Water Supply Program (9,563 AFY) would result in a total demand of 11,269 AFY for Alternate "A" Water Supply Program which is lower than the level of groundwater pumping under the Proposed Water Supply Program, which is less than the sustainable level of the aquifer. Accordingly, this additional demand under the Alternate "A" Water Supply Program would also be sustainable.

demands for M&I water during normal and critical dry years, the estimated reserve of Settlement Contract water is as follows:

Reserves of Settlement Contract Water
Using Various Surface Water "Supplies" Approaches

Water Supply Program /Water Year	Contract Water Demand (AFY)	Historical Usage (AFY)		Historical Diversions (AFY)		NCMWC Shares (AFY)	
		Supply	Surplus	Supply	Surplus	Supply	Surplus
Proposed Water Supply Program							
Normal Year	12,128	30,000	17,872	22,000	9,872	13,930	1,802
Critical Dry Year	9,099	22,500	13,401	16,500	7,401	10,450	1,347
Alternate "A" Water Supply Program							
Normal Year	15,638	30,000	14,362	22,000	6,362	13,930	<1,708>[32]
Critical Dry Year	9,616	22,500	12,884	16,500	6,884	10,450	830
Alternate "B" Water Supply Program							
Normal Year	13,126	30,000	16,874	22,000	8,874	13,930	804
Critical Dry Year	8,591	22,500	13,909	16,500	7,909	10,448	1,857

[32] Since Alternate "A" Water Program has a groundwater pumping requirement that is 3,510 AFY less than the Proposed Water Supply Program groundwater pumping requirement during a normal year (9,561 AFY v.13,071 AFY). The apparent "shortfall" of 1,708 AFY could easily be eliminated by additional groundwater pumping during the Settlement Contract diversion period to make up 1,708 Acre-Feet shortage for Alternate "A" Water Supply Program during a normal year.

4.0 Municipal & Industrial Water Demands

The current development proposal for the Sutter Pointe Specific Plan area is to convert approx. 7527.6± acres of land, within the project area, to various urban land uses. The Land Use Plan (Figure 2) shows the proposed land use designations of the SPSP area.

Anticipated municipal and industrial (M&I) water demands for the Sutter Pointe Specific Plan Area were estimated using generally accepted average annual and peak water demand rates for similar land uses within the greater Sacramento metropolitan area. Based on these demands, ultimate build out of the planning area will result in the following M&I demands (Normal Year):

Table 2: M&I Demand (Normal Year)

M&I Demand	Approximate Demand
Average Annual Demand	25,199± Acre Feet per Year (AFY)
Average Day Demand (ADD)	15,622± gallons per minute (GPM) / 22.5± Million Gallons per Day (MGD)
Maximum Day Demand (MDD)	28,902± gallons per minute (GPM) / 41.6± Million Gallons per Day (MGD)
Peak Hour Demand	55,202± gallons per minute (GPM) / 79.5± Million Gallons per Day (MGD)

Peaking factors are used to simulate system-operation scenarios for the design and analysis of the water distribution facilities. Maximum Day Demand (MDD) is established by applying a peaking factor to Average Day Demand (ADD). MDD estimates and Fire Flows (FF) are typically used to size transmission pipelines, pumps, and storage facilities and to determine water supply rates. The ADD was multiplied by a peaking factor of 1.85 to obtain the MDD.

Peak Hour Flow (PHF) is established by applying a peaking factor to the MDD. Typically this demand scenario occurs during a hot summer day and represents the diurnal peaks in water usage. The PHF estimates are typically used to verify adequate sizing of the water distribution system. The MDD was multiplied by a peaking factor of 1.91 to obtain the PHF (see Appendix B, Table C).

An allowance for system losses of 7.5% has been included in this analysis. This level of loss is normally used in the planning of water systems constructed to current standards with modern materials and methods of construction. This estimate includes system leakage, unmetered services, filter backflushing, construction water, and fire hydrant flows.

A system of transmission pipelines, storage reservoirs, booster pump stations and distribution pipelines will deliver treated water to all future M&I customers within the planning area (see Appendix A, Exhibit 1). Over time, as the public potable water system is developed within the planning area, existing domestic water users within the planning area will be provided the opportunity to connect to the public system in lieu of continuing their use of private groundwater wells.

Based upon the Shasta Index, cutbacks in supply and conservation efforts will be enacted during Critical Years. During a Critical Year, as determined by the inflow into to Shasta Lake, the Bureau will mandate a 25% cutback in deliveries of surface water to CVP Settlement Contractors. The community will then need to institute water conservation measures to balance the water supply / demand equation. Due to the availability of groundwater during the summer months, the severity of the Bureau's 25% cutback can be significantly mitigated by conservation and additional groundwater pumping to meet the maximum day demands within the community.

A responsible water conservation program, one that future customers would find acceptable in severity, will be developed to yield a net reduction in demands of 12.5% and will balance the supply of water with the M&I demands within the community. A 12.5% conservation program, technically achievable and politically acceptable, would consist of a combination of varying reductions in usage by the

various M&I customer classes, brought about by public education and awareness efforts, rate structure incentives, and water use enforcement. The water conservation program would be nearly identical for the Proposed Water Supply Program, the Alternate "A" Revised Water Supply Program, the Alternate "B" Winter Diversion Water Supply Program, but for the corresponding changes in the mix of water supply between the three programs. The water conservation program will be developed and submitted to the County prior to the approval of the first project Tentative Map.

5.0 Water Supply Programs

5.1 The Proposed Water Supply Program

The Proposed Water Supply Program is a conjunctive use water supply program that uses both surface and ground water to meet the M&I demand of the community at ultimate build out. Groundwater will be developed from the aquifers lying below the community utilizing the overlaying groundwater rights of the lands within the planning area.

Converting the existing surface water rights, currently being used for agricultural irrigation within the planning area, will be required to allow the use of surface water from the Sacramento River to meet M&I demands. The conversion of these rights is explained below:

> The NCMWC holds two types of rights to divert water from the Sacramento River – appropriative rights acquired under State law and contract rights pursuant to a settlement agreement with the U.S. Bureau of Reclamation for water from the CVP. The State water rights are also affected by the CVP settlement contract, as it defines and limits the monthly and annual maximum diversion amounts. In the Settlement Contract the State rights are called “base supply” and the CVP water is called “project water.”
>
> The base supply may be diverted from the Sacramento River during the agricultural growing season for irrigation purposes only. Approval by the State Water Resources Control Board will be necessary to obtain before the base supply can be used for urban (M&I) uses. Additionally, State Board approval will be necessary to include all SPSP lands within the place of use of these water rights. The process of obtaining these approvals from the State Board includes submittal of a petition to change the place and the purpose of use. This application will be reviewed by the staff of the State Board, and by the general public via a public review

period, before proceeding to a public hearing before the Board for final consideration. The State Board would be a responsible agency under CEQA with respect to the Sutter Pointe Specific Plan EIR.

The CVP project water, by contract, is currently limited to use for irrigation during the growing season (April through October). However, the CVP water rights permits issued to the Bureau by the State Board include M&I as a permitted use. Therefore, while the Bureau must contractually approve the right to convert the project water to M&I uses, there are no discretionary acts required of any local or state agency to allow such use to take place.

Since surface water is available only in the summer months, the proposed water supply program includes a ground water element that will augment this supply to meet the water demands of the community. Not only will ground water meet the year around needs of the non-shareholder lands within the planning area, it will also meet the wintertime demands of the entire community when surface water is not available. The two basic elements of the Proposed Water Supply Program are described below:

5.1.1 Ground Water Element

A ground water well field system will be developed to yield up to 13,073± AFY in normal years and 12,949± AFY in Critical Years. The long-term average annual groundwater demand is approximately 13,057± AFY.[33] This groundwater supply system will provide the initial water supply for the planning area serving the first several years of development (approximately 51.9%± of the ultimate build out of the planning area).

This well field system would consist of approximately fourteen (14) operational groundwater wells, raw water transmission pipelines, and two (2) standby wells. Each of these wells will be capable of producing approximately 1,800± gallons

[33] Long-term average annual groundwater demand is determined by a weighted average of the normal year occurring eight out of nine years and the critical year occurring once in nine years.

per minute from the groundwater basin that underlies the planning area. Two well fields will be developed, one west of SR 99/70, and one east of SR 99/70. These two well fields will be constructed in phases as development within the planning area occurs. The proposed well fields will be capable of producing both the total water needs of the initial phases of development within the planning area, approximately 51.9%± of the total water needs of the community at ultimate build out. The remaining 48.1%± of the demand generated by the community at ultimate build out will be served from the surface water program, further described below.

In addition to the two well fields, the groundwater program will include two groundwater treatment plants, one westerly and one easterly of SR 99/70, the Western and Eastern Groundwater Treatment Plants, respectively. Each well field could contain up to 9 wells each so as to provide flexibility during development of the SPSP area, depending on the preferred water supply scenario that is chosen, for a maximum total of 18 wells. Each groundwater treatment plant, one east and one west, will be built in four phases of approximately 3.1± MGD each and yielding an ultimate capacity of 25.0± MGD.

Over time, as development within the planning area occurs, and as the surface water program is phased in, the ground water element will transition from a year-round supply, for the entire community, to a conjunctive use water supply program capable of meeting the demands of the development at full build out.

During the early period of development within the planning area, as water demands are being created, the majority of the agricultural lands lying within the planning area that are irrigated from existing groundwater sources will remain in agricultural production. Currently the existing irrigation demand from these agricultural lands is approximately 8,367 ± AFY.[34]

As a result, the net demand on groundwater pumping, within the SPSP area, will increase initially. Then, over time, the groundwater pumping will decrease and

[34] Source: Ludhorff & Scalamini Consulting Engineers.

approach current levels at full build out of the project. This is largely due to the continuation of agricultural groundwater pumping continuing on non-Shareholder lands to supply the remaining agricultural lands with irrigation water until such time that they are developed. Basically the groundwater extraction will increase initially within the early stages of the development, and diminish over time, eventually returning towards pre-development levels of pumping at the completion of the project. Thereafter, the net demand for ground water within the planning area will decrease to a point, at full build out, that the need for pumping to groundwater to irrigate agricultural lands will be effectively eliminated. This phenomenon will be evaluated further and included as part of the groundwater study.

It is proposed that the western well field will consist of a total of 9 wells (eight production wells at 1,800± gpm per well plus one standby well at 1,800± gpm) connected to a centralized ground water treatment plant by a series of raw groundwater transmission pipelines. Similarly, the eastern well field will consist of 7 wells (six production wells at 1,800± gpm per well plus one standby well at 1,800± gpm) connected to a second centralized ground water treatment plant by another series of raw groundwater transmission pipelines. Each well site, spaced no closer than every 3,000± feet on center, will be situated on a site approximately one-quarter acre in size. The centralized groundwater treatment plants will be situated on sites approximately five acres in size.

In order to provide time for the surface water element to develop, it is assumed that the groundwater elements, two well fields, will be built out in their entirety. With this assumption in place, the groundwater element will be able to serve the project water demands through nearly the end of Phase 2+B (11.5± years), at which time the surface water element will need to come on line. All proposed wells will be designed and constructed in accordance with the requirements of Bulletin 74-81 “Water Well Standards: State of California”.

5.1.2 Surface Water Element

The surface water supply will be developed to serve the remaining 48.1%± of the water demands of the development. The surface water needed to serve the community is estimated to be 12,128± AFY in normal years and 9,099± AFY in Critical Years.

The facilities required to implement the surface water element of the Proposed Water Supply Program will consist of a Sutter Pointe Raw Water Turnout from NCMWC's existing Bennett Pumping Plant (244± CFS), located on the Natomas Cross Canal approximately 1.1± miles easterly (upstream) of the Sacramento River (see Appendix A, Exhibit 7). The Bennett Pumping Plant is an existing agricultural diversion facility that may not have the reliability that is normal and customary for a municipal water diversion facility and it may need to be substantially upgraded to accommodate the demands of the project.[35]

Depending on the timing of NCMWC's efforts to replace the Bennett Pumping Plant with the proposed Sankey Diversion Facility, surface water may not actually be provided from the Bennett Pumping Plant. Accordingly, while a detailed evaluation for upgrading of the Bennett Pumping Plant was deemed beyond the scope of this master plan, Chapter 6 includes a discussion of the types of improvements that would be required to upgrade this facility to M&I standards. Further study will be needed, during the design phases of the SPSP project, to determine the extent of retrofit and/or expansion of the existing Bennett Pumping Plant, if any.

Some of the water diverted from the Sacramento River by the Bennett Pumping Plant will be delivered to the proposed Sutter Pointe Raw Water Booster Pump Station through a raw water turnout located on the landside of the levee at the

[35] This older agricultural facility probably does not have redundancy of pumps, backup of electrical power, proper intake screens, and appropriate controls. Additionally, it has been reported that once every few years the level of the Sacramento River falls below the flowline of the cross canal requiring the installation of a temporary dam at the mouth of the canal and pumping of water from the river up into the canal to supply the Bennett Pumping Plant with sufficient water.

head works of the NCMWC's existing high-line ditch system. The booster pump station, with a capacity of approximately 29.3± million gallons per day, will pressurize the flows prior to discharge into the Sutter Pointe Raw Water Transmission Pipeline for conveyance to surface water treatment plant located in the westerly portion of the planning area. The pipeline will be approximately 42-inches in diameter.[36] This surface water element will need to begin development near the end of Phase 2+B and will operate in conjunction with the two proposed groundwater well fields in order to meet the water demands of the Sutter Pointe planning area at ultimate build out.

The Sutter Pointe Raw Water Transmission Pipeline will extend due south from the location of the Bennett Pumping Plant, along a local farm road, to Sankey Road. The pipeline would then head easterly along Sankey Road to Powerline Road, then southerly along Powerline Road to Riego Road, then easterly along Riego Road, and finally southerly to the location of a proposed Sutter Pointe Surface Water Treatment Plant (SWTP) located southerly of Riego Road and westerly of SR 99/70 (see Appendix A, Exhibit 1).

The proposed Sutter Pointe SWTP will be located in a joint treatment plant site that would also contain one of the two proposed groundwater treatment plants. The space requirements for this combined facility will be in the range of 10 ± to 15± acres.

Surface water treatment processes, facilities and chemicals used are discussed in Section 5.4 of this report. The SWTP will be constructed in four phases of approximately 7.3± million gallons per day (MGD) yielding an ultimate capacity of 29.3± MGD. The SWTP would operate at various flow rates throughout the year. Staffing levels and operator qualification would comply with applicable regulatory requirements.

[36] Instead of a single transmission pipeline, the phased installation of a dual raw water transmission pipelines is also envisioned. Dual 33-inch diameter pipelines could be substituted for the proposed 42-inch diameter transmission pipeline without any significant implications.

5.2 Alternate "A" Revised Water Supply Program

The Alternate "A" Revised Water Supply Program consists of a base supply of surface water in summer and a base supply of groundwater in winter to meet the M&I demand of the community at ultimate build out. Groundwater will be developed from the aquifers below the community utilizing the overlaying groundwater rights of the lands within the planning area. Converting the existing surface water rights, currently being used for agricultural irrigation within the planning area and as described above, will be required to allow the use of surface water from the Sacramento River to meet M&I demands within the non-shareholder lands described above (a change in the place of use).

Since surface water is available only in the summer months, the Alternate "A" Revised Water Supply Program includes a ground water element that will supply the water demands of the community in the winter months, when surface water is not available. The two basic elements of the Alternate "A" Revised Water Supply Program are described below.

5.2.1 Ground Water Element

A ground water well field system will be developed to yield up to 9,563± AFY in normal years[37], and 12,432± AFY in Critical Years. The long-term average annual groundwater demand is approximately 9,880± AFY. This groundwater supply system will provide the initial water supply for the planning area serving the first several years of development (approximately 37.9%± of the ultimate build out of the planning area).

This well field system would consist of approximately fourteen (14) operational groundwater wells, raw water transmission pipelines, and two (2) standby wells. Each of these wells will be capable of producing approximately 1,800± gallons per minute from the groundwater basin that underlies the planning area. Two

[37] Depending on the final scenario used to estimate the SPSP "supplies" to NCMWC surface water rights under the Settlement Contract, an additional 1,708 AFY could be needed for Alternate "A" Water Supply Program during a normal year. Refer to Footnotes 30 and 31 above.

well fields will be developed, one west of SR 99/70, and one east of SR 99/70.[38] These two well fields will be capable of producing both the total water needs of the initial phases of development within the planning area, and also capable of serving approximately 37.9%± of the total water needs of the community at ultimate build out. The remaining 62.1%± of the demand generated by the community, at ultimate build out, will be served from the surface water element of the Alternate "A" Revised Water Supply Program, which is further described below.

In addition to the two well fields, the groundwater program will include two groundwater treatment plants, one westerly and one easterly of SR 99/70, the Western and Eastern Groundwater Treatment Plants, respectively. Each well field could contain up to 9 wells each so as to provide flexibility during development of the SPSP area, depending on the preferred water supply scenario that is chosen, for a maximum total of 18 wells. Each groundwater treatment plant, one east and one west, will be built in four phases of approximately 3.1± MGD each and yielding an ultimate capacity of 25.0± MGD.

Over time, as development within the planning area occurs, and as the surface water program is phased in, the groundwater program will transition from a year-round supply to principally a wintertime supply to meet the demands of the development when the NCMWC surface water diversions are not available. While the groundwater supply will be capable of meeting the equivalent annual water demands of the non-shareholder lands within the planning area, i.e., approximately 2518.3± acres of the 7527.6± acres in the planning area, changes in the existing surface water rights and settlement contract will be required to serve CVP water to the non-shareholder lands.

It is proposed that the western well field will consist of a total of eight (8) production wells plus one (1) standby well at 1,800± gpm per well connected to a centralized ground water treatment plant by a series of raw groundwater

[38] Final design consideration and further engineering studies will need to be performed in order to determine which well field should be constructed first, the east or the west.

transmission pipelines. Similarly, the eastern well field will consist of six (6) production wells plus one (1) standby well at 1,800± gpm per well connected to a second centralized ground water treatment plant by another series of raw groundwater transmission pipelines.[39] Each well site, spaced no closer than every 3,000± feet on center, will be situated on a site approximately one-quarter acre in size. The centralized groundwater treatment plants will be situated on sites approximately 5± acres in size. Similar to the Proposed Water Supply Program it is assume that both well field will be built in their entirety and serve the water demands until the surface water element is constructed near the end of Phase 2+B.

5.2.2 Surface Water Element

The surface water supply will be developed to serve the remaining 62.1%± of the water demands of the development. The surface water needed to serve the community is estimated to be 15,638± AFY in normal years, and 9,616± AFY in Critical Years.

The facilities required to implement the surface water element of the Alternate "A" Revised Water Supply Program will consist of a Sutter Pointe Raw Water Turnout from NCMWC's existing Bennett Pumping Plant (150± CFS), located on the Natomas Cross Canal approximately 1.1± miles easterly (upstream) of the Sacramento River (See Appendix A, Exhibit 6). Some of the water diverted from the Sacramento River by the Bennett Pumping Plant will be delivered to the proposed Sutter Pointe Raw Water Booster Pump Station through a raw water turnout located on the landside of the levee at the head works of the NCMWC's existing high-line ditch system. The booster pump station, with a capacity of approximately 35.1± million gallons per day, will pressurize the flows prior to

[39] Final design studies will confirm the actual number of wells in each well field such that the minimum number of wells needed (14) is provided, and determine if it is more economical to develop a larger number of smaller groundwater treatment plants clustered with several smaller groups of wells rather than the centralized approach discussed herein. Likewise, individual wellhead treatment will be evaluated during final design to determine if this alternative approach is more economical than the centralized or clustered approach.

discharge into the Sutter Pointe Raw Water Transmission Pipeline for conveyance to the proposed Sutter Pointe Surface Water Treatment Plant located in the westerly portion of the planning area. The pipeline will be approximately 42-inches in diameter.[40] Similar to the Proposed Water Supply Program, the surface water element will need to begin development near the end of Phase 2+B and will operate in conjunction with the proposed groundwater system to meet the water demands of the Sutter Pointe planning area at ultimate build out.

The Sutter Pointe Raw Water Transmission Pipeline would extend due south from the location of the Bennett Pumping Plant, along a local farm road, to Sankey Road. The pipeline would then head easterly along Sankey Road to Powerline Road, then southerly along Powerline Road to Riego Road, then easterly along Riego Road, and finally southerly to the location of a proposed Sutter Pointe Surface Water Treatment Plant located southerly of Riego Road and westerly of SR 99/70 (See Appendix A, Exhibit 1).

The proposed Sutter Pointe Surface Water Treatment Plant will be located in a joint treatment plant site that would also contain the proposed Western Groundwater Treatment Plant (See Appendix A, Exhibit 1). The space requirements for this combined facility will be in the range of 10±-15± acres.

Surface water treatment processes, facilities and chemicals used are discussed in Section 5.4 of this report. The SWTP will be constructed in four phases of approximately 8.8± million gallons per day (MGD) yielding an ultimate capacity of 35.1± MGD. The SWTP would operate continuously at various flow rates throughout the year. Staffing levels and operator qualification would comply with applicable regulatory requirements.

[40] Instead of a single transmission pipeline, the phased installation of a dual raw water transmission pipelines is also envisioned. Dual 33-inch diameter pipelines could be substituted for the proposed 42-inch diameter transmission pipeline without any significant implications.

5.3 Alternate "B" Winter Diversion Water Supply Program

The Alternate "B" Winter Diversion Water Supply Program is a traditional conjunctive use water supply program that assumes a wintertime diversion, from the Sacramento River, will be obtained to serve the planning area. This winter time diversion, together with summer surface water made available from NCMWC, would provide year round surface water to help meet the M&I needs of the community thereby reducing the dependency of the community on groundwater during normal water years.

As is the case with the Proposed Water Supply Program, the Alternate "B" Winter Diversion Water Supply Program will still require the development of a groundwater system to augment flows from the surface water system during Critical Years, when the Bureau institute a 25% cutback in surface water deliveries to the community. Also, the same conversion of the existing surface water rights, permits, licenses, and the settlement contract currently being used for agricultural irrigation will be needed to allow the use of surface water to meet M&I demands for the community.

The substantive difference between the Proposed Water Supply Program and the Alternate "B" Winter Diversion Water Supply Program is the acquisition of a new water right for diversion of approximately 6,000± acre feet per year from the Sacramento River during the winter (October 1 – March 31).[41] While the process of obtaining new water rights is very time consuming, it is probable that these additional water rights could be obtained since it is generally known that there is un-appropriated water in the Sacramento River during the winter.

The two basic elements of the Alternate "B" Winter Diversion Water Supply Program are described below:

[41] The identification of the entity that will have responsibility to procure the new water right, identification of the permittee, and timing of when the permit application should be filed should be addressed in the SPSP Development Agreement between the County and the developers.

5.3.1 Ground Water Element

A ground water well field system will be developed to yield up to 6,579± AFY in normal years, and 9,276± AFY in Critical Years. The long-term average annual groundwater demand is approximately 6,877± AFY. This groundwater supply system will provide the initial water supply for the planning area serving the first several years of development (approximately 26.1%± of the ultimate build out of the planning area).

This well field system would consist of approximately eight (8) operational groundwater wells and one (1) standby well. Each of these wells will be capable of producing approximately 1,800± gallons per minute from the groundwater basin that underlies the planning area. Depending on the on-going ground water modeling efforts, this well field will be located either westerly or easterly of SR 99/70. This well field will be capable of producing both the total water needs of the initial phases of development within the planning area, and also capable of serving approximately 26.1%± of the total water needs of the community at ultimate build out. The well field could contain up to 9 wells each so as to provide flexibility during development of the SPSP area, depending on the preferred water supply scenario that is chosen. The remaining 73.9%± of the demand generated by the community at ultimate build out will be served from the surface water program, further described below.

In addition to the well field, the groundwater program will include a series of raw groundwater transmission pipelines connecting the wells to a centralized groundwater treatment plant. These treatment plants will be constructed in four phases of approximately 3.8± MGD each and yielding an ultimate capacity of 15.1± MGD.[42]

Over time, as development within the planning area occurs, and as the surface water program is phased in, near the beginning of Phase 2+B, the groundwater

[42] Ground Water Treatment Plant incremental phasing may not coincide with the Sutter Pointe development phasing or Phasing Plan.

program will transition from a year-round supply to principally a peak flow augmentation supply to meet the demands of the development during summer peak demand periods. As is the case with the Proposed Water Supply Program, changes to the existing water rights licenses and the settlement contract will be required to serve CVP water to the non-shareholder lands.

Wells will be spaced no closer than every 3,000± feet on center and will be situated on a site approximately one-quarter acre in size. The centralized groundwater treatment plant will be situated on site approximately 5± acres in size.

The proposed treatment process for groundwater under the Alternate "B" Winter Diversion Water Supply Program would be nearly identical to the treatment process described for the Proposed Water Supply Program except for minor changes in groundwater availability and/or quality that may exist easterly and westerly of SR 99/70.[43]

5.3.2 Surface Water Element

The surface water supply will be developed to serve the remaining 73.9%± of the water demands of the development. The Settlement Contract surface water needed to serve the community is estimated to be 13,126± AFY in normal years, and 8,590± AFY in Critical Years. Additionally, a new winter diversion would be needed to provide 5,496± AFY in Normal Years and 4,182± AFY in Critical Years (a new winter time 6,000 AFY water rights permit and license will be sought).

The facilities required to implement the surface water element of the Alternate "B" Winter Diversion Water Supply Program will be nearly identical to those described above for the Proposed Water Supply Program. The Raw Water Turnout and Raw Water Booster Pump Station, with a capacity of approximately 33.1± million gallons per day, will pressurize the flows prior to discharge into the Sutter Pointe Raw Water Transmission Pipeline for conveyance to the Surface

[43] The final determination whether to use centralized, clustered, or individual well head treatment approaches will be determined during final design.

Water Treatment Plant (proposed to be located either in the eastern or western portion of the planning area and coming online near the beginning of Phase 2+B). The pipeline, approximately 42-inches in diameter, would follow the same routes (proposed and alternative routes) described above.[44] The proposed surface water treatment plant would be located in the same common water treatment plant site containing the proposed groundwater treatment plant. The space requirements for this combined facility will remain approximately 10± - 15± acres.

Surface water treatment processes, facilities and chemicals used are discussed in Section 5.4 of this report. The SWTP will be constructed in four phases of approximately 8.3± million gallons per day (MGD) yielding an ultimate capacity of 33.1± MGD. The SWTP would operate continuously at various flow rates throughout the year. Staffing levels and operator qualification would comply with applicable regulatory requirements.

5.4 Water Conservation Measures

During Critical Years, when the Bureau mandates a 25% cutback in deliveries of surface water to CVP Settlement Contractors, the community will need to institute water conservation measures to balance the water supply demand equation. Due to the availability of groundwater during the summer months, the severity of the Bureau's 25% cutback can be significantly mitigated by additional groundwater pumping to meet the maximum day demands within the community. The proposed water conservation program, described earlier, would yield a net reduction in demands of 12.5% as measured against normal demands and would consist of a combination of varying reductions in usage by the various M&I customer classes, brought about by public education and awareness, rate structure incentives, and water use enforcement.

[44] Instead of a single transmission pipeline, the phased installation of a dual raw water transmission pipelines is also envisioned. Dual 33-inch diameter pipelines could be substituted for the proposed 42-inch diameter transmission pipeline without any significant implications.

It is widely understood that customer demands typically increase during dry years, principally to compensate for lower precipitation levels, and the resulting increase in irrigation demands. While it is beyond the scope of this master plan to estimate the magnitude of these increased demands, experience has shown that this increase in demand occurs and is manageable. To be clear, water conservation levels will have to be higher among certain customer classes in order to achieve an overall net reduction of 12.5% as measured against normal year demands.

More importantly, it is essential to develop strategies to balance the overall supply/demand equation to achieve greater levels of conservation in certain customer classes (e.g., irrigation customers) to achieve an overall conservation goal. This will be the case for Sutter Pointe, as it is for most communities in the region.

In addition to conservation measures, water rates should be structured to promote conservation during normal years as well as penalize excess water use during periods of drought. Carefully designed quantity- based water rates will establish economic incentives to future customers to use water efficiently. These water rate structures will likely conform to the 2007 requirements of Best Management Practice 11 from the California Urban Water Conservation MOU (or later edition if applicable).

Table G in Appendix B includes an analysis of the levels of conservation by the various water supply elements that make up three water supply programs described in this master plan. These calculations demonstrate the magnitude of conservation that can be reasonably expected for each element, and the flexibility available to the operator to adjust the degree of conservation applied to each element in meeting the challenges of any particular dry year event.

Reductions in dry-year demands of 12.5 percent are reasonable compared to what other water purveyors have achieved through either requests for voluntary reductions or enforced demand management measures. Below are summaries

of dry-year demand reductions that have either been achieved or assumed for some water purveyors throughout central and northern California:

- *City of Stockton Municipal Utility District*: Between 1993-1999, the City of Stockton Municipal Utility District (COSMUD) utilized a program calling for a voluntary 10 percent reduction in water use through conservation, and achieved actual savings between 12 and 19 percent.[45] COSMUD's significant demand reductions that resulted after its request for voluntary demand management measures indicate that even without implementation of mandatory demand management measures, significant demand reductions can be achieved.
- *City of Folsom:* The City of Folsom – located in a similar climate to Sutter Pointe – anticipates a savings of greater than 7% of its overall demand based on implementation of its demand management measures under its municipal code in dry years. These demand management measures include mandatory water reduction measures associated with outdoor irrigation, water waste (including runoff from property and sidewalk or driveway cleaning), and bans on refilling swimming pools.
- *City of Clovis*: The City of Clovis – located in a climate that is generally hotter and drier than the Sutter Pointe – anticipates a demand reduction savings between 18 percent and 35 percent by reducing outdoor irrigation to two or one days per week.[46] These savings are anticipated through calculations of reduced water application and consumption through outdoor irrigation.
- *City of Modesto:* The City of Modesto – located in a warmer and drier climate than Sutter Pointe – anticipates achieving a 10 to 20 percent conservation savings by implementing its Stage 1 actions as part of its demand management measures.

[45] Draft 2005 City of Stockton Urban Water Management Plan, p. 7-3.
[46] City of Clovis 2005 Urban Water Management Plan at Table 35, p. 49.

- *East Bay Municipal Utility District:* During the 1976-1977 drought – one of the most severe single drought years in the State's hydrologic record – EBMUD measured demand reductions at 39 percent of its overall demand.[47] EBMUD used numerous demand management measures including enforcing bans on outdoor irrigation and encouraging water supply efficiency with indoor uses.
- *City of San Francisco:* During the 1987-1992 drought, the City of San Francisco achieved a 25 percent reduction in overall demand by targeting a 10 percent reduction in indoor use and a 60 percent reduction in outdoor use. Because the City of San Francisco has relatively low landscape demands due to its climate and high level of urbanization, a lower level of conservation may be more realistic for Sutter Pointe. However, a 12.5 percent reduction in normal-year water demands is still reasonable during dry years.
- *Zone 7 Water Agency*: In 2007, Zone 7 Water Agency's retail agencies – located in the Bay Area – were successful in reducing short-term water demand by almost 20 percent by asking residents to undertake "voluntary demand reduction measures" during the state curtailments of State Water Project water supplies. [48]
- *City of Napa:* The City of Napa, located in a climatic region that is wetter and cooler than Sutter Pointe, anticipates being able to achieve 10 percent conservation through a public awareness campaign, which is analogous to a voluntary conservation request.[49] This public awareness campaign operates as Stage 1 of the City of Napa's conservation plan, and thus the City anticipates relying upon more restrictive measures to achieve even greater conservation savings.

[47] East Bay Municipal Utility District's 2005 Urban Water Management Plan at p. 3-2 and Table 6-1 on p. 6-2.
[48] Telephone Call with Karla Nemeth Environmental and Public Affairs Manager with Zone 7 Water Agency on July 16, 2007.
[49] City of Napa, Urban Water Management Plan: 2005 Update, p. 7-4.

Although a 12.5% reduction in normal-year demands within Sutter Pointe is reasonably attainable, Sutter County currently has no ordinance giving it authority to implement either a water shortage contingency plan or temporary demand management measures within Sutter Pointe. This is largely due to the fact that Sutter County supplies only small amounts of water to service areas and therefore has not been required to prepare an Urban Water Management Plan.

Because this authority will be necessary, the County plans to adopt a water shortage contingency plan applicable to Sutter Pointe prior to issuance of a written verification of sufficient water supply pursuant to the requirements of SB 221. This water shortage contingency plan will include mandate reductions during dry years through staged measures that may include the following:

- Prohibition on water waste;
- Limitations on outdoor use; and
- Prohibitions on some types of water uses.

5.5 Treatment Processes

Ground water and surface water treatment will be essential in providing a reliable and safe potable water system for the SPSP area. The proposed treatment plants, for both the ground water and surface water elements, will be capable of producing potable drinking water meeting the requirements of the California Department of Health Services and the United States of America Environmental Protection Agency (EPA).

5.5.1 Groundwater Treatment

Ground water will be treated at the Eastern and/or Western Groundwater Treatment Plants to meet the regulations of both the State of California, and the EPA. The capacity of the groundwater treatment plants will vary depending upon which of the water supply programs is actually implemented.

Additionally, the capacity of these plants will depend upon whether centralized, clustered or individual well treatment scenarios are determined to be most cost effective. The final decision on which of these scenarios is most cost effective is premature at this time and beyond the scope of this WSMP and will be made during final design of the facilities.

The treatment process, however, will be essentially the same for each of these scenarios with the only significant difference being one of scale. That is, the centralized approach would concentrate the treatment process into only one or two locations, while the clustered and individual well approaches would reduce the size but increase the number of treatment facilities spread throughout the project area.

A search of California Department of Water Resources literature indicates the presence of iron, manganese and arsenic in the groundwater in the vicinity of the SPSP planning area with some variation in levels depending location (lower levels generally occurring farthest from the river). Preliminary groundwater quality testing confirms the existence of the presence of elevated levels of iron, manganese and arsenic, all in treatable concentrations. With those constituents present in levels approaching or exceeding current drinking standards, treatment for those contaminants will be required.

The treatment process for removal of these constituents involves the oxidation of the soluble form of each constituent into an insoluble form for subsequent removal, of the precipitates, by filtration. A typical layout of a groundwater treatment plant is shown in Appendix A, Exhibit 8.

Typically, ferric chloride and chlorine are introduced to form the precipitates then conveyed to a filter containing a mixed media usually consisting of graded sands, gravels and a bed of anthracite. Depending on the contaminant level of manganese, a manganese greensand media is often utilized.

After several hours of service duty, the filters will require backwashing to remove the precipitated constituents. Treated water from storage is utilized to backwash

the filters, as with all backwash water, it will be pumped to an on-site containment storage tank. The backwash water will either be sent to waste through the public sewer system or recycled to the filtration system to conserve water. This is accomplished by allowing the solids within the backwash water to settle out, then pumping the decanted water back through the treatment process.

The remaining solids from the treatment process will be disposed in accordance with commonly acceptable practices, including discharge to the public sewer system, transportation and disposal at a landfill, and/or other suitable methods of disposal. If discharge to the public sewer system is determined to be unacceptable by local sewer authority, then these solids will be handled in one of two ways:

1. Storage of the decanted sludge would occur in the bottom of the on-site containment storage tank for periodic “dead” pumping and trucking to a landfill as a low water content sludge (3% - 4% water content), or
2. Periodically transferring the low water content sludge to sludge drying beds and then harvesting the dried sludge and trucking to a landfill.

This approach to groundwater treatment is relatively common in the greater Sacramento metropolitan area, especially in areas where these types of constituents are found in the ground water. Regulatory agencies have accepted these treatment processes because they have reliably produced safe, aesthetically acceptable water supplies that meet the drinking water quality objectives specified in Title 22 of the California Code of Regulations.

These treatment plants, depending on their scale, will include an administration / operations building, maintenance buildings, chemical buildings, electrical buildings, and a treated water pump station. Emergency backup power is also provided from an on-site diesel generator. These treatment plants would operate continuously at various flow rates with ongoing operations and maintenance activities. Staffing levels and operator qualifications would comply with applicable regulatory requirements.

5.5.2 Surface Water Treatment

Surface water will be treated at the Sutter Pointe Surface Water Treatment Plant (SWTP) to meet the surface water treatment regulations of both the State of California, and the Untied States Environmental Protection Agency (EPA). The SWTP will be constructed in four phases of approximately 7.3± MGD each and yielding an ultimate capacity of 29.3± MGD.[50]

The SWTP would use conventional or advanced filtration technologies that have been successfully used to treatment M&I water supplies from the Sacramento River by other urban water users. Regulatory agencies have accepted these processes because they have reliably produced safe, aesthetically acceptable water supplies that meet the drinking water quality objectives specified in Title 22 of the California Code of Regulations. These regulations specify drinking water quality standards for bacteriological quality, disinfection by-products, lead, copper, radioactivity, and maximum contaminant levels for specific inorganic and organic chemicals.

The following components are typically used at local water treatment plants that treat surface water diverted from the Sacramento River:

- Chemical addition and rapid mixing
- Coagulation/flocculation and clarification
- Filtration
- Disinfection

The SWTP facilities will include grit basins, flow splitters, flocculation and sedimentation basins, filters, equalization basins, backwash clarification, and above ground potable water storage reservoirs. Membrane filtration may also be considered as an alternative to the conventional treatment process. An

[50] Treatment Plant capacities provided in text are for the Proposed Water Supply Program. The capacities for Alternate "A" are approximately 7.9± MG for each of the four phases yielding an ultimate capacity of 31.5± MG. The capacities for Alternate "B" are approximately 3.8± MG for each of the four phases yielding an ultimate capacity of 15.1± MG.

administration/operations building, maintenance building, chemical building, electrical building and a treated water pump station will be provided. Emergency backup power will also be provided from an on-site diesel generator.

The SWTP would operate at various flow rates with ongoing operations and maintenance activities. Staffing levels and operator qualifications would comply with applicable regulatory requirements.

The anticipated chemicals to be stored and used at the SWTP include aluminum sulfate (Alum), cationic polymer, sodium hydroxide, anionic polymer, activated carbon, sodium hypochlorite, citric acid, sodium bisulfate, and oxygen. Waste from the SWTP would include grit from the grit basins, sludge removed from the sedimentations basins, filter backwash water, filter-to-waste water, sampling water, and sludge drying decant water. These wastes would be disposed in accordance with commonly acceptable practices, including discharge to the public sewer system, transportation and disposal at a landfill, and/or other suitable methods of disposal.

Since surface water diverted from the Sacramento River, a short distance down stream of the SPSP area, has been the source for M&I water for a long period of time, the acceptability of surface water from the Sacramento River for domestic consumption is not in question. Special attention, however, will need to be given to the quality of Sacramento River water diverted by the Bennett Pumping Plant through the Natomas Cross Canal for M&I use to account for any changes in the quality of surface water that may occur by conveyance through the Natomas Cross Canal.

5.6 Alternative Point of Surface Water Supply & Treatment Plant Location

5.6.1 Alternative Point of Surface Water Supply

NCMWC is proposing to consolidate its five existing pumping plants into two new facilities with fish screens. If NCMWC is successful in gaining the necessary entitlements, permits and funding to consolidate its existing pumping plants, the

Bennett Pumping Plant, along with other pumping facilities serving their Northern and Central Service Areas, would be abandoned once NCMWC's proposed Sankey Diversion Facility (435± CFS) is operational. NCMWC proposes to construct this new facility along the Sacramento River, at the foot of Sankey Road, immediately downstream of the confluence of the river with the Natomas Cross Canal.

While it is uncertain when NCMWC will actually construct the Sankey Diversion Facility, NCMWC has completed a joint EIR/EIS for which a Record of Decision was completed in July 2008.Construction of the new diversion facility could begin as early as the spring of 2009. If construction starts in the spring of 2009, then this facility could be completed and ready for operation in the fall of 2010. NCMWC is in the process of securing funding for the facility at this time. This timeline suggests that it is reasonably foreseeable that the Sankey Diversion Facility will be operational in time for delivery of surface water to the SPSP planning area by 2018. In all likelihood, the point of delivery of raw surface water for M&I uses within the planning area will occur at the new point of diversion, not at the location of the Bennett Pumping Plant.

Should the Sankey Diversion Facility actually be constructed, the raw water turnout and booster pump station described above will be located at the site of the proposed Sankey Diversion Facility, and the route of the raw water transmission pipeline would vary slightly from that described above. The pipeline route would head easterly from the location of the proposed Sankey Diversion Facility along Sankey Road to the point where the pipeline would have been extended southerly to Sankey Road from the location of the Bennett Pumping Plant. The remainder of the pipeline route would be identical to that described above.

5.6.2 Alternative Location of Surface Water Treatment Plant

While it is assumed that the Western Well Field and Groundwater Treatment Plant will be constructed first, it may be that the Eastern Well Field and

Groundwater Treatment Plant may actually be constructed prior to the western facilities. If this were the case, and assuming that the Alternate "B" Winter Diversion Water Supply Program were to become a reality, it may be preferable to locate the surface water treatment plant in a common site adjacent to the Eastern Groundwater Treatment Plant, see Appendix A, Exhibit 2. As a result, the alignment of the raw surface water transmission pipeline would change slightly as described below.

5.6.3 Alternative Surface Water Transmission Pipeline Alignment

The route and size of the Raw Surface Water Transmission Pipeline will be slightly different than described above, if the alternative SWTP location is utilized. In lieu of the transmission pipeline turning southerly on Powerline Road from Sankey Road, the pipeline would continue easterly along Sankey Road, crossing under SR 99/70, to the realigned Pacific Avenue, where it will head southerly to the alternative location of the Surface Water Treatment Plant. (See Appendix A, Exhibit 2).

5.7 Annual Water Supply Schedule

The water demands of any community vary annually, with higher demands experienced during summer months and lower demand periods in winter. Using generally accepted industry standards, the average annual demand, average day demand, maximum day demand, and peak hour demands were tabulated based on the proposed land use designations and unit demands factors for the SPSP area.

The Tables 3.1 through 3.3 show the project water demands for normal and critically dry years and summarizes how the demands will be met for the Proposed Water Supply Program, Alternate "A" and Alternate "B" Water Supply Programs. Tables 4 - 13 show the detailed demand calculations and variations for normal year and critical dry year conditions envisioned for the SPSP area.

Table 3.1: Proposed Water Supply Program (all values in AFY)

	Normal Year				Critical Dry Year			
Phase	**Average Annual Demand**	**Total Demand**	**Ground Water Supply**	**Surface Water Supply**	**Average Annual Demand**	**Total Demand**	**Ground Water Supply**	**Surface Water Supply**
1+A	8,442	8,442	8,442	0	7,387	7,387	7,387	0
2+B	7,343	15,785	10,918	4,867	6,423	13,810	9,591	4, 219
3+C	4,683	20,468	11,486	8,982	4,097	17,907	10,088	7, 819
4+D	4,731	**25,199**	13,071	12,128	4,141	**22,048**	12,949	9,099

Table 3.2: Alternate "A" Revised Water Supply Program (all values in AFY)

	Normal Year				Critical Dry Year			
Phase	**Average Annual Demand**	**Total Demand**	**Ground Water Supply**	**Surface Water Supply**	**Average Annual Demand**	**Total Demand**	**Ground Water Supply**	**Surface Water Supply**
1+A	8,442	8,442	8,442	0	7,387	7,387	7,387	0
2+B	7,343	15,785	4,976	10,809	6,423	13,810	6,913	6,897
3+C	4,683	20,468	6,544	13,924	4,097	17,907	9,605	8,302
4+D	4,731	**25,199**	9,561	15,638	4,141	**22,048**	12,432	9,616

Note: Numbers may not add due to rounding.

Table 3.3: Alternate "B" Winter Diversion Water Supply Program (all values in AFY)

	Normal Year				Critical Dry Year			
Phase	**Average Annual Demand**	**Total Demand**	**Ground Water Supply**	**Surface Water Supply**	**Average Annual Demand**	**Total Demand**	**Ground Water Supply**	**Surface Water Supply**
1+A	8,442	8,442	8,442	0	7,387	7,387	7,387	0
2+B	7,343	15,785	6,536	9,249	6,423	13,810	9,239	4,571
3+C	4,683	20,468	6,270	14,198	4,097	17,907	9,007	8,900
4+D	4,731	**25,199**	6,577	18,622	4,141	**22,048**	9,276	12,772

Note: Numbers may not add due to rounding.

Table 4

Project# 7900-00

Date: 02/27/08

Sutter Pointe - Total Water Demand Calculations - Normal Year (Ultimate Buildout)

	Land Use	Rate [1] (ac-ft/ac/yr)	Area [2] (acre)	Avg. Annual Demand (ac-ft/yr)	Avg. Day Demand (gpm)	Max Day Demand (gpm)	Peak Hour Demand (gpm)
a	b	c	d	f=c*d	g=f*0.62	h=g*1.85	I=h*1.91
Residential	Low Density (LDR)	3.67	512.8	1,882	1,167	2,159	4,123
	Medium Density (MDR)	4.17	1,950.3	8,133	5,042	9,328	17,816
	High Density (HDR)	4.67	187.7	877	544	1,006	1,921
	Residential Roads	0.20	244.2	49	30	56	107
	Res. Total		***2,895.0***	***10,941***	***6,783***	***12,549***	***23,968***
Public Facilities	Community Parks	4.08	431.9	1,762	1,092	2,021	3,860
	Open Space - High	4.08	166.4	679	421	779	1,487
	Open Space - Medium	2.34	132.3	310	192	356	679
	Open Space - Low	0.60	96.1	58	36	67	127
	K-8 School	3.67	121.7	447	277	513	979
	High School	3.67	52.9	194	120	223	425
	Public Total		***1,001.3***	***3,450***	***2,139***	***3,957***	***7,558***
Industrial	Employment 1	3.00	580.4	1,741	1,079	1,997	3,814
	Employment 2	3.00	1,990.5	5,972	3,702	6,849	13,082
	Employment Roads	0.20	303.8	61	38	70	134
	Commercial Retail	3.00	178.2	535	332	614	1,172
	Mixed Use	3.00	164.1	492	305	564	1,078
	Industrial Drainage Basins	0.60	414.3	249	154	286	545
	Indus. Total		***3,631.3***	***9,050***	***5,611***	***10,380***	***19,825***
	Subtotal		**7,527.6**	**23,441**	***14,533***	***26,885***	***51,351***
	7.5% System Loss		-	1,758	1,090	2,016	3,851
	Totals		**7,527.6**	**25,199**	**15,622**	**28,902**	**55,202**
	Totals (mgd)				**22.5**	**41.6**	**79.5**

[1] Unit Water Demands based on typical urban water demand factors for the Sacramento Region.

[2] Areas were determined from the land use plan prepared by EDAW dated 02-08-08.

Table 5

Project# 7900-00
Date: 02/28/08
Sutter Pointe -Water Demand Calculations Normal Year - Phase 1+A

	Land Use	Rate [1] (ac-ft/ac/yr)	Area [2] (acre)	Avg. Annual Demand (ac-ft/yr)	Avg. Day Demand (gpm)	Max Day Demand (gpm)	Peak Hour Demand (gpm)
a	b	c	d	f=c*d	g=f*0.62	h=g*1.85	I=h*1.91
Residential	Low Density (LDR)	3.67	121.0	444	275	509	973
	Medium Density (MDR)	4.17	874.8	3,648	2,262	4,184	7,991
	High Density (HDR)	4.67	91.4	427	265	490	935
	Residential Roads	0.20	127.2	25	15	29	55
	Res. Total		***1,214.4***	***4,544***	***2,817***	***5,212***	***9,954***
Public Facilities	Community Parks	4.08	99.4	406	252	466	889
	Open Space - High	4.08	47.3	193	120	221	423
	Open Space - Medium	2.34	47.4	111	69	127	243
	Open Space - Low	0.60	21.1	13	8	15	28
	K-8 School	3.67	61.1	224	139	257	491
	High School	3.67	52.9	194	120	223	425
	Public Total		***329.2***	***1,141***	***707***	***1,309***	***2,500***
Industrial	Employment 1 (E1)	3.00	96.8	290	180	333	635
	Employment 2 (E2)	3.00	380.3	1,141	707	1,309	2,500
	Employment Roads	0.20	73.9	15	9	17	33
	Commercial Retail (CR)	3.00	129.9	390	242	447	854
	Mixed Use (MU)	3.00	100.8	302	187	346	662
	Industrial Drainage Basins (IDB)	0.60	50.6	30	19	34	66
	Indus. Total		***832.3***	***2,168***	***1,344***	***2,487***	***4,749***
	Subtotal		**2,375.9**	**7,853**	***4,869***	***9,007***	***17,203***
	7.5% System Loss		-	589	365	676	1,290
	Totals		**2,375.9**	**8,442**	**5,234**	**9,682**	**18,493**
	Totals (mgd)				**7.5**	**13.9**	**26.6**

[1] Unit Water Demands based on typical urban water demand factors for the Sacramento Region.
[2] Areas were determined from the land use plan prepared by EDAW, dated 02/08/08.

Table 6

Project# 7900-00
Date: 02/28/08
Sutter Pointe -Water Demand Calculations Normal Year - Phase 2+B

	Land Use	Rate [1] (ac-ft/ac/yr)	Area [2] (acre)	Avg. Annual Demand (ac-ft/yr)	Avg. Day Demand (gpm)	Max Day Demand (gpm)	Peak Hour Demand (gpm)
a	b	c	d	f=c*d	g=f*0.62	h=g*1.85	I=h*1.91
Residential	Low Density (LDR)	3.67	316.3	1,161	720	1,332	2,543
	Medium Density (MDR)	4.17	491.9	2,051	1,272	2,352	4,493
	High Density (HDR)	4.67	-	-	-	-	-
	Residential Roads	0.20	48.4	10	6	11	22
	Res. Total		***856.6***	***3,222***	***1,998***	***3,695***	***7,058***
Public Facilities	Community Parks	4.08	181.8	742	460	851	1,625
	Open Space - High	4.08	119.1	486	301	557	1,065
	Open Space - Medium	2.34	26.1	61	38	70	134
	Open Space - Low	0.60	38.3	23	14	26	50
	K-8 School	3.67	20.9	77	48	88	169
	High School	3.67	-	-	-	-	-
	Public Total		***386.2***	***1,389***	***861***	***1,593***	***3,043***
Industrial	Employment 1 (E1)	3.00	100.9	303	188	348	664
	Employment 2 (E2)	3.00	611.4	1,834	1,137	2,103	4,018
	Employment Roads	0.20	63.1	13	8	15	28
	Commercial Retail (CR)	3.00	-	-	-	-	-
	Mixed Use (MU)	3.00	-	-	-	-	-
	Industrial Drainage Basins (IDB)	0.60	116.3	70	43	80	153
	Indus. Total		***891.7***	***2,220***	***1,376***	***2,546***	***4,863***
	Subtotal		**2,134.5**	**6,831**	***4,235***	***7,835***	***14,964***
	7.5% System Loss		-	512	318	588	1,122
	Totals		**2,134.5**	**7,343**	**4,553**	**8,422**	**16,087**
	Totals (mgd)				**6.6**	**12.1**	**23.2**

[1] Unit Water Demands based on typical urban water demand factors for the Sacramento Region.
[2] Areas were determined from the land use plan prepared by EDAW, dated 02/08/08.

Table 7

Project# 7900-00

Date: 02/28/08

Sutter Pointe -Water Demand Calculations Normal Year - Phase 3+C

	Land Use	Rate [1] (ac-ft/ac/yr)	Area [2] (acre)	Avg. Annual Demand (ac-ft/yr)	Avg. Day Demand (gpm)	Max Day Demand (gpm)	Peak Hour Demand (gpm)
a	b	c	d	f=c*d	g=f*0.62	h=g*1.85	I=h*1.91
Residential	Low Density (LDR)	3.67	-	-	-	-	-
	Medium Density (MDR)	4.17	331.3	1,382	857	1,585	3,027
	High Density (HDR)	4.67	57.8	270	167	310	591
	Residential Roads	0.20	40.1	8	5	9	18
	Res. Total		***429.2***	***1,660***	***1,029***	***1,904***	***3,636***
Public Facilities	Community Parks	4.08	67.0	273	169	313	598
	Open Space - High	4.08	-	-	-	-	-
	Open Space - Medium	2.34	37.5	88	55	101	193
	Open Space - Low	0.60	13.9	8	5	9	18
	K-8 School	3.67	21.0	77	48	88	169
	High School	3.67	-	-	-	-	-
	Public Total		***139.4***	***446***	***277***	***512***	***977***
Industrial	Employment 1 (E1)	3.00	188.5	566	351	649	1,240
	Employment 2 (E2)	3.00	506.2	1,519	942	1,742	3,328
	Employment Roads	0.20	67.3	13	8	15	28
	Commercial Retail (CR)	3.00	21.8	65	40	75	142
	Mixed Use (MU)	3.00	-	-	-	-	-
	Industrial Drainage Basins (IDB)	0.60	145.0	87	54	100	191
	Indus. Total		***928.8***	***2,250***	***1,395***	***2,581***	***4,929***
	Subtotal		**1,497.4**	**4,356**	***2,701***	***4,996***	***9,542***
	7.5% System Loss		-	327	203	375	716
	Totals		**1,497.4**	**4,683**	**2,903**	**5,371**	**10,258**
	Totals (mgd)				**4.2**	**7.7**	**14.8**

[1] Unit Water Demands based on typical urban water demand factors for the Sacramento Region.

[2] Areas were determined from the land use plan prepared by EDAW, dated 02/08/08.

Table 8

Project# 7900-00
Date: 02/28/08
Sutter Pointe -Water Demand Calculations Normal Year - Phase 4+D

	Land Use	Rate [1] (ac-ft/ac/yr)	Area [2] (acre)	Avg. Annual Demand (ac-ft/yr)	Avg. Day Demand (gpm)	Max Day Demand (gpm)	Peak Hour Demand (gpm)
a	b	c	d	f=c*d	g=f*0.62	h=g*1.85	I=h*1.91
Residential	Low Density (LDR)	3.67	75.5	277	172	318	607
	Medium Density (MDR)	4.17	252.3	1,052	652	1,207	2,305
	High Density (HDR)	4.67	38.5	180	112	206	394
	Residential Roads	0.20	28.5	6	4	7	13
	Res. Total		***394.8***	***1,515***	***939***	***1,738***	***3,319***
Public Facilities	Community Parks	4.08	83.7	341	211	391	747
	Open Space - High	4.08	-	-	-	-	-
	Open Space - Medium	2.34	21.3	50	31	57	110
	Open Space - Low	0.60	22.8	14	9	16	31
	K-8 School	3.67	18.7	69	43	79	151
	High School	3.67	-	-	-	-	-
	Public Total		***146.5***	***474***	***294***	***544***	***1,038***
Industrial	Employment 1 (E1)	3.00	194.2	583	361	669	1,277
	Employment 2 (E2)	3.00	492.6	1,478	916	1,695	3,238
	Employment Roads	0.20	99.5	20	12	23	44
	Commercial Retail (CR)	3.00	26.5	80	50	92	175
	Mixed Use (MU)	3.00	63.3	190	118	218	416
	Industrial Drainage Basins (IDB)	0.60	102.4	61	38	70	134
	Indus. Total		***978.5***	***2,412***	***1,495***	***2,766***	***5,284***
	Subtotal		**1,519.8**	**4,401**	***2,728***	***5,048***	***9,641***
	7.5% System Loss		-	330	205	379	723
	Totals		**1,519.8**	**4,731**	**2,933**	**5,426**	**10,364**
	Totals (mgd)				**4.2**	**7.8**	**14.9**

[1] Unit Water Demands based on typical urban water demand factors for the Sacramento Region.
[2] Areas were determined from the land use plan prepared by EDAW, dated 02/08/08.

Table 9

Project# 7900-00

Date: 02/27/08

Sutter Pointe - Total Water Demand Calculations - Critical Dry Year (Ultimate Buildout)

	Land Use	Rate [1] (ac-ft/ac/yr)	Area [2] (acre)	Avg. Annual Demand (ac-ft/yr)	Avg. Day Demand (gpm)	Max Day Demand (gpm)	Peak Hour Demand (gpm)
a	b	c	d	f=(c*d)*0.875	g=f*0.62	h=g*1.85	I=h*1.91
Residential	Low Density (LDR)	3.67	512.8	1,647	1,021	1,889	3,608
	Medium Density (MDR)	4.17	1,950.3	7,116	4,412	8,162	15,589
	High Density (HDR)	4.67	187.7	767	476	880	1,680
	Residential Roads	0.20	244.2	43	27	49	94
	Res. Total		***2,895.0***	***9,573***	***5,935***	***10,980***	***20,971***
Public Facilities	Community Parks	4.08	431.9	1,542	956	1,769	3,378
	Open Space - High	4.08	166.4	594	368	681	1,301
	Open Space - Medium	2.34	132.3	271	168	311	594
	Open Space - Low	0.60	96.1	50	31	57	110
	K-8 School	3.67	121.7	391	242	448	857
	High School	3.67	52.9	170	105	195	372
	Public Total		***1,001.3***	***3,018***	***1,871***	***3,461***	***6,611***
Industrial	Employment 1	3.00	580.4	1,524	945	1,748	3,339
	Employment 2	3.00	1,990.5	5,225	3,239	5,993	11,446
	Employment Roads	0.20	303.8	53	33	61	116
	Commercial Retail	3.00	178.2	468	290	537	1,025
	Mixed Use	3.00	164.1	431	267	494	944
	Industrial Drainage Basins	0.60	414.3	218	135	250	478
	Indus. Total		***3,631.3***	***7,919***	***4,909***	***9,083***	***17,348***
	Subtotal		**7,527.6**	**20,510**	***12,715***	***23,523***	***44,930***
	7.5% System Loss		-	1,538	954	1,764	3,370
	Totals		**7,527.6**	**22,048**	**13,669**	**25,288**	**48,300**
	Totals (mgd)				**19.7**	**36.4**	**69.6**

[1] Unit Water Demands based on typical urban water demand factors for the Sacramento Region.

[2] Areas were determined from the land use plan prepared by EDAW dated 02-08-08.

Table 10

Project# 7900-00
Date: 02/28/08
Sutter Pointe -Water Demand Calculations Critical Dry Year - Phase 1+A

	Land Use	Rate [1] (ac-ft/ac/yr)	Area [2] (acre)	Avg. Annual Demand (ac-ft/yr)	Avg. Day Demand (gpm)	Max Day Demand (gpm)	Peak Hour Demand (gpm)
a	b	c	d	f=(c*d)*0.875	g=f*0.62	h=g*1.85	I=h*1.91
Residential	Low Density (LDR)	3.67	121.0	389	241	446	852
	Medium Density (MDR)	4.17	874.8	3,192	1,979	3,661	6,992
	High Density (HDR)	4.67	91.4	373	231	428	817
	Residential Roads	0.20	127.2	22	14	25	48
	Res. Total		***1,214.4***	***3,976***	***2,465***	***4,560***	***8,710***
Public Facilities	Community Parks	4.08	99.4	355	220	407	778
	Open Space - High	4.08	47.3	169	105	194	370
	Open Space - Medium	2.34	47.4	97	60	111	212
	Open Space - Low	0.60	21.1	11	7	13	24
	K-8 School	3.67	61.1	196	122	225	429
	High School	3.67	52.9	170	105	195	372
	Public Total		***329.2***	***998***	***619***	***1,145***	***2,186***
Industrial	Employment 1 (E1)	3.00	96.8	254	157	291	556
	Employment 2 (E2)	3.00	380.3	998	619	1,145	2,186
	Employment Roads	0.20	73.9	13	8	15	28
	Commercial Retail (CR)	3.00	129.9	341	211	391	747
	Mixed Use (MU)	3.00	100.8	265	164	304	581
	Industrial Drainage Basins (IDB)	0.60	50.6	27	17	31	59
	Indus. Total		***832.3***	***1,898***	***1,177***	***2,177***	***4,158***
	Subtotal		**2,375.9**	**6,872**	***4,260***	***7,882***	***15,054***
	7.5% System Loss		-	515	320	591	1,129
	Totals		**2,375.9**	**7,387**	**4,580**	**8,473**	**16,183**
	Totals (mgd)				**6.6**	**12.2**	**23.3**

[1] Unit Water Demands based on typical urban water demand factors for the Sacramento Region.
[2] Areas were determined from the land use plan prepared by EDAW, dated 02/08/08.

Table 11

Project# 7900-00
Date: 02/28/08
Sutter Pointe -Water Demand Calculations Critical Dry Year - Phase 2+B

	Land Use	Rate [1] (ac-ft/ac/yr)	Area [2] (acre)	Avg. Annual Demand (ac-ft/yr)	Avg. Day Demand (gpm)	Max Day Demand (gpm)	Peak Hour Demand (gpm)
a	b	c	d	f=(c*d)*0.875	g=f*0.62	h=g*1.85	I=h*1.91
Residential	Low Density (LDR)	3.67	316.3	1,016	630	1,165	2,226
	Medium Density (MDR)	4.17	491.9	1,795	1,113	2,059	3,932
	High Density (HDR)	4.67	-	-	-	-	-
	Residential Roads	0.20	48.4	8	5	9	18
	Res. Total		***856.6***	***2,819***	***1,748***	***3,233***	***6,175***
Public Facilities	Community Parks	4.08	181.8	649	402	744	1,422
	Open Space - High	4.08	119.1	425	263	487	931
	Open Space - Medium	2.34	26.1	53	33	61	116
	Open Space - Low	0.60	38.3	20	12	23	44
	K-8 School	3.67	20.9	67	42	77	147
	High School	3.67	-	-	-	-	-
	Public Total		***386.2***	***1,214***	***753***	***1,392***	***2,659***
Industrial	Employment 1 (E1)	3.00	100.9	265	164	304	581
	Employment 2 (E2)	3.00	611.4	1,605	995	1,841	3,516
	Employment Roads	0.20	63.1	11	7	13	24
	Commercial Retail (CR)	3.00	-	-	-	-	-
	Mixed Use (MU)	3.00	-	-	-	-	-
	Industrial Drainage Basins (IDB)	0.60	116.3	61	38	70	134
	Indus. Total		***891.7***	***1,942***	***1,204***	***2,227***	***4,254***
	Subtotal		**2,134.5**	**5,975**	***3,704***	***6,853***	***13,089***
	7.5% System Loss		-	448	278	514	982
	Totals		**2,134.5**	**6,423**	**3,982**	**7,367**	**14,071**
	Totals (mgd)				**5.7**	**10.6**	**20.3**

[1] Unit Water Demands based on typical urban water demand factors for the Sacramento Region.
[2] Areas were determined from the land use plan prepared by EDAW, dated 02/08/08.

Table 12

Project# 7900-00
Date: 02/28/08
Sutter Pointe -Water Demand Calculations Critical Dry Year - Phase 3+C

	Land Use	Rate [1] (ac-ft/ac/yr)	Area [2] (acre)	Avg. Annual Demand (ac-ft/yr)	Avg. Day Demand (gpm)	Max Day Demand (gpm)	Peak Hour Demand (gpm)
a	b	c	d	f=(c*d)*0.875	g=f*0.62	h=g*1.85	I=h*1.91
Residential	Low Density (LDR)	3.67	-	-	-	-	-
	Medium Density (MDR)	4.17	331.3	1,209	750	1,387	2,648
	High Density (HDR)	4.67	57.8	236	146	271	517
	Residential Roads	0.20	40.1	7	4	8	15
	Res. Total		***429.2***	***1,452***	***900***	***1,665***	***3,181***
Public Facilities	Community Parks	4.08	67.0	239	148	274	524
	Open Space - High	4.08	-	-	-	-	-
	Open Space - Medium	2.34	37.5	77	48	88	169
	Open Space - Low	0.60	13.9	7	4	8	15
	K-8 School	3.67	21.0	67	42	77	147
	High School	3.67	-	-	-	-	-
	Public Total		***139.4***	***390***	***242***	***447***	***854***
Industrial	Employment 1 (E1)	3.00	188.5	495	307	568	1,084
	Employment 2 (E2)	3.00	506.2	1,329	824	1,524	2,911
	Employment Roads	0.20	67.3	12	7	14	26
	Commercial Retail (CR)	3.00	21.8	57	35	65	125
	Mixed Use (MU)	3.00	-	-	-	-	-
	Industrial Drainage Basins (IDB)	0.60	145.0	76	47	87	166
	Indus. Total		***928.8***	***1,969***	***1,221***	***2,258***	***4,313***
	Subtotal		**1,497.4**	**3,811**	***2,363***	***4,371***	***8,348***
	7.5% System Loss		-	286	177	328	626
	Totals		**1,497.4**	**4,097**	**2,540**	**4,699**	**8,975**
	Totals (mgd)				**3.7**	**6.8**	**12.9**

[1] Unit Water Demands based on typical urban water demand factors for the Sacramento Region.
[2] Areas were determined from the land use plan prepared by EDAW, dated 02/08/08.

Table 13

Project# 7900-00
Date: 02/28/08
Sutter Pointe -Water Demand Calculations Critical Dry Year - Phase 4+D

	Land Use	Rate [1] (ac-ft/ac/yr)	Area [2] (acre)	Avg. Annual Demand (ac-ft/yr)	Avg. Day Demand (gpm)	Max Day Demand (gpm)	Peak Hour Demand (gpm)
a	b	c	d	f=(c*d)*0.875	g=f*0.62	h=g*1.85	I=h*1.91
Residential	Low Density (LDR)	3.67	75.5	243	151	279	532
	Medium Density (MDR)	4.17	252.3	921	571	1,056	2,018
	High Density (HDR)	4.67	38.5	157	97	180	344
	Residential Roads	0.20	28.5	5	3	6	11
	Res. Total		***394.8***	***1,326***	***822***	***1,521***	***2,905***
Public Facilities	Community Parks	4.08	83.7	299	185	343	655
	Open Space - High	4.08	-	-	-	-	-
	Open Space - Medium	2.34	21.3	44	27	50	96
	Open Space - Low	0.60	22.8	12	7	14	26
	K-8 School	3.67	18.7	60	37	69	131
	High School	3.67	-	-	-	-	-
	Public Total		***146.5***	***415***	***257***	***476***	***909***
Industrial	Employment 1 (E1)	3.00	194.2	510	316	585	1,117
	Employment 2 (E2)	3.00	492.6	1,293	802	1,483	2,832
	Employment Roads	0.20	99.5	18	11	21	39
	Commercial Retail (CR)	3.00	26.5	70	43	80	153
	Mixed Use (MU)	3.00	63.3	166	103	190	364
	Industrial Drainage Basins (IDB)	0.60	102.4	54	33	62	118
	Indus. Total		***978.5***	***2,111***	***1,309***	***2,421***	***4,624***
	Subtotal		**1,519.8**	**3,852**	***2,388***	***4,418***	***8,438***
	7.5% System Loss		-	289	179	331	633
	Totals		**1,519.8**	**4,141**	**2,567**	**4,749**	**9,071**
	Totals (mgd)				**3.7**	**6.8**	**13.1**

[1] Unit Water Demands based on typical urban water demand factors for the Sacramento Region.
[2] Areas were determined from the land use plan prepared by EDAW, dated 02/08/08.

5.8 NCMWC Non-Shareholder Area

The area of non-shareholder land (2518.3± acres) is irrigated by existing ground water wells. The non-shareholder area is expected to have an average annual water demand of 8,817± AFY at ultimate build-out. Detailed demand calculations for the non-shareholder area are presented in Tables 15 & 16.

5.9 M&I / Agricultural Water Demand Comparison

The amount of CVP Settlement Contract water available to meet the irrigation needs of the shareholder lands within the planning area has been estimated to be 30,000± AFY during Normal Years (22,500± AFY during Critical Years assuming 25% cutback). In comparison, the amount of surface water needed to meet the M&I demand of the planning area during Normal and Critical Dry Years in the Proposed Water Supply Program, the Alternate "A" Revised Water Supply Program and the Alternate "B" Winter Diversion Water Supply Program are significantly lower. Accordingly, the conversion of land uses within the planning area from agricultural to urban will result in the creation of surplus surface water in the magnitudes summarized below:

Table 14: Summary of Surplus Surface Water

Scenario	Description	Normal Year	Critical Year
Proposed Water Supply Program	CVP Settlement Contract Water	30,000 AFY	22,500 AFY
	Winter Diversion Right	0 AFY	0 AFY
	Total Surface Water	30,000 AFY	22,500 AFY
	Less M&I Demand	<12,128AFY>	<9,099 AFY>
	Surplus Water	**17,872 AFY**	**13,401 AFY**
Alternate "A" Revised Water Supply Program	CVP Settlement Contract Water	30,000 AFY	22,500 AFY
	Winter Diversion Right	0 AFY	0 AFY
	Total Surface Water	30,000 AFY	22,500 AFY
	Less M&I Demand	<15,638AFY>	<9,616 AFY>
	Surplus Water	**14,362 AFY**	**12,884AFY**
Alternate "B" Winter Diversion Water Supply Program	CVP Settlement Contract Water	30,000 AFY	22,500 AFY
	Winter Diversion Right	6,000 AFY	6,000 AFY
	Total Surface Water	36,000 AFY	28,500 AFY
	Less M&I Demand	<13,126 AFY>	<8,590 AFY>
	Surplus Water	**22,874 AFY**	**19,910 AFY**

Note: Numbering may not add due to rounding.

The projected reduction in surface water usage within the planning area resulting from urbanization provides a unique opportunity for water banking and subsequent transfer of these surplus waters to other water purveyors in the need of highly reliable surface water during Normal and Critical Years.

Table 15

Project# 7900-00

Date: 02/29/08

Sutter Pointe - (Non NCMWC Shareholder Area) Total Water Demand Calculations - Normal Year (Ultimate Buildout)

	Land Use	Rate [1] (ac-ft/ac/yr)	Area [2] (acre)	Avg. Annual Demand (ac-ft/yr)	Avg. Day Demand (gpm)	Max Day Demand (gpm)	Peak Hour Demand (gpm)
a	b	c	d	f=c*d	g=f*0.62	h=g*1.85	I=h*1.91
Residential	Low Density (LDR)	3.67	178.2	654	405	750	1,433
	Medium Density (MDR)	4.17	827.6	3,452	2,140	3,959	7,562
	High Density (HDR)	4.67	48.6	227	141	260	497
	Residential Roads	0.20	82.5	17	11	19	37
	Res. Total		***1,136.9***	***4,350***	***2,697***	***4,989***	***9,529***
Public Facilities	Community Parks	4.08	92.9	379	235	435	830
	Open Space - High	4.08	166.4	679	421	779	1,487
	Open Space - Medium	2.34	28.1	66	41	76	145
	Open Space - Low	0.60	-	-	-	-	-
							-
	K-8 School	3.67	40.3	148	92	170	324
	High School	3.67	-	-	-	-	-
	Public Total		***327.7***	***1,272***	***789***	***1,459***	***2,786***
Industrial	Employment 1	3.00	385.3	1,156	717	1,326	2,532
	Employment 2	3.00	379.4	1,138	706	1,305	2,493
	Employment Roads	0.20	94.6	20	12	23	44
	Commercial Retail	3.00	62.4	187	116	214	410
	Mixed Use	3.00	-	-	-	-	-
	Industrial Drainage Basins	0.60	132.0	79	49	91	173
	Indus. Total		***1,053.7***	***2,580***	***1,599***	***2,959***	***5,652***
	Subtotal		**2,518.3**	**8,202**	***5,085***	***9,407***	***17,968***
	7.5% System Loss		-	615	381	706	1,348
	Totals		**2,518.3**	**8,817**	**5,466**	**10,113**	**19,315**
	Totals (mgd)				**7.9**	**14.6**	**27.8**

[1] Unit Water Demands based on typical urban water demand factors for the Sacramento Region.

[2] Areas were determined from the land use plan prepared by EDAW dated 02-08-08.

Table 16

Project# 7900-00

Date: 02/29/08

Sutter Pointe - (Non NCMWC Shareholder Area) Total Water Demand Calculations - Critical Dry Year (Ultimate Buildout)

	Land Use	Rate [1] (ac-ft/ac/yr)	Area [2] (acre)	Avg. Annual Demand (ac-ft/yr)	Avg. Day Demand (gpm)	Max Day Demand (gpm)	Peak Hour Demand (gpm)
a	b	c	d	f=(c*d)*0.875	g=f*0.62	h=g*1.85	I=h*1.5
Residential	Low Density (LDR)	3.67	178.2	572	355	656	984
	Medium Density (MDR)	4.17	827.6	3,020	1,872	3,464	5,196
	High Density (HDR)	4.67	48.6	199	123	228	342
	Residential Roads	0.20	82.5	14	9	16	24
	Res. Total		***1,136.9***	***3,805***	***2,359***	***4,364***	***6,546***
Public Facilities	Community Parks	4.08	92.9	332	206	381	571
	Open Space - High	4.08	166.4	594	368	681	1,022
	Open Space - Medium	2.34	28.1	58	36	67	100
	Open Space - Low	0.60	-	-	-	-	-
	K-8 School	3.67	40.3	129	80	148	222
	High School	3.67	-	-	-	-	-
	Public Total		***327.7***	***1,113***	***690***	***1,277***	***1,915***
Industrial	Employment 1	3.00	385.3	1,011	627	1,160	1,739
	Employment 2	3.00	379.4	996	617	1,142	1,714
	Employment Roads	0.20	94.6	17	11	19	29
	Commercial Retail	3.00	62.4	164	102	188	282
	Mixed Use	3.00	-	-	-	-	-
	Industrial Drainage Basins	0.60	132.0	69	43	79	119
	Indus. Total		***1,053.7***	***2,257***	***1,399***	***2,589***	***3,883***
	Subtotal		**2,518.3**	**7,175**	***4,448***	***8,229***	***12,344***
	7.5% System Loss		-	538	334	617	926
	Totals		**2,518.3**	**7,713**	**4,782**	**8,846**	**13,270**
	Totals (mgd)				**6.9**	**12.7**	**19.1**

[1] Unit Water Demands based on typical urban water demand factors for the Sacramento Region.

[2] Areas were determined from the land use plan prepared by EDAW dated 02-08-08.

5.10 Operational Considerations

Several considerations guided the development of the three water supply scenarios described in this master plan. These considerations guided initial allocation of water utilization between surface and ground water for planning purposes, and are sufficient for the current level of planning. There are a number of different ways to allocate water between these two sources, and in some cases not all available surface water was used based on several of the operational considerations listed below.

A more definitive operations plan will be defined as the project is developed beyond Phase 1+A, and as surface water supplies are secured for the project through a combination of contract and separate water rights. The allocation rules will also be guided by the goals of the eventual operating entity for the water supply system. Here are the major considerations in developing the water supply scenarios:

1. Water conservation during single and multiple dry years (12.5% goal for demand reduction).
2. Development of the second well field prior to working out the details of the preferred surface water supply program.
3. Reliance on the first well field for the initial stages of development.
4. Balancing of ground wand surface water supplies in an effort to make more effective use of both resources.
5. Preservation of existing rights to surface water under the Bureau of Reclamation Settlement Contract.
6. Availability of Bureau water during irrigation season.

7. Compliance with monthly and annual diversion limits under the Settlement Contract during normal and critically dry years when cutback in diversions is mandatory.[51]
8. Flexibility to adjust the final mix of surface and ground water to optimize the overall operation of the system.
9. Flexibility to use each water supply to the maximum extent possible when the other supply is in limited availability.
10. Minimizing the likelihood of a binary water supply system (the "Proposed Water Supply Program") and the resulting over building of combined surface and ground treatment capacities needed to meet projected demands.
11. Enhancing the likelihood of a more effective conjunctive water supply program (the Alternate "B" Water Supply Program) with resulting water quality and resource conservation benefits.
12. Creating adequate reserves of ground and surface water to provide appropriate levels of operational flexibility and system redundancy to react to unforeseen events.
13. Balancing the need for adequate ground and surface water reserves with the creation of excess infrastructure capacity that is rarely, if ever, used.
14. Minimize the capital and operational costs of the system during the early stages of the development.
15. Reduction in total water supply costs to the future residents of the project.

Given the above range of considerations that must be evaluated in selecting the mix of the three surface water supplies in any particular period, it is clear that considerable judgment must be used in striking the right balance between numerous completing interests. Accordingly, a trial and error approach is

[51] Table C-1 in Appendix B demonstrates the ability of the Project to meet the monthly and annual diversion caps under the Settlement Contract during both normal and critically dry water years.

needed where small changes in the water supply mix are made on an incremental basis until a balance point is found.

Over time, this balance point may shift depending on changing circumstances and constraints. Obviously not a formulaic exercise that can be quantitatively documented, the determination of each balance point must be evaluated with in the context of the regulatory, environmental, economic and political realities of the times.

While the Proposed Water Supply Program has been designed to address the above considerations, it is clear that progressing to the Alternate "A" Water Supply Program allows greater satisfaction of the above considerations. Likewise, if a wintertime diversion can be secured; further progression to the Alternate "B" Water Supply Program provides an opportunity to satisfy these considerations to an even greater degree.

Apportionment of surface and ground water resources will vary between normal and critically dry years. While this apportionment differs in each of the three water supply programs described in this master plan, the following considerations will guide the operator in adjusting the water supply mix when dealing with a dry year scenario:

a) Greater reliance on groundwater during dry years.

b) Decreased use of surface water during dry years.

c) Reliance on wintertime diversions, either through the procurement of a new wintertime water right or restructuring of the Bureau diversion schedule, to help balance the supply/demand equation.

d) Use of ground and surface water reserves.

Finally, it is envisioned that final design of the system, subsequent to approval of the Sutter Pointe Specific Plan, will include considerable thought regarding how best to address these considerations to optimize the water supply system and to maximize the benefits for the future residents of the community. This effort was determined to be beyond the scope of this master plan.

5.11 SB 610 & SB 221

SB 610 (Water Supply Assessment)

A companion to this water master plan is a Water Supply Assessment (WSA) prepared in compliance with the requirements of SB 610 (Water Code, § 10910 et seq.). The WSA demonstrates that the proposed water supply is sufficient to meet the anticipated water demands of the project.

Compliance with the requirements of SB 610 requires the demonstration either of "existing" water supplies for a proposed project or a plan for how to obtain "anticipated" or "potential" supplies that can serve the project. In ascertaining whether a particular water supply qualifies as an "existing" supply, there are several threshold issues that must be considered.

This master plan has provided the necessary data to prepare the SB 610 Water Supply Assessment for this project. The threshold criteria that must be evaluated in the SB 610 are generally summarized as follows:

1. One must differentiate between water that is "wet" and "paper" water. It is clear that the water needed to serve the project exists and, in the case of the surface water supply, has historically been diverted and delivered to the project area as agricultural irrigation water. The groundwater required to serve the project has been adequately determined to be available in sustainable quantities. It is clear from a physical perspective the ground and surface waters needed to serve the project are "wet".
2. One must demonstrate the "firmness" of the water supply. That is, the reliability of the supply in normal water years, as well as in single and multiple dry years. It is clear the ground and surface water supplies for Sutter Pointe are adequate to serve the demands of the project in both normal and critically dry years (single and multiple years). Accordingly, from a physical perspective, the ground and surface waters needed to serve the project are "firm".

3. One must demonstrate the "legal" right to the water. In structuring SB 610, the Legislature seems to have reasonably concluded that acquiring the legal entitlement to a water supply is the hardest part of the process, while building conveyance and delivery infrastructure is relatively easy, so much so that its accomplishment can be safely assumed. It is clear that the legal right to both ground and surface waters exists vis-à-vis both the underlying groundwater rights and the shares of NCMWC stock held by the owners of land within the SPSP planning area.
4. One must differentiate between "existing" and "potential" water supplies. A determination of the existence of an "existing" water supply ("wet" water) can be made even though regulatory approvals are still required for the conveyance and delivery infrastructure. In the case of Sutter Pointe it is clear that the "legal" right to the water exists for both surface and ground water since there are no major discretionary approvals required to secure a reliable water supply for the project. Notwithstanding the need for future improvement of the existing Bennett Pumping Plant to meet M&I reliability standards, or the potential need to make minor modifications to the proposed Sankey Diversion Facility to deliver M&I water to Sutter Pointe, it is clear that the approvals needed for these conveyance and delivery infrastructure projects are relatively minor in nature by comparison to those required to gain land use entitlements for the SPSP.

With regard to the proposed winter diversion incorporated into Alternate "B" Water Supply Program, it is a common understanding that there is an abundance of un-appropriated wintertime water rights in the Sacramento River. While procurement of this additional water right will require a new water right permit from the State water Resources Control Board, one can only make a conclusion that this water is simply a "potential" supply within the framework of SB 610. The WSA can envision this future water supply as a potential water supply and fulfill the requirements of SB 610 for this water supply at this time should this water supply be successfully procured.

A similar wintertime water diversion program could be developed as a subset of Alternate "A" Water Supply Program. The data presented in this master plan indicates there may be adequate Project Water available under the existing Bureau Settlement Contract to meet a major portion of the wintertime surface water demands of the project.

Subject to the approval of the Bureau, restructuring of the diversion schedule for Project Water contained in the existing Bureau Settlement Contract could decrease the demands on this resource during the summertime by permitting wintertime diversions when Project Water is more plentiful and in less demand. Such a restructuring could result in many of the same benefits that are inherent with Alternate "B" Water Supply Program. This restructuring is perhaps less difficult to secure than a new wintertime water right and, therefore, more "reasonably likely to occur" within the context of the requirements of SB 610. Likewise, the WSA can envision this future supply as a potential water supply and fulfill the requirements of SB 610 for this water supply at this time should this restructuring be approved by the Bureau.

With regards to the surface water, it is clear that the NCMWC shareholder lands within the SPSP planning area have a legal right to the beneficial use to their prorata share of the existing surface waters held by NCMWC. After all, the NCMWC shareholder lands within the SPSP planning area are the real parties that benefit from the water rights held by NCMWC. While it may take some time to finalize an agreement between NCMWC and Sutter County, the development can progress using groundwater for several years (to nearly 52%± build out, if required) before surface water is actually needed.[52] Sufficient time exists to finalize an agreement with NCMWC since the underlying right to the water is not in question.

[52] This can be accomplished by constructing both well fields under all three water scenarios are constructed prior to the time when surface water becomes available.

SB 221 (Written Verification of Water Supply)

Prior to approval of final small-lot subdivision maps containing more than 500 lots, the local water purveyor must comply with the requirements of SB 221. The requirements of SB 221 require the local water purveyor to demonstrate the availability of water to serve the subdivision at issue before the final map is approved.

In the case of Sutter Pointe, this master plan lays out a "road map" of the steps that are required to develop the groundwater supply and one of the two herein identified water supplies – either the existing Bennett Pumping Plant or the proposed Sankey Diversion Facility. Once all the necessary approvals are secured for the selected surface water supply are secured, the local water purveyor can then comply with the requirements of SB 221. This will occur after the Sutter Pointe Specific Plan, and accompanying entitlements, are approved by Sutter County, in conjunction the discrete subdivision triggering the need for either ground or surface water.

6.0 Proposed Water System Improvements

The SPSP development will require an extensive network of water supply and distribution facilities, consisting of transmission pipelines, distribution pipelines, storage reservoirs, boosters pump stations, treatment facilities, and groundwater wells. It is envisioned that water will be diverted from the Sacramento River and delivered to the site through the facilities described in the previous sections. In addition to diverted surface water, a well field will be constructed to supply ground water to the community as previously described. The various elements of the proposed water supply system design are discussed in following sections.

6.1 On Site Improvements

In addition to the ground and surface water supply and treatment facilities previously described above, an on-site water transmission and distribution system will be required to serve the planning area. The water system has been laid out in a looping network following major street alignments. Future development will draw connections from these pipelines (see Appendix A, Exhibit 5). Dual Tanks will provide redundancy in design, will provide flexibility during routine maintenance activities to rotate each tank out of service, and will allow rotation of the tanks during low demand periods (winter time, for instance) to decrease the chances of the stored water supply becoming stagnant.

Depending on the final location of the water treatment facilities, this water system will consist of a series of interconnected water transmission and distribution pipelines (varying in size from 12” to 42” in diameter), plus water storage reservoirs and booster pump stations. The transmission and distribution pipelines will deliver treated water to storage reservoir sites strategically located throughout the community.

As is typical in the water industry, these above ground water storage reservoirs will provide for fire, peak hour equalization and emergency storage to adequately serve the community. A total of approximately 34± MG of storage will be required to serve full build out of the planning area. At each reservoir site, dual

water tanks will be constructed, each having a capacity of approximately 2.5± to 3± MG and combined storage totaling 5± - 6± MG. The use of dual tanks will increase the turnover of the stored water stored, facilitate ease of maintenance, and provide redundancy in the proposed system. Booster pump stations, each equipped with an emergency auxiliary electrical generator, will provide the required operational pressures of the water distribution system at each reservoir site.

6.2 Off Site Improvements

As described earlier, the off-site water facilities needed to serve this development consists of a raw water turnout, a raw water booster pump station, and a raw water transmission pipeline.[53] These facilities will be required to help support the development of the SPSP planning area subsequent to development of Phase 1+A.

Additionally, a reliable diversion facility will be required to deliver surface water to the project. It is envisioned that either the Bennett Pumping Plant will be improved to meet M&I reliability standards or the proposed NCMWC Sankey Diversion Facility will need to be constructed to accomplish this objective. As previously mentioned, the proposed Sankey Diversion Facility will be a state-of-the-art screened diversion facility that would meet M&I reliability standards. The Bennett Pumping Plant, however, will probably need significant upgrades to meet these standards.

The Bennett Pumping Plant, in addition to being an aged and unscreened agricultural diversion facility, draws from the relatively shallow Natomas Cross Canal. As mentioned above, during some water years the level of the Sacramento River falls below the flowline of the cross canal requiring the installation of a temporary dam at the mouth of the canal and pumping of water

[53] The County of Sutter would prefer pipeline and canal/ditch rights-of-way to be conveyed in fee for single purpose facilities (easements may be acceptable/desirable for multi-use corridors). The County, however, is willing to accept these rights-of-way as easements so long as the easement contains sufficient restrictive language on the allowable uses the underlying fee owner may exercise over these lands subsequent to installation of the pertinent facility.

from the river up into the canal to supply the Bennett Pumping Plant with sufficient water. It is envisioned that this practice will continue after upgrading the Bennett Pumping Plant to M&I standards.

In addition to the lack of fish screens, there are concerns that predation is occurring in the deep scour holes below the existing pump intakes where larger fish forage on smaller fish (especially juvenile Anadromous Salmonids and other endangered and threatened fish species). Additionally, due to the shallow nature of the Cross Canal, concerns have been raised about the practicality of installing fish screens and keeping adequate submergence over the pump bowls.

Reconstruction of the existing Bennett Pumping Plant will need to address these design challenges. It is envisioned that a sunken and screened intake structure could be constructed that would provide the required submergence for proper operation of the pump intakes. This intake structure would include a self-cleaning trash rack that would be designed to allow sufficient flow to the screened pumps while keeping trash, debris and predatory fish out of the pump forebay. Such an intake structure, along with redundant pumps, backup electrical power, and appropriate controls, would provide a modern and reliable diversion facility that would replace the existing Bennett Pumping Plant.

Regulatory approvals required for this facility will be required from various local, state and federal agencies, including, but not limited to Reclamation District No. 1000, Sacramento Area Flood Control Authority (SAFCA), U.S. Army Corps of Engineers (COE), California Department of Fish and Game (DFG), U.S. Natural Marine Fisheries Service (NMFS), and the U.S. Fish and Wildlife Service (FWS). Fish screens would have to meet all the NMFS and DFG Fish Screening Criteria.

Notwithstanding the above discussion, as mentioned earlier in this report, the proposed upgrading of the Bennett Pumping Facility may not actually be necessary. In all likelihood, the proposed Sankey Diversion Facility will be operational by the time surface water diversions are necessary to meet the potable M&I water demands in the SPSP area. Nonetheless, on a programmatic

basis, such upgrading of the existing Bennett Pumping Plant has been included in the proposed system improvements for the project. [54]

6.3 Water System Design Methodology

As a part of the Sutter Pointe Specific Plan, new backbone water system facilities will need to be developed to meet the estimated demands for the proposed land uses. This report section focuses on the water distribution pipelines and the water storage requirements to serve the Plan Area.

The water distribution and storage facilities are laid out based on the backbone street plan proposed for the SPSP area. These facilities have been analyzed using a water system computer model (H2ONET®) to determine appropriate sizing of the system components.

6.4 Water Demands and Hydraulic Criteria

The water system modeling criteria is based on criteria established from best engineering practices and meeting State and Federal regulations. System demands based on land use were established using typical urban water demand factors for the Sacramento Region. The standards used were compared to existing Sutter County standards and were found to meet or exceed these standards. In order to be conservative the higher of these standards were used.

6.4.1 System Demands:

1. Fire flow is defined as the minimum design flow requirement that will provide sufficient water to control a major fire at a specific structure. The fire flow for areas (Low and Medium Density Residential) is 1,800 gpm and 2,500 GPM for High Density Residential areas. Commercial

[54] The total cost of upgrading of the Bennett Pumping Plant is estimated to be approximately $39.2 million and would be shared with NCMWC, with the M&I customers contributing approximately 19%± - 22%± of the total cost to upgrade the facility depending upon which water supply program is actually implemented (M&I demand expressed as a percentage of the total pumping requirements of this facility (244± cfs)). NCMWC agricultural shareholders would be responsible for the remaining costs of upgrade. The equivalent costs associated with upgrading of the existing Bennett Pumping Plant are presumed representative of the M&I share of the costs of the proposed Sankey Diversion Facility.

Districts have a minimum fire flow of 3,000 GPM, with schools requiring a fire flow of 4,000 GPM.

2. Average day flow (ADF) was estimated based on the type of land use. The maximum daily flow (MDF) was determined by multiplying the average daily flow (ADF) by a factor of 1.85. Peak Hour was found by multiplying MDF by 1.91.

Tables 4-13, in Section 5, provide a summary of the design demands used for this study.

6.4.2 Distribution System Criteria:

Sutter County design criteria for water systems will be used for design of the system. Generally, for the sake of conservatism, the intent of this master plan is not to push the "limit" of the County's design criteria. Instead, a concerted effort has been made in this master plan to leave a comfortable margin between the backbone water system performance characteristics and the County's minimum design criteria. This will allow for extension of the system to the farthest corners of the development while still meeting the County's minimum criteria.

The proposed system provides the backbone elements of the water system. By providing greater residual pressures and minimum pressures the additional head loss through the future smaller delivery pipes will not reduce the pressures below the minimum residual pressure requirements in the outer limits of the distribution system. This is a more conservative approach to the sizing of the backbone pipelines, resulting in slightly larger backbone pipelines and assuring that adequate pressures will be achievable at full build out of the community.

6.5 Water Storage Requirements:

Water storage is required to supply fire flow, operational water and emergency storage in the system. Storage requirements will consist of the following components:

1. Operational = ¼ Maximum Day Demand
2. Fire = Highest fire flow demand in service area multiplied by the required duration assuming two simultaneous fires (one in a commercial area at 4,000 gpm and one in a residential area at 2,500 gpm).
3. Emergency = Average Day Demand

Water storage requirement for the SPSP area calculated below:

Operational	= ¼ x 28,901 GPM x 1,440 minutes/day	= 10.40 MG
Fire #1	= 4,000 GPM x 4 hr.	= 0.96 MG
Fire #2	= 2,500 GPM x 3 hr.	= 0.45 MG
Emergency	= 15,622 GPM x 1,440 minutes/day	= 22.50 MG
	Total Storage Requirement	= 34.31 MG

For the Specific Plan Area the total water storage requirement is approximately 34.3± MG.

6.6 Water Distribution System Model

The proposed water distribution system was modeled using H2ONET® (version 6.0) to determine the minimum pipe sizes necessary to meet the criteria as stated above.

The MDF was applied at nodes throughout the entire grid based on the proposed land use plan. Appendix A, Exhibit 5 shows the H2ONET® model (Proposed Water System Composite). At the same time, the potential fire flow was calculated at each node, while maintaining minimum residual design pressures. The model utilizes the Hazen-Williams pipe flow equations. All pipes were assigned a Hazen-Williams friction factor (C-factor) of 130. It is assumed that the water treatment plant will supply water to the system at a maximum pressure of 70 PSI. Detailed model input and results are presented in Appendix C of this report.

The required storage was divided between several water storage tanks (with booster stations) located throughout the site. Proposed locations of storage tanks can be found in Appendix A, Exhibit 1. The tanks were modeled as approximately 6± million gallons each. However, in order to create more turnover in the system and for purposes of redundancy, two 3± MG tanks at each storage location can be used. In addition, the tanks located at the far end of the system may have additional volume, as they will see the lowest pressures in the system and operate more frequently.

The system was sized to deliver maximum day demand with the tanks off-line. Tanks were brought on-line during peak hour demands and fire flow analysis. The main line pipes were sized for a residual pressure of greater than 45 PSI during a fire flow analysis. This will allow adequate pressures in the smaller pipes within the streets (not shown at this time) during a fire flow scenario. The overall proposed layout of the pipe network is also shown in Appendix A, Exhibit 1.

6.7 Water System Modeling Scenarios

As discussed above, the location of the ground and surface water treatment plants have yet to be determined: eastern or western well fields (or both), centralized or decentralized groundwater treatment facilities, western or eastern surface water treatment plant locations. To simulate these various combinations and permutations, three "point of water supply" scenarios were developed to model the proposed on-site water transmission and distribution system.

The scenarios are summarized as follows:

1. Proposed System Scenario

   This scenario assumes the existence of both the eastern and western well fields and the existence of the surface water treatment plant adjacent to the western groundwater treatment plant. This scenario is consistent with the Proposed Water Supply Program and Alternate "A" Revised Water Supply Program. In the summer,

when only surface water is available, all demands will be met from the western "point of water supply" via the surface water treatment plant. In the winter, when surface water isn't available, all demands will be met from both the western and eastern "points of water supply" via the groundwater treatment plants, more or less in equal amounts. The on-site transmission system was modeled under both conditions to be sure the system could perform adequately during the different periods of the year.

2. Alternative System Scenario

This scenario consists of two sub-scenarios:

A. Western Well Field and Surface Water Treatment Plant

This scenario assumes the existence of both the western well field, and the surface water treatment plant adjacent to the western groundwater treatment plant. This scenario is consistent with the first permutation of the Alternate "B" Winter Diversion Water Supply Program. All demands will be met from the western "point of water supply" via the western groundwater treatment plant, and from the western surface water treatment plant location.

B. Eastern Well Field and Surface Water Treatment Plant

This scenario assumes the existence of both the western well field, and the surface water treatment plant adjacent to the eastern groundwater treatment plant. This scenario is consistent with the second permutation of the Alternate "B" Winter Diversion Water Supply Program. All demands will be met from the eastern "point of water supply" via the eastern groundwater treatment plants, and from the eastern surface water treatment plant location.

6.8 Model Results

Several scenarios were run using the model to size the facilities and analyze the proposed systems. The following scenarios were run:

1. Maximum Day demands without storage tanks.
2. Peak Day Demand with storage tanks.
3. Max Day plus Fire flow with storage tanks.
4. Additional Max Day plus fire flow scenarios were run with various tanks offline and with two fires occurring at the same time.

Results from each of these runs showed that the proposed layouts meet the criteria described above. The model results for each of the first three scenarios are provided in the attachments to this report. Additional scenarios were run to confirm the adequacy of the layout; however results are not included in this report.

The lowest residual pressure found in the system during a fire flow simulation was over 45psi. This occurs in the northeast corner of the system. Currently there is a storage tank planned near this location. The tanks are currently set to output between 48 and 60psi. The pressures were set to allow the tanks to provide water during the fire flow and peak hour scenarios, but not during a max day scenario. This pressure setting could be increased if higher residual pressures are desired. Results for each of the modeling scenarios can be found in the appendix of this report.

The Sutter Pointe Specific Plan water distribution system and storage facilities were sized using criteria based on industry standards, which meet or exceed Sutter County standards. The system was then analyzed using an H2ONET® water model. The model found that the proposed system layouts under each scenario described, would meet the current standards and criteria laid out in this report. Additional refinements to the proposed distribution system layout and storage areas will take place during the design phase of the project in order to further optimize the system.

7.0 Wastewater Recycling

It is possible that reclaimed wastewater may be available within the planning area at some point in the future. Accordingly, the estimated M&I demands discussed above could be reduced to some degree over time. While the likelihood of reclamation becoming a reality within the planning area is thought to be small at this time, it is appropriate to consider what impacts reclamation could have on the projected water demands within the planning area.

The land use plan for the SPSP indicates several large open space and park areas will likely be developed within the planning area. It is estimated that approximately 823.3± acres of large open space and park areas could be developed during build out of the planning area and approximately 414.9 ± acres of detention basins.

Based on an average of 4.08 acre-feet per acre per year irrigation demand, the annual demands for the planning area could be reduced up to 5,100± AFY from those shown herein, depending on the area and number of detention basins that are actually being used for recycling. Conversion of these areas from potable to reclaimed water supplies could have a direct and significant impact on the final configuration of the community water supply program. A reduced potable water demand in the magnitude of 5,100 ± AFY could lower the total demands, under normal year conditions, by approximately one-fifth (20%±). The corresponding reduction in demand for potable water could be used to either lessen the amount of groundwater pumping and/or decrease the demand for surface water deliveries.

Certainly, the availability of wastewater flows, in significant quantities, is required to achieve a meaningful reclamation program. Accordingly, the integration of a wastewater reclamation program into the water supply program for the SPSP area could only occur after a significant level of development has been realized. Furthermore, detailed studies on a wastewater reclamation program for the SPSP area will be required before a final decision on the engineering and

economic feasibility can be made. Conversion of these areas will have a direct, although less significant, impact on the average, maximum and peak hour water demands of the community since irrigation of large open space and park areas typically happens at off-peak times.

It is recommended that these park and open space areas be plumbed with "purple" pipe but connected initially to the potable water system. If a reclaimed wastewater system ever becomes available within the planning area overtime, then the irrigation service points for each of these parks and open spaces could be converted over to the reclaimed wastewater system and irrigation of these areas with reclaimed wastewater could occur without significant trouble. All irrigation and reclaimed wastewater system facilities will be designed in accordance with the Department of Public Health standards.

8.0 Water Service Timing

A groundwater program will be relatively straightforward to implement. Groundwater studies have been performed to confirm the adequacy of the groundwater supply and quality for M&I use. Additionally, land use and environmental entitlements and permits will need to be obtained, along with the design and construction of well fields and treatment plants. It is estimated that these efforts will take 2± - 3± years to complete. In order to provide water service in time to serve the initial phase of development within the planning area, it is necessary that these efforts be initiated in parallel with land use entitlement processing of the SPSP.

Furthermore, the development of the surface water program is anticipated to take several years, perhaps 5± - 10± years in total duration. Assuming the existence of a robust real estate market at the time the SPSP is approved and permitted, it would be reasonable to anticipate that the build out of the initial phase of the SPSP area, which can be served with ground water, would occur in approximately 7± - 8± years for the Proposed, Alternate “B”, and Alternate “A” Water Supply Programs.

Presuming the SPSP is approved and permitted within the next couple of years, the maximum capacity of the groundwater program could theoretically be reached by approximately 2017±. Accordingly, in order to continue uninterrupted development of the planning area before the capacity of the groundwater system is reached, work needs to start in the very near future in order that the surface water system become operational in time to meet the growing demands of the community. This time frame can be significantly extended for all three water supply scenarios described in this master plan if both well fields are constructed prior to the time when surface water is actually available.

9.0 Operation & Maintenance

It is the intent of Sutter County to own, operate and maintain the public water system under the authority of a dependent or independent special district (a County Service Area, Community Services District or some other County agency). It is also the intent of the County to enter into an agreement with NCMWC to act as the M&I wholesale distributor of surface water at cost. The County would then deliver the water at cost (plus processing and delivery costs) to the end users. It is also the intent of the County to develop the organizational structure, management and technical staff, rates, fees, plant and equipment to manage the water service function.

10.0 NCMWC Agricultural Irrigation

Currently, NCMWC operates and maintains an existing irrigation system for conveying irrigation waters to and through the Sutter Pointe Specific Plan (SPSP) area. The facilities consist of canals, laterals, underground pipes, turnouts, check gates, and pump stations. It is the intent of the SPSP to maintain the operation of this system during the development of the project.

East of State Route 99, the NCMWC owns and operates the "Northern Main" Irrigation Canal that conveys irrigation waters from north to south through the project area. This is a major feature of the NCMWC system. This ditch feeds laterals to the east and west through turnouts, check gates, and/or pumps. The shape of the ditch and laterals varies widely throughout the project area. Since the existing flow must be maintained through the project area, the existing high line ditch will be replaced with a new earthen lined high line canal located along a relocated alignment compatible with the 2008 Land Use Plan.

For the most part, the existing laterals within the SPSP area do not serve lands outside of the project area. In those cases where a lateral serves lands outside of the project area, the lateral will be relocated as needed to accommodate development and continue to serve the irrigation needs. Laterals that serve only areas within the SPSP will be abandoned over time as the development builds out.

For conceptual design purposes the new high line canal has been sized to convey the maximum flow capacity of the Northern Pumping Plant, with a design capacity of 244± cfs. In addition, all proposed interim and permanent laterals have been sized to convey this flow rate. The proposed canal would have a trapezoidal cross section with a bottom width of 10 feet, a maximum water depth of 6 feet, and 1 foot of freeboard. The side slopes of the proposed canal are designed at 2:1 or flatter. The proposed longitudinal slope of this new canal is dictated by the existing fall across the project area (approximately 0.000375 feet/feet as determined from elevations ranging from 21± feet at the northern

boundary of the plan area to 15± feet at the southern boundary (approximately 6'± of fall) across a distance of 16,000± feet). The proposed canal has been designed to include a 15' foot access road on both sides of the canal and an overall right-of-way width of approximately 70 feet or wider, depending on the final side slope used.

While the Bureau of Reclamation Settlement Contract does not set monthly limits on diversions from any particular diversion facility, it is important that the monthly M&I diversions not exceed the historical schedule to the shareholder lands within the SPSP area. Nearly all of the shareholder lands within the SPSP area are currently served by the Northern Main Channel, which is principally feed from the Bennett Pumping Plant. Since the monthly M&I demands for these lands are less than the corresponding monthly agricultural irrigation rate for the same lands, the monthly water deliveries contained in this report should not conflict with the ability of NCMWC to deliver water to shareholder lands outside of the SPSP area under nearly all, if not all, cases. Should a conflict in delivery schedules arise, the system operator could adjust the mix of ground water pumping and surface water diversions to accommodate the irrigation needs of the neighboring farmers.

Where the new alignment of the proposed irrigation canal conflicts with proposed roadways and/or drainage ditches, inverted siphons will be constructed to convey the irrigation flows underneath the conflicting facility. These siphons will consist of a headwall and drop structure at both ends with a reinforced concrete box culvert in between, estimated to be 8'± x 10'± in size.

Where the proposed laterals connect to the new canal, new turnouts and check gates will be installed. Also, existing pumps will be relocated during the four phases of development to serve interim and permanent laterals and canals.

It may be possible that the irrigation of major parks and open spaces could be served directly from the "Northern Main" Irrigation Canal, thereby saving the cost of M&I treatment of these waters. Challenges to be addressed in serving these

areas with raw water include the absence of year around availability, diversion, filtration, pressurization, and conveyance.

Exhibit 10 and Exhibits 11-1 thru 11-4 (in Appendix A) show the extent of the existing system within the project area, the proposed system after full development, and the incremental changes in the system on a phased basis throughout the development of the SPSP area.

Issues to be addressed during the design of the relocated irrigation facilities include: (1) control of seepage from the elevated irrigation canals and laterals, (2) stability and erosion potential of 2:1 side slopes (they may need to be flatter), (3) the need for fencing, (4) potential for silt buildup in inverted siphons, (5) the use of bridges in lieu of inverted siphons at road crossings, (6) potential undergrounding of the canal and laterals, (7) the compatibility of the final alignment of the canal and laterals with surrounding land uses, and (8) other attractive nuisance and public safety concerns associate with open irrigation channels in suburban settings.

APPENDICIES

Appendix A. Exhibits

Exhibit 1 Backbone Water Plan

Exhibit 2 Off-site Water Plan

Exhibit 3 NCMWC Non-Shareholder Service Area

Exhibit 4 Conceptual Phasing Plan

Exhibit 5 H2ONET® Model (Proposed Water System Composite)

Exhibit 6 NCMWC Corporate Boundary Map

Exhibit 7 NCMWC Facilities Map

Exhibit 8 Natomas Basin and Natomas Central Mutual Water Company Service Area

Exhibit 9 Typical Ground Water Treatment Plant Layout

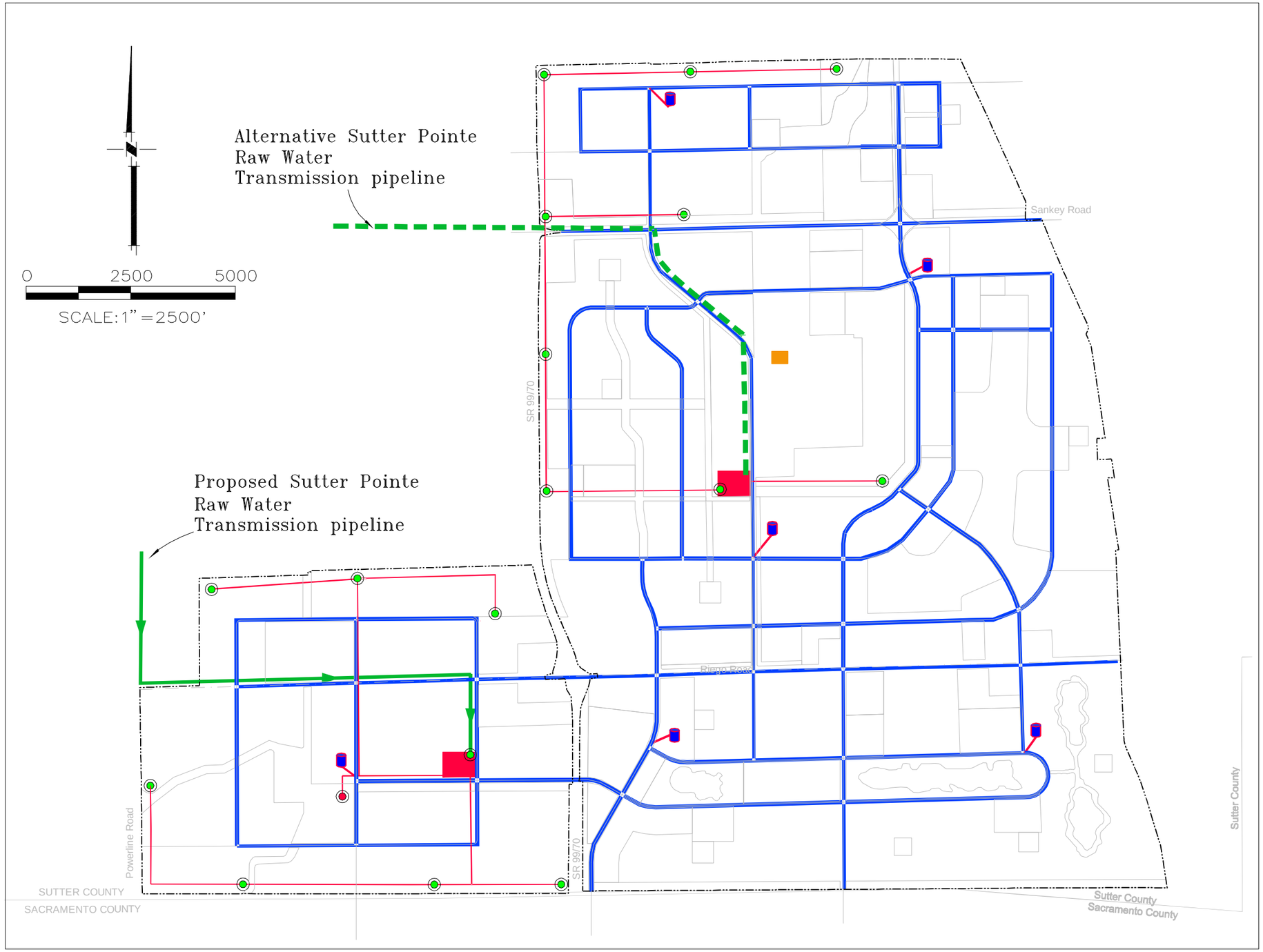
Exhibit 10 NCMWC Irrigation Canal Crossings

Exhibit 11-1 NCMWC Irrigation Canal Improvements – Phase 1

Exhibit 11-2 NCMWC Irrigation Canal Improvements – Phase 2

Exhibit 11-3 NCMWC Irrigation Canal Improvements – Phase 3

Exhibit 11-4 NCMWC Irrigation Canal Improvements – Phase 4



L E G E N D

- Raw Water Line
- Alternate Raw Water Line
- Potable Water Line
- Well Line
- Existing Well
- Holt of California
- Proposed Groundwater Well
- 6-mg Storage Tank
- Water Treatment Plant
- Sutter Pointe Specific Plan Boundary

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SUTTER POINTE

MEASURE "M" GROUP

Exhibit 1

Backbone Water Plan

MacKay & Somps
ENGINEERS PLANNERS SURVEYORS

November 14, 2008

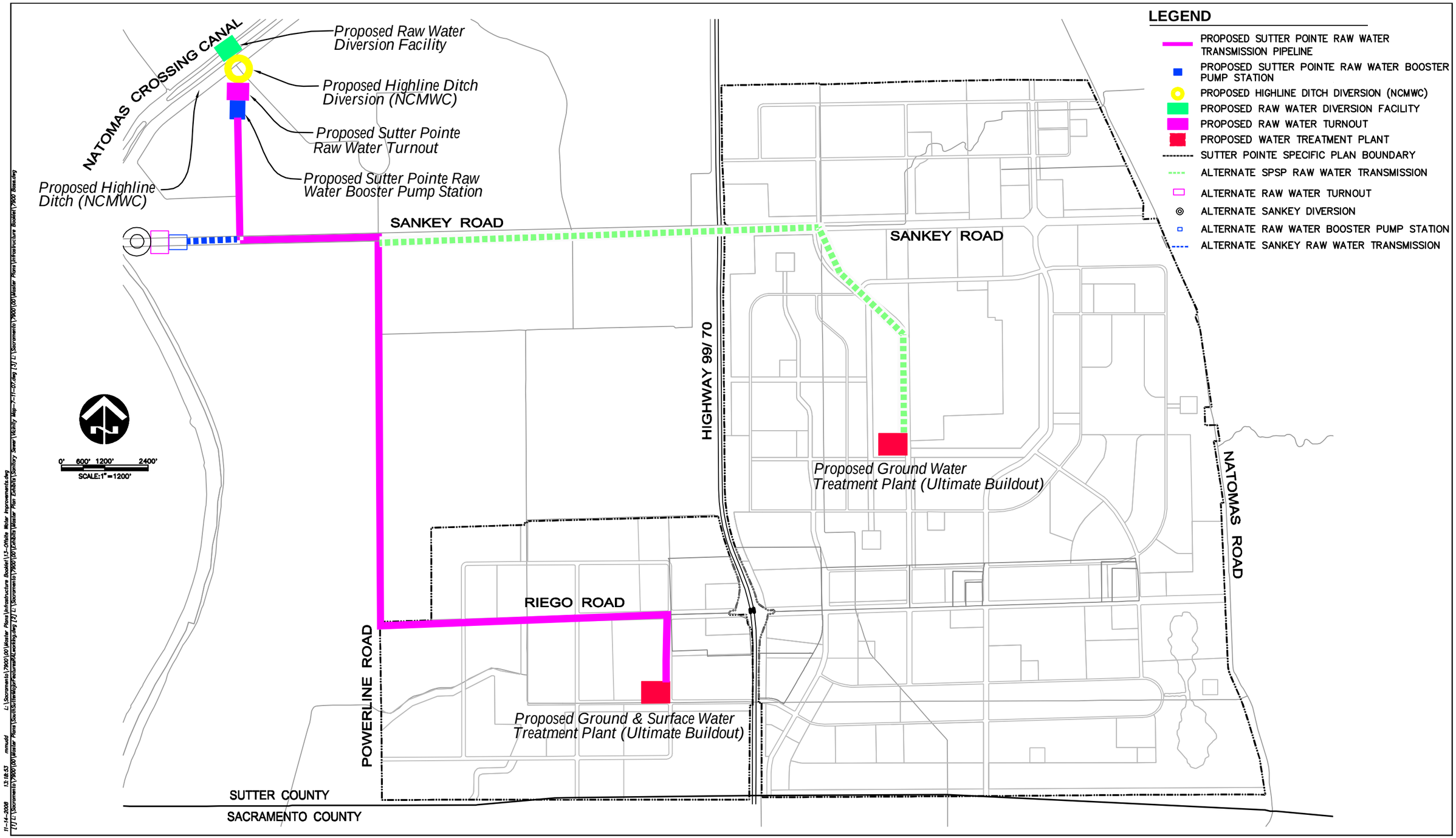


Exhibit 2

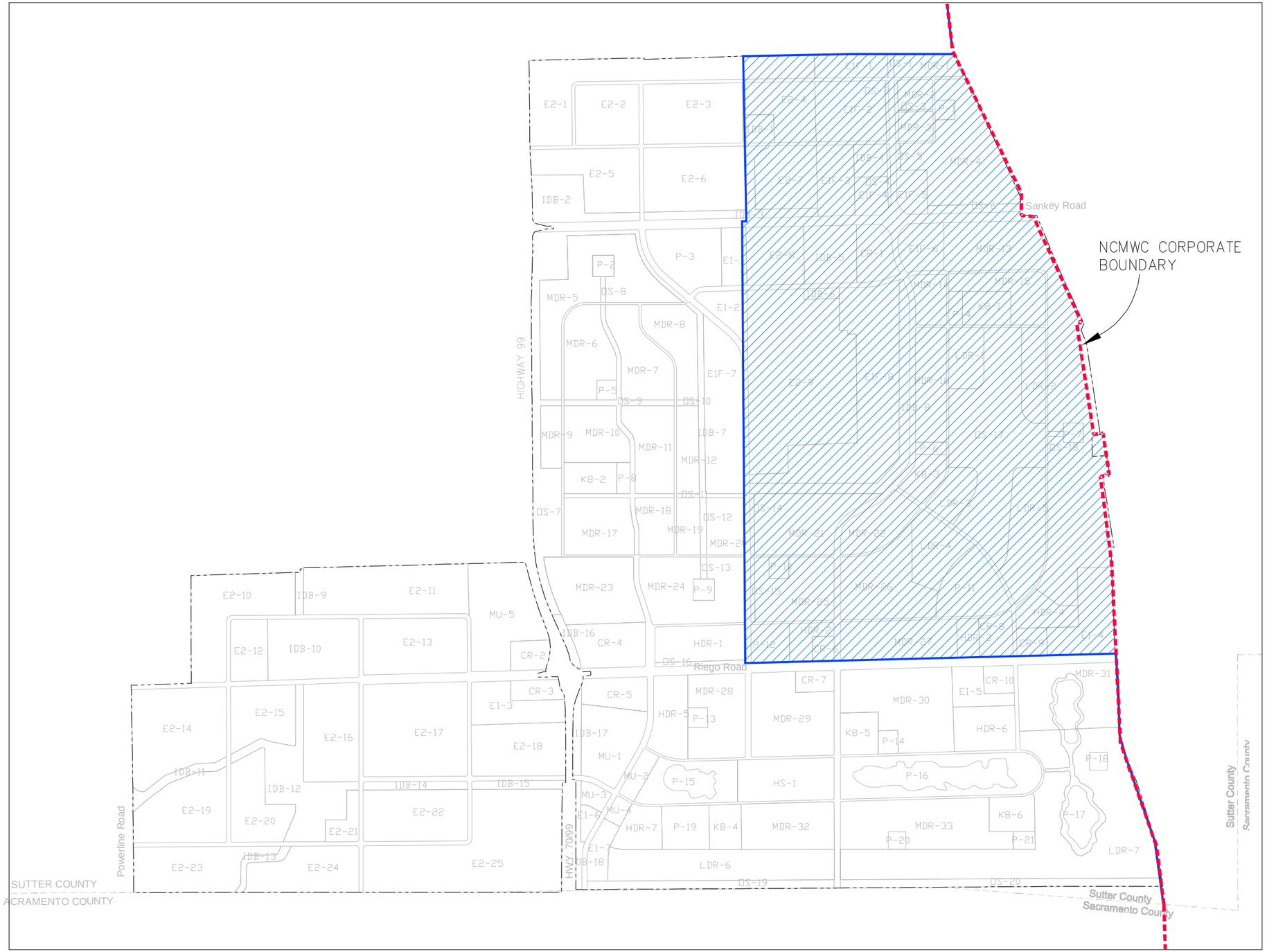
SUTTER POINTE

MEASURE "M" GROUP

Off-Site Water Improvements

MacKay & Somps
ENGINEERS PLANNERS SURVEYORS
1771 Tribute Road, Suite E, Sacramento, CA 95815 (916) 929-2002

November 13, 2008



L E G E N D

- NCMWC Corporate Boundary
- NCMWC Shareholder Area Boundary
- Non NCMWC Shareholder Area
- Sutter Pointe Specific Plan Boundary

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SUTTER POINTE

MEASURE "M" GROUP

Exhibit 3

NCMWC Service Area

0 2500' 5000'

MACKAY & SOMPS ENGINEERS PLANNERS SURVEYORS

November 14, 2008

Land Use Summary Phase 1-4
Residential Mixed Use Community

LDR ~ LOW DENSITY RESIDENTIAL (ac)

Phase	1	2	3	4	Total
LDR-1	-	37.7	-	-	37.7
LDR-2	-	39.8	-	-	39.8
LDR-3	22.7	-	-	-	22.7
LDR-4	39.2	-	-	-	39.2
LDR-5	59.1	-	-	-	59.1
LDR-6	-	15.6	-	75.6	91.0
LDR-7	-	343.6	-	-	343.6
Subtotal	121.0	316.3	-	75.6	512.8

MDR ~ MEDIUM RESIDENTIAL (ac)

Phase	1	2	3	4	Total
MDR-1	-	-	-	20.0	20.0
MDR-2	-	-	-	13.8	13.8
MDR-3	-	-	-	13.2	13.2
MDR-4	-	-	109.3	-	109.3
MDR-5	-	-	103.9	-	103.9
MDR-6	-	-	51.7	-	51.7
MDR-7	-	-	53.7	-	53.7
MDR-8	-	-	43.7	-	43.7
MDR-9	-	17.1	-	-	17.1
MDR-10	-	44.0	-	-	44.0
MDR-11	-	49.3	-	-	49.3
MDR-12	-	35.6	-	-	35.6
MDR-13	68.0	119.8	17.8	66.6	297.5
MDR14	-	-	21.4	-	21.4
MDR-15	-	-	38.1	-	38.1
MDR-16	-	49.3	-	-	49.3
MDR-17	51.1	-	-	-	51.1
MDR-18	27.8	-	-	-	27.8
MDR-19	17.4	-	-	-	17.4
MDR-20	28.1	-	-	-	28.1
MDR-21	73.3	-	-	-	73.3
MDR-22	57.5	-	-	-	57.5
MDR-23	73.7	-	-	-	73.7
MDR-24	53.2	-	-	-	53.2
MDR-25	65.0	-	-	-	65.0
MDR-26	76.4	-	-	-	76.4
MDR-27	68.0	-	-	-	68.0
MDR-28	57.8	-	-	-	57.8
MDR-29	65.0	-	-	-	65.0
MDR-30	57.8	-	-	-	57.8
MDR-31	-	65.2	-	-	65.2
MDR-32	-	28.6	-	28.3	56.1
MDR-33	-	88.1	-	-	88.1
Subtotal	574.9	491.8	331.3	267.3	1665.3

HDR ~ HIGH DENSITY RESIDENTIAL (ac)

Phase	1	2	3	4	Total
HDR-1	41.4	-	-	-	41.4
HDR-2	16.5	-	-	-	16.5
HDR-3	11.1	-	-	-	11.1
HDR-4	-	-	22.0	-	22.0
HDR-5	28.4	14.9	-	-	27.8
HDR-6	-	-	35.8	-	35.8
HDR-7	-	-	-	34.0	34.0
Subtotal	91.4	14.9	57.9	34.0	197.7

MU ~ MIXED USE (ac)

Phase	1	2	3	4	Total
MU-1	18.5	37.3	-	-	55.8
MU-2	-	11.8	-	-	11.8
MU-5	-	8.2	-	-	8.2
MU-4	-	6.0	-	-	6.0
Subtotal	18.5	63.3	-	-	81.8

CR ~ COMMERCIAL RETAIL (ac)

Phase	1	2	3	4	Total
CR-1	-	-	-	39.6	39.6
CR-2	-	-	-	-	-
CR-3	-	-	-	-	-
CR-4	43.8	-	-	-	43.8
CR-5	39.6	-	-	-	39.6
CR-6	7.3	-	-	-	7.3
CR-7	13.5	-	-	-	13.5
CR-8	17.8	-	-	-	17.8
CR-9	-	-	18.8	-	18.8
CR-10	-	-	19.8	-	19.8
Subtotal	121.9	-	21.3	39.6	182.2

P ~ PARKS (ac)

Phase	1	2	3	4	Total
P-1	-	-	-	5.0	5.0
P-2	-	-	6.0	-	6.0
P-3	-	-	60.0	-	60.0
P-4	-	-	5.0	-	5.0
P-5	-	-	5.0	-	5.0
P-6	5.0	-	-	-	5.0
P-7	-	5.0	-	-	5.0
P-8	5.0	-	-	-	5.0
P-9	6.0	-	-	-	6.0
P-10	5.5	-	-	-	5.5
P-11	40.8	-	-	-	40.8
P-12	19.8	-	-	-	19.8
P-13	5.0	-	-	-	5.0
P-14	6.0	-	-	-	6.0
P-15	-	-	-	51.6	51.6
P-16	-	107.3	-	-	107.3
P-17	-	68.0	-	-	68.0
P-18	-	4.0	-	-	4.0
P-19	-	-	-	27.1	27.1
P-20	-	4.0	-	-	4.0
P-21	-	5.0	-	-	5.0
Subtotal	99.4	191.8	97.0	83.7	491.8

OS ~ OPEN SPACE (ac)

Phase	1	2	3	4	Total
OS-1	-	-	-	1.8	1.8
OS-2	-	-	-	3.3	3.3
OS-3	-	-	-	3.3	3.3
OS-4	-	-	-	2.4	2.4
OS-5	-	-	-	1.8	1.8
OS-6	-	-	-	10.0	10.0
OS-7	39.5	8.8	43.9	-	92.3
OS-8	-	-	1.5	-	1.5
OS-9	9.5	14.5	6.0	-	30.0
OS-10	-	1.7	-	-	1.7
OS-11	1.3	-	-	-	1.3
OS-12	4.7	-	-	-	4.7
OS-13	1.6	-	-	-	1.6
OS-14	3.3	-	-	-	3.3
OS-15	3.8	-	-	-	3.8
OS-16	4.8	-	-	-	4.8
OS-17	47.3	119.1	-	-	166.4
OS-18	-	1.8	-	-	1.8
OS-19	-	4.3	-	22.8	27.1
OS-20	-	34.0	-	-	34.0
Subtotal	115.8	183.3	51.4	44.1	394.6

HS/K-8 ~ SCHOOLS (ac)

Phase	1	2	3	4	Total
High School-1	52.8	-	-	-	52.8
K-8 School-1	-	-	21.0	-	21.0
K-8 School-2	31.2	-	-	-	31.2
K-8 School-3	19.3	-	-	-	19.3
K-8 School-4	-	-	-	18.7	18.7
K-8 School-5	30.8	-	-	-	30.8
K-8 School-6	-	30.8	-	-	30.8
Subtotal	114.0	30.8	21.0	18.7	174.5

E1~EMPLOYMENT 1(ac)

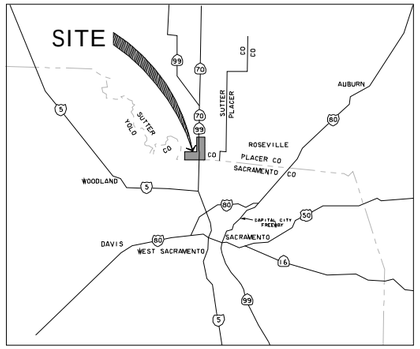
Phase	1	2	3	4	Total
E1-4	-	-	68.8	-	68.8
E1-6	-	-	31.4	-	31.4
E1-8	-	-	-	6.0	6.0
E1-7	-	-	-	16.0	16.0
Subtotal	-	-	72.8	22.0	94.8

E1F ~ INTERIM FLOOD ZONE (ac)

Phase	1	2	3	4	Total
E1F-4	-	-	-	16.8	16.8
E1F-8	-	-	-	26.8	26.8
Subtotal	-	-	-	43.7	43.7

IDB~ INDUSTRIAL DETENTION BASIN

Phase	1	2	3	4	Total
IDB-16	6.2	-	-	-	6.2
IDB-17	3.4	6.3	-	-	9.7
IDB-18	-	1.6	6.3	7.9	7.9
Subtotal	9.6	6.9	-	6.3	22.9



VICINITY MAP
NTS

Legend

RESIDENTIAL

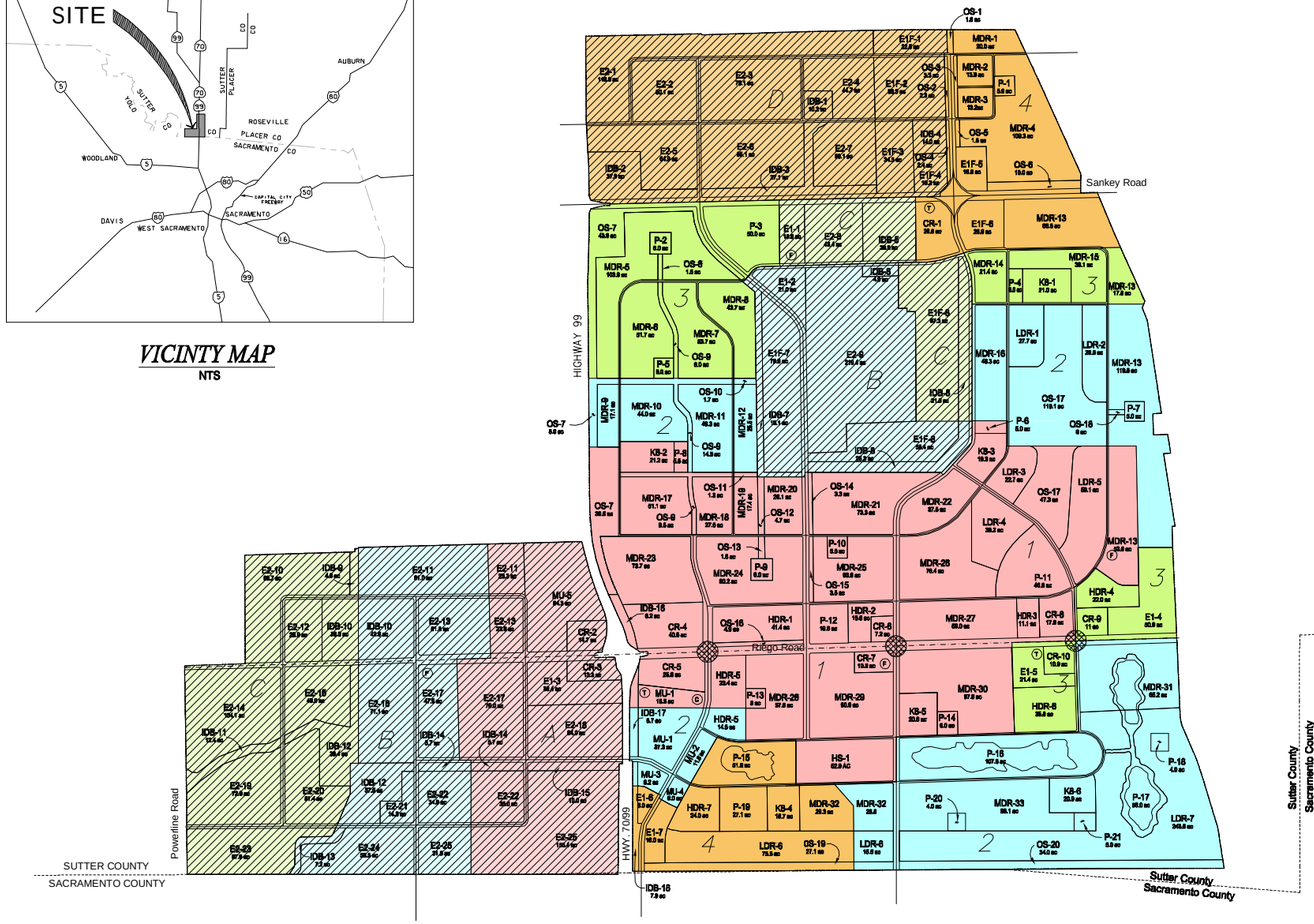
LDR	Low Density Residential
MDR	Medium Density Residential
HDR	High Density Residential

EMPLOYMENT

E1	Employment 1
E1F	E1 Interim Flood Zone
E2	Employment 2
CR	Commercial Retail
IDB	Industrial Drainage Basin
MU	Mixed Use

COMMUNITY FACILITIES

POS	Parks & Open Space
NP	Neighborhood Parks
K-8	K-8 School
HS	High School
Ⓣ	Transit Center
Ⓒ	Civic Center
Ⓕ	Fire Station
	Pedestrain Enhanced Intersections
	Phase 1 / Phase A
	Phase 2 / Phase B
	Phase 3 / Phase C
	Phase 4 / Phase D



SUMMARY

Residential	
Land Use	Acres
LDR	512.8
MDR	1,665.3
HDR	197.7
Residential Roads	364.2
Subtotal Residential	2,888.0
Measure M	2,000
Employment	
Land Use	Acres
Employment 1	172.8
EIF Interim Flood Zone	407.8
Employment 2	1,888.6
Commercial Retail	178.3
Industrial Drainage Basins	414.8
Mixed Use	164.1
Employment Roads	309.8
Subtotal Employment	3,891.3
Measure M	3,400
Community Facilities	
Land Use	Acres
Parks	491.8
Open Space	394.6
K-8 Schools	121.7
High School	52.8
Subtotal Community	1061.3
Measure M	1,000

Grand Total = 7,827.6
Measure M Grand Total = 7,500

Land Use Summary Phase A-D
Industrial

E1 ~ EMPLOYMENT 1 (ac)

Phase	A	B	C	D	Total
E1-1	-	-	18.8	-	18.8
E1-2	-	31.0	-	-	31.0
E1-3	36.4	-	-	-	36.4
Subtotal	36.4	31.0	18.8	-	16.3

E2 ~ EMPLOYMENT 2 (ac)

Phase	A	B	C	D	Total
E2-1	-	-	-	118.8	118.8
E2-2	-	-	-	80.1	80.1
E2-3	-	-	-	76.1	76.1
E2-4	-	-	-	44.7	44.7
E2-5	-	-	-	84.8	84.8
E2-6	-	-	-	65.1	65.1
E2-7	-	-	-	85.1	85.1
E2-8	-	-	43.4	-	43.4
E2-9	-	219.4	-	-	219.4
E2-10	-	-	88.7	-	88.7
E2-11	23.3	81.0	-	-	104.3
E2-12	-	-	38.8	-	38.8
E2-13	35.8	81.5	-	-	76.1
E2-14	-	-	104.1	-	104.1
E2-15	-	-	48.8	-	48.8
E2-16	-	71.1	-	-	71.1
E2-17	76.0	47.8	-	-	123.8
E2-18	54.0	-	-	-	54.0
E2-19	-	-	72.9	-	72.9
E2-20	-	-	51.4	-	51.4
E2-21	-	14.3	-	-	14.3
E2-22	35.0	34.8	-	-	69.8
E2-23	-	-	67.9	-	67.9
E2-24	-	88.8	-	-	88.8
E2-25	109.4	31.8	-	-	187.2
Subtotal	383.3	611.4	626.2	482.6	1883.5

MU ~ MIXED USE (ac)

Phase	A	B	C	D	Total
MU-5	84.3	-	-	-	84.3
Subtotal	84.3	-	-	-	84.3

E1F ~ INTERIM FLOOD ZONE (ac)

Phase	A	B	C	D	Total
E1F-1	-	-	-	22.8	22.8
E1F-2	-	-	-	55.3	55.3
E1F-3	-	-	-	34.5	34.5
E1F-4	-	-	-	16.2	16.2
E1F-7	-	79.8	-	-	79.8
E1F-8	-	56.4	67.3	-	103.7
Subtotal	-	136.3	67.3	128.8	356.1

IDB ~ INDUSTRIAL DRAINAGE BASIN (ac)

Phase	A	B	C	D	Total
IDB-1	-	-	-	10.2	10.2
IDB-2	-	-	-	37.8	37.8
IDB-3	-	-	-	37.1	37.1
IDB-4	-	-	-	14.0	14.0
IDB-5	-	-	38.8	-	38.8
IDB-6	-	4.8	-	-	4.8
IDB-7	-	18.1	-	-	18.1
IDB-8	-	28.3	21.5	-	49.8
IDB-9	-	-	4.8	-	4.8
IDB-10	-	42.8	28.3	-	71.2
IDB-11	-	-	12.4	-	12.4
IDB-12	-	37.5	36.4	-	73.8
IDB-13	-	7.2	-	-	7.2
IDB-14	5.7	5.7	-	-	11.4
IDB-15	15.0	-	-	-	15.0
Subtotal	18.7	141.8	149.0	99.2	391.8

CR~COMMERCIAL RETAIL(ac)

Phase	A	B	C	D	Total
CR-2	14.7	-	-	-	14.7
CR-5	13.3	-	-	-	13.3
Subtotal	28.0	-	-	-	28.0

MU ~ MIXED USE (ac)

Phase	A	B	C	D	Total
MU-5	84.3	-	-	-	84.3
Subtotal	84.3	-	-	-	84.3

SPECIFIC PLAN COMMUNITY ~RESIDENTIAL, MIXED USE ,COMMERCIAL RETAIL, EMPLOYMENT 1, SCHOOLS, NP, POS, EIF & ROADS

PHASE	LDR		MDR		HDR		MIXED USE		LDR + MDR + HDR + MU				E1	CR	E1+CR		P	OS	SCHOOLS	DETENTION		ROADS	PHASE 1-4
	ACRES	UNITS	ACRES	UNITS	ACRES	UNITS	ACRES	UNITS	TOTAL ACRES	% ACRES	TOTAL UNITS	% UNITS	ACRES	ACRES	TOTAL ACRES	% ACRES	ACRES	ACRES	ACRES	INTERIM(E1F) Acres	PERMANENT (CDS)Acres	ACRES	TOTAL ACRES
1	121.0	348	274.5	6,388	61.4	1,269	18.8	69	1,103.7	48.4	7,483	49.4	-	101.8	101.8	41.7	68.4	116.8	114.8	-	8.8	188.3	1,703.7
2	316.3	881	491.8	9,208	14.5	285	63.3	291	885.9	33.4	4,427	26.8	-	-	-	-	191.8	183.8	20.8	-	8.8	88.8	1,389.7
3	-	-	331.3	2,941	57.8	1,266	-	-	389.1	14.2	3,208	19.8	72.8	21.8	94.1	38.5	57.0	51.4	21.0	-	8.8	81.8	674.5
4	76.8	218	302.5	1,884	34.8	436	-	-	391.8	12.9	2,297	13.8	22.0	38.8	60.8	16.8	83.7	44.1	18.7	43.7	8.3	86.8	662.7
TOTAL	512.8	1,481	1,665.3	13,814	167.7	3,437	76.8	291	2,720.8	100.0	17,163	100.0	94.8	160.2	244.8	100.0	421.8	396.8	174.8	43.7	32.8	333.7	4,388.8

SPECIFIC PLAN INDUSTRIAL ~ EMPLOYMENT 1 AND 2, COMMERCIAL RETAIL, DETENTION & ROADS

PHASE	MIXED USE		E1	E2	CR	E1 + E2 + CR		DETENTION		ROADS	PHASE A-D
	Acres	Units	ACRES	ACRES	ACRES	TOTAL ACRES	% ACRES	INTERIM (E1F) Acres	PERMANENT (CDS) Acres	ACRES	TOTAL ACRES
A	84.3	338	36.4	383.3	28.8	448.7	21.3	-	18.7	41.8	538.3
B	-	-	31.0	611.4	-	642.4	30.3	136.3	141.8	66.3	676.8
C	-	-	18.8	626.2	-	644.1	30.6	67.3	149.0	88.8	650.8
D	-	-	-	482.6	-	482.6	22.8	128.8	99.2	66.8	771.2
TOTAL	84.3	338	76.8	1,883.5	28.8	2,218.8	100.0	384.1	391.8	234.3	3,191.0

BUILDING UNIT MULTIPLIERS
LDR: DU = Area X 3.85
MDR: DU = Area X 6.19
HDR: DU = Area X 18.38
MIXED USE: DU= (20% of Area) X 18.38

Exhibit 4

Sutter Pointe Specific Plan

Conceptual Phasing Plan

Sutter County, California
June 27, 2008

MacKAY & SOMPS
CIVIL ENGINEERS, INC.
SACRAMENTO, CALIFORNIA (916) 929-8092

7900-00

6-27-2008 11:57:54 jhardy
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[1] I:\Sacramento\7900\001\Exhibits\95-Land Use Plan_Feb0808.dwg [2] I:\Sacramento\7900\001\Exhibits\OPP-Phasing_Feb0808.dwg

Alternative Sutter Pointe
Raw Water
Transmission pipeline (42")

Proposed Sutter Pointe
Raw Water
Transmission pipeline (42")

Sankey Road

SR 99/70

Powerline Road

SUTTER COUNTY

SACRAMENTO COUNTY

Sutter County

Sacramento County

L E G E N D

- Raw Water Line
- Alternate Raw Water Line
- Potable Water Line
- Well Line
- Ground Water Well
- 6mg Storage Tank
- Water Treatment Plant
- Sutter Pointe Specific Plan Boundary
- 18" — Pipe Size
- J28 — H20 Net Element Name

SUTTER POINTE

MEASURE "M" GROUP

Exhibit 5
H2O Net Model (Proposed Water System Composite)

0 2,500 5,000

MACKAY & SOMPS
CIVIL ENGINEERS, INC.
SACRAMENTO, CALIFORNIA (916) 929-6092

November 13, 2008

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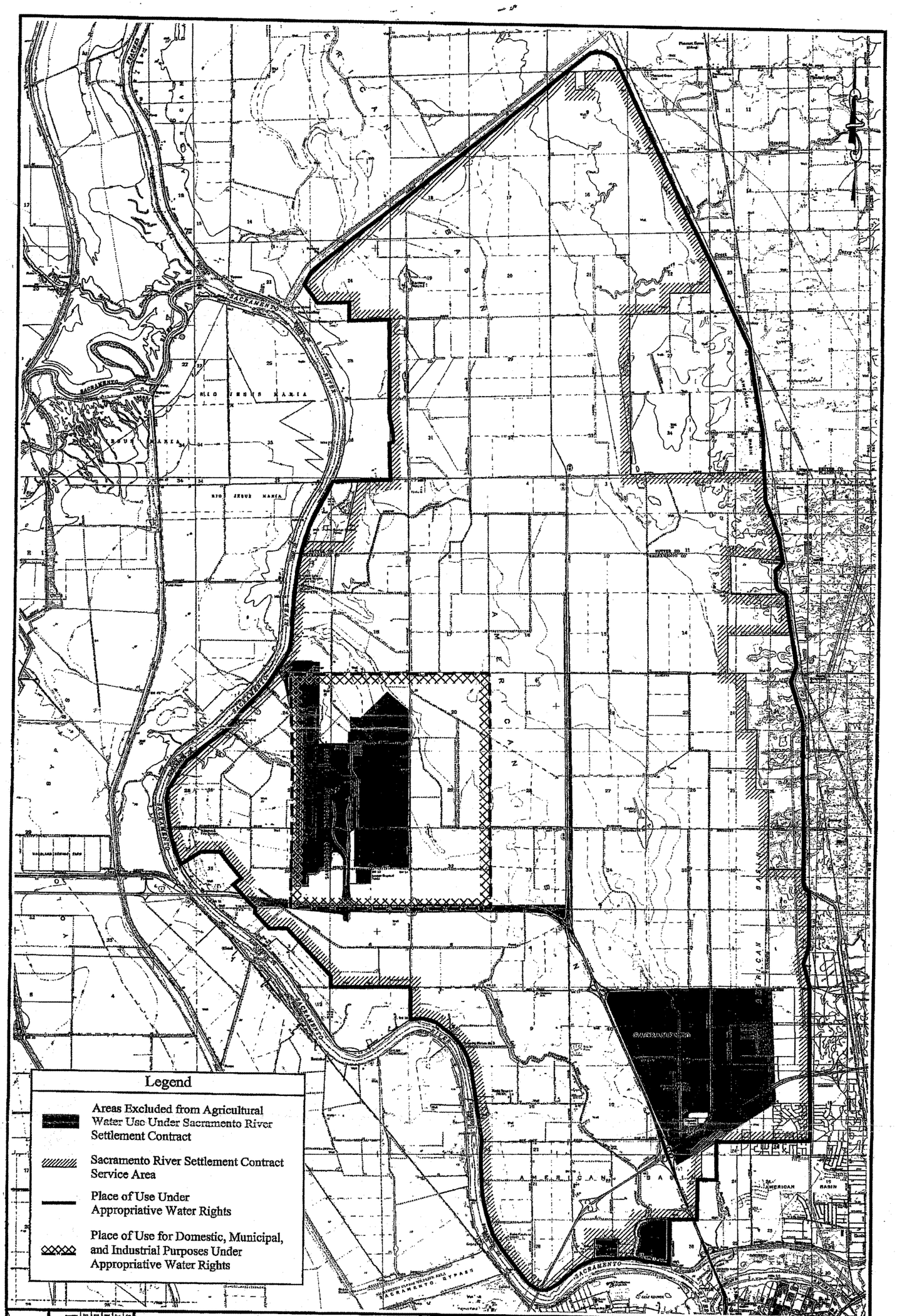


SHEET 1 OF 1 SHEETS

SCALE: 1" = 6000'
JOB NUMBER: 3525
REQUESTED BY: DC
DRAWN BY: JN
DATE: July 2003

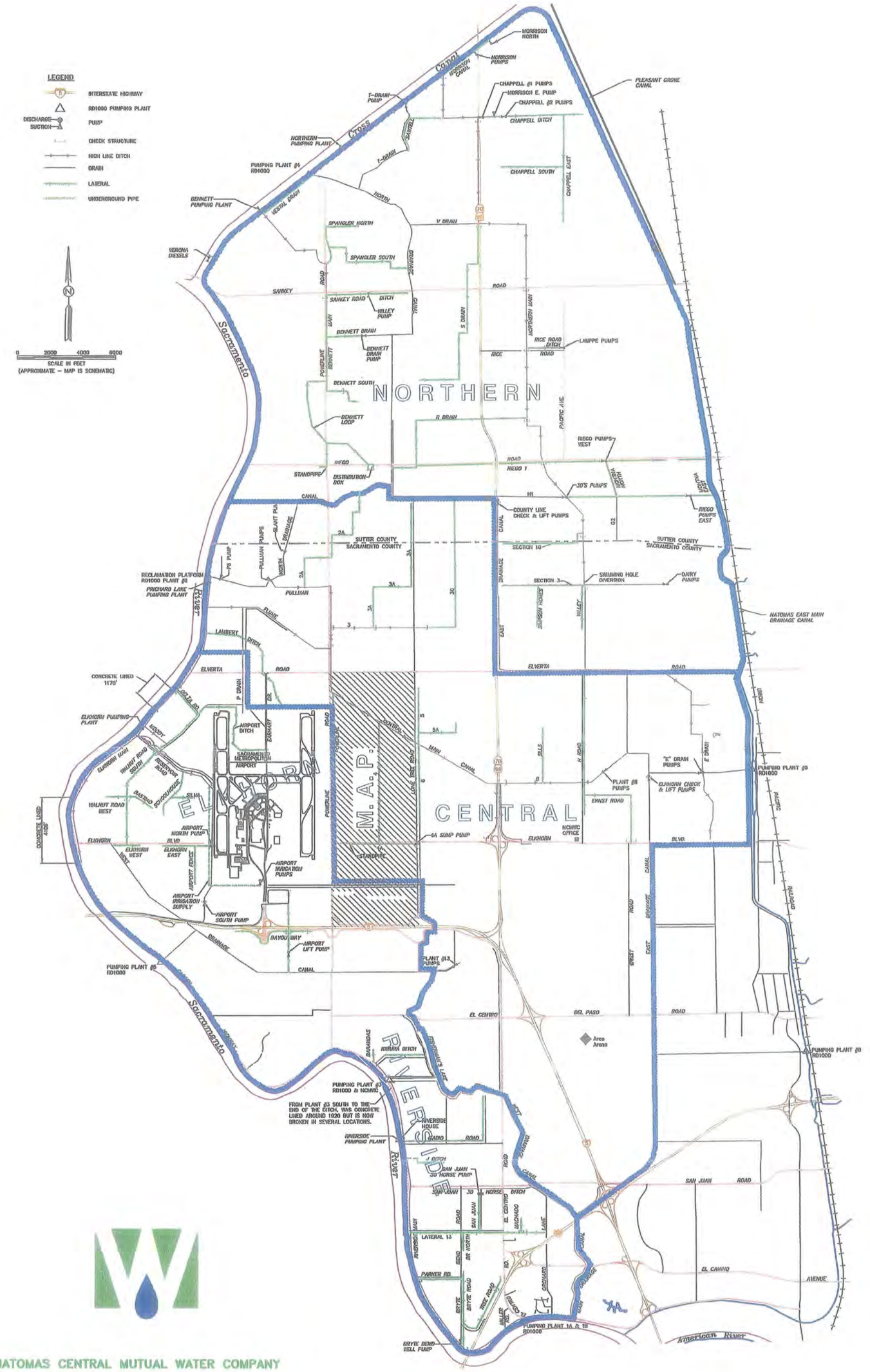
Bar Length On Original Drawing Equals One Inch, Adjust Scale Accordingly

Boundary Map

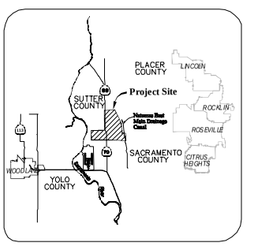
Natomas Central Mutual Water Company

No.	DATE	APPROVED	REVISION

MBK ENGINEERS
2450 Alhambra Boulevard, 2nd Floor
Sacramento, California 95817
Phone: (916) 456-4400 • Fax: (916) 456-0253

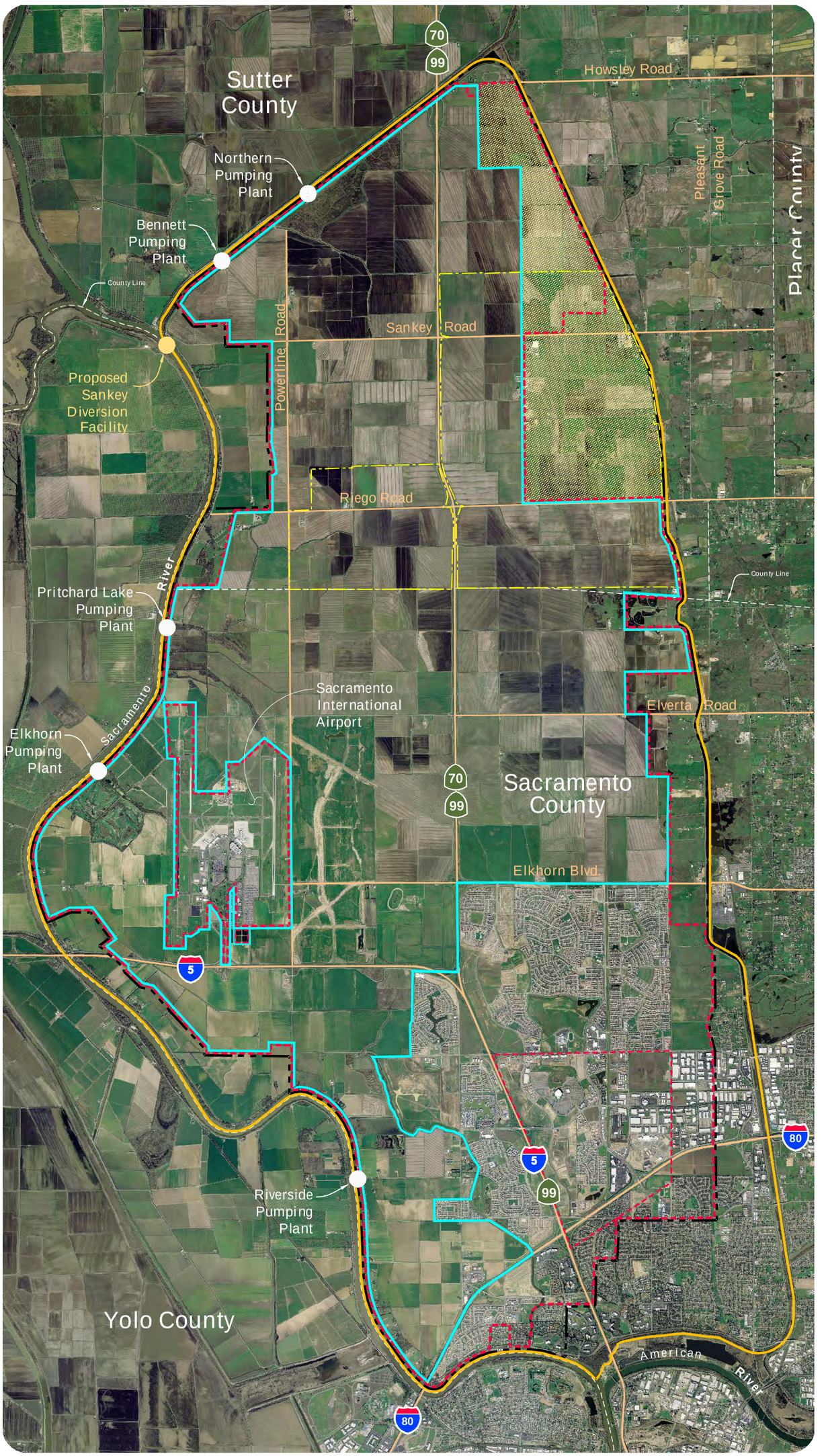

LEGEND
INTERSTATE HIGHWAY
RD1000 PUMPING PLANT
DISCHARGE
SUCTION
PUMP
CHECK STRUCTURE
HIGH LINE DITCH
DRAIN
LATERAL
UNDERGROUND PIPE
N
0 2000 4000 8000
SCALE IN FEET
(APPROXIMATE – MAP IS SCHEMATIC)
NORTHERN
CENTRAL
RIVERSIDE
M.A.P.
MORRISON NORTH
MORRISON PUMPS
MORRISON CANAL
CHAPPELL #1 PUMPS
MORRISON E. PUMP
CHAPPELL #2 PUMPS
CHAPPELL DITCH
CHAPPELL SOUTH
CHAPPELL EAST
PLEASANT GROVE CANAL
CROSS
T-DRAIN PUMP
T-DRAIN
NORTHERN PUMPING PLANT
PUMPING PLANT #4 RD1000
BENNETT PUMPING PLANT
VERONA DIESELS
SPANGLER NORTH
SPANGLER SOUTH
SANKEY ROAD DITCH
VALLEY PUMP
BENNETT DRAIN
BENNETT DRAIN PUMP
BENNETT SOUTH
BENNETT LOOP
V DRAIN
S DRAIN
R DRAIN
RICE ROAD DITCH
LAUPPE PUMPS
RIEGO PUMPS WEST
RIEGO 1
STANDPIPE
DISTRIBUTION BOX
30'S PUMPS
COUNTY LINE CHECK & LIFT PUMPS
RIEGO PUMPS EAST
SUTTER COUNTY
SACRAMENTO COUNTY
SECTION 10
SECTION 3
SWIMMING HOLE DIVERSION
DAIRY PUMPS
NATOMAS EAST MAIN DRAINAGE CANAL
RECLAMATION PLATFORM RD1000 PLANT #2
PRICHARD LAKE PUMPING PLANT
PULLMAN PUMPS
PULLMAN
LAMBERT DITCH
ELVERTA ROAD
CONCRETE LINED 1170'
ELKHORN PUMPING PLANT
AIRPORT DITCH
SACRAMENTO METROPOLITAN AIRPORT
WALNUT ROAD SOUTH
WALNUT ROAD WEST
ELKHORN
ELKHORN WEST
ELKHORN EAST
AIRPORT NORTH PUMP
AIRPORT IRRIGATION PUMPS
AIRPORT IRRIGATION SUPPLY
AIRPORT SOUTH PUMP
AIRPORT LIFT PUMP
BAYOU WAY
PUMPING PLANT #5 RD1000
SACRAMENTO RIVER
PLANT #3 PUMPS
6A SUMP PUMP
PLANT #8 PUMPS
ELKHORN CHECK & LIFT PUMPS
"E" DRAIN PUMPS
ERNST ROAD
NCMWC OFFICE
PUMPING PLANT #9 RD1000
EL CENTRO
DEL PASO ROAD
Area Arena
PUMPING PLANT #8 RD1000
PUMPING PLANT #3 RD1000 & NCMWC
FROM PLANT #3 SOUTH TO THE END OF THE DITCH, WAS CONCRETE LINED AROUND 1920 BUT IS NOW BROKEN IN SEVERAL LOCATIONS.
RIVERSIDE PUMPING PLANT
RIVERSIDE HOUSE
SAN JUAN ROAD
SAN JUAN 30 HORSE PUMP
SAN JUAN 30 HORSE DITCH
LATERAL 13
PARKER RD.
BRYTE ROAD
BRYTE BEND WELL PUMP
PUMPING PLANT 1A & 1B RD1000
EL CAMINO AVENUE
ARCADE CREEK
NATOMAS CENTRAL MUTUAL WATER COMPANY
FACILITIES MAP
LAST REVISED: AUGUST 26, 2005
MEAD & HUNT
ENGINEERS ARCHITECTS SCIENTISTS PLANNERS
3327 Longview Drive Sacramento, California 95821
Phone: (916) 971-3961 Fax: (916) 971-0536

Natomas Basin and Natomas Central Mutual Water Company Service Area



Vicinity Map

Not to Scale

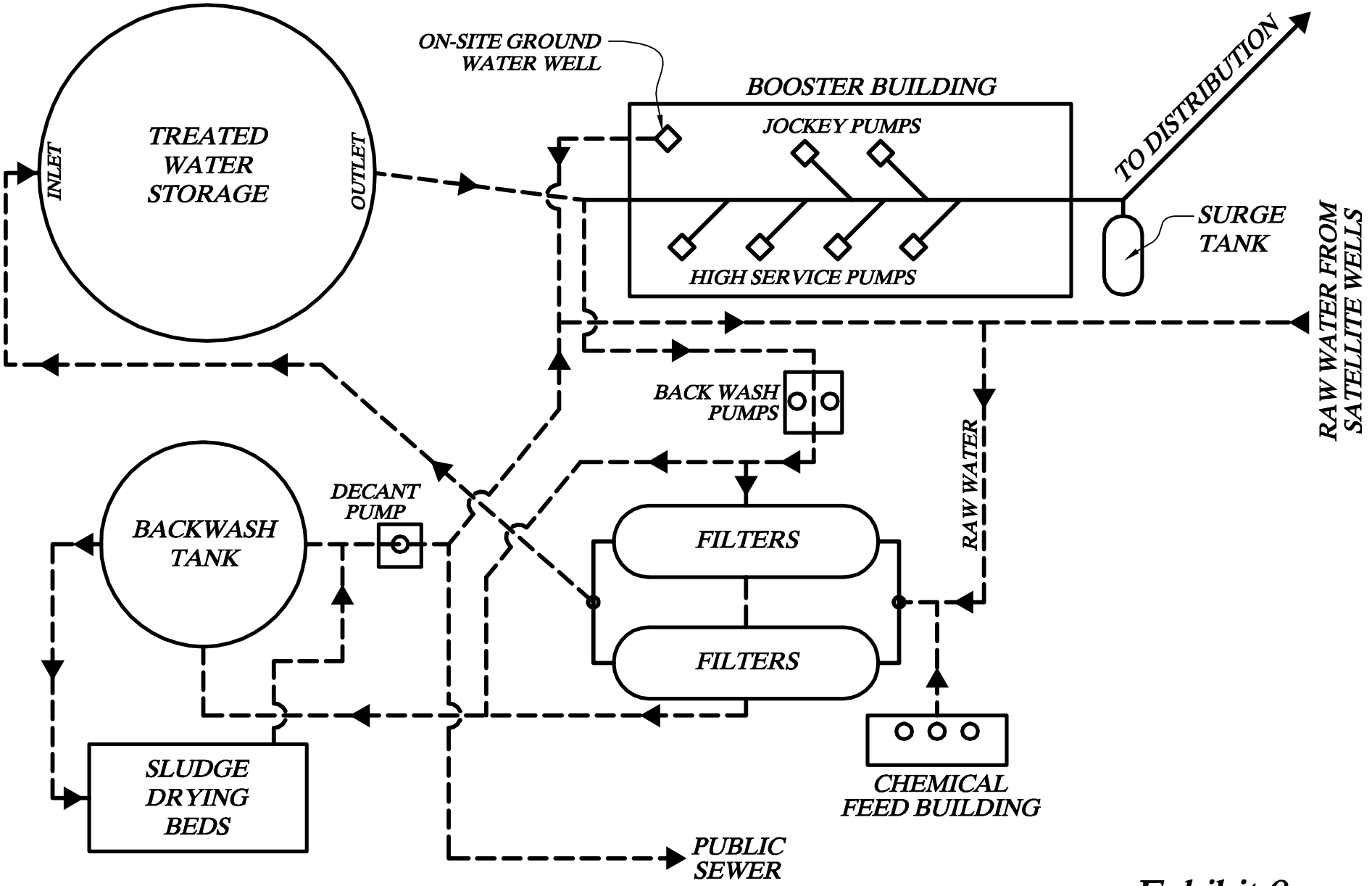


L E G E N D

- Sutter Pointe Specific Plan Area Boundary
- Natomas Basin & RD 1000 ≈ 55,439 Acres±
- NCMWC Place of Use Boundary for "Base Supply" under State Water Rights ≈ 49,361 Acres±
- NCMWC Corporate Boundary or Place of Use Boundary for "Project Water" U.S.B.R. Contract ≈ 30,967 Acres±
- NCMWC Current Water Users Area / Shareholder Lands ≈ 31,653 Acres±
- NCMWC Non-Shareholder Lands ≈ 2,518 Acres± (Currently Served by Groundwater)

MACKAY & SOMPS
ENGINEERS PLANNERS SURVEYORS
1771 Tribute Road, Suite E, Sacramento, CA 95815 (916) 929-6092

Scale: Not to Scale *Date: 11-14-2008*



Typical Ground Water Treatment Plant Layout

Exhibit 9
Sutter Pointe

Sacramento, California
Not to Scale
November 14, 2008

MACKAY & SOMPS
ENGINEERS PLANNERS SURVEYORS
7900-00

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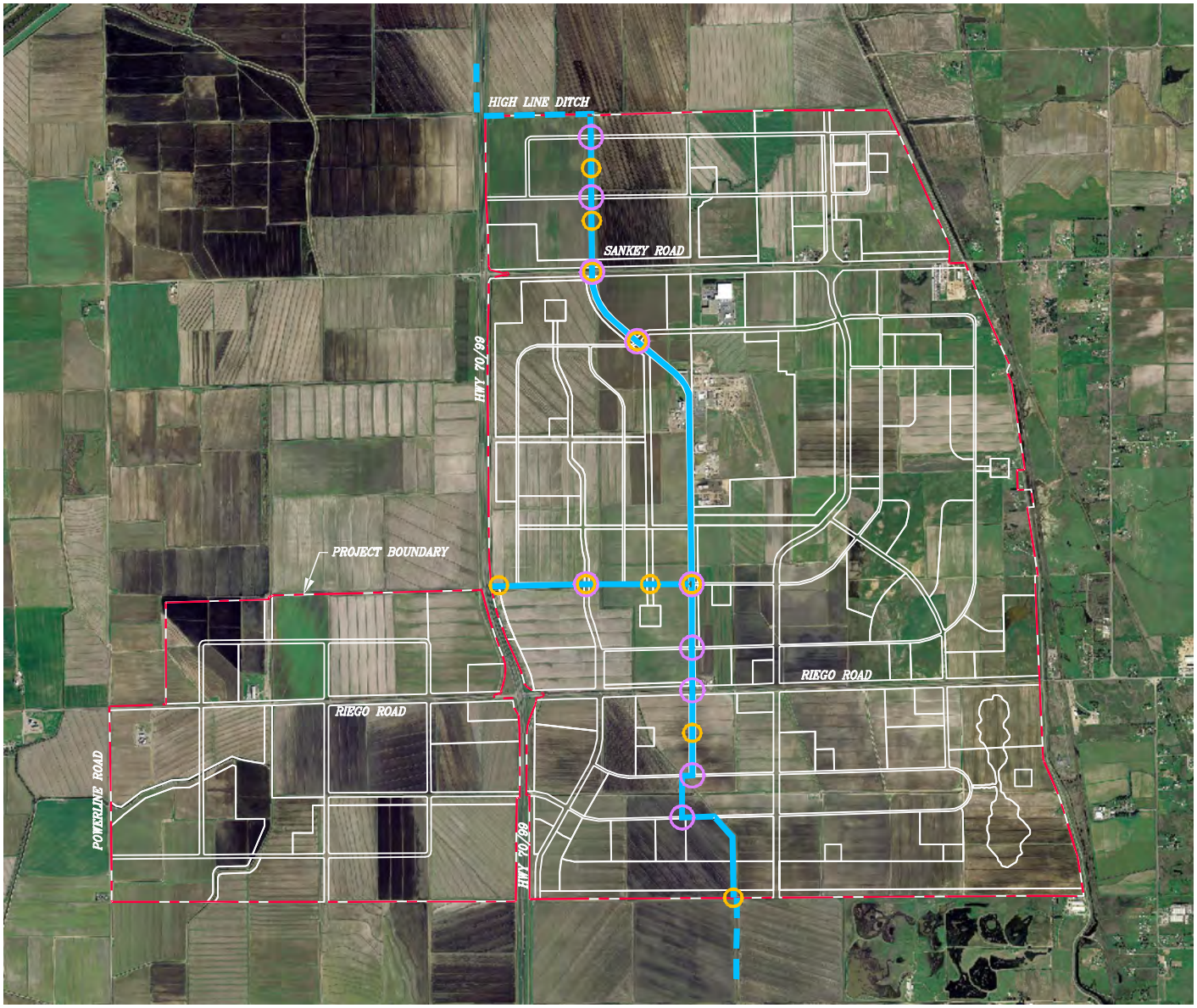

LEGEND

- Existing Canal
- Proposed Canal
- Roadway Crossing
- Drainage Crossing

0' 2,500' 5,000'

SCALE: 1" = 2,500'

EXHIBIT 10

IRRIGATION CANAL CROSSINGS

SUTTER POINTE

MEASURE "M" GROUP

NCMWC Agricultural Irrigation
November 14, 2008

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ENGINEERS PLANNERS SURVEYORS
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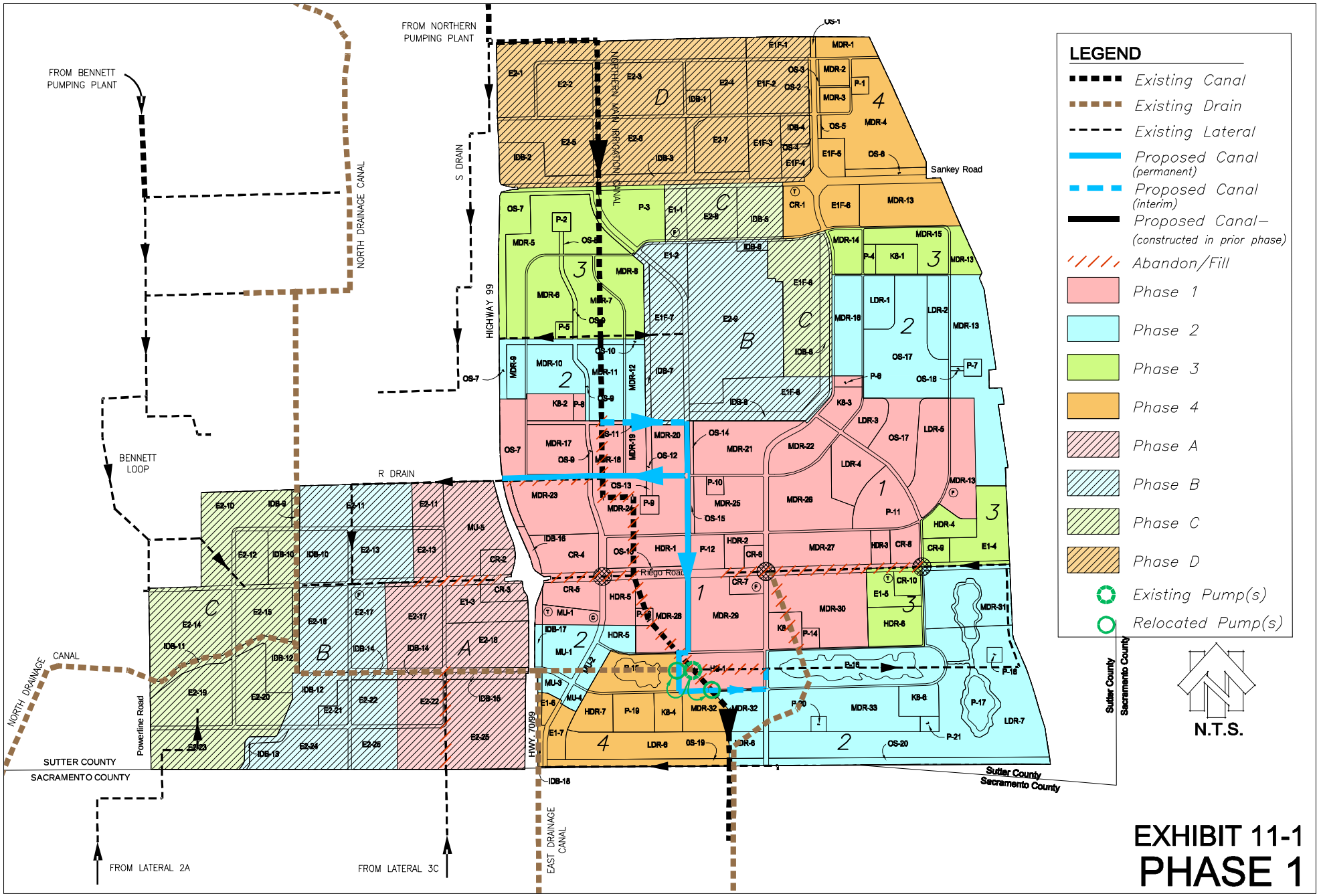

EXHIBIT 11-1
PHASE 1

SUTTER POINTE
MEASURE "M" GROUP

NCMWC Agricultural Irrigation
November 14, 2008

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ENGINEERS PLANNERS SURVEYORS
1771 Tribute Road, Suite E, Sacramento, CA 95815 (916) 929-6092

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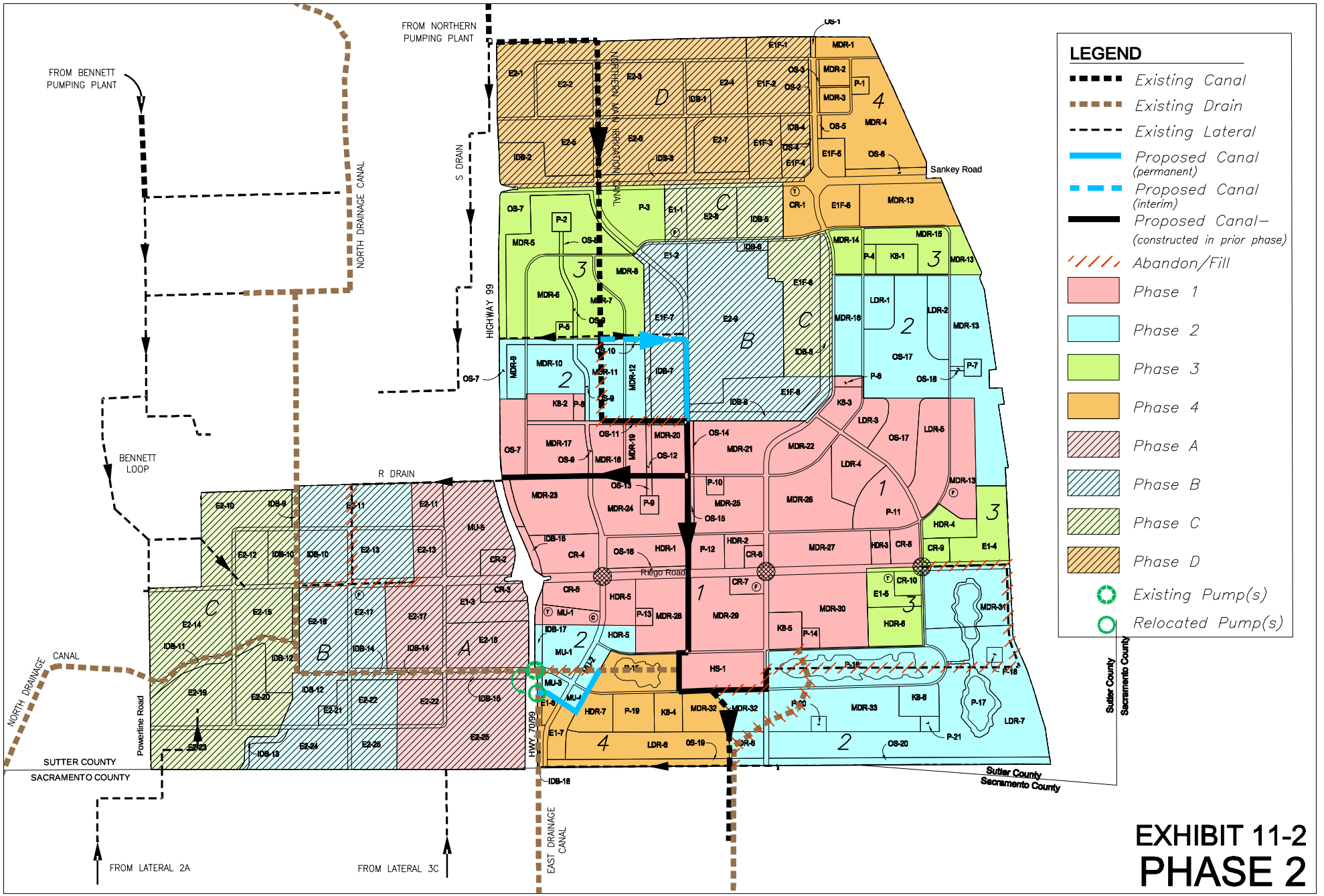

EXHIBIT 11-2
PHASE 2

SUTTER POINTE
MEASURE "M" GROUP

NCMWC Agricultural Irrigation
Nov. 14, 2008

MACKAY & SOMPS
ENGINEERS PLANNERS SURVEYORS
1771 Tribute Road, Suite E, Sacramento, CA 95815 (916) 929-6092

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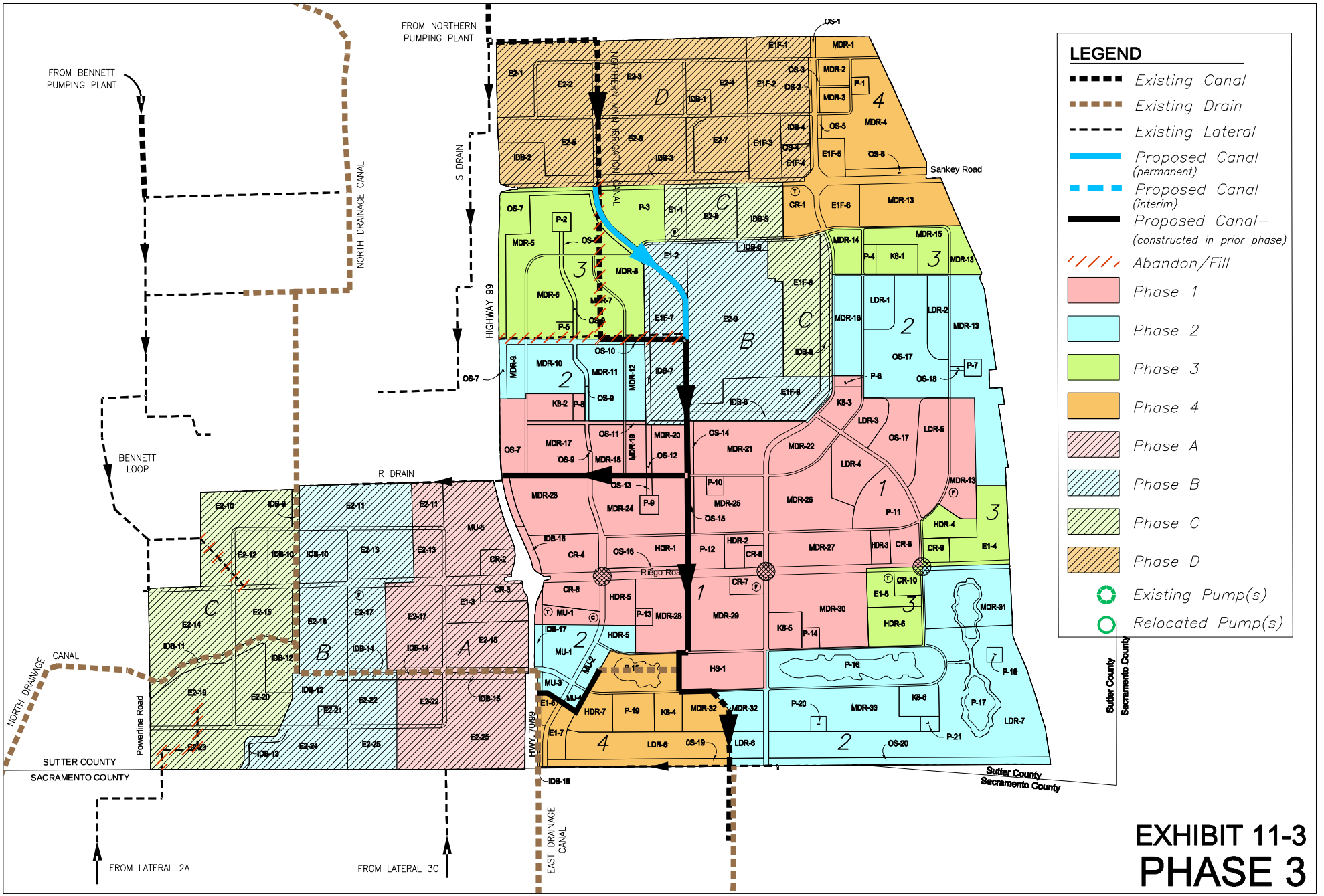

EXHIBIT 11-3
PHASE 3

SUTTER POINTE
MEASURE "M" GROUP

NCMWC Agricultural Irrigation
Nov. 14, 2008

MACKAY & SOMPS
ENGINEERS PLANNERS SURVEYORS
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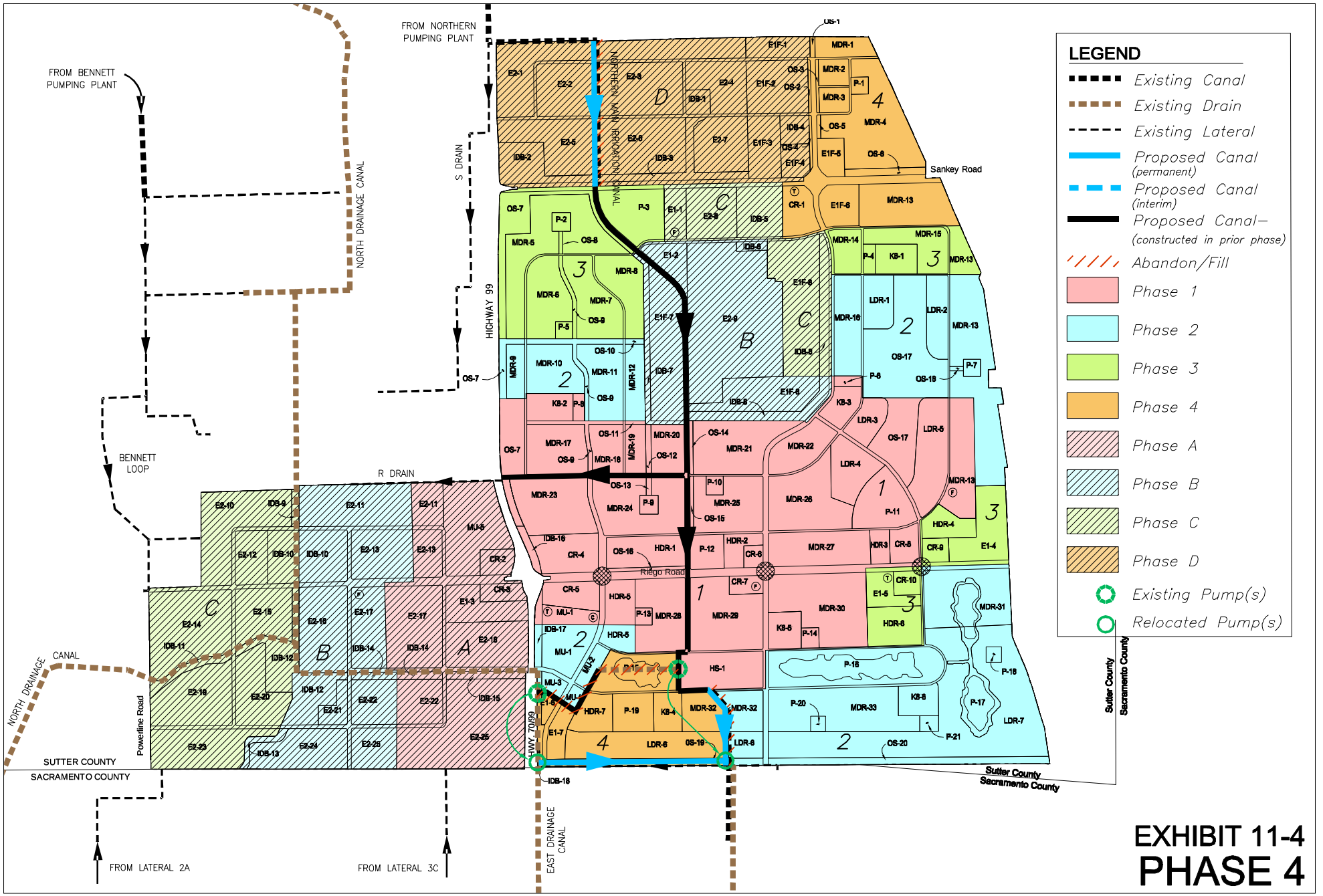

EXHIBIT 11-4
PHASE 4

SUTTER POINTE
MEASURE "M" GROUP

NCMWC Agricultural Irrigation
Nov. 14, 2008

MACKAY & SOMPS
ENGINEERS PLANNERS SURVEYORS
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Appendix B. Water Supply Comparison Tables

Table A: NCMWC Shareholder Irrigation Estimates

Table B: Sutter Pointe Specific Plan Area Peaking Factor Estimate

Table C-1: Sutter Pointe B.O.R. Contract Monthly Supply Calculations (Assuming 120,200 AFY Settlement Contract)

Table C-2: Monthly Surface Water Diversions & Alternate "B" Settlement Contract versus Winter Diversion

Table C-3 Sutter Pointe B.O.R. Contract Monthly Supply Calculations (Assuming Folsom Agreement - 110,200 AFY)

Monthly Water Budgets:

Tables D-1 thru D-4: Proposed Water Supply Program (Phases 1+A thru 4+D)

Tables E-1 thru E-4: Alternate "A" Revised Water Supply Program (Phases 1+A thru 4+D)

Tables F-1 thru F-4: Alternate "B" Winter Diversion Water Supply Program (Phases 1+A thru 4+D)

Table G: Water Conservation Calculation

Supplemental Data:

Table H: Current to Future Land Use for Irrigated Agriculture in Project Area

Table J-1: Current & Projected Indoor/Outdoor Water Demands (Normal Year)

Table J-2: Current & Projected Indoor/Outdoor Water Demands (Critical Year)

Table K: Sutter Pointe – Ultimate Build-Out Water Demand & EDU Calculations (NY)

Table L: Water Demand Factor & Peaking Factor Comparison by Land Use Category

Water Demands vs. Time Comparison Chart

Table - A
NCMWC Shareholder Irrigation Estimates
(Estimate of Historical Usage)

1. Evapotransporation Method					
		Acre	AFY		
Rice		5001			
Non Irrigated		179			
Ditches and Roads		400			
Total (acre)		**5580**			
Evapotranspiration Rate (ac-ft/ac)	(1)	3.47			
10% Tailwater Loss		0.35			
Subtotal (ac-ft/ac)		3.82			
20% System Loss		0.76			
Subtotal (ac-ft/ac)		**4.58**	22,905	AFY	for Rice Acreage = 5001 acres
Fall Flooding Applied Acreage (ac)	(2)	4001			
Flooding Water Applied (ac-ft)	(3)	1.5	6,002	AFY	
Estimated Total Useage			28,907	AFY	

2. DWR Applied Water Method				
Rice		5001	Acre	
Typical Applied Water Rate	(1)	5.71	ac-ft/ac	
Estimated Total Useage		28,556	AFY	

3. NCMWC Applied Water Method				
Rice		5001	Acre	
Typical Applied Water Rate	(4)	6.7	ac-ft/ac	
Estimated Total Useage		33,507	AFY	

Average:			
1. Evapotransporation Method	28,907	AFY	
2. DWR Applied Water Method	28,556	AFY	
3. NCMWC Applied Water Method	33,507	AFY	
	90,969	AFY	
Divide By 3 =			
Average Estimated Total Useage	30,300	AFY	v. 30,000 AFY Cited by Dee Swearingen on June 13, 2007

Estiamte of Historical Usage = 30,000+/- AFY

(1) Obtained from the Department of Water Resource's Annual Water Data 2001 for Rice Detailed Analysis Unit #172 (Placer).
(2) Assumes fall flooding is applied to 80% total rice acreage.
(3) Assumes fall flooding acreage is filled to a depth of 1.5 ft for rice stubble decomposition.
(4) Personal communication from Dee Swearingen, General Manage NCMWC, June 13, 2007.
(5) Amount of ground water available for use in NCMWC service area
(7) Rice irrigation and fall flooding assumptions based on telephone discussions with Cass Mutters at the University of California Agriculture and Natural Resources Cooperative Extension (Butte County) on 8/5/2005 and 8/24/2005; and Luhdorff & Scalamini Consulting Engineers on July 13, 2007.

Table - B

Sutter Pointe Specific Plan Area Peaking Factor Estimate

Month	Evapotranspiration Rate (%)	MDD Peaking Factor [1]
January	4.40%	0.59
February	4.00%	0.54
March	4.80%	0.65
April	6.80%	0.92
May	9.50%	1.28
June	11.40%	1.54
July	13.70%	1.85
August	13.60%	1.84
September	11.50%	1.55
October	9.50%	1.28
November	6.00%	0.81
December	4.80%	0.65
SUM	100.00%	

Adjusted Oct. (x 15%) → 1.50

[1] Max Day Demand (MDD) rate to be applied for the given month

Calculation: $\left(\frac{\text{Monthly Evap -Trans \%}}{\text{July Evap -Trans \%}}\right) \times 1.85$

Table C-1

Sutter Pointe Monthly Bureau of Reclamation Settlement Contract Surface Water Supply Calculation

(Assumes Full Bureau of Reclamation Settlement Contract Right of 120,200 AFY (98,200 AFY Base Supply + 22,000 AFY Project Water))

HISTORICAL USAGE — NCMWC Shareholder Irrigation Estimate (Table A) = **30,000** Acre-Feet Per Year

Month	Bureau of Reclamation Settlement Contract Monthly Cap (AF)	Bureau of Reclamation Settlement Contract Monthly %	Normal Year (Acre-Feet) SPSP Monthly Cap	Normal Year (Acre-Feet) SPSP Demand	Normal Year (Acre-Feet) SPSP Settlement Contract Reserve Proposed	Normal Year (Acre-Feet) SPSP Settlement Contract Reserve Alternate A	Normal Year (Acre-Feet) SPSP Settlement Contract Reserve Alternate B	Critical Dry Year (Acre-Feet) SPSP Monthly Cap	Critical Dry Year (Acre-Feet) SPSP Demand	Critical Dry Year (Acre-Feet) SPSP Settlement Contract Reserve Proposed	Critical Dry Year (Acre-Feet) SPSP Settlement Contract Reserve Alternate A	Critical Dry Year (Acre-Feet) SPSP Settlement Contract Reserve Alternate B
April	14,000	11.65%	3,494	Refer to Table C-2	2,285	1,780	2,229	2,621	Refer to Table C-2	1,814	2,002	2,160
May	27,700	23.04%	6,913		5,225	4,519	5,218	5,185		3,958	3,970	4,138
June	23,000	19.13%	5,740		3,714	2,867	3,566	4,305		2,756	2,672	2,850
July	18,700	15.56%	4,667		2,233	1,750	1,914	3,500		1,620	1,359	1,545
August	18,700	15.56%	4,667		2,251	1,750	1,939	3,500		1,635	1,381	1,559
September	16,100	13.39%	4,018		1,975	1,507	1,819	3,014		1,476	1,358	1,516
October	2,000	1.66%	499		187	187	187	374		140	140	140
Total	**120,200**	**100.00%**	**30,000**		**17,872**	**14,362**	**16,874**	**22,500**		**13,400**	**12,883**	**13,909**
			100% Allocation					**25% Cutback**				

ACTUAL DIVERSIONS — 88,000 Acre-Feet Per Year (Avg.) x 25% Customer Base = **22,000** Acre-Feet Per Year

Month	Bureau of Reclamation Settlement Contract Monthly Cap (AF)	Bureau of Reclamation Settlement Contract Monthly %	Normal Year (Acre-Feet) SPSP Monthly Cap	Normal Year (Acre-Feet) SPSP Demand	Normal Year (Acre-Feet) SPSP Settlement Contract Reserve Proposed	Normal Year (Acre-Feet) SPSP Settlement Contract Reserve Alternate A	Normal Year (Acre-Feet) SPSP Settlement Contract Reserve Alternate B	Critical Dry Year (Acre-Feet) SPSP Monthly Cap	Critical Dry Year (Acre-Feet) SPSP Demand	Critical Dry Year (Acre-Feet) SPSP Settlement Contract Reserve Proposed	Critical Dry Year (Acre-Feet) SPSP Settlement Contract Reserve Alternate A	Critical Dry Year (Acre-Feet) SPSP Settlement Contract Reserve Alternate B
April	14,000	11.65%	2,562	Refer to Table C-2	1,353	848	1,297	1,922	Refer to Table C-2	1,115	1,303	1,461
May	27,700	23.04%	5,070		3,382	2,676	3,375	3,802		2,575	2,587	2,755
June	23,000	19.13%	4,210		2,184	1,337	2,036	3,157		1,608	1,524	1,702
July	18,700	15.56%	3,423		989	506	670	2,567		687	426	612
August	18,700	15.56%	3,423		1,007	506	695	2,567		702	448	626
September	16,100	13.39%	2,947		904	436	748	2,210		672	554	712
October	2,000	1.66%	366		54	54	1,424	275		41	41	891
Total	**120,200**	**100.00%**	**22,000**		**9,872**	**6,362**	**10,244**	**16,500**		**7,400**	**6,883**	**8,759**
			100% Allocation					**25% Cutback**				

NCMWC SHARES — 120,200 Acre-Feet Per Year x 15.83% Est. NCMWC Shares = **19,020** Acre-Feet Per Year

Month	Bureau of Reclamation Settlement Contract Monthly Cap (AF)	Bureau of Reclamation Settlement Contract Monthly %	Normal Year (Acre-Feet) SPSP Monthly Cap	Normal Year (Acre-Feet) SPSP Demand	Normal Year (Acre-Feet) SPSP Settlement Contract Reserve Proposed	Normal Year (Acre-Feet) SPSP Settlement Contract Reserve Alternate A	Normal Year (Acre-Feet) SPSP Settlement Contract Reserve Alternate B	Critical Dry Year (Acre-Feet) SPSP Monthly Cap	Critical Dry Year (Acre-Feet) SPSP Demand	Critical Dry Year (Acre-Feet) SPSP Settlement Contract Reserve Proposed	Critical Dry Year (Acre-Feet) SPSP Settlement Contract Reserve Alternate A	Critical Dry Year (Acre-Feet) SPSP Settlement Contract Reserve Alternate B
April	14,000	11.65%	2,215	Refer to Table C-2	1,006	501	950	1,661	Refer to Table C-2	854	1,042	1,200
May	27,700	23.04%	4,383		2,695	1,989	2,688	3,287		2,060	2,072	2,240
June	23,000	19.13%	3,639		1,613	766	1,465	2,730		1,181	1,097	1,275
July	18,700	15.56%	2,959		525	42	206	2,219		339	78	264
August	18,700	15.56%	2,959		543	42	231	2,219		354	100	278
September	16,100	13.39%	2,548		505	37	349	1,911		373	255	413
October	2,000	1.66%	316		4	4	4	237		3	3	3
Total	**120,200**	**100.00%**	**19,020**		**6,892**	**3,382**	**5,894**	**14,265**		**5,165**	**4,648**	**5,674**
			100% Allocation					**25% Cutback**				

Table C-2

SURFACE WATER DIVERSIONS

SURFACE WATER DIVERSIONS BY WATER SUPPLY PROGRAM

Proposed Water Supply Project

Normal Year (Acre Feet)

Phase / Year / Month	2010	2015	1+A 2017	2020	2+B 2022	3+C 2025	4+D 2030
January	-	-	-	-	-	-	-
Februray	-	-	-	-	-	-	-
March	-	-	-	-	-	-	-
April	-	-	-	181	301	887	1,209
May	-	-	-	306	510	1,238	1,688
June	-	-	-	465	775	1,486	2,026
July	-	-	-	658	1,097	1,786	2,434
August	-	-	-	655	1,091	1,773	2,416
September	-	-	-	469	781	1,499	2,043
October	-	-	-	187	312	312	312
November	-	-	-	-	-	-	-
December	-	-	-	-	-	-	-
Total	-	-	-	2,920	4,867	8,981	12,128

Critical Dry Year (Acre-Feet)

Phase / Year / Month	2010	2015	1+A 2017	2020	2+B 2022	3+C 2025	4+D 2030
January	-	-	-	-	-	-	-
Februray	-	-	-	-	-	-	-
March	-	-	-	-	-	-	-
April	-	-	-	159	265	776	807
May	-	-	-	268	446	1,083	1,227
June	-	-	-	407	678	1,301	1,549
July	-	-	-	575	959	1,563	1,880
August	-	-	-	572	954	1,550	1,865
September	-	-	-	410	683	1,311	1,538
October	-	-	-	140	234	234	234
November	-	-	-	-	-	-	-
December	-	-	-	-	-	-	-
Total	-	-	-	2,531	4,219	7,818	9,100

Alternate A Water Supply Project

Normal Year (Acre Feet)

Phase / Year / Month	2010	2015	1+A 2017	2020	2+B 2022	3+C 2025	4+D 2030
January	-	-	-	-	-	-	-
Februray	-	-	-	-	-	-	-
March	-	-	-	-	-	-	-
April	-	-	-	644	1,073	1,392	1,714
May	-	-	-	900	1,500	1,944	2,394
June	-	-	-	1,079	1,799	2,333	2,873
July	-	-	-	1,298	2,163	2,804	2,917
August	-	-	-	1,288	2,147	2,784	2,917
September	-	-	-	1,089	1,815	2,354	2,511
October	-	-	-	187	312	312	312
November	-	-	-	-	-	-	-
December	-	-	-	-	-	-	-
Total	-	-	-	6,485	10,809	13,923	15,638

Critical Dry Year (Acre-Feet)

Phase / Year / Month	2010	2015	1+A 2017	2020	2+B 2022	3+C 2025	4+D 2030
January	-	-	-	-	-	-	-
Februray	-	-	-	-	-	-	-
March	-	-	-	-	-	-	-
April	-	-	-	311	519	578	619
May	-	-	-	535	892	1,061	1,215
June	-	-	-	692	1,154	1,401	1,633
July	-	-	-	883	1,472	1,813	2,141
August	-	-	-	875	1,458	1,795	2,119
September	-	-	-	701	1,168	1,419	1,656
October	-	-	-	140	234	234	234
November	-	-	-	-	-	-	-
December	-	-	-	-	-	-	-
Total	-	-	-	4,138	6,897	8,301	9,617

Alternate B Water Supply Project

Normal Year (Acre Feet)

Phase / Year / Month	2010	2015	1+A 2017	2020	2+B 2022	3+C 2025	4+D 2030
January	-	-	-	240	400	650	836
Februray	-	-	-	240	400	600	738
March	-	-	-	240	400	600	933
April	-	-	-	344	573	1,084	1,265
May	-	-	-	510	850	1,537	1,695
June	-	-	-	671	1,119	1,726	2,174
July	-	-	-	848	1,413	1,998	2,753
August	-	-	-	850	1,417	1,993	2,728
September	-	-	-	699	1,165	1,747	2,199
October	-	-	-	427	712	962	1,141
November	-	-	-	240	400	650	1,227
December	-	-	-	240	400	650	933
Total	-	-	-	5,549	9,249	14,197	18,622

Critical Dry Year (Acre-Feet)

Phase / Year / Month	2010	2015	1+A 2017	2020	2+B 2022	3+C 2025	4+D 2030
January	-	-	-	120	200	325	741
Februray	-	-	-	120	200	300	656
March	-	-	-	120	200	300	627
April	-	-	-	65	109	605	461
May	-	-	-	181	302	1,002	1,047
June	-	-	-	318	530	1,167	1,455
July	-	-	-	496	826	1,406	1,955
August	-	-	-	493	822	1,400	1,941
September	-	-	-	329	548	1,185	1,498
October	-	-	-	260	434	559	882
November	-	-	-	120	200	325	683
December	-	-	-	120	200	325	827
Total	-	-	-	2,743	4,571	8,899	12,773

Alternate B Breakdown (Settlement Contract v. Winter Diversion)

Normal Year (Acre-Feet)

Month /	2010	2015	1+A 2017	2020	2+B 2022	3+C 2025	4+D 2030
January							
Contract	-	-	-	-	-	-	-
Winter Diversion	-	-	-	240	400	650	836
Sub-Total	-	-	-	240	400	650	836
Februray							
Contract	-	-	-	-	-	-	-
Winter Diversion	-	-	-	240	400	650	738
Sub-Total	-	-	-	240	400	650	738
March							
Contract	-	-	-	-	-	-	-
Winter Diversion	-	-	-	240	400	650	933
Sub-Total	-	-	-	240	400	650	933
April							
Contract	-	-	-	344	573	1,084	1,265
Winter Diversion	-	-	-	-	-	-	-
Sub-Total	-	-	-	344	573	1,084	1,265
May							
Contract	-	-	-	510	850	1,537	1,695
Winter Diversion	-	-	-	-	-	-	-
Sub-Total	-	-	-	510	850	1,537	1,695
June							
Contract	-	-	-	671	1,119	1,726	2,174
Winter Diversion	-	-	-	-	-	-	-
Sub-Total	-	-	-	671	1,119	1,726	2,174
July							
Contract	-	-	-	848	1,413	1,998	2,753
Winter Diversion	-	-	-	-	-	-	-
Sub-Total	-	-	-	848	1,413	1,998	2,753
August							
Contract	-	-	-	850	1,417	1,993	2,728
Winter Diversion	-	-	-	-	-	-	-
Sub-Total	-	-	-	850	1,417	1,993	2,728
September							
Contract	-	-	-	699	1,165	1,747	2,199
Winter Diversion	-	-	-	-	-	-	-
Sub-Total	-	-	-	699	1,165	1,747	2,199
October							
Contract	-	-	-	187	312	312	312
Winter Diversion	-	-	-	240	400	650	829
Sub-Total	-	-	-	427	712	962	1,141
November							
Contract	-	-	-	-	-	-	-
Winter Diversion	-	-	-	240	400	650	1,227
Sub-Total	-	-	-	240	400	650	1,227
December							
Contract	-	-	-	-	-	-	-
Winter Diversion	-	-	-	240	400	650	933
Sub-Total	-	-	-	240	400	650	933
Total	-	-	-	5,549	9,249	14,297	18,622

Critical Dry Year (Acre-Feet)

Month /	2010	2015	1+A 2017	2020	2+B 2022	3+C 2025	4+D 2030
January							
Contract	-	-	-	-	-	-	-
Winter Diversion	-	-	-	120	200	325	741
Sub-Total	-	-	-	120	200	325	741
Februray							
Contract	-	-	-	-	-	-	-
Winter Diversion	-	-	-	120	200	300	656
Sub-Total	-	-	-	120	200	300	656
March							
Contract	-	-	-	-	-	-	-
Winter Diversion	-	-	-	120	200	300	627
Sub-Total	-	-	-	120	200	300	627
April							
Contract	-	-	-	65	109	605	461
Winter Diversion	-	-	-	-	-	-	-
Sub-Total	-	-	-	65	109	605	461
May							
Contract	-	-	-	181	302	1,002	1,047
Winter Diversion	-	-	-	-	-	-	-
Sub-Total	-	-	-	181	302	1,002	1,047
June							
Contract	-	-	-	318	530	1,167	1,455
Winter Diversion	-	-	-	-	-	-	-
Sub-Total	-	-	-	318	530	1,167	1,455
July							
Contract	-	-	-	496	826	1,406	1,955
Winter Diversion	-	-	-	-	-	-	-
Sub-Total	-	-	-	496	826	1,406	1,955
August							
Contract	-	-	-	493	822	1,400	1,941
Winter Diversion	-	-	-	-	-	-	-
Sub-Total	-	-	-	493	822	1,400	1,941
September							
Contract	-	-	-	329	548	1,185	1,498
Winter Diversion	-	-	-	-	-	-	-
Sub-Total	-	-	-	329	548	1,185	1,498
October							
Contract	-	-	-	140	234	234	234
Winter Diversion	-	-	-	120	200	325	648
Sub-Total	-	-	-	260	434	559	882
November							
Contract	-	-	-	-	-	-	-
Winter Diversion	-	-	-	120	200	325	683
Sub-Total	-	-	-	120	200	325	683
December							
Contract	-	-	-	-	-	-	-
Winter Diversion	-	-	-	120	200	325	827
Sub-Total	-	-	-	120	200	325	827
Total	-	-	-	2,743	4,571	8,899	12,773

Table C-3
Sutter Pointe Monthly Bureau of Reclamation Settlement Contract Surface Water Supply Calculation
(Assuming City of Folsom Sale of 10,000 Acre-Feet of Project Water)

HISTORICAL USAGE — NCMWC Shareholder Irrigation Estimate (Table A) = 30,000 Acre-Feet Per Year

Month	Bureau of Reclamation Settlement Contract Monthly Cap (AF)	Bureau of Reclamation Settlement Contract Monthly %	Normal Year (Acre-Feet) SPSP Monthly Cap	Normal Year (Acre-Feet) SPSP Demand	Normal Year (Acre-Feet) SPSP Settlement Contract Reserve Proposed	Normal Year (Acre-Feet) SPSP Settlement Contract Reserve Alternate A	Normal Year (Acre-Feet) SPSP Settlement Contract Reserve Alternate B	Critical Dry Year (Acre-Feet) SPSP Monthly Cap	Critical Dry Year (Acre-Feet) SPSP Demand	Critical Dry Year (Acre-Feet) SPSP Settlement Contract Reserve Proposed	Critical Dry Year (Acre-Feet) SPSP Settlement Contract Reserve Alternate A	Critical Dry Year (Acre-Feet) SPSP Settlement Contract Reserve Alternate B
April	14,000	12.70%	3,811	Refer to Table C-2	2,602	2,097	2,546	2,858	Refer to Table C-2	2,051	2,239	2,397
May	27,700	25.14%	7,541		5,853	5,147	5,846	5,656		4,429	4,441	4,609
June	23,000	20.87%	6,261		4,235	3,388	4,087	4,696		3,147	3,063	3,241
July	15,427	14.00%	4,200		1,766	1,283	1,447	3,150		1,270	1,009	1,195
August	11,973	10.86%	3,259		843	342	531	2,445		580	326	504
September	16,100	14.61%	4,383		2,340	1,872	2,184	3,287		1,749	1,631	1,789
October	2,000	1.81%	544		232	232	232	408		174	174	174
Total	**110,200**	**100.00%**	**30,000**		**17,872**	**14,362**	**16,874**	**22,500**		**13,400**	**12,883**	**13,909**
			100% Allocation					**25% Cutback**				

ACTUAL DIVERSIONS — 88,000 Acre-Feet Per Year (Avg.) x 25% Customer Base = 22,000 Acre-Feet Per Year

Month	Bureau of Reclamation Settlement Contract Monthly Cap (AF)	Bureau of Reclamation Settlement Contract Monthly %	Normal Year (Acre-Feet) SPSP Monthly Cap	Normal Year (Acre-Feet) SPSP Demand	Normal Year (Acre-Feet) SPSP Settlement Contract Reserve Proposed	Normal Year (Acre-Feet) SPSP Settlement Contract Reserve Alternate A	Normal Year (Acre-Feet) SPSP Settlement Contract Reserve Alternate B	Critical Dry Year (Acre-Feet) SPSP Monthly Cap	Critical Dry Year (Acre-Feet) SPSP Demand	Critical Dry Year (Acre-Feet) SPSP Settlement Contract Reserve Proposed	Critical Dry Year (Acre-Feet) SPSP Settlement Contract Reserve Alternate A	Critical Dry Year (Acre-Feet) SPSP Settlement Contract Reserve Alternate B
April	14,000	12.70%	2,795	Refer to Table C-2	1,586	1,081	1,530	2,096	Refer to Table C-2	1,289	1,477	1,635
May	27,700	25.14%	5,530		3,842	3,136	3,835	4,147		2,920	2,932	3,100
June	23,000	20.87%	4,592		2,566	1,719	2,418	3,444		1,895	1,811	1,989
July	15,427	14.00%	3,080		646	163	327	2,310		430	169	355
August	11,973	10.86%	2,390		(26)	(527)	(338)	1,793		(72)	(326)	(148)
September	16,100	14.61%	3,214		1,171	703	1,015	2,411		873	755	913
October	2,000	1.81%	399		87	87	1,457	299		65	65	915
Total	**110,200**	**100.00%**	**22,000**		**9,872**	**6,362**	**10,244**	**16,500**		**7,400**	**6,883**	**8,759**
			100% Allocation					**25% Cutback**				

NCMWC SHARES — 110,200 Acre-Feet Per Year x 15.83% Est. NCMWC Shares = 17,440 Acre-Feet Per Year

Month	Bureau of Reclamation Settlement Contract Monthly Cap (AF)	Bureau of Reclamation Settlement Contract Monthly %	Normal Year (Acre-Feet) SPSP Monthly Cap	Normal Year (Acre-Feet) SPSP Demand	Normal Year (Acre-Feet) SPSP Settlement Contract Reserve Proposed	Normal Year (Acre-Feet) SPSP Settlement Contract Reserve Alternate A	Normal Year (Acre-Feet) SPSP Settlement Contract Reserve Alternate B	Critical Dry Year (Acre-Feet) SPSP Monthly Cap	Critical Dry Year (Acre-Feet) SPSP Demand	Critical Dry Year (Acre-Feet) SPSP Settlement Contract Reserve Proposed	Critical Dry Year (Acre-Feet) SPSP Settlement Contract Reserve Alternate A	Critical Dry Year (Acre-Feet) SPSP Settlement Contract Reserve Alternate B
April	14,000	12.70%	2,216	Refer to Table C-2	1,007	502	951	1,662	Refer to Table C-2	855	1,043	1,201
May	27,700	25.14%	4,384		2,696	1,990	2,689	3,288		2,061	2,073	2,241
June	23,000	20.87%	3,640		1,614	767	1,466	2,730		1,181	1,097	1,275
July	15,427	14.00%	2,441		7	(476)	(312)	1,831		(49)	(310)	(124)
August	11,973	10.86%	1,895		(521)	(1,022)	(833)	1,421		(444)	(698)	(520)
September	16,100	14.61%	2,548		505	37	349	1,911		373	255	413
October	2,000	1.81%	317		5	5	5	237		3	3	3
Total	**110,200**	**100.00%**	**17,440**		**5,312**	**1,802**	**4,314**	**13,080**		**3,980**	**3,463**	**4,489**
			100% Allocation					**25% Cutback**				

Note: While it appears that a sufficient quantity of surface water may not exist in July and/or August in one or more of the three approaches to determining the Sutter Pointe share of monthly Bureau of Reclamation Settlement Contract rights (assuming the Folsom Agreement is implemented), it is important to note that there is an annual reserve (surplus) of surface water in all scenarios. This indcates that the mix of surface water diversions and ground water pumping can be adjusted slightly month-to-month throughout the year to cover the potential shortage of surface water by pumping slightly more ground water during July and/or August and pumping slightly less during the remainder of the year when surface water supplies are more abundant. Such an adjustment would have a zero sum effect on the overall water supply picture (surface water diversions and ground water pumping) over a year's time.

Table D-1: Proposed Water Supply Program

Proposed Water Supply Program - Phase 1 + A

Normal Year

		Demand	Ground	Contract	Winter (E)	Winter (N)	Total
January	4.40%	371	371	-	-	-	371
February	4.00%	338	338	-	-	-	338
March	4.80%	405	405	-	-	-	405
April	6.80%	574	574	-	-	-	574
May	9.50%	802	802	-	-	-	802
June	11.40%	962	962	-	-	-	962
July	13.70%	1,157	1,157	-	-	-	1,157
August	13.60%	1,148	1,148	-	-	-	1,148
September	11.50%	971	971	-	-	-	971
October	9.50%	802	802	-	-	-	802
November	6.00%	507	507	-	-	-	507
December	4.80%	405	405	-	-	-	405
	100.00%	**8,442**	8,442	-	-	-	**8,442**

Critical Dry Year (12.5% Conservation)

		Demand	Ground	Contract	Winter (E)	Winter (N)	Total
January	4.40%	325	325	-	-	-	325
February	4.00%	295	295	-	-	-	295
March	4.80%	355	355	-	-	-	355
April	6.80%	502	502	-	-	-	502
May	9.50%	702	702	-	-	-	702
June	11.40%	842	842	-	-	-	842
July	13.70%	1,012	1,012	-	-	-	1,012
August	13.60%	1,005	1,005	-	-	-	1,005
September	11.50%	849	849	-	-	-	849
October	9.50%	702	702	-	-	-	702
November	6.00%	443	443	-	-	-	443
December	4.80%	355	355	-	-	-	355
	100.00%	**7,387**	7,387	-	-	-	**7,387**

(Gal/Min)/Well	Min/Day	Days/Month	Gal/Ft3	ft3/ac-ft	Duty Factor	Supply ((ac-ft/mo)/well)
1800	1440	30	7.48	43560	0.67	159.90

Phase 1+A (NY)		**Use**
Number Supply Wells	7.24	7
Number Standby Wells		1
Total		**8**

		Use	
Number Supply Wells (Max Day)	5.38	5	**Max Day =9,682 gpm / 13.9 MGD**
Number Standby Wells		1	
Total		**6**	

Phase 1+A (CDY)		**Use**
Number Supply Wells	6.33	6
Number Standby Wells		1
Total		**7**

		Use	
Number Supply Wells (Max Day)	4.71	5	**Max Day = 8,473 gpm / 12.2 MGD**
Number Standby Wells		1	
Total		**6**	

ONE WELL FIELD REQUIRED

Table D-2: Proposed Water Supply Program

Proposed Water Supply Program - Phase 2+B

Normal Year

		Demand	Ground	Contract	Winter (E)	Winter (N)	Total
January	4.40%	694	694	-	-	-	694
February	4.00%	631	631	-	-	-	631
March	4.80%	758	758	-	-	-	758
April	6.80%	1,073	772	301	-	-	1,073
May	9.50%	1,500	990	510	-	-	1,500
June	11.40%	1,799	1,024	775	-	-	1,799
July	13.70%	2,163	1,066	1,097	-	-	2,163
August	13.60%	2,147	1,056	1,091	-	-	2,147
September	11.50%	1,815	1,034	781	-	-	1,815
October	9.50%	1,500	1,188	312	-	-	1,500
November	6.00%	947	947	-	-	-	947
December	4.80%	758	758	-	-	-	758
	100.00%	**15,785**	10,918	4,867	-	-	**15,785**

Critical Dry Year (12.5% Conservation)

		Demand	Ground	Contract	Winter (E)	Winter (N)	Total
January	4.40%	608	608	-	-	-	608
February	4.00%	552	552	-	-	-	552
March	4.80%	663	663	-	-	-	663
April	6.80%	939	675	265	-	-	939
May	9.50%	1,312	866	446	-	-	1,312
June	11.40%	1,574	896	678	-	-	1,574
July	13.70%	1,892	933	959	-	-	1,892
August	13.60%	1,878	924	954	-	-	1,878
September	11.50%	1,588	905	683	-	-	1,588
October	9.50%	1,312	1,078	234	-	-	1,312
November	6.00%	829	829	-	-	-	829
December	4.80%	663	663	-	-	-	663
	100.00%	**13,810**	9,591	4,219	-	-	**13,810**

(Gal/Min)/Well	Min/Day	Days/Month	Gal/Ft3	ft3/ac-ft	Duty Factor	Supply ((ac-ft/mo)/well)
1800	1440	30	7.48	43560	0.67	159.90

Phase 2+B (NY)		**Use**
Number Supply Wells	7.43	7
Number Standby Wells		1
Total		**8**

		Use	
Number Supply Wells (Max Day)	7.97	8	**Max Day =18,104 gpm / 26.0 MGD**
Number Standby Wells		1	
Total		**9**	

Phase 2+B (CDY)		**Use**
Number Supply Wells	6.74	7
Number Standby Wells		1
Total		**8**

		Use	
Number Supply Wells (Max Day)	7.23	7	**Max Day = 15,840 gpm / 22.8 MGD**
Number Standby Wells		1	
Total		**8**	

ONE WELL FIELD REQUIRED

Table D-3: Proposed Water Supply Program

Proposed Water Supply Program - Phase 3+C

Normal Year

		Demand	Ground	Contract	Winter (E)	Winter (N)	Total
January	4.40%	901	901	-	-	-	901
February	4.00%	819	819	-	-	-	819
March	4.80%	982	982	-	-	-	982
April	6.80%	1,392	505	887	-	-	1,392
May	9.50%	1,944	706	1,238	-	-	1,944
June	11.40%	2,334	847	1,487	-	-	2,334
July	13.70%	2,804	1,018	1,786	-	-	2,804
August	13.60%	2,784	1,011	1,773	-	-	2,784
September	11.50%	2,354	855	1,499	-	-	2,354
October	9.50%	1,944	1,632	312	-	-	1,944
November	6.00%	1,228	1,228	-	-	-	1,228
December	4.80%	982	982	-	-	-	982
	100.00%	**20,468**	11,486	8,982	-	-	**20,468**

Critical Dry Year (12.5% Conservation)

		Demand	Ground	Contract	Winter (E)	Winter (N)	Total
January	4.40%	788	788	-	-	-	788
February	4.00%	716	716	-	-	-	716
March	4.80%	860	860	-	-	-	860
April	6.80%	1,218	442	776	-	-	1,218
May	9.50%	1,701	618	1,083	-	-	1,701
June	11.40%	2,042	741	1,301	-	-	2,042
July	13.70%	2,453	890	1,563	-	-	2,453
August	13.60%	2,435	885	1,550	-	-	2,435
September	11.50%	2,059	748	1,311	-	-	2,059
October	9.50%	1,701	1,467	234	-	-	1,701
November	6.00%	1,074	1,074	-	-	-	1,074
December	4.80%	860	860	-	-	-	860
	100.00%	**17,907**	10,088	7,819	-	-	**17,907**

(Gal/Min)/Well	Min/Day	Days/Month	Gal/Ft3	ft3/ac-ft	Duty Factor	Supply ((ac-ft/mo)/well)
1800	1440	30	7.48	43560	0.67	159.90

Phase 3+C (NY)		**Use**	
Number Supply Wells	10.21	10	
Number Standby Wells		2	
Total		**12**	

		Use	
Number Supply Wells (Max Day)	10.95	11	**Max Day = 23,475 gpm / 33.7 MGD**
Number Standby Wells		2	
Total		**13**	

Phase 3+C (CDY)		**Use**	
Number Supply Wells	9.17	9	
Number Standby Wells		2	
Total		**11**	

		Use	
Number Supply Wells (Max Day)	9.84	10	**Max Day = 20,539 gpm / 29.6 MGD**
Number Standby Wells		2	
Total		**12**	

TWO WELL FIELDS REQUIRED

Table D-4: Proposed Water Supply Program

Proposed Water Supply Program - Phase 4+D

Normal Year

		Demand	Ground	Contract	Winter (E)	Winter (N)	Total	Treatment Plant Capacity (MGD)[1]	
								Ground	Surface
January	4.40%	1,109	1,109	-	-	-	1,109	13.3	0.0
February	4.00%	1,008	1,008	-	-	-	1,008	12.1	0.0
March	4.80%	1,209	1,209	-	-	-	1,209	14.5	0.0
April	6.80%	1,714	505	1,209	-	-	1,714	6.1	14.5
May	9.50%	2,394	706	1,688	-	-	2,394	8.5	20.3
June	11.40%	2,873	847	2,026	-	-	2,873	10.2	24.4
July	13.70%	3,452	1,018	2,434	-	-	3,452	12.2	29.3
August	13.60%	3,427	1,011	2,416	-	-	3,427	12.1	29.0
September	11.50%	2,898	855	2,043	-	-	2,898	10.3	24.6
October	9.50%	2,394	2,082	312	-	-	2,394	25.0	3.8
November	6.00%	1,512	1,512	-	-	-	1,512	18.2	0.0
December	4.80%	1,209	1,209	-	-	-	1,209	14.5	0.0
	100.00%	**25,199**	13,071	12,128	-	-	**25,199**		

Critical Dry Year (12.5% Conservation)

		Demand	Ground	Contract	Winter (E)	Winter (N)	Total	Treatment Plant Capacity (MGD)[1]	
								Ground	Surface
January	4.40%	970	970	-	-	-	970	11.7	0.0
February	4.00%	882	882	-	-	-	882	10.6	0.0
March	4.80%	1,058	1,058	-	-	-	1,058	12.8	0.0
April	6.80%	1,499	692	807	-	-	1,499	8.3	9.7
May	9.50%	2,095	868	1,227	-	-	2,095	10.5	14.8
June	11.40%	2,513	964	1,549	-	-	2,513	11.6	18.7
July	13.70%	3,021	1,141	1,880	-	-	3,021	13.7	22.7
August	13.60%	2,999	1,134	1,865	-	-	2,999	13.7	22.5
September	11.50%	2,535	998	1,537	-	-	2,535	12.0	18.5
October	9.50%	2,095	1,861	234	-	-	2,095	22.4	2.8
November	6.00%	1,323	1,323	-	-	-	1,323	15.9	0.0
December	4.80%	1,058	1,058	-	-	-	1,058	12.8	0.0
	100.00%	**22,048**	12,949	9,099	-	-	**22,048**		

(Gal/Min)/Well	Min/Day	Days/Month	Gal/Ft3	ft3/ac-ft	Duty Factor	Supply ((ac-ft/mo)/well)
1800	1440	30	7.48	43560	0.67	159.90

Phase 4+D (NY)		**Use**
Number Supply Wells	13.02	13
Number Standby Wells		2
Total		**15**

		Use	
Number Supply Wells (Max Day)	13.96	14	**Max Day = 28,901 gpm / 41.5 MGD**
Number Standby Wells		2	
Total		**16**	

Phase 4+D (CDY)		**Use**
Number Supply Wells	11.64	12
Number Standby Wells		2
Total		**14**

		Use	
Number Supply Wells (Max Day)	12.48	12	**Max Day = 25,288 gpm / 36.4 MGD**
Number Standby Wells		2	
Total		**14**	

TWO WELL FIELDS REQUIRED

[1] The Treatment Plant Capacity is determined by the ratio of ground or surface water to the total monthly demand times the maximum day demand for the month. The maximum day demand for the month is determined by the ratio of the demand for the month to the demand in July times the maximum day demand in July.

Treatment Plant Capacity = (ground or surface water demand for given month)/(total demand for given month) x (max day demand for given month)

Max Day Demand (for given month) = (total demand for given month)/(total demand for July) x (max day demand for July)

Table E-1: Alternate "A" Revised Water Supply Program

Alternate A - Revised Water Supply Program - Phase 1 + A

Normal Year

		Demand	Ground	Contract	Winter (E)	Winter (N)	Total
January	4.40%	371	371	-	-	-	371
February	4.00%	338	338	-	-	-	338
March	4.80%	405	405	-	-	-	405
April	6.80%	574	574	-	-	-	574
May	9.50%	802	802	-	-	-	802
June	11.40%	962	962	-	-	-	962
July	13.70%	1,157	1,157	-	-	-	1,157
August	13.60%	1,148	1,148	-	-	-	1,148
September	11.50%	971	971	-	-	-	971
October	9.50%	802	802	-	-	-	802
November	6.00%	507	507	-	-	-	507
December	4.80%	405	405	-	-	-	405
	100.00%	**8,442**	8,442	-	-	-	**8,442**

Critical Dry Year (12.5% Conservation)

		Demand	Ground	Contract	Winter (E)	Winter (N)	Total
January	4.40%	325	325	-	-	-	325
February	4.00%	295	295	-	-	-	295
March	4.80%	355	355	-	-	-	355
April	6.80%	502	502	-	-	-	502
May	9.50%	702	702	-	-	-	702
June	11.40%	842	842	-	-	-	842
July	13.70%	1,012	1,012	-	-	-	1,012
August	13.60%	1,005	1,005	-	-	-	1,005
September	11.50%	849	849	-	-	-	849
October	9.50%	702	702	-	-	-	702
November	6.00%	443	443	-	-	-	443
December	4.80%	355	355	-	-	-	355
	100.00%	**7,387**	7,387	-	-	-	**7,387**

(Gal/Min)/Well	Min/Day	Days/Month	Gal/Ft3	ft3/ac-ft	Duty Factor	Supply ((ac-ft/mo)/well)
1800	1440	30	7.48	43560	0.67	159.90

Phase 1+A (NY)		**Use**
Number Supply Wells	7.24	7
Number Standby Wells		1
Total		**8**

		Use	
Number Supply Wells (Max Day)	5.38	5	**Max Day =9,682 gpm / 13.9 MGD**
Number Standby Wells		1	
Total		**6**	

Phase 1+A (CDY)		**Use**
Number Supply Wells	6.33	6
Number Standby Wells		1
Total		**7**

		Use	
Number Supply Wells (Max Day)	4.71	5	**Max Day = 8,473 gpm / 12.2 MGD**
Number Standby Wells		1	
Total		**6**	

ONE WELL FIELD REQUIRED

Table E-2: Alternate "A" Revised Water Supply Program

Alternate A - Revised Water Supply Program - Phase 2+B

Normal Year

		Demand	Ground	Contract	Winter (E)	Winter (N)	Total
January	4.40%	694	694	-	-	-	694
February	4.00%	631	631	-	-	-	631
March	4.80%	758	758	-	-	-	758
April	6.80%	1,073	-	1,073	-	-	1,073
May	9.50%	1,500	-	1,500	-	-	1,500
June	11.40%	1,799	-	1,799	-	-	1,799
July	13.70%	2,163	-	2,163	-	-	2,163
August	13.60%	2,147	-	2,147	-	-	2,147
September	11.50%	1,815	-	1,815	-	-	1,815
October	9.50%	1,500	1,188	312	-	-	1,500
November	6.00%	947	947	-	-	-	947
December	4.80%	758	758	-	-	-	758
	100.00%	**15,785**	4,976	10,809	-	-	**15,785**

Critical Dry Year (12.5% Conservation)

		Demand	Ground	Contract	Winter (E)	Winter (N)	Total
January	4.40%	608	608	-	-	-	608
February	4.00%	552	552	-	-	-	552
March	4.80%	663	663	-	-	-	663
April	6.80%	939	420	519	-	-	939
May	9.50%	1,312	420	892	-	-	1,312
June	11.40%	1,574	420	1,154	-	-	1,574
July	13.70%	1,892	420	1,472	-	-	1,892
August	13.60%	1,878	420	1,458	-	-	1,878
September	11.50%	1,588	420	1,168	-	-	1,588
October	9.50%	1,312	1,078	234	-	-	1,312
November	6.00%	829	829	-	-	-	829
December	4.80%	663	663	-	-	-	663
	100.00%	**13,810**	6,913	6,897	-	-	**13,810**

(Gal/Min)/Well	Min/Day	Days/Month	Gal/Ft3	ft3/ac-ft	Duty Factor	Supply ((ac-ft/mo)/well)
1800	1440	30	7.48	43560	0.67	159.90

Phase 2+B (NY)		**Use**	
Number Supply Wells	7.43	7	
Number Standby Wells		1	
Total		**8**	

		Use	
Number Supply Wells (Max Day)	7.97	8	**Max Day =18,104 gpm / 26.0 MGD**
Number Standby Wells		1	
Total		**9**	

Phase 2+B (CDY)		**Use**	
Number Supply Wells	6.74	7	
Number Standby Wells		1	
Total		**8**	

		Use	
Number Supply Wells (Max Day)	7.23	7	**Max Day = 15,840 gpm / 22.8 MGD**
Number Standby Wells		1	
Total		**8**	

ONE WELL FIELD REQUIRED

Table E-3: Alternate "A" Revised Water Supply Program

Alternate A - Revised Water Supply Program - Phase 3+C

Normal Year

		Demand	Ground	Contract	Winter (E)	Winter (N)	Total
January	4.40%	901	901	-	-	-	901
February	4.00%	819	819	-	-	-	819
March	4.80%	982	982	-	-	-	982
April	6.80%	1,392	-	1,392	-	-	1,392
May	9.50%	1,944	-	1,944	-	-	1,944
June	11.40%	2,334	-	2,334	-	-	2,334
July	13.70%	2,804	-	2,804	-	-	2,804
August	13.60%	2,784	-	2,784	-	-	2,784
September	11.50%	2,354	-	2,354	-	-	2,354
October	9.50%	1,944	1,632	312	-	-	1,944
November	6.00%	1,228	1,228	-	-	-	1,228
December	4.80%	982	982	-	-	-	982
	100.00%	**20,468**	6,544	13,924	-	-	**20,468**

Critical Dry Year (12.5% Conservation)

		Demand	Ground	Contract	Winter (E)	Winter (N)	Total
January	4.40%	788	788	-	-	-	788
February	4.00%	716	716	-	-	-	716
March	4.80%	860	860	-	-	-	860
April	6.80%	1,218	640	578	-	-	1,218
May	9.50%	1,701	640	1,061	-	-	1,701
June	11.40%	2,042	640	1,402	-	-	2,042
July	13.70%	2,453	640	1,813	-	-	2,453
August	13.60%	2,435	640	1,795	-	-	2,435
September	11.50%	2,059	640	1,419	-	-	2,059
October	9.50%	1,701	1,467	234	-	-	1,701
November	6.00%	1,074	1,074	-	-	-	1,074
December	4.80%	860	860	-	-	-	860
	100.00%	**17,907**	9,605	8,302	-	-	**17,907**

(Gal/Min)/Well	Min/Day	Days/Month	Gal/Ft3	ft3/ac-ft	Duty Factor	Supply ((ac-ft/mo)/well)
1800	1440	30	7.48	43560	0.67	159.90

Phase 3+C (NY)		**Use**	
Number Supply Wells	10.21	10	
Number Standby Wells		2	
Total		**12**	

		Use	
Number Supply Wells (Max Day)	10.95	11	**Max Day = 23,475 gpm / 33.7 MGD**
Number Standby Wells		2	
Total		**13**	

Phase 3+C (CDY)		**Use**	
Number Supply Wells	9.17	9	
Number Standby Wells		2	
Total		**11**	

		Use	
Number Supply Wells (Max Day)	9.84	10	**Max Day = 20,539 gpm / 29.6 MGD**
Number Standby Wells		2	
Total		**12**	

TWO WELL FIELDS REQUIRED

Table E-4: Alternate "A" Revised Water Supply Program

Alternate A - Revised Water Supply Program - Phase 4+D

Normal Year

		Demand	Ground	Contract	Winter (E)	Winter (N)	Total	Treatment Plant Capacity (MGD)[1]	
								Ground	Surface
January	4.40%	1,109	1,109	-	-	-	1,109	13.3	0.0
February	4.00%	1,008	1,008	-	-	-	1,008	12.1	0.0
March	4.80%	1,209	1,209	-	-	-	1,209	14.5	0.0
April	6.80%	1,714	-	1,714	-	-	1,714	0.0	20.6
May	9.50%	2,394	-	2,394	-	-	2,394	0.0	28.8
June	11.40%	2,873	-	2,873	-	-	2,873	0.0	34.5
July	13.70%	3,452	535	2,917	-	-	3,452	6.4	35.1
August	13.60%	3,427	510	2,917	-	-	3,427	6.1	35.1
September	11.50%	2,898	387	2,511	-	-	2,898	4.7	30.2
October	9.50%	2,394	2,082	312	-	-	2,394	25.0	3.8
November	6.00%	1,512	1,512	-	-	-	1,512	18.2	0.0
December	4.80%	1,209	1,209	-	-	-	1,209	14.5	0.0
	100.00%	**25,199**	9,561	15,638	-	-	**25,199**		

Critical Dry Year (12.5% Conservation)

		Demand	Ground	Contract	Winter (E)	Winter (N)	Total	Treatment Plant Capacity (MGD)[1]	
								Ground	Surface
January	4.40%	970	970	-	-	-	970	11.7	0.0
February	4.00%	882	882	-	-	-	882	10.6	0.0
March	4.80%	1,058	1,058	-	-	-	1,058	12.8	0.0
April	6.80%	1,499	880	619	-	-	1,499	10.6	7.5
May	9.50%	2,095	880	1,215	-	-	2,095	10.6	14.6
June	11.40%	2,513	880	1,633	-	-	2,513	10.6	19.7
July	13.70%	3,021	880	2,141	-	-	3,021	10.6	25.8
August	13.60%	2,999	880	2,119	-	-	2,999	10.6	25.5
September	11.50%	2,535	880	1,655	-	-	2,535	10.6	19.9
October	9.50%	2,095	1,861	234	-	-	2,095	22.4	2.8
November	6.00%	1,323	1,323	-	-	-	1,323	15.9	0.0
December	4.80%	1,058	1,058	-	-	-	1,058	12.8	0.0
	100.00%	**22,048**	12,432	9,616	-	-	**22,048**		

(Gal/Min)/Well	Min/Day	Days/Month	Gal/Ft3	ft3/ac-ft	Duty Factor	Supply ((ac-ft/mo)/well)
1800	1440	30	7.48	43560	0.67	159.90

Phase 4+D (NY)		**Use**
Number Supply Wells	13.02	13
Number Standby Wells		2
Total		**15**

		Use	
Number Supply Wells (Max D	13.96	14	**Max Day = 28,901 gpm / 41.5 MGD**
Number Standby Wells		2	
Total		**16**	

Phase 4+D (CDY)		**Use**
Number Supply Wells	11.64	12
Number Standby Wells		2
Total		**14**

		Use	
Number Supply Wells (Max D	12.48	12	**Max Day = 25,288 gpm / 36.4 MGD**
Number Standby Wells		2	
Total		**14**	

TWO WELL FIELDS REQUIRED

[1] The Treatment Plant Capacity is determined by the ratio of ground or surface water to the total monthly demand times the maximum day demand for the month. The maximum day demand for the month is determined by the ratio of the demand for the month to the demand in July times the maximum day demand in July.

Treatment Plant Capacity = (ground or surface water demand for given month)/(total demand for given month) x (max day demand for given month)

Max Day Demand (for given month) = (total demand for given month)/(total demand for July) x (max day demand for July)

Table F-1: Alternate "B" Winter Diversion Water Supply Program

Alternate B - Winter Diversion Water Supply Program - Phase 1 + A

Normal Year

		Demand	Ground	Contract	Winter (E)	Winter (N)	Total
January	4.40%	371	371	-	-	-	371
February	4.00%	338	338	-	-	-	338
March	4.80%	405	405	-	-	-	405
April	6.80%	574	574	-	-	-	574
May	9.50%	802	802	-	-	-	802
June	11.40%	962	962	-	-	-	962
July	13.70%	1,157	1,157	-	-	-	1,157
August	13.60%	1,148	1,148	-	-	-	1,148
September	11.50%	971	971	-	-	-	971
October	9.50%	802	802	-	-	-	802
November	6.00%	507	507	-	-	-	507
December	4.80%	405	405	-	-	-	405
	100.00%	**8,442**	8,442	-	-	-	**8,442**

Critical Dry Year (12.5% Conservation)

		Demand	Ground	Contract	Winter (E)	Winter (N)	Total
January	4.40%	325	325	-	-	-	325
February	4.00%	295	295	-	-	-	295
March	4.80%	355	355	-	-	-	355
April	6.80%	502	502	-	-	-	502
May	9.50%	702	702	-	-	-	702
June	11.40%	842	842	-	-	-	842
July	13.70%	1,012	1,012	-	-	-	1,012
August	13.60%	1,005	1,005	-	-	-	1,005
September	11.50%	849	849	-	-	-	849
October	9.50%	702	702	-	-	-	702
November	6.00%	443	443	-	-	-	443
December	4.80%	355	355	-	-	-	355
	100.00%	**7,387**	7,387	-	-	-	**7,387**

(Gal/Min)/Well	Min/Day	Days/Month	Gal/Ft3	ft3/ac-ft	Duty Factor	Supply ((ac-ft/mo)/well)
1800	1440	30	7.48	43560	0.67	159.90

Phase 1+A (NY)		**Use**	
Number Supply Wells	7.24	7	
Number Standby Wells		1	
Total		**8**	

		Use	
Number Supply Wells (Max Day)	5.38	5	**Max Day =9,682 gpm / 13.9 MGD**
Number Standby Wells		1	
Total		**6**	

Phase 1+A (CDY)		**Use**	
Number Supply Wells	6.33	6	
Number Standby Wells		1	
Total		**7**	

		Use	
Number Supply Wells (Max Day)	4.71	5	**Max Day = 8,473 gpm / 12.2 MGD**
Number Standby Wells		1	
Total		**6**	

ONE WELL FIELD REQUIRED

Table F-2: Alternate "B" Winter Diversion Water Supply Program

Alternate B - Winter Diversion Water Supply Program - Phase 2+B

Normal Year

		Demand	Ground	Contract	Winter (E)	Winter (N)	Total
January	4.40%	694	294	-	-	400	694
February	4.00%	631	231	-	-	400	631
March	4.80%	758	358	-	-	400	758
April	6.80%	1,073	500	573	-	-	1,073
May	9.50%	1,500	650	850	-	-	1,500
June	11.40%	1,799	680	1,119	-	-	1,799
July	13.70%	2,163	750	1,413	-	-	2,163
August	13.60%	2,147	730	1,417	-	-	2,147
September	11.50%	1,815	650	1,165	-	-	1,815
October	9.50%	1,500	788	312	-	400	1,500
November	6.00%	947	547	-	-	400	947
December	4.80%	758	358	-	-	400	758
	100.00%	**15,785**	6,536	6,849	-	2,400	**15,785**

Critical Dry Year (12.5% Conservation)

		Demand	Ground	Contract	Winter (E)	Winter (N)	Total
January	4.40%	608	408	-	-	200	608
February	4.00%	552	352	-	-	200	552
March	4.80%	663	463	-	-	200	663
April	6.80%	939	830	109	-	-	939
May	9.50%	1,312	1,010	302	-	-	1,312
June	11.40%	1,574	1,044	530	-	-	1,574
July	13.70%	1,892	1,066	826	-	-	1,892
August	13.60%	1,878	1,056	822	-	-	1,878
September	11.50%	1,588	1,040	548	-	-	1,588
October	9.50%	1,312	878	234	-	200	1,312
November	6.00%	829	629	-	-	200	829
December	4.80%	663	463	-	-	200	663
	100.00%	**13,810**	9,239	3,371	-	1,200	**13,810**

(Gal/Min)/Well	Min/Day	Days/Month	Gal/Ft3	ft3/ac-ft	Duty Factor	Supply ((ac-ft/mo)/well)
1800	1440	30	7.48	43560	0.67	159.90

Phase 2+B (NY)		**Use**
Number Supply Wells	4.93	5
Number Standby Wells		1
Total		**6**

		Use	
Number Supply Wells (Max Day)	5.28	5	**Max Day =18,104 gpm / 26.0 MGD**
Number Standby Wells		1	
Total		**6**	

Phase 2+B (CDY)		**Use**
Number Supply Wells	6.67	7
Number Standby Wells		1
Total		**8**

		Use	
Number Supply Wells (Max Day)	4.96	5	**Max Day = 15,840 gpm / 22.8 MGD**
Number Standby Wells		1	
Total		**6**	

ONE WELL FIELD REQUIRED

Table F-3: Alternate "B" Winter Diversion Water Supply Program

Alternate B - Winter Diversion Water Supply Program - Phase 3+C

Normal Year

		Demand	Ground	Contract	Winter (E)	Winter (N)	Total
January	4.40%	901	251	-	-	650	901
February	4.00%	819	219	-	-	600	819
March	4.80%	982	382	-	-	600	982
April	6.80%	1,392	308	1,084	-	-	1,392
May	9.50%	1,944	407	1,537	-	-	1,944
June	11.40%	2,334	607	1,727	-	-	2,334
July	13.70%	2,804	806	1,998	-	-	2,804
August	13.60%	2,784	791	1,993	-	-	2,784
September	11.50%	2,354	607	1,747	-	-	2,354
October	9.50%	1,944	982	312	-	650	1,944
November	6.00%	1,228	578	-	-	650	1,228
December	4.80%	982	332	-	-	650	982
	100.00%	**20,468**	6,270	10,398	-	3,800	**20,468**

Critical Dry Year (12.5% Conservation)

		Demand	Ground	Contract	Winter (E)	Winter (N)	Total
January	4.40%	788	463	-	-	325	788
February	4.00%	716	416	-	-	300	716
March	4.80%	860	560	-	-	300	860
April	6.80%	1,218	613	605	-	-	1,218
May	9.50%	1,701	699	1,002	-	-	1,701
June	11.40%	2,042	874	1,168	-	-	2,042
July	13.70%	2,453	1,047	1,406	-	-	2,453
August	13.60%	2,435	1,035	1,400	-	-	2,435
September	11.50%	2,059	874	1,185	-	-	2,059
October	9.50%	1,701	1,142	234	-	325	1,701
November	6.00%	1,074	749	-	-	325	1,074
December	4.80%	860	535	-	-	325	860
	100.00%	**17,907**	9,007	7,000	-	1,900	**17,907**

(Gal/Min)/Well	Min/Day	Days/Month	Gal/Ft3	ft3/ac-ft	Duty Factor	Supply ((ac-ft/mo)/well)
1800	1440	30	7.48	43560	0.67	159.90

Phase 3+C (NY)		**Use**
Number Supply Wells	6.14	6
Number Standby Wells		1
Total		**7**

		Use	
Number Supply Wells (Max Day)	6.59	7	**Max Day = 23,475 gpm / 33.7 MGD**
Number Standby Wells		1	
Total		**8**	

Phase 3+C (CDY)		**Use**
Number Supply Wells	7.14	7
Number Standby Wells		1
Total		**8**

		Use	
Number Supply Wells (Max Day)	7.66	8	**Max Day = 20,539 gpm / 29.6 MGD**
Number Standby Wells		1	
Total		**9**	

ONE WELL FIELD REQUIRED

Table F-4: Alternate "B" Winter Diversion Water Supply Program

Alternate B - Winter Diversion Water Supply Program - Phase 4+D

Normal Year

		Demand	Ground	Contract	Winter (E)	Winter (N)	Total	Treatment Plant Capacity (MGD)[1] Ground	Surface
January	4.40%	1,109	273	-	-	836	1,109	3.3	0.0
February	4.00%	1,008	270	-	-	738	1,008	3.2	0.0
March	4.80%	1,209	276	-	-	933	1,209	3.3	0.0
April	6.80%	1,714	449	1,265	-	-	1,714	5.4	15.2
May	9.50%	2,394	699	1,695	-	-	2,394	8.4	20.4
June	11.40%	2,873	699	2,174	-	-	2,873	8.4	26.1
July	13.70%	3,452	699	2,753	-	-	3,452	8.4	33.1
August	13.60%	3,427	699	2,728	-	-	3,427	8.4	32.8
September	11.50%	2,898	699	2,199	-	-	2,898	8.4	26.4
October	9.50%	2,394	1,253	312	-	829	2,394	15.1	3.8
November	6.00%	1,512	285	-	-	1,227	1,512	3.4	0.0
December	4.80%	1,209	276	-	-	933	1,209	3.3	0.0
	100.00%	**25,199**	6,577	13,126	-	5,496	**25,199**		

Critical Dry Year (12.5% Conservation)

		Demand	Ground	Contract	Winter (E)	Winter (N)	Total	Treatment Plant Capacity (MGD)[1] Ground	Surface
January	4.40%	970	229	-	-	741	970	2.8	0.0
February	4.00%	882	226	-	-	656	882	2.7	0.0
March	4.80%	1,058	431	-	-	627	1,058	5.2	0.0
April	6.80%	1,499	1,038	461	-	-	1,499	12.5	5.6
May	9.50%	2,095	1,048	1,047	-	-	2,095	12.6	12.6
June	11.40%	2,513	1,058	1,455	-	-	2,513	12.8	17.5
July	13.70%	3,021	1,066	1,955	-	-	3,021	12.8	23.6
August	13.60%	2,999	1,058	1,941	-	-	2,999	12.7	23.4
September	11.50%	2,535	1,038	1,497	-	-	2,535	12.5	18.0
October	9.50%	2,095	1,213	234	-	648	2,095	14.6	2.8
November	6.00%	1,323	640	-	-	683	1,323	7.7	0.0
December	4.80%	1,058	231	-	-	827	1,058	2.8	0.0
	100.00%	**22,048**	9,276	8,590	-	4,182	**22,048**		

(Gal/Min)/Well	Min/Day	Days/Month	Gal/Ft3	ft3/ac-ft	Duty Factor	Supply ((ac-ft/mo)/well)
1800	1440	30	7.48	43560	0.67	159.90

Phase 4+D (NY)		**Use**
Number Supply Wells	7.84	8
Number Standby Wells		1
Total		**9**

		Use	
Number Supply Wells (Max Day)	8.40	8	**Max Day = 28,901 gpm / 41.5 MGD**
Number Standby Wells		1	
Total		**9**	

Phase 4+D (CDY)		**Use**
Number Supply Wells	7.59	8
Number Standby Wells		1
Total		**9**

		Use	
Number Supply Wells (Max Day)	8.13	8	**Max Day = 25,288 gpm / 36.4 MGD**
Number Standby Wells		1	
Total		**9**	

ONE WELL FIELD REQUIRED

[1] The Treatment Plant Capacity is determined by the ratio of ground or surface water to the total monthly demand times the maximum day demand for the month. The maximum day demand for the month is determined by the ratio of the demand for the month to the demand in July times the maximum day demand in July.

Treatment Plant Capacity = (ground or surface water demand for given month)/(total demand for given month) x (max day demand for given month)

Max Day Demand (for given month) = (total demand for given month)/(total demand for July) x (max day demand for July)

Table G
Water Conservation Calculation

Proposed Water Supply Program

	Groundwater Supply			Surface Water Supply						Total Water Supply		
				Settlement Contract			Winter Diversion					
Month	Normal Year	Critically Dry Year	Reduction	Normal Year	Critically Dry Year	Reduction	Normal Year	Critically Dry Year	Reduction	Normal Year	Critically Dry Year	Reduction
January	1,109	970	12.5%	-	-	-	-	-	n/a	1,109	970	12.5%
February	1,008	882	12.5%	-	-	-	-	-	n/a	1,008	882	12.5%
March	1,209	1,058	12.5%	-	-	-	-	-	n/a	1,209	1,058	12.5%
April	505	692	-37.0%	1,209	807	33.3%	-	-	n/a	1,714	1,499	12.5%
May	706	868	-22.9%	1,688	1,227	27.3%	-	-	n/a	2,394	2,095	12.5%
June	847	964	-13.8%	2,026	1,549	23.5%	-	-	n/a	2,873	2,513	12.5%
July	1,018	1,141	-12.1%	2,434	1,880	22.8%	-	-	n/a	3,452	3,021	12.5%
August	1,011	1,134	-12.2%	2,416	1,865	22.8%	-	-	n/a	3,427	2,999	12.5%
September	855	998	-16.7%	2,043	1,537	24.8%	-	-	n/a	2,898	2,535	12.5%
October	2,082	1,861	10.6%	312	234	25.0%	-	-	n/a	2,394	2,095	12.5%
November	1,512	1,323	12.5%	-	-	-	-	-	n/a	1,512	1,323	12.5%
December	1,209	1,058	12.5%	-	-	-	-	-	n/a	1,209	1,058	12.5%
Total	**13,071**	**12,949**	**0.9%**	**12,128**	**9,099**	**25.0%**	**-**	**-**	**n/a**	**25,199**	**22,048**	**12.5%**

Alternate "A" Water Supply Program

	Groundwater			Surface Water Supply						Total Water Supply		
				Settlement Contract			Winter Diversion					
Month	Normal Year	Critically Dry Year	Reduction	Normal Year	Critically Dry Year	Reduction	Normal Year	Critically Dry Year	Reduction	Normal Year	Critically Dry Year	Reduction
January	1,109	970	12.5%	-	-	-	-	-	n/a	1,109	970	12.5%
February	1,008	882	12.5%	-	-	-	-	-	n/a	1,008	882	12.5%
March	1,209	1,058	12.5%	-	-	-	-	-	n/a	1,209	1,058	12.5%
April	-	880	n/a	1,714	619	63.9%	-	-	n/a	1,714	1,499	12.5%
May	-	880	n/a	2,394	1,215	49.2%	-	-	n/a	2,394	2,095	12.5%
June	-	880	n/a	2,873	1,633	43.2%	-	-	n/a	2,873	2,513	12.5%
July	535	880	-64.5%	2,917	2,141	26.6%	-	-	n/a	3,452	3,021	12.5%
August	510	880	-72.5%	2,917	2,119	27.4%	-	-	n/a	3,427	2,999	12.5%
September	387	880	-127.4%	2,511	1,655	34.1%	-	-	n/a	2,898	2,535	12.5%
October	2,082	1,861	10.6%	312	234	25.0%	-	-	n/a	2,394	2,095	12.5%
November	1,512	1,323	12.5%	-	-	-	-	-	n/a	1,512	1,323	12.5%
December	1,209	1,058	12.5%	-	-	-	-	-	n/a	1,209	1,058	12.5%
Total	**9,561**	**12,432**	**-30.0%**	**15,638**	**9,616**	**38.5%**	**-**	**-**	**n/a**	**25,199**	**22,048**	**12.5%**

Table G (continued)
Water Conservation Calculation

Alternate "B" Water Supply Program

	Groundwater			Surface Water Supply						Total Water Supply		
				Settlement Contract			Winter Diversion					
Month	Normal Year	Critically Dry Year	Reduction	Normal Year	Critically Dry Year	Reduction	Normal Year	Critically Dry Year	Reduction	Normal Year	Critically Dry Year	Reduction
January	273	229	16.1%	-	-	-	836	741	11.4%	1,109	970	12.5%
February	270	226	16.3%	-	-	-	738	656	11.1%	1,008	882	12.5%
March	276	431	-56.2%	-	-	-	933	627	32.8%	1,209	1,058	12.5%
April	449	1,038	-131.2%	1,265	461	63.6%	-	-	n/a	1,714	1,499	12.5%
May	699	1,048	-49.9%	1,695	1,047	38.2%	-	-	n/a	2,394	2,095	12.5%
June	699	1,058	-51.4%	2,174	1,455	33.1%	-	-	n/a	2,873	2,513	12.5%
July	699	1,066	-52.5%	2,753	1,955	29.0%	-	-	n/a	3,452	3,021	12.5%
August	699	1,058	-51.4%	2,728	1,941	28.8%	-	-	n/a	3,427	2,999	12.5%
September	699	1,038	-48.5%	2,199	1,497	31.9%	-	-	n/a	2,898	2,535	12.5%
October	1,253	1,213	3.2%	312	234	25.0%	829	648	21.8%	2,394	2,095	12.5%
November	285	640	-124.6%	-	-	-	1,227	683	44.3%	1,512	1,323	12.5%
December	276	231	16.3%	-	-	-	933	827	11.4%	1,209	1,058	12.5%
Total	**6,577**	**9,276**	**-41.0%**	**13,126**	**8,590**	**34.6%**	**5,496**	**4,182**	**23.9%**	**25,199**	**22,048**	**12.5%**

Table H
Current to Future Land Use for Irrigated Agriculture in Project Area

Phase	Development Type	Irrigated Lands	Irrigated Lands (acres by years from start of project)						
			Current	5	7[1]	10	12[2]	15[3]	20[4]
Phase 1+A	Residential	shareholders	990	283	0	0	0	0	0
		non-shareholders	563	161	0	0	0	0	0
	Industrial	shareholders	601	172	0	0	0	0	0
		non-shareholders	88	25	0	0	0	0	0
Phase 2+B	Residential	shareholders	1,187	1,187	1,187	475	0	0	0
		non-shareholders	223	223	223	89	0	0	0
	Industrial	shareholders	598	598	598	239	0	0	0
		non-shareholders	268	268	268	107	0	0	0
Phase 3+C	Residential	shareholders	425	425	425	425	425	0	0
		non-shareholders	427	427	427	427	427	0	0
	Industrial	shareholders	708	708	708	708	708	0	0
		non-shareholders	186	186	186	186	186	0	0
Phase 4+D	Residential	shareholders	129	129	129	129	129	129	0
		non-shareholders	363	363	363	363	363	363	0
	Industrial	shareholders	746	746	746	746	746	746	0
		non-shareholders	23	23	23	23	23	23	0
Total Irrigated Acres[5]			**7,525**	**5,924**	**5,283**	**3,917**	**3,007**	**1,261**	**0**

(1) Anticipated Phase 1+A build out.
(2) Anticipated Phase 2+B build out.
(3) Anticipated Phase 3+C build out.
(4) Anticipated Phase 4+D build out.
(5) The totals represented in this table exclude non-irrigated lands that are currently part of the existing large businesses within the plan area, approximately 250 Acres+\-.
(6) This table reflects 2007 land use absorption assumptions. These numbers may differ slightly from the 2008 Land Use Plan, but probably not significantly.

Table I

Intentionally Blank

Table J-1
Current and Projected Water Demands in Sutter Pointe Service Area
Normal Year Condition

Sutter Pointe Demand Scenarios		Project Demands (ac-ft by 5-Yr Increments)						
		Current	5	7[1]	10	12[2]	15[3]	20[4]
Proposed WSP Phase 1+A	Indoor Demands	0	3,794	5,312	5,312	5,312	5,312	5,312
	Outdoor Demands	0	2,236	3,130	3,130	3,130	3,130	3,130
Proposed WSP Ultimate	Indoor Demands	0	3,794	5,312	7,798	9,455	12,722	16,002
	Outdoor Demands	0	2,236	3,130	5,050	6,330	7,746	9,197
Alternate A WSP Phase 1+A	Indoor Demands	0	3,794	5,312	5,312	5,312	5,312	5,312
	Outdoor Demands	0	2,236	3,130	3,130	3,130	3,130	3,130
Alternate A WSP Ultimate	Indoor Demands	0	3,794	5,312	7,798	9,455	12,722	16,002
	Outdoor Demands	0	2,236	3,130	5,050	6,330	7,746	9,197
Alternate B WSP Phase 1+A	Indoor Demands	0	3,794	5,312	5,312	5,312	5,312	5,312
	Outdoor Demands	0	2,236	3,130	3,130	3,130	3,130	3,130
Alternate B WSP Ultimate	Indoor Demands	0	3,794	5,312	7,798	9,455	12,722	16,002
	Outdoor Demands	0	2,236	3,130	5,050	6,330	7,746	9,197

(1) Anticipated Phase 1+A build out.

(2) Anticipated Phase 2+B build out.

(3) Anticipated Phase 3+C build out.

(4) Anticipated Phase 4+D build out.

Table J-2
Current and Projected Water Demands in Sutter Pointe Service Area
Critical Dry Year Condition

Sutter Pointe Demand Scenarios		Project Demands (ac-ft by 5-Yr Increments)						
		Current	5	7[(1)]	10	12[(2)]	15[(3)]	20[(4)]
Proposed WSP Phase 1+A	Indoor Demands	0	3,320	4,648	4,648	4,648	4,648	4,648
	Outdoor Demands	0	1,956	2,739	2,739	2,739	2,739	2,739
Proposed WSP Ultimate	Indoor Demands	0	3,320	4,648	6,822	8,271	11,129	14,000
	Outdoor Demands	0	1,956	2,739	4,419	5,539	6,778	8,048
Alternate A WSP Phase 1+A	Indoor Demands	0	3,320	4,648	4,648	4,648	4,648	4,648
	Outdoor Demands	0	1,956	2,739	2,739	2,739	2,739	2,739
Alternate A WSP Ultimate	Indoor Demands	0	3,320	4,648	6,822	8,271	11,129	14,000
	Outdoor Demands	0	1,956	2,739	4,419	5,539	6,778	8,048
Alternate B WSP Phase 1+A	Indoor Demands	0	3,320	4,648	4,648	4,648	4,648	4,648
	Outdoor Demands	0	1,956	2,739	2,739	2,739	2,739	2,739
Alternate B WSP Ultimate	Indoor Demands	0	3,320	4,648	6,822	8,271	11,129	14,000
	Outdoor Demands	0	1,956	2,739	4,419	5,539	6,778	8,048

(1) Anticipated Phase 1+A build out.

(2) Anticipated Phase 2+B build out.

(3) Anticipated Phase 3+C build out.

(4) Anticipated Phase 4+D build out.

Table K

Project# 7900-00
Date: 05/16/08
Sutter Pointe - Total Water Demand & EDU Calculations - Normal Year (Ultimate Buildout)

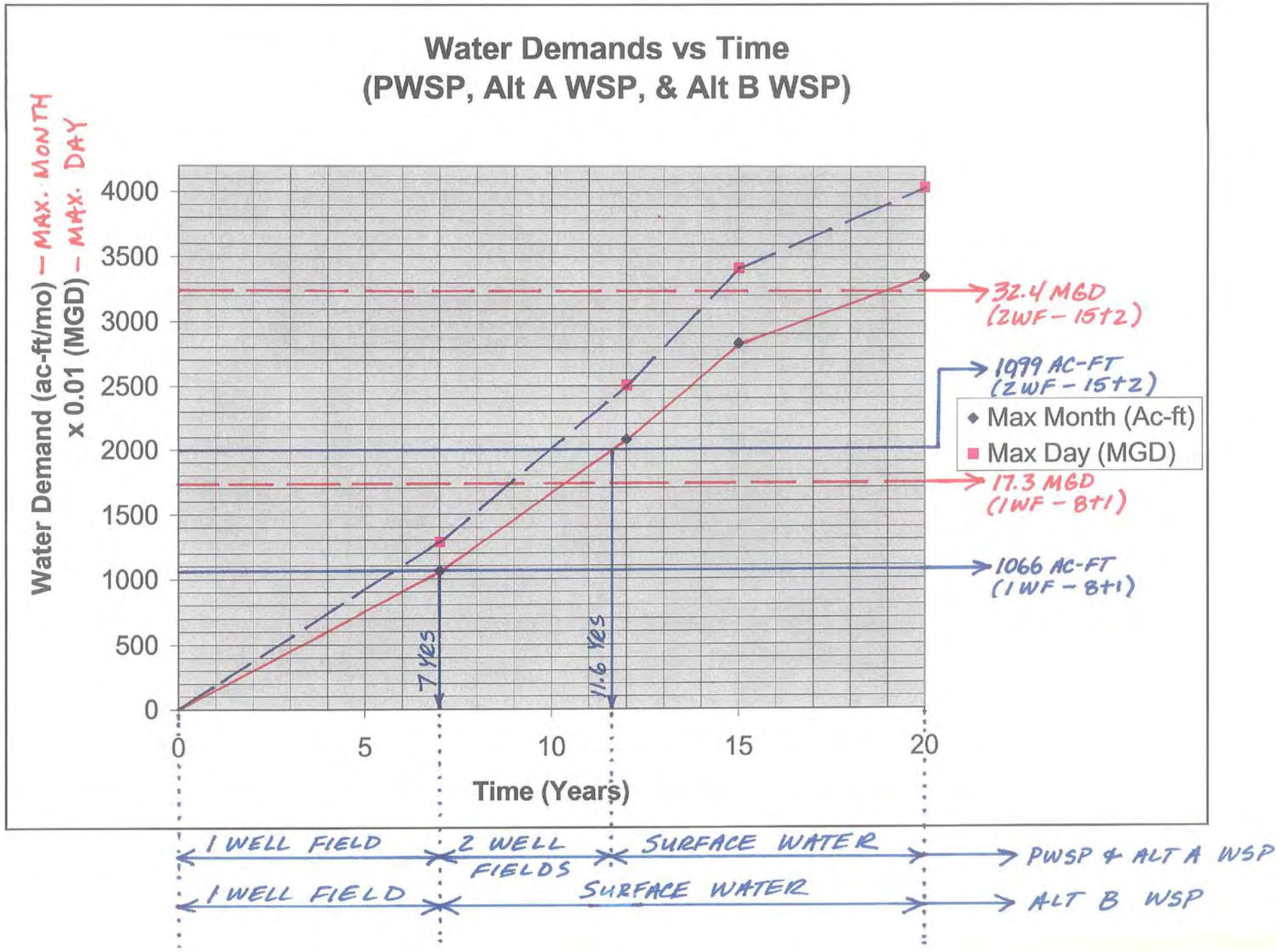
	Land Use	Rate [1] (ac-ft/ac/yr)	Area [2] (acre)	Avg. Annual Demand (ac-ft/yr)	Avg. Day Demand (gpm)	Max Day Demand (gpm)	Peak Hour Demand (gpm)	Proposed Units	Proposed Area (acres)	EDU's [3]	EDU Ratio (EDU/DU)	EDU Ratio (EDU/acre)
a	b	c	d	f=c*d	g=f*0.62	h=g*1.85	I=h*1.91					
Residential	Low Density (LDR)	3.67	512.8	1,882	1,167	2,159	4,123	1,461	-	2,780	1.90	-
	Medium Density (MDR)	4.17	1,950.3	8,133	5,042	9,328	17,816	12,014	-	12,014	1.00	-
	High Density (HDR)	4.67	187.7	877	544	1,006	1,921	3,378	-	1,296	0.38	-
	Residential Roads	0.20	244.2	49	30	56	107	-	244	72	-	0.30
	Res. Total		***2,895.0***	***10,941***	***6,783***	***12,549***	***23,968***			***16,162***		
Public Facilities	Community Parks	4.08	431.9	1,762	1,092	2,021	3,860	-	432	2,603	-	6.03
	Open Space - High	4.08	166.4	679	421	779	1,487	-	166	1,003	-	6.03
	Open Space - Medium	2.34	132.3	310	192	356	679	-	132	458	-	3.46
	Open Space - Low	0.60	96.1	58	36	67	127	-	96	86	-	0.89
												-
	K-8 School	3.67	121.7	447	277	513	979	-	122	660	-	5.42
	High School	3.67	52.9	194	120	223	425	-	53	287	-	5.42
	Public Total		***1,001.3***	***3,450***	***2,139***	***3,957***	***7,558***			***5,096***		
Industrial	Employment 1	3.00	580.4	1,741	1,079	1,997	3,814	-	580	2,572	-	4.43
	Employment 2	3.00	1,990.5	5,972	3,702	6,849	13,082	-	1,991	8,822	-	4.43
	Employment Roads	0.20	303.8	61	38	70	134	-	304	90	-	0.30
	Commercial Retail	3.00	178.2	535	332	614	1,172	-	178	790	-	4.43
	Mixed Use	3.00	164.1	492	305	564	1,078	-	164	727	-	4.43
	Industrial Drainage Basins	0.60	414.3	249	154	286	545	-	414	368	-	0.89
	Indus. Total		***3,631.3***	***9,050***	***5,611***	***10,380***	***19,825***			***13,369***		
	Subtotal		**7,527.6**	**23,441**	***14,533***	***26,885***	***51,351***			***34,627***		
	7.5% System Loss		-	1,758	1,090	2,016	3,851			2,597		
	Totals		**7,527.6**	**25,199**	**15,622**	**28,902**	**55,202**			***37,224***		
	Totals (mgd)				**22.5**	**41.6**	**79.5**					

[1] Unit Water Demands based on typical urban water demand factors for the Sacramento Region.
[2] Areas were determined from the land use plan prepared by EDAW dated 02-08-08.
[3] 1 EDU is equivalent to 0.6769 ac-ft/yr/DU.

Table L: Water Demand Factor and Peaking Factor Comparison

5/15/2008

Land Use Category	*Sutter Pointe Water Master Plan*			*City of Sacramento - Panhandle Project*			*SCWA Zone 40 Water Master Plan*			*NCMWC-Integrated Water Resources Management Plan*			*Arden Cordova - Westborough Project*		
	Unit Water Demand Factor (ac-ft/ac/yr)	*Max. Day Demand PF*	*Peak Hour Demand PF*	*Unit Water Demand Factor* (ac-ft/ac/yr)	*Max. Day Demand PF*	*Peak Hour Demand PF*	*Unit Water Demand Factor* (ac-ft/ac/yr)	*Max. Day Demand PF*	*Peak Hour Demand PF*	*Unit Water Demand Factor* (ac-ft/ac/yr)	*Max. Day Demand PF*	*Peak Hour Demand PF*	*Unit Water Demand Factor* (ac-ft/ac/yr)	*Max. Day Demand PF*	*Peak Hour Demand PF*
Residential															
LDR	3.67	1.85	1.91	2.81	1.80	1.30	2.89	2.00	2.00	3.60	1.24	-	3.67	1.85	1.50
MDR	4.17	1.85	1.91	3.60	1.80	1.30	3.70	2.00	2.00	3.60	1.24	-	3.67	1.85	1.50
HDR	4.67	1.85	1.91	3.60	1.80	1.30	4.12	2.00	2.00	3.60	1.24	-	4.67	1.85	1.50
Public Facilities															
Parks/Recreational	4.08	1.85	1.91	4.20	1.80	1.30	3.46	2.00	2.00	-	1.24	-	4.08	1.85	1.50
Open Space (Non-Irrigated)	0.60	1.85	1.91	-	1.80	1.30	-	2.00	2.00	-	1.24	-	0.00	1.85	1.50
Schools	3.67	1.85	1.91	2.50	1.80	1.30	3.46	2.00	2.00	-	1.24	-	3.67	1.85	1.50
Industrial															
Commercial Retail	3.00	1.85	1.91	3.00	1.80	1.30	2.75	2.00	2.00	-	1.24	-	3.00	1.85	1.50
Mixed Use	3.00	1.85	1.91	3.00	1.80	1.30	2.51	2.00	2.00	-	1.24	-	3.00	1.85	1.50
Industrial/Employment	3.00	1.85	1.91	4.00	1.80	1.30	2.71	2.00	2.00	-	1.24	-	3.00	1.85	1.50
Drainage Basins/Channels	0.60	1.85	1.91	-	1.80	1.30	-	2.00	2.00	-	1.24	-	0.40	1.85	1.50
Develeoped Land Use															
Roadways	0.20	1.85	1.91	0.00	1.80	1.30	0.21	2.00	2.00	-	1.24	-	0.00	1.85	1.50


Water Demands vs Time
(PWSP, Alt A WSP, & Alt B WSP)
Water Demand (ac-ft/mo) – MAX. MONTH
x 0.01 (MGD) – MAX. DAY
4000
3500
3000
2500
2000
1500
1000
500
0
0
5
10
15
20
Time (Years)
32.4 MGD
(2WF – 15+2)
1099 AC-FT
(2WF – 15+2)
Max Month (Ac-ft)
Max Day (MGD)
17.3 MGD
(1WF – 8+1)
1066 AC-FT
(1WF – 8+1)
7 YRS
11.6 YRS
1 WELL FIELD
2 WELL FIELDS
SURFACE WATER
PWSP & ALT A WSP
1 WELL FIELD
SURFACE WATER
ALT B WSP

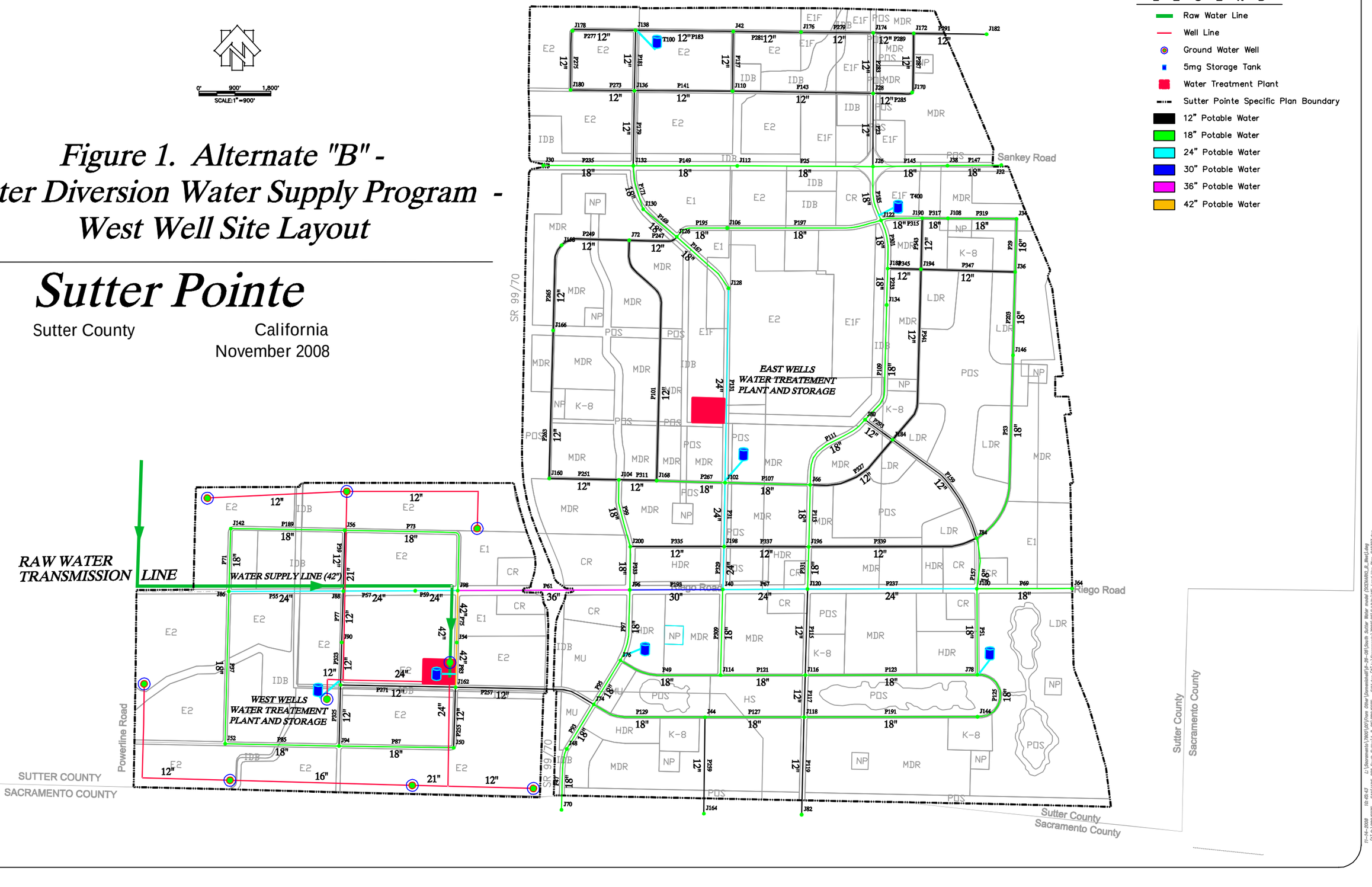
Appendix C. H2ONET® Model Results

0' 900' 1,800'
SCALE:1" = 900'

Figure 1. Alternate "B" - Winter Diversion Water Supply Program - West Well Site Layout

Sutter Pointe

Sutter County California
November 2008



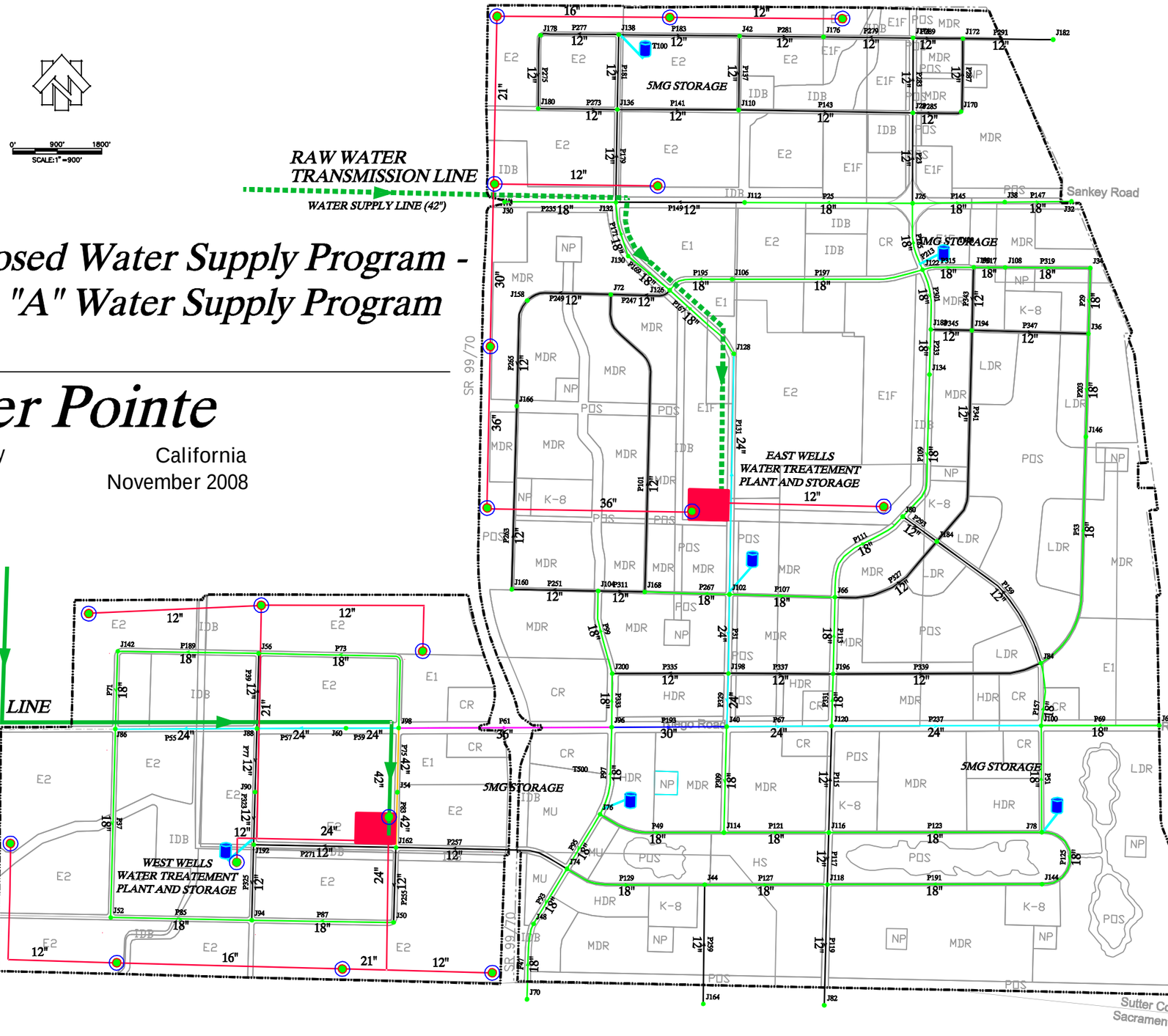


Figure 2. Proposed Water Supply Program - and Alternate "A" Water Supply Program

Sutter Pointe

Sutter County California

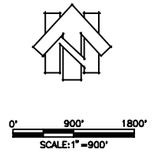
November 2008

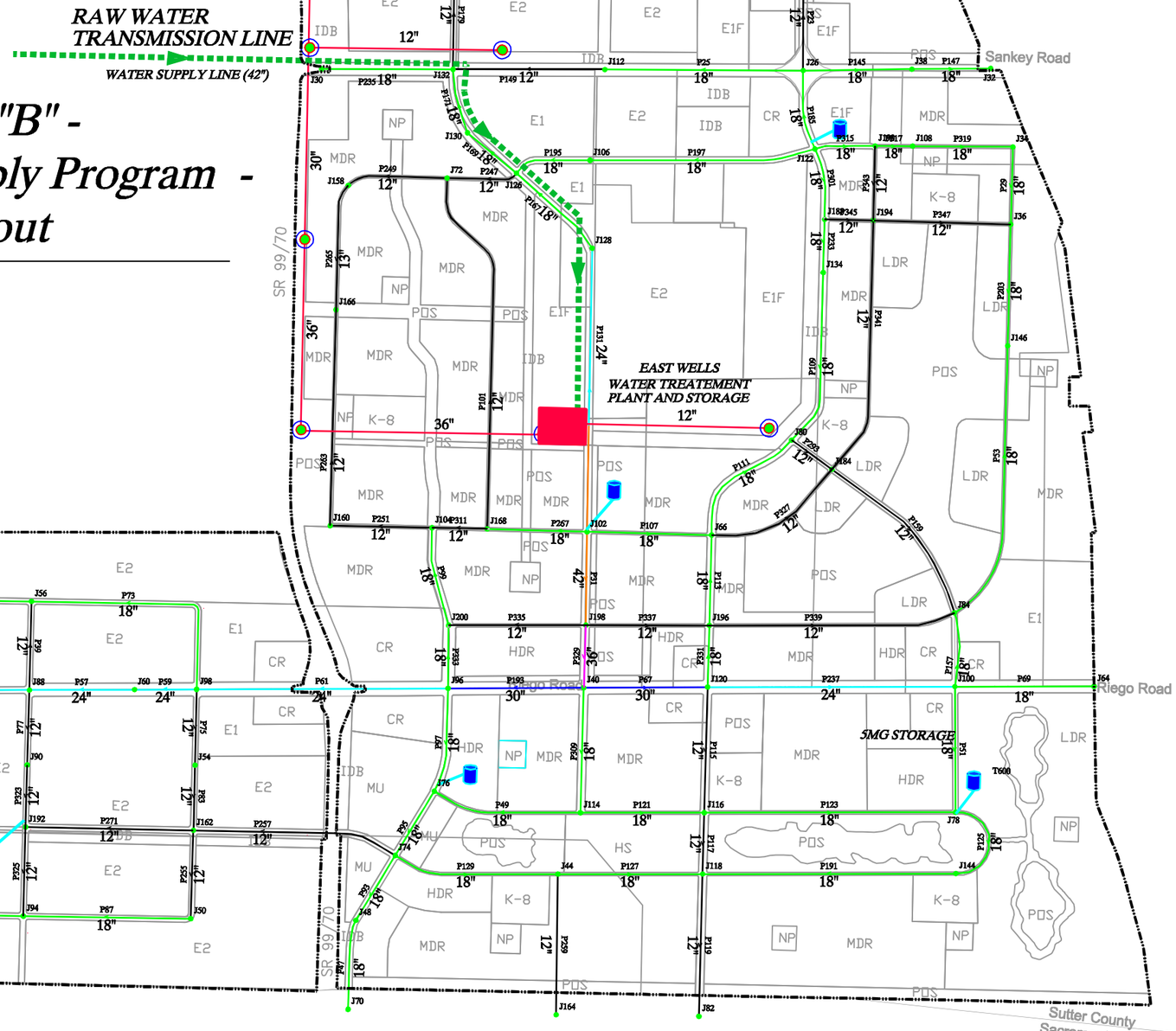
Figure 3. Alternate "B" - Winter Diversion Water Supply Program - East Well Site Layout

Sutter Pointe

Sutter County California

November 2008





ALTERNATE A FIREFLOW MAX DAY JUNCTION REPORT

ID	Elevation (ft)	Demand (gpm)	Head (ft)	Pressure (psi)
J-SOURCE1	16.00	3,000.00	16.00	-0.00000
J-SOURCE2	14.50	0.00	166.15	65.71
J100	22.30	694.20	162.86	60.90
J102	24.50	861.60	164.19	60.53
J104	18.00	0.00	163.45	63.02
J106	25.80	210.60	164.93	60.28
J108	31.60	0.00	166.89	58.62
J110	24.00	265.80	159.43	58.68
J112	24.00	171.50	165.47	61.30
J114	20.00	308.80	163.76	62.29
J116	22.50	367.90	162.37	60.60
J118	18.00	664.80	160.70	61.83
J120	21.00	290.70	163.54	61.76
J122	30.50	178.90	169.10	60.05
J126	22.50	396.70	163.77	61.21
J128	33.00	730.70	163.81	56.68
J130	22.30	330.40	163.57	61.21
J132	17.00	0.00	163.51	63.48
J134	31.00	409.10	165.67	58.35
J136	21.00	571.50	159.60	60.06
J138	21.00	0.00	159.60	60.06
J142	19.50	401.80	164.64	62.89
J144	22.30	1,664.80	160.52	59.89
J146	30.10	1,080.80	163.27	57.70
J158	19.00	367.20	158.12	60.28
J160	16.50	0.00	161.11	62.66
J162	14.00	0.00	162.94	64.53
J164	14.50	0.00	161.13	63.53
J166	19.00	1,282.20	156.14	59.42
J168	18.50	1,628.30	163.00	62.61
J170	31.00	0.00	160.06	55.92
J172	31.00	178.00	159.85	55.83
J174	29.00	0.00	159.85	56.70
J176	28.00	261.70	159.33	56.91
J178	20.00	412.60	159.31	60.36
J180	19.50	0.00	159.45	60.64
J182	31.00	0.00	159.85	55.83
J184	22.30	723.40	163.39	61.14
J188	32.00	246.30	166.66	58.35
J190	32.20	0.00	167.45	58.61
J192	16.00	27.50	162.87	63.64
J194	22.30	100.00	166.18	62.34
J196	21.50	150.00	163.56	61.55
J198	24.50	150.00	164.16	60.52
J200	16.50	100.00	164.18	63.99
J202	24.50	0.00	24.50	0.00
J204	24.50	0.00	164.19	60.53
J26	31.00	277.30	166.07	58.53
J28	29.00	387.00	160.19	56.85
J30	20.00	0.00	163.51	62.18
J32	33.00	580.30	165.66	57.48
J34	37.70	319.30	165.37	55.32
J36	36.00	397.60	164.58	55.71
J38	35.80	0.00	165.83	56.34
J40	21.00	538.10	164.16	62.03
J42	25.00	375.30	159.32	58.20
J44	15.00	694.60	161.13	63.32
J48	22.30	453.70	162.84	60.90
J50	14.00	367.30	162.46	64.33
J52	14.80	878.80	162.62	64.05
J54	20.00	512.20	163.36	62.12
J56	14.50	383.50	165.01	65.22

ALTERNATE A FIREFLOW MAX DAY JUNCTION REPORT

ID	Elevation (ft)	Demand (gpm)	Head (ft)	Pressure (psi)
J60	15.00	292.30	166.15	65.49
J64	32.00	0.00	162.86	56.70
J66	26.50	509.40	163.60	59.40
J70	14.50	0.00	162.84	64.28
J72	20.00	0.00	162.06	61.55
J74	15.00	182.50	162.95	64.11
J76	14.50	507.10	164.65	65.06
J78	23.00	865.80	161.60	60.06
J80	26.00	1,130.30	163.60	59.62
J82	15.50	475.40	159.14	62.24
J84	22.30	100.00	163.04	60.98
J86	22.00	550.30	164.62	61.80
J88	16.00	0.00	165.22	64.66
J90	16.00	564.10	163.06	63.72
J92	23.00	0.00	166.15	62.03
J94	16.50	590.50	162.47	63.25
J96	15.00	520.40	164.75	64.89
J98	15.00	347.90	165.91	65.39

ALTERNATE A FIREFLOW MAX DAY PIPE REPORT

ID	Length (ft)	Diameter (in)	Roughness	Flow (gpm)	Velocity (ft/s)	Headloss (ft)	HL/1000
P101	6,331.65	12.00	130.00	-216.38	0.61	0.94	0.15
P107	2,136.18	18.00	130.00	879.92	1.11	0.59	0.28
P109	3,054.53	18.00	130.00	-1,427.53	1.80	2.08	0.68
P111	2,316.24	18.00	130.00	17.72	0.02	0.000	0.000
P113	1,552.25	18.00	130.00	231.99	0.29	0.04	0.02
P115	2,156.25	12.00	130.00	436.30	1.24	1.18	0.55
P117	1,054.31	12.00	130.00	774.62	2.20	1.67	1.58
P119	2,443.09	12.00	130.00	475.40	1.35	1.56	0.64
P121	2,123.48	18.00	130.00	1,398.15	1.76	1.39	0.65
P123	4,311.44	18.00	130.00	691.93	0.87	0.77	0.18
P125	1,761.32	18.00	130.00	-1,349.35	1.70	1.08	0.61
P127	2,484.66	18.00	130.00	-681.02	0.86	0.43	0.17
P129	2,865.08	18.00	130.00	1,375.62	1.73	1.82	0.63
P131	4,870.25	24.00	130.00	943.78	0.67	0.38	0.08
P137	1,498.08	12.00	130.00	144.60	0.41	0.11	0.07
P141	2,459.06	12.00	130.00	-144.70	0.41	0.17	0.07
P143	3,525.87	12.00	130.00	-265.70	0.75	0.77	0.22
P145	1,865.59	18.00	130.00	580.30	0.73	0.24	0.13
P147	1,352.28	18.00	130.00	580.30	0.73	0.17	0.13
P149	2,605.51	12.00	130.00	519.46	1.47	1.96	0.75
P157	1,279.39	18.00	130.00	-612.29	0.77	0.18	0.14
P159	3,333.64	12.00	130.00	-179.88	0.51	0.35	0.11
P167	1,837.39	18.00	130.00	213.08	0.27	0.04	0.02
P169	1,089.65	18.00	130.00	708.97	0.89	0.20	0.19
P171	1,121.28	18.00	130.00	378.57	0.48	0.07	0.06
P179	1,880.34	12.00	130.00	898.03	2.55	3.91	2.08
P181	1,515.06	12.00	130.00	11.99	0.03	0.00	0.000
P183	2,447.51	12.00	130.00	187.12	0.53	0.28	0.11
P185	1,381.61	18.00	130.00	2,684.54	3.38	3.03	2.19
P189	2,854.02	18.00	130.00	-581.40	0.73	0.37	0.13
P191	4,344.57	18.00	130.00	-315.45	0.40	0.18	0.04
P193	2,329.93	30.00	130.00	3,204.15	1.45	0.59	0.25
P195	1,344.13	18.00	130.00	-1,617.30	2.04	1.15	0.86
P197	3,882.51	18.00	130.00	-1,827.90	2.30	4.17	1.07
P199	1.00	99.00	199.00	13,234.81	0.55	0.00000	0.00
P203	2,085.61	18.00	135.00	-1,418.45	1.79	1.31	0.63
P205	694.77	99.00	199.00	417.88	0.02	0.00000	0.00000
P207	1,564.32	99.00	199.00	0.00	0.00	0.00	0.00
P209	1.00	99.00	199.00	10,234.81	0.43	0.00000	0.00
P211	1.00	99.00	199.00	10,234.81	0.43	0.00000	0.00
P213	642.66	99.00	199.00	9,477.14	0.40	0.00	0.00
P215	2,964.56	99.00	199.00	0.00	0.00	0.00	0.00
P217	986.47	99.00	199.00	3,161.64	0.13	0.000	0.000
P223	1.00	99.00	199.00	10,234.81	0.43	0.00000	0.00
P225	632.69	99.00	199.00	207.75	0.01	0.000000	0.00000
P23	1,831.28	12.00	130.00	1,135.99	3.22	5.88	3.21
P233	911.23	18.00	130.00	-1,836.63	2.32	0.99	1.08
P235	2,254.24	18.00	130.00	0.00	0.00	0.00	0.00
P237	4,243.68	24.00	130.00	1,397.39	0.99	0.68	0.16
P247	1,228.92	12.00	130.00	-724.71	2.06	1.72	1.40
P249	1,737.12	12.00	130.00	941.09	2.67	3.93	2.26
P25	3,401.10	18.00	130.00	-690.96	0.87	0.60	0.18
P251	1,747.43	12.00	130.00	708.31	2.01	2.34	1.34
P255	1,700.86	12.00	130.00	304.14	0.86	0.48	0.28
P257	3,304.33	12.00	130.00	-28.27	0.08	0.01	0.00
P259	2,414.57	12.00	130.00	0.00	0.00	0.00	0.00
P263	3,708.14	12.00	130.00	708.31	2.01	4.96	1.34
P265	2,183.83	12.00	130.00	-573.89	1.63	1.98	0.91
P267	1,717.02	18.00	130.00	1,441.82	1.82	1.19	0.69
P271	2,880.31	12.00	130.00	82.23	0.23	0.07	0.02
P273	1,600.32	12.00	130.00	169.85	0.48	0.15	0.10
P275	1,492.48	12.00	130.00	-169.85	0.48	0.14	0.10
P277	1,590.41	12.00	130.00	242.75	0.69	0.29	0.18

ALTERNATE A FIREFLOW MAX DAY PIPE REPORT

ID	Length (ft)	Diameter (in)	Roughness	Flow (gpm)	Velocity (ft/s)	Headloss (ft)	HL/1000
P279	1,814.31	12.00	130.00	305.29	0.87	0.51	0.28
P281	1,699.00	12.00	130.00	43.59	0.12	0.01	0.01
P283	1,515.07	12.00	130.00	274.12	0.78	0.35	0.23
P285	985.39	12.00	130.00	209.17	0.59	0.14	0.14
P287	1,484.84	12.00	130.00	209.17	0.59	0.21	0.14
P289	1,009.71	12.00	130.00	-31.17	0.09	0.00	0.00
P29	1,329.63	18.00	130.00	-1,326.03	1.67	0.79	0.59
P291	1,826.74	12.00	130.00	0.00	0.00	0.00	0.00
P293	853.55	12.00	130.00	-279.51	0.79	0.20	0.24
P301	1,236.58	18.00	130.00	-2,535.31	3.20	2.44	1.97
P309	2,146.04	18.00	130.00	-717.86	0.91	0.41	0.19
P31	1,599.98	24.00	130.00	402.47	0.29	0.03	0.02
P311	944.65	12.00	130.00	402.86	1.14	0.44	0.47
P315	1,040.74	18.00	130.00	2,250.49	2.84	1.64	1.58
P317	640.25	18.00	130.00	1,645.33	2.07	0.57	0.88
P319	1,720.14	18.00	130.00	1,645.33	2.07	1.52	0.88
P323	1,067.48	12.00	130.00	237.79	0.67	0.19	0.18
P325	1,530.14	12.00	130.00	292.52	0.83	0.40	0.26
P327	2,500.36	12.00	130.00	156.25	0.44	0.20	0.08
P329	1,076.73	24.00	130.00	18.21	0.01	0.0000	0.0000
P331	1,057.49	18.00	130.00	-194.41	0.25	0.02	0.02
P333	1,085.58	18.00	130.00	1,247.69	1.57	0.58	0.53
P335	2,353.95	12.00	130.00	36.51	0.10	0.01	0.01
P337	2,119.20	12.00	130.00	307.18	0.87	0.60	0.28
P339	4,242.25	12.00	130.00	194.76	0.55	0.52	0.12
P341	4,487.30	12.00	130.00	-467.52	1.33	2.78	0.62
P343	1,278.99	12.00	130.00	-605.16	1.72	1.28	1.00
P345	834.90	12.00	130.00	452.37	1.28	0.49	0.58
P347	2,361.88	12.00	130.00	490.01	1.39	1.60	0.68
P349	1.00	99.00	199.00	4,529.58	0.19	0.000000	0.000
P351	1.00	99.00	199.00	4,529.58	0.19	0.000000	0.000
P353	1.00	99.00	199.00	4,529.58	0.19	0.000000	0.000
P355	1.00	99.00	199.00	4,529.58	0.19	0.000000	0.000
P37	3,816.18	18.00	130.00	1,239.93	1.56	2.00	0.52
P39	1,521.24	12.00	130.00	-207.71	0.59	0.21	0.14
P41	1.00	99.00	199.00	-10,234.81	0.43	0.00000	0.00
P47	1,542.01	18.00	130.00	0.00	0.00	0.00	0.00
P49	2,593.59	18.00	130.00	989.09	1.25	0.89	0.34
P51	2,155.63	18.00	130.00	-1,315.48	1.66	1.26	0.58
P53	4,888.13	18.00	130.00	-337.65	0.43	0.23	0.05
P55	2,868.44	24.00	130.00	-1,610.63	1.14	0.60	0.21
P57	1,803.44	24.00	130.00	-2,620.23	1.86	0.93	0.52
P59	1,065.98	42.00	130.00	7,322.28	1.70	0.24	0.23
P61	4,312.06	36.00	130.00	5,346.88	1.69	1.16	0.27
P67	2,123.48	24.00	130.00	1,929.98	1.37	0.62	0.29
P69	2,388.21	18.00	130.00	0.00	0.00	0.00	0.00
P71	1,575.50	18.00	130.00	-179.60	0.23	0.02	0.01
P73	4,275.78	18.00	130.00	757.19	0.95	0.90	0.21
P75	1,299.46	12.00	130.00	870.31	2.47	2.55	1.96
P77	1,285.28	12.00	130.00	801.89	2.27	2.16	1.68
P83	1,120.85	12.00	130.00	358.11	1.02	0.42	0.38
P85	2,854.95	18.00	130.00	361.13	0.46	0.15	0.05
P87	2,872.76	18.00	130.00	63.16	0.08	0.01	0.00
P93	1,302.22	18.00	130.00	453.70	0.57	0.11	0.08
P95	1,290.95	18.00	130.00	2,040.09	2.57	1.70	1.32
P97	1,801.16	18.00	130.00	374.65	0.47	0.10	0.06
P99	1,711.96	18.00	130.00	1,111.18	1.40	0.73	0.43

Scenario A Max Day (No Tanks) Junction Report

ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
J-SOURCE1	0.00	16.00	16.00	-0.00000
J-SOURCE2	0.00	14.50	166.15	65.71
J100	694.20	22.30	155.88	57.88
J102	861.60	24.50	164.19	60.53
J104	0.00	18.00	161.70	62.27
J106	210.60	25.80	151.36	54.41
J108	0.00	31.60	150.22	51.40
J110	265.80	24.00	141.73	51.01
J112	171.50	24.00	148.72	54.04
J114	308.80	20.00	159.54	60.46
J116	367.90	22.50	157.25	58.39
J118	664.80	18.00	155.30	59.49
J120	290.70	21.00	158.80	59.71
J122	178.90	30.50	150.19	51.86
J126	396.70	22.50	151.95	56.09
J128	730.70	33.00	158.28	54.28
J130	330.40	22.30	150.62	55.60
J132	0.00	17.00	149.64	57.47
J134	409.10	31.00	150.91	51.96
J136	571.50	21.00	142.02	52.44
J138	0.00	21.00	141.64	52.27
J142	401.80	19.50	164.27	62.73
J144	1,664.80	22.30	154.69	57.36
J146	1,080.80	30.10	150.52	52.18
J158	367.20	19.00	149.73	56.64
J160	0.00	16.50	157.64	61.16
J162	0.00	14.00	161.17	63.77
J164	0.00	14.50	156.02	61.32
J166	1,282.20	19.00	149.03	56.34
J168	1,628.30	18.50	161.59	62.00
J170	0.00	31.00	142.38	48.26
J172	178.00	31.00	142.15	48.16
J174	0.00	29.00	142.15	49.03
J176	261.70	28.00	141.57	49.21
J178	412.60	20.00	141.48	52.64
J180	0.00	19.50	141.74	52.97
J182	0.00	31.00	142.15	48.16
J184	723.40	22.30	153.32	56.77
J188	246.30	32.00	150.50	51.35
J190	0.00	32.20	150.22	51.14
J192	27.50	16.00	161.38	62.99
J194	100.00	22.30	150.49	55.55
J196	150.00	21.50	158.58	59.40
J198	150.00	24.50	162.54	59.81
J200	100.00	16.50	162.47	63.25
J202	0.00	24.50	24.50	-0.00000
J204	0.00	24.50	164.19	60.53
J26	277.30	31.00	148.67	50.99
J28	387.00	29.00	142.53	49.19
J30	0.00	20.00	149.64	56.17
J32	580.30	33.00	148.26	49.94
J34	319.30	37.70	150.22	48.76
J36	397.60	36.00	150.28	49.52
J38	0.00	35.80	148.43	48.80
J40	538.10	21.00	161.95	61.07
J42	375.30	25.00	141.54	50.50
J44	694.60	15.00	156.02	61.10
J48	453.70	22.30	158.31	58.93
J50	367.30	14.00	161.06	63.72
J52	878.80	14.80	161.50	63.57
J54	512.20	20.00	162.07	61.56
J56	383.50	14.50	164.71	65.08

Scenario A Max Day (No Tanks) Junction Report

ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
J60	292.30	15.00	166.15	65.49
J64	0.00	32.00	155.88	53.68
J66	509.40	26.50	158.13	57.04
J70	0.00	14.50	158.31	62.31
J72	0.00	20.00	151.97	57.18
J74	182.50	15.00	158.42	62.14
J76	507.10	14.50	159.62	62.88
J78	865.80	23.00	155.37	57.36
J80	1,130.30	26.00	153.31	55.16
J82	475.40	15.50	153.73	59.90
J84	100.00	22.30	154.83	57.43
J86	550.30	22.00	164.24	61.63
J88	0.00	16.00	164.96	64.55
J90	564.10	16.00	161.89	63.21
J92	0.00	23.00	166.15	62.03
J94	590.50	16.50	161.12	62.67
J96	520.40	15.00	162.97	64.11
J98	347.90	15.00	165.67	65.28

ALTERNATE A MAX DAY (NO TANKS) PIPE REPORT

ID	Length (ft)	Diameter (in)	Roughness	Flow (gpm)	Velocity (ft/s)	Headloss (ft)	HL/1000 (ft/kft)
P101	6,331.65	12.00	130.00	-758.54	2.15	9.62	1.52
P107	2,136.18	18.00	130.00	3,086.61	3.89	6.06	2.84
P109	3,054.53	18.00	130.00	1,544.07	1.95	2.40	0.79
P111	2,316.24	18.00	130.00	-2,612.64	3.29	4.82	2.08
P113	1,552.25	18.00	130.00	-897.20	1.13	0.45	0.29
P115	2,156.25	12.00	130.00	506.81	1.44	1.55	0.72
P117	1,054.31	12.00	130.00	845.05	2.40	1.96	1.86
P119	2,443.09	12.00	130.00	475.40	1.35	1.56	0.64
P121	2,123.48	18.00	130.00	1,828.75	2.31	2.28	1.08
P123	4,311.44	18.00	130.00	1,122.61	1.42	1.88	0.44
P125	1,761.32	18.00	130.00	-1,056.71	1.33	0.69	0.39
P127	2,484.66	18.00	130.00	-903.24	1.14	0.72	0.29
P129	2,865.08	18.00	130.00	1,597.84	2.01	2.40	0.84
P131	4,870.25	24.00	130.00	4,158.53	2.95	5.91	1.21
P137	1,498.08	12.00	130.00	198.71	0.56	0.19	0.13
P141	2,459.06	12.00	130.00	-192.99	0.55	0.30	0.12
P143	3,525.87	12.00	130.00	-271.52	0.77	0.80	0.23
P145	1,865.59	18.00	130.00	580.30	0.73	0.24	0.13
P147	1,352.28	18.00	130.00	580.30	0.73	0.17	0.13
P149	2,605.51	12.00	130.00	-344.84	0.98	0.92	0.35
P157	1,279.39	18.00	130.00	1,573.11	1.98	1.04	0.81
P159	3,333.64	12.00	130.00	395.09	1.12	1.51	0.45
P167	1,837.39	18.00	130.00	3,427.83	4.32	6.33	3.44
P169	1,089.65	18.00	130.00	1,963.30	2.48	1.34	1.23
P171	1,121.28	18.00	130.00	1,632.90	2.06	0.98	0.87
P179	1,880.34	12.00	130.00	1,288.06	3.65	7.62	4.05
P181	1,515.06	12.00	130.00	287.12	0.81	0.38	0.25
P183	2,447.51	12.00	130.00	110.97	0.31	0.11	0.04
P185	1,381.61	18.00	130.00	1,848.10	2.33	1.52	1.10
P189	2,854.02	18.00	130.00	-634.54	0.80	0.43	0.15
P191	4,344.57	18.00	130.00	-608.09	0.77	0.61	0.14
P193	2,329.93	30.00	130.00	4,319.30	1.96	1.02	0.44
P195	1,344.13	18.00	130.00	1,131.11	1.43	0.59	0.44
P197	3,882.51	18.00	130.00	920.51	1.16	1.17	0.30
P199	1.00	99.00	199.00	13,915.55	0.58	0.00000	0.00
P203	2,085.61	18.00	135.00	562.99	0.71	0.24	0.11
P209	1.00	99.00	199.00	13,915.55	0.58	0.00000	0.01
P211	1.00	99.00	199.00	13,915.55	0.58	0.00	0.00
P223	1.00	99.00	199.00	13,915.55	0.58	0.0000	0.02
P23	1,831.28	12.00	130.00	1,163.84	3.30	6.15	3.36
P233	911.23	18.00	130.00	1,134.97	1.43	0.41	0.44
P235	2,254.24	18.00	130.00	0.00	0.00	0.00	0.00
P237	4,243.68	24.00	130.00	3,067.21	2.18	2.93	0.69
P247	1,228.92	12.00	130.00	63.28	0.18	0.02	0.02
P249	1,737.12	12.00	130.00	695.26	1.97	2.25	1.29
P25	3,401.10	18.00	130.00	173.34	0.22	0.05	0.01
P251	1,747.43	12.00	130.00	954.14	2.71	4.06	2.32
P255	1,700.86	12.00	130.00	137.66	0.39	0.11	0.06
P257	3,304.33	12.00	130.00	547.67	1.55	2.75	0.83
P259	2,414.57	12.00	130.00	0.00	0.00	0.00	0.00
P263	3,708.14	12.00	130.00	954.14	2.71	8.62	2.32
P265	2,183.83	12.00	130.00	-328.06	0.93	0.70	0.32
P267	1,717.02	18.00	130.00	2,198.40	2.77	2.60	1.51
P271	2,880.31	12.00	130.00	-147.94	0.42	0.21	0.07
P273	1,600.32	12.00	130.00	236.45	0.67	0.28	0.18
P275	1,492.48	12.00	130.00	-236.45	0.67	0.26	0.18
P277	1,590.41	12.00	130.00	176.15	0.50	0.16	0.10
P279	1,814.31	12.00	130.00	327.32	0.93	0.58	0.32
P281	1,699.00	12.00	130.00	65.62	0.19	0.03	0.02
P283	1,515.07	12.00	130.00	287.00	0.81	0.38	0.25
P285	985.39	12.00	130.00	218.32	0.62	0.15	0.15
P287	1,484.84	12.00	130.00	218.32	0.62	0.22	0.15
P289	1,009.71	12.00	130.00	-40.32	0.11	0.01	0.01

ALTERNATE A MAX DAY (NO TANKS) PIPE REPORT

ID	Length (ft)	Diameter (in)	Roughness	Flow (gpm)	Velocity (ft/s)	Headloss (ft)	HL/1000 (ft/kft)
P29	1,329.63	18.00	130.00	329.18	0.42	0.06	0.04
P291	1,826.74	12.00	130.00	0.00	0.00	0.00	0.00
P293	853.55	12.00	130.00	61.74	0.18	0.01	0.01
P301	1,236.58	18.00	130.00	835.40	1.05	0.31	0.25
P309	2,146.04	18.00	130.00	-1,871.64	2.36	2.41	1.12
P31	1,599.98	24.00	130.00	3,808.11	2.70	1.65	1.03
P311	944.65	12.00	130.00	188.44	0.53	0.11	0.12
P315	1,040.74	18.00	130.00	-271.09	0.34	0.03	0.03
P317	640.25	18.00	130.00	-9.88	0.01	0.0000	0.0000
P319	1,720.14	18.00	130.00	-9.88	0.01	0.000	0.0000
P323	1,067.48	12.00	130.00	405.57	1.15	0.51	0.48
P325	1,530.14	12.00	130.00	230.13	0.65	0.26	0.17
P327	2,500.36	12.00	130.00	861.77	2.44	4.81	1.92
P329	1,076.73	24.00	130.00	-2,719.59	1.93	0.59	0.55
P331	1,057.49	18.00	130.00	764.44	0.96	0.23	0.21
P333	1,085.58	18.00	130.00	1,152.60	1.45	0.50	0.46
P335	2,353.95	12.00	130.00	-89.98	0.26	0.07	0.03
P337	2,119.20	12.00	130.00	848.53	2.41	3.96	1.87
P339	4,242.25	12.00	130.00	565.77	1.60	3.74	0.88
P341	4,487.30	12.00	130.00	471.73	1.34	2.83	0.63
P343	1,278.99	12.00	130.00	261.21	0.74	0.27	0.21
P345	834.90	12.00	130.00	53.27	0.15	0.01	0.01
P347	2,361.88	12.00	130.00	163.79	0.46	0.21	0.09
P349	1.00	99.00	199.00	14,113.25	0.59	0.00000	0.01
P351	1.00	99.00	199.00	14,113.25	0.59	0.00000	0.01
P353	1.00	99.00	199.00	14,113.25	0.59	0.00	0.00
P355	1.00	99.00	199.00	14,113.25	0.59	0.0000	0.02
P37	3,816.18	18.00	130.00	1,468.81	1.85	2.74	0.72
P39	1,521.24	12.00	130.00	-232.22	0.66	0.26	0.17
P41	1.00	99.00	199.00	-13,915.55	0.58	0.00	0.00
P47	1,542.01	18.00	130.00	0.00	0.00	0.00	0.00
P49	2,593.59	18.00	130.00	265.91	0.34	0.08	0.03
P51	2,155.63	18.00	130.00	-799.90	1.01	0.50	0.23
P53	4,888.13	18.00	130.00	1,643.79	2.07	4.32	0.88
P55	2,868.44	24.00	130.00	-1,786.38	1.27	0.73	0.25
P57	1,803.44	24.00	130.00	-2,988.26	2.12	1.19	0.66
P59	1,065.98	42.00	130.00	10,634.99	2.46	0.48	0.45
P61	4,312.06	36.00	130.00	8,451.68	2.66	2.70	0.63
P67	2,123.48	24.00	130.00	4,629.15	3.28	3.14	1.48
P69	2,388.21	18.00	130.00	0.00	0.00	0.00	0.00
P71	1,575.50	18.00	130.00	-232.74	0.29	0.04	0.02
P73	4,275.78	18.00	130.00	785.82	0.99	0.96	0.23
P75	1,299.46	12.00	130.00	1,049.59	2.98	3.60	2.77
P77	1,285.28	12.00	130.00	969.67	2.75	3.08	2.39
P83	1,120.85	12.00	130.00	537.39	1.52	0.90	0.80
P85	2,854.95	18.00	130.00	590.01	0.74	0.38	0.13
P87	2,872.76	18.00	130.00	229.64	0.29	0.07	0.02
P93	1,302.22	18.00	130.00	453.70	0.57	0.11	0.08
P95	1,290.95	18.00	130.00	1,686.37	2.13	1.20	0.93
P97	1,801.16	18.00	130.00	2,459.38	3.10	3.35	1.86
P99	1,711.96	18.00	130.00	1,142.58	1.44	0.77	0.45

ALTERNATE A PEAK HOUR DEMAND WITH TANKS JUNCTION REPORT

	ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
1	J-SOURCE1	0.00	16.00	16.00	-0.00000
2	J-SOURCE2	0.00	14.50	166.15	65.71
3	J100	1,325.92	22.30	161.38	60.27
4	J102	1,645.66	24.50	164.19	60.53
5	J104	0.00	18.00	160.86	61.90
6	J106	402.25	25.80	162.59	59.27
7	J108	0.00	31.60	165.41	57.98
8	J110	507.68	24.00	154.87	56.71
9	J112	327.57	24.00	162.41	59.97
10	J114	589.81	20.00	163.08	61.99
11	J116	702.69	22.50	161.44	60.20
12	J118	1,269.77	18.00	155.98	59.79
13	J120	555.24	21.00	162.18	61.18
14	J122	341.70	30.50	169.10	60.05
15	J126	757.70	22.50	161.01	60.01
16	J128	1,395.64	33.00	161.83	55.82
17	J130	631.06	22.30	160.63	59.94
18	J132	0.00	17.00	160.58	62.21
19	J134	781.38	31.00	163.52	57.42
20	J136	1,091.56	21.00	157.03	58.94
21	J138	0.00	21.00	159.60	60.06
22	J142	767.44	19.50	161.60	61.57
23	J144	3,179.77	22.30	156.00	57.93
24	J146	2,064.33	30.10	160.43	56.47
25	J158	701.35	19.00	142.87	53.67
26	J160	0.00	16.50	153.02	59.15
27	J162	0.00	14.00	157.66	62.25
28	J164	0.00	14.50	156.32	61.45
29	J166	2,449.00	19.00	136.39	50.87

ALTERNATE A PEAK HOUR DEMAND WITH TANKS JUNCTION REPORT

		ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
30		J168	3,110.05	18.50	159.77	61.21
31		J170	0.00	31.00	154.79	53.64
32		J172	339.98	31.00	154.52	53.52
33		J174	0.00	29.00	154.55	54.40
34		J176	499.85	28.00	154.32	54.73
35		J178	788.07	20.00	157.03	59.37
36		J180	0.00	19.50	157.03	59.59
37		J182	0.00	31.00	154.52	53.52
38		J184	1,381.69	22.30	160.89	60.05
39		J188	470.43	32.00	165.04	57.64
40		J190	0.00	32.20	166.36	58.13
41		J192	52.53	16.00	156.85	61.03
42		J194	191.00	22.30	164.31	61.53
43		J196	286.50	21.50	162.07	60.91
44		J198	286.50	24.50	163.64	60.29
45		J200	191.00	16.50	163.06	63.50
46		J202	0.00	24.50	24.50	-0.00000
47		J204	0.00	24.50	164.19	60.53
48		J26	529.64	31.00	163.25	57.30
49		J28	739.17	29.00	154.97	54.58
50		J30	0.00	20.00	160.58	60.91
51		J32	1,108.37	33.00	161.88	55.84
52		J34	609.86	37.70	162.85	54.23
53		J36	759.42	36.00	161.77	54.50
54		J38	0.00	35.80	162.45	54.88
55		J40	1,027.77	21.00	163.55	61.77
56		J42	716.82	25.00	154.77	56.23
57		J44	1,326.69	15.00	156.32	61.24
58		J48	866.57	22.30	159.39	59.40

ALTERNATE A PEAK HOUR DEMAND WITH TANKS JUNCTION REPORT

		ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
59		J50	701.54	14.00	155.39	61.26
60		J52	1,678.51	14.80	155.70	61.05
61		J54	978.30	20.00	158.58	60.05
62		J56	732.48	14.50	162.77	64.24
63		J60	558.29	15.00	166.15	65.49
64		J64	0.00	32.00	161.38	56.06
65		J66	972.95	26.50	161.92	58.68
66		J70	0.00	14.50	159.39	62.78
67		J72	0.00	20.00	155.80	58.84
68		J74	348.58	15.00	159.74	62.71
69		J76	968.56	14.50	164.65	65.06
70		J78	1,653.68	23.00	161.60	60.06
71		J80	2,158.87	26.00	161.17	58.57
72		J82	908.01	15.50	150.80	58.63
73		J84	191.00	22.30	161.15	60.16
74		J86	1,051.07	22.00	161.54	60.46
75		J88	0.00	16.00	163.38	63.86
76		J90	1,077.43	16.00	157.20	61.18
77		J92	0.00	23.00	166.15	62.03
78		J94	1,127.85	16.50	155.39	60.18
79		J96	993.96	15.00	164.33	64.71
80		J98	664.49	15.00	165.75	65.32

ALTERNATE A PEAK HOUR DEMAND WITH TANKS PIPE REPORT

		ID	From Node	To Node	Length (ft)	Diameter (in)	Roughness	Flow (gpm)	Velocity (ft/s)	Headloss (ft)	HL/1000 (ft/kft)
1		P101	J72	J168	6,331.65	12.00	130.00	-470.40	1.33	3.97	0.63
2		P107	J102	J66	2,136.18	18.00	130.00	1,815.72	2.29	2.27	1.06
3		P109	J80	J134	3,054.53	18.00	130.00	-1,528.71	1.93	2.36	0.77
4		P111	J80	J66	2,316.24	18.00	130.00	-960.47	1.21	0.76	0.33
5		P113	J66	J196	1,552.25	18.00	130.00	-493.43	0.62	0.15	0.10
6		P115	J120	J116	2,156.25	12.00	130.00	342.11	0.97	0.75	0.35
7		P117	J116	J118	1,054.31	12.00	130.00	1,470.09	4.17	5.45	5.17
8		P119	J118	J82	2,443.09	12.00	130.00	908.01	2.58	5.18	2.12
9		P121	J114	J116	2,123.48	18.00	130.00	1,529.40	1.93	1.64	0.77
10		P123	J116	J78	4,311.44	18.00	130.00	-301.27	0.38	0.16	0.04
11		P125	J144	J78	1,761.32	18.00	130.00	-3,282.22	4.14	5.60	3.18
12		P127	J118	J44	2,484.66	18.00	130.00	-605.24	0.76	0.34	0.14
13		P129	J74	J44	2,865.08	18.00	130.00	1,931.92	2.44	3.41	1.19
14		P131	J102	J128	4,870.25	24.00	130.00	2,534.97	1.80	2.36	0.49
15		P137	J110	J42	1,498.08	12.00	130.00	141.32	0.40	0.10	0.07
16		P141	J110	J136	2,459.06	12.00	130.00	-563.35	1.60	2.15	0.88
17		P143	J110	J28	3,525.87	12.00	130.00	-85.64	0.24	0.09	0.03
18		P145	J26	J38	1,865.59	18.00	130.00	1,108.37	1.40	0.79	0.43
19		P147	J38	J32	1,352.28	18.00	130.00	1,108.37	1.40	0.58	0.43
20		P149	J112	J132	2,605.51	12.00	130.00	499.97	1.42	1.83	0.70
21		P157	J100	J84	1,279.39	18.00	130.00	703.65	0.89	0.23	0.18
22		P159	J84	J184	3,333.64	12.00	130.00	152.93	0.43	0.26	0.08
23		P167	J128	J126	1,837.39	18.00	130.00	1,139.33	1.44	0.82	0.45
24		P169	J126	J130	1,089.65	18.00	130.00	983.89	1.24	0.37	0.34
25		P171	J130	J132	1,121.28	18.00	130.00	352.82	0.44	0.06	0.05
26		P179	J132	J136	1,880.34	12.00	130.00	852.79	2.42	3.55	1.89
27		P181	J136	J138	1,515.06	12.00	130.00	-805.50	2.29	2.57	1.70
28		P183	J138	J42	2,447.51	12.00	130.00	873.34	2.48	4.83	1.97
29		P185	J122	J26	1,381.61	18.00	130.00	3,832.36	4.83	5.85	4.23
30		P189	J142	J56	2,854.02	18.00	130.00	-1,083.56	1.37	1.16	0.41
31		P191	J144	J118	4,344.57	18.00	130.00	102.45	0.13	0.02	0.01
32		P193	J96	J40	2,329.93	30.00	130.00	3,744.17	1.70	0.78	0.34
33		P195	J126	J106	1,344.13	18.00	130.00	-1,921.40	2.42	1.58	1.18
34		P197	J106	J122	3,882.51	18.00	130.00	-2,323.64	2.93	6.51	1.68

ALTERNATE A PEAK HOUR DEMAND WITH TANKS PIPE REPORT

		ID	From Node	To Node	Length (ft)	Diameter (in)	Roughness	Flow (gpm)	Velocity (ft/s)	Headloss (ft)	HL/1000 (ft/kft)
35		P199	WEST_WELLS	J-SOURCE1	1.00	99.00	199.00	14,889.28	0.62	0.00000	0.01
36		P203	J146	J36	2,085.61	18.00	135.00	-1,439.35	1.81	1.34	0.64
37		P205	T100	J138	694.77	99.00	199.00	2,463.52	0.10	0.000	0.000
38		P207	T200	J92	1,564.32	99.00	199.00	0.00	0.00	0.00	0.00
39		P209	J-SOURCE1	U7000	1.00	99.00	199.00	14,889.28	0.62	0.00000	0.01
40		P211	U7000	J-SOURCE2	1.00	99.00	199.00	14,889.28	0.62	0.00	0.00
41		P213	T400	J122	642.66	99.00	199.00	12,800.60	0.53	0.00	0.00
42		P215	T300	J102	2,964.56	99.00	199.00	0.00	0.00	0.00	0.00
43		P217	T500	J76	986.47	99.00	199.00	6,614.94	0.28	0.00	0.00
44		P223	J-SOURCE2	J92	1.00	99.00	199.00	14,889.28	0.62	0.00	0.00
45		P225	T600	J78	632.69	99.00	199.00	5,744.10	0.24	0.000	0.00
46		P23	J26	J28	1,831.28	12.00	130.00	1,366.81	3.88	8.28	4.52
47		P233	J134	J188	911.23	18.00	130.00	-2,310.10	2.91	1.51	1.66
48		P235	J132	J30	2,254.24	18.00	130.00	0.00	0.00	0.00	0.00
49		P237	J120	J100	4,243.68	24.00	130.00	1,522.64	1.08	0.80	0.19
50		P247	J72	J126	1,228.92	12.00	130.00	-1,319.14	3.74	5.20	4.23
51		P249	J72	J158	1,737.12	12.00	130.00	1,789.55	5.08	12.94	7.45
52		P25	J112	J26	3,401.10	18.00	130.00	-827.54	1.04	0.84	0.25
53		P251	J104	J160	1,747.43	12.00	130.00	1,360.81	3.86	7.84	4.48
54		P255	J162	J50	1,700.86	12.00	130.00	707.68	2.01	2.27	1.34
55		P257	J162	J74	3,304.33	12.00	130.00	-470.61	1.34	2.07	0.63
56		P259	J44	J164	2,414.57	12.00	130.00	0.00	0.00	0.00	0.00
57		P263	J160	J166	3,708.14	12.00	130.00	1,360.81	3.86	16.63	4.48
58		P265	J166	J158	2,183.83	12.00	130.00	-1,088.19	3.09	6.47	2.96
59		P267	J102	J168	1,717.02	18.00	130.00	2,928.34	3.69	4.42	2.57
60		P271	J162	J192	2,880.31	12.00	130.00	306.59	0.87	0.82	0.28
61		P273	J136	J180	1,600.32	12.00	130.00	3.37	0.01	0.000	0.0000
62		P275	J178	J180	1,492.48	12.00	130.00	-3.37	0.01	0.000	0.0000
63		P277	J138	J178	1,590.41	12.00	130.00	784.69	2.23	2.57	1.62
64		P279	J174	J176	1,814.31	12.00	130.00	202.02	0.57	0.24	0.13
65		P281	J176	J42	1,699.00	12.00	130.00	-297.83	0.84	0.46	0.27
66		P283	J28	J174	1,515.07	12.00	130.00	300.70	0.85	0.41	0.27
67		P285	J28	J170	985.39	12.00	130.00	241.30	0.68	0.18	0.18
68		P287	J170	J172	1,484.84	12.00	130.00	241.30	0.68	0.27	0.18

ALTERNATE A PEAK HOUR DEMAND WITH TANKS PIPE REPORT

		ID	From Node	To Node	Length (ft)	Diameter (in)	Roughness	Flow (gpm)	Velocity (ft/s)	Headloss (ft)	HL/1000 (ft/kft)
69		P289	J174	J172	1,009.71	12.00	130.00	98.68	0.28	0.04	0.03
70		P29	J36	J34	1,329.63	18.00	130.00	-1,569.68	1.98	1.08	0.81
71		P291	J172	J182	1,826.74	12.00	130.00	0.00	0.00	0.00	0.00
72		P293	J184	J80	853.55	12.00	130.00	-330.31	0.94	0.28	0.33
73		P301	J188	J122	1,236.58	18.00	130.00	-3,341.62	4.21	4.06	3.28
74		P309	J114	J40	2,146.04	18.00	130.00	-776.96	0.98	0.47	0.22
75		P31	J102	J198	1,599.98	24.00	130.00	2,097.90	1.49	0.55	0.34
76		P311	J104	J168	944.65	12.00	130.00	652.12	1.85	1.08	1.15
77		P315	J122	J190	1,040.74	18.00	130.00	2,961.27	3.73	2.73	2.63
78		P317	J190	J108	640.25	18.00	130.00	2,179.55	2.75	0.95	1.49
79		P319	J108	J34	1,720.14	18.00	130.00	2,179.55	2.75	2.56	1.49
80		P323	J90	J192	1,067.48	12.00	130.00	334.90	0.95	0.36	0.33
81		P325	J192	J94	1,530.14	12.00	130.00	588.97	1.67	1.45	0.95
82		P327	J66	J184	2,500.36	12.00	130.00	375.72	1.07	1.03	0.41
83		P329	J40	J198	1,076.73	24.00	130.00	-1,010.41	0.72	0.10	0.09
84		P331	J120	J196	1,057.49	18.00	130.00	529.86	0.67	0.11	0.11
85		P333	J96	J200	1,085.58	18.00	130.00	1,918.26	2.42	1.28	1.18
86		P335	J200	J198	2,353.95	12.00	130.00	-285.66	0.81	0.59	0.25
87		P337	J198	J196	2,119.20	12.00	130.00	515.32	1.46	1.57	0.74
88		P339	J196	J84	4,242.25	12.00	130.00	265.26	0.75	0.92	0.22
89		P341	J184	J194	4,487.30	12.00	130.00	-522.74	1.48	3.42	0.76
90		P343	J194	J190	1,278.99	12.00	130.00	-781.73	2.22	2.05	1.61
91		P345	J188	J194	834.90	12.00	130.00	561.09	1.59	0.73	0.87
92		P347	J194	J36	2,361.88	12.00	130.00	629.08	1.78	2.54	1.07
93		P349	EAST_WELLS	J202	1.00	99.00	199.00	11,022.58	0.46	0.00000	0.00
94		P351	J202	EAST_PMP	1.00	99.00	199.00	11,022.58	0.46	0.00000	0.00
95		P353	EAST_PMP	J204	1.00	99.00	199.00	11,022.58	0.46	0.0000	0.02
96		P355	J204	J102	1.00	99.00	199.00	11,022.58	0.46	0.00	0.00
97		P37	J86	J52	3,816.18	18.00	130.00	2,211.26	2.79	5.84	1.53
98		P39	J56	J88	1,521.24	12.00	130.00	-368.71	1.05	0.61	0.40
99		P41	J60	J92	1.00	99.00	199.00	-14,889.28	0.62	0.0000	0.02
100		P47	J48	J70	1,542.01	18.00	130.00	0.00	0.00	0.00	0.00
101		P49	J76	J114	2,593.59	18.00	130.00	1,342.25	1.69	1.57	0.61
102		P51	J78	J100	2,155.63	18.00	130.00	506.93	0.64	0.22	0.10

ALTERNATE A PEAK HOUR DEMAND WITH TANKS PIPE REPORT

		ID	From Node	To Node	Length (ft)	Diameter (in)	Roughness	Flow (gpm)	Velocity (ft/s)	Headloss (ft)	HL/1000 (ft/kft)
103		P53	J84	J146	4,888.13	18.00	130.00	624.98	0.79	0.72	0.15
104		P55	J86	J88	2,868.44	24.00	130.00	-2,946.20	2.09	1.84	0.64
105		P57	J88	J60	1,803.44	24.00	130.00	-4,727.25	3.35	2.77	1.54
106		P59	J60	J98	1,065.98	42.00	130.00	9,603.74	2.22	0.40	0.37
107		P61	J98	J96	4,312.06	36.00	130.00	5,969.95	1.88	1.42	0.33
108		P67	J40	J120	2,123.48	24.00	130.00	2,949.85	2.09	1.36	0.64
109		P69	J100	J64	2,388.21	18.00	130.00	0.00	0.00	0.00	0.00
110		P71	J86	J142	1,575.50	18.00	130.00	-316.13	0.40	0.07	0.04
111		P73	J98	J56	4,275.78	18.00	130.00	1,447.34	1.82	2.98	0.70
112		P75	J98	J54	1,299.46	12.00	130.00	1,521.97	4.32	7.17	5.52
113		P77	J88	J90	1,285.28	12.00	130.00	1,412.33	4.01	6.17	4.80
114		P83	J54	J162	1,120.85	12.00	130.00	543.66	1.54	0.92	0.82
115		P85	J52	J94	2,854.95	18.00	130.00	532.75	0.67	0.31	0.11
116		P87	J94	J50	2,872.76	18.00	130.00	-6.14	0.01	0.0000	0.0000
117		P93	J74	J48	1,302.22	18.00	130.00	866.57	1.09	0.35	0.27
118		P95	J76	J74	1,290.95	18.00	130.00	3,617.67	4.56	4.91	3.81
119		P97	J96	J76	1,801.16	18.00	130.00	-686.45	0.87	0.32	0.18
120		P99	J200	J104	1,711.96	18.00	130.00	2,012.92	2.54	2.20	1.28

ALTERNATE B EAST FIREFLOW MAX DAY JUNCTION REPORT

ID	Elevation (ft)	Demand (gpm)	Head (ft)	Pressure (psi)
J100	22.30	3,694.20	165.25	61.94
J102	24.50	861.60	174.60	65.04
J104	18.00	0.00	169.41	65.61
J106	25.80	210.60	168.67	61.90
J108	31.60	0.00	167.89	59.05
J110	24.00	265.80	159.70	58.80
J112	24.00	171.50	167.02	61.97
J114	20.00	308.80	167.17	63.77
J116	22.50	367.90	165.65	62.03
J118	18.00	664.80	163.09	62.87
J120	21.00	290.70	169.99	64.56
J122	30.50	178.90	169.10	60.06
J126	22.50	396.70	168.61	63.31
J128	33.00	730.70	171.45	59.99
J130	22.30	330.40	167.67	62.99
J132	17.00	0.00	167.04	65.01
J134	31.00	409.10	168.35	59.51
J136	21.00	571.50	159.94	60.20
J138	21.00	0.00	159.60	60.06
J142	19.50	401.80	162.14	61.81
J144	22.30	1,664.80	162.96	60.95
J146	30.10	1,080.80	165.67	58.74
J26	31.00	277.30	167.05	58.95
J28	29.00	387.00	160.59	57.02
J30	20.00	0.00	167.04	63.71
J32	33.00	580.30	166.63	57.90
J34	37.70	319.30	166.90	55.98
J36	36.00	397.60	166.44	56.52
J38	35.80	0.00	166.81	56.76
J40	21.00	538.10	171.25	65.10
J42	25.00	375.30	159.51	58.28
J44	15.00	694.60	163.28	64.25
J48	22.30	453.70	164.43	61.59
J50	14.00	367.30	160.67	63.55
J52	14.80	878.80	160.68	63.21
J54	20.00	512.20	161.92	61.49
J56	14.50	383.50	162.52	64.14
J60	15.00	292.30	163.22	64.22
J64	32.00	0.00	165.25	57.74
J66	26.50	509.40	170.00	62.18
J70	14.50	0.00	164.43	64.97
J72	20.00	0.00	167.61	63.96
J74	15.00	182.50	164.54	64.80
J76	14.50	507.10	166.69	65.94
J78	23.00	865.80	164.10	61.14
J80	26.00	1,130.30	168.32	61.67
J82	15.50	475.40	161.53	63.27
J84	22.30	100.00	165.67	62.12
J86	22.00	550.30	162.11	60.71
J88	16.00	0.00	162.58	63.51
J90	16.00	564.10	161.14	62.89
J92	23.00	0.00	163.22	60.76
J94	16.50	590.50	160.65	62.46
J96	15.00	520.40	169.22	66.83
J98	15.00	347.90	163.67	64.42

ALTERNATE B EAST FIREFLOW MAX DAY PIPE REPORT

ID	Length (ft)	Diameter (in)	Roughness	Flow (gpm)	Velocity (ft/s)	Headloss (ft)	HL/1000
P101	6,331.65	12.00	130.00	-408.83	1.16	3.06	0.48
P107	2,136.18	18.00	130.00	2,658.19	3.35	4.59	2.15
P109	3,054.53	18.00	130.00	-140.74	0.18	0.03	0.01
P111	2,316.24	18.00	130.00	-1,480.64	1.87	1.69	0.73
P113	1,552.25	18.00	130.00	94.44	0.12	0.01	0.00
P115	2,156.25	12.00	130.00	883.62	2.51	4.35	2.02
P117	1,054.31	12.00	130.00	976.09	2.77	2.56	2.42
P119	2,443.09	12.00	130.00	475.40	1.35	1.56	0.64
P121	2,123.48	18.00	130.00	1,470.15	1.85	1.52	0.72
P123	4,311.44	18.00	130.00	1,009.78	1.27	1.54	0.36
P125	1,761.32	18.00	130.00	-1,394.47	1.76	1.15	0.65
P127	2,484.66	18.00	130.00	-434.44	0.55	0.19	0.08
P129	2,865.08	18.00	130.00	1,129.04	1.42	1.26	0.44
P131	4,870.25	24.00	130.00	2,957.74	2.10	3.14	0.65
P137	1,498.08	12.00	130.00	194.53	0.55	0.18	0.12
P141	2,459.06	12.00	130.00	-172.31	0.49	0.24	0.10
P143	3,525.87	12.00	130.00	-288.02	0.82	0.89	0.25
P145	1,865.59	18.00	130.00	580.30	0.73	0.24	0.13
P147	1,352.28	18.00	130.00	580.30	0.73	0.17	0.13
P149	2,605.51	12.00	130.00	-46.65	0.13	0.02	0.01
P157	1,279.39	18.00	130.00	-965.99	1.22	0.42	0.33
P159	3,333.64	12.00	130.00	-467.41	1.33	2.07	0.62
P167	1,837.39	18.00	130.00	2,227.04	2.81	2.85	1.55
P169	1,089.65	18.00	130.00	1,617.89	2.04	0.93	0.86
P171	1,121.28	18.00	130.00	1,287.49	1.62	0.63	0.56
P179	1,880.34	12.00	130.00	1,240.84	3.52	7.11	3.78
P181	1,515.06	12.00	130.00	268.20	0.76	0.34	0.22
P183	2,447.51	12.00	130.00	100.18	0.28	0.09	0.04
P185	1,381.61	18.00	130.00	2,177.76	2.75	2.05	1.49
P189	2,854.02	18.00	130.00	-589.79	0.74	0.38	0.13
P191	4,344.57	18.00	130.00	-270.33	0.34	0.14	0.03
P193	2,329.93	30.00	130.00	-6,253.62	2.84	2.03	0.87
P195	1,344.13	18.00	130.00	-327.21	0.41	0.06	0.04
P197	3,882.51	18.00	130.00	-537.81	0.68	0.43	0.11
P203	2,085.61	18.00	135.00	-1,067.92	1.35	0.77	0.37
P205	694.77	99.00	199.00	15.76	0.000	0.00	0.00
P207	1,564.32	99.00	199.00	72.24	0.00	0.00	0.00
P213	642.66	99.00	199.00	5,701.44	0.24	0.000	0.000
P215	2,964.56	99.00	199.00	0.00	0.00	0.00	0.00
P217	986.47	99.00	199.00	0.00	0.00	0.00	0.00
P23	1,831.28	12.00	130.00	1,195.31	3.39	6.46	3.53
P25	3,401.10	18.00	130.00	-124.85	0.16	0.03	0.01
P29	1,329.63	18.00	130.00	-985.21	1.24	0.45	0.34
P31	1,599.98	42.00	130.00	16,015.62	3.71	1.54	0.97
P37	3,816.18	18.00	130.00	1,036.15	1.31	1.43	0.38
P39	1,521.24	12.00	130.00	-105.38	0.30	0.06	0.04
P41	1,272.63	24.00	130.00	-72.24	0.05	0.000	0.000
P47	1,542.01	18.00	130.00	0.00	0.00	0.00	0.00
P49	2,593.59	18.00	130.00	-708.59	0.89	0.48	0.19
P51	2,155.63	18.00	130.00	-1,250.49	1.58	1.15	0.53
P53	4,888.13	18.00	130.00	12.88	0.02	0.000	0.000
P55	2,868.44	24.00	130.00	-1,398.45	0.99	0.46	0.16
P57	1,803.44	24.00	130.00	-2,145.43	1.52	0.64	0.36
P59	1,065.98	24.00	130.00	-2,365.50	1.68	0.45	0.43
P61	4,312.06	24.00	130.00	-4,293.81	3.05	5.55	1.29
P67	2,123.48	30.00	130.00	5,082.54	2.31	1.26	0.59
P69	2,388.21	18.00	130.00	0.00	0.00	0.00	0.00
P71	1,575.50	18.00	130.00	-187.99	0.24	0.03	0.02
P73	4,275.78	18.00	130.00	867.91	1.09	1.16	0.27
P75	1,299.46	12.00	130.00	712.50	2.02	1.76	1.35
P77	1,285.28	12.00	130.00	641.60	1.82	1.43	1.11
P83	1,120.85	12.00	130.00	200.30	0.57	0.14	0.13
P85	2,854.95	18.00	130.00	157.35	0.20	0.03	0.01

ALTERNATE B EAST FIREFLOW MAX DAY PIPE REPORT

ID	Length (ft)	Diameter (in)	Roughness	Flow (gpm)	Velocity (ft/s)	Headloss (ft)	HL/1000
P87	2,872.76	18.00	130.00	-112.22	0.14	0.02	0.01
P93	1,302.22	18.00	130.00	453.70	0.57	0.11	0.08
P95	1,290.95	18.00	130.00	2,315.39	2.92	2.15	1.67
P97	1,801.16	18.00	130.00	2,113.90	2.67	2.53	1.41
P99	1,711.96	18.00	130.00	-8.18	0.01	0.0000	0.0000

ALTERNATE B WEST FIREFLOW MAX DAY JUNCTION REPORT

ID	Elevation (ft)	Demand (gpm)	Head (ft)	Pressure (psi)
J-SOURCE1	16.00	3,000.00	16.00	-0.00000
J-SOURCE2	14.50	0.00	166.15	65.71
J100	22.30	694.20	162.43	60.72
J102	24.50	861.60	163.10	60.06
J104	18.00	0.00	162.79	62.74
J106	25.80	210.60	164.42	60.07
J108	31.60	0.00	166.75	58.56
J110	24.00	265.80	159.34	58.64
J112	24.00	171.50	163.88	60.61
J114	20.00	308.80	163.36	62.12
J116	22.50	367.90	162.13	60.50
J118	18.00	664.80	160.63	61.80
J120	21.00	290.70	162.92	61.49
J122	30.50	178.90	169.10	60.06
J126	22.50	396.70	163.11	60.93
J128	33.00	730.70	163.03	56.34
J130	22.30	330.40	163.09	61.00
J132	17.00	0.00	163.09	63.30
J134	31.00	409.10	165.34	58.21
J136	21.00	571.50	159.58	60.05
J138	21.00	0.00	159.60	60.06
J142	19.50	401.80	164.63	62.89
J144	22.30	1,664.80	160.48	59.87
J146	30.10	1,080.80	162.90	57.54
J158	19.00	367.20	157.40	59.97
J160	16.50	0.00	160.43	62.37
J162	14.00	0.00	162.92	64.53
J164	14.50	0.00	161.07	63.51
J166	19.00	1,282.20	155.44	59.12
J168	18.50	1,628.30	162.10	62.22
J170	31.00	0.00	159.84	55.83
J172	31.00	178.00	159.66	55.75
J174	29.00	0.00	159.66	56.61
J176	28.00	261.70	159.23	56.86
J178	20.00	412.60	159.30	60.36
J180	19.50	0.00	159.43	60.63
J182	31.00	0.00	159.66	55.75
J184	22.30	723.40	162.80	60.88
J188	32.00	246.30	166.45	58.26
J190	32.20	0.00	167.35	58.56
J192	16.00	27.50	162.85	63.63
J194	22.30	100.00	165.94	62.24
J196	21.50	150.00	162.92	61.28
J198	24.50	150.00	163.32	60.15
J200	16.50	100.00	163.66	63.76
J26	31.00	277.30	165.31	58.19
J28	29.00	387.00	159.97	56.75
J30	20.00	0.00	163.09	62.00
J32	33.00	580.30	164.89	57.15
J34	37.70	319.30	165.14	55.22
J36	36.00	397.60	164.30	55.59
J38	35.80	0.00	165.07	56.01
J40	21.00	538.10	163.50	61.75
J42	25.00	375.30	159.23	58.16
J44	15.00	694.60	161.07	63.29
J48	22.30	453.70	162.82	60.89
J50	14.00	367.30	162.45	64.32
J52	14.80	878.80	162.61	64.04
J54	20.00	512.20	163.34	62.11
J56	14.50	383.50	164.99	65.21
J60	15.00	292.30	166.15	65.49
J64	32.00	0.00	162.43	56.52

ALTERNATE B WEST FIREFLOW MAX DAY JUNCTION REPORT

ID	Elevation (ft)	Demand (gpm)	Head (ft)	Pressure (psi)
J66	26.50	509.40	162.92	59.11
J70	14.50	0.00	162.82	64.27
J72	20.00	0.00	161.32	61.23
J74	15.00	182.50	162.93	64.10
J76	14.50	507.10	164.65	65.06
J78	23.00	865.80	161.60	60.06
J80	26.00	1,130.30	162.95	59.34
J82	15.50	475.40	159.07	62.21
J84	22.30	100.00	162.59	60.79
J86	22.00	550.30	164.61	61.79
J88	16.00	0.00	165.21	64.65
J90	16.00	564.10	163.04	63.71
J92	23.00	0.00	166.15	62.03
J94	16.50	590.50	162.45	63.24
J96	15.00	520.40	164.50	64.78
J98	15.00	347.90	165.88	65.37

ALTERNATE B WEST FIREFLOW MAX DAY PIPE REPORT

ID	Length (ft)	Diameter (in)	Roughness	Flow (gpm)	Velocity (ft/s)	Headloss (ft)	HL/1000
P101	6,331.65	12.00	130.00	-195.55	0.55	0.78	0.12
P107	2,136.18	18.00	130.00	462.35	0.58	0.18	0.08
P109	3,054.53	18.00	130.00	-1,540.35	1.94	2.39	0.78
P111	2,316.24	18.00	130.00	170.93	0.22	0.03	0.01
P113	1,552.25	18.00	130.00	5.41	0.01	0.0000	0.0000
P115	2,156.25	12.00	130.00	353.33	1.00	0.80	0.37
P117	1,054.31	12.00	130.00	731.29	2.07	1.50	1.42
P119	2,443.09	12.00	130.00	475.40	1.35	1.56	0.64
P121	2,123.48	18.00	130.00	1,310.22	1.65	1.23	0.58
P123	4,311.44	18.00	130.00	564.35	0.71	0.53	0.12
P125	1,761.32	18.00	130.00	-1,378.27	1.74	1.12	0.64
P127	2,484.66	18.00	130.00	-695.44	0.88	0.45	0.18
P129	2,865.08	18.00	130.00	1,390.04	1.75	1.85	0.65
P131	4,870.25	24.00	130.00	389.22	0.28	0.07	0.02
P137	1,498.08	12.00	130.00	144.50	0.41	0.11	0.07
P141	2,459.06	12.00	130.00	-172.06	0.49	0.24	0.10
P143	3,525.87	12.00	130.00	-238.24	0.68	0.63	0.18
P145	1,865.59	18.00	130.00	580.30	0.73	0.24	0.13
P147	1,352.28	18.00	130.00	580.30	0.73	0.17	0.13
P149	2,605.51	18.00	130.00	926.20	1.17	0.80	0.31
P157	1,279.39	18.00	130.00	-577.85	0.73	0.16	0.13
P159	3,333.64	12.00	130.00	-133.68	0.38	0.20	0.06
P167	1,837.39	18.00	130.00	-341.48	0.43	0.09	0.05
P169	1,089.65	18.00	130.00	252.02	0.32	0.03	0.03
P171	1,121.28	18.00	130.00	-78.38	0.10	0.00	0.00
P179	1,880.34	12.00	130.00	847.82	2.41	3.51	1.87
P181	1,515.06	12.00	130.00	-61.36	0.17	0.02	0.01
P183	2,447.51	12.00	130.00	217.20	0.62	0.37	0.15
P185	1,381.61	18.00	130.00	3,033.84	3.83	3.79	2.75
P189	2,854.02	18.00	130.00	-577.97	0.73	0.36	0.13
P191	4,344.57	18.00	130.00	-286.53	0.36	0.15	0.03
P193	2,329.93	30.00	130.00	4,267.00	1.94	1.00	0.43
P195	1,344.13	18.00	130.00	-1,733.25	2.19	1.31	0.97
P197	3,882.51	18.00	130.00	-1,943.85	2.45	4.68	1.20
P199	1.00	99.00	199.00	13,756.53	0.57	0.00000	0.01
P203	2,085.61	18.00	135.00	-1,473.72	1.86	1.40	0.67
P205	1.00	99.00	199.00	525.54	0.02	0.00	0.0000
P207	1.00	99.00	199.00	0.00	0.00	0.00	0.00
P209	1.00	99.00	199.00	10,756.53	0.45	0.00000	0.00
P211	1.00	99.00	199.00	10,756.53	0.45	0.00000	0.00
P213	1.00	99.00	199.00	10,142.45	0.42	0.00000	0.00
P215	1.00	99.00	199.00	1,753.62	0.07	0.00	0.000
P217	1.00	99.00	199.00	4,222.21	0.18	0.000000	0.000
P223	1.00	99.00	199.00	10,756.53	0.45	0.00000	0.00
P225	1.00	99.00	199.00	628.44	0.03	0.00	0.0000
P23	1,831.28	12.00	130.00	1,078.54	3.06	5.34	2.92
P233	911.23	18.00	130.00	-1,949.45	2.46	1.10	1.21
P235	2,254.24	18.00	130.00	0.00	0.00	0.00	0.00
P237	4,243.68	24.00	130.00	1,167.63	0.83	0.49	0.12
P247	1,228.92	12.00	130.00	-743.05	2.11	1.80	1.46
P249	1,737.12	12.00	130.00	938.59	2.66	3.92	2.25
P25	3,401.10	18.00	130.00	-1,097.70	1.38	1.42	0.42
P251	1,747.43	12.00	130.00	710.81	2.02	2.35	1.35
P255	1,700.86	12.00	130.00	303.01	0.86	0.47	0.28
P257	3,304.33	12.00	130.00	-27.12	0.08	0.01	0.00
P259	2,414.57	12.00	130.00	0.00	0.00	0.00	0.00
P263	3,708.14	12.00	130.00	710.81	2.02	4.99	1.35
P265	2,183.83	12.00	130.00	-571.39	1.62	1.96	0.90
P267	1,717.02	18.00	130.00	1,313.66	1.66	1.00	0.58
P271	2,880.31	12.00	130.00	80.50	0.23	0.07	0.02
P273	1,600.32	12.00	130.00	165.62	0.47	0.15	0.09
P275	1,492.48	12.00	130.00	-165.62	0.47	0.14	0.09
P277	1,590.41	12.00	130.00	246.98	0.70	0.30	0.19

ALTERNATE B WEST FIREFLOW MAX DAY PIPE REPORT

ID	Length (ft)	Diameter (in)	Roughness	Flow (gpm)	Velocity (ft/s)	Headloss (ft)	HL/1000
P279	1,814.31	12.00	130.00	275.30	0.78	0.42	0.23
P281	1,699.00	12.00	130.00	13.60	0.04	0.00	0.000
P283	1,515.07	12.00	130.00	256.70	0.73	0.31	0.20
P285	985.39	12.00	130.00	196.60	0.56	0.12	0.12
P287	1,484.84	12.00	130.00	196.60	0.56	0.19	0.12
P289	1,009.71	12.00	130.00	-18.60	0.05	0.00	0.00
P29	1,329.63	18.00	130.00	-1,374.20	1.73	0.84	0.63
P291	1,826.74	12.00	130.00	0.00	0.00	0.00	0.00
P293	853.55	12.00	130.00	-239.12	0.68	0.15	0.18
P301	1,236.58	18.00	130.00	-2,655.89	3.35	2.65	2.15
P309	2,146.04	18.00	130.00	-411.90	0.52	0.15	0.07
P31	1,599.98	24.00	130.00	-1,273.20	0.90	0.22	0.14
P311	944.65	12.00	130.00	510.19	1.45	0.69	0.73
P315	1,040.74	18.00	130.00	2,329.98	2.94	1.75	1.68
P317	640.25	18.00	130.00	1,693.50	2.14	0.60	0.93
P319	1,720.14	18.00	130.00	1,693.50	2.14	1.60	0.93
P323	1,067.48	12.00	130.00	239.24	0.68	0.19	0.18
P325	1,530.14	12.00	130.00	292.24	0.83	0.40	0.26
P327	2,500.36	12.00	130.00	118.47	0.34	0.12	0.05
P329	1,076.73	24.00	130.00	1,454.44	1.03	0.19	0.17
P331	1,057.49	18.00	130.00	50.91	0.06	0.00	0.00
P333	1,085.58	18.00	130.00	1,534.69	1.93	0.84	0.78
P335	2,353.95	12.00	130.00	213.69	0.61	0.34	0.15
P337	2,119.20	12.00	130.00	244.93	0.69	0.40	0.19
P339	4,242.25	12.00	130.00	151.25	0.43	0.33	0.08
P341	4,487.30	12.00	130.00	-499.50	1.42	3.14	0.70
P343	1,278.99	12.00	130.00	-636.48	1.81	1.40	1.10
P345	834.90	12.00	130.00	460.13	1.31	0.50	0.60
P347	2,361.88	12.00	130.00	497.12	1.41	1.64	0.69
P37	3,816.18	18.00	130.00	1,241.34	1.57	2.00	0.52
P39	1,521.24	12.00	130.00	-212.04	0.60	0.22	0.14
P41	1.00	99.00	130.00	-10,756.53	0.45	0.00000	0.01
P47	1,542.01	18.00	130.00	0.00	0.00	0.00	0.00
P49	2,593.59	18.00	130.00	1,207.12	1.52	1.29	0.50
P51	2,155.63	18.00	130.00	-1,051.28	1.33	0.83	0.39
P53	4,888.13	18.00	130.00	-392.92	0.50	0.30	0.06
P55	2,868.44	24.00	130.00	-1,615.47	1.15	0.60	0.21
P57	1,803.44	24.00	130.00	-2,630.85	1.87	0.94	0.52
P59	1,065.98	42.00	130.00	7,833.38	1.81	0.27	0.26
P61	4,312.06	36.00	130.00	5,867.45	1.85	1.37	0.32
P67	2,123.48	24.00	130.00	1,862.56	1.32	0.58	0.27
P69	2,388.21	18.00	130.00	0.00	0.00	0.00	0.00
P71	1,575.50	18.00	130.00	-176.17	0.22	0.02	0.01
P73	4,275.78	18.00	130.00	749.43	0.94	0.88	0.21
P75	1,299.46	12.00	130.00	868.60	2.46	2.54	1.95
P77	1,285.28	12.00	130.00	803.34	2.28	2.17	1.69
P83	1,120.85	12.00	130.00	356.40	1.01	0.42	0.38
P85	2,854.95	18.00	130.00	362.54	0.46	0.15	0.05
P87	2,872.76	18.00	130.00	64.29	0.08	0.01	0.00
P93	1,302.22	18.00	130.00	453.70	0.57	0.11	0.08
P95	1,290.95	18.00	130.00	2,053.36	2.59	1.72	1.33
P97	1,801.16	18.00	130.00	-454.64	0.57	0.15	0.08
P99	1,711.96	18.00	130.00	1,220.99	1.54	0.87	0.51

ALTERNATE B WEST MAX DAY (NO TANKS) JUNCTION REPORT

ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
J-SOURCE1	0.00	16.00	16.00	-0.000000
J-SOURCE2	0.00	14.50	166.15	65.71
J100	694.20	22.30	162.43	60.72
J102	861.60	24.50	163.10	60.06
J104	0.00	18.00	162.79	62.74
J106	210.60	25.80	164.42	60.07
J108	0.00	31.60	166.75	58.56
J110	265.80	24.00	159.34	58.64
J112	171.50	24.00	163.88	60.61
J114	308.80	20.00	163.36	62.12
J116	367.90	22.50	162.13	60.50
J118	664.80	18.00	160.63	61.80
J120	290.70	21.00	162.92	61.49
J122	178.90	30.50	169.10	60.06
J126	396.70	22.50	163.11	60.93
J128	730.70	33.00	163.03	56.34
J130	330.40	22.30	163.09	61.00
J132	0.00	17.00	163.09	63.30
J134	409.10	31.00	165.34	58.21
J136	571.50	21.00	159.58	60.05
J138	0.00	21.00	159.60	60.06
J142	401.80	19.50	164.63	62.89
J144	1,664.80	22.30	160.48	59.87
J146	1,080.80	30.10	162.90	57.54
J158	367.20	19.00	157.40	59.97
J160	0.00	16.50	160.43	62.37
J162	0.00	14.00	162.92	64.53
J164	0.00	14.50	161.07	63.51
J166	1,282.20	19.00	155.44	59.12
J168	1,628.30	18.50	162.10	62.22
J170	0.00	31.00	159.84	55.83
J172	178.00	31.00	159.66	55.75
J174	0.00	29.00	159.66	56.61
J176	261.70	28.00	159.23	56.86
J178	412.60	20.00	159.30	60.36
J180	0.00	19.50	159.43	60.63
J182	0.00	31.00	159.66	55.75
J184	723.40	22.30	162.80	60.88
J188	246.30	32.00	166.45	58.26
J190	0.00	32.20	167.35	58.56
J192	27.50	16.00	162.85	63.63
J194	100.00	22.30	165.94	62.24
J196	150.00	21.50	162.92	61.28
J198	150.00	24.50	163.32	60.15
J200	100.00	16.50	163.66	63.76
J26	277.30	31.00	165.31	58.19
J28	387.00	29.00	159.97	56.75
J30	0.00	20.00	163.09	62.00
J32	580.30	33.00	164.89	57.15
J34	319.30	37.70	165.14	55.22
J36	397.60	36.00	164.30	55.59
J38	0.00	35.80	165.07	56.01
J40	538.10	21.00	163.50	61.75
J42	375.30	25.00	159.23	58.16
J44	694.60	15.00	161.07	63.29
J48	453.70	22.30	162.82	60.89
J50	367.30	14.00	162.45	64.32
J52	878.80	14.80	162.61	64.04
J54	512.20	20.00	163.34	62.11
J56	383.50	14.50	164.99	65.21
J60	292.30	15.00	166.15	65.49
J64	0.00	32.00	162.43	56.52

ALTERNATE B WEST MAX DAY (NO TANKS) JUNCTION REPORT

ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
J66	509.40	26.50	162.92	59.11
J70	0.00	14.50	162.82	64.27
J72	0.00	20.00	161.32	61.23
J74	182.50	15.00	162.93	64.10
J76	507.10	14.50	164.65	65.06
J78	865.80	23.00	161.60	60.06
J80	1,130.30	26.00	162.95	59.34
J82	475.40	15.50	159.07	62.21
J84	100.00	22.30	162.59	60.79
J86	550.30	22.00	164.61	61.79
J88	0.00	16.00	165.21	64.65
J90	564.10	16.00	163.04	63.71
J92	0.00	23.00	166.15	62.03
J94	590.50	16.50	162.45	63.24
J96	520.40	15.00	164.50	64.78
J98	347.90	15.00	165.88	65.37

ALTERNATE B WEST MAX DAY (NO TANKS) PIPE REPORT

ID	Length (ft)	Diameter (in)	Roughness	Flow (gpm)	Velocity (ft/s)	Headloss (ft)	HL/1000 (ft/kft)
P101	6,331.65	12.00	130.00	-195.55	0.55	0.78	0.12
P107	2,136.18	18.00	130.00	462.35	0.58	0.18	0.08
P109	3,054.53	18.00	130.00	-1,540.35	1.94	2.39	0.78
P111	2,316.24	18.00	130.00	170.93	0.22	0.03	0.01
P113	1,552.25	18.00	130.00	5.41	0.01	0.0000	0.0000
P115	2,156.25	12.00	130.00	353.33	1.00	0.80	0.37
P117	1,054.31	12.00	130.00	731.29	2.07	1.50	1.42
P119	2,443.09	12.00	130.00	475.40	1.35	1.56	0.64
P121	2,123.48	18.00	130.00	1,310.22	1.65	1.23	0.58
P123	4,311.44	18.00	130.00	564.35	0.71	0.53	0.12
P125	1,761.32	18.00	130.00	-1,378.27	1.74	1.12	0.64
P127	2,484.66	18.00	130.00	-695.44	0.88	0.45	0.18
P129	2,865.08	18.00	130.00	1,390.04	1.75	1.85	0.65
P131	4,870.25	24.00	130.00	389.22	0.28	0.07	0.02
P137	1,498.08	12.00	130.00	144.50	0.41	0.11	0.07
P141	2,459.06	12.00	130.00	-172.06	0.49	0.24	0.10
P143	3,525.87	12.00	130.00	-238.24	0.68	0.63	0.18
P145	1,865.59	18.00	130.00	580.30	0.73	0.24	0.13
P147	1,352.28	18.00	130.00	580.30	0.73	0.17	0.13
P149	2,605.51	18.00	130.00	926.20	1.17	0.80	0.31
P157	1,279.39	18.00	130.00	-577.85	0.73	0.16	0.13
P159	3,333.64	12.00	130.00	-133.68	0.38	0.20	0.06
P167	1,837.39	18.00	130.00	-341.48	0.43	0.09	0.05
P169	1,089.65	18.00	130.00	252.02	0.32	0.03	0.03
P171	1,121.28	18.00	130.00	-78.38	0.10	0.00	0.00
P179	1,880.34	12.00	130.00	847.82	2.41	3.51	1.87
P181	1,515.06	12.00	130.00	-61.36	0.17	0.02	0.01
P183	2,447.51	12.00	130.00	217.20	0.62	0.37	0.15
P185	1,381.61	18.00	130.00	3,033.84	3.83	3.79	2.75
P189	2,854.02	18.00	130.00	-577.97	0.73	0.36	0.13
P191	4,344.57	18.00	130.00	-286.53	0.36	0.15	0.03
P193	2,329.93	30.00	130.00	4,267.00	1.94	1.00	0.43
P195	1,344.13	18.00	130.00	-1,733.25	2.19	1.31	0.97
P197	3,882.51	18.00	130.00	-1,943.85	2.45	4.68	1.20
P199	1.00	99.00	199.00	10,756.53	0.45	0.00000	0.00
P203	2,085.61	18.00	135.00	-1,473.72	1.86	1.40	0.67
P205	1.00	99.00	199.00	525.54	0.02	0.00	0.00
P207	1.00	99.00	199.00	0.00	0.00	0.00	0.00
P209	1.00	99.00	199.00	10,756.53	0.45	0.00000	0.00
P211	1.00	99.00	199.00	10,756.53	0.45	0.00	0.00
P213	1.00	99.00	199.00	10,142.45	0.42	0.00	0.00
P215	1.00	99.00	199.00	1,753.62	0.07	0.00	0.00
P217	1.00	99.00	199.00	4,222.21	0.18	0.00	0.00
P223	1.00	99.00	199.00	10,756.53	0.45	0.00	0.00
P225	1.00	99.00	199.00	628.44	0.03	0.00	0.00
P23	1,831.28	12.00	130.00	1,078.54	3.06	5.34	2.92
P233	911.23	18.00	130.00	-1,949.45	2.46	1.10	1.21
P235	2,254.24	18.00	130.00	0.00	0.00	0.00	0.00
P237	4,243.68	24.00	130.00	1,167.63	0.83	0.49	0.12
P247	1,228.92	12.00	130.00	-743.05	2.11	1.80	1.46
P249	1,737.12	12.00	130.00	938.59	2.66	3.92	2.25
P25	3,401.10	18.00	130.00	-1,097.70	1.38	1.42	0.42
P251	1,747.43	12.00	130.00	710.81	2.02	2.35	1.35
P255	1,700.86	12.00	130.00	303.01	0.86	0.47	0.28
P257	3,304.33	12.00	130.00	-27.12	0.08	0.01	0.00
P259	2,414.57	12.00	130.00	0.00	0.00	0.00	0.00
P263	3,708.14	12.00	130.00	710.81	2.02	4.99	1.35
P265	2,183.83	12.00	130.00	-571.39	1.62	1.96	0.90
P267	1,717.02	18.00	130.00	1,313.66	1.66	1.00	0.58
P271	2,880.31	12.00	130.00	80.50	0.23	0.07	0.02
P273	1,600.32	12.00	130.00	165.62	0.47	0.15	0.09
P275	1,492.48	12.00	130.00	-165.62	0.47	0.14	0.09
P277	1,590.41	12.00	130.00	246.98	0.70	0.30	0.19

ALTERNATE B WEST MAX DAY (NO TANKS) PIPE REPORT

ID	Length (ft)	Diameter (in)	Roughness	Flow (gpm)	Velocity (ft/s)	Headloss (ft)	HL/1000 (ft/kft)
P279	1,814.31	12.00	130.00	275.30	0.78	0.42	0.23
P281	1,699.00	12.00	130.00	13.60	0.04	0.00	0.000
P283	1,515.07	12.00	130.00	256.70	0.73	0.31	0.20
P285	985.39	12.00	130.00	196.60	0.56	0.12	0.12
P287	1,484.84	12.00	130.00	196.60	0.56	0.19	0.12
P289	1,009.71	12.00	130.00	-18.60	0.05	0.00	0.00
P29	1,329.63	18.00	130.00	-1,374.20	1.73	0.84	0.63
P291	1,826.74	12.00	130.00	0.00	0.00	0.00	0.00
P293	853.55	12.00	130.00	-239.12	0.68	0.15	0.18
P301	1,236.58	18.00	130.00	-2,655.89	3.35	2.65	2.15
P309	2,146.04	18.00	130.00	-411.90	0.52	0.15	0.07
P31	1,599.98	24.00	130.00	-1,273.20	0.90	0.22	0.14
P311	944.65	12.00	130.00	510.19	1.45	0.69	0.73
P315	1,040.74	18.00	130.00	2,329.98	2.94	1.75	1.68
P317	640.25	18.00	130.00	1,693.50	2.14	0.60	0.93
P319	1,720.14	18.00	130.00	1,693.50	2.14	1.60	0.93
P323	1,067.48	12.00	130.00	239.24	0.68	0.19	0.18
P325	1,530.14	12.00	130.00	292.24	0.83	0.40	0.26
P327	2,500.36	12.00	130.00	118.47	0.34	0.12	0.05
P329	1,076.73	24.00	130.00	1,454.44	1.03	0.19	0.17
P331	1,057.49	18.00	130.00	50.91	0.06	0.00	0.00
P333	1,085.58	18.00	130.00	1,534.69	1.93	0.84	0.78
P335	2,353.95	12.00	130.00	213.69	0.61	0.34	0.15
P337	2,119.20	12.00	130.00	244.93	0.69	0.40	0.19
P339	4,242.25	12.00	130.00	151.25	0.43	0.33	0.08
P341	4,487.30	12.00	130.00	-499.50	1.42	3.14	0.70
P343	1,278.99	12.00	130.00	-636.48	1.81	1.40	1.10
P345	834.90	12.00	130.00	460.13	1.31	0.50	0.60
P347	2,361.88	12.00	130.00	497.12	1.41	1.64	0.69
P37	3,816.18	18.00	130.00	1,241.34	1.57	2.00	0.52
P39	1,521.24	12.00	130.00	-212.04	0.60	0.22	0.14
P41	1.00	99.00	130.00	-10,756.53	0.45	0.0000	0.02
P47	1,542.01	18.00	130.00	0.00	0.00	0.00	0.00
P49	2,593.59	18.00	130.00	1,207.12	1.52	1.29	0.50
P51	2,155.63	18.00	130.00	-1,051.28	1.33	0.83	0.39
P53	4,888.13	18.00	130.00	-392.92	0.50	0.30	0.06
P55	2,868.44	24.00	130.00	-1,615.47	1.15	0.60	0.21
P57	1,803.44	24.00	130.00	-2,630.85	1.87	0.94	0.52
P59	1,065.98	42.00	130.00	7,833.38	1.81	0.27	0.26
P61	4,312.06	36.00	130.00	5,867.45	1.85	1.37	0.32
P67	2,123.48	24.00	130.00	1,862.56	1.32	0.58	0.27
P69	2,388.21	18.00	130.00	0.00	0.00	0.00	0.00
P71	1,575.50	18.00	130.00	-176.17	0.22	0.02	0.01
P73	4,275.78	18.00	130.00	749.43	0.94	0.88	0.21
P75	1,299.46	12.00	130.00	868.60	2.46	2.54	1.95
P77	1,285.28	12.00	130.00	803.34	2.28	2.17	1.69
P83	1,120.85	12.00	130.00	356.40	1.01	0.42	0.38
P85	2,854.95	18.00	130.00	362.54	0.46	0.15	0.05
P87	2,872.76	18.00	130.00	64.29	0.08	0.01	0.00
P93	1,302.22	18.00	130.00	453.70	0.57	0.11	0.08
P95	1,290.95	18.00	130.00	2,053.36	2.59	1.72	1.33
P97	1,801.16	18.00	130.00	-454.64	0.57	0.15	0.08
P99	1,711.96	18.00	130.00	1,220.99	1.54	0.87	0.51

ALTERNATE B WEST PEAK HOUR DEMAND WITH TANKS JUNCTION REPORT

		ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
1		J-SOURCE1	0.00	16.00	16.00	-0.00000
2		J-SOURCE2	0.00	14.50	166.15	65.71
3		J100	1,325.92	22.30	161.14	60.16
4		J102	1,645.66	24.50	163.10	60.06
5		J104	0.00	18.00	160.26	61.64
6		J106	402.25	25.80	162.38	59.18
7		J108	0.00	31.60	165.32	57.94
8		J110	507.68	24.00	154.67	56.62
9		J112	327.57	24.00	161.11	59.41
10		J114	589.81	20.00	162.74	61.85
11		J116	702.69	22.50	161.27	60.13
12		J118	1,269.77	18.00	155.94	59.77
13		J120	555.24	21.00	161.75	60.99
14		J122	341.70	30.50	169.10	60.06
15		J126	757.70	22.50	160.74	59.90
16		J128	1,395.64	33.00	161.22	55.56
17		J130	631.06	22.30	160.54	59.90
18		J132	0.00	17.00	160.53	62.19
19		J134	781.38	31.00	163.29	57.32
20		J136	1,091.56	21.00	156.97	58.92
21		J138	0.00	21.00	159.60	60.06
22		J142	767.44	19.50	161.59	61.57
23		J144	3,179.77	22.30	155.96	57.92
24		J146	2,064.33	30.10	160.21	56.38
25		J158	701.35	19.00	142.38	53.46
26		J160	0.00	16.50	152.45	58.91
27		J162	0.00	14.00	157.64	62.24
28		J164	0.00	14.50	156.29	61.44
29		J166	2,449.00	19.00	135.88	50.64

ALTERNATE B WEST PEAK HOUR DEMAND WITH TANKS JUNCTION REPORT

		ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
30		J168	3,110.05	18.50	158.95	60.86
31		J170	0.00	31.00	154.54	53.53
32		J172	339.98	31.00	154.27	53.41
33		J174	0.00	29.00	154.31	54.30
34		J176	499.85	28.00	154.09	54.64
35		J178	788.07	20.00	156.97	59.35
36		J180	0.00	19.50	156.97	59.57
37		J182	0.00	31.00	154.27	53.41
38		J184	1,381.69	22.30	160.49	59.88
39		J188	470.43	32.00	164.88	57.58
40		J190	0.00	32.20	166.29	58.10
41		J192	52.53	16.00	156.83	61.02
42		J194	191.00	22.30	164.15	61.46
43		J196	286.50	21.50	161.59	60.70
44		J198	286.50	24.50	162.98	60.00
45		J200	191.00	16.50	162.61	63.31
46		J26	529.64	31.00	162.55	57.00
47		J28	739.17	29.00	154.71	54.47
48		J30	0.00	20.00	160.53	60.89
49		J32	1,108.37	33.00	161.19	55.54
50		J34	609.86	37.70	162.71	54.17
51		J36	759.42	36.00	161.60	54.42
52		J38	0.00	35.80	161.76	54.58
53		J40	1,027.77	21.00	162.98	61.52
54		J42	716.82	25.00	154.58	56.15
55		J44	1,326.69	15.00	156.29	61.22
56		J48	866.57	22.30	159.37	59.39
57		J50	701.54	14.00	155.37	61.26
58		J52	1,678.51	14.80	155.69	61.05

ALTERNATE B WEST PEAK HOUR DEMAND WITH TANKS JUNCTION REPORT

		ID	Demand (gpm)	Elevation (ft)	Head (ft)	Pressure (psi)
59		J54	978.30	20.00	158.56	60.04
60		J56	732.48	14.50	162.75	64.24
61		J60	558.29	15.00	166.15	65.49
62		J64	0.00	32.00	161.14	55.96
63		J66	972.95	26.50	161.36	58.44
64		J70	0.00	14.50	159.37	62.77
65		J72	0.00	20.00	155.34	58.64
66		J74	348.58	15.00	159.72	62.71
67		J76	968.56	14.50	164.65	65.06
68		J78	1,653.68	23.00	161.60	60.06
69		J80	2,158.87	26.00	160.73	58.38
70		J82	908.01	15.50	150.76	58.61
71		J84	191.00	22.30	160.88	60.05
72		J86	1,051.07	22.00	161.52	60.46
73		J88	0.00	16.00	163.37	63.85
74		J90	1,077.43	16.00	157.19	61.18
75		J92	0.00	23.00	166.15	62.03
76		J94	1,127.85	16.50	155.37	60.17
77		J96	993.96	15.00	164.05	64.58
78		J98	664.49	15.00	165.71	65.30

ALTERNATE B WEST PEAK HOUR DEMAND WITH TANKS PIPE REPORT

		ID	From Node	To Node	Length (ft)	Diameter (in)	Roughness	Flow (gpm)	Velocity (ft/s)	Headloss (ft)	HL/1000 (ft/kft)
1		P101	J72	J168	6,331.65	12.00	130.00	-446.48	1.27	3.60	0.57
2		P107	J102	J66	2,136.18	18.00	130.00	1,571.87	1.98	1.74	0.81
3		P109	J80	J134	3,054.53	18.00	130.00	-1,595.81	2.01	2.55	0.84
4		P111	J80	J66	2,316.24	18.00	130.00	-870.41	1.10	0.63	0.27
5		P113	J66	J196	1,552.25	18.00	130.00	-614.45	0.77	0.22	0.14
6		P115	J120	J116	2,156.25	12.00	130.00	270.56	0.77	0.49	0.23
7		P117	J116	J118	1,054.31	12.00	130.00	1,451.73	4.12	5.33	5.05
8		P119	J118	J82	2,443.09	12.00	130.00	908.01	2.58	5.18	2.12
9		P121	J114	J116	2,123.48	18.00	130.00	1,442.46	1.82	1.47	0.69
10		P123	J116	J78	4,311.44	18.00	130.00	-441.39	0.56	0.33	0.08
11		P125	J144	J78	1,761.32	18.00	130.00	-3,294.35	4.15	5.64	3.20
12		P127	J118	J44	2,484.66	18.00	130.00	-611.48	0.77	0.35	0.14
13		P129	J74	J44	2,865.08	18.00	130.00	1,938.16	2.44	3.43	1.20
14		P131	J102	J128	4,870.25	24.00	130.00	2,244.08	1.59	1.88	0.39
15		P137	J110	J42	1,498.08	12.00	130.00	132.20	0.38	0.09	0.06
16		P141	J110	J136	2,459.06	12.00	130.00	-584.00	1.66	2.30	0.94
17		P143	J110	J28	3,525.87	12.00	130.00	-55.88	0.16	0.04	0.01
18		P145	J26	J38	1,865.59	18.00	130.00	1,108.37	1.40	0.79	0.43
19		P147	J38	J32	1,352.28	18.00	130.00	1,108.37	1.40	0.58	0.43
20		P149	J112	J132	2,605.51	18.00	130.00	779.17	0.98	0.58	0.22
21		P157	J100	J84	1,279.39	18.00	130.00	749.79	0.95	0.26	0.21
22		P159	J84	J184	3,333.64	12.00	130.00	189.40	0.54	0.39	0.12
23		P167	J128	J126	1,837.39	18.00	130.00	848.44	1.07	0.48	0.26
24		P169	J126	J130	1,089.65	18.00	130.00	706.58	0.89	0.20	0.18
25		P171	J130	J132	1,121.28	18.00	130.00	75.52	0.10	0.00	0.00
26		P179	J132	J136	1,880.34	12.00	130.00	854.69	2.42	3.56	1.90
27		P181	J136	J138	1,515.06	12.00	130.00	-815.06	2.31	2.63	1.74
28		P183	J138	J42	2,447.51	12.00	130.00	892.07	2.53	5.02	2.05
29		P185	J122	J26	1,381.61	18.00	130.00	4,072.18	5.13	6.55	4.74
30		P189	J142	J56	2,854.02	18.00	130.00	-1,080.88	1.36	1.16	0.41
31		P191	J144	J118	4,344.57	18.00	130.00	114.58	0.14	0.03	0.01
32		P193	J96	J40	2,329.93	30.00	130.00	4,424.74	2.01	1.07	0.46
33		P195	J126	J106	1,344.13	18.00	130.00	-1,961.22	2.47	1.65	1.22
34		P197	J106	J122	3,882.51	18.00	130.00	-2,363.46	2.98	6.72	1.73

ALTERNATE B WEST PEAK HOUR DEMAND WITH TANKS PIPE REPORT

		ID	From Node	To Node	Length (ft)	Diameter (in)	Roughness	Flow (gpm)	Velocity (ft/s)	Headloss (ft)	HL/1000 (ft/kft)
35		P199	WEST_WELLS	J-SOURCE1	1.00	99.00	199.00	15,416.05	0.64	0.00000	0.01
36		P203	J146	J36	2,085.61	18.00	135.00	-1,464.93	1.85	1.39	0.67
37		P205	T100	J138	1.00	99.00	199.00	2,501.01	0.10	0.00	0.00
38		P207	T200	J92	1.00	99.00	199.00	0.00	0.00	0.00	0.00
39		P209	J-SOURCE1	U7000	1.00	99.00	199.00	15,416.05	0.64	0.00000	0.01
40		P211	U7000	J-SOURCE2	1.00	99.00	199.00	15,416.05	0.64	0.0000	0.02
41		P213	T400	J122	1.00	99.00	199.00	13,192.16	0.55	0.00	0.00
42		P215	T300	J102	1.00	99.00	199.00	9,219.50	0.38	0.00	0.00
43		P217	T500	J76	1.00	99.00	199.00	7,055.41	0.29	0.00	0.00
44		P223	J-SOURCE2	J92	1.00	99.00	199.00	15,416.05	0.64	0.00	0.00
45		P225	T600	J78	1.00	99.00	199.00	6,150.87	0.26	0.00	0.00
46		P23	J26	J28	1,831.28	12.00	130.00	1,327.43	3.77	7.84	4.28
47		P233	J134	J188	911.23	18.00	130.00	-2,377.19	3.00	1.59	1.75
48		P235	J132	J30	2,254.24	18.00	130.00	0.00	0.00	0.00	0.00
49		P237	J120	J100	4,243.68	24.00	130.00	1,314.25	0.93	0.61	0.14
50		P247	J72	J126	1,228.92	12.00	130.00	-1,345.38	3.82	5.40	4.39
51		P249	J72	J158	1,737.12	12.00	130.00	1,791.86	5.08	12.97	7.46
52		P25	J112	J26	3,401.10	18.00	130.00	-1,106.74	1.40	1.44	0.42
53		P251	J104	J160	1,747.43	12.00	130.00	1,358.49	3.85	7.81	4.47
54		P255	J162	J50	1,700.86	12.00	130.00	707.09	2.01	2.27	1.33
55		P257	J162	J74	3,304.33	12.00	130.00	-471.18	1.34	2.08	0.63
56		P259	J44	J164	2,414.57	12.00	130.00	0.00	0.00	0.00	0.00
57		P263	J160	J166	3,708.14	12.00	130.00	1,358.49	3.85	16.58	4.47
58		P265	J166	J158	2,183.83	12.00	130.00	-1,090.51	3.09	6.50	2.98
59		P267	J102	J168	1,717.02	18.00	130.00	2,832.38	3.57	4.15	2.42
60		P271	J162	J192	2,880.31	12.00	130.00	305.88	0.87	0.81	0.28
61		P273	J136	J180	1,600.32	12.00	130.00	-5.82	0.02	0.000	0.000
62		P275	J178	J180	1,492.48	12.00	130.00	5.82	0.02	0.000	0.000
63		P277	J138	J178	1,590.41	12.00	130.00	793.88	2.25	2.63	1.65
64		P279	J174	J176	1,814.31	12.00	130.00	192.40	0.55	0.22	0.12
65		P281	J176	J42	1,699.00	12.00	130.00	-307.45	0.87	0.48	0.29
66		P283	J28	J174	1,515.07	12.00	130.00	294.75	0.84	0.40	0.26
67		P285	J28	J170	985.39	12.00	130.00	237.62	0.67	0.17	0.18
68		P287	J170	J172	1,484.84	12.00	130.00	237.62	0.67	0.26	0.18

ALTERNATE B WEST PEAK HOUR DEMAND WITH TANKS PIPE REPORT

		ID	From Node	To Node	Length (ft)	Diameter (in)	Roughness	Flow (gpm)	Velocity (ft/s)	Headloss (ft)	HL/1000 (ft/kft)
69		P289	J174	J172	1,009.71	12.00	130.00	102.36	0.29	0.04	0.04
70		P29	J36	J34	1,329.63	18.00	130.00	-1,593.66	2.01	1.11	0.83
71		P291	J172	J182	1,826.74	12.00	130.00	0.00	0.00	0.00	0.00
72		P293	J184	J80	853.55	12.00	130.00	-307.35	0.87	0.24	0.29
73		P301	J188	J122	1,236.58	18.00	130.00	-3,411.12	4.30	4.22	3.41
74		P309	J114	J40	2,146.04	18.00	130.00	-541.21	0.68	0.24	0.11
75		P31	J102	J198	1,599.98	24.00	130.00	925.51	0.66	0.12	0.08
76		P311	J104	J168	944.65	12.00	130.00	724.15	2.05	1.32	1.39
77		P315	J122	J190	1,040.74	18.00	130.00	3,003.70	3.79	2.81	2.70
78		P317	J190	J108	640.25	18.00	130.00	2,203.53	2.78	0.97	1.52
79		P319	J108	J34	1,720.14	18.00	130.00	2,203.53	2.78	2.61	1.52
80		P323	J90	J192	1,067.48	12.00	130.00	335.62	0.95	0.36	0.34
81		P325	J192	J94	1,530.14	12.00	130.00	588.97	1.67	1.45	0.95
82		P327	J66	J184	2,500.36	12.00	130.00	342.96	0.97	0.87	0.35
83		P329	J40	J198	1,076.73	24.00	130.00	67.54	0.05	0.000	0.000
84		P331	J120	J196	1,057.49	18.00	130.00	648.16	0.82	0.17	0.16
85		P333	J96	J200	1,085.58	18.00	130.00	2,049.90	2.58	1.44	1.33
86		P335	J200	J198	2,353.95	12.00	130.00	-223.75	0.63	0.37	0.16
87		P337	J198	J196	2,119.20	12.00	130.00	482.80	1.37	1.39	0.66
88		P339	J196	J84	4,242.25	12.00	130.00	230.01	0.65	0.71	0.17
89		P341	J184	J194	4,487.30	12.00	130.00	-541.99	1.54	3.66	0.82
90		P343	J194	J190	1,278.99	12.00	130.00	-800.17	2.27	2.15	1.68
91		P345	J188	J194	834.90	12.00	130.00	563.50	1.60	0.73	0.88
92		P347	J194	J36	2,361.88	12.00	130.00	630.68	1.79	2.55	1.08
93		P37	J86	J52	3,816.18	18.00	130.00	2,211.84	2.79	5.84	1.53
94		P39	J56	J88	1,521.24	12.00	130.00	-372.02	1.06	0.62	0.41
95		P41	J60	J92	1.00	99.00	130.00	-15,416.05	0.64	0.0000	0.02
96		P47	J48	J70	1,542.01	18.00	130.00	0.00	0.00	0.00	0.00
97		P49	J76	J114	2,593.59	18.00	130.00	1,491.06	1.88	1.91	0.74
98		P51	J78	J100	2,155.63	18.00	130.00	761.46	0.96	0.46	0.21
99		P53	J84	J146	4,888.13	18.00	130.00	599.40	0.76	0.67	0.14
100		P55	J86	J88	2,868.44	24.00	130.00	-2,949.47	2.09	1.84	0.64
101		P57	J88	J60	1,803.44	24.00	130.00	-4,734.54	3.36	2.78	1.54
102		P59	J60	J98	1,065.98	42.00	130.00	10,123.22	2.34	0.44	0.41

ALTERNATE B WEST PEAK HOUR DEMAND WITH TANKS PIPE REPORT

		ID	From Node	To Node	Length (ft)	Diameter (in)	Roughness	Flow (gpm)	Velocity (ft/s)	Headloss (ft)	HL/1000 (ft/kft)
103		P61	J98	J96	4,312.06	36.00	130.00	6,497.29	2.05	1.66	0.38
104		P67	J40	J120	2,123.48	24.00	130.00	2,788.22	1.98	1.23	0.58
105		P69	J100	J64	2,388.21	18.00	130.00	0.00	0.00	0.00	0.00
106		P71	J86	J142	1,575.50	18.00	130.00	-313.44	0.40	0.06	0.04
107		P73	J98	J56	4,275.78	18.00	130.00	1,441.34	1.82	2.96	0.69
108		P75	J98	J54	1,299.46	12.00	130.00	1,520.09	4.31	7.15	5.50
109		P77	J88	J90	1,285.28	12.00	130.00	1,413.05	4.01	6.18	4.81
110		P83	J54	J162	1,120.85	12.00	130.00	541.79	1.54	0.91	0.81
111		P85	J52	J94	2,854.95	18.00	130.00	533.33	0.67	0.31	0.11
112		P87	J94	J50	2,872.76	18.00	130.00	-5.55	0.01	0.0000	0.0000
113		P93	J74	J48	1,302.22	18.00	130.00	866.57	1.09	0.35	0.27
114		P95	J76	J74	1,290.95	18.00	130.00	3,624.48	4.57	4.93	3.82
115		P97	J96	J76	1,801.16	18.00	130.00	-971.31	1.22	0.60	0.33
116		P99	J200	J104	1,711.96	18.00	130.00	2,082.65	2.63	2.34	1.37

Appendix D. Engineer's Opinion of Costs

PRELIMINARY COST ESTIMATE

WATER MASTER PLAN

SUTTER POINTE

Sutter County, California

November 14, 2008

MACKAY & SOMPS
CIVIL ENGINEERS, INC.
SACRAMENTO, CALIFORNIA (916) 929-6092

1. This estimate is prepared as a guide only and is subject to possible change. It has been prepared to a standard of accuracy which, to the best of our knowledge and judgment, is sufficient to satisfy our understanding of the purpose of this estimate. MacKay & Somps makes no warranty, either expressed or implied, as to the accuracy of this estimate.

2. This estimate assumes that the demands for the initial phases of developement will be served by groudwater sources. Surface water will then be brought on to meet the demands of the developement as the community builds out.

3. This estimate assumes the Sutter Pointe Specific Plan would be successful in converting a portion of their agricultural water rights to municipal and industrial uses for the Specific Plan Area.

4. This estimate assumes that the primary source for raw surface water will be from the Bennet Pumping Plant (BPP), and the alternate location would be NCMWC's proposed Sankey Water Diversion Project (SWDP). The developement costs include the turnout, booster pump and raw water transmission line as one line item, and an estimated fair share cost for a proposed diversion as another item (see fair share calculation at rear of estimate). Estimate assumes that fair share cost is the same whether Bennet, or Sankey Diversion option is chosen.

5. The proposed primary route for raw water transmission will be from the BPP then southerly to Sankey Road, easterly to Powerline Road, then southerly to Riego Road, easterly on Riego Road, and southerly to a to a proposed raw water treatment plant. Alternatively, a raw surface water treatment plant could be placed on the eastern portion of the project, whereas the alignment for raw surface water transmission would be from the BPP then southerly to Sankey Road, then easterly (crossing HWY 99) to within the project boundary and south easterly to a proposed raw water treatment site. Both alignment options can utilize a potential tie in to a possible booster pump from a Sankey Diversion Project, thereby reducing the transmission length by +/- 2,400 LF. The alternative costs are shown in the estimate and reflected as potential cost deductions.

6. This estimate does not include any fees by a retail water purveyor providing services in the South Sutter Specific Plan Area. This estimate does, however, include the full cost of the water system, and no fees or credits are applicable.

7. This estimate does not consider the following:

a. Cost associated with environmental (wetland) mitigations or biological surveys
b. Phased construction or out-of-regular-sequence construction
c. Costs associated with ground water or inclement weather conditions
d. Financial Charges
e. Bonds
f. Land costs, acquisition of right of way, easements, and/or rights of entry
g. Assessments from assessment, lighting & landscaping, Mello-Roos districts or the like

8. Costs presented herein represent an opinion based on historical information. No provision has been made for inflation.

9. Costs have been been tabulated and extracted for Phase as well as annual costs according the SPSP Conceptual Phasing Plan dated March, 2008.

10. The "cash flow" situation may be different than the fees, credits, and reimbursements itemized in this estimate.

11. Interim improvements may be required depending on development timing of individual units.

12. This cost estimate is based only on the quantities as shown on the exhibits provided in the Sutter Pointe Specific Plan Water Master Plan Report, which includes backbone onsite and offsite utilities.

13. 4 Cost esimtates have been included for the 3 water supply scenarios options shown below:

1. Proposed - Water Supply Program: Includes both east and west well fields, and surface water treatment plant adjacent to the western ground water treatment plant. Proposed surface water transmission is from Bennet to West Treatment Plant site with a 42" transmission line sized for 29.3 MGD flows. Assumes ground water well and pump facilities will be completed in the initial phases.

2. Alt. "A" Revised - Water Supply Program: Includes both east and west well fields, and surface water treatment plant adjacent to the western ground water treatment plant. Proposed surface water transmission is from Bennet to the West Treatment site with a 42" transmission line sized for 35.1 MGD flows. Assumed ground water well and pump facilities will be completed in the initial phases.

3. Alt "B" Winter Diversion - Water Supply Program (West Well Field): Includes west well field, and surface water treatment plant adjacent to the western ground water treatment plant. Proposed surface water transmission is from Bennet to the West Treatment site with a 42" transmission line sized for 33.1 MGD flows.

4. Alt "B" Winter Diversion - Water Supply Program (East Well Field): Includes east well field, and surface water treatment plant adjacent to the eastern ground water treatment plant. Proposed surface water transmission is from Bennet to the EastTreatment site with a 42" transmission line sized for 33.1 MGD flows.

ENGINEER'S PRELIMINARY OPINION OF COSTS

Sutter County

Based on the Sutter Pointe Water System Model for Proposed Water Supply Program (PWSP)

CONSTRUCTION COSTS (PWSP)

ITEM No.	DESCRIPTION	UNIT PRICE	PHASE 1 QTY	PHASE 1 UNIT	PHASE 1 AMOUNT	PHASE A QTY	PHASE A UNIT	PHASE A AMOUNT	PHASE 2 QTY	PHASE 2 UNIT	PHASE 2 AMOUNT	PHASE B QTY	PHASE B UNIT	PHASE B AMOUNT	PHASE 3 QTY	PHASE 3 UNIT	PHASE 3 AMOUNT	PHASE C QTY	PHASE C UNIT	PHASE C AMOUNT	PHASE 4 QTY	PHASE 4 UNIT	PHASE 4 AMOUNT	PHASE D QTY	PHASE D UNIT	PHASE D AMOUNT	TOTAL QTY	TOTAL UNIT	TOTAL AMOUNT
A. WATER TRANSMISSION																													
1.	12" T-Main incl. pipe and fittings, DIP	$64.00	26,500	LF	$1,696,000	11,000	LF	$704,000	9,500	LF	$608,000	6,800	LF	$435,200	9,800	LF	$627,200	0	LF	$0	11,400	LF	$729,600	21,400	LF	$1,369,600	96,400	LF	$6,169,600
1.a	12" T-Main (parallel on 4 lane ROW and larger)	$94.00	26,500	LF	$2,491,000	3,300	LF	$310,200	6,000	LF	$564,000	10,400		$977,600	7,500	LF	$705,000	5,700		$535,800	9,000	LF	$846,000	0	LF	$0	68,400	LF	$6,429,600
2.	18" T-Main incl. pipe and fittings, DIP	$94.00	26,400	LF	$2,481,600	5,200	LF	$488,800	20,000	LF	$1,880,000	9,900	LF	$930,600	11,000	LF	$1,034,000	15,000	LF	$1,410,000	19,000	LF	$1,786,000	0	LF	$0	106,500	LF	$10,011,000
3.	24" T-Main incl. pipe and fittings, DIP	$135.00	4,400	LF	$594,000	1,000	LF	$135,000	0	LF	$0	7,800	LF	$1,053,000	0	LF	$0	1,800	LF	$243,000	0	LF	$0	0	LF	$0	15,000	LF	$2,025,000
4.	30" T-Main incl. pipe and fittings, DIP	$170.00	4,700	LF	$799,000	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	4,700	LF	$799,000
5.	36" T-Main incl. pipe and fittings, DIP	$205.00	2,500	LF	$512,500	2,200	LF	$451,000	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	4,700	LF	$963,500
6.	42" T-Main incl. pipe and fittings, DIP	$240.00	5,400	LF	$1,296,000	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	5,400	LF	$1,296,000
7.	48" T-Main incl. pipe and fittings, DIP	$275.00	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0
8.	12" Butterfly Valve Assembly	$2,500.00	13	EA	$32,500	8	EA	$20,000	5	EA	$12,500	3	EA	$7,500	8	EA	$20,000	0	EA	$0	9	EA	$22,500	14	EA	$35,000	60	EA	$150,000
9.	18" Butterfly Valve Assembly	$4,000.00	13	EA	$52,000	4	EA	$16,000	12	EA	$48,000	2	EA	$8,000	9	EA	$36,000	11	EA	$44,000	11	EA	$44,000	0	EA	$0	62	EA	$248,000
2.	24" Butterfly Valve Assembly	$7,200.00	3	EA	$21,600	2	EA	$14,400	0	EA	$0	3	EA	$21,600	0	EA	$0	1	EA	$7,200	0	EA	$0	0	EA	$0	9	EA	$64,800
3.	30" Line Valve	$28,000.00	4	EA	$112,000	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	4	EA	$112,000
4.	36" Line Valve	$35,000.00	2	EA	$70,000	2	EA	$70,000	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	4	EA	$140,000
5.	42" Line Valve	$40,000.00	2	EA	$80,000	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	2	EA	$80,000
6.	48" Line Valve	$50,000.00	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0
7.	Fire Hydrant Assembly (assumed 1000" spacing)	$5,000.00	96	EA	$482,000	23	EA	$113,500	36	EA	$177,500	35	EA	$174,500	28	EA	$141,500	23	EA	$112,500	39	EA	$197,000	21	EA	$107,000	301	EA	$1,505,500
8.	Bore and Jack under HWY 99/70 (54" Casing)	$1,000.00	600	LF	$600,000	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	600	LF	$600,000
9.	Bore and Jack under HWY 99/70 (24" Casing)	$500.00	600	LF	$300,000	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	600	LF	$300,000
	TOTAL WATER TRANSMISSION				**$11,620,200**			**$2,322,900**			**$3,290,000**			**$3,608,000**			**$2,563,700**			**$2,352,500**			**$3,625,100**			**$1,511,600**			**$30,894,000**
B. WATER STORAGE TANKS																													
1.	Treatment Plant Storage Tank (4MG) (Includes booster pump station and hydromatic tank)	$5,000,000.00	0	EA	$0	1	EA	$5,000,000	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	1	EA	$5,000,000
2.	Storage Tank (6MG) (Includes booster pump station and hydromatic tank)	$7,500,000.00	1	EA	$7,500,000	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	1	EA	$7,500,000
3.	Storage Tank (6MG) (Includes booster pump station and hydromatic tank)	$7,500,000.00	0	EA	$0	0	EA	$0	0	EA	$0	1	EA	$7,500,000	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	1	EA	$7,500,000
4.	Storage Tank (6MG) (Includes booster pump station and hydromatic tank)	$7,500,000.00	0	EA	$0	0	EA	$0	1	EA	$7,500,000	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	1	EA	$7,500,000
5.	Storage Tank (6MG) (Includes booster pump station and hydromatic tank)	$7,500,000.00	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	1	EA	$7,500,000	0	EA	$0	1	EA	$7,500,000
6.	Storage Tank (6MG) (Includes booster pump station and hydromatic tank)	$7,500,000.00	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	1	EA	$7,500,000	1	EA	$7,500,000
	TOTAL WATER STORAGE				**$7,500,000**			**$5,000,000**			**$7,500,000**			**$7,500,000**			**$0**			**$0**			**$7,500,000**			**$7,500,000**			**$42,500,000**

CONSTRUCTION COSTS (PWSP)

ITEM No.	DESCRIPTION	UNIT PRICE	PHASE 1 QTY	PHASE 1 UNIT	PHASE 1 AMOUNT	PHASE A QTY	PHASE A UNIT	PHASE A AMOUNT	PHASE 2 QTY	PHASE 2 UNIT	PHASE 2 AMOUNT	PHASE B QTY	PHASE B UNIT	PHASE B AMOUNT	PHASE 3 QTY	PHASE 3 UNIT	PHASE 3 AMOUNT	PHASE C QTY	PHASE C UNIT	PHASE C AMOUNT	PHASE 4 QTY	PHASE 4 UNIT	PHASE 4 AMOUNT	PHASE D QTY	PHASE D UNIT	PHASE D AMOUNT	TOTAL QTY	TOTAL UNIT	TOTAL AMOUNT
C. SURFACE WATER TREATMENT PLANT																													
1.	Surface Water Treatment Plant (29.3 mgd)	$1,250,000.00	0	mgd	$0	INC	mgd	INC	14.7	mgd	$18,375,000	INC	mgd	INC	14.6	mgd	$18,250,000	INC	mgd	INC	0	mgd	$0	INC	mgd	INC	29.3	mgd	$36,625,000
	TOTAL SURFACE WATER TREATMENT PLANT				**$0**			**INC**			**$18,375,000**			**INC**			**$18,250,000**			**INC**			**$0**			**INC**			**$36,625,000**
D. GROUND WATER TREATMENT PLANT																													
1.	West Ground Water Treatment Plant (12.5 mgd)	$1,250,000.00	12.5	mgd	$15,625,000	INC	mgd	INC	0	mgd	$0	INC	mgd	INC	0	mgd	$0	INC	mgd	INC	0	mgd	$0	INC	mgd	INC	12.5	mgd	$15,625,000
2	East Ground Water Treatment Plant (12.5 mgd)	$1,250,000.00	0	mgd	$0	INC	mgd	INC	12.5	mgd	$15,625,000	INC	mgd	INC	0	mgd	$0	INC	mgd	INC	0	mgd	$0	INC	mgd	INC	12.5	mgd	$15,625,000
	TOTAL GROUND WATER TREATMENT PLANT				**$15,625,000**			**INC**			**$15,625,000**			**INC**			**$0**			**INC**			**$0**			**INC**			**$31,250,000**
E. GROUND WATER WELL FIELDS																													
E.1 - EAST WELL AND PUMP FACILITY																													
1.	Well & Pump Facility	$1,000,000.00	0	EA	$0	0	EA		7	EA	$7,000,000	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		7	EA	$7,000,000
2.	12" Raw Water incl. Fittings, DIP	$85.00	0	LF	$0	0	LF		10,100	LF	$858,500	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		10,100	LF	$858,500
3.	16" Raw Water incl. Fittings, DIP	$120.00	0	LF	$0	0	LF		3,500	LF	$420,000	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		3,500	LF	$420,000
4.	21" Raw Water incl. Fittings, DIP	$160.00	0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0
5.	24" Raw Water incl. Fittings, DIP	$180.00	0	LF	$0	0	LF		3,400	LF	$612,000	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		3,400	LF	$612,000
6.	30" Raw Water incl. Fittings, DIP	$225.00	0	LF	$0	0	LF		3,300	LF	$742,500	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		3,300	LF	$742,500
7.	36" Raw Water incl. Fittings, DIP	$270.00	0	LF	$0	0	LF		7,500	LF	$2,025,000	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		7,500	LF	$2,025,000
8.	12" Butterfly Valve Assembly	$2,500.00	0	EA	$0	0	EA		1	EA	$2,500	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		1	EA	$2,500
9.	16" Butterfly Valve Assembly	$3,500.00	0	EA	$0	0	EA		2	EA	$7,000	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		2	EA	$7,000
10.	21" Butterfly Valve Assembly	$4,600.00	0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0
11.	24" Butterfly Valve Assembly	$7,300.00	0	EA	$0	0	EA		4	EA	$29,200	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		4	EA	$29,200
12.	30" Butterfly Valve Assembly	$14,000.00	0	EA	$0	0	EA		1	EA	$14,000	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		1	EA	$14,000
13.	36" Butterfly Valve Assembly	$17,000.00	0	EA	$0	0	EA		1	EA	$17,000	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		1	EA	$17,000
	SUBTOTAL EAST WELL AND PUMP FACILITY				**$0**			**INC.**			**$11,727,700**			**INC.**			**$0**			**INC.**			**$0**			**INC.**			**$11,727,700**
E.2- WEST WELL AND PUMP FACILITY																													
2.	Well & Pump Facility	$1,000,000.00	9	EA	$9,000,000	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		9	EA	$9,000,000
3.	12" Raw Water incl. Fittings, DIP	$85.00	14,850	LF	$1,262,250	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		14,850	LF	$1,262,250
4.	16" Raw Water incl. Fittings, DIP	$120.00	4,500	LF	$540,000	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		4,500	LF	$540,000
5.	21" Raw Water incl. Fittings, DIP	$160.00	6,300	LF	$1,008,000	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		6,300	LF	$1,008,000
6.	24" Raw Water incl. Fittings, DIP	$180.00	5,850	LF	$1,053,000	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		5,850	LF	$1,053,000
7.	30" Raw Water incl. Fittings, DIP	$225.00	0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0
8.	36" Raw Water incl. Fittings, DIP	$270.00	0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0
9.	12" Butterfly Valve Assembly	$2,500.00	5	EA	$12,500	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		5	EA	$12,500
10.	16" Butterfly Valve Assembly	$3,500.00	1	EA	$3,500	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		1	EA	$3,500
11.	21" Butterfly Valve Assembly	$4,600.00	1	EA	$4,600	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		1	EA	$4,600
12.	24" Butterfly Valve Assembly	$7,300.00	1	EA	$7,300	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		1	EA	$7,300
13.	30" Butterfly Valve Assembly	$14,000.00	0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0
14.	36" Butterfly Valve Assembly	$17,000.00	0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0
	SUBTOTAL WEST WELL AND PUMP FACILITY				$12,891,150			INC.			$0			INC.			$0			INC.			$0			INC.			$12,891,150
	TOTAL GROUND WATER WELL FIELDS				**$12,891,150**			**INC.**			**$11,727,700**			**INC.**			**$0**			**INC.**			**$0**			**INC.**			**$24,618,850**

CONSTRUCTION COSTS (PWSP)

ITEM No.	DESCRIPTION	UNIT PRICE	PHASE 1 QTY	PHASE 1 UNIT	PHASE 1 AMOUNT	PHASE A QTY	PHASE A UNIT	PHASE A AMOUNT	PHASE 2 QTY	PHASE 2 UNIT	PHASE 2 AMOUNT	PHASE B QTY	PHASE B UNIT	PHASE B AMOUNT	PHASE 3 QTY	PHASE 3 UNIT	PHASE 3 AMOUNT	PHASE C QTY	PHASE C UNIT	PHASE C AMOUNT	PHASE 4 QTY	PHASE 4 UNIT	PHASE 4 AMOUNT	PHASE D QTY	PHASE D UNIT	PHASE D AMOUNT	TOTAL QTY	TOTAL UNIT	TOTAL AMOUNT	
F. RAW WATER PUMP STATION																														
1.	Raw Water Booster Pump Station (Bennet or Sankey)	$2,200,000.00	0	EA	$0	0	EA	$0	1	EA	$2,200,000	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	1	EA	$2,200,000	
2.	Raw Water Diversoin Facility (Fair Share Cost)	$7,278,078.00	0	EA	$0	0	EA	$0	1	EA	$7,278,078	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	1	EA	$7,278,078	
	TOTAL RAW WATER PUMP STATION				**$0**			**$0**			**$9,478,078**			**$0**			**$0**			**$0**			**$0**			**$0**			**$9,478,078**	
G. SURFACE RAW-WATER SUPPLY (BENNET TO WEST TREATMENT SITE)																														
1.	42" Steel Cylinder Pipe (CMCL, D.I.P. or Equal) incl. fittin	$350.00	0	LF	$0	0	LF	$0	29,500	LF	$10,325,000	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	29,500	LF	$10,325,000	
2.	42" Line Valves	$60,000.00	0	EA	$0	0	EA	$0	6	EA	$360,000	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	6	EA	$360,000	
	TOTAL SURFACE RAW-WATER SUPPLY				**$0**			**$0**			**$10,685,000**			**$0**			**$0**			**$0**			**$0**			**$0**			**$10,685,000**	
G. (ALT-1) SURFACE RAW-WATER SUPPLY (SANKEY TO WEST TREATMENT SITE)																														
1.A	42" Steel Cylinder Pipe (CMCL, D.I.P., or Equal) incl. fittir	$350.00	0	LF	$0	0	LF	$0	27,200	LF	$9,520,000	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	27,200	LF	$9,520,000	
2.A	42" Line Valves	$60,000.00	0	EA	$0	0	EA	$0	6	EA	$360,000	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	6	EA	$360,000	
	TOTAL (ALT-1) SURFACE RAW-WATER SUPPLY				**$0**			**$0**			**$9,880,000**			**$0**			**$0**			**$0**			**$0**			**$0**			**(ALT-1)**	**$9,880,000**
****G. (ALT-2) SURFACE RAW-WATER SUPPLY (BENNET TO EAST TREATMENT SITE)****																														
1.B	42" Steel Cylinder Pipe (CMCL, D.I.P., or Equal) incl. fittir	$350.00	0	LF	$0	0	LF	$0	28,500	LF	$9,975,000	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	28,500	LF	$9,975,000	
2.B	42" Line Valves	$60,000.00	0	EA	$0	0	EA	$0	6	EA	$360,000	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	6	EA	$360,000	
3.B	Bore and Jack under HWY 99/70 (60" Casing)	$1,100.00	0	LF	$0	0	LF	$0	600	LF	$660,000	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	600	LF	$660,000	
	TOTAL (ALT-2) SURFACE RAW-WATER SUPPLY				**$0**			**$0**			**$10,995,000**			**$0**			**$0**			**$0**			**$0**			**$0**			**(ALT-2)**	**$10,995,000**
*****G. (ALT-3) SURFACE RAW-WATER SUPPLY (SANKEY TO EAST TREATMENT SITE)*****																														
1.C	42" Steel Cylinder Pipe (CMCL) incl. fittings	$400.00	0	LF	$0	0	LF	$0	26,100	LF	$10,440,000	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	26,100	LF	$10,440,000	
2.C	42" Line Valves	$80,000.00	0	EA	$0	0	EA	$0	6	EA	$480,000	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	6	EA	$480,000	
3.C	Bore and Jack under HWY 99/70 (60" Casing)	$1,100.00	0	LF	$0	0	LF	$0	600	LF	$660,000	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	600	LF	$660,000	
	TOTAL (ALT-3) SURFACE RAW-WATER SUPPLY				**$0**			**$0**			**$11,580,000**			**$0**			**$0**			**$0**			**$0**			**$0**			**(ALT-3)**	**$11,580,000**

CONSTRUCTION COSTS (PWSP)

ITEM No.	DESCRIPTION	UNIT PRICE	PHASE 1 QTY	PHASE 1 UNIT	PHASE 1 AMOUNT	PHASE A QTY	PHASE A UNIT	PHASE A AMOUNT	PHASE 2 QTY	PHASE 2 UNIT	PHASE 2 AMOUNT	PHASE B QTY	PHASE B UNIT	PHASE B AMOUNT	PHASE 3 QTY	PHASE 3 UNIT	PHASE 3 AMOUNT	PHASE C QTY	PHASE C UNIT	PHASE C AMOUNT	PHASE 4 QTY	PHASE 4 UNIT	PHASE 4 AMOUNT	PHASE D QTY	PHASE D UNIT	PHASE D AMOUNT	TOTAL QTY	TOTAL UNIT	TOTAL AMOUNT
	CONSTRUCTION COST ESTIMATE SUMMARY																												
	A. WATER TRANSMISSION				$11,620,200			$2,322,900			$3,290,000			$3,608,000			$2,563,700			$2,352,500			$3,625,100			$1,511,600			$30,894,000
	B. WATER STORAGE TANKS				$7,500,000			$5,000,000			$7,500,000			$7,500,000			$0			$0			$7,500,000			$7,500,000			$42,500,000
	C. SURFACE WATER TREATMENT PLANT				$0			INC			$18,375,000			INC			$18,250,000			INC			$0			INC			$36,625,000
	D. GROUND WATER TREATMENT PLANT				$15,625,000			INC			$15,625,000			INC			$0			INC			$0			INC			$31,250,000
	E. GROUND WATER WELL FIELD				$12,891,150			INC.			$11,727,700			INC.			$0			INC.			$0			INC.			$24,618,850
	F. RAW WATER PUMP STATION				$0			$0			$9,478,078			$0			$0			$0			$0			$0			$9,478,078
	G. SURFACE RAW-WATER SUPPLY				$0			$0			$10,685,000			$0			$0			$0			$0			$0			$10,685,000
	Subtotal Construction Costs (A-G)				$47,636,350			$7,322,900			$76,680,778			$11,108,000			$20,813,700			$2,352,500			$11,125,100			$9,011,600			$186,050,928
	15% Engineering/Inspection				$7,145,453			$1,098,435			$11,502,117			$1,666,200			$3,122,055			$352,875			$1,668,765			$1,351,740			$27,907,639
	20% Contingency				$9,527,270			$1,464,580			$15,336,156			$2,221,600			$4,162,740			$470,500			$2,225,020			$1,802,320			$37,210,186
	GRAND TOTAL CONSTRUCTION COST				$64,309,073			$9,885,915			$103,519,050			$14,995,800			$28,098,495			$3,175,875			$15,018,885			$12,165,660			$251,168,753

ALTERNATIVES FOR SURFACE RAW-WATER SUPPLY (Refer to section "G")

G. (ALT-1) SURFACE RAW-WATER SUPPLY (SANKEY TO WEST TREATMENT SITE)
(Adjust from Proposed Proposed Water Supply Project if used)

Proposed Surface Raw-Water Supply (Item 'G') Total	$10,685,000
Alternative 1 Total	$9,880,000
Difference From Proposed Surface Raw-Water Supply	($805,000)
15% Engineering/Inspection	($120,750)
20% Contingency	($161,000)
Total Adjustment for Alt-1	($1,086,750)

****G. (ALT-2) SURFACE RAW-WATER SUPPLY (BENNET TO EAST TREATMENT SITE)****
(Adjust from Proposed Proposed Water Supply Project if used)

Proposed Surface Raw-Water Supply (Item 'G') Total	$10,685,000
Alternative 2 Subtotal	$10,995,000
Difference From Proposed Surface Raw-Water Supply	$310,000
15% Engineering/Inspection	$46,500
20% Contingency	$62,000
Total Adjustment for Alt-2	$418,500

*****G. (ALT-3) SURFACE RAW-WATER SUPPLY (SANKEY TO EAST TREATMENT SITE)*****
(Adjust from Proposed Proposed Water Supply Project if used)

Proposed Surface Raw-Water Supply (Item 'G') Total	$10,685,000
Alternative 3 Subtotal	$11,580,000
Difference From Proposed Surface Raw-Water Supply	$895,000
15% Engineering/Inspection	$134,250
20% Contingency	$179,000
Total Adjustment for Alt-3	$1,208,250

ENGINEER'S PRELIMINARY OPINION OF ANNUAL COSTS

Sutter County

Based on the Sutter Pointe Water System Model for Proposed Project Water Supply Program (PWSP)

RESIDENTIAL FACILITIES / YEAR	PHASE 1 (million $)							PHASE 2 (million $)					PHASE 3 (million $)			PHASE 4 (million $)		(RESIDENTIAL COMPLETED) (million $)																												TOTAL (million $)
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	
Percent of Total Phase Cost	25%	12.5%	12.5%	12.5%	12.5%	12.5%	12.5%	25%	18.75%	18.75%	18.75%	18.75%	40%	30%	30%	50%	50%																										
A. WATER TRANSMISSION	2.91	1.45	1.45	1.45	1.45	1.45	1.45	0.82	0.62	0.62	0.62	0.62	1.03	0.77	0.77	1.81	1.81																										**21.10**
B. WATER STORAGE TANKS	1.88	0.94	0.94	0.94	0.94	0.94	0.94	1.88	1.41	1.41	1.41	1.41				3.75	3.75																										**22.50**
	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%	0%	0%	0%	100%	0%	0%																										
C. SURFACE WATER TREATMENT PLANT											18.38				18.25																										**36.63**
	100%	0%	0%	0%	0%	0%	0%	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%																										
D. GROUND WATER TREATMENT PLANT	15.63							15.63																																		**31.25**
	25%	12.5%	12.5%	12.5%	12.5%	12.5%	12.5%	25%	25%	25%	25%	0%	0%	0%	0%	0%	0%																										
E. GROUND WATER WELL FIELD	3.22	1.61	1.61	1.61	1.61	1.61	1.61	2.93	2.93	2.93	2.93	0.00																														**24.62**
	0%	0%	0%	0%	0%	0%	0%	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%																										
F. RAW WATER PUMP STATION								9.48																																		**9.48**
G. SURFACE RAW-WATER SUPPLY								10.69																																		**10.69**
Subtotal	23.63	4.00	4.00	4.00	4.00	4.00	4.00	41.42	4.96	4.96	23.33	2.02	1.03	0.77	19.02	5.56	5.56																										**156.26**
15% Engineering/Inspection	3.54	0.60	0.60	0.60	0.60	0.60	0.60	6.21	0.74	0.74	3.50	0.30	0.15	0.12	2.85	0.83	0.83																										**23.44**
20% Contingency	4.73	0.80	0.80	0.80	0.80	0.80	0.80	8.28	0.99	0.99	4.67	0.40	0.21	0.15	3.80	1.11	1.11																										**31.25**
YEAR TOTAL	**31.90**	**5.40**	**5.40**	**5.40**	**5.40**	**5.40**	**5.40**	**55.91**	**6.69**	**6.69**	**31.50**	**2.73**	**1.38**	**1.04**	**25.68**	**7.51**	**7.51**																										**210.95**
CUMULATIVE TOTAL	**31.90**	**37.30**	**42.70**	**48.10**	**53.51**	**58.91**	**64.31**	**120.22**	**126.91**	**133.60**	**165.10**	**167.83**	**169.21**	**170.25**	**195.93**	**203.44**	**210.95**																										

EMPLOYMENT FACILITIES / YEAR	PHASE A (million $)										PHASE B (million $)										PHASE C (million $)										PHASE D (million $)										TOTAL (million $)
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	
	50%	0%	0%	0%	50%	0%	0%	0%	0%	0%	50%	0%	0%	0%	50%	0%	0%	0%	0%	0%	50%	0%	0%	0%	50%	0%	0%	0%	0%	0%	50%	0%	0%	0%	50%	0%	0%	0%	0%	0%	
A. WATER TRANSMISSION	1.16				1.16						1.80				1.80						1.18				1.18						0.76				0.76						**9.80**
B. WATER STORAGE TANKS	2.50				2.50						3.75				3.75																3.75				3.75						**20.00**
C. SURFACE WATER TREATMENT PLANT																																									
D. GROUND WATER TREATMENT PLANT																																									
E. GROUND WATER WELL FIELD																																									
F. RAW WATER PUMP STATION																																									
G. SURFACE RAW-WATER SUPPLY																																									
Subtotal	3.66				3.66						5.55				5.55						1.18				1.18						4.51				4.51						**29.80**
15% Engineering/Inspection	0.55				0.55						0.83				0.83						0.18				0.18						0.68				0.68						**4.47**
20% Contingency	0.73				0.73						1.11				1.11						0.24				0.24						0.90				0.90						**5.96**
YEAR TOTAL	**4.94**				**4.94**						**7.50**				**7.50**						**1.59**				**1.59**						**6.08**				**6.08**						**40.22**
CUMULATIVE TOTAL	**4.94**				**9.89**						**17.38**				**24.88**						**26.47**				**28.06**						**34.14**				**40.22**						
GRAND YEAR TOTAL	**36.84**	**5.40**	**5.40**	**5.40**	**10.34**	**5.40**	**5.40**	**55.91**	**6.69**	**6.69**	**38.99**	**2.73**	**1.38**	**1.04**	**33.17**	**7.51**	**7.51**				**1.59**				**1.59**						**6.08**				**6.08**						**251.17**
GRAND CUMULATIVE TOTAL	**36.84**	**42.24**	**47.64**	**53.05**	**63.39**	**68.79**	**74.19**	**130.11**	**136.80**	**143.49**	**182.48**	**185.21**	**186.60**	**187.63**	**220.81**	**228.32**	**235.83**				**237.42**				**239.00**						**245.09**				**251.17**						

NOTE: *ANNUAL COST TABULATIONS DO NOT TAKE INTO ACCOUNT ADJUSTMENTS RESULTING FROM CHOOSING ANOTHER ALTERNATE FOR SURFACE WATER RAW-WATER SUPPLY (IE. ALT-1 THROUGH ALT-3)*

ENGINEER'S PRELIMINARY OPINION OF COSTS

Sutter County

Quantities based on the Sutter Pointe Water System Model for Alternate "A" Revised Water Supply Program

CONSTRUCTION COSTS (Alt "A")

ITEM No.	DESCRIPTION	UNIT PRICE	PHASE 1 QTY	PHASE 1 UNIT	PHASE 1 AMOUNT	PHASE A QTY	PHASE A UNIT	PHASE A AMOUNT	PHASE 2 QTY	PHASE 2 UNIT	PHASE 2 AMOUNT	PHASE B QTY	PHASE B UNIT	PHASE B AMOUNT	PHASE 3 QTY	PHASE 3 UNIT	PHASE 3 AMOUNT	PHASE C QTY	PHASE C UNIT	PHASE C AMOUNT	PHASE 4 QTY	PHASE 4 UNIT	PHASE 4 AMOUNT	PHASE D QTY	PHASE D UNIT	PHASE D AMOUNT	TOTAL QTY	TOTAL UNIT	TOTAL AMOUNT
A. WATER TRANSMISSION																													
1.	12" T-Main incl. pipe and fittings, DIP	$64.00	26,500	LF	$1,696,000	11,000	LF	$704,000	9,500	LF	$608,000	6,800	LF	$435,200	9,800	LF	$627,200	0	LF	$0	11,400	LF	$729,600	21,400	LF	$1,369,600	96,400	LF	$6,169,600
1a.	12" T-Main (Parallel on 4 lane ROW and larger)	$94.00	26,500	LF	$2,491,000	3,300	LF	$310,200	6,000	LF	$564,000	10,400		$977,600	7,500	LF	$705,000	5,700		$535,800	9,000	LF	$846,000	0	LF	$0	68,400		$6,429,600
2.	18" T-Main incl. pipe and fittings, DIP	$94.00	26,400	LF	$2,481,600	5,200	LF	$488,800	20,000	LF	$1,880,000	9,900	LF	$930,600	11,000	LF	$1,034,000	15,000	LF	$1,410,000	19,000	LF	$1,786,000	0	LF	$0	106,500	LF	$10,011,000
3.	24" T-Main incl. pipe and fittings, DIP	$135.00	4,400	LF	$594,000	1,000	LF	$135,000	0	LF	$0	7,800	LF	$1,053,000	0	LF	$0	1,800	LF	$243,000	0	LF	$0	0	LF	$0	15,000	LF	$2,025,000
4.	30" T-Main incl. pipe and fittings, DIP	$170.00	4,700	LF	$799,000	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	4,700	LF	$799,000
5.	36" T-Main incl. pipe and fittings, DIP	$205.00	2,500	LF	$512,500	2,200	LF	$451,000	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	4,700	LF	$963,500
6.	42" T-Main incl. pipe and fittings, DIP	$240.00	5,400	LF	$1,296,000		LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	5,400	LF	$1,296,000
7.	48" T-Main incl. pipe and fittings, DIP	$275.00	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0
8.	12" Butterfly Valve Assembly	$2,500.00	13	EA	$32,500	8	EA	$20,000	5	EA	$12,500	3	EA	$7,500	8	EA	$20,000	0	EA	$0	9	EA	$22,500	14	EA	$35,000	60	EA	$150,000
9.	18" Butterfly Valve Assembly	$4,000.00	13	EA	$52,000	4	EA	$16,000	12	EA	$48,000	2	EA	$8,000	9	EA	$36,000	11	EA	$44,000	11	EA	$44,000	0	EA	$0	62	EA	$248,000
2.	24" Butterfly Valve Assembly	$7,200.00	3	EA	$21,600	2	EA	$14,400	0	EA	$0	3	EA	$21,600	0	EA	$0	1	EA	$7,200	0	EA	$0	0	EA	$0	9	EA	$64,800
3.	30" Line Valve	$28,000.00	4	EA	$112,000	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	4	EA	$112,000
4.	36" Line Valve	$35,000.00	2	EA	$70,000	2	EA	$70,000	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	4	EA	$140,000
5.	42" Line Valve	$40,000.00	2	EA	$80,000	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	2	EA	$80,000
6.	48" Line Valve	$50,000.00	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0
7.	Fire Hydrant Assembly (Assumed 1000' spacing)	$5,000.00	96	EA	$482,000	23	EA	$113,500	36	EA	$177,500	35	EA	$174,500	28	EA	$141,500	23	EA	$112,500	39	EA	$197,000	21	EA	$107,000	301		$1,505,500
8.	Bore and Jack under HWY 99/70 (54" Casing)	$1,000.00	600	LF	$600,000	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	600	LF	$600,000
9.	Bore and Jack under HWY 99/70 (24" Casing)	$500.00	600	LF	$300,000	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	600	LF	$300,000
	TOTAL WATER TRANSMISSION				**$11,620,200**			**$2,322,900**			**$3,290,000**			**$3,608,000**			**$2,563,700**			**$2,352,500**			**$3,625,100**			**$1,511,600**			**$30,894,000**
B. WATER STORAGE TANKS																													
1.	Treatment Plant Storage Tank (4MG) (Includes booster pump station and hydromatic tank)	$5,000,000.00	0	EA	$0	1	EA	$5,000,000	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	1	EA	$5,000,000
2.	Storage Tank (6MG) (Includes booster pump station and hydromatic tank)	$7,500,000.00	1	EA	$7,500,000	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	1	EA	$7,500,000
3.	Storage Tank (6MG) (Includes booster pump station and hydromatic tank)	$7,500,000.00	0	EA	$0	0	EA	$0	0	EA	$0	1	EA	$7,500,000	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	1	EA	$7,500,000
4.	Storage Tank (6MG) (Includes booster pump station and hydromatic tank)	$7,500,000.00	0	EA	$0	0	EA	$0	1	EA	$7,500,000	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	1	EA	$7,500,000
5.	Storage Tank (6MG) (Includes booster pump station and hydromatic tank)	$7,500,000.00	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	1	EA	$7,500,000	0	EA	$0	1	EA	$7,500,000
6.	Storage Tank (6MG) (Includes booster pump station and hydromatic tank)	$7,500,000.00	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	1	EA	$7,500,000	1	EA	$7,500,000
	TOTAL WATER STORAGE				**$7,500,000**			**$5,000,000**			**$7,500,000**			**$7,500,000**			**$0**			**$0**			**$7,500,000**			**$7,500,000**			**$42,500,000**

CONSTRUCTION COSTS (Alt "A")

ITEM No.	DESCRIPTION	UNIT PRICE	PHASE 1 QTY	PHASE 1 UNIT	PHASE 1 AMOUNT	PHASE A QTY	PHASE A UNIT	PHASE A AMOUNT	PHASE 2 QTY	PHASE 2 UNIT	PHASE 2 AMOUNT	PHASE B QTY	PHASE B UNIT	PHASE B AMOUNT	PHASE 3 QTY	PHASE 3 UNIT	PHASE 3 AMOUNT	PHASE C QTY	PHASE C UNIT	PHASE C AMOUNT	PHASE 4 QTY	PHASE 4 UNIT	PHASE 4 AMOUNT	PHASE D QTY	PHASE D UNIT	PHASE D AMOUNT	TOTAL QTY	TOTAL UNIT	TOTAL AMOUNT
C. SURFACE WATER TREATMENT PLANT																													
1.	Surface Water Treatment Plant (35.1 mgd)	$1,250,000.00	0	mgd	$0	INC	mgd	INC	17.6	mgd	$22,000,000	INC	mgd	INC	17.5	mgd	$21,875,000	INC	mgd	INC	0	mgd	$0	INC	mgd	INC	35.1	mgd	$43,875,000
	TOTAL SURFACE WATER TREATMENT PLANT				**$0**			**INC**			**$22,000,000**			**INC**			**$21,875,000**			**INC**			**$0**			**INC**			**$43,875,000**
D. GROUND WATER TREATMENT PLANT																													
1.	West Ground Water Treatment Plant (12.5 mgd)	$1,250,000.00	12.5	mgd	$15,625,000	INC	mgd	INC	0	mgd	$0	INC	mgd	INC	0	mgd	$0	INC	mgd	INC	0	mgd	$0	INC	mgd	INC	12.5	EA	$15,625,000
2	East Ground Water Treatment Plant (12.5 mgd)	$1,250,000.00	0	mgd	$0	0	mgd	$0	12.5	mgd	$15,625,000	0	mgd	$0	0	mgd	$0	0	mgd	$0	0	mgd	$0	0	mgd	$0	12.5	EA	$15,625,000
	TOTAL GROUND WATER TREATMENT PLANT				**$15,625,000**			**$0**			**$15,625,000**			**$0**			**$0**			**$0**			**$0**			**$0**			**$31,250,000**
E. GROUND WATER WELL FIELDS																													
E.1 - EAST WELL AND PUMP FACILITY																													
1.	Well & Pump Facility	$1,000,000.00	0	EA	$0	0	EA		7	EA	$7,000,000	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		7	EA	$7,000,000
2.	12" Raw Water incl. Fittings, DIP	$85.00	0	LF	$0	0	LF		10,100	LF	$858,500	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		10,100	LF	$858,500
3.	16" Raw Water incl. Fittings, DIP	$120.00	0	LF	$0	0	LF		3,500	LF	$420,000	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		3,500	LF	$420,000
4.	21" Raw Water incl. Fittings, DIP	$160.00	0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0
5.	24" Raw Water incl. Fittings, DIP	$180.00	0	LF	$0	0	LF		3,400	LF	$612,000	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		3,400	LF	$612,000
6.	30" Raw Water incl. Fittings, DIP	$225.00	0	LF	$0	0	LF		3,300	LF	$742,500	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		3,300	LF	$742,500
7.	36" Raw Water incl. Fittings, DIP	$270.00	0	LF	$0	0	LF		7,500	LF	$2,025,000	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		7,500	LF	$2,025,000
8.	12" Butterfly Valve Assembly	$2,500.00	0	EA	$0	0	EA		1	EA	$2,500	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		1	EA	$2,500
9.	16" Butterfly Valve Assembly	$3,500.00	0	EA	$0	0	EA		2	EA	$7,000	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		2	EA	$7,000
10.	21" Butterfly Valve Assembly	$4,600.00	0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0
11.	24" Butterfly Valve Assembly	$7,300.00	0	EA	$0	0	EA		4	EA	$29,200	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		4	EA	$29,200
12.	30" Butterfly Valve Assembly	$14,000.00	0	EA	$0	0	EA		1	EA	$14,000	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		1	EA	$14,000
13.	36" Butterfly Valve Assembly	$17,000.00	0	EA	$0	0	EA		1	EA	$17,000	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		1	EA	$17,000
	SUBTOTAL EAST WELL AND PUMP FACILITY				**$0**			**INC.**			**$11,727,700**			**INC.**			**$0**			**INC.**			**$0**			**INC.**			**$11,727,700**
E.2- WEST WELL AND PUMP FACILITY																													
1.	Well & Pump Facility	$1,000,000.00	9	EA	$9,000,000	0	EA		0	EA	$0	0	EA	$0	0	EA	$0	0	EA		0	EA	$0	0	EA		9	EA	$9,000,000
3.	12" Raw Water incl. Fittings, DIP	$85.00	14,850	LF	$1,262,250	0	LF		0	LF	$0	0	LF	$0	0	LF	$0	0	LF		0	LF	$0	0	LF		14,850	LF	$1,262,250
4.	16" Raw Water incl. Fittings, DIP	$120.00	4,500	LF	$540,000	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		4,500	LF	$540,000
5.	21" Raw Water incl. Fittings, DIP	$160.00	6,300	LF	$1,008,000	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		6,300	LF	$1,008,000
6.	24" Raw Water incl. Fittings, DIP	$180.00	5,850	LF	$1,053,000	0	LF		0	LF	$0	0	LF	$0	0	LF	$0	0	LF		0	LF	$0	0	LF		5,850	LF	$1,053,000
7.	30" Raw Water incl. Fittings, DIP	$225.00	0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0
8.	36" Raw Water incl. Fittings, DIP	$270.00	0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0
9.	12" Butterfly Valve Assembly	$2,500.00	5	EA	$12,500	0	EA		0	EA	$0	0	EA	$0	0	EA	$0	0	EA		0	EA	$0	0	EA		5	EA	$12,500
10.	16" Butterfly Valve Assembly	$3,500.00	1	EA	$3,500	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		1	EA	$3,500
11.	21" Butterfly Valve Assembly	$4,600.00	1	EA	$4,600	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		1	EA	$4,600
12.	24" Butterfly Valve Assembly	$7,300.00	1	EA	$7,300	0	EA		0	EA	$0	0	EA	$0	0	EA	$0	0	EA		0	EA	$0	0	EA		1	EA	$7,300
13.	30" Butterfly Valve Assembly	$14,000.00	0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0
14.	36" Butterfly Valve Assembly	$17,000.00	0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0
	SUBTOTAL WEST WELL AND PUMP FACILITY				**$12,891,150**			**INC.**			**$0**			**INC.**			**$0**			**INC.**			**$0**			**INC.**			**$12,891,150**
	TOTAL GROUND WATER WELL FIELDS				**$12,891,150**			**$0**			**$11,727,700**			**$0**			**$0**			**$0**			**$0**			**$0**			**$24,618,850**

CONSTRUCTION COSTS (Alt "A")

ITEM No.	DESCRIPTION	UNIT PRICE	PHASE 1 QTY	PHASE 1 UNIT	PHASE 1 AMOUNT	PHASE A QTY	PHASE A UNIT	PHASE A AMOUNT	PHASE 2 QTY	PHASE 2 UNIT	PHASE 2 AMOUNT	PHASE B QTY	PHASE B UNIT	PHASE B AMOUNT	PHASE 3 QTY	PHASE 3 UNIT	PHASE 3 AMOUNT	PHASE C QTY	PHASE C UNIT	PHASE C AMOUNT	PHASE 4 QTY	PHASE 4 UNIT	PHASE 4 AMOUNT	PHASE D QTY	PHASE D UNIT	PHASE D AMOUNT	TOTAL QTY	TOTAL UNIT	TOTAL AMOUNT	
F. RAW WATER PUMP STATION																														
1.	Raw Water Booster Pump Station (Bennet or Sankey)	$2,600,000.00	0	EA	$0	0	EA	$0	1	EA	$2,600,000	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	1	EA	$2,600,000	
2.	Raw Water Diversion Facility (Fair Share Cost)	$8,804,386.00	0	EA	$0	0	EA	$0	1	EA	$8,804,386	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	1	EA	$8,804,386	
	TOTAL RAW WATER PUMP STATION				**$0**			**$0**			**$11,404,386**			**$0**			**$0**			**$0**			**$0**			**$0**			**$11,404,386**	
G. SURFACE RAW-WATER SUPPLY (BENNET TO WEST TREATMENT SITE)																														
1.	42" Steel Cylinder Pipe (CMCL, D.I.P. or Equal) incl. fittin	$350.00	0	LF	$0	0	LF	$0	29,500	LF	$10,325,000	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	29,500	LF	$10,325,000	
2.	42" Line Valves	$60,000.00	0	EA	$0	0	EA	$0	6	EA	$360,000	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	6	EA	$360,000	
	TOTAL SURFACE RAW-WATER SUPPLY				**$0**			**$0**			**$10,685,000**			**$0**			**$0**			**$0**			**$0**			**$0**			**$10,685,000**	
G. (ALT-1) SURFACE RAW-WATER SUPPLY (SANKEY TO WEST TREATMENT SITE)																														
1.A	42" Steel Cylinder Pipe (CMCL, D.I.P., or Equal) incl. fittir	$350.00	0	LF	$0	0	LF	$0	27,200	LF	$9,520,000	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	27,200	LF	$9,520,000	
2.A	42" Line Valves	$60,000.00	0	EA	$0	0	EA	$0	6	EA	$360,000	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	6	EA	$360,000	
	TOTAL (ALT-1) SURFACE RAW-WATER SUPPLY				**$0**			**$0**			**$9,880,000**			**$0**			**$0**			**$0**			**$0**			**$0**			**(ALT-1)**	**$9,880,000**
****G. (ALT-2) SURFACE RAW-WATER SUPPLY (BENNET TO EAST TREATMENT SITE)****																														
1.B	42" Steel Cylinder Pipe (CMCL, D.I.P., or Equal) incl. fittir	$350.00	0	LF	$0	0	LF	$0	28,500	LF	$9,975,000	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	28,500	LF	$9,975,000	
2.B	42" Line Valves	$60,000.00	0	EA	$0	0	EA	$0	6	EA	$360,000	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	6	EA	$360,000	
3.B	Bore and Jack under HWY 99/70 (60" Casing)	$1,100.00	0	LF	$0	0	LF	$0	600	LF	$660,000	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	600	LF	$660,000	
	TOTAL (ALT-1) SURFACE RAW-WATER SUPPLY				**$0**			**$0**			**$10,995,000**			**$0**			**$0**			**$0**			**$0**			**$0**			**(ALT-2)**	**$10,995,000**
*****G. (ALT-3) SURFACE RAW-WATER SUPPLY (SANKEY TO EAST TREATMENT SITE)*****																														
1.C	42" Steel Cylinder Pipe (CMCL) incl. fittings	$400.00	0	LF	$0	0	LF	$0	26,100	LF	$10,440,000	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	26,100	LF	$10,440,000	
2.C	42" Line Valves	$80,000.00	0	EA	$0	0	EA	$0	6	EA	$480,000	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	6	EA	$480,000	
3.C	Bore and Jack under HWY 99/70 (60" Casing)	$1,100.00	0	LF	$0	0	LF	$0	600	LF	$660,000	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	600	LF	$660,000	
	TOTAL (ALT-1) SURFACE RAW-WATER SUPPLY				**$0**			**$0**			**$11,580,000**			**$0**			**$0**			**$0**			**$0**			**$0**			**(ALT-3)**	**$11,580,000**

CONSTRUCTION COSTS (Alt "A")

ITEM No.	DESCRIPTION	UNIT PRICE	PHASE 1 QTY	PHASE 1 UNIT	PHASE 1 AMOUNT	PHASE A QTY	PHASE A UNIT	PHASE A AMOUNT	PHASE 2 QTY	PHASE 2 UNIT	PHASE 2 AMOUNT	PHASE B QTY	PHASE B UNIT	PHASE B AMOUNT	PHASE 3 QTY	PHASE 3 UNIT	PHASE 3 AMOUNT	PHASE C QTY	PHASE C UNIT	PHASE C AMOUNT	PHASE 4 QTY	PHASE 4 UNIT	PHASE 4 AMOUNT	PHASE D QTY	PHASE D UNIT	PHASE D AMOUNT	TOTAL QTY	TOTAL UNIT	TOTAL AMOUNT
	CONSTRUCTION COST ESTIMATE SUMMARY																												
	A. WATER TRANSMISSION				$11,620,200			$2,322,900			$3,290,000			$3,608,000			$2,563,700			$2,352,500			$3,625,100			$1,511,600			$30,894,000
	B. WATER STORAGE TANKS				$7,500,000			$5,000,000			$7,500,000			$7,500,000			$0			$0			$7,500,000			$7,500,000			$42,500,000
	C. SURFACE WATER TREATMENT PLANT				$0			INC			$22,000,000			INC			$21,875,000			INC			$0			INC			$43,875,000
	D. GROUND WATER TREATMENT PLANT				$15,625,000			$0			$15,625,000			$0			$0			$0			$0			$0			$31,250,000
	E. GROUND WATER WELL FIELD				$12,891,150			$0			$11,727,700			$0			$0			$0			$0			$0			$24,618,850
	F. RAW WATER PUMP STATION				$0			$0			$11,404,386			$0			$0			$0			$0			$0			$11,404,386
	G. SURFACE RAW-WATER SUPPLY				$0			$0			$10,685,000			$0			$0			$0			$0			$0			$10,685,000
	Subtotal Construction Costs (A-G)				$47,636,350			$7,322,900			$82,232,086			$11,108,000			$24,438,700			$2,352,500			$11,125,100			$9,011,600			$195,227,236
	15% Engineering/Inspection				$7,145,453			$1,098,435			$12,334,813			$1,666,200			$3,665,805			$352,875			$1,668,765			$1,351,740			$29,284,085
	20% Contingency				$9,527,270			$1,464,580			$16,446,417			$2,221,600			$4,887,740			$470,500			$2,225,020			$1,802,320			$39,045,447
	GRAND TOTAL CONSTRUCTION COST				$64,309,073			$9,885,915			$111,013,316			$14,995,800			$32,992,245			$3,175,875			$15,018,885			$12,165,660			$263,556,769

ALTERNATIVES FOR SURFACE RAW-WATER SUPPLY (Refer to section "G")

G. (ALT-1) SURFACE RAW-WATER SUPPLY (SANKEY TO WEST TREATMENT SITE)
(Adjust from Alternate "A" Water Supply Project if used)

Proposed Surface Raw-Water Supply (Item 'G') Total	$10,685,000
Alternative 1 Total	$9,880,000
Difference From Proposed Surface Raw-Water Supply	($805,000)
15% Engineering/Inspection	($120,750)
20% Contingency	($161,000)
Total Adjustment for Alt-1	($1,086,750)

****G. (ALT-2) SURFACE RAW-WATER SUPPLY (BENNET TO EAST TREATMENT SITE)****
(Adjust from Alternate "A" Water Supply Project if used)

Proposed Surface Raw-Water Supply (Item 'G') Total	$10,685,000
Alternative 2 Subtotal	$10,995,000
Difference From Proposed Surface Raw-Water Supply	$310,000
15% Engineering/Inspection	$46,500
20% Contingency	$62,000
Total Adjustment for Alt-2	$418,500

*****G. (ALT-3) SURFACE RAW-WATER SUPPLY (SANKEY TO EAST TREATMENT SITE)*****
(Adjust from Alternate "A" Water Supply Project if used)

Proposed Surface Raw-Water Supply (Item 'G') Total	$10,685,000
Alternative 3 Subtotal	$11,580,000
Difference From Proposed Surface Raw-Water Supply	$895,000
15% Engineering/Inspection	$134,250
20% Contingency	$179,000
Total Adjustment for Alt-3	$1,208,250

ENGINEER'S PRELIMINARY OPINION OF ANNUAL COSTS

Sutter County

Based on the South Sutter Water System Model for Alternate "A" Revised Water Supply Program

RESIDENTIAL FACILITIES / YEAR	PHASE 1 (million $)							PHASE 2 (million $)					PHASE 3 (million $)			PHASE 4 (million $)		(RESIDENTIAL COMPLETED) (million $)	TOTAL (million $)
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40	
Percent of Total Phase Cost	25%	12.5%	12.5%	12.5%	12.5%	12.5%	12.5%	25%	18.75%	18.75%	18.75%	18.75%	40%	30%	30%	50%	50%		
A. WATER TRANSMISSION	2.91	1.45	1.45	1.45	1.45	1.45	1.45	0.82	0.62	0.62	0.62	0.62	1.03	0.77	0.77	1.81	1.81		**21.10**
B. WATER STORAGE TANKS	1.88	0.94	0.94	0.94	0.94	0.94	0.94	1.88	1.41	1.41	1.41	1.41				3.75	3.75		**22.50**
	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%	0%	0%	0%	100%	0%	0%		
C. SURFACE WATER TREATMENT PLANT											22.00				21.88				**43.88**
	100%	0%	0%	0%	0%	0%	0%	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%		
D. GROUND WATER TREATMENT PLANT	15.63							15.63											**31.25**
	25%	12.5%	12.5%	12.5%	12.5%	12.5%	12.5%	25.00%	25.00%	25.00%	25.00%	0.00%	0%	0%	0%	0%	0%		
E. GROUND WATER WELL FIELD	3.22	1.61	1.61	1.61	1.61	1.61	1.61	2.93	2.93	2.93	2.93	0.00							**24.62**
	0%	0%	0%	0%	0%	0%	0%	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%		
F. RAW WATER PUMP STATION								11.40											**11.40**
G. SURFACE RAW-WATER SUPPLY								10.69											**10.69**
Subtotal	23.63	4.00	4.00	4.00	4.00	4.00	4.00	43.34	4.96	4.96	26.96	2.02	1.03	0.77	22.64	5.56	5.56		**165.43**
15% Engineering/Inspection	3.54	0.60	0.60	0.60	0.60	0.60	0.60	6.50	0.74	0.74	4.04	0.30	0.15	0.12	3.40	0.83	0.83		**24.81**
20% Contingency	4.73	0.80	0.80	0.80	0.80	0.80	0.80	8.67	0.99	0.99	5.39	0.40	0.21	0.15	4.53	1.11	1.11		**33.09**
YEAR TOTAL	**31.90**	**5.40**	**5.40**	**5.40**	**5.40**	**5.40**	**5.40**	**58.51**	**6.69**	**6.69**	**36.39**	**2.73**	**1.38**	**1.04**	**30.57**	**7.51**	**7.51**		**223.33**
CUMULATIVE TOTAL	**31.90**	**37.30**	**42.70**	**48.10**	**53.51**	**58.91**	**64.31**	**122.82**	**129.51**	**136.20**	**172.59**	**175.32**	**176.71**	**177.75**	**208.31**	**215.82**	**223.33**		

EMPLOYMENT FACILITIES / YEAR	PHASE A (million $)										PHASE B (million $)										PHASE C (million $)										PHASE D (million $)										TOTAL (million $)
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	
	50%	0%	0%	0%	50%	0%	0%	0%	0%	0%	50%	0%	0%	0%	50%	0%	0%	0%	0%	0%	50%	0%	0%	0%	50%	0%	0%	0%	0%	0%	50%	0%	0%	0%	50%	0%	0%	0%	0%	0%	
A. WATER TRANSMISSION	1.16				1.16						1.80				1.80						1.18				1.18						0.76				0.76						**9.80**
B. WATER STORAGE TANKS	2.50				2.50						3.75				3.75																3.75				3.75						**20.00**
C. SURFACE WATER TREATMENT PLANT																																									
D. GROUND WATER TREATMENT PLANT																																									
E. GROUND WATER WELL FIELD																																									
F. RAW WATER PUMP STATION																																									
G. SURFACE RAW-WATER SUPPLY																																									
Subtotal	3.66				3.66						5.55				5.55						1.18				1.18						4.51				4.51						**29.80**
15% Engineering/Inspection	0.55				0.55						0.83				0.83						0.18				0.18						0.68				0.68						**4.47**
20% Contingency	0.73				0.73						1.11				1.11						0.24				0.24						0.90				0.90						**5.96**
YEAR TOTAL	**4.94**				**4.94**						**7.50**				**7.50**						**1.59**				**1.59**						**6.08**				**6.08**						**40.22**
CUMULATIVE TOTAL	**4.94**				**9.89**						**17.38**				**24.88**						**26.47**				**28.06**						**34.14**				**40.22**						
GRAND YEAR TOTAL	**36.84**	**5.40**	**5.40**	**5.40**	**10.34**	**5.40**	**5.40**	**58.51**	**6.69**	**6.69**	**43.89**	**2.73**	**1.38**	**1.04**	**38.07**	**7.51**	**7.51**				**1.59**				**1.59**						**6.08**				**6.08**						**263.56**
GRAND CUMULATIVE TOTAL	**36.84**	**42.24**	**47.64**	**53.05**	**63.39**	**68.79**	**74.19**	**132.71**	**139.40**	**146.09**	**189.97**	**192.71**	**194.09**	**195.13**	**233.20**	**240.71**	**248.22**				**249.80**				**251.39**						**257.47**				**263.56**						

NOTE: ***ANNUAL COST TABULATIONS DO NOT TAKE INTO ACCOUNT ADJUSTMENTS RESULTING FROM CHOOSING ANOTHER ALTERNATE FOR SURFACE WATER RAW-WATER SUPPLY (IE. ALT-1 THROUGH ALT-3)***

ENGINEER'S PRELIMINARY OPINION OF COSTS

Sutter County

Based on the Sutter Pointe Water System Model for Alternate "B" Winter Diversion Water Supply Program (West Well Field)

CONSTRUCTION COSTS (Alt "B" west well field)

ITEM No.	DESCRIPTION	UNIT PRICE	PHASE 1 QTY	PHASE 1 UNIT	PHASE 1 AMOUNT	PHASE A QTY	PHASE A UNIT	PHASE A AMOUNT	PHASE 2 QTY	PHASE 2 UNIT	PHASE 2 AMOUNT	PHASE B QTY	PHASE B UNIT	PHASE B AMOUNT	PHASE 3 QTY	PHASE 3 UNIT	PHASE 3 AMOUNT	PHASE C QTY	PHASE C UNIT	PHASE C AMOUNT	PHASE 4 QTY	PHASE 4 UNIT	PHASE 4 AMOUNT	PHASE D QTY	PHASE D UNIT	PHASE D AMOUNT	TOTAL QTY	TOTAL UNIT	TOTAL AMOUNT
A. WATER TRANSMISSION																													
1.	12" T-Main incl. pipe and fittings, DIP	$64.00	26,500	LF	$1,696,000	11,000	LF	$704,000	9,500	LF	$608,000	6,800	LF	$435,200	9,800	LF	$627,200	0	LF	$0	11,400	LF	$729,600	21,400	LF	$1,369,600	96,400	LF	$6,169,600
1a.	12" T-Main (Parallel on 4 lane ROW and larger)	$94.00	26,500	LF	$2,491,000	3,300	LF	$310,200	6,000	LF	$564,000	10,400		$977,600	7,500	LF	$705,000	5,700		$535,800	9,000	LF	$846,000	0	LF	$0	68,400	LF	$6,429,600
2.	18" T-Main incl. pipe and fittings, DIP	$94.00	26,400	LF	$2,481,600	5,200	LF	$488,800	20,000	LF	$1,880,000	9,900	LF	$930,600	11,000	LF	$1,034,000	15,000	LF	$1,410,000	19,000	LF	$1,786,000	0	LF	$0	106,500	LF	$10,011,000
4.	24" T-Main incl. pipe and fittings, DIP	$135.00	4,400	LF	$594,000	1,000	LF	$135,000	0	LF	$0	7,800	LF	$1,053,000	0	LF	$0	1,800	LF	$243,000	0	LF	$0	0	LF	$0	15,000	LF	$2,025,000
5.	30" T-Main incl. pipe and fittings, DIP	$170.00	4,700	LF	$799,000	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	4,700	LF	$799,000
6.	36" T-Main incl. pipe and fittings, DIP	$205.00	2,500	LF	$512,500	2,200	LF	$451,000	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	4,700	LF	$963,500
7.	42" T-Main incl. pipe and fittings, DIP	$240.00	5,400	LF	$1,296,000	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	5,400	LF	$1,296,000
8.	48" T-Main incl. pipe and fittings, DIP	$275.00	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0
9.	12" Butterfly Valve Assembly	$2,500.00	13	EA	$32,500	8	EA	$20,000	5	EA	$12,500	3	EA	$7,500	8	EA	$20,000	0	EA	$0	9	EA	$22,500	14	EA	$35,000	60	EA	$150,000
10.	18" Butterfly Valve Assembly	$4,000.00	13	EA	$52,000	4	EA	$16,000	12	EA	$48,000	2	EA	$8,000	9	EA	$36,000	11	EA	$44,000	11	EA	$44,000	0	EA	$0	62	EA	$248,000
12.	24" Butterfly Valve Assembly	$7,200.00	3	EA	$21,600	2	EA	$14,400	0	EA	$0	3	EA	$21,600	0	EA	$0	1	EA	$7,200	0	EA	$0	0	EA	$0	9	EA	$64,800
13.	30" Line Valve	$28,000.00	4	EA	$112,000	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	4	EA	$112,000
14.	36" Line Valve	$35,000.00	2	EA	$70,000	2	EA	$70,000	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	4	EA	$140,000
15.	42" Line Valve	$40,000.00	2	EA	$80,000	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	2	EA	$80,000
16.	48" Line Valve	$50,000.00	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0
17.	Fire Hydrant Assembly (Assumed 1000' spacing)	$5,000.00	96	EA	$482,000	23	EA	$113,500	36	EA	$177,500	35	EA	$174,500	28	EA	$141,500	23	EA	$112,500	39	EA	$197,000	21	EA	$107,000	301		$1,505,500
18.	Bore and Jack under HWY 99/70 (54" Casing)	$1,000.00	600	LF	$600,000	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	600	LF	$600,000
19.	Bore and Jack under HWY 99/70 (24" Casing)	$500.00	600	LF	$300,000	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	600	LF	$300,000
	TOTAL WATER TRANSMISSION				**$11,620,200**			**$2,322,900**			**$3,290,000**			**$3,608,000**			**$2,563,700**			**$2,352,500**			**$3,625,100**			**$1,511,600**			**$30,894,000**
B. WATER STORAGE TANKS																													
1.	Treatment Plant Storage Tank (4MG) (Includes booster pump station and hydromatic tank)	$5,000,000.00	0	EA	$0	1	EA	$5,000,000	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	1	EA	$5,000,000
2.	Storage Tank (6MG) (Includes booster pump station and hydromatic tank)	$7,500,000.00	1	EA	$7,500,000	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	1	EA	$7,500,000
3.	Storage Tank (6MG) (Includes booster pump station and hydromatic tank)	$7,500,000.00	0	EA	$0	0	EA	$0	0	EA	$0	1	EA	$7,500,000	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	1	EA	$7,500,000
4.	Storage Tank (6MG) (Includes booster pump station and hydromatic tank)	$7,500,000.00	0	EA	$0	0	EA	$0	1	EA	$7,500,000	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	1	EA	$7,500,000
5.	Storage Tank (6MG) (Includes booster pump station and hydromatic tank)	$7,500,000.00	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	1	EA	$7,500,000	0	EA	$0	1	EA	$7,500,000
6.	Storage Tank (6MG) (Includes booster pump station and hydromatic tank)	$7,500,000.00	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	1	EA	$7,500,000	1	EA	$7,500,000
	TOTAL WATER STORAGE				**$7,500,000**			**$5,000,000**			**$7,500,000**			**$7,500,000**			**$0**			**$0**			**$7,500,000**			**$7,500,000**			**$42,500,000**

CONSTRUCTION COSTS (Alt "B" west well field)

ITEM No.	DESCRIPTION	UNIT PRICE	PHASE 1 QTY	PHASE 1 UNIT	PHASE 1 AMOUNT	PHASE A QTY	PHASE A UNIT	PHASE A AMOUNT	PHASE 2 QTY	PHASE 2 UNIT	PHASE 2 AMOUNT	PHASE B QTY	PHASE B UNIT	PHASE B AMOUNT	PHASE 3 QTY	PHASE 3 UNIT	PHASE 3 AMOUNT	PHASE C QTY	PHASE C UNIT	PHASE C AMOUNT	PHASE 4 QTY	PHASE 4 UNIT	PHASE 4 AMOUNT	PHASE D QTY	PHASE D UNIT	PHASE D AMOUNT	TOTAL QTY	TOTAL UNIT	TOTAL AMOUNT
C. SURFACE WATER TREATMENT PLANT																													
1.	Surface Water Treatment Plant (33.1 mgd)	$1,250,000.00	0	mgd	$0	INC	mgd	INC	16.6	mgd	$20,750,000	INC	mgd	INC	16.5	mgd	$20,625,000	INC	mgd	INC	0	mgd	$0	INC	mgd	INC	33.1	mgd	$41,375,000
	TOTAL SURFACE WATER TREATMENT PLANT				**$0**			**INC**			**$20,750,000**			**INC**			**$20,625,000**			**INC**			**$0**			**INC**			**$41,375,000**
D. GROUND WATER TREATMENT PLANT																													
1.	West Ground Water Treatment Plant (15.1 mgd)	$1,250,000.00	15.1	mgd	$18,875,000	INC	mgd	INC	0	mgd	$0	INC	mgd	INC	0	mgd	$0	INC	mgd	INC	0	mgd	$0	INC	mgd	INC	15.1	mgd	$18,875,000
2	East Ground Water Treatment Plant (0 mgd)	$1,250,000.00	0	mgd	$0	0	mgd	$0	0	mgd	$0	0	mgd	$0	0	mgd	$0	0	mgd	$0	0	mgd	$0	0	mgd	$0	0	mgd	$0
	TOTAL GROUND WATER TREATMENT PLANT				**$18,875,000**			**$0**			**$0**			**$0**			**$0**			**$0**			**$0**			**$0**			**$18,875,000**
E. GROUND WATER WELL FIELDS																													
E.1 - EAST WELL AND PUMP FACILITY																													
1.	Well & Pump Facility	$1,000,000.00	0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0
2.	12" Raw Water incl. Fittings, DIP	$85.00	0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0
3.	16" Raw Water incl. Fittings, DIP	$120.00	0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0
4.	21" Raw Water incl. Fittings, DIP	$160.00	0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0
5.	24" Raw Water incl. Fittings, DIP	$180.00	0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0
6.	30" Raw Water incl. Fittings, DIP	$225.00	0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0
7.	36" Raw Water incl. Fittings, DIP	$270.00	0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0
8.	12" Butterfly Valve Assembly	$2,500.00	0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0
9.	16" Butterfly Valve Assembly	$3,500.00	0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0
10.	21" Butterfly Valve Assembly	$4,600.00	0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0
11.	24" Butterfly Valve Assembly	$7,300.00	0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0
12.	30" Butterfly Valve Assembly	$14,000.00	0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0
13.	36" Butterfly Valve Assembly	$17,000.00	0	EA	$0	0	EA			EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0
	SUBTOTAL EAST WELL AND PUMP FACILITY				**$0**			**INC.**			**$0**			**INC.**			**$0**			**INC.**			**$0**			**INC.**			**$0**
E.2- WEST WELL AND PUMP FACILITY																													
2.	Well & Pump Facility	$1,000,000.00	9	EA	$9,000,000	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		9	EA	$9,000,000
3.	12" Raw Water incl. Fittings, DIP	$85.00	14,850	LF	$1,262,250	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		14,850	LF	$1,262,250
4.	16" Raw Water incl. Fittings, DIP	$120.00	4,500	LF	$540,000	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		4,500	LF	$540,000
5.	21" Raw Water incl. Fittings, DIP	$160.00	6,300	LF	$1,008,000	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		6,300	LF	$1,008,000
6.	24" Raw Water incl. Fittings, DIP	$180.00	5,850	LF	$1,053,000	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		5,850	LF	$1,053,000
7.	30" Raw Water incl. Fittings, DIP	$225.00	0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0
8.	36" Raw Water incl. Fittings, DIP	$270.00	0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0
9.	12" Butterfly Valve Assembly	$2,500.00	5	EA	$12,500	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		5	EA	$12,500
10.	16" Butterfly Valve Assembly	$3,500.00	1	EA	$3,500	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		1	EA	$3,500
11.	21" Butterfly Valve Assembly	$4,600.00	1	EA	$4,600	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		1	EA	$4,600
12.	24" Butterfly Valve Assembly	$7,300.00	1	EA	$7,300	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		1	EA	$7,300
13.	30" Butterfly Valve Assembly	$14,000.00	0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0
14.	36" Butterfly Valve Assembly	$17,000.00	0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0
	SUBTOTAL WEST WELL AND PUMP FACILITY				**$12,891,150**			**INC.**			**$0**			**INC.**			**$0**			**INC.**			**$0**			**INC.**			**$12,891,150**
	TOTAL GROUND WATER WELL FIELDS				**$12,891,150**			**$0**			**$0**			**$0**			**$0**			**$0**			**$0**			**$0**			**$12,891,150**

CONSTRUCTION COSTS (Alt "B" west well field)

ITEM No.	DESCRIPTION	UNIT PRICE	PHASE 1 QTY	PHASE 1 UNIT	PHASE 1 AMOUNT	PHASE A QTY	PHASE A UNIT	PHASE A AMOUNT	PHASE 2 QTY	PHASE 2 UNIT	PHASE 2 AMOUNT	PHASE B QTY	PHASE B UNIT	PHASE B AMOUNT	PHASE 3 QTY	PHASE 3 UNIT	PHASE 3 AMOUNT	PHASE C QTY	PHASE C UNIT	PHASE C AMOUNT	PHASE 4 QTY	PHASE 4 UNIT	PHASE 4 AMOUNT	PHASE D QTY	PHASE D UNIT	PHASE D AMOUNT	TOTAL QTY	TOTAL UNIT	TOTAL AMOUNT
F. RAW WATER PUMP STATION																													
1.	Raw Water Booster Pump Station (Bennet or Sankey)	$2,500,000.00	0	EA	$0	0	EA	$0	1	EA	$2,500,000	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	1	EA	$2,500,000
2.	Raw Water Diversion Facility (Fair Share Cost)	$8,225,996.00	0	EA	$0	0	EA	$0	1	EA	$8,225,996	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	1	EA	$8,225,996
	TOTAL RAW WATER PUMP STATION				**$0**			**$0**			**$10,725,996**			**$0**			**$0**			**$0**			**$0**			**$0**			**$10,725,996**
G. SURFACE RAW-WATER SUPPLY (BENNET TO WEST TREATMENT SITE)																													
1.	42" Steel Cylinder Pipe (CMCL, D.I.P. or Equal) incl. fittings	$350.00	0	LF	$0	0	LF	$0	29,500	LF	$10,325,000	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	29,500	LF	$10,325,000
2.	42" Line Valves	$60,000.00	0	EA	$0	0	EA	$0	6	EA	$360,000	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	6	EA	$360,000
	TOTAL SURFACE RAW-WATER SUPPLY				**$0**			**$0**			**$10,685,000**			**$0**			**$0**			**$0**			**$0**			**$0**			**$10,685,000**
G. (ALT-1) SURFACE RAW-WATER SUPPLY (SANKEY TO WEST TREATMENT SITE)																													
1.A	42" Steel Cylinder Pipe (CMCL, D.I.P. or Equal) incl. fittings	$350.00	0	LF	$0	0	LF	$0	27,200	LF	$9,520,000	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	27,200	LF	$9,520,000
2.A	42" Line Valves	$60,000.00	0	EA	$0	0	EA	$0	6	EA	$360,000	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	6	EA	$360,000
	TOTAL (ALT-1) SURFACE RAW-WATER SUPPLY				**$0**			**$0**			**$9,880,000**			**$0**			**$0**			**$0**			**$0**			**$0**			**(ALT-1)**	**$9,880,000**

CONSTRUCTION COSTS (Alt "B" west well field)

ITEM No.	DESCRIPTION	UNIT PRICE	PHASE 1 QTY	PHASE 1 UNIT	PHASE 1 AMOUNT	PHASE A QTY	PHASE A UNIT	PHASE A AMOUNT	PHASE 2 QTY	PHASE 2 UNIT	PHASE 2 AMOUNT	PHASE B QTY	PHASE B UNIT	PHASE B AMOUNT	PHASE 3 QTY	PHASE 3 UNIT	PHASE 3 AMOUNT	PHASE C QTY	PHASE C UNIT	PHASE C AMOUNT	PHASE 4 QTY	PHASE 4 UNIT	PHASE 4 AMOUNT	PHASE D QTY	PHASE D UNIT	PHASE D AMOUNT	TOTAL QTY	TOTAL UNIT	TOTAL AMOUNT
	CONSTRUCTION COST ESTIMATE SUMMARY																												
	A. WATER TRANSMISSION				$11,620,200			$2,322,900			$3,290,000			$3,608,000			$2,563,700			$2,352,500			$3,625,100			$1,511,600			$30,894,000
	B. WATER STORAGE TANKS				$7,500,000			$5,000,000			$7,500,000			$7,500,000			$0			$0			$7,500,000			$7,500,000			$42,500,000
	C. SURFACE WATER TREATMENT PLANT				$0			INC			$20,750,000			INC			$20,625,000			INC			$0			INC			$41,375,000
	D. GROUND WATER TREATMENT PLANT				$18,875,000			$0			$0			$0			$0			$0			$0			$0			$18,875,000
	E. GROUND WATER WELL FIELD				$12,891,150			$0			$0			$0			$0			$0			$0			$0			$12,891,150
	F. RAW WATER PUMP STATION				$0			$0			$10,725,996			$0			$0			$0			$0			$0			$10,725,996
	G. SURFACE RAW-WATER SUPPLY				$0			$0			$10,685,000			$0			$0			$0			$0			$0			$10,685,000
	Subtotal Construction Costs (A-G)				$50,886,350			$7,322,900			$52,950,996			$11,108,000			$23,188,700			$2,352,500			$11,125,100			$9,011,600			$167,946,146
	15% Engineering/Inspection				$7,632,953			$1,098,435			$7,942,649			$1,666,200			$3,478,305			$352,875			$1,668,765			$1,351,740			$25,191,922
	20% Contingency				$10,177,270			$1,464,580			$10,590,199			$2,221,600			$4,637,740			$470,500			$2,225,020			$1,802,320			$33,589,229
	GRAND TOTAL CONSTRUCTION COST				$68,696,573			$9,885,915			$71,483,845			$14,995,800			$31,304,745			$3,175,875			$15,018,885			$12,165,660			$226,727,297

ALTERNATIVES FOR SURFACE RAW-WATER SUPPLY (Refer to section "G")

G. (ALT-1) SURFACE RAW-WATER SUPPLY (SANKEY TO WEST TREATMENT SITE)
(Adjust from Alternate B Water Supply Program if used)

Proposed Surface Raw-Water Supply (Item 'G') Total	$10,685,000
Alternative 1 Total	$9,880,000
Difference From Proposed Surface Raw-Water Supply	($805,000)
15% Engineering/Inspection	($120,750)
20% Contingency	($161,000)
Total Adjustment for Alt-1	($1,086,750)

ENGINEER'S PRELIMINARY OPINION OF ANNUAL COSTS

Sutter County

Based on the Sutter Pointe Water System Model for Alternate "B" Winter Diversion Water Supply Program (West Well Field)

RESIDENTIAL FACILITIES / YEAR	PHASE 1 (million $)							PHASE 2 (million $)					PHASE 3 (million $)			PHASE 4 (million $)		(RESIDENTIAL COMPLETED) (million $)	TOTAL (million $)
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40	
Percent of Total Phase Cost	25%	12.5%	12.5%	12.5%	12.5%	12.5%	12.5%	25%	18.75%	18.75%	18.75%	18.75%	40%	30%	30%	50%	50%		
A. WATER TRANSMISSION	2.91	1.45	1.45	1.45	1.45	1.45	1.45	0.82	0.62	0.62	0.62	0.62	1.03	0.77	0.77	1.81	1.81		21.10
B. WATER STORAGE TANKS	1.88	0.94	0.94	0.94	0.94	0.94	0.94	1.88	1.41	1.41	1.41	1.41				3.75	3.75		22.50
	0%	0%	0%	0%	0%	0%	0%	100%	0%	0%	0%	0%	100%	0%	0%	0%	0%		
C. SURFACE WATER TREATMENT PLANT								20.75					20.63						41.38
	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%		
D. GROUND WATER TREATMENT PLANT	18.88																		18.88
	25%	12.5%	12.5%	12.5%	12.5%	12.5%	12.5%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%		
E. GROUND WATER WELL FIELD	3.22	1.61	1.61	1.61	1.61	1.61	1.61												12.89
	0%	0%	0%	0%	0%	0%	0%	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%		
F. RAW WATER PUMP STATION								10.73											10.73
G. SURFACE RAW-WATER SUPPLY								10.69											10.69
Subtotal	26.88	4.00	4.00	4.00	4.00	4.00	4.00	44.86	2.02	2.02	2.02	2.02	21.65	0.77	0.77	5.56	5.56		138.15
15% Engineering/Inspection	4.03	0.60	0.60	0.60	0.60	0.60	0.60	6.73	0.30	0.30	0.30	0.30	3.25	0.12	0.12	0.83	0.83		20.72
20% Contingency	5.38	0.80	0.80	0.80	0.80	0.80	0.80	8.97	0.40	0.40	0.40	0.40	4.33	0.15	0.15	1.11	1.11		27.63
YEAR TOTAL	36.29	5.40	5.40	5.40	5.40	5.40	5.40	60.56	2.73	2.73	2.73	2.73	29.23	1.04	1.04	7.51	7.51		186.50
CUMULATIVE TOTAL	36.29	41.69	47.09	52.49	57.89	63.29	68.70	129.26	131.99	134.72	137.45	140.18	169.41	170.45	171.49	178.99	186.50		

EMPLOYMENT FACILITIES / YEAR	PHASE A (million $)										PHASE B (million $)										PHASE C (million $)										PHASE D (million $)										TOTAL (million $)
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	
	50%	0%	0%	0%	50%	0%	0%	0%	0%	0%	50%	0%	0%	0%	50%	0%	0%	0%	0%	0%	50%	0%	0%	0%	50%	0%	0%	0%	0%	0%	50%	0%	0%	0%	50%	0%	0%	0%	0%	0%	
A. WATER TRANSMISSION	1.16				1.16						1.80				1.80						1.18				1.18						0.76				0.76						9.80
B. WATER STORAGE TANKS	2.50				2.50						3.75				3.75																3.75				3.75						20.00
C. SURFACE WATER TREATMENT PLANT																																									
D. GROUND WATER TREATMENT PLANT																																									
E. GROUND WATER WELL FIELD																																									
F. RAW WATER PUMP STATION																																									
G. SURFACE RAW-WATER SUPPLY																																									
Subtotal	3.66				3.66						5.55				5.55						1.18				1.18						4.51				4.51						29.80
15% Engineering/Inspection	0.55				0.55						0.83				0.83						0.18				0.18						0.68				0.68						4.47
20% Contingency	0.73				0.73						1.11				1.11						0.24				0.24						0.90				0.90						5.96
YEAR TOTAL	4.94				4.94						7.50				7.50						1.59				1.59						6.08				6.08						40.22
CUMULATIVE TOTAL	4.94				9.89						17.38				24.88						26.47				28.06						34.14				40.22						
GRAND YEAR TOTAL	41.23	5.40	5.40	5.40	10.34	5.40	5.40	60.56	2.73	2.73	10.23	2.73	29.23	1.04	8.54	7.51	7.51				1.59				1.59						6.08				6.08						226.73
GRAND CUMULATIVE TOTAL	41.23	46.63	52.03	57.43	67.78	73.18	78.58	139.14	141.87	144.60	154.83	157.56	186.79	187.83	196.37	203.88	211.39				212.97				214.56						220.64				226.73						

NOTE: *ANNUAL COST TABULATIONS DO NOT TAKE INTO ACCOUNT ADJUSTMENTS RESULTING FROM CHOOSING ANOTHER ALTERNATE FOR SURFACE WATER RAW-WATER SUPPLY (IE. ALT-1 THROUGH ALT-3)*

ENGINEER'S PRELIMINARY OPINION OF COSTS

Sutter County

Based on the Sutter Pointe Water System Model for Alternate "B" Winter Diversion Water Supply Program (East Well Field)

CONSTRUCTION COSTS (Alt "B" east well field)

ITEM No.	DESCRIPTION	UNIT PRICE	PHASE 1 QTY	PHASE 1 UNIT	PHASE 1 AMOUNT	PHASE A QTY	PHASE A UNIT	PHASE A AMOUNT	PHASE 2 QTY	PHASE 2 UNIT	PHASE 2 AMOUNT	PHASE B QTY	PHASE B UNIT	PHASE B AMOUNT	PHASE 3 QTY	PHASE 3 UNIT	PHASE 3 AMOUNT	PHASE C QTY	PHASE C UNIT	PHASE C AMOUNT	PHASE 4 QTY	PHASE 4 UNIT	PHASE 4 AMOUNT	PHASE D QTY	PHASE D UNIT	PHASE D AMOUNT	TOTAL QTY	TOTAL UNIT	TOTAL AMOUNT
A. WATER TRANSMISSION																													
1.	12" T-Main incl. pipe and fittings, DIP	$64.00	28,500	LF	$1,824,000	11,000	LF	$704,000	9,500	LF	$608,000	6,800	LF	$435,200	9,800	LF	$627,200	0	LF	$0	11,400	LF	$729,600	21,400	LF	$1,369,600	98,400	LF	$6,297,600
1a.	12" T-Main (Parallel on 4 lane ROW and larger)	$94.00	26,500	LF	$2,491,000	3,300	LF	$310,200	6,000	LF	$564,000	10,400		$977,600	7,500	LF	$705,000	5,700		$535,800	9,000	LF	$846,000	0	LF	$0	68,400		$6,429,600
2.	18" T-Main incl. pipe and fittings, DIP	$94.00	26,400	LF	$2,481,600	5,200	LF	$488,800	20,000	LF	$1,880,000	9,900	LF	$930,600	11,000	LF	$1,034,000	15,000	LF	$1,410,000	19,000	LF	$1,786,000	0	LF	$0	106,500	LF	$10,011,000
3.	24" T-Main incl. pipe and fittings, DIP	$135.00	4,400	LF	$594,000	1,000	LF	$135,000	0	LF	$0	7,800	LF	$1,053,000	0	LF	$0	1,800	LF	$243,000	0	LF	$0	0	LF	$0	15,000	LF	$2,025,000
4.	30" T-Main incl. pipe and fittings, DIP	$170.00	4,700	LF	$799,000	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	4,700	LF	$799,000
5.	36" T-Main incl. pipe and fittings, DIP	$205.00	2,500	LF	$512,500	2,200	LF	$451,000	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	4,700	LF	$963,500
6.	42" T-Main incl. pipe and fittings, DIP	$240.00	3,200	LF	$768,000	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	3,200	LF	$768,000
7.	48" T-Main incl. pipe and fittings, DIP	$275.00	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0
8.	12" Butterfly Valve Assembly	$2,500.00	13	EA	$32,500	8	EA	$20,000	5	EA	$12,500	3	EA	$7,500	8	EA	$20,000	0	EA	$0	9	EA	$22,500	14	EA	$35,000	60	EA	$150,000
9.	18" Butterfly Valve Assembly	$4,000.00	13	EA	$52,000	4	EA	$16,000	12	EA	$48,000	2	EA	$8,000	9	EA	$36,000	11	EA	$44,000	11	EA	$44,000	0	EA	$0	62	EA	$248,000
2.	24" Butterfly Valve Assembly	$7,200.00	3	EA	$21,600	2	EA	$14,400	0	EA	$0	3	EA	$21,600	0	EA	$0	1	EA	$7,200	0	EA	$0	0	EA	$0	9	EA	$64,800
3.	30" Line Valve	$28,000.00	4	EA	$112,000	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	4	EA	$112,000
4.	36" Line Valve	$35,000.00	2	EA	$70,000	2	EA	$70,000	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	4	EA	$140,000
5.	42" Line Valve	$40,000.00	2	EA	$80,000	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	2	EA	$80,000
6.	48" Line Valve	$50,000.00	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0
7.	Fire Hydrant Assembly (Assumed 1000' spacing)	$5,000.00	96	EA	$481,000	23	EA	$113,500	36	EA	$177,500	35	EA	$174,500	28	EA	$141,500	23	EA	$112,500	39	EA	$197,000	21	EA	$107,000	301		$1,504,500
8.	Bore and Jack under HWY 99/70 (54" Casing)	$1,000.00	600	LF	$600,000	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	600	LF	$600,000
9.	Bore and Jack under HWY 99/70 (24" Casing)	$500.00	600	LF	$300,000	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	600	LF	$300,000
	TOTAL WATER TRANSMISSION				**$11,219,200**			**$2,322,900**			**$3,290,000**			**$3,608,000**			**$2,563,700**			**$2,352,500**			**$3,625,100**			**$1,511,600**			**$30,493,000**
B. WATER STORAGE TANKS																													
1.	Treatment Plant Storage Tank (4MG) (Includes booster pump station and hydromatic tank)	$5,000,000.00	0	EA	$0	1	EA	$5,000,000	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	1	EA	$5,000,000
2.	Storage Tank (6MG) (Includes booster pump station and hydromatic tank)	$7,500,000.00	1	EA	$7,500,000	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	1	EA	$7,500,000
3.	Storage Tank (6MG) (Includes booster pump station and hydromatic tank)	$7,500,000.00	0	EA	$0	0	EA	$0	0	EA	$0	1	EA	$7,500,000	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	1	EA	$7,500,000
4.	Storage Tank (6MG) (Includes booster pump station and hydromatic tank)	$7,500,000.00	0	EA	$0	0	EA	$0	1	EA	$7,500,000	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	1	EA	$7,500,000
5.	Storage Tank (6MG) (Includes booster pump station and hydromatic tank)	$7,500,000.00	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	1	EA	$7,500,000	0	EA	$0	1	EA	$7,500,000
6.	Storage Tank (6MG) (Includes booster pump station and hydromatic tank)	$7,500,000.00	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	1	EA	$7,500,000	1	EA	$7,500,000
	TOTAL WATER STORAGE				**$7,500,000**			**$5,000,000**			**$7,500,000**			**$7,500,000**			**$0**			**$0**			**$7,500,000**			**$7,500,000**			**$42,500,000**

CONSTRUCTION COSTS (Alt "B" east well field)

ITEM No.	DESCRIPTION	UNIT PRICE	PHASE 1 QTY	PHASE 1 UNIT	PHASE 1 AMOUNT	PHASE A QTY	PHASE A UNIT	PHASE A AMOUNT	PHASE 2 QTY	PHASE 2 UNIT	PHASE 2 AMOUNT	PHASE B QTY	PHASE B UNIT	PHASE B AMOUNT	PHASE 3 QTY	PHASE 3 UNIT	PHASE 3 AMOUNT	PHASE C QTY	PHASE C UNIT	PHASE C AMOUNT	PHASE 4 QTY	PHASE 4 UNIT	PHASE 4 AMOUNT	PHASE D QTY	PHASE D UNIT	PHASE D AMOUNT	TOTAL QTY	TOTAL UNIT	TOTAL AMOUNT
C. SURFACE WATER TREATMENT PLANT																													
1.	Surface Water Treatment Plant (33.1 mgd)	$1,250,000.00	0	mgd	$0	INC	mgd	INC	16.6	mgd	$20,750,000	INC	mgd	INC	16.5	mgd	$20,625,000	INC	mgd	INC	0	mgd	$0	INC	mgd	INC	33.1	mgd	$41,375,000
	TOTAL SURFACE WATER TREATMENT PLANT				**$0**			**INC**			**$20,750,000**			**INC**			**$20,625,000**			**INC**			**$0**			**INC**			**$41,375,000**
D. GROUND WATER TREATMENT PLANT																													
1.	West Ground Water Treatment Plant (0 mgd)	$1,250,000.00	0	mgd	$0	INC	mgd	INC	0	mgd	$0	INC	mgd	INC	0	mgd	$0	INC	mgd	INC	0	mgd	$0	INC	mgd	INC	0	mgd	$0
2	East Ground Water Treatment Plant (15.1 mgd)	$1,250,000.00	15.1	mgd	$18,875,000	0	mgd	$0	0	mgd	$0	0	mgd	$0	0	mgd	$0	0	mgd	$0	0	mgd	$0	0	mgd	$0	15.1	mgd	$18,875,000
	TOTAL GROUND WATER TREATMENT PLANT				**$18,875,000**			**$0**			**$0**			**$0**			**$0**			**$0**			**$0**			**$0**			**$18,875,000**
E. GROUND WATER WELL FIELDS																													
E.1 - EAST WELL AND PUMP FACILITY																													
1.	Well & Pump Facility	$1,000,000.00	9	EA	$9,000,000	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$9,000,000
2.	12" Raw Water incl. Fittings, DIP	$85.00	10,100	LF	$858,500	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$858,500
3.	16" Raw Water incl. Fittings, DIP	$120.00	3,500	LF	$420,000	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$420,000
4.	21" Raw Water incl. Fittings, DIP	$160.00	0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0
5.	24" Raw Water incl. Fittings, DIP	$180.00	3,400	LF	$612,000	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$612,000
6.	30" Raw Water incl. Fittings, DIP	$225.00	3,300	LF	$742,500	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$742,500
7.	36" Raw Water incl. Fittings, DIP	$270.00	7,500	LF	$2,025,000	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$2,025,000
8.	12" Butterfly Valve Assembly	$2,500.00	1	EA	$2,500	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$2,500
9.	16" Butterfly Valve Assembly	$3,500.00	2	EA	$7,000	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$7,000
10.	21" Butterfly Valve Assembly	$4,600.00	0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0
11.	24" Butterfly Valve Assembly	$7,300.00	4	EA	$29,200	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$29,200
12.	30" Butterfly Valve Assembly	$14,000.00	1	EA	$14,000	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$14,000
13.	36" Butterfly Valve Assembly	$17,000.00	1	EA	$17,000	0	EA			EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$17,000
	SUBTOTAL EAST WELL AND PUMP FACILITY				**$13,727,700**			**INC.**			**$0**			**INC.**			**$0**			**INC.**			**$0**			**INC.**			**$13,727,700**
E.2- WEST WELL AND PUMP FACILITY																													
2.	Well & Pump Facility	$1,000,000.00	0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0
3.	12" Raw Water incl. Fittings, DIP	$85.00	0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0
4.	16" Raw Water incl. Fittings, DIP	$120.00	0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0
5.	21" Raw Water incl. Fittings, DIP	$160.00	0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0
6.	24" Raw Water incl. Fittings, DIP	$180.00	0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0
7.	30" Raw Water incl. Fittings, DIP	$225.00	0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0
8.	36" Raw Water incl. Fittings, DIP	$270.00	0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0	0	LF		0	LF	$0
9.	12" Butterfly Valve Assembly	$2,500.00	0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0
10.	16" Butterfly Valve Assembly	$3,500.00	0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0
11.	21" Butterfly Valve Assembly	$4,600.00	0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0
12.	24" Butterfly Valve Assembly	$7,300.00	0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0
13.	30" Butterfly Valve Assembly	$14,000.00	0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0
14.	36" Butterfly Valve Assembly	$17,000.00	0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0	0	EA		0	EA	$0
	SUBTOTAL WEST WELL AND PUMP FACILITY				**$0**			**INC.**			**$0**			**INC.**			**$0**			**INC.**			**$0**			**INC.**			**$0**
	TOTAL GROUND WATER WELL FIELDS				**$13,727,700**			**$0**			**$0**			**$0**			**$0**			**$0**			**$0**			**$0**			**$13,727,700**

CONSTRUCTION COSTS (Alt "B" east well field)

ITEM No.	DESCRIPTION	UNIT PRICE	PHASE 1 QTY	PHASE 1 UNIT	PHASE 1 AMOUNT	PHASE A QTY	PHASE A UNIT	PHASE A AMOUNT	PHASE 2 QTY	PHASE 2 UNIT	PHASE 2 AMOUNT	PHASE B QTY	PHASE B UNIT	PHASE B AMOUNT	PHASE 3 QTY	PHASE 3 UNIT	PHASE 3 AMOUNT	PHASE C QTY	PHASE C UNIT	PHASE C AMOUNT	PHASE 4 QTY	PHASE 4 UNIT	PHASE 4 AMOUNT	PHASE D QTY	PHASE D UNIT	PHASE D AMOUNT	TOTAL QTY	TOTAL UNIT	TOTAL AMOUNT
F. RAW WATER PUMP STATION																													
1.	Raw Water Booster Pump Station (Bennet or Sankey)	$2,500,000.00	0	EA	$0	0	EA	$0	1	EA	$2,500,000	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	1	EA	$2,500,000
2.	Raw Water Diversion Facility (Fair Share Cost)	$8,225,996.00	0	EA	$0	0	EA	$0	1	EA	$8,225,996	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	1	EA	$8,225,996
	TOTAL RAW WATER PUMP STATION				**$0**			**$0**			**$10,725,996**			**$0**			**$0**			**$0**			**$0**			**$0**			**$10,725,996**
G. SURFACE RAW-WATER SUPPLY (BENNET TO EAST TREATMENT SITE)**																													
1.	42" Steel Cylinder Pipe (CMCL, D.I.P., or Equal) incl. fittings	$350.00	0	LF	$0	0	LF	$0	28,500	LF	$9,975,000	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	28,500	LF	$9,975,000
2.	42" Line Valves	$60,000.00	0	EA	$0	0	EA	$0	6	EA	$360,000	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	6	EA	$360,000
3	Bore and Jack under HWY 99/70 (60" Casing)	$1,100.00	0	LF	$0	0	LF	$0	600	LF	$660,000	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	600	LF	$660,000
	TOTAL (ALT-1) SURFACE RAW-WATER SUPPLY				**$0**			**$0**			**$10,995,000**			**$0**			**$0**			**$0**			**$0**			**$0**			**$10,995,000**
G. (ALT-1) SURFACE RAW-WATER SUPPLY (SANKEY TO EAST TREATMENT SITE)																													
1.A	42" Steel Cylinder Pipe (CMCL, D.I.P., or Equal) incl. fittings	$350.00	0	LF	$0	0	LF	$0	26,100	LF	$9,135,000	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	26,100	LF	$9,135,000
2.B	42" Line Valves	$60,000.00	0	EA	$0	0	EA	$0	6	EA	$360,000	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	6	EA	$360,000
3.B	Bore and Jack under HWY 99/70 (60" Casing)	$1,100.00	0	LF	$0	0	LF	$0	600	LF	$660,000	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	600	LF	$660,000
	TOTAL (ALT-1) SURFACE RAW-WATER SUPPLY				**$0**			**$0**			**$10,155,000**			**$0**			**$0**			**$0**			**$0**			**$0**		**ALT**	**$10,155,000**

CONSTRUCTION COSTS (Alt "B" east well field)

ITEM No.	DESCRIPTION	UNIT PRICE	PHASE 1 QTY	PHASE 1 UNIT	PHASE 1 AMOUNT	PHASE A QTY	PHASE A UNIT	PHASE A AMOUNT	PHASE 2 QTY	PHASE 2 UNIT	PHASE 2 AMOUNT	PHASE B QTY	PHASE B UNIT	PHASE B AMOUNT	PHASE 3 QTY	PHASE 3 UNIT	PHASE 3 AMOUNT	PHASE C QTY	PHASE C UNIT	PHASE C AMOUNT	PHASE 4 QTY	PHASE 4 UNIT	PHASE 4 AMOUNT	PHASE D QTY	PHASE D UNIT	PHASE D AMOUNT	TOTAL QTY	TOTAL UNIT	TOTAL AMOUNT
	CONSTRUCTION COST ESTIMATE SUMMARY																											
	A. WATER TRANSMISSION				$11,219,200			$2,322,900			$3,290,000			$3,608,000			$2,563,700			$2,352,500			$3,625,100			$1,511,600			$30,493,000
	B. WATER STORAGE TANKS				$7,500,000			$5,000,000			$7,500,000			$7,500,000			$0			$0			$7,500,000			$7,500,000			$42,500,000
	C. SURFACE WATER TREATMENT PLANT				$0			INC			$20,750,000			INC			$20,625,000			INC			$0			INC			$41,375,000
	D. GROUND WATER TREATMENT PLANT				$18,875,000			$0			$0			$0			$0			$0			$0			$0			$18,875,000
	E. GROUND WATER WELL FIELD				$13,727,700			$0			$0			$0			$0			$0			$0			$0			$13,727,700
	F. RAW WATER PUMP STATION				$0			$0			$10,725,996			$0			$0			$0			$0			$0			$10,725,996
	G. SURFACE RAW-WATER SUPPLY				$0			$0			$10,995,000			$0			$0			$0			$0			$0			$10,995,000
	Subtotal Construction Costs (A-G)				$51,321,900			$7,322,900			$53,260,996			$11,108,000			$23,188,700			$2,352,500			$11,125,100			$9,011,600			$168,691,696
	15% Engineering/Inspection				$7,698,285			$1,098,435			$7,989,149			$1,666,200			$3,478,305			$352,875			$1,668,765			$1,351,740			$25,303,754
	20% Contingency				$10,264,380			$1,464,580			$10,652,199			$2,221,600			$4,637,740			$470,500			$2,225,020			$1,802,320			$33,738,339
	GRAND TOTAL CONSTRUCTION COST				$69,284,565			$9,885,915			$71,902,345			$14,995,800			$31,304,745			$3,175,875			$15,018,885			$12,165,660			$227,733,790

ALTERNATIVES FOR SURFACE RAW-WATER SUPPLY (Refer to section "G")

G. (ALT-1) SURFACE RAW-WATER SUPPLY (SANKEY TO EAST TREATMENT SITE)
(Adjust from Alternate B Water Supply Program if used)

Proposed Surface Raw-Water Supply (Item 'G') Total	$10,995,000
Alternative 1 Total	$10,155,000
Difference From Proposed Surface Raw-Water Supply	($840,000)
15% Engineering/Inspection	($126,000)
20% Contingency	($168,000)
Total Adjustment for Alt-1	($1,134,000)

ENGINEER'S PRELIMINARY OPINION OF ANNUAL COSTS

Sutter County

Based on the Sutter Pointe Water System Model for Alternate "B" Winter Diversion Water Supply Program (east well field)

RESIDENTIAL FACILITIES / YEAR	PHASE 1 (million $)							PHASE 2 (million $)					PHASE 3 (million $)			PHASE 4 (million $)		(RESIDENTIAL COMPLETED) (million $)	TOTAL (million $)
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40	
Percent of Total Phase Cost	25%	12.5%	12.5%	12.5%	12.5%	12.5%	12.5%	25%	18.75%	18.75%	18.75%	18.75%	40%	30%	30%	50%	50%		
A. WATER TRANSMISSION	2.80	1.40	1.40	1.40	1.40	1.40	1.40	0.82	0.62	0.62	0.62	0.62	1.03	0.77	0.77	1.81	1.81		20.70
B. WATER STORAGE TANKS	1.88	0.94	0.94	0.94	0.94	0.94	0.94	1.88	1.41	1.41	1.41	1.41				3.75	3.75		22.50
	0%	0%	0%	0%	0%	0%	0%	100%	0%	0%	0%	0%	100%	0%	0%	0%	0%		
C. SURFACE WATER TREATMENT PLANT								20.75					20.63						41.38
	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%		
D. GROUND WATER TREATMENT PLANT	18.88																		18.88
	25%	12.5%	12.5%	12.5%	12.5%	12.5%	12.5%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%		
E. GROUND WATER WELL FIELD	3.43	1.72	1.72	1.72	1.72	1.72	1.72												13.73
	0%	0%	0%	0%	0%	0%	0%	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%		
F. RAW WATER PUMP STATION								10.73											10.73
G. SURFACE RAW-WATER SUPPLY								11.00											11.00
Subtotal	26.99	4.06	4.06	4.06	4.06	4.06	4.06	45.17	2.02	2.02	2.02	2.02	21.65	0.77	0.77	5.56	5.56		138.90
15% Engineering/Inspection	4.05	0.61	0.61	0.61	0.61	0.61	0.61	6.78	0.30	0.30	0.30	0.30	3.25	0.12	0.12	0.83	0.83		20.83
20% Contingency	5.40	0.81	0.81	0.81	0.81	0.81	0.81	9.03	0.40	0.40	0.40	0.40	4.33	0.15	0.15	1.11	1.11		27.78
YEAR TOTAL	36.43	5.48	5.48	5.48	5.48	5.48	5.48	60.98	2.73	2.73	2.73	2.73	29.23	1.04	1.04	7.51	7.51		187.51
CUMULATIVE TOTAL	36.43	41.91	47.38	52.86	58.33	63.81	69.28	130.26	132.99	135.72	138.46	141.19	170.42	171.45	172.49	180.00	187.51		

EMPLOYMENT FACILITIES / YEAR	PHASE A (million $)										PHASE B (million $)										PHASE C (million $)										PHASE D (million $)										TOTAL (million $)
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	
	50%	0%	0%	0%	50%	0%	0%	0%	0%	0%	50%	0%	0%	0%	50%	0%	0%	0%	0%	0%	50%	0%	0%	0%	50%	0%	0%	0%	0%	0%	50%	0%	0%	0%	50%	0%	0%	0%	0%	0%	
A. WATER TRANSMISSION	1.16				1.16						1.80				1.80						1.18				1.18						0.76				0.76						9.80
B. WATER STORAGE TANKS	2.50				2.50						3.75				3.75																3.75				3.75						20.00
C. SURFACE WATER TREATMENT PLANT																																									
D. GROUND WATER TREATMENT PLANT																																									
E. GROUND WATER WELL FIELD																																									
F. RAW WATER PUMP STATION																																									
G. SURFACE RAW-WATER SUPPLY																																									
Subtotal	3.66				3.66						5.55				5.55						1.18				1.18						4.51				4.51						29.80
15% Engineering/Inspection	0.55				0.55						0.83				0.83						0.18				0.18						0.68				0.68						4.47
20% Contingency	0.73				0.73						1.11				1.11						0.24				0.24						0.90				0.90						5.96
YEAR TOTAL	4.94				4.94						7.50				7.50						1.59				1.59						6.08				6.08						40.22
CUMULATIVE TOTAL	4.94				9.89						17.38				24.88						26.47				28.06						34.14				40.22						
GRAND YEAR TOTAL	41.38	5.48	5.48	5.48	10.42	5.48	5.48	60.98	2.73	2.73	10.23	2.73	29.23	1.04	8.54	7.51	7.51				1.59				1.59						6.08				6.08						227.73
GRAND CUMULATIVE TOTAL	41.38	46.85	52.33	57.80	68.22	73.70	79.17	140.15	142.88	145.61	155.84	158.57	187.80	188.84	197.37	204.88	212.39				213.98				215.57						221.65				227.73						

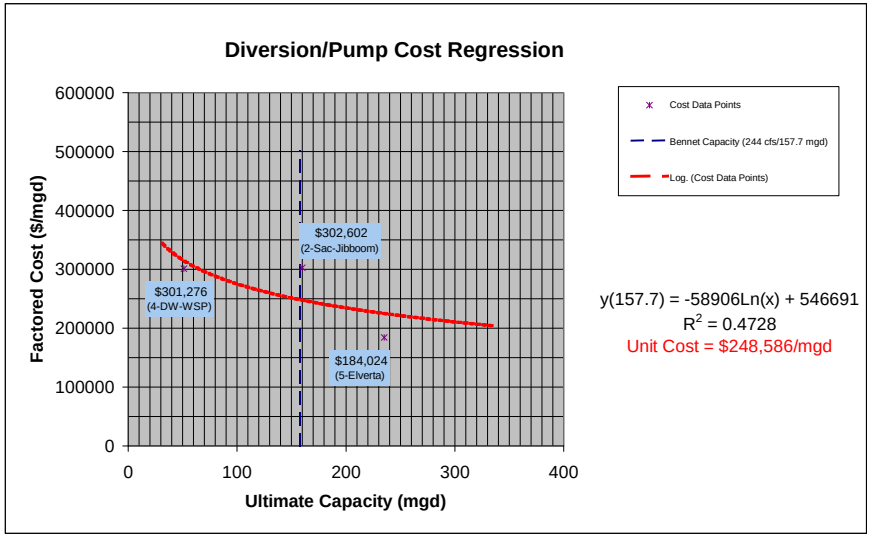
NOTE: *ANNUAL COST TABULATIONS DO NOT TAKE INTO ACCOUNT ADJUSTMENTS RESULTING FROM CHOOSING ANOTHER ALTERNATE FOR SURFACE WATER RAW-WATER SUPPLY (IE. ALT-1 THROUGH ALT-3)*

Raw Water Diversion Facility - Backup Cost Data

NO.	PROJECT	DIVERSION TYPE (Bank/In River)	STATUS (Pro/Ex?)	CONSTRUCTION COST				CAPACITY			UNIT COST			CONTACT		
				COST	YEAR (estimated)	*CCCI	Cost & Index now	(mgd)	(cfs)	(AFA)	Per mgd	Per AFA	SOURCE/DOCUMENT	Name	Company/Agency	Number
							5194									
1	SANKEY DIVERSION	ank (for agg only	Pro	$ 25,000,000	2008		$ 25,000,000	278	430	311,360	$ 89,928	$ 80	CH2MHILL - Verbal (rough est.)	Becky Chelonis/Wane C	CH2MHill	(530) 243-5831/ (530) 229-3374
2	SACTO. (JIBOOM)	In River	Ex - built 200	$ 36,000,000	2001	3862	$ 48,416,365	160	248	179,200	$ 302,602	$ 270	City of Sacto. - Verbal from past bid info.	Dan Sherry	Sac. Utilities Dep	(916) 808-1419
3	FREEPORT	Bank	In Const.	$ 120,587,000	2007	4842	$ 129,353,341	185	286	207,200	$ 699,207	$ 624	Bid (original) copy from contractor	Robert Yoshimira	Parsons	(916) 226-8300
4	DAVIS-WOODLAND W	In River	Pro	$ 12,750,000	Oct 2004	4310	$ 15,365,081	51	79	57,120	$ 301,276	$ 269	Technical Memo attachment to DEIR (2004)			WEBSITE: http://daviswoodlandwatersupply.org/pdfs/wsr/2004_Technical_Memorandum_Davis-UCDavis-Woodland_Joint_Water_Supply_Project.pdf
5	ELVERTA SRWRS	In River	Pro	$ 38,300,000	2006	4600	$ 43,245,696	235	364	263,200	$ 184,024	$ 164	SRWRS Elverta Reliability Study (2006)	Einer Maisch / Anna Foc	PCWA / MWH	(530) 823-4850 /(916) 924-8844 (website: http://www.usbr.gov/mp/srwrs/docs/arps_elverta_11-2006.pdf)
6	LOW OUTLIER - not used STOCKTON WSP	In River	Pro	$ 20,000,000	2003	3988	$ 26,048,144	160	248	179,200	$ 162,801	$ 145	Capacity Analysis Memo (2005)	Anna Fock	MWH	(916) 924-8844

*Escalations based on the California Construction Cost Index (CCCI), produced by ENR

*Soft Costs, including Engineering & Inspection are included



Raw Water Diversion Facility- Fair Share Cost Calculation

			157.7 mgd
		X	**$ 248,586 /mgd**
	Bennet P.S. Estimated Upgrade Cost =		**$ 39,202,012**

Water Supply Scenario	**Raw Surface Water: Design Capacity**		**Percent of Bennet PS (244 cfs)**	**Fair Share Cost ($)**
	(mgd)	**(cfs)**		
Proposed Water Supply Program	29.3	45.3	19%	$ 7,278,078
Alt. A - Water Supply Program	35.1	54.8	22%	$ 8,804,386
Alt. B - Water Supply Program (West Well Field)	33.1	51.2	21%	$ 8,225,996
Alt. B - Water Supply Program (East Well Field)	33.1	51.2	21%	$ 8,225,996

PRELIMINARY COST ESTIMATE

NCMWC Agricultural Irrigation

SUTTER POINTE

Sutter County, California

November 10, 2008

MACKAY & SOMPS
CIVIL ENGINEERS, INC.
SACRAMENTO, CALIFORNIA (916) 929-6092

NOTES

SUTTER POINTE SPECIFIC PLAN

NCMWC Agricultural Irrigation

Sutter County California

1. This estimate is prepared as a guide only and is subject to possible change. It has been prepared to a standard of accuracy which, to the best of our knowledge and judgment, is sufficient to satisfy our understanding of the purpose of this estimate. MacKay & Somps makes no warranty, either expressed or implied, as to the accuracy of this estimate.

2. This estimate is based on the Conceptual Plan for Natomas Central Mutual Water Company (NCMWC) Agricultural Irrigation for Sutter Pointe Specific Plan, dated March 21, 2008 by MacKay & Somps. The Conceptual Plan has not been reviewed or approved by NCMWC. Minor adjustments have been made to individual phases, subsequent to March, 2008.

3. The Conceptual Irrigation Plan is predicated on keeping as much agricultural land irrigated as possible as development progresses.

4. The Conceptual Irrigation Plan is not the result of detailed engineering studies and is schematic in nature.

5. The interim and permanent canal facilities have been designed to convey the maximum capacity of the Northern Pumping Plant (240 cfs). The prelim. canal design is trapezoidal with a 10-foot bottom width, 2:1 side slopes, maximum depth of 6 feet, and 1-foot freeboard. There will be a 15-foot wide access road and 6-foot chain link fence on both sides. The approximate corridor width is 70 feet.

6. This estimate does not consider the following:

   a. Cost associated with environmental (wetland) mitigations or biological surveys
   b. Phased construction or out-of-regular-sequence construction
   c. Financial Charges
   d. Bonds
   e. Land costs, acquisition of right of way, easements, and/or rights of entry
   f. Assessments from assessment, lighting & landscaping, Mello-Roos districts or the like

7. Costs presented herein represent an opinion based on historical information. No provision has been made for inflation.

8. Costs have been been tabulated and extracted for Phase as well as annual costs according the SPSP Conceptual Phasing Plan
dated March 10, 2008.

9. The "cash flow" situation may be different than the fees, credits, and reimbursements itemized in this estimate.

10. Interim improvements may be required depending on development timing of individual units.

PRELIMINARY COST ESTIMATE

Sutter Pointe - NCMWC Agricultural Irrigation

Sutter County

Dated: November 10, 2008

CONSTRUCTION COSTS			PHASE 1			PHASE A			PHASE 2			PHASE B			PHASE 3			PHASE C			PHASE 4			PHASE D			TOTAL		
ITEM No.	DESCRIPTION	UNIT PRICE	QTY	UNIT	AMOUNT	QTY	UNIT	AMOUNT	QTY	UNIT	AMOUNT	QTY	UNIT	AMOUNT	QTY	UNIT	AMOUNT	QTY	UNIT	AMOUNT	QTY	UNIT	AMOUNT	QTY	UNIT	AMOUNT	QTY	UNIT	AMOUNT
1.0 - IRRIGATION CANAL																												
1.A PERMANENT CANAL																												
1.	Excavation (6.2 CY per LF of canal)	$25.00 LF	12,520	LF	$313,000	0	LF	$0	0	LF	$0	5,150	LF	$128,750	2,010	LF	$50,250	0	LF	$0	2,080	LF	$52,000	3,540	LF	$88,500	25,300	LF	$632,500
2.	Access Road (15' wide - 6"AB section)	$30.00 LF	25,040	LF	$751,200	0	LF	$0	0	LF	$0	10,300	LF	$309,000	4,020	LF	$120,600	0	LF	$0	4,160	LF	$124,800	7,080	LF	$212,400	50,600	LF	$1,518,000
3.	6' Chain Link Fence	$16.00 LF	25,040	LF	$400,640	0	LF	$0	0	LF	$0	10,300	LF	$164,800	4,020	LF	$64,320	0	LF	$0	4,160	LF	$66,560	7,080	LF	$113,280	50,600	LF	$809,600
4.	Turnout (Headwall w/Gate)	$65,000.00 EA	1	EA	$65,000	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	1	EA	$65,000
	TOTAL PERMANENT CANAL				**$1,529,840**			**$0**			**$0**			**$602,550**			**$235,170**			**$0**			**$243,360**			**$414,180**			**$3,025,100**
1.B INTERIM CANAL																												
1.	Excavation (6.2 CY per LF of canal)	$25.00 LF	4,360	LF	$109,000	0	LF	$0	1,200	LF	$30,000	1,120	LF	$28,000	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	6,680	LF	$167,000
2.	Access Road (15' wide - 6"AB section)	$30.00 LF	8,720	LF	$261,600	0	LF	$0	2,400	LF	$72,000	2,240	LF	$67,200	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	13,360	LF	$400,800
3.	6' Chain Link Fence	$16.00 LF	8,720	LF	$139,520	0	LF	$0	2,400	LF	$38,400	2,240	LF	$35,840	0	LF	$0	0	LF	$0	0	LF	$0	0	LF	$0	13,360	LF	$213,760
4.	Turnout (Headwall w/Gate)	$65,000.00 EA	1	EA	$65,000	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	1	EA	$65,000
5.	Relocate Existing Pump	$50,000.00 EA	1	EA	$50,000	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	0	EA	$0	1	EA	$50,000
	TOTAL INTERIM CANAL				**$625,120**			**$0**			**$140,400**			**$131,040**			**$0**			**$0**			**$0**			**$0**			**$896,560**
1.C CROSSINGS																												
1.	Headwall/Drop Structure	$40,000.00 EA	18	EA	$720,000	0	EA	$0	0	EA	$0	1	EA	$40,000	2	EA	$80,000	0	EA	$0	2	EA	$80,000	9	EA	$360,000	32	EA	$1,280,000
2.	8' x 10' Culvert/Crossing	$650.00 LF	1,100	LF	$715,000	0	LF	$0	0	LF	$0	50	LF	$32,500	180	LF	$117,000	0	LF	$0	100	LF	$65,000	440	LF	$286,000	1,870	LF	$1,215,500
	TOTAL CROSSINGS				**$1,435,000**			**$0**			**$0**			**$72,500**			**$197,000**			**$0**			**$145,000**			**$646,000**			**$2,495,500**
2.0 - OTHER																												
2A. OTHER																												
1.	Abandon Existing Irrigation Canal (12.5 CY per LF)	$40.00 LF	8920	LF	$356,800	0	LF	$0	2230	LF	$89,200	0	LF	$0	4160	LF	$166,400	0	LF	$0	2230	LF	$89,200	3980	LF	$159,200	21,520	LF	$860,800
2.	Abandon Interim Irrigation Canal (6.2 CY per LF)	$20.00 LF	0	LF	$0	0	LF	$0	2120	LF	$42,400	2240	LF	$44,800	1200	LF	$24,000	1120	LF	$22,400	0	LF	$0	0	LF	$0	6,680	LF	$133,600
	TOTAL OTHER				**$356,800**			**$0**			**$131,600**			**$44,800**			**$190,400**			**$22,400**			**$89,200**			**$159,200**			**$994,400**

CONSTRUCTION COST ESTIMATE SUMMARY

1.0 - IRRIGATION CANAL																												
1A. PERMANENT CANAL					**$1,529,840**			**$0**			**$0**			**$602,550**			**$235,170**			**$0**			**$243,360**			**$414,180**			**$3,025,100**
1B. INTERIM CANAL					**$625,120**			**$0**			**$140,400**			**$131,040**			**$0**			**$0**			**$0**			**$0**			**$896,560**
1C. CROSSINGS					**$1,435,000**			**$0**			**$0**			**$72,500**			**$197,000**			**$0**			**$145,000**			**$646,000**			**$2,495,500**
2.0 - OTHER																												
2A. OTHER					**$356,800**			**$0**			**$131,600**			**$44,800**			**$190,400**			**$22,400**			**$89,200**			**$159,200**			**$994,400**
	Subtotal Construction Costs				**$3,946,760**			**$0**			**$272,000**			**$850,890**			**$622,570**			**$22,400**			**$477,560**			**$1,219,380**			**$7,411,560**
	15% Engineering/Inspection				**$592,014**			**$0**			**$40,800**			**$127,634**			**$93,386**			**$3,360**			**$71,634**			**$182,907**			**$1,111,734**
	20% Contingency				**$789,352**			**$0**			**$54,400**			**$170,178**			**$124,514**			**$4,480**			**$95,512**			**$243,876**			**$1,482,312**
	GRAND TOTAL CONSTRUCTION COST				**$5,328,126**			**$0**			**$367,200**			**$1,148,702**			**$840,470**			**$30,240**			**$644,706**			**$1,646,163**			**$10,005,606**

Appendix E. B.O.R. Settlement Contract

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
Central Valley Project, California

CONTRACT BETWEEN THE UNITED STATES AND NATOMAS CENTRAL MUTUAL WATER COMPANY, DIVERTER OF WATER FROM SACRAMENTO RIVER SOURCES, SETTLING WATER RIGHTS DISPUTES AND PROVIDING FOR PROJECT WATER

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UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
Central Valley Project, California

CONTRACT BETWEEN THE UNITED STATES AND
NATOMAS CENTRAL MUTUAL WATER COMPANY,
DIVERTER OF WATER FROM SACRAMENTO RIVER SOURCES,
SETTLING WATER RIGHTS DISPUTES AND
PROVIDING FOR PROJECT WATER

THIS CONTRACT, hereinafter referred to as "Settlement Contract," is entered into by THE UNITED STATES OF AMERICA, hereinafter referred to as the United States, made this 10th day of May, 2005, pursuant to the applicable authority granted to it generally in the Act of June 17, 1902 (32 Stat. 388), and acts amendatory or supplementary thereto, including, but not limited to, the Acts of August 26, 1937 (50 Stat. 844), as amended and supplemented, August 4, 1939 (53 Stat. 1187), as amended and supplemented, including, but not limited to, Sections 9 and 14 thereto, July 2, 1956 (70 Stat. 483), June 21, 1963 (77 Stat. 68), October 12, 1982 (96 Stat. 1263), October 27, 1986 (100 Stat. 3050), as amended, and Title XXXIV of the Act of October 30, 1992 (106 Stat. 4706), all collectively hereinafter referred to as Federal Reclamation law, and NATOMAS CENTRAL MUTUAL WATER COMPANY, hereinafter referred to as the Contractor, a corporation, acting pursuant to Sections 12003 and 12004 of the California Water Code, with its principal place of business in California;

WITNESSETH, that:

EXPLANATORY RECITALS

[1st] WHEREAS, the United States has constructed and is operating the Central Valley Project, California, for multiple purposes pursuant to its statutory authority; and

[2nd] WHEREAS, the Contractor has rights to divert, is diverting, and will continue to divert for reasonable beneficial use, water from the natural flow of the Sacramento River and tributaries thereto, that would have been flowing therein if the Central Valley Project were not in existence;

[3rd] WHEREAS, the construction and operation of the integrated and coordinated Central Valley Project has changed and will further change the regimen of the Sacramento, American, San Joaquin, and Trinity Rivers and the Sacramento-San Joaquin Delta from unregulated flow to regulated flow; and

[4th] WHEREAS, the United States has rights to divert, is diverting, and will continue to divert waters from said Rivers and said Delta in connection with the operation of said Central Valley Project; and

[5th] WHEREAS, the Contractor and the United States had a dispute over the respective rights of the parties to divert and use water from the regulated flow of the Sacramento River which threatened to result in litigation, and as a means to settle that dispute entered into Contract No. 14-06-200-885A, as revised, hereinafter referred to as the Existing Contract, which established terms for the delivery to the Contractor of Central Valley Project Water, and the quantities of Base Supply the United States and the Contractor agreed may be diverted by the Contractor from the Sacramento River pursuant to such contract; and

[6th] WHEREAS, the United States and the Contractor disagree with respect to the authority of the United States to change the quantities of Base Supply and/or Project Water

specified as available for diversion in this Settlement Contract from the quantities specified in the Existing Contract, and other issues related thereto. That dispute was the subject of litigation in a lawsuit entitled *Glenn-Colusa Irrigation District, et al. v. United States, et al.* [Civ. No. S-01-1816 GEB/JFM (E.D. Cal.)], but that litigation was dismissed, without prejudice, pursuant to a stipulation of dismissal filed by the parties thereto on August 29, 2002. Notwithstanding that dismissal, the Contractor and the United States enter into this Settlement Contract to renew the Existing Contract, pursuant to the terms of the Existing Contract, Federal Reclamation law, and the laws of the State of California; and

[7th] WHEREAS, to assure the Contractor of the enjoyment and use of the regulated flow of the said Rivers and the Delta, and to provide for the economical operation of the Central Valley Project by, and the reimbursement to, the United States for expenditures made for said Project.

NOW, THEREFORE, in consideration of the performance of the herein contained provisions, conditions, and covenants, it is agreed as follows:

DEFINITIONS

1. When used herein, unless otherwise expressed or incompatible with the intent hereof, the term:

(a) "Base Supply" shall mean the quantity of Surface Water established in Articles 3 and 5 which may be diverted by the Contractor from the Sacramento River each month during the period April through October of each Year without payment to the United States for such quantities diverted;

(b) "Basin-Wide Water Management Plan" shall mean the mutually agreeable Sacramento River Basinwide Water Management Plan, dated October 11, 2004, developed by

Glenn-Colusa Irrigation District, Maxwell Irrigation District, Natomas Central Mutual Water Company, Pelger Mutual Water Company, Princeton-Codora-Glenn Irrigation District, Provident Irrigation District, Reclamation District 108, Sutter Mutual Water Company, Anderson-Cottonwood Irrigation District, Meridian Farms Water Company, Reclamation District 1004, and the U.S. Bureau of Reclamation;

(c) "Charges" shall mean the payments for Project Water that the Contractor is required to pay to the United States in addition to the "Rates" specified in this Settlement Contract. The Contracting Officer will, on an annual basis, determine the extent of these Charges. The type and amount of each Charge shall be specified in Exhibit D;

(d) "Contract Total" shall mean the sum of the Base Supply and Project Water available for diversion by the Contractor for the period April 1 through October 31;

(e) "Critical Year" shall mean any Year in which either of the following eventualities exists:

(1) The forecasted full natural inflow to Shasta Lake for the current Water Year, as such forecast is made by the United States on or before February 15 and reviewed as frequently thereafter as conditions and information warrant, is equal to or less than 3.2 million acre-feet; or

(2) The total accumulated actual deficiencies below 4 million acre-feet in the immediately prior Water Year or series of successive prior Water Years each of which had inflows of less than 4 million acre-feet, together with the forecasted deficiency for the current Water Year, exceed 800,000 acre-feet.

For the purpose of determining a Critical Year, the computation of inflow to Shasta Lake shall be performed in a manner that considers the extent of upstream development

above Shasta Lake during the year in question, and shall be used as the full natural flow to Shasta Lake. In the event that major construction has occurred or occurs above Shasta Lake after September 1, 1963, and which has materially altered or alters the regimen of the stream systems contributing to Shasta Lake, the computed inflow to Shasta Lake used to define a Critical Year will be adjusted to eliminate the effect of such material alterations. After consultation with the State of California, the National Weather Service, and other recognized forecasting agencies, the Contracting Officer will select the forecast to be used and will make the details of it available to the Contractor. The same forecasts used by the United States for the operation of the Project shall be used to make the forecasts hereunder;

(f) "CVPIA" shall mean the Central Valley Project Improvement Act, Title XXXIV of the Act of October 30, 1992 (106 Stat. 4706);

(g) "Eligible Lands" shall mean all lands to which Project Water may be delivered in accordance with Section 204 of the Reclamation Reform Act of October 12, 1982 (96 Stat. 1263), as amended, hereinafter referred to as RRA;

(h) "Excess Lands" shall mean all lands in excess of the limitations contained in Section 204 of the RRA, other than those lands exempt from acreage limitation under Federal Reclamation law;

(i) "Full Cost Rate" shall mean that water rate described in Sections 205(a)(3) or 202(3) of the RRA, whichever is applicable;

(j) "Ineligible Lands" shall mean all lands to which Project Water may not be delivered in accordance with Section 204 of the RRA;

(k) "Landholder" shall mean a party that directly or indirectly owns or leases nonexempt land, as provided in 43 CFR 426.2;

(l) "Project" shall mean the Central Valley Project owned by the United States and managed by the Department of the Interior, Bureau of Reclamation;

(m) "Project Water" shall mean all Surface Water diverted or scheduled to be diverted each month during the period April through October of each Year by the Contractor from the Sacramento River which is in excess of the Base Supply. The United States recognizes the right of the Contractor to make arrangements for acquisition of water from projects of others than the United States for delivery through the Sacramento River and tributaries subject to written agreement between Contractor and the United States as to identification of such water which water when so identified shall not be deemed Project Water under this Settlement Contract;

(n) "Rates" shall mean the payments for Project Water determined annually by the Contracting Officer in accordance with the then current applicable water ratesetting policies for the Project, as described in subdivision (a) of Article 8 of this Settlement Contract;

(o) "Secretary" or "Contracting Officer" shall mean the Secretary of the Interior, a duly appointed successor, or an authorized representative acting pursuant to any authority of the Secretary and through any agency of the Department of the Interior;

(p) "Surface Water" shall mean only those waters that are considered as surface water under California law;

(q) "Water Year" shall mean the period commencing with October 1 of one year and extending through September 30 of the next; and

(r) "Year" shall mean a calendar year.

TERM OF SETTLEMENT CONTRACT

2. (a) This Settlement Contract shall become effective April 1, 2005, and shall remain in effect until and including March 31, 2045; Provided, that under terms and conditions mutually agreeable to the parties hereto, renewals may be made for successive periods not to exceed 40 years each. The terms and conditions of each renewal shall be agreed upon not later than one year prior to the expiration of the then existing Settlement Contract.

(b) With respect to Project Water and the portions of this Settlement Contract pertaining thereto, upon written request by the Contractor of the Secretary made not later than one year prior to the expiration of this Settlement Contract, whenever, account being taken of the amount then credited to the costs of construction of water supply works, the remaining amount of construction costs of water supply work which is properly assignable for ultimate return by the Contractor as established by the Secretary of the Interior pursuant to (3) of Section 1 of Public Law 643 (70 Stat. 483), probably can be repaid to the United States within the term of a contract under subsection 9(d) of the 1939 Reclamation Project Act (53 Stat. 1187), the relevant portions of this Settlement Contract may be converted to a contract under said subsection 9(d) upon terms and conditions mutually agreeable to the United States and the Contractor. The Secretary shall make a determination ten years after the date of execution of this Settlement Contract, and every five years thereafter, of whether a conversion to a contract under said subsection 9(d) can be accomplished pursuant to Public Law 643. Notwithstanding any provision of this Settlement Contract, the Contractor reserves and shall have all rights and benefits under Public Law 643.

WATER TO BE FURNISHED TO CONTRACTOR

3. (a) Subject to the conditions, limitations, and provisions hereinafter expressed, the Contractor is hereby entitled and authorized to divert from the Sacramento River

at the locations shown in Exhibit A, for beneficial use within the area delineated on Exhibit B, (both Exhibits are attached hereto and made a part hereof), the Contract Total designated in Exhibit A, or any revision thereof, in accordance with the monthly operating schedule required by Article 3(c) of this Settlement Contract. The quantity of any water diverted under this Settlement Contract from the Sacramento River, during the period April through October, for use on any lands delineated on Exhibit B, by the owner of such lands or otherwise shall constitute a part of the Contract Total as shown on Exhibit A and shall be subject to all the provisions of this Settlement Contract relating to such Contract Total as if such diversion were made by the Contractor.

(b) The Contractor may have acquired rights to divert water from the Sacramento River during the period April through October, that were obtained after the date of execution of the Existing Contract, or the Contractor may acquire such rights in the future. All diversions made from the Sacramento River, pursuant to such rights, during the period April through October, shall not be considered a part of the quantity of Base Supply and Project Water specified in Exhibit A; Provided, that the quantities diverted pursuant to the above rights shall be identified on the schedule submitted pursuant to Article 3(c) below, and shall not be substituted for any Base Supply or Project Water; Provided, further, that any such identified quantities of other acquired rights may be diverted by the Contractor before incurring any fee pursuant to Article 3(c)(1), below.

(c) Before April 1 and before the first day of each month thereafter when a revision is needed, the Contractor shall submit a written schedule to the Contracting Officer indicating the Contract Total to be diverted by the Contractor for agricultural and municipal and industrial purposes during each month under this Settlement Contract. The United States shall

furnish water to the Contractor in accordance with the monthly operating schedule or any revisions thereof. However, the United States recognizes the need of the Contractor to change from time to time its monthly diversions of water from the quantities shown in Exhibit A; the Contractor may make such changes, provided:

(1) that for the quantity of Base Supply diverted in excess of the monthly quantity shown in Exhibit A, and as may be reduced in accordance with Article 5(a), during June, July, August, September, or October of any Water Year, the Contractor shall be charged a rescheduling fee equal to 50 percent of the sum of the storage operations and maintenance rate and the storage capital rate components of the Project ratesetting policy.

(2) that in no event shall the total quantity scheduled for diversion by the Contractor from the Sacramento River:

(i) During the period April through October exceed the aggregate of the Contract Total for that period shown in Exhibit A or any revision thereof;

(ii) During the period July through September exceed the aggregate of the Contract Total for that period shown in Exhibit A or any revision thereof.

(d) In the event conditions warrant, the Contracting Officer reserves the right to require the Contractor to submit, at least 72 hours prior to the beginning of each weekly period, its estimate of daily diversion requirements for each such period from the Sacramento River; Provided, however, that changes during any such period may be made upon the giving of 72 hours' notice thereof to the Contracting Officer.

(e) No sale, transfer, exchange, or other disposal of any of the Contract Total designated in Exhibit A or the right to the use thereof for use on land other than that shown on Exhibit B shall be made by the Contractor without first obtaining the written consent of the Contracting Officer. Such consent will not be unreasonably withheld and a decision will be rendered in a timely manner. For short-term actions that will occur within one year or less, the decision will be rendered within 30 days after receipt of a complete written proposal. For long-term actions that will occur in a period longer than one year, the decision will be rendered within 90 days after receipt of a complete written proposal. For a proposal to be deemed complete by the Contracting Officer, it must comply with all provisions required by State and Federal law, including information sufficient to enable the Contracting Officer to comply with the National Environmental Policy Act, the Endangered Species Act, and applicable rules or regulations then in effect; Provided, that such consent does not authorize the use of Federal facilities to facilitate or effectuate the sale, transfer, exchange, or other disposal of Base Supply. Such use of Federal facilities will be the subject of a separate agreement to be entered into between the Contractor and Reclamation.

(f) For the purpose of determining whether Section 3405(a)(1)(M) of the CVPIA applies to the Contractor as a transferor or transferee of Project Water, the Contracting Officer acknowledges that the Contractor is within a county, watershed, or other area of origin, as those terms are utilized under California law.

(g) Nothing herein contained shall prevent the Contractor from diverting water during the months of November through March for beneficial use on the land shown on Exhibit B or elsewhere to the extent authorized under the laws of the State of California.

(h) The United States assumes no responsibility for and neither it nor its officers, agents, or employees shall have any liability for or on account of:

(1) The quality of water to be diverted by the Contractor;

(2) The control, carriage, handling, use, disposal, or distribution of water diverted by the Contractor outside the facilities constructed and then being operated and maintained by or on behalf of the United States;

(3) Claims of damage of any nature whatsoever, including but not limited to, property loss or damage, personal injury, or death arising out of or connected with the control, carriage, handling, use, disposal, or distribution of said water outside of the hereinabove referred to facilities; and

(4) Any damage whether direct or indirect arising out of or in any manner caused by a shortage of water whether such shortage be on account of errors in operation, drought, or unavoidable causes.

(i) In addition to the provisions of subdivision (h) of Article 3 of this Contract, if there is a shortage of Project Water because of actions taken by the Contracting Officer to meet legal obligations then, except as provided in subdivision (a) of Article 30 of this Contract, no liability shall accrue against the United States or any of its officers, agents, or employees for any damage, direct or indirect, arising therefrom.

RETURN FLOW

4. Nothing herein shall be construed as an abandonment or a relinquishment by the United States of any right it may have to the use of waste, seepage, and return flow water derived from water diverted by the Contractor hereunder and which escapes or is discharged beyond the boundaries of the lands shown on Exhibit B; Provided, that this shall not be construed as

claiming for the United States any right to such water which is recovered by the Contractor pursuant to California law from within the boundaries of the lands shown on Exhibit B, and which is being used pursuant to this Settlement Contract for surface irrigation or underground storage for the benefit of the lands shown on Exhibit B by the Contractor.

CONSTRAINTS ON THE AVAILABILITY OF WATER

5. (a) In a Critical Year, the Contractor's Base Supply and Project Water agreed to be diverted during the period April through October of the Year in which the principal portion of the Critical Year occurs and, each monthly quantity of said period shall be reduced by 25 percent.

(b) The amount of any overpayment by the Contractor shall, at its option, be refunded or credited upon amounts to become due to the United States from the Contractor under the provisions hereof in the ensuing Year. To the extent of such deficiency such adjustment of overpayment shall constitute the sole remedy of the Contractor.

INTEGRATED WATER MANAGEMENT AND PARTNERSHIPS

6. The Contractor and United States desire to work together to maximize the reasonable beneficial use of water for their mutual benefit. As a consequence, the United States and the Contractor will work in partnership and with others within the Sacramento Valley, including other contractors, to facilitate the better integration within the Sacramento Valley of all water supplies including, but not limited to, the better management and integration of surface water and groundwater, the development and better utilization of surface water storage, the effective utilization of waste, seepage and return flow water, and other operational and management options that may be identified in the future.

USE OF WATER FURNISHED TO CONTRACTOR

7. (a) The parties anticipate that, during the term of this Settlement Contract, a gradual change in the purpose of use of water will occur within the place of water use shown in Exhibit B from predominantly agricultural purposes to a mixture of municipal and industrial, wildlife habitat and agricultural purposes, and the parties agree to work cooperatively to accommodate and facilitate such change. Project Water furnished to the Contractor pursuant to this Settlement Contract may be delivered or furnished by the Contractor for agricultural or municipal and industrial purposes; Provided, however, that the Contractor shall not deliver or furnish Project Water for municipal and industrial purposes outside those areas delineated on Exhibit B, as approved for such purposes by the Contracting Officer, without the written consent of the Contracting Officer. Such consent will not be unreasonably withheld and a decision will be provided in a timely manner following completion of any environmental review required under applicable law. For purposes of this Settlement Contract, "agricultural purposes" includes, but is not restricted to, the irrigation of crops, the watering of livestock, incidental domestic use including related landscape irrigation, and underground water replenishment; and "municipal and industrial purposes" includes, but is not limited to, the watering of landscaping or pasture for animals (e.g., horses) which are kept for personal enjoyment or water delivered to landholdings operated in units of less than five acres unless the Contractor establishes to the satisfaction of the Contracting Officer that the use of Project Water is for agricultural purposes.

(b) The Contractor shall comply with requirements applicable to the Contractor in biological opinion(s) prepared as a result of a consultation regarding the execution of this Settlement Contract undertaken pursuant to Section 7 of the Endangered Species Act of 1973, as amended, that are within the Contractor's legal authority to implement. The Existing

Contract, which evidences in excess of 40 years of diversions, for agricultural uses, of the quantities of water provided for in Article 3, and the underlying water rights of the Contractor will be considered in developing an appropriate base-line for the Biological Assessment prepared pursuant to the Endangered Species Act, and in any other needed environmental review. Nothing herein shall be construed to prevent the Contractor from challenging or seeking judicial relief in a court of competent jurisdiction with respect to any biological opinion or other environmental documentation referred to in this Article.

RATE AND METHOD OF PAYMENT FOR WATER

8. (a) The Contractor shall make payments to the United States as provided in this Article for all Project Water shown in Exhibit A as follows:

(1) 75 percent of the amount shown as Project Water shall be paid for by the Contractor in each Year; and in addition

(2) the Contractor shall pay for Project Water actually diverted in excess of 75 percent of the amount shown as Project Water.

Such payments shall be at Rates and Charges established in accordance with: (i) the Secretary's then-current ratesetting policies for the Project; and (ii) applicable Reclamation law and associated rules and regulations, or policies; Provided, that if the Contractor desires to use Project Water for other than agricultural purposes the Rates and Charges set forth above will be adjusted by the Contracting Officer to the applicable Rates and Charges for such purposes; Provided, further, that to enable the Contracting Officer to compute the applicable Rates and Charges for Project Water diverted by the Contractor for other than agricultural use, including, but not limited to diversions for municipal and industrial uses and diversions for direct application to wildlife habitat (not including re-use of tailwater for habitat purposes), prior to

initiating any such diversions, the Contractor shall provide the Contracting Officer with an estimate of the annual quantities of Project Water to be diverted or furnished for such purposes through the end of the CVP repayment period as identified in the then-current ratesetting policies. The Rates and Charges applicable to the Contractor upon execution of this Settlement Contract are set forth in Exhibit D, as may be revised annually. The Secretary's ratesetting policies for the Project shall be amended, modified, or superseded only through a public notice and comment procedure. The Contracting Officer shall adjust the amount of Project Water for which payment is required to the extent of any reduction in diversions of Project Water made in accordance with the water conservation provisions of Article 29(e).

(b) The Contracting Officer shall notify the Contractor of the Rates and Charges as follows:

(1) Prior to July 1 of each Year, the Contracting Officer shall provide the Contractor an estimate of the Charges for Project Water that will be applied to the period October 1, of the current Year, through September 30, of the following Year, and the basis for such estimate. The Contractor shall be allowed not less than two months to review and comment on such estimates. On or before September 15 of each Year, the Contracting Officer shall notify the Contractor in writing of the Charges to be in effect during the period October 1 of the current Year, through September 30, of the following Year, and such notification shall revise Exhibit D.

(2) Prior to October 1 of each Year, the Contracting Officer shall make available to the Contractor an estimate of the Rates for Project Water for the following Year and the computations and cost allocations upon which those Rates are based. The Contractor shall be allowed not less than two months to review and comment on such computations and cost allocations. By December 31 of each Year, the Contracting Officer shall provide the Contractor

with the final Rates to be in effect for the upcoming Year, and such notification shall revise Exhibit D.

(c) The Contractor shall pay the United States for Project Water in the following manner:

(1) With respect to Rates, prior to May 1 of each Year, the Contractor shall pay the United States one-half the total amount payable pursuant to subdivision (a) of this Article and the remainder shall be paid prior to July 1 or such later date or dates as may be specified by the United States in a written notice to the Contractor; Provided, however, that if at any time during the Year the amount of Project Water diverted by the Contractor shall equal the amount for which payment has been made, the Contractor shall pay for the remaining amount of such water as shown in Exhibit A in advance of any further diversion of Project Water.

(2) With respect to Charges, the Contractor shall also make a payment to the United States, in addition to the Rate(s) in subdivision (c)(1) of this Article, at the Charges then in effect, before the end of the month following the month of delivery or transfer. The payments shall be consistent with the quantities of Project Water delivered or transferred. Adjustment for overpayment or underpayment of Charges shall be made through the adjustment of payments due to the United States for Charges for the next month. Any amount to be paid for past due payment of Charges shall be computed pursuant to Article 13 of this Settlement Contract.

(d) Payments to be made by the Contractor to the United States under this Settlement Contract may be paid from any revenues available to the Contractor. All revenues received by the United States from the Contractor relating to the delivery of Project Water or the delivery of non-Project Water through Project facilities shall be allocated and applied in

accordance with Federal Reclamation law and the associated rules or regulations, and the then current Project ratesetting policies for irrigation water.

(e) The Contracting Officer shall keep its accounts pertaining to the administration of the financial terms and conditions of its long-term water service and Settlement Contracts, in accordance with applicable Federal standards, so as to reflect the application of Project costs and revenues. The Contracting Officer shall, each Year upon request of the Contractor, provide to the Contractor a detailed accounting of all Project and Contractor expense allocations, the disposition of all Project and Contractor revenues, and a summary of all water delivery information. The Contracting Officer and the Contractor shall enter into good faith negotiations to resolve any discrepancies or disputes relating to accountings, reports, or information.

(f) The parties acknowledge and agree that the efficient administration of this Settlement Contract is their mutual goal. Recognizing that experience has demonstrated that mechanisms, policies, and procedures used for establishing Rates and Charges and/or for making and allocating payments, other than those set forth in this Article may be in the mutual best interest of the parties, it is expressly agreed that the parties may enter into agreements to modify the mechanisms, policies, and procedures for any of those purposes while this Settlement Contract is in effect without amendment of this Settlement Contract.

(g) For the term of this Settlement Contract, Rates under the respective ratesetting policies for the Project will be established to recover only reimbursable operation and maintenance (including any deficits) and capital costs of the Project, as those terms are used in the then current Project ratesetting policies, and interest, where appropriate, except in instances where a minimum Rate is applicable in accordance with the relevant Project ratesetting policy.

Proposed changes of significance in practices which implement the ratesetting policies for the Project will not be implemented until the Contracting Officer has provided the Contractor an opportunity to discuss the nature, need, and impact of the proposed change. The Contractor retains all rights to challenge the validity of Rates and Charges imposed pursuant to this Settlement Contract, including but not limited to operation and maintenance expenses and operation and maintenance deficits, in an appropriate administrative or judicial proceeding.

(h) Except as provided in subsection 3405(a)(1)(B) of the CVPIA, the Rates for Project Water transferred, exchanged, or otherwise disposed of, by the Contractor shall be the Contractor's Rates adjusted upward or downward to reflect the changed costs of delivery (if any) of the transferred, exchanged, or otherwise disposed of Project Water to the transferee's point of delivery in accordance with the then-current ratesetting policies for the Project. Except as provided in subsection 3407(d)(2)(A) of the CVPIA, the Charges for Project Water transferred, exchanged, or otherwise disposed of, by the Contractor shall be the Contractor's Charges specified in Exhibit D. If the Contractor is receiving lower Rates and Charges because of inability to pay and is transferring, exchanging, or otherwise disposing of Project Water to another entity whose Rates and Charges are not adjusted due to inability to pay, the Rates and Charges for transferred, exchanged, or otherwise disposed of Project Water shall be the Contractor's Rates and Charges unadjusted for ability to pay.

(i) Pursuant to the Act of October 27, 1986 (100 Stat. 3050), the Contracting Officer is authorized to adjust determinations of ability to pay every five years.

(j) Each payment to be made pursuant to subdivisions (a) and (c) of this Article shall be made at the office of the Bureau of Reclamation, MP Region: Mid-Pacific,

P.O. Box 894242, Los Angeles, CA 90189-4242, or at such other place as the United States may designate in a written notice to the said Contractor. Payments shall be made by cash transaction, wire, or any other mechanism as may be agreed to in writing by the Contractor and the Contracting Officer. In the event there should be a default in the payment of the amount due, the delinquent payment provisions of Article 13 shall apply. The Contractor shall not be relieved of the whole or any part of its said obligation by, on account of, or notwithstanding, as the case may be:

(1) Its failure, refusal, or neglect to divert 75 percent of the quantity of Project Water shown on Exhibit A;

(2) The default in payment to it by any water user of assessments, tolls, or other charges levied by or owing to said Contractor;

(3) Any judicial determination that any assessment, toll, or other charge referred to in subsection 8(c)(2) of this Settlement Contract is irregular, void, or ineffectual; or

(4) Any injunctive process enjoining or restraining the Contractor from making or collecting any such assessment, toll, or other charge referred to in subsection 8(c)(2) of this Settlement Contract.

AGREEMENT ON WATER QUANTITIES

9. (a) During the term of this Settlement Contract and any renewals thereof:

(1) It shall constitute full agreement as between the United States and the Contractor as to the quantities of water and the allocation thereof between Base Supply and Project Water which may be diverted by the Contractor from the Sacramento River for beneficial use on the land shown on Exhibit B from April 1 through October 31, which said diversion, use,

and allocation shall not be disturbed so long as the Contractor shall fulfill all of its obligations hereunder;

(2) Neither party shall claim any right against the other in conflict with the provisions of Article 9(a)(1) hereof.

(b) Nothing herein contained is intended to or does limit rights of the Contractor against others than the United States or of the United States against any person other than the Contractor; Provided, however, that in the event the Contractor, the United States, or any other person shall become a party to a general adjudication of rights to the use of water of the Sacramento River system, this Settlement Contract shall not jeopardize the rights or position of either party hereto or of any other person and the rights of all such persons in respect to the use of such water shall be determined in such proceedings the same as if this Settlement Contract had not been entered into, and if final judgment in any such general adjudication shall determine that the rights of the parties hereto are different from the rights as assumed herein, the parties shall negotiate an amendment to give effect to such judgment. In the event the parties are unable to agree on an appropriate amendment they shall, within 60 days of determining that there is an impasse, employ the services of a neutral mediator, experienced in resolving water rights disputes, to assist in resolving the impasse. The cost of the mediation will be shared equally. A failure to reach agreement on an amendment within 60 days of the end of mediation will cause the immediate termination of this Settlement Contract.

(c) In the event that the California State Water Resources Control Board or a court of competent jurisdiction issues a final decision or order modifying the terms and conditions of the water rights of either party to this Settlement Contract in order to impose Bay-Delta water quality obligations, the Contractor and the United States shall promptly meet to

455 determine whether or not to modify any of the terms of this Settlement Contract to comply with
456 the final decision or order, including, but not limited to, the applicability of the rescheduling
457 charge in Article 3(c)(1) of this Settlement Contract. If within 60 days of the date of the issuance
458 of the final decision or order the parties are not able to reach agreement regarding either the need
459 to modify this Settlement Contract or the manner in which this Settlement Contract is to be
460 modified, the parties shall promptly retain a neutral mediator, experienced in resolving water
461 right disputes, to assist the parties in resolving their dispute. The cost of the mediator shall be
462 shared equally. In the event that either of the parties to this Settlement Contract determines that
463 the parties will not be able to develop mutually-agreeable modification(s) to this Settlement
464 Contract even with the assistance of a mediator, either of the parties to this Settlement Contract
465 may attempt to resolve the impasse by seeking appropriate judicial relief including, but not
466 limited to, filing a general adjudication of the rights to the use of water in the Sacramento River
467 system. The foregoing provisions of this sub-article shall only apply to the incremental
468 obligations contained within a final decision or order of the State Water Resources Control
469 Board that reflects a modification to the obligations imposed in State Water Resources Control
470 Board Revised Water Rights Decision 1641 dated March 15, 2000, and its associated 1995 Water
471 Quality Control Plan which, taken together, will be considered the baseline for the application of
472 the provisions of this sub-article.

473 (d) In the event this Settlement Contract terminates, the rights of the parties to
474 thereafter divert and use water shall exist as if this Settlement Contract had not been entered into;
475 and the fact that as a compromise settlement of a controversy as to the respective rights of the
476 parties to divert and use water and the yield of such rights during the term hereof, this Settlement
477 Contract places a limit on the Contract Total to be diverted annually by the Contractor during the

Settlement Contract term and segregates it into Base Supply and Project Water shall not jeopardize the rights or position of either party with respect to its water rights or the yield thereof at all times after the Settlement Contract terminates. It is further agreed that the Contractor at all times will first use water to the use of which it is entitled by virtue of its own water rights, and neither the provisions of this Settlement Contract, action taken thereunder, nor payments made thereunder to the United States by the Contractor shall be construed as an admission that any part of the water used by the Contractor during the term of this Settlement Contract was in fact water to which it would not have been entitled under water rights owned by it nor shall receipt of payments thereunder by the United States from the Contractor be construed as an admission that any part of the water used by the Contractor during the term of this Settlement Contract was in fact water to which it would have been entitled under water rights owned by it.

MEASUREMENT OF WATER

10. (a) All water diverted by the Contractor from the Sacramento River will be diverted at the existing point or points of diversion shown on Exhibit A or at such other points as may be mutually agreed upon in writing by the Contracting Officer and the Contractor.

(b) All water diverted from the Sacramento River pursuant to this Settlement Contract will be measured or caused to be measured by the United States at each point of diversion with existing equipment or equipment to be installed, operated, and maintained by the United States, and/or others, under contract with and at the option of the United States. The equipment and methods used to make such measurement shall be in accordance with sound engineering practices. Upon request of the Contractor, the accuracy of such measurements will be investigated by the Contracting Officer and any errors appearing therein will be corrected.

(c) The right of ingress to and egress from all points of diversion is hereby granted to all authorized employees of the United States. The Contractor also hereby grants to the United States the right to install, operate, maintain, and replace such equipment on diversion or carriage facilities at each point of diversion as the Contracting Officer deems necessary.

(d) The Contractor shall not modify, alter, remove, or replace diversion facilities or do any other act which would alter the effectiveness or accuracy of the measuring equipment installed by the United States or its representatives unless and until the Contracting Officer has been notified with due diligence and has been given an opportunity to modify such measuring equipment in such manner as may be necessary or appropriate. In the event of an emergency the Contractor shall notify the United States within a reasonable time thereafter as to the existence of the emergency and the nature and extent of such modification, alteration, removal, or replacement of diversion facilities.

(e) The Contractor shall pay the United States for the costs to repair, relocate, or replace measurement equipment when the Contractor modifies, alters, removes, or replaces diversion or carriage facilities.

(f) Contractor and Contracting Officer shall develop a mutually agreeable surface water delivery water measurement program which shall be implemented by the Contractor, and such measurement program shall be consistent with the conservation and efficiency criteria for evaluating water conservation plans as provided in Article 29(a).

(g) All new surface water delivery systems installed within the lands delineated on Exhibit B after the effective date of this Settlement Contract shall also comply with the measurement provisions described in this Article.

(h) The Contractor shall inform the Contracting Officer on or before the 10th calendar day of each month of the quantity of Contract Total diverted or furnished for agricultural and municipal and industrial purposes during the preceding month.

RULES AND REGULATIONS

11. The parties agree that the delivery of Project Water for irrigation use or use of Federal facilities pursuant to this Settlement Contract is subject to Federal Reclamation law, including but not limited to, the Reclamation Reform Act of 1982 (43 U.S.C. 390aa et seq.), as amended and supplemented, and the rules and regulations promulgated by the Secretary of the Interior under Federal Reclamation law.

GENERAL OBLIGATION--BENEFITS CONDITIONED UPON PAYMENT

12. (a) The obligation of the Contractor to pay the United States as provided in this Settlement Contract is a general obligation of the Contractor notwithstanding the manner in which the obligation may be distributed among the Contractor's water users and notwithstanding the default of individual water users in their obligations to the Contractor.

(b) The payment of Charges becoming due hereunder is a condition precedent to receiving benefits under this Settlement Contract. The United States shall not make water available to the Contractor through Project facilities during any period in which the Contractor may be in arrears in the advance payment of water Rates due the United States. The Contractor shall not furnish water made available pursuant to this Settlement Contract for lands or parties which are in arrears in the advance payment of water rates levied or established by the Contractor.

(c) With respect to subdivision (b) of this Article, the Contractor shall have no obligation to require advance payment for water Rates which it levies.

CHARGES FOR DELINQUENT PAYMENTS

13. (a) The Contractor shall be subject to interest, administrative and penalty charges on delinquent installments or payments. When a payment is not received by the due date, the Contractor shall pay an interest charge for each day the payment is delinquent beyond the due date. When a payment becomes 60 days delinquent, the Contractor shall pay an administrative charge to cover additional costs of billing and processing the delinquent payment. When a payment is delinquent 90 days or more, the Contractor shall pay an additional penalty charge of six percent per year for each day the payment is delinquent beyond the due date.

Further, the Contractor shall pay any fees incurred for debt collection services associated with a delinquent payment.

(b) The interest charge rate shall be the greater of the rate prescribed quarterly in the Federal Register by the Department of the Treasury for application to overdue payments, or the interest rate of one-half of one percent per month prescribed by Section 6 of the Reclamation Project Act of 1939 (Public Law 76-260). The interest charge rate shall be determined as of the due date and remain fixed for the duration of the delinquent period.

(c) When a partial payment on a delinquent account is received, the amount received shall be applied, first to the penalty, second to the administrative charges, third to the accrued interest, and finally to the overdue payment.

QUALITY OF WATER

14. The operation and maintenance of Project facilities shall be performed in such manner as is practicable to maintain the quality of raw water made available through such facilities at the highest level reasonably attainable as determined by the Contracting Officer. The United States does not warrant the quality of water and is under no obligation to construct or furnish water treatment facilities to maintain or better the quality of water.

WATER AND AIR POLLUTION CONTROL

15. The Contractor, in carrying out this Settlement Contract, shall comply with all applicable water and air pollution laws and regulations of the United States and the State of California, and shall obtain all required permits or licenses from the appropriate Federal, State, or local authorities.

EQUAL OPPORTUNITY

16. During the performance of this Settlement Contract, the Contractor agrees as follows:

(a) The Contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. The Contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, or national origin. Such action shall include, but not be limited to, the following: Employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination, rates of payment or other

forms of compensation; and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the Contracting Officer setting forth the provisions of this nondiscrimination clause.

(b) The Contractor will, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment without discrimination because of race, color, religion, sex, or national origin.

(c) The Contractor will send to each labor union or representative of workers with which it has a collective bargaining agreement or other contract or understanding, a notice, to be provided by the Contracting Officer, advising the said labor union or workers' representative of the Contractor's commitments under Section 202 of Executive Order No. 11246 of September 24, 1965, as amended, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

(d) The Contractor will comply with all provisions of Executive Order No. 11246 of September 24, 1965, as amended, and of the rules, regulations, and relevant orders of the Secretary of Labor.

(e) The Contractor will furnish all information and reports required by said amended Executive Order and by the rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to its books, records, and accounts by the Contracting Officer and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

(f) In the event of the Contractor's noncompliance with the nondiscrimination clauses of this Settlement Contract or with any of the said rules, regulations, or orders, this Settlement Contract may be canceled, terminated, or suspended, in whole or in part, and the Contractor may be declared ineligible for further Government contracts in accordance with procedures authorized in said amended Executive Order, and such other sanctions may be imposed and remedies invoked as provided in said Executive Order, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

(g) The Contractor will include the provisions of paragraphs (a) through (g) in every subcontract or purchase order unless exempted by the rules, regulations, or orders of the Secretary of Labor issued pursuant to Section 204 of said amended Executive Order, so that such provisions will be binding upon each subcontractor or vendor. The Contractor will take such action with respect to any subcontract or purchase order as may be directed by the Secretary of Labor as a means of enforcing such provisions, including sanctions for noncompliance: Provided, however, that in the event the Contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction, the Contractor may request the United States to enter into such litigation to protect the interests of the United States.

COMPLIANCE WITH CIVIL RIGHTS LAWS AND REGULATIONS

17. (a) The Contractor shall comply with Title VI of the Civil Rights Act of 1964 (42 U.S.C. 2000d), Section 504 of the Rehabilitation Act of 1975 (P.L. 93-112, as amended), the Age Discrimination Act of 1975 (42 U.S.C. 6101, et seq.) and any other applicable civil rights laws, as well as with their respective implementing regulations and guidelines imposed by the U.S. Department of the Interior and/or Bureau of Reclamation.

(b) These statutes require that no person in the United States shall, on the grounds of race, color, national origin, handicap, or age, be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination under any program or activity receiving financial assistance from the Bureau of Reclamation. By executing this Settlement Contract, the Contractor agrees to immediately take any measures necessary to implement this obligation, including permitting officials of the United States to inspect premises, programs, and documents.

(c) The Contractor makes this agreement in consideration of and for the purpose of obtaining any and all Federal grants, loans, contracts, property discounts, or other Federal financial assistance extended after the date hereof to the Contractor by the Bureau of Reclamation, including installment payments after such date on account of arrangements for Federal financial assistance which were approved before such date. The Contractor recognizes and agrees that such Federal assistance will be extended in reliance on the representations and agreements made in this Article, and that the United States reserves the right to seek judicial enforcement thereof.

MINGLING OF CONTRACTOR'S PROJECT AND NON-PROJECT WATER

18. (a) Project Water must of necessity be transported by the Contractor to its water users by means of the same works and channels used for the transport of its non-Project Water including Base Supply. Notwithstanding such mingling of water, the provisions of Article 11 hereof shall be applicable only to Project Water, and such mingling of water shall not in any manner subject to the provisions of Article 11 hereof the Contractor's non-Project Water including Base Supply.

(b) If required in accordance with subdivision (c) of this Article, the Contractor shall install and maintain such measuring equipment and distribution facilities and maintain such records as may be necessary to determine the amounts of water delivered to Excess Lands served by the Contractor. The Contractor shall not within any month deliver to

Ineligible Lands water in excess of the non-Project Water, including Base Supply, for that month. The Contracting Officer or authorized representative shall have the right at all reasonable times to inspect such records and measuring equipment.

(c) The Contractor will not be considered in violation of the requirement that Project Water be delivered only to Eligible Lands during any month of the irrigation season that the water requirement for beneficial use on Eligible Lands for that month is equal to or in excess of the Project Water for that month as shown on Exhibit A or any revision thereof pursuant to subdivision (c) of Article 3. The water requirement for beneficial use on Eligible Lands will be determined by multiplying:

(1) the number of irrigable acres of the particular types of crops grown in that year on the acreage designated as eligible by

(2) the Unit Duties as set forth in Exhibit C attached hereto and made a part hereof, or by such other Unit Duties mutually agreed upon by the Contractor and the Contracting Officer. In order to make the computation of the water requirement for Eligible Lands, on April 1 of each Year and concurrently with its order for water for the irrigation season, the Contractor shall designate the acreage of and type of crops to be grown on its Eligible Lands that irrigation season. During any month the water requirement as above determined for crops growing on Eligible Lands during such month is equal to or in excess of the Project Water for that month as provided herein the Contractor shall not be required to measure the water delivered to Excess Lands. Any month the said water requirement is less than the amount of Project Water as provided herein, the Contractor will be required to measure water delivered to excess land in accordance with subdivision (b) hereof.

BOOKS, RECORDS, AND REPORTS

19. The Contractor shall establish and maintain accounts and other books and records pertaining to administration of the terms and conditions of this Settlement Contract, including: the Contractor's financial transactions, water supply data, and Project land and right-of-way agreements; the water users' land-use (crop census), land ownership, land-leasing and water use data; and other matters that the Contracting Officer may require. Reports thereon shall be furnished to the Contracting Officer in such form and on such date or dates as the Contracting Officer may require. Subject to applicable Federal laws and regulations, each party to this Settlement Contract shall have the right during office hours to examine and make copies of each other's books and official records relating to matters covered by this Settlement Contract.

CHANGE OF PLACE OF USE OR ORGANIZATION

20. (a) Unless the written consent of the United States is first obtained no change shall be made in the place of water use shown on Exhibit B.

(b) While this Settlement Contract is in effect, no change shall be made in the area of the Contractor as shown on its Exhibit B, by inclusion, exclusion, annexation, or detachment of lands, by dissolution, consolidation, or merger or otherwise, except upon the Contracting Officer's written consent thereto. Such consent will not be unreasonably withheld and a decision will be provided in a timely manner.

(c) In the event lands are annexed to or detached from the area of the Contractor, as provided herein, the quantity of Project Water to be diverted may be increased or decreased, as may be appropriate, pursuant to a supplemental agreement to be executed in respect thereto.

CONSOLIDATION OF CONTRACTING ENTITIES

21. Consolidation of Contractors may be approved by the Contracting Officer provided: (i) the Contracting Officer approves the form and organization of the resulting entity and the utilization by it of the Contract Total; and (ii) the obligations of the Contractors are assumed by such entity.

No such consolidation shall be valid unless and until approved by the Contracting Officer.

NOTICES

22. Any notice, demand, or request authorized or required by this Settlement Contract shall be deemed to have been given, on behalf of the Contractor, when mailed, postage prepaid, or delivered to the Area Manager, Northern California Area Office, Bureau of Reclamation, 16349 Shasta Dam Boulevard, Shasta Lake, California 96019, and on behalf of the United States, when mailed, postage prepaid, or delivered to the Board of Directors of the Natomas Central Mutual Water Company, 2601 West Elkhorn Boulevard, Rio Linda, California 95673. The designation of the addressee or the address may be changed by notice given in the same manner as provided in this Article for other notices.

ASSIGNMENT LIMITED--SUCCESSORS AND ASSIGNS OBLIGATED

23. (a) The provisions of this Settlement Contract shall apply to and bind the successors and assigns of the parties hereto, but no assignment or transfer of this Settlement Contract or any right or interest therein shall be valid until approved in writing by the Contracting Officer.

(b) The assignment of any right or interest in this Settlement Contract by either party shall not interfere with the rights or obligations of the other party to this Settlement Contract absent the written concurrence of said other party.

(c) The Contracting Officer shall not unreasonably condition or withhold his approval of any proposed assignment.

OFFICIALS NOT TO BENEFIT

24. (a) No Member of or Delegate to Congress, Resident Commissioner, or official of the Contractor shall benefit from this Settlement Contract other than as a water user or landowner in the same manner as other water users or landowners.

(b) No officer or member of the governing board of the Contractor shall receive any benefit that may arise by reason of this Settlement Contract other than as a landowner within the Contractor's Service Area and in the same manner as other landowners within the said service area.

CONTINGENT UPON APPROPRIATION OR ALLOTMENT OF FUNDS

25. The expenditure or advance of any money or the performance of any obligation of the United States under this Settlement Contract shall be contingent upon appropriation or allotment of funds. Absence of appropriation or allotment of funds shall not relieve the Contractor from any obligations under this Settlement Contract. No liability shall accrue to the United States in case funds are not appropriated or allotted.

CONFIRMATION OF SETTLEMENT CONTRACT

26. The Contractor, after the execution of this Settlement Contract, shall promptly seek to secure a decree of a court of competent jurisdiction of the State of California, if appropriate, confirming the execution of this Settlement Contract. The Contractor shall furnish the United States a certified copy of the final decree, the validation proceedings, and all pertinent supporting records of the court approving and confirming this Settlement Contract, and decreeing and adjudging it to be lawful, valid, and binding on the Contractor. This Settlement Contract shall not be binding on the United States until such final decree has been secured.

UNAVOIDABLE GROUNDWATER PERCOLATION

27. To the extent applicable, the Contractor shall not be deemed to have delivered Project Water to Excess Lands or Ineligible Lands if such lands are irrigated with groundwater that reaches the underground strata as an unavoidable result of the delivery of Project Water by the Contractor to Eligible Lands.

PRIVACY ACT COMPLIANCE

28. (a) The Contractor shall comply with the Privacy Act of 1974 (5 U.S.C. 552a) (the Act) and the Department of the Interior rules and regulations under the Act (43 CFR 2.45 et seq.) in maintaining Landholder acreage certification and reporting records, required to be submitted to the Contractor for compliance with Sections 206 and 228 of the Reclamation Reform Act of 1982 (96 Stat. 1266), and pursuant to 43 CFR 426.18.

(b) With respect to the application and administration of the criminal penalty provisions of the Act (5 U.S.C. 552a(i)), the Contractor and the Contractor's employees responsible for maintaining the certification and reporting records referenced in (a) above are considered to be employees of the Department of the Interior. See 5 U.S.C. 552a(m).

(c) The Contracting Officer or a designated representative shall provide the Contractor with current copies of the Interior Department Privacy Act regulations and the Bureau of Reclamation Federal Register Privacy Act System of Records Notice (Acreage Limitation--Interior, Reclamation-31) which govern the maintenance, safeguarding, and disclosure of information contained in the Landholder's certification and reporting records.

(d) The Contracting Officer shall designate a full-time employee of the Bureau of Reclamation to be the System Manager who shall be responsible for making decisions on denials pursuant to 43 CFR 2.61 and 2.64 amendment requests pursuant to 43 CFR 2.72. The Contractor is authorized to grant requests by individuals for access to their own records.

(e) The Contractor shall forward promptly to the System Manager each proposed denial of access under 43 CFR 2.64; and each request for amendment of records filed under 43 CFR 2.71; notify the requester accordingly of such referral; and provide the System Manager with information and records necessary to prepare an appropriate response to the requester. These requirements do not apply to individuals seeking access to their own certification and reporting forms filed with the Contractor pursuant to 43 CFR 426.18, unless the requester elects to cite the Privacy Act as a basis for the request.

WATER CONSERVATION

29. (a) Prior to the diversion of Project Water, the Contractor shall be implementing an effective water conservation and efficiency program based on the Basin-Wide Water Management Plan and/or Contractor's water conservation plan that has been determined by the Contracting Officer to meet the conservation and efficiency criteria for evaluating water conservation plans established under Federal law. The water conservation and efficiency program shall contain definite water conservation objectives, appropriate economically feasible water conservation measures, and time schedules for meeting those objectives. Continued diversion of Project Water pursuant to this Settlement Contract shall be contingent upon the Contractor's continued implementation of such water conservation program. In the event the Contractor's water conservation plan or any revised water conservation plan completed pursuant to subdivision (c) of Article 29 of this Settlement Contract have not yet been determined by the Contracting Officer to meet such criteria, due to circumstances which the Contracting Officer determines are beyond the control of the Contractor, Project Water deliveries shall be made under this Settlement Contract so long as the Contractor diligently works with the Contracting Officer to obtain such determination at the earliest practicable date, and thereafter the Contractor

immediately begins implementing its water conservation and efficiency program in accordance with the time schedules therein.

(b) The Contractor shall submit to the Contracting Officer a report on the status of its implementation of the water conservation plan on the reporting dates specified in the then existing conservation and efficiency criteria established under Federal law.

(c) At five-year intervals, the Contractor shall revise its water conservation plan to reflect the then current conservation and efficiency criteria for evaluating water conservation plans established under Federal law and submit such revised water management plan to the Contracting Officer for review and evaluation. The Contracting Officer will then determine if the water conservation plan meets Reclamation's then current conservation and efficiency criteria for evaluating water conservation plans established under Federal law.

(d) If the Contractor is engaged in direct groundwater recharge, such activity shall be described in the Contractor's water conservation plan.

(e) In order to provide incentives for water conservation, the Contractor may reduce the amount of Project Water for which payment is required under Article 8(a) in accordance with the provisions of this Article 29(e).

(1) On or before February 15 of any Water Year, the Contractor may file with Reclamation an offer to reduce Project Water use, hereinafter referred to as Offer. The Offer shall specify the maximum quantity of Project Water to be diverted by the Contractor for each month that Project Water is available for that Water Year under this Settlement Contract. The Contracting Officer shall provide the Contractor with a decision, in writing, to the Offer on or before March 15 of that Water Year. The dates specified in this Article 29(e)(1) can be changed if mutually agreed to, in writing, by the Contractor and Contracting Officer.

(2) If Reclamation accepts the Offer, the Contractor's payment obligation under Article 8(a)(1) shall be reduced to the maximum quantity of Project Water to be diverted by the Contractor as specified in the Offer. The Contractor shall not divert Project Water in excess of the quantities set forth in the Offer; Provided, however, if the Contractor's diversions of Project Water exceed the quantities set forth in the Offer, the Contractor shall pay to Reclamation the applicable Rates and Charges plus an amount equal to the applicable Rates and Charges, unadjusted for ability to pay, for each acre-foot of Project Water diverted in excess of the quantities set forth in the Offer.

(3) If Reclamation decides not to accept the Offer, the Contractor's payment obligation will remain as specified in Article 8(a)(1).

(4) The provisions of this Article 29(e) shall be in addition to and shall not affect the provisions of Article 3(e) pertaining to the sale, transfer, exchange, or other disposal of the Contract Total designated in Exhibit A.

OPINIONS AND DETERMINATIONS

30. (a) Where the terms of this Settlement Contract provide for actions to be based upon the opinion or determination of either party to this Settlement Contract, said terms shall not be construed as permitting such action to be predicated upon arbitrary, capricious, or unreasonable opinions or determinations. Both parties, notwithstanding any other provisions of this Settlement Contract, expressly reserve the right to seek relief from and appropriate adjustment for any such arbitrary, capricious, or unreasonable opinion or determination. Each opinion or determination by either party shall be provided in a timely manner. Nothing in subdivision (a) of Article 30 of this Settlement Contract is intended to or shall affect or alter the

standard of judicial review applicable under Federal law to any opinion or determination implementing a specific provision of Federal law embodied in statute or regulation.

(b) The Contracting Officer shall have the right to make determinations necessary to administer this Settlement Contract that are consistent with the provisions of this Settlement Contract, the laws of the United States and of the State of California, and the rules and regulations promulgated by the Secretary of the Interior. Such determinations shall be made in consultation with the Contractor to the extent reasonably practicable.

CONTRACTOR TO PAY CERTAIN MISCELLANEOUS COSTS

31. (a) In addition to all other payments to be made by the Contractor pursuant to this Settlement Contract, the Contractor shall pay to the United States, within 60 days after receipt of a bill and detailed statement submitted by the Contracting Officer to the Contractor for such specific items of direct cost incurred by the United States for work requested by the Contractor associated with this Settlement Contract plus indirect costs in accordance with applicable Bureau of Reclamation policies and procedures. All such amounts referred to in this Article shall not exceed the amount agreed to in writing in advance by the Contractor. This Article shall not apply to costs for routine contract administration.

(b) All advances for miscellaneous costs incurred for work requested by the Contractor pursuant to Article 31 of this Settlement Contract shall be adjusted to reflect the actual costs when the work has been completed. If the advances exceed the actual costs incurred, the difference will be refunded to the Contractor. If the actual costs exceed the Contractor's advances, the Contractor will be billed for the additional costs pursuant to Article 31 of this Settlement Contract.

WAIVER OF DEFAULT

32. The waiver by either party to this Settlement Contract as to any default shall not be construed as a waiver of any other default or as authority of the other party to continue such default or to make, do, or perform, or not to make, do, or perform, as the case may be, any act or thing which would constitute a default.

IN WITNESS WHEREOF, the parties hereto have executed this Settlement Contract as of the day and year first hereinabove written.

THE UNITED STATES OF AMERICA

APPROVED AS TO LEGAL FORM AND SUFFICIENCY
OFFICE OF REGIONAL SOLICITOR
DEPARTMENT OF THE INTERIOR

By: _____
Regional Director, Mid-Pacific Region
Bureau of Reclamation

(SEAL)

NATOMAS CENTRAL MUTUAL WATER COMPANY

By: _____
President

ATTEST:

_____
Secretary

(H:\public\Sac River Final LTRC's\2005-01-31 Natomas Central MWC Final Draft Contract with exhibits.doc)

Exhibit A

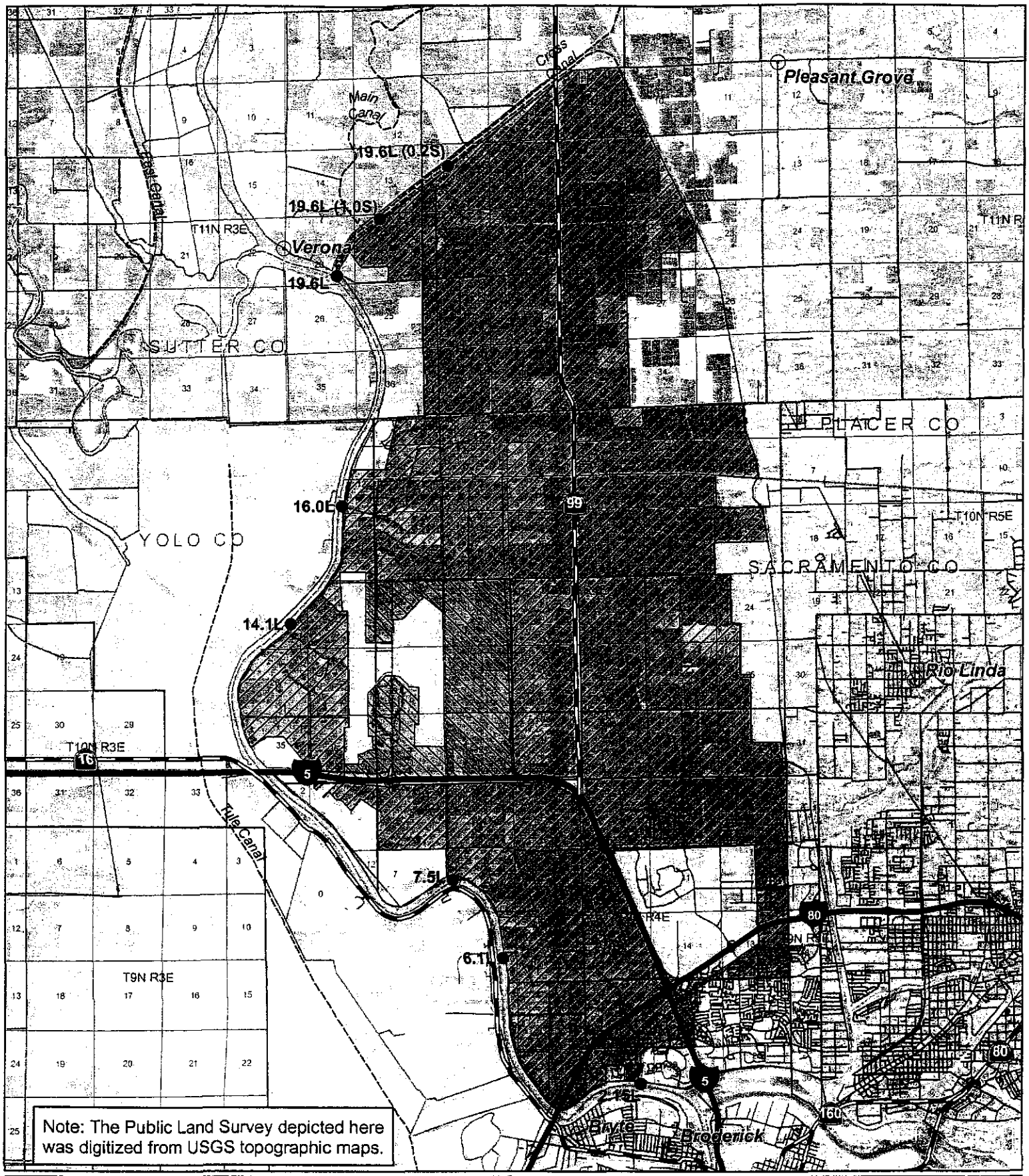
NATOMAS CENTRAL MUTUAL WATER COMPANY
Sacramento River

SCHEDULE OF MONTHLY DIVERSIONS OF WATER

	Base Supply (acre-feet)	Project Water (acre-feet)	Contract Total (acre-feet)
April	14,000	0	14,000
May	27,700	0	27,700
June	23,000	0	23,000
July	11,500	7,200	18,700
August	3,900	14,800	18,700
September	16,100	0	16,100
October	2,000	0	2,000
Total	98,200	22,000	120,200

Points of Diversion: 2.15L, 6.1L, 7.5L, 14.1L, 16.0L, 19.6L (Cross Canal 1.0S & 2.0S)

Dated: 01-31-2005



Natomas Central Mutual Water Co.

Contract No. 14-06-200-885A-R-1

Exhibit B

- Contractor's Service Area - Ag Only
- Contractor's Service Area - Ag and/or M&I
- District Boundary
- Point of Diversion

N

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

Miles
0 0.5 1 2 3

Date: 3/7/05, Revised 4/11/05
File Name: N:\districts\contracts\natomas_central\natomas_central.mxd

725-202-35

Exhibit C

NATOMAS CENTRAL MUTUAL WATER COMPANY
Sacramento River

UNIT DUTY

(In Acre-Feet Per Acre)

	Rice	Alfalfa and Irrigated Pasture	General Crops
June	1.70	0.80	0.60
July	1.80	1.00	0.70
August	1.70	0.80	0.70
September	0.50	0.60	0.40

Dated: 01-31-2005

Exhibit D

NATOMAS CENTRAL MUTUAL WATER COMPANY
Sacramento River
2005 Water Rates and Charges per Acre-Foot

	Cost of Service		Calculated Payment Capacity 1/
	Irrigation	M&I	Irrigation
COST OF SERVICE RATES:			
Capital Rate			
Storage	$4.57	$9.70	$0.00
O&M Rates:			
Water Marketing	$6.61	$3.89	$6.61
Storage	$5.93	$6.67	$5.93
Deficit Rates:			
Interest Bearing	$0.00	$0.00	$0.00
CFO/PFR Adjustment Rate 2/	$0.00	$0.00	$0.00
TOTAL	$17.11	$20.26	$12.54
RESCHEDULING FEE:	$5.59	$8.19	$5.59
FULL-COST RATES:			
Section 202(3) Rate is applicable to a Qualified Recipient or to a Limited Recipient receiving irrigation water on or before October 1, 1981.	$21.47	N/A	$21.47
Section 205(a)(3) Rate is applicable to a Limited Recipient that did not receive irrigation water on or before October 1, 1981.	$23.82	N/A	$23.82
CHARGES UNDER P.L. 102-575 TO THE RESTORATION FUND 3/			
Restoration Payments (3407(d)(2)(A))	$7.93	$15.87	$0.00

1/ Established pursuant to the Sutter, Natomas and Pelger MWC Payment Capacity Analysis dated October, 2001.

2/ Chief Financial Officer (CFO) adjustment and Provision for Replacement (PFR) expense is being distributed over a 5-year period beginning in FY 2003 for those contractors that requested those costs be deferred.

3/ These surcharges are payments in addition to the water rates and are determined pursuant to Title XXXIV of P.L. 102-575. Restoration Fund surcharges under P.L. 102-575 are on a fiscal year basis (10/1 -9/30). Contractors with ability to pay relief do not pay Restoration Fund charges for agricultural water.

BOARD OF DIRECTORS

NATOMAS CENTRAL MUTUAL WATER COMPANY

RESOLUTION NO. 2005-03-02

RESOLUTION APPROVING LONG-TERM RENEWAL OF CONTRACT BETWEEN THE UNITED STATES AND NATOMAS CENTRAL MUTUAL WATER COMPANY, DIVERTER OF WATER FROM SACRAMENTO RIVER SOURCES, SETTLING WATER RIGHTS DISPUTES AND PROVIDING FOR PROJECT WATER

WHEREAS Natomas Central Mutual Water Company (the "Company") has, since 1964, held a settlement contract with the United States Department of the Interior, Bureau of Reclamation ("Reclamation") bearing Contract No. 14-06-200-885A (the "Original Contract").

WHEREAS the Original Contract would have expired on March 31, 2004.

WHEREAS in advance of that expiration, the Company and Reclamation entered into negotiations for a long-term renewal of the Original Contract.

WHEREAS by Act of Congress, the Original Contract was extended for a period of two years, because the negotiations and related procedures had not been completed by March 31, 2004.

WHEREAS the negotiations and related procedures have now been completed, and Reclamation has presented to the Company the agreed-upon final form of renewal contract bearing Contract No. 14-06-200-885A-R1 (the "Renewal Contract").

WHEREAS the Board of Directors of the Company finds and determines that it is in the best interest of the Company to approve the Renewal Contract and to authorize the General Manager and staff of the Company to carry out any actions necessary to implement the Renewal Contract.

NOW, THEREFORE, BE IT RESOLVED that:

1. The Board of Directors of the Company hereby approves the Renewal Contract between Reclamation and the Company with the correction of Exhibit B to include the 428 acres of airport land into Natomas' contractual service area.

2. The General Manager and staff of the Company are authorized and directed to take any other action necessary to implement the terms of the Renewal Contract.

PASSED AND ADOPTED by unanimous written consent of the Board of Directors on April 21, 2005.

By _____
Dan F. Spangler
President, Board of Directors

By _____
Herb Niederberger, Jr.
Vice President, Board of Directors

By _____
Mark Enes
Secretary, Board of Directors

By _____
Jim Sopwith
Board of Directors

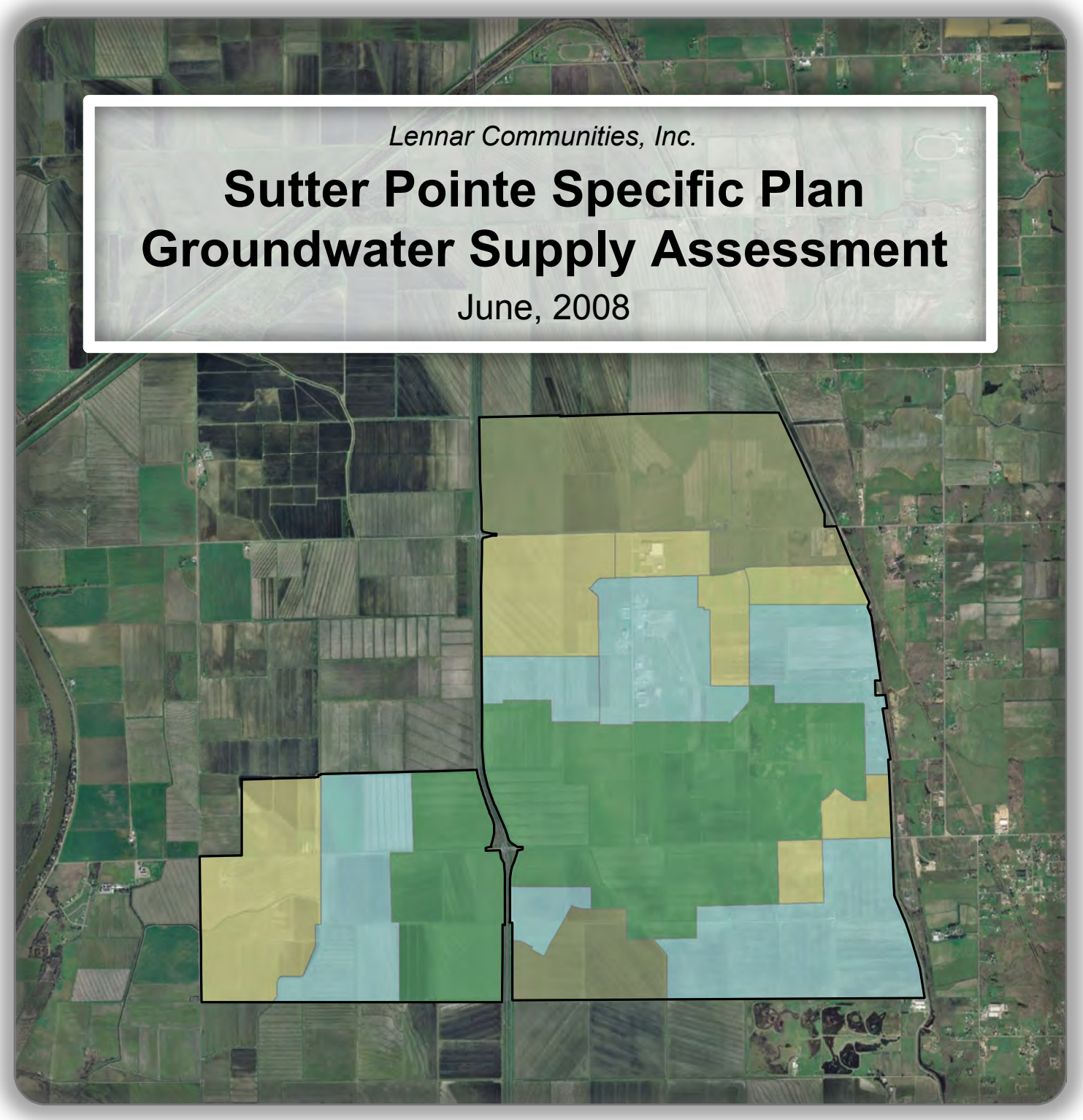
By _____
Doug Ose
Board of Directors

By _____
Michael George
Board of Directors

By _____
Rod Rosa
Board of Directors

APPENDIX B

SUTTER POINTE SPECIFIC PLAN GROUNDWATER SUPPLY ASSESSMENT



Lennar Communities, Inc.

Sutter Pointe Specific Plan Groundwater Supply Assessment

June, 2008

Prepared for:

Lennar Communities, Inc.

Prepared by:

LUHDORFF & SCALMANINI CONSULTING ENGINEERS

Sutter Pointe Specific Plan
Groundwater Supply Assessment

Prepared for

Lennar Communities, Inc.

Prepared by

Luhdorff & Scalmanini
Consulting Engineers

June 2008

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Acronyms and Abbreviations

AFB	Air Force Base
af	Acre-feet
af/ac	Acre-feet/acre
afy	Acre-feet per year
ASWC	American States Water Company
bgs	Below ground surface
BMOs	Basin Management Objectives
BWMP	*Sacramento River Basinwide Water Management Plan*
CDEC	California Data Exchange Center
CEQA	California Environmental Quality Act
DAUs	Detailed Analysis Units
DPH	California Department of Public Health
DWR	California Department of Water Resources
EC	Electrical Conductivity
ECB	Existing Conditions Baseline
EIR	Environmental Impact Report
ET	Evapotranspiration
FCB	Future Conditions Baseline
ft	Feet
gpd	Gallons per day
gpm	Gallons per minute
GMP	Groundwater Management Plan
GPS	Global Positioning System
GSA	Groundwater Supply Assessment
Holt	Holt of California
IGSM	Integrated Groundwater and Surface Water Models
IRWMP	Integrated Regional Water Management Plan
IWRMP	Integrated Water Resources Management Plan
LSCE	Luhdorff & Scalmanini, Consulting Engineers
M&I	Municipal and Industrial
M&S	MacKay & Somps
MCL	Maximum Contaminant Level
msl	Mean sea level
MTBE	Methyl tertiary butyl ether
MWH	Montgomery Watson Harza
NARIGSM	North American River Integrated Groundwater and Surface Water Model
NBC	Natomas Basin Conservancy
NBHCP	Natomas Basin Habitat Conservation Plan
NCMWC	Natomas Central Mutual Water Company
NCWA	Northern California Water Association
NGS	National Geodetic Survey
pers. comm.	Personal communication
PW-1	Paulson production well
PVC	Polyvinyl chloride

Acronyms and Abbreviations (cont.)

RD 1000	Reclamation District No. 1000
RWA	Regional Water Authority
SACIGSM	Sacramento County Integrated Groundwater and Surface Water Model
SIA	Sacramento International Airport
SSWD	Sacramento Suburban Water District
SB	Senate Bill
SCS	Soil Conservation Service
SGA	Sacramento Groundwater Authority
SPSP	Sutter Pointe Specific Plan
SWRCB	State Water Resources Control Board
TDS	Total dissolved solids
TWP	*Sutter Pointe Specific Plan Technical Water Plan*
USBR	United States Bureau of Reclamation
USGS	United States Geological Survey
UWMP	Urban Water Management Plan
VOCs	Volatile organic compounds
WRIME	Water Resources & Information Management Engineering
WSA	Water Supply Assessment
WSMP	*Sutter Pointe Specific Plan Water Supply Master Plan*

EXECUTIVE SUMMARY

ES.1 Introduction

Cities and counties with large development projects are required by Senate Bill (SB) 610 (Part 2.10, Division 6 of the California Water Code enacted in 2001) to prepare a Water Supply Assessment (WSA). This Groundwater Supply Assessment (GSA) addresses groundwater-related issues required for the WSA. This GSA describes projected water demands resulting from the proposed Sutter Pointe Specific Plan (SPSP) project and the availability of water to supply those demands during normal and dry years. Sutter County is the Lead Agency for the project. The County has requested that a WSA be prepared for the project as required by SB 610. This GSA has been prepared to provide an analysis of groundwater demands, supplies, and predicted impacts for the groundwater portion of the WSA and to provide input to the analysis of groundwater conditions for the Environmental Impact Report (EIR). This report evaluates the water needs of the project until the year 2030 in relation to existing and future water demands and supply within the SPSP area and the North American Subbasin.

Water demand and supply for the SPSP area were analyzed in the draft *Sutter Pointe Specific Plan Water Supply Master Plan* (WSMP) (MacKay & Somps [M&S], 2007). The WSMP has been updated (M&S, 2008); accordingly, the most current information pertaining to groundwater use for the SPSP project and project alternatives is incorporated in this GSA. Detailed information on historical and projected water requirements, especially groundwater requirements, in the proposed SPSP area is included in this GSA. All information pertaining to the WSA requirements is being prepared by Tully & Young (2008). Based upon the information in the WSA, the Sutter County Board of Supervisors will determine whether projected water supplies are sufficient to satisfy the demands of the proposed SPSP project, in addition to existing and other planned future uses. The WSA (including the appended GSA) will be included in the EIR prepared for the project pursuant to the California Environmental Quality Act (CEQA). The WSA is also intended to establish a framework for future cooperative water resources management and land use planning efforts in the future SPSP service area.

The SPSP area includes 7,528 acres within the boundary of Natomas Central Mutual Water Company (NCMWC) and Reclamation District No. 1000 (RD 1000) in the southern portion of Sutter County. The SPSP area is bordered by Power Line Road on the west, the Pleasant Grove and Natomas East Main Drainage Canals on the east, and the Sutter County/Sacramento County line on the south.

As groundwater is one of the sources of supply to the proposed SPSP project, the WSA is required by Water Code Section 10910, among other information such as documentation of the projected water demands for the project, the following additional information:

- A review of any information contained in an Urban Water Management Plan (UWMP) relevant to the identified water supply for the proposed project. Since there is no UWMP for this area, a guidance document provided by the California Department of Water Resources (DWR) suggests that the WSA include discussion of any existing groundwater

management plan and how it would affect the water supplier's use of the basin (DWR, 2003a).

- A description of any groundwater basin from which the proposed project would be supplied with groundwater, including information obtained from the most current DWR bulletin that characterizes the condition of the groundwater basin (i.e., whether DWR has identified the basin as overdrafted, or projected that the basin will become overdrafted if present management conditions continue, and what measures are being taken to prevent overdraft conditions from occurring). As suggested in the DWR guidance document relating to the implementation of SB 610, if the basin has not been (or recently been) evaluated by DWR, data that indicate historical and recent groundwater level trends should be evaluated.

- A detailed description and analysis of the amount and location of groundwater pumped by the public water system for the past five years from any groundwater basin from which the proposed project will be supplied. Since a public or private water system has not served the project area for municipal and industrial (M&I) purposes, this GSA evaluates other historical groundwater uses in the project area and the subbasin.

- A detailed description and analysis of the amount and location of groundwater that is projected to be pumped for at least a 20-year horizon by the public water system from any basin from which the proposed project will be supplied.

- An analysis of the sufficiency of groundwater from the basin from which the proposed project will be supplied to meet the projected water demands associated with the Project.

This GSA addresses the above requirements, including evaluation of the water needs of the SPSP project until the year 2030 in relation to existing and future water demands and supply within the SPSP area, the Natomas Basin, and the North American Subbasin.

ES.1.1 Setting

The area from which groundwater will be withdrawn to meet the projected demands for the SPSP project and other public, agricultural, and industrial uses is the future SPSP water system service area that overlies a portion of the North American Subbasin of the Sacramento Valley Groundwater Basin. The boundaries of the future SPSP water system service area are located within the Natomas Basin. Historical, current, and projected groundwater conditions in the North American Subbasin were also evaluated and are summarized below as part of the groundwater supply sufficiency analysis.

ES.2 Existing Groundwater Conditions

Groundwater conditions vary considerably across the North American Subbasin. Groundwater levels have been high and relatively stable in the northern and western portions of the subbasin. This is in contrast to groundwater level declines that have occurred in much of the central, eastern, and southern portions of the subbasin. Overdraft has occurred historically in the latter areas and

appears to still be occurring in the central portion of the subbasin east of the SPSP area. In recent years, groundwater levels have stabilized in other areas where historical overdraft had been reported. This suggests that overdraft conditions have abated in most of the subbasin. Groundwater levels are generally higher in the upper zone, creating a downward gradient for vertical flow.

In the Natomas Basin, groundwater levels have generally been high and relatively stable in the northern and western portion but have declined in recent years in a few wells in the southern portion. Groundwater levels along the eastern edge of the Natomas Basin show historical declines followed by stabilization. Groundwater levels in this area are significantly affected by the cones of depression centered a few miles to the east. The direction of groundwater flow is easterly toward these pumping depressions, and the gradient for flow is relatively steep in this area.

Water level data are limited in the SPSP area, but groundwater levels appear to have been consistently high (generally within ten feet of the ground surface in the spring) and relatively stable in recent years. Similar to the rest of the Natomas Basin, groundwater levels near the eastern edge of the SPSP area are significantly affected by the cone of depression centered about three miles to the east.

ES.3 Land Use, Water Demand, Water Supply, and Water Budget Estimates

The GSA contains a detailed analysis of land use, water demands, and water supplies for the Natomas Basin for current (2004) and projected (2030) conditions with and without the proposed project. The primary purpose of this analysis was to estimate pumpage and surface-water deliveries for the SPSP and other areas within the Natomas Basin. These estimates were used to develop the baseline scenarios simulated with the groundwater flow model. A simplified 2004 water budget was also prepared to estimate groundwater recharge due to deep percolation of precipitation and applied water. The water budget results are compared against the deep percolation simulated by the model.

ES.4 Summary of SPSP Proposed Project and Project Alternatives – Model Scenarios and Results

The analysis of potential pumping impacts and groundwater sufficiency used a pair of existing numerical groundwater flow models (North American River Integrated Groundwater and Surface Water Model [NARIGSM] and Sacramento County Integrated Groundwater and Surface Water Model [SACIGSM]) to evaluate the impacts of the SPSP project on groundwater conditions in the North American Subbasin. Two baseline (no-project) scenarios (2004 and 2030) and five project scenarios were developed and simulated with the linked NARIGSM and SACIGSM models.

Project Scenarios 1 and 2A are compared against the Existing Conditions Baseline (ECB). Project Scenario 1 simulates groundwater conditions at the end of Phases 2 and B (approximately 12 years into the SPSP project). Phases 2 and B were used for this scenario because these phases represent the period of maximum groundwater pumping (used for both the project and agricultural purposes) in the SPSP area. Project Scenario 2A represents the proposed project at full buildout of the

SPSP, which would occur at the end of Phases 4 and D (Year 20). By this time, all agricultural land uses (and associated groundwater pumping) would be replaced by M&I land uses.

Project Scenarios 2B, 3, 4, and 5 are compared against the Future Conditions Baseline (FCB). Project Scenario 2B represents the proposed project at full buildout of the SPSP compared against the FCB. This scenario is otherwise identical to Scenario 2A. Project Scenario 3 represents full buildout of the SPSP at the end of Phases 4 and D (Year 20) for Alternative A. NCMWC's contract with the U.S. Bureau of Reclamation (USBR) provides for a base supply of 98,200 afy, which can be diverted during April through October, and an additional supply of supplemental water of 22,000 afy during July and August (total of 120,200 afy). Alternative A is based on the assumption that NCMWC's contract with USBR would not be modified to allow the SPSP to use NCMWC surface water during the fall and winter. Alternative A would require well fields in both the southwestern and eastern portions of the SPSP area with a maximum of 14 active wells and two standby wells.

Project Scenarios 4 and 5 represent full buildout of the SPSP at the end of Phases 4 and D (Year 20) for Alternative B. Alternative B is based on the assumption that NCMWC's contract with USBR would be modified to allow the SPSP to use NCMWC surface water during the fall and winter. During normal years, this would allow surface-water utilization to increase to 18,622 afy and groundwater utilization to decrease to 6,579 afy. During critically-dry years, groundwater utilization would increase to 9,276 afy and surface-water utilization would decrease to 12,773 afy. Only one well field with a total of eight wells would be required for Alternative B. The well field location is the only difference between Scenarios 4 and 5, with the southwestern portion of the SPSP area used for Scenario 4 and the eastern portion used for Scenario 5.

The model output for each of the five scenarios includes simulated groundwater elevations and annual water budgets for each year of the 35-year simulation. The water budget information allowed analysis of inflows to and outflows from the Natomas Basin and change in storage within the Natomas Basin for normal, wet, single-dry, and multiple-dry water year types.

One of the baseline scenarios (the ECB) generally represents existing conditions (2004) in the subbasin. The other baseline scenario (the FCB) represents future conditions in 2030 without the SPSP project. The project scenarios simulate both the proposed project and the project alternatives. Two of the project scenarios simulate different phases of the proposed project (Phases 2 and B and buildout); the other three scenarios simulate Alternatives A and B at buildout. For each scenario, the models were run for a 35-year simulation period based on historical 1970-2004 hydrologic conditions. This was a period of approximately average precipitation that included a wet, normal, single-dry, and multiple-dry years.

ES.5 Potential Pumping Impacts

The potential impacts of pumping for the SPSP proposed project and project alternatives are summarized below.

For all scenarios, the simulated drawdowns are primarily localized in the SPSP area. Off-site drawdowns are greatest for the proposed project, and Scenario 2 (buildout) has larger off-site

drawdowns than Scenario 1 even though total pumpage in the SPSP area is less. This is the result of the well field location since simulated drawdowns are smaller for scenarios that utilize the western well field due to a greater percentage of the water to supply the pumpage coming from the Sacramento River and the western model boundary (beneath the River). For the proposed project at buildout (Scenario 2), the maximum predicted off-site drawdowns are slightly more than 15 feet in Sutter County and about 10 feet in Sacramento County. Off-site drawdowns are considered to be relatively small given that groundwater levels in the Natomas Basin have historically been high and are predicted to remain stable in the future. East of the Natomas Basin, where a cone of depression already exists, the proposed project will have relatively small drawdown impacts of less than three feet.

For scenarios based on the FCB, year-to-year groundwater level fluctuations during wet and dry periods are magnified due to planned conjunctive use to meet municipal water demands. These fluctuations are the result of increased use of surface water in wet years and increased groundwater pumping during dry years (WRIME, 2007). Almost all hydrographs show increasing groundwater levels over the 35-year simulation period, including wells located in the cones of depression east of the Natomas Basin.

The impacts of the proposed project and the project alternatives on groundwater conditions in the North American Subbasin are summarized in the water budget tables included in this report. Although most impacts are larger for the proposed project than the project alternatives, the reduction in deep percolation (about 6,600 afy based on the 1982 to 2004 average) results from the conversion of irrigated agricultural land to urban land uses and is the same for all buildout scenarios.

Recharge from the Sacramento River is predicted to vary for each scenario, with losing stream conditions occurring for Scenarios 1 and 2 and gaining conditions for Scenarios 3, 4, and 5. Stream recharge is predicted to increase for all scenarios, with the largest increases (an average of 3,800 to 3,900 afy for the 1982 to 2004 period) occurring for the proposed project. The increased stream recharge represents a corresponding reduction in Sacramento River streamflow, but the magnitude of the reduction as a percentage of total streamflow is very small. In the 2004 water year, which is considered to be a normal water year, the average streamflow at the Verona Gage on the Sacramento River was over 15 million af (CDEC, 2008), suggesting that the predicted increases in stream recharge would be about one-tenth of a percent of the average streamflow.

Groundwater inflow from the western model boundary to the Natomas Basin is also predicted to increase due to the proposed project and alternatives. Similar to the increase in stream recharge, this occurs as a result of steeper gradients due to increased pumping in the SPSP area, but the magnitude of the predicted increase is smaller than the increase in stream recharge. As discussed in Chapter 6, some of this boundary inflow, especially in the upper portion of the aquifer system, may actually represent additional recharge from the Sacramento River rather than groundwater flow beneath the River from the west.

For the ECB, the simulated subsurface outflow to the rest of the North American Subbasin is about 11,800 afy based on the 1982 to 2004 average. The amount of outflow is reduced due to additional pumping in the SPSP area as a result of the project, with the greatest reduction in

outflow (about 5,900 afy) occurring for Scenario 2A and the smallest reduction occurring for Scenario 4 (about 2,500 afy) due to the use of the western well field.

For the FCB, the higher groundwater levels predicted to occur east of the Natomas Basin due to the planned transition from groundwater to surface-water supply would result in much less subsurface outflow (about 4,500 afy). The addition of project pumping will further reduce subsurface outflow and is expected to result in a positive subsurface inflow for Scenarios 2B, 3, and 5. Whether this predicted reversal of gradient actually occurs will depend primarily on the assumptions about the future source of municipal water supply as indicated in UWMPs for the North American Subbasin.

The water budget analyses also allowed assessment of the change in groundwater storage occurring during selected periods of analysis, including the various water year types and the average change in storage for the 1982 to 2004 period. The change in storage in the Natomas Basin is positive for all scenarios, which indicates that heads are predicted to rise even with increased pumping in the SPSP area.

ES.6 Groundwater Supply Sufficiency

The results of the analyses conducted for this GSA lead to the conclusion that groundwater supplies from the North American Subbasin are sufficient to serve the proposed SPSP project or project alternatives and other existing and projected uses through the year 2030. The primary reasons for this conclusion are summarized below:

- In the Natomas Basin, groundwater levels have generally been high and relatively stable in the northern and western portion but have declined in recent years in a few wells in the southern portion. Groundwater levels along the eastern edge of the Natomas Basin show historical declines followed by stabilization. Groundwater levels in the eastern area are significantly affected by the cone of depression centered a few miles to the east.

- Historical groundwater level declines have occurred in much of the central, eastern, and southern portions of the North American Subbasin. Overdraft has occurred historically in the latter areas and appears to still be occurring in the central portion of the subbasin east of the SPSP area. In recent years, groundwater levels have stabilized in other areas where historical overdraft has been reported. This suggests that overdraft conditions have abated in most of the subbasin.

- Water level data are limited in the SPSP area, but groundwater levels appear to have been consistently high (generally within ten feet of the ground surface in the spring) and relatively stable in recent years. Similar to the rest of the Natomas Basin, groundwater levels near the eastern edge of the SPSP area are significantly affected by the cone of depression centered about three miles to the east.

- Land use and water supplies were evaluated for current (2004) and future (2030) conditions in the Natomas Basin (Chapter 2); this analysis shows total groundwater utilization in 2004 in the Natomas Basin. Estimated future pumpage with the project is

31,963 afy and without the project is 27,258 afy. Without the project, pumpage estimates for the Natomas Basin are similar for current (28,636 afy) and future conditions (27,258 afy). Groundwater pumping would increase by only 4,705 afy with the project even though proposed pumping at buildout (Phases 4 and D) during a normal year is 13,072 afy. This is due to the phasing out of groundwater pumping for agricultural land uses in the project area and also the shift from groundwater to surface-water utilization in other parts of the Natomas Basin.

- Future water demand and supply estimates for northern Sacramento County were primarily based on UWMPs for each water district in the northern area. As reported by WRIME (2007), all of the plans identified future demand projections and water supply sources to meet the demands. Most of the plans also indicate a significant transition from groundwater to surface-water utilization to meet municipal water demands.

- Projected water demand and supply for the five SPSP project scenarios (Chapter 6) in normal and critically-dry years served as the basis for the analysis of potential pumping impacts and groundwater supply sufficiency**.** The total simulated water supply for the ECB in the North American Subbasin includes 384,300 afy of surface water (used only for water supply) and 389,800 afy of groundwater (which includes some remediation pumping along with water supply pumping) (Jim Blanke, pers. comm., April 23, 2008). The total simulated water supply for the FCB in the North American Subbasin includes 535,800 afy of surface water (used only for water supply) and 328,000 afy of groundwater (including some remediation pumping along with water supply pumping). On a subbasin scale, this indicates a significant transition from groundwater to surface water to meet future water demands.

- Current pumpage in the Natomas Basin is somewhat less than the average annual rate of groundwater recharge; the ECB showed a positive change in storage of 183 afy for 1982 to 2004 of the simulation period.

- Future pumpage in the Natomas Basin, without the SPSP proposed project, is less than the current average annual pumping rate and also less than the average annual rate of groundwater recharge; the FCB showed a positive change in storage of 922 afy based on the 1982-2004 average.

- The simulated deep percolation rates in the Natomas Basin for the ECB and FCB were about 0.7 af/ac on average. As discussed in Chapter 2, total deep percolation estimated for the Natomas Basin based on projected land use, applied water, ET, runoff, canal seepage, and other factors ranged from about 0.6 to 0.8 af/ac based on deep percolation estimates for rice of 0.5 and 1.0 af/ac, respectively. The model results for deep percolation on a per acre basis for the Natomas Basin are within the range of the deep percolation estimates in Chapter 2. The simulated deep percolation rate was reduced by about 6,600 afy (to approximately 0.6 af/ac) due to land use changes resulting from the project. The reduction in deep percolation is offset by increased recharge from the Sacramento River and other factors.

- Scenarios 1 and 2A simulated groundwater conditions at the end of Phases 2 and B (about 12 years into the project) and Phases 4 and D (Year 20), respectively. These two scenarios were compared to the ECB. The average annual water budget results for a 23-year future period (based on 1982 to 2004 hydrologic conditions) showed a positive change in storage of 61 afy (Scenario 2A) and 65 afy (Scenario 1). These results are consistent with the simulated groundwater conditions (i.e., generally stable groundwater levels in most of the Natomas Basin). Scenario 1, the most conservative scenario, simulates SPSP pumpage along with existing agricultural pumpage. The pumpage for Scenario 1 is 2,400 afy more than for the SPSP proposed project at buildout (Scenarios 2A and 2B).

- Scenarios 2B, 3, 4, and 5 (which simulated full buildout of the SPSP) all showed a somewhat smaller change in groundwater storage compared to the FCB; however, these four scenarios showed a positive change in storage ranging from 840 afy (Scenario 2B) to 929 afy (Scenario 4). These positive changes in storage are consistent with the simulated groundwater conditions (i.e., increases in groundwater levels in the Natomas Basin) for the FCB.

In summary, the analyses of observed and simulated groundwater levels and the water budget results demonstrate that groundwater supplies from the Natomas Basin and the North American Subbasin are sufficient to meet the demands of the SPSP proposed project and the project alternatives as well as other pumpage in the Natomas Basin and the North American Subbasin for more than a 20-year horizon. The model results indicate that groundwater supplies will be sufficient to meet these demands for simulations based either on existing or future conditions in the North American Subbasin. Groundwater supplies are indicated to be sufficient for the SPSP proposed project and project alternatives, as shown by the positive change in storage in the Natomas Basin and simulated groundwater levels for the North American Subbasin that are generally stable or increasing following the initial years of the 35-year simulation period.

1.0 INTRODUCTION

1.1 Purpose

Cities and counties with large development projects are required by Senate Bill (SB) 610 (Part 2.10, Division 6 of the California Water Code enacted in 2001) to prepare a Water Supply Assessment (WSA). This Groundwater Supply Assessment (GSA) addresses groundwater-related issues required for the WSA. This GSA describes projected water demands resulting from the proposed Sutter Pointe Specific Plan (SPSP) project and the availability of water to supply those demands during normal and dry years. Sutter County is the Lead Agency for the project but has not yet identified the public water system or other entity that will supply water for the Project. The County has requested that a WSA be prepared for the project as required by SB 610. This GSA has been prepared to provide the analysis of groundwater demand, supply, and predicted impacts for the groundwater portion of the WSA and to provide input to the analysis of groundwater conditions for the Environmental Impact Report (EIR). This report evaluates the water needs of the project until the year 2030 in relation to existing and future water demands and supply within the SPSP area and the North American Subbasin.

Detailed information on historical and projected water requirements in the SPSP area included in this GSA will be summarized in the WSA. Based upon the information in the WSA and other studies, the Sutter County Board of Supervisors will determine whether projected water supplies are sufficient to satisfy the demands of the proposed Project, in addition to existing and other planned future uses. The WSA (including the appended GSA) will be included in the EIR prepared for the project pursuant to the California Environmental Quality Act (CEQA). The WSA is also intended to establish a framework for future cooperative water resources management and land use planning efforts in the future SPSP service area.

1.2 Sutter Pointe Specific Plan

The SPSP area includes 7,528 acres within the boundary of Natomas Central Mutual Water Company (NCMWC) and Reclamation District No. 1000 (RD 1000) in the southern portion of Sutter County. It is bordered by Power Line Road on the west, the Pleasant Grove and Natomas East Main Drainage Canals on the east, and the Sutter County/Sacramento County line on the south (**Figure 1-1**). The Plan Area is bisected by Highway 99. On the west side of the highway, the northern boundary of the Plan Area is approximately 0.6 miles north of Riego Road; on the east side of the highway, the northern boundary extends approximately 0.8 miles north of Sankey Road.

The Sutter Pointe Specific Plan was prepared by the Measure M group in July 2006. The SPSP follows the guidelines of Measure M, which was passed by Sutter County voters in November 2004. Measure M is an advisory measure that indicated support for future development in the SPSP area. Measure M included a number of guidelines that specified how future development would occur. The guidelines specified that no more than 2,900 acres would be developed for residential use; at least 3,600 acres would be developed for commercial and industrial use; and at least 1,000 acres would be provided for parks, open space, schools, libraries, retail areas, and other

civic uses. Measure M also specified that all necessary infrastructure including roads, water supply, storm drainage, sewers, and other improvements would be paid for by the development. Another provision of Measure M was that on-going law enforcement, fire, library, and other public services would be paid for by the development.

Water demand and supply for the SPSP area were analyzed in the *Technical Water Plan* (TWP) prepared by MacKay & Somps (M&S, 2006), which was included as an appendix to the Sutter Pointe Specific Plan (Measure M Group, 2006). Information in the TWP has been updated in the *Sutter Pointe Specific Plan Water Supply Master Plan* (WSMP) (M&S, 2008). Information pertaining to groundwater in the WSMP is summarized in Chapter 2.

1.3 Scope Of Analysis

The GSA includes a review of groundwater conditions in the basin from which the SPSP will use groundwater as a source of supply and the existing and future water demand and groundwater supply within the SPSP area to the year 2030. The GSA also describes groundwater availability, historical and projected use, quality, and plans and programs related to use and management of the resource.

1.3.1 SB 610 Requirements for Groundwater Sources

SB 610 (Costa) became effective January 1, 2002. The stated intent of SB 610 is to strengthen the process by which local agencies determine the adequacy and sufficiency of current and future water supplies to meet current and future demands. SB 610 amended the California Public Resources Code to incorporate Water Code findings within the CEQA process for certain types of projects. SB 610 amended the Water Code to broaden the types of information included in Urban Water Management Plans (UWMPs) – (Water Code Section 10620 *et seq.*) and to add Water Code Part 2.10 Water Supply Planning to Support Existing and Planned Future Uses (Section 10910 *et seq.*). Part 2.10 defines "Projects" that are subject to a WSA and the water supplier's responsibilities related to the WSA. Part 2.10 also clarifies the roles and responsibilities of the Lead Agency under CEQA and the public water system (water supplier) with respect to comparing current and future water supplies with current and future water demands. The water supplier for the SPSP area has not yet been determined.

Water Code Part 2.10

As specified in Part 2.10 of the Water Code, a WSA is required for (1) a proposed residential development of more than 500 dwelling units; (2) a proposed shopping center or business establishment employing more than 1,000 persons or having more than 500,000 square feet of floor space; (3) a proposed commercial office building employing more than 1,000 persons or having more than 250,000 square feet of floor space; (4) a proposed hotel or motel, or both, having more than 500 rooms; (5) a proposed industrial, manufacturing, or processing plant, or industrial park planned to house more than 1,000 persons, occupying more than 40 acres of land, or having more than 650,000 square feet of floor area; (6) a mixed-use development that includes one or more of the uses described above; (7) a development that would demand an amount of water equivalent to or greater than the amount of water required by a 500-dwelling-unit project;

and (8) for water suppliers with under 5,000 water service connections, any new development that will increase the number of water service connections in the service area by ten percent or more.

If the water supplier has completed a UWMP, it must identify whether the new demands are included in the UWMP. If the UWMP includes the demands, it may be incorporated by reference. There is no UWMP that includes the SPSP; therefore, Water Code Section 10910 requires the preparation of a WSA. To comply with the SB 610 requirements, the WSA must include the following information:

- A description of the water service area including climate, current and projected population and other demographic factors that affect water management planning. Demographic data are presented in five-year increments for the period 2005 to 2030.

- A description and quantification of the existing and planned water sources.

- A description of the water source availability during normal, single-dry, and multiple dry water year types.

- A description of current and projected water demands among all user classes in the future public water system service area in five-year increments.

- A discussion of the total projected water supplies determined to be available to the public water system during normal, single-dry, and multiple-dry water years for a 20-year horizon that will meet the projected water demand associated with the proposed project, in addition to existing and planned future uses.

WSA Requirements when Groundwater Is a Source

Groundwater is planned to serve as one of the sources of supply to the proposed Project. Accordingly, where groundwater is a source of supply, the WSA is to include, among other information such as documentation of the projected water demands for the Project, the following additional information:

- A review of any information contained in a UWMP relevant to the identified water supply for the proposed project. Since there is no UWMP for this area, a guidance document provided by the California Department of Water Resources (DWR) suggests that the WSA include discussion of any existing groundwater management plan and how it would affect the water supplier's use of the basin (DWR, 2003a).

- A description of any groundwater basin from which the proposed project would be supplied with groundwater, including information obtained from the most current DWR bulletin that characterizes the condition of the groundwater basin (i.e., whether DWR has identified the basin as overdrafted, or projected that the basin will become overdrafted if present management conditions continue, and what measures are being taken to prevent overdraft conditions from occurring). As suggested in the DWR guidance document relating to the implementation of SB 610, if the basin has not been (or recently

been) evaluated by DWR, data that indicate historical and recent groundwater level trends should be evaluated.

- A detailed description and analysis of the amount and location of groundwater pumped by the public water system for the past five years from any groundwater basin from which the proposed project will be supplied. Since a public or private water system has not served the project area for municipal and industrial (M&I) purposes, this GSA evaluates other historical groundwater uses in the project area and the subbasin.

- A detailed description and analysis of the amount and location of groundwater that is projected to be pumped (for at least a 20-year horizon) by the public water system from any basin from which the proposed project will be supplied.

- An analysis of the sufficiency of groundwater from the basin from which the proposed project will be supplied to meet the projected water demands associated with the Project.

The GSA is based upon and intended to fulfill the requirements of SB 610 for groundwater sources as described above.

1.4 Definition of Terms

1.4.1 Sufficiency

Water Code Section 10910(f)(5) requires "an analysis of the sufficiency of the groundwater from the basin or basins from which the proposed project will be supplied to meet the projected water demand associated with the proposed project." A "sufficient water supply" is defined in Government Code 66473.7 (a)(2) as follows:

> "'Sufficient water supply' means the total water supplies available during the normal, single-dry, and multiple-dry years within a 20-year projection that will meet the projected demand associated with the proposed subdivisions, in addition to existing and planned future uses, including, but not limited to, agricultural and industrial uses…."

The public water system is as defined in Water Code Section 10912. The written verification prepared under Section 66473.7(g) is to include:

> "[A] description, to the extent that data is reasonably available based on published records maintained by federal and state agencies, and public records of local agencies, of the reasonably foreseeable impacts of the proposed subdivision on the availability of water resources for agricultural and industrial uses within the public water system's service area (emphasis added) that are not currently receiving water from the public water system but are utilizing the same sources of water. To the extent that those reasonably foreseeable impacts have previously been evaluated in a document prepared pursuant to the California Environmental Quality Act (Division 13 (commencing with Section 21000) of the Public Resources Code) or the National Environmental Policy Act (Public Law 91-190) for the proposed subdivision, the public water system may utilize that information in preparing the written verification."

The above Government and Water Codes (Gov. Code Section 666473.7 and Water Code 10910 *et seq.*) are understood to mean that the analysis of the sufficiency of groundwater from the basin applies to the availability of water supplies to meet the projected water demands during normal and multiple-dry years within a 20-year projection. The area from which groundwater will be withdrawn to meet the projected demands for the project and other public, agricultural, and industrial uses is the future SPSP water system service area that overlies a portion of the North American Subbasin of the Sacramento Valley Groundwater Basin. The boundaries of the future SPSP water system service area have not been determined but are assumed to be coincident with the SPSP boundaries for the supply sufficiency analysis. Historical and current groundwater conditions in the rest of the North American Subbasin were also evaluated and considered as part of this analysis.

1.4.2 Overdraft

The SB 610 requirements discussed above include evaluation of the condition of the groundwater basin, including whether DWR has identified the basin to be in overdraft or projected to become overdrafted. The word "overdraft" is defined in Bulletin 118 as follows (DWR, 2003b):

> "[T]he condition of a groundwater basin or subbasin in which the amount of water withdrawn by pumping exceeds the amount of water that recharges the basin over a period of years, during which the water supply conditions approximate average conditions (DWR, 1998a)."

The primary indication of overdraft is steadily declining water levels over a period of many years. If water levels eventually recover or stabilize at a lower level, groundwater pumping no longer exceeds recharge and, by definition, overdraft is no longer occurring. Therefore, water level declines followed by stabilization but without full recovery to historically high water levels do not represent overdraft, although lack of full recovery following a period of water level declines has been used incorrectly as an indication of overdraft. Groundwater levels that stabilize at a lower level are not exhibiting chronic declines or leading to groundwater depletion. Further, lowered groundwater levels are often necessary to create storage capacity and increase the yield of a basin. Stabilization can occur due to reduced pumping, but it can also be caused by induced recharge as lower groundwater levels create a steeper gradient for recharge from streams and overlying zones of the aquifer. Although lower water levels do not necessarily indicate overdraft, they can cause similar impacts including increased pumping costs, costs of well deepening or replacement, water quality degradation, streamflow reductions, and land subsidence.

A review of DWR's findings relative to overdraft in the groundwater basin is discussed in Chapter 4 along with an independent analysis based on historical groundwater level data.

1.5 Water Management Plans and Other Studies

1.5.1 Water Management Plans

NCMWC Groundwater Management Plan

NCMWC prepared a draft Groundwater Management Plan (GMP) in 2002, but the GMP has not been formally adopted by the NCMWC Board of Directors. The GMP contains a description of the NCMWC and RD 1000 service areas, including land use and water supply from surface-water diversions, groundwater, and tailwater recirculation. Groundwater management objectives listed in the GMP include:

- Continued development of groundwater supplies within the perennial yield of the aquifer system (avoidance of overdraft);
- implementation of conjunctive use to preserve surface-water rights and supplies, integrated with local groundwater supplies;
- cooperation in the solution of nearby local, regional groundwater problems (recovering groundwater level depression); and
- cooperation in creating and implementing CALFED Regional Partnerships for beneficial use of surplus surface-water supplies via local or other transfers.

The GMP contains seven primary elements, including:

- monitoring of groundwater levels and quality;
- monitoring of surface-water flows and quality;
- groundwater development and implementation of conjunctive use;
- avoidance of overdraft;
- avoidance of groundwater quality degradation;
- development and continuation of federal, state, and local agency relationships; and
- continuation of public education and water conservation programs.

The GMP also contains three secondary (potential) elements, including:

- well construction, abandonment, and destruction policies;
- management and protection of recharge areas and wellhead protection areas
    - water quality protection

  - manage vertical distribution of pumpage and control of river impact; and

- provisions to add components.

NCMWC Integrated Water Resources Management Plan

The NCMWC *Integrated Water Resources Management Plan* (IWRMP) was prepared by American States Water Company (ASWC), Wood Rodgers, Inc., Stratecon, Inc., and Hatch and Parent in May 2006. The IWRMP was adopted by the NCMWC Board of Directors in October 2006. The IWRMP summarizes current and future land use and the availability and utilization of surface water, groundwater, and recycled tailwater within the NCMWC service area. It also includes a summary of potential water transfers to third parties outside the NCMWC service area.

The IWRMP also summarizes the results of groundwater modeling conducted for the NCMWC area conducted using two linked Integrated Groundwater and Surface Water Models (IGSM). Together these models, the North American River and Sacramento County IGSM, simulate groundwater flow in the entire North American Subbasin. The model results were presented in a memorandum by Water Resources and Information Management Engineering, Inc. (WRIME) entitled *Evaluation of Groundwater Impacts of Proposed Developments by the Natomas Central Mutual Water Company* (2005). Based on the model results, the IWRMP concludes that pumpage in NCMWC that averages between 38,000 and 63,800 acre-feet per year (afy) would be sustainable on a long-term basis. As discussed in Chapters 5 and 6, updated versions of these IGSM models also have been used to simulate potential impacts of proposed pumping in the SPSP area. The estimate of sustainable pumping will probably be less for the GSA analysis because aquifer properties and other assumptions have changed, as discussed below.

Sacramento Valley Integrated Regional Water Management Plan

The *Sacramento Valley Integrated Regional Water Management Plan* (IRWMP) was prepared by the Northern California Water Association (NCWA) and finalized in December 2006. Its primary purpose is to provide a framework for the management of water resources throughout the Sacramento Valley. It includes a chapter on Sutter County, which contains a general description of current and future (2020) land use and water demand for four Detailed Analysis Units (DAUs) within the County. The SPSP area is located in the Placer Subarea (DAU 172), which includes western Placer County and the southeastern portion of Sutter County. The IWRMP contains groundwater demand and supply estimates by DAU for 2004 and 2020. Current water demand for the Sutter County portion of DAU 172 was estimated to be 346,000 afy, and demand was projected to increase to by 9% to 377,600 afy by 2020.

American River Basin Integrated Regional Water Management Plan

The *American River Basin Integrated Regional Water Management Plan* was completed in May 2006 by the Regional Water Authority (RWA). It encompasses all of Sacramento County and most of Placer and El Dorado counties but does not include the Sutter County portion of the North American Subbasin. Its objectives are similar to the Sacramento Valley IRWMP, and there is considerable overlap between the two plan areas.

Sacramento River Basinwide Water Management Plan

The *Sacramento River Basinwide Water Management Plan* (BWMP) was prepared by DWR in 2003(c) in response to a settlement agreement between eight Sacramento River Settlement Contractors (including NCMWC) and the U.S. Bureau of Reclamation (USBR). The agreement was intended to resolve litigation brought against the federal government by the Settlement Contractors. The BWMP was one of the documents prepared to aid in contract renewal negotiations.

The BWMP contains various information about groundwater conditions and utilization in NCMWC. It indicates a total of 94 irrigation wells in NCMWC, ranging in depth from 76 to 1,025 feet, with an average of 313 feet. The BWMP estimates that 29,500 acres within NCMWC are irrigated with surface water, and 2,800 acres are irrigated with groundwater. Groundwater pumping was estimated to be 15,000 afy based on DWR's 1990 and 1998 land use maps for Sutter and Sacramento Counties, respectively.

SGA Groundwater Management Plan

The *Sacramento Groundwater Authority Groundwater Management Plan* was adopted by SGA in December 2003. The GMP area covers the Sacramento County portion of the North American Subbasin; thus it, includes the southern two-thirds of the Natomas Basin. The GMP contains five basin management objectives (BMOs):

- Maintain or improve groundwater quality in the SGA area for the benefit of basin groundwater users.
- Maintain or improve groundwater elevations that result in a net benefit to basin groundwater users.
- Protect against any potential inelastic land surface subsidence.
- Protect against adverse impacts to surface-water flows in the American and Sacramento rivers.
- Protect against adverse impacts to water quality resulting from interaction between groundwater in the basin and surface-water flows in the American and Sacramento rivers.

Western Placer County Groundwater Management Plan

The *Western Placer County Groundwater Management Plan* was prepared by Montgomery Watson Harza (MWH) on behalf of the City of Roseville, City of Lincoln, Placer County Water Agency, and California American Water. The GMP was finalized in August 2007 and contains five BMOs:

- Management of the groundwater basin shall not have a significant adverse effect on groundwater quality.

- Manage groundwater elevations to ensure an adequate groundwater supply for backup, emergency, and peak demands without adversely impacting adjacent areas.

- Participate in state and federal land surface subsidence monitoring programs.

- Protect against adverse impacts to surface-water flows in creeks and rivers due to groundwater pumping.

- Ensure groundwater recharge projects comply with state and federal regulations and protect beneficial uses of groundwater.

The GMP includes a number of components grouped into five categories:

- Stakeholder involvement,
- Monitoring program,
- Groundwater resource protection,
- Groundwater sustainability, and
- Planning integration.

A biennial GMP implementation report will be prepared to summarize groundwater conditions, management actions, and progress toward meeting the BMOs.

1.5.2 Other Studies

In addition to the water management plans, a number of other studies containing information about geology and groundwater conditions in the North American Subbasin were reviewed and utilized for this study. The *Feasibility Report for the American Basin Conjunctive Use Project* (DWR, 1997) and the DWR Bulletin 118 online basin description entitled *Sacramento Valley Groundwater Basin, North American Subbasin* (DWR, 2006) were key references. Other DWR reports reviewed included *Evaluation of Ground Water Resources: Sacramento County* (Bulletin 118-3, 1974a) and *Evaluation of Ground Water Resources: Sacramento Valley* (Bulletin 118-6, 1978). Several Sacramento Groundwater Authority (SGA) reports were reviewed, including *Sacramento Groundwater Authority, Summary of Basin Conditions* (MWH, 2002). Also reviewed was a report prepared by LSCE (2008) for the Sacramento Area Flood Control Agency (SAFCA) entitled *Evaluation of Potential Groundwater Impacts Due to Proposed Sacramento River East Levee Improvements with Emphasis on Reaches 2 and 3*. Groundwater elevation contour maps prepared for that report are included in Chapter 4.

Several groundwater model reports were reviewed for the WSA. These included *Sacramento County Groundwater Model, Model Development and Basin Groundwater Yield* (MWH, 1993), *Northern American River Service Area Groundwater Model, Model Development and Basin Groundwater Management* (MWH, 1995), *Hydrologic and Modeling Analysis for Zone 40 Water Supply Master Plan* (WRIME, 2004), *Technical Memorandum, Sacramento County, Integrated Groundwater and Surface Water Model (SACIGSM, v.3), Model Refinement- North Area* (WRIME, 2007).

1.6 Report Organization

This report is structured to facilitate the presentation of information required by Water Code Section 10910 *et seq.* including the analyses necessary to evaluate the sufficiency of the groundwater supply to meet projected future demands.

Chapter 1 provides an overview of the legal requirements for a WSA, describes the project, which is located in the southeastern corner of Sutter County. It provides definitions of key terms, describes water resources management plans that include the SPSP area, and describes local and regional studies pertinent to this GSA.

Chapter 2 describes the NCMWC service area and the SPSP area, and includes a detailed summary of land use, water demand, and existing and planned sources of water supply in the Natomas Basin. Groundwater pumpage and other water supplies were estimated for 2004 and 2030. The proposed phasing of the SPSP project is described, and land use and water demand and supply are summarized for each phase. A simplified 2004 water budget for the Natomas Basin is described in this chapter. This water budget estimates groundwater recharge due to deep percolation of precipitation, applied water, and canal seepage. In Chapter 6, these results are compared against the deep percolation simulated by the groundwater model.

Chapter 3 describes the hydrogeology of the North American Subbasin, including geology, well yields, and aquifer characteristics.

Chapter 4 describes regional and local groundwater conditions. Historical and current groundwater level data in the North American Subbasin and the SPSP vicinity are analyzed. Groundwater quality in and near the SPSP area was also evaluated. Because both water level and water quality data vary with depth, an effort was made to display and summarize the data based on well depth.

Chapter 5 describes the groundwater flow model used for the groundwater impact analyses. The model structure, assumptions, and calibration are discussed in this chapter.

Chapter 6 describes the baseline and project scenarios simulated with the groundwater model and the predicted project impacts resulting from these simulations.

Chapter 7 summarizes the conclusions of the GSA concerning the sufficiency of groundwater supplies from the North American Subbasin to serve the project and other projected demands through the year 2030.

2.0 SUTTER POINTE SPECIFIC PLAN AND SURROUNDING AREA

2.1 Natomas Central Mutual Water Company and Reclamation District 1000

The following discussion of NCMWC and RD 1000 is based primarily on the draft NCMWC Groundwater Management Plan (NCMWC, 2002). NCMWC was formed in 1921 to divert water from the Sacramento River primarily for irrigation use, and also for limited municipal and industrial use.

RD 1000 was formed by an act of the legislature on April 14, 1911, and its boundaries are generally coincident with the original boundaries of NCMWC. These boundaries are labeled as the Natomas Basin boundaries on **Figure 2-1**. RD 1000 was created to reclaim and protect land within its boundaries from floodwaters of the American and Sacramento Rivers. To this end, levees were constructed around the perimeter and a drainage system was constructed inside the levees to capture and discharge natural runoff. RD 1000 now has 42 miles of levees around an area of 81 square miles and is responsible for maintaining the levees in accordance with standards established by the U.S. Army Corps of Engineers and an assurance agreement with the State of California. RD 1000 also operates and maintains a large drainage system within its boundaries to dispose of agricultural and urban runoff. This system includes seven large pumping plants and 180 miles of canals and ditches.

2.1.1 NCMWC Service Area and Distribution System

NCMWC and RD 1000 are located on the east side of the Sacramento River, between the rural community of Pleasant Grove and the City of Sacramento, in Sutter and Sacramento counties in the western portion of the North American Subbasin. **Figure 2-1** shows these boundaries along with the service areas of other water purveyors in the subbasin. NCMWC and RD 1000 encompass agricultural and urban land within the area surrounded by the Sacramento River on the west, the Natomas Cross Canal on the north, the Pleasant Grove Canal and the Natomas East Main Drainage Canal on the east, and the American River on the south. RD 1000 and NCMWC operate and maintain 310 miles of drainage ditches and irrigation canals. The RD 1000 boundary encompasses approximately 54,400 acres and is the same as the Natomas Basin boundary shown on **Figures 2-1** and **2-2**. An "official" NCMWC service area boundary is not available because the service area continues to change as more land is annexed by the City of Sacramento. For this study, the service area has been defined as an area of approximately 33,900 acres that is currently served by NCMWC's surface-water distribution system or has the potential to be served by NCMWC. The NCMWC service area is considered to be identical to the USBR contract boundary (also shown on **Figure 2-2**) except in the southeastern area where new residential developments served by the City of Sacramento are not considered part of the current service area.

Most of the landowners within the NCMWC service area are shareholders, but the service area also includes about 1,400 acres of non-shareholder lands. Non-shareholders rely on groundwater for irrigation water supply. NCMWC's service area also includes lands surrounding the

Sacramento International Airport (SIA) that are currently fallow as they transition to urban land uses.

NCMWC operates three primary river diversion points on the Sacramento River. Water is also diverted at two locations from the Natomas Cross Canal, which is located along the northern boundary of NCMWC. Water diverted from the Cross Canal flows from north to south, while water diverted from the Sacramento River flows generally from west to east, then south.

NCMWC's distribution and conveyance system includes approximately 130 miles of canals and laterals, with 84 pumps in over 35 internal locations. In addition, NCMWC makes use of a portion of RD 1000's approximately 180 miles of drainage ditches. NCMWC completed the installation of a tailwater recirculation system in 1986 so that drainage water can be reused during the irrigation season to improve Sacramento River water quality, reduce river diversions, and increase overall efficiency. The recirculation system includes 16 pumping station locations that recapture tailwater for re-use either directly into fields or back into the main irrigation canals.

2.1.2 2004 Land Use

Rice is the predominant crop grown within the Natomas Basin. Most of the rice is white rice, but wild rice is also grown, especially in the SPSP area. In 2004, rice accounted for about 79% of the irrigated acreage. Other crops include alfalfa, clover, and oat hay; tomatoes and sugar beets; and crops such as wheat and safflower that are rotated with rice and tomatoes. Except for the SIA and the Teal Bend Golf Course along the Sacramento River west of the SIA, urban development has thus far been limited to the southeast corner of the Natomas Basin.

Estimates of irrigated acreage, water demand, and water supply in NCMWC made by previous studies have varied widely, as shown in **Table 2-1**. Although the primary purpose of **Table 2-1** is to summarize estimates of groundwater pumpage within the NCMWC Basin, estimates of the acreage irrigated with both surface and groundwater, and estimates of supply from surface-water deliveries and tailwater recycling are also shown. Estimates of agricultural land irrigated primarily with groundwater range from a high of 3,500 acres for the potion of NCMWC north of I-5 (DWR, 1997) and a low of 2,800 acres in the BWMP (DWR, 2003c). An estimate of about 3,300 acres was made for this report based primarily on the 1998 and 2004 DWR land use maps for Sutter County and the 2000 land use map for Sacramento County.

A detailed estimate of 2004 land use in the Natomas Basin prepared for this study is illustrated on **Figure 2-3** and summarized in **Table 2-2**. Land use within the NCMWC service area is based on NCMWC water delivery records for 2004, and land use in other areas is based on the most current DWR online land use maps (2004 for Sutter County and 2000 for Sacramento County). The 2000 Sutter County DWR agricultural and urban acreage estimates were updated using a USDA aerial photograph from July 2004. The total irrigated acreage is about 28,600 acres, with approximately 22,400 acres (78%) planted to rice. As indicated on **Figure 2-3**, areas irrigated primarily with groundwater were identified on the 2000 Sacramento County DWR land use map but not on the 2004 Sutter County DWR land use map. The delineation of areas irrigated with surface water and groundwater in Sutter County are based on the 1998 DWR land use map and discussions with local growers (Chris McKenzie and Jack De Wit, pers. comm., May 23, 2007).

The Natomas Basin Conservancy (NBC) currently owns over 4,000 acres of land in the Natomas Basin. The NBC began land acquisitions after completion of the Natomas Basin Habitat Conservation Plan (NBHCP) by the U.S. Fish and Wildlife Service and the California Department of Fish and Game in 1997. The NBHCP specified that lands be acquired for habitat conservation as mitigation for the effects of urban development in the Natomas Basin on endangered species and other wildlife. Under the terms of the NBHCP, NBC will ultimately acquire 8,750 acres of land to mitigate the loss of 17,500 acres slated for development. Most of the NBC mitigation lands have historically been planted to rice, and NBC plans to keep 50% of the lands in rice production and convert 25% to managed marsh and another 25% to upland habitat. As of 2004, approximately 475 acres had been converted to managed marsh.

Irrigated acreage within the NCMWC Basin has decreased in recent years as more land has been converted to urban uses. Land use estimates in the IWRMP indicate that the acreage irrigated with surface water decreased by about 4.7% per year between 1996 and 2006 (ASWC, et al., 2006). NCMWC land use data indicate that the amount of irrigated shareholder lands decreased by about 5.2% per year between 2004 and 2007.

2.1.3 2004 Water Demand

Table 2-2 contains estimates of 2004 water demand in the Natomas Basin based on land use discussed above and water demand estimates obtained from DWR and other sources. The total water demand was estimated to be about 188,500 afy, of which about 158,100 afy is used for agriculture and 30,400 afy for non-agricultural uses. Approximately 142,500 afy of the total estimated agricultural demand is used to irrigate rice. The largest non-agricultural demand (about 19,100 afy) is water for the urban area in the Sacramento County portion of the Natomas Basin that is supplied by the City of Sacramento. The next largest non-agricultural demand (about 4,000 afy) is water for the Sterling Caviar sturgeon farm located at the eastern edge of the Natomas Basin in southeastern Sutter County. The other estimated water demands include about 3,100 afy to irrigate managed marsh owned by NBC, about 3,100 afy for industrial and other commercial uses, including irrigation of landscape plantings at the SIA and the Teal Bend Golf Course and potable water at the SIA, and about 1,100 afy for rural residential.

Water requirements for white rice are greatest during May through August due to the need to flood the rice fields for planting and to keep them flooded during the peak months of the growing season. The vast majority of agricultural irrigation water requirements are met through surface water and recycled tailwater, but groundwater is used in certain areas, especially the northeast corner of the Natomas Basin, that are not served by NCMWC's surface or recycled water distribution system. In other areas, groundwater is only used in drought years.

In response to increasingly stringent limitations on rice straw burning, many of the rice fields are flooded in the fall to decompose leftover rice straw. The NCMWC GMP notes that approximately 7,000 acres have been flooded for this purpose in the past, and this is expected to increase unless other options (such as the sale of stubble for ethanol production) are determined to be more economically feasible. This practice of reflooding provides additional winter habitat for waterfowl above that which has been available within the Sacramento Valley since the development of agriculture.

For most crops, the amount of applied water (the demand factor in **Table 2-2**) is based on estimates in Table 1 of the IWRMP (ASWC, et al., 2006). The IWRMP applied water estimate for rice (6.5 acre-feet/acre [af/ac]) was decreased to 6.0 af/ac in the SPSP area where about half of the non-shareholder lands are planted to wild rice, which has a lower water demand during the irrigation season and does not require reflooding. The water demand for NBC managed marsh is assumed to be the same or less than white rice (6.5 af/ac) based on discussions with John Roberts (pers. comm., August 30, 2007).

2.1.4 2004 Water Supply

As summarized in **Table 2-2** and discussed below, agricultural water demands within the Natomas Basin are met primarily by NCMWC surface water and recycled tailwater, but groundwater is also used in some areas. Urban water demands are supplied primarily by City of Sacramento surface water, but groundwater (3,300 afy) and NCMWC surface water (212 afy) are also used in Sacramento County.

Surface Water

NCMWC signed a water rights Settlement Contract with USBR in 1964 and renewed it in 2005 for a 40-year term. The Renewal Contract provides NCMWC with a base supply of 98,200 afy, which can be diverted during April through October, and a project supply of supplemental water of 22,000 af during July and August (total of 120,200 afy). In addition to the contract water, NCMWC has a permit to divert up to 10,000 af of Sacramento River water during the fall and winter for wetlands and rice straw decomposition.

Surface-water delivery data for shareholder lands in NCMWC were obtained from USBR for 1965 to 2006. Annual diversions during the irrigation season ranged from a low of about 63,600 af in 1967 to a high of about 116,000 af in 1975, with an average of about 88,400 af during this period. USBR reported surface-water deliveries of about 93,700 af in 2004. Because diversions during the fall and winter are not metered, the annual total is assumed to match the 10,000 af allocation for this purpose. For the estimate shown in **Table 2-2**, 10,000 af of fall/winter diversions were added to the reported deliveries, for a total of 103,700 af.

The City of Sacramento delivers surface water to the area southeast and outside the NCMWC Service Area and to the SIA as of January 2006. Estimates of surface water supplied by the City of Sacramento were based on land use. Riparian surface-water supply is the diversion of Sacramento River water by private land owners with riparian rights located adjacent to the River. These amounts are not known and were estimated for properties located outside the NCMWC and adjacent to the River.

Groundwater

The NCMWC GMP states that approximately 53 privately-owned irrigation wells and one NCMWC-owned well are known to be located within NCMWC's service area (NCMWC, 2002). A much higher total (94 wells) was reported in the BWMP (DWR, 2003c). Several areas within NCMWC, including the entire northeastern portion, are irrigated primarily with groundwater because the existing surface-water distribution system does not serve these areas. Other wells are

used primarily during drought years. The NCMWC-owned well is used to provide additional capacity in a small area at the southern end of the overall service area.

Groundwater usage in the NCMWC service area is unmetered, and estimates are variable as shown in **Table 2-1**. A detailed estimate was made for this report based on the land use data shown on **Figure 2-3**, and this estimate is summarized in **Table 2-2**. Land use in the SPSP area is shown separately from other areas on **Table 2-2** and is discussed in detail in the next section. For the entire Natomas Basin, a total of 3,260 agricultural acres were indicated to be irrigated primarily with groundwater, including about 2,600 acres (79%) planted to rice. Other crops identified on the land use maps in groundwater areas are grain and hay, pasture, tomatoes, corn, safflower, and sugar beets. The total groundwater pumpage in the Natomas Basin was estimated to be about 28,600 af in 2004.

Recycled Tailwater

In recent years, NCMWC has relied heavily on recycled tailwater to supplement its Sacramento River entitlement. Tailwater is recycled partly because it cannot be discharged back to the Sacramento River due to water quality regulations. NCMWC completed the installation of a recirculation system in 1986 for the purpose of improving Sacramento River water quality, reducing River diversions, and increasing overall efficiency within its boundaries. The recirculation system includes 30 pumping stations at 16 locations that recapture water for reuse either directly into fields or back into the main irrigation canals. The system also includes lift pumps at two locations that lift drain water from the Southern service area to the Central service area and then from the Central service area to the Northern service area. During a normal irrigation season, all agricultural drainage water is recirculated during the rice growing season, which ends during the last half of August. This management effort maximizes water re-use as a standard operational procedure by NCMWC.

As discussed above, landowners within NCMWC are not allowed to return tailwater to the Sacramento River; as a result, there is extensive reuse of recycled tailwater. Tailwater recycling is unmetered, and few estimates are available. The NCMWC GMP (NCMWC, 2002) contains an estimate of 30,000 afy of recycled tailwater. The IWRMP (ASWC, et al., 2006) estimates recycled tailwater usage at 20% of surface-water diversions. Based on the average diversions during 1965-2006 (including the estimated fall/winter diversions), this represents a lower estimate of about 20,000 afy.

As shown in **Table 2-2**, recycled tailwater was estimated to supply about 31,200 af of the total demand in 2004, which is very similar to the estimate in the NCMWC GMP. This includes about 900 af of recycled water from the sturgeon farm, which supplies one of the NBC managed marsh areas. Recycled water was estimated to supply about 22.5% of the demand in areas irrigated primarily with NCMWC water. Non-NCMWC sources of recycled water also include groundwater, riparian water, NBC water, and City of Sacramento detention ponds.

2.1.5 Future Land Use

Irrigated agricultural acreage in NCMWC will continue to decrease as more land is converted to urban uses in the future. An estimate of 2030 land use in the Natomas Basin is shown in **Table**

2-3. For this estimate, it was assumed that areas not slated for development would continue to be farmed as they have been in the past.

Buildout of four areas of proposed urban development are assumed for the 2030 land use estimate. These are the SPSP, the Metro Air Park, the Greenbriar Development Project, and the southeastern portion of the Natomas Basin. The first three of these are located within the current NCMWC service area as defined on **Figure 2-2**. The SPSP is the subject of this study; the other three proposed developments are discussed below:

- Metro Air Park (1,900 acres) – The Metro Air Park project is located adjacent to the eastern edge of the SIA north of Interstate 5 within the NCMWC service area. Plans for the Metro Air Park include 8.6 million square feet of industrial and office space, a hotel, and a golf course. No residential areas are planned.

- Greenbriar Development Project (577 acres) – The Greenbriar project is located east of the Metro Air Park north of Interstate 5. It is projected to include 3,473 residential units, about 27.5 acres of commercial land uses, a 39-acre lake/detention basin, a 10-acre elementary school, and about 49 acres of parks and open space.

- Southeastern portion of Natomas Basin – Much of this area has already been developed or is currently in transition from agricultural to urban land uses. **Figure 2-3** shows only about 124 acres of irrigated agricultural land in this area in 2004. It is assumed that no agricultural land uses will remain by 2030.

The irrigated acreage will decline by 2030, as more agricultural lands are fallowed and converted to urban uses. **Table 2-3** shows that the total irrigated acreage is expected to decline to about 20,700 acres, which represents a decrease of 28% from the 2004 level. Rice acreage would decline by 43% to about 12,700 acres in 2030.

For comparison purposes, **Table 2-4** shows an estimate of 2030 land use, demand, and supply values for the Natomas Basin without the project; it assumes that 2030 land status in the SPSP area is the same as 2004 (shown in **Table 2-2**) and changes in the remaining portions of the Natomas Basin are the same as shown in **Table 2-3**.

2.1.6 Future Water Demand and Supply

Estimates of future water demand and supply in the Natomas Basin in 2030 are also summarized in **Table 2-3**. The total demand supplied by all sources is projected to increase by about 6% from the 2004 level (to 198,900 afy), and the agricultural demand is projected to decrease by about 38% to 97,700 afy. Approximately 82,700 afy of this total would be used to irrigate rice. Water demand and supply estimates shown in **Table 2-3** include the SPSP, Metro Air Park, Greenbriar, and other areas of urban development in the southeastern portion of the Natomas Basin. Water for developments other than the SPSP would be provided by the City of Sacramento.

As shown in **Table 2-3**, the use of NCMWC surface water and recycled tailwater to meet demands would decrease and groundwater utilization would increase by 2030. Use of NCMWC surface

water would decrease by about 21% to 82,000 afy, groundwater use would increase by about 13% to 32,000 afy, and use of recycled water would decrease by about 32% to 21,300 afy.

Estimates of future water demand and supply in the Natomas Basin in 2030 without the project are summarized in **Table 2-4**. Future groundwater use without the project (27,258 afy) is comparable to current 2004 groundwater use (28,636 afy) and less than future groundwater use with the project (31,963 afy).

2.1.7 Water Budget for Estimate of Deep Percolation in the Natomas Basin

Surface water, groundwater, and recycled water applied to lands in the Natomas Basin, along with precipitation, meet the demands of various land uses and also result in some deep percolation, which recharges the underlying aquifer system. Based on the estimated (2004) land uses, water demands, and water supplies described in this chapter, this section describes a water budget developed to estimate the amount of precipitation and applied water that would be expected to deep percolate to groundwater. This estimate is compared to the deep percolation simulated by the groundwater flow model in Chapter 6.

A simplified water budget for land uses in the Natomas Basin includes two inflow components (precipitation and applied water) and three outflow components (consumptive use, runoff, and deep percolation). For the purpose of this water budget, the average precipitation is assumed to be 18 inches per year, and the applied water is based on estimates in **Table 2-2**. For urban land uses, only water estimated to be applied for outdoor use is included in the calculation. For rural residential land uses, indoor water use is also included because the deep percolation estimate includes water discharged to septic systems.

The estimated consumptive use is based primarily on DWR's estimates of growing season evapotranspiration (ET) rates for principal crops in the main agricultural areas in the state. The crop ET values shown in **Table 2-5** are largely based on DWR's ET estimates for the Sacramento Valley region (DWR, 1974b). DWR's growing season ET values were increased slightly to convert them to annual ET estimates. Crop ET estimates range from a low of 1.5 af/ac for safflower to a high of 5.0 af/ac for rice. The ET estimate for rice is significantly higher than the DWR estimate of 3.7 af/ac because it includes evaporation of water applied in the fall for rice straw decomposition. ET was also estimated for non-agricultural land uses based on DWR values and LSCE's estimates of water demands for landscaping and other outdoor water uses.

The other outflow components (runoff and deep percolation) were estimated based on literature values and/or calculated by subtraction. Runoff is difficult to estimate without a model because it varies significantly due to factors such as soil hydraulic conductivity, slope, and vegetative cover. The 2006 Rice Production Workshop Manual published by the University of California Cooperative Extension (UCCE, 2006) indicates that runoff from rice fields in California ranges from 0 to 2 af/ac/yr. As a percentage of the total precipitation and applied water discussed above, this represents a range of 0 to 25%.

The UCCE 2006 Rice Production Workshop Manual indicates that deep percolation from rice fields in California ranges from 0.5 to 2.0 af/ac/yr. This represents a range of 6 to 25% of the total precipitation and applied water. Based on soil types and irrigation practices in the Natomas Basin,

deep percolation from rice fields was assumed to be closer to the lower end of this range (0.5 to 1.0 af/ac/yr). Deep percolation estimates are not readily available for other crops, but the California Water Plan Update (Bulletin 160-93) (DWR, 1994) contains a general estimate of deep percolation from applied irrigation water of 15 to 20%. Again, deep percolation from rice fields and for other crops in the Natomas Basin is assumed to be toward the low end of these ranges.

The water budget detailed in **Table 2-5** and summarized in **Table 2-6** includes all land uses shown in **Table 2-2** except the 8-acre aquaculture facility in southeastern Sutter County. This facility uses a large amount of water, but not enough information is known about its operation to estimate the outflow components for the water budget. **Table 2-2** did not include the estimated 310 miles of canals, laterals, and drainage ditches in the Natomas Basin. These are included as a separate line item at the bottom of **Table 2-5** because these canals are considered to contribute significantly to groundwater recharge.

As shown in **Table 2-5**, inflows and outflows for the Natomas Basin are estimated to total 255,693 afy. The outflows include 154,593 afy of ET, 64,591 afy of runoff, and 36,509 afy of deep percolation. The runoff is assumed to flow to canal and ditches where additional evaporation and deep percolation would occur. Canal evaporation was estimated to be 2,292 afy based on pan evaporation data from the Davis climate station (DWR, 1979). Deep percolation from canals was estimated to be 8,120 afy based on modeling conducted by Kleinfelder for a new canal proposed by SAFCA in the Natomas Basin. Using the SEEP/W groundwater flow model, Kleinfelder, Inc. (2007) estimated that deep percolation from the new canal would range from seven to 45 afy/mi; an average value of 26 afy/mi was used for the estimate shown in **Table 2-5**. The estimated canal seepage increased the estimated deep percolation by 8,120 afy to a total of 44,629 afy. This represents 17% of the sum of precipitation and applied water or 0.82 af/ac on a per acre basis.

Subtracting the estimated canal evaporation and seepage from the total runoff leaves a net runoff of 54,179 afy. This is shown at the bottom of **Table 2-5** along with revised deep percolation estimate of 44,629 afy. A total of about 54,000 afy of runoff represents 21% of the sum of precipitation and applied water or about 1.0 af/ac on a per acre basis. As shown on **Table 2-2**, about 31,000 afy of this runoff is estimated to be recycled for irrigation of other fields within the Natomas Basin. This leaves an estimated 23,000 afy of runoff which would need to be pumped out of the basin at the end of the irrigation season or following winter storms.

Most of the applied water in the Natomas Basin is used for rice irrigation, and this water is the primary source of the estimated deep percolation shown in **Table 2-5**, which is based on a deep percolation estimate of 1.0 af/ac/yr for rice. **Table 2-6** contains a summary of this water budget along with a similar water budget based on the low end of the deep percolation estimate for rice (0.5 af/ac/yr). **Table 2-6** also shows the additional deep percolation estimated for ditches and canals. Using the 0.5 af/ac/yr estimate, the total deep percolation would decrease to 33,198 afy (13% or 0.61 af/ac) and the net runoff would increase to 65,610 afy (26% or 1.21 af/ac).

The estimated deep percolation for 2004 ranges from 33,198 afy to 44,629 afy (0.61 to 0.82 af/ac) depending on the assumption about deep percolation from rice fields. These values are compared against model generated deep percolation estimates in Chapter 6. Although there are many uncertainties associated with the water budget assumptions, the estimates are considered to be

reasonable. Deep percolation in the Natomas Basin is expected to be within the estimated range of about 33,000 to 45,000 afy or 0.6 to 0.8 af/ac.

2.2 Sutter Pointe Specific Plan Area

The SPSP area includes 7,528 acres within the boundary of NCMWC and RD 1000 in the southern portion of Sutter County (**Figure 1-1**). As specified in the Measure M guidelines, up to 17,500 homes would be constructed in the SPSP area on a maximum of 2,900 acres. The rest of the SPSP would be used for commercial/industrial development and public facilities including schools, parks, and open space.

2.2.1 2004 Land Use, Water Demand, and Water Supply

Land use in the SPSP area in 2004 is shown on **Figure 2-3** and summarized in **Table 2-2**. There were an estimated 6,072 total irrigated acres in 2004, including 5,977 acres of rice, 57 acres of grain or hay, and 38 acres of pasture. Approximately 29 acres were used for farmsteads and other rural residences, and there were about 146 acres of industrial land uses. Other land uses had no water demand, including 811 acres of fallow agricultural land, 184 acres of native vegetation, and 287 acres of roads and other infrastructure.

Approximately 1,353 acres of the SPSP area were irrigated with groundwater in 2004, and 4,719 acres were irrigated with NCMWC surface water and recycled water. As shown on **Figure 2-3**, groundwater is used as the source of supply in the northeastern portion of the SPSP area.

As shown in **Table 2-2**, agricultural water demand in the SPSP area based on 2004 land use data was estimated to be about 36,200 afy, of which 35,900 afy is for rice cultivation. Non-agricultural water demands include about 60 afy for farmsteads and other rural residential and 440 afy for industrial/commercial use. The water supply is provided primarily by surface water (21,900 afy), with the remainder provided by groundwater (8,400 afy) and recycled water (6,400 afy). All non-agricultural water demands were met by groundwater.

2.2.2 Future Land Use, Water Demand, and Water Supply

The SPSP project is divided into eight phases as shown on **Figure 2-4**. Phases 1 through 4 represent residential development, and Phases A through D represent commercial and industrial development. During each period, some residential and commercial development will occur simultaneously, and it is assumed that Phases 1 and A, 2 and B, 3 and C, and 4 and D would be developed during the same period. It is estimated that the residential phases will be developed at an average rate of 1,000 units per year, with buildout occurring within 20 years, but this could vary depending on the economic strength of the housing market. The assumption that commercial and industrial areas would be developed over the same period is conservative in that these areas would more likely develop at a slower rate than the residential areas. For purposes of estimating water demand and supply, however, it is assumed that all residential and commercial phases will be fully developed in about 20 years.

The timing, acreage, and projected water demand for each phase is shown in **Table 2-7**. As each phase is developed, current (mostly agricultural) land uses will continue on other lands in the

SPSP area. Projected land use, water demand, and water supply at the end of each phase are summarized below. Water demand calculations are for a normal year and would decrease in a critically-dry year based on an assumption of 12.5% conservation during drought periods (M&S, 2008). Urban water demand and water supply for the each phase of the proposed project during both normal and critically-dry years are summarized in **Table 2-8**.

During Phases 1 and A, all M&I demands will be supplied by groundwater. Subsequent phases call for a combination of groundwater and surface water to meet M&I demands. Groundwater would be pumped year-round, with the highest pumping rates occurring in the summer months. Surface water would only be utilized from April through October.

The number of wells that will be required to supply M&I demands varies for each phase. Phases 1 and A would require eight active water supply wells and one standby well. There are two proposed well field locations, as shown on **Figure 2-7**. One potential well field would be located in the southwestern portion of the SPSP area, and these wells are labeled PW-1 through PW-9 on **Figure 2-5**. The other potential well field is located in the northeastern portion of the SPSP area, and these wells are labeled PW-10 through PW-18 on **Figure 2-5**. Both well fields would be required for subsequent phases. A total of 14 active water supply wells and two standby wells would be required by the end of Phases 2 and B. M&I groundwater usage would be capped at 13,072 afy, with additional demands met by surface water. A surface-water treatment plant and distribution system is expected to be completed by about year ten of the project.

Phases 1 + A

Phases 1 and A are projected to be developed during the first seven years of the SPSP project. As shown in **Tables 2-7** and **2-8**, a total of 2,376 acres would be developed during these phases, including 1,214 acres of residential uses, 832 acres of commercial uses, and 329 acres of public facilities. The total M&I water demand for these areas is estimated to be 8,442 afy in a normal year and would be supplied entirely by groundwater. In a critical year, M&I water demands would be expected to decrease by 12.5% to 7,387 afy due to conservation measures.

Existing (mostly agricultural) land uses would continue on the remaining 5,152 acres. 4,611 acres would remain agricultural (including 4,010 irrigated acres), and 541 acres would remain in other existing land uses. The water demand for these non-developed land uses is estimated to be 24,347 afy, and the total water demand in the SPSP area would be 32,789 afy. Water supply for Phases 1 and A include 13,987 afy supplied by groundwater, and 14,544 afy supplied by surface water. About 4,258 afy would be supplied by recycled water.

Phases 2 + B

Phases 2 and B are projected to be developed during years 8 through 12 of the SPSP project. The total M&I acreage would increase to 4,510 acres during this phase, including 2,071 acres of residential uses, 1,724 acres of industrial uses, and 715 acres of public facilities. Total M&I water demands are estimated to be 15,785 afy in a normal year, and groundwater would supply 10,918 afy of this demand. Completion of a surface-water treatment plant is expected to be completed by about year ten of the project, and surface water would supply the remaining 4,867 afy of the M&I

demand. In a critical year, M&I water demands would be expected to decrease by 12.5% to 13,812 afy due to conservation measures.

The acreage remaining in existing land uses in the SPSP area decrease during each phase, and agricultural land uses would decrease to 2,751 acres, of which 2,220 acres would be irrigated. The total water demand for new and existing land uses would decrease to 29,384 afy, but the percentage of this demand supplied with groundwater would increase from 43% to 53%. The normal-year water supply for Phases 2 and B include 15,477 afy supplied by groundwater, 11,854 afy supplied by surface water, and 2,047 afy supplied by recycled water.

Phases 3 + C

Phases 3 and C are projected to be developed during years 13 through 15 of the SPSP project. The total M&I acreage would increase to 6,008 acres during this phase, including 2,500 acres of residential uses, 2,653 acres of commercial uses, and 855 acres of public facilities. Total M&I water demands are estimated to be 20,468 afy in a normal year, with groundwater supplying 11,487 afy of this demand. The other 8,981 afy would be supplied by surface water. In a critical year, M&I water demands would be expected to decrease by 12.5% to 17,910 afy due to conservation measures.

Agricultural land uses would decrease to 1,468 acres during this phase, including 947 irrigated acres. The total water demand for new and existing land uses would decrease to 26,177 afy, and the percentage of this demand supplied with groundwater would remain the same (53%) as in Phases 2 and B. The normal-year water supply for Phases 3 and C includes 13,830 afy supplied by groundwater, 11,584 afy supplied by surface water, and 762 afy supplied by recycled water.

Phases 4 + D

Completion of Phases 4 + D (years 16 through 20) will represent buildout of the SPSP. By this time, all agricultural land uses would be replaced by M&I land uses. This would include 2,895 acres of residential uses, 3,631 acres of commercial uses, and 1,001 acres of public facilities. The total M&I water demand is estimated to be 25,199 afy in a normal year, and there would be no agricultural water demand. Groundwater usage would continue to be capped at 13,072 afy. The remaining 12,127 afy of M&I demands would be supplied by surface water. Recycled tailwater would no longer be used because there would be no irrigated agriculture. In a critical year, M&I water demands would be expected to decrease by 12.5% to 22,049 afy due to conservation measures.

2.2.3 Project Alternatives

Two alternatives to the proposed project that emphasize conjunctive use of surface and groundwater have been developed by M&S (2007). Both alternatives would allow the SPSP to use less groundwater and more surface water during normal years, and the reverse would occur in critically-dry years. Groundwater utilization would be significantly lower during normal years compared to the proposed project. Groundwater utilization would increase during critically-dry years when surface-water supplies are limited but would still be lower than for the proposed project. For both alternatives, the water demand would remain the same as the proposed project.

Alternative A is based on the assumption that NCMWC's contract with USBR would not be modified to allow the SPSP to use NCMWC surface water during the fall and winter. Urban water demand and supply for each phase of Alternative A during both normal and critically-dry years are summarized in **Table 2-9**. During normal years, M&I groundwater pumping would be reduced to a maximum of 9,562 afy at buildout and would occur from October through March. The SPSP would use a total of 15,637 afy of surface water between April and October. During critically-dry years, M&I groundwater pumping would increase to a maximum of 12,432 afy and would occur year around. Surface water would still be used from April to October, but usage would decrease to 9,617 afy. A maximum of 14 water-supply wells and two standby wells would be required for M&I supply for this alternative. Therefore, both of the well field locations shown on **Figure 2-5** would be required to supply the groundwater demand.

Alternative B is based on the assumption that NCMWC's contract with USBR would be modified to allow the SPSP to use NCMWC surface water during the fall and winter months. Urban water demand and supply for each phase of Alternative B during both normal and critically-dry years are summarized in **Table 2-10**. For this alternative, both groundwater and surface water would be used year around in both normal and critically-dry years. During normal years, M&I groundwater pumping would be reduced to a maximum of 6,578 afy at buildout, and surface-water utilization would increase to 18,621 afy. During critically-dry years, M&I groundwater pumping would increase to a maximum of 9,276 afy, and surface-water usage would decrease to 12,773 afy. A maximum of eight water-supply wells and one standby well would be required for M&I supply for this alternative. Therefore, only one of the well field locations shown on **Figure 2-5** would be required to supply the groundwater demand.

2.3 Summary of 2004 and 2030 Water Supplies for the Natomas Basin

The previous section of this chapter detailed land use, water demands, and water supplies for the Natomas Basin for current (2004) conditions and projected conditions (2030) with and without the project. Also described in this chapter are the water demands and supplies for the proposed project and project alternatives for normal and critically-dry water years. **Table 2-11** summarizes the total water supplies estimated for 2004 and projected for 2030 with and without the project. **Table 2-11** also shows the changes in water utilization in the Natomas Basin for the following: 1) 2004 compared to 2030 without the project, 2) 2004 compared to 2030 with the project, and 3) 2030 without the project compared to 2030 with the project. Groundwater pumping in 2030 without the project is projected to be 27,258 afy, while groundwater pumping in 2030 with the project is 31,963 afy. Therefore, the increase in groundwater pumping in 2030 due to the project is only 4,705 afy even though proposed project pumping at buildout (Phase 4 and D) during a normal year is 13,072 afy. The non-linear increase in pumpage for 2030 with the proposed project is due to the reduction in groundwater pumping for agricultural land uses in the project area and also the shift from groundwater to surface-water utilization in other parts of Natomas Basin.

2.4 Climate and Precipitation

The "Mediterranean" type climate in southern Sutter County is characterized by mild wet winters and hot dry summers. Precipitation provides water to the area's surface-water supply and recharge to the groundwater supply. An isohyetal map prepared by MWH (1995) indicates that the average

annual precipitation in the SPSP is about 16 inches. The average precipitation rate increases slightly from west to east.

Annual precipitation data from the Sacramento Executive Airport gauge are plotted on **Figure 2-6**. This precipitation gauge is located at an elevation of about 60 feet above mean sea level (msl) and has a period of record of 1952 to the present. The lowest annual rainfall during this period was 6.62 inches during the 1977 water year (October 1, 1976 to September 30, 1977), and the highest annual rainfall was 34.46 inches during the 1983 water year. The mean annual precipitation at this gauge is 18.1 inches.

The long-term precipitation characteristics at the Sacramento Executive Airport gage are shown by a plot of cumulative departure from mean annual precipitation on **Figure 2-7**. This plot shows alternating wet, average, and dry periods of various durations, which are indicated by the slope of the cumulative departure curve. An upward slope indicates a wet period, and a downward slope indicates a dry period on the cumulative departure curve.

A hydrologic water year index was established for the study area to identify wet, normal, drier, drier and critical, and driest water years based on surface-water supplies from both the Sacramento River and the American River (WRIME, 2007). The period of 1970 to 2004 contains 19 years designated as wet, eight years designated as normal, two drier years, five drier and critical years, and one driest year. Further discussion of the use of these year types appears in Chapter 6.

3.0 HYDROGEOLOGY OF THE GROUNDWATER BASIN

3.1 Groundwater Basin and Subbasin Descriptions

The SPSP area is located in the North American Subbasin of the Sacramento Valley Groundwater Basin (DWR Basin number 5-21). This groundwater basin is the second largest in California, and includes a total of 18 subbasins. The Sacramento Valley consists of a large northwest-trending, elongated, asymmetric structural trough that extends 150 miles north from the Sacramento-San Joaquin Delta to the City of Red Bluff. The valley is dominated by sedimentary water-bearing deposits that are thickest west of the valley axis. These deposits thin in the eastern portion of the valley where they overlie the crystalline rocks of the Sierra Nevada basement complex.

The North American Subbasin (Subbasin Number 5-21.64) is located along the eastern edge of the Sacramento River Valley (**Figure 3-1**) and is described in the online version of DWR's Bulletin 118 update (DWR, 2006; see Appendix A). The subbasin encompasses about 351,000 acres in Sutter, Placer, and Sacramento counties. The North American Subbasin is bounded by the Bear River on the north, the Feather River on the west, the Sacramento River on the south, and the approximate edge of the alluvial aquifer in the Sierra Nevada foothills on the east. The SPSP area is located near the western edge of this subbasin.

3.2 Geology of the North American Subbasin

Prior to development, groundwater in the northern portion of the subbasin flowed to the west and southwest from the Sierra Nevada toward the Feather and Sacramento Rivers. Water bearing alluvial deposits range in thickness from a few hundred feet near the Sierra Nevada in the east to over 2,000 feet along the western edge of the subbasin. Most wells in the subbasin pump groundwater from either the volcanic Mehrten Formation or the overlying alluvial deposits. All of these formations have a westerly dip toward the axis of the valley. These water-bearing deposits are discussed in more detail below. The source for most of this discussion and the associated geologic map (**Figure 3-2**) is the *Feasibility Report, American Basin Conjunctive Use Project* (DWR, 1997). One of the geologic cross sections in the DWR (1997) report was modified for this study and is presented on **Figure 3-3**.

3.2.1 Mehrten Formation

The oldest major fresh water-bearing formation in the North American Subbasin is the Mehrten Formation of late Miocene to mid-Pliocene age. This formation is of volcanic origin and unconformably overlies marine sediments of Eocene age (Olmstead and Davis, 1961). It is exposed in a discontinuous band along the eastern edge of the subbasin and dips westward beneath the central and western portion of the subbasin. The top of the Mehrten Formation trends deeper from the north to the south beneath the subbasin.

The Mehrten Formation is often subdivided into two distinct units. One is a sedimentary unit consisting of gray to black andesitic sands, which are often reported by well drillers as "black sands". The black sands are fluvial deposits derived from andesitic source rock in the Sierra

Nevada. Associated with the black sands are lenses of stream gravel deposits containing andesitic cobbles and boulders, sometimes measuring several feet in diameter. The sand and gravel lenses are interbedded with thicker blue and brown clay (DWR, 1974a). The black sand units in the Mehrten Formation are capable of yielding large quantities of groundwater to wells. In the northern portion of the subbasin, near Coon Creek, two wells completed in the Mehrten black sands are reported to produce 3,000 gallons per minute (gpm). In the southwest corner of the study area, one well completed primarily in the Mehrten black sands produced 3,200 gpm during development (DWR, 1997).

The second extensive Mehrten Formation unit is a dense, hard, gray tuff breccia, sometimes reported by well drillers as "lava". It is composed of angular pieces and blocks of andesite in a cemented ash matrix derived from volcanic eruptions in the Sierra Nevada. Where present, the tuff breccia acts as an aquitard and yields very little water to wells.

Based on data from DWR monitoring wells, the Mehrten Formation is at least 900 feet thick near the SIA. The dense, hard, gray tuff breccia is not present at this location.

3.2.2 Laguna and Turlock Lake Formations

The Laguna Formation of Pliocene age and the Turlock Lake Formation of early Pleistocene-age overlie the Mehrten Formation unconformably. Exposures of the Laguna are small, discontinuous, and limited to the northeastern corner of the subbasin. The Turlock Lake Formation outcrops in a wide band in the southeastern portion of the subbasin.

The Laguna and Turlock Lake formations are very similar in composition and are indistinguishable in the subsurface. They are differentiated in outcrop by the presence of a preserved clay soil horizon in the Turlock Lake Formation. The former soil profiles of the Laguna Formation have been stripped by erosion (Helley and Harwood, 1985). Both formations consist of a heterogeneous mixture of tan to brown interbedded silt, clay, and sand. They contain a few gravel lenses, which are poorly sorted and have relatively low permeability.

Sediments of these two formations are typically more fine-grained than overlying units, although it is difficult to determine subsurface boundaries from drillers' logs. Wells completed in clean Laguna Formation sands and gravels can produce significant quantities of groundwater. The combined thickness of the two units in the subbasin is probably less than 200 feet.

3.2.3 Riverbank and Modesto Formations

The Riverbank and Modesto formations of Pleistocene age are the most widely exposed geologic units in the subbasin. The easternmost exposures of the Riverbank and Modesto formations unconformably overlie the Turlock Lake, Laguna, and Mehrten formations and pre-Cretaceous metamorphic and igneous rocks. Like the Laguna and Turlock Lake formations, the Riverbank and Modesto formations are so similar as to be indistinguishable in drill cuttings. In outcrop, the Riverbank Formation has thicker argillic soil horizons and forms terraces that are topographically above Modesto terraces (Helley and Harwood, 1985).

The Riverbank and Modesto formations consist of a heterogeneous mixture of silt, sand, gravel and clay. The units exhibit large variability in grain size over short distances, both laterally and vertically. The maximum combined thickness of the two units is 50 to 75 feet in the subbasin. These units have moderate permeability on average but contain some coarser zones with high permeability (Olmstead and Davis, 1961).

3.2.4 Flood Basin Deposits and Alluvium

The youngest geologic units in the subbasin are flood basin deposits and alluvium. Laterally extensive exposures generally occur along the northern and western margins, adjacent to and within the active channels of the Bear, Feather, and Sacramento rivers. Smaller exposures occur adjacent to minor streams.

The flood basin deposits are predominantly fine-grained sediments that have accumulated in flood basins along the major rivers of the Sacramento Valley. In the subbasin, there are also a few smaller exposures north and east of Pleasant Grove. The flood basin deposits consist primarily of silt and clay, which yield little water to wells. The flood basin deposits contain local lenses of sand and gravel deposited by the migrating ancestral river channels. These lenses can yield large quantities of groundwater to wells. The thickness of the flood basin deposits in the subbasin ranges up to 100 feet (Olmstead and Davis, 1961).

The alluvium consists primarily of sand, gravel, and silt, with minor amounts of clay, deposited in Recent geologic time (last 10,000 years) by active streams flowing through the study area. The most extensive deposits occur along the Bear, Feather, and Sacramento rivers. The thickness of the alluvium is estimated at 25 to 60 feet along the Bear River (Olmstead and Davis, 1961). Thinner deposits of alluvium are also exposed along the smaller streams draining the subbasin, including Coon Creek, Auburn Ravine, and Pleasant Grove Creek. Although the alluvium is highly permeable, it is too thin to represent a significant groundwater source. Most high-yield wells completed in the recent alluvium also draw groundwater from underlying formations.

3.3 Local Hydrogeology and Groundwater Production Zones

The thickness of the fresh water-bearing deposits beneath NCMWC increases from about 1,100 feet in the northeast to about 1,400 feet in the southwest portion of the SPSP area. These deposits can be divided into upper and lower aquifer systems. The division between the two aquifer systems is inexact due to data limitations and the difficulty in accurately determining formation contacts.

DWR (1997) indicates that the upper aquifer system consists of saturated Laguna Formation and younger sediments and extends to a depth of 200 to 300 feet. Geologic data collected during construction of the Paulson production and monitoring wells the Lauppe monitoring wells suggest the division between upper and lower zones should be deeper, probably on the order of 400 feet, at least in the SPSP area. Geologic conditions are generally similar in the upper 400 feet of the aquifer system, and the water level data discussed in Chapter 4 also show that groundwater levels exhibit similar responses to a depth of about 400 feet. Therefore, for purposes of this study, the upper zone is defined as the upper 400 feet of the aquifer system, and the lower zone is assumed to extend from a depth of 400 feet to the base of fresh water.

In the Natomas Basin, the upper aquifer system generally appears to be semi-confined due to the presence of shallow clay and silt confining layers overlying the upper zone and deeper confining layers within the upper zone. Sands and gravels in the upper zone are generally thin and laterally discontinuous, and there are thick sequences of fine-grained strata between the more permeable aquifer materials. Wells completed in the upper 100 feet or so of the upper zone exhibit unconfined conditions in some areas.

The lower aquifer system consists of non-marine, Mehrten Formation deposits and includes a smaller percentage of coarse-grained sediments. However, individual coarse-grained zones in the lower aquifer are typically thicker than in the upper aquifer. In some areas, the lower aquifer is further divided into two distinct units. The upper unit is comprised of gray to black andesitic sand and associated lenses of stream gravel containing andesitic cobbles and boulders interbedded with thicker blue or brown clay. The lower unit has been described as a dense, hard, gray tuff breccia. It is composed of angular pieces and blocks of andesite in a cemented matrix of andesite, devitrified lapilli, and ash derived from volcanic eruptions in the Sierra Nevada. Based on information from DWR monitoring wells, the Mehrten Formation is at least 900 feet thick near the Sacramento Airport and the typical lower unit gray tuff does not occur at that location. The lower zone exhibits more confinement than the upper zone, but is still considered to be semi-confined. There is a delayed response to imposed stresses in the upper aquifer, indicating hydraulic interconnection between these water-bearing strata.

For the Sacramento River BWMP, DWR reviewed drillers' logs in the NCMWC service area and reported that average well depths were 149 feet for domestic wells, 313 feet for irrigation wells, 378 feet for industrial wells, and 308 feet for municipal wells (DWR, 2003c). Therefore, the majority of the wells in NCMWC extract groundwater from the upper aquifer system as defined above.

3.3.1 Paulson Production and Monitoring Wells

A multiple-completion monitoring well and a production well were installed in the southeastern portion of the SPSP area by Luhdorff and Scalmanini, Consulting Engineers (LSCE) in 2007. The well locations are shown on **Figure 3-4**, along with other wells in the vicinity of the SPSP that have either water level or water quality data. The primary purpose of installing the wells at this time was to determine groundwater quality in the SPSP area at different depths and allow an aquifer test to be conducted so that aquifer characteristics could be determined. As discussed below, a 36-hour aquifer test was conducted using these wells in July 2007. The production well was designed to be used as a water supply well after development of the SPSP begins.

The two monitoring wells were constructed in April 2007 using 2-inch polyvinyl chloride [PVC] casing to depths of 250 and 400 feet, respectively. The screened intervals of the Paulson monitoring wells are 210-220 and 230-240 feet for MW-250 and 360-370 and 380-390 feet for MW-400. The Paulson production well (PW-1) was constructed in June 2007 using 18.625-inch stainless steel casing to a depth of 408 feet. Paulson PW-1 has four separate screen sections: 185-225 feet, 265-285 feet, 325-339 feet, and 378-397 feet. As-built drawings of the Paulson production and monitoring wells are included in Appendix B, and a summary of well construction

and testing is presented in the report *Well Construction and Testing Summary of the Lennar Communities Paulson Production Well* (LSCE, 2007).

3.4 Well Yields and Aquifer Characteristics

Aquifer characteristics refer to the ability of aquifers to transmit and store groundwater. Calculations based on data from long-term, constant rate pumping tests are the preferred method for estimating aquifer characteristics. No aquifer test data for the Natomas Basin are available in the published literature, but the results of the aquifer test conducted for this study using the Paulson production and monitoring wells are summarized below.

3.4.1 Well Yields and Specific Capacities

Well yields and aquifer characteristics in the North American Subbasin were summarized by DWR (1997). A review of drillers' logs indicated that wells drilled in Sutter County since 1980 range in depth from less than a hundred to over 500 feet, with an average of 183 feet. In the Natomas Basin, DWR reviewed driller's logs that contained well yield information. The yield of these wells generally ranges from 1,000 to 2,500 gpm, with an average of about 1,900 gpm. The Sacramento River BWMP (DWR, 2003c) indicates that driller's logs for 27 irrigation wells in the NCMWC service area contained well yield information, and the average yield of these wells was 1,625 gpm.

NCMWC prepared a DWR Groundwater Storage Grant Application in 2003, which provided yield information for 13 irrigation wells, including five wells located in the SPSP. The yields of these wells ranged from 800 to 3,500 gpm, with an average of about 2,100 gpm. An industrial well in the SPSP area, the Sysco Well, has a smaller capacity than most irrigation wells (about 650 gpm). The new Paulson production well was tested at capacities ranging from 1,233 to 2,630 gpm. The test results suggest that the well will yield about 2,000 gpm on a long-term basis.

Specific capacity is the ratio of well yield to drawdown and provides a measure of productivity for both the aquifer and the well. Specific capacity is calculated as Q/s, where Q is the yield of the well in gpm and s is the drawdown in feet. Because specific capacity changes with time, it is typically estimated based on a projected 24-hour pumping period.

Specific capacity data are only available for three wells in the SPSP area. The 24-hour specific capacities of the Bianchi-1 and 2 agricultural wells are 37 and 25 gpm/ft, respectively. The 24-hour specific capacity of the Paulson production well is 23 gpm/ft.

3.4.2 Transmissivity and Hydraulic Conductivity

The ability of an aquifer to transmit water is measured by the transmissivity, which can be defined as the hydraulic conductivity (permeability) times the saturated thickness. Transmissivity is best estimated from aquifer test data, and the results of a 36-hour constant rate aquifer test conducted using the Paulson production and monitoring wells are summarized in **Table 3-1**. Plots of water level data collected during the aquifer test are presented in Appendix B. The test results were plotted on log-log plots and analyzed using the Theis (1935) method, which calculates aquifer

properties based on drawdown data from wells completed in a confined aquifer. Although there are low permeability confining layers above and below the zone in which Paulson PW-1 is completed, there is some vertical groundwater flow though these zones, which means that the aquifer is semi-confined. Although the Theis model simulates confined conditions, it produced the best curve matches because there was little evidence of vertical leakage until the end of the test. A longer test would be expected to show more indication of vertical leakage.

Transmissivity values estimated from the Paulson aquifer test data range from 43,800 to 64,700 gallons per day per foot [gpd/ft], with a mean of 56,600 gpd/ft (7,600 ft^2/day). Dividing the mean value by the total screened interval of the Paulson production well yields a hydraulic conductivity of 36 ft/day.

Aquifer test data are not available for other wells in the area, but transmissivity was estimated from specific capacity using an empirical equation for a confined aquifer: T = Q/s * 2000, where T is the transmissivity in gpd/ft and Q/s is the specific capacity in gpm/ft. Transmissivities estimated from specific capacity Bianchi wells 1 and 2 are 74,000 and 50,000 gpd/ft, respectively.

DWR developed a groundwater flow model of the Sacramento Valley in the 1970s and estimated hydraulic conductivity for the model element that includes the SPSP area to be 51 ft/day for the 30-230 foot depth zone and 28 ft/day for the 230-500 foot depth zone (DWR, 1978). The estimate of 36 ft/day based on the Paulson aquifer test falls within this range, which is appropriate since the screened interval of the Paulson production well (185-397 feet) includes part of both layers simulated with the DWR model.

3.4.3 Storage Coefficient and Storage Capacity

The ability of an aquifer to store groundwater is measured by the storage coefficient, which is defined as the volume of water that is released from or added to storage per unit surface area and per unit change in hydraulic head. For unconfined aquifers, a change in hydraulic head means a change in the elevation of the water table, and the storage coefficient is called the specific yield. Specific yields are lower for fine-grained aquifer materials, and range from about 3% for clay to 20% for unconsolidated sand or sand and gravel (Olmsted and Davis, 1961). In its online description of the North American Subbasin, DWR assumed a specific yield of 7% for the upper 200 feet of the aquifer system.

Storage coefficients in confined aquifers are much smaller, and accurate estimates are only possible based on aquifer tests in which drawdown is measured in an observation well located at some distance from the pumped well. As shown in **Table 3-1**, storage coefficients estimated from the Paulson aquifer test ranged from 8.6×10^{-4} to 1.2×10^{-3}, with a mean of 1.0×10^{-3}.

The DWR 2006 basin description (see Appendix A) contains an estimated groundwater storage capacity of 4.9 million af based on an assumed aquifer thickness of only 200 feet and a specific yield of 7%. The are no available estimates of the actual amount of groundwater in storage in the subbasin, but DWR (2003b) contains an estimate of groundwater in storage beneath the NCMWC service area from a depth of 15 feet to the base of fresh water (about 1,400 af). That estimate is 3.24 million af.

Although it has not been quantified by DWR, the total volume of groundwater in storage in the subbasin is very large. However, this volume does not indicate what portion of the storage can safely be extracted (the safe yield) to meet water demands in the subbasin. As discussed in Chapter 1, the volume of groundwater extraction cannot exceed the rate of groundwater recharge over a period of years without causing a depletion of aquifer storage.

3.4.4 Summary

Available data to determine aquifer characteristics in the North American Subbasin are limited, and the subsurface sediments are heterogeneous. Overall, the well yields, specific capacities, transmissivities, and storage coefficients calculated from the Paulson aquifer test and other data are indicative of a semi-confined aquifer containing relatively high-yielding formation materials.

4.0 GROUNDWATER CONDITIONS

4.1 Groundwater Levels

4.1.1 Groundwater Level Monitoring Program

Groundwater levels have historically been measured in a large number of wells in the North American Subbasin by DWR and other agencies. As shown in **Table 4-1**, water levels have historically been measured in over 500 wells in the North American Subbasin. Hydrographs prepared for this GSA included 242 wells monitored by DWR, 155 wells monitored by the U.S. Geological Survey (USGS), 85 wells monitored by SGA members, 19 wells monitored by entities that provide data to the State Water Resources Control Board (SWRCB), and five wells monitored by private parties. These totals include all wells monitored by DWR and the USGS in the subbasin, but the data provided by SGA only includes wells north of Interstate 80. SGA member agencies measured water levels in more than 200 wells in the subbasin, and the SWRCB's Geotracker database contains data for hundreds of mostly shallow monitoring wells. In recent years, the total number of wells monitored by state and federal agencies has been greatly reduced. In 2006, there were only 97 wells monitored by DWR and 13 wells monitored by the USGS in the subbasin.

4.1.2 Evaluation of Groundwater Level Hydrographs

Groundwater Levels in the North American Subbasin

All available water level data were compiled into a database and hydrographs generated for about 500 wells. The locations of these wells are shown on **Figure 4-1**. A total of 362 hydrographs are included in Appendix C, including 79 wells in the Natomas Basin. Not included in this set of hydrographs are wells with less than three water level measurements. When well construction information was available, wells shown on this map are classified as perforated in the upper zone (<400 feet in depth), the lower zone (>400 feet in depth), or multiple zones (perforated in both zones or well depth >400 feet with no perforation information). Wells with no construction information are classified as "unknown zone" on **Figure 4-1**. The depth zones are identified by color, and symbol shapes on the map indicate the monitoring entity. Wells with water level data in and near the SPSP area were also shown on **Figure 3-4**.

Examination of the hydrographs in Appendix C indicates that groundwater conditions vary considerably across the subbasin. In general, groundwater levels have been high and relatively stable in the northern and western portions of the subbasin, including the western portion of NCMWC. This is in contrast to the central, eastern, and southern portions of the subbasin where groundwater level declines have occurred in most wells. Representative hydrographs from each of these areas are discussed below.

In the northwestern portion of the subbasin, north of NCMWC, wells such as 13N/04E-16N1 have experienced high and relatively stable water levels since the late 1940s. Only in 1977 did spring groundwater levels drop to more than 20 feet below ground surface (bgs) in this well. East of this area, water levels have been much more variable in wells such as 13N/05E-17R1 south of

Wheatland. Spring depths to water declined from less than 20 feet bgs in 1949 to about 60 feet bgs in the early 1960s but had recovered fully by the mid-1970s due to surface-water deliveries from Camp Far West Reservoir. Water levels declined again during the 1976-1977 drought but had recovered to 1949 levels by the mid-1980s. Since that time, spring water levels have continued to rise and have been above 15 feet bgs for most of the last ten years.

The central portion of the subbasin is one of the areas where chronic groundwater level declines have been identified in DWR (1997) and other reports. East of the SPSP area, well 11N/05E-29G2 is one of very few wells in the subbasin showing declining groundwater levels from the early 1950s to the present with no recovery or stabilization in recent years. Spring depths to water declined from less than 30 feet bgs in 1950 to about 107 feet bgs in 2007, and it appears that groundwater levels are still declining in the vicinity of this well. Groundwater levels in most other wells in the central portion of the subbasin have stabilized at a lower level (an elevation of approximately –25 feet msl). The McClellan AFB area, which experienced large groundwater level declines historically, has shown stable groundwater levels in recent years. Spring groundwater levels at well 10N/5E-14Q2 north of McClellan AFB declined from about 50 feet bgs in the mid-1950s to about 120 feet bgs in the early 1990s. Since that time, however, water levels have generally stabilized at about 115 feet bgs (an elevation of –30 feet msl).

In the eastern portion of the subbasin, groundwater levels in the Roseville area show a similar pattern of historical water level declines followed by stabilization in recent years. Well 10N/06E-10C1 experienced groundwater level declines totaling about 70 feet from the late-1940s until 1997. For the last ten years, water levels have been stable with some recovery. In the southeastern portion of the subbasin, groundwater levels in the Carmichael area also showed historical declines. At well 09N/06E-27D1, groundwater levels declined by about 25 feet from the early 1960s to the early 1990s. The rate of groundwater level decline decreased after 1990, and water levels have been stable since 2001.

Groundwater Levels in and Near the SPSP Area

Selected hydrographs for wells in and near the SPSP area are shown on **Figure 4-2**. These hydrographs show the variability of groundwater conditions in the vicinity of the SPSP. Some wells, such as wells 10N/04E-23A1 south of the SPSP and 11N/04E-09D2 in the northern portion of the Natomas Basin, show relatively stable groundwater levels from the 1950s to the present. Recent spring depths to water were about five feet bgs in well 23A1 and three feet bgs in well 09D2. Seasonal fluctuations typically ranged from one to ten feet in well 23A1 and two to 12 feet in well 09D2.

Wells 10N/04E-02K1 and 11N/04E-34N01 are the only wells in the SPSP area that have long periods of record of historical water level data. The spring depth to water was about 20 feet in well 02K1 when water level measurements began in 1953. Spring groundwater levels generally declined until the late 1970s, reaching a low of about 38 feet bgs in 1977. Spring water levels rose from 1980 to the present, reaching about 18 feet bgs by 2001. Seasonal water level fluctuations range from about two to 15 feet. Well 34N01 has water level data from 1968 to the present, and spring depths to water have generally been less than 20 feet bgs throughout the period of record. Spring groundwater levels were fairly constant from 1969 to the mid-1980s, ranging from about 12 to 20 feet bgs, and increased to about eight feet by 2006. Seasonal fluctuations were two to

seven feet during most years. Slightly greater seasonal fluctuations (about 12 feet) during 1977-1978 were partly due to more frequent water level measurements during those years. Summer water level measurements are not available in other years because the monitoring frequency is semi-annual (spring and fall).

Wells east of the SPSP area, such as 10N/04E-12A1 and 10N/05E-08L2, experienced larger groundwater level declines from 1950 to the early 1980s, followed by stabilization but limited or no recovery. The spring depth to water in well 12A1 declined from about 21 feet in 1948 to about 71 feet in 1981, and has since recovered to about 44 feet bgs in 2005. Seasonal fluctuations range from about one to 15 feet in this well. In well 08L2, the spring depth to water declined from about 21 feet in 1949 to about 80 feet bgs in 1980. Since that time, groundwater levels have been stable with minor fluctuations but limited recovery until 2007 when water levels recovered to 1979 levels. Seasonal fluctuations are typically about five feet in this well.

Groundwater Levels in Multiple-Completion Monitoring Wells in the Natomas Basin

Water level data for the lower zone are limited in the subbasin, but there are five multiple-completion monitoring well sites in or adjacent to the Natomas Basin. Four of these contain both upper and lower zone completions, and data from these wells indicate hydraulic head differences between zones and the extent of aquifer confinement in the lower zone. Three of these multiple-completion monitoring well sites were installed by DWR and have been monitored for at least the last ten years. The other two sites (Paulson and Lauppe) were installed by LSCE in April 2007 and April 2006, respectively, and do not have long-term data.

Figure 4-3 shows hydrographs for the three DWR multiple-completion monitoring well sites. The northernmost DWR well site, 11N/04E-04N, is located just north of the northern tip of the Natomas Basin near the Sutter Extensometer and consists of four completions with perforated intervals of 110-120 feet bgs (04N4), 185-195 feet bgs (04N3), 295-305 feet bgs (04N2), and 880-890 feet bgs (04N1). These wells have a period of record from 1994 to 2005, and water levels in all completions have been stable during this period. Water levels in the two shallowest completions are very similar, and water levels in the 295-305 completion (04N2) were similar during the spring but show slightly more drawdown during the summer months. Seasonal fluctuations in 04N2 are about 10 to 15 feet during most years. Water levels in 04N1, completed in the lower zone from 880 to 890 feet, are about 10 to 15 feet lower than in the three shallower completions during the spring. Seasonal fluctuations are slightly greater in 04N1, ranging from 15 to 20 feet during most years.

The central DWR monitoring well site, 10N/04E-27R, is located about 3½ miles south of the SPSP area in the east-central portion of the Natomas Basin and consists of three completions with perforated intervals of 190-210 feet bgs (27R4), 470-490 feet bgs (27R3), and 745-985 feet bgs (27R2). These wells have a period of record from 1996 to the present. There was about ten feet of water level decline in the only upper zone completion (27R4), with seasonal fluctuations of three to five feet during most years. Other upper zone wells in the southern portion of the Natomas Basin also exhibit this declining water level trend. Spring water levels in the middle completion, 27R3, were about ten feet lower than in 27R4 in 1997, but this head difference had decreased to about six feet by 2007. Spring water levels in the deepest completion (27R2) were 21 to 30 feet lower than in 27R3. Water levels in 27R2 declined by about eight feet from 1997 to 2000, and

there was about seven feet of recovery from 2000 to 2007. Seasonal fluctuations were greatest in this well, ranging from five to ten feet during most years.

The southern DWR monitoring well site, 10N/04E-31M, is located south of the SIA in the western portion of the Natomas Basin. This site contains four completions with perforated intervals of 170-190 feet bgs (31M4), 380-400 feet bgs (31M3), 795-805 feet bgs (31M2), and 1,060-1,070 feet bgs (31M1). These wells have a period of record from 1997 to 2007, and water levels have been relatively stable in all completions during this period. Spring water levels were similar in the two upper zone completions (31M4 and 31M3), but 31M3 showed more drawdown during the summer months. Well 31M3 has the largest seasonal fluctuations (up to ten feet), which suggests that more pumping in the area occurs from that zone. Spring water levels were about 10 to 12 feet lower in the shallower of the two lower zone completions, 31M2, and another 15 feet lower in the deepest completion, 31M1.

The other two multiple-completion monitoring wells in the Natomas Basin are Paulson monitoring wells in the SPSP area and the Lauppe monitoring wells west of the SPSP. These wells do not have historical water level data, but short-term hydrographs are included in Appendix B. There are two completions at each location, and the Paulson monitoring wells are completed from 210 to 240 and 360 to 390 feet bgs. The hydrographs of these wells show that water levels were four to six feet lower in the deeper completion. At the Lauppe site, monitoring wells are completed from 180 to 235 and 420 to 430 feet bgs, and water levels were four to five feet lower in the deeper completion.

The hydrographs discussed above are indicative of semi-confined conditions with a relatively good hydraulic connection between zones at all five multiple-completion monitoring well sites in the Natomas Basin. The lower zone is more confined than the upper zone, and there is a downward vertical gradient for groundwater flow at each site. At two of the DWR sites, seasonal fluctuations were largest in the deepest wells. The southernmost site, 10N/04E-31M, was the exception with more seasonal fluctuation in the well completed at the bottom of the upper zone. The Paulson and Lauppe wells had insufficient data to show seasonal fluctuations. At all three DWR sites, there is a lag in the timing of seasonal fluctuations between the upper and lower zones. This is particularly apparent at the 10N/04E-31M site, where lower zone groundwater levels lag upper zone groundwater levels by about two months. That lag is another indication of increased confinement of the lower zone.

4.1.3 Evaluation of Groundwater Elevation Contour Maps

Groundwater elevations and flow directions in the SPSP area are illustrated on groundwater elevation contour maps. DWR prepared nine spring water level contour maps for its *Feasibility Report, American Basin Conjunctive Use Project* (DWR, 1997), including contour maps for 1950, 1960, 1965, 1970, 1977, 1980, 1985, 1990, and 1992.

DWR (1997) notes that groundwater generally flowed in a southwesterly direction (from the foothills toward the axis of the valley) under pre-development conditions. Groundwater levels began to decline during the 1940s (or earlier), and the 1960 water level contour map shows that three pumping depressions had started to develop by 1960. From north to south, these were located east of Nicolaus, near Pleasant Grove, and near the eastern boundary of NCMWC along

the Sutter-Sacramento County line. By 1965, the pumping depression east of Nicolaus had largely disappeared, but the pumping depression near Pleasant Grove had deepened and merged with that along the eastern boundary of NCMWC. The center of the pumping depression reached a maximum depth of –30 feet msl about 1980, and the 1980 DWR contour map is shown on **Figure 4-4**. This map also shows the northern portion of the pumping depression beneath McClellan Air Force Base (AFB) in Sacramento County.

The pumping depression in southeastern Placer County was centered about three miles east of the SPSP area two miles south of Pleasant Grove in 1980. It is linked with three deeper pumping depressions in Sacramento County, which are shown on a Fall1997 groundwater elevation contour map prepared by the Sacramento County Water Resources Division (**Figure 4-5**). This map shows the major pumping depressions centered beneath McClellan AFB, the City of Elk Grove, and east of the City of Galt. The Elk Grove pumping depression is the largest and deepest of the three, with a groundwater elevation below –70 feet msl at the center. The Placer County and McClellan AFB pumping depressions are located in the North American Subbasin; the other two depressions are located in the South American Subbasin.

The DWR and Sacramento County groundwater elevation contour maps were developed using data from wells of variable and often unknown perforated intervals. These composite maps must be considered approximations that do not reflect the fact that wells of different depths can have significantly different groundwater elevations. As discussed above for the hydrographs of multiple-completion monitoring wells shown on **Figure 4-3**, deeper wells in the area have lower groundwater elevations than shallower wells because most irrigation and M&I pumping occurs from deeper zones and these zones are more confined. Zone-specific groundwater elevation contour maps were prepared for this study, as discussed below.

Water level data for wells completed in the upper and lower zones were evaluated to select periods with sufficient data for contouring purposes. Because there are many more upper zone wells, five contour maps were prepared for that zone. Only one contour map was prepared for wells completed in the lower zone, it also includes data for multiple zones. Both historical and recent periods were selected to show changes in groundwater elevations and flow directions over time. Periods selected for groundwater contour maps and the number of wells used for each map are as follows:

- Upper zone: Spring 1980 – 95 wells (**Figure 4-6**),
- Upper zone: Spring 1992 – 52 wells (**Figure 4-7**),
- Upper zone: Spring 2001 – 61 wells (**Figure 4-8**),
- Lower (and multiple) zones: Spring 2001 – 29 wells (**Figure 4-9**),
- Upper zone: Spring 2003 – about 90 wells (**Figure 4-10**),
- Upper zone: Spring 2003 – Natomas Basin (**Figure 4-11**).

The Spring 1980 groundwater elevation contour map for the upper zone (**Figure 4-6**) shows that groundwater elevations in the SPSP area ranged from about 10 feet msl in the center to –20 feet msl along the eastern edge. The gradient for flow is relatively steep in this area (approximately 20 feet/mile). This is much steeper than the hydraulic gradient in the western portion of NCMWC near the Sacramento River. The direction of groundwater flow is easterly toward the pumping depression in southeastern Placer County, which has a minimum elevation of about –30 feet msl.

The easterly groundwater flow direction in the eastern half of the SPSP is also indicated on contour maps for later years as discussed below. There are no contours in the western half of the SPSP due to a flatter gradient and lack of data, but it is assumed that the flow direction is also easterly in this area. In the eastern portion of the subbasin, groundwater flow is westerly toward the pumping depressions.

The Spring 1992 groundwater elevation contour map for the upper zone (**Figure 4-7**) shows that groundwater elevations in the eastern half of the SPSP area rose slightly from the 1980 levels, with the minimum elevation in the southeastern corner of the SPSP area increasing to –10 ft feet msl. By 1992, the pumping depression east of the SPSP area had shifted to the southeast, but the minimum elevation of about –30 feet msl was unchanged.

The Spring 2001 groundwater elevation contour map for the upper zone (**Figure 4-8**) shows that groundwater elevations in the eastern half of the SPSP area continued to rise, ranging from about 10 feet msl in the center to –5 feet msl along the eastern edge. By 2001, the pumping depression in southwestern Placer County had deepened to a minimum elevation of –40 feet msl.

The Spring 2001 groundwater elevation contours for the lower and multiple zones (**Figure 4-9**) have a similar shape to the upper zone contours for the same time period. In the eastern half of the SPSP area, groundwater elevations were slightly lower in the lower zone, ranging from 0 to –10 feet msl. The pumping depression in southwestern Placer County and northern Sacramento had the same minimum groundwater elevation as the upper zone (–40 feet msl), but the area encompassed by the –40 foot contour was larger in the lower zone.

The Spring 2003 groundwater elevation contour map for the upper zone (**Figure 4-10**) shows additional water level recovery in the eastern portion of the SPSP area, with groundwater elevations ranging from about 10 feet msl in the center of the SPSP to sea level along the eastern edge. This map was prepared for a study of the potential groundwater impacts of slurry cutoff walls proposed by SAFCA for two reaches of the Sacramento River east levee (LSCE, 2008). [Note: A second phase of this study, currently underway, is assessing the potential affects of all slurry cutoff walls proposed for levees that surround the Natomas Basin.] **Figure 4-10** includes data from 13 piezometers (with screened intervals ranging from 20 to 90 feet below ground surface) installed by the U.S. Army Corps of Engineers along the Sacramento River east levee in the Natomas Basin for previous investigations of seepage beneath the levee. By 2003, the minimum groundwater elevation in the pumping depression in southwestern Placer County had increased by five feet to about –35 feet msl. This suggests that water levels may be stabilizing in this area.

In order to provide additional detail on groundwater elevations and flow directions in the Natomas Basin, the Spring 2003 water level data were also contoured with a contour interval of two feet. The resulting map, shown on **Figure 4-11**, confirms that the direction of groundwater flow is easterly across most of the Natomas Basin. All reaches of the Sacramento River appear to be losing in Spring 2003. A losing reach occurs when the river stage is higher than groundwater levels adjacent to the river, which results in recharge from the River to the aquifer, but the magnitude of the hydraulic gradient near the River gradually increases from north to south. In the northern portion of the Natomas Basin, the hydraulic gradient for flow away from the River is less

than three ft/mile. In the southern portion, the easterly hydraulic gradient increases to about nine ft/mile.

The study of the proposed slurry cutoff walls conducted for SAFCA evaluated hydrographs of groundwater elevations in shallow piezometers and estimated Sacramento River stages to assess seasonal variations in gaining and losing conditions (LSCE, 2008). During the winter, when the River stage is high, all hydrographs for the period January 2002 to July 2006 show losing conditions and steep gradients for groundwater flow away from the River. Gaining conditions are most likely to occur during the summer and fall when the River stage is lowest and recharge from rice irrigation keeps shallow groundwater levels high.

4.1.4 Overdraft

Overdraft occurs in a groundwater basin when extraction exceeds recharge on a long-term basis. If water levels eventually recover or stabilize at a lower level, overdraft is no longer occurring since recharge is equal to or greater than extraction. DWR's current basin description for the North American Subbasin (Appendix A) discusses declining groundwater levels in the subbasin but does not contain an explicit finding of overdraft. One DWR bulletin that contains a finding of overdraft is the *California Water Plan Update, Bulletin 160-98* (DWR, 1998b). That bulletin states: "Two areas of overdraft exist in Sacramento County, one near McClellan Air Force Base and the other in the Elk Grove area." As noted above, McClellan AFB is in the North American Subbasin but Elk Grove is not. Overdraft in Placer County is also referenced in Bulletin 160-98 relative to changes in groundwater conditions expected to occur by 2020: "Some increases in groundwater overdraft are expected in Sacramento, Placer, and El Dorado Counties of the Sacramento River Region."

The review of groundwater level hydrographs in the North American Subbasin discussed above shows that there have been large groundwater level declines in the central and eastern portion of the subbasin beginning with the first available water level measurements (typically in the 1950s). These groundwater level declines resulted in the large pumping depressions discussed above and were considered to represent overdraft while they were occurring. In most cases, however, these declines have been followed by partial recovery or stabilization at a lower level, typically in the 1980s or 1990s. This means that the previously defined overdraft conditions have abated in most areas. That is the case for McClellan AFB area, where the historical overdraft that began in the 1950s appears to have abated since the early 1990s as water levels stabilized. In the Roseville area, a similar stabilization occurred in the late 1990s. One of the areas where overdraft appears to be continuing is the central portion of the subbasin east of the SPSP area in southwestern Placer County. Due to the proximity of this overdrafted area to the SPSP, there is concern about the potential effect of the project on groundwater levels in this area. The potential effect of the project and the cumulative effect of the project and other future pumping on groundwater levels in the North American Subbasin and especially in southwestern Placer County, is discussed in Chapters 6 and 7.

The SGA GMP discusses chronic groundwater level declines in the central portion of the subbasin and notes that "historic groundwater extractions resulted in a net depletion of groundwater stored under the SGA area." The GMP proposes two primary mitigation measures to ensure a sustainable groundwater supply:

- Conjunctive Management Activities – The Western Placer County GMP states that "[r]ecent conjunctive use activities have resulted in providing new surface-water supplies to these areas. Although water purveyors in the region will rely more heavily on groundwater during dry periods, the net increase in available surface [water] will result in a maintained or improved amount of groundwater in storage in the basin over the long term…. The SGA and RWA members are committed to expanded conjunctive use operations and are investigating a variety of ways of recharging water into the available storage space in the basin."

- Demand Reduction – Increased water conservation and use of recycled water are also cited as ways to reduce potable water demand to stay within the sustainable yield of the basin.

The Western Placer County GMP states: "Generally, the documents reviewed describe conditions of overdraft in southwestern Placer County and northern Sacramento County". It also notes that three wells in southern Placer County had exhibited groundwater level declines from the late 1940s until water levels stabilized between 1980 and 1997. "All three of these wells now exhibit stabilized groundwater elevations implying that the basin is in a state of equilibrium." In order to ensure that groundwater supplies are sustainable, the GMP proposes similar actions as the SGA GMP:

- Conjunctive Management Activities – The GMP states that "[r]ecent conjunctive use activities have resulted in providing new surface-water supplies to these areas. Although water purveyors in the region will rely more heavily on groundwater during dry periods, the net increase in available surface [water] will result in a maintained or improved amount of groundwater in storage in the basin over the long term…. The SGA and RWA members are committed to expanded conjunctive use operations and are investigating a variety of ways of recharging water into the available storage space in the basin."

4.1.5 Summary

Groundwater conditions vary considerably across the subbasin. Groundwater levels have been high and relatively stable in the northern and western portions of the subbasin. This is in contrast to groundwater level declines that have occurred in much of the central, eastern, and southern portions of the subbasin. Overdraft has occurred historically in these areas and appears to still be occurring in the central portion of the subbasin east of the SPSP area. In recent years, groundwater levels have stabilized in other areas where historical overdraft has been reported. This suggests that overdraft conditions have abated in most of the subbasin. Groundwater levels are generally higher in the upper zone, creating a downward gradient for vertical flow.

In the Natomas Basin, groundwater levels have generally been high and relatively stable in the northern and western portions but have declined in recent years in the southern portion. Groundwater levels along the eastern edge of the Natomas Basin show historical declines followed by stabilization. Groundwater levels in this area are significantly affected by the cones of depression centered a few miles to the east. The direction of groundwater flow is easterly toward these pumping depressions, and the gradient for flow is relatively steep in this area.

Water level data are limited in the SPSP area, but groundwater levels appear to have been consistently high (generally within ten feet of the ground surface in the spring) and relatively stable in recent years. Similar to the rest of the Natomas Basin, groundwater levels near the eastern edge of the SPSP area are significantly affected by the cone of depression centered about three miles to the east.

4.2 Land Subsidence

Land subsidence is the lowering of the ground surface through compaction of compressible, fine-grained strata. It is most often caused by pumping from unconsolidated, interbedded aquifer-aquitard systems, but can also be caused by other factors such as extraction of oil and gas. Compaction can be fully reversible (elastic) or permanent (inelastic). Elastic compaction and expansion generally occur in response to seasonal groundwater level fluctuations. Inelastic compaction is most likely to occur when groundwater levels reach new historical lows during the summer or do not recover fully during the winter. Although land subsidence is most likely to occur in the areas with the largest groundwater level declines, some areas are more susceptible to subsidence than others because of geologic conditions.

Monitoring of land subsidence has been limited in the North American Subbasin. Historically, land subsidence was monitored along transects by comparing periodic spirit level surveys conducted by the USGS and the National Geodetic Survey (NGS). In the mid-1980s, a transition was made from spirit level surveys to global positioning system (GPS) surveys. GPS surveys were conducted in the southern portion of the Sacramento Valley from 1985 through 1989 (Blodgett et al., 1990; Ikehara, 1994). Like spirit level transects, GPS monitoring of subsidence relies on periodic resurveying of a network of monuments. The accuracy of GPS surveys has gradually improved and is currently on the order of plus or minus one centimeter.

Ikehara (1994) estimated subsidence rates in the southern Sacramento Valley by comparing 1989 GPS survey data with historical data from spirit level transects. Although the accuracy of the 1989 survey (plus or minus 0.1 meter) was much less than more recent GPS surveys (Ikehara, 2004, pers. comm.), these are the best available data to estimate subsidence prior to 1989 at multiple locations. As shown on **Figure 4-12**, almost all monuments with historical data that were resurveyed in 1989 showed significant subsidence, with a maximum of 5.4 feet reported at one of the Yolo County sites. There are five subsidence monuments in the North American Subbasin shown on **Figure 4-12**. The maximum subsidence reported in the subbasin was 2.4 feet between 1949 and 1989 north of Roseville in Placer County. The only subsidence monument in the Natomas Basin is near the SIA, and 1.9 feet of subsidence was reported at this location between 1959 and 1989.

Land subsidence is also monitored at specific locations using borehole extensometers. Extensometers are typically more accurate than GPS monitoring stations but only measure compaction occurring within a specific depth zone. The Sutter Extensometer, located at the northern tip of the Natomas Basin as shown on **Figure 3-4**, is the only extensometer in the North American Subbasin. This extensometer is operated by DWR and is located adjacent to the DWR multiple-completion monitoring wells at 11N/04E-04N. The Sutter Extensometer is a pipe extensometer that measures compaction from the ground surface to its total depth of 780 feet.

The Sutter Extensometer began operation in April 1994, and **Figure 4-13** shows the compaction/expansion data through March 2007. Also shown on this plot are water levels for the deepest adjacent monitoring well (11N/04E-04N1), which is perforated from 880 to 890 feet. The compaction data show elastic compaction ranging from 0.015 to 0.02 feet during most years. There was a small amount of inelastic compaction each year between 1995 (the first full year of operation) and 2001, followed by expansion from 2001 to 2006. As expected, inelastic compaction generally occurred during years of large drawdowns and declining water levels, while expansion occurred during periods of smaller drawdowns and rising water levels. The cumulative land subsidence from Spring 1995 to Spring 2006 shown on **Figure 4-13** is 0.017 foot, and the average rate of subsidence is 0.0015 foot per year.

Subsidence at the Sutter Extensometer has been relatively small as expected given high and relatively stable groundwater levels at this location. Subsidence in the SPSP area would also be expected to be small for the same reasons. Much more subsidence probably occurred further east in areas of large water level declines and historical overdraft. The subsidence reported north of Roseville on **Figure 4-12** (2.4 feet from 1949 to 1989) provides an indication of the likely magnitude of subsidence in the central and eastern portion of the subbasin.

4.3 Groundwater Quality

4.3.1 General Minerals and Inorganics

Groundwater quality throughout the subbasin is discussed in several reports, including the *Feasibility Report, American Basin Conjunctive Use Project* (DWR, 1997). Groundwater quality in the majority of the North American Subbasin is suitable for all uses, but water quality is generally poorer in the western portion of the subbasin, along the Sacramento and Feather Rivers. DWR's online basin description (Appendix A) indicates that the area east of the Sacramento and Feather Rivers extending from the SIA north to the Bear River contains elevated concentrations of a number of naturally occurring constituents, including total dissolved solids (TDS), chloride, sodium, bicarbonate, arsenic, and manganese. There are also areas where significant groundwater contamination has occurred, including the former McClellan AFB, the Union Pacific Railroad Rail Yard in Roseville, and the Aerojet Superfund Site.

The evaluation of groundwater quality conducted for this study focused on wells in and near the SPSP area, as shown on **Figure 3-4**. That figure shows 63 wells with water quality data, which were obtained from various sources and compiled into a database. Water quality data were obtained from the following sources: USGS (34 wells), DWR (20 wells), California Department of Public Health (DPH) (3 wells), and LSCE (6 wells). All available general mineral data for these wells are summarized in **Table D-1** in Appendix D, and data for metals and other trace elements are summarized in **Table D-2**.

The data for individual wells shown in Appendix D are also summarized in **Table 4-2**, which shows the range and median value for each constituent, classified by zone. Groundwater salinity is low in most wells, but tends to be slightly higher in the upper than the lower zone. Median TDS concentrations were 342 mg/L in the upper zone, 335 mg/L in the lower zone, and 315 mg/L for wells completed in multiple or unknown zones. The pattern of slightly lower salinity with depth also occurs at the Paulson monitoring wells in the SPSP area, where the TDS concentrations were

260 and 220 mg/L at the shallower and deeper completions, respectively. The pattern is reversed at the Lauppe monitoring wells located northeast of the Paulson wells. From shallow to deep, TDS concentrations in the three Lauppe wells are 180, 210, and 280 mg/L, respectively. The TDS concentration at the Paulson production well was 220 mg/L.

Results are similar for electrical conductivity (EC), which is another measure of salinity. EC values for wells in and near the Natomas Basin are plotted on **Figure 4-14**. This figure and **Figure 4-15** cover a larger geographic area and include additional wells not shown in Appendix D or **Table 4-2**. The geographic distribution of EC is most apparent for the upper zone due to the larger number of wells. The easternmost wells have the lowest EC values (<250 µmhos/cm), and higher EC values (>750 µmhos/cm) generally occur in the western and southern portions of the Natomas Basin. In the SPSP area, most wells have EC values between 250 and 500 µmhos/cm, which is indicative of low salinity groundwater. Only one well in the SPSP area had an EC value above 500 µmhos/cm. There are insufficient data for the lower zone to draw conclusions about the geographic distribution of salinity, but DWR's multiple-completion monitoring wells near the SIA in the western portion of the Natomas Basin had the highest EC values reported for the lower zone.

As indicated by DWR (1997) and other reports, trace elements such as arsenic also tend to be present in higher concentrations along the western edge of the subbasin. The horizontal and vertical distribution of arsenic in groundwater is shown on **Figure 4-15**. Similar to EC, more arsenic data are available for the upper zone, and concentrations in this zone are quite variable across the Natomas Basin. Arsenic concentrations are generally higher in the western and central portions of the Natomas Basin, except for a few wells along the Sacramento River that had lower concentrations. Arsenic concentrations were also low in the southeastern corner of the Natomas Basin, and were lowest in wells located east of the Natomas Basin. There were insufficient data available for the lower zone to identify geographical differences in this zone.

In contrast to salinity, **Table 4-2** shows that concentrations of arsenic and some other trace elements tend to be lower in shallower wells than in deeper wells. The median arsenic concentrations were 13 µg/L for the upper zone, 27 µg/L in the lower zone, and 23 µg/L for wells completed multiple or unknown zones. This was also the case for the Paulson monitoring wells in the SPSP area, where the arsenic concentrations were 12 and 24 µg/L at the shallower (210-240 feet bgs) and deeper (360-390 feet bgs) completions, respectively. At the Lauppe monitoring wells, the shallowest (180-235 feet bgs) and deepest (960-1045 feet bgs) completions had low arsenic concentrations (4 µg/L), while the middle completion (420-430 feet bgs) had an arsenic concentration of 29 µg/L. At the Paulson production well, the arsenic concentration was 14 µg/L. Water from this well will require treatment because it is above the primary maximum contaminant level (MCL) of 10 µg/L for arsenic. Due to the prevalence of arsenic in groundwater in the Natomas Basin, treatment will likely be required for the other SPSP M&I wells also.

Manganese is the other trace element that tends to be elevated in groundwater from wells near the SPSP area. **Table 4-2** shows that the median manganese concentrations were similar in the upper and lower zones (97 and 103 µg/L, respectively), but higher (154 µg/L) for wells completed in multiple or unknown zones. Manganese concentrations at the Paulson monitoring wells were 56 and 65 µg/L at the shallower and deeper completions, respectively. At the Lauppe monitoring wells, manganese concentrations were similar in the shallow and middle completions (55-56 µg/L)

and much higher in the deepest completion (170 µg/L). At the Paulson production well, the manganese concentration was 47 µg/L. Although this concentration is currently below the secondary MCL of 50 µg/L, treatment will likely be required at this and other SPSP M&I wells.

4.3.2 VOCs and Other Contaminants

Previous reports have summarized available data for organic compounds and other manmade contaminants in the North American Subbasin. Because the northern portion of the subbasin is primarily agricultural, DWR (1997) focused its evaluation of contaminants on about 50 wells that had been sampled for pesticides. Either Bentazon or Simazine was detected in nine wells, one of which is located in the Natomas Basin south of the SPSP area. The other eight wells are located in the northern portion of the subbasin, north of the NCMWC service area.

The USGS also evaluated contamination in the North American Subbasin as part of its study entitled *Ground-Water Quality in the Southeastern Sacramento Valley Aquifer, California, 1996* (Dawson, 2001). Ten wells included in that study are located in the subbasin, and pesticides were detected in three of these wells. One well was located in the west-central portions of the subbasin and two wells in the northwestern portion. Volatile organic compounds (VOCs) were detected in four wells located in the northern, eastern, and southwestern portion of the subbasin.

The SWRCB's Geotracker database contains data for hundreds of monitoring wells in the North American Subbasin that have been installed to track groundwater contamination at state regulated sites. The majority of these are gas stations and other small leaky underground storage tank sites; large Superfund sites such as the former McClellan AFB are not included. Most of the SWRCB sites are located in urban areas in the southern and eastern portions of the subbasin.

The SWRCB database contains data for one site in the SPSP area, the Holt of California (Holt) site on Pacific Avenue. Groundwater contamination at this site resulted from leaking underground storage tanks that had been removed by 1992. Site characterization activities have included the installation of 19 monitoring wells. Contaminants in shallow groundwater at the site include petroleum hydrocarbons, fuel oxygenates such as methyl tertiary butyl ether (MTBE), and VOCs. A pump-and-treat system with two extraction wells was installed for remediation in 2005, but was temporarily removed from service in February 2006. Available data suggest that groundwater contamination is localized in the vicinity of the former underground tanks and has not spread offsite. However, the vertical extent of the contamination is unknown because all monitoring wells at the site are less than 50 feet deep. It will be important for wells installed to meet M&I water demands in the SPSP area to maintain sufficient distance from this site. The closest proposed M&I well in the eastern well field shown on **Figure 2-5** is approximately 3,000 feet away from the Holt site, and no M&I wells would be located downgradient of the site.

5.0 GROUNDWATER FLOW MODEL

A pair of existing numerical groundwater flow models were used to evaluate the impacts of the SPSP project on groundwater conditions in the North American Subbasin. The models are based on the Integrated Groundwater and Surface Water Model (IGSM) platform developed by Montgomery Watson Harza Global, Inc. (MWH) in the 1990s. The Sacramento County IGSM is referred to as the SACIGSM and was originally developed by MWH in 1993. The SACIGSM was updated in 1995, 2005, and 2007. The IGSM model for the Sutter/Placer County portion of the North American Subbasin, which includes the SPSP, is referred to as the North American River (NAR) IGSM and was originally developed by MWH in 1995. The NARIGSM was subsequently updated by DWR (1997) and MWH (2001). The SACIGSM and NARIGSM models cover the North American Subbasin and are the only calibrated groundwater flow models that encompass a large enough area to simulate all potential project-related groundwater and surface-water impacts. Although there are limitations to these models, they are well documented and generally accepted by local water purveyors and state agencies. More background on the SACIGSM and NARIGSM models is provided below.

For purposes of the SPSP evaluation of potential project pumping impacts, including locally and regionally in the North American Subbasin, WRIME linked the NARIGSM and SACIGSM models and used them to simulate the effect of variations in the rate, timing, and location of SPSP pumpage and also other pumpage as identified for the study area for a 35-year horizon and under different water year types.

5.1 Numerical Model

IGSM is a finite element, quasi three-dimensional numerical groundwater flow model that simulates all major components of the hydrologic cycle. These include precipitation, runoff, evaporation, consumptive use, groundwater recharge, groundwater extraction and injection, and subsurface inflow and outflow along the model boundaries. As indicated in the model name, the simulation also includes interactions between surface water (streams and lakes) and groundwater. The primary components of the groundwater budget are:

Inflows

- Deep percolation from rainfall and irrigation applied water;
- Recharge due to stream seepage;
- Recharge from other sources such as irrigation canals and recharge ponds;
- Boundary inflows from outside the model area; and
- Subsurface inflows from adjacent subregions.

Outflows

- Groundwater pumping;
- Outflow to streams and rivers;
- Subsurface outflows to adjacent subregions; and
- Boundary outflows.

5.1.1 Model Objectives

The NARIGSM and SACIGSM models were used to evaluate potential groundwater and surface-water impacts of the SPSP project. The potential impacts assessed include:

- The effect of land use changes in the SPSP area on groundwater recharge;
- Groundwater level drawdown due to project pumping;
- The effects of project pumping on the cone of depression east of the project area;
- Impacts to streamflow in the Sacramento River;
- Analysis of whether any "new" groundwater developed for and used by the project is sufficiently replenished (recharged) to avoid chronic groundwater level declines; and
- The cumulative impacts of the project and other existing and proposed developments in the Natomas area.

5.1.2 Sacramento County IGSM Model

The Sacramento County IGSM model covers most of Sacramento County but also includes the northern part of San Joaquin County and the western part of Amador County (**Figure 5-1**). The northern portion of the SACIGSM, which is bounded on the north by Sutter and Placer Counties and on the south by the American River, recently underwent a comprehensive overhaul, including refinement of spatial and temporal data sets and model code features (WRIME, 2007). Improvements to the northern area of the SACIGSM model included:

- Updating the hydrology for the calibration period (1970 to 1995) from monthly to daily;
- Extending the simulation period to 2004;
- Refining the model grid to improve the model simulation, particularly along stream nodes where recharge to the aquifer system is or may be occurring;
- Adding additional calibration wells to increase the number of groundwater elevation measurements used in calibrating aquifer hydrogeologic parameters.
- Updating the model from the IGSM Model Code 6.0 to IGSM Model 6.2; and
- Recalibrating the model.

For purposes of the SPSP impact evaluation, the focus is on the northern area of the SACISGM, which comprises the southern half of the North American Subbasin. Details of the model components and the update are provided in *Technical Memorandum, Sacramento County, Integrated Groundwater and Surface Water Model (SACIGSM, v.3), Model Refinement- North Area* (WRIME, 2007).

The northern SACISGM area covers 1,071 square miles and includes 54 subregions that generally correspond with the service areas of the water districts/purveyors. The average size of model elements in the northern SACIGSM is about 116 acres.

The model is physically represented as a three-layer system consisting of the following layers: 1) an uppermost unconfined or semi-confined aquifer system representing alluvial sediments that overlie the Mehrten Formation, 2) the middle layer represents the confined aquifer system of the

Mehrten Formation, and 3) the lowermost layer represents groundwater of generally poorer quality that underlies the Mehrten Formation.

Model layers in the prior version of the SACIGSM were delineated based on DWR Bulletin 118-3, USGS reports, numerous well logs, and California Division of Oil and Gas logs (WRIME, 2007). The layering was refined in the newest version using information from DWR Bulletin 118-6 and Digital Elevation Model data. With these data, the aquifer thicknesses were mapped to the refined model grid proportional to the relative thickness used in the prior SACIGSM. Cross-section B to B' (**Figure 5-2**) depicts the model layering near the southern boundary of the Natomas Basin. In this area, Layer 1 of the model is about 200 feet thick and is overlain and underlain by aquitards with thicknesses of about 60 and 130 feet, respectively. Layer 2 is over 1,500 feet thick and starts at a depth of about 360 feet in this area. Differences between actual geologic conditions and modeled conditions are further discussed below. Additional cross sections for the SACIGSM are contained in WRIME (2007).

Boundary conditions were established to designate heads for all boundary nodes and allow for surface and subsurface flows through the model boundaries. Some boundary conditions have been updated since the prior version of the SACIGSM. As reported by WRIME (2007):

- The eastern boundary of the model is a no flow boundary but incorporates surface-water inflow to the model based on ungaged watersheds.

- General head conditions are used for the southern boundary, which is the Mokelumne River. The heads for this boundary are provided from the Stanislaus Basin IGSM, which ends its simulation in 1993, and values of head in nodes along this boundary in 1994 to 2004 use values from 1993.

- The western boundary is along the Sacramento River. The northern section (north of Pocket Road) uses general head boundary conditions provided by the Central Valley IGSM. The southern section of the western boundary (south of Pocket Road) is simulated as constant head conditions. Both the general head and constant head conditions are interpolated from prior model nodes to the updated SACIGSM nodes for the western boundary. Because the general heads in the prior SACIGSM stop in 1995, the updated SACIGSM uses the 1995 values for subsequent years (1996 to 2004).

- General head conditions are used for the northern boundary. These heads are provided by the NARIGSM, which was run concurrently with the SACIGSM. The linkage between the two models was done by correlating the boundary nodes of the models, updating the NARIGSM from monthly to daily time steps, and using the 1995 general heads in the NARISGM for subsequent years (1996 to 2004).

5.1.3 North American River IGSM Model

The NARIGSM includes the portions of eastern Sutter County and western Placer County that comprise the northern portion of the North American Subbasin. The original NARIGSM model, which includes the SPSP, was developed by MWH in 1995 and was subsequently updated by DWR (1997) and MWH (2001). In 2001, the NARIGSM was refined to better assess groundwater

impacts resulting from the water supply project and program alternatives being considered for the Regional Water Master Plan (MWH, 2001). The data sets that were updated included land use, streamflow, agricultural demand, surface-water diversions, urban water demand, groundwater pumping, precipitation, and groundwater levels. As described in this report, similar updates were made for portions of the NARIGSM, particularly within the Natomas Basin area and also the southern portion of Placer County. Details of the model development and components are provided in *North American River Service Area Groundwater Model, Model Development and Basin Groundwater Management* (MWH, 1995).

The NARIGSM model area covers 371 square miles. This area includes 16 subregions; the average size of model elements is about 410 acres. Similar to the SACIGSM, the model is physically represented as a three-layer system. The aquifer system was delineated based on data contained in DWR Bulletin 118-6 supplemented by review of lithologic and electric logs (MWH, 1995). Seven cross sections were developed to depict the model layering and aquifer thicknesses, including four north-south sections that were extensions of cross sections previously generated for the SACIGSM. The seven cross sections are contained in MWH (1995).

The layering of the NARIGSM is similar to that of the SACIGSM depicted on cross-section B-B' (**Figure 5-2**). In the SPSP area where project wells are proposed to be located, Layer 1 extends from about 80 to 300 feet in depth, and Layer 2 extends from about 420 to 1,420 feet in depth. These aquifer thicknesses do not exactly match the interpretation of local geologic conditions described in Chapter 3 and shown on cross-section A-A' (**Figure 3-3**). The difference between the actual geologic conditions and the modeled conditions makes it difficult to accurately simulate pumping from project wells that are planned to be on the order of 400 to 500 feet deep, as this depth could potentially span both upper layers, with only a small fraction of pumping occurring in Layer 2.

The boundaries for the NARIGSM were developed based on a combination of geological, hydrological, and political boundaries. MWH (1995) describes the original model boundaries as follows:

- The western model boundary is the Feather and Sacramento Rivers, which are an important source of recharge that create a groundwater divide in the upper aquifer system. General head conditions are used for this boundary based on the regional Central Valley IGSM.

- The southern model boundary follows the Placer/Sacramento and Sutter/Sacramento County lines, and extends from the Sacramento River in the west to Folsom Lake in the east. This boundary is also the northern boundary of the SACIGSM. General head conditions are used for this boundary. As described above, the SACIGSM was linked to the NARIGSM to achieve consistent boundary conditions.

- The eastern model boundary represents the geologic boundary between the Sacramento Valley groundwater basin and the Sierra Nevada foothills. No flow conditions are used for this boundary.

- The northern model boundary is the Bear River, which coincides with the Placer/Yuba and Sutter/Yuba County lines. General head conditions are used for this boundary based on the regional CVIGSM.

5.1.4 Model Limitations

Limitations of the existing NARIGSM and SACIGSM models include the following:

- IGSM models are generally considered to be regional planning tools and are typically used to predict the effect of groundwater management changes on a large (e.g. subbasin) scale.

- The NARIGSM model has a relatively coarse grid compared to the SACIGSM, particularly after the latest refinement of the latter model. The model contains about 22 nodes in the SPSP area (3,000 to 5,000-foot node spacing). This limits the resolution of simulated drawdowns and streamflow impacts.

- The vertical discretization of the IGSM models is also limited for similar reasons. As described above, the models contain three layers, but only two of these represent the freshwater aquifer system. The layering is too coarse to precisely correlate with known well completions and the cross section developed for the project area.

- Model boundary conditions rely on general head values from adjacent models that end in1993 or 1995. General heads for the final year of these simulations are repeated until the end of the simulation period (2004). Although the model simulation is an approximation of the physical system, this limits the resolution of the simulated conditions.

Although these existing IGSM models have a number of limitations, they are capable of simulating the relative impact of the SPSP on groundwater and surface water. Due to the different model updates that have occurred, model results are more precise in some portions of the North American Subbasin than others.

5.1.5 NARIGSM and SACIGSM Models for SPSP Evaluation

As discussed above, WRIME has linked the most current revisions of the NARIGSM and SACIGSM models (**Figure 5-1**). IGSM Code Version 6.2 was used for the linked model simulations. In coordination with LSCE, WRIME used the linked NARIGSM and SACIGSM models to simulate the effect of variations in the rate, timing, and location of SPSP pumpage and also other pumpage as identified in the North American Subbasin, with emphasis on the Natomas Basin, for a 35-year horizon and under different water year types.

For purposes of the SPSP impact evaluation, additional emphasis was placed on refinements to the portions of both models that encompass the Natomas Basin, including all of the SPSP area. The model refinements included:

- Adjustments to the Sacramento River stream geometry;

- Changes to land use in the Natomas Basin and western Placer County, including crop types in the Natomas Basin;

- Updating the type and quantity of water sources utilized, or projected to be utilized in the Natomas Basin;

- Adjustments to aquifer parameters in the Natomas Basin based on the results of the aquifer testing conducted at the Paulson well as described in Chapter 3; hydraulic conductivities in Layer 1 were changed based on the site-specific test results.

- Adjustments to soil properties, including reducing the hydraulic conductivity in some areas of the Natomas Basin to better match simulated water level results with observed measurements;

- Shifting most of the pumpage in the Natomas Basin from in Layer 2 to Layer 1; and

- Adjustments to the initial head conditions.

The Natomas Basin includes eight model subregions, including NARIGSM Subregions10, 11, and 13 and SACIGSM Subregions 1, 2, 3, 4, and 14 (**Figure 5-3**). NARIGSM Subregion 10 extends outside the Natomas Basin, and all of this subregion is included when reference is made to the model results for the Natomas Basin in the following chapters unless otherwise noted.

5.1.6 Initial Conditions

Initial conditions (starting heads) for the calibration period (1970-2004) were established using historical groundwater levels published by DWR to generate regional groundwater level contour maps and assign initial (September/October 1969) groundwater levels to each model node. Initial conditions for the 35-year baseline and project simulation are discussed in Chapter 6.

5.2 Time Discretization

The NARIGSM and SACIGSM models simulate transient conditions whereby hydraulic heads and groundwater flow can vary with time. Discretization over time occurs by dividing the continuous simulation period into time steps. As discussed above, the previous version of the NARIGSM model used monthly time steps. The SACIGSM model uses daily time steps, and the NARIGSM model was updated in 2007 to also use daily time steps (WRIME, 2007). Some model inputs such as streamflow and precipitation are daily, while others such as surface-water deliveries and M&I groundwater pumping are monthly. Agricultural water demands are estimated by the model based on historical crop acreage, soil moisture requirements, effective rainfall, potential evapotranspiration, and irrigation efficiency.

5.3 Aquifer Properties

The aquifer properties required by the model include hydraulic conductivity, storage coefficient, and specific yield for each layer. In the Natomas Basin, hydraulic conductivities previously ranged from 33-118 ft/day in Layer 1. Hydraulic conductivities for Subregions 10 and 11, which

include the SPSP, were 118 and 86 ft/day, respectively), 15-20 ft/day in Layer 2, and 3-12 ft/day in Layer 3. A hydraulic conductivity of 36 ft/day was estimated based on the aquifer testing conducted at the Paulson well, and aquifer parameters in Layer 1 were adjusted accordingly. The hydraulic conductivity for Layer 1 now ranges from 37 to 60 ft/day across the Natomas Basin, and the hydraulic conductivity in Subregions 10 and 11 are 60 and 54 ft/day, respectively.

Storage coefficients in the model in the Natomas Basin area ranged from 1.4×10^{-4} to 1.4×10^{-3} in Layer 1 to 3.5×10^{-5} to 3.0×10^{-4} in Layer 2, and 3.0×10^{-5} to 3.0×10^{-3} in Layer 3. Storage coefficients estimated from the Paulson well aquifer test ranged from 8.6×10^{-4} to 1.2×10^{-3}, with a mean of 1.0×10^{-3}. Similar to the test results, the storage coefficient in Layer 1 of the model in the SPSP area is 1.4×10^{-3}.

5.4 Simulation of Streams

To simulate streamflow, the IGSM models calculate a water balance for each stream element. The stream elements are a series of one-dimensional line elements that are used to describe the stream system in the model area. The gain or loss due to stream-aquifer interaction is computed based on water levels in the stream and the underlying aquifer (WRIME, 2006). The surface-water elevation (stage) in the stream is computed using stage-discharge relationships at the corresponding stream node. Input data for the stream system include:

- Stream configuration;
- Stream node elevation;
- Stream channel cross section;
- Stage-discharge relationship;
- Stream inflows at boundary (including surface-water flow entering the model area and also gains or losses of the stream system due to stream-aquifer interaction),
- Tributary inflows;
- Wastewater discharges to streams; and
- Streamflow diversions that remove water from the stream system.

In the NARIGSM, the largest component of the streamflow is the volume of flow in rivers entering the model area; the second largest component is direct runoff from precipitation (MWH, 1995). Surface-water diversions and seepage from the rivers to the groundwater system are the two main sources of streamflow losses.

A number of streams, including the Sacramento and American Rivers, are simulated in the northern SACIGSM. As noted above, the streams were reconfigured with more stream nodes to more accurately follow stream courses, and the total stream nodes were doubled compared to the number of nodes in previous versions of the SACIGSM (WRIME, 2007). Streambed elevations were also updated.

5.5 Areal Recharge

The IGSM models account for a number of processes in the soil zone, including evapotranspiration, direct runoff, infiltration, and deep percolation from rainfall and applied water

(WRIME, 2006). Evapotranspiration (ET) is computed based on crop consumptive use requirements and available soil moisture. Direct runoff from rainfall and applied water is computed using a modified Soil Conservation Service (SCS) runoff curve number method. Input data for simulation of hydrologic processes in the soil zone include (MWH, 1995; WRIME, 2006):

- Initial soil moisture;
- Rainfall;
- Land use category;
- SCS hydrologic soil group;
- Minimum soil moisture requirements for each crop type;
- Crop consumptive use (amount of applied water consumptively used to satisfy ET or soil moisture requirements);
- Root zone depth for each crop; and
- Surface drainage pattern.

The two primary sources of water to the soil zone in agricultural and urban areas are precipitation and applied water. Agricultural areas in the NARIGSM area tend to have the largest amount of deep percolation due to the amount of irrigation water applied to rice fields in addition to the natural rainfall, while the amount of deep percolation from undeveloped areas is relatively small (MWH, 1995). Soils in Subregions 10 and 13 are also modeled as having relatively high hydraulic conductivities.

Water infiltrating beyond the soil zone (deep percolation) results in groundwater recharge. IGSM models simulate the vadose zone with the mathematical equation of unsaturated flow solved numerically at every time step (WRIME, 2006). The vadose zone is divided into a number of discrete layers of specified thickness; the water passing through the soil zone becomes the inflow to the uppermost vadose zone layer. This process repeats until the outflow from the last vadose zone layer becomes inflow to the first layer of the aquifer system. As discussed further in Chapter 6, deep percolation is a significant inflow component of the overall groundwater budget.

5.6 Model Calibration

Calibration is the process of adjusting parameters used in the model so the model approximates the observed behavior of the aquifer system, especially measured groundwater levels. After the model is calibrated, it can be used to evaluate the response of the aquifer system to new or changing stresses.

When the original NARIGSM and SACIGSM models were developed, each model was calibrated independently. In 2001, when both the NARIGSM and SACIGSM were used to evaluate program alternatives for the Regional Water Master Plan (MWH, 2001), the two models were run together using their original calibration. At that time, 67 calibration wells were used for the SACIGSM, and 81 calibration wells were used for the NARIGSM; both models were run for the period from 1970-1995. The models were found to have simulated water levels in Sacramento County that were in good agreement with observed values (MWH, 2001). On average, however, both models tended to produce simulated water levels that were slightly lower than observed levels.

WRIME reports use of a systematic calibration process that includes review of the overall water budgets for the model area, calibration of simulated groundwater levels to observed groundwater levels, comparison of calibration performance to calibration targets, and making further model refinements as needed (WRIME, 2007). During the recent update of the SACIGSM, the model was calibrated for the period 1970-2004 using a series of wells from the DWR inventory and selected wells from Aerojet and McClellan Park. A total of 138 wells were used for calibration; 90 of these wells were used for calibration of the northern SACIGSM area (WRIME, 2007). The calibration results for the recent SACIGSM reasonably simulated long-term water level responses under various hydrologic conditions. For the northern SACIGSM area, WRIME (2007) reported 76% of the simulated values fell within ten feet of observed values.

The model calibration period for the NARIGSM and SACIGSM models used for the SPSP evaluation is 1970-2004. The locations of the calibration wells are shown in **Figure 5-5**. Hydrographs showing simulated and measured heads for six of these calibration wells in the NARIGSM and SACIGSM areas are shown in **Figures 5-6** through **5-8**. Since the model is an approximation of the physical system, it does not exactly reproduce observed groundwater levels. Three of the wells (NAR-30 [11N4E9D2], SAC-2 [10N4E31M04M], and SAC-2 [10N4E31M02M]) show a good to very good match between observed and simulated water levels. The latter two wells are completed in Layers 1 and 2, respectively, and located in the southern part of the Natomas Basin at the Sacramento International Airport. Well NAR-41 [11N4E34N1M], located in the SPSP area, shows a comparable trend between simulated and observed levels from 1970 to about 1986. Subsequently, the simulated and observed levels diverge and then stabilize; the simulated levels are underestimated by about ten feet from the early 1990s to 2004. Well NAR-2 [10N4E12A00M], located immediately east of the SPSP area, shows an overestimation of water levels during the early portion of the calibration period; then the simulated and observed levels show improved correlation from about 1995 to 2004. Well SAC-3 [10N4E23A1M] shows a comparable trend between simulated and observed levels from 1970 to about 1986. Subsequently, the simulated and observed levels diverge and then stabilize; the simulated levels are underestimated by about ten feet from the early 1990s to 2004.

Since they were last calibrated (1995 for the NARIGSM and 2007 for the SACIGSM) as discussed above, a number of changes have been made to both models. A check of the calibration was performed in fall 2007 after the refinement of the hydraulic conductivity values in the Natomas Basin to match recent aquifer test data. This check showed that the calibration remained within guidelines established in the latest modeling reports. Further updates and refinements were made to the model through late 2007 and early 2008 to incorporate new and more detailed information for the Natomas area. While additional checks of the calibration were not performed, the changes were considered to have only a minor effect on the calibration. Although the calibration of the NARIGSM and SACIGSM models used for the SPSP evaluation exhibits heads that are somewhat overestimated or underestimated at some locations, the calibration is considered acceptable and the use of the models is reasonable for evaluating the impacts of the proposed project and project alternatives.

6.0 EVALUATION OF GROUNDWATER IMPACTS

The SACIGSM and NARIGSM models discussed in Chapter 5 were used to evaluate the impacts of the SPSP project on groundwater conditions in the North American Subbasin. These simulations and results are discussed below.

6.1 Model Scenarios

Two baseline (no-project) scenarios and five project scenarios were developed and simulated with the IGSM models. For each scenario, the models were run for a 35-year simulation period based on 1970-2004 hydrologic conditions. As indicated on the plot of Cumulative Departure from Mean Annual Precipitation (**Figure 2-7**), this was a period of approximately average precipitation. Based on DWR's Sacramento River Basin Index, the simulation period includes three single-dry years and three periods of multiple-dry years.

The Existing Conditions Baseline (ECB) scenario generally represents existing conditions in the groundwater basin, and the Future Conditions Baseline (FCB) scenario represents future conditions in 2030 without the SPSP project. The project scenarios simulate both the proposed project and the project alternatives. One of the project scenarios simulates Phases 2 and B of the proposed project; the other four scenarios simulate the proposed project and Alternatives A and B at buildout. Water demand and supply for the five project scenarios in normal and critically-dry years is summarized in **Table 6-1**. A detailed summary of the baseline and project scenarios and the results of each scenario are provided below.

The model output for each scenario includes simulated groundwater elevations (hydraulic heads) for each node, which are shown on contour maps and hydrographs. The output also includes groundwater budgets for each model subregion. The water budget components are grouped into six categories, as discussed below. Positive values for water budget components represent inflow to the groundwater basin, and negative values indicate outflow.

- Deep Percolation – This includes infiltration from precipitation, applied irrigation water, and seepage from ditches and canals. Deep percolation is always positive and is estimated to be greatest from areas planted to rice.

- Net Recharge from Streams – Positive values represent flow from a stream to the aquifer system (losing conditions); negative values represent flow from the aquifer system to a stream (gaining conditions). For the Natomas Basin, this component represents flow to and from the Sacramento and American Rivers. Net recharge is positive for the ECB because all reaches of these rivers are simulated as losing under current conditions, and overall losing conditions are predicted to continue under the proposed project. The simulated net recharge is negative (gaining conditions) for the FCB and Alternatives A and B.

- Net Boundary Inflow – This represents groundwater flow through model boundaries and can be positive or negative. The Sacramento River forms the western boundary of both

models, and positive values of boundary inflow represent groundwater flow into the Natomas Basin beneath the Sacramento River. Flow between the NARIGSM and SACIGSM across the Sutter County/Sacramento County boundary is also shown as boundary inflow, with any positive value (inflow) shown in one model corresponding to a negative value (outflow) in the other model, resulting in a net inflow of zero for the Natomas Basin.

- Net Subsurface Inflow – This component represents groundwater flow between model subregions. For most scenarios, there is a small amount of inflow to the Natomas Basin from the north and a larger amount of outflow to the east. Therefore, the net value of this component for the Natomas Basin is typically negative.

- Groundwater Pumping – Pumping represents outflow from the groundwater basin and is always negative.

- Change in Storage – The basic equation for a water budget is:

  Inflow – Outflow = Change in Storage.

  A positive change in storage indicates rising groundwater levels while a negative change in storage indicates declining groundwater levels. Groundwater levels in the Natomas Basin are generally simulated as rising; therefore, the change in storage is positive for all scenarios.

The water budgets discussed below are based on the last 23 years of the simulation period (1982-2004) to avoid problems caused by the initial conditions used for the baseline and project scenarios. Starting heads for the scenarios are based on measured groundwater elevations collected between July 1 and December 31, 2005 for the SACIGSM and July 1 and December 31, 2006 for the NARIGSM (Jim Blanke, WRIME, pers. comm., April 16, 2008). However, most of the starting heads are either low or high relative to measured and simulated values at the calibration wells in the Natomas Basin. This causes relatively steep and artificial increases in head during the first few years of the simulation period. The simulated heads generally stabilize during a few years after reaching equilibrium with model inputs. The early years of the 35-year simulation period were not used in the water budgets discussed below so that problems with the initial conditions would not bias the results. Precipitation during the 1982 to 2004 period was approximately average, as shown on the plot of cumulative departure from mean annual precipitation (**Figure 2-7**). Based on the Sacramento River 40-30-30 Index, this period includes nine wet years, four normal years, two single-dry years, and two multiple-dry periods (1987-1992 and 2001-2002).

6.1.1 Baseline Scenarios

Existing Conditions Baseline

The ECB simulates "current" conditions in the groundwater basin based on 1994 to 2004 data. Land use, water demand, and water supply for this scenario are shown in **Table 6-2** for each of the model subregions that cover the Natomas Basin. As shown in **Figure 5-3**, the Natomas Basin

includes Subregions 10, 11, and 13 in Sutter County (NARIGSM model) and Subregions 1, 2, 3, 4, and 14 in Sacramento County (SACIGSM model). **Figure 6-1** shows the percentage of each model element simulated as agricultural land use in and near the Natomas Basin, and **Figure 6-2** shows the percentage of each model element simulated as urban land use.

For the SACIGSM, land use data are based primarily on the 2000 DWR land use survey, which was updated based on a Sacramento County Assessor's parcel map showing changes between 2000 and 2006. Agricultural water demands are held constant at 2004 levels (the end of the calibration period). Urban water demands are based on 2004 levels reported in the UWMP for each water purveyor. For the NARIGSM, land use data are based on DWR land use maps for 1994 (Placer County) and 1998 (Sutter County), and estimates of water demand for agricultural and urban uses were updated from estimates used in the original version of the model (MWH, 1993) based on the land use data.

In the Natomas Basin, the land use and water demand estimates in the NARIGSM and SACIGSM models were updated to better correspond to the estimates provided in Chapter 2. However, there are still differences between the 2004 Natomas Basin land use, water demand, and water supply values described in Chapter 2 (and shown on **Table 2-2**) compared to **Table 6-2.** As discussed below, these differences do not have a significant effect on the analysis of impacts associated with the project and project alternatives described in this chapter because the simulated impacts are mostly independent of the details of the baseline scenario against which they are compared. Project Scenarios 1 and 2A are compared against the ECB, and the difference between the ECB results and the model scenario represents the predicted impacts. While it is preferred to have the estimated and simulated values match more closely, the differences have a relatively minor effect on the impact analyses. One of the biggest differences between the estimate of 2004 conditions in Chapter 2 and the ECB simulation is groundwater pumping. Table 2-2 shows that the 2004 pumpage estimate for the Natomas Basin was 28,636 af, which is significantly smaller than the simulated pumpage in the ECB (35,269 af). Most of this difference occurs in the SACIGSM because the pumpage estimates in Sutter County were very similar (18,527 af in Chapter 2 versus 19,828 af for the ECB). In Sacramento County, the estimated pumpage was 10,109 af, while the simulated pumpage was 15,441 af. The majority of this difference occurs in Subregion 3 where groundwater in the SACIGSM was simulated as the source of supply for agricultural land use in an area where NCMWC data and other records showed that most of the agricultural demands were met with surface-water sources.

As shown in **Table 6-2**, the simulated water demand is about 87,800 afy in the Sutter County portion of the Natomas Basin (including approximately 33,100 afy in the SPSP area). The simulated water demand is about 100,700 afy in the Sacramento County portion of the Natomas Basin, for a total of about 188,500 afy. The total demand includes about 158,500 afy for agricultural uses and 26,000 afy for urban uses. Over the entire simulation period, this demand was supplied by about 33,400 afy of groundwater pumping and 155,200 afy of surface and recycled water. Water demand and supply vary with year type, with groundwater pumping and surface-water diversions at their highest in normal years such as 2004 and lowest in wet years such as 1983. The average annual water supply for existing conditions in the North American Subbasin is estimated to be about 384,300 afy of surface water (used for water supply) and 389,800 afy of groundwater (which includes minor amounts of remediation pumping along with water supply pumping) (Jim Blanke, WRIME, pers. comm., April 23, 2008).

The results of the ECB are summarized below. Spring groundwater elevations in Layer 1 in and near the Natomas Basin in the last year of the simulation are shown on **Figure 6-3**. Year 35 of the simulation period was used for this and other head contour maps because the maximum impact for the project scenarios discussed below generally occurs in the final year of the simulation. Groundwater elevations shown on **Figure 6-3** ranged from 10 feet msl in the western portion of the Natomas Basin to –10 feet msl in the eastern area. In the Sacramento County portion of Natomas Basin, the direction of groundwater flow was easterly toward the cone of depression beneath McClellan AFB. In the SPSP area, the direction of groundwater flow is to the southeast, also toward the McClellan AFB area. This is somewhat inconsistent with groundwater elevation contour maps in Chapter 4 (i.e., contours based on actual data) that show an easterly direction of flow in this area toward a cone of depression in southwestern Placer County. However, simulated head contours for the final year of the ECB should not be expected to match actual head contours for two reasons:

- Instead of being based on a single year, the simulated land use, water demand, and water supply for the ECB are based on land use maps and other available data between 1994 and 2004. Because the SACIGSM has been updated more recently, the data used in that model are generally more current than the data used in the NARIGSM. For the NARIGSM, recent updates to the model were limited to the Natomas Basin.
- The contour map represents the final year of a 35-year simulation period, and heads at the end of the simulation are very different from heads at the beginning. This can be seen on the simulated hydrographs in Appendix E discussed below.

Hydrographs of simulated hydraulic head (groundwater elevations) at 13 selected calibration wells and one model node are provided in Appendix E for the baseline and project scenarios. As shown on the well location map (**Figure 5-4**), most of the selected wells are located in or adjacent to the Natomas Basin, but two wells are located in the cone of depression east of the Natomas Basin. "Well" No. 173 represents a NARIGSM node rather than an actual well and was included because there are no calibration wells in this area to show water level impacts between the proposed SPSP wells and the Sacramento River. All hydrographs show simulated heads for the calibration period (1970-2004) and the 35-year simulation period for baseline and project scenarios. Starting heads for the scenarios generally do not match up with the heads at the end of the calibration period because the former are based on measured values. The measured heads are based on available data between July 1 and December 31, 2005 for the SACIGSM, and July 1 and December 31, 2006 for the NARIGSM. The fact that the starting heads are based on measured rather than simulated values resulted in artificial increases or decreases in head during the first few years of the simulation period. The simulated heads stabilize after reaching equilibrium with model inputs. Hydrographs for the baseline scenarios show the simulated heads in both Layers 1 and 2; hydrographs for the project scenarios only show heads in Layer 1.

For the ECB, hydrographs of the NARIGSM calibration wells show overall stable conditions with no discernable upward or downward trends. Even the well located in the Placer County cone of depression (NAR-11) shows stable conditions after equilibrium is reached in about Year 8 of the 35-year simulation. As expected, all wells show seasonal fluctuations and also show increasing heads during wetter than average periods and decreasing heads during dryer than average periods.

Hydrographs of the SACIGSM calibration wells also show fluctuations due to seasonal conditions and year type. Groundwater conditions are generally stable, but heads at some wells show a slightly increasing trend during the simulation period. The primary exception is the well located in the McClellan AFB cone of depression (SAC-31), which shows overall declining heads during the simulation period.

The groundwater budget for the ECB (**Table 6-3**) from 1982 to 2004 shows that for the entire Natomas Basin, the inflow components include deep percolation (37,414 afy), net recharge from streams (6,168 afy), and net boundary inflow (4,653 afy). The outflow components were net subsurface outflow (–11,764 afy) and groundwater pumping (-36,288 afy). The calculated change in storage was 183 afy, which means that, on average, groundwater levels were higher at the end of the simulation period.

The groundwater budget varies significantly based on year type, as shown on **Table 6-4**. Deep percolation was much higher in wet years such as 1983 (55,744 afy) than in single-dry years such as 1994 (32,202 afy). Net recharge from streams was also much higher in 1983 (8,927 afy) than in 1994 (3,296 afy). The simulated groundwater pumping was highest in normal years such as 2004 (38,269 afy) and lowest in wet years such as 1983 (34,108 afy). In single-dry and multiple-dry years, the simulated pumpage was in between the normal and wet year values. The calculated change in storage varies greatly by year type, ranging from a high of 25,948 afy in a wet year (1983) to a low of –7,460 afy in a multiple-dry year period (1987-1992).

Future Conditions Baseline

The FCB simulates conditions in the groundwater basin in 2030. Land use, water demand, and water supply for this scenario for each of the model subregions that cover the Natomas Basin are shown in **Table 6-5**. The percentage of each model element simulated as agricultural in and near the Natomas Basin is shown on **Figure 6-4**, and **Figure 6-5** shows the percentage of each model element simulated as urban. The simulated land use and water demand are reported to be similar to the detailed summary shown on **Table 2-3** in Chapter 2.

As shown in **Table 6-5**, the simulated 2030 water demand in the Sutter County portion of the Natomas Basin (about 87,800 afy) is the same as the ECB. The simulated water demand increases to about 116,800 afy in the Sacramento County portion of the Natomas Basin, for a total of about 204,600 afy. In this portion of Sacramento County, the agricultural demand decreased by about 6,300 afy and the urban demand increased by about 22,300 afy as compared to the ECB. In the Natomas Basin, averaged over the 35-year simulation period, these demands are supplied by about 25,300 afy of groundwater pumping and 179,300 afy of surface and recycled water. As with the ECB, the simulated surface-water diversions for this scenario are highest in normal years and lowest in wet years, and simulated groundwater pumping is lowest during wet years and highest during dry years. The average annual water supply for future conditions in the North American Subbasin is 535,800 afy for surface water (used for water supply) and 328,000 afy for groundwater (pumping includes minor amounts of remediation pumping along with water supply pumping) (Jim Blanke, WRIME, pers. comm., April 23, 2008).

As described above, there were also differences between the estimated 2030 land use, water demands, and water supplies summarized in Chapter 2 and the simulated values. The 2030

estimated pumpage shown in Table 2-4 was 27,258 af, and the pumpage simulated in the FCB was 23,814 af for the final year of the simulation. As for the ECB discussed above, the estimated pumpage for Sutter County (20,008 af) was quite similar to the simulated pumpage (19,828 af excluding the portion of Subregion 10 that extends east of the Natomas Basin). The difference in the total pumpage for the Natomas Basin was largely the result of the estimated versus simulated pumpage in Sacramento County (e.g., the estimated pumpage was 7,251 af, while the simulated groundwater pumpage was 3,986 af; this results in a difference of 3,265 af). A portion of this pumpage difference occurs in subregions where groundwater is projected to serve as one of the sources of supply for managed marsh (i.e., groundwater has been and would continue to be used at the beginning and end of the irrigation season), whereas the simulation assumes that this demand would be met with surface-water sources. Other reasons for the estimated pumpage being greater for the FCB in Sacramento County include continuation of groundwater utilization in subregions to meet water demands for field and truck crops, grains and hay, some rice, and landscaping at the airport. Similar to the ECB discussion above, the FCB is consistently compared to the project and project alternative scenarios, and the predicted impacts are based on the difference between the FCB results and the model scenario. The predicted impacts are, therefore, mostly independent of the baseline simulation.

For the FCB, future water supply conditions for northern Sacramento County were primarily based on UWMPs for each water district in the north area. As reported by WRIME (2007), all of the plans identified future demand projections and water supply sources to meet the demands. Most of the plans also indicate a significant transition from groundwater to surface-water utilization to meet municipal water demands. Following is a summary of the data sources listed in WRIME (2007) for districts and municipalities in northern Sacramento County, except for the Sacramento County portion of NCMWC, which is described in Chapter 2.

- The data sources for Rio Linda and Elverta are the Rio Linda/Elverta Community Water District UWMP (Dec. 2005) and the Sacramento Groundwater Authority GWMP (Dec. 2002).
- The data source for the Sacramento Suburban Water District (SSWD) was primarily the SSWD UWMP (Dec. 2005). Some data on surface-water deliveries to the District for the City of Sacramento UWMP (Nov. 2006) and from the CalAm UWMP (2006).
- The data for the City of Sacramento were obtained from the City of Sacramento UWMP (Nov. 2006). Land use data were obtained from the City of Sacramento General Plan Draft (May 2007).
- The data for the City of Folsom were obtained from the City of Folsom UWMP (Dec. 2005 Public Review Draft).
- The data for the San Juan Family Districts were obtained from the following sources: San Juan Water District UWMP (Dec. 2005), Orangevale Water Company (Dec. 2005), Fair Oaks Water District UWMP (Dec. 2005), and Citrus Heights Water District UWMP (Jan. 2007).
- The data for CalAm were obtained from the California American Water Company's Northern Division UWMP (2006-2010). Additional data on surface-water deliveries to the district from the City of Sacramento were obtained from the City of Sacramento UWMP (Nov. 2006).
- The data for Carmichael Water District were obtained from the Carmichael Water District UWMP (Dec. 2005).
- The data for Golden State Water Company came from the Cordova UWMP (Dec. 2005).

- Water demand estimates for proposed developments in the Natomas Basin (Greenbriar and Metro Air Park) came from the NCMWC IWRMP (ASWC, et al., 2006).

Future water supply conditions for Placer County were based on several sources including the *Western Placer County Groundwater Management Plan* prepared by MWH (2007) on behalf of the City of Roseville, City of Lincoln, Placer County Water Agency, and California American Water. Data for proposed developments such as Placer Vineyards and Placer Ranch were obtained from the Specific Plan, EIR, or Notice of Preparation for each development.

For the FCB, spring groundwater elevation contours in Layer 1 in and near the Natomas Basin in the last year of the simulation are shown on **Figure 6-6**. Heads in the Natomas Basin were higher than for the ECB (>10 feet msl except in the eastern portion of the basin). In the Sacramento County portion of Natomas Basin, the direction of groundwater flow was still easterly but the gradient for flow is less steep because heads are much higher in the cone of depression east of the Natomas Basin. Heads in the deepest cone of depression beneath McClellan AFB are projected to be 40 to 50 feet higher in 2030 due to the planned transition from groundwater to surface water as the primary source of urban supply (WRIME, 2007).

Simulated hydrographs of selected calibration wells for the FCB are included in Appendix E. As for the ECB, many hydrographs show sharply rising or declining water levels during the first several years of the simulation period before the model reaches equilibrium. Except for this initial period, wells NAR-30 and NAR-34 in the northern portion of the Natomas Basin show generally stable groundwater levels for the remainder of the simulation. Heads at all other wells show increases during the remainder of the simulation period, including wells located in the cone of depression east of the Natomas Basin. Seasonal and year-to-year fluctuations are similar to those for the ECB.

The groundwater budget for the FCB based on the 1982 to 2004 average is summarized in **Table 6-6**. For the Sutter County portion of the Natomas Basin, the inflow components for the FCB are deep percolation (21,190 afy), net recharge from streams (346 afy), and net boundary inflow (1,239 afy). Net recharge from streams is positive in Sutter County (losing reach) and negative in Sacramento County (gaining reach). For the Natomas Basin as a whole, the net recharge from streams is negative (–3,043 afy), indicating gaining conditions. The other outflow components for the entire Natomas Basin were net subsurface inflow (–4,543 afy) and groundwater pumping (–28,438 afy). The inflow components were deep percolation (36,045 afy) and net boundary inflow (901 afy). The average change in storage was 922 afy, which indicates increasing heads over the simulation period.

The groundwater budgets for both baselines are compared in **Table 6-4** for different year types. Based on the 1982 to 2004 average, the water budget for the FCB shows significant differences compared to the ECB partly due to higher heads east of the Natomas Basin as a result of the predicted transition from groundwater to surface-water utilization. For the FCB, deep percolation in the Natomas Basin decreased by about 1,400 afy, net recharge from streams decreased by about 9,200 afy, net boundary inflow decreased by about 3,800 afy, net subsurface inflow increased by about 7,200 afy, and groundwater pumping decreased by about 7,900 afy. The calculated change in storage increased by about 700 afy, indicating higher heads for the FCB.

6.1.2 Project Scenarios

Water demand and supply for the five project scenarios in normal and critically-dry years are summarized in **Table 6-1**. These scenarios and the simulation results are discussed below.

Scenario 1

Project Scenario 1 simulates groundwater conditions at the end of Phases 2 and B (approximately 12 years into the SPSP project). Land use, water demand, and water supply for this scenario are discussed in Chapter 2. Phases 2 and B were used for this scenario because they represent the period of maximum groundwater pumping in the SPSP area. The total M&I acreage in the SPSP area for these phases is 4,510 acres, and the total M&I water demands are projected to be 15,785 afy in a normal year. Completion of a surface-water treatment plant is expected by about year ten of the project, and surface water would supply 4,867 afy of the M&I demand.

Groundwater would supply the remaining 10,918 afy of the M&I demand, and one well field (total of eight active wells and one standby well) would be required. The rest of the SPSP area would remain in agriculture, and the agricultural water demand of about 13,598 afy would be supplied by a combination of groundwater (4,559 afy), surface water (7,007 afy), and recycled water (2,033 afy), as shown in **Table 6-1**. Agricultural water demands are assumed to remain the same in a critically-dry year, but M&I water demands are expected to decrease by 12.5% due to conservation measures.

The IGSM model estimates agricultural pumping by element, and agricultural wells are not simulated at specific locations. The model is able to simulate wells at any location, however, and the wells in the SPSP well fields were simulated as individual wells, not as elemental pumping. Simulation as individual wells provides a more accurate depiction of drawdown compared to elemental pumping, but even simulation as individual wells will underestimate drawdown in the immediate vicinity of each well. For the SPSP wells, this underestimation is generally limited to the SPSP area.

Spring groundwater elevations in Layer 1 in and near the Natomas Basin in the last year of the simulation are shown on **Figure 6-7**. The head contours look similar to the ECB (**Figure 6-3**) except for a small cone of depression in the southwestern portion of the SPSP area. Drawdown caused by SPSP pumping is readily apparent on **Figure 6-8**, which shows the difference between Scenario 1 and ECB heads near the end of the 35-year simulation period. As discussed above, Year 35 was considered to represent the period of maximum impact based on some of the hydrographs discussed below. Year 35 of the simulation is based on 2004, which was classified as a normal year. Due to M&I conservation measures in dry years and other factors, the water budget for Scenario 1 varies by year type, as shown in **Table 6-7**. The simulated pumpage is highest in a normal years such as 2004 and lowest in a single-dry year such as 1994.

A variable contour interval was used for **Figure 6-8** and similar plots (a five-foot interval for head differences greater than five feet and a one-foot interval for head differences less than five feet). The maximum drawdown beneath the well field in the southwestern SPSP area is about 15 feet. At the eastern edge of the SPSP area, the drawdown is about 4.5 feet. The maximum drawdown in the cones of depression east of the Natomas Basin is less than three feet.

Simulated hydrographs of the Layer 1 head in selected calibration wells are included in Appendix E. These hydrographs show heads for the ECB, Scenario 1, and Scenario 2A. Calibration wells in and near the SPSP area show up to about eight feet of head decline due to increased pumping in the SPSP area for Scenario 1 (see **Figure 5-5** for well locations). At NAR-11, located in the cone of depression east of the SPSP area, there is only about two feet of head decline due to the project. The SACIGSM calibration wells generally show less head decline than the NARIGSM wells, with the maximum decline (less than five feet) occurring at SAC-4. More distant wells such as SAC-1 and SAC-31 show almost no change in head due to the project. For both models, the simulated heads are stable at all wells except NAR-11 and SAC-31 east of the Natomas Basin. Although the simulated hydraulic heads vary by year type, the hydrographs suggest that drawdown due to the project is similar in all year types. The drawdown gradually increases during the first ten years of the simulation period but generally remains the same in subsequent years. A few wells show slightly larger drawdowns at the end of the simulation period.

The 1982 to 2004 average annual groundwater budget for Scenario 1 is summarized and compared against the ECB in **Table 6-7**. For Scenario 1, deep percolation decreased by about 3,800 afy due to conversion of land in the SPSP area from agricultural to urban uses. The largest change is an increase in groundwater pumping of about 6,900 afy in the SPSP area. The cone of depression created by the SPSP municipal wells combined with the reduced deep percolation results in increased net recharge from streams (about 3,800 afy) and increased net boundary inflow (about 3,200 afy). Subsurface outflow to the east from the Natomas Basin decreases to about 8,200 afy, a reduction of about 3,600 afy. The change in storage is reduced by 118 afy but is still positive (65 afy) for this scenario.

Scenario 2A

Project Scenario 2 represents the proposed project at full buildout of the SPSP, which would occur at the end of Phases 4 and D (Year 20). By this time, all agricultural land uses would be replaced by M&I land uses. The total M&I water demand is estimated to be 25,199 afy in a normal year, and there would be no agricultural water demand. Slightly less than half of the M&I demands (12,127 afy) would be supplied by surface water.

Groundwater usage is projected to be 13,072 afy in a normal year, and two well fields (total of 14 active wells and two standby wells) would be required. Recycled tailwater would no longer be used because there would be no irrigated agriculture. In a critically-dry year, M&I water demands would be expected to decrease by 12.5% to 22,049 afy due to conservation measures. This is the only scenario that is run on and compared against both baseline scenarios. Scenario 2A is compared against the ECB in this section, and Scenario 2B is compared against the FCB below.

Spring groundwater elevations for Scenario 2A (Layer 1) in and near the Natomas Basin in the last year of the simulation are shown on **Figure 6-9**. The head contours look similar to Scenario 1 except that the cone of depression in the SPSP area extends into the northern and eastern areas of the SPSP for Scenario 2A. Drawdown caused by SPSP pumping near the end of the 35-year simulation period is provided on **Figure 6-10**, which shows the difference between Scenario 2A and ECB simulated heads. The maximum drawdown in the western portion of the SPSP area is about 15 feet. At the eastern edge of the SPSP area, the maximum drawdown is about eight feet.

The maximum drawdown in the cones of depression east of the Natomas Basin is less than four feet for this scenario.

Simulated hydrographs of Layer 1 heads in the calibration wells are included in Appendix E. Calibration wells in and near the SPSP area show up to about ten feet of head decline due to increased pumpage in the SPSP area for Scenario 2A. At NAR-11, located in the cone of depression east of the SPSP area, there is only about three feet of head decline due to the project. The SACIGSM calibration wells show less head decline, with the maximum decline (about five feet) occurring at SAC-4. More distant wells such as SAC-1 and SAC-31 show almost no change in head due to Scenario 2A. For both models, the simulated heads are stable at all wells except NAR-11 and SAC-31 east of the Natomas Basin.

The groundwater budget for Scenario 2A is summarized and compared against the ECB for different year types in **Table 6-8**. Based on the 1982 to 2004 average, deep percolation for Scenario 2A decreased by about 6,600 afy due to conversion of land in the SPSP area from agricultural to urban uses. The next largest change is an increase in groundwater pumping of about 6,200 afy in the SPSP area. The cone of depression created by the SPSP municipal wells combined with the reduced deep percolation results in increased net recharge from streams (about 3,900 afy) and increased net boundary inflow (about 2,800 afy). Subsurface outflow to the east from the Natomas Basin decreases to about 5,800 afy, a reduction of about 5,900 afy. The change in storage is reduced by 122 afy but is still positive (61 afy) for this scenario.

Scenario 2B

Project Scenario 2B represents the proposed project at full buildout of the SPSP compared against the FCB. This scenario is otherwise identical to Scenario 2A. The results of Scenario 2B are discussed in this section.

Spring groundwater elevations for Scenario 2B (Layer 1) in and near the Natomas Basin in the last year of the simulation are shown on **Figure 6-11**. Heads in most areas are significantly higher than for Scenario 2A due primarily to reduced pumping east of the Natomas Basin. Drawdown caused by SPSP pumping near the end of the 35-year simulation period is shown on **Figure 6-12**, which looks very similar to **Figure 6-10** (Scenario 2A). Again, the maximum drawdown is about 15 feet in the western portion of the SPSP area and eight feet along the eastern edge. The maximum drawdown in the cones of depression east of the Natomas Basin is about three feet for this scenario.

Simulated hydrographs of Layer 1 heads in the selected calibration wells are included in Appendix E. Calibration wells in and near the SPSP area are predicted to experience five to ten feet of head decline due to increased pumpage in the SPSP area for Scenario 2B. At NAR-11, located in the cone of depression east of the SPSP area, there is about two feet of head decline due to the project at the end of the simulation period. The SACIGSM calibration wells show much less head decline, with the maximum decline (about five feet) occurring at SAC-4. More distant wells such as SAC-1 and SAC-31 show almost no change in head due to Scenario 2B. For both models, the simulated heads are stable at NAR-30, 34, and 173 and increasing at all other calibration wells.

The groundwater budget for Scenario 2B is summarized and compared against the FCB for different year types in **Table 6-9**. Based on the 1982 to 2004 average, deep percolation for Scenario 2B decreased by about 6,600 afy due to conversion of land in the SPSP area from agricultural to urban uses. Another large change in this scenario involves an increase in groundwater pumping of about 6,200 afy in the SPSP area. The cone of depression created by the SPSP municipal wells combined with the reduced deep percolation results in increased net recharge from streams (about 3,700 afy) and increased net boundary inflow (about 2,700 afy). Subsurface outflow to the east from the Natomas Basin decreases by about 6,200 afy. Subsurface outflow was only about 4,500 afy for the FCB due primarily to decreased groundwater pumping east of the Natomas Basin. The reduction in subsurface outflow for Scenario 2B is sufficient to change the outflow to a net inflow of about 1,700 afy. The positive change in storage is reduced by 82 afy but is still relatively large (840 afy) for this scenario.

Scenario 3

Project Scenario 3 represents full buildout of the SPSP at the end of Phases 4 and D (Year 20) for Alternative A. As described in Chapter 2, Alternatives A and B are conjunctive use alternatives that would allow the SPSP to use less groundwater and more surface water during normal years and increase groundwater pumping in critically-dry years when surface-water supplies are limited. For both alternatives, the water demand would remain the same as for the proposed project.

Alternative A is based on the assumption that NCMWC's contract with USBR would not be modified to allow the SPSP to use NCMWC surface water during the fall and winter. During normal years, the surface-water supply would increase to 15,637 afy, and groundwater utilization would decrease to 9,562 afy. During critically-dry years, groundwater utilization would increase to 12,432 afy and surface-water utilization would decrease to 9,617 afy. Two well fields with a total of 14 active wells and two standby wells would be required.

Spring groundwater elevations for Scenario 3 (Layer 1) in and near the Natomas Basin in the last year of the simulation are shown on **Figure 6-13**. The head contours look similar to Scenario 2B except that the cone of depression in the SPSP area is smaller and not as deep. Drawdown caused by SPSP pumping near the end of the 35-year simulation period is provided on **Figure 6-14**, which shows the difference between the Scenario 3 and FCB simulated heads. The maximum drawdown in the western portion of the SPSP area is about ten feet. At the eastern edge of the SPSP area, the maximum drawdown ranges from three to five feet. The maximum drawdown in the cones of depression east of the Natomas Basin is about two feet.

Simulated hydrographs of Layer 1 heads in selected calibration wells are included in Appendix E. The results indicate that calibration wells in and near the SPSP area would experience five to ten feet of head decline due increased pumpage in the SPSP area for Scenario 3. Predicted drawdowns for this scenario are slightly smaller but generally similar to Scenario 2B at NAR-30, 34, and 173; and drawdowns for Scenario 3 are less at NAR-41, 1, and 2. At NAR-11, located in the cone of depression east of the SPSP area, there is less than two feet of head decline due to the project. The SACIGSM calibration wells show much less head decline, with the maximum decline (about four feet) occurring at SAC-4. More distant wells such as SAC-1 and SAC-31 show almost no change in head due to Scenario 3. For both models, the simulated heads are stable at NAR-30, 34, and 173 and increasing at all other calibration wells.

The average annual groundwater budget for Scenario 3 is summarized and compared against the FCB for different year types in **Table 6-10**. Based on the 1982 to 2004 average, deep percolation for Scenario 3 decreased by about 6,600 afy due to conversion of land in the SPSP area from agricultural to urban uses, and groundwater pumping increased by about 3,300 afy in the SPSP area. The cone of depression created by the SPSP municipal wells combined with the reduced deep percolation results in increased net recharge from streams (about 2,800 afy) and increased net boundary inflow (about 2,100 afy). Subsurface outflow to the east from the Natomas Basin decreased by about 4,900 afy, which changes the outflow to a net inflow of about 400 afy. The positive change in storage is reduced by 28 afy but is still relatively large (893 afy) for this scenario.

Scenarios 4 and 5

Project Scenarios 4 and 5 represent full buildout of the SPSP at the end of Phases 4 and D (Year 20) for Alternative B. This alternative is based on the assumption that NCMWC's contract with USBR would be modified to allow the SPSP to use NCMWC surface water during the fall and winter. During normal years, this would allow surface-water utilization to increase to 18,621 afy and groundwater utilization to decrease to 6,578 afy. During critically-dry years, groundwater utilization would increase to 9,276 afy, and surface-water utilization would decrease to 12,773 afy. Only one well field with a total of 8 active wells and 2 standby wells would be required for this alternative. The well field location is the only difference between Scenarios 4 and 5, with the southwestern portion of the SPSP area used for Scenario 4 and the eastern portion used for Scenario 5.

Spring groundwater elevations for Layer 1 in and near the Natomas Basin in the last year of the simulation are shown on **Figures 6-15** and **6-16** for Scenarios 4 and 5, respectively. For both scenarios, the cone of depression in the SPSP area is smaller than for the other project scenarios. Drawdown caused by SPSP pumping near the end of the 35-year simulation period is provided on **Figures 6-17** (Scenario 4) and **6-18** (Scenario 5). The maximum drawdown for Scenario 4 is about five feet, and most of the drawdown is localized in the vicinity of the western well field. The maximum drawdown for Scenario 5 is about ten feet, and the five-foot drawdown contour covers a larger area for this scenario. At the eastern edge of the SPSP area, the maximum drawdown for Scenario 5 ranges from two to five feet. The maximum drawdown in the cones of depression east of the Natomas Basin is zero for Scenario 4 and one to two feet for Scenario 5.

Simulated hydrographs of Layer 1 heads in selected calibration wells are included in Appendix E. The results indicate that calibration wells in and near the SPSP area would experience up to about seven feet of head decline due to increased pumpage in the SPSP area for Scenarios 4 and 5. Except at NAR-173, predicted drawdowns for wells in or near the SPSP area are larger for Scenario 5 because most of the calibration wells are located closer to the eastern well field. East of the SPSP area, predicted drawdown at NAR-11 is negligible for Scenario 4 and less than one foot for Scenario 5. For the SACIGSM calibration wells, the maximum head decline (about three feet for Scenario 4) occurs at SAC-4. The predicted drawdown at the other SACIGSM calibration wells is less than one foot. For both scenarios and both models, the simulated heads are stable at the northernmost calibration wells (NAR-30 and 34) and increasing at all other calibration wells.

The 1982 to 2004 average annual groundwater budget for Scenarios 4 and 5 is summarized and compared against the FCB for different year types in **Tables 6-11** and **6-12**. Based on the 1982 to 2004 average, deep percolation for both scenarios is decreased by about 6,600 afy due to conversion of land in the SPSP area from agricultural to urban uses, and groundwater pumping increased by about 300 afy in the SPSP area. The cone of depression created by the SPSP municipal wells combined with the reduced deep percolation results in increased net recharge from streams (about 2,400 afy and 1,500 afy for Scenarios 4 and 5 respectively) and increased net boundary inflow (about 2,000 afy and 700 afy for Scenarios 4 and 5 respectively). Subsurface outflow to the east from the Natomas Basin decreased in Scenarios 4 and 5 by about 2,500 afy and 4,600 afy, respectively, which changes the outflow to a net inflow in Scenario 5 of 72 afy. The positive change in storage is increased in Scenario 4 by 7 afy and reduced by 18 afy in Scenario 5, but is still relatively large (929 afy and 903 afy for Scenarios 4 and 5, respectively) for these scenarios.

6.2 Summary

As discussed above, the NARIGSM and SACIGSM models were used to simulate hydrologic impacts of the proposed project (Scenarios 1 and 2), Alternative A (Scenario 3), and Alternative B (Scenarios 4 and 5). The predicted impacts are summarized below.

6.2.1 Groundwater Level Impacts

Groundwater level impacts are depicted on contour maps showing simulated head and change in head (drawdown) for the each scenario. For all scenarios, the simulated drawdowns are primarily localized in the SPSP area. Off-site drawdowns are greatest for the proposed project, and Scenario 2 (buildout) has larger off-site drawdowns than Scenario 1 even though total pumpage in the SPSP area is less. This is the result of the well field location since simulated drawdowns are smaller for scenarios that utilize the western well field due to a greater percentage of the water to supply the pumpage coming from the Sacramento River and the western model boundary (beneath the River). For the proposed project at buildout (Scenario 2), the maximum predicted off-site drawdowns are slightly more than 15 feet in Sutter County and about 10 feet in Sacramento County. The 10-foot drawdown contour extends up to a mile away from the site to the northeast, but only about ½ mile from the site to the north and ¼ mile to the south. These off-site drawdowns are considered to be relatively small given that groundwater levels in the Natomas Basin have historically been high and are predicted to remain high in the future. In the area east of the Natomas Basin, where a cone of depression already exists, the proposed project will have relatively small drawdown impacts of less than three feet.

As expected, the project alternatives result in smaller water level impacts. Predicted drawdowns are slightly smaller for Alternative A (Scenario 3) and much smaller for Alternative B (Scenarios 4 and 5). Scenario 4 has the smallest off-site drawdowns due to the use of the western well field.

All simulated groundwater elevation hydrographs for selected calibration wells included in Appendix E show seasonal fluctuations and year-to-year changes in head due to wet and dry periods. For Scenarios 1 and 2A, which are based on the ECB, heads in the Natomas Basin are generally stable over the entire simulation period, with no discernable upward or downward trend. Calibration wells located in the cones of depression east of the Natomas Basin show declining

heads for the ECB and Scenarios 1 and 2A, although the additional decline due to the proposed project is considered to be negligible.

For scenarios based on the FCB, year-to-year head fluctuations due to wet and dry periods are magnified due to planned conjunctive use by SGA and RWA member agencies (WRIME, 2007). These fluctuations are the result of increased use of surface water in wet years and increased groundwater pumping during dry years. Almost all hydrographs show increasing heads over the 35-year simulation period, including wells located in the cone of depression east of the Natomas Basin. Both the hydrographs and the head contour maps discussed above show that water level impacts caused by the proposed project and Alternatives A and B are generally localized in and near the SPSP area.

In terms of the potential for degradation of water quality as a result of the proposed project, constituents of concern include arsenic, manganese, and VOCs. Arsenic and manganese are naturally occurring and highly variable in the Natomas Basin (**Figure 4-15**), and public supply wells would most likely require treatment. Such wells would not be further impacted by arsenic or manganese as a result of the proposed project. VOCs may be found in elevated concentrations near McClellan AFB to the east, where remediation is active and a cone of depression exists, forcing groundwater to flow to the east and southeast out of the SPSP area. If a gradient reversal occurs, as a result of the disappearance of the eastern cone of depression and the predicted drawdowns due to the proposed project, it may be possible to induce the flow of potentially contaminated groundwater from the east towards the SPSP area.

The lack of continuous or recent subsidence monitoring in the SPSP area makes it difficult to determine what impacts the predicted drawdowns might have on subsidence locally. The fluctuations of measured groundwater levels indicate seasonal fluctuations on the order of almost ten feet in some wells along with greater fluctuations (some over 20 feet) seen over the last thirty years in the SPSP area (**Figure 4-2**). The ability of water levels to rebound seasonally and over the years may indicate that subsidence would be minimal due to increased drawdowns from the proposed project. Off-site, where subsidence monitoring has occurred, the predicted drawdown would be less than the seasonal fluctuations already seen (**Figure 4-13**).

6.2.2 Water Budget Impacts

The impacts of the proposed project and the alternatives on groundwater conditions in the North American Subbasin are also shown on the water budget tables discussed above. The water budgets show the change in groundwater inflow to and outflow from the Natomas Basin due to each project scenario. Although most impacts are larger for the proposed project than the alternatives, the reduction in deep percolation (about 6,600 afy) results from the conversion of irrigated agricultural land to urban land uses and is the same for all buildout scenarios.

As shown in **Table 6-4**, the total deep percolation amounts for ECB and FCB conditions based on the 1982 to 2004 average were 37,414 and 36,045 afy, respectively. This results in deep percolation on a per acre basis in the Natomas Basin of about 0.7 af/ac (0.70 and 0.68 af/ac, respectively). As discussed in Chapter 2, total deep percolation estimated based on projected land use, applied water, evapotranspiration, runoff, and other factors for the Natomas Basin ranged from about 0.6 to 0.8 af/ac based on deep percolation estimates for rice of 0.5 and 1.0 af/ac,

respectively. The model results for deep percolation on a per acre basis for the Natomas Basin are within the range of the deep percolation estimates in Chapter 2.

Recharge from the Sacramento River is predicted to be positive (losing stream conditions) for Scenarios 1 and 2 and negative (gaining conditions) for Scenarios 3-5. Stream recharge is predicted to increase for all scenarios, with the largest increases (3,800 to 3,900 afy) occurring for the proposed project. The predicted increase is less for Alternative A (about 2,800 afy). For Alternative B, the predicted increase in stream recharge depends on the SPSP well field location. The predicted increase is about 2,400 afy for the western well field location (Scenario 4) and about 1,500 afy for the eastern well field (Scenario 5). The increased stream recharge represents a corresponding reduction in Sacramento River streamflow, but the magnitude of the reduction as a percentage of total streamflow is very small. In the 2004 water year, which is considered to be a normal water year, the average streamflow at the Verona Gage station of the Sacramento River was 15.1 million afy (California Data Exchange Center [CDEC], 2008), suggesting that the predicted simulated increases in stream recharge would be about one-tenth of a percent of the average streamflow of the river.

Groundwater inflow to the Natomas Basin from the western model boundary is also predicted to increase due to the proposed project and alternatives. Like the increase in stream recharge, this occurs as a result of steeper gradients due to increased pumping in the SPSP area, but the magnitude of the predicted increase is smaller than the increase in stream recharge. For Scenarios 1-4, which utilize either the western well field or both well fields, the increase ranges from a high of about 3,200 afy for Scenario 1 to a low of about 2,000 afy for Scenario 4. It is lowest (about 700 afy) for Scenario 5, which uses only the eastern well field. As discussed above, some of this boundary inflow, especially that which occurs in Layer 1, may actually represent additional recharge from the Sacramento River rather than groundwater flow beneath the River from the west.

Subsurface inflow to the Natomas Basin is negative for Scenarios 1, 2A, and 4, which means that there is a net outflow of groundwater to the rest of the North American Subbasin. The subsurface outflow for the ECB (about 11,800 afy) is predicted to continue for Scenarios 1, 2A, and 4. However, the amount of outflow is greatly reduced due to additional pumping in the SPSP area as a result of the project. The greatest reduction in outflow (about 5,900 afy) is predicted to occur for Scenario 2A, and Scenario 4 shows the smallest reduction (about 2,500 afy) due to the use of the western well field.

For the FCB, higher heads east of the Natomas Basin due to the planned transition from groundwater to surface-water supply result in much less subsurface outflow (about 4,500 afy). Additional reductions in subsurface outflow due to SPSP pumping are expected to result in a positive subsurface inflow for Scenarios 2B, 3, and 5. The magnitude of the predicted inflow ranges from a high of about 1,700 afy for Scenario 2B to a low of only about 70 afy for Scenario 5. Whether this predicted reversal of gradient actually occurs will depend primarily on the accuracy of assumptions about the future source of municipal supply as indicated in UWMPs for water purveyors in the North American Subbasin.

The change in storage in the Natomas Basin is positive for all scenarios, which indicates that heads are predicted to rise even with increased pumping in the SPSP area. The change in storage

is slightly less positive for most of the project scenarios, which represents a relatively minor impact of additional SPSP pumping. This magnitude of the impact ranges from about 100 afy for Scenarios 1 and 2A to less than 30 afy for Scenarios 3 and 5. As discussed above, heads are predicted to rise for all scenarios, although the rate of increase will be less with the proposed project. Simulated groundwater pumping for the FCB is about 28,400 afy in the Natomas Basin, and it is projected to increase by only about 300 afy for Scenarios 4 and 5. Due to changes in the pumping location, however, there is a small net increase in change in storage for Scenario 4 compared to the FCB.

7.0 GROUNDWATER SUPPLY SUFFICIENCY

As groundwater is one of the sources of supply to the proposed SPSP project, the WSA is required by Water Code Section 10910 to provide, among other information such as documentation of the projected water demands for the project, an analysis of the sufficiency of groundwater from the basin from which the proposed project will be supplied to meet the projected water demands associated with the project. This GSA has addressed this and other groundwater source requirements, including evaluation of the water needs of the SPSP project until the year 2030 in relation to existing and future water demands and supplies within the SPSP area, the Natomas Basin, and the North American Subbasin.

As described in this GSA, the area from which groundwater will be withdrawn to meet the projected demands for the SPSP project and other public, agricultural, and industrial uses is the future SPSP water system service area that overlies a portion of the North American Subbasin of the Sacramento Valley Groundwater Basin. The boundaries of the future SPSP water system service area are located within the Natomas Basin. Historical, current, and projected groundwater conditions in the North American Subbasin were also evaluated as part of the groundwater supply sufficiency analysis.

The analysis of the proposed project pumping impacts and groundwater sufficiency used a pair of existing numerical groundwater flow models (NARIGSM and SACIGSM) to evaluate the impacts of the proposed SPSP project and project alternatives on groundwater conditions in the North American Subbasin. Two baseline (no-project) scenarios (2004 [ECB] and 2030 [FCB]) and five project scenarios were developed and simulated with the linked NARIGSM and SACIGSM models. The model output for each scenario includes simulated monthly groundwater elevations and annual water budgets for each year of the 35-year simulation. The water budget information allowed analysis of inflows to and outflows from the Natomas Basin and change in storage within the Natomas Basin for normal, wet, single-dry, and multiple-dry water year types and also average annual values during the simulation period.

This chapter summarizes the potential impacts of SPSP project pumping and analysis of the sufficiency of groundwater from the basin from which the proposed project will be supplied to meet the projected water demands associated with the SPSP proposed project and project alternatives.

7.1 Potential Pumping Impacts

The potential impacts of pumping for the SPSP proposed project and project alternatives are summarized below.

For all scenarios, the simulated drawdowns are primarily localized in the SPSP area. Off-site drawdowns are greatest for the proposed project, and Scenario 2 (buildout) has larger off-site drawdowns than Scenario 1 even though total pumpage in the SPSP area is less. This is the result of the well field location since simulated drawdowns are smaller for scenarios that utilize the western well field due to a greater percentage of the water to supply the pumpage coming from the

Sacramento River and the western model boundary (beneath the River). For the proposed project at buildout (Scenario 2), the maximum predicted off-site drawdowns are slightly more than 15 feet in Sutter County and about 10 feet in Sacramento County. Off-site drawdowns are considered to be relatively small given that groundwater levels in the Natomas Basin have historically been high and are predicted to remain high in the future. East of the Natomas Basin, where a cone of depression already exists, the proposed project will have relatively small drawdown impacts of less than three feet.

For scenarios based on the FCB, year-to-year groundwater level fluctuations due to wet and dry periods are magnified due to planned conjunctive use to meet municipal water demands. These fluctuations are the result of increased use of surface water in wet years and increased groundwater pumping during dry years (WRIME, 2007). Almost all hydrographs show increasing groundwater levels over the 35-year simulation period, including wells located in the cones of depression east of the Natomas Basin.

The impacts of the proposed project and the project alternatives on groundwater conditions in the North American Subbasin are shown on the water budget tables discussed in **Chapter 6**. Although most impacts are larger for the proposed project than the project alternatives, the reduction in deep percolation (about 6,600 afy based on the 1982 to 2004 average) results from the conversion of irrigated agricultural land to urban land uses and is the same for all buildout scenarios.

Recharge from the Sacramento River is predicted to result in losing stream conditions for Scenarios 1 and 2 and gaining conditions for Scenarios 3, 4, and 5. Stream recharge is predicted to increase for all scenarios, with the largest increases (an average of 3,800 to 3,900 afy for the 1982 to 2004 period) occurring for the proposed project. The increased stream recharge represents a corresponding reduction in Sacramento River streamflow, but the magnitude of the reduction as a percentage of total streamflow is very small. In the 2004 water year, which is considered to be a normal water year, the average streamflow at the Verona Gage on the Sacramento River was over 15 million af (CDEC, 2008), suggesting that the predicted increases in stream recharge would be about one-tenth of a percent of the average streamflow.

Groundwater inflow from the western model boundary to the Natomas Basin is also predicted to increase due to the proposed project and alternatives. Similar to the increase in stream recharge, this occurs as a result of steeper gradients due to increased pumping in the SPSP area, but the magnitude of the predicted increase is smaller than the increase in stream recharge. As discussed in Chapter 6, some of this boundary inflow, especially in the upper portion of the aquifer system, may actually represent additional recharge from the Sacramento River rather than groundwater flow beneath the River from the west.

For the ECB, the simulated subsurface outflow to the rest of the North American Subbasin is about 11,800 afy based on the 1982 to 2004 average. The amount of outflow is reduced due to additional pumping in the SPSP area as a result of the project, with the greatest reduction in outflow (about 5,900 afy) occurring for Scenario 2A and the smallest reduction occurring for Scenario 4 (about 2,500 afy) due to the use of the western well field.

For the FCB, the higher groundwater levels predicted to occur east of the Natomas Basin due to the planned transition from groundwater to surface-water supply would result in much less subsurface outflow (about 4,500 afy). The addition of project pumping will further reduce subsurface outflow and is expected to result in a positive subsurface inflow for Scenarios 2B, 3, and 5. Whether this predicted reversal of gradient actually occurs will depend primarily on the assumptions about the future source of municipal water supply as indicated in UWMPs for the North American Subbasin.

The water budget analyses also allowed assessment of the change in groundwater storage occurring during selected periods of analysis, including the various water year types and the average change in storage for the 1982 to 2004 period. The change in storage in the Natomas Basin is positive for all scenarios, which indicates that heads are predicted to rise even with increased pumping in the SPSP area.

7.2 Groundwater Supply Sufficiency

The results of the analyses conducted for this GSA lead to the conclusion that groundwater supplies from the North American Subbasin are sufficient to serve the proposed SPSP project or project alternatives and other existing and projected uses through the year 2030. The primary reasons for this conclusion are summarized below:

- In the Natomas Basin, groundwater levels have generally been high and relatively stable in the northern and western portion but have declined in recent years in a few wells in the southern portion. Groundwater levels along the eastern edge of the Natomas Basin show historical declines followed by stabilization. Groundwater levels in the eastern area are significantly affected by the cone of depression centered a few miles to the east.

- Historical groundwater level declines have occurred in much of the central, eastern, and southern portions of the North American Subbasin. Overdraft has occurred historically in the latter areas and appears to still be occurring in the central portion of the subbasin east of the SPSP area. In recent years, groundwater levels have stabilized in other areas where historical overdraft has been reported. This suggests that overdraft conditions have abated in most of the subbasin.

- Water level data are limited in the SPSP area, but groundwater levels appear to have been consistently high (generally within ten feet of the ground surface in the spring) and relatively stable in recent years. Similar to the rest of the Natomas Basin, groundwater levels near the eastern edge of the SPSP area are significantly affected by the cone of depression centered about three miles to the east.

- Land use and water supplies were evaluated for current (2004) and future (2030) conditions in the Natomas Basin (Chapter 2); this analysis shows total groundwater utilization in 2004 in the Natomas Basin. Estimated future pumpage with the project is 31,963 afy (**Table 2-3**) and without the project is 27,258 afy (**Table 2-4**). Without the project, pumpage estimates for the Natomas Basin are similar for current (28,636 afy) (**Table 2-2**) and future conditions (27,258 afy). Groundwater pumping would increase by only 4,705 afy with the project even though proposed pumping at buildout (Phases 4 and

D) during a normal year is 13,072 afy. This is due to the phasing out of groundwater pumping for agricultural land uses in the project area and also the shift from groundwater to surface-water utilization in other parts of the Natomas Basin.

- Future water demand and supply estimates for northern Sacramento County were primarily based on UWMPs for each water district in the northern area. As reported by WRIME (2007), all of the plans identified future demand projections and water supply sources to meet the demands. Most of the plans also indicate a significant transition from groundwater to surface-water utilization to meet municipal water demands.

- Projected water demand and supply for the five SPSP project scenarios (Chapter 6) in normal and critically-dry years served as the basis for the analysis of potential pumping impacts and groundwater supply sufficiency**.** The total simulated water supply for the ECB in the North American Subbasin includes 384,300 afy of surface water (used only for water supply) and 389,800 afy of groundwater (which includes some remediation pumping along with water supply pumping) (Jim Blanke, pers. comm., April 23, 2008). The total simulated water supply for the FCB in the North American Subbasin includes 535,800 afy of surface water (used only for water supply) and 328,000 afy of groundwater (including some remediation pumping along with water supply pumping). On a subbasin scale, this indicates a significant transition from groundwater to surface water to meet future water demands.

- Current pumpage in the Natomas Basin is somewhat less than the average annual rate of groundwater recharge; the ECB showed a positive change in storage of 183 afy (**Table 6-3**) for 1982 to 2004 of the simulation period.

- Future pumpage in the Natomas Basin, without the SPSP proposed project, is less than the current average annual pumping rate and also less than the average annual rate of groundwater recharge; the FCB showed a positive change in storage of 922 afy based on the 1982-2004 average (**Table 6-6**).

- The simulated deep percolation rates in the Natomas Basin for the ECB and FCB were about 0.7 af/ac on average. As discussed in Chapter 2, total deep percolation estimated for the Natomas Basin based on projected land use, applied water, ET, runoff, canal seepage, and other factors ranged from about 0.6 to 0.8 af/ac based on deep percolation estimates for rice of 0.5 and 1.0 af/ac, respectively. The model results for deep percolation on a per acre basis for the Natomas Basin are within the range of the deep percolation estimates in Chapter 2. The simulated deep percolation rate was reduced by about 6,600 afy (to approximately 0.6 af/ac) due to land use changes resulting from the project. The reduction in deep percolation is offset by increased recharge from the Sacramento River and other factors.

- Scenarios 1 and 2A simulated groundwater conditions at the end of Phases 2 and B (about 12 years into the project) and Phases 4 and D (Year 20), respectively. These two scenarios were compared to the ECB. The average annual water budget results for a 23-year future period (based on 1982 to 2004 hydrologic conditions) showed a positive change in storage of 61 afy (Scenario 2A) and 65 afy (Scenario 1) (**Tables 6-7** and **6-8**). These results are

consistent with the simulated groundwater conditions (i.e., generally stable groundwater levels in most of the Natomas Basin). Scenario 1, the most conservative scenario, simulates SPSP pumpage along with existing agricultural pumpage. The pumpage for Scenario 1 is 2,400 afy more than for the SPSP proposed project at buildout (Scenarios 2A and 2B).

- Scenarios 2B, 3, 4, and 5 (which simulated full buildout of the SPSP) all showed a somewhat smaller change in groundwater storage compared to the FCB; however, these four scenarios showed a positive change in storage ranging from 840 afy (Scenario 2B) to 929 afy (Scenario 4) (**Tables 6-8** to **6-12**). These positive changes in storage are consistent with the simulated groundwater conditions (i.e., increases in groundwater levels in the Natomas Basin) for the FCB.

In summary, the analyses of observed and simulated groundwater levels and the water budget results demonstrate that groundwater supplies from the Natomas Basin and the North American Subbasin are sufficient to meet the demands of the SPSP proposed project and the project alternatives as well as other pumpage in the Natomas Basin and the North American Subbasin for more than a 20-year horizon. The model results indicate that groundwater supplies will be sufficient to meet these demands for simulations based either on existing or future conditions in the North American Subbasin. Groundwater supplies are indicated to be sufficient for the SPSP proposed project and project alternatives, as shown by the positive change in storage in the Natomas Basin and simulated groundwater levels for the North American Subbasin that are generally stable or increasing following the initial years of the 35-year simulation period.

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Tables

Table 2-1
Estimated Water Supply in the Natomas Basin

Study	Author/Date	Study Area	Area Irrigated with Surface Water (ac)	Area Irrigated with Groundwater (ac)	Water Supply (af)		
					Surface Water Deliveries	Tailwater Recycling	Groundwater Pumpage[1]
Evaluation of Groundwater Resources: Sacramento Valley (Bulletin 118-6)	DWR (1978)	Natomas Basin					28,000 (1961 & 70) [2]
A Summary of Ground-Water Pumpage in the Central Valley, California, 1961-77	USGS (1983)	Natomas Basin					25,000 - 49,000 (1961-77 range) 32,000 (1961-77 avg) [2]
Feasibility Report: American Basin Conjunctive Use Project	DWR (1997)	Natomas Basin north of I-5	30,200 [3]	3,500 [3]			12,000 - 23,000 (1970-90 range) 19,000 (1970-90 avg) [4]
Natomas Area Ground-Water Management Plan (Draft)	NCMWC (2002)	Natomas Basin[5]	36,000			30,000	18,000 - 20,000 (1970-90) (based on DWR, 1997)[5]
Sacramento River Basinwide Water Management Plan	DWR (2003)	NCMWC service area (50,800 ac)	29,500	2,800			15,000 (based on 1990 & 1998 DWR land use maps)
Regional Water Master Plan	American River Basin Cooperating Agencies (2003)	Sac County portion of Natomas Basin					11,500 (1990) (including 1,700 for airport)
Evaluation of Groundwater Impacts of Proposed Developments by the NCMWC (Draft Memo)	WRIME (2005)	Natomas Basin			134,600 (combined surface and recycled water, 2004)		30,300 (2004)
Integrated Water Resources Management Plan	American States Water Co., et al. (2006)	Natomas Basin	25,000 (1996) 19,700 (2006)	2,800 (all), 2,000 (part), 4,800 (total)	92,494 (1985-2004 avg) [5]	20% of surface water deliveries	>10,000 to ~50,000 based on four of the studies above
Sutter Pointe Groundwater Supply Assessment (this report[6])	LSCE (2007)	Natomas Basin	22,700 (2004)	3,300 (2004)	103,700 (2004)	31,000 (2004)	24,500 (2004)

1. Pumpage estimates do not include Sacramento International Airport except as indicated.
2. Estimate in IWRMP (Am. States Water Co. et al, 2006) based on pumpage estimates by township in DWR and USGS reports.
3. Acreages are for study area (Natomas Basin north of I-5) only. Almost are areas indicated to use groundwater are in Sutter County.
4. Pumpage is for study area (Natomas Basin north of I-5) only. Pumpage based on IGSM model inputs as plotted on Figure 3.
5. Groundwater pumpage estimate only for Natomas Basin north of I-5 (34,000 ac). Pumpage estimate based on incorrect interpretation of graph (Figure 3) in DWR (1997).
6. See detailed estimate in Table 2-2.

Table 2-2
2004 Land Use and Estimated Water Demand and Supply in the Natomas Basin

Location	Category	Land Use[1]	Area (acres)[1]					Demand Factor[3]	Water Demand[4]	Water Supply (afy)[5]				
			Source of Supply				Total Acres			Ground-water	Surface Water			Recycled Water
			Ground-water	Surface Water		No Supply or Other[2]					NCMWC	Riparian Rights	Sac City /County	
				NCMWC	Riparian Rights									
Sutter Pointe Specific Plan	Agriculture	Rice	1,258	4,719	0	0	5,977	6.0	35,862	7,548	21,902	0		6,412
		Grain/Hay	57	0	0	0	57	2.5	143	143	0	0		0
		Pasture	38	0	0	0	38	4.8	182	182	0	0		0
		Fallow	811	0	0	0	811	0.0	0	0	0	0		0
		Subtotal	**2,164**	**4,719**	**0**	**0**	**6,883**	**-**	**36,187**	**7,873**	**21,902**	**0**		6,412
	Other	Rural Residential	29	0	0	0	29	2.0	58	58	0	0		0
		Industrial/Commercial	146	0	0	0	146	3.0	437	437	0	0		0
		Native Vegetation	184	0	0	0	184	0.0	0	0	0	0		0
		Infrastructure/Vacant	287	0	0	0	287	0.0	0	0	0	0		0
		Subtotal	**645**	**0**	**0**	**0**	**645**	**-**	**495**	**495**	**0**	**0**		0
	Total		**2,809**	**4,719**	**0**	**0**	**7,528**	**-**	**36,681**	**8,367**	**21,902**	**0**		**6,412**
Sutter County Other	Agriculture	Rice	798	5,851	660	0	7,308	6.5	47,504	5,185	29,419	4,287		8,613
		Grain/Hay	0	0	73	0	73	2.5	182	0	0	182		0
		Pasture	19	54	244	0	317	4.8	1,522	92	200	1,170		59
		Field Crops	0	20	81	0	101	2.5	252	0	39	202		11
		Truck & Misc. Crops	56	0	57	0	112	2.2	247	122	0	125		0
		Fallow	104	113	120	0	338	0.0	0	0	0	0		0
		Subtotal	**977**	**6,038**	**1,234**	**0**	**8,249**	**-**	**49,707**	**5,400**	**29,658**	**5,966**		**8,683**
	Other	Rural Residential	88	0	0	0	88	2.0	176	176	0	0		0
		Aquaculture Facility[6]	8	0	0	0	8	500	4,000	4,000	0	0		0
		Industrial/Commercial	30	0	0	0	30	3.0	90	90	0	0		0
		Native Vegetation	2	0	224	89	315	0.0	0	0	0	0		0
		Managed Marsh[7]	0	304	0	0	304	6.5	1,976	494	1,146	0		336
		Infrastructure/Vacant	1	0	0	715	716	0.0	0	0	0	0		0
		Subtotal	**129**	**304**	**224**	**804**	**1,461**	**-**	**6,242**	**4,760**	**1,146**	**0**		**336**
	Total		**1,106**	**6,342**	**1,458**	**804**	**9,710**	**-**	**55,949**	**10,160**	**30,804**	**5,966**		**9,019**
Sutter County Total			**3,915**	**11,061**	**1,458**	**804**	**17,238**	**-**	**92,630**	**18,527**	**52,706**	**5,966**		**15,431**
Sacramento County	Agriculture	Rice	530	8,572	0	0	9,102	6.5	59,162	3,444	43,100	0		12,618
		Grain/Hay	89	872	215	0	1,176	2.5	2,941	223	1,686	538		494
		Pasture	38	459	147	0	644	4.8	3,093	184	1,704	706		499
		Safflower	204	543	215	0	962	1.0	962	204	420	215		123
		Other Field Crops	113	866	472	0	1,451	2.5	3,628	283	1,675	1,180		490
		Fruits/Nuts	0	88	110	0	198	4.0	792	0	272	440		80
		Truck & Misc. Crops	59	634	67	0	760	2.2	1,673	131	1,079	147		316
		Fallow	93	953	250	5,396	6,692	0.0	0	0	0	0		0
		Subtotal	**1,128**	**12,987**	**1,476**	**5,396**	**20,987**	**-**	**72,252**	**4,470**	**49,936**	**3,226**		**14,620**
	Other	Rural Residential	453	0	0	0	453	2.0	906	906	0	0		0
		Industrial/Commercial	103	0	0	0	103	3.0	309	309	0	0		0
		Other Urban/City of Sac[4]	0	0	0	6,357	6,357	3.0	19,071	3,300	0	0	15,771	0
		Sacramento Int. Airport[8]	355	0	0	0	355	3.0	1,065	1,065	0	0	0	0
		Airport Landscaping[8]	0	64	0	212	276	4.3	275	0	212	0		62
		Golf Course[9]	0	306	0	0	306	3.0	918	0	710	0		208
		Native Vegetation	0	105	1,526	941	2,572	0.0	0	0	0	0		0
		Managed Marsh[7]	0	36	0	135	171	6.5	1,112	59	136	0		917
		Infrastructure/Vacant	7	0	562	4,993	5,562	0.0	0	0	0	0		0
		Subtotal	**918**	**511**	**2,088**	**12,638**	**16,155**	**-**	**23,655**	**5,639**	**1,058**	**0**	**15,771**	**1,187**
Sacramento County Total			**2,046**	**13,498**	**3,564**	**18,034**	**37,142**	**-**	**95,907**	**10,109**	**50,994**	**3,226**	**15,771**	**15,807**
Natomas Basin Total			**5,961**	**24,559**	**5,022**	**18,838**	**54,380**	**-**	**188,537**	**28,636**	**103,700**	**9,191**	**15,771**	**31,238**

Footnotes:

1 Land use and acreage for NCMWC shareholder lands from NCMWC records. Land use and acreage for other areas from DWR online GIS land use maps for Sutter County (2004) and Sacramento County (2000). "Rice" designation is primarily white rice but includes wild rice.

2 Includes areas supplied by City of Sacramento or by 100% recycled water (BKS parcel owned by NBC).

3 Most demand factors from IWRMP (American States, et. al, 2006). Demand factor for rice in SPSP reduced to 6.0 af/ac because about half is planted to wild rice, which has a shorter growing season and does not require fall flooding (Chris McKenzie, pers. comm., 2007). Demand factor for pasture (4.8 af/ac) based on DWR (1974) estimate for Placer County. Demand factor for industrial from M&S (2007). Demand factor for rural residential (2.0 af/ac) estimated based on visual inspection. Managed marsh assumed to have same demand factor as rice (6.5 af/ac) based

4 Total urban acres in southeast Natomas Basin based DWR online GIS land use map for Sacramento County (2000) and updated/revised based on 2004 aerial photo from USDA. Pumpage (3,300 af) for Sacramento County and City of Sacramento is based on 2004 water year.

5 Recycled water estimated to supply 22.6% of the demand in areas irrigated with NCMWC water. Recycled water from the aquaculture facility aslo estimated to supply about 900 af of water to NBC managed marsh. In 2004 NCMWC reports having delivered 93,705 af of Base Supply and Project Water and 10,000 af of Sacramento River Water for rice decomposition totaling 103,705 af surface water delivered in 2004.

6 Water demand based on discharge limit (4,113 afy) in NPDES Permit No. CA 0085197.

7 NBC managed marsh irrigated primarily with surface water, but groundwater used at beginning and end of irrigation season assumed to account for 25% of the total. In Sacramento County, NBC has 135 acres of managed marsh (BKS property) in "Other" source of supply category served by 100% recycled water from aquaculture facility (pers. comm., NBC, 2007).

8 In 2004 SIA potable water demands were supplied by groundwater and landscaping demands were met by NCMWC surface water.

9 Water demand for golf course reduced because acreage includes non-irrigated areas.

Table 2-3
Projected 2030 Land Use and Water Demand and Supply in the Natomas Basin

Location	Category	Land Use[1]	Area (acres)[1]					Demand Factor[3]	Water Demand	Water Supply (afy)[5]				
			Source of Supply				Total Acres			Groundwater	Surface Water			Recycled Water
			Groundwater	Surface Water		No Supply or Other[2]					NCMWC	Riparian	Sac City/ County	
				NCMWC	Riparian Rights									
Sutter Pointe Specific Plan	Urban	Residential	1,496	1,399	0	0	2,895.0	4.1	11,762	6,101	5,660	0		0
		Industrial/Commercial	1,876	1,755	0	0	3,631.3	2.7	9,729	5,047	4,682	0		0
		Public	517	484	0	0	1,001.3	3.7	3,709	1,924	1,785	0		0
	Agriculture		0	0	0	0	0.0	-	0	0	0	0		0
	Total		**3,890**	**3,638**	**0**	**0**	**7,527.6**	**-**	**25,199**	**13,072**	**12,127**	**0**		**0**
Sutter County Other	Agriculture	Rice	798	4,007	660	0	5,464	6.5	35,518	5,185	20,147	4,287		5,899
		Grain/Hay	0	0	73	0	73	2.5	182	0	0	182		0
		Pasture	19	54	244	0	317	4.8	1,522	92	200	1,170		59
		Field Crops	0	20	81	0	101	2.5	252	0	39	202		11
		Truck & Misc. Crops	56	0	57	0	112	2.2	247	122	0	125		0
		Fallow	104	113	120	0	338	0.0	0	0	0	0		0
		Subtotal	**977**	**4,194**	**1,234**	**0**	**6,405**	**-**	**37,721**	**5,400**	**20,386**	**5,966**		**5,969**
	Other	Rural Residential	88	0	0	0	88	2.0	176	176	0	0		0
		Aquaculture Facility[6]	8	0	0	0	8	500	4,000	4,000	0	0		0
		Industrial/Commercial	30	0	0	0	30	3.0	90	90	0	0		0
		Native Vegetation	2	933	224	89	1,248	0.0	0	0	0	0		0
		Managed Marsh[7]	0	1,215	0	0	1,215	6.5	7,898	1,974	4,582	0		1,341
		Infrastructure/Vacant	1	0	0	715	716	0.0	0	0	0	0		0
		Subtotal	**129**	**2,148**	**224**	**804**	**3,305**	**-**	**12,164**	**6,240**	**4,582**	**0**		**1,341**
	Total		**1,106**	**6,342**	**1,458**	**804**	**9,710**	**-**	**49,884**	**11,640**	**24,968**	**5,966**		**7,310**
Sutter County Total			**4,996**	**9,980**	**1,458**	**804**	**17,238**	**-**	**75,083**	**24,713**	**37,095**	**5,966**		**7,310**
Sacramento County	Agriculture	Rice	530	6,728	0	0	7,258	6.5	47,176	3,444	33,828	0		9,904
		Grain/Hay	89	872	215	0	1,176	2.5	2,941	223	1,686	538		494
		Pasture	38	422	147	0	607	4.8	2,916	184	1,567	706		459
		Safflower	80	543	215	0	838	1.0	838	80	420	215		123
		Other Field Crops	113	866	472	0	1,451	2.5	3,628	283	1,675	1,180		490
		Fruits/Nuts	0	88	110	0	198	4.0	792	0	272	440		80
		Truck & Misc. Crops	59	634	67	0	760	2.2	1,673	131	1,079	147		316
		Fallow	93	835	250	368	1,546	0.0	0	0	0	0		0
		Subtotal	**1,004**	**10,988**	**1,476**	**368**	**13,836**	**-**	**59,964**	**4,346**	**40,527**	**3,226**		**11,865**
Sacramento County	Other (Existing)	Rural Residential	391	0	0	0	391	2.0	782	782	0	0		0
		Industrial/Commercial	103	0	0	0	103	3.0	309	309	0	0		0
		Other Urban/City of Sac[4]	0	0	0	15,312	15,312	3.0	45,936	0	0	0	45,936	0
		Sacramento Int. Airport	0	0	0	355	355	3.0	1,065	0	0	0	1,065	0
		Airport Landscaping[8]	64	0	0	212	276	4.3	275	275	0	0		0
		Golf Course[9]	0	306	0	0	306	3.0	918	0	710	0		208
		Native Vegetation	0	1,038	1,382	0	2,420	0.0	0	0	0	0		0
		Managed Marsh[7]	0	947	0	135	1,082	6.5	7,033	1,539	3,571	0		1,923
		Infrastructure/Vacant	0	0	562	0	562	0.0	0	0	0	0		0
	Other (New)	Metro Airpark[4]	0	0	0	1,900	1,900	3.0	5700	-	-	-	5,700.0	-
		Greenbriar[4]	0	0	0	600	600	3.0	1800	-	-	-	1,800.0	-
		Subtotal	**558**	**2,291**	**1,944**	**18,514**	**23,307**	**-**	**63,818**	**2,904**	**4,281**	**0**	**54,501**	**2,131**
Sacramento County Total			**1,562**	**13,279**	**3,420**	**18,882**	**37,143**	**-**	**123,782**	**7,251**	**44,808**	**3,226**	**54,501**	**13,996**
Natomas Basin Total			**6,557**	**23,259**	**4,878**	**19,686**	**54,380**	**-**	**198,865**	**31,963**	**81,903**	**9,191**	**54,501**	**21,306**

Footnotes:

1 Land use and acreage for NCMWC shareholder lands from NCMWC records. Land use and acreage for other areas from DWR online GIS land use maps for Sutter County (2004) and Sacramento County (2000).

2 Includes acres supplied by City of Sacramento or by 100% recycled water (BKS property managed marsh).

3 Most demand factors from IWRMP (American States, et. al, 2006). Demand factor for pasutre (4.8 af/ac) based on DWR (1974) estimate for Placer County. Demand factor for industrial from M&S (2007). Demand factor for rural residential in Sutter County (2.0 af/ac) estimated based on visual inspection. Managed marsh same demand factor as rice (6.5 af/ac) based on discussions with NBC.

4 Southeast Natomas Basin, Metro Airpark and Greenbriar assumed to be built-out and served by City of Sacramento.

5 Recycled water estimated to supply 22.6% of the demand in areas irrigated with NCMWC water.

6 Water demand based on discharge limit (4,113 afy) in NPDES Permit No. CA 0085197.

7 NBC managed marsh irrigated primarily with surface water, but groundwater used at beginning and end of irrigation season assumed to account for 25% of the total. In Sacramento County, NBC has 135 acres of managed marsh (BKS property) in "Other" source of supply category served by 100% recycled water from aquaculture facility (pers. comm., NBC, 2007). New managed marsh assumed to be half in Sutter County and half in Sacramento County.

8 Sacramento International Airport demands met by City of Sacramento and landscaping demands met by groundwater (pers. comm., Sacramento County Airport System, 2008). Use 2020 projected water demands by HDR (Water Requirements and Alternatives Analysis, 2003).

9 Water demand for golf course reduced because acreage includes non-irrigated areas.

Table 2-4
Projected 2030 Land Use and Water Demand and Supply in the Natomas Basin
No Project

Location	Category	Land Use[1]	Area (acres)[1]					Demand Factor[3]	Water Demand	Water Supply (afy)[5]				
			Source of Supply				Total Acres			Groundwater	Surface Water			Recycled Water
			Groundwater	Surface Water		No Supply or Other[2]					NCMWC	Riparian	Sac City/ County	
				NCMWC	Riparian Rights									
Sutter Pointe Specific Plan	Agriculture	Rice	1,258	4,719	0	0	5,977	6.0	35,862	7,548	21,902	0		6,412
		Grain/Hay	57	0	0	0	57	2.5	143	143	0	0		0
		Pasture	38	0	0	0	38	4.8	182	182	0	0		0
		Fallow	811	0	0	0	811	0.0	0	0	0	0		0
		Subtotal	**2,164**	**4,719**	**0**	**0**	**6,883**	**-**	**36,187**	**7,873**	**21,902**	**0**		6,412
	Other	Rural Residential	29	0	0	0	29	2.0	58	58	0	0		0
		Industrial/Commercial	146	0	0	0	146	3.0	437	437	0	0		0
		Native Vegetation	184	0	0	0	184	0.0	0	0	0	0		0
		Infrastructure/Vacant	287	0	0	0	287	0.0	0	0	0	0		0
		Subtotal	**645**	**0**	**0**	**0**	**645**	**-**	**495**	**495**	**0**	**0**		0
	Total		**2,809**	**4,719**	**0**	**0**	**7,528**	**-**	**36,681**	**8,367**	**21,902**	**0**		**6,412**
Sutter County Other	Agriculture	Rice	798	4,007	660	0	5,464	6.5	35,518	5,185	20,147	4,287		5,899
		Grain/Hay	0	0	73	0	73	2.5	182	0	0	182		0
		Pasture	19	54	244	0	317	4.8	1,522	92	200	1,170		59
		Field Crops	0	20	81	0	101	2.5	252	0	39	202		11
		Truck & Misc. Crops	56	0	57	0	112	2.2	247	122	0	125		0
		Fallow	104	113	120	0	338	0.0	0	0	0	0		0
		Subtotal	**977**	**4,194**	**1,234**	**0**	**6,405**	**-**	**37,721**	**5,400**	**20,386**	**5,966**		**5,969**
	Other	Rural Residential	88	0	0	0	88	2.0	176	176	0	0		0
		Aquaculture Facility[6]	8	0	0	0	8	500	4,000	4,000	0	0		0
		Industrial/Commercial	30	0	0	0	30	3.0	90	90	0	0		0
		Native Vegetation	2	933	224	89	1,248	0.0	0	0	0	0		0
		Managed Marsh[7]	0	1,215	0	0	1,215	6.5	7,898	1,974	4,582	0		1,341
		Infrastructure/Vacant	1	0	0	715	716	0.0	0	0	0	0		0
		Subtotal	**129**	**2,148**	**224**	**804**	**3,305**	**-**	**12,164**	**6,240**	**4,582**	**0**		**1,341**
	Total		**1,106**	**6,342**	**1,458**	**804**	**9,710**	**-**	**49,884**	**11,640**	**24,968**	**5,966**		**7,310**
Sutter County Total			**3,915**	**11,061**	**1,458**	**804**	**17,238**	**-**	**86,566**	**20,008**	**46,870**	**5,966**		**13,722**
Sacramento County	Agriculture	Rice	530	6,728	0	0	7,258	6.5	47,176	3,444	33,828	0		9,904
		Grain/Hay	89	872	215	0	1,176	2.5	2,941	223	1,686	538		494
		Pasture	38	422	147	0	607	4.8	2,916	184	1,567	706		459
		Safflower	80	543	215	0	838	1.0	838	80	420	215		123
		Other Field Crops	113	866	472	0	1,451	2.5	3,628	283	1,675	1,180		490
		Fruits/Nuts	0	88	110	0	198	4.0	792	0	272	440		80
		Truck & Misc. Crops	59	634	67	0	760	2.2	1,673	131	1,079	147		316
		Fallow	93	835	250	368	1,546	0.0	0	0	0	0		0
		Subtotal	**1,004**	**10,988**	**1,476**	**368**	**13,836**	**-**	**59,964**	**4,346**	**40,527**	**3,226**		**11,865**
Sacramento County	Other (Existing)	Rural Residential	391	0	0	0	391	2.0	782	782	0	0		0
		Industrial/Commercial	103	0	0	0	103	3.0	309	309	0	0		0
		Other Urban/City of Sac[4]	0	0	0	15,312	15,312	3.0	45,936	0	0	0	45,936	0
		Sacramento Int. Airport	0	0	0	355	355	3.0	1,065	0	0	0	1,065	0
		Airport Landscaping[8]	64	0	0	212	276	4.3	275	275	0	0		0
		Golf Course[9]	0	306	0	0	306	3.0	918	0	710	0		208
		Native Vegetation	0	1,038	1,382	0	2,420	0.0	0	0	0	0		0
		Managed Marsh[7]	0	947	0	135	1,082	6.5	7,033	1,539	3,571	0		1,923
		Infrastructure/Vacant	0	0	562	0	562	0.0	0	0	0	0		0
	Other (New)	Metro Airpark[4]	0	0	0	1,900	1,900	3.0	5700	-	-	-	5,700.0	-
		Greenbriar[4]	0	0	0	600	600	3.0	1800	-	-	-	1,800.0	-
		Subtotal	**558**	**2,291**	**1,944**	**18,514**	**23,307**	**-**	**63,818**	**2,904**	**4,281**	**0**	**54,501**	**2,131**
Sacramento County Total			**1,562**	**13,279**	**3,420**	**18,882**	**37,143**	**-**	**123,782**	**7,251**	**44,808**	**3,226**	**54,501**	**13,996**
Natomas Basin Total			**5,477**	**24,340**	**4,878**	**19,686**	**54,381**	**-**	**210,347**	**27,258**	**91,678**	**9,191**	**54,501**	**27,718**

Footnotes:

1 Land use and acreage for NCMWC shareholder lands from NCMWC records. Land use and acreage for other areas from DWR online GIS land use maps for Sutter County (2004) and Sacramento County (2000).

2 Includes acres supplied by City of Sacramento or by 100% recycled water (BKS property managed marsh).

3 Most demand factors from IWRMP (American States, et. al, 2006). Demand factor for rice in SPSP reduced to 6.0 af/ac because about half is planted to wild rice, which has a shorter growing season and does not require fall flooding (Chris McKenzie, pers. comm., 2007). Demand factor for pasture (4.8 af/ac) based on DWR (1974) estimate for Placer County. Demand factor for industrial from M&S (2007). Demand factor for rural residential (2.0 af/ac) estimated based on visual inspection. Managed marsh assumed to have same demand factor as rice (6.5 af/ac) based on discussions with NBC.

4 Southeast Natomas Basin, Metro Airpark and Greenbriar assumed to be built-out and served by City of Sacramento.

5 Recycled water estimated to supply 22.6% of the demand in areas irrigated with NCMWC water.

6 Water demand based on discharge limit (4,113 afy) in NPDES Permit No. CA 0085197.

7 NBC managed marsh irrigated primarily with surface water, but groundwater used at beginning and end of irrigation season assumed to account for 25% of the total. In Sacramento County, NBC has 135 acres of managed marsh (BKS property) in "Other" source of supply category served by 100% recycled water from aquaculture facility (pers. comm., NBC, 2007). New managed marsh assumed to be half in Sutter County and half in Sacramento County.

8 Sacramento International Airport demands met by City of Sacramento and landscaping demands met by groundwater (pers. comm., Sacramento County Airport System, 2008). Use 2020 projected water demands by HDR (Water Requirements and Alternatives Analysis, 2003).

9 Water demand for golf course reduced because acreage includes non-irrigated areas.

Table 2-5
Water Budget for 2004 Land Uses in the Natomas Basin

						Water Budget (af/ac)					Water Budget (afy)					Outflow Components as Percent of Inflow		
						Inflow		Outflow			Inflow		Outflow					
Location	**Category**	**Land Use**	**Area (ac)**	**Demand Factor (af/ac)**	**Water Demand (afy)**	**Precip**	**Applied Water[1]**	**ET[2]**	**Runoff[3,4]**	**Deep Perc[3]**	**Precip**	**Applied Water**	**ET**	**Runoff**	**Deep Perc**	**ET**	**Runoff**	**Deep Perc**
Sutter Pointe Specific Plan	Agriculture	Rice	5,977	6.0	35,862	1.5	6.0	4.5	2.00	1.00	8,966	35,862	26,897	11,954	5,977	60%	27%	13%
		Grain/Hay	57	2.5	143	1.5	2.5	2.6	0.80	0.64	86	143	146	46	37	64%	20%	16%
		Pasture	38	4.8	182	1.5	4.8	4.2	1.26	0.84	57	182	160	48	32	67%	20%	13%
		Fallow	811	0.0	0	1.5	0.0	0.5	0.63	0.38	1,216	0	405	507	304	33%	42%	25%
		Subtotal	**6,883**	**-**	**36,187**	**-**	**-**	**-**	**-**	**-**	**10,324**	**36,187**	**27,607**	**12,554**	**6,350**	**-**	**-**	**-**
	Other	Rural Residential	29	2.0	58	1.5	2.0	2.5	0.53	0.48	44	58	73	15	14	71%	15%	14%
		Industrial/ Commercial	146	3.0	437	1.5	0.5	1.3	0.39	0.26	218	65	189	57	38	67%	20%	13%
		Native Vegetation	184	0.0	0	1.5	0.0	1.0	0.28	0.23	275	0	184	50	41	67%	18%	15%
		Infrastructure/ Vacant	287	0.0	0	1.5	0.0	0.5	0.63	0.38	431	0	144	180	108	33%	42%	25%
		Subtotal	**645**	**-**	**495**	**-**	**-**	**-**	**-**	**-**	**968**	**123**	**589**	**302**	**201**	**-**	**-**	**-**
	Total		**7,528**	**-**	**36,681**	**-**	**-**	**-**	**-**	**-**	**11,292**	**36,310**	**28,196**	**12,856**	**6,550**	**-**	**-**	**-**
Sutter County Other	Agriculture	Rice	7,308	6.5	47,504	1.5	6.5	5.0	2.00	1.00	10,962	47,504	36,541	14,617	7,308	63%	25%	13%
		Grain/Hay	73	2.5	182	1.5	2.5	2.6	0.80	0.64	109	182	186	58	47	64%	20%	16%
		Pasture	317	4.8	1,522	1.5	4.8	4.2	1.26	0.84	476	1,522	1,332	399	266	67%	20%	13%
		Field Crops	101	2.5	252	1.5	2.5	2.7	0.80	0.48	151	252	273	81	49	68%	20%	12%
		Truck & Misc. Crops	112	2.2	247	1.5	2.2	2.9	0.56	0.28	168	247	322	62	31	77%	15%	8%
		Fallow	338	0.0	0	1.5	0.0	0.5	0.63	0.38	507	0	169	211	127	33%	42%	25%
		Subtotal	**8,249**	**-**	**49,707**	**-**	**-**	**-**	**-**	**-**	**12,373**	**49,707**	**38,824**	**15,428**	**7,828**	**-**	**-**	**-**
	Other	Rural Residential	88	2.0	176	1.5	2.0	2.5	0.53	0.48	132	176	220	46	42	71%	15%	14%
		Aquaculture Facility[5]	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Industrial/ Commercial	30	3.0	90	1.5	0.5	1.3	0.39	0.26	45	14	39	12	8	67%	20%	13%
		Native Vegetation	315	0.0	0	1.5	0.0	1.0	0.28	0.23	473	0	315	87	71	67%	18%	15%
		Managed Marsh	304	6.5	1,976	1.5	6.5	5.0	2.00	1.00	456	1,976	1,520	608	304	63%	25%	13%
		Infrastructure/ Vacant	716	0.0	0	1.5	0.0	0.5	0.63	0.38	1,074	0	358	448	269	33%	42%	25%
		Subtotal	**1,461**	**-**	**2,242**	**-**	**-**	**-**	**-**	**-**	**2,180**	**2,166**	**2,452**	**1,200**	**693**	**-**	**-**	**-**
	Total		**9,710**	**-**	**51,949**	**-**	**-**	**-**	**-**	**-**	**14,553**	**51,872**	**41,276**	**16,628**	**8,521**	**-**	**-**	**-**
Sutter County Total			**17,238**	**-**	**88,630**	**-**	**-**	**-**	**-**	**-**	**25,845**	**88,182**	**69,472**	**29,485**	**15,071**	**-**	**-**	**-**
Sacramento County	Agriculture	Rice	9,102	6.5	59,162	1.5	6.5	5.0	2.00	1.00	13,653	59,162	45,510	18,204	9,102	63%	25%	13%
		Grain/Hay	1,176	2.5	2,941	1.5	2.5	2.6	0.80	0.64	1,764	2,941	3,006	941	758	64%	20%	16%
		Pasture	644	4.8	3,093	1.5	4.8	4.2	1.26	0.84	967	3,093	2,706	812	541	67%	20%	13%
		Safflower	962	1.0	962	1.5	1.0	1.5	0.50	0.50	1,444	962	1,444	481	481	60%	20%	20%
		Other Field Crops	1,451	2.5	3,628	1.5	2.5	2.7	0.80	0.48	2,177	3,628	3,943	1,161	701	68%	20%	12%
		Fruits/Nuts	198	4.0	792	1.5	4.0	3.5	1.10	0.91	297	792	691	218	180	63%	20%	17%
		Truck & Misc. Crops	760	2.2	1,673	1.5	2.2	2.9	0.56	0.28	1,140	1,673	2,180	422	212	77%	15%	8%
		Fallow	6,692	0.0	0	1.5	0.0	0.5	0.63	0.38	10,038	0	3,346	4,182	2,509	33%	42%	25%
		Subtotal	**20,987**	**-**	**72,252**	**-**	**-**	**-**	**-**	**-**	**31,480**	**72,252**	**62,825**	**26,421**	**14,485**	**-**	**-**	**-**
	Other	Rural Residential	453	2.0	906	1.5	2.0	2.5	0.53	0.48	680	906	1,133	238	215	71%	15%	14%
		Industrial/ Commercial	103	3.0	309	1.5	0.5	1.3	0.39	0.26	155	46	134	40	27	67%	20%	13%
		Other Urban/ City of Sac	6,357	3.0	19,071	1.5	1.5	2.0	0.45	0.55	9,536	9,536	12,714	2,861	3,496	67%	15%	18%
		Sacramento Int. Airport	355	3.0	1,065	1.5	0.0	0.0	1.20	0.30	533	0	0	426	107	0%	80%	20%
		Airport Landscaping	276	4.3	275	1.5	4.3	4.2	1.16	0.43	414	1,184	1,159	320	119	73%	20%	7%
		Golf Course	306	3.0	918	1.5	3.0	3.1	0.90	0.50	459	918	949	275	153	69%	20%	11%
		Native Vegetation	2,572	0.0	0	1.5	0.0	1.0	0.28	0.23	3,858	0	2,572	707	579	67%	18%	15%
		Managed Marsh	171	6.5	1,112	1.5	6.5	5.0	2.00	1.00	257	1,112	855	342	171	63%	25%	13%
		Infrastructure/ Vacant	5,562	0.0	0	1.5	0.0	0.5	0.63	0.38	8,343	0	2,781	3,476	2,086	33%	42%	25%
		Subtotal	**16,155**	**-**	**23,656**	**-**	**-**	**-**	**-**	**-**	**24,233**	**13,701**	**22,296**	**8,685**	**6,952**	**-**	**-**	**-**
Sacramento County Total			**37,142**	**-**	**95,907**	**-**	**-**	**-**	**-**	**-**	**55,712**	**85,953**	**85,122**	**35,107**	**21,437**	**-**	**-**	**-**
Natomas Basin Total (w/o Canals)			**54,380**	**-**	**184,537**	**-**	**-**	**-**	**-**	**-**	**81,557**	**174,136**	**154,593**	**64,591**	**36,509**	**-**	**-**	**-**
Natomas Basin Canal ET and Deep Perc[6]			**376**	**-**	**0**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2,292**	**-10,413**	**8,120**	**-**	**-**	**-**
Natomas Basin Total (with Canals)			**54,380**	**-**	**184,537**	**-**	**-**	**-**	**-**	**-**	**81,557**	**174,136**	**156,885**	**54,179**	**44,629**	**-**	**-**	**-**
Natomas Basin Average (with Canals)			**-**	**-**	**-**	**1.50**	**3.20**	**2.88**	**1.00**	**0.82**	**-**	**-**	**-**	**-**	**-**	**59%**	**25%**	**16%**

Footnotes: See Table 2-2 for other footnotes.

1 Applied water for agricultural use based on Table 2-2. Applied water for Industrial/Commercial and Other Urban/City of Sac is an estimate of outside water use only (10% and 50% of Water Demand, respectively) that would contribute to deep percolation. It is assumed that water used indoors would be consumed or go to a waste water treatment plant and would not contribute to deep percolation. Rural Residential indoor water use is expected to go to septic and would contribute to deep percolation.

2 Source of ET for crops: DWR, 1974b, Vegetative Water Use in California, Table 22. Estimated Growing Season Et for Prin. Crops-Sac Valley, pg 37, adjusted for 12 month growing season. ET for rice increased from 3.7 to 4.5 af/ac (SPSP) and 5.0 af/ac (elsewhere) due to fall and winter flooding.

3 Deep Percolation is estimated to be 15% of total inflow for Native Veg, 25% of total inflow for Fallow and Infastructure/Vacant, and 1.0 af/ac for Rice and Managed Marsh. The remaining Land Uses have Runoff estimated at 20% of total inflow with the exception of Rural Residential, City of Sacramento, and Truck & Misc that are estimated at 15% of total inflow.

4 Deep Perc (af/ac) for rice in California ranges from 0.5 to 2.0 (Rice Production Workshop Manual, 2006, http://ucce.ucdavis.edu/files/filelibrary/6318/36235.pdf). 1.0 af/ac used for this table.

5 Aquaculture Facility not included in water budget.

6 Portion of runoff estimated to go to ET and deep perc from 310 miles of Natomas Basin and RD 1000 canals and laterals (10,413 afy) is subtracted from the total runoff. The canal area is estimated using the reported length of 310 miles of canals and laterals in the Natomas Basin and assuming an average width of 10 feet..

Table 2-6
Summary of 2004 Water Budget for Natomas Basin

		Low End of Range[1] (Rice Deep Perc = 0.5 af/ac/yr)		High End of Range [1] (Rice Deep Perc = 1.0 af/ac/yr)	
		(afy)	(af/ac)	(afy)	(af/ac)
Inflow	Precipitation	81,557	1.5	81,557	1.5
	Applied Water	174,136	3.2	174,136	3.2
	Total	255,693	4.7	255,693	4.7
Outflow	Evapotranspiration (ET)	156,885	2.9	156,885	2.9
	Runoff [2]	65,610	1.2	54,179	1.0
	Deep Percolation	33,198	0.6	44,629	0.8
	Total	255,693	4.7	255,693	4.7

1 The 2006 Rice Production Workshop Manual (UCCE, 2006) indicates that deep percolation from rice fields in California ranges from 0.5 to 2.0 af/ac/yr. Deep percolation in the Natomas Basin is considered to be closer to the lower end of this range. Water budgets were prepared based on rice deep percolation estimates of 0.5 and 1.0 af/ac/yr. A detailed water budget based on the 1.0 af/ac/yr estimate is shown in Table 2-5.

2 Runoff includes recycled water (i.e., recirculated tailwater) estimated to be 31,238 afy on Table 2-2, and unused runoff is periodically pumped out of the Natomas Basin as part of RD 1000's drainage canal management operations. Runoff from the City of Sacramento storm drain system (estimated to be 2,861 af in Table 2-5) is pumped into RD 1000's canal system and is included in total runoff.

Table 2-7
Future Land Use, Water Demand, and Water Supply in the SPSP Area for the Proposed Project in a Normal Year

Phase	Category	Land Use	Area[1] (ac)	Demand Factor[2] (af/ac/yr)	Water Demand[3] (afy)	Water Supply (afy)		
						Ground-water	Surface Water	Recycled Water
Phases 1 + A (Year 7)	Sutter Pointe Specific Plan	Residential	1214.4	4.0	4,885	4,885	0	0
		Industrial	832.3	2.8	2,331	2,331	0	0
		Public	329.2	3.7	1,227	1,227	0	0
		Total	**2375.9**	**-**	**8,442**	**8,442**	**0**	**0**
	Agriculture	Rice	3928.1	6.0	23,569	4,766	14,544	4,258
		Grain/Hay	45.7	2.5	114	114	0	0
		Pasture	36.9	4.8	177	177	0	0
		Fallow	599.9	0.0	0	0	0	0
		Total	**4610.7**	**-**	**23,860**	**5,058**	**14,544**	**4,258**
	Other	Rural Residential	29.0	2.0	58	58	0	0
		Industrial	143.0	3.0	429	429	0	0
		Native Veg.	183.0	0.0	0	0	0	0
		Infrastructure	186.0	0.0	0	0	0	0
		Total	**541.0**	**-**	**487**	**487**	**0**	**0**
	Phase 1 + A Total		**7527.6**	**-**	**32,789**	**13,987**	**14,544**	**4,258**
Phases 2 + B (Year 12)	Sutter Pointe Specific Plan	Residential	2071.0	3.9	8,349	5,774	2,574	0
		Industrial	1724.0	2.8	4,717	3,263	1,454	0
		Public	715.4	3.2	2,720	1,881	839	0
		Total	**4510.4**	**-**	**15,785**	**10,918**	**4,867**	**0**
	Agriculture	Rice	2181.1	6.0	13,087	4,047	6,992	2,047
		Grain/Hay	1.0	2.5	3	3	0	0
		Pasture	38.1	4.8	183	183	0	0
		Fallow	531.0	0.0	0	0	0	0
		Total	**2751.2**	**-**	**13,272**	**4,233**	**6,992**	**2,047**
	Other	Rural Residential	19.0	2.0	38	38	0	0
		Industrial	96.0	3.0	288	288	0	0
		Native Veg.	60.0	0.0	0	0	0	0
		Infrastructure	91.0	0.0	0	0	0	0
		Total	**266.0**	**-**	**326**	**326**	**0**	**0**
	Phase 2 + B Total		**7527.6**	**-**	**29,384**	**15,477**	**11,859**	**2,047**

Table 2-7 (continued)
Future Land Use, Water Demand, and Water Supply in the SPSP Area for the Proposed Project in a Normal Year

Phase	Category	Land Use	Area[1] (ac)	Demand Factor[2] (af/ac/yr)	Water Demand[3] (afy)	Water Supply (afy)		
						Ground-water	Surface Water	Recycled Water
Phases 3 + C (Year 15)	Sutter Pointe Specific Plan	Residential	2500.2	4.0	10,133	5,687	4,446	0
		Industrial	2652.8	2.7	7,136	4,005	3,131	0
		Public	854.8	3.2	3,199	1,796	1,404	0
		Total	**6007.8**	**-**	**20,468**	**11,487**	**8,981**	**0**
	Agriculture	Rice	900.8	6.0	5,405	2,040	2,603	762
		Grain/Hay	0.0	2.5	0	0	0	0
		Pasture	46.1	4.8	221	221	0	0
		Fallow	520.8	0.0	0	0	0	0
		Total	**1467.8**	**-**	**5,626**	**2,261**	**2,603**	**762**
	Other	Rural Residential	5.0	2.0	10	10	0	0
		Industrial	24.0	3.0	72	72	0	0
		Native Veg.	2.0	0.0	0	0	0	0
		Infrastructure	21.0	0.0	0	0	0	0
		Total	**52.0**	**-**	**82**	**82**	**0**	**0**
	Phase 3 + C Total		**7527.6**	**-**	**26,177**	**13,830**	**11,584**	**762**
Phases 4 + D (Year 20)	Sutter Pointe Specific Plan	Residential	2895.0	4.1	11,762	6,101	5,660	0
		Industrial	3631.3	2.7	9,729	5,047	4,682	0
		Public	1001.3	3.7	3,709	1,924	1,785	0
		Agriculture	0.0	-	0	0	0	0
	Phase 4 + D Total		**7527.6**	**-**	**25,199**	**13,072**	**12,127**	**0**

1. Acreage within each phase from M&S (2008). Other acreage calculated based on land use evaluation summarized in Table 2-2.
2. Urban demand factors calculated as Water Demand divided by Area. Other demand factors from Table 2-2.
3. Water demand within each phase from M&S (2008). Other water demands calculated based on Table 2-2.

Table 2-8

Urban Land Uses, Water Demand, and Water Supply in the SPSP Area for the Proposed Project [1]

Phase	Land Use	Area[2] (ac)	Normal Year				Critically-Dry Year			
			Water Demand[2] (afy)	Water Supply (afy)			Water Demand[2] (afy)	Water Supply (afy)		
				Ground-water	Surface Water	Recycled Water		Ground-water	Surface Water	Recycled Water
Phases 1 + A (Year 7)	Residential	1,214	4,885	4,885	0	0	4,274	4,274	0	0
	Industrial	832	2,331	2,331	0	0	2,039	2,039	0	0
	Public	329	1,227	1,227	0	0	1,073	1,073	0	0
	Total	**2,376**	**8,442**	**8,442**	**0**	**0**	**7,387**	**7,387**	**0**	**0**
Phases 2 + B (Year 12)	Residential	2,071	8,349	5,774	2,574	0	7,305	5,072	2,232	0
	Industrial	1,724	4,717	3,263	1,454	0	4,127	2,866	1,261	0
	Public	715	2,720	1,881	839	0	2,380	1,653	727	0
	Total	**4,510**	**15,785**	**10,918**	**4,867**	**0**	**13,812**	**9,591**	**4,221**	**0**
Phases 3 + C (Year 15)	Residential	2,500	10,133	5,687	4,446	0	8,866	4,994	3,872	0
	Industrial	2,653	7,136	4,005	3,131	0	6,244	3,517	2,727	0
	Public	855	3,199	1,796	1,404	0	2,799	1,577	1,223	0
	Total	**6,008**	**20,468**	**11,487**	**8,981**	**0**	**17,910**	**10,088**	**7,822**	**0**
Phases 4 + D (Year 20)	Residential	2,895	11,762	6,101	5,660	0	10,291	6,044	4,248	0
	Industrial	3,631	9,729	5,047	4,682	0	8,513	4,999	3,513	0
	Public	1,001	3,709	1,924	1,785	0	3,245	1,906	1,339	0
	Total	**7,528**	**25,199**	**13,072**	**12,127**	**0**	**22,049**	**12,949**	**9,100**	**0**

1. Non-urban land uses, water demand, and water supply assumed to remain the same as Table 2-4.
2. Acreage and water demand within each phase from M&S (2008).

Table 2-9

Urban Land Uses, Water Demand, and Water Supply in the SPSP Area for Alternative A [1]

Phase	Land Use	Area[2] (ac)	Normal Year				Critically-Dry Year			
			Water Demand[2] (afy)	Water Supply (afy)			Water Demand[2] (afy)	Water Supply (afy)		
				Ground-water	Surface Water	Recycled Water		Ground-water	Surface Water	Recycled Water
Phases 1 + A (Year 7)	Residential	1,214	4,885	4,885	0	0	4,274	4,274	0	0
	Industrial	832	2,331	2,331	0	0	2,039	2,039	0	0
	Public	329	1,227	1,227	0	0	1,073	1,073	0	0
	Total	**2,376**	**8,442**	**8,442**	**0**	**0**	**7,387**	**7,387**	**0**	**0**
Phases 2 + B (Year 12)	Residential	2,071	8,349	2,632	5,716	0	7,305	3,657	3,648	0
	Industrial	1,724	4,717	1,487	3,230	0	4,127	2,066	2,061	0
	Public	715	2,720	858	1,862	0	2,380	1,191	1,189	0
	Total	**4,510**	**15,785**	**4,977**	**10,808**	**0**	**13,812**	**6,914**	**6,898**	**0**
Phases 3 + C (Year 15)	Residential	2,500	10,133	3,240	6,893	0	8,866	4,756	4,110	0
	Industrial	2,653	7,136	2,282	4,854	0	6,244	3,350	2,894	0
	Public	855	3,199	1,023	2,176	0	2,799	1,502	1,298	0
	Total	**6,008**	**20,468**	**6,544**	**13,924**	**0**	**17,910**	**9,608**	**8,302**	**0**
Phases 4 + D (Year 20)	Residential	2,895	11,762	4,463	7,298	0	10,291	5,803	4,489	0
	Industrial	3,631	9,729	3,692	6,037	0	8,513	4,800	3,713	0
	Public	1,001	3,709	1,407	2,301	0	3,245	1,830	1,415	0
	Total	**7,528**	**25,199**	**9,562**	**15,637**	**0**	**22,049**	**12,432**	**9,617**	**0**

1. Non-urban land uses, water demand, and water supply assumed to remain the same as Table 2-4.
2. Acreage and water demand within each phase from M&S (2008).

Table 2-10

Urban Land Uses, Water Demand, and Water Supply in the SPSP Area for Alternative B [1]

Phase	Land Use	Area[2] (ac)	Normal Year				Critically-Dry Year			
			Water Demand[2] (afy)	Water Supply (afy)			Water Demand[2] (afy)	Water Supply (afy)		
				Ground-water	Surface Water	Recycled Water		Ground-water	Surface Water	Recycled Water
Phases 1 + A (Year 7)	Residential	1,214	4,885	4,885	0	0	4,274	4,274	0	0
	Industrial	832	2,331	2,331	0	0	2,039	2,039	0	0
	Public	329	1,227	1,227	0	0	1,073	1,073	0	0
	Total	**2,376**	**8,442**	**8,442**	**0**	**0**	**7,387**	**7,387**	**0**	**0**
Phases 2 + B (Year 12)	Residential	2,071	8,349	3,457	4,891	0	7,305	4,887	2,418	0
	Industrial	1,724	4,717	1,953	2,764	0	4,127	2,761	1,366	0
	Public	715	2,720	1,126	1,593	0	2,380	1,592	788	0
	Total	**4,510**	**15,785**	**6,537**	**9,248**	**0**	**13,812**	**9,240**	**4,572**	**0**
Phases 3 + C (Year 15)	Residential	2,500	10,133	3,104	7,029	0	8,866	4,460	4,406	0
	Industrial	2,653	7,136	2,186	4,950	0	6,244	3,141	3,103	0
	Public	855	3,199	980	2,219	0	2,799	1,408	1,391	0
	Total	**6,008**	**20,468**	**6,270**	**14,198**	**0**	**17,910**	**9,010**	**8,900**	**0**
Phases 4 + D (Year 20)	Residential	2,895	11,762	3,070	8,691	0	10,291	4,330	5,962	0
	Industrial	3,631	9,729	2,540	7,189	0	8,513	3,581	4,931	0
	Public	1,001	3,709	968	2,741	0	3,245	1,365	1,880	0
	Total	**7,528**	**25,199**	**6,578**	**18,621**	**0**	**22,049**	**9,276**	**12,773**	**0**

1. Non-urban land uses, water demand, and water supply assumed to remain the same as Table 2-4.
2. Acreage and water demand within each phase from M&S (2008).

Table 2-11
2004 and 2030 Water Supply Comparison in the Natomas Basin

Year	Project or No Project	Location	Water Supply (afy)					
			Ground-water	Surface Water			Recycled Water	Total
				NCMWC	Riparian Rights	Sac City /County		
2004 A	No Project	Sutter County Total	18,527	52,706	5,966	0	15,431	92,630
		Sacramento County Total	10,109	50,994	3,226	15,771	15,807	95,907
		Natomas Basin Total	**28,636**	**103,700**	**9,191**	**15,771**	**31,238**	**188,537**
2030 B	No Project	Sutter County Total	20,008	46,870	5,966	0	13,722	86,566
		Sacramento County Total	7,251	44,808	3,226	54,501	13,996	123,782
		Natomas Basin Total	**27,258**	**91,678**	**9,191**	**54,501**	**27,718**	**210,347**
2030 C	With Project	Sutter County Total	24,713	37,095	5,966	0	7,310	75,083
		Sacramento County Total	7,251	44,808	3,226	54,501	13,996	123,782
		Natomas Basin Total	**31,963**	**81,903**	**9,191**	**54,501**	**21,306**	**198,865**

Comparison

B-A	2004	2030 (no project)	-1,378	-12,022	0	38,730	-3,520	21,810
C-A	2004	2030 (with project)	3,327	-21,797	0	38,730	-9,932	10,328
C-B	2030 (no project)	2030 (with project)	4,705	-9,775	0	0	-6,412	-11,482

Table 4-1
Hydrographs Reviewed for Sutter Pointe Specific Plan Groundwater Supply Assessment

	No. of Wells by Depth of Perforation or Total Depth[1]					No. of Wells by Monitoring Entity					
	Upper Zone	Lower Zone	Multiple Zone	Unknown	TOTAL	USGS	DWR	SWRCB	SGA	Private	TOTAL
Wells Within the North American Subbasin	319	13	85	89	506	155	242	19	85	5	506
Wells Within the Natomas Basin	57	5	5	12	79	30	24	19	1	5	79

[1]Zone Designations:

Upper Zone - bottom perforation is less than or equal to 400 feet or if no perforation is available, total well depth is less than or equal to 400 feet.

Lower Zone - top of perforation is greater than 400 feet.

Multiple Zone - top of perforation is less than 400 feet and bottom of perforation is greater than 400 feet or, if no perforation is available, the well depth is greater than 400 feet.

Unknown - no perforation or well depth information available.

Table 4-2
Summary of Groundwater Quality Data
Wells in Vicinity of Sutter Pointe Specific Plan
1967 to 2007

Analyte	Limit	Units	Upper Zone (46 Wells)				Lower Zone (7 Wells)				Multiple Zones and Unknown (10 Wells)			
			No. of Meas.	Range of Values	Median Value	No. of Detects	No. of Meas.	Range of Values	Median Value	No. of Detects	No. of Meas.	Range of Values	Median Value	No. of Detects
Alkalinity (total)	N/A	mg/L as CaCO3	35	101-591	267.91	35	7	120-183	146.29	7	8	103-267	186.12	8
Aluminum	1000 (2)/200 (3)	mg/L	25	<0.001-0.17	0.04	7	7	<0.01-0.16	0.16	1	4	<0.05	-	-
Antimony	N/A	ug/L	15	<0.2-0.07	0.07	1	5	<1-<6	-	-	2	<6	-	-
Arsenic	10 (1)	ug/L	35	<1-55	13.09	33	9	3.3-103	27.26	9	13	<2-60	22.81	11
Barium	1000 (2)	ug/L	17	<50-352	222.44	9	7	<50-244	179	5	3	<1-106	106	1
Beryllium	4	ug/L	15	<0.06-<1	-	-	5	<1	-	-	1	<1	-	-
Bicarbonate	N/A	mg/L	35	100-386	190.43	35	3	120-160	136.67	3	8	132-325	227.75	8
Boron	N/A	mg/L	53	<0.1-2.2	0.29	46	7	0.2-0.9	0.44	7	3	0.2-1.5	0.7	3
Cadmium	5 (2)	ug/L	20	<1-1.5	0.52	3	7	<1	-	-	3	<1-1	1	1
Calcium	N/A	mg/L	62	7.3-170	42.86	62	7	11-27	18.71	7	9	14.4-26.4	21.63	9
Carbonate	N/A	mg/L	33	<1-14	5.4	10	3	<1-1	1	1	8	<1	-	-
Chloride	250/500 (3)	mg/L	77	0.18-380	58.91	77	7	22-276	87.43	7	9	<0.1-190.5	61	8
Chromium	50 (2)	ug/L	21	<1-25	6.41	10	7	<1-12	7.75	4	2	<10	-	-
Copper	1300 (2)/1000 (3)	ug/L	17	<1-2.8	2.17	6	7	<1-2	2	2	4	<10-11	11	1
Electrical Conductivity	900/1600 (3)	umhos/cm	79	234-1610	597.7	79	7	336-1124	542.86	7	12	247-905	521.25	12
Fluoride	2	mg/L	36	<0.1-0.3	0.18	29	7	<0.1-0.33	0.21	5	5	<0.1-0.2	0.17	3
Hardness as CaCO3	N/A	mg/L as CaCO3	69	31-920	151.81	69	7	40-100	68.29	7	9	59-102	87.11	9
Hydroxide as CaCO3	N/A	mg/L	8	<1-<5	-	-	3	<1-<5	-	-	4	<1	-	-
Iron	0.3 (3)	mg/L	34	<0.003-4.9	0.32	19	7	<0.005-0.499	0.22	6	11	<0.01-1.43	0.36	9
Lead	15 (2)	ug/L	17	<0.08-<5	-	-	7	<1-<5	-	-	1	7	7	1
Magnesium	N/A	mg/L	63	1.8-120	22.95	63	7	3-8	5.27	7	9	5.6-12	8.32	9
Manganese	50 (3)	ug/L	34	<1-410	96.79	28	9	8-170	102.56	9	10	<10-203	153.56	9
Mercury	2 (2)	ug/L	15	<0.1-<1	-	-	7	<0.2-<1	-	-	3	<0.5-<1	-	-
Nickel	100	ug/L	16	<1-3.22	2.05	4	5	<1-1	1	2	1	<10	-	-
Nitrate (as NO3)	45 (2)	mg/L	106	<0.002-41.8	11.95	85	7	<0.1-<2	-	-	18	<0.886-14	4.08	7
pH	6.5-8.5 (4)	pH units	47	6.7-8.4	7.85	47	7	8-8.9	8.32	7	9	7.4-8.2	7.99	9
Potassium	N/A	mg/L	52	<0.5-4.9	1.69	51	3	1.3-4.5	3.33	3	7	<0.1-7	4.02	6
Selenium	50 (2)	ug/L	16	<1-0.9	0.6	2	3	<1-1	1	1	3	<5	-	-
Silver	100 (3)	ug/L	16	<0.2-<10	-	-	7	<1-<10	-	-	4	<10-<50	-	-
Sodium	N/A	mg/L	70	18-220	56.46	70	7	51-184	88.71	7	9	26-150	65.27	9
Sulfate as SO4	250/500 (3)	mg/L	60	<0.2-100	18.03	57	7	<0.5-3	2.13	3	9	<0.1-20	5.39	7
Thallium	2	ug/L	10	<0.04-<1	-	-	2	<1	-	-	3	<1-<10	-	-
Total Dissolved Solids	500/1000 (3)	mg/L	32	155-1100	342.03	32	7	210-623	335.43	7	8	189-518	315.12	8
Vanadium	N/A	ug/L	8	<1-31.5	30.75	2	2	<3	-	-	-	-	-	-
Zinc	5000 (3)	ug/L	19	<5-10	5.4	4	7	<5-<50	-	-	2	<50	-	-

note: See Figure 3-4 for location of wells with water quality used in this table.

1. USEPA Primary MCL, State to be determined
2. California Primary MCL
3. California Secondary MCL (recommended/upper)
4. USEPA Secondary MCL (range of values)

Table 6-1
Sutter Pointe Model Scenarios

		Proposed Project		Alternative A	Alternative B	
		Scenario 1	**Scenario 2[1]**	**Scenario 3**	**Scenario 4**	**Scenario 5**
Phase		Phase 2+B	Buildout	Buildout	Buildout	Buildout
Year		12	20	20	20	20
Wells	No.	8	14	14	8	8
	Location	W	W & E	W & E	W	E
SPSP M&I Acreage		4,510.0	7,527.6	7,527.6	7,527.6	7,527.6
SPSP Normal Year Water Demand and Supply						
Water Demand	M&I Demand	15,785	25,199	25,199	25,199	25,199
	Existing Demand	13,598	0	0	0	0
	Total Demand	29,384	25,199	25,199	25,199	25,199
Groundwater Supply	M&I Uses	10,918	13,072	9,562	6,578	6,578
	Existing Uses	4,559	0	0	0	0
	Total	15,477	13,072	9,562	6,578	6,578
Surface Water Supply	M&I Uses	4,867	12,127	15,637	18,621	18,621
	Existing Uses	7,007	0	0	0	0
	Total	11,874	12,127	15,637	18,621	18,621
Recycled Water Supply	M&I Uses	0	0	0	0	0
	Existing Uses	2,033	0	0	0	0
	Total	2,033	0	0	0	0
Total supply		29,384	25,199	25,199	25,199	25,199
Additional NCMWC Pumpage		0	0	0	0	0
SPSP Critical Year Water Demand and Supply						
Water Demand	M&I Demand	13,812	22,049	22,049	22,049	22,049
	Existing Demand	13,598	0	0	0	0
	Total Demand	27,410	22,049	22,049	22,049	22,049
Groundwater Supply	M&I Uses	9,591	12,949	12,432	9,276	9,276
	Existing Uses	4,559	0	0	0	0
	Total	14,150	12,949	12,432	9,276	9,276
Surface Water Supply	M&I Uses	4,221	9,100	9,617	12,773	12,773
	Existing Uses	7,007	0	0	0	0
	Total	11,228	9,100	9,617	12,773	12,773
Recycled Water Supply	M&I Uses	0	0	0	0	0
	Existing Uses	2,033	0	0	0	0
	Total	2,033	0	0	0	0
Total supply		27,410	22,049	22,049	22,049	22,049
Additional NCMWC Pumpage		0	0	0	0	0
Compare Against:						
2004 Baseline		X	X			
2030 Baseline			X	X	X	X

1. Scenario 2A is the Proposed Project at buildout compared to the 2004 Baseline; Scenario 2B is the Proposed Project at buildout compared to the 2030 Baseline.

Table 6-2

Existing Conditions Baseline: Simulated Land Use, Water Demand, and Water Supply in the Natomas Basin

Model	Subregion	Land Use				Average Water Demand						Total Water Supply (afy)											
												1970-2004 Average		1982-2004 Average		Wet (1983)		Normal (2004)		Single Dry (1994)		Multiple Dry (1987-1992)	
		Ag Acreage (ac)	Urban Acreage (ac)	Other Acreage[1] (ac)	Total Acreage (ac)	Ag Demand (afy)	Ag Water Duty (af/ac)	Urban Demand (afy)	Urban Water Duty (af/ac)	Aqua-culture Demand (afy)	Total Water Demand (afy)	GW Pumping	SW Supply	GW Pumping	SW Supply	GW Pumping	SW Supply	GW Pumping	SW Supply	GW Pumping	SW Supply	GW Pumping	SW Supply
NARIGSM	10	4,799	174	1,582	6,555	26,048	5.4	495	2.8	3,996	30,539	16,153	14,386	16,047	14,305	14,573	13,326	17,067	15,031	16,664	14,629	16,337	14,474
	11	8,954	0	708	9,662	54,059	6.0	0	-	0	54,059	53	54,006	75	53,702	12	50,027	325	56,428	7	54,919	16	54,338
	13	538	126	243	907	2,966	5.5	267	2.1	0	3,233	2,321	912	2,317	905	2,251	712	2,436	925	2,355	925	2,333	917
Sutter County Subtotal		**14,291**	**300**	**2,533**	**17,124**	**83,073**	**-**	**762**	**-**	**3,996**	**87,831**	**18,527**	**69,304**	**18,439**	**68,911**	**16,836**	**64,065**	**19,828**	**72,384**	**19,026**	**70,473**	**18,686**	**69,728**
SACIGSM	1	3,653	437	49	4,139	11,663	3.2	950	2.2	0	12,613	1,929	10,685	1,919	10,593	1,828	9,677	2,014	11,322	1,983	11,005	1,956	10,914
	2	379	1,406	528	2,313	486	1.3	1,133	0.8	0	1,619	1,174	445	1,173	440	1,168	370	1,180	506	1,177	474	1,176	473
	3	8,497	300	3,579	12,376	54,697	6.4	608	2.0	0	55,305	5,309	49,996	5,301	49,909	5,057	47,318	5,554	52,601	5,436	51,343	5,401	50,972
	4	436	26	686	1,148	2,599	6.0	62	2.4	0	2,661	2,661	0	2,667	0	2,481	0	2,856	0	2,850	0	2,741	0
	14	2,082	8,744	5,456	16,282	6,011	2.9	22,506	2.6	0	28,517	3,791	24,726	3,789	24,702	3,738	24,156	3,837	25,223	3,810	24,944	3,810	24,930
Sacramento County Subtotal		**15,047**	**10,913**	**10,298**	**36,258**	**75,456**	**-**	**25,259**	**-**	**0**	**100,715**	**14,863**	**85,851**	**14,849**	**85,644**	**14,272**	**81,521**	**15,441**	**89,652**	**15,256**	**87,766**	**15,084**	**87,290**
Natomas Basin Total		**29,338**	**11,213**	**12,831**	**53,382**	**158,528**	**-**	**26,021**	**-**	**3,996**	**188,545**	**33,390**	**155,155**	**33,288**	**154,555**	**31,108**	**145,586**	**35,269**	**162,036**	**34,282**	**158,239**	**33,769**	**157,018**
SPSP Area		**6,074**	**0**	**1,451**	**7,525**	**33,065**	**5.4**	**0**	**-**	**0**	**33,065**	**7,975**	**25,090**	**7,922**	**24,930**	**7,046**	**23,090**	**8,601**	**26,311**	**8,255**	**25,563**	**8,070**	**25,250**

1. Includes native vegetation, infrastructure, and other land uses with no water demand.

Note: Subregion 10 values include only those areas within the Natomas Basin boundary.

Table 6-3
Existing Conditions Baseline: Simulated Groundwater Budget for Natomas Basin
(1982-2004 Average)

Model	Subregion	Inflow and Outflow Components (afy)[1]					Change in Storage (afy)
		Deep Percolation	Net Recharge from Streams	Net Boundary Inflow	Net Subsurface Inflow	Groundwater Pumping	
NARIGSM	10[2]	14,926	0	-176	4,405	-19,047	108
	11	4,599	213	-5	-4,662	-75	70
	13	1,663	1,416	-245	-510	-2,317	7
Sutter County Subtotal		**21,188**	**1,629**	**-426**	**-767**	**-21,439**	**185**
SACIGSM	1	3,478	706	2,555	-4,792	-1,919	28
	2	322	0	0	861	-1,173	9
	3	8,367	312	-856	-2,506	-5,301	17
	4	614	0	-163	2,216	-2,667	0
	14	3,444	3,521	3,543	-6,776	-3,789	-56
Sacramento County Subtotal		**16,226**	**4,540**	**5,079**	**-10,996**	**-14,849**	**-2**
Total Natomas Basin		**37,414**	**6,168**	**4,653**	**-11,764**	**-36,288**	**183**

1. Groundwater inflow to the Natomas Basin is shown as a positive value; outflow is shown as negative.
2. NARIGSM Subregion 10 includes about 1,000 acres outside of the Natomas Basin. This area is irrigated with groundwater and has an estimated water demand of 3,000 af. This area was removed from Table 6-2, but this table reflects the full subregion.

Table 6-4
Groundwater Budget for Existing and Future Conditions Baseline Based on Year Type

Scenario	Year Type	Inflow and Outflow Components (afy)[1]					Change in Storage (afy)
		Deep Percolation	Net Recharge from Streams	Net Boundary Inflow	Net Subsurface Inflow	Groundwater Pumping	
Existing Conditions Baseline	Normal (2004)[2]	35,953	8,231	4,193	-11,733	-38,269	-1,626
	Wet (1983)[2]	55,744	8,927	7,075	-11,687	-34,108	25,948
	Single Dry (1994)[2]	32,202	3,296	5,935	-12,417	-37,282	-8,269
	Multiple Dry (1987-1992)[3]	32,171	2,858	5,402	-11,121	-36,769	-7,460
	1982-2004 Average[3]	37,414	6,168	4,653	-11,764	-36,288	183
Future Conditions Baseline	Normal (2004)[2]	34,531	-3,238	-550	-4,850	-26,814	-924
	Wet (1983)[2]	54,500	-650	2,128	-7,040	-23,324	25,616
	Single Dry (1994)[2]	30,010	-2,985	3,503	-3,039	-41,099	-13,610
	Multiple Dry (1987-1992)[3]	30,357	-4,785	2,363	-3,323	-35,508	-10,897
	1982-2004 Average[3]	36,045	-3,043	901	-4,543	-28,438	922
Difference	Normal (2004)[2]	-1,422	-11,469	-4,743	6,883	11,455	702
	Wet (1983)[2]	-1,244	-9,577	-4,947	4,647	10,784	-332
	Single Dry (1994)[2]	-2,192	-6,281	-2,432	9,378	-3,817	-5,341
	Multiple Dry (1987-1992)[3]	-1,814	-7,643	-3,040	7,798	1,262	-3,437
	1982-2004 Average[3]	-1,369	-9,212	-3,752	7,220	7,850	739

1. Groundwater inflow to the Natomas Basin is shown as a positive value; outflow is shown as negative.
2. Represents the sum of all subregions in the Natomas Basin for the particular year
3. Represents the average of the sum of all subregions in the Natomas Basin for the particular years

Table 6-5

Future Conditions Baseline: Simulated Land Use, Water Demand, and Water Supply in the Natomas Basin

		Land Use				Average Water Demand						Total Water Supply (afy)											
												1970-2004 Average		1982-2004 Average		Wet (1983)		Normal (2004)		Single Dry (1994)		Multiple Dry (1987-1992)	
Model	Subregion	Ag Acreage (ac)	Urban Acreage (ac)	Other Acreage[1] (ac)	Total Acreage (ac)	Ag Demand (afy)	Ag Water Duty (af/ac)	Urban Demand (afy)	Urban Water Duty (af/ac)	Aqua-culture Demand (afy)	Total Water Demand (afy)	GW Pumping	SW Supply	GW Pumping	SW Supply	GW Pumping	SW Supply	GW Pumping	SW Supply	GW Pumping	SW Supply	GW Pumping	SW Supply
NARIGSM	10	4,799	174	1,582	6,555	26,048	5.4	495	2.8	3,996	30,539	16,153	14,386	16,047	14,305	14,573	13,326	17,067	15,031	16,664	14,629	16,337	14,474
	11	8,954	0	708	9,662	54,059	6.0	0	-	0	54,059	53	54,006	75	53,702	12	50,027	325	56,428	7	54,919	16	54,338
	13	538	126	243	907	2,966	5.5	267	2.1	0	3,233	2,321	912	2,317	905	2,251	712	2,436	925	2,354	925	2,333	917
Sutter County Subtotal		**14,291**	**300**	**2,533**	**17,124**	**83,073**	**-**	**762**	**-**	**3,996**	**87,831**	**18,527**	**69,304**	**18,439**	**68,911**	**16,836**	**64,065**	**19,828**	**72,384**	**19,025**	**70,473**	**18,686**	**69,728**
SACIGSM	1	3,831	1,499	-1,191	4,139	10,424	2.7	2,407	1.6	0	12,831	740	12,090	781	11,957	175	11,384	210	13,554	2,958	10,468	1,992	11,193
	2	0	2,234	79	2,313	0	-	3,590	1.6	0	3,590	201	3,389	214	3,376	54	3,536	54	3,536	790	2,799	545	3,045
	3	7,903	2,763	1,710	12,376	50,751	6.4	4,437	1.6	0	55,188	3,136	52,052	3,346	51,776	789	51,682	871	57,036	12,482	44,162	8,553	47,679
	4	437	40	671	1,148	2,590	5.9	62	1.6	0	2,652	2,652	0	2,659	0	2,470	0	2,851	0	2,844	0	2,732	0
	14	1,781	12,298	2,203	16,282	5,410	3.0	37,079	3.0	0	42,489	0	42,489	0	42,489	0	42,489	0	42,489	0	42,490	0	42,490
Sacramento County Subtotal		**13,952**	**18,834**	**3,472**	**36,258**	**69,175**	**-**	**47,575**	**-**	**0**	**116,750**	**6,730**	**110,020**	**6,999**	**109,598**	**3,488**	**109,091**	**3,986**	**116,615**	**19,074**	**99,919**	**13,822**	**104,406**
Natomas Basin Total		**28,243**	**19,134**	**6,005**	**53,382**	**152,248**	**-**	**48,337**	**-**	**3,996**	**204,581**	**25,257**	**179,324**	**25,438**	**178,509**	**20,324**	**173,156**	**23,814**	**188,999**	**38,099**	**170,392**	**32,508**	**174,134**
SPSP Area		**6,074**	**0**	**1,451**	**7,525**	**33,065**	**5.4**	**0**	**-**	**0**	**33,065**	**7,975**	**25,090**	**7,922**	**24,930**	**7,046**	**23,090**	**8,601**	**26,311**	**8,255**	**25,563**	**8,070**	**25,250**

1. Includes native vegetation, infrastructure, and other land uses with no water demand.

Note: Subregion 10 values include only those areas within the Natomas Basin boundary.

Table 6-6
Future Conditions Baseline: Simulated Groundwater Budget for Natomas Basin
(1982-2004 Average)

Model	Subregion	Inflow and Outflow Components (afy)[1]					Change in Storage (afy)
		Deep Percolation	Net Recharge from Streams	Net Boundary Inflow	Net Subsurface Inflow	Groundwater Pumping	
NARIGSM	10[2]	14,928	0	987	3,385	-19,047	254
	11	4,599	82	257	-4,701	-75	162
	13	1,663	264	-5	407	-2,317	12
Sutter County Subtotal		**21,190**	**346**	**1,239**	**-909**	**-21,439**	**428**
SACIGSM	1	2,448	-1,422	1,062	-1,244	-781	64
	2	302	0	0	-59	-214	29
	3	7,389	-232	-1,790	-1,805	-3,346	216
	4	576	0	-218	2,325	-2,659	25
	14	4,140	-1,735	606	-2,851	0	160
Sacramento County Subtotal		**14,855**	**-3,389**	**-339**	**-3,635**	**-6,999**	**494**
Total Natomas Basin		**36,045**	**-3,043**	**901**	**-4,543**	**-28,438**	**922**

1. Groundwater inflow to the Natomas Basin is shown as a positive value; outflow is shown as negative.
2. NARIGSM Subregion 10 includes about 1,000 acres outside of the Natomas Basin. This area is irrigated with groundwater and has an estimated water demand of 3,000 af. This area was removed from Table 6-5, but this table reflects the full subregion.

Table 6-7
Groundwater Budget Comparison for Existing Conditions Baseline and Scenario 1 Based on Year Type

Scenario	Year Type	Deep Percolation (afy)	Net Recharge from Streams (afy)	Net Boundary Inflow (afy)	Net Subsurface Inflow (afy)	Groundwater Pumping (afy)	Change in Storage (afy)
Existing Conditions Baseline	Normal (2004)[1]	35,953	8,231	4,193	-11,733	-38,269	-1,626
	Wet (1983)[1]	55,744	8,927	7,075	-11,687	-34,108	25,948
	Single Dry (1994)[1]	32,202	3,296	5,935	-12,417	-37,282	-8,269
	Multiple Dry (1987-1992)[2]	32,171	2,858	5,402	-11,121	-36,769	-7,460
	1982-2004 Average[3]	37,414	6,168	4,653	-11,764	-36,288	183
Scenario 1	Normal (2004)[1]	32,038	12,152	7,485	-8,116	-45,675	-2,117
	Wet (1983)[1]	51,793	12,666	10,351	-7,787	-41,311	25,714
	Single Dry (1994)[1]	28,230	6,962	8,978	-8,856	-43,234	-7,920
	Multiple Dry (1987-1992)[2]	28,259	6,486	8,489	-7,601	-43,012	-7,379
	1982-2004 Average[3]	33,621	9,922	7,856	-8,186	-43,147	65
Difference	Normal (2004)[1]	-3,915	3,921	3,292	3,617	-7,406	-491
	Wet (1983)[1]	-3,951	3,739	3,276	3,900	-7,203	-234
	Single Dry (1994)[1]	-3,972	3,666	3,043	3,561	-5,952	349
	Multiple Dry (1987-1992)[2]	-3,912	3,628	3,086	3,520	-6,242	81
	1982-2004 Average[3]	-3,793	3,753	3,203	3,578	-6,859	-118

[1] Represents a sum of all subregions for the particular year

[2] Represents an average of the sum of all subregions for the particular years

[3] Time period selected to avoid large head changes in early years of simulation period caused by initial conditions.

Table 6-8
Groundwater Budget Comparison for Existing Conditions Baseline and Scenario 2A Based on Year Type

Scenario	Year Type	Deep Percolation (afy)	Net Recharge from Streams (afy)	Net Boundary Inflow (afy)	Net Subsurface Inflow (afy)	Groundwater Pumping (afy)	Change in Storage (afy)
Existing Conditions Baseline	Normal (2004)[1]	35,953	8,231	4,193	-11,733	-38,269	-1,626
	Wet (1983)[1]	55,744	8,927	7,075	-11,687	-34,108	25,948
	Single Dry (1994)[1]	32,202	3,296	5,935	-12,417	-37,282	-8,269
	Multiple Dry (1987-1992)[2]	32,171	2,858	5,402	-11,121	-36,769	-7,460
	1982-2004 Average[3]	37,414	6,168	4,653	-11,764	-36,288	183
Scenario 2A	Normal (2004)[1]	29,144	12,199	7,030	-5,889	-44,570	-2,085
	Wet (1983)[1]	49,150	12,659	9,888	-5,393	-40,567	25,736
	Single Dry (1994)[1]	25,411	7,220	8,738	-6,518	-43,427	-8,575
	Multiple Dry (1987-1992)[2]	25,344	6,666	8,213	-5,261	-42,820	-7,858
	1982-2004 Average[3]	30,852	10,036	7,485	-5,847	-42,465	61
Difference	Normal (2004)[1]	-6,809	3,968	2,837	5,844	-6,301	-459
	Wet (1983)[1]	-6,594	3,732	2,813	6,294	-6,459	-212
	Single Dry (1994)[1]	-6,791	3,924	2,803	5,899	-6,145	-306
	Multiple Dry (1987-1992)[2]	-6,828	3,809	2,811	5,860	-6,050	-398
	1982-2004 Average[3]	-6,562	3,868	2,832	5,917	-6,177	-122

[1] Represents a sum of all subregions for the particular year

[2] Represents an average of the sum of all subregions for the particular years

[3] Time period selected to avoid large head changes in early years of simulation period caused by initial conditions

Table 6-9
Groundwater Budget Comparison for Future Conditions Baseline and Scenario 2B Based on Year Type

Scenario	Year Type	Deep Percolation (afy)	Net Recharge from Streams (afy)	Net Boundary Inflow (afy)	Net Subsurface Inflow (afy)	Groundwater Pumping (afy)	Change in Storage (afy)
Future Conditions Baseline	Normal (2004)[1]	34,531	-3,238	-550	-4,850	-26,814	-924
	Wet (1983)[1]	54,500	-650	2,128	-7,040	-23,324	25,616
	Single Dry (1994)[1]	30,010	-2,985	3,503	-3,039	-41,099	-13,610
	Multiple Dry (1987-1992)[2]	30,357	-4,785	2,363	-3,323	-35,508	-10,897
	1982-2004 Average[3]	36,045	-3,043	901	-4,543	-28,438	922
Scenario 2B	Normal (2004)[1]	27,757	479	2,175	1,344	-33,115	-1,361
	Wet (1983)[1]	47,958	2,922	4,955	-375	-29,783	25,677
	Single Dry (1994)[1]	23,213	744	6,215	3,192	-47,245	-13,878
	Multiple Dry (1987-1992)[2]	23,516	-1,170	5,082	2,825	-41,558	-11,303
	1982-2004 Average[3]	29,487	620	3,647	1,699	-34,615	840
Difference	Normal (2004)[1]	-6,774	3,717	2,725	6,194	-6,301	-437
	Wet (1983)[1]	-6,542	3,572	2,827	6,665	-6,459	61
	Single Dry (1994)[1]	-6,797	3,729	2,712	6,231	-6,146	-268
	Multiple Dry (1987-1992)[2]	-6,841	3,615	2,720	6,148	-6,050	-407
	1982-2004 Average[3]	-6,558	3,663	2,747	6,243	-6,177	-82

[1] Represents a sum of all subregions for the particular year

[2] Represents an average of the sum of all subregions for the particular years

[3] Time period selected to avoid large head changes in early years of simulation period caused by initial conditions.

Table 6-10
Groundwater Budget Comparison for Future Conditions Baseline and Scenario 3 Based on Year Type

Scenario	Year Type	Deep Percolation (afy)	Net Recharge from Streams (afy)	Net Boundary Inflow (afy)	Net Subsurface Inflow (afy)	Groundwater Pumping (afy)	Change in Storage (afy)
Future Conditions Baseline	Normal (2004)[1]	34,531	-3,238	-550	-4,850	-26,814	-924
	Wet (1983)[1]	54,500	-650	2,128	-7,040	-23,324	25,616
	Single Dry (1994)[1]	30,010	-2,985	3,503	-3,039	-41,099	-13,610
	Multiple Dry (1987-1992)[2]	30,357	-4,785	2,363	-3,323	-35,508	-10,897
	1982-2004 Average[3]	36,045	-3,043	901	-4,543	-28,438	922
Scenario 3	Normal (2004)[1]	27,764	-533	1,345	-243	-29,605	-1,270
	Wet (1983)[1]	47,945	1,999	4,144	-2,013	-26,273	25,802
	Single Dry (1994)[1]	23,183	139	5,761	2,328	-46,728	-15,315
	Multiple Dry (1987-1992)[2]	23,502	-1,898	4,542	1,750	-40,043	-12,148
	1982-2004 Average[3]	29,488	-205	2,967	398	-31,756	893
Difference	Normal (2004)[1]	-6,767	2,705	1,895	4,607	-2,791	-346
	Wet (1983)[1]	-6,555	2,649	2,016	5,027	-2,949	186
	Single Dry (1994)[1]	-6,827	3,124	2,258	5,367	-5,629	-1,705
	Multiple Dry (1987-1992)[2]	-6,856	2,888	2,179	5,072	-4,536	-1,251
	1982-2004 Average[3]	-6,557	2,838	2,067	4,941	-3,318	-28

[1] Represents a sum of all subregions for the particular year.

[2] Represents an average of the sum of all subregions for the particular years.

[3] Time period selected to avoid large head changes in early years of simulation period caused by initial conditions.

Table 6-11
Groundwater Budget for Future Conditions Baseline and Scenario 4 Based on Year Type

Scenario	Year Type	Deep Percolation (afy)	Net Recharge from Streams (afy)	Net Boundary Inflow (afy)	Net Subsurface Inflow (afy)	Groundwater Pumping (afy)	Change in Storage (afy)
Future Conditions Baseline	Normal (2004)[1]	34,531	-3,238	-550	-4,850	-26,814	-924
	Wet (1983)[1]	54,500	-650	2,128	-7,040	-23,324	25,616
	Single Dry (1994)[1]	30,010	-2,985	3,503	-3,039	-41,099	-13,610
	Multiple Dry (1987-1992)[2]	30,357	-4,785	2,363	-3,323	-35,508	-10,897
	1982-2004 Average[3]	36,045	-3,043	901	-4,543	-28,438	922
Scenario 4	Normal (2004)[1]	27,771	-1,028	1,186	-2,571	-26,621	-1,263
	Wet (1983)[1]	47,934	1,580	3,981	-4,520	-23,289	25,684
	Single Dry (1994)[1]	23,174	-226	5,767	-108	-43,572	-14,964
	Multiple Dry (1987-1992)[2]	23,506	-2,227	4,532	-732	-36,944	-11,866
	1982-2004 Average[3]	29,489	-632	2,857	-2,051	-28,734	929
Difference	Normal (2004)[1]	-6,760	2,210	1,736	2,279	193	-339
	Wet (1983)[1]	-6,566	2,230	1,853	2,520	35	68
	Single Dry (1994)[1]	-6,836	2,759	2,264	2,931	-2,473	-1,354
	Multiple Dry (1987-1992)[2]	-6,852	2,558	2,170	2,591	-1,437	-970
	1982-2004 Average[3]	-6,556	2,411	1,956	2,492	-297	7

[1] Represents a sum of all subregions for the particular year.

[2] Represents an average of the sum of all subregions for the particular years.

[3] Time period selected to avoid large head changes in early years of simulation period caused by initial conditions.

Table 6-12
Groundwater Budget for Future Conditions Baseline and Scenario 5 Based on Year Type

Scenario	Year Type	Deep Percolation (afy)	Net Recharge from Streams (afy)	Net Boundary Inflow (afy)	Net Subsurface Inflow (afy)	Groundwater Pumping (afy)	Change in Storage (afy)
Future Conditions Baseline	Normal (2004)[1]	34,531	-3,238	-550	-4,850	-26,814	-924
	Wet (1983)[1]	54,500	-650	2,128	-7,040	-23,324	25,616
	Single Dry (1994)[1]	30,010	-2,985	3,503	-3,039	-41,099	-13,610
	Multiple Dry (1987-1992)[2]	30,357	-4,785	2,363	-3,323	-35,508	-10,897
	1982-2004 Average[3]	36,045	-3,043	901	-4,543	-28,438	922
Scenario 5	Normal (2004)[1]	27,764	-1,827	52	-634	-26,621	-1,266
	Wet (1983)[1]	47,926	726	2,823	-2,445	-23,289	25,740
	Single Dry (1994)[1]	23,184	-1,243	4,349	2,156	-43,572	-15,125
	Multiple Dry (1987-1992)[2]	23,513	-3,286	3,121	1,565	-36,944	-12,032
	1982-2004 Average[3]	29,488	-1,540	1,618	72	-28,734	903
Difference	Normal (2004)[1]	-6,767	1,411	602	4,216	193	-342
	Wet (1983)[1]	-6,574	1,376	695	4,595	35	124
	Single Dry (1994)[1]	-6,826	1,742	846	5,195	-2,473	-1,515
	Multiple Dry (1987-1992)[2]	-6,845	1,499	759	4,887	-1,437	-1,136
	1982-2004 Average[3]	-6,557	1,503	718	4,615	-297	-18

[1] Represents a sum of all subregions for the particular year.

[2] Represents an average of the sum of all subregions for the particular years.

[3] Time period selected to avoid large head changes in early years of simulation period caused by initial conditions.

Figures

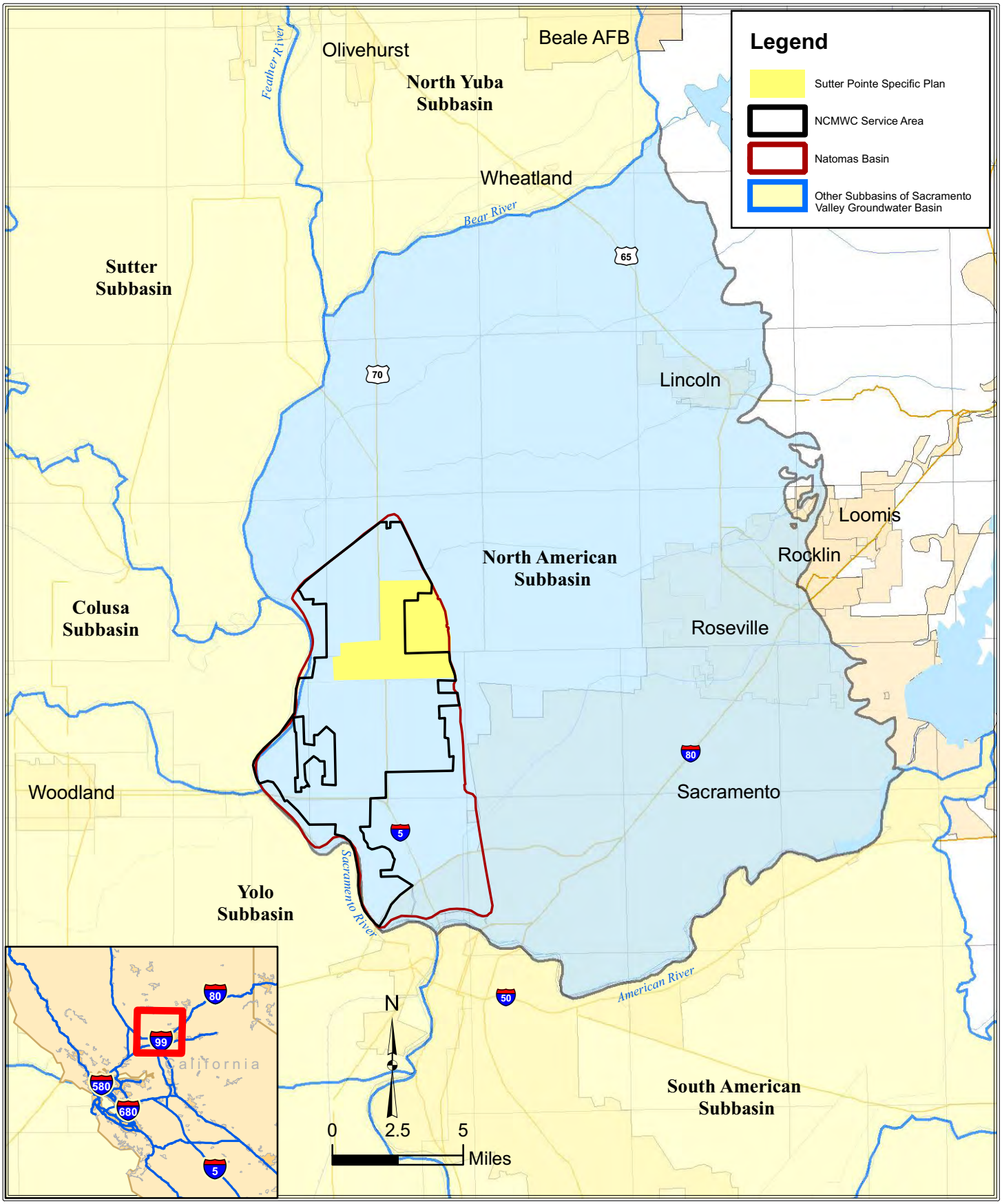

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Figure 1-1
Location of Sutter Pointe Specific Plan Within North American Subbasin

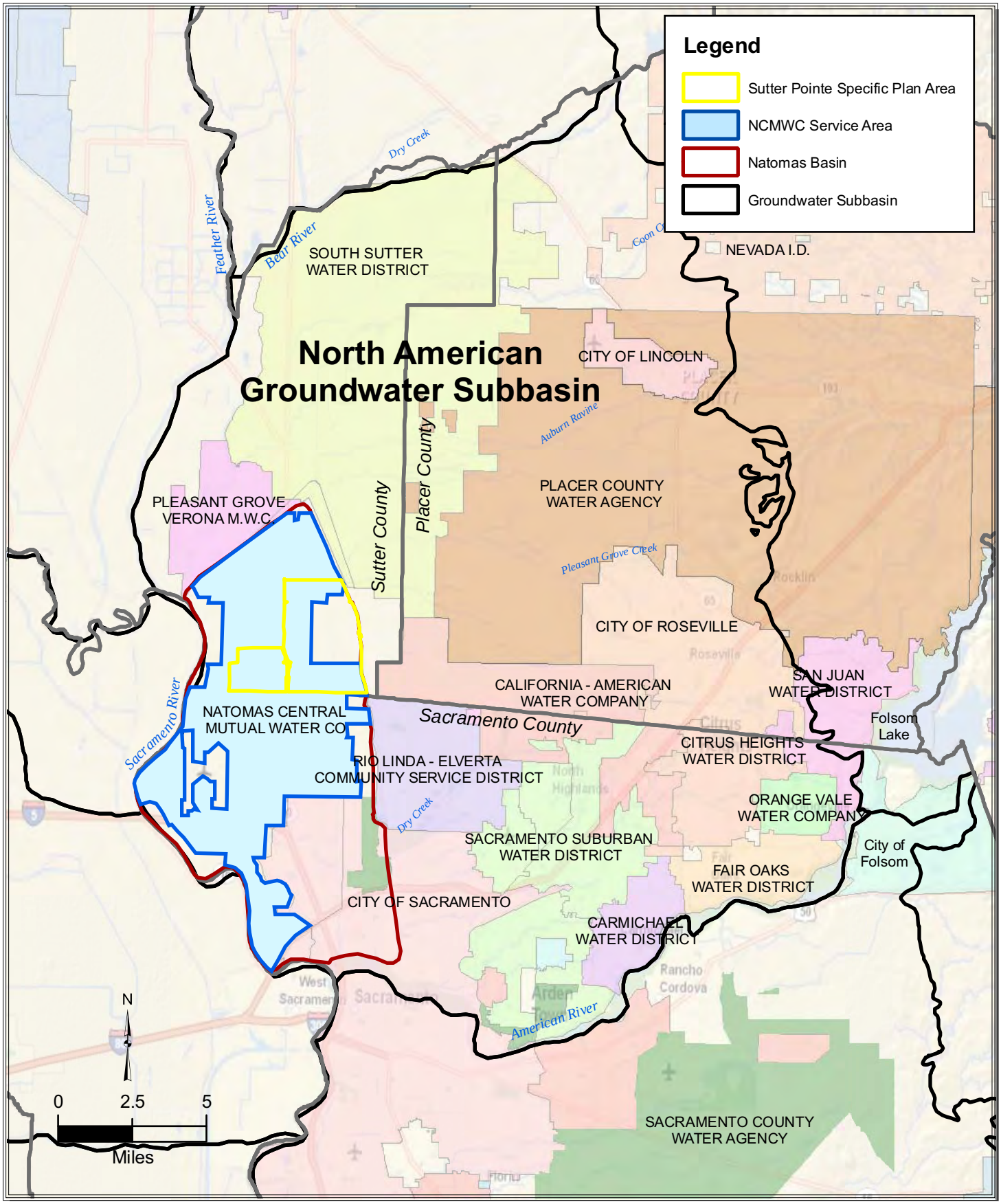

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Figure 2-1
Water Purveyors in North American Subbasin

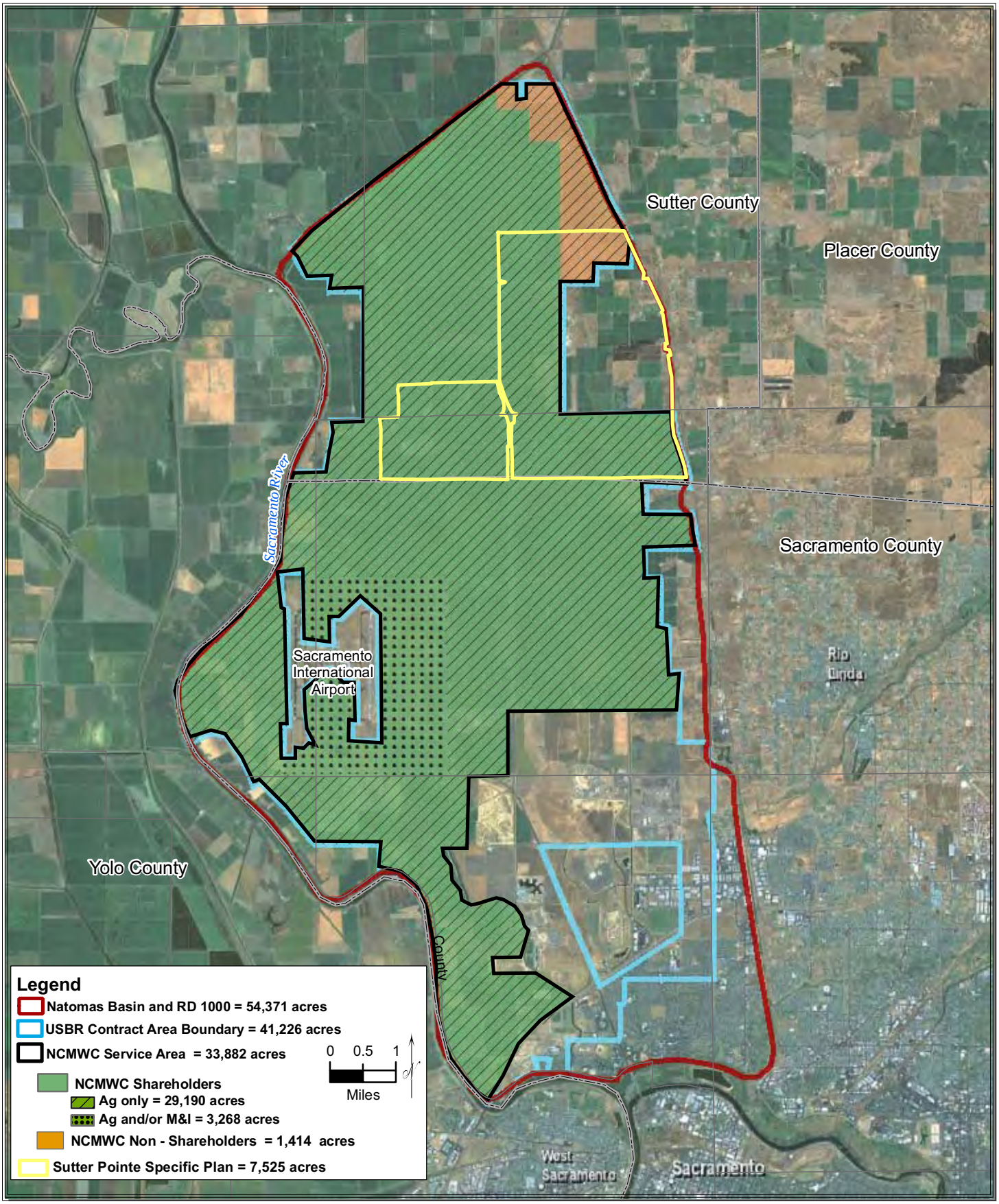

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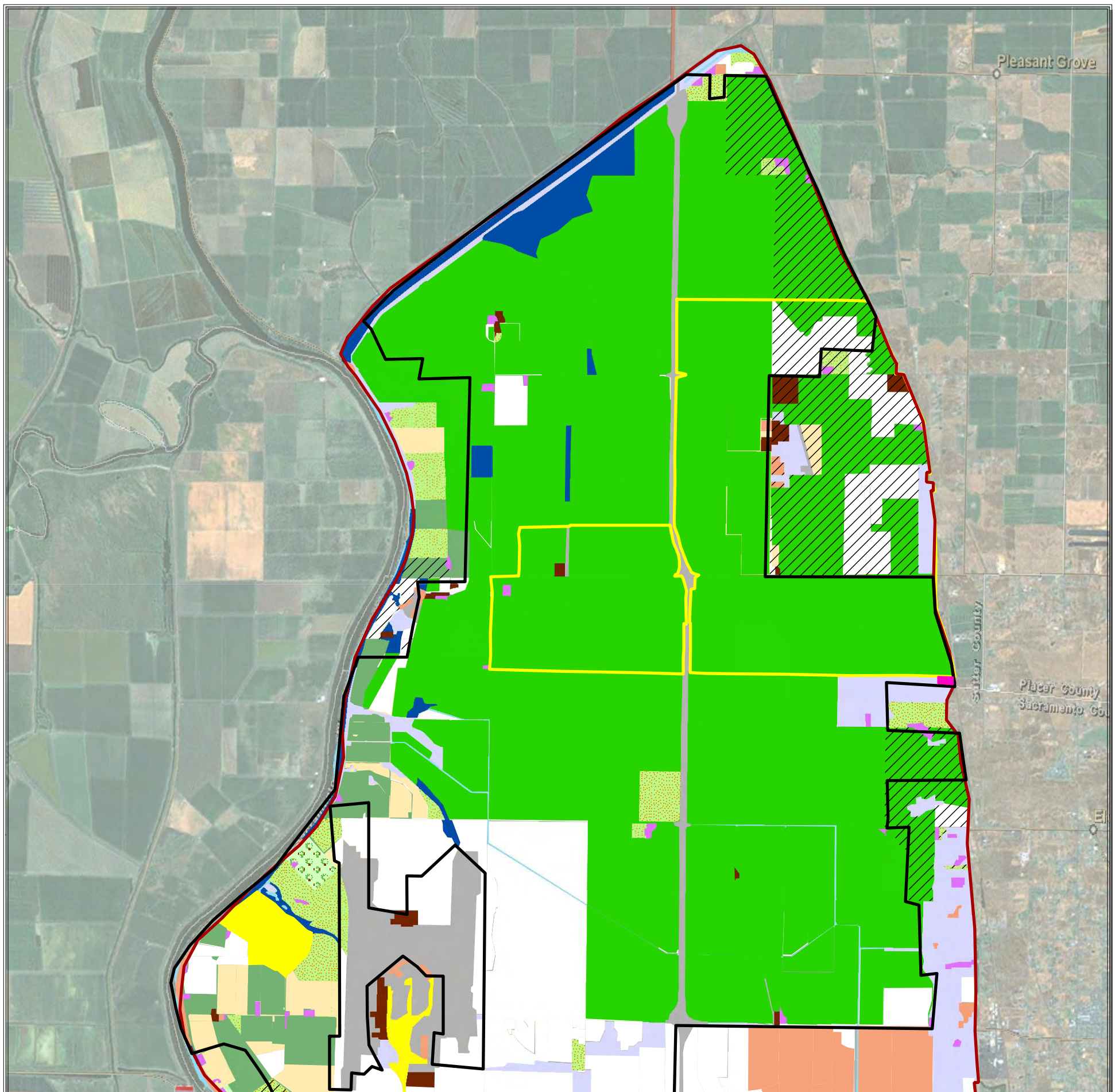
Figure 2-2
Natomas Basin and Natomas Central Mutual Water Company Service Area



FILE: \public\Sutter Pointe 07-1-012\GIS\Figure 2-3 Land Use.mxd DATE: 9/11/2007 3:02:30 PM

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Figure 2-3
2004 Land Use and Areas Irrigated with Groundwater in Natomas Basin

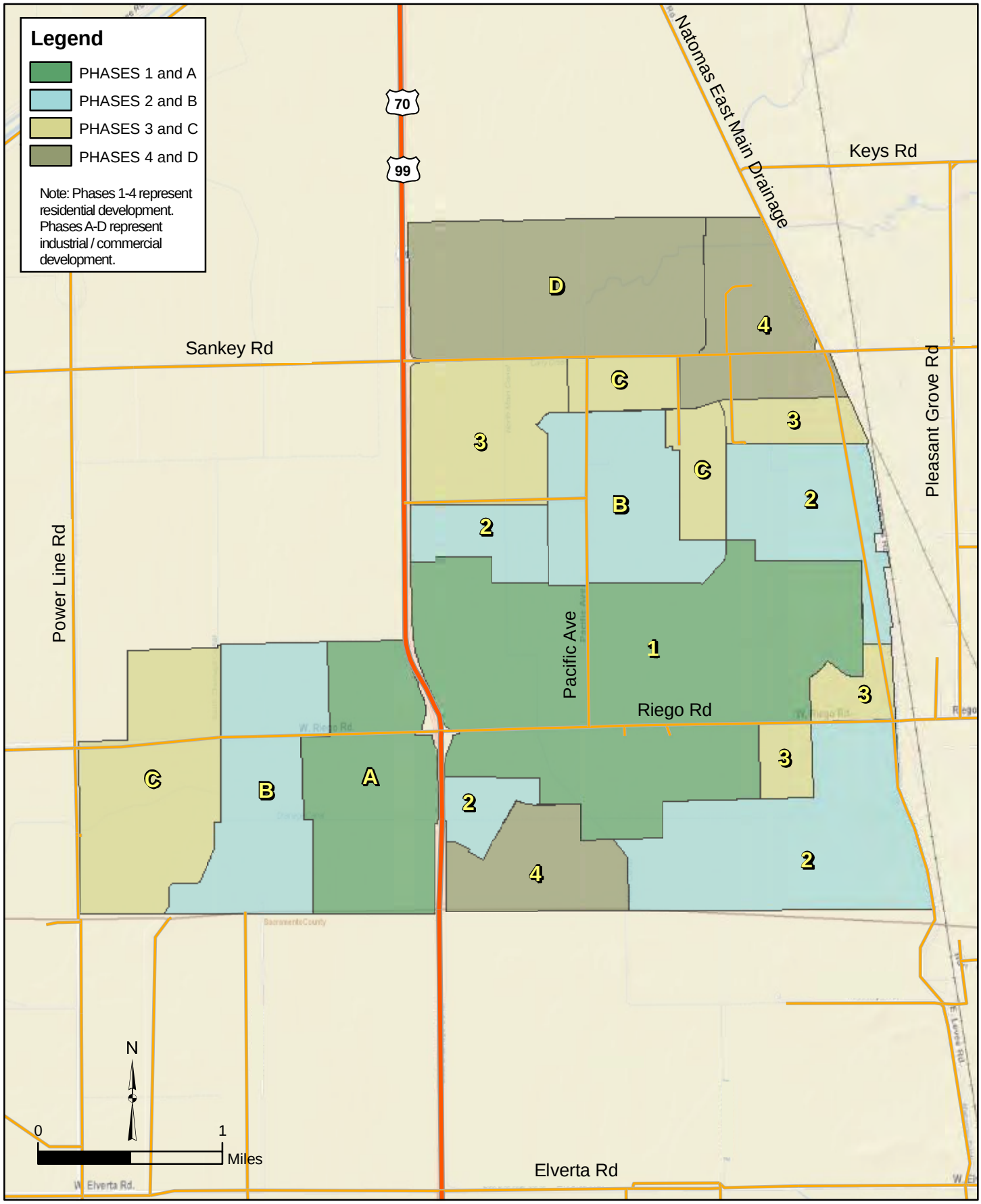

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Figure 2-4
Sutter Pointe Specific Plan Phasing Map

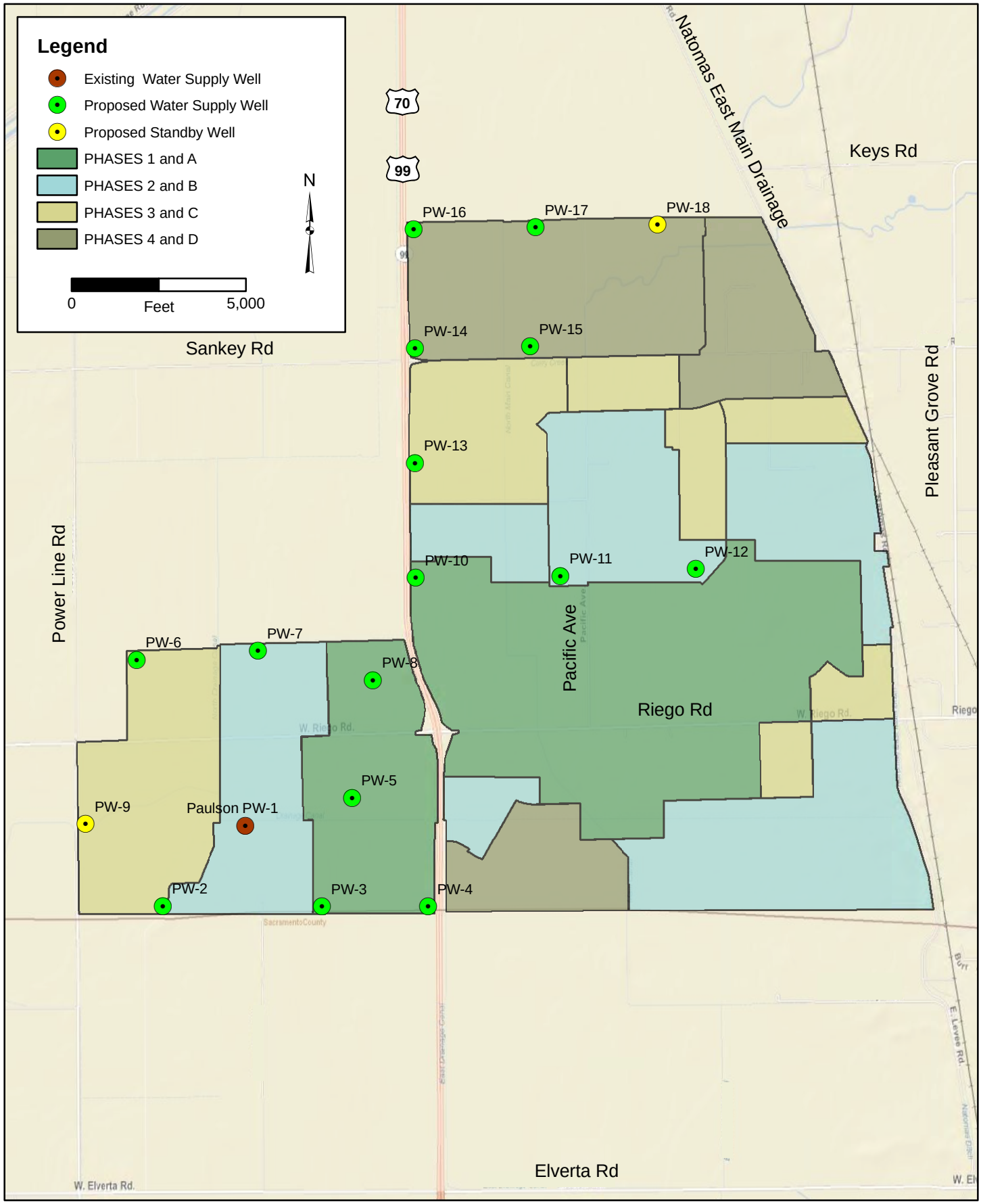

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Figure 2-5
Sutter Pointe Specific Plan
Proposed Well Locations

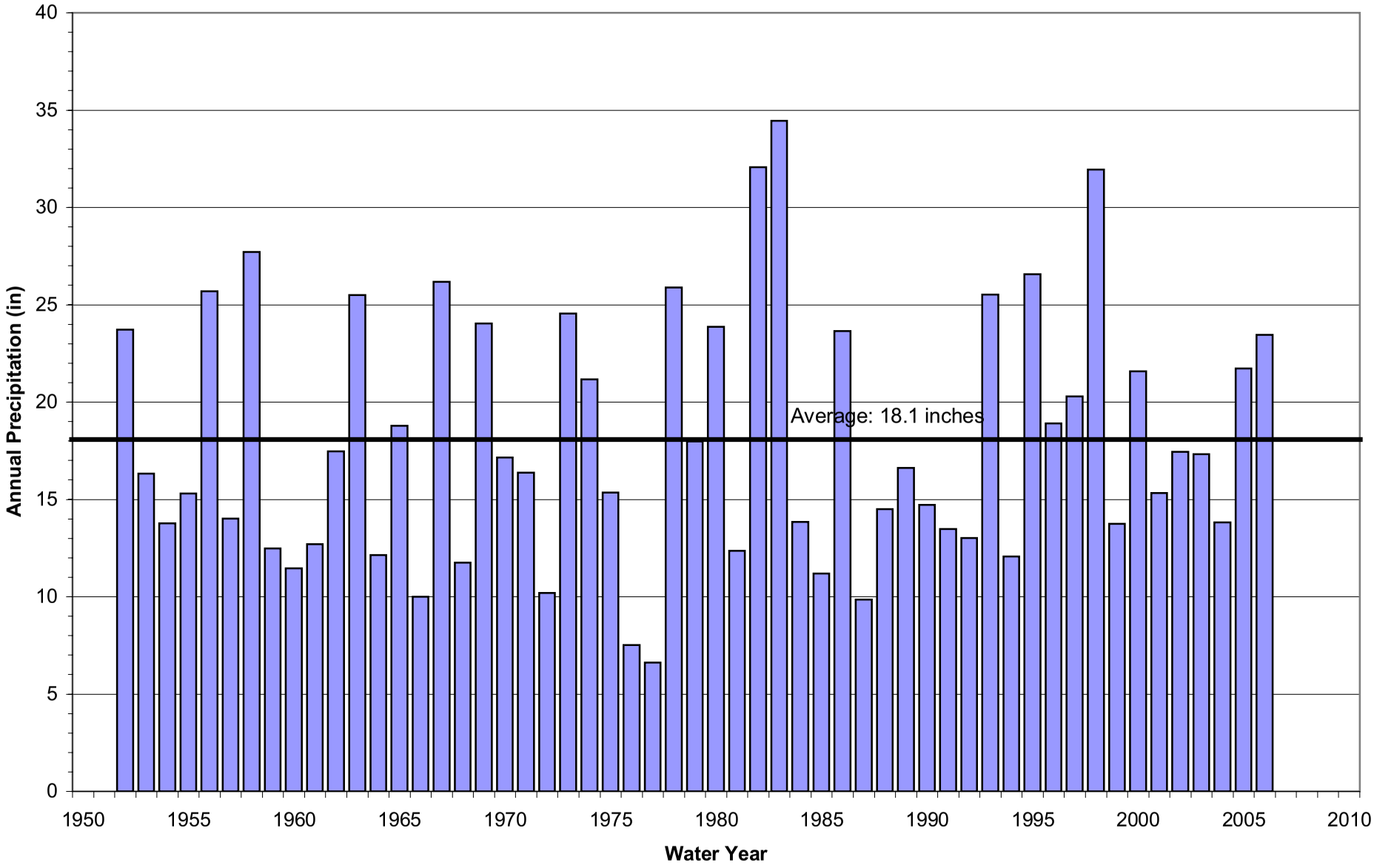

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Figure 2-6
Annual Precipitation at Sacramento Executive Airport Gage
Water Years 1952-2006

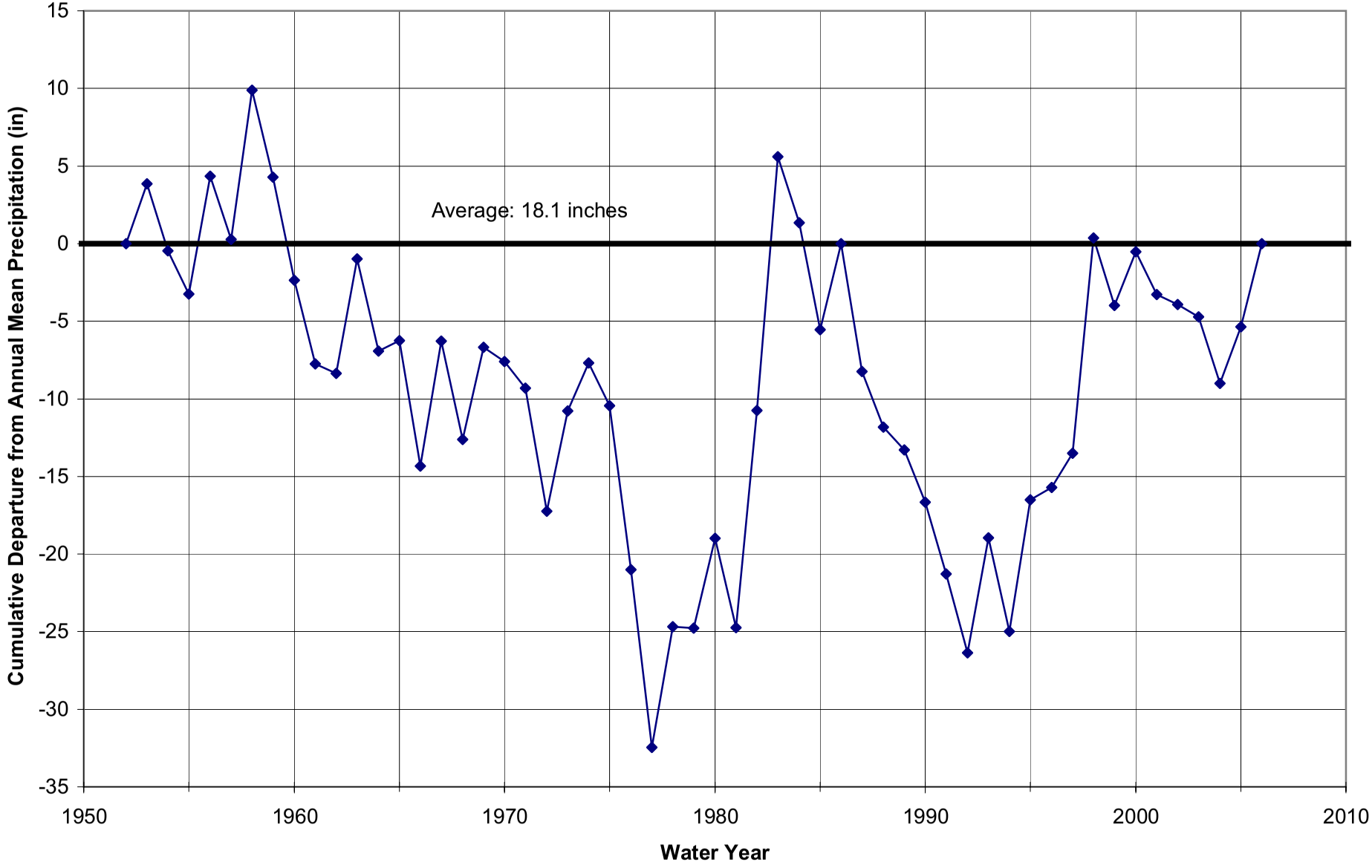

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Figure 2-7
Cumulative Departure from Mean Annual Precipitation at Sacramento Executive Airport Gage

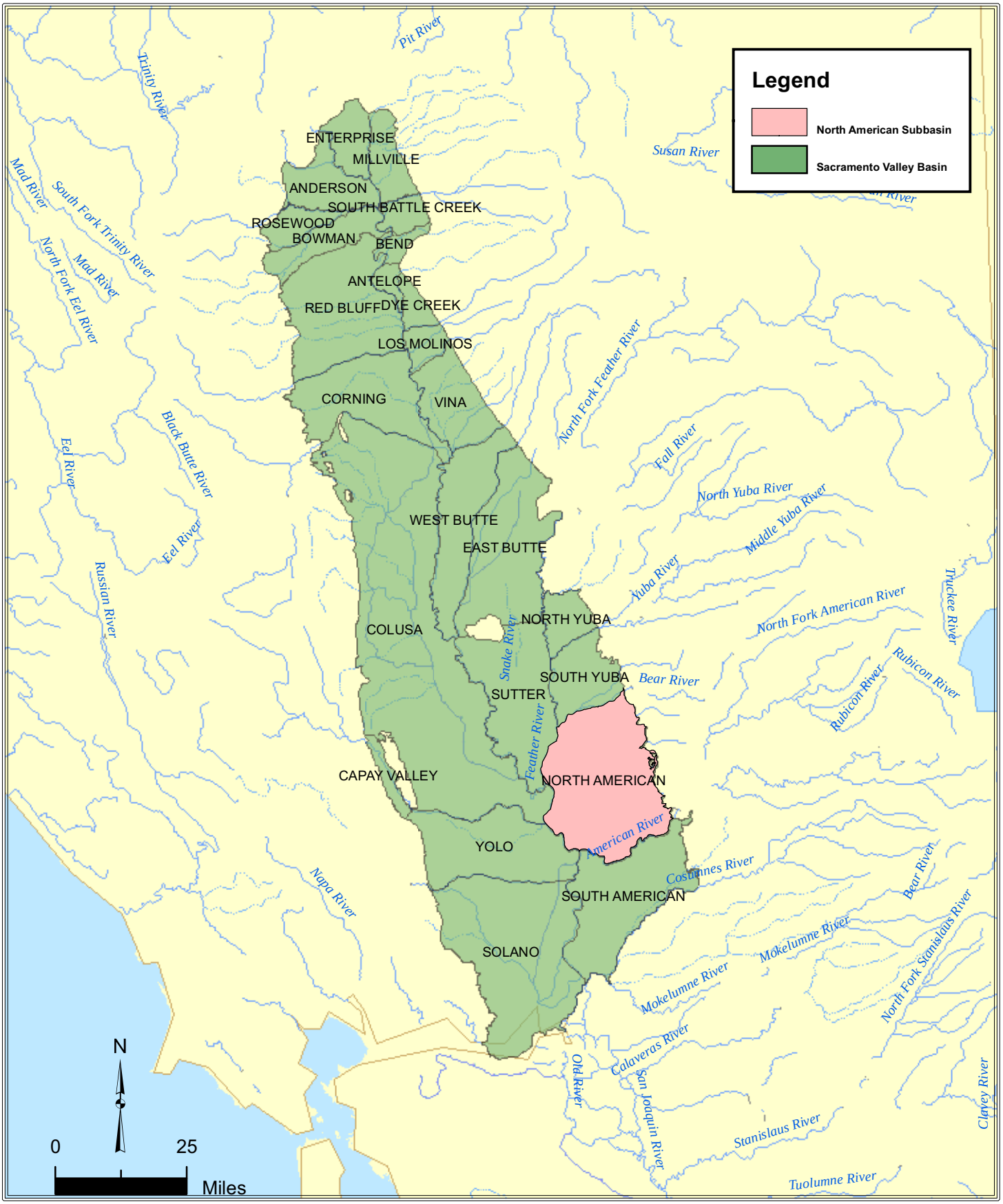

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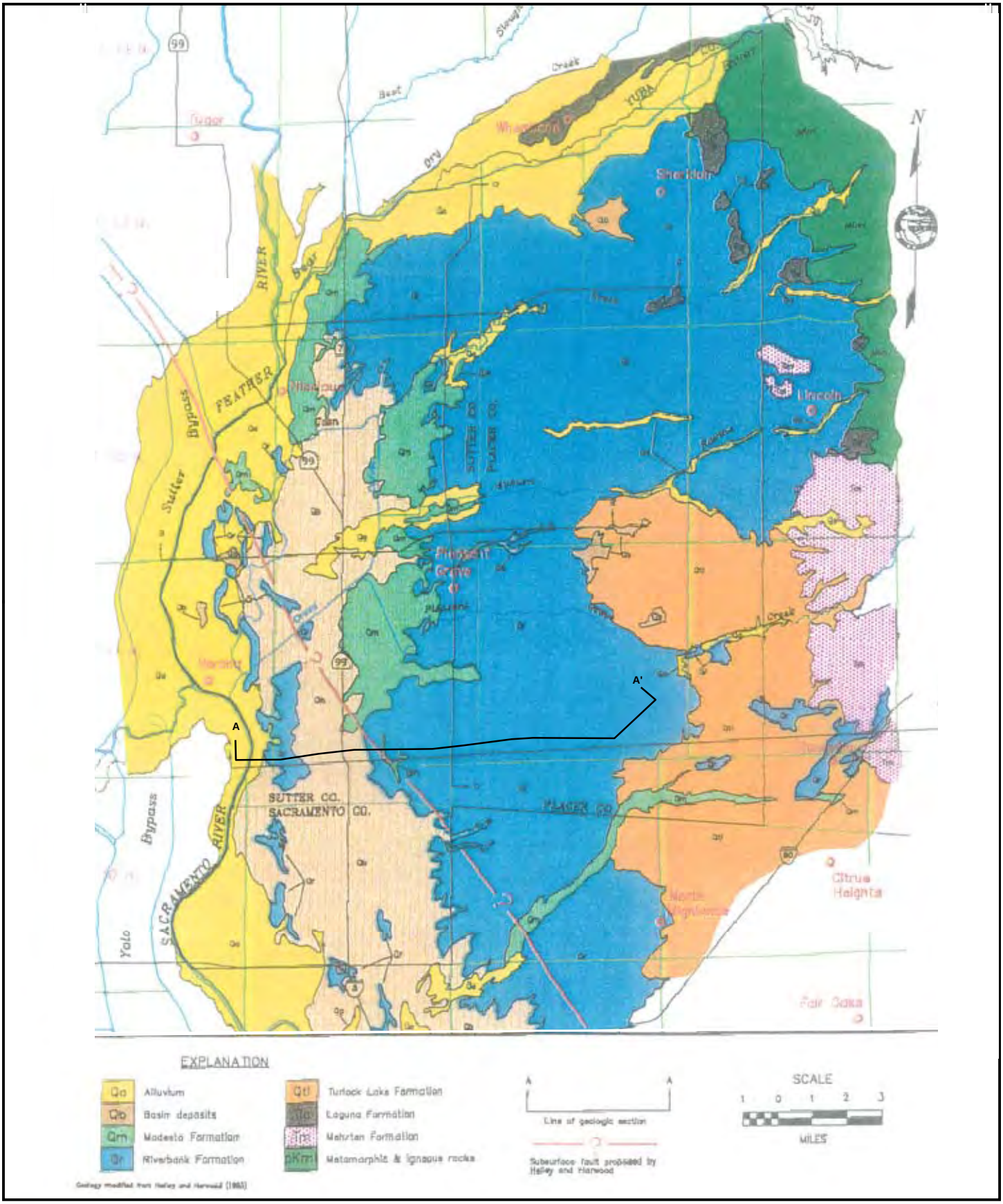
Figure 3-1
Sacramento Valley Groundwater Basin and Subbasins



FILE: \public\Sutter Pointe 07-1-012\GIS\Figure 3-2.mxd DATE: 8/17/2007 8:30:58 AM

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Figure 3-2
Geologic Map of North American Subbasin

A

A'

Natomas Central Mutual Water District

Natomas #1

Natomas #2

Paulson MW

Lauppe MW

Lauppe 1-28

Elevation (ft, msl)

Sea Level

-300

-600

-900

-1200

-1500

-1800

TD = 518'

TOL

TOL

TD = 1200'

Base of non-marine at 1710' depth

Base of non-marine at 1500' depth

Base of non-marine & TOL at 1500' depth

0 1 2 3 4 5 6 7 8 9 10 11 12 13

Distance (miles)

State Well Number
Distance & direction Well is projected to section

TYPE OF LOG:
D= DRILLER'S LOG
E= ELECTRIC LOG

DOG = Oil & Gas Testhole

TOL = Top of E Log

Lithologic materials encountered during drilling of the well

AQUICLUDE
Generally Silt and Clay

UNKNOWN
whether aquiclude or aquifer

AQUIFER
Generally Sand & Gravel

Source of original cross section: DWR, 1995, Pre-feasibility Report, American Basin Conjuctive Use Project.

FILE: \public\Sutter Pointe 07-1-012\GIS\Figure 3-3.mxd

DATE: 8/22/2007 10:09:17 AM

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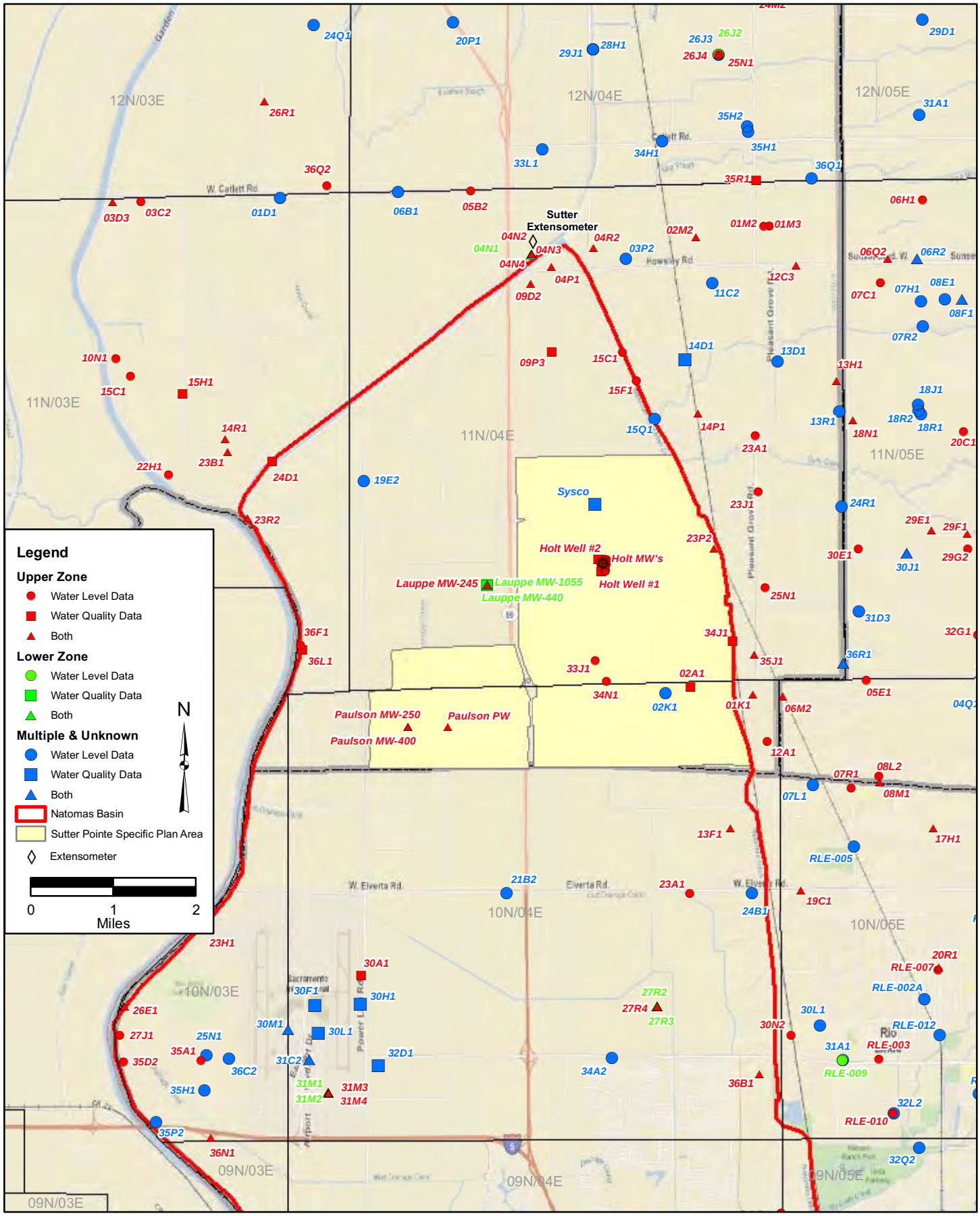
Figure 3-3
Geologic Cross-Section A - A'



FILE: \public\Sutter Pointe 07-1-012\GIS\Figure 3-4.mxd

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Figure 3-4
Wells in Vicinity of SPSP with Water Level and/or Water Quality Data

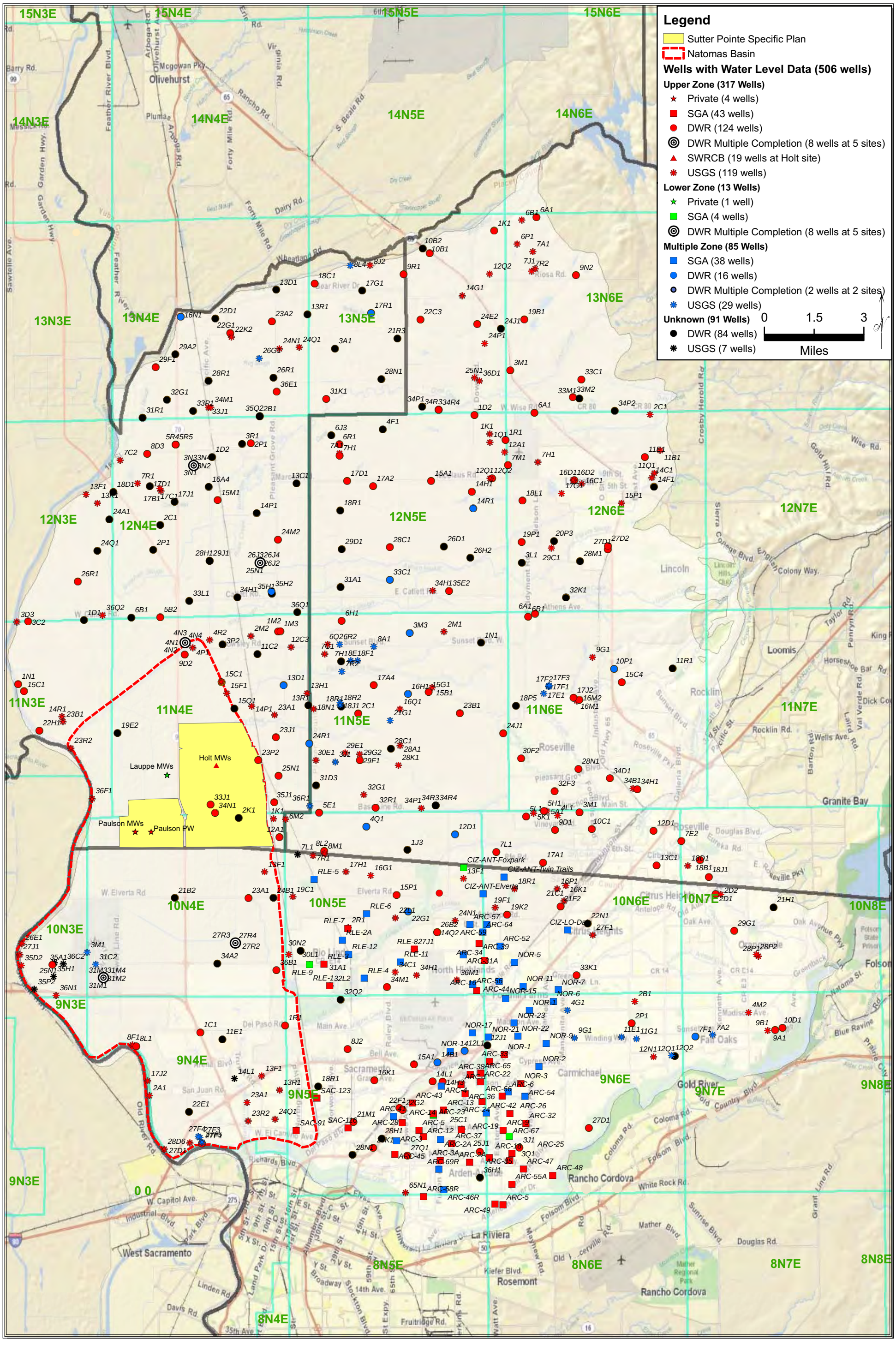

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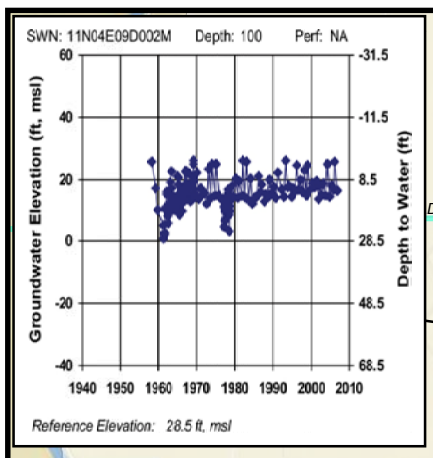
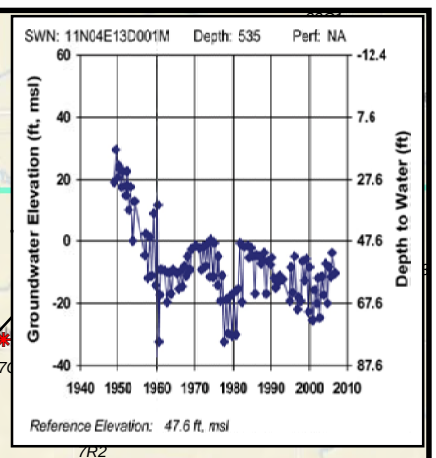
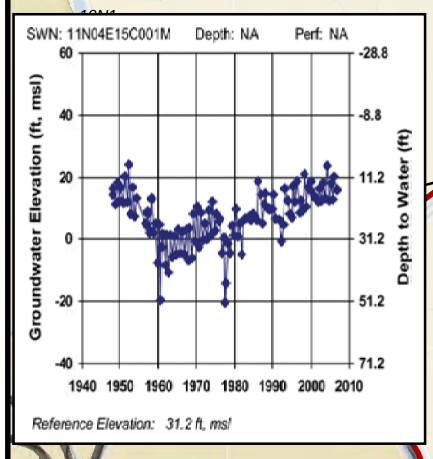
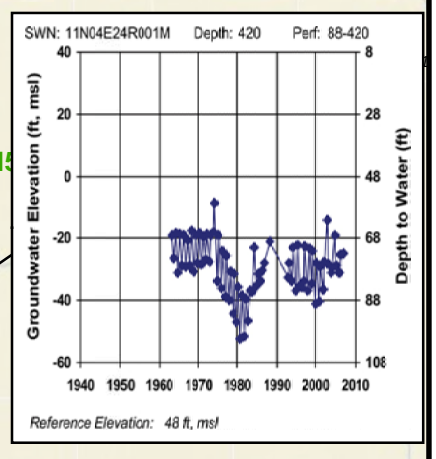
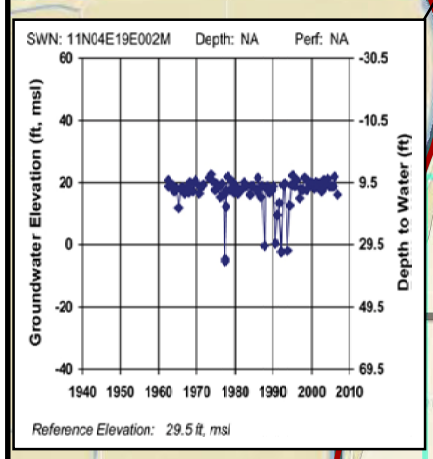
Figure 4-1
Location of Wells with Water Level Data Evaluated for Sutter Pointe Groundwater Supply Assessment

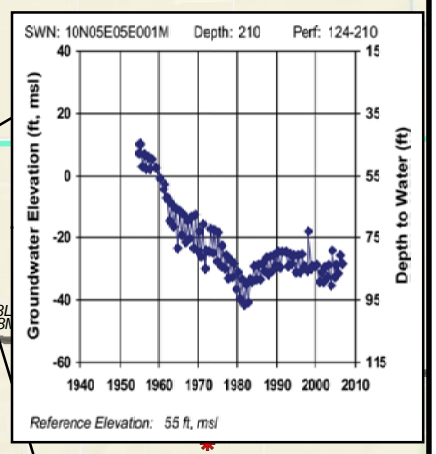


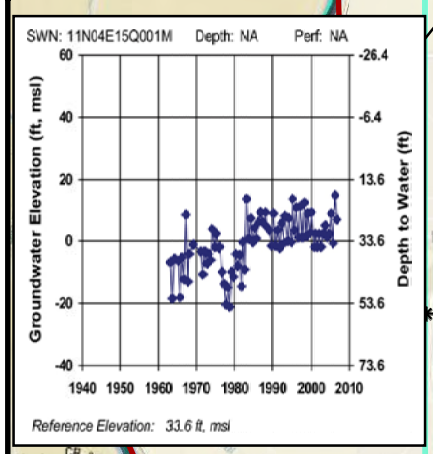


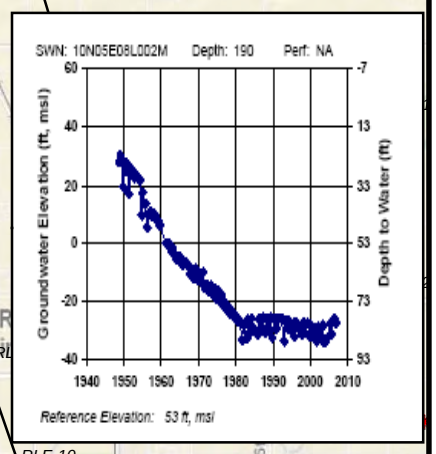


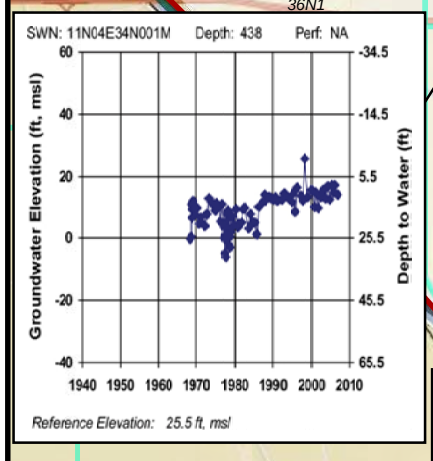


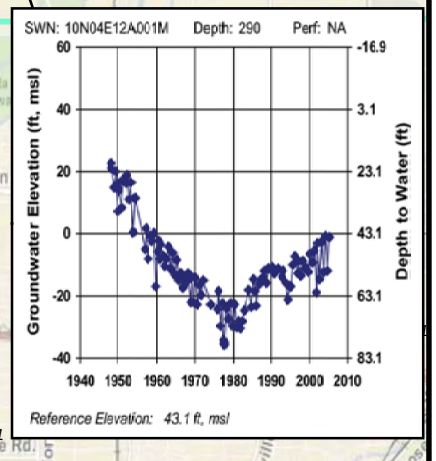


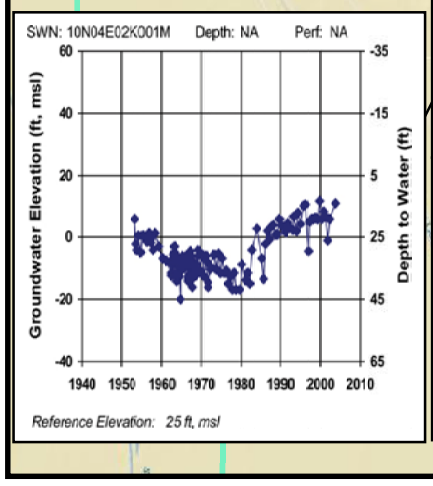












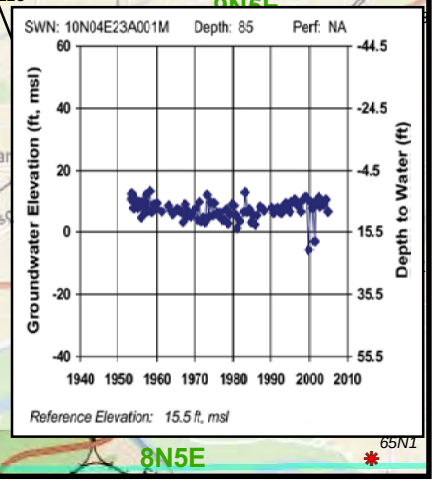


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Figure 4-2
Representative Water Level Hydrographs in Vicinity of Sutter Pointe Specific Plan

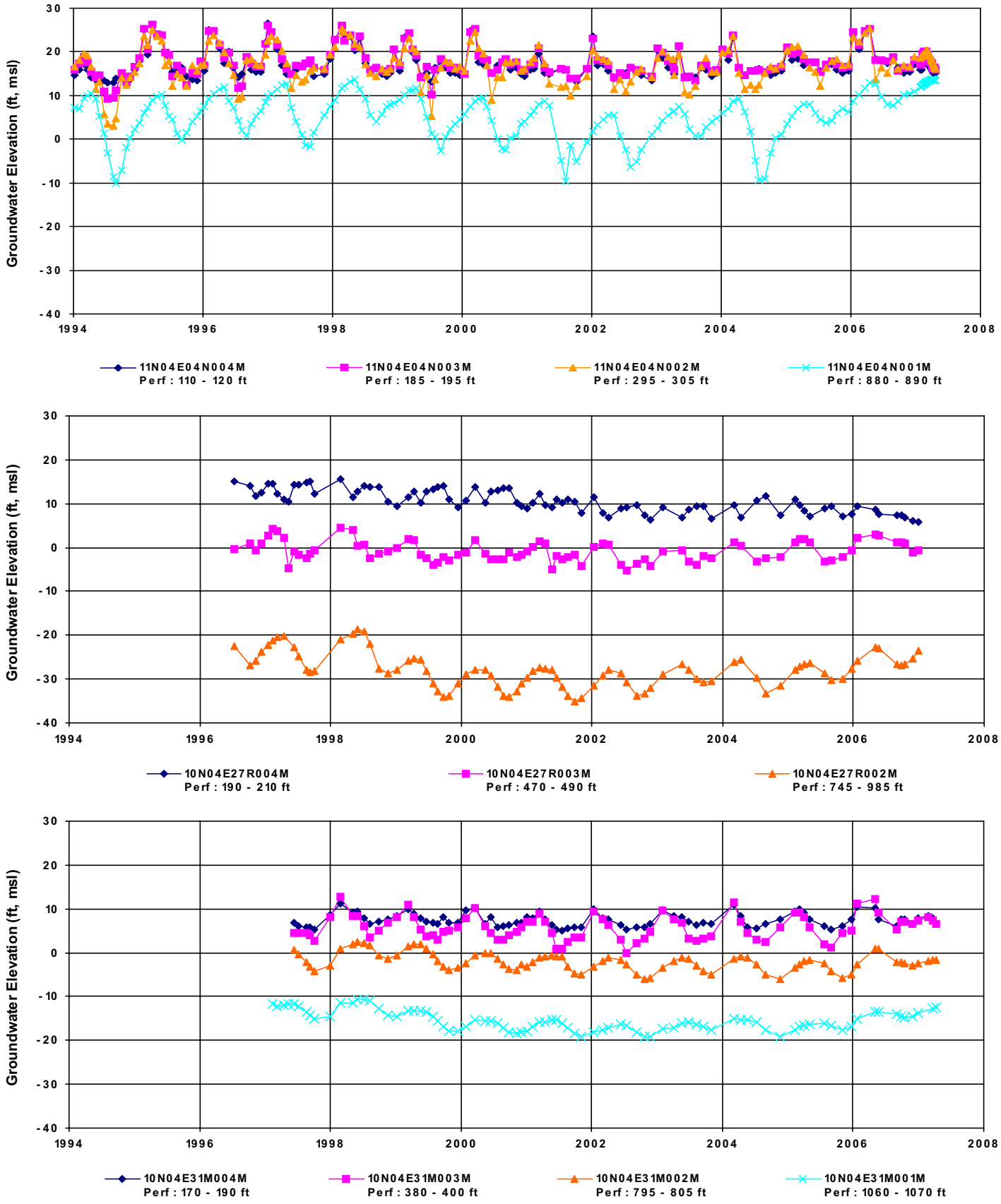

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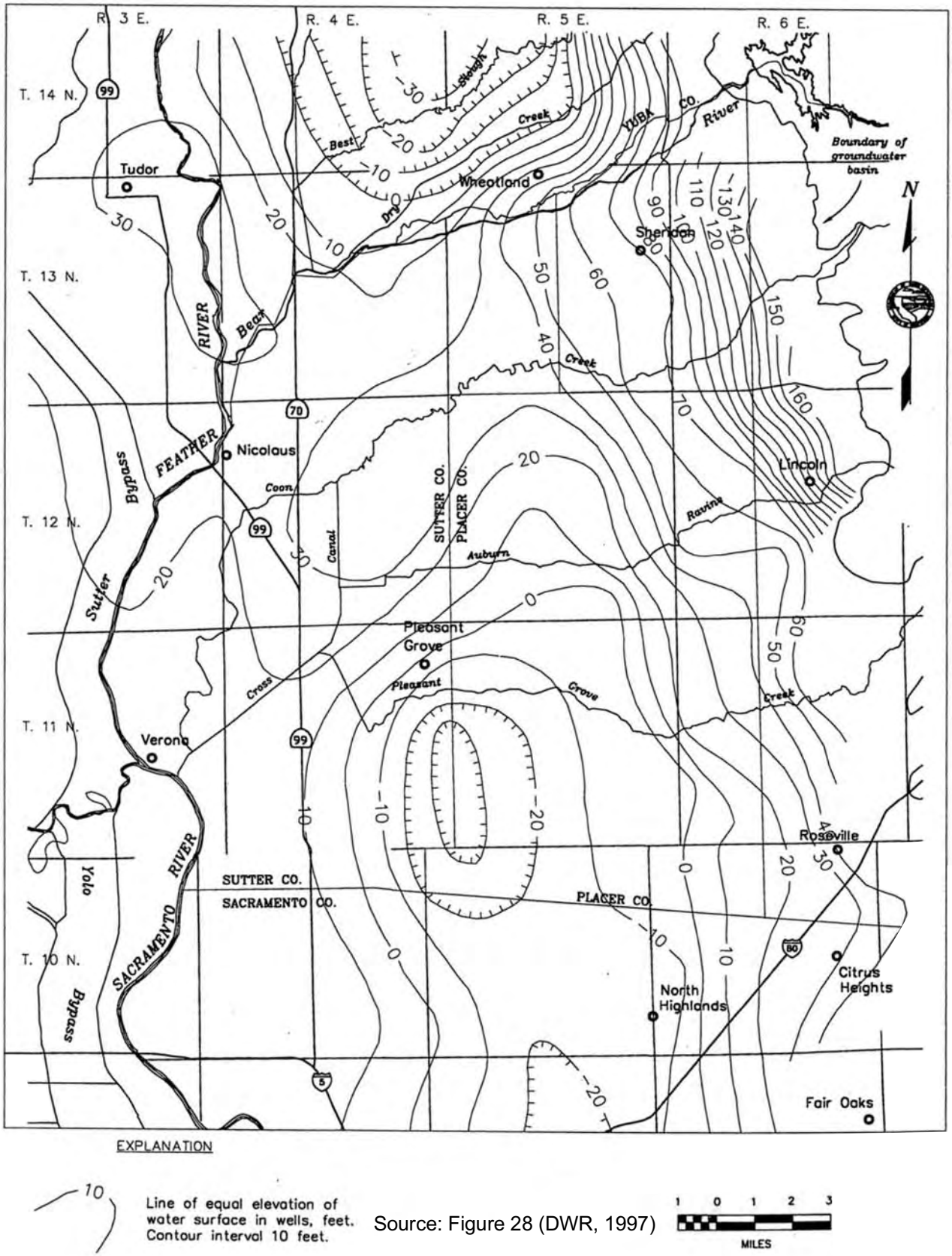
Figure 4-3
Hydrographs of Multiple-Completion Monitoring Wells in Natomas Basin



Source: Figure 28 (DWR, 1997)

FILE: \public\Sutter Pointe 07-1-012\GIS\Figure 4-4 Spring 1980 GWE contours.mxd DATE: 8/22/2007 1:54:38 PM

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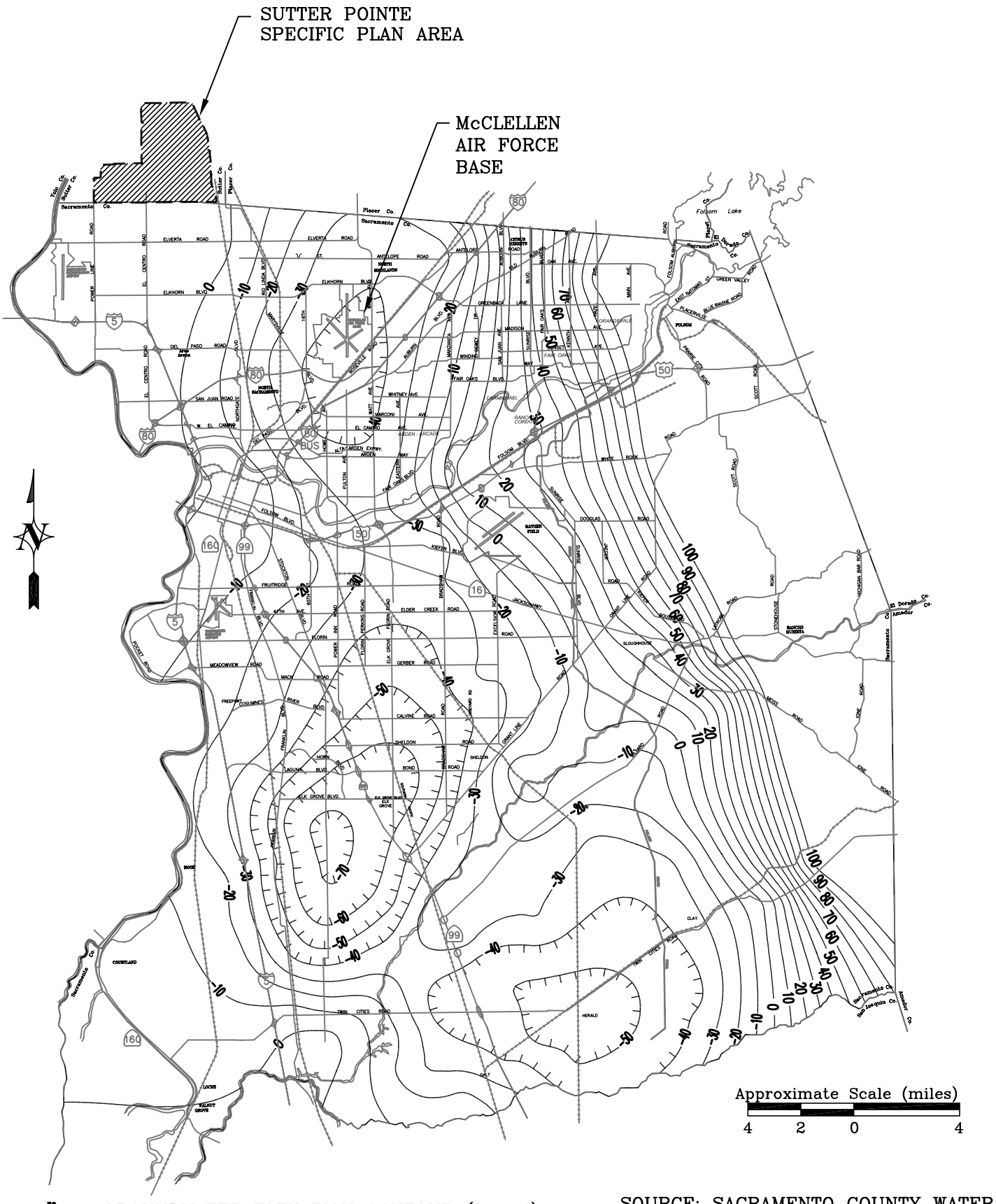
Figure 4-4
Spring 1980 Groundwater Elevation Contours
Multiple Zone Wells in North American Subbasin



SOURCE: SACRAMENTO COUNTY WATER RESOURCES DIVISION

CAD FILE: G:/Projects/Lennar Communities/07-1-012/Figure 4-5.dwg CFG FILE: LSCE2500.PCP_MRG DATE: 08-22-07 9:33am

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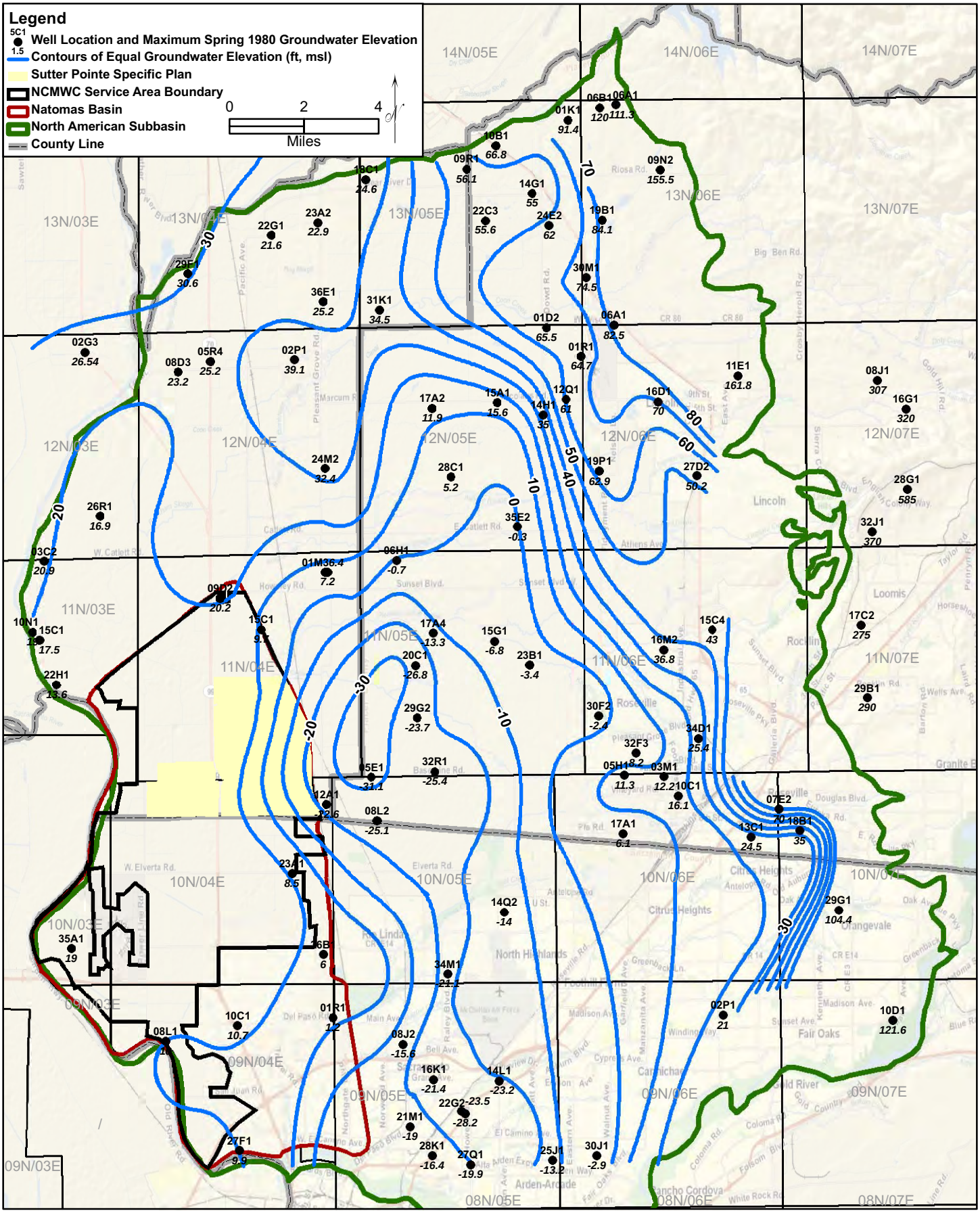
CONSULTING ENGINEERS

Figure 4-5
Fall 1997 Groundwater Elevation Contours
Multiple Zone Wells in Sacramento County



FILE: \public\Sutter Pointe 07-1-012\GIS\Figure 4-6 spring 1980 contours.mxd DATE: 8/22/2007 2:03:18 PM

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Figure 4-6
Spring 1980 Groundwater Elevation Contours
Upper Zone Wells in North American Subbasin

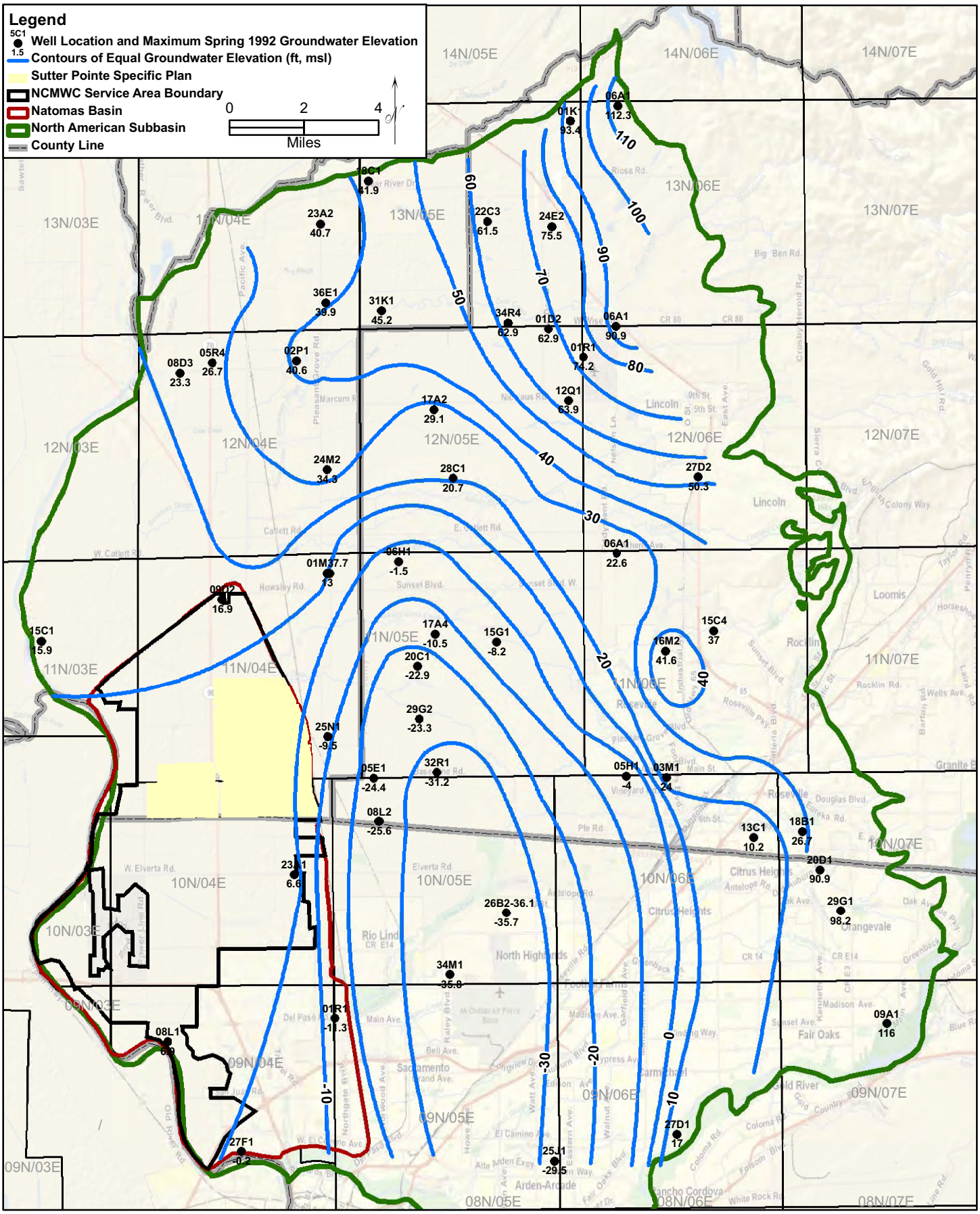

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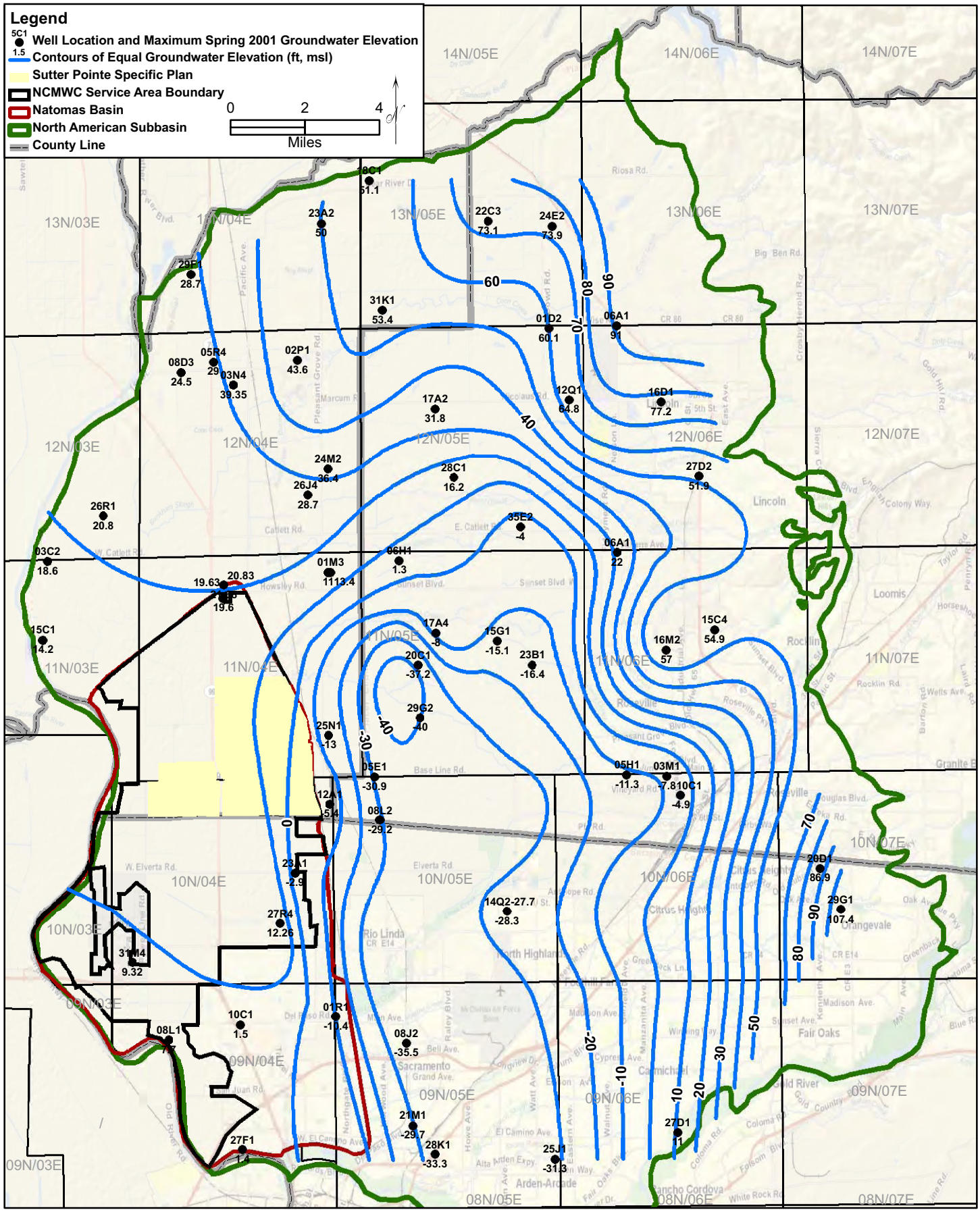
Figure 4-7
Spring 1992 Groundwater Elevation Contours
Upper Zone Wells in North American Subbasin


Legend
Well Location and Maximum Spring 2001 Groundwater Elevation
Contours of Equal Groundwater Elevation (ft, msl)
Sutter Pointe Specific Plan
NCMWC Service Area Boundary
Natomas Basin
North American Subbasin
County Line
0 2 4
Miles
14N/05E
14N/06E
14N/07E
13N/03E
13N/04E
13N/05E
13N/06E
13N/07E
12N/03E
12N/04E
12N/05E
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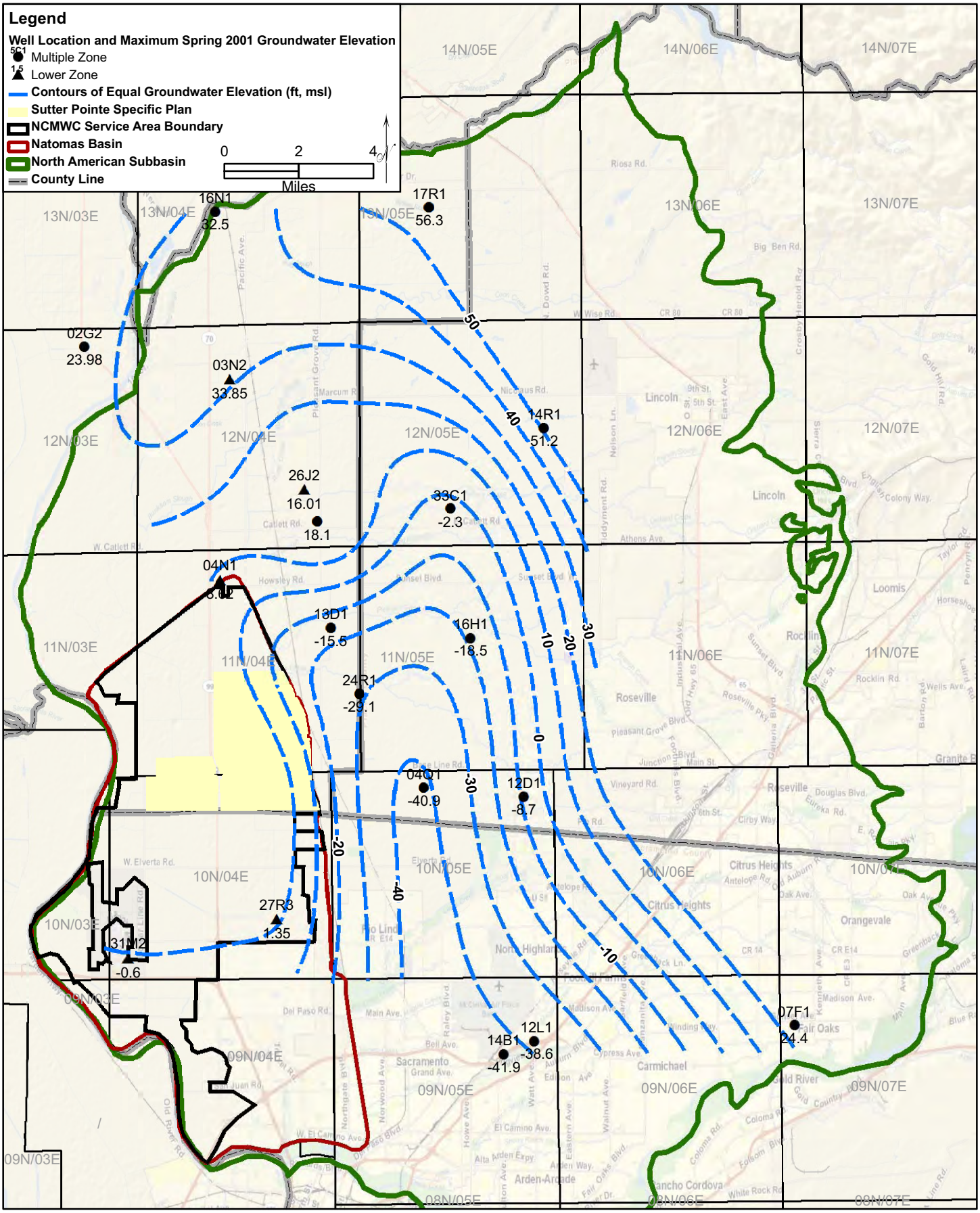
10N/07E
09N/03E
09N/04E
09N/05E
09N/06E
09N/07E
08N/05E
08N/06E
08N/07E
Lincoln
Loomis
Rocklin
Roseville
Citrus Heights
Orangevale
Fair Oaks
Carmichael
Sacramento
Rio Linda
Arden-Arcade
Folsom
Elverta Rd.
Base Line Rd.
Sunset Blvd.
Howsley Rd.
E. Catlett Rd.
Pleasant Grove Rd.
Riosa Rd.
Big Ben Rd.
English Colony Way
Rocklin Rd.
Madison Ave.
Fair Oaks Blvd.
Greenback Ln.
Folsom Blvd.
White Rock Rd.
Sierra College Blvd.
Pacific Ave.
Watt Ave.
Howe Ave.
Walnut Ave.
Auburn Blvd.
Douglas Blvd.
Taylor Rd.
Penryn Rd.
Laird Rd.
Wells Ave.
Granite Dr.
Gold Hill Rd.
Crosby Herold Rd.
Dry Creek
Natomas Main Drain
Sutter Bypass
Sacramento River
Pleasant Grove Creek
Coon Creek
Cross Canal
Gold River
Coloma Rd.
Old Auburn Rd.
Del Paso Rd.
Northgate Blvd.
Raley Blvd.
Bell Ave.
Grand Ave.
Longview Dr.
Cypress Ave.
Manzanita Ave.
Kenneth Ave.
Oak Ave.
Greenback Ln.
Madison Ave.
Sunset Ave.
Winding Way
Main Ave.
Elkhorn Blvd.
Northgate Blvd.
Howe Ave.
Watt Ave.
Walnut Ave.
Auburn Blvd



FILE: \public\Sutter Pointe 07-1-012\GIS\Figure 4-9 spring 2001 contours lower and multiple zone.mxd DATE: 8/22/2007 9:46:00 AM

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Figure 4-9
Spring 2001 Groundwater Elevation Contours
Lower and Multiple Zone Wells in North American Subbasin

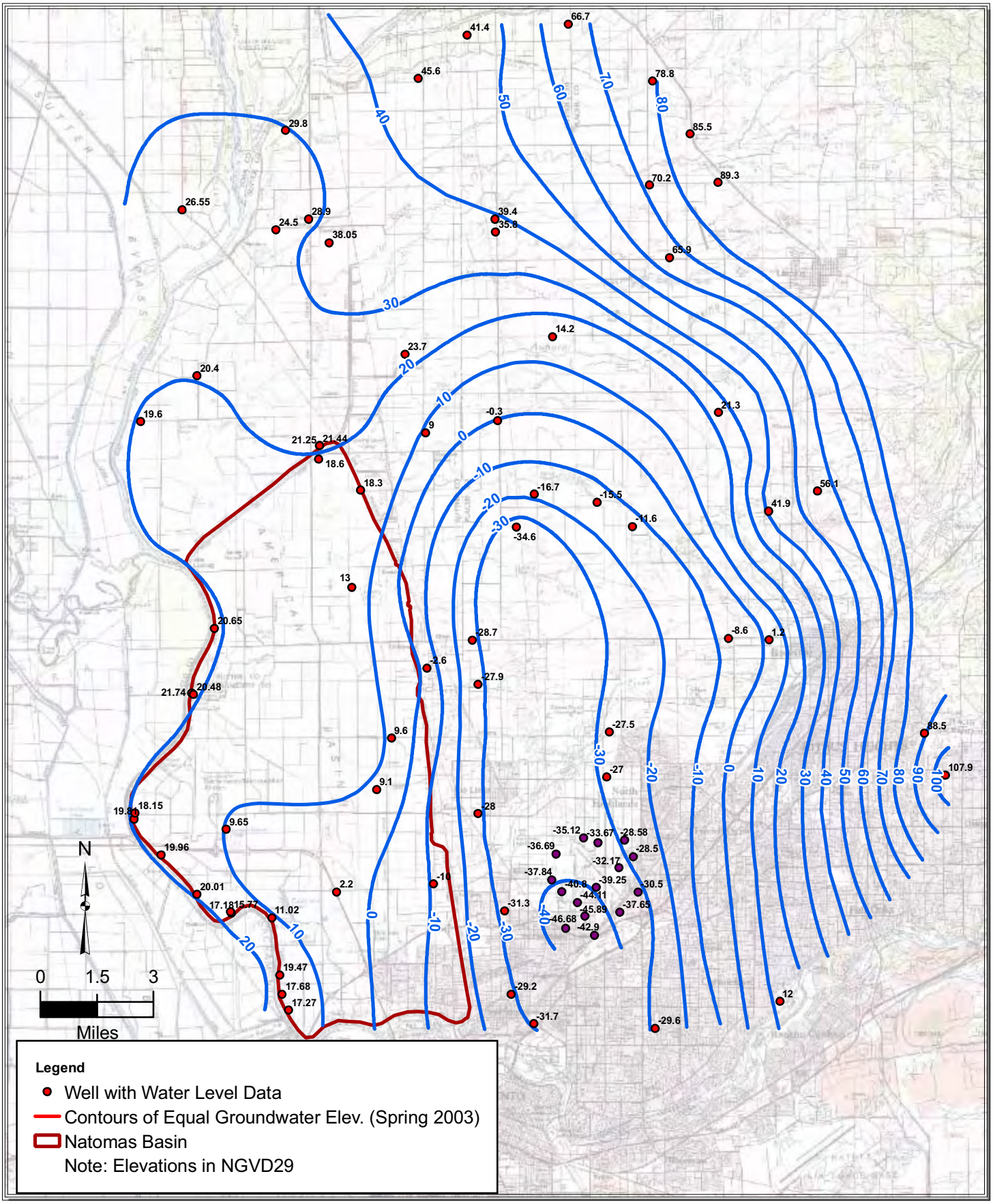

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Figure 4-10
Spring 2003 Groundwater Elevations Contours for Uppper Zone Wells in Natomas Basin

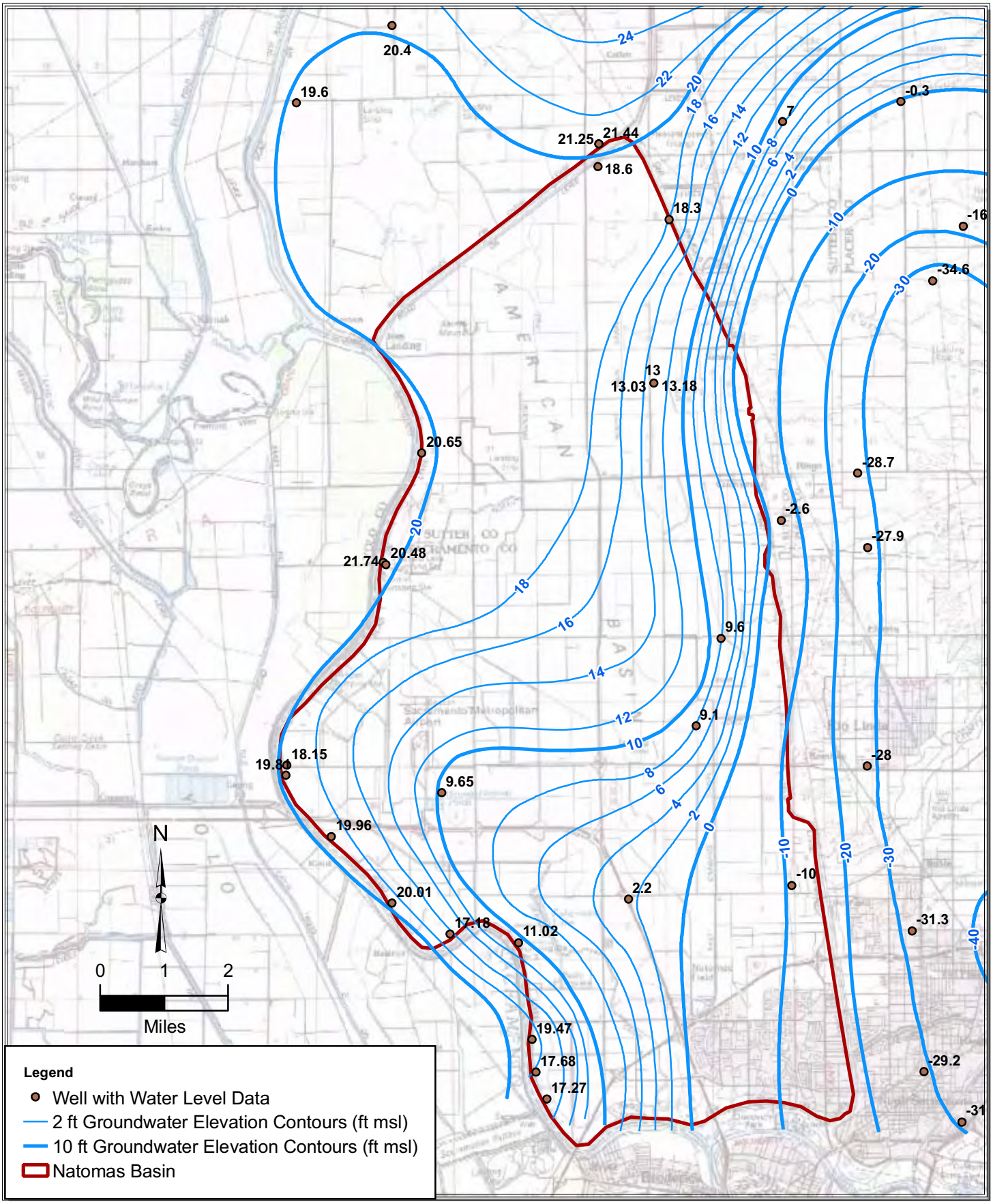

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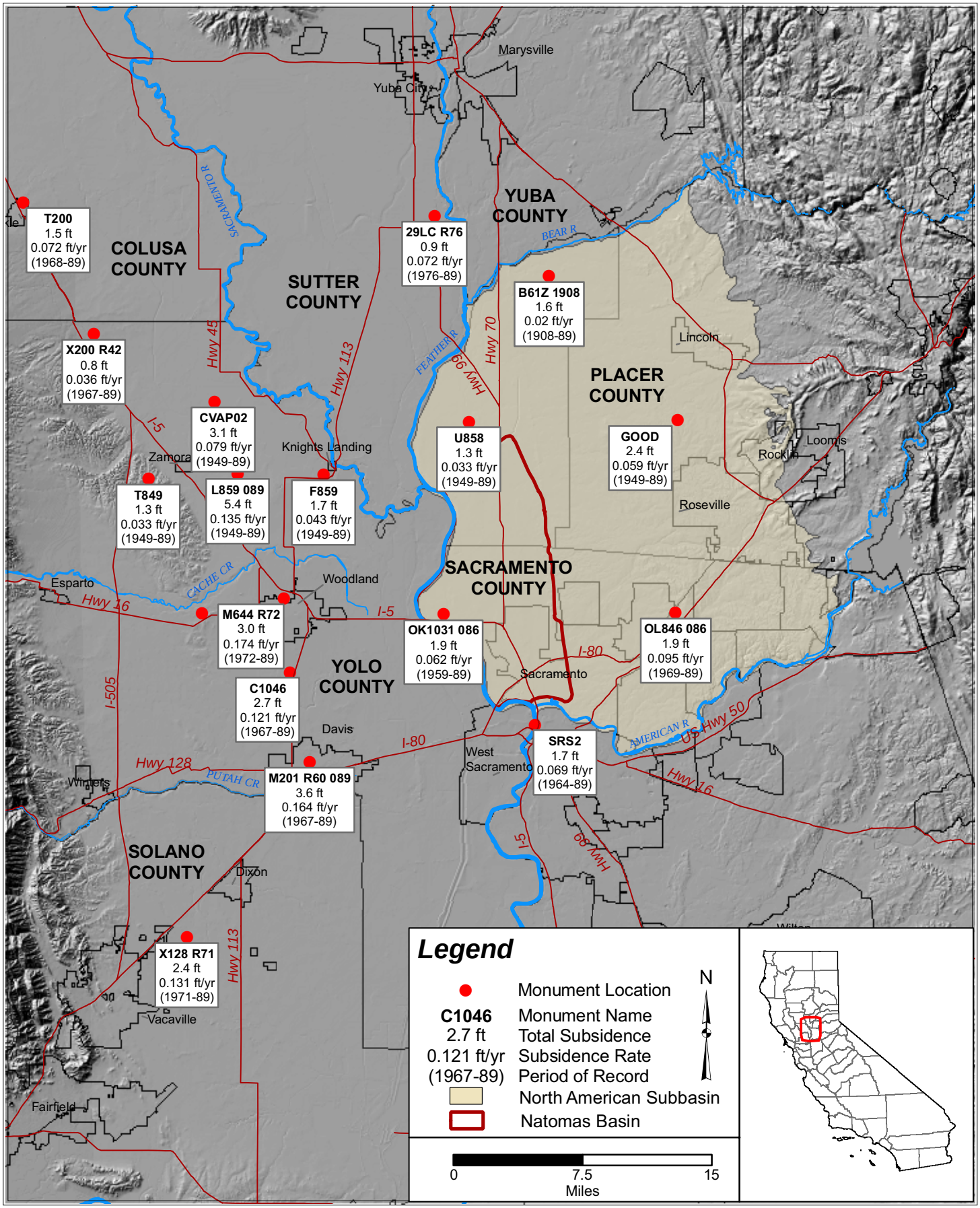
Figure 4-11
Spring 2003 Groundwater Elevation Contours for Upper Zone Wells in Natomas Basin



FILE: \public\Sutter Pointe 07-1-012\GIS\Figure 4-11 Total estimated Subsidence Rates.mxd

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Figure 4-12
Total Estimated Subsidence and Subsidence Rates in Southern Sacramento Valley as of 1989

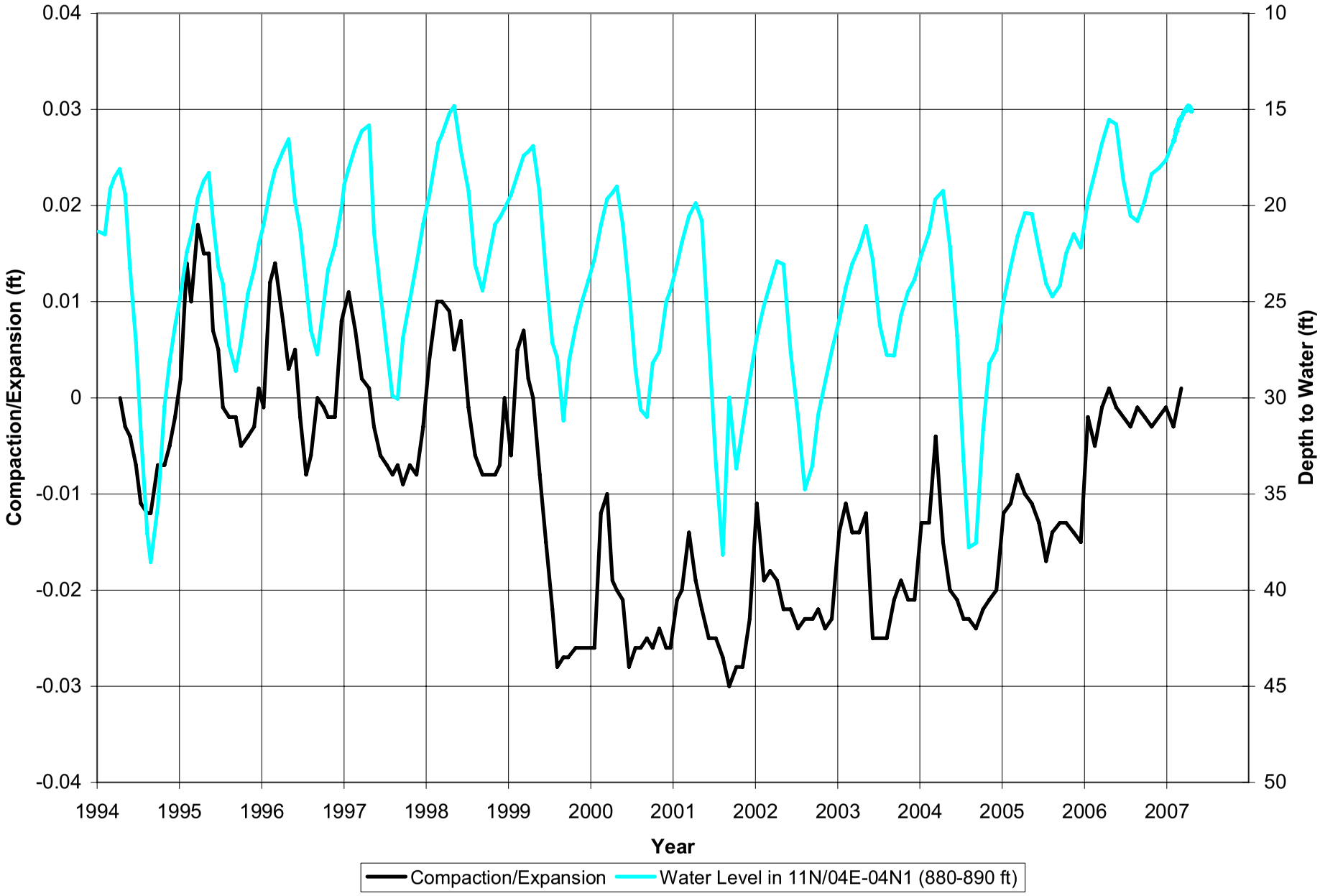

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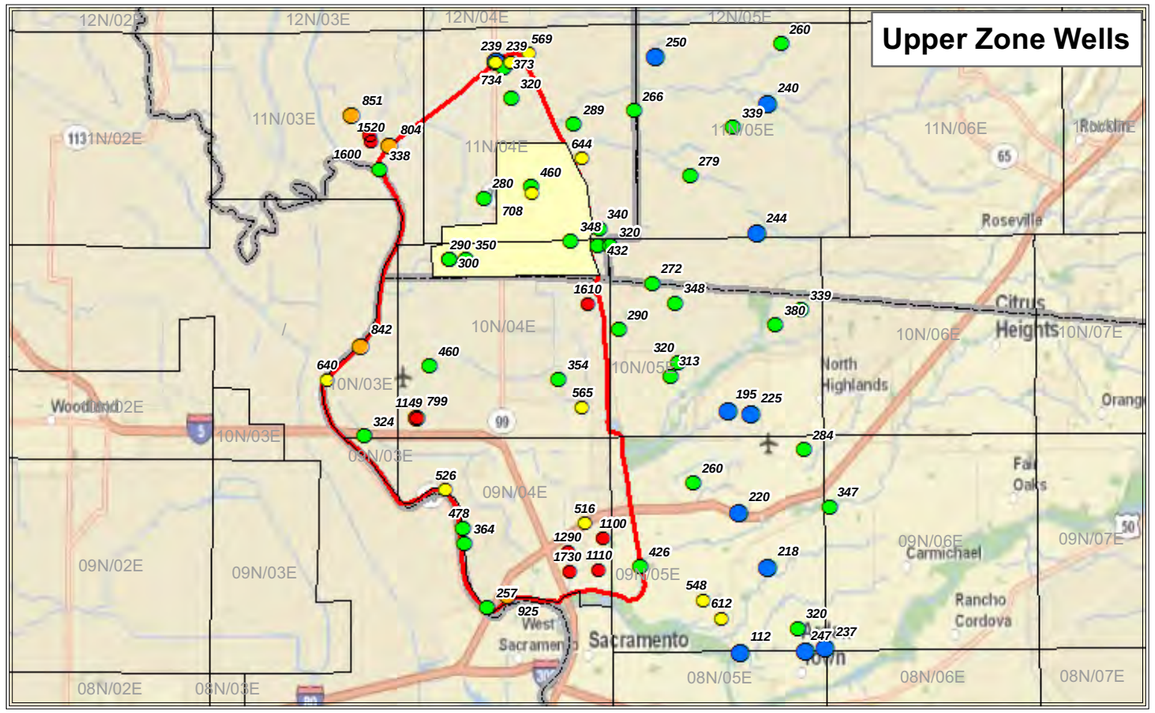
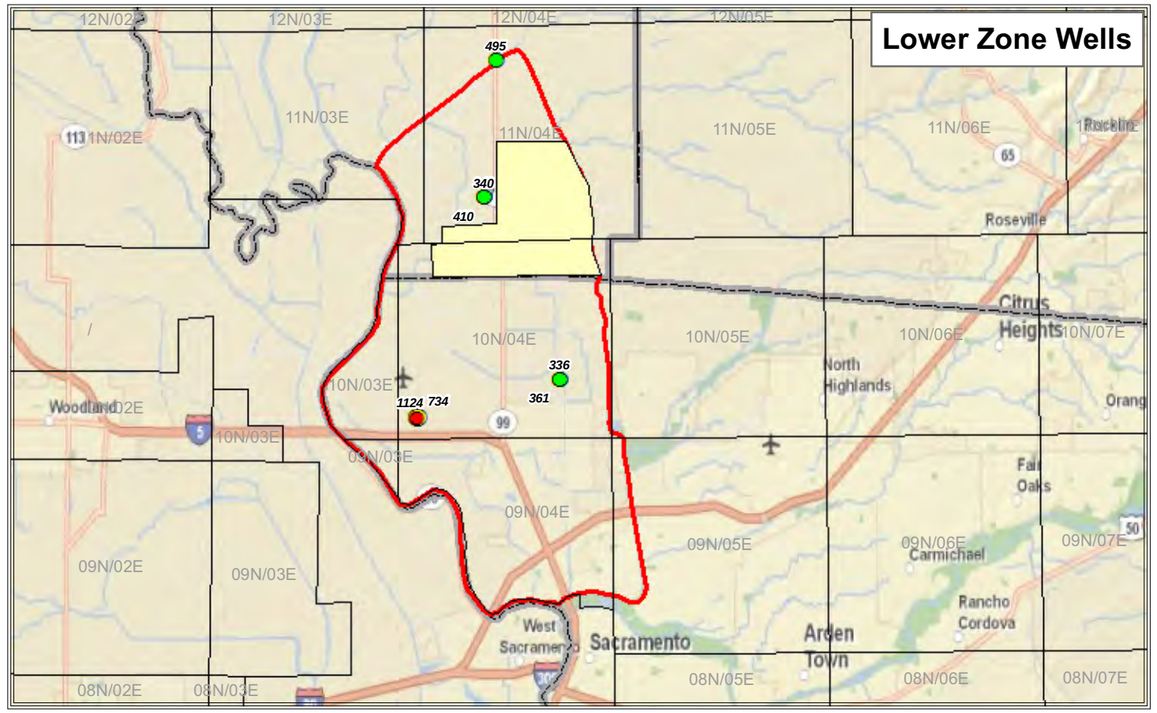
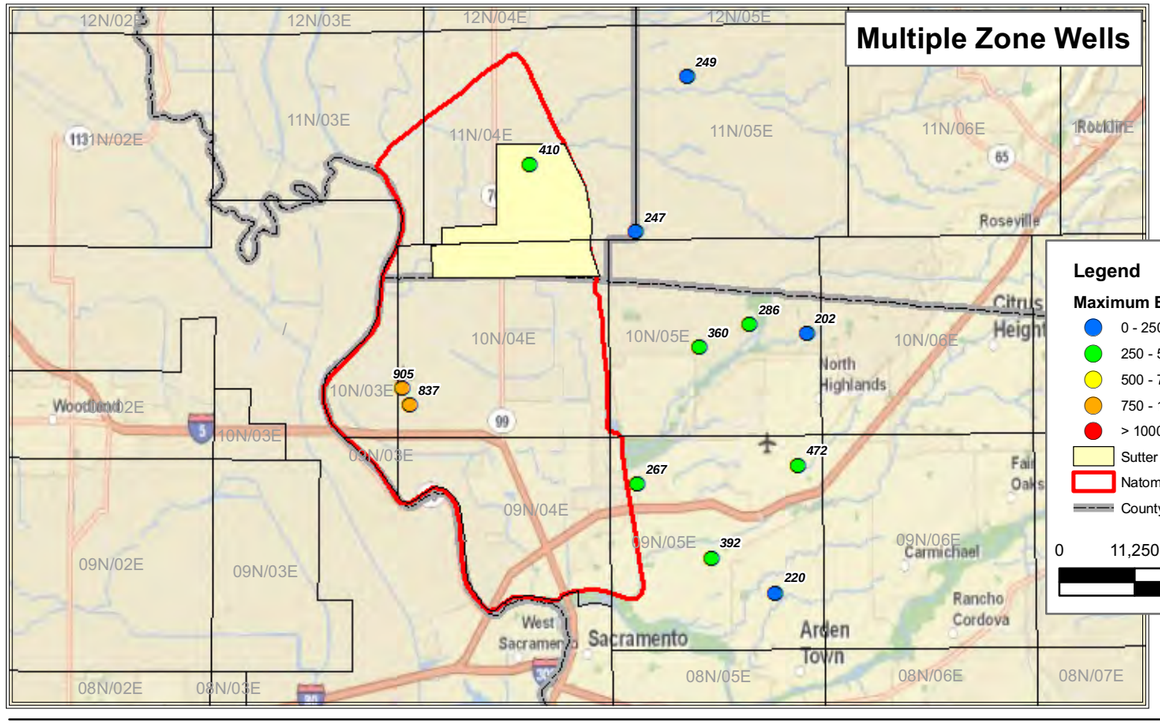
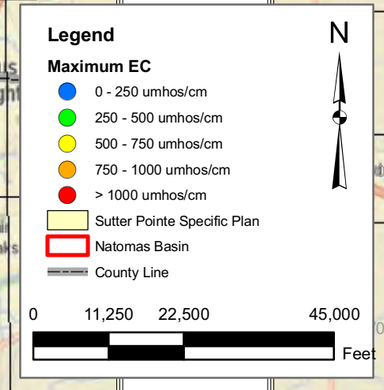
Figure 4-13
Compaction and Water Level Data for the Sutter Extensometer









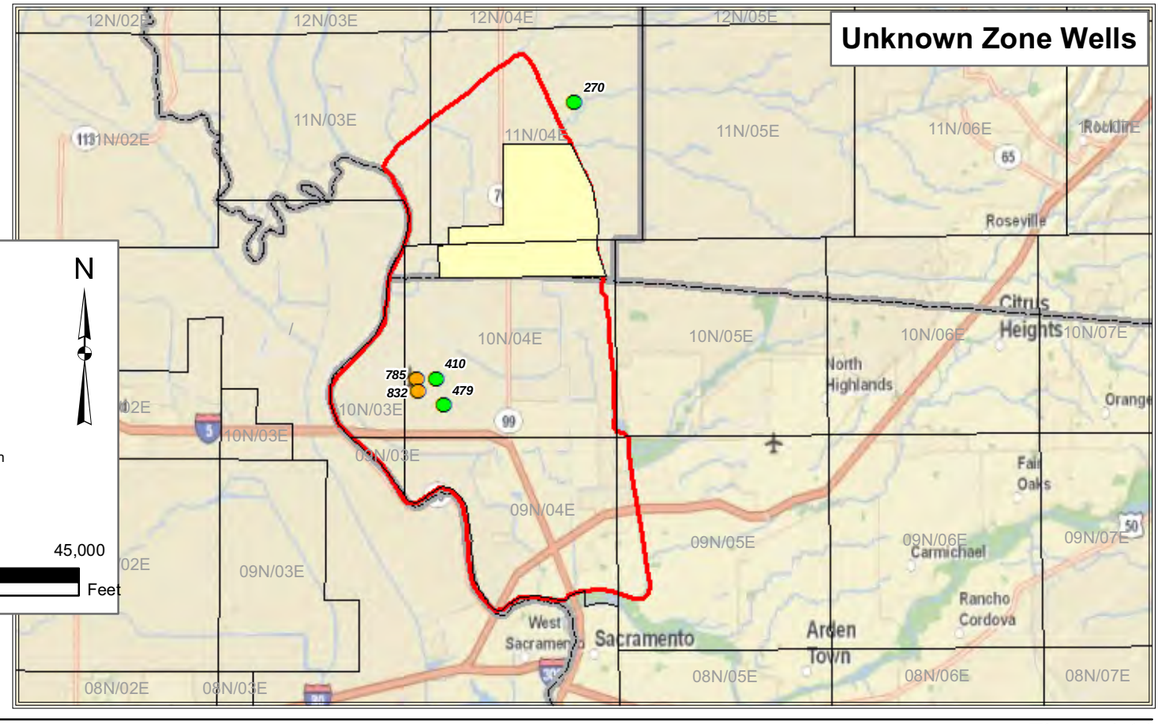


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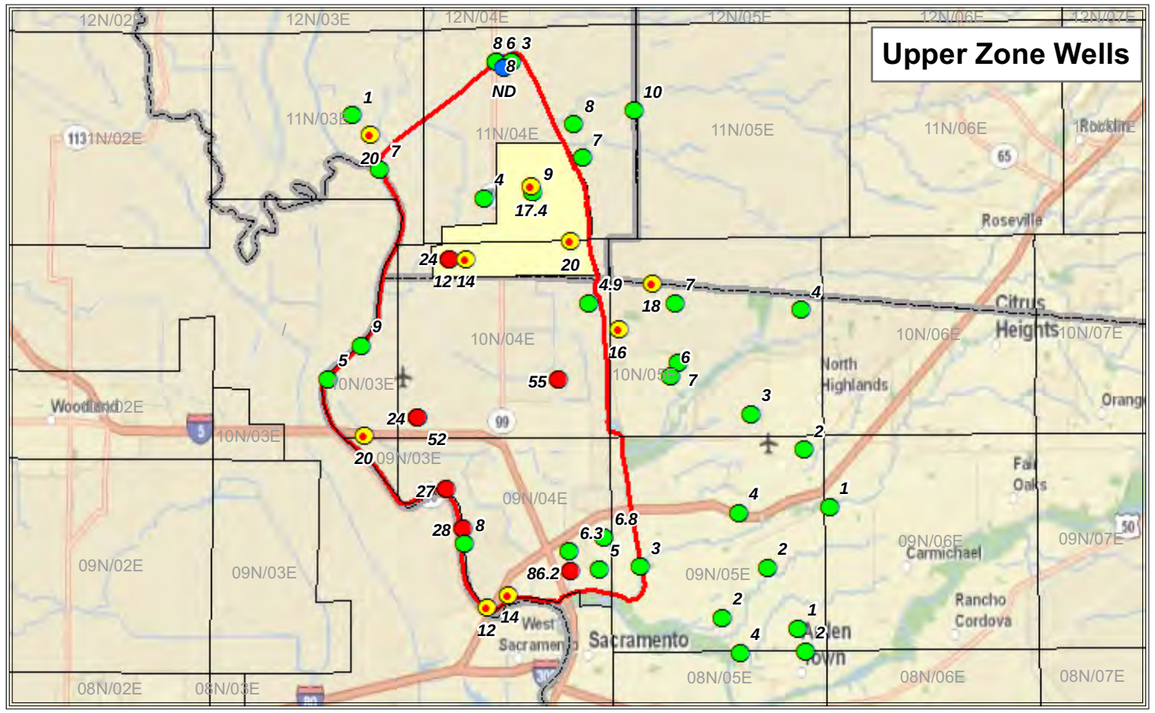
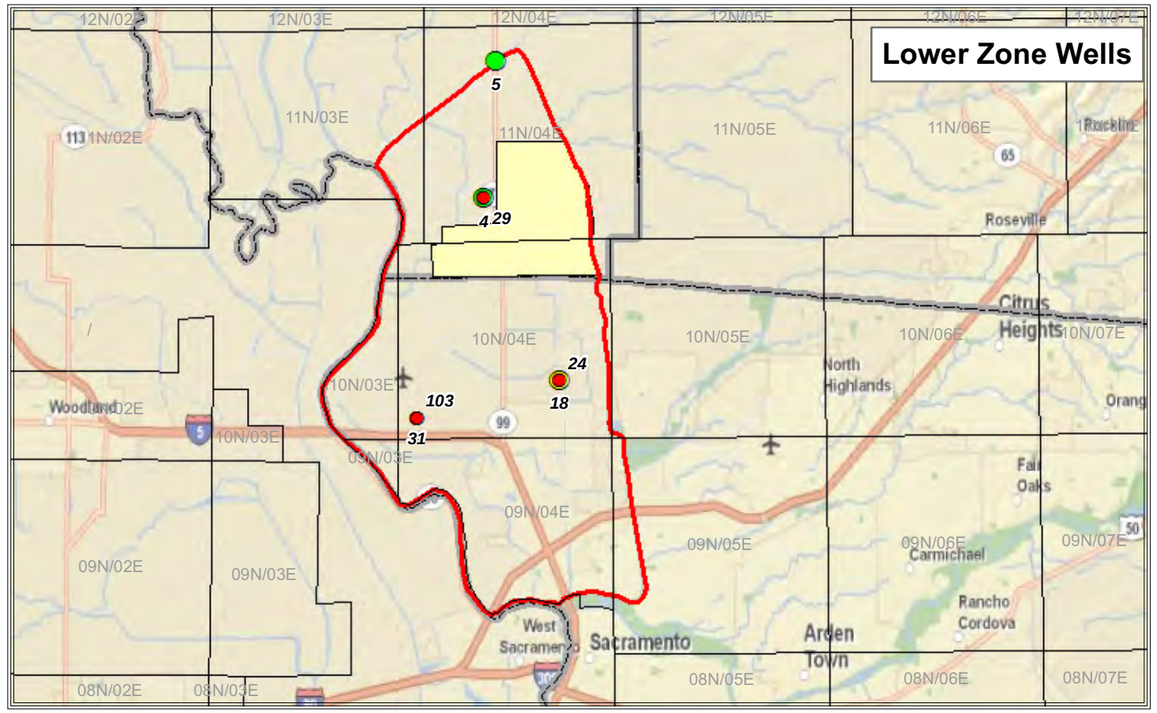
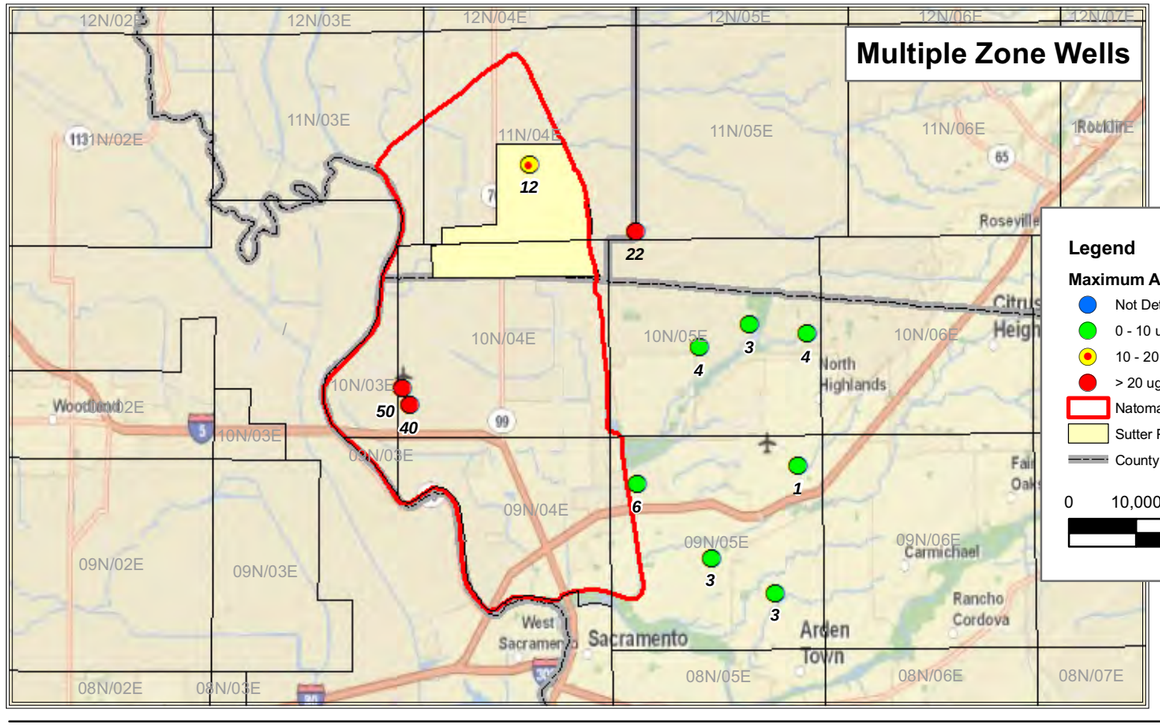
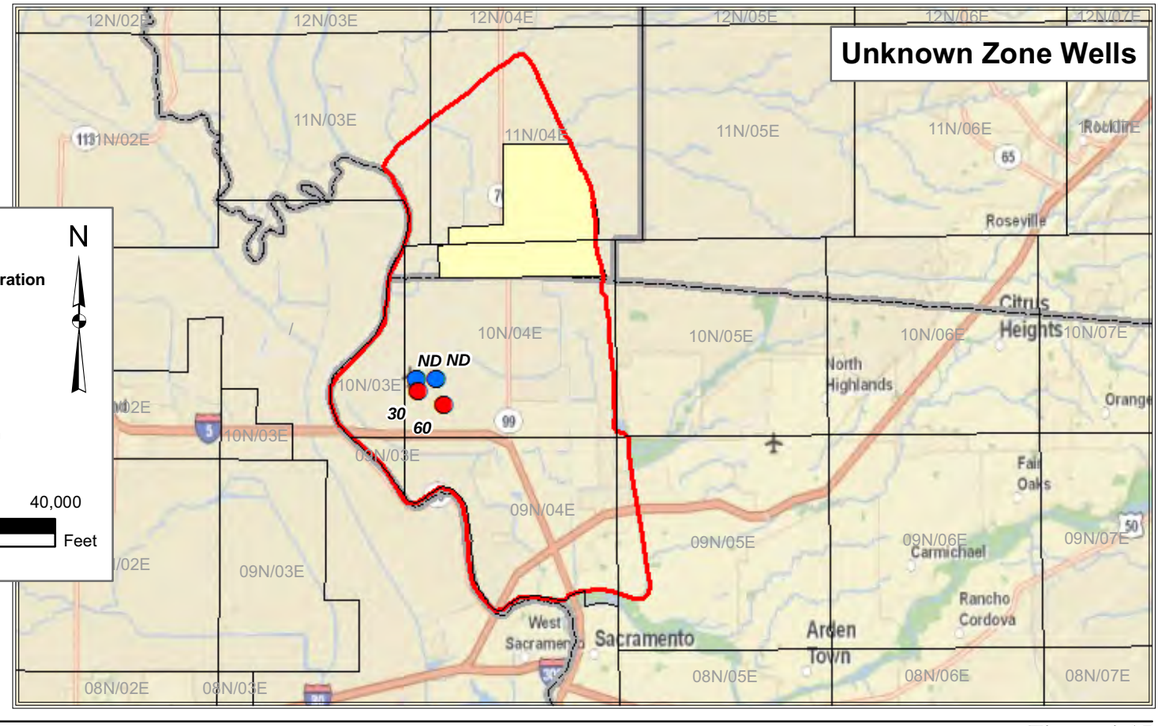
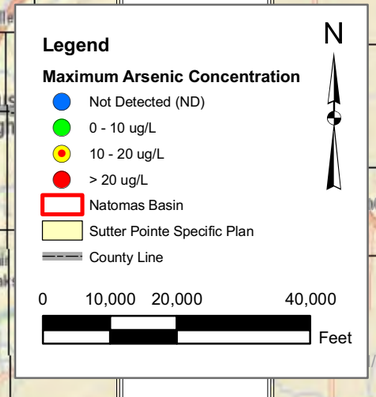
Figure 4-14
Maximum Electrical Conductivity (EC)
for Wells in and near the Natomas Basin
1967 to 2007











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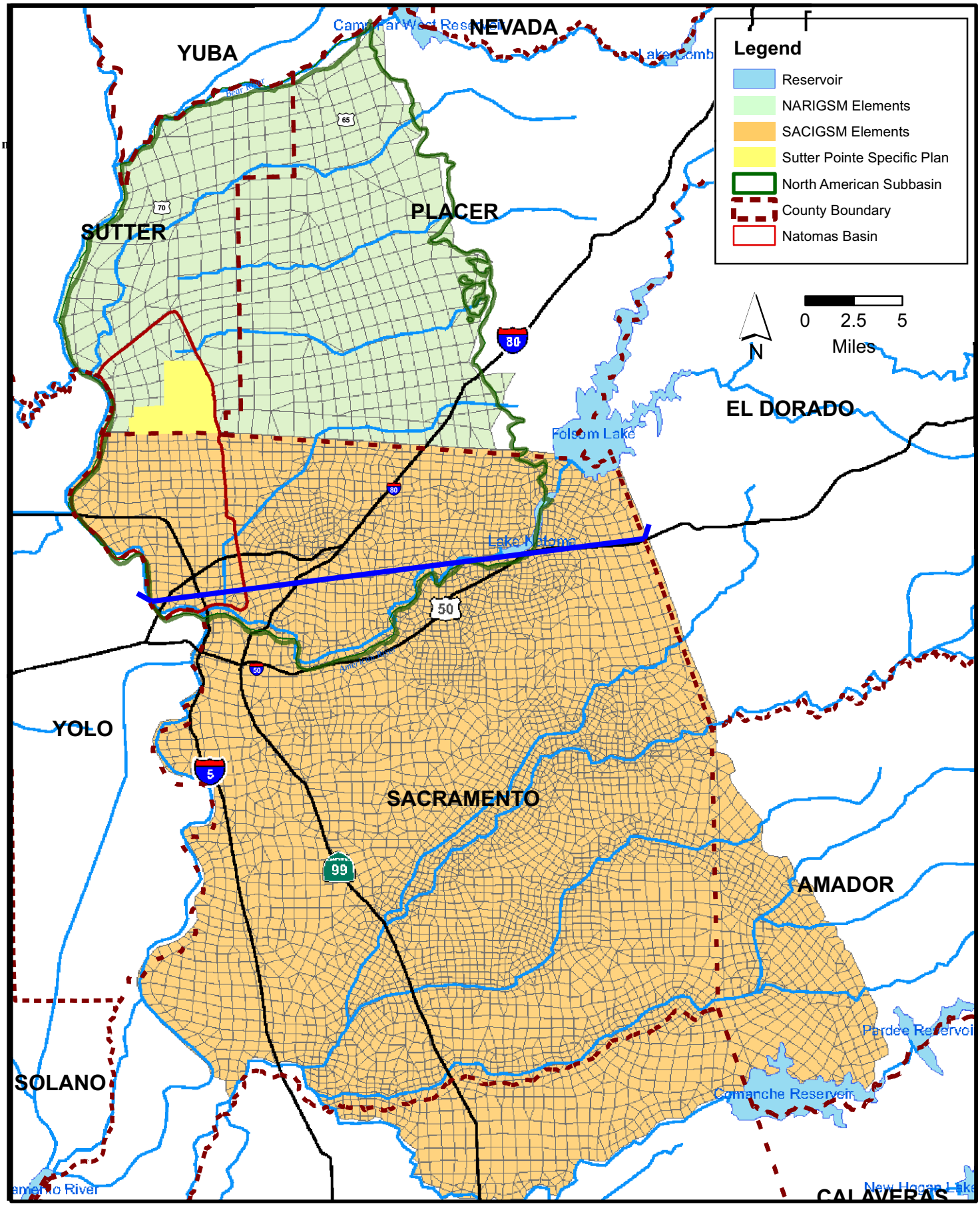
CONSULTING ENGINEERS

Figure 4-15
Maximum Arsenic Concentration for Wells in and near the Natomas Basin 1967 to 2007



FILE: n_office\Public\Sutter Pointe 07-1-012\GIS\Figure 2.mxd

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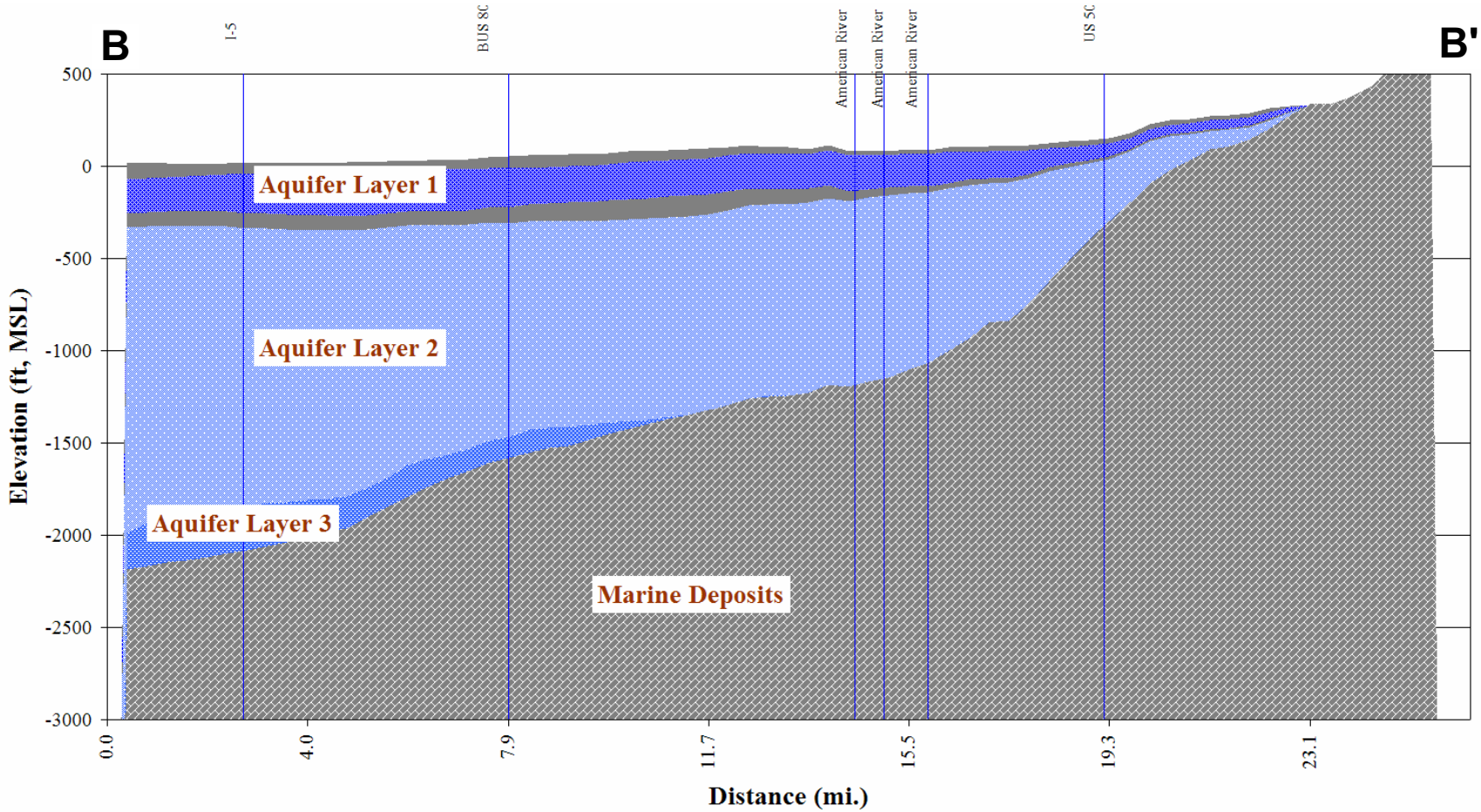
Figure 5-1
Model Grids for SACIGSM and NARIGSM



From WRIME, September 2007

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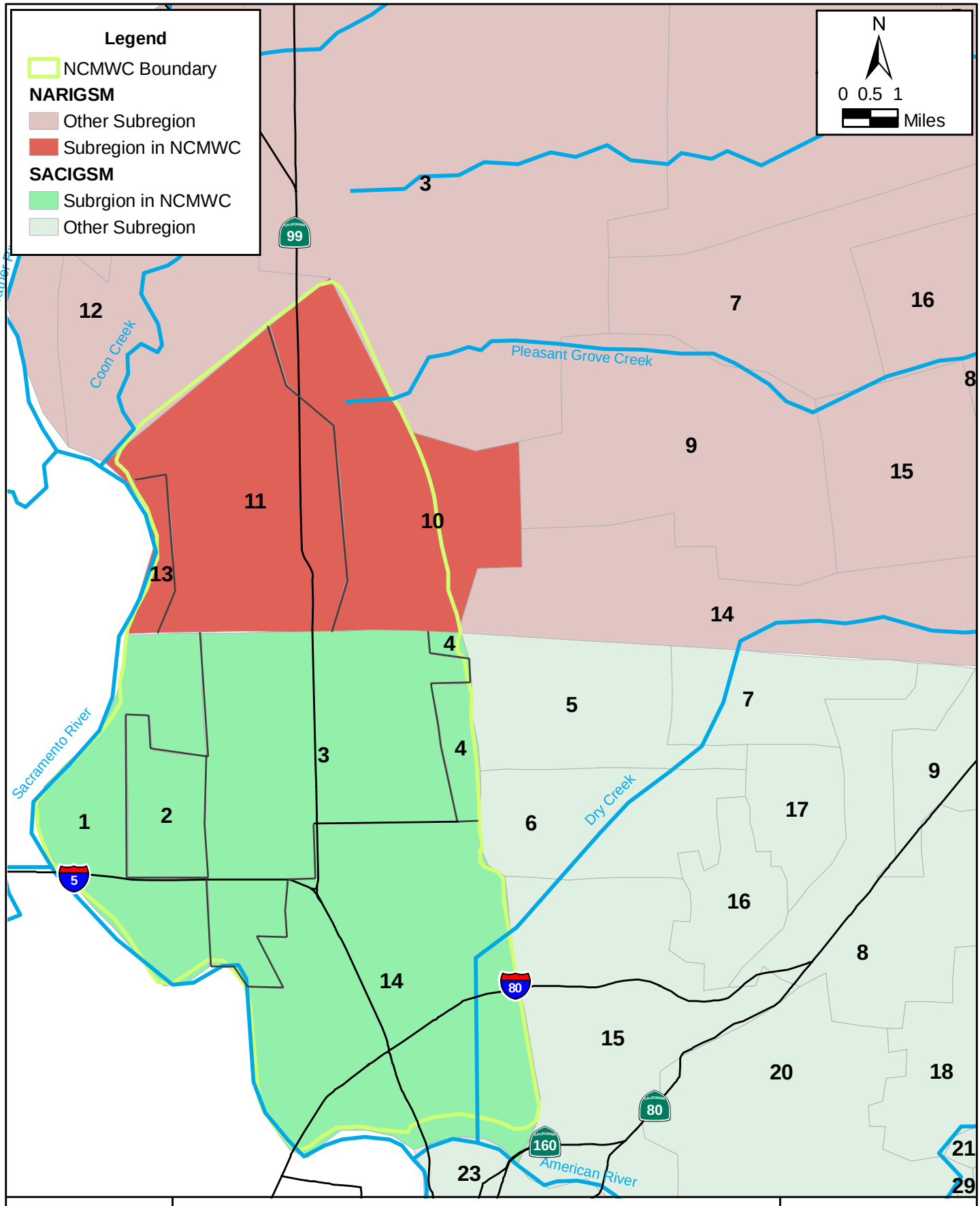
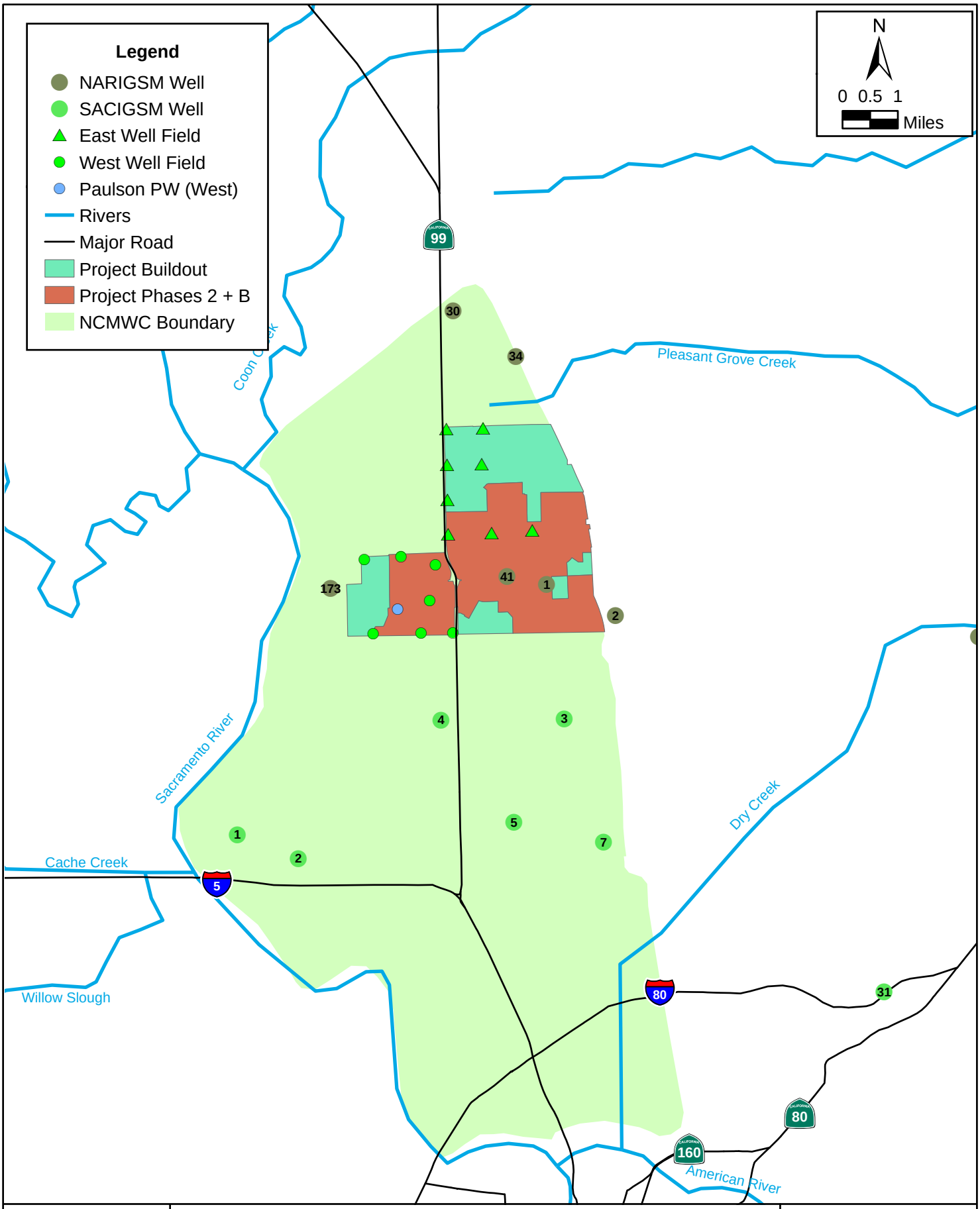
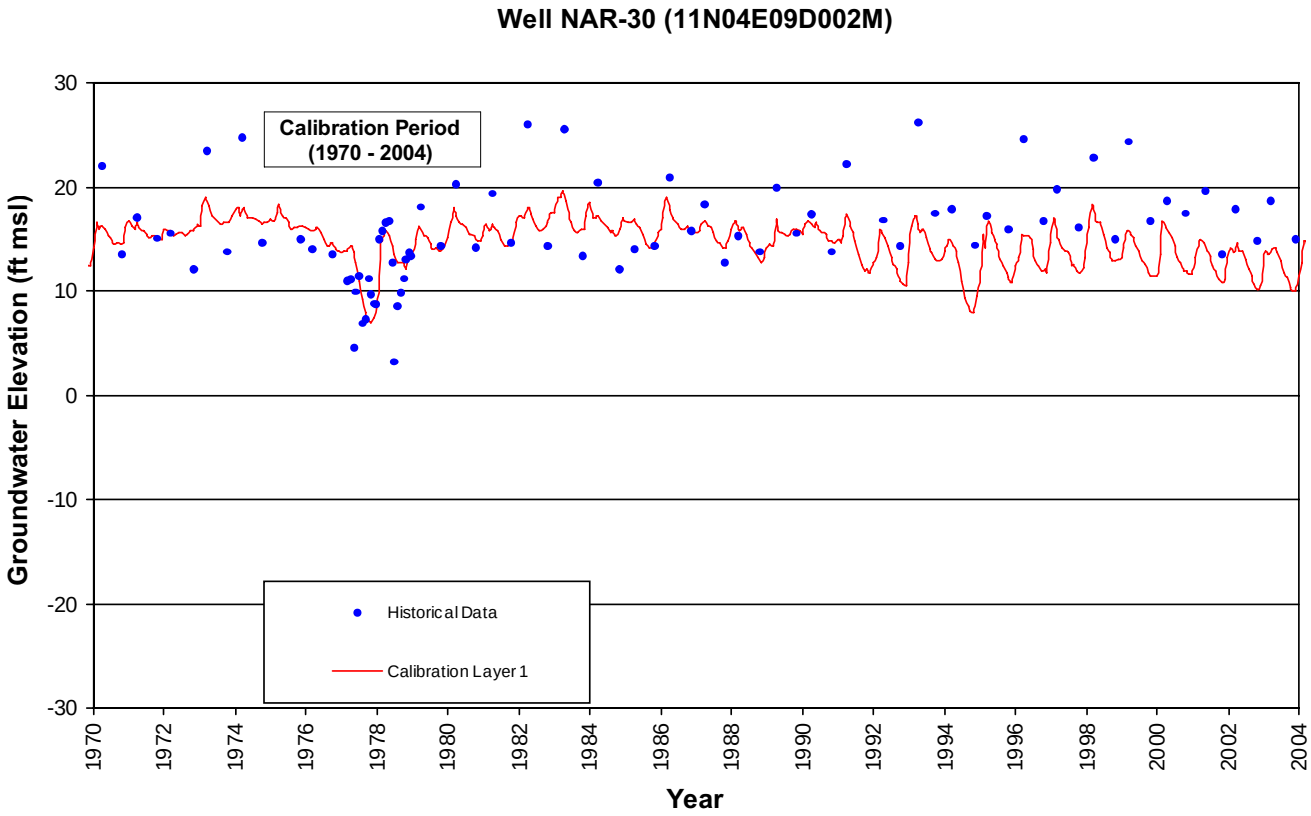
Figure 5-2
Model Cross - Section



ωRIME	NARIGSM and SACIGSM Subregions	March 2008
		Figure 5-3



WRIME	Location of Calibration Wells	June 2008
		Figure 5-4



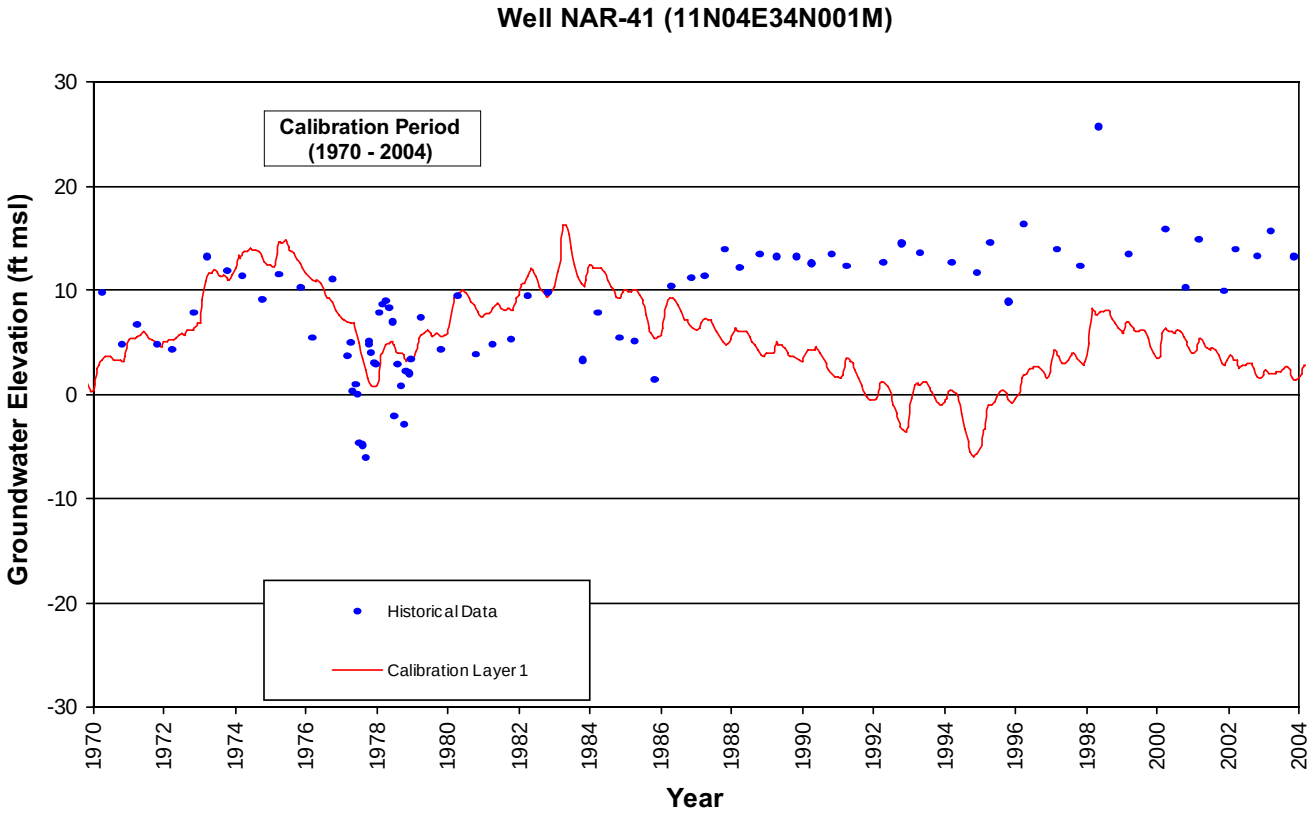
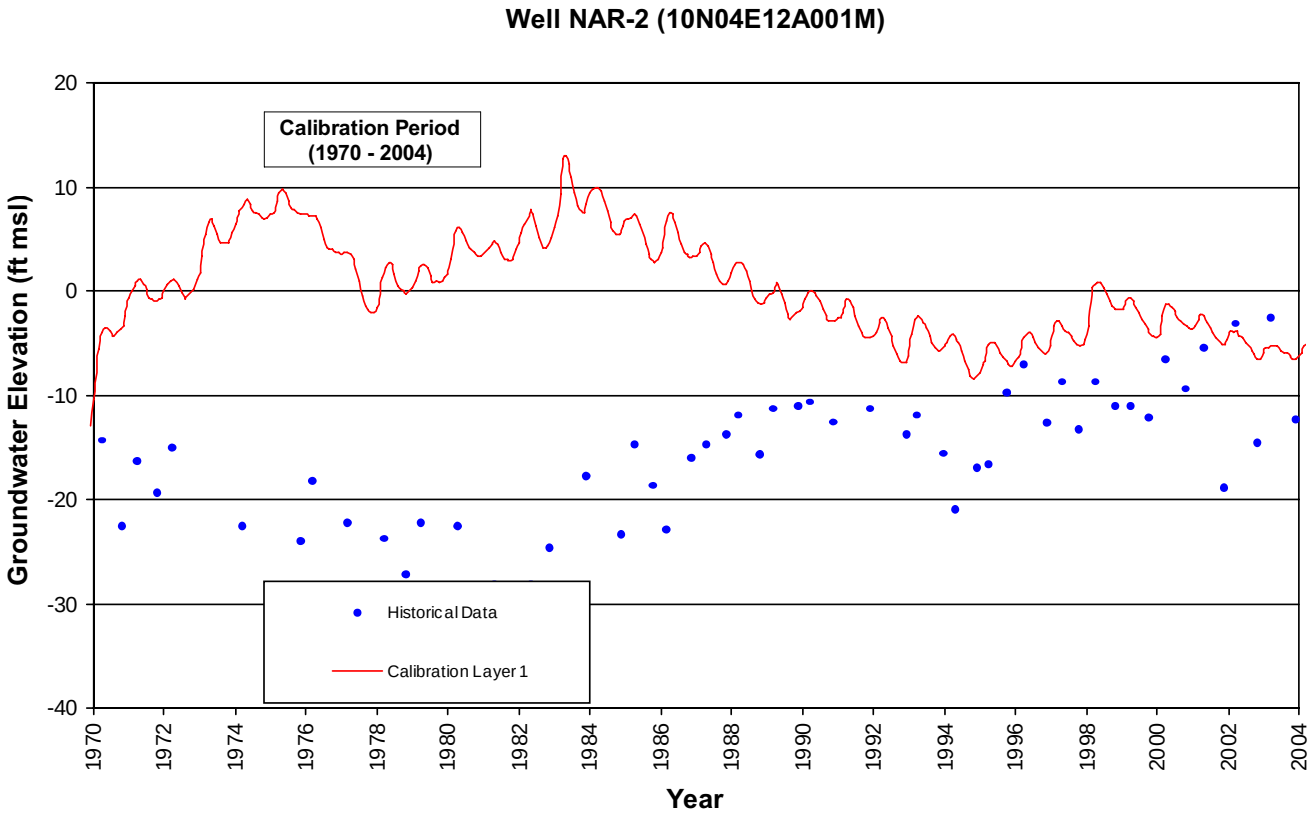
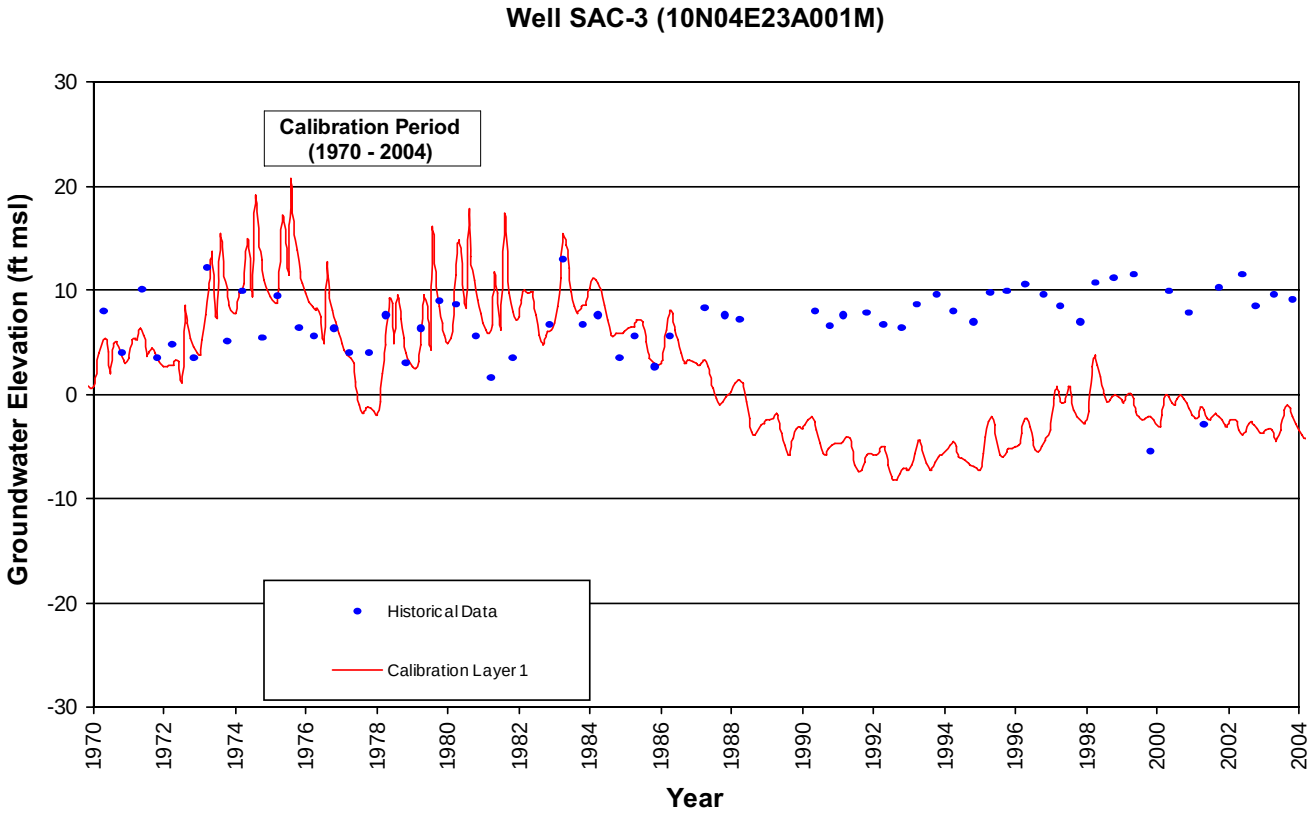


Figure 5-5
Simulated Hydrographs for
Calibration Wells NAR-30 and NAR-41





Y:\Sutter Pointe 07-1-012\Data\Water Level Hydrographs\WL Simulation.mdb -- (Report - Hydrographs 7a)

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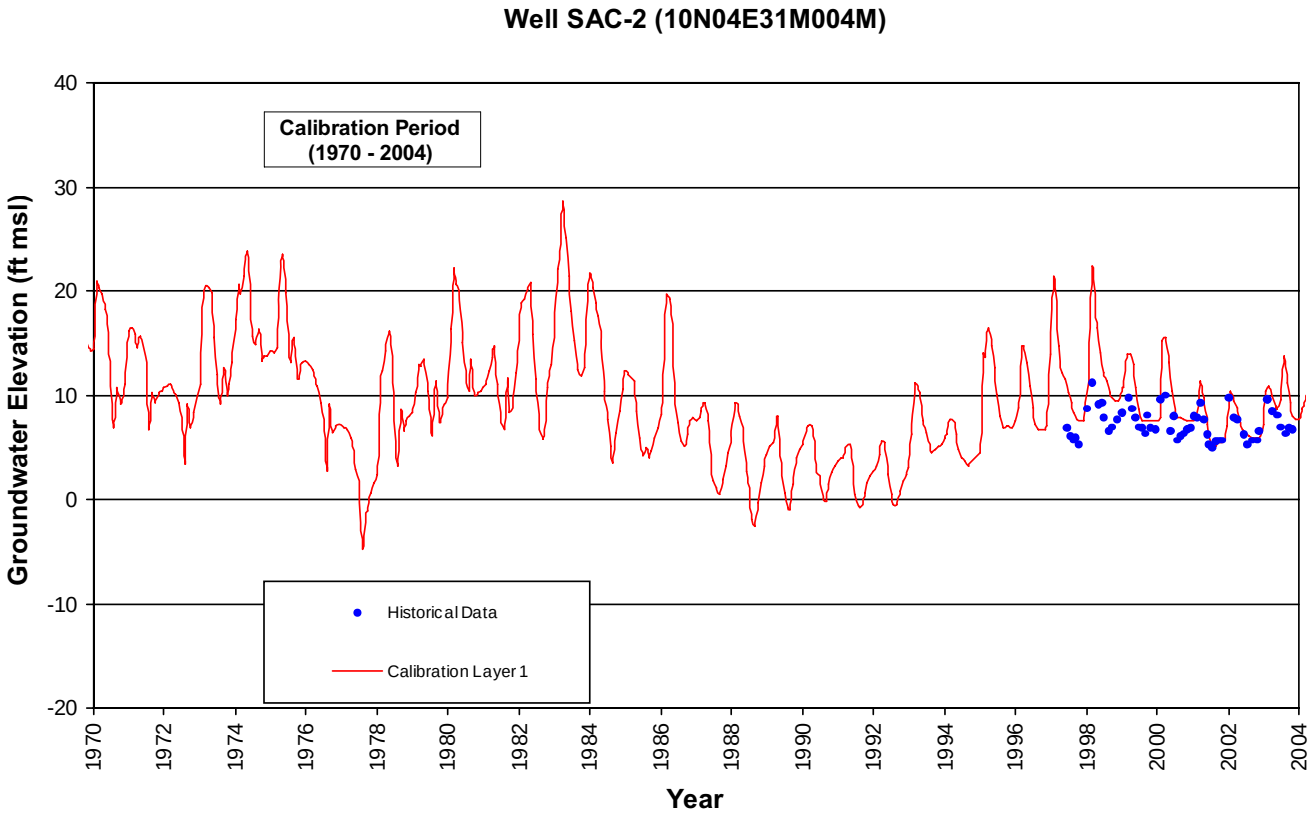
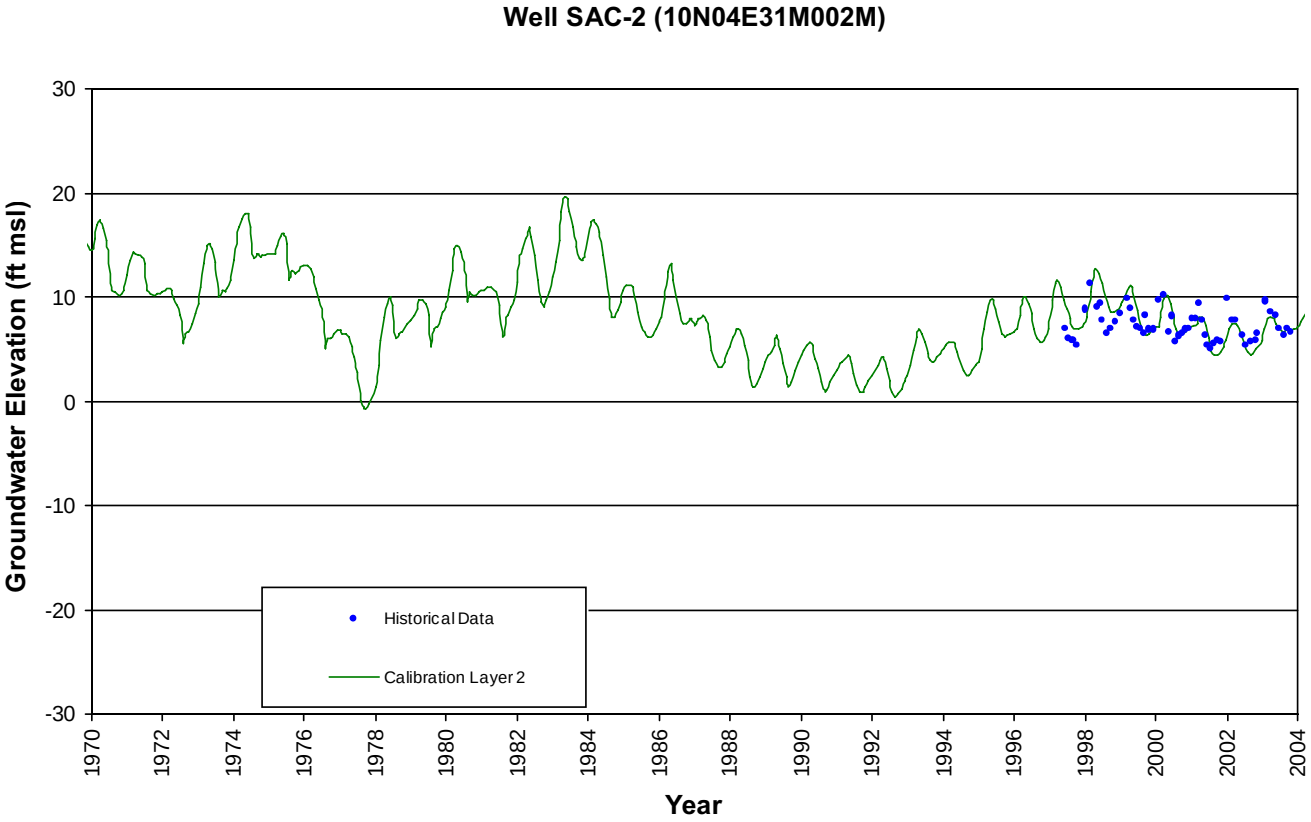
Figure 5-6
Simulated Hydrographs for Calibration Wells NAR-2 and SAC-3





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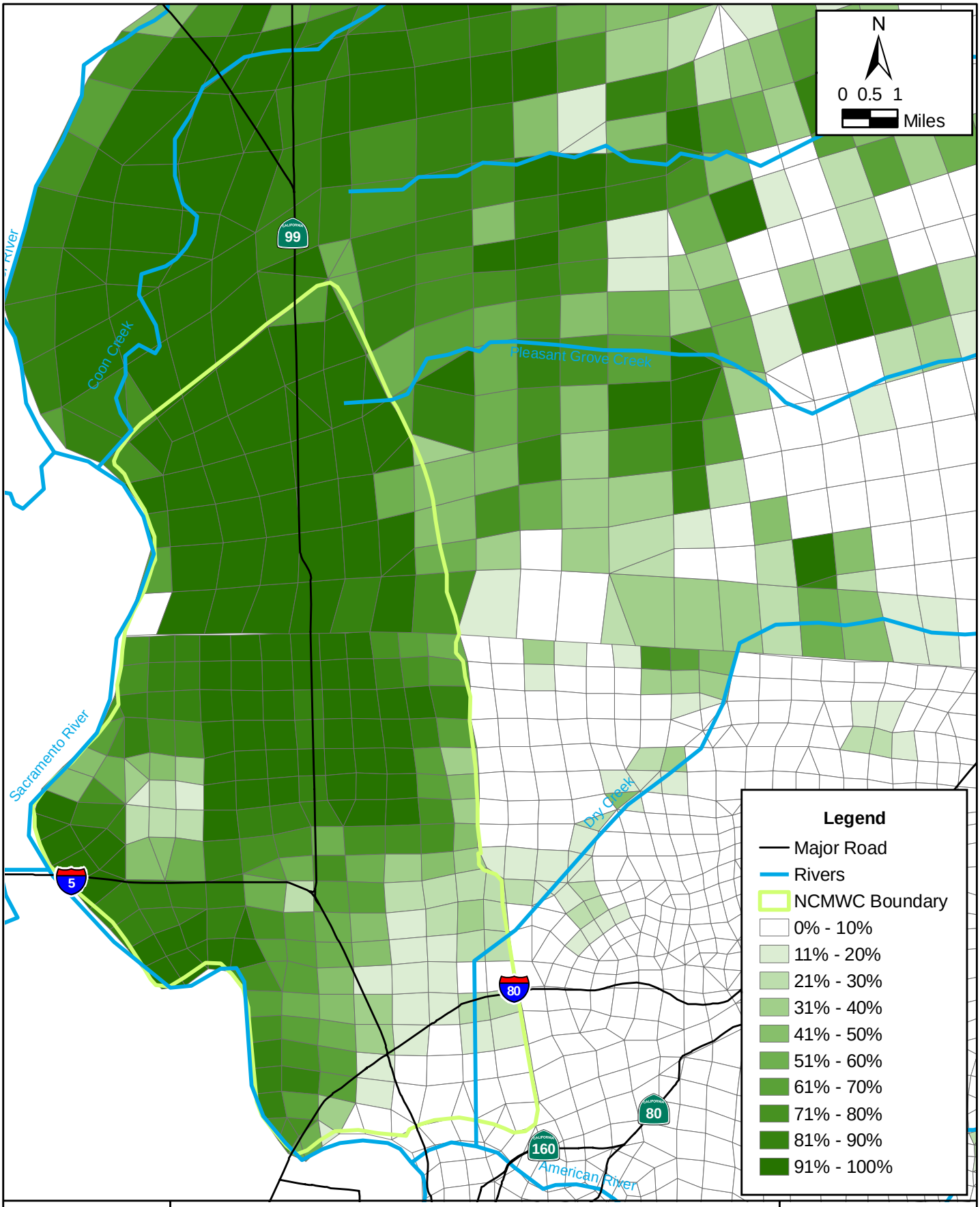
CONSULTING ENGINEERS

Figure 5-7
Simulated Hydrographs for Calibration Wells SAC-2

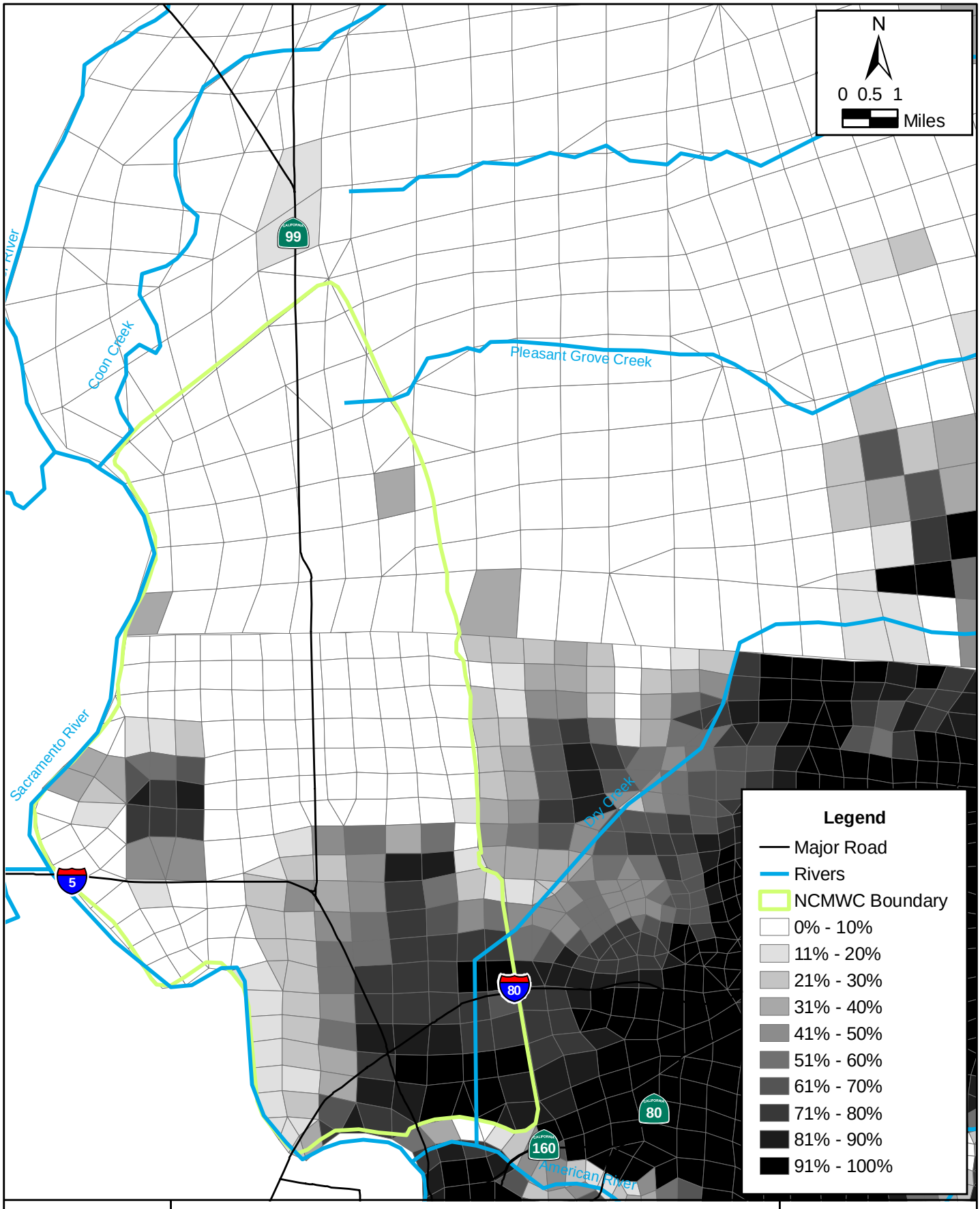


ωRIME

Existing Conditions Baseline Land Use
Percent Agriculture Area by Element

March 2008

Figure 6-1

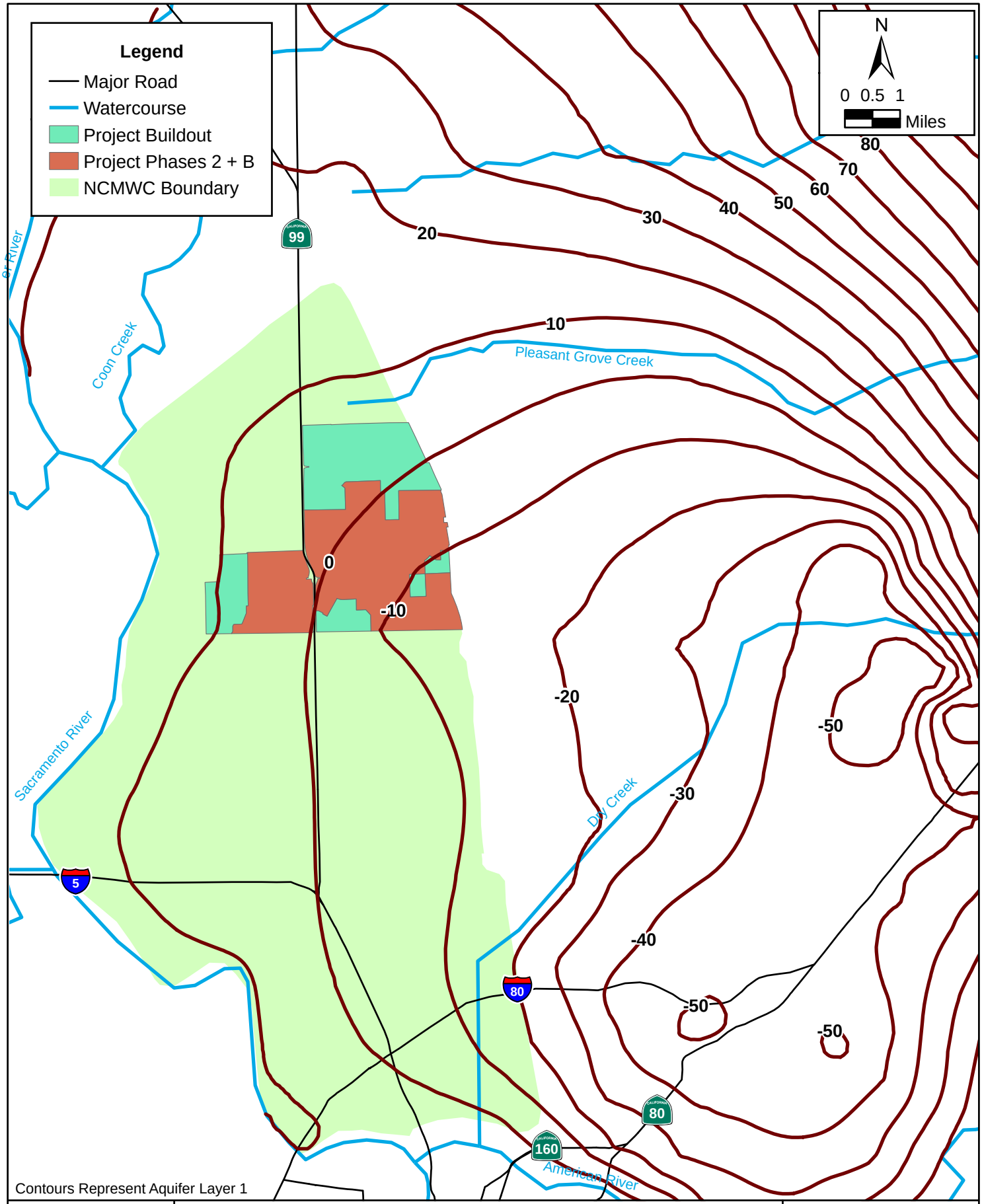


WRIME

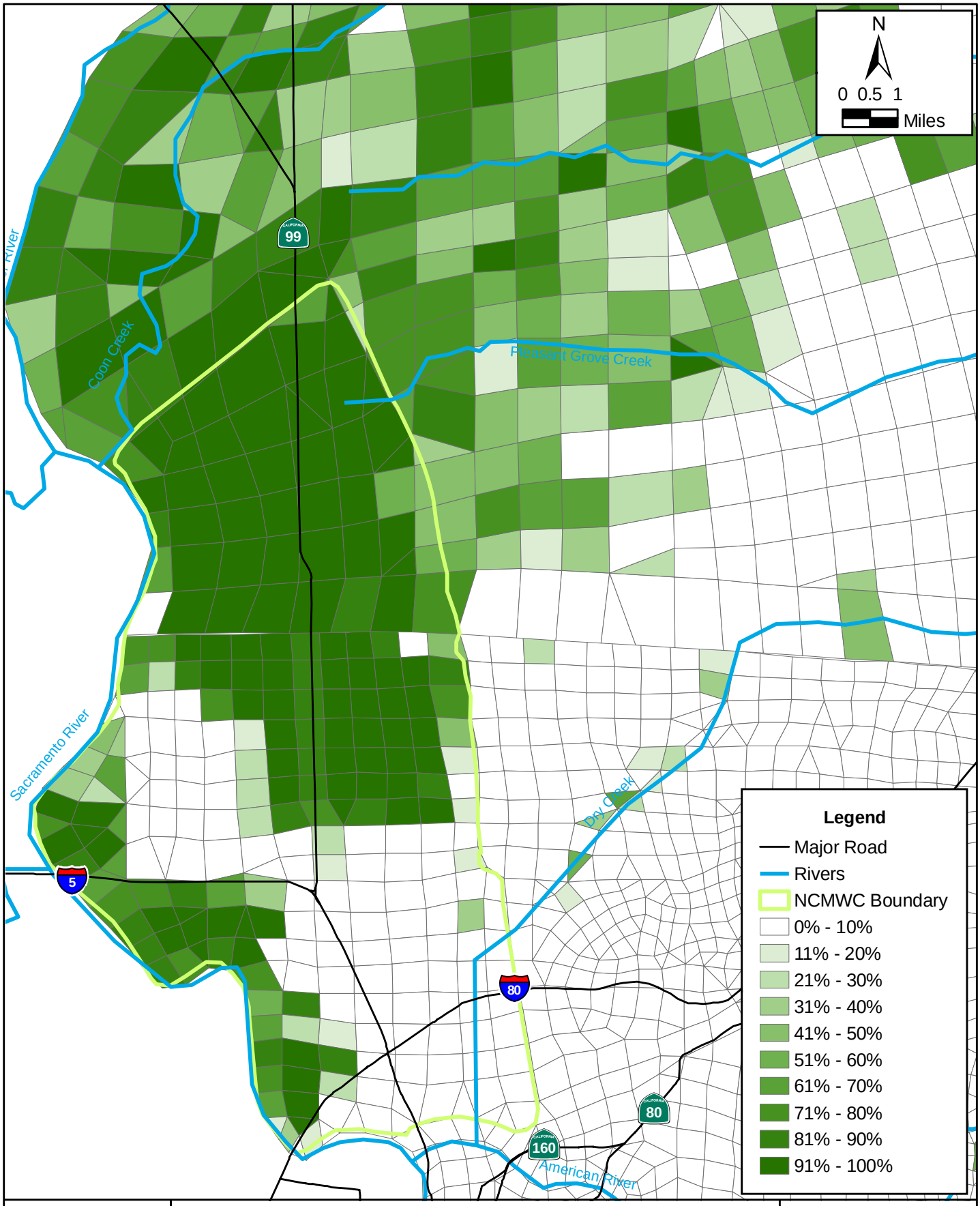
Exisiting Condition Baseline Land Use
Percent Urban Area by Element

March 2008

Figure 6-2



WRIME	Groundwater Level (feet, msl) Exisiting Conditions Baseline Model Simulation Year 35, March	June 2008 Figure 6-3

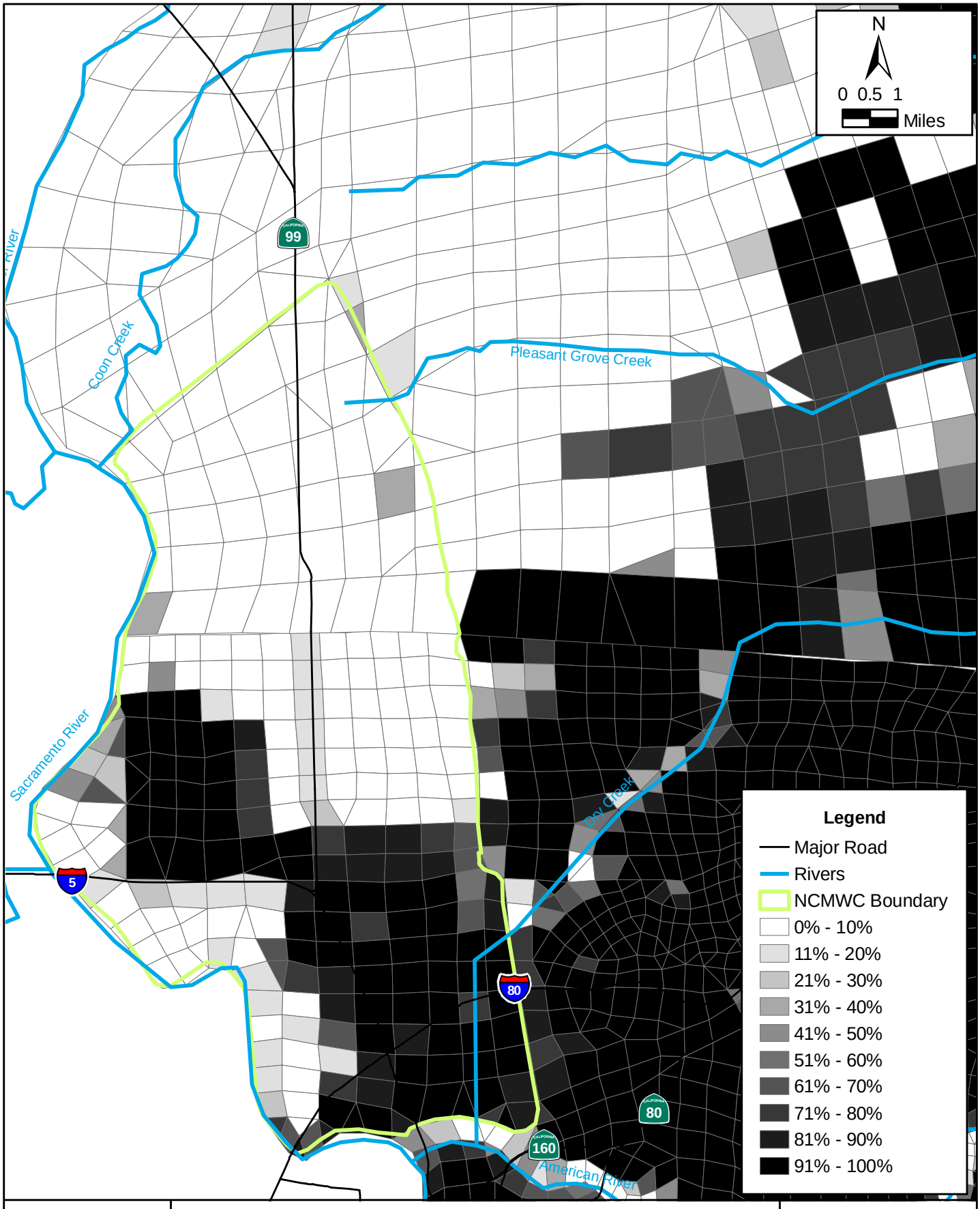


WRIME

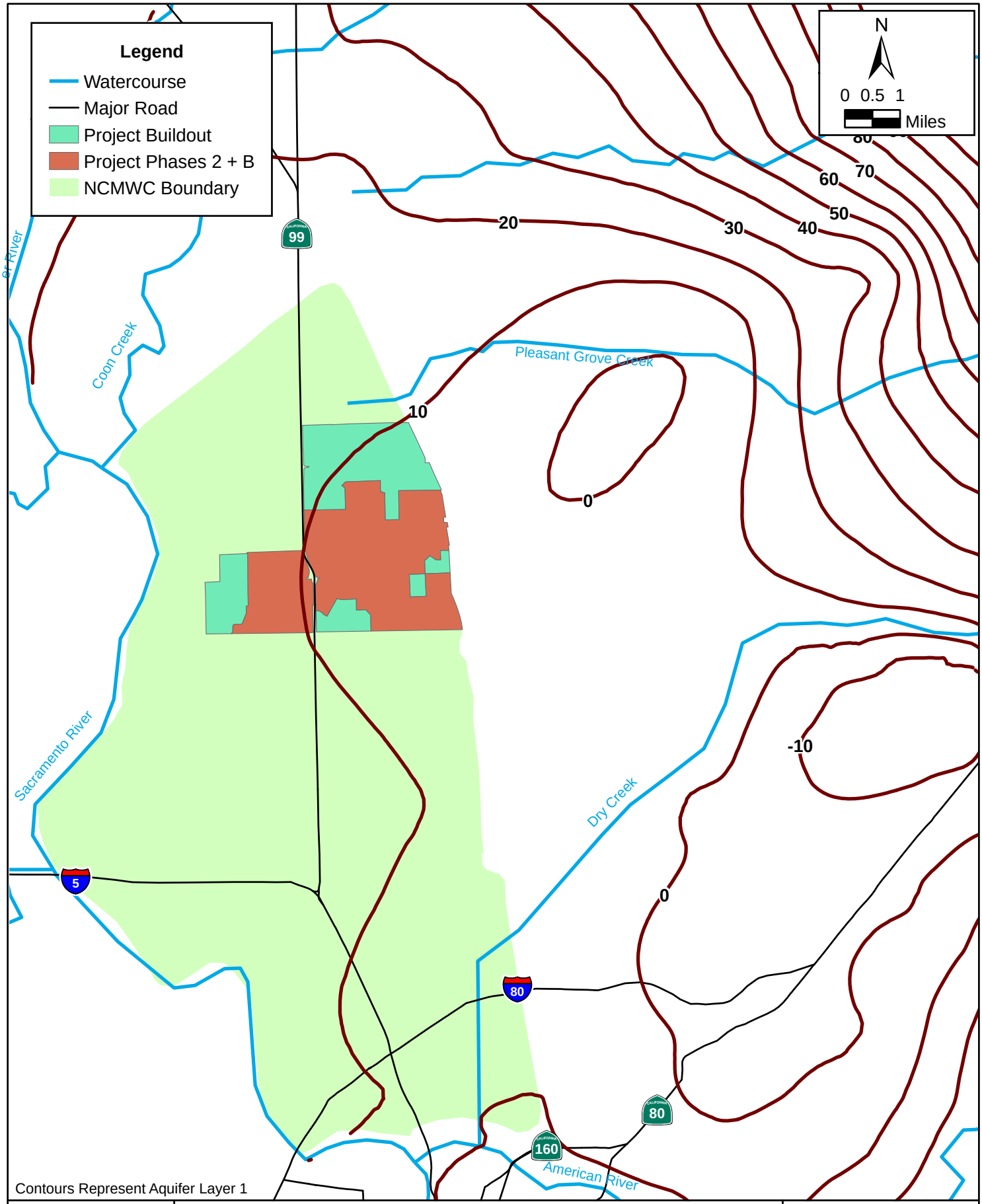
2030 Baseline Land Use
Percent Agriculture Area by Element

March 2008

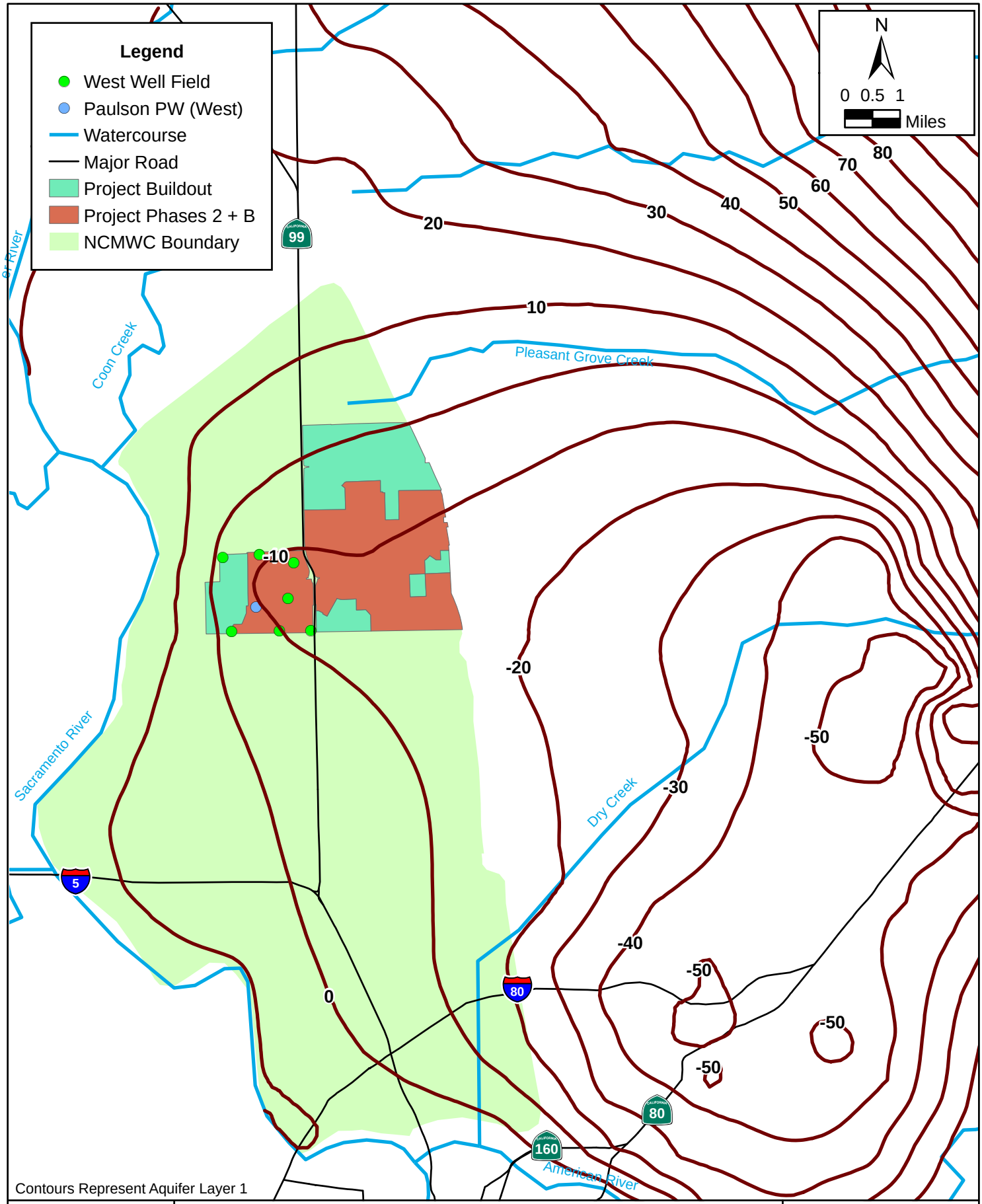
Figure 6-4



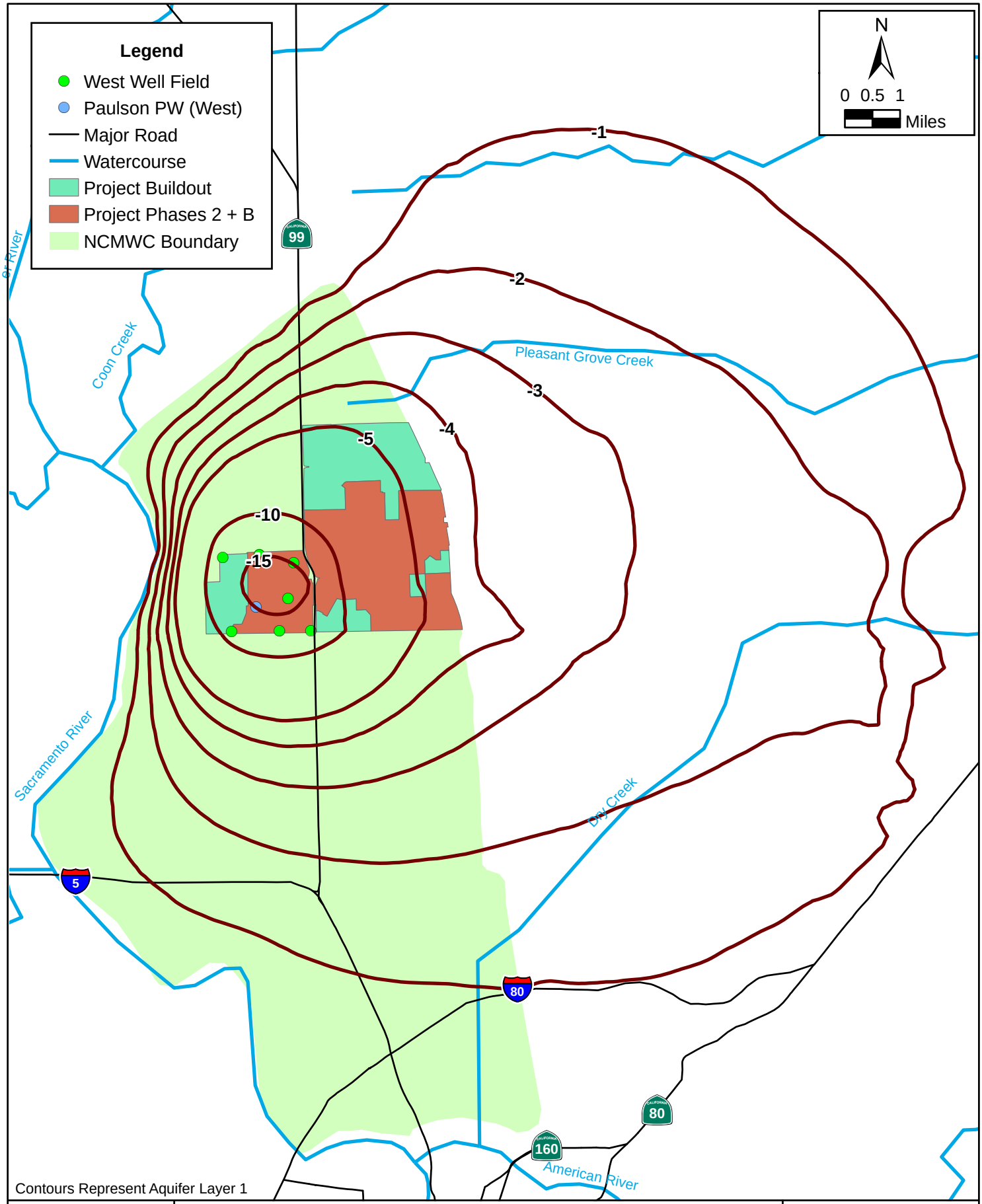
WRIME	2030 Baseline Land Use Percent Urban Area by Element	March 2008 Figure 6-5



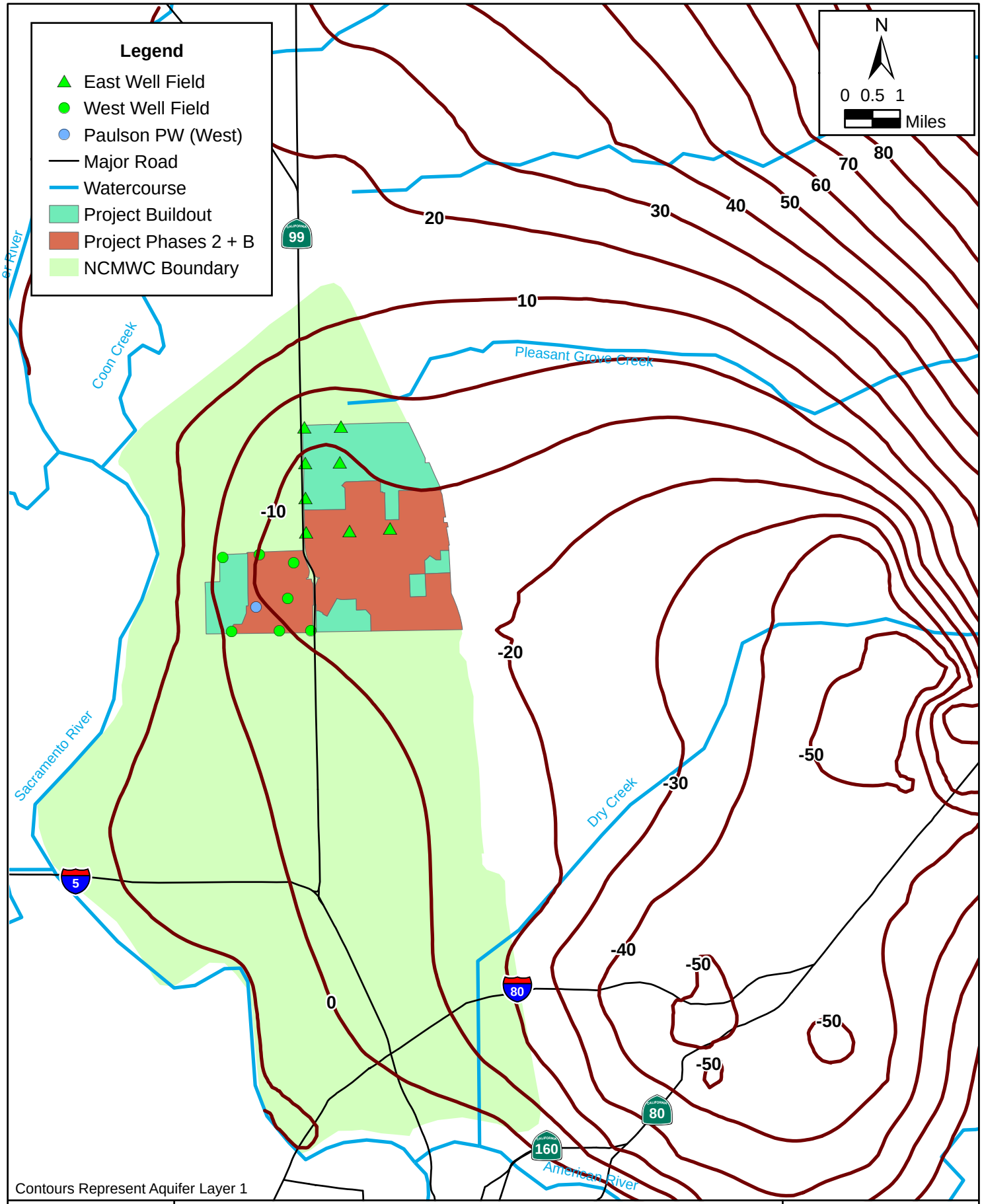
WRIME	Groundwater Level (feet, msl) Baseline 2030 Model Simulation Year 35, March	June 2008 Figure 6-6



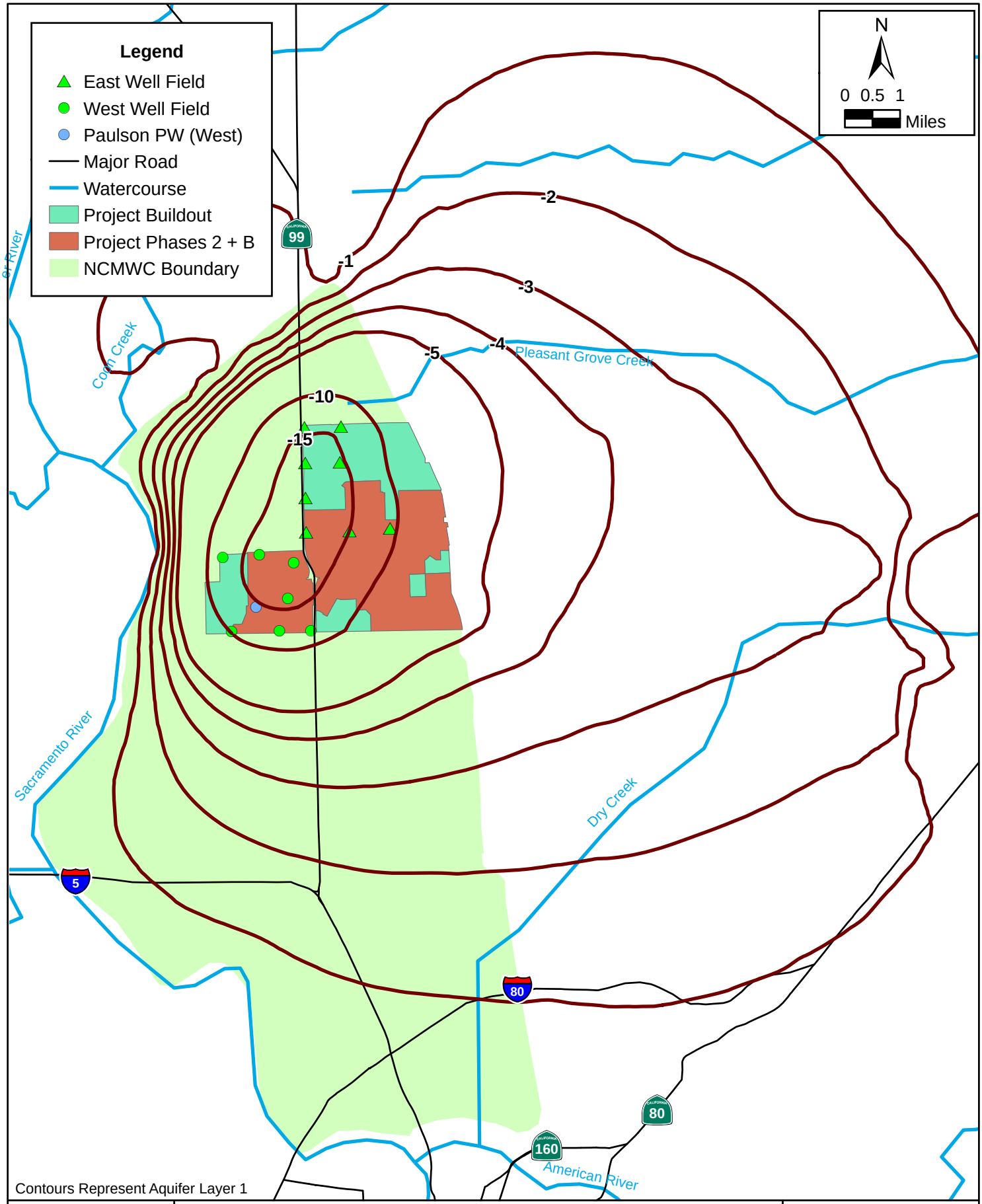
WRIME	Groundwater Level (feet, msl) Scenario 1 Model Simulation Year 35, March	June 2008 Figure 6-7



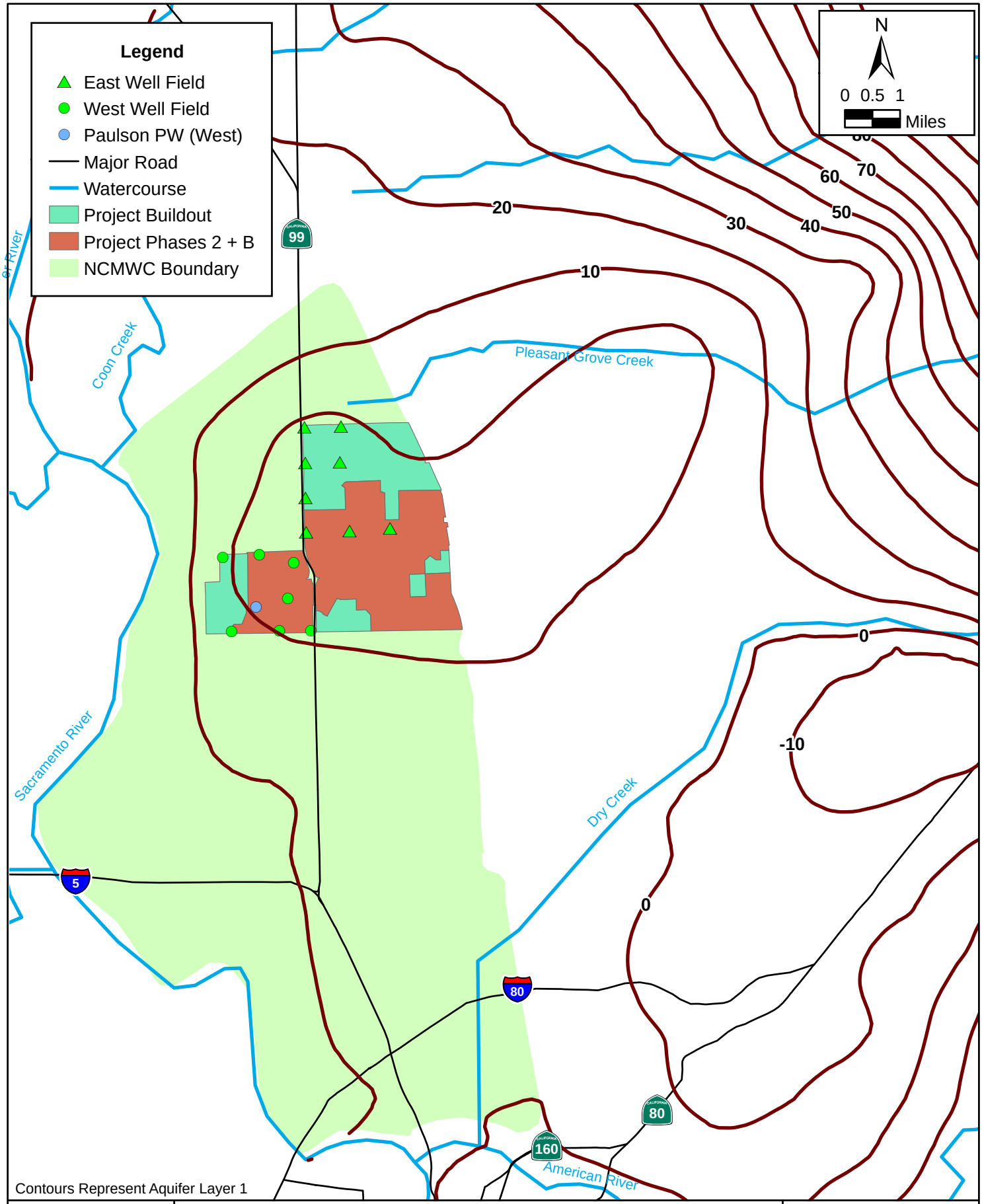
WRIME	Groundwater Level Difference (feet) Scenario 1 minus Existing Conditions Baseline Model Simulation Year 35, March	June 2008 Figure 6-8



WRIME	Groundwater Level (feet, msl) Scenario 2a Model Simulation Year 35, March	June 2008 Figure 6-9



WRIME	Groundwater Level Difference (feet) Scenario 2a minus Existing Conditions Baseline Model Simulation Year 35, March	June 2008 Figure 6-10



WRIME

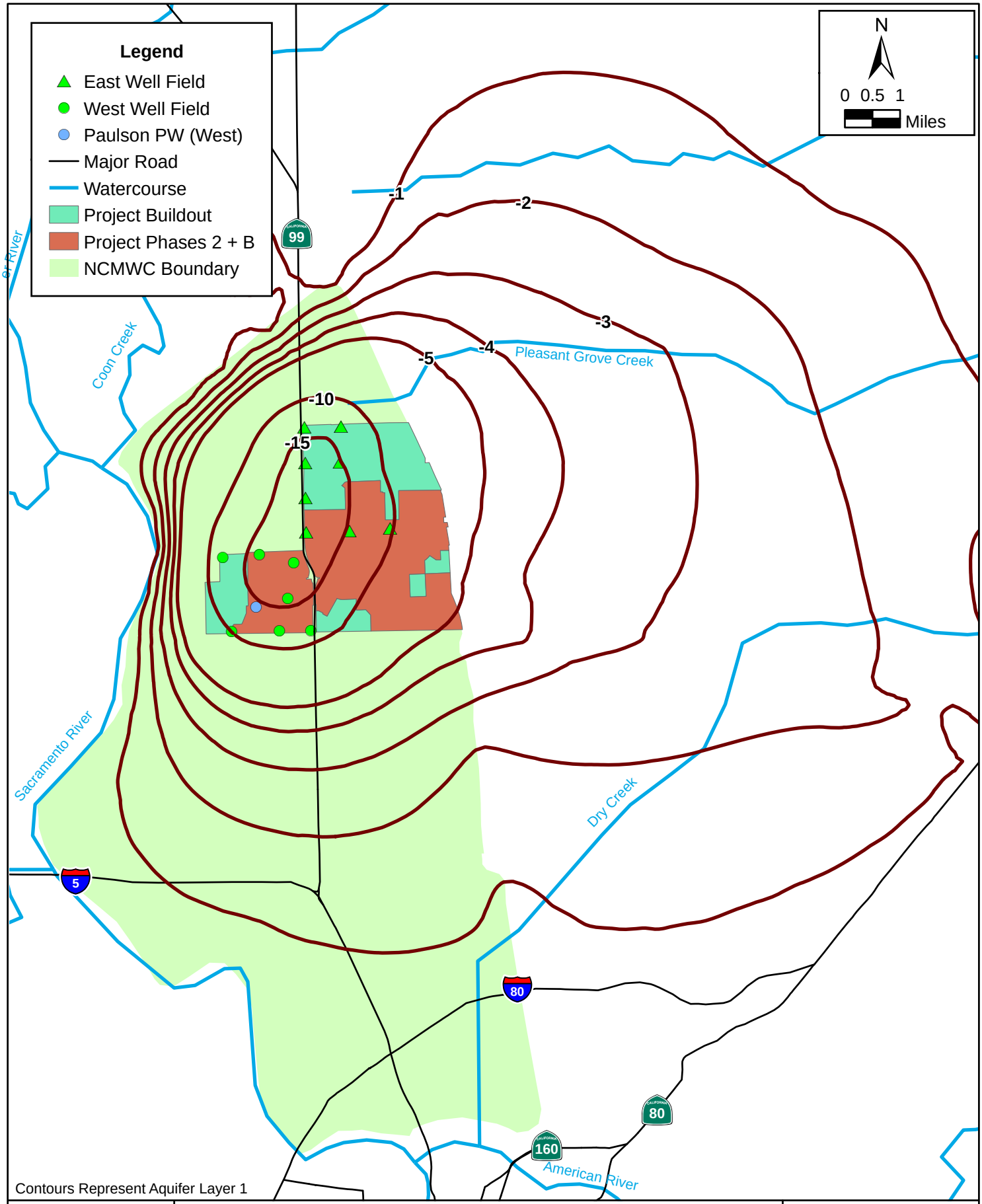
Groundwater Level (feet, msl)

Scenario 2b

Model Simulation Year 35, March

June 2008

Figure 6-11



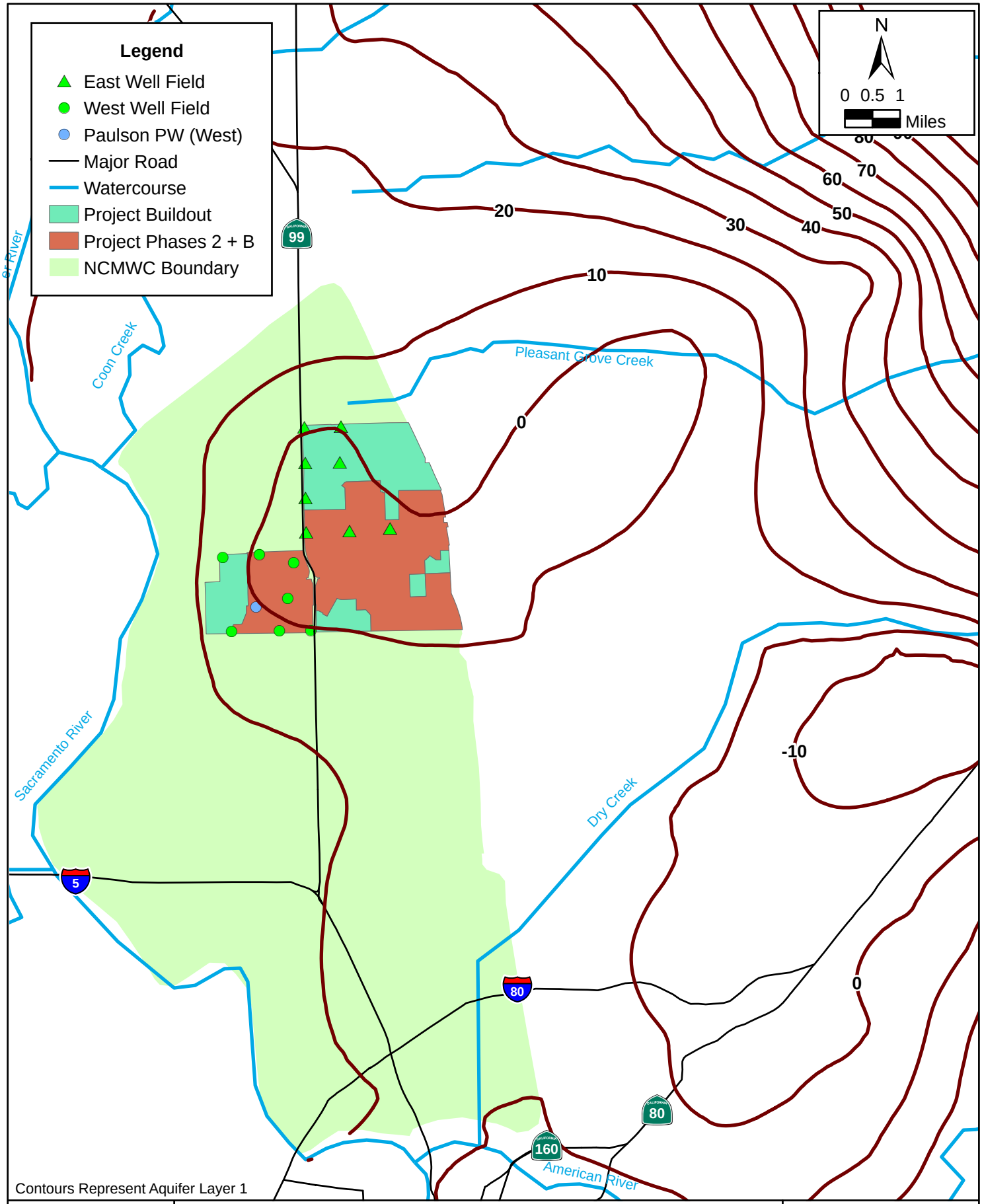
Groundwater Level Difference (feet)

Scenario 2b minus 2030 Baseline

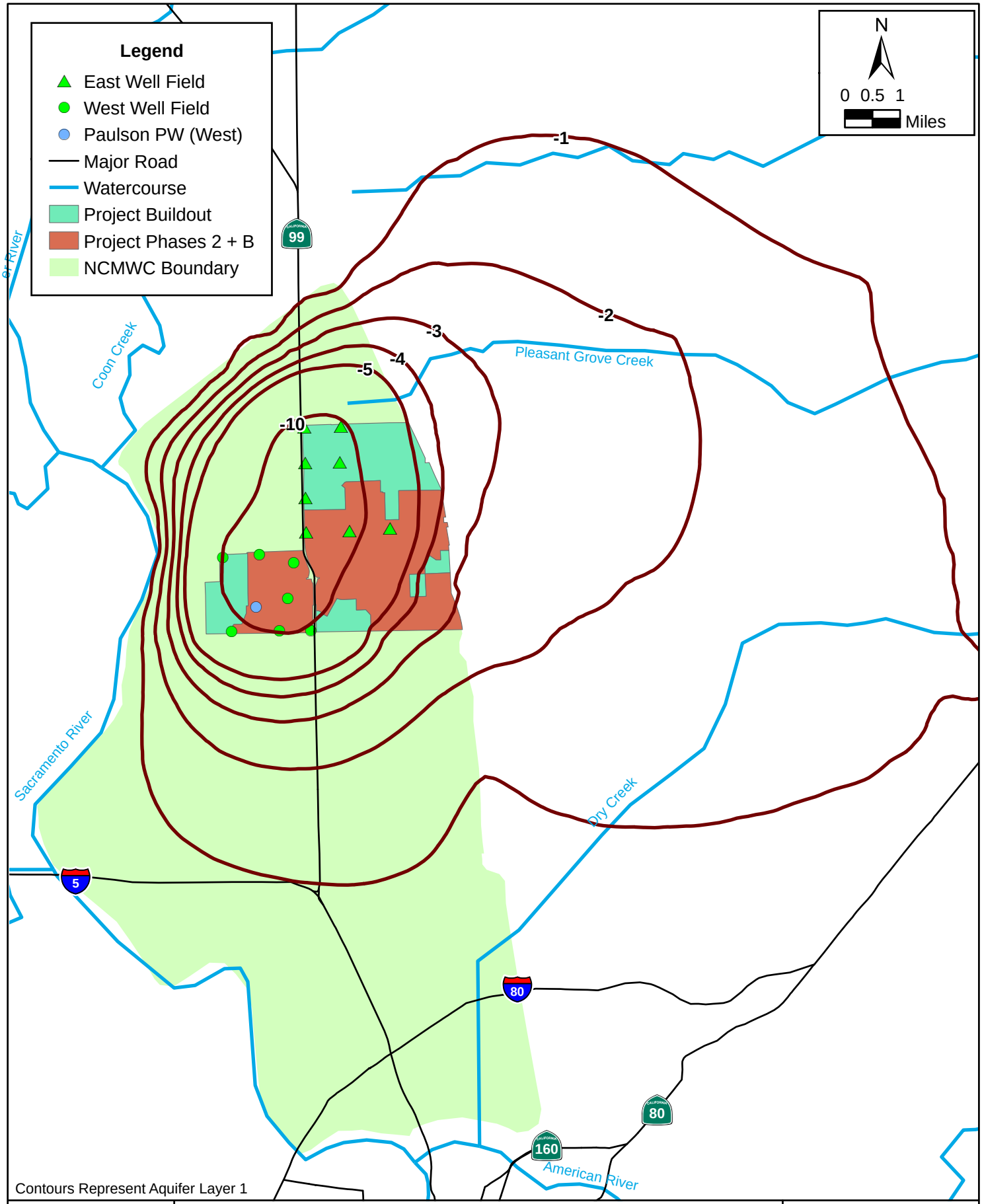
Model Simulation Year 35, March

June 2008

Figure 6-12



WRIME	Groundwater Level (feet, msl) Scenario 3 Model Simulation Year 35, March	June 2008 Figure 6-13



Contours Represent Aquifer Layer 1

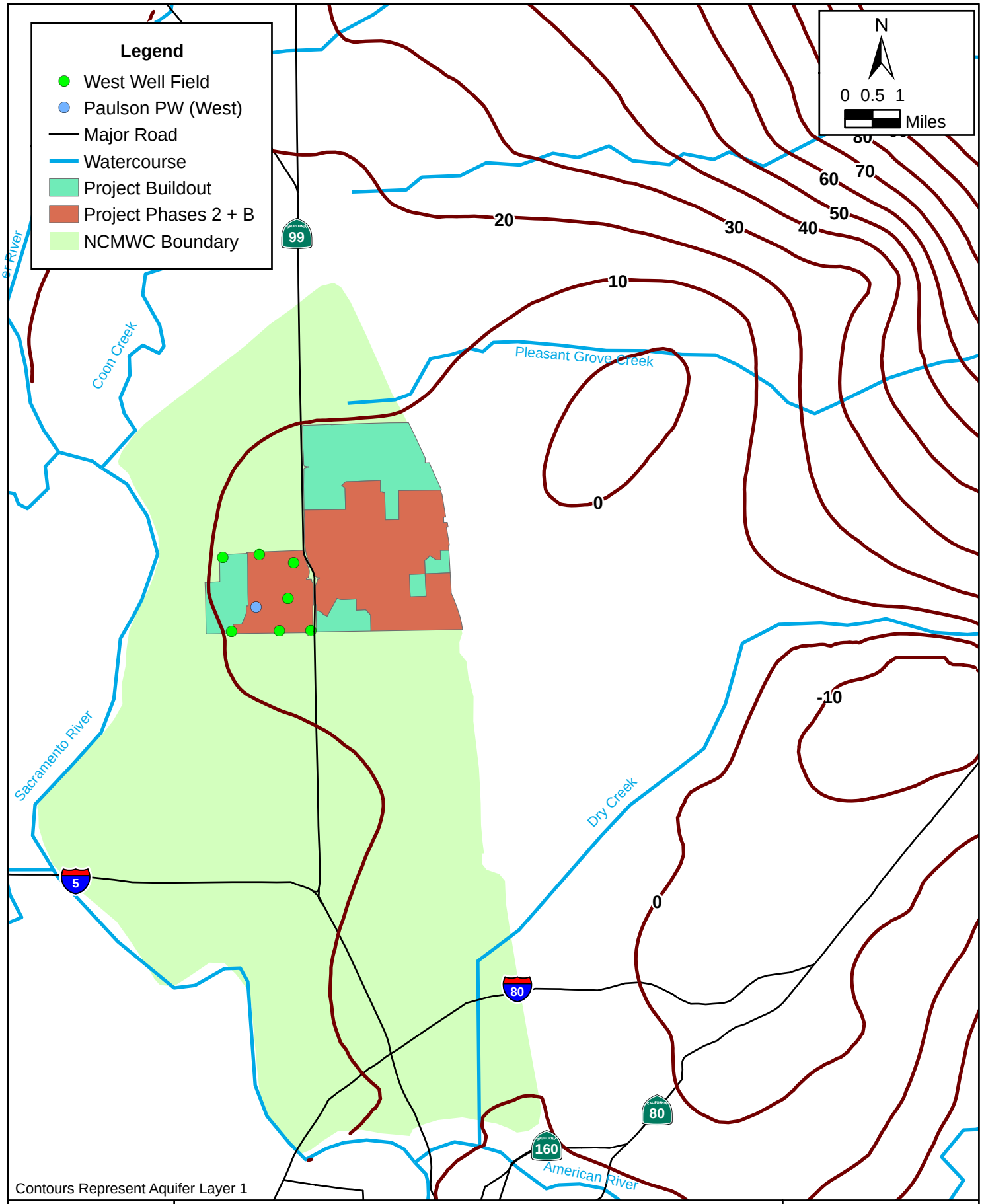
Groundwater Level Difference (feet)

Scenario 3 minus 2030 Baseline

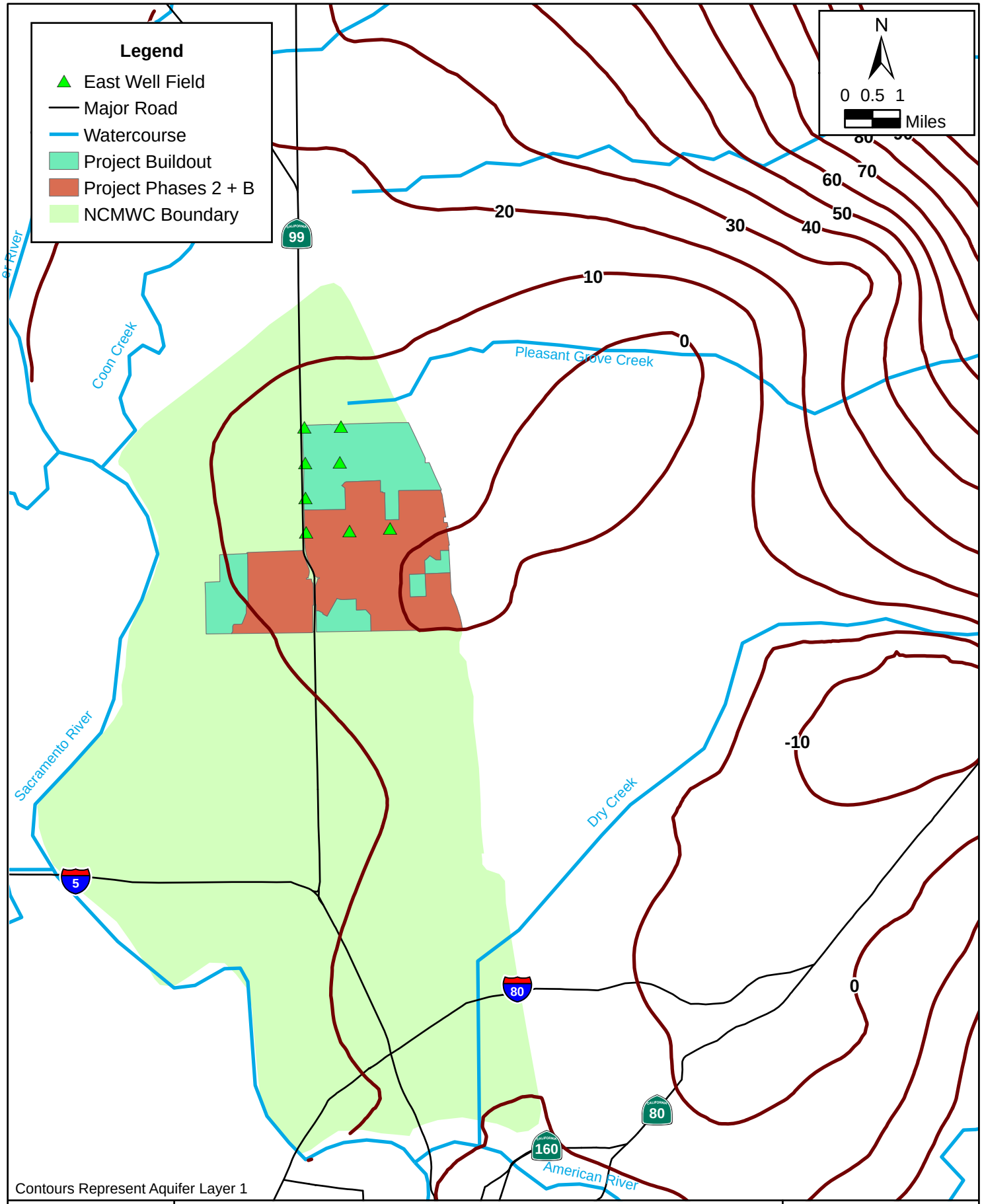
Model Simulation Year 35, March

June 2008

Figure 6-14



WRIME	Groundwater Level (feet, msl) Scenario 4 Model Simulation Year 35, March	June 2008 Figure 6-15



WRIME

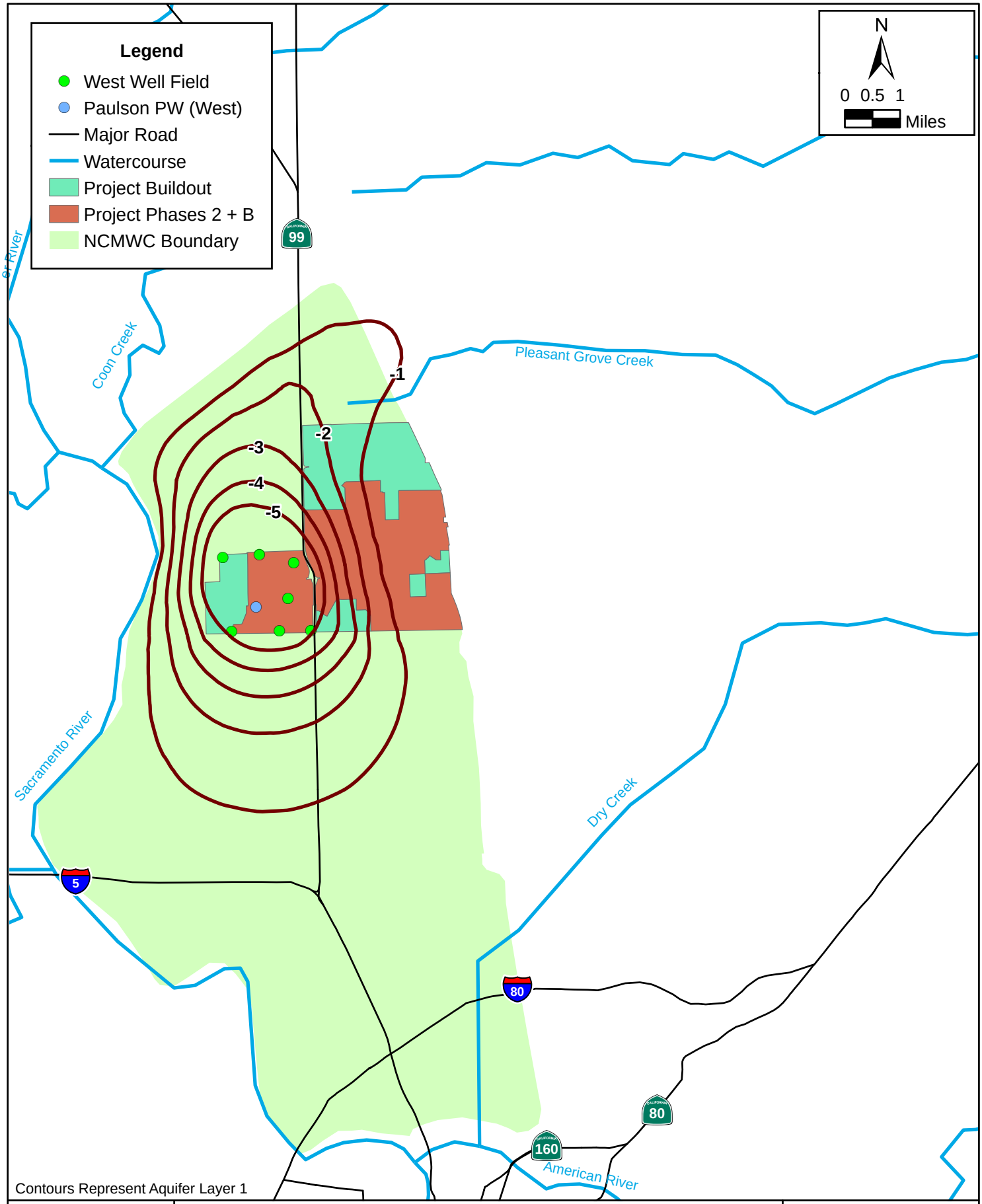
Groundwater Level (feet, msl)

Scenario 5

Model Simulation Year 35, March

June 2008

Figure 6-16



Contours Represent Aquifer Layer 1

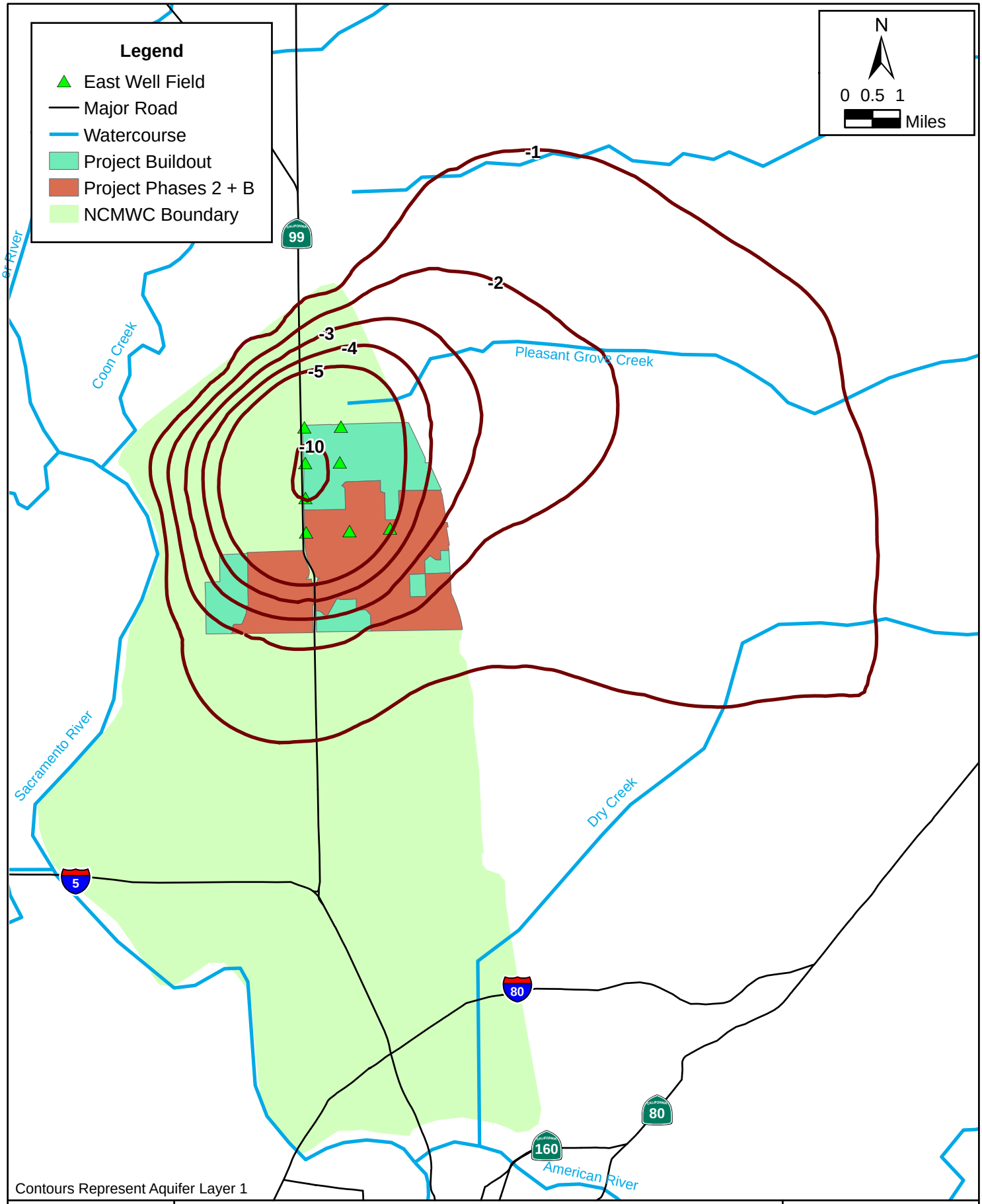
Groundwater Level Difference (feet)

Scenario 4 minus 2030 Baseline

Model Simulation Year 35, March

June 2008

Figure 6-17



WRIME	Groundwater Level Difference (feet) Scenario 5 minus 2030 Baseline Model Simulation Year 35, March	June 2008 Figure 6-18

Appendix A

California Department of Water Resource Bulletin 118, Sacramento Valley Groundwater Basin, North American Subbasin

Sacramento Valley Groundwater Basin
North American Subbasin

- Groundwater Basin Number: 5-21.64
- County: Sutter, Placer, Sacramento
- Surface Area: 351,000 acres (548 square miles)

Basin Boundaries and Hydrology

The North American subbasin lies in the eastern central portion of the Sacramento Groundwater Basin. The Bear River is its northern boundary, the Feather River is its western boundary, and the Sacramento River is its southern boundary. The eastern boundary is a north-south line extending from the Bear River south to Folsom Lake, which passes about 2 miles east of the town of Lincoln. The eastern boundary represents the approximate edge of the alluvial basin, where little or no groundwater flows into or out of the groundwater basin from the rock of the Sierra Nevada (DWR 1997). The eastern portion of the study area is characterized by low rolling dissected uplands. The western portion is nearly a flat flood basin for the Bear, Feather, Sacramento and American rivers, and several small east side tributaries. The general direction of drainage is west-southwest at an average grade of about 5 percent.

Precipitation ranges from 18-20 inches in the western half of the subbasin to 20-24 inches in the eastern half of the subbasin.

Hydrogeologic Information

The following geologic references are presented in Feasibility Report, American Basin Conjunctive Use Project by California Department of Water Resources (1997).

Water Bearing Formations

The water-bearing materials of the North American subbasin are dominated by unconsolidated continental deposits of Late Tertiary and Quaternary age. Deposits include Miocene/Pliocene volcanics, older alluvium, and younger alluvium. The alluvium can be characterized as comprising the upper aquifer system, occupying the upper 200 to 300 feet below ground surface; the Mehrten and older geologic units can be characterized as comprising the lower aquifer system, occurring generally deeper than 300 feet towards the west side of the subbasin. The cumulative thickness of these deposits increases from a few hundred feet near the Sierra Nevada foothills on the east to over 2,000 feet along the western margin of the subbasin. Most of the groundwater is produced in the northern portion of the subbasin. The aquifer zones in the upper 200 to 300 feet of this portion of the subbasin appear to be unconfined and behave similarly to stresses imposed on them. Conversely, deeper zones show a delayed response to stresses in the upper zone, indicating possibly limited interconnection with the shallower zones (DWR 1997).

Younger Alluvium. These deposits include flood basin deposits and recent stream channel deposits. The flood basin deposits occur along the western margin of the subbasin adjacent to the Sacramento River. The flood basin

deposits consist primarily of silts and clays, although they may be locally interbedded with stream channel deposits of the Sacramento River. Thickness of the unit ranges from 0 to 100 feet. Because of the fine-grained nature, the flood basin deposits have low permeability and generally yield low quantities of water to wells. Brackish water is often encountered in these deposits.

The stream channel deposits include sediments deposited in the channels of active streams as well as overbank deposits of those streams, terraces, and local dredge tailings. These deposits occur predominantly along the Sacramento and American Rivers and their major tributaries, and consist primarily of unconsolidated silt, fine- to medium-grained sand, and gravel. Thickness of the unit ranges from 0 to about 100 feet. Sand and gravel zones in the younger alluvium are highly permeable and yield significant quantities of water to wells.

Older Alluvium. These deposits consist of loosely to moderately compacted sand, silt, and gravel deposited in alluvial fans during the Pliocene and Pleistocene. A number of formational names have been assigned to the older alluvium, including the Modesto, Riverbank, and Turlock Lake Formations (Helley and Harwood 1985), Victor and Laguna Formations (Olmstead and Davis 1961), and Arroyo Seco Gravels, South Fork Gravels, and Fair Oaks Formation (DWR 1974). The older alluvial units are widely exposed between the Sierra Nevada foothills and overlying younger alluvial units near the axis of the Sacramento Valley. Thickness of the older alluvium ranges between 100 to 650 feet. It is moderately permeable.

Miocene/Pliocene Volcanics. These deposits consist of the Mehrten Formation, a sequence of fragmented volcanic rocks. The Mehrten Formation is exposed along the eastern margin of the subbasin between the towns of Lincoln and Folsom. It is composed of intervals of "black sands," stream gravels, silt, and clay interbedded with intervals of dense tuff breccia. The sand and gravel intervals are highly permeable and wells completed in them have reported yields of over 1,000 gpm. The tuff breccia intervals act as confining layers. Thickness of the unit is between 200 and 1,200 feet.

Groundwater Level Trends

Groundwater levels in southwestern Placer County and northern Sacramento County have generally decreased, with many wells experiencing declines at a rate of about one and one-half feet per year for the last 40 years or more (PCWA1999). Some of the largest decreases have occurred in the area of the former McClellan AFB. Groundwater levels in Sutter and northern Placer Counties generally have remained stable, although some wells in southern Sutter County have experienced declines (DWR 1997).

Groundwater Storage

Groundwater Storage Capacity. DWR (1997) assumed a specific yield of 7% and an aquifer thickness of 200 feet for 200,000 acres within the North American subbasin. Storage capacity can be estimated for the North American subbasin by applying the same assumptions as DWR (1997) – specific yield of 7% and an assumed thickness of 200 feet over the entire

351,000 acre subbasin. This results in an estimated storage capacity of approximately 4.9 million acre-feet.

Groundwater in Storage. There are no known published reports that discuss groundwater in storage.

Groundwater Budget (Type B)

As part of its water planning process, DWR estimated the following components of the groundwater budget. The calculations are for a 1990 level of development. Estimated inflows include natural recharge at 83,800 acre-feet and applied water recharge at 29,800 acre-feet. There was no artificial recharge. Estimated outflows include urban extraction at 109,900 acre-feet and agricultural extraction at 289,100 acre-feet.

Groundwater Quality

Characterization. The chemistry and quality of groundwater has been assessed for the American Basin. Many areas of good quality groundwater exist in the North American subbasin. In some portions of the basin groundwater quality is marginal. The three major groundwater types are: magnesium calcium bicarbonate or calcium magnesium bicarbonate; magnesium sodium bicarbonate or sodium magnesium bicarbonate; and sodium calcium bicarbonate or calcium sodium bicarbonate (DWR 1997).

Comparison of groundwater quality data with applicable water quality standards and guidelines for drinking and irrigation indicate elevated levels of TDS/specific conductance, chloride, sodium, bicarbonate, boron, fluoride, nitrate, iron manganese, and arsenic may be of concern in some locations within the subbasin (DWR 1997).

High TDS levels exist in an area along the Sacramento River extending from Sacramento International Airport northward to the Bear River. The highest levels of TDS are found in an area extending just south of Nicholas to Verona, between Reclamation District 1001 and the Sutter Bypass. Some wells in this area have reported TDS exceeding 1,000 mg/L.

This same area along the Sacramento River extending from Sacramento International Airport northward to the Bear River also contains high levels of chloride, sodium, bicarbonate, manganese, and arsenic. The groundwater in the southern part of the basin is generally characterized as good quality, low in disinfection by-product precursor materials and moderate in mineral content, although some localized contamination issues do exist.

Impairments. There are three sites within the subbasin with significant groundwater contamination issues: the former McClellan AFB, Union Pacific Railroad Rail Yard in Roseville and the Aerojet Superfund Site. Although the Aerojet site lies south of the North American subbasin, a contaminant plume (including TCE and PCE) extends north from Aerojet, under the American River and into the North American subbasin (Montgomery Watson 2000). Other localized areas of contamination exist throughout the basin and are generally smaller in scope and extent of contamination.

Water Quality in Public Supply Wells

Constituent Group[1]	Number of wells sampled[2]	Number of wells with a concentration above an MCL[3]
Inorganics – Primary	265	7
Radiological	254	2
Nitrates	276	0
Pesticides	268	0
VOCs and SVOCs	267	6
Inorganics – Secondary	265	75

[1] A description of each member in the constituent groups and a generalized discussion of the relevance of these groups are included in *California's Groundwater – Bulletin 118* by DWR (2003).
[2] Represents distinct number of wells sampled as required under DHS Title 22 program from 1994 through 2000.
[3] Each well reported with a concentration above an MCL was confirmed with a second detection above an MCL. This information is intended as an indicator of the types of activities that cause contamination in a given basin. It represents the water quality at the sample location. It does not indicate the water quality delivered to the consumer. More detailed drinking water quality information can be obtained from the local water purveyor and its annual Consumer Confidence Report.

Well Characteristics

	Well yields (gal/min)	
Municipal/Irrigation	Range: 752-2,500	Average: 800 (DWR 1997)
	Total depths (ft)	
Domestic	Range: 50-1,750	Average: 190 (665 well completion reports)
Municipal/Irrigation	Range: 77-1,025	Average: 396 (105 well completion reports)

Active Monitoring Data

Agency	Parameter	Number of wells /measurement frequency
DWR	Groundwater levels	53 wells semi-annually, 7 monthly
Sacramento County		17 wells semi-annually
South Sutter WD		21 wells semi-annually, 1 monthly
Sutter County		22 wells semi-annually
DWR	Mineral, nutrient, & minor element.	32 wells biennially
Department of Health Services (including co-operators)	Title 22	Approximately 275 wells

Basin Management

Groundwater management:	The Sacramento Groundwater Authority (SGA) is a joint powers authority responsible for the protection of the regional groundwater basin within Sacramento County north of the American River. SGA adopted a groundwater management plan on December 11, 2003. South Sutter WD adopted an AB 3030 plan in 1995. Placer County Water Agency adopted an AB 3030 plan in 1998 and updated this plan in 2003. City of Lincoln adopted a groundwater management plan on November 12, 2003.
Water agencies	
Public	South Sutter WD, Camp Far West ID, Rio Linda/Elverta CWD, Citrus Heights WD, San Juan Suburban WD, Fair Oaks WD, Carmichael WD, Sacramento Suburban WD, Western Placer ID, Placer County WA, Del Paso Manor WD, City of Sacramento WSA, City of Roseville, Sacramento County Water Agency
Private	Pleasant Grove – Verona MWC, Natomas Central MWC, California-American WC, Orangevale WC, Southern California WC,

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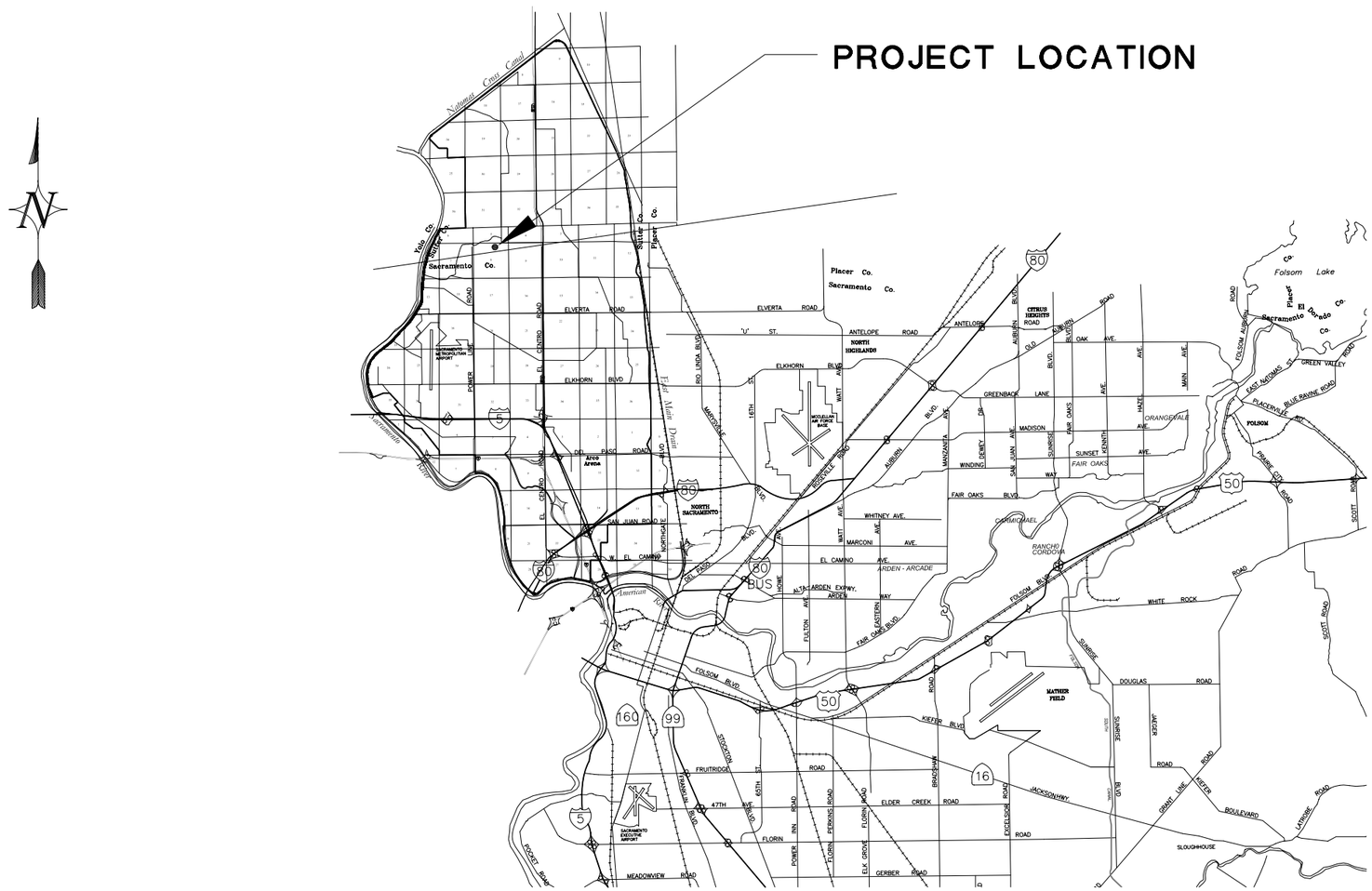
Errata

Updated groundwater management information and added hotlinks to applicable websites. (1/20/06)

Appendix B

Well Construction Information – Paulson Production and Monitoring Wells

LENNAR COMMUNITIES
SUTTER COUNTY, CALIFORNIA
PAULSON PRODUCTION WELL
MAY 2007



VICINITY MAP

Scale in Miles

0 0.5 1 2

TABLE OF CONTENTS	
Sheet #	Title
1 of 4	TITLE SHEET AND VICINITY MAP
2 of 4	SITE PLAN
3 of 4	MONITORING WELL PROFILE
4 of 4	PRODUCTION WELL PROFILE

TITLE SHEET AND VICINITY MAP
Lennar Communites
South Sutter – Paulson Well
Sutter County, California

LUHDORFF & SCALMANINI
CONSULTING ENGINEERS

REVISIONS

NO.	DATE	REVISION

DATE: MAY 2007
JOB NO.: 07-1-012
DESIGN BY: ASL
DRAWN BY: DWT
CHECKED BY: TDE
FILE: Sheet 1 of 5 .dwg

SHEET: 1 OF: 4

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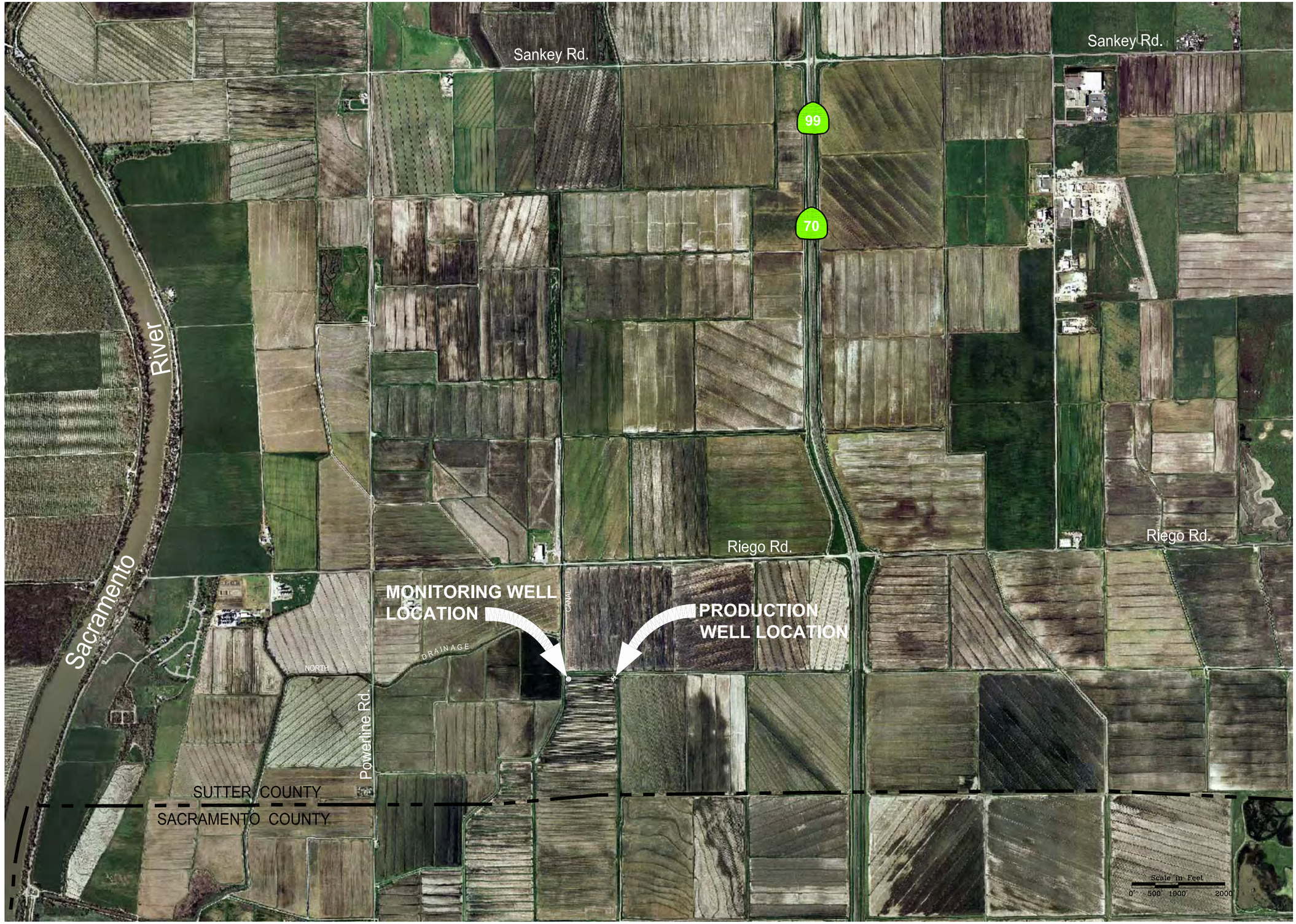


SITE PLAN

Lennar Communites
South Sutter – Paulson Well
Sutter County, California

LUHDORFF & SCALMANINI
CONSULTING ENGINEERS

REVISIONS

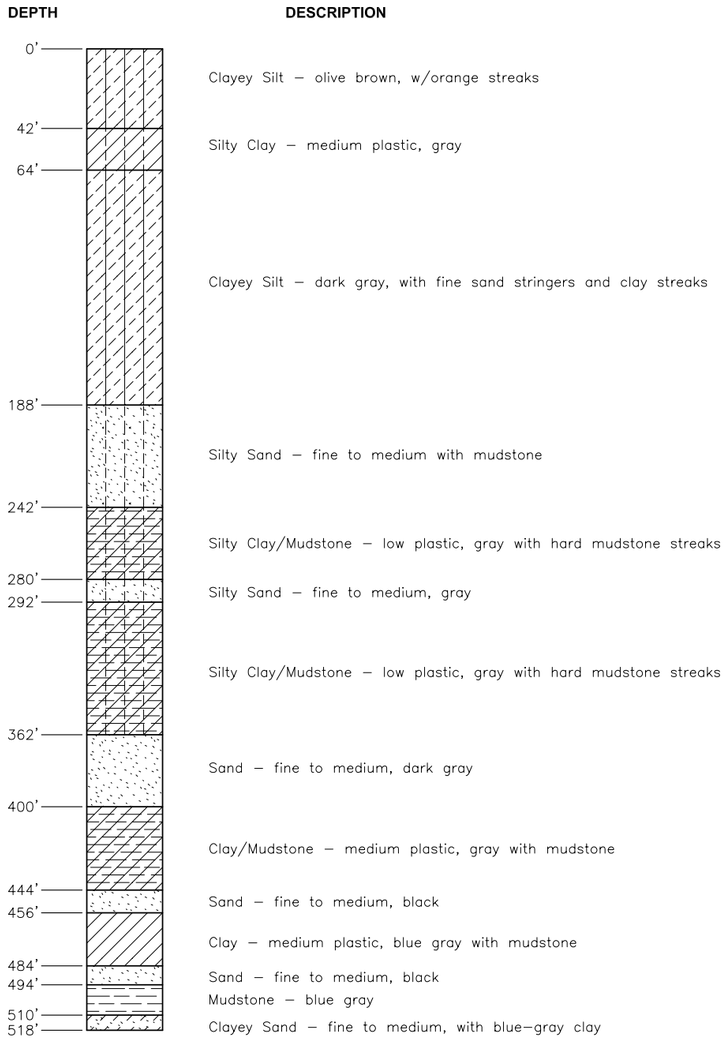
NO.	DATE	REVISION

DATE: MAY 2007
JOB NO. : 07-1-012
DESIGN BY: ASL
DRAWN BY: DWT
CHECKED BY: TDE
FILE: Sheet 2 of 5 .dwg

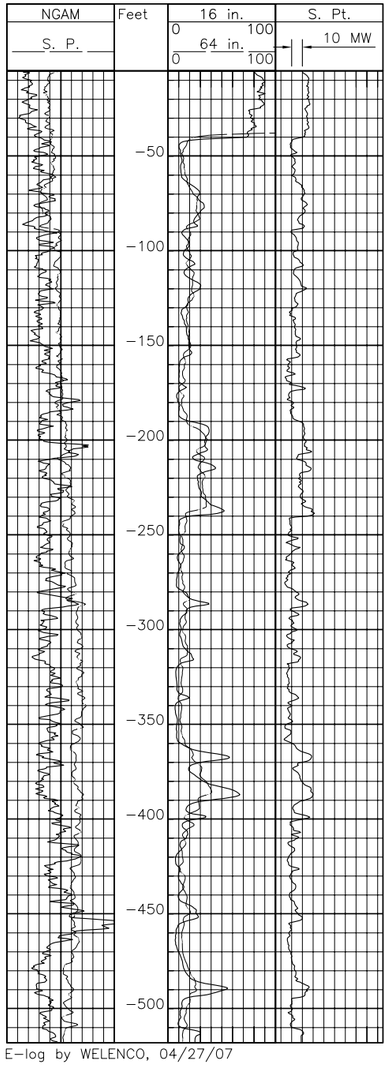
SHEET: 2/4
OF:

CAD FILE: G:/Projects/Lennar Communities/07-1-012/Sheet 2 of 5.dwg CFG FILE: LSCE2500.PCP_MRG DATE: 05-10-07 1:53pm

PAULSON WELL TEST HOLE LITHOLOGY

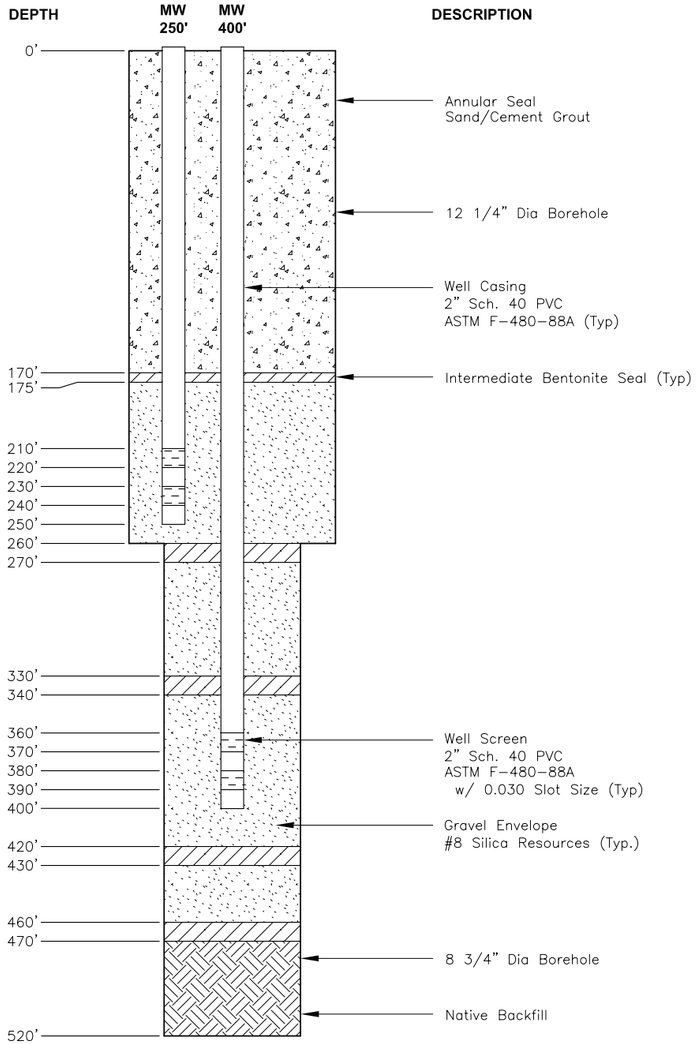


PAULSON WELL TEST HOLE ELECTRICAL LOG



E–log by WELENCO, 04/27/07

PAULSON MONITORING WELL PROFILE



MONITORING WELL PROFILE
Lennar Communites
South Sutter – Paulson Well
Sutter County, California

LUHDORFF & SCALMANINI CONSULTING ENGINEERS

REVISIONS

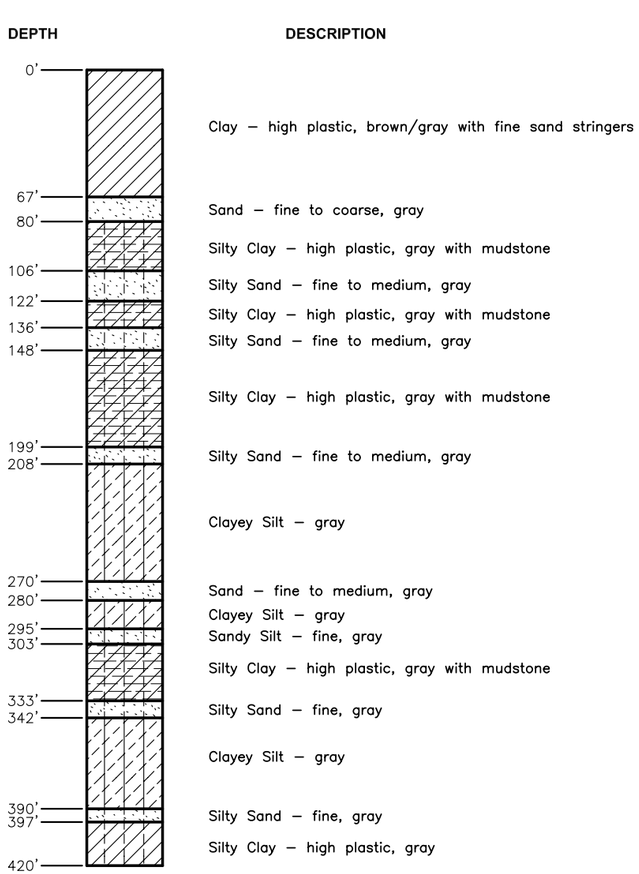
NO.	DATE	REVISION

DATE: MAY 2007
JOB NO. : 07-1-012
DESIGN BY: ASL
DRAWN BY: DWT
CHECKED BY: TDE
FILE: Sheet 3 of 5 .dwg

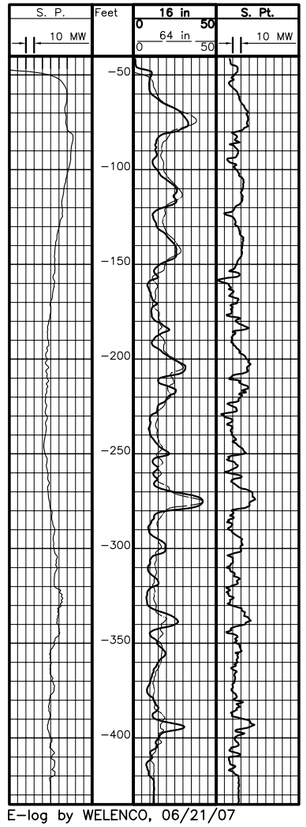
SHEET: 3 OF: 4

CAD FILE: G:/Projects/Lennar Communities/07-1-012/Sheet 2 of 5 (MW).dwg CFG FILE: LSCE2500.PCP_MRG DATE: 05-10-07 1:42pm

PAULSON WELL
PRODUCTION WELL BOREHOLE
LITHOLOGY

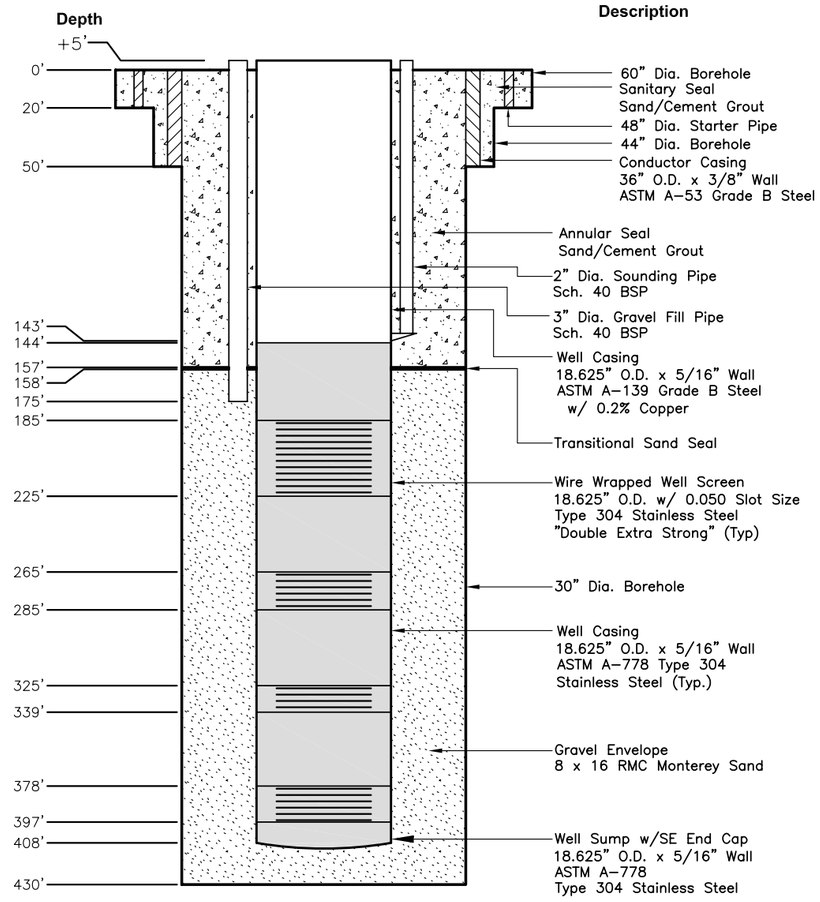


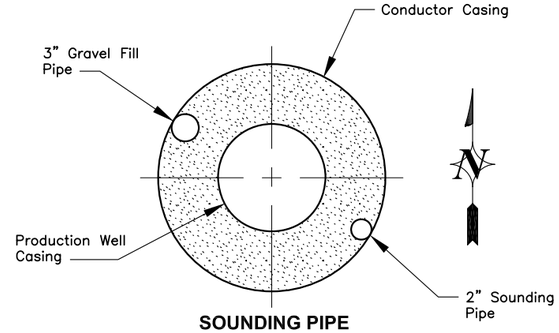
PAULSON WELL
PRODUCTION WELL BOREHOLE
ELECTRICAL LOG



E–log by WELENCO, 06/21/07

PAULSON PRODUCTION
WELL PROFILE





SOUNDING PIPE ORIENTATION

AS-BUILT

PRODUCTION WELL PROFILE
Lennar Communites
Sutter Point – Paulson Well
Sutter County, California

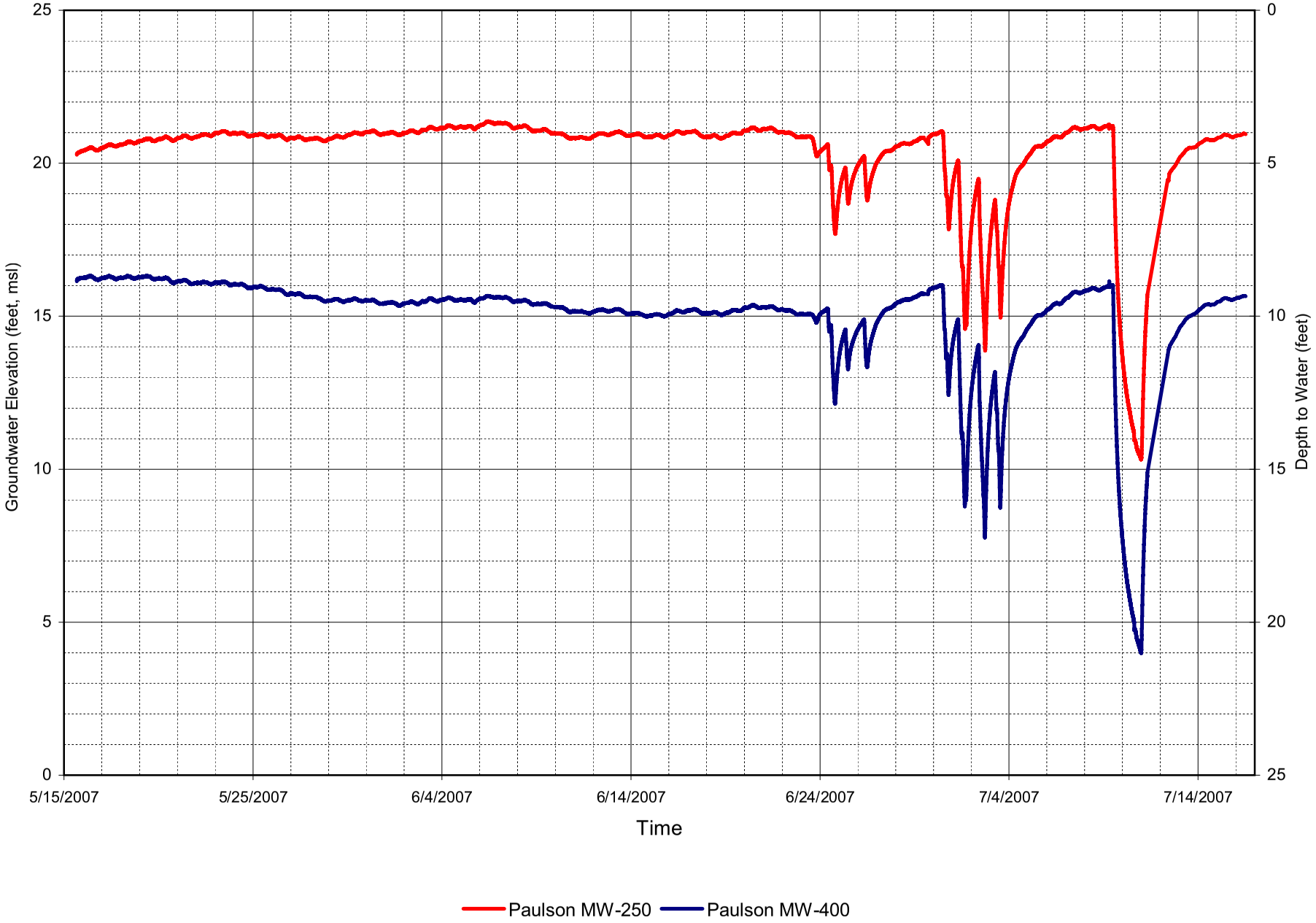
LUHDORFF & SCALMANINI CONSULTING ENGINEERS

REVISIONS		
NO.	DATE	REVISION

DATE: MAY 2007
JOB NO. : 07–1–012
DESIGN BY: ASL
DRAWN BY: DWT
CHECKED BY: TDE
FILE: Sheet 3 of 5 .dwg

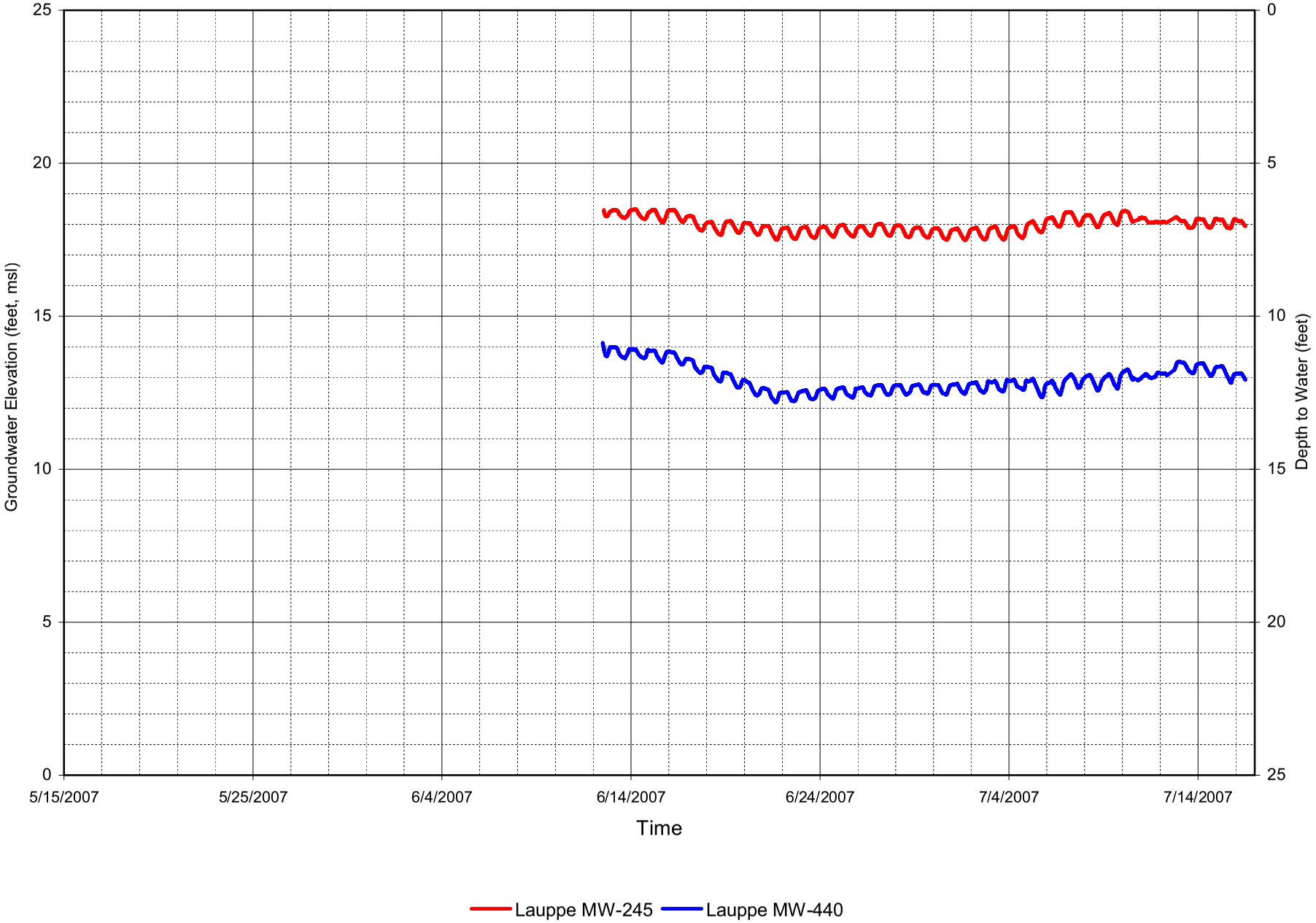
SHEET: A–2
OF:

CAD FILE: G:/Projects/Lennar Communities/07–1–012/Sheet 3 of 5 (PW) As–Built.dwg CFG FILE: LSCE2500.PCP_MRG DATE: 07–17–07 2:03pm



LUHDORFF & SCALMANINI
CONSULTING ENGINEERS

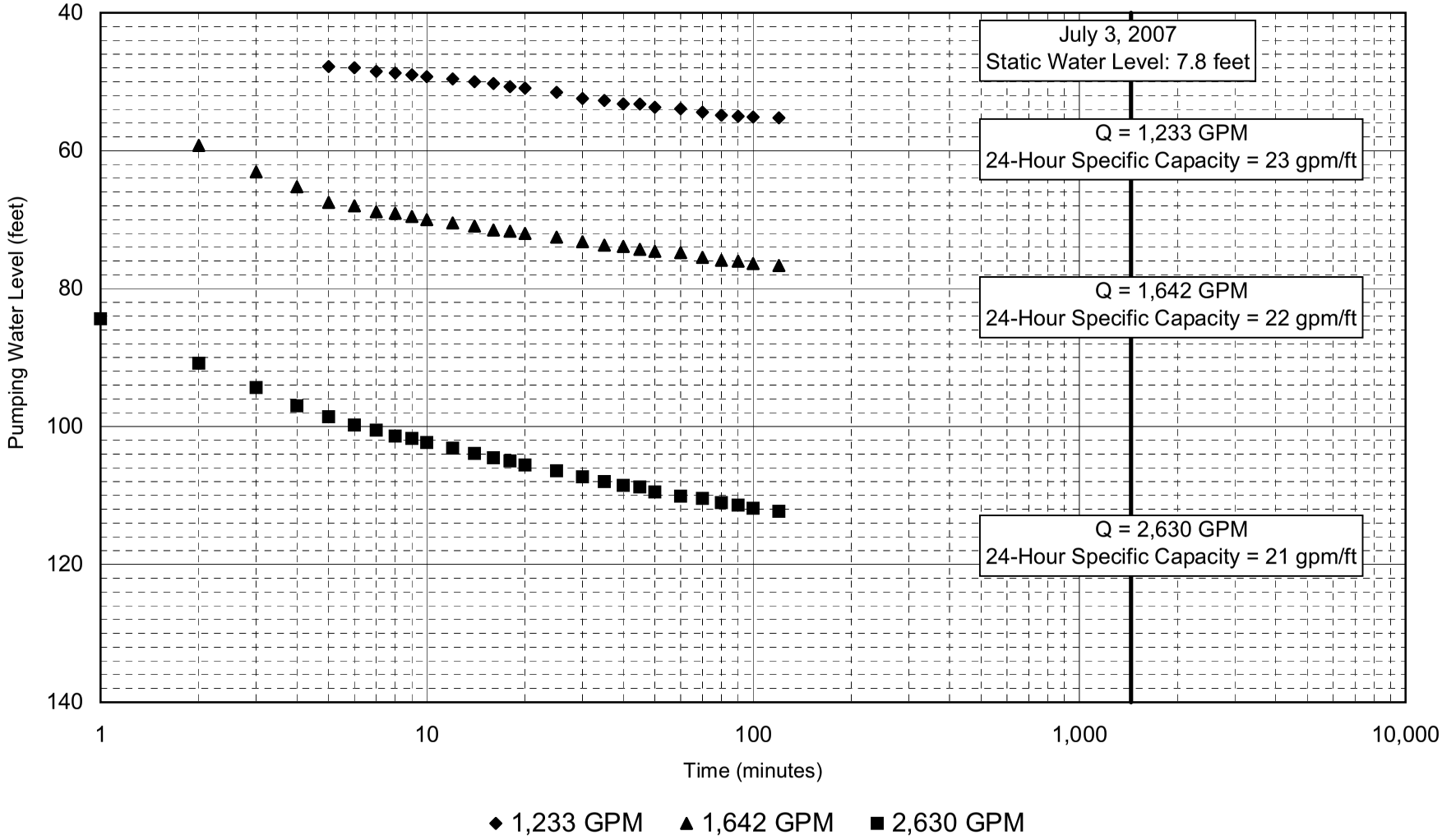
Hydrograph of Paulson Monitoring Wells



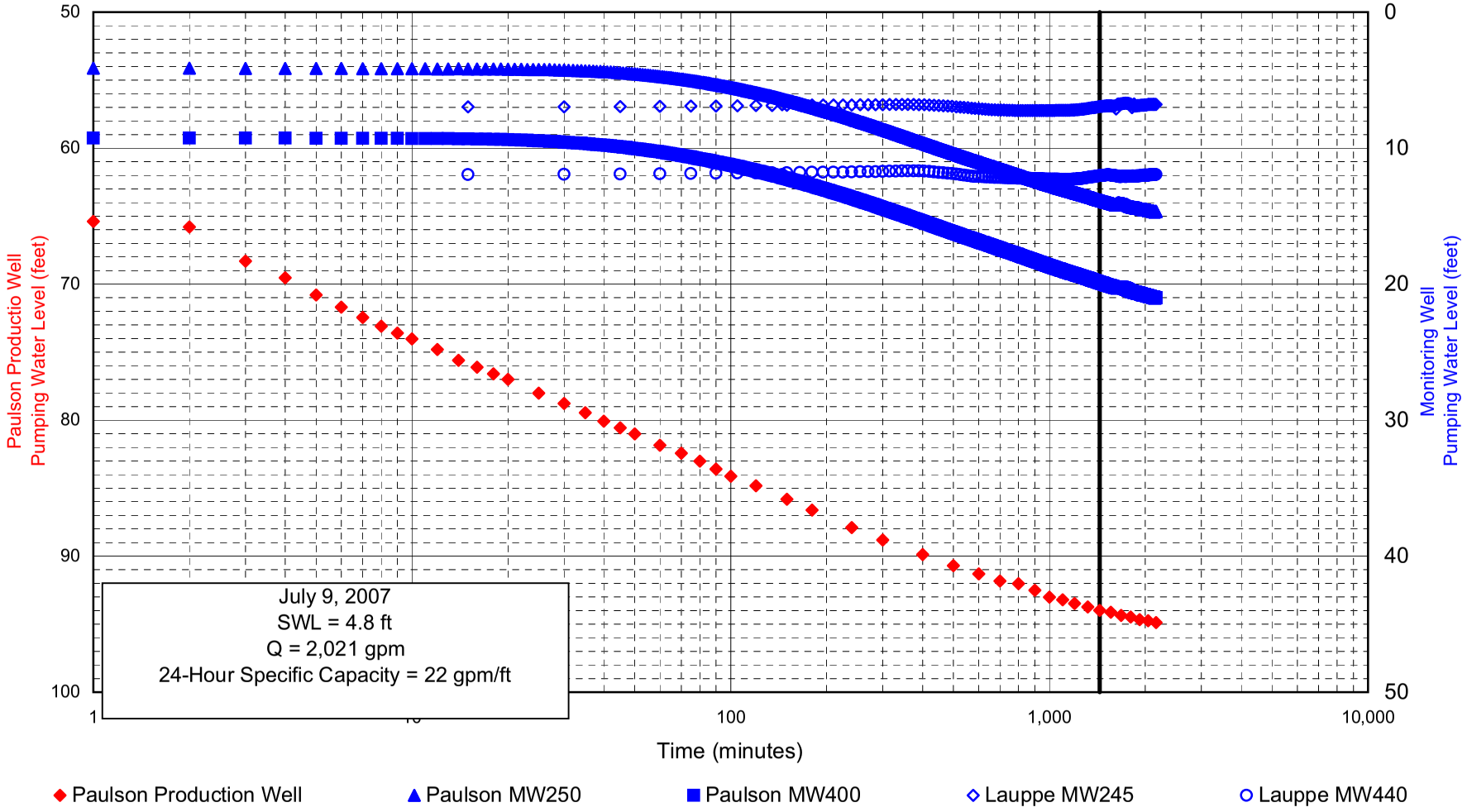
LUHDORFF & SCALMANINI
CONSULTING ENGINEERS

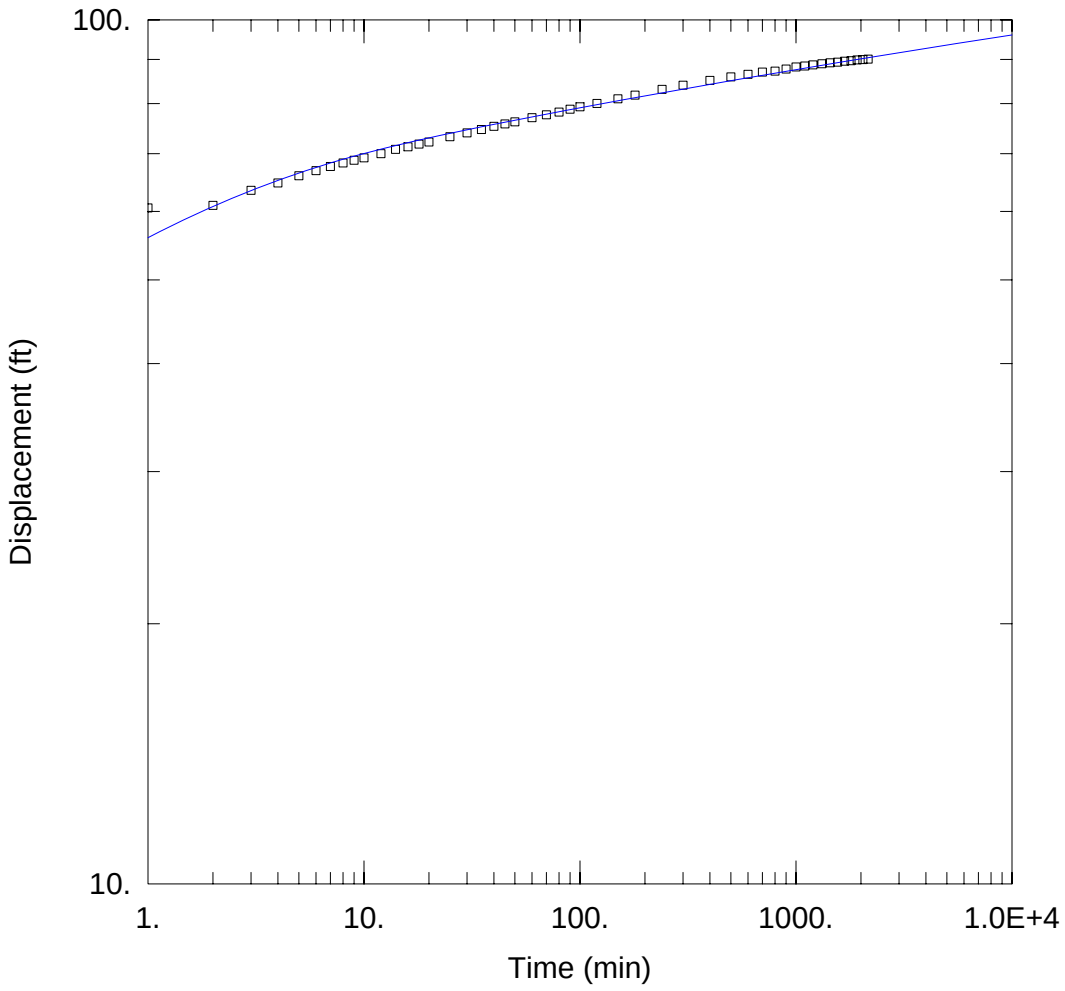
Hydrograph of Lauppe Monitoring Wells

Lennar Communites
Paulson Production Well
2-Hour Constant Rate Tests



Lennar Communities
Paulson Production Well
36-Hour Constant Rate Test Drawdown





PAULSON PRODUCTION WELL: DRAWDOWN USING THEIS

Data Set: Y:\Sutter Pointe 07-1-012\Data\Paulson Well\Aquifer Test\PaulsonPW_drawdown_Theis.aqt
Date: 08/07/07 Time: 09:49:32

PROJECT INFORMATION

Company: LSCE
Client: Sutter Pointe
Project: 07-1-012
Location: Sutter Pointe
Test Well: Pumping Well: Paulson PW
Test Date: 7/9/2007

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
Paulson PW	0	0

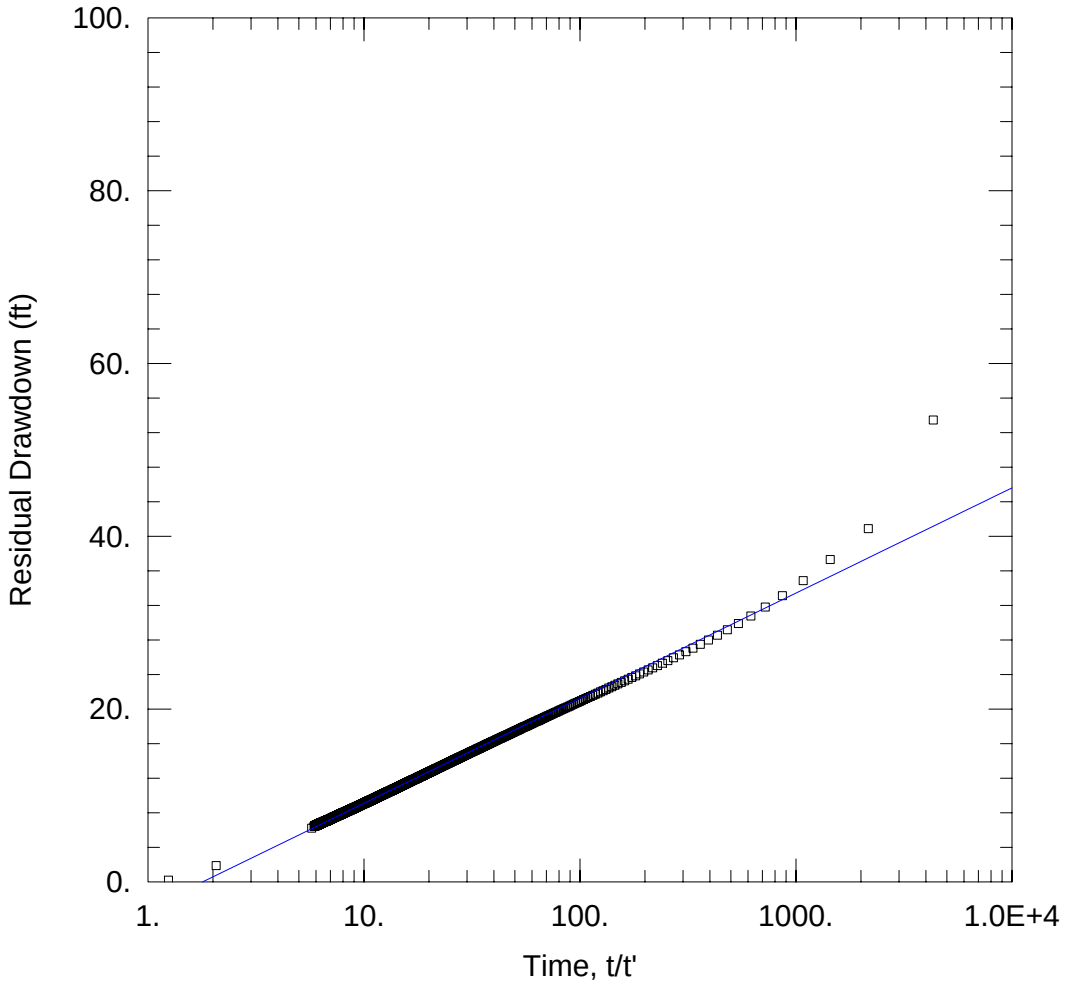
Observation Wells

Well Name	X (ft)	Y (ft)
▫ Paulson PW	0	0

SOLUTION

Aquifer Model: Confined
Solution Method: Theis

T = 6.292E+4 gal/day/ft
Kz/Kr = 1.
S = 0.006358
b = 500. ft



PAULSON PRODUCTION WELL: RECOVERY USING THEIS

Data Set: Y:\Sutter Pointe 07-1-012\Data\Paulson Well\Aquifer Test\PaulsonPW_recovery_Theis.aqt
Date: 08/07/07 Time: 09:41:56

PROJECT INFORMATION

Company: LSCE
Client: Sutter Pointe
Project: 07-1-012
Location: Sutter Pointe
Test Well: Pumping Well: Paulson PW
Test Date: 7/9/2007

AQUIFER DATA

Saturated Thickness: 500. ft Anisotropy Ratio (Kz/Kr): 1.

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
Paulson PW	0	0

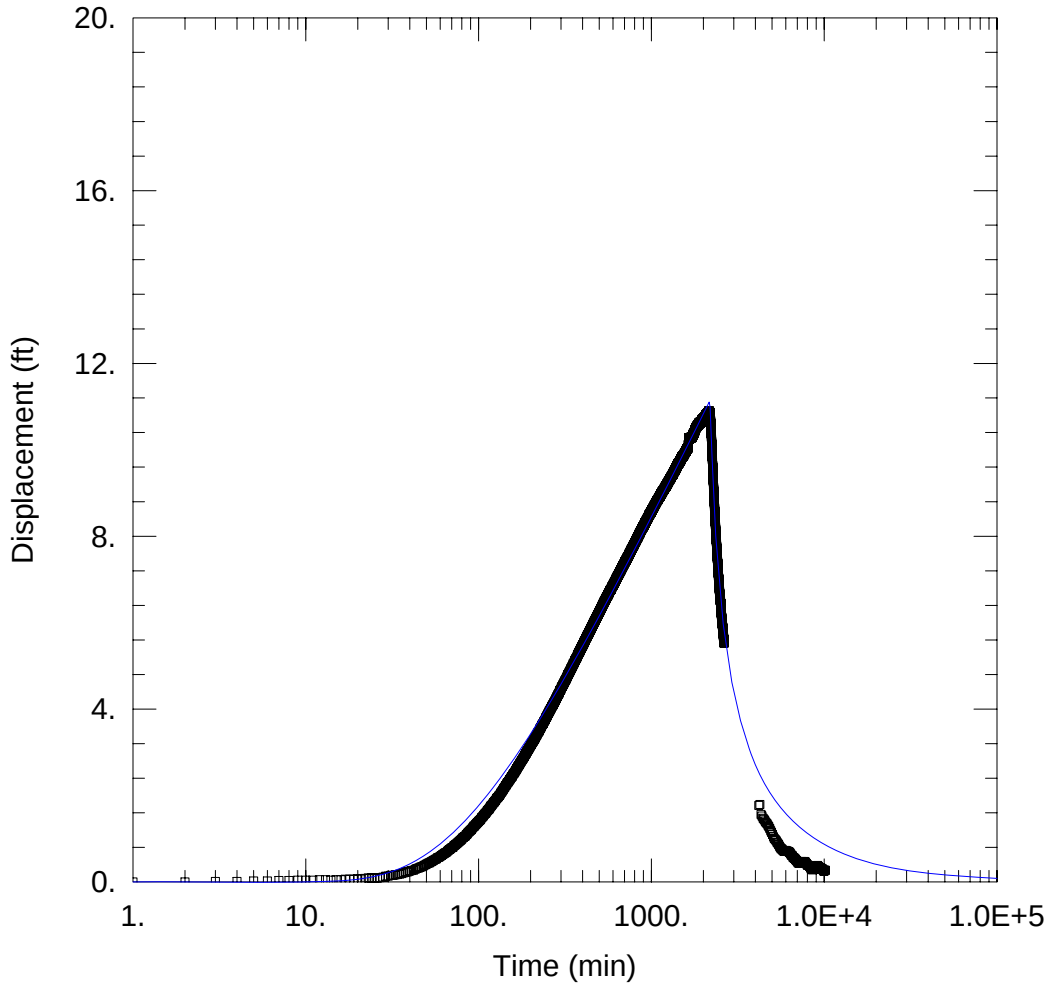
Observation Wells

Well Name	X (ft)	Y (ft)
Paulson PW	0	0

SOLUTION

Aquifer Model: Confined Solution Method: Theis (Recovery)

T = 4.384E+4 gal/day/ft S/S' = 1.791



PAULSON MW-250: DRAWDOWN USING THEIS

Data Set: Y:\...\PaulsonMW250_drawdown_theis.aqt
Date: 08/07/07 Time: 09:50:27

PROJECT INFORMATION

Company: LSCE
Client: Sutter Pointe
Project: 07-1-012
Location: Sutter Pointe
Test Well: Pumping Well: Paulson PW
Test Date: 7/9/2007

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
Paulson PW	0	0

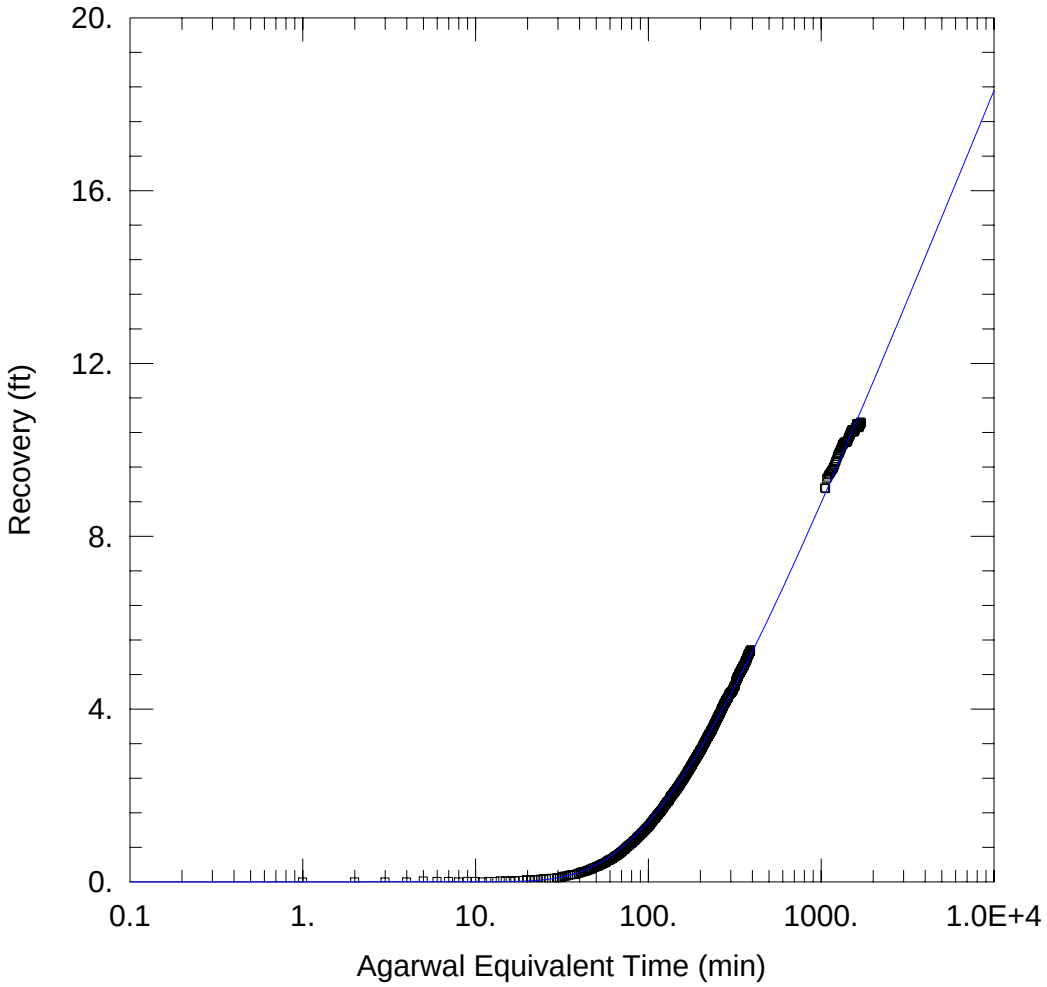
Observation Wells

Well Name	X (ft)	Y (ft)
▫ Paulson MW-250	0	1160

SOLUTION

Aquifer Model: Confined
Solution Method: Theis

T = 6.467E+4 gal/day/ft
Kz/Kr = 1.
S = 0.001
b = 500. ft



PAULSON MW-250: RECOVERY USING THEIS

Data Set: Y:\...\PaulsonMW250_recovery_theis.aqt
Date: 08/07/07 Time: 09:51:16

PROJECT INFORMATION

Company: LSCE
Client: Sutter Pointe
Project: 07-1-012
Location: Sutter Pointe
Test Well: Pumping Well: Paulson PW
Test Date: 7/9/2007

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
Paulson PW	0	0

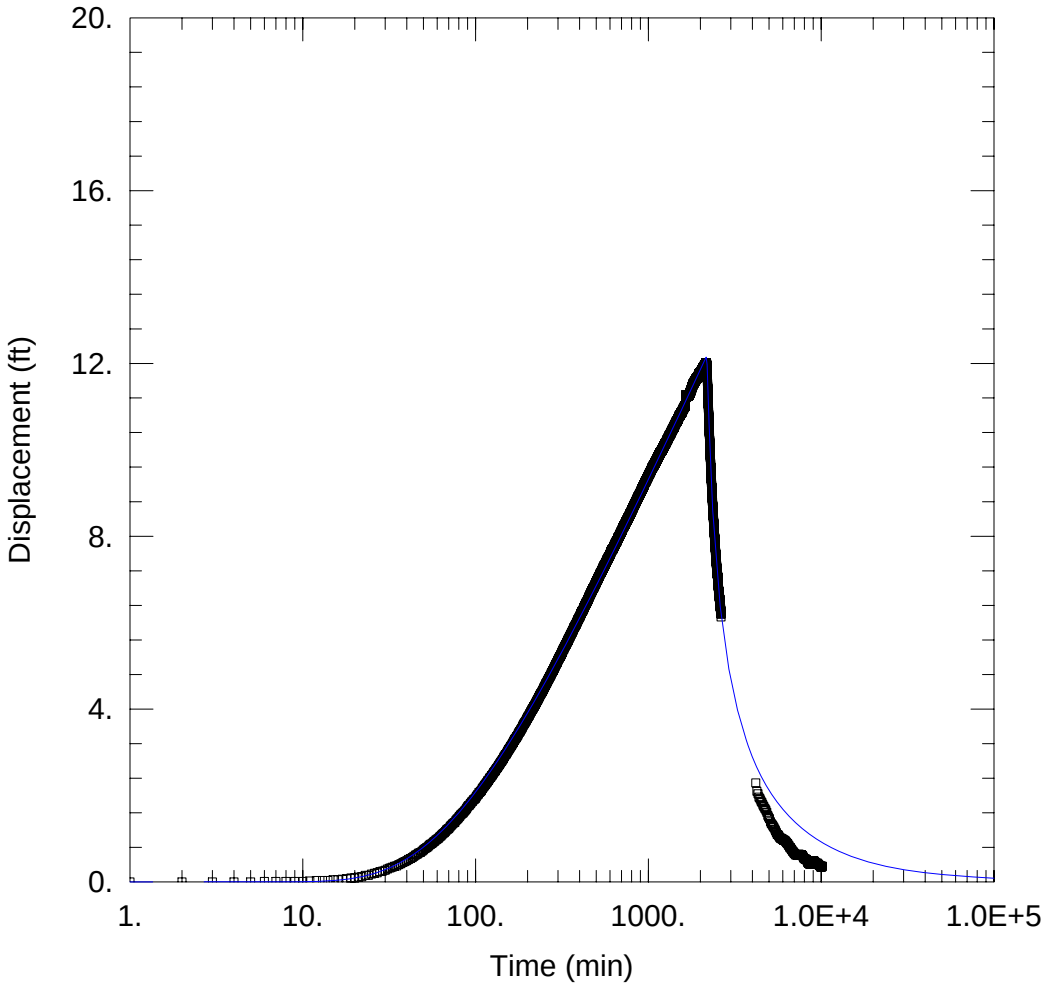
Observation Wells

Well Name	X (ft)	Y (ft)
▫ Paulson MW-250	0	1160

SOLUTION

Aquifer Model: Confined
Solution Method: Theis

T = 5.424E+4 gal/day/ft
S = 0.001161
Kz/Kr = 1.
b = 500. ft



PAULSON MW-400: DRAWDOWN USING THEIS

Data Set: Y:\...\PaulsonMW400_drawdown_theis.aqt
Date: 08/07/07 Time: 09:50:50

PROJECT INFORMATION

Company: LSCE
Client: Sutter Pointe
Project: 07-1-012
Location: Sutter Pointe
Test Well: Pumping Well: Paulson PW
Test Date: 7/9/2007

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
Paulson PW	0	0

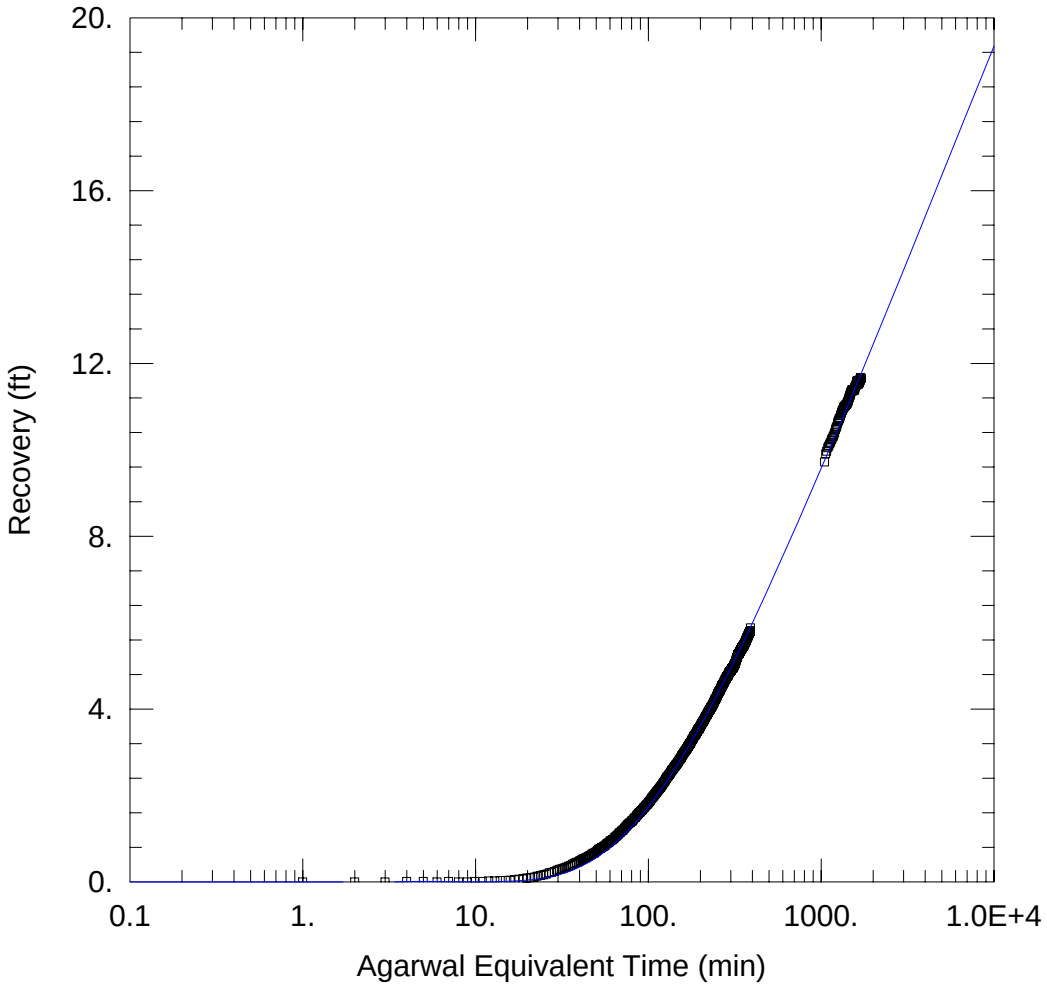
Observation Wells

Well Name	X (ft)	Y (ft)
▫ Paulson MW-400	0	1160

SOLUTION

Aquifer Model: Confined
Solution Method: Theis

T = 6.084E+4 gal/day/ft
S = 0.0008583
Kz/Kr = 1.
b = 500. ft



PAULSON MW-400: RECOVERY USING THEIS

Data Set: Y:\...\PaulsonMW400_recovery_theis.aqt
Date: 08/07/07 Time: 09:49:09

PROJECT INFORMATION

Company: LSCE
Client: Sutter Pointe
Project: 07-1-012
Location: Sutter Pointe
Test Well: Pumping Well: Paulson PW
Test Date: 7/9/2007

WELL DATA

Pumping Wells

Well Name	X (ft)	Y (ft)
Paulson PW	0	0

Observation Wells

Well Name	X (ft)	Y (ft)
▫ Paulson MW-400	0	1160

SOLUTION

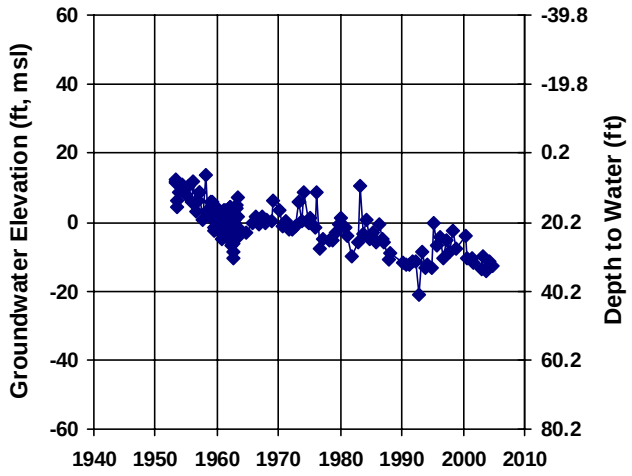
Aquifer Model: Confined
Solution Method: Theis

T = 5.317E+4 gal/day/ft
S = 0.0009777
Kz/Kr = 1.
b = 500. ft

Appendix C

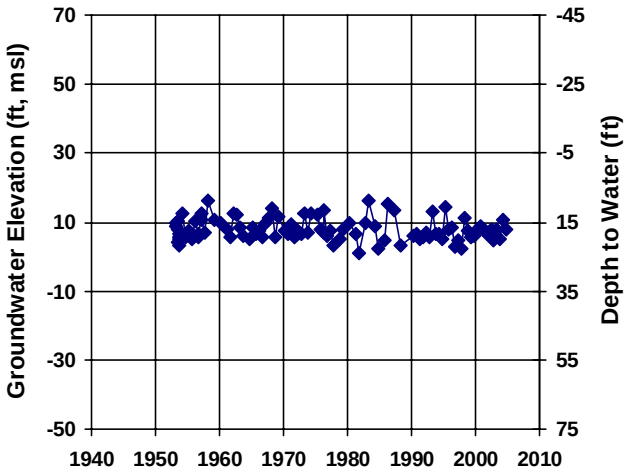
Groundwater Level Hydrographs

SWN: 09N04E01R001M Depth: 82 Perf: NA



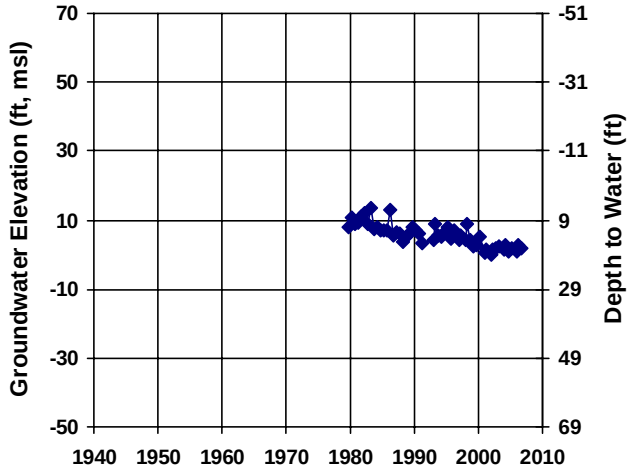
Reference Elevation: 20.2 ft, msl

SWN: 09N04E08L001M Depth: 105 Perf: 96-105



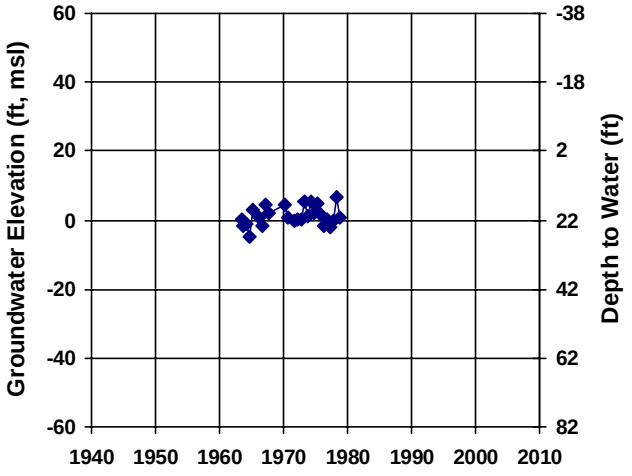
Reference Elevation: 25.0 ft, msl

SWN: 09N04E10C001M Depth: 200 Perf: 140-200



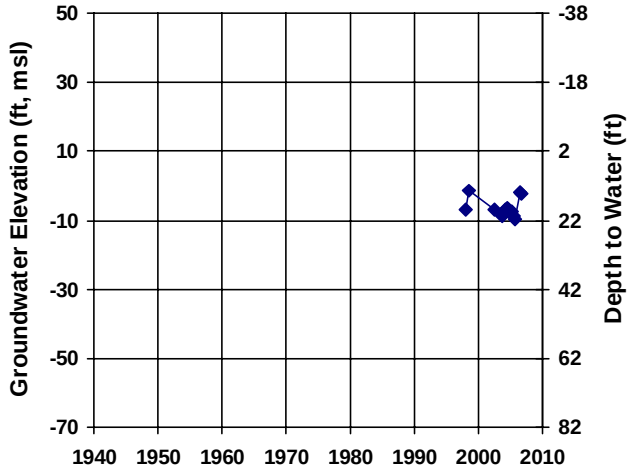
Reference Elevation: 19.0 ft, msl

SWN: 09N04E11E001M Depth: NA Perf: NA



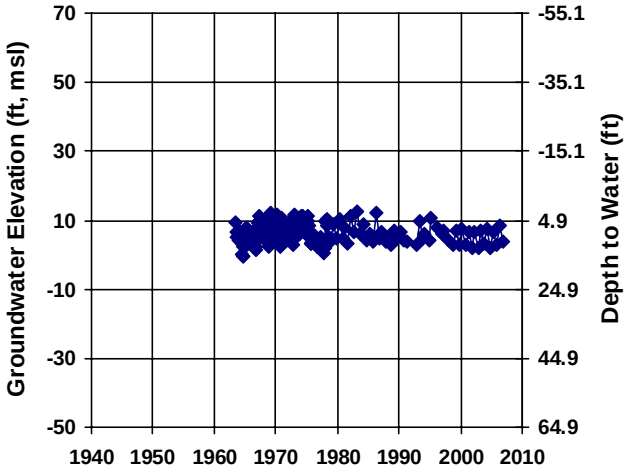
Reference Elevation: 22.0 ft, msl

SWN: 09N04E13R001M Depth: 52 Perf: NA



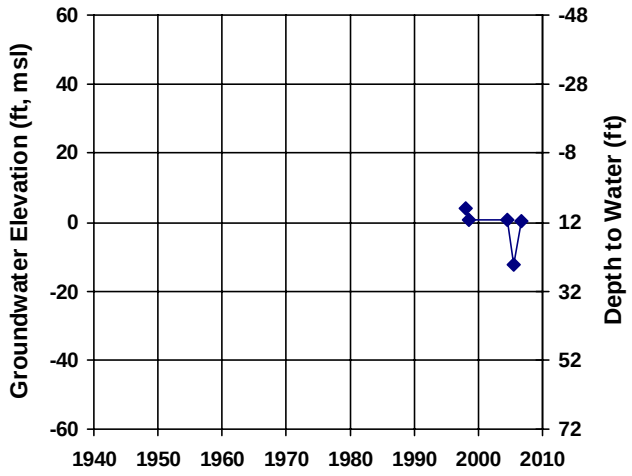
Reference Elevation: 12.0 ft, msl

SWN: 09N04E22E001M Depth: NA Perf: NA



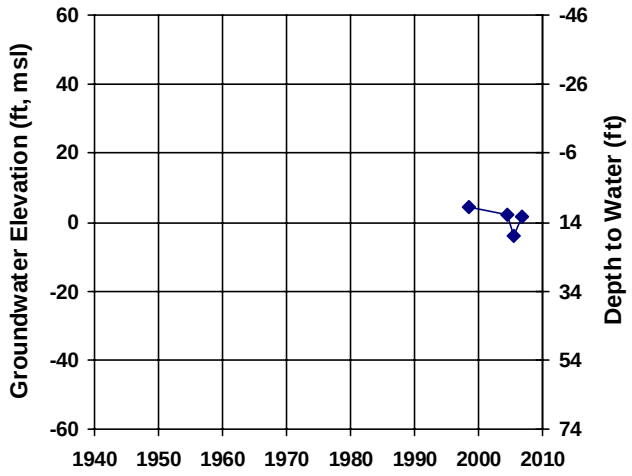
Reference Elevation: 14.9 ft, msl

SWN: 09N04E23A001M Depth: 36 Perf: NA



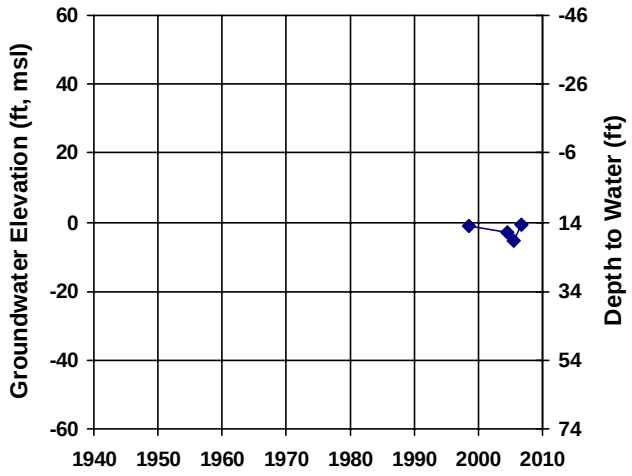
Reference Elevation: 12.0 ft, msl

SWN: 09N04E23R002M Depth: 48 Perf: NA



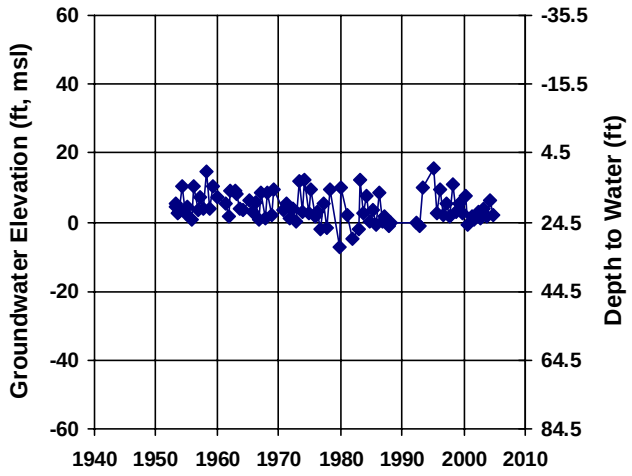
Reference Elevation: 14.0 ft, msl

SWN: 09N04E24Q001M Depth: 42 Perf: NA



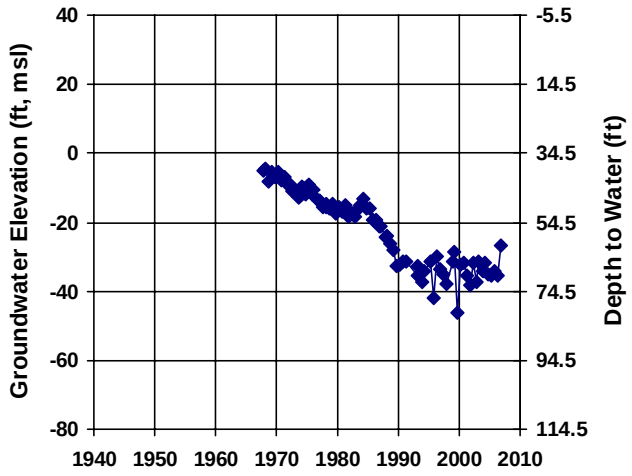
Reference Elevation: 14.0 ft, msl

SWN: 09N04E27F001M Depth: 320 Perf: 145-320



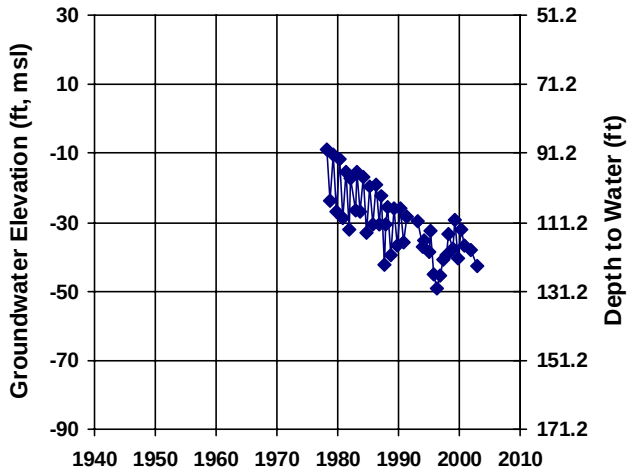
Reference Elevation: 24.5 ft, msl

SWN: 09N05E08J002M Depth: 95 Perf: 50-95



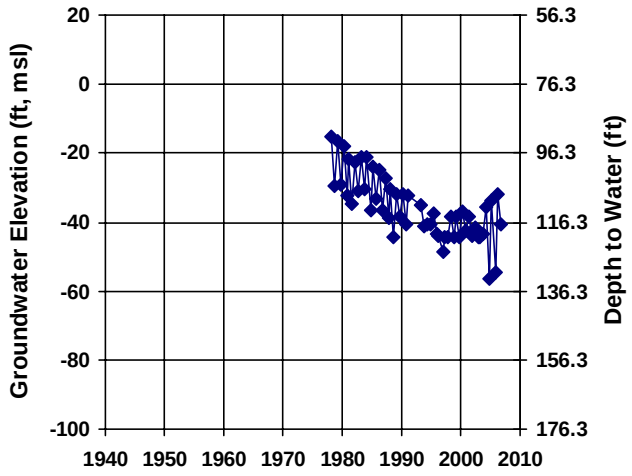
Reference Elevation: 34.5 ft, msl

SWN: 09N05E12J001M Depth: NA Perf: NA



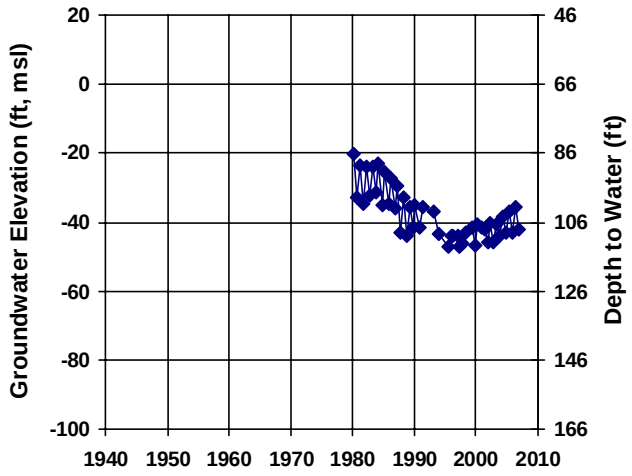
Reference Elevation: 81.2 ft, msl

SWN: 09N05E12L001M Depth: 528 Perf: 220-508



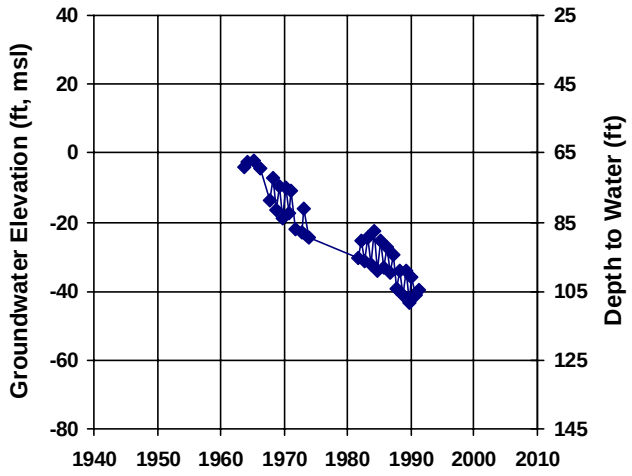
Reference Elevation: 76.3 ft, msl

SWN: 09N05E14B001M Depth: 550 Perf: 298-520



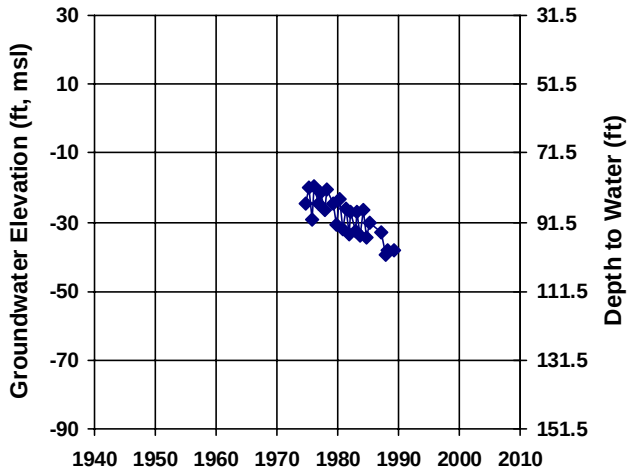
Reference Elevation: 66.0 ft, msl

SWN: 09N05E14H003M Depth: 250 Perf: 201-221



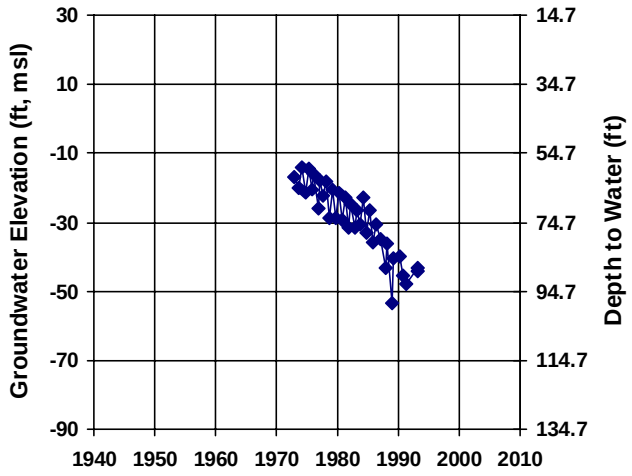
Reference Elevation: 65.0 ft, msl

SWN: 09N05E14L001M Depth: 191 Perf: 140-190



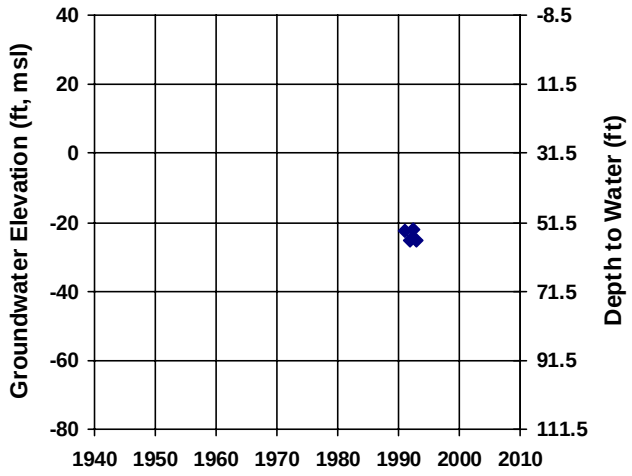
Reference Elevation: 61.5 ft, msl

SWN: 09N05E16K001M Depth: 365 Perf: NA



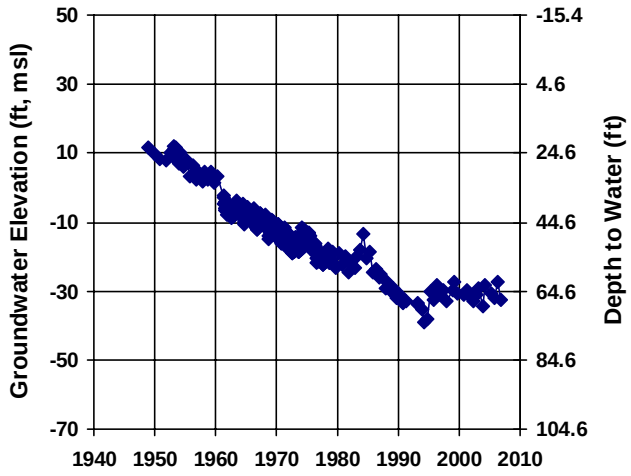
Reference Elevation: 44.7 ft, msl

SWN: 09N05E18R001M Depth: NA Perf: NA



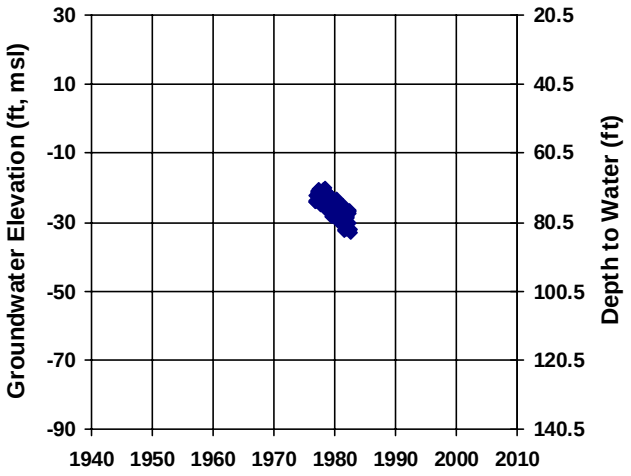
Reference Elevation: 31.5 ft, msl

SWN: 09N05E21M001M Depth: 89 Perf: NA



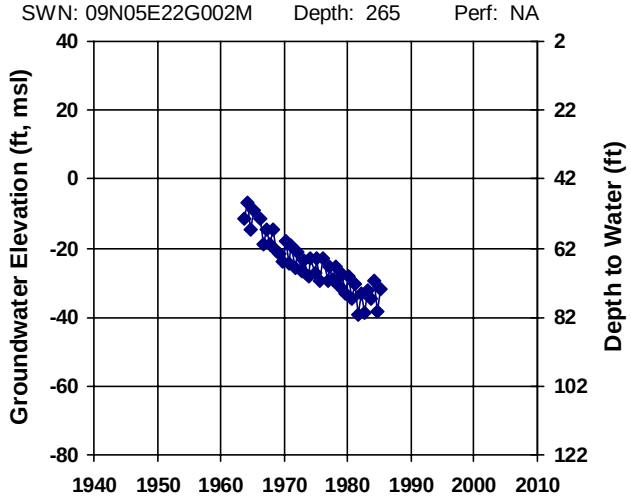
Reference Elevation: 34.6 ft, msl

SWN: 09N05E22F001M Depth: 155 Perf: NA



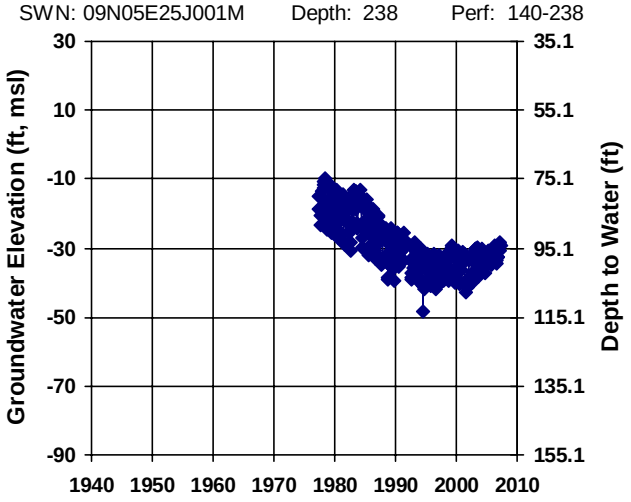
Reference Elevation: 50.5 ft, msl

SWN: 09N05E22G002M Depth: 265 Perf: NA



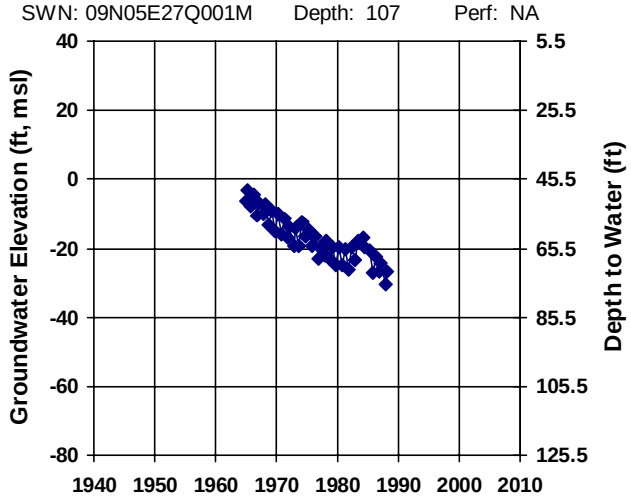
Reference Elevation: 42.0 ft, msl

SWN: 09N05E25J001M Depth: 238 Perf: 140-238



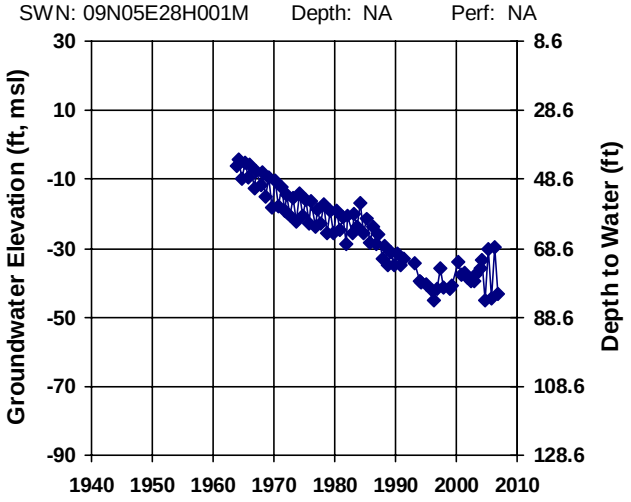
Reference Elevation: 65.1 ft, msl

SWN: 09N05E27Q001M Depth: 107 Perf: NA



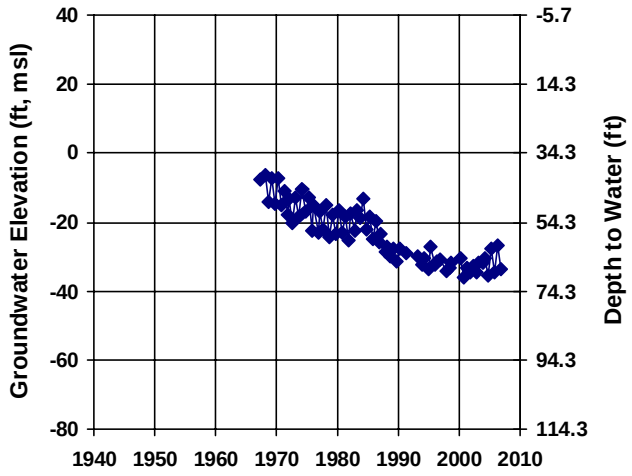
Reference Elevation: 45.5 ft, msl

SWN: 09N05E28H001M Depth: NA Perf: NA



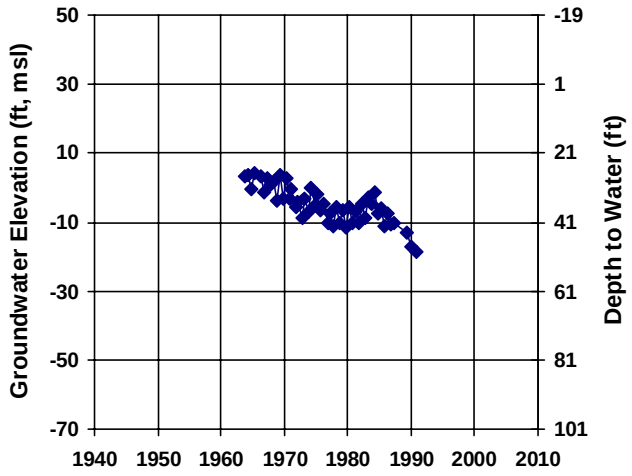
Reference Elevation: 38.6 ft, msl

SWN: 09N05E28K001M Depth: 250 Perf: 221-225



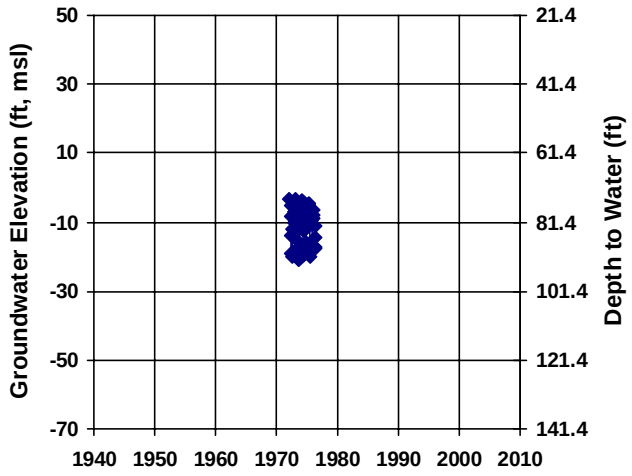
Reference Elevation: 34.3 ft, msl

SWN: 09N05E28N001M Depth: NA Perf: NA



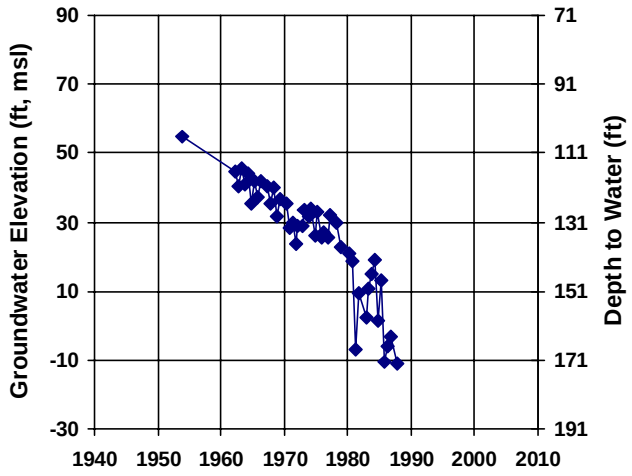
Reference Elevation: 31.0 ft, msl

SWN: 09N05E36H001M Depth: NA Perf: NA



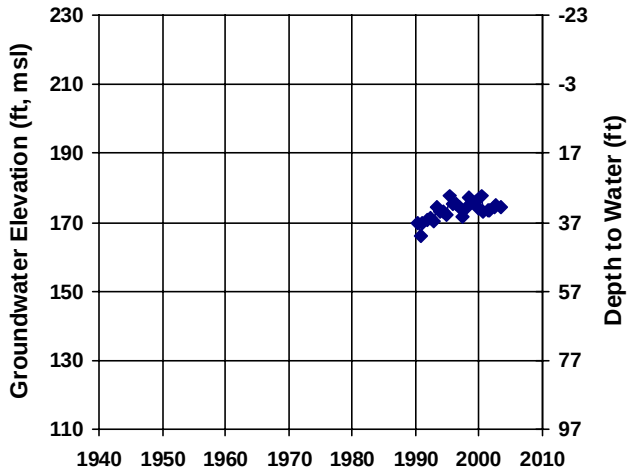
Reference Elevation: 71.4 ft, msl

SWN: 09N06E02P001M Depth: 320 Perf: 254-290



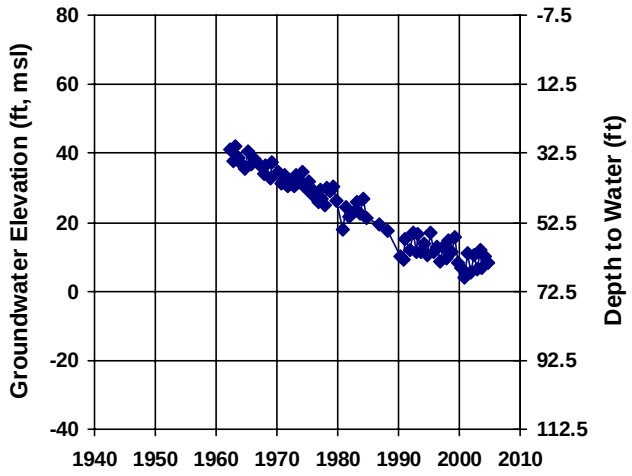
Reference Elevation: 161.0 ft, msl

SWN: 09N06E12Q001M Depth: NA Perf: NA



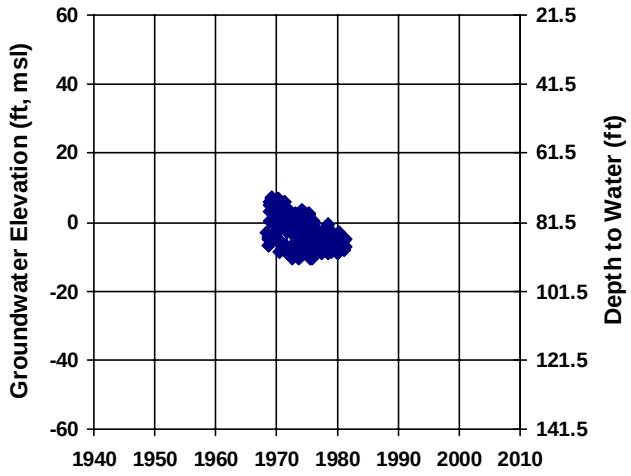
Reference Elevation: 207.0 ft, msl

SWN: 09N06E27D001M Depth: 200 Perf: NA



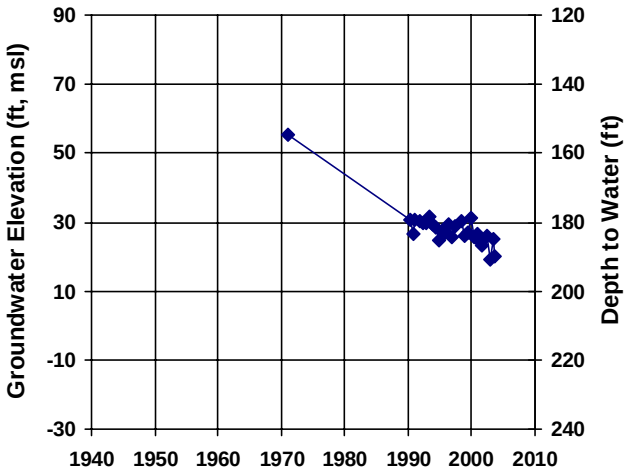
Reference Elevation: 72.5 ft, msl

SWN: 09N06E30J001M Depth: 96 Perf: NA



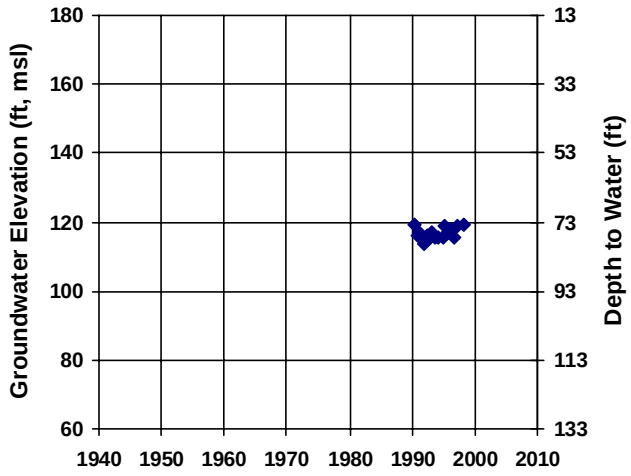
Reference Elevation: 81.5 ft, msl

SWN: 09N07E07F001M Depth: 600 Perf: NA



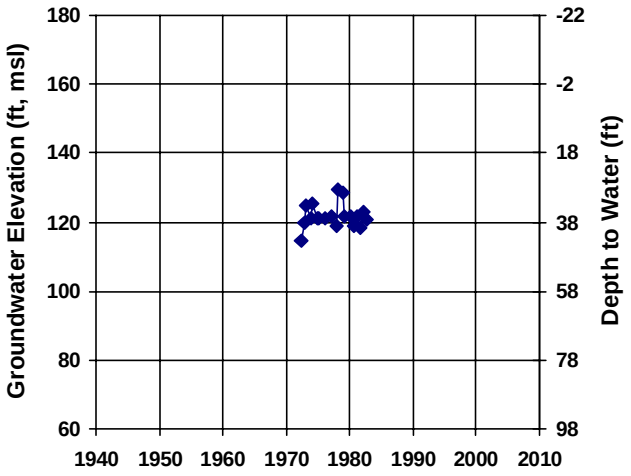
Reference Elevation: 210.0 ft, msl

SWN: 09N07E09A001M Depth: 130 Perf: NA



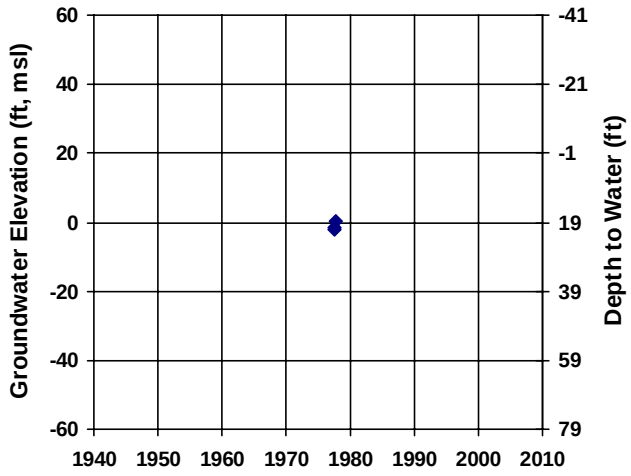
Reference Elevation: 193.0 ft, msl

SWN: 09N07E10D001M Depth: 175 Perf: NA



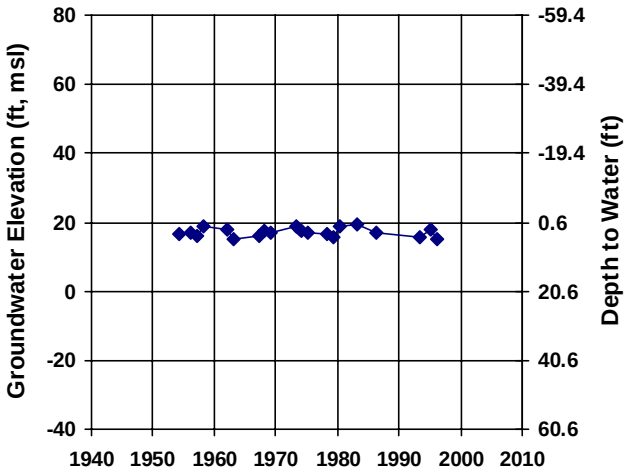
Reference Elevation: 158.0 ft, msl

SWN: 10N03E25N001M Depth: NA Perf: NA



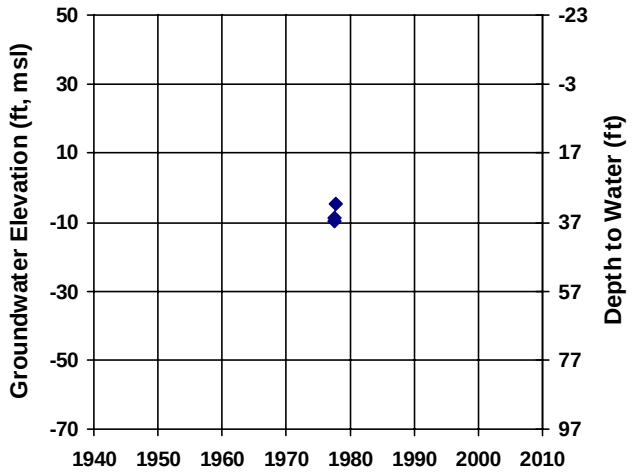
Reference Elevation: 19.0 ft, msl

SWN: 10N03E35A001M Depth: 96 Perf: 73-96



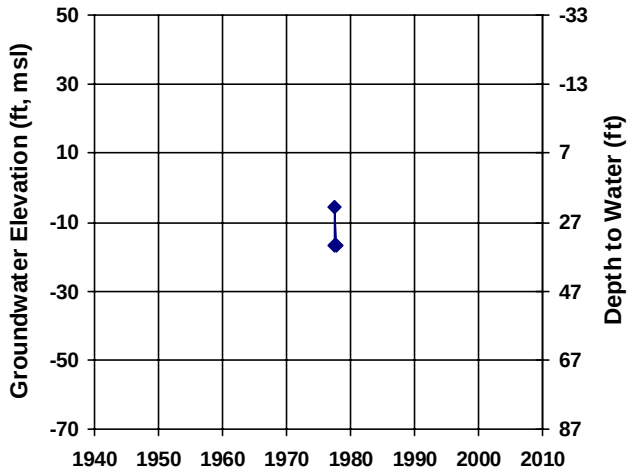
Reference Elevation: 20.6 ft, msl

SWN: 10N03E35P002M Depth: NA Perf: NA



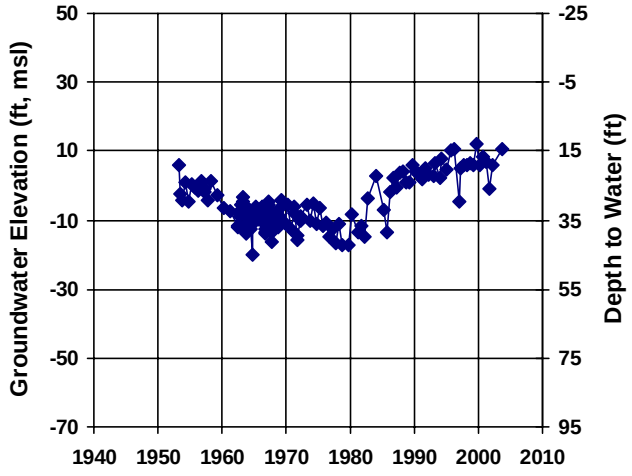
Reference Elevation: 27.0 ft, msl

SWN: 10N03E36C002M Depth: NA Perf: NA



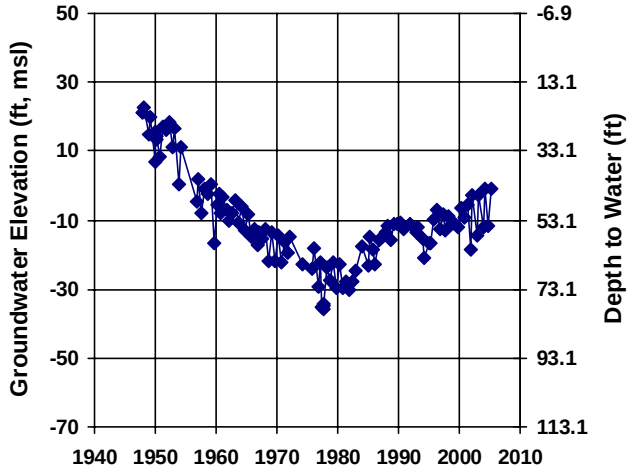
Reference Elevation: 17.0 ft, msl

SWN: 10N04E02K001M Depth: NA Perf: NA



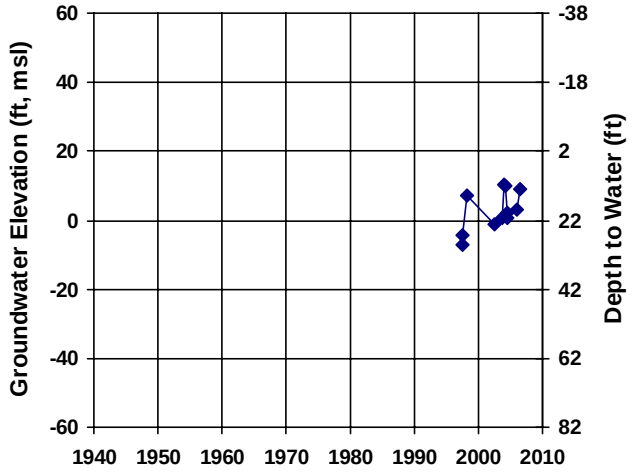
Reference Elevation: 25.0 ft, msl

SWN: 10N04E12A001M Depth: 290 Perf: NA



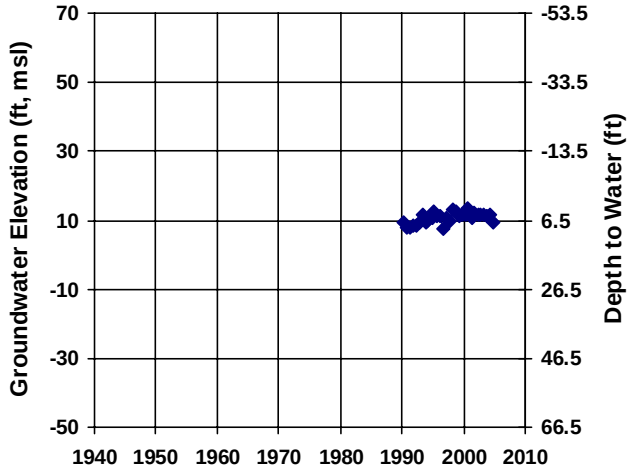
Reference Elevation: 43.1 ft, msl

SWN: 10N04E13F001M Depth: 50 Perf: NA



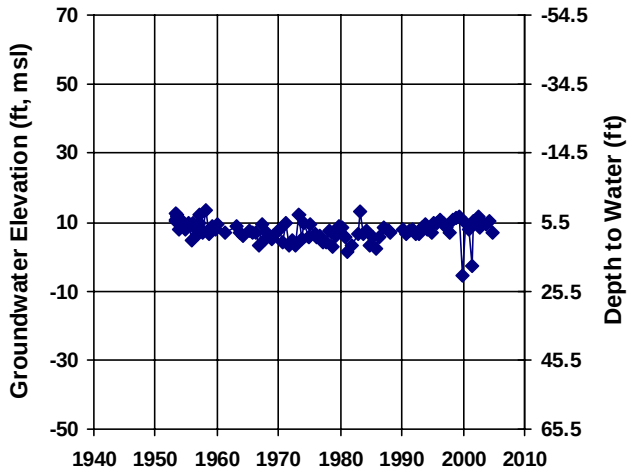
Reference Elevation: 22.0 ft, msl

SWN: 10N04E21B002M Depth: NA Perf: NA



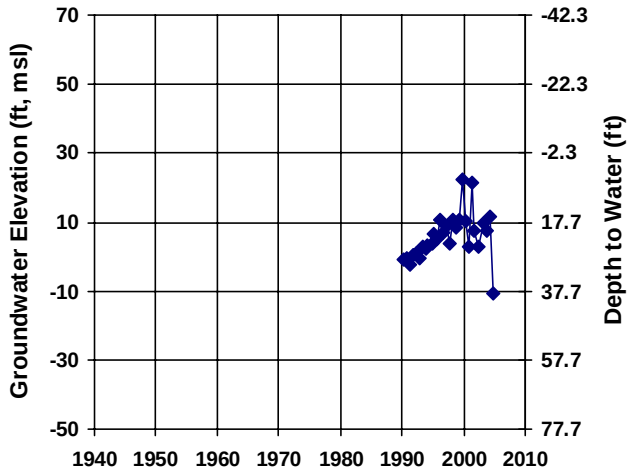
Reference Elevation: 16.5 ft, msl

SWN: 10N04E23A001M Depth: 85 Perf: NA



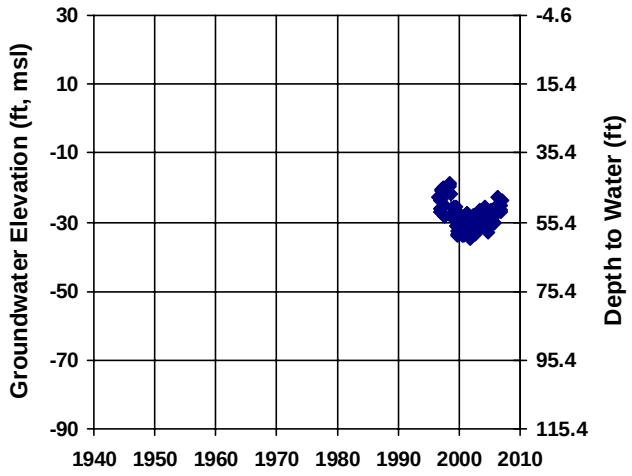
Reference Elevation: 15.5 ft, msl

SWN: 10N04E24B001M Depth: NA Perf: NA



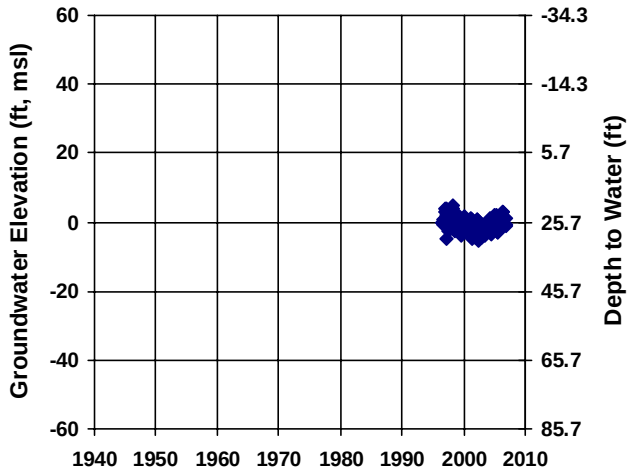
Reference Elevation: 27.7 ft, msl

SWN: 10N04E27R002M Depth: 995 Perf: 745-985



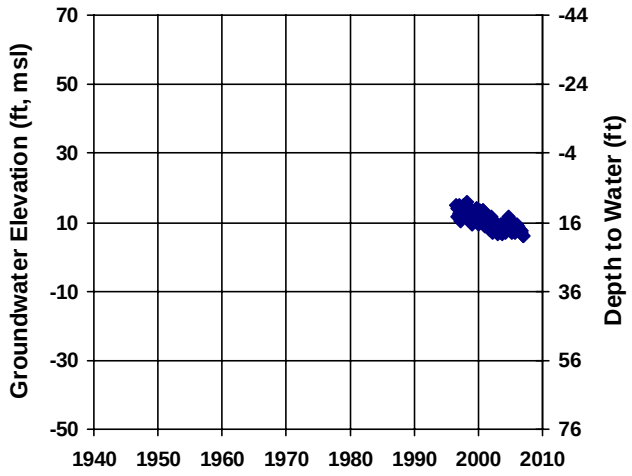
Reference Elevation: 25.4 ft, msl

SWN: 10N04E27R003M Depth: 500 Perf: 470-490



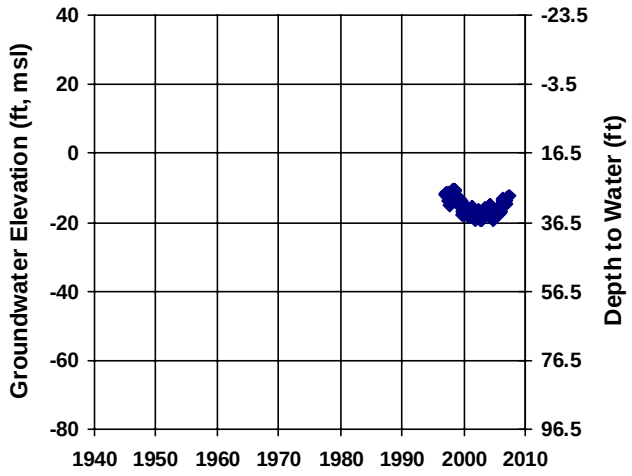
Reference Elevation: 25.7 ft, msl

SWN: 10N04E27R004M Depth: 220 Perf: 190-210



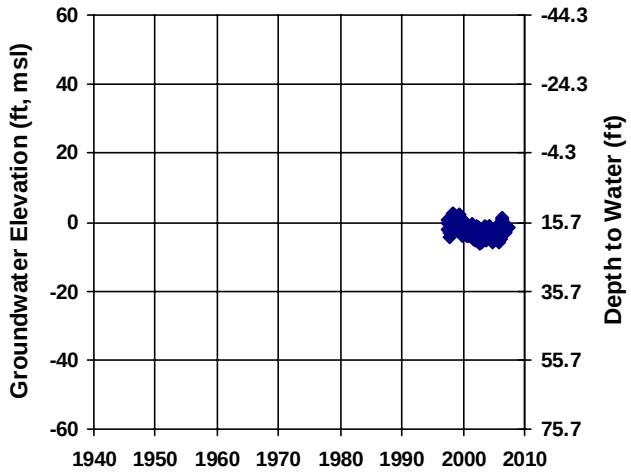
Reference Elevation: 26.0 ft, msl

SWN: 10N04E31M001M Depth: 1080 Perf: 1060-1070



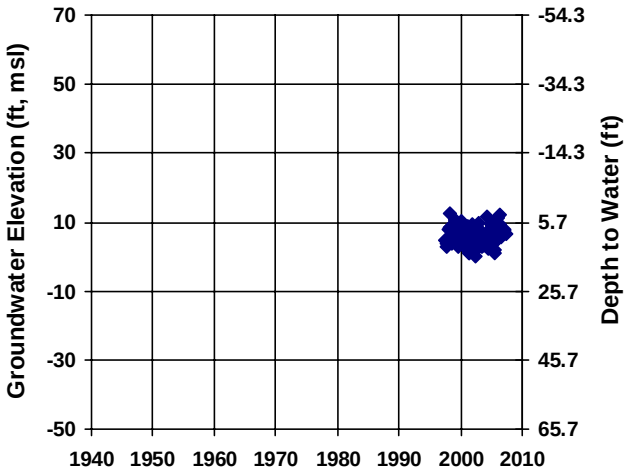
Reference Elevation: 16.5 ft, msl

SWN: 10N04E31M002M Depth: 815 Perf: 795-805



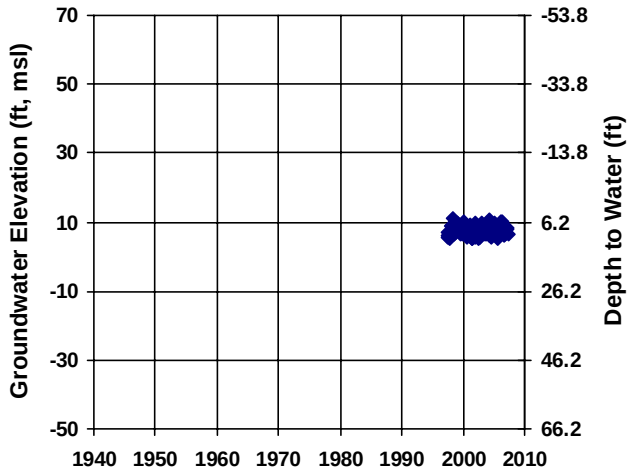
Reference Elevation: 15.7 ft, msl

SWN: 10N04E31M003M Depth: 410 Perf: 380-400



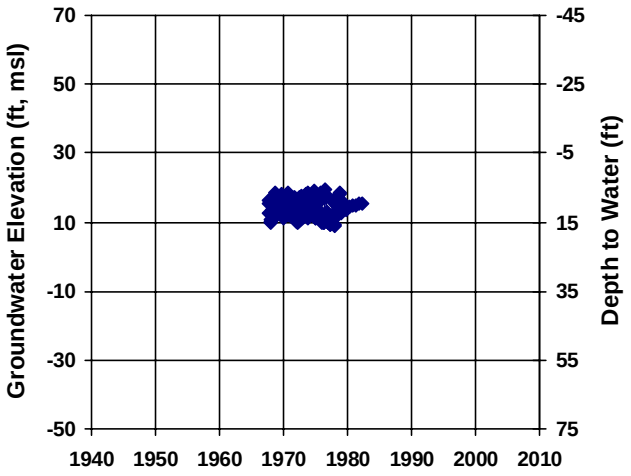
Reference Elevation: 15.7 ft, msl

SWN: 10N04E31M004M Depth: 200 Perf: 170-190



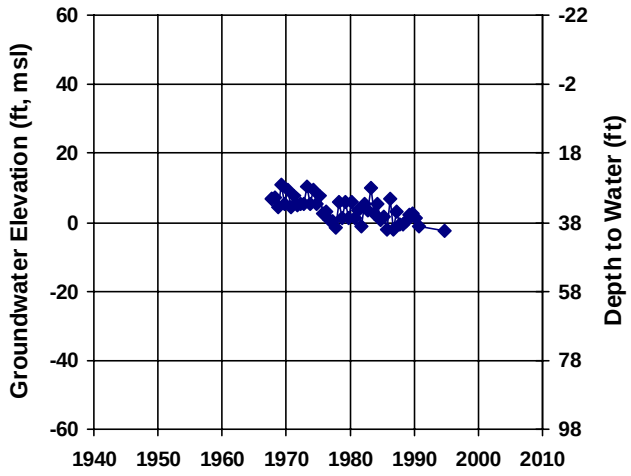
Reference Elevation: 16.2 ft, msl

SWN: 10N04E34A002M Depth: NA Perf: NA



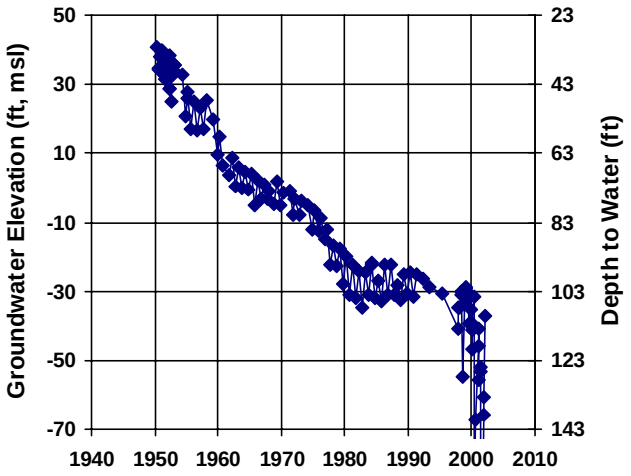
Reference Elevation: 25.0 ft, msl

SWN: 10N04E36B001M Depth: 147 Perf: NA



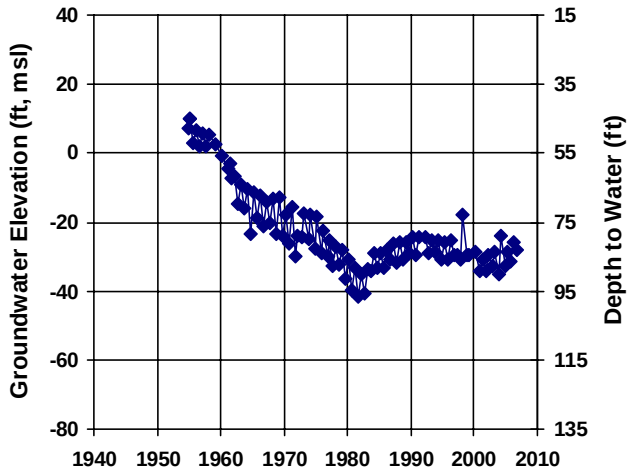
Reference Elevation: 38.0 ft, msl

SWN: 10N05E04Q001M Depth: 550 Perf: NA



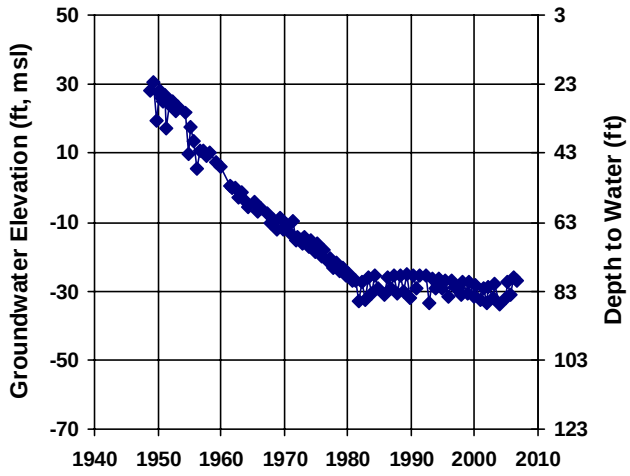
Reference Elevation: 73.0 ft, msl

SWN: 10N05E05E001M Depth: 210 Perf: 124-210



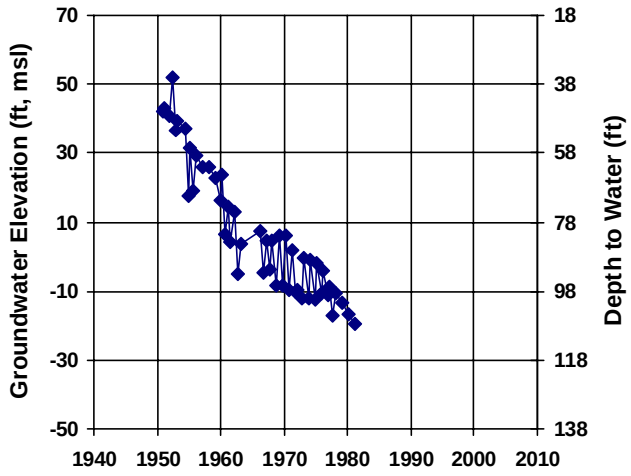
Reference Elevation: 55.0 ft, msl

SWN: 10N05E08L002M Depth: 190 Perf: NA



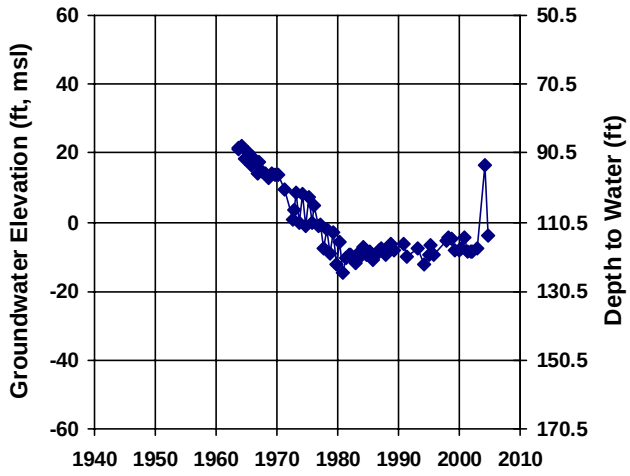
Reference Elevation: 53.0 ft, msl

SWN: 10N05E10J003M Depth: NA Perf: NA



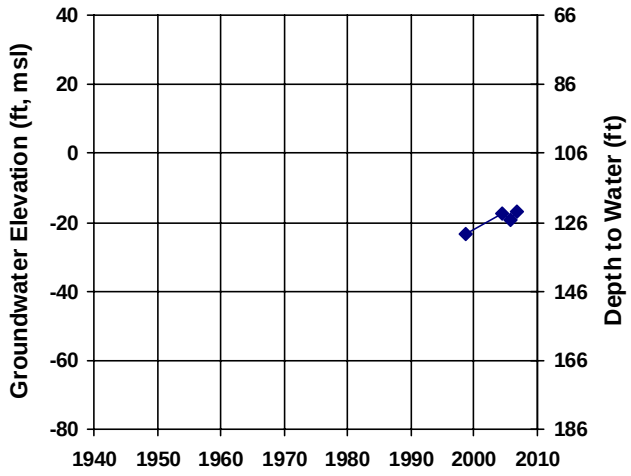
Reference Elevation: 88.0 ft, msl

SWN: 10N05E12D001M Depth: 410 Perf: NA



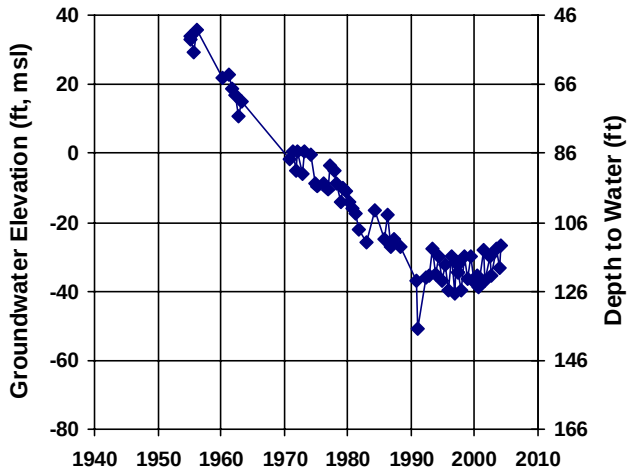
Reference Elevation: 110.5 ft, msl

SWN: 10N05E13F001M Depth: 166 Perf: NA



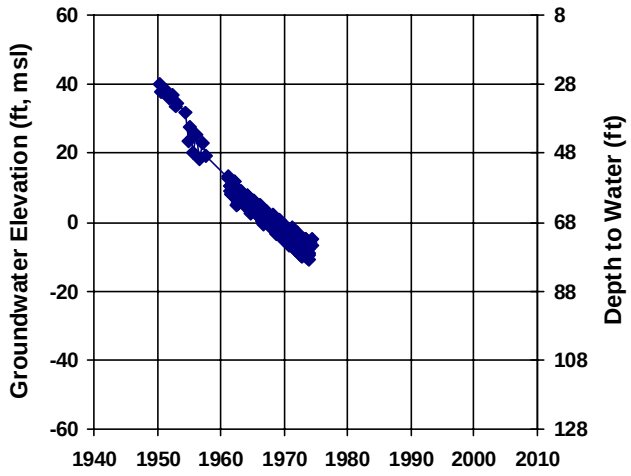
Reference Elevation: 106.0 ft, msl

SWN: 10N05E14Q002M Depth: 225 Perf: 116-225



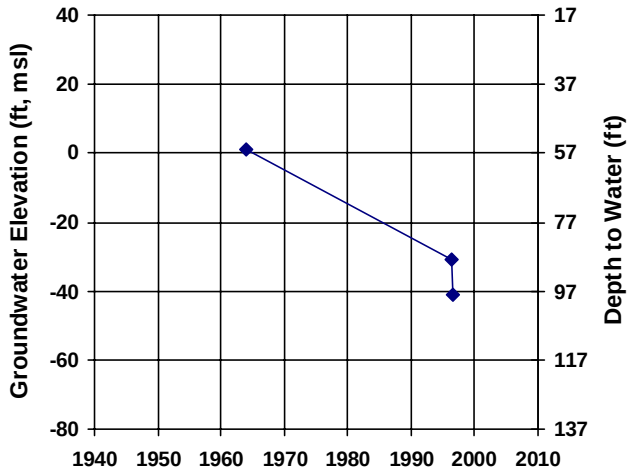
Reference Elevation: 86.0 ft, msl

SWN: 10N05E15P001M Depth: 180 Perf: NA



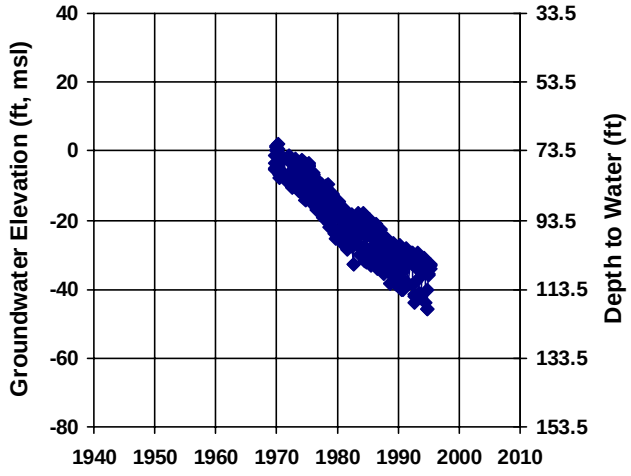
Reference Elevation: 68.0 ft, msl

SWN: 10N05E17H001M Depth: 240 Perf: NA



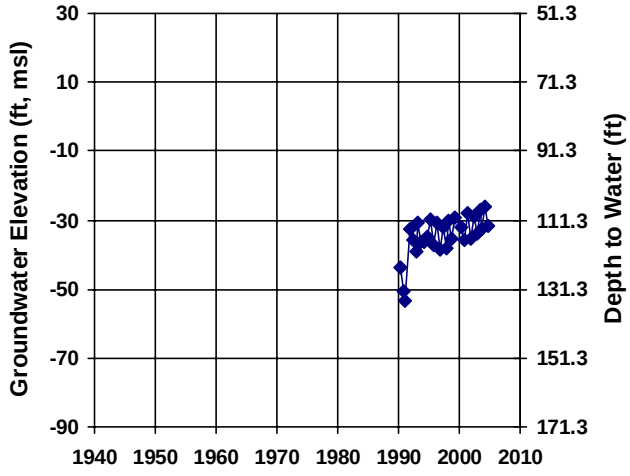
Reference Elevation: 57.0 ft, msl

SWN: 10N05E22G001M Depth: 482 Perf: 333-460



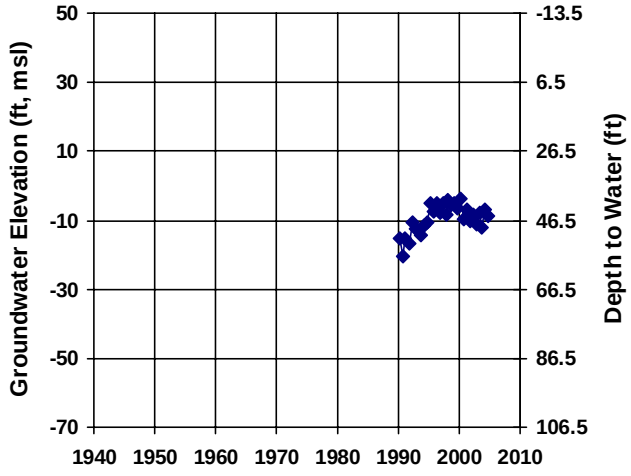
Reference Elevation: 73.5 ft, msl

SWN: 10N05E26B002M Depth: 150 Perf: NA



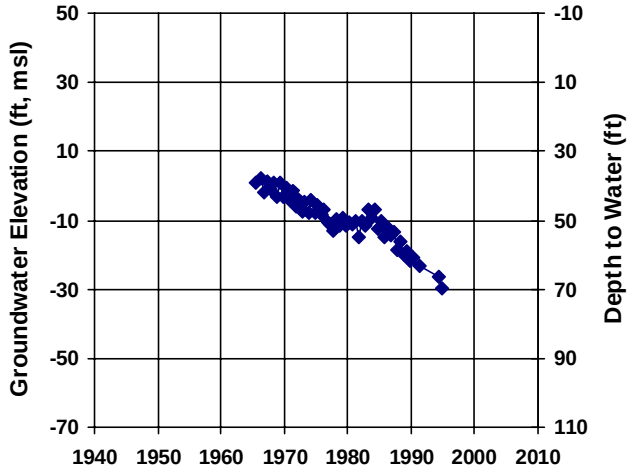
Reference Elevation: 81.3 ft, msl

SWN: 10N05E30L001M Depth: NA Perf: NA



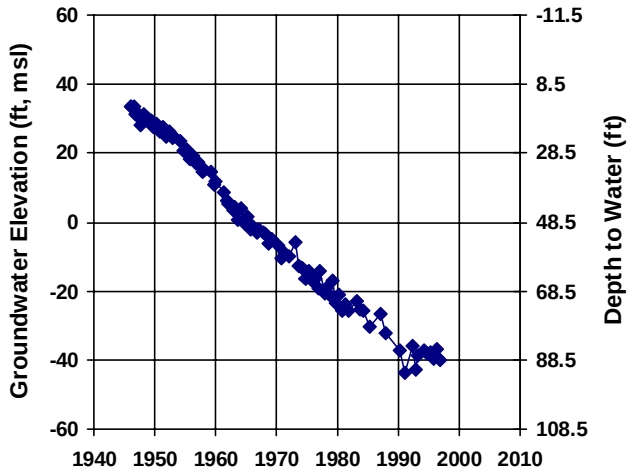
Reference Elevation: 36.5 ft, msl

SWN: 10N05E32Q002M Depth: NA Perf: NA



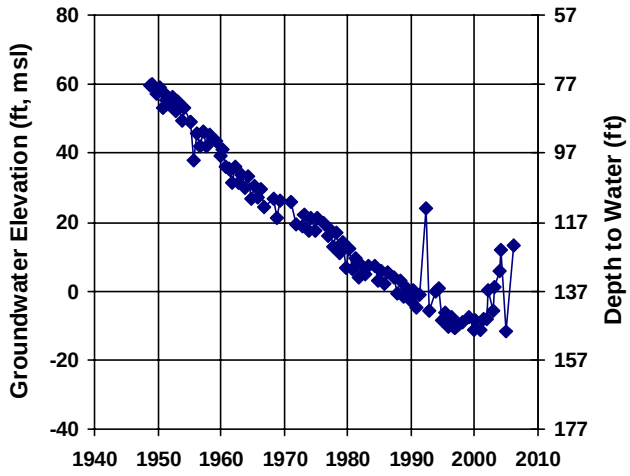
Reference Elevation: 40.0 ft, msl

SWN: 10N05E34M001M Depth: 125 Perf: NA



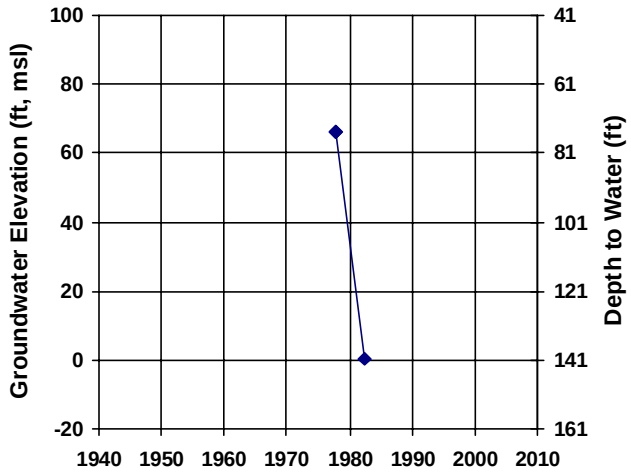
Reference Elevation: 48.5 ft, msl

SWN: 10N06E03M001M Depth: 270 Perf: NA



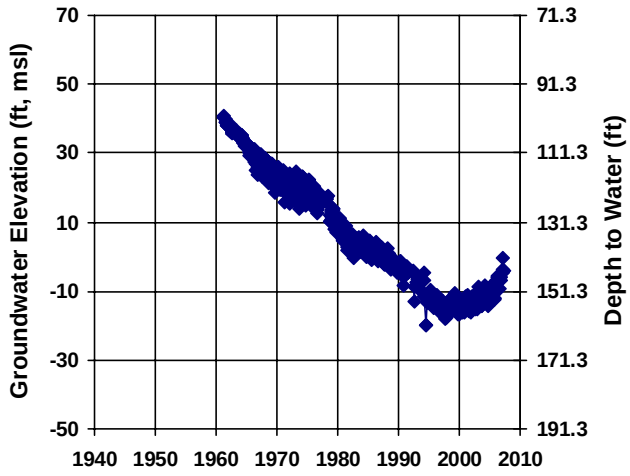
Reference Elevation: 137.0 ft, msl

SWN: 10N06E05A001M Depth: 255 Perf: NA



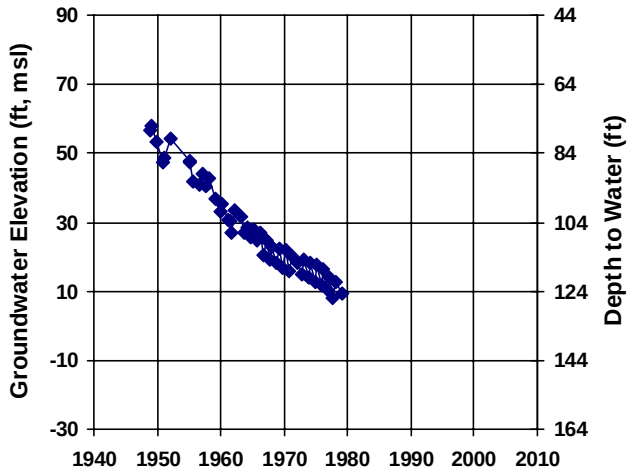
Reference Elevation: 141.0 ft, msl

SWN: 10N06E05H001M Depth: 256 Perf: 150-256



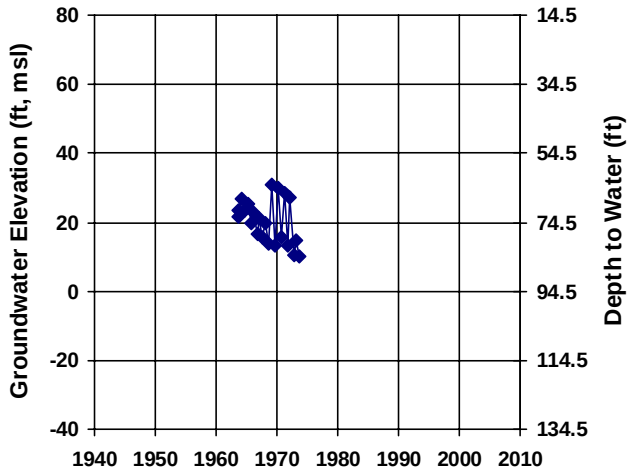
Reference Elevation: 141.3 ft, msl

SWN: 10N06E05L001M Depth: 400 Perf: NA



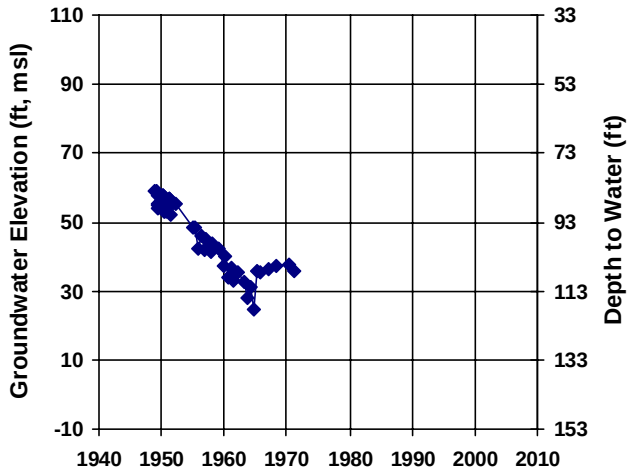
Reference Elevation: 134.0 ft, msl

SWN: 10N06E07L001M Depth: 180 Perf: NA



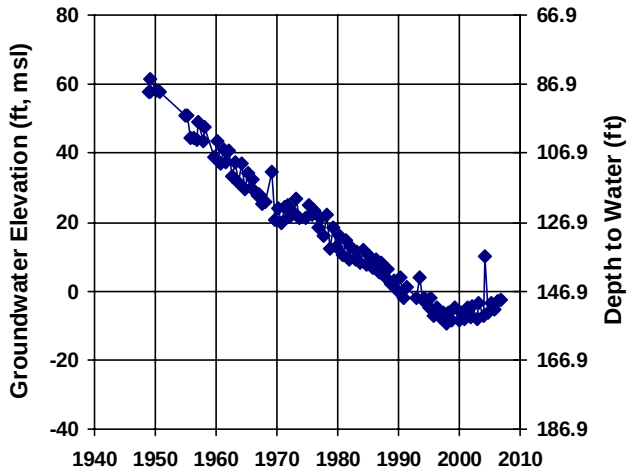
Reference Elevation: 94.5 ft, msl

SWN: 10N06E09D001M Depth: 350 Perf: NA



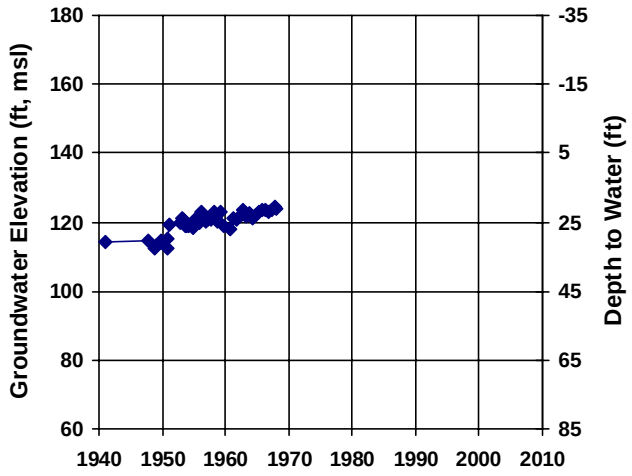
Reference Elevation: 143.0 ft, msl

SWN: 10N06E10C001M Depth: 400 Perf: NA



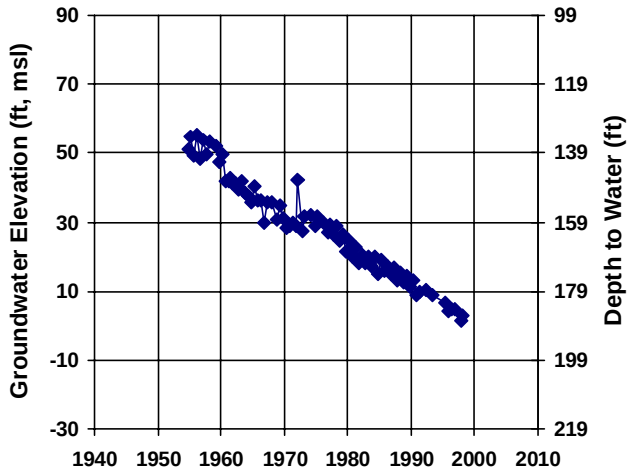
Reference Elevation: 146.9 ft, msl

SWN: 10N06E12D001M Depth: 62 Perf: NA



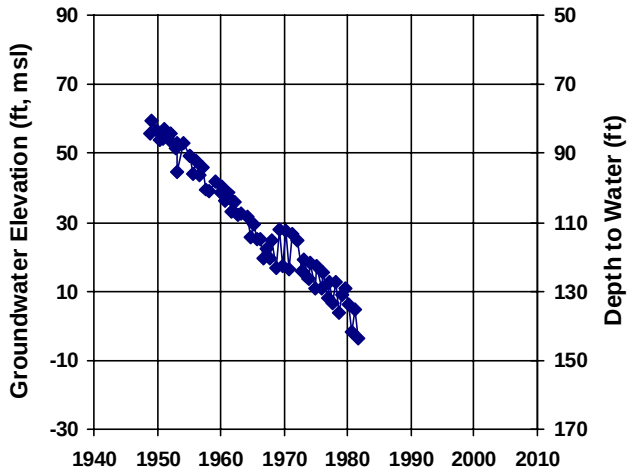
Reference Elevation: 145.0 ft, msl

SWN: 10N06E13C001M Depth: 218 Perf: 192-218



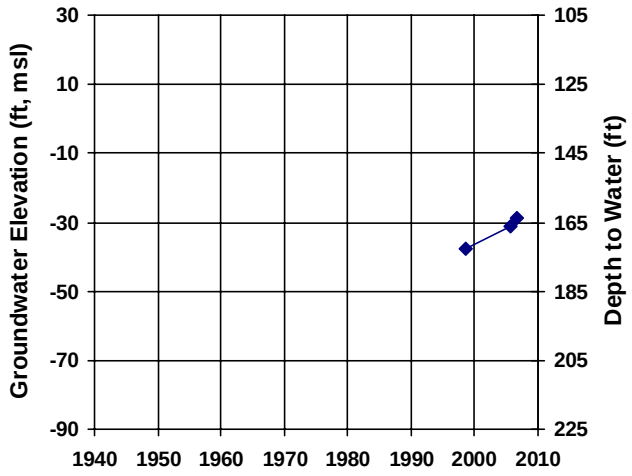
Reference Elevation: 189.0 ft, msl

SWN: 10N06E17A001M Depth: 340 Perf: NA



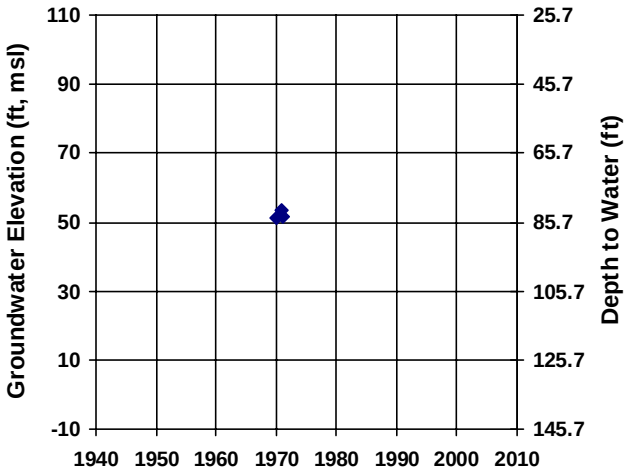
Reference Elevation: 140.0 ft, msl

SWN: 10N06E18R001M Depth: 200 Perf: NA



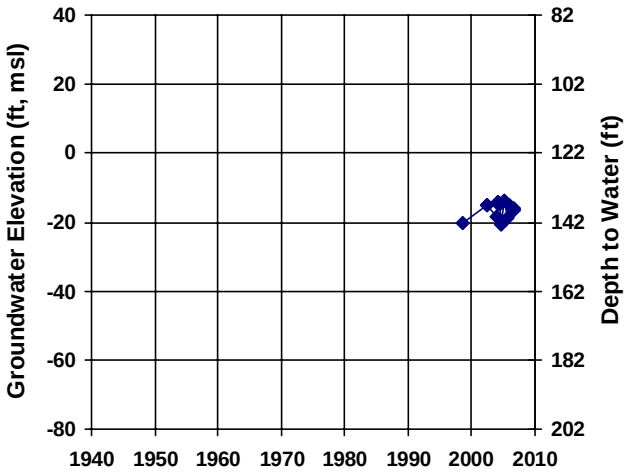
Reference Elevation: 135.0 ft, msl

SWN: 10N06E22N001M Depth: NA Perf: NA



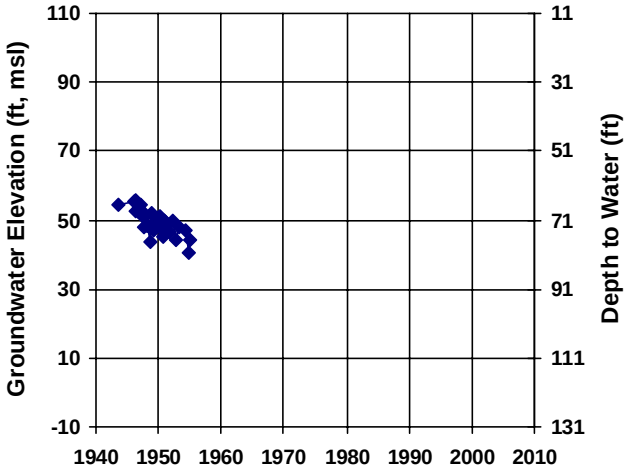
Reference Elevation: 135.7 ft, msl

SWN: 10N06E27F001M Depth: 198 Perf: NA



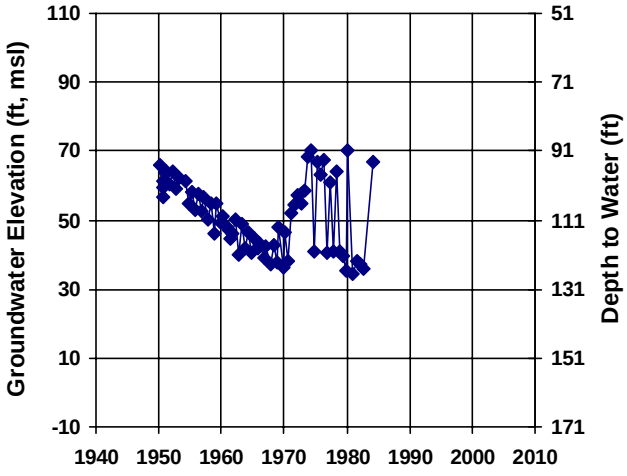
Reference Elevation: 122.0 ft, msl

SWN: 10N06E33K001M Depth: 166 Perf: NA



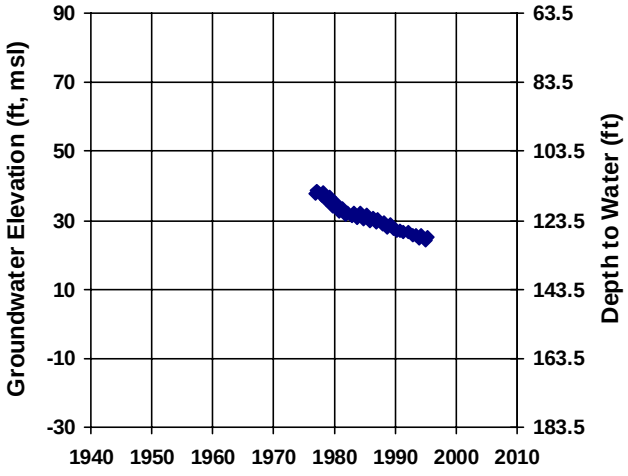
Reference Elevation: 121.0 ft, msl

SWN: 10N07E07E002M Depth: 300 Perf: NA



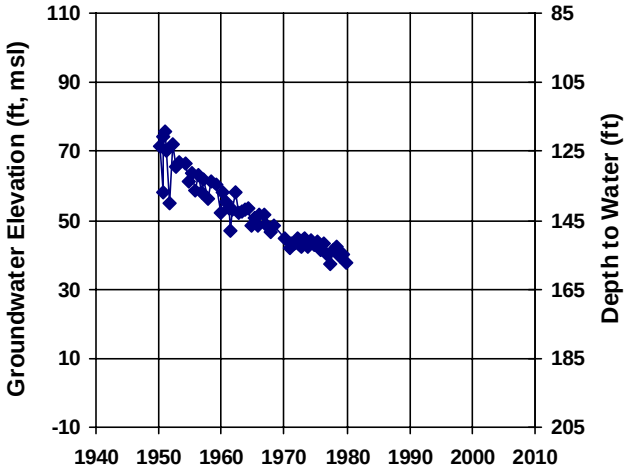
Reference Elevation: 161.0 ft, msl

SWN: 10N07E18B001M Depth: 270 Perf: NA



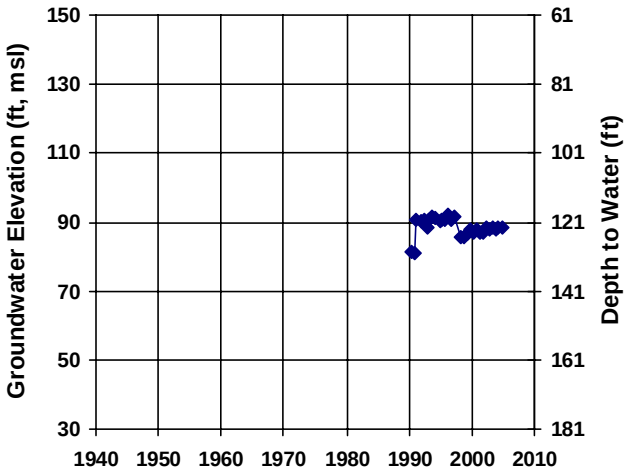
Reference Elevation: 153.5 ft, msl

SWN: 10N07E18J001M Depth: 164 Perf: NA



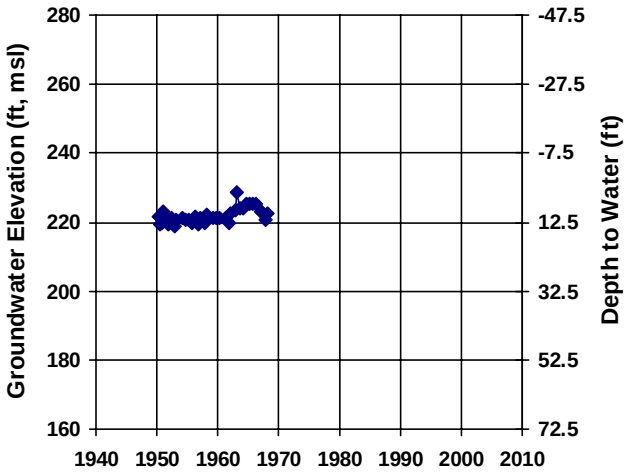
Reference Elevation: 195.0 ft, msl

SWN: 10N07E20D001M Depth: 185 Perf: NA



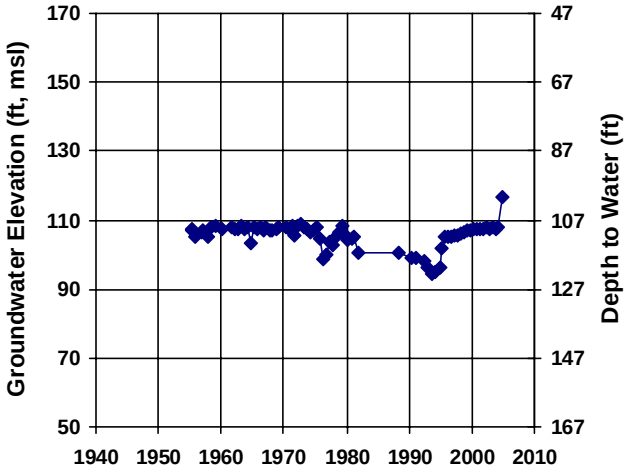
Reference Elevation: 211.0 ft, msl

SWN: 10N07E21H001M Depth: NA Perf: NA



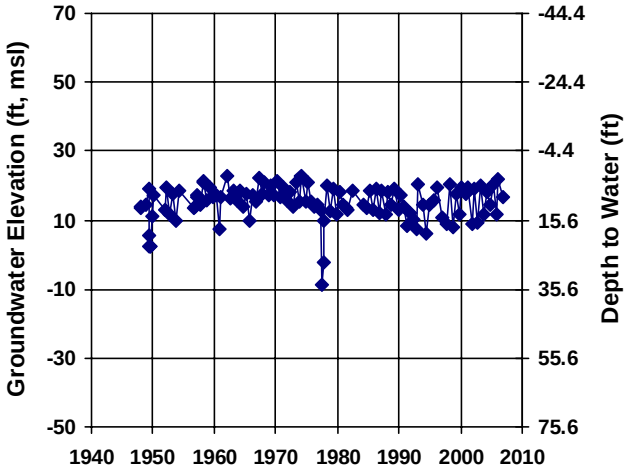
Reference Elevation: 232.5 ft, msl

SWN: 10N07E29G001M Depth: 240 Perf: NA



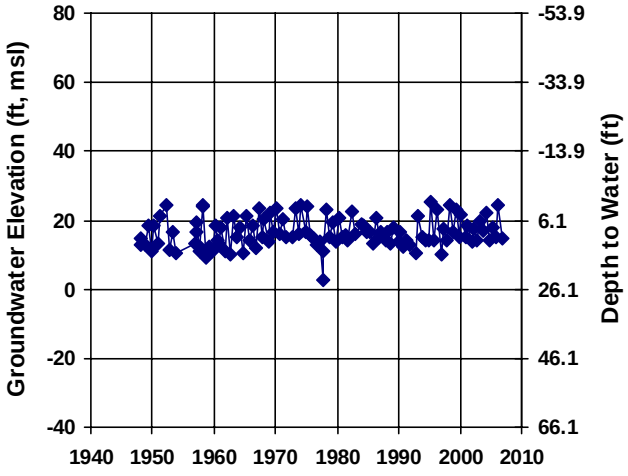
Reference Elevation: 217.0 ft, msl

SWN: 11N03E01D001M Depth: NA Perf: NA



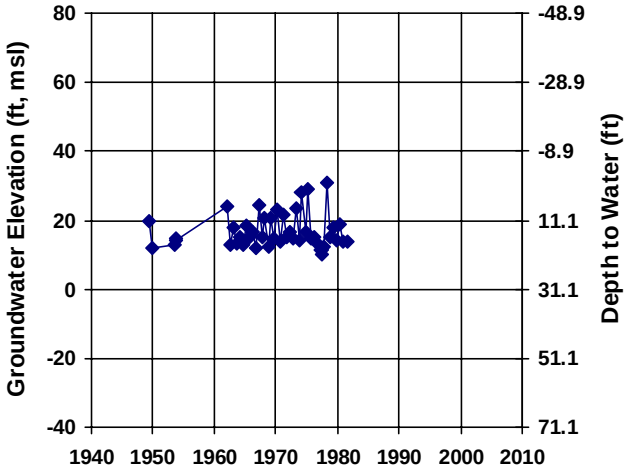
Reference Elevation: 25.6 ft, msl

SWN: 11N03E03C002M Depth: 97 Perf: NA



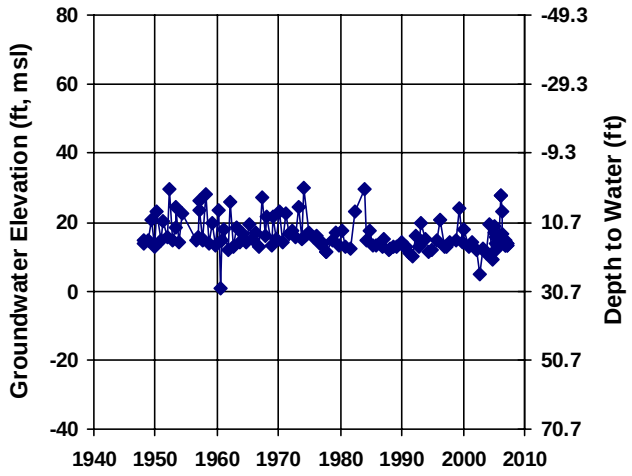
Reference Elevation: 26.1 ft, msl

SWN: 11N03E10N001M Depth: 200 Perf: 92-190



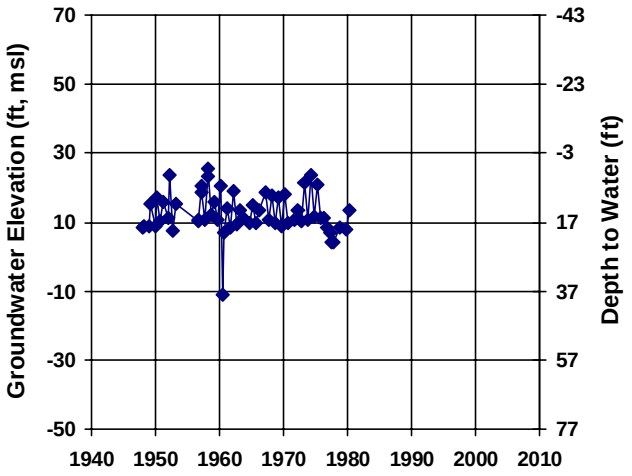
Reference Elevation: 31.1 ft, msl

SWN: 11N03E15C001M Depth: 108 Perf: 68-90



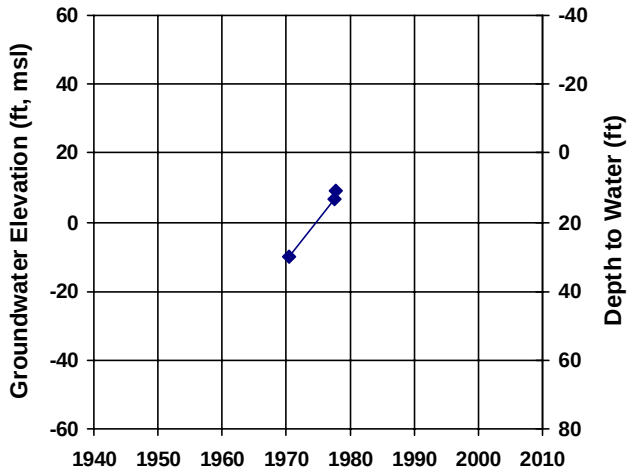
Reference Elevation: 30.7 ft, msl

SWN: 11N03E22H001M Depth: 129 Perf: NA



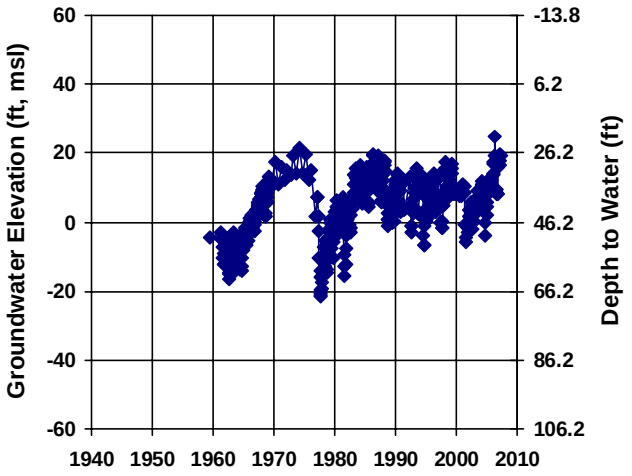
Reference Elevation: 27.0 ft, msl

SWN: 11N03E23R002M Depth: 180 Perf: NA



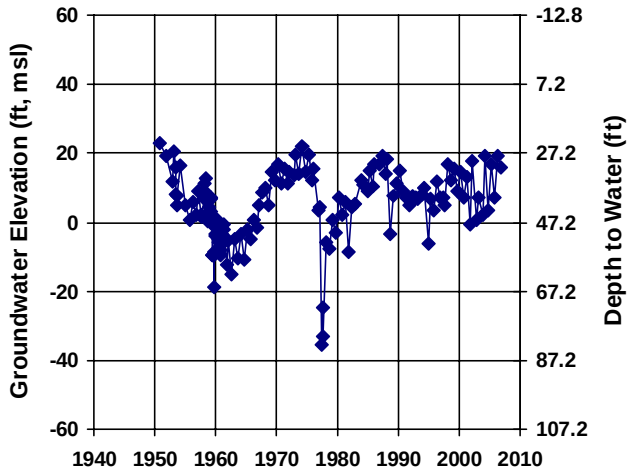
Reference Elevation: 20.0 ft, msl

SWN: 11N04E01M002M Depth: 76 Perf: NA



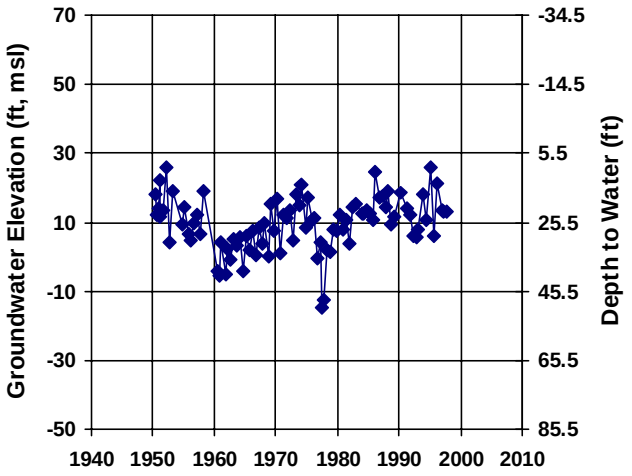
Reference Elevation: 46.2 ft, msl

SWN: 11N04E01M003M Depth: 152 Perf: NA



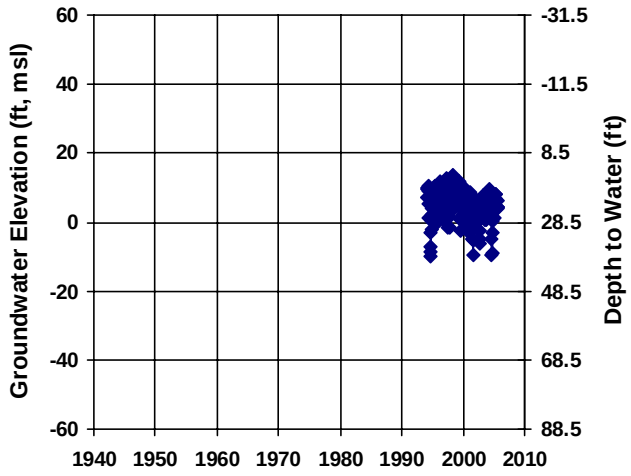
Reference Elevation: 47.2 ft, msl

SWN: 11N04E03P002M Depth: NA Perf: NA



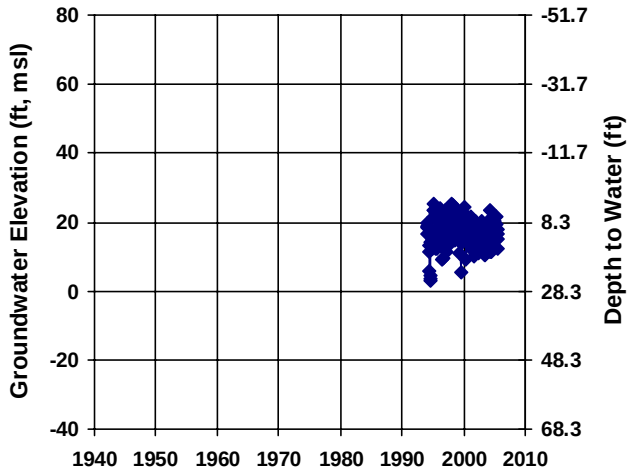
Reference Elevation: 35.5 ft, msl

SWN: 11N04E04N001M Depth: 890 Perf: 880-890



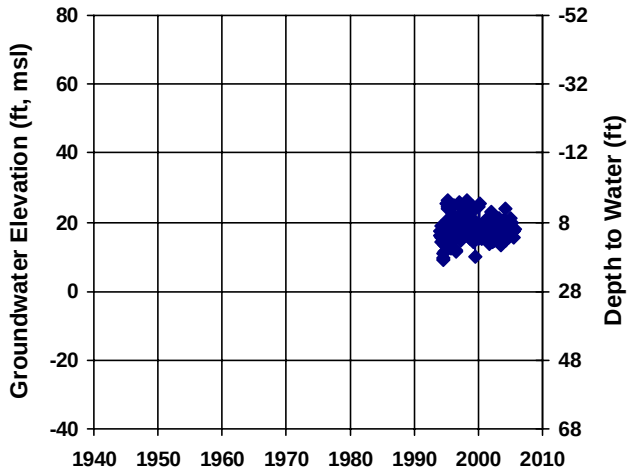
Reference Elevation: 28.5 ft, msl

SWN: 11N04E04N002M Depth: 305 Perf: 295-305



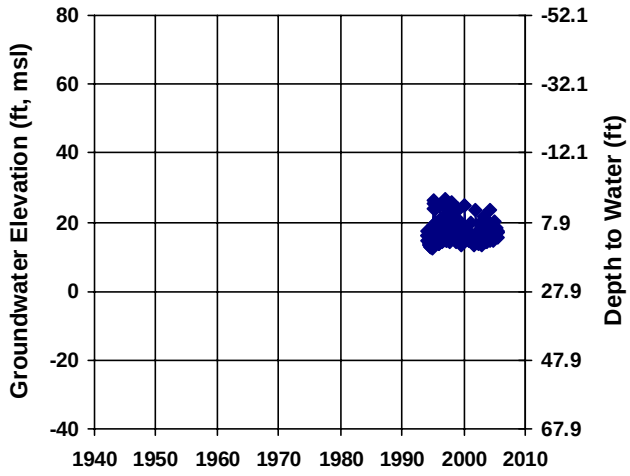
Reference Elevation: 28.3 ft, msl

SWN: 11N04E04N003M Depth: 195 Perf: 185-195



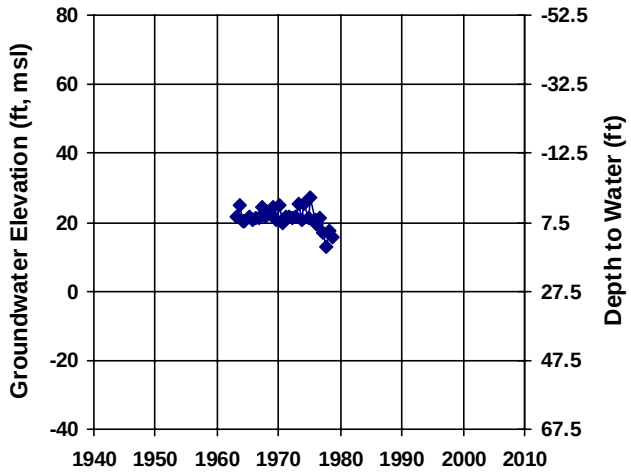
Reference Elevation: 28.0 ft, msl

SWN: 11N04E04N004M Depth: 120 Perf: 110-120



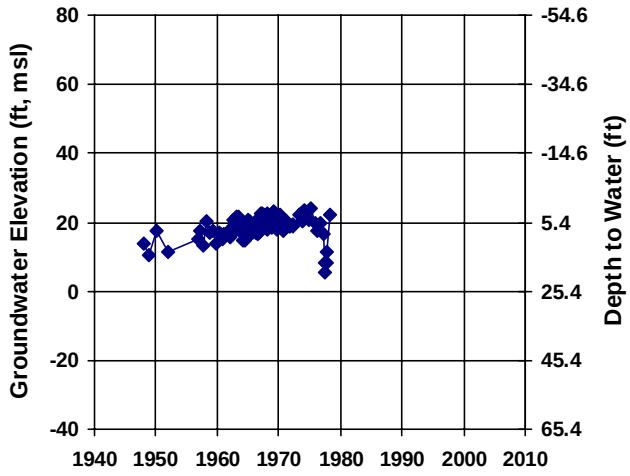
Reference Elevation: 27.9 ft, msl

SWN: 11N04E05B002M Depth: 76 Perf: NA



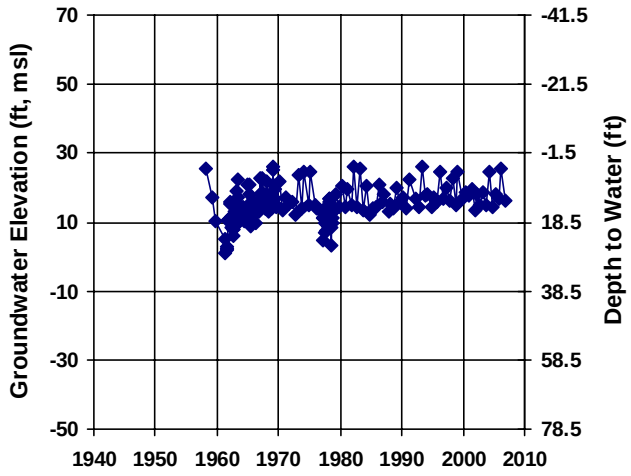
Reference Elevation: 27.5 ft, msl

SWN: 11N04E06B001M Depth: NA Perf: NA



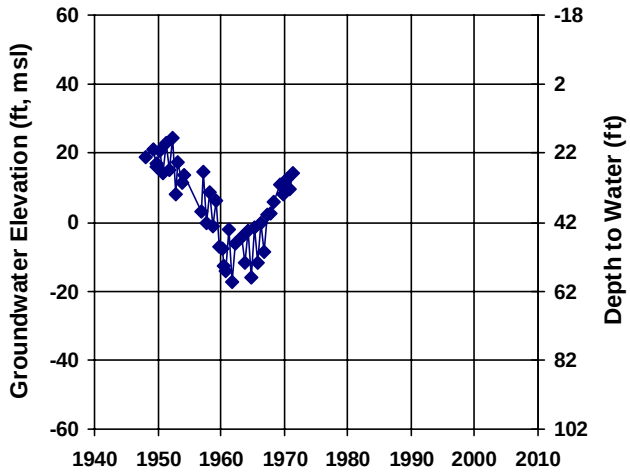
Reference Elevation: 25.4 ft, msl

SWN: 11N04E09D002M Depth: 100 Perf: NA



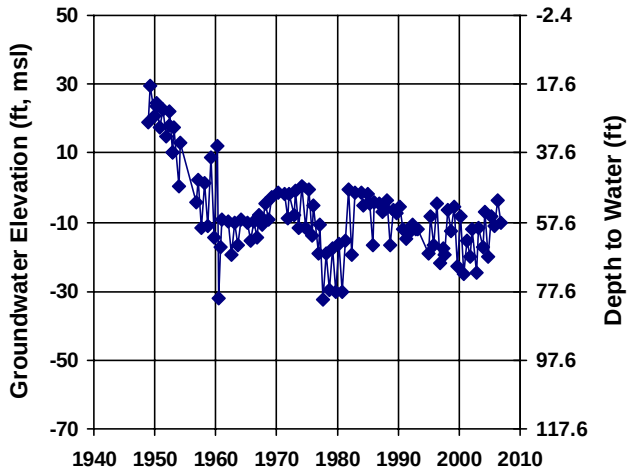
Reference Elevation: 28.5 ft, msl

SWN: 11N04E11C002M Depth: NA Perf: NA



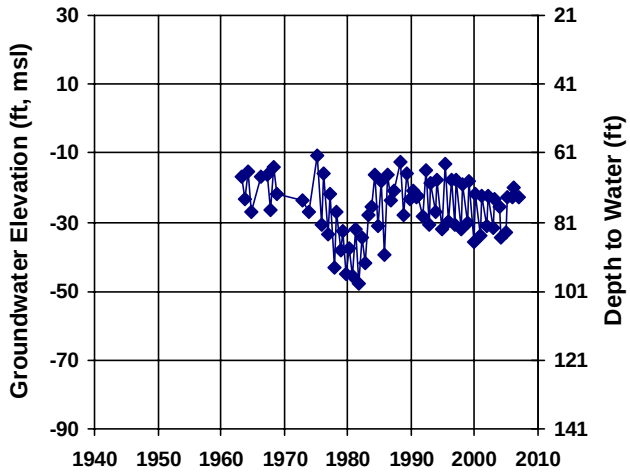
Reference Elevation: 42.0 ft, msl

SWN: 11N04E13D001M Depth: 535 Perf: NA



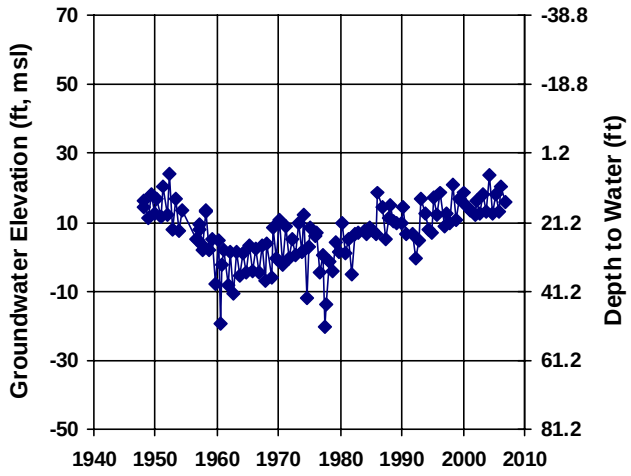
Reference Elevation: 47.6 ft, msl

SWN: 11N04E13R001M Depth: NA Perf: NA



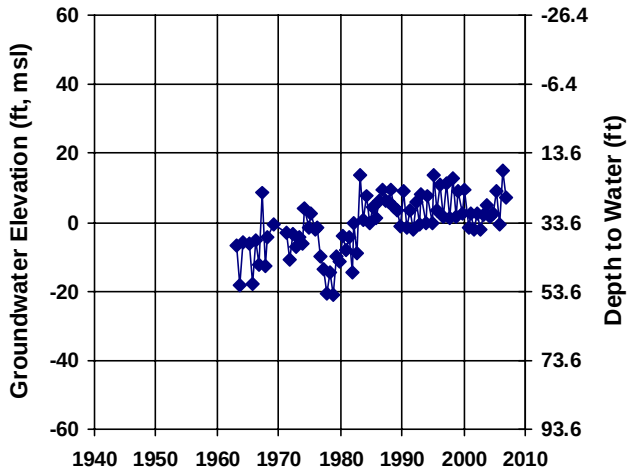
Reference Elevation: 51.0 ft, msl

SWN: 11N04E15C001M Depth: 136 Perf: NA



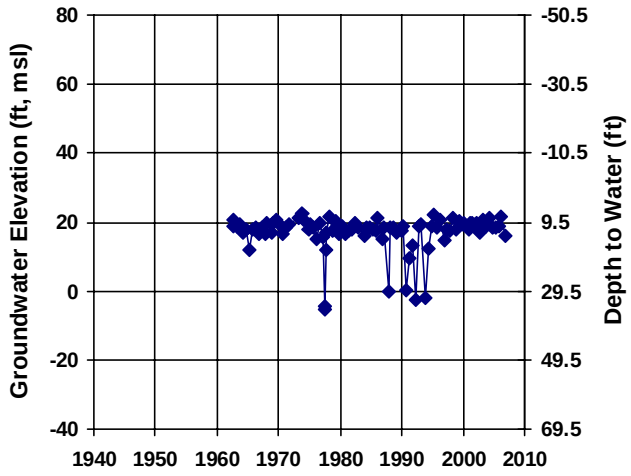
Reference Elevation: 31.2 ft, msl

SWN: 11N04E15Q001M Depth: NA Perf: NA



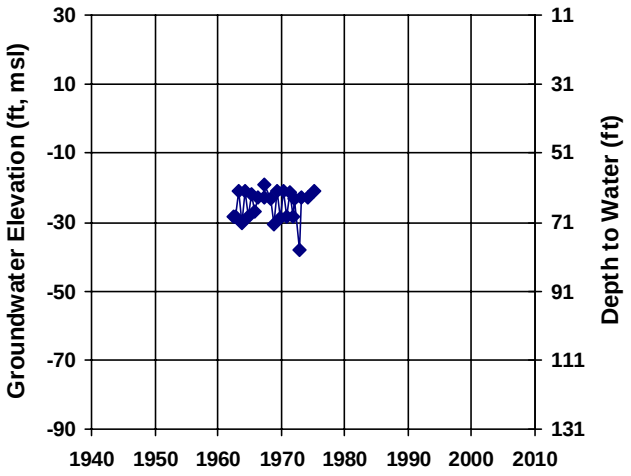
Reference Elevation: 33.6 ft, msl

SWN: 11N04E19E002M Depth: NA Perf: NA



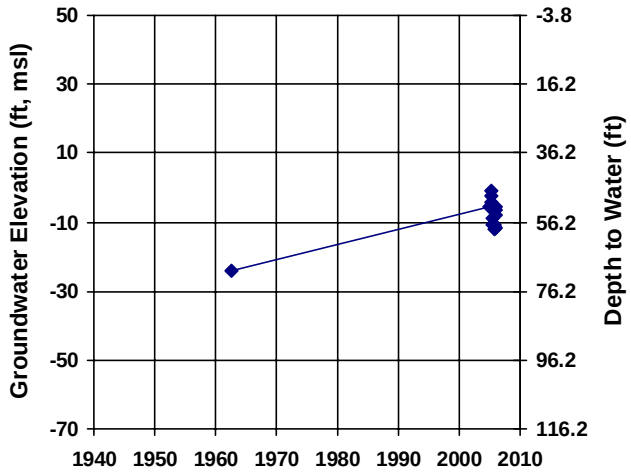
Reference Elevation: 29.5 ft, msl

SWN: 11N04E23J001M Depth: 280 Perf: NA



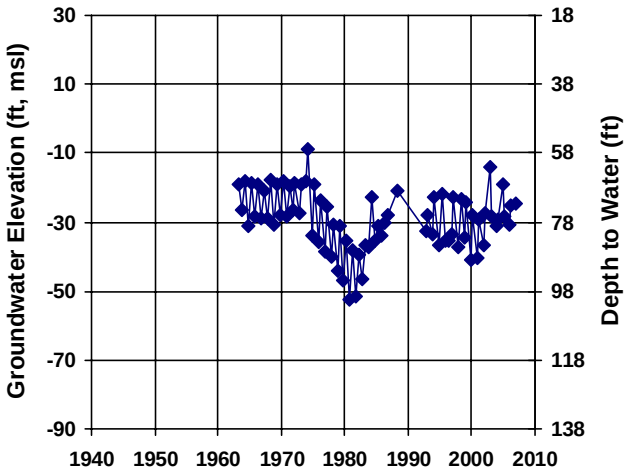
Reference Elevation: 41.0 ft, msl

SWN: 11N04E23P002M Depth: 200 Perf: 80-200



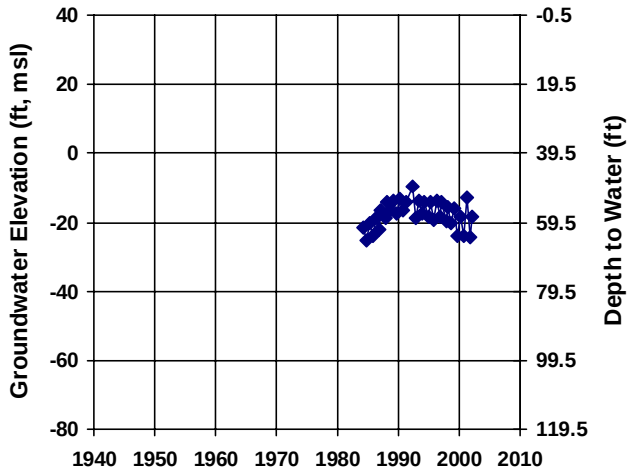
Reference Elevation: 46.2 ft, msl

SWN: 11N04E24R001M Depth: 420 Perf: 88-420



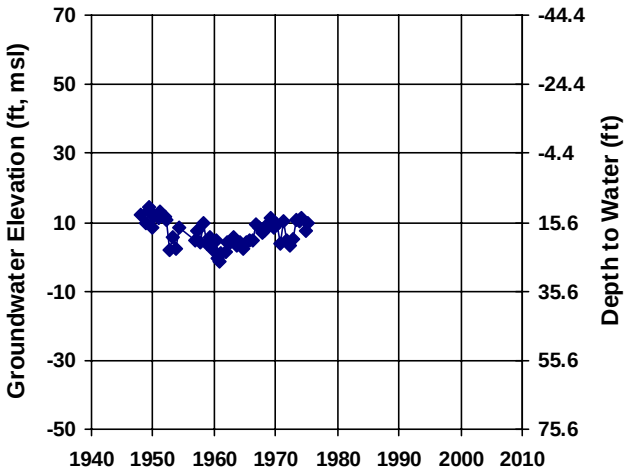
Reference Elevation: 48.0 ft, msl

SWN: 11N04E25N001M Depth: 190 Perf: NA



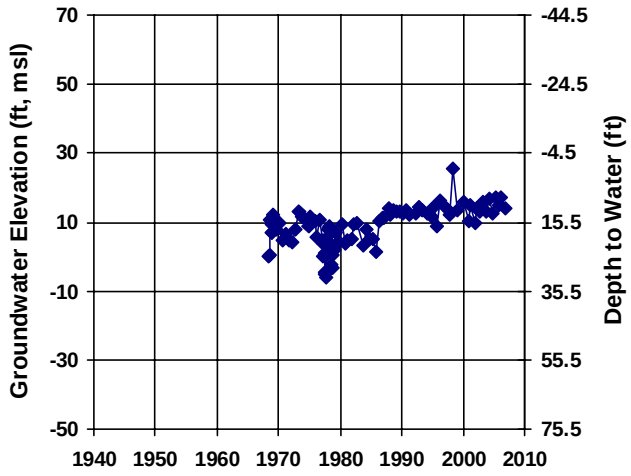
Reference Elevation: 39.5 ft, msl

SWN: 11N04E33J001M Depth: 285 Perf: 82-168



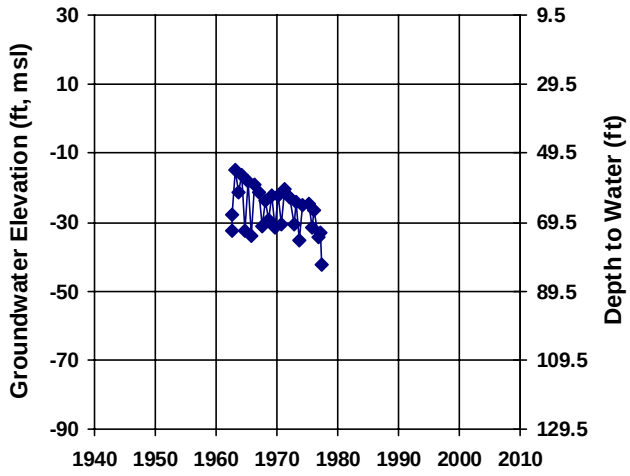
Reference Elevation: 25.6 ft, msl

SWN: 11N04E34N001M Depth: 438 Perf: NA



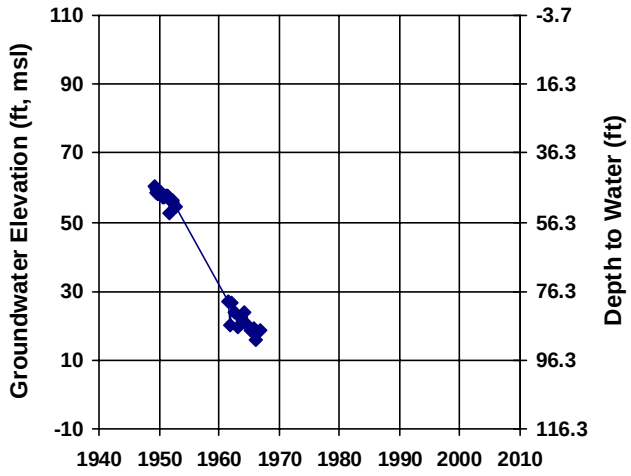
Reference Elevation: 25.5 ft, msl

SWN: 11N04E35J001M Depth: 133 Perf: 20-133



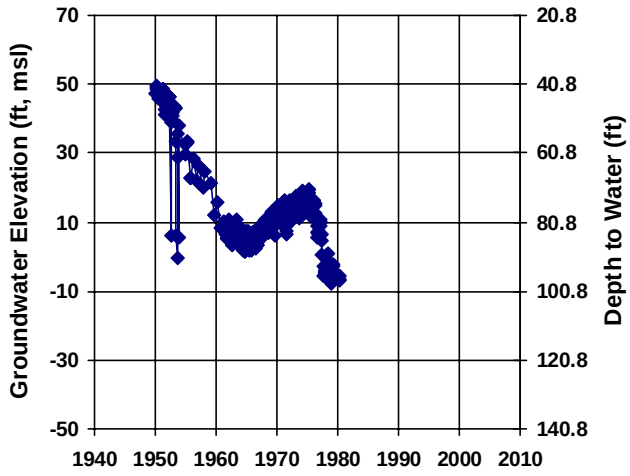
Reference Elevation: 39.5 ft, msl

SWN: 11N05E01N001M Depth: NA Perf: NA



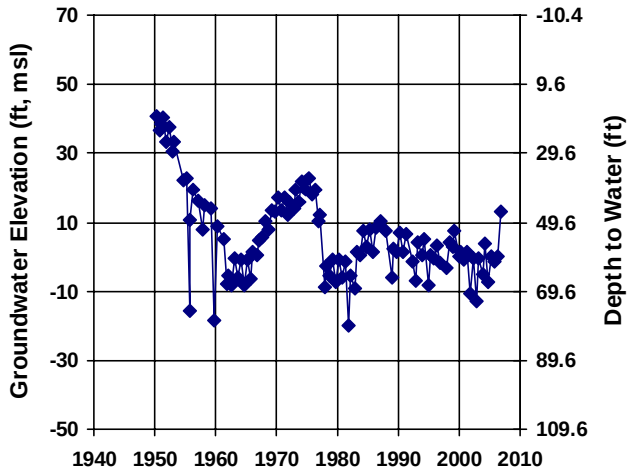
Reference Elevation: 106.3 ft, msl

SWN: 11N05E03M003M Depth: 600 Perf: NA



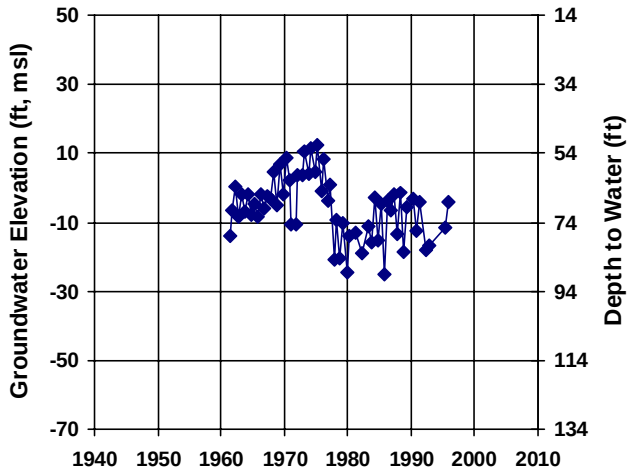
Reference Elevation: 90.8 ft, msl

SWN: 11N05E06H001M Depth: 250 Perf: NA



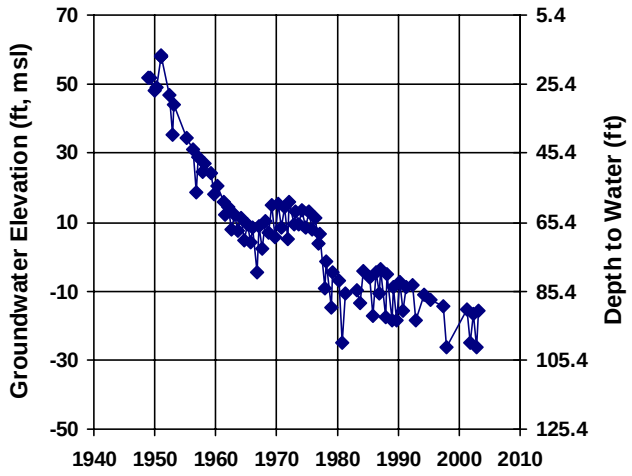
Reference Elevation: 59.6 ft, msl

SWN: 11N05E07H001M Depth: NA Perf: NA



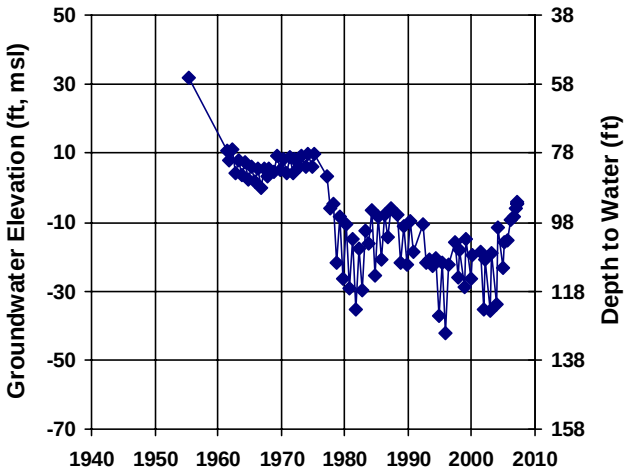
Reference Elevation: 64.0 ft, msl

SWN: 11N05E15G001M Depth: 134 Perf: NA



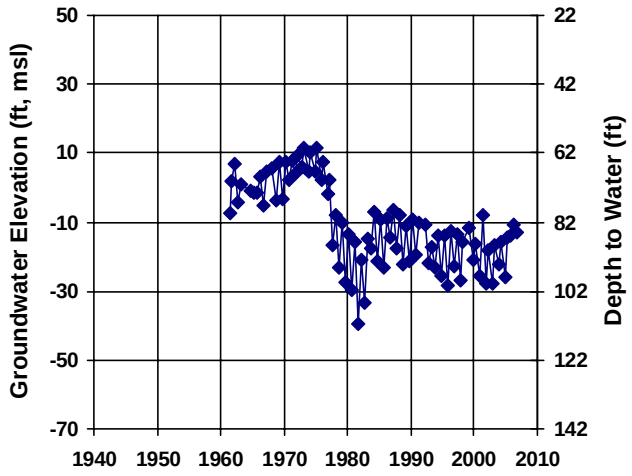
Reference Elevation: 75.4 ft, msl

SWN: 11N05E16H001M Depth: 460 Perf: 135-460



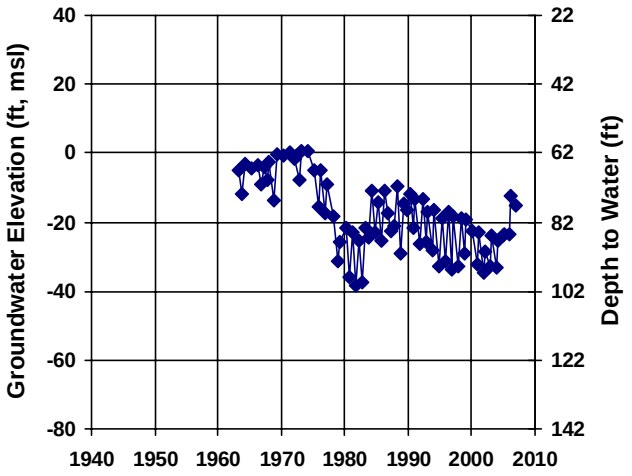
Reference Elevation: 88.0 ft, msl

SWN: 11N05E17A004M Depth: 210 Perf: NA



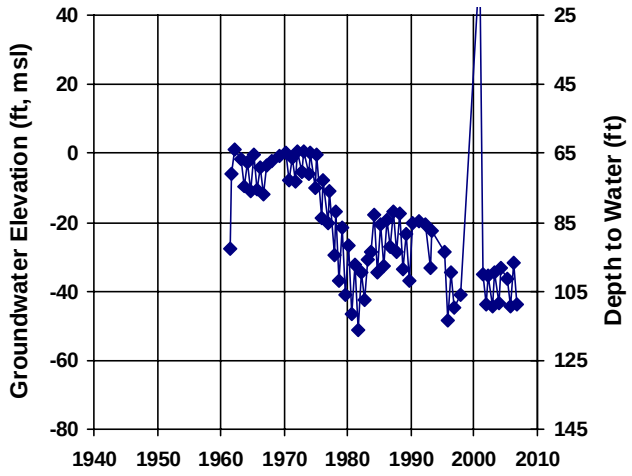
Reference Elevation: 72.0 ft, msl

SWN: 11N05E18R001M Depth: NA Perf: NA



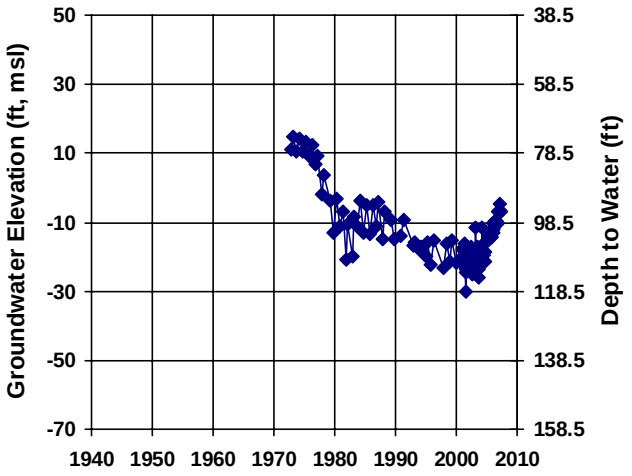
Reference Elevation: 62.0 ft, msl

SWN: 11N05E20C001M Depth: 286 Perf: 152-286



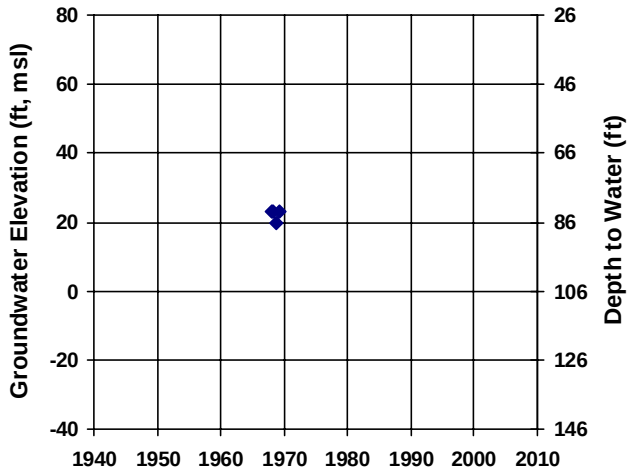
Reference Elevation: 65.0 ft, msl

SWN: 11N05E23B001M Depth: 195 Perf: NA



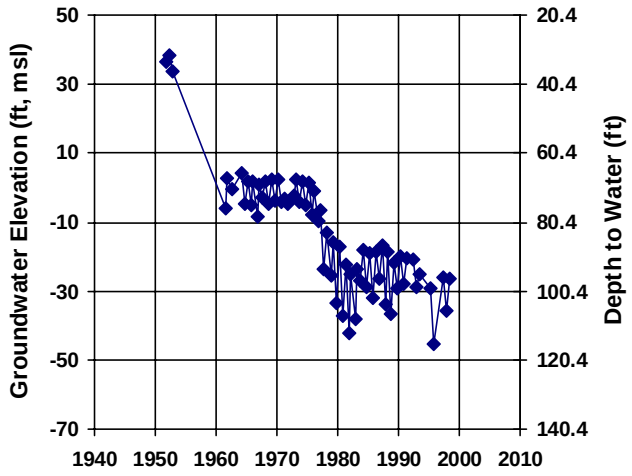
Reference Elevation: 88.5 ft, msl

SWN: 11N05E24J001M Depth: 170 Perf: NA



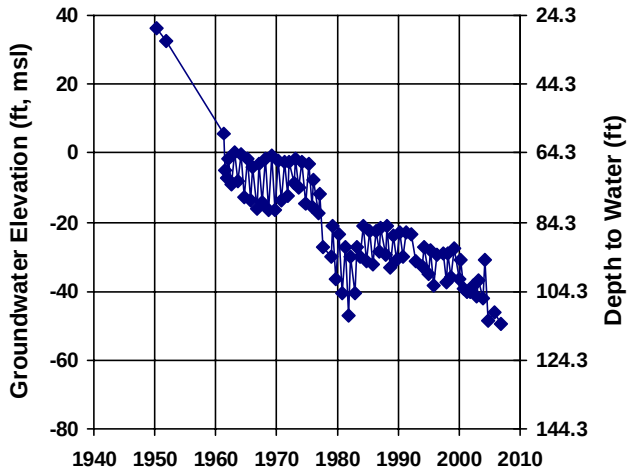
Reference Elevation: 106.0 ft, msl

SWN: 11N05E28C001M Depth: NA Perf: NA



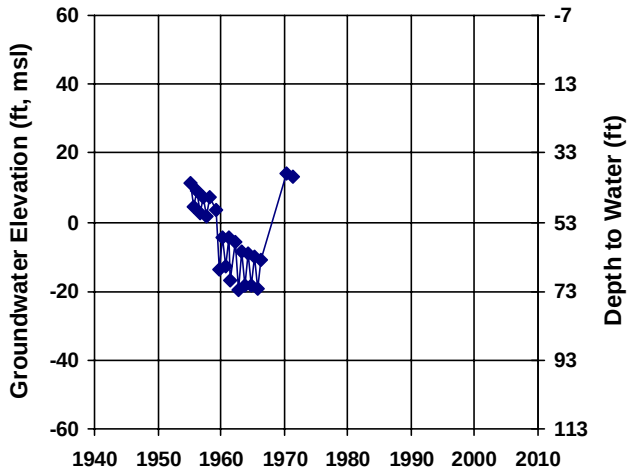
Reference Elevation: 70.4 ft, msl

SWN: 11N05E29G002M Depth: 388 Perf: NA



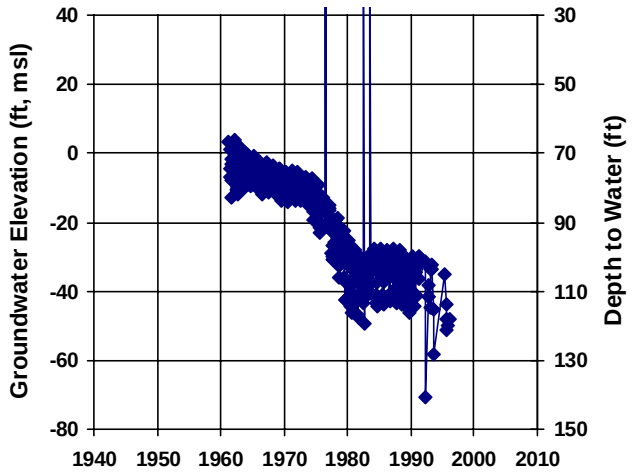
Reference Elevation: 64.3 ft, msl

SWN: 11N05E31D003M Depth: NA Perf: NA



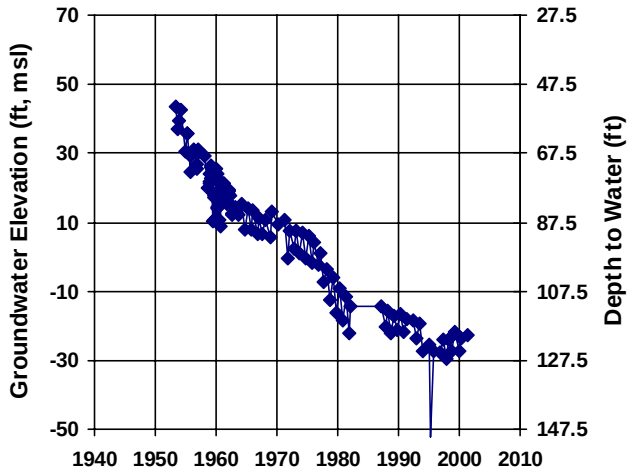
Reference Elevation: 53.0 ft, msl

SWN: 11N05E32R001M Depth: 397 Perf: NA



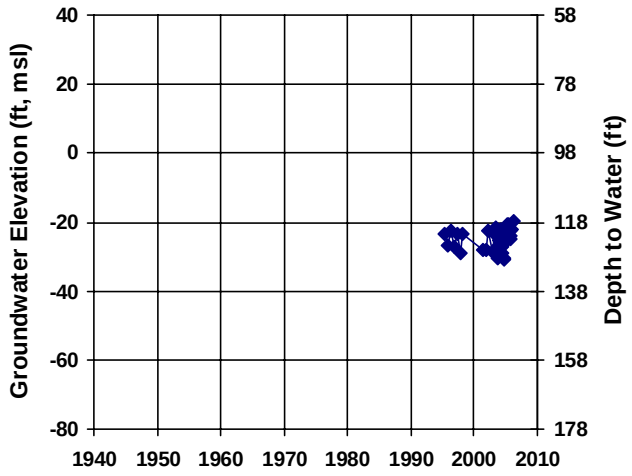
Reference Elevation: 70.0 ft, msl

SWN: 11N05E34R003M Depth: NA Perf: NA



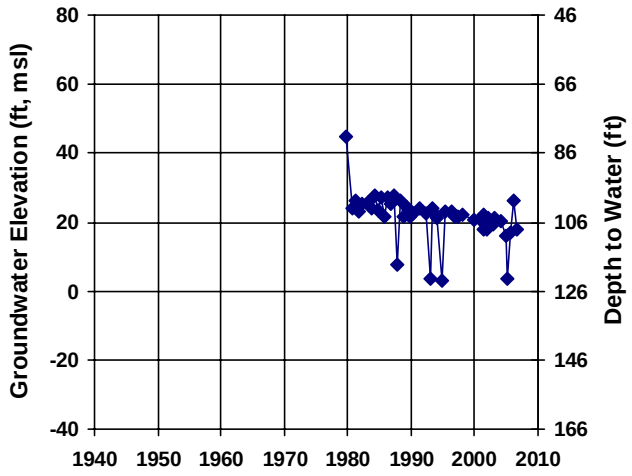
Reference Elevation: 97.5 ft, msl

SWN: 11N05E34R004M Depth: NA Perf: NA



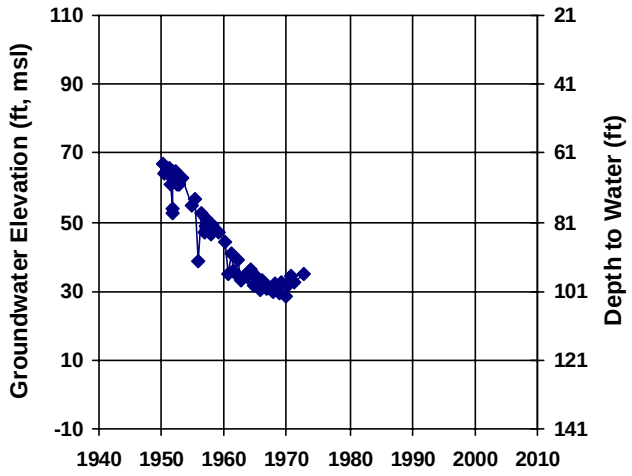
Reference Elevation: 98.0 ft, msl

SWN: 11N06E06A001M Depth: 265 Perf: 185-265



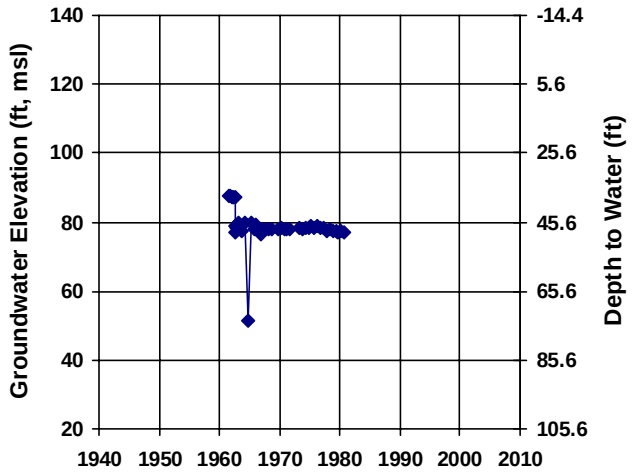
Reference Elevation: 126.0 ft, msl

SWN: 11N06E06B001M Depth: 180 Perf: NA



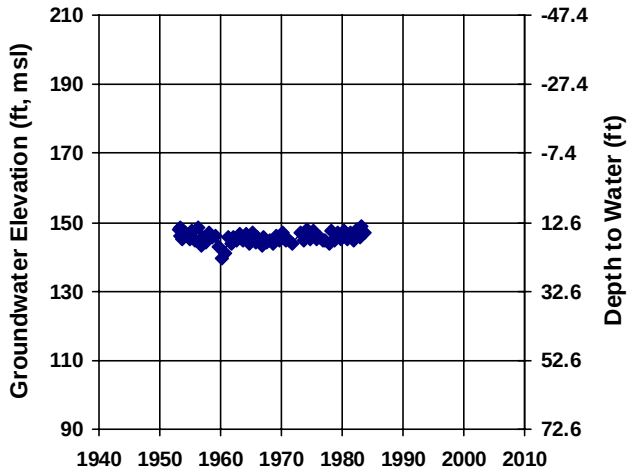
Reference Elevation: 131.0 ft, msl

SWN: 11N06E10P001M Depth: 410 Perf: NA



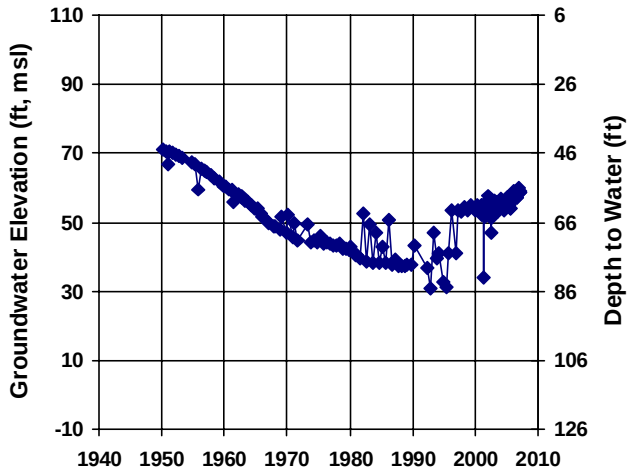
Reference Elevation: 125.6 ft, msl

SWN: 11N06E11R001M Depth: NA Perf: NA



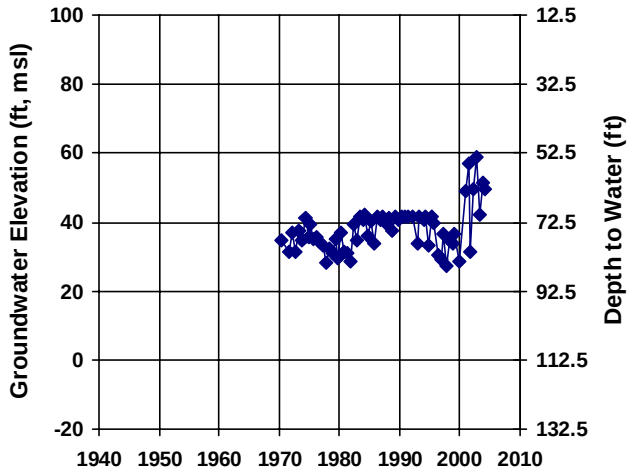
Reference Elevation: 162.6 ft, msl

SWN: 11N06E15C004M Depth: 98 Perf: NA



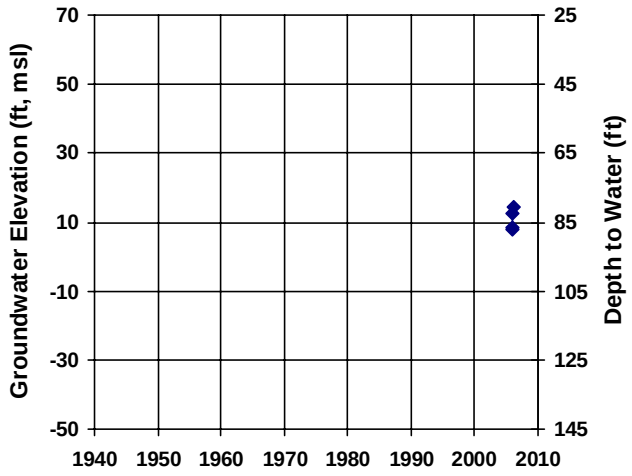
Reference Elevation: 116.0 ft, msl

SWN: 11N06E16M002M Depth: 160 Perf: NA



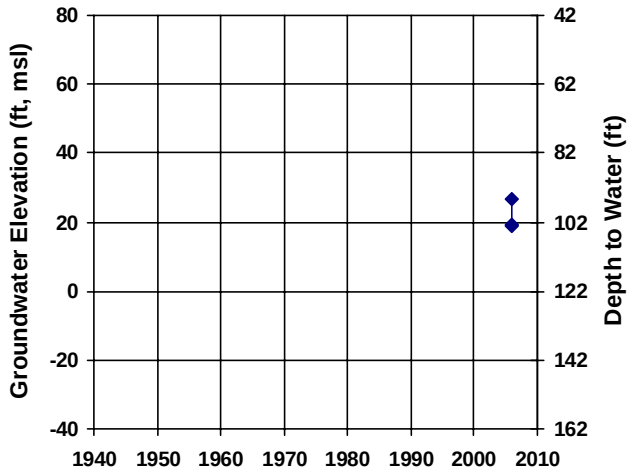
Reference Elevation: 112.5 ft, msl

SWN: 11N06E17E001M Depth: 520 Perf: NA



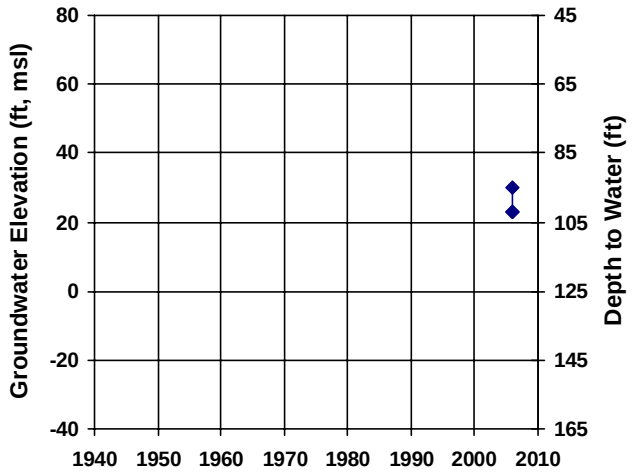
Reference Elevation: 95.0 ft, msl

SWN: 11N06E17F002M Depth: 455 Perf: NA



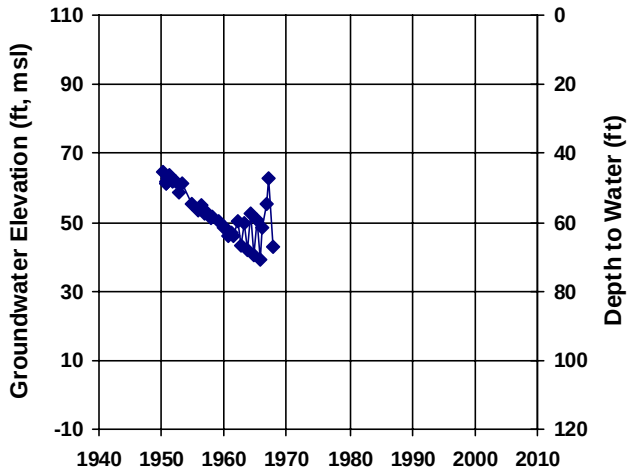
Reference Elevation: 122.0 ft, msl

SWN: 11N06E17F003M Depth: 437 Perf: NA



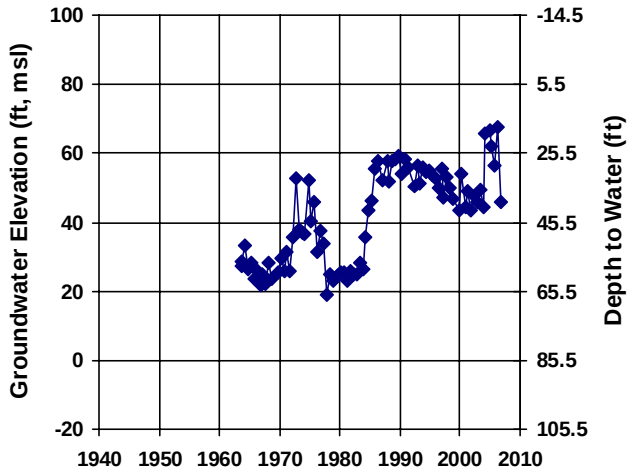
Reference Elevation: 125.0 ft, msl

SWN: 11N06E17J002M Depth: 113 Perf: NA



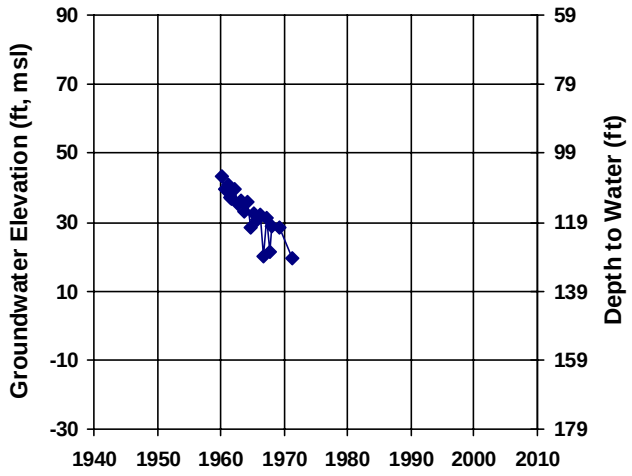
Reference Elevation: 110.0 ft, msl

SWN: 11N06E18P005M Depth: NA Perf: NA



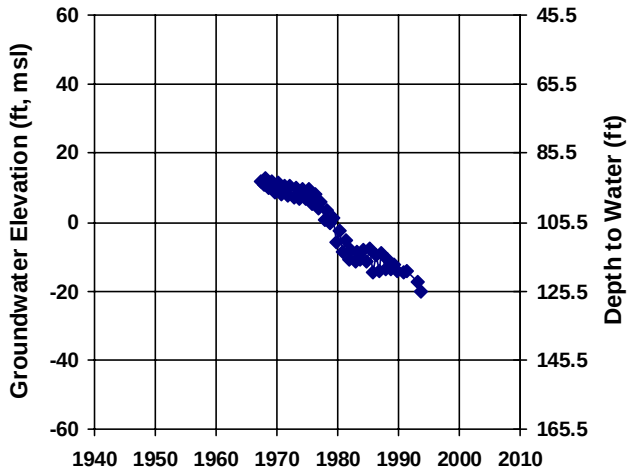
Reference Elevation: 85.5 ft, msl

SWN: 11N06E28N001M Depth: 200 Perf: NA



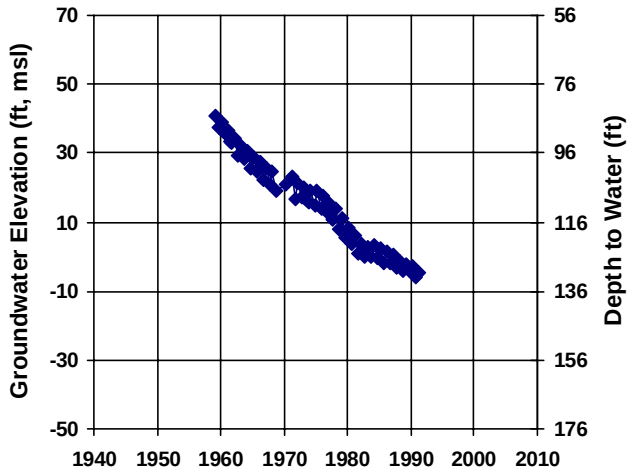
Reference Elevation: 149.0 ft, msl

SWN: 11N06E30F002M Depth: 195 Perf: NA



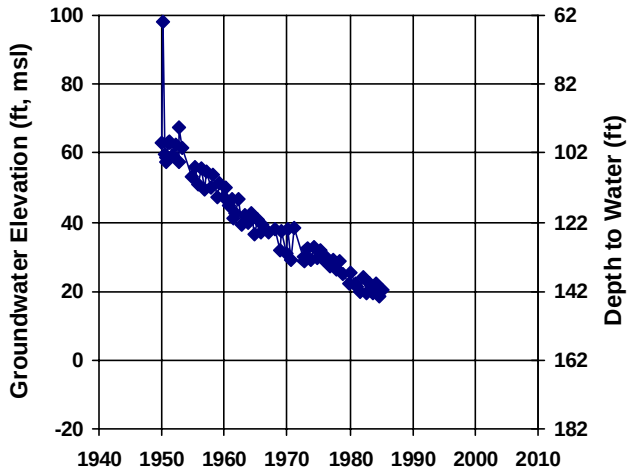
Reference Elevation: 105.5 ft, msl

SWN: 11N06E32F003M Depth: 290 Perf: NA



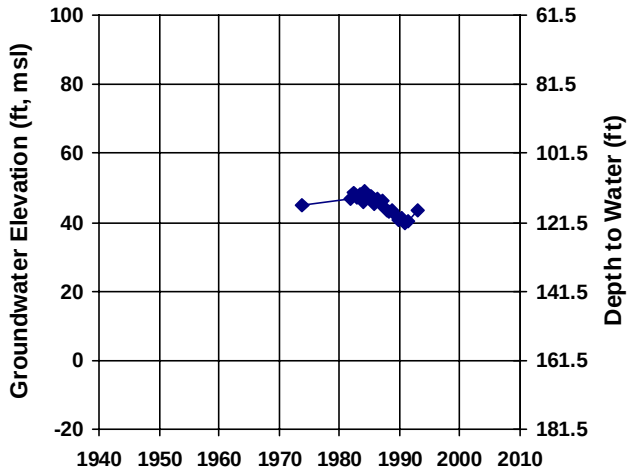
Reference Elevation: 126.0 ft, msl

SWN: 11N06E34D001M Depth: 320 Perf: NA



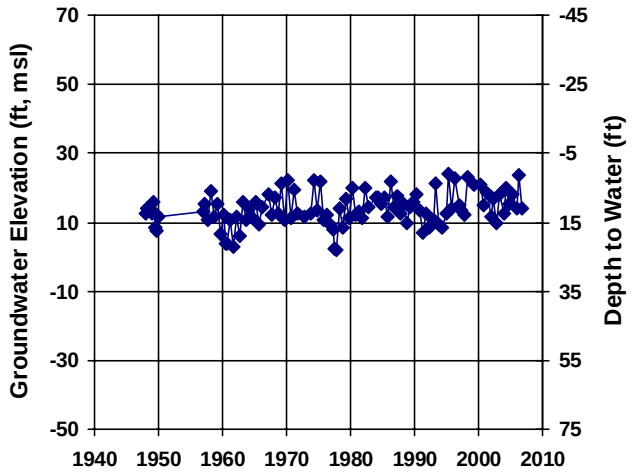
Reference Elevation: 162.0 ft, msl

SWN: 11N06E34H001M Depth: 280 Perf: 180-270



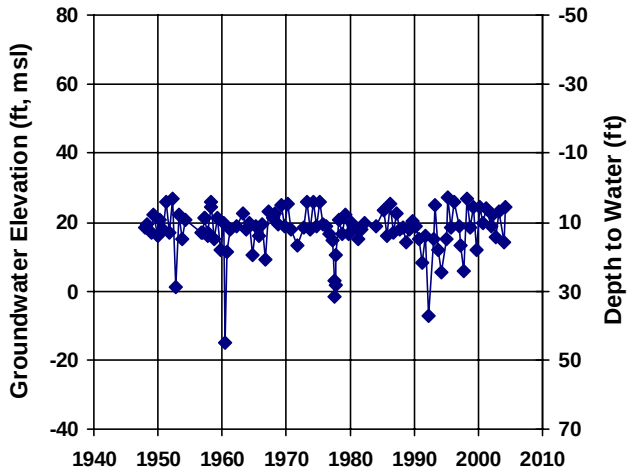
Reference Elevation: 161.5 ft, msl

SWN: 12N03E24A001M Depth: NA Perf: NA



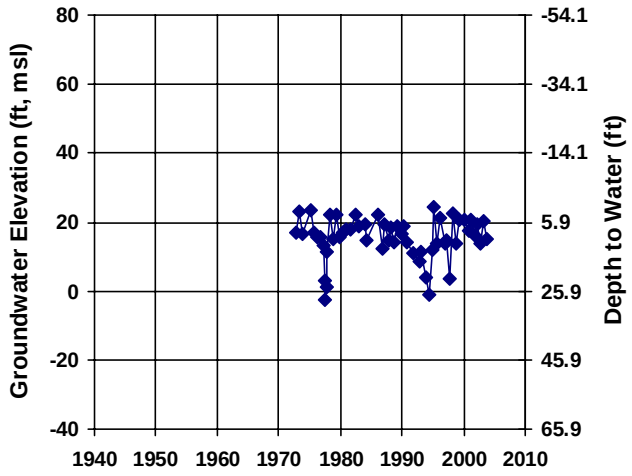
Reference Elevation: 25.0 ft, msl

SWN: 12N03E24Q001M Depth: NA Perf: NA



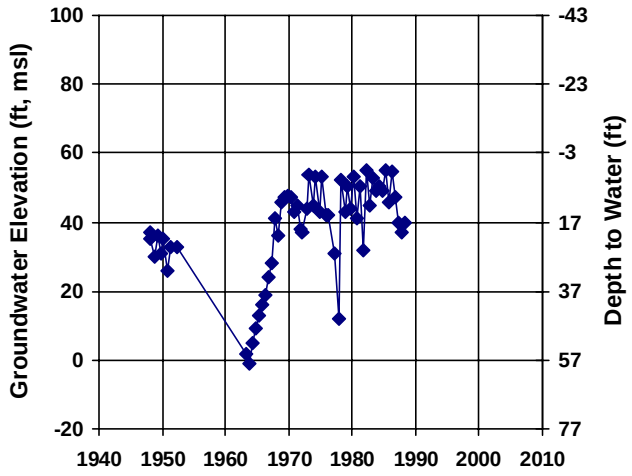
Reference Elevation: 30.0 ft, msl

SWN: 12N03E26R001M Depth: 180 Perf: 0-180



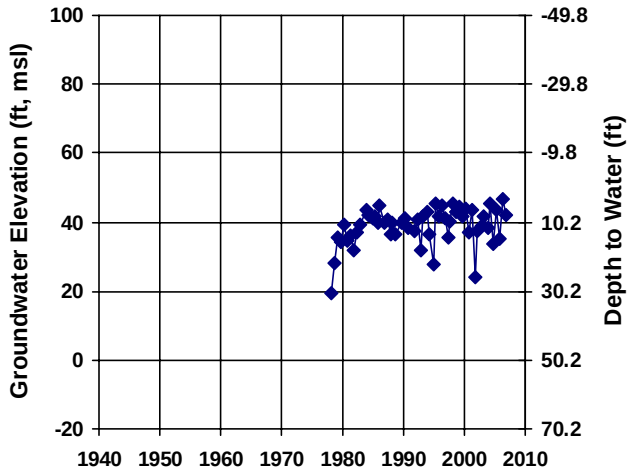
Reference Elevation: 25.9 ft, msl

SWN: 12N04E02B001M Depth: NA Perf: NA



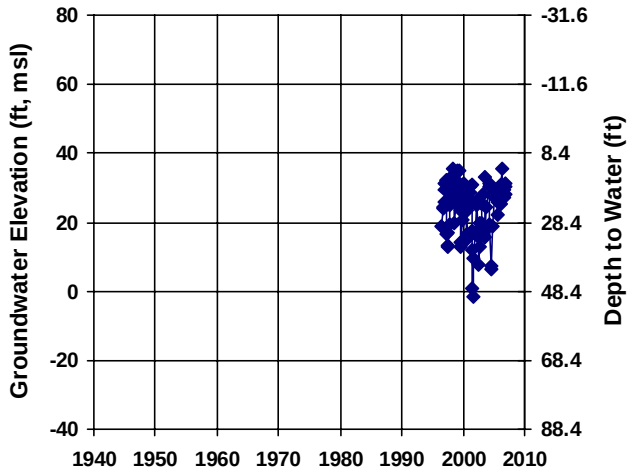
Reference Elevation: 57.0 ft, msl

SWN: 12N04E02P001M Depth: 400 Perf: NA



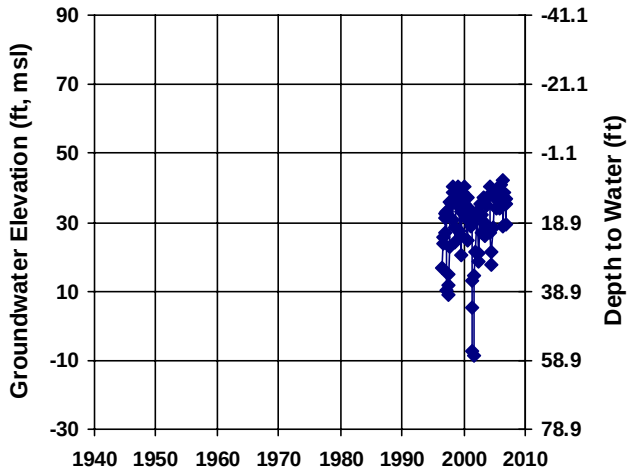
Reference Elevation: 50.2 ft, msl

SWN: 12N04E03N001M Depth: 980 Perf: 950-970



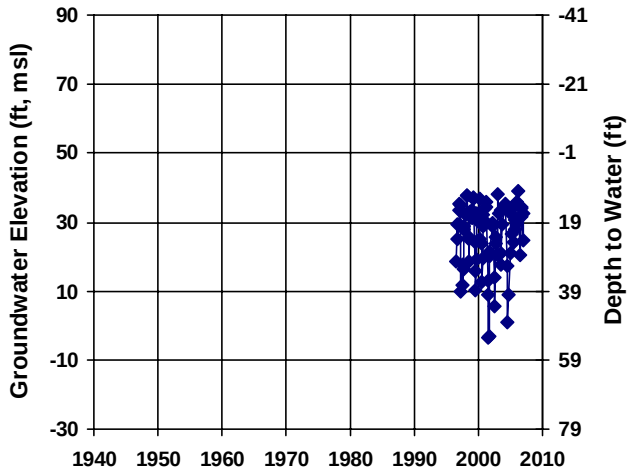
Reference Elevation: 48.4 ft, msl

SWN: 12N04E03N002M Depth: 710 Perf: 680-700



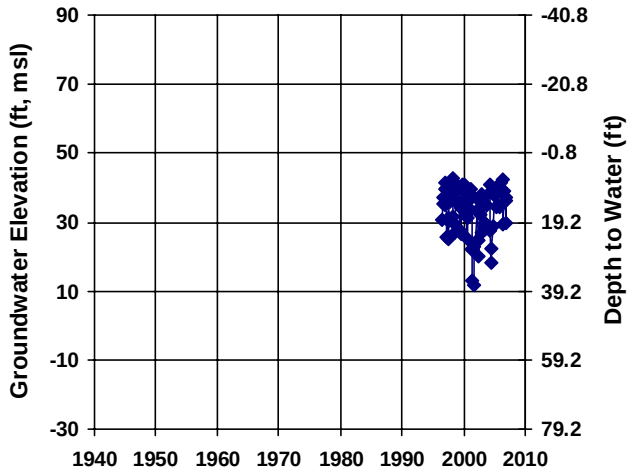
Reference Elevation: 48.9 ft, msl

SWN: 12N04E03N003M Depth: 530 Perf: 390-520



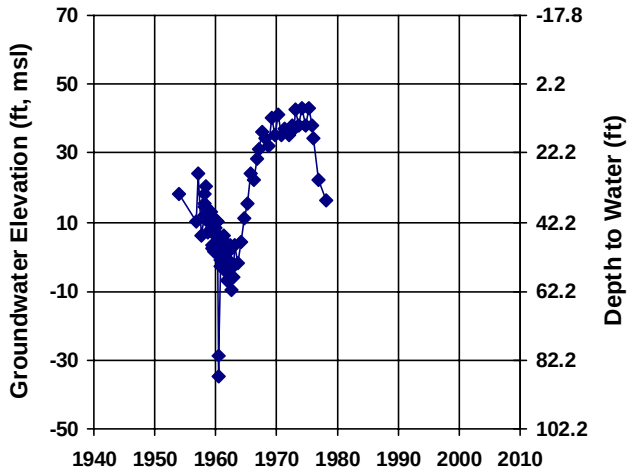
Reference Elevation: 49.0 ft, msl

SWN: 12N04E03N004M Depth: 190 Perf: 170-190



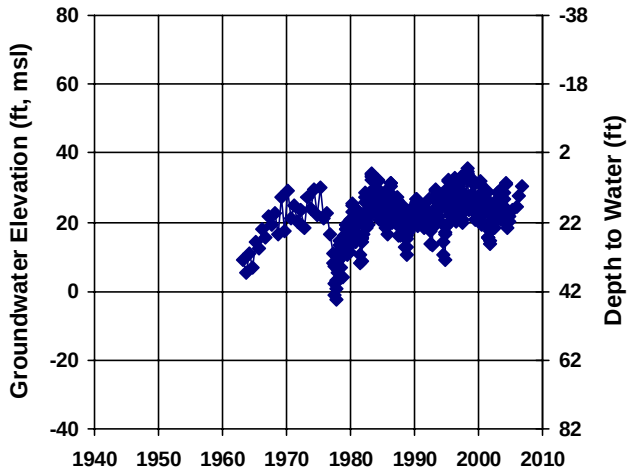
Reference Elevation: 49.2 ft, msl

SWN: 12N04E03R001M Depth: NA Perf: NA



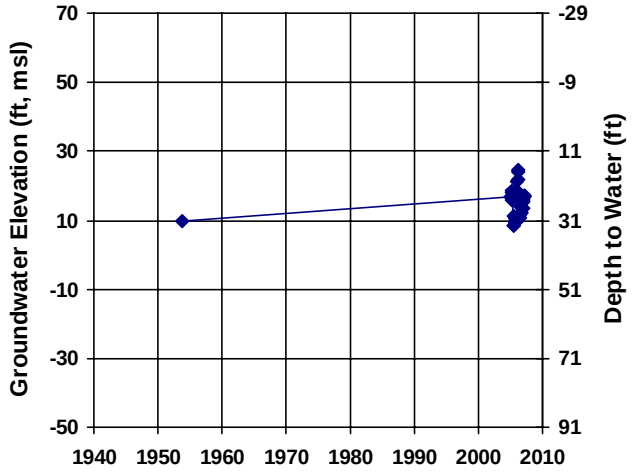
Reference Elevation: 52.2 ft, msl

SWN: 12N04E05R004M Depth: 90 Perf: NA



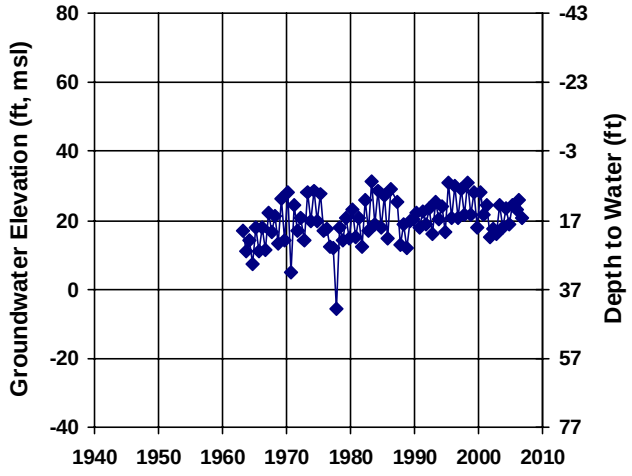
Reference Elevation: 42.0 ft, msl

SWN: 12N04E05R005M Depth: 269 Perf: 243-269



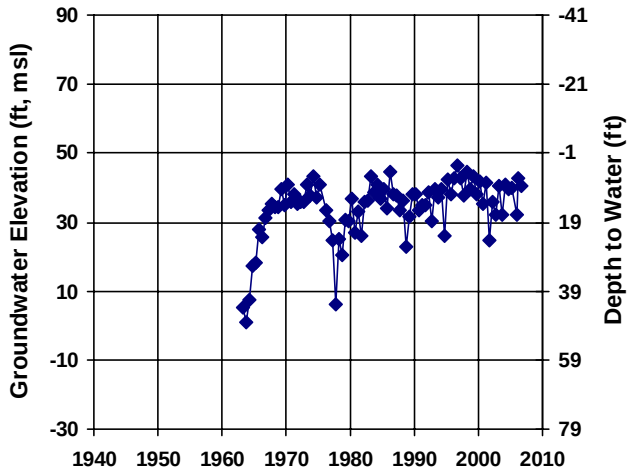
Reference Elevation: 41.0 ft, msl

SWN: 12N04E08D003M Depth: 80 Perf: NA



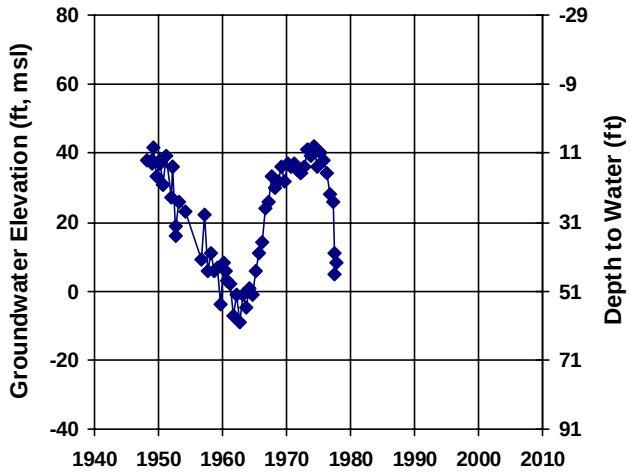
Reference

SWN: 12N04E10D002M Depth: NA Perf: NA



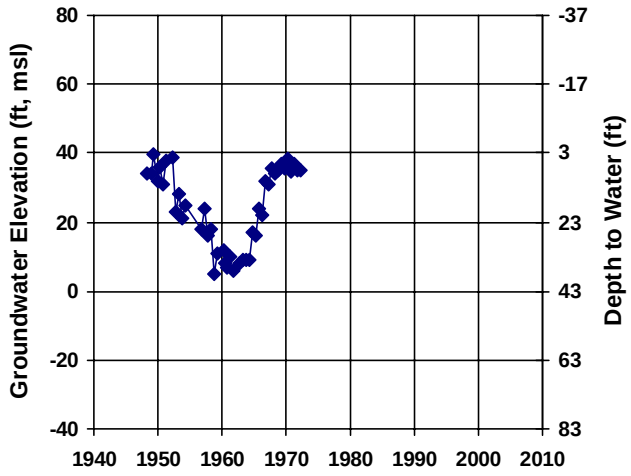
Reference Elevation: 49.0 ft, msl

SWN: 12N04E13C001M Depth: NA Perf: NA



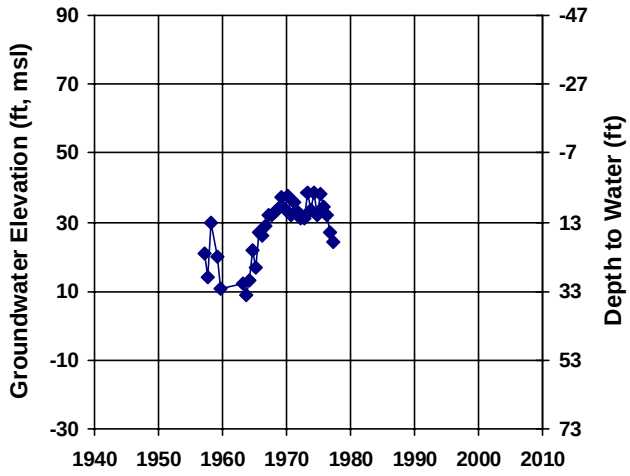
Reference Elevation: 51.0 ft, msl

SWN: 12N04E14P001M Depth: NA Perf: NA



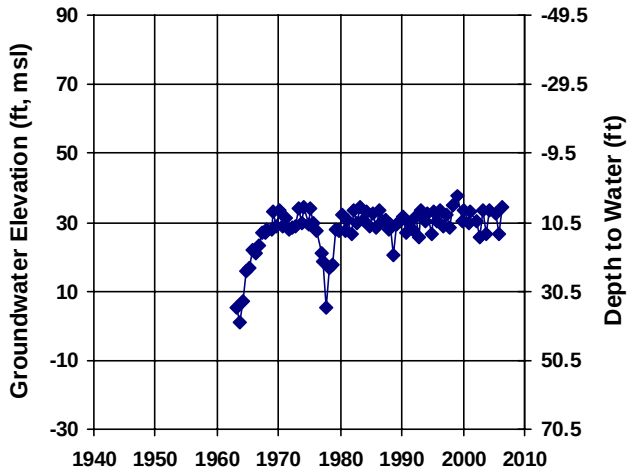
Reference Elevation: 43.0 ft, msl

SWN: 12N04E15M001M Depth: 150 Perf: NA



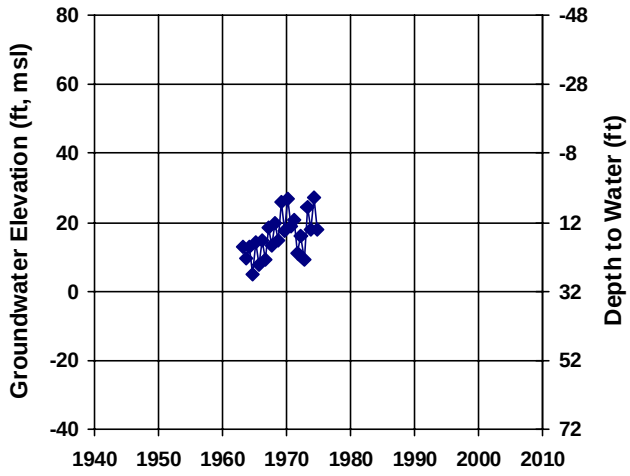
Reference Elevation: 43.0 ft, msl

SWN: 12N04E16A004M Depth: NA Perf: NA



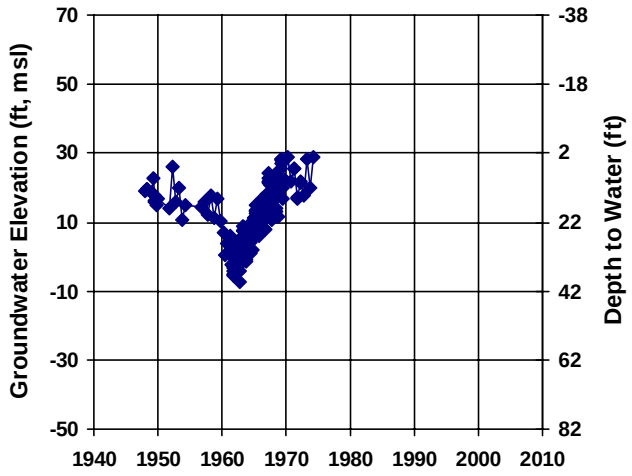
Reference Elevation: 40.5 ft, msl

SWN: 12N04E17D001M Depth: NA Perf: NA



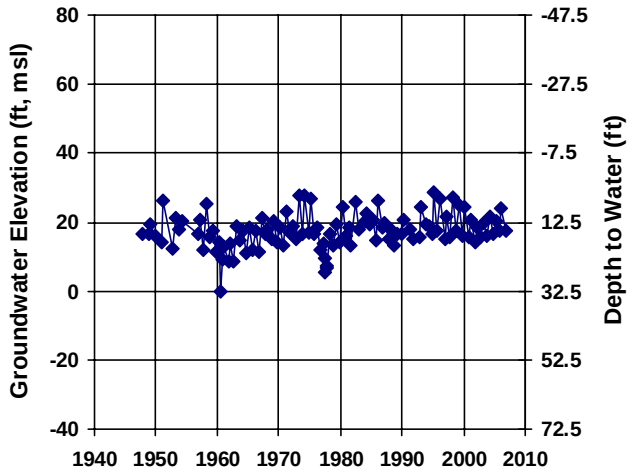
Reference Elevation: 32.0 ft, msl

SWN: 12N04E17J001M Depth: NA Perf: NA



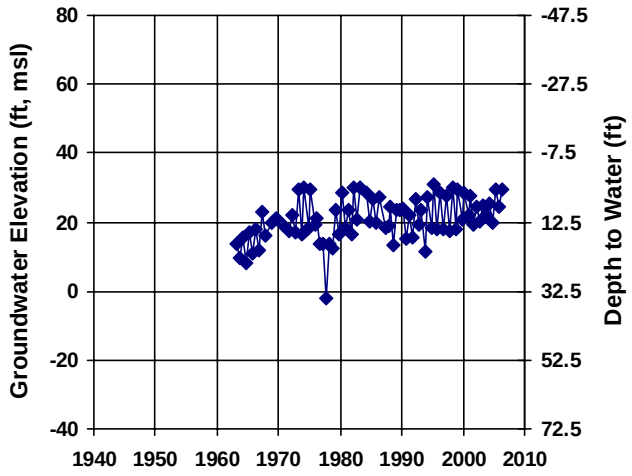
Reference Elevation: 32.0 ft, msl

SWN: 12N04E18D001M Depth: NA Perf: NA



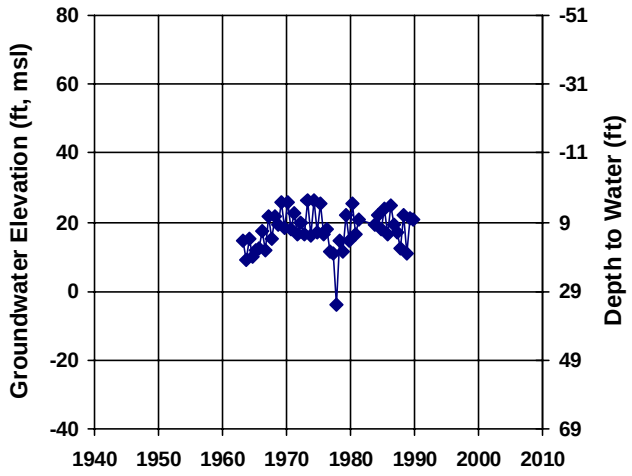
Reference Elevation: 32.5 ft, msl

SWN: 12N04E20C001M Depth: NA Perf: NA



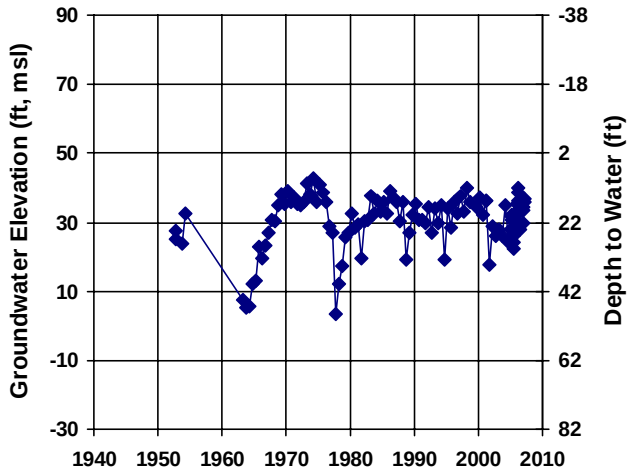
Reference Elevation: 32.5 ft, msl

SWN: 12N04E20P001M Depth: NA Perf: NA



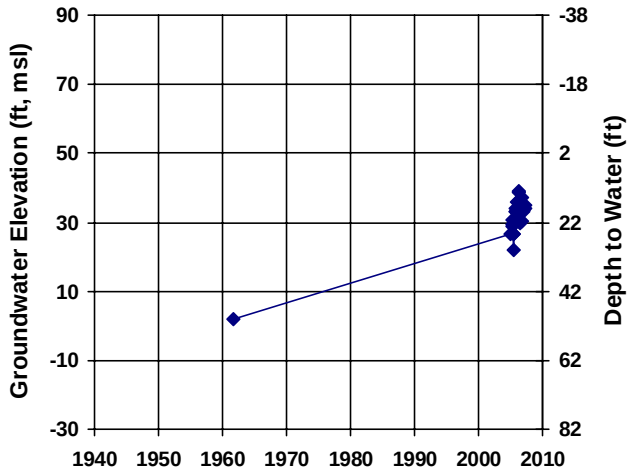
Reference Elevation: 29.0 ft, msl

SWN: 12N04E24M002M Depth: 340 Perf: 144-340



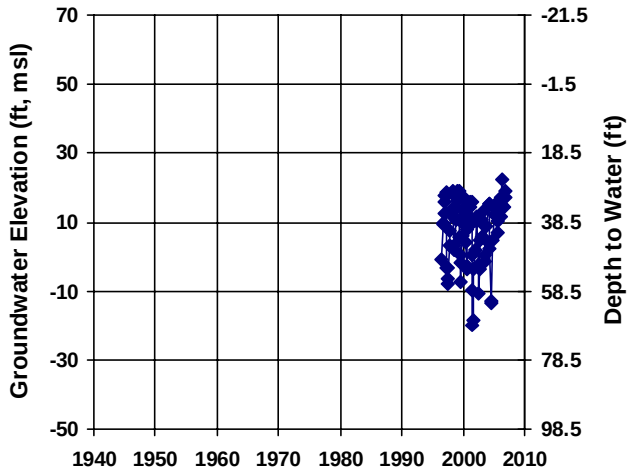
Reference Elevation: 52.0 ft, msl

SWN: 12N04E25N001M Depth: 150 Perf: 68-150



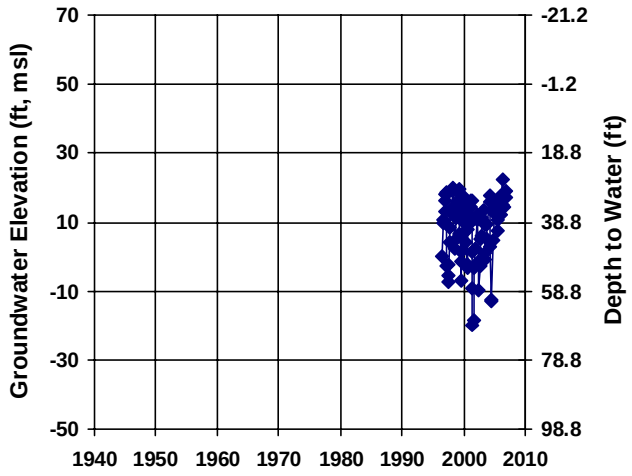
Reference Elevation: 52.0 ft, msl

SWN: 12N04E26J002M Depth: 700 Perf: 680-700



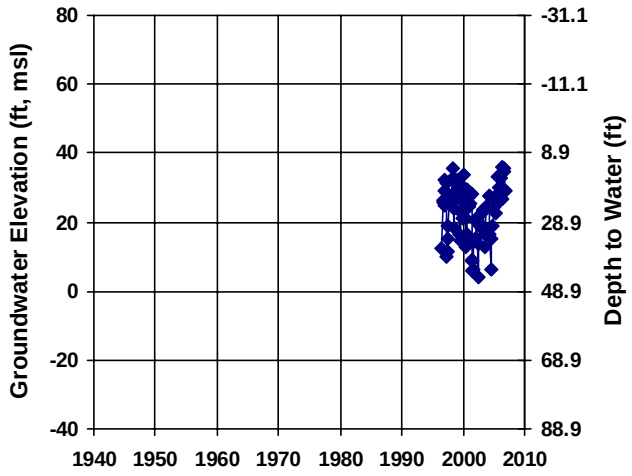
Reference Elevation: 48.5 ft, msl

SWN: 12N04E26J003M Depth: 500 Perf: 380-490



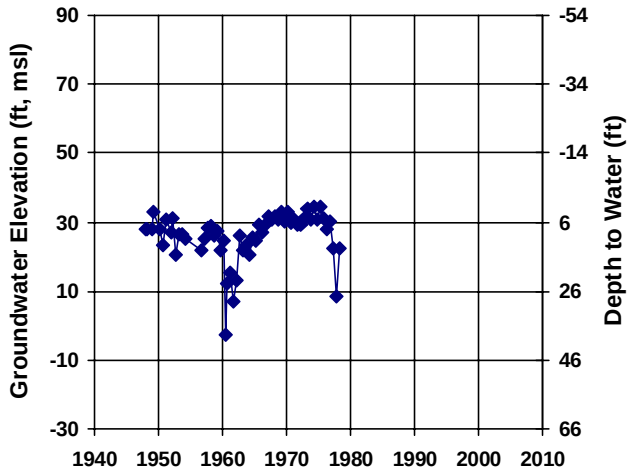
Reference Elevation: 48.8 ft, msl

SWN: 12N04E26J004M Depth: 155 Perf: 135-145



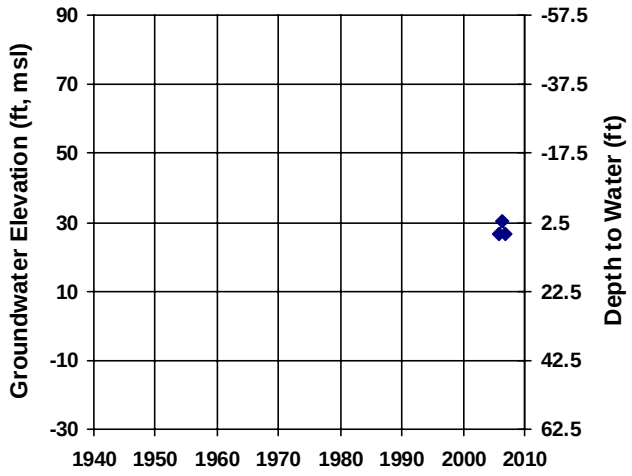
Reference Elevation: 48.9 ft, msl

SWN: 12N04E28H001M Depth: NA Perf: NA



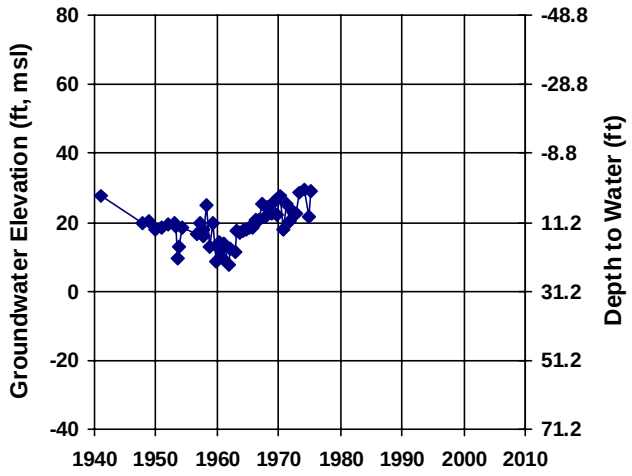
Reference Elevation: 36.0 ft, msl

SWN: 12N04E29J001M Depth: NA Perf: NA



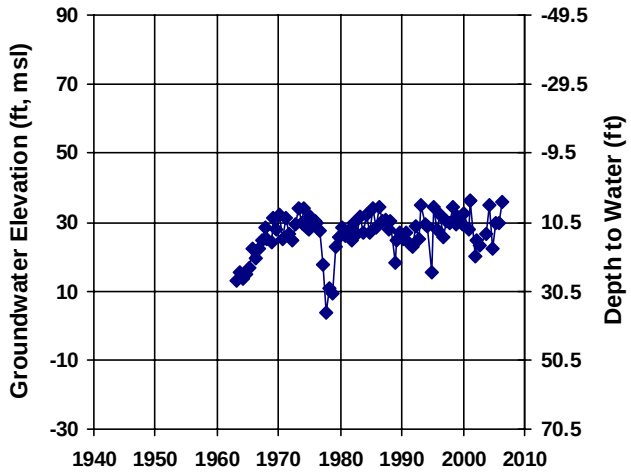
Reference Elevation: 32.5 ft, msl

SWN: 12N04E33L001M Depth: NA Perf: NA



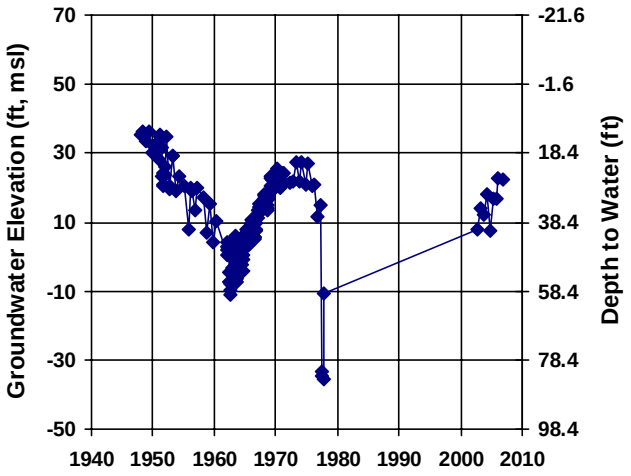
Reference Elevation: 31.2 ft, msl

SWN: 12N04E34H001M Depth: NA Perf: NA



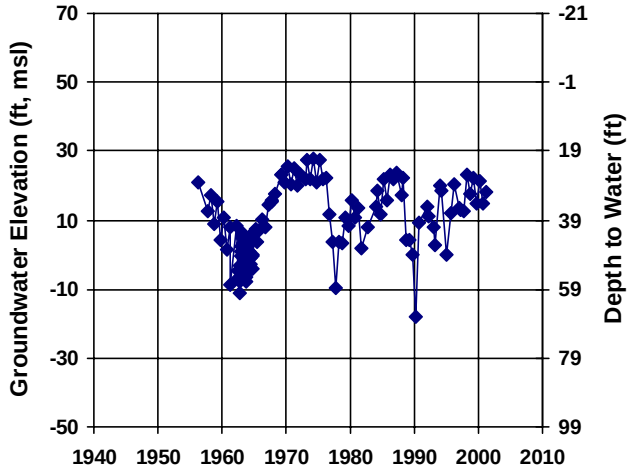
Reference Elevation: 40.5 ft, msl

SWN: 12N04E35H001M Depth: NA Perf: NA



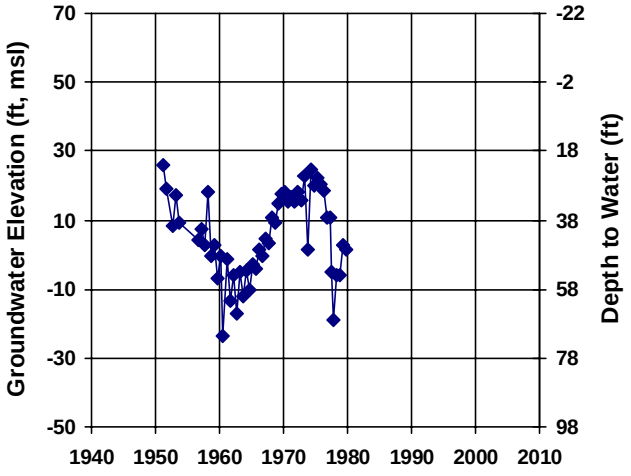
Reference Elevation: 48.4 ft, msl

SWN: 12N04E35H002M Depth: 555 Perf: NA



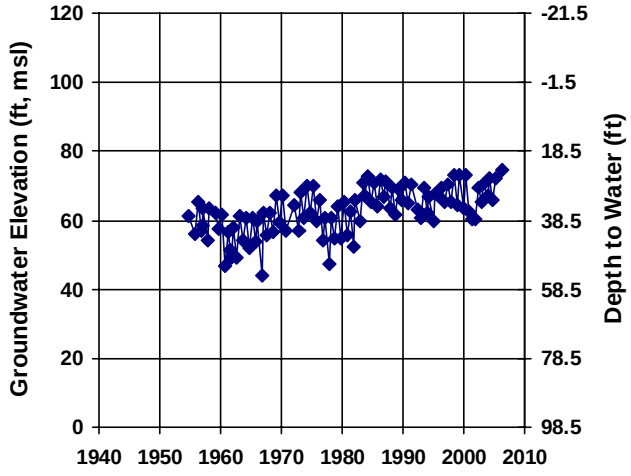
Reference Elevation: 49.0 ft, msl

SWN: 12N04E36Q001M Depth: NA Perf: NA



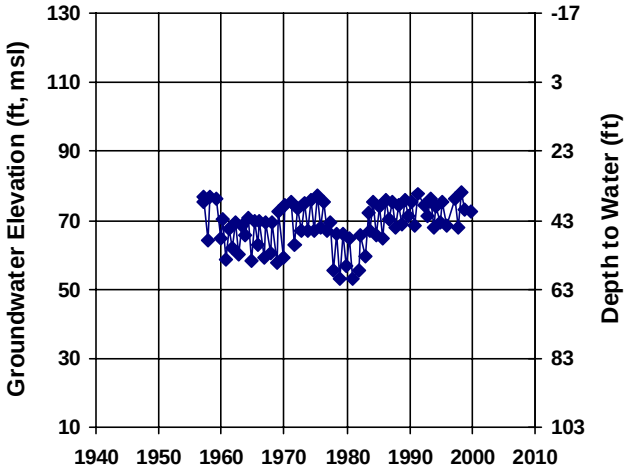
Reference Elevation: 48.0 ft, msl

SWN: 12N05E01D002M Depth: 140 Perf: NA



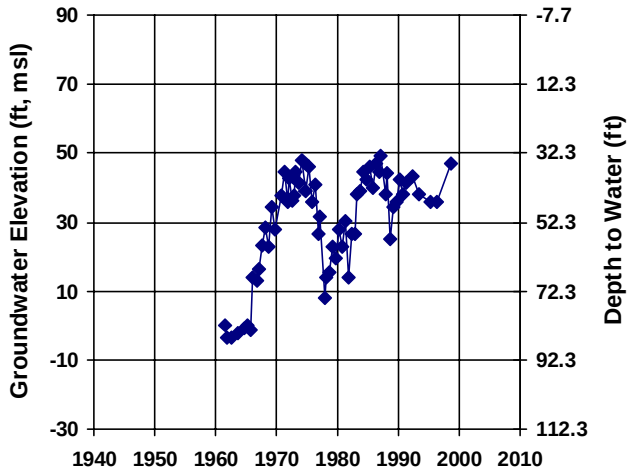
Reference Elevation: 98.5 ft, msl

SWN: 12N05E01R001M Depth: 370 Perf: NA



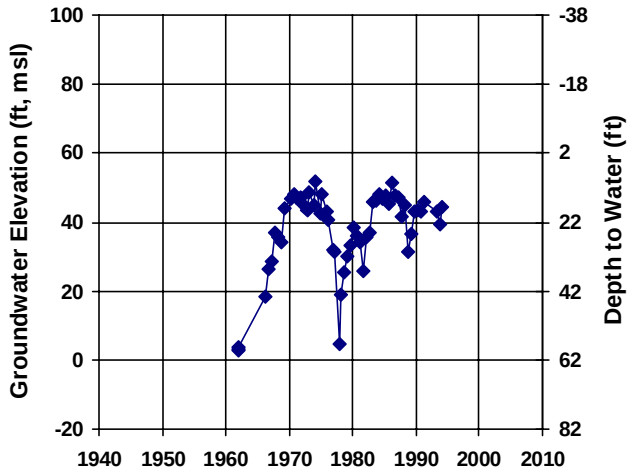
Reference Elevation: 113.0 ft, msl

SWN: 12N05E04F001M Depth: NA Perf: NA



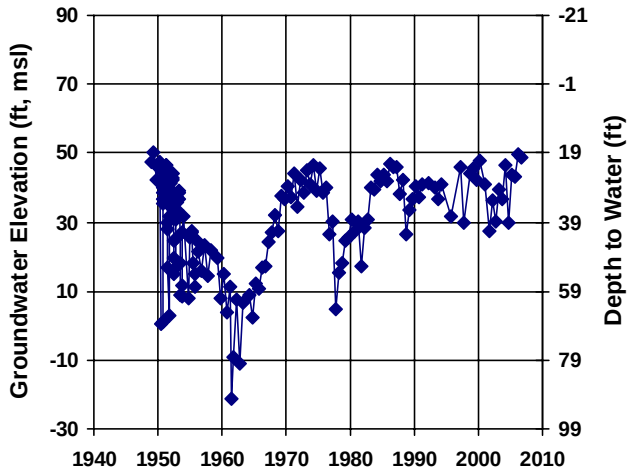
Reference Elevation: 82.3 ft, msl

SWN: 12N05E06J003M Depth: NA Perf: NA



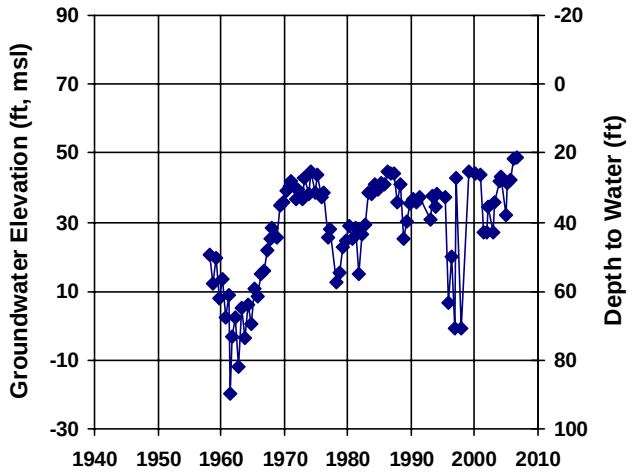
Reference Elevation: 62.0 ft, msl

SWN: 12N05E06R001M Depth: NA Perf: NA



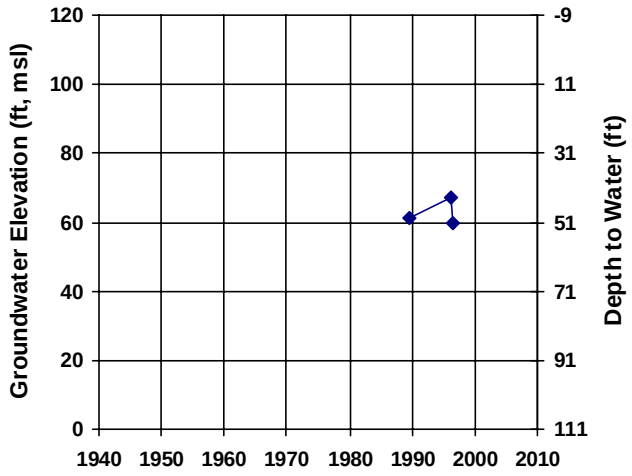
Reference Elevation: 69.0 ft, msl

SWN: 12N05E07H001M Depth: 415 Perf: 105-210



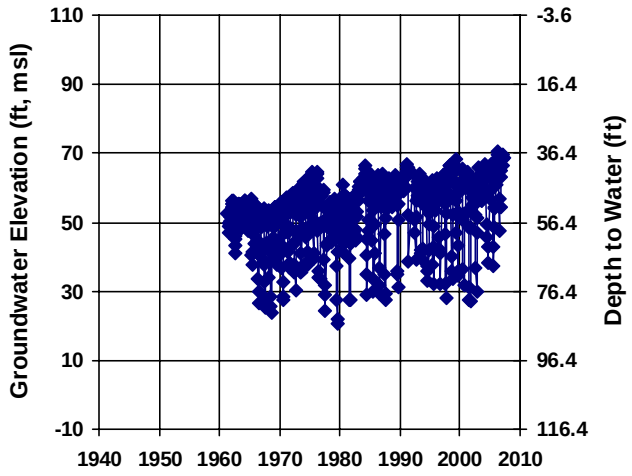
Reference Elevation: 70.0 ft, msl

SWN: 12N05E12A001M Depth: 110 Perf: NA



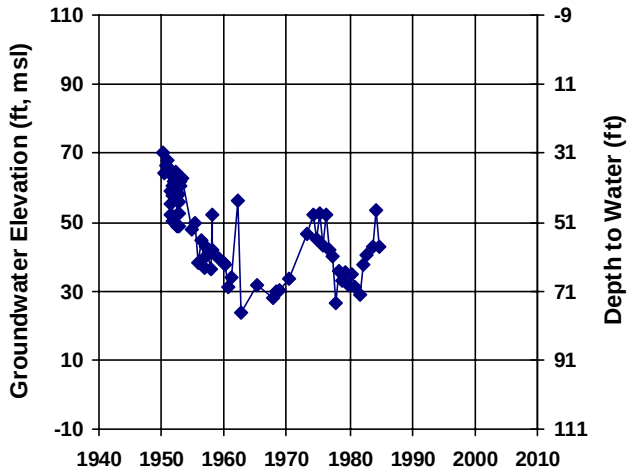
Reference Elevation: 111.0 ft, msl

SWN: 12N05E12Q001M Depth: 300 Perf: NA



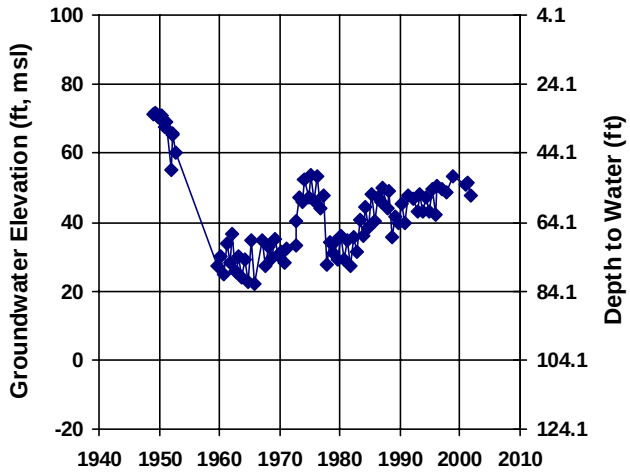
Reference Elevation: 106.4 ft, msl

SWN: 12N05E14H001M Depth: 300 Perf: NA



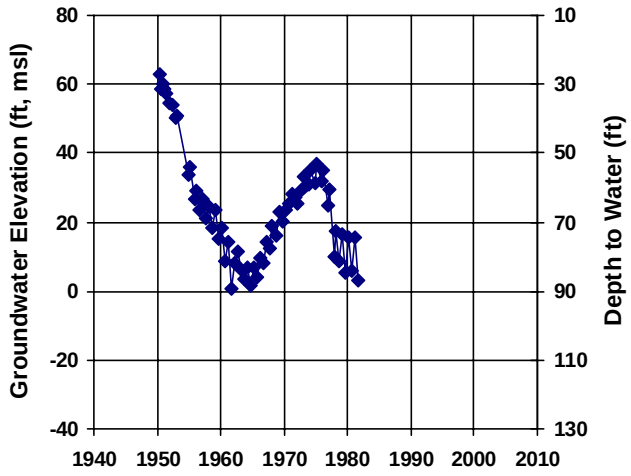
Reference Elevation: 101.0 ft, msl

SWN: 12N05E14R001M Depth: 653 Perf: NA



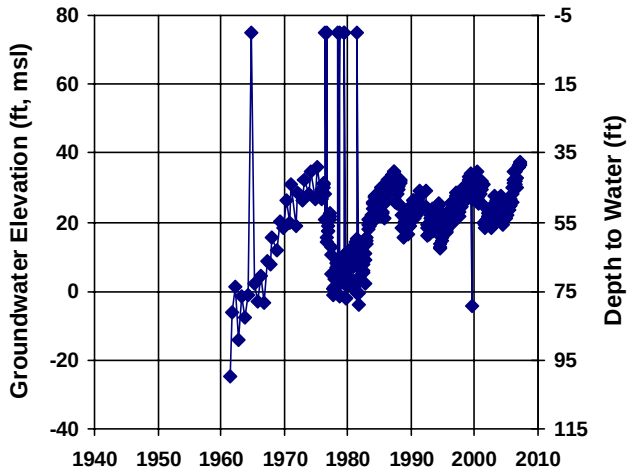
Reference Elevation: 104.1 ft, msl

SWN: 12N05E15A001M Depth: 100 Perf: NA



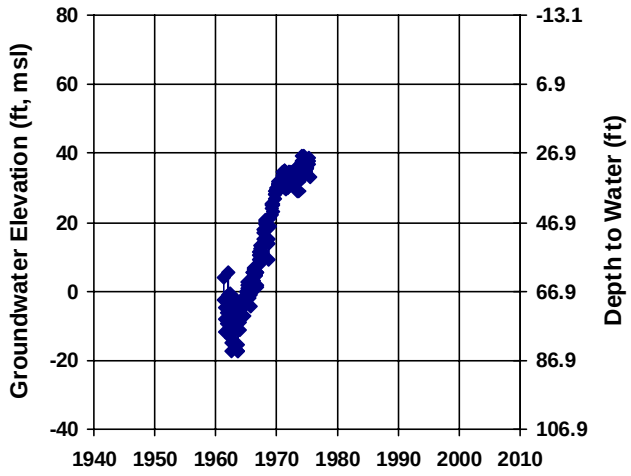
Reference Elevation: 90.0 ft, msl

SWN: 12N05E17A002M Depth: 380 Perf: NA



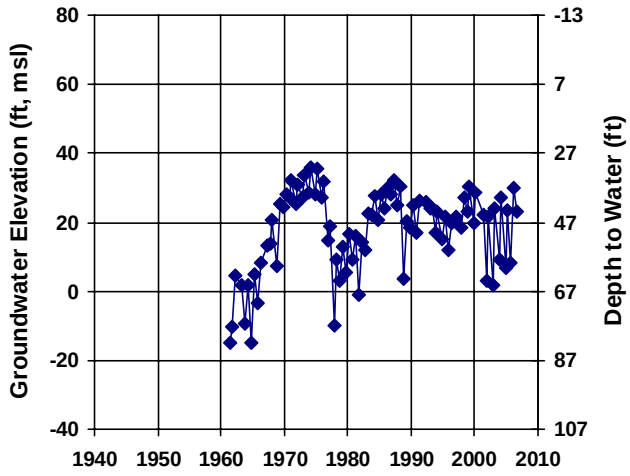
Reference Elevation: 75.0 ft, msl

SWN: 12N05E17D001M Depth: 185 Perf: NA



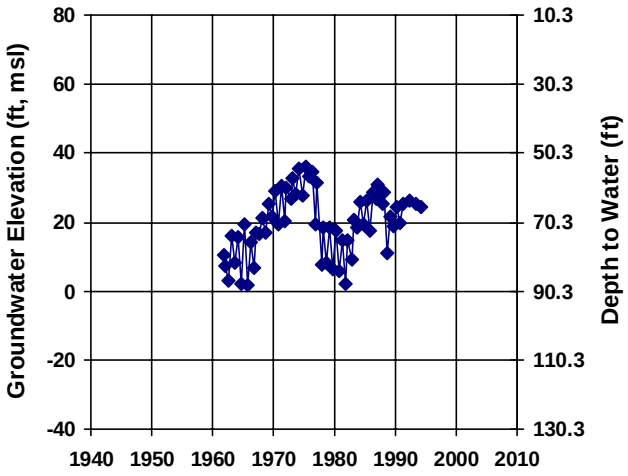
Reference Elevation: 66.9 ft, msl

SWN: 12N05E18R001M Depth: NA Perf: NA



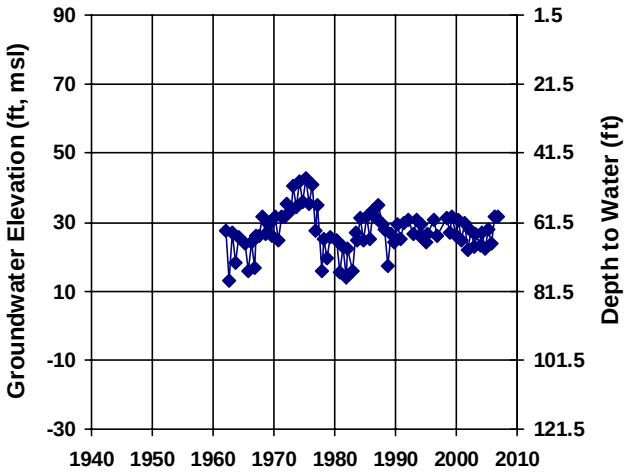
Reference Elevation: 67.0 ft, msl

SWN: 12N05E26D001M Depth: NA Perf: NA



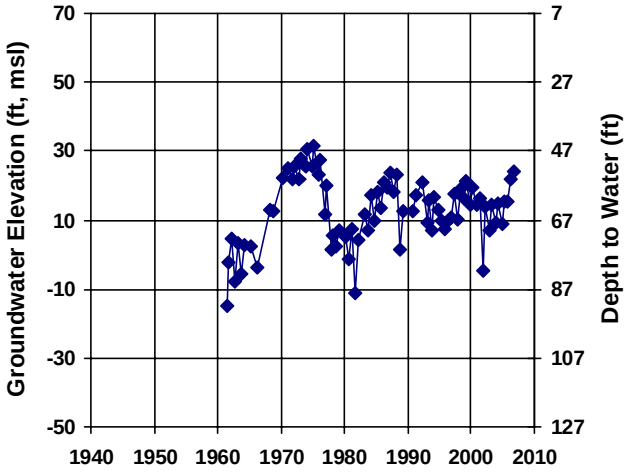
Reference Elevation: 90.3 ft, msl

SWN: 12N05E26H002M Depth: NA Perf: NA



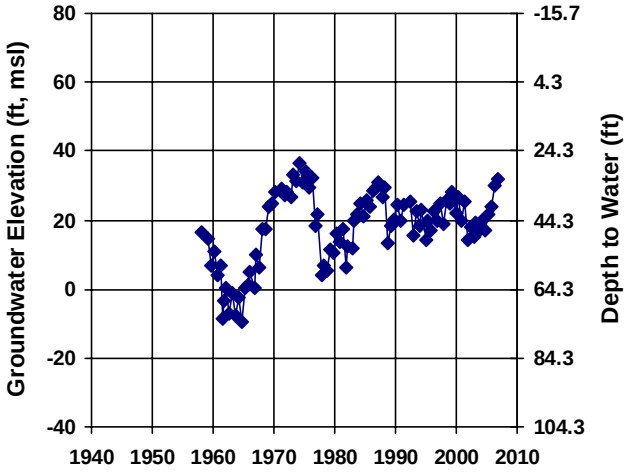
Reference Elevation: 91.5 ft, msl

SWN: 12N05E28C001M Depth: 160 Perf: NA



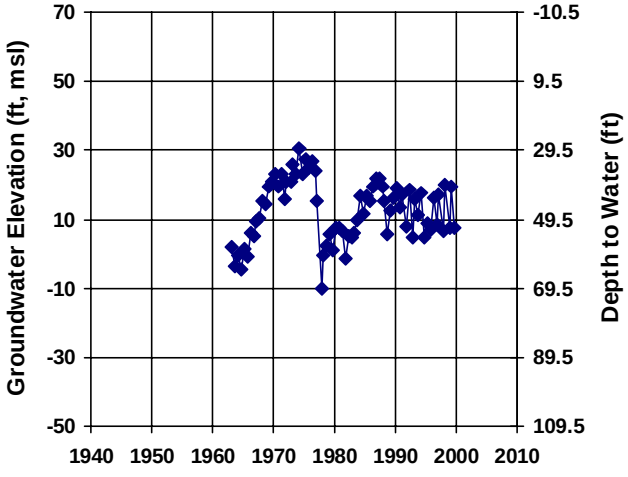
Reference Elevation: 77.0 ft, msl

SWN: 12N05E29D001M Depth: NA Perf: NA



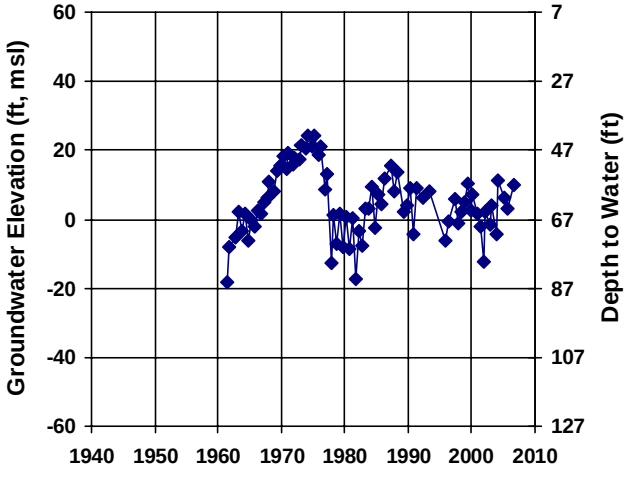
Reference Elevation: 64.3 ft, msl

SWN: 12N05E31A001M Depth: NA Perf: NA



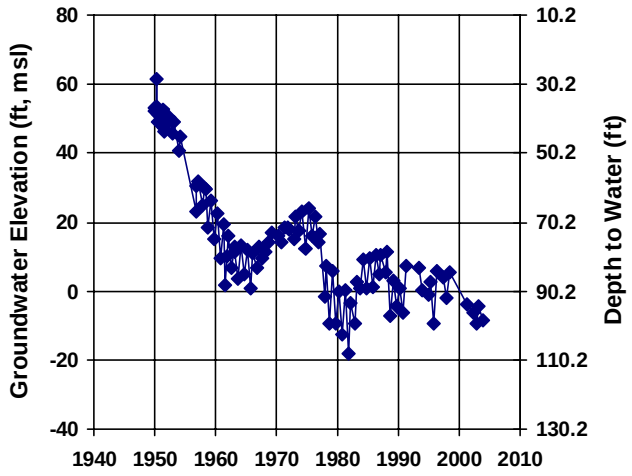
Reference Elevation: 59.5 ft, msl

SWN: 12N05E33C001M Depth: 610 Perf: NA



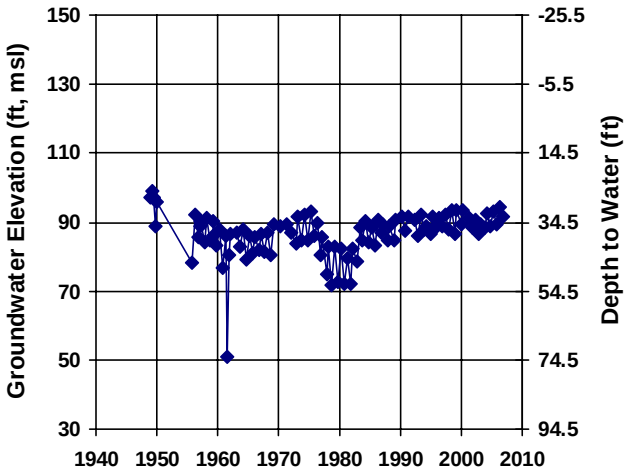
Reference Elevation: 67.0 ft, msl

SWN: 12N05E35E002M Depth: 352 Perf: NA



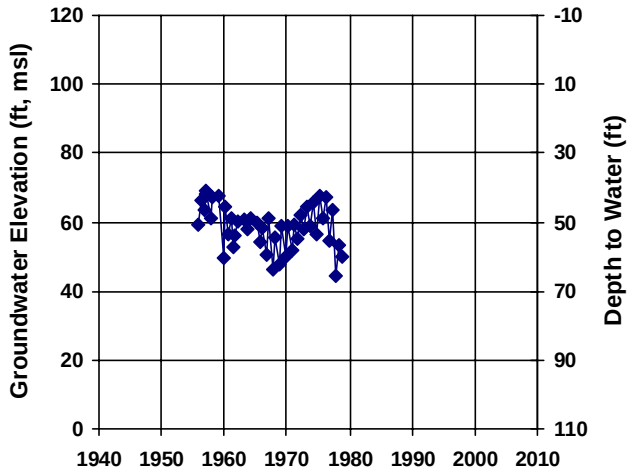
Reference Elevation: 90.2 ft, msl

SWN: 12N06E06A001M Depth: 180 Perf: NA



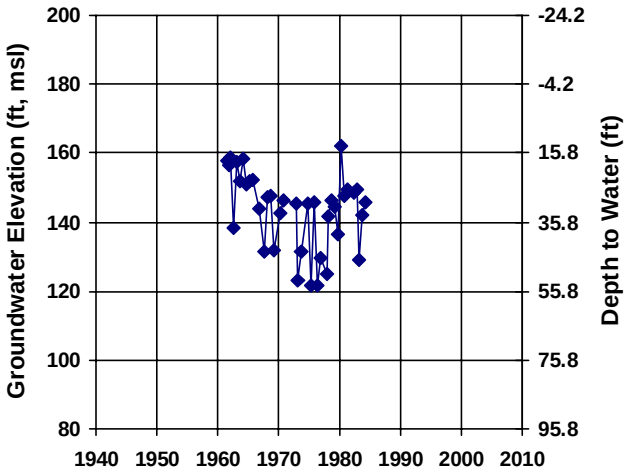
Reference Elevation: 124.5 ft, msl

SWN: 12N06E07M001M Depth: 175 Perf: 78-94



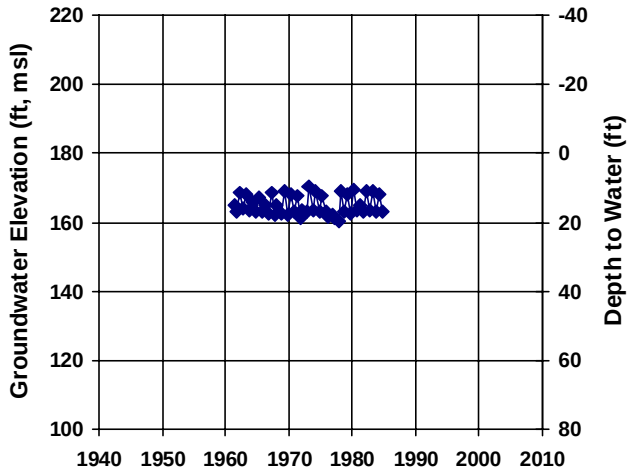
Reference Elevation: 110.0 ft, msl

SWN: 12N06E11E001M Depth: 145 Perf: NA



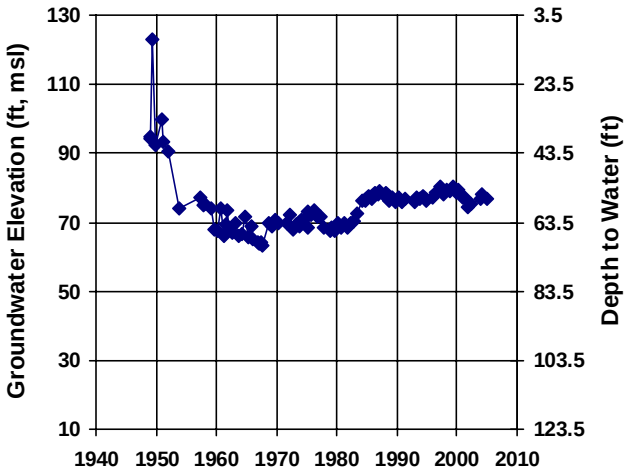
Reference Elevation: 175.8 ft, msl

SWN: 12N06E14F001M Depth: NA Perf: NA



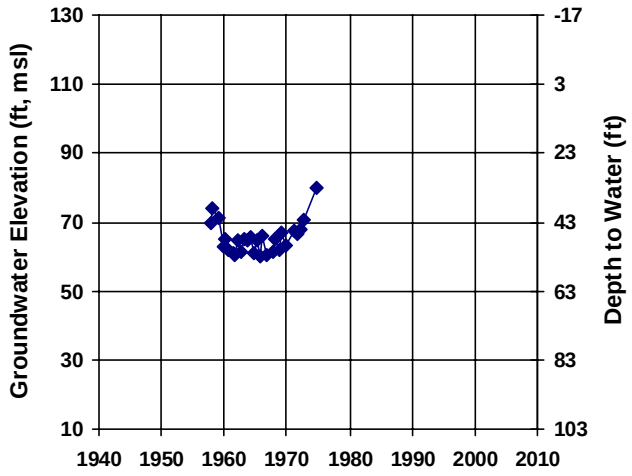
Reference Elevation: 180.0 ft, msl

SWN: 12N06E16D001M Depth: 106 Perf: NA



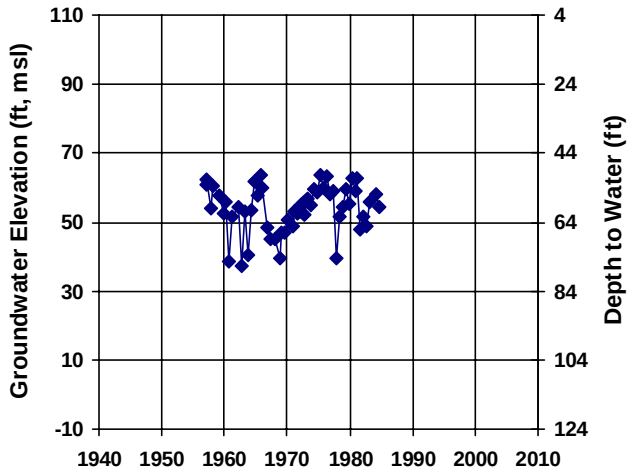
Reference Elevation: 133.5 ft, msl

SWN: 12N06E18L001M Depth: 300 Perf: NA



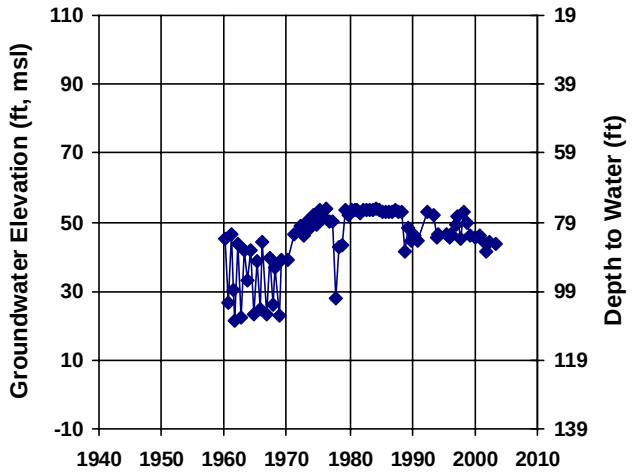
Reference Elevation: 113.0 ft, msl

SWN: 12N06E19P001M Depth: 300 Perf: NA



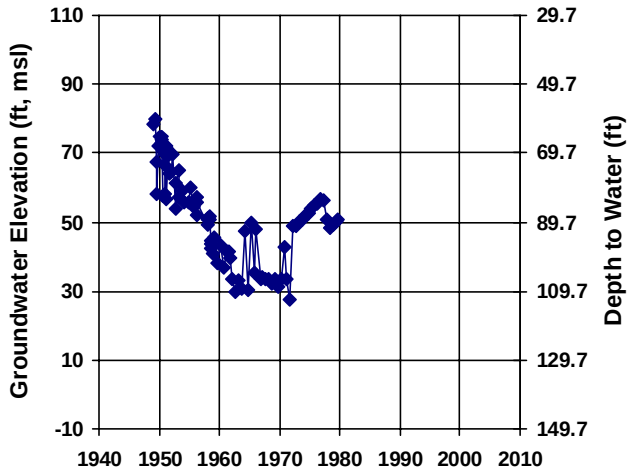
Reference Elevation: 114.0 ft, msl

SWN: 12N06E20P003M Depth: NA Perf: NA



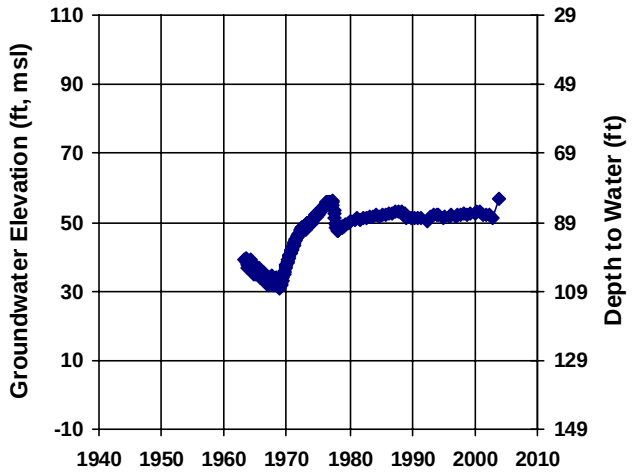
Reference Elevation: 129.0 ft, msl

SWN: 12N06E27D001M Depth: 126 Perf: NA



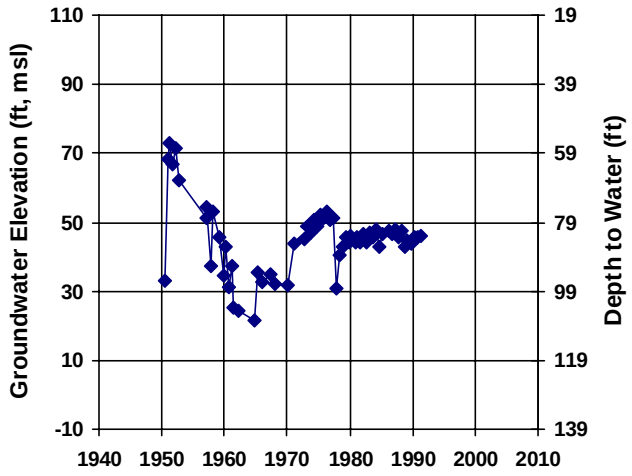
Reference Elevation: 139.7 ft, msl

SWN: 12N06E27D002M Depth: 231 Perf: NA



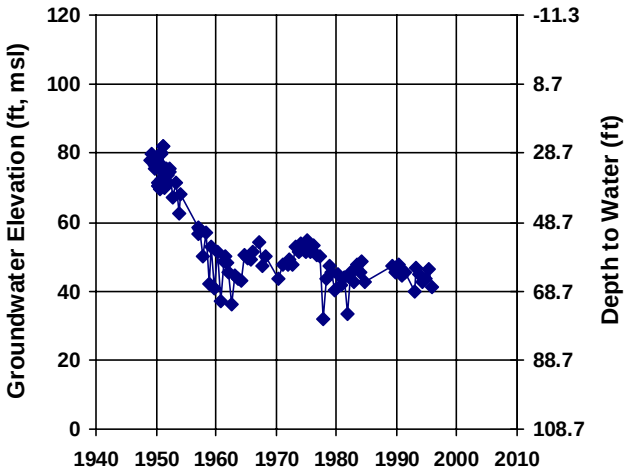
Reference Elevation: 139.0 ft, msl

SWN: 12N06E28M001M Depth: NA Perf: NA



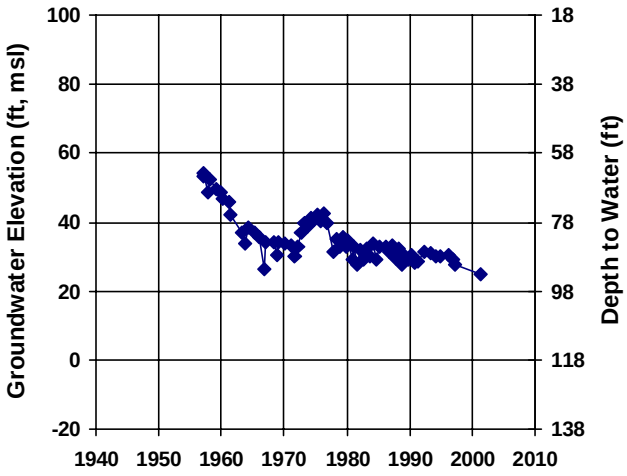
Reference Elevation: 129.0 ft, msl

SWN: 12N06E30L001M Depth: NA Perf: NA



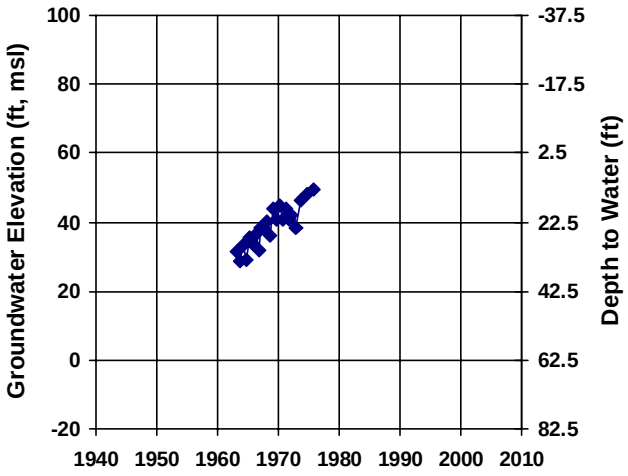
Reference Elevation: 108.7 ft, msl

SWN: 12N06E32K001M Depth: NA Perf: NA



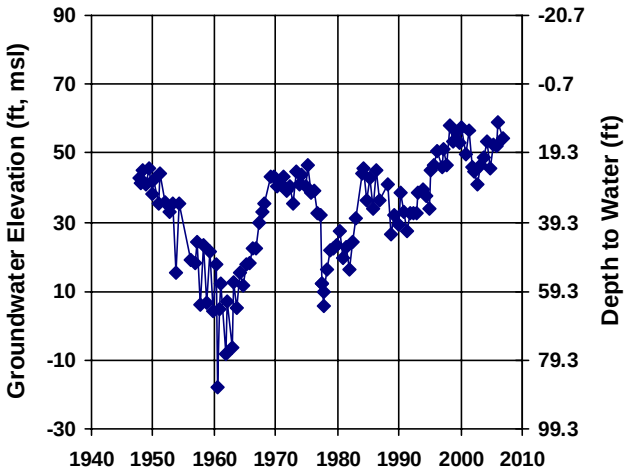
Reference Elevation: 118.0 ft, msl

SWN: 13N04E13D001M Depth: NA Perf: NA



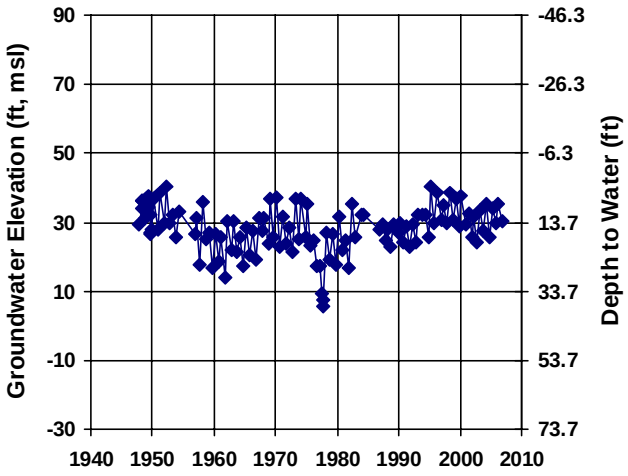
Reference Elevation: 62.5 ft, msl

SWN: 13N04E13R001M Depth: NA Perf: NA



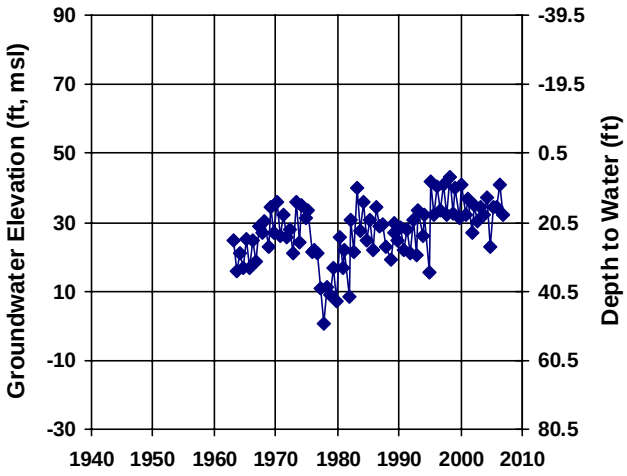
Reference Elevation: 69.3 ft, msl

SWN: 13N04E16N001M Depth: 500 Perf: NA



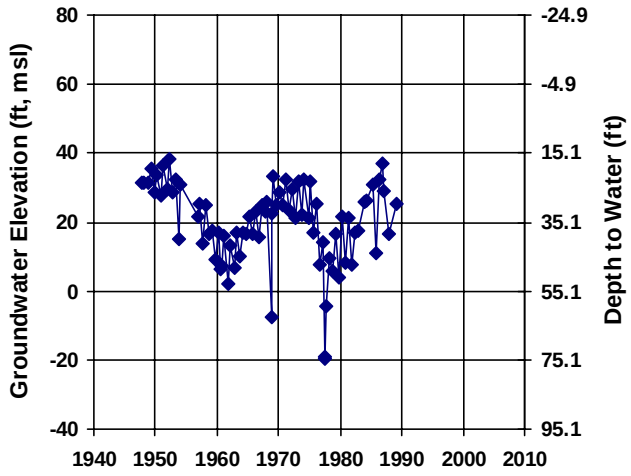
Reference Elevation: 43.7 ft, msl

SWN: 13N04E22D001M Depth: NA Perf: NA



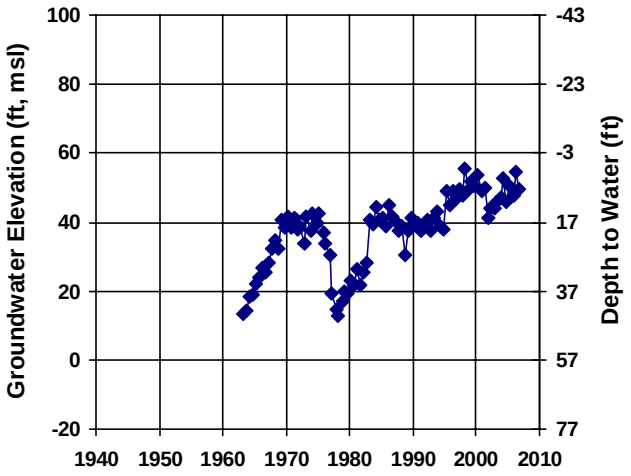
Reference Elevation: 50.5 ft, msl

SWN: 13N04E22G001M Depth: 209 Perf: NA



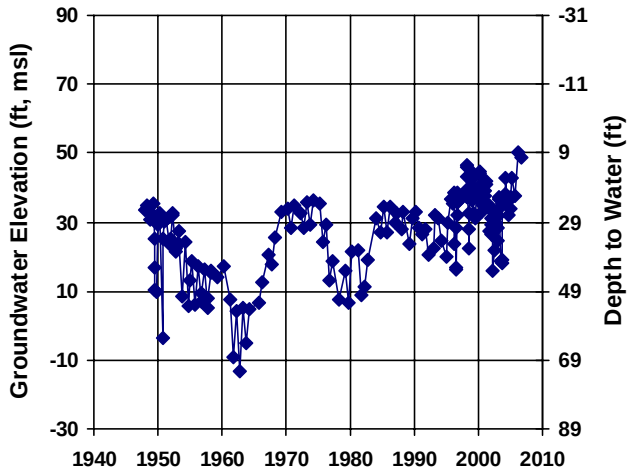
Reference Elevation: 55.1 ft, msl

SWN: 13N04E23A002M Depth: 83 Perf: 56-83



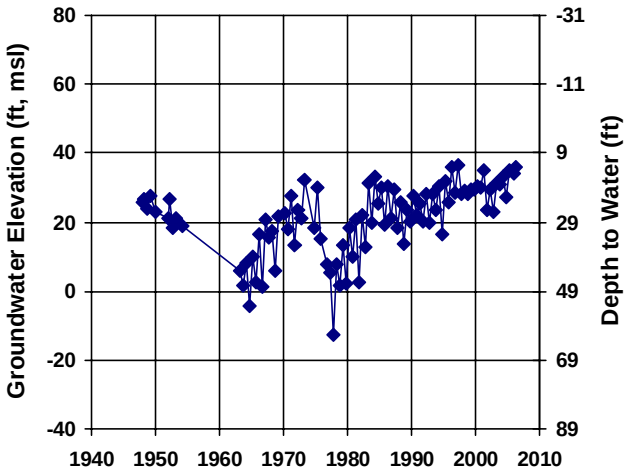
Reference Elevation: 57.0 ft, msl

SWN: 13N04E26R001M Depth: NA Perf: NA



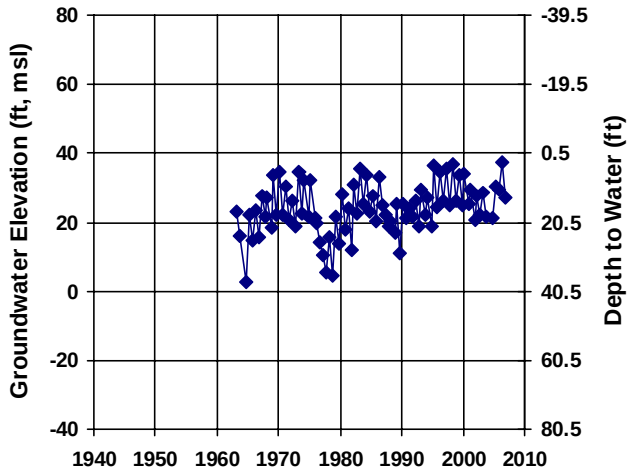
Reference Elevation: 59.0 ft, msl

SWN: 13N04E28R001M Depth: NA Perf: NA



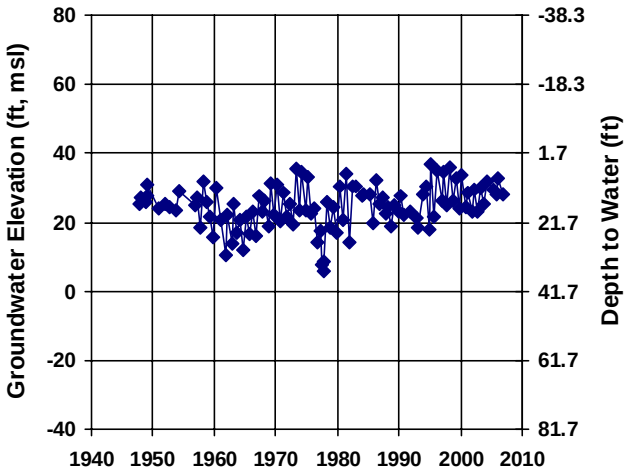
Reference Elevation: 49.0 ft, msl

SWN: 13N04E29A002M Depth: NA Perf: NA



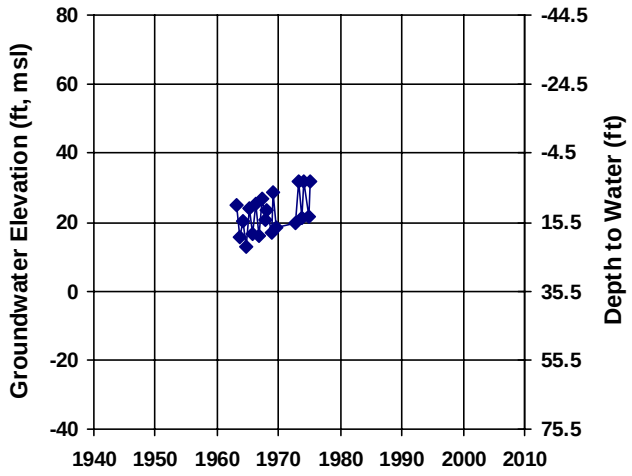
Reference Elevation: 40.5 ft, msl

SWN: 13N04E29F001M Depth: 148 Perf: NA



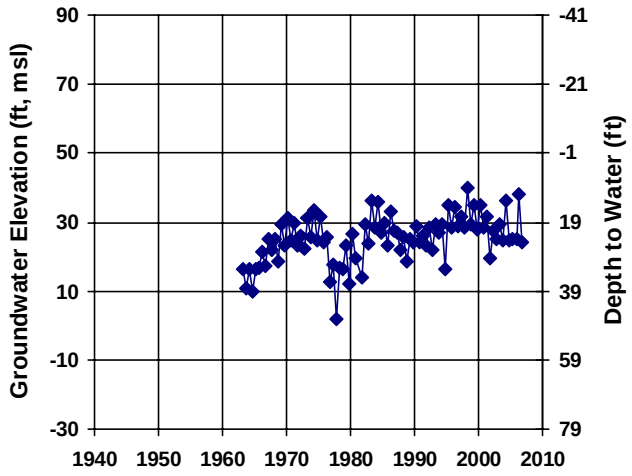
Reference Elevation: 41.7 ft, msl

SWN: 13N04E31R001M Depth: NA Perf: NA



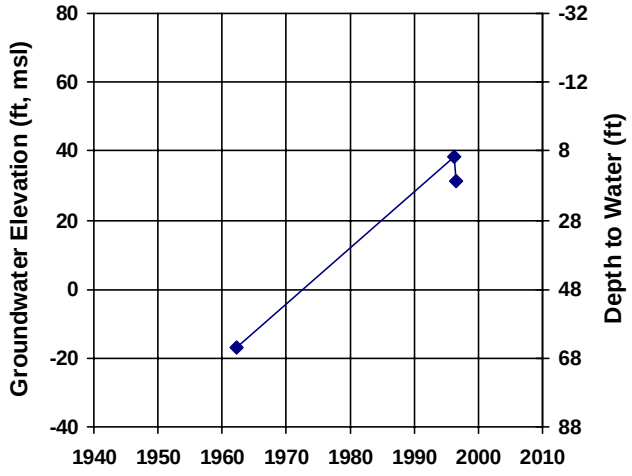
Reference Elevation: 35.5 ft, msl

SWN: 13N04E32G001M Depth: NA Perf: NA



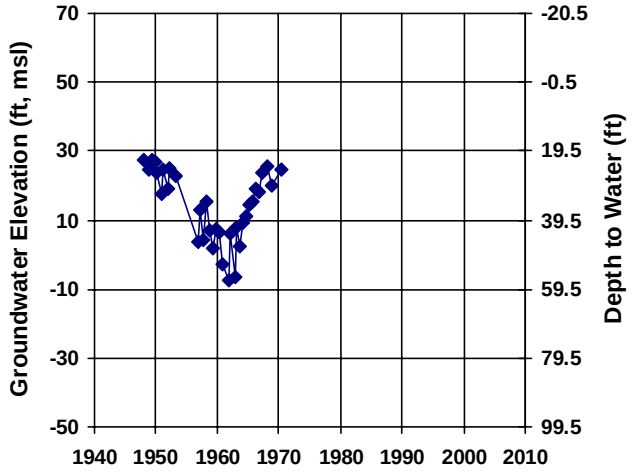
Reference Elevation: 49.0 ft, msl

SWN: 13N04E33J001M Depth: 155 Perf: NA



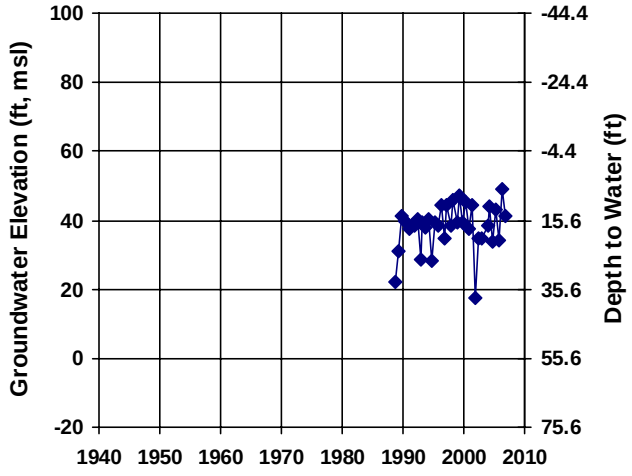
Reference Elevation: 48.0 ft, msl

SWN: 13N04E33P001M Depth: NA Perf: NA



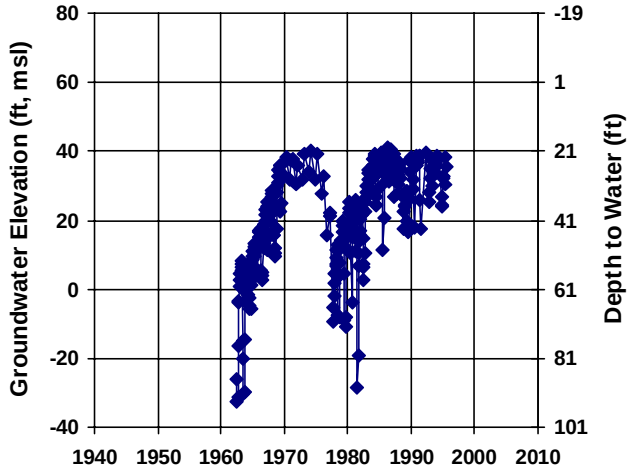
Reference Elevation: 49.5 ft, msl

SWN: 13N04E35Q002M Depth: NA Perf: NA



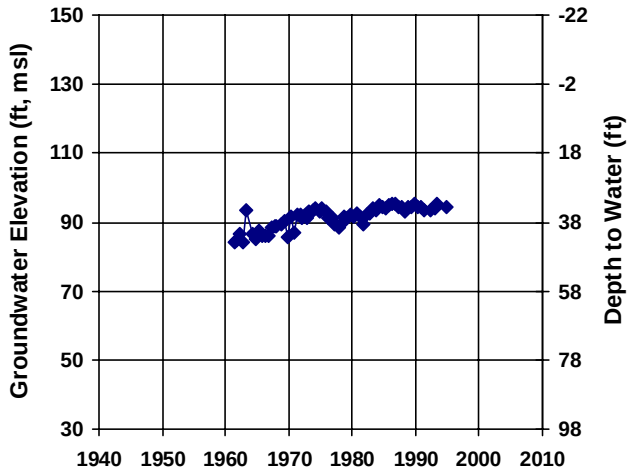
Reference Elevation: 55.6 ft, msl

SWN: 13N04E36E001M Depth: 254 Perf: NA



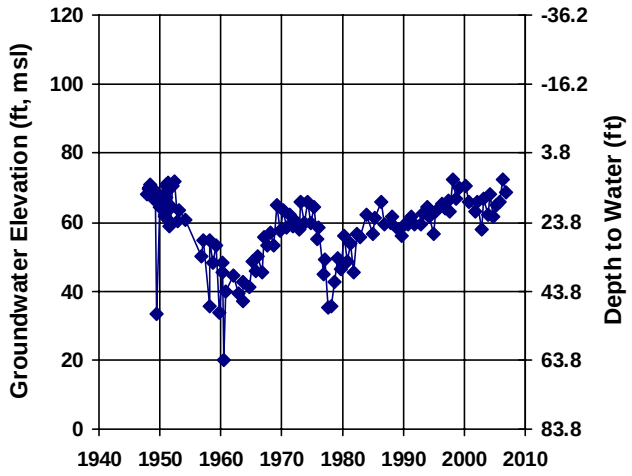
Reference Elevation: 61.0 ft, msl

SWN: 13N05E01K001M Depth: 100 Perf: NA



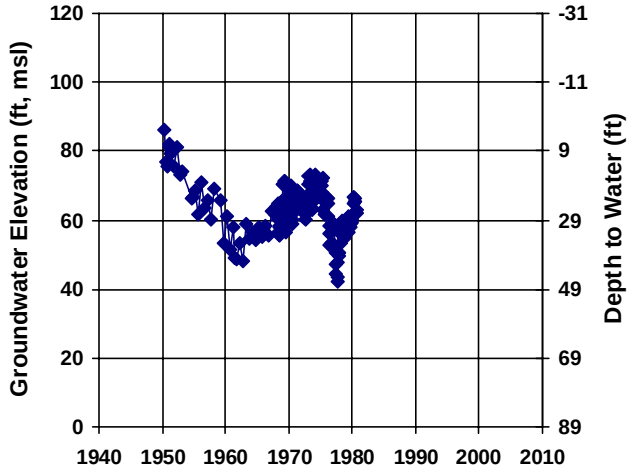
Reference Elevation: 128.0 ft, msl

SWN: 13N05E09R001M Depth: 150 Perf: NA



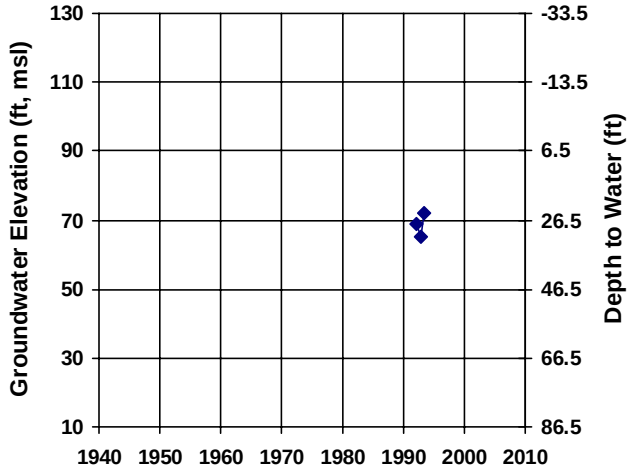
Reference Elevation: 83.8 ft, msl

SWN: 13N05E10B001M Depth: 100 Perf: NA



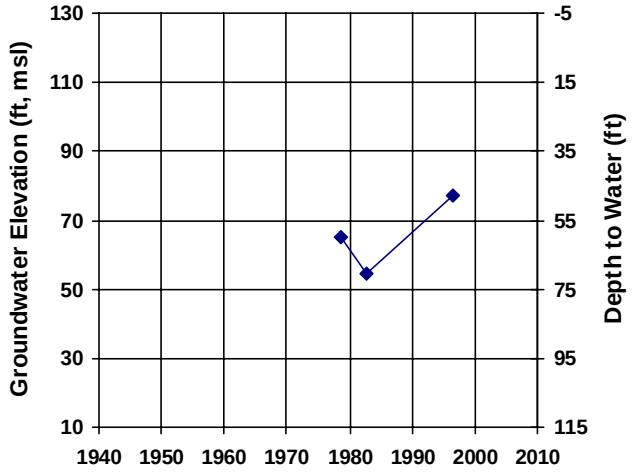
Reference Elevation: 89.0 ft, msl

SWN: 13N05E10B002M Depth: NA Perf: NA



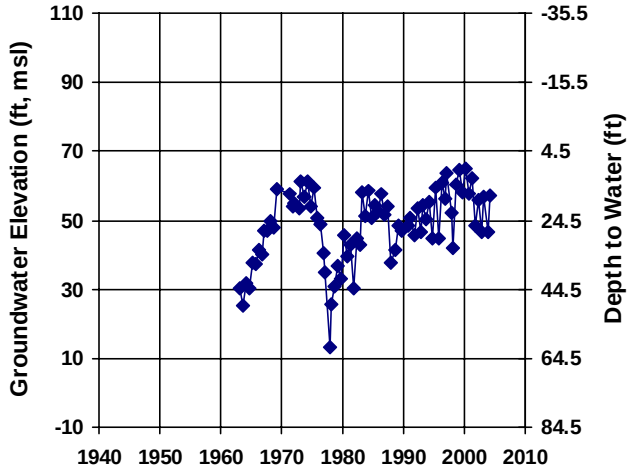
Reference Elevation: 96.5 ft, msl

SWN: 13N05E12Q002M Depth: 107 Perf: NA



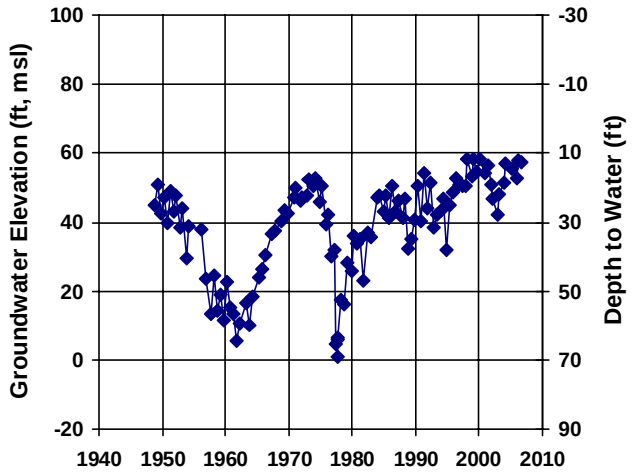
Reference Elevation: 125.0 ft, msl

SWN: 13N05E17G001M Depth: NA Perf: NA



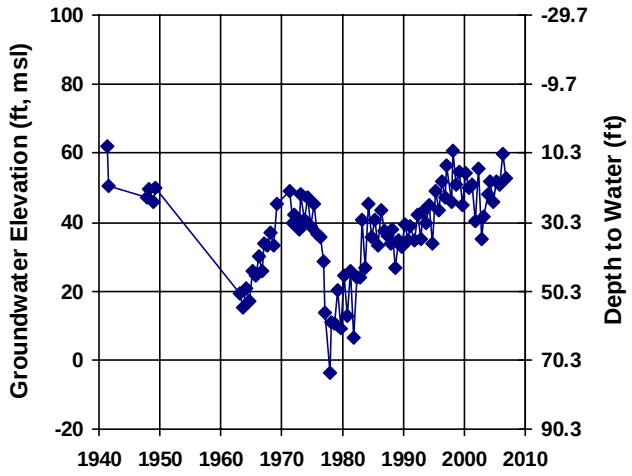
Reference Elevation: 74.5 ft, msl

SWN: 13N05E17R001M Depth: 480 Perf: NA



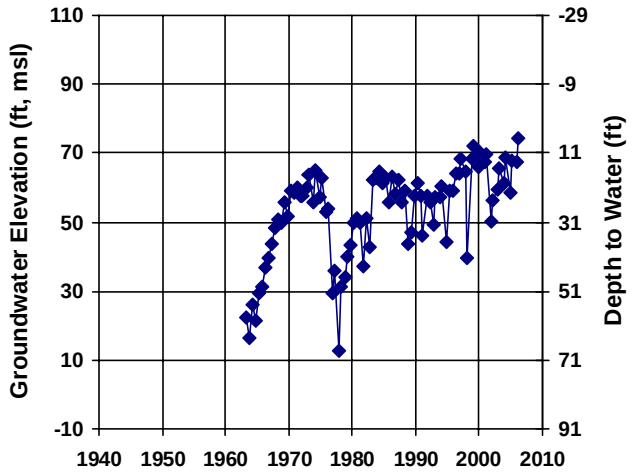
Reference Elevation: 70.0 ft, msl

SWN: 13N05E18C001M Depth: 210 Perf: NA



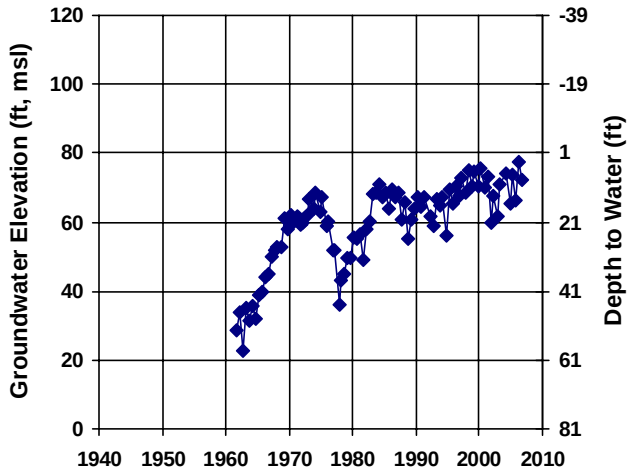
Reference Elevation: 70.3 ft, msl

SWN: 13N05E21R003M Depth: NA Perf: NA



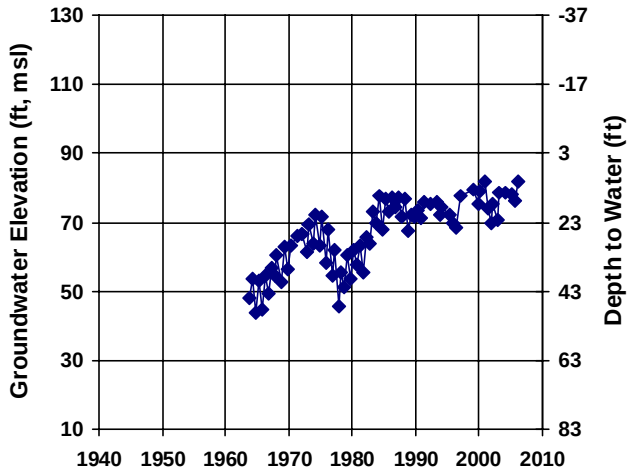
Reference Elevation: 81.0 ft, msl

SWN: 13N05E22C003M Depth: 400 Perf: NA



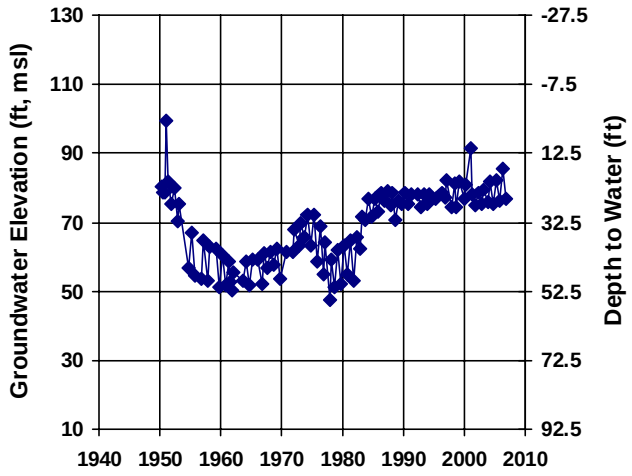
Reference Elevation: 81.0 ft, msl

SWN: 13N05E24E002M Depth: 140 Perf: NA



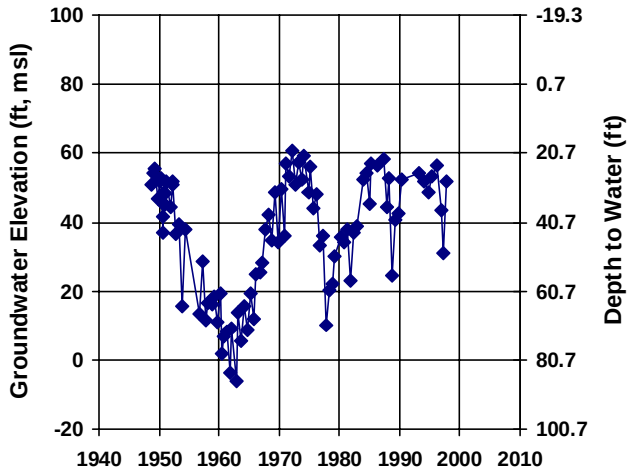
Reference Elevation: 93.0 ft, msl

SWN: 13N05E24J001M Depth: NA Perf: NA



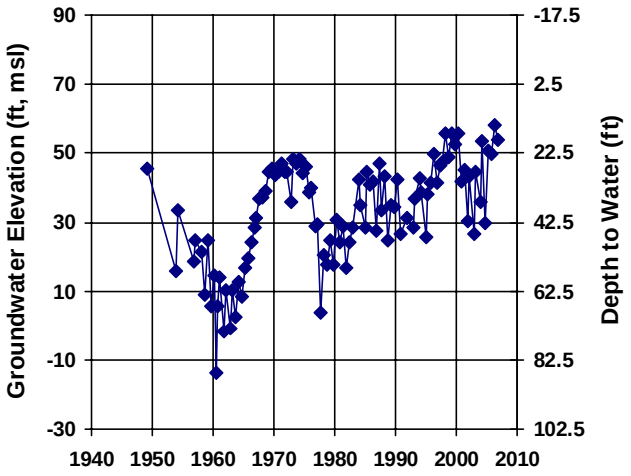
Reference Elevation: 102.5 ft, msl

SWN: 13N05E28N001M Depth: NA Perf: NA



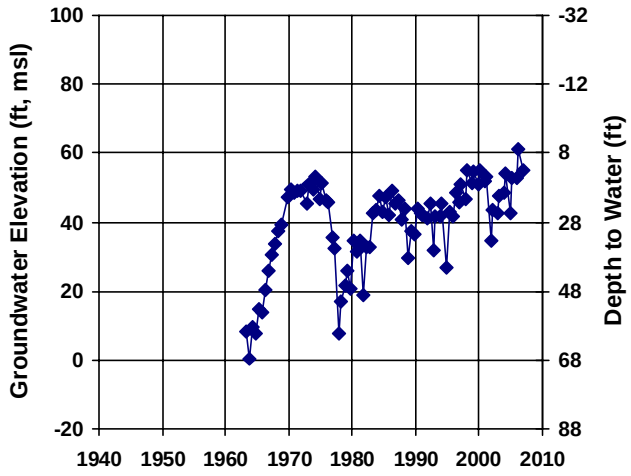
Reference Elevation: 80.7 ft, msl

SWN: 13N05E30A001M Depth: NA Perf: NA



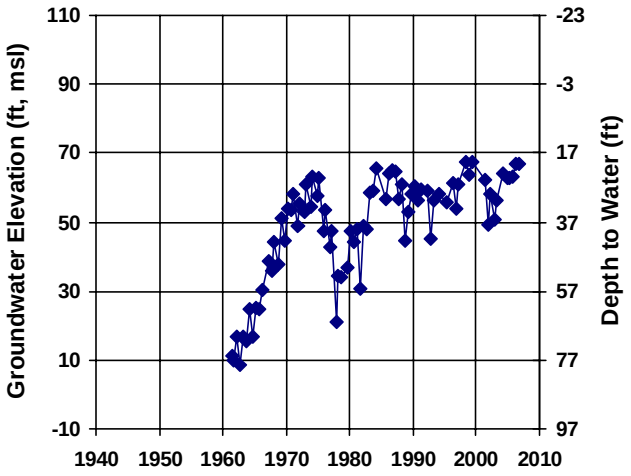
Reference Elevation: 72.5 ft, msl

SWN: 13N05E31K001M Depth: 393 Perf: NA



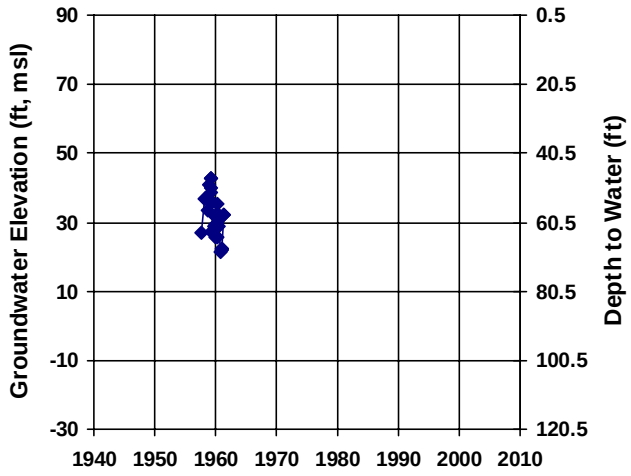
Reference Elevation: 68.0 ft, msl

SWN: 13N05E34P001M Depth: NA Perf: NA



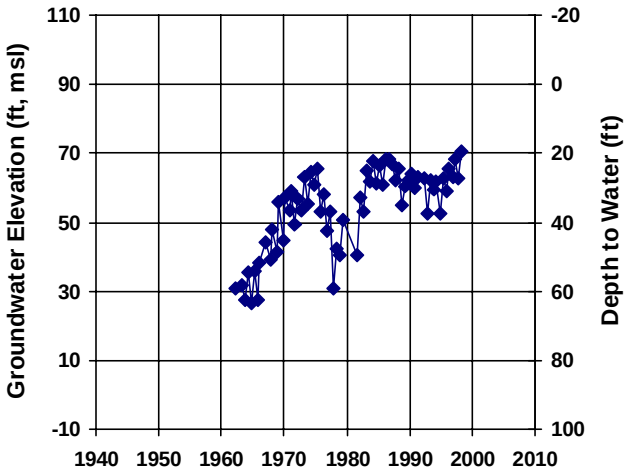
Reference Elevation: 87.0 ft, msl

SWN: 13N05E34R003M Depth: 70 Perf: NA



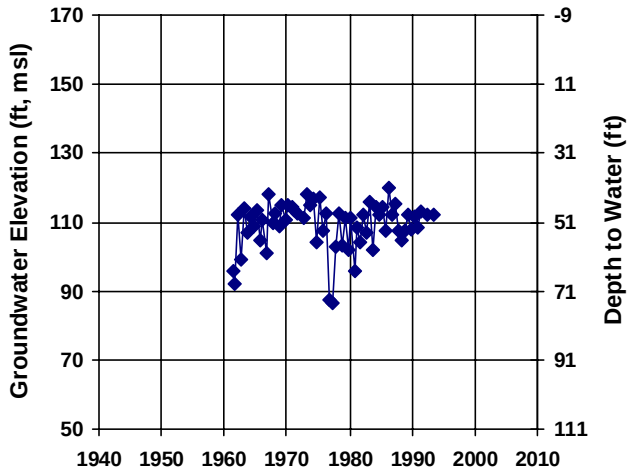
Reference Elevation: 90.5 ft, msl

SWN: 13N05E34R004M Depth: 100 Perf: 80-100



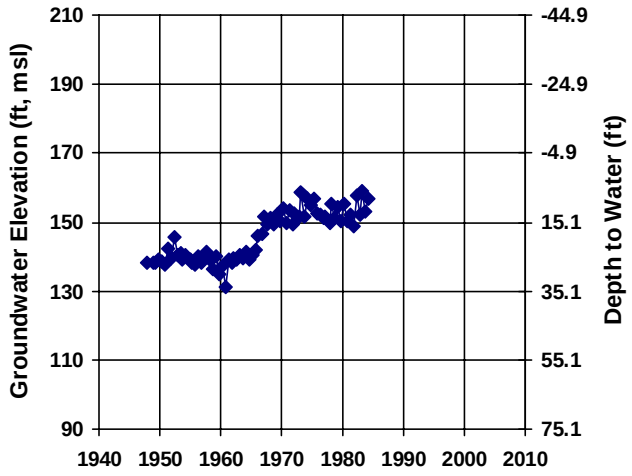
Reference Elevation: 90.0 ft, msl

SWN: 13N06E06A001M Depth: 300 Perf: NA



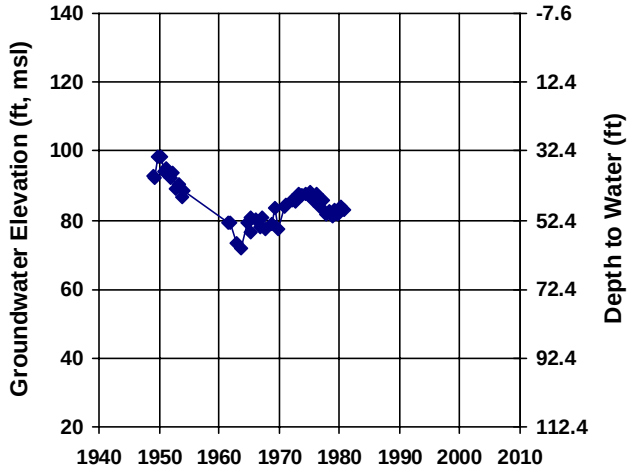
Reference Elevation: 161.0 ft, msl

SWN: 13N06E09N002M Depth: 52 Perf: NA



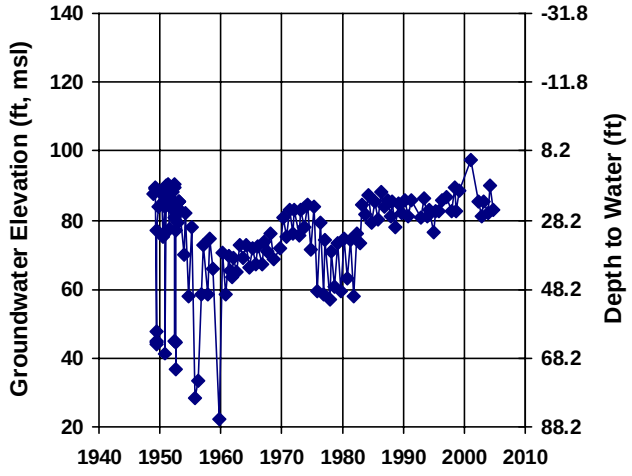
Reference Elevation: 165.1 ft, msl

SWN: 13N06E19B001M Depth: 330 Perf: NA



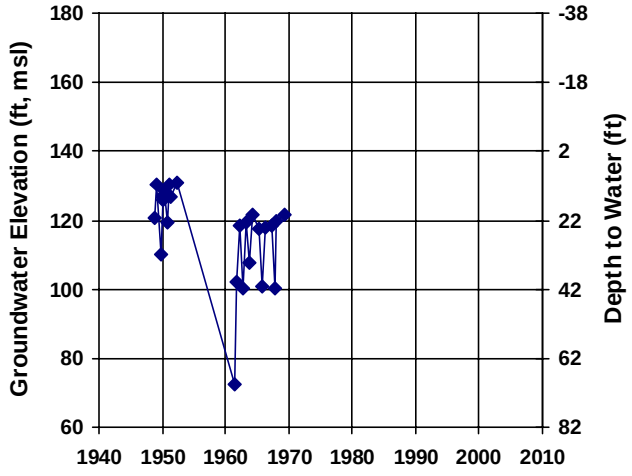
Reference Elevation: 132.4 ft, msl

SWN: 13N06E30M001M Depth: 270 Perf: NA



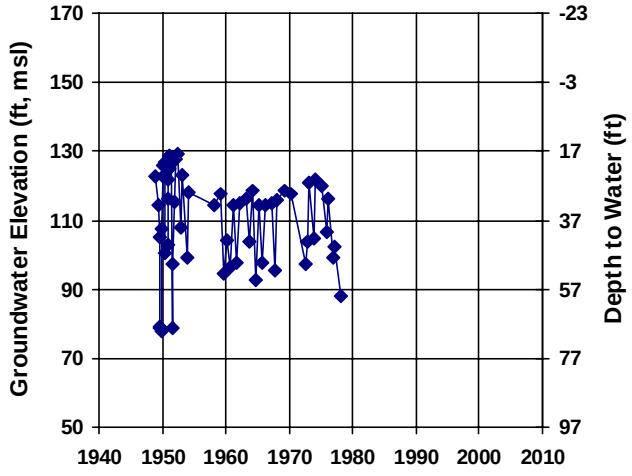
Reference Elevation: 108.2 ft, msl

SWN: 13N06E33C001M Depth: 391 Perf: NA



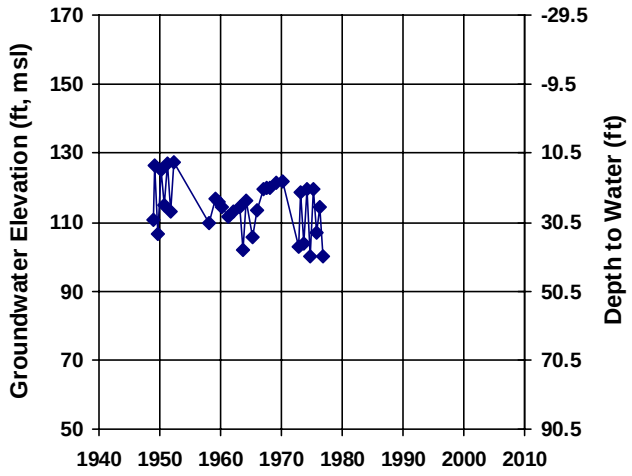
Reference Elevation: 142.0 ft, msl

SWN: 13N06E33M001M Depth: NA Perf: NA



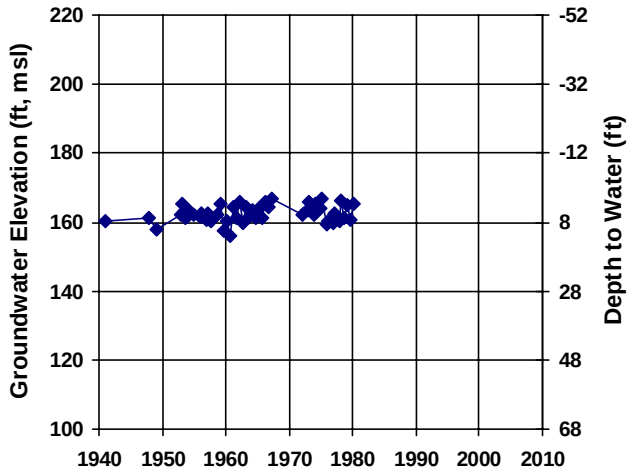
Reference Elevation: 147.0 ft, msl

SWN: 13N06E33M002M Depth: 85 Perf: NA



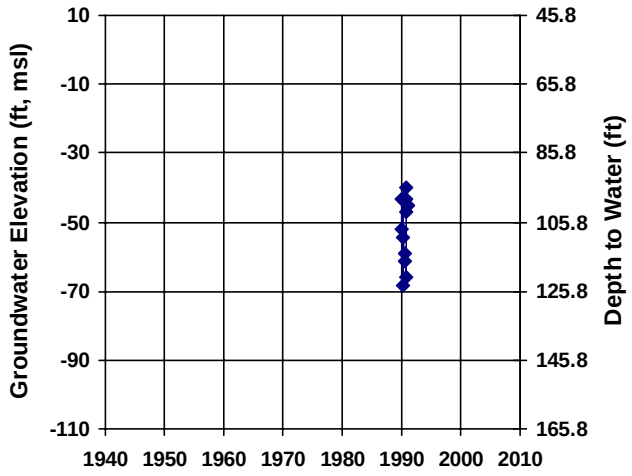
Reference Elevation: 140.5 ft, msl

SWN: 13N06E34P002M Depth: NA Perf: NA



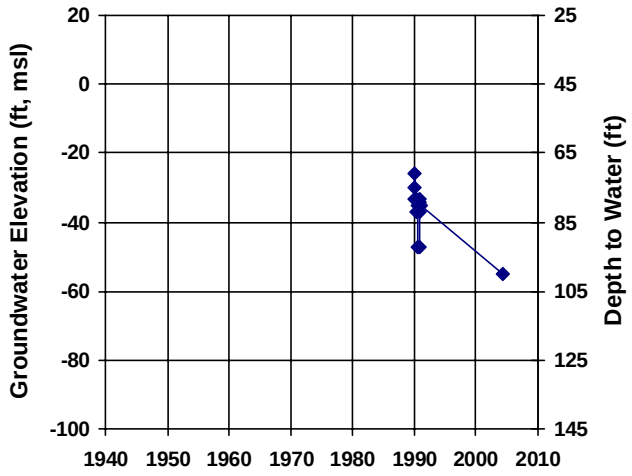
Reference Elevation: 168.0 ft, msl

SWN: ARC-002A Depth: 420 Perf: 170-415



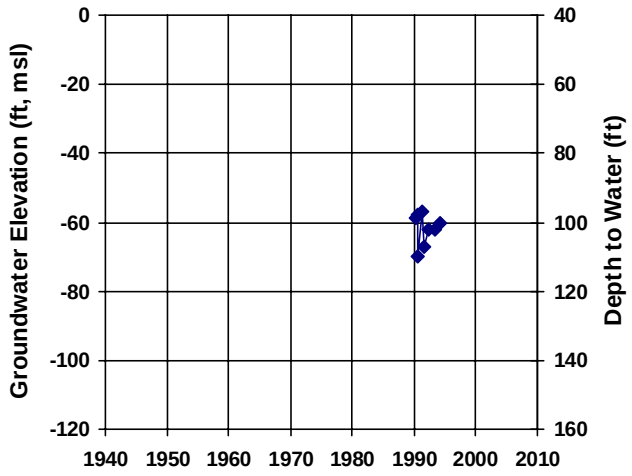
Reference Elevation: 55.8 ft, msl

SWN: ARC-003A Depth: 430 Perf: 200-225



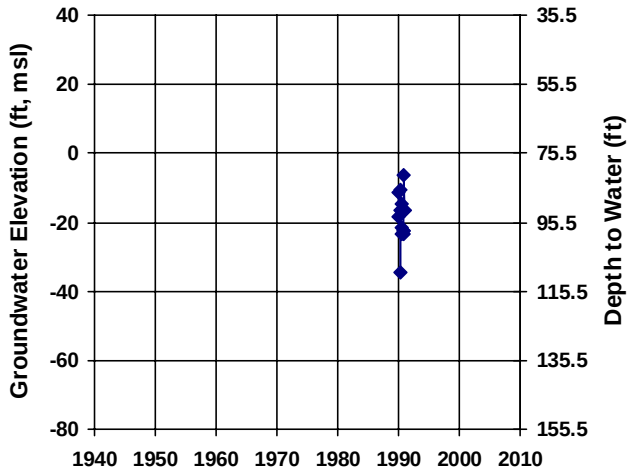
Reference Elevation: 45.0 ft, msl

SWN: ARC-005 Depth: 345 Perf: 230-312



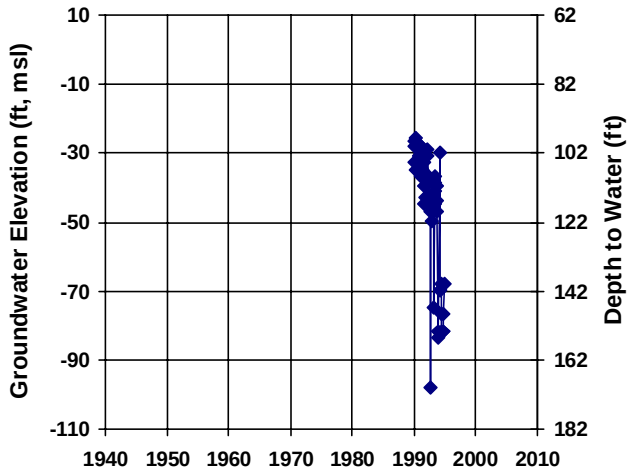
Reference Elevation: 40.0 ft, msl

SWN: ARC-009 Depth: 270 Perf: 170-225



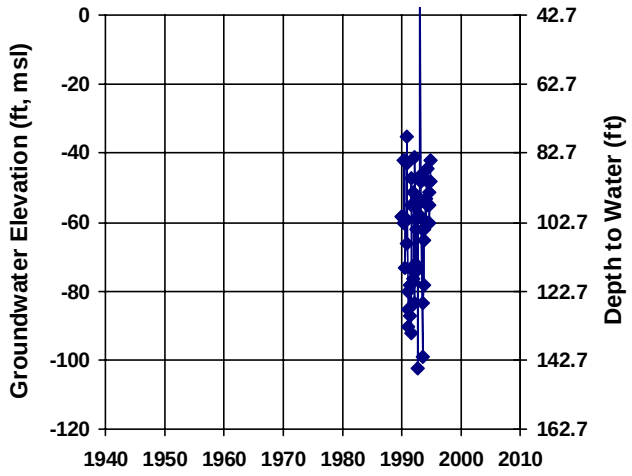
Reference Elevation: 75.5 ft, msl

SWN: ARC-010 Depth: 265 Perf: 210-262



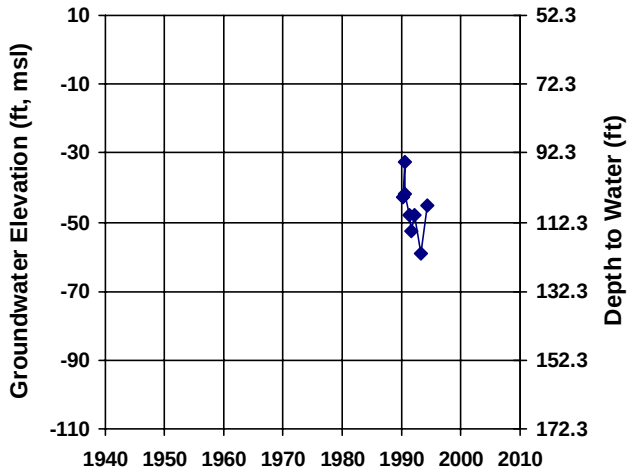
Reference Elevation: 72.0 ft, msl

SWN: ARC-012 Depth: 294 Perf: 168-271



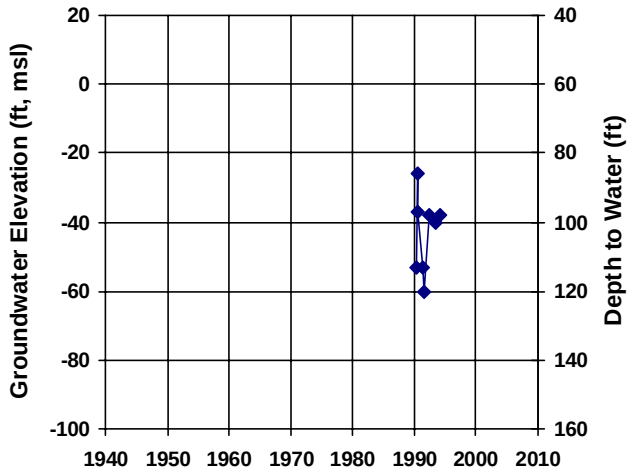
Reference Elevation: 42.7 ft, msl

SWN: ARC-013 Depth: 374 Perf: 350-368



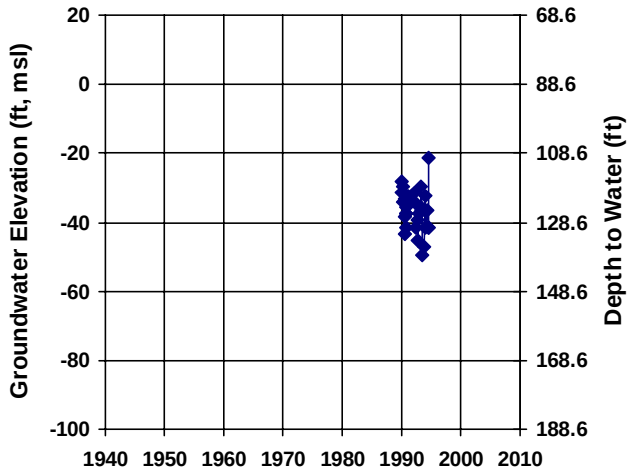
Reference Elevation: 62.3 ft, msl

SWN: ARC-014 Depth: 470 Perf: 456-466



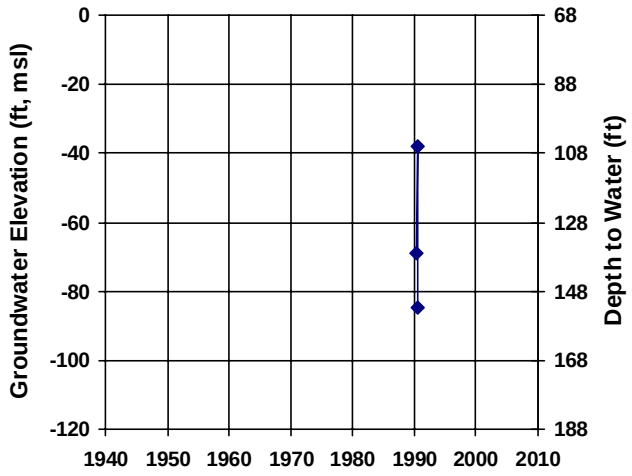
Reference Elevation: 60.0 ft, msl

SWN: ARC-016 Depth: 240 Perf: 245-359



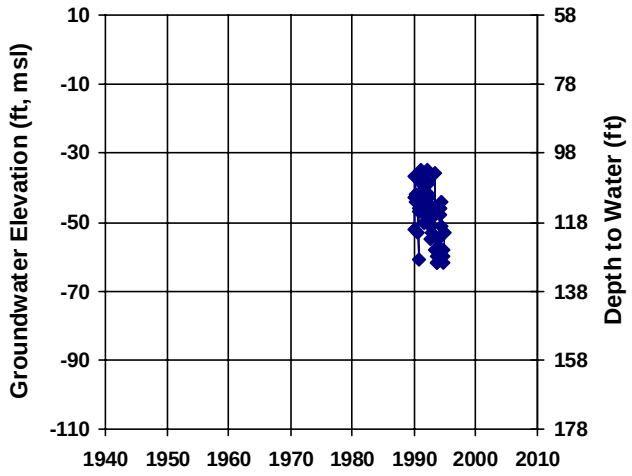
Reference Elevation: 88.6 ft, msl

SWN: ARC-018 Depth: 420 Perf: 140-345



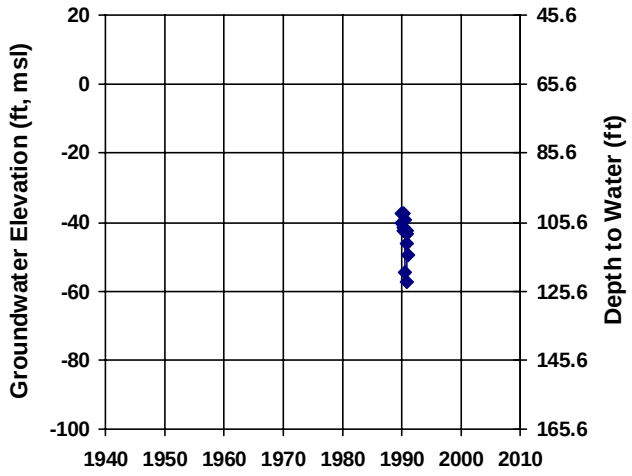
Reference Elevation: 68.0 ft, msl

SWN: ARC-019 Depth: 340 Perf: 190-300



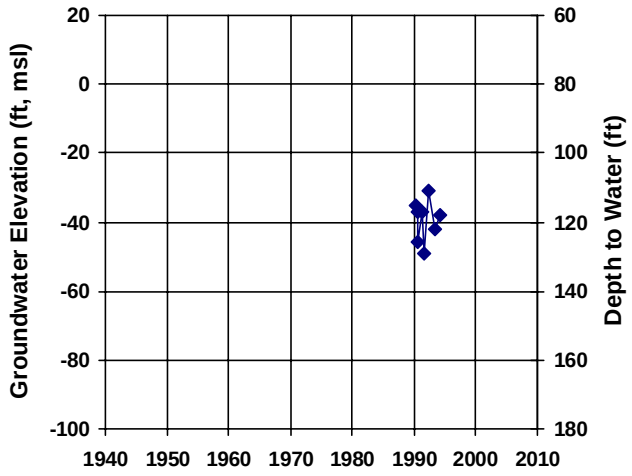
Reference Elevation: 68.0 ft, msl

SWN: ARC-020A Depth: 475 Perf: 194-400



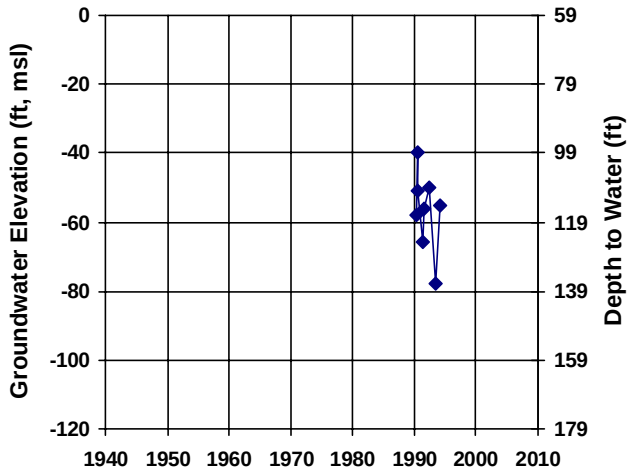
Reference Elevation: 65.6 ft, msl

SWN: ARC-022 Depth: 327 Perf: 155-350



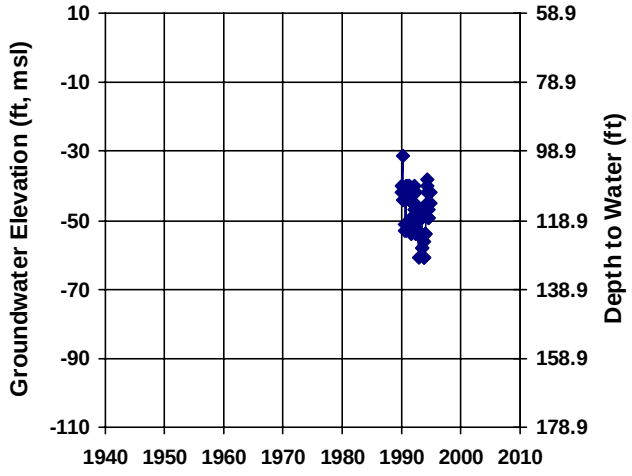
Reference Elevation: 80.0 ft, msl

SWN: ARC-023 Depth: 360 Perf: 326-360



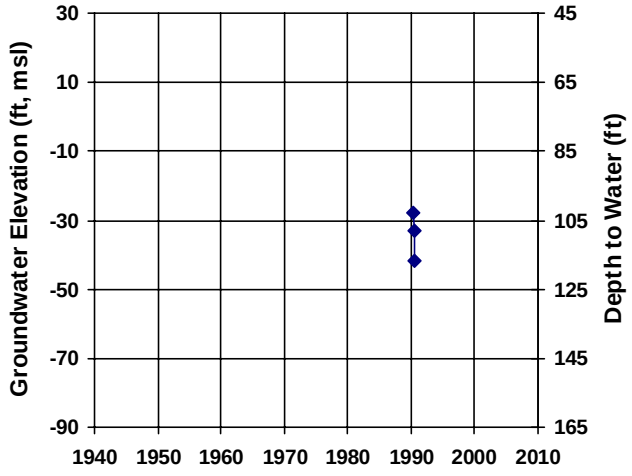
Reference Elevation: 59.0 ft, msl

SWN: ARC-024 Depth: 270 Perf: 212-260



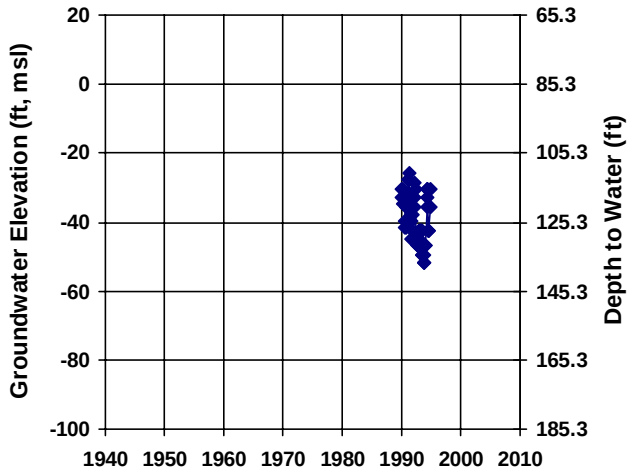
Reference Elevation: 68.9 ft, msl

SWN: ARC-025 Depth: 318 Perf: 115-170



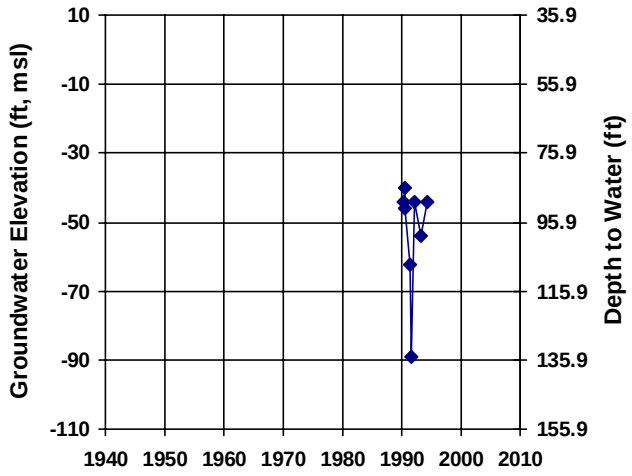
Reference Elevation: 75.0 ft, msl

SWN: ARC-026 Depth: 360 Perf: 194-283



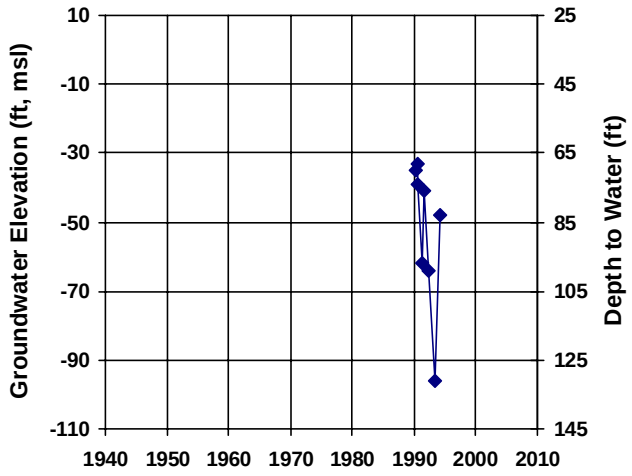
Reference Elevation: 85.3 ft, msl

SWN: ARC-028 Depth: 222 Perf: 222-254



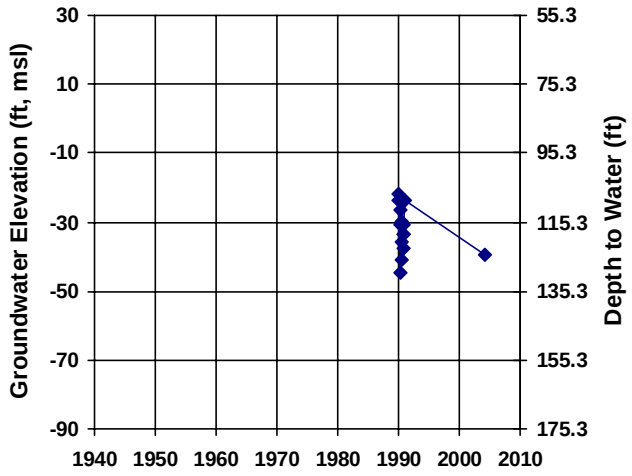
Reference Elevation: 45.9 ft, msl

SWN: ARC-030 Depth: 460 Perf: 370-410



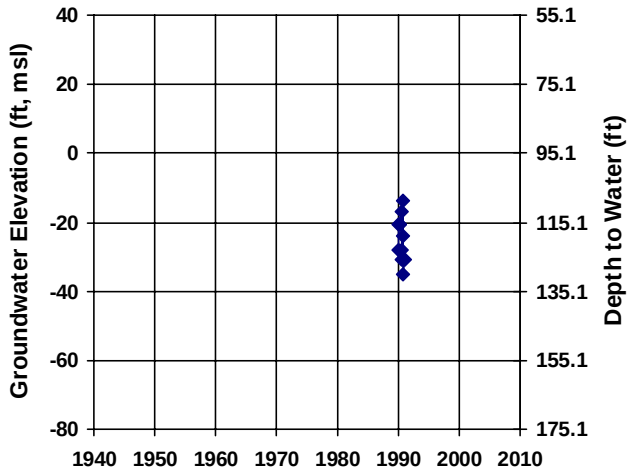
Reference Elevation: 35.0 ft, msl

SWN: ARC-031A Depth: 660 Perf: 185-655



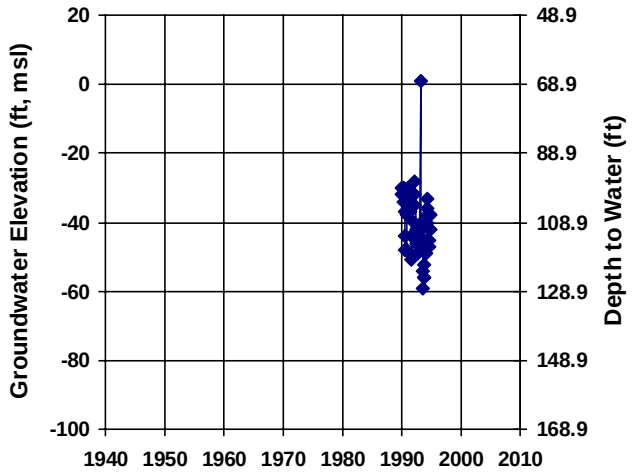
Reference Elevation: 85.3 ft, msl

SWN: ARC-032 Depth: 360 Perf: 254-355



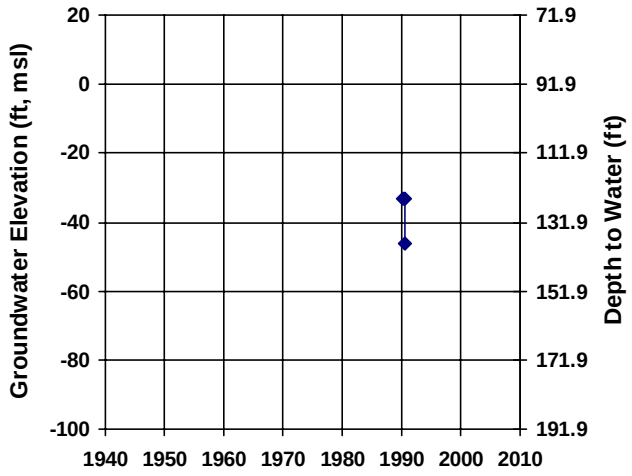
Reference Elevation: 95.1 ft, msl

SWN: ARC-033 Depth: 320 Perf: 198-318



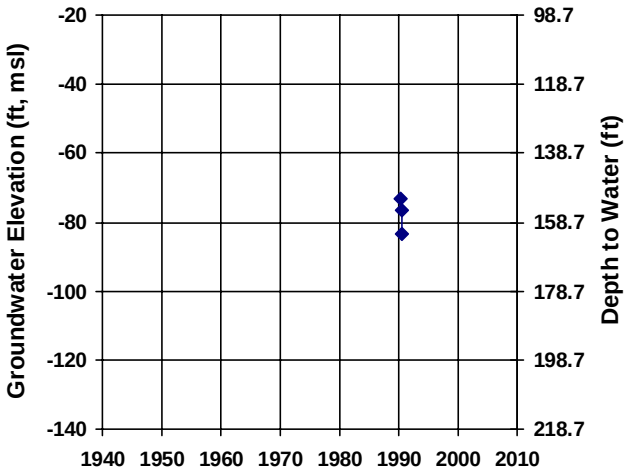
Reference Elevation: 68.9 ft, msl

SWN: ARC-034 Depth: 400 Perf: 225-286



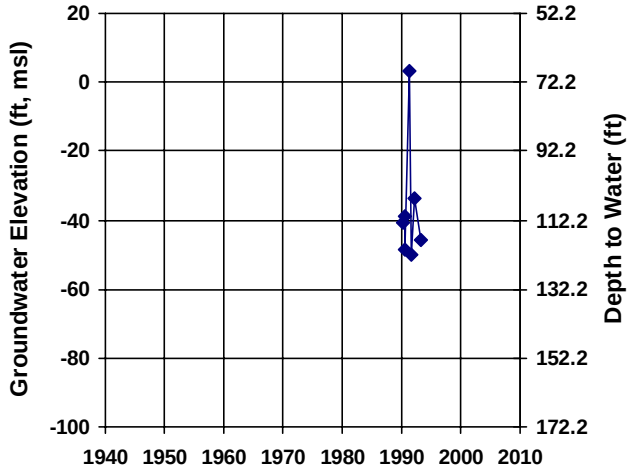
Reference Elevation: 91.9 ft, msl

SWN: ARC-035 Depth: 316 Perf: 152-312



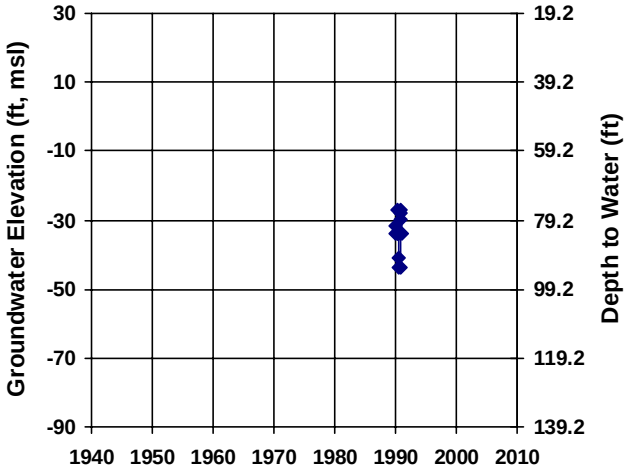
Reference Elevation: 78.7 ft, msl

SWN: ARC-036 Depth: 335 Perf: 140-335



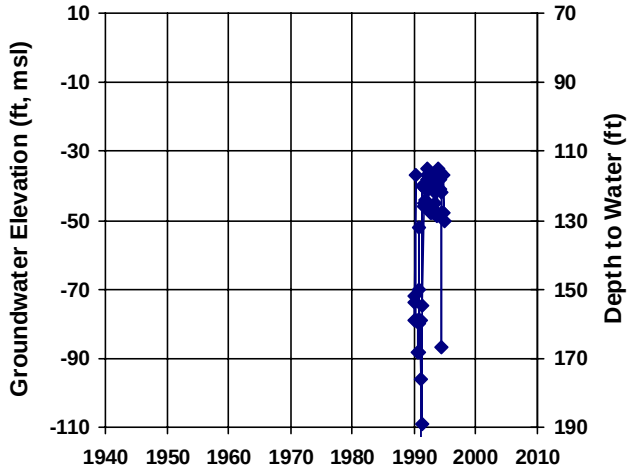
Reference Elevation: 72.2 ft, msl

SWN: ARC-037 Depth: 405 Perf: 180-400



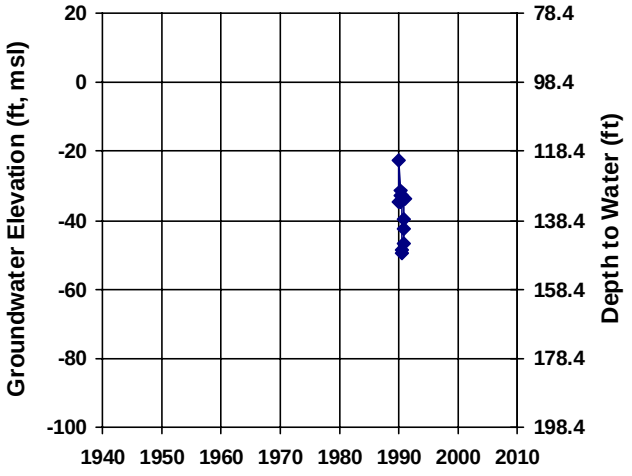
Reference Elevation: 49.2 ft, msl

SWN: ARC-038 Depth: 375 Perf: 180-370

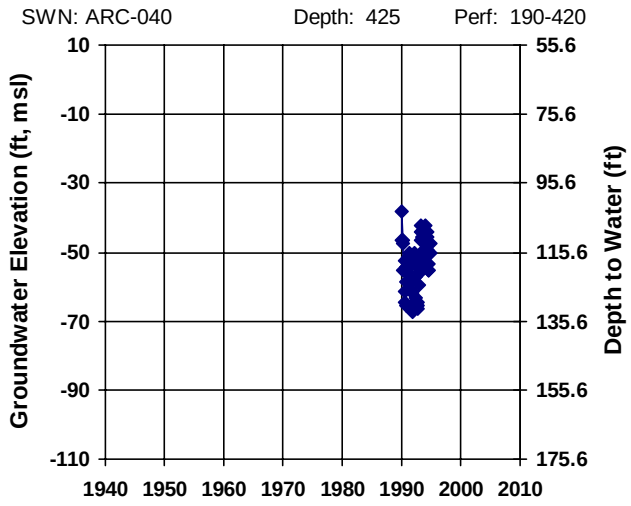


Reference Elevation: 80.0 ft, msl

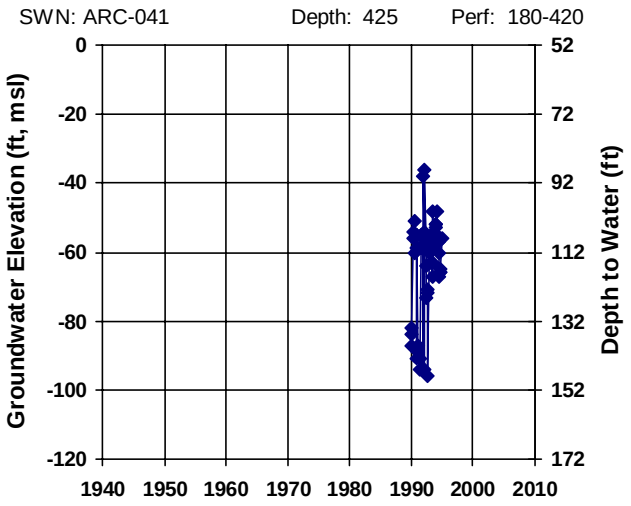
SWN: ARC-039 Depth: 385 Perf: 95-380



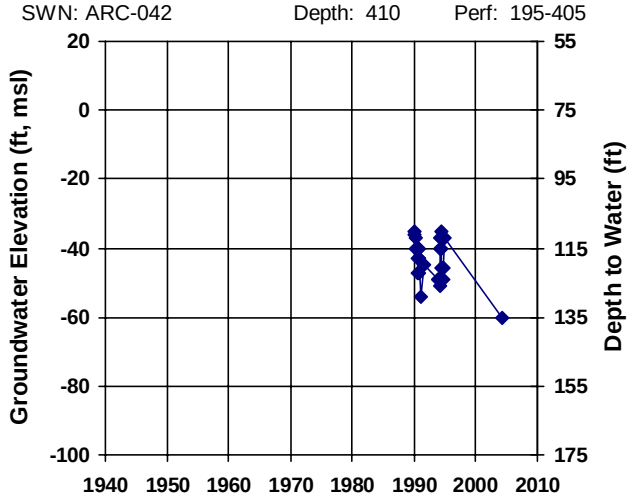
Reference Elevation: 98.4 ft, msl



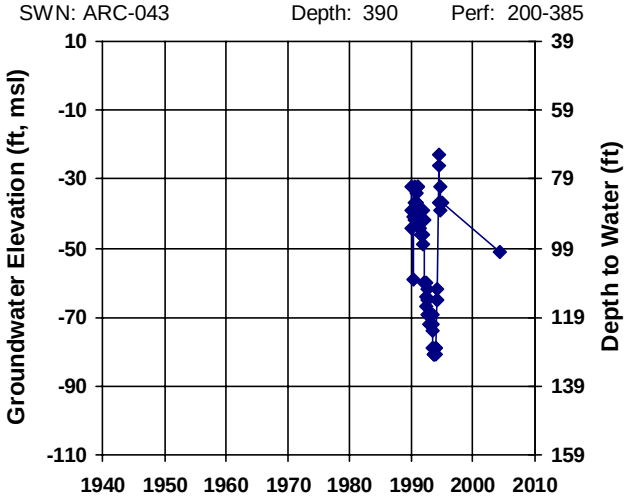
Reference Elevation: 65.6 ft, msl



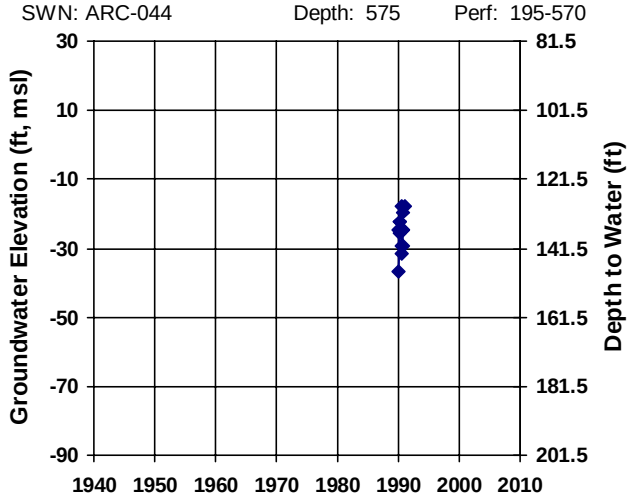
Reference Elevation: 52.0 ft, msl



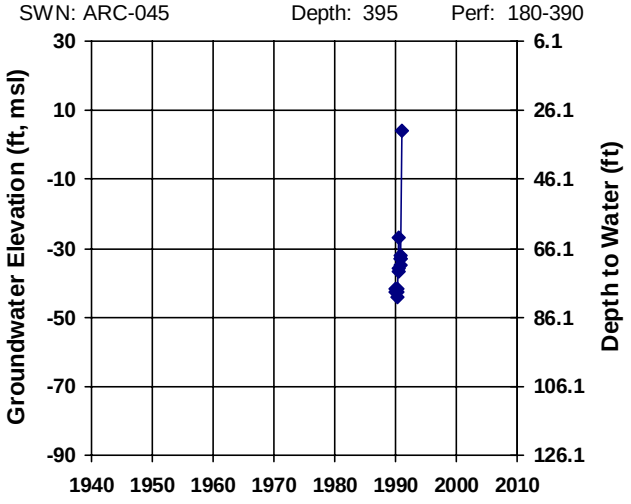
Reference Elevation: 75.0 ft, msl



Reference Elevation: 49.0 ft, msl

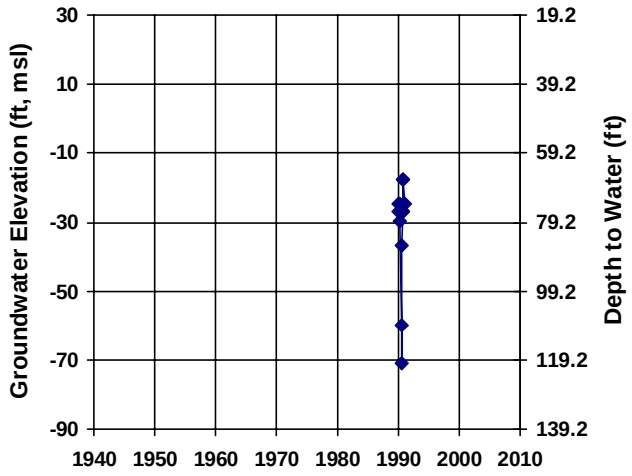


Reference Elevation: 111.5 ft, msl



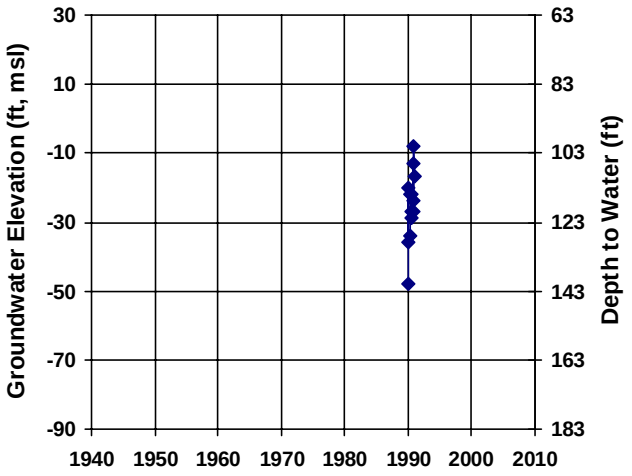
Reference Elevation: 36.1 ft, msl

SWN: ARC-046R Depth: 232 Perf: 150-407



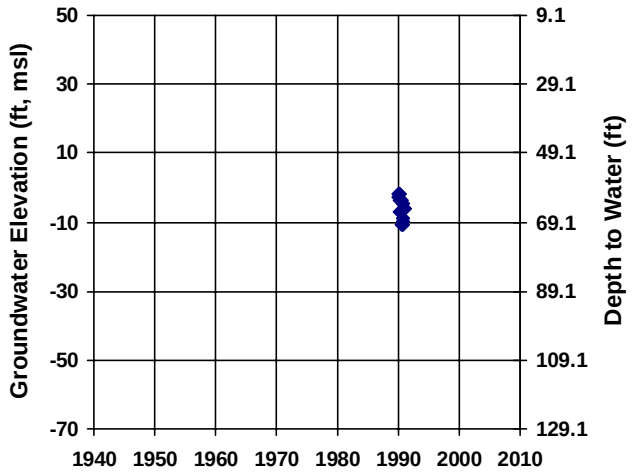
Reference Elevation: 49.2 ft, msl

SWN: ARC-047 Depth: 350 Perf: 145-346



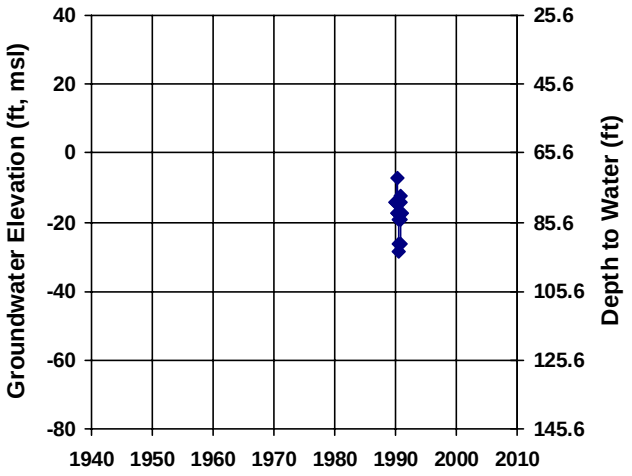
Reference Elevation: 93.0 ft, msl

SWN: ARC-048 Depth: 335 Perf: 130-185



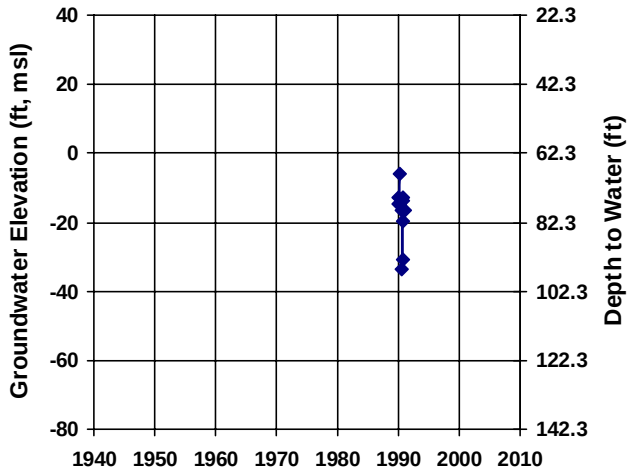
Reference Elevation: 59.1 ft, msl

SWN: ARC-049 Depth: 176 Perf: 146-180



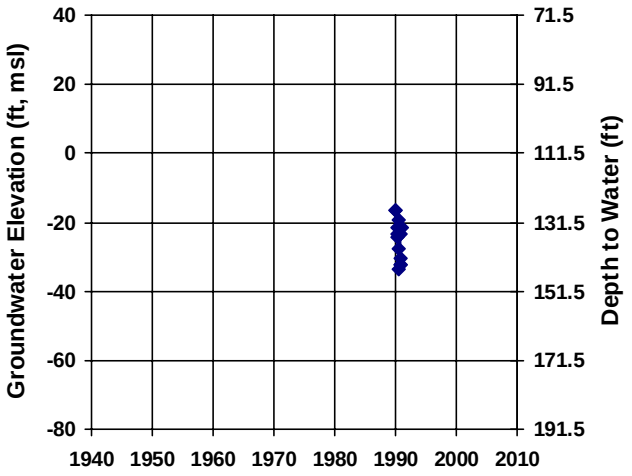
Reference Elevation: 65.6 ft, msl

SWN: ARC-050 Depth: 180 Perf: 142-158



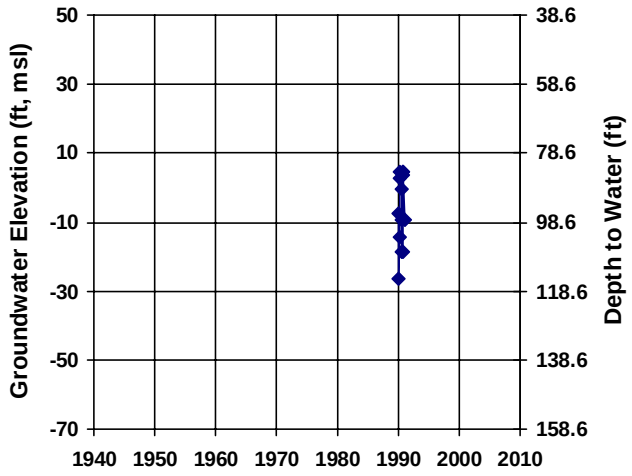
Reference Elevation: 62.3 ft, msl

SWN: ARC-052 Depth: 600 Perf: 220-600



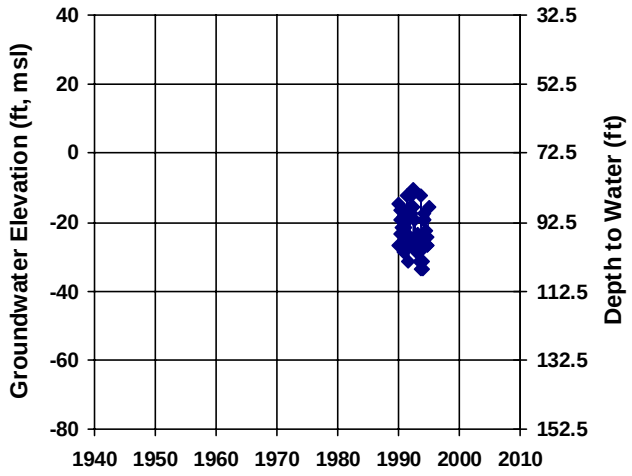
Reference Elevation: 111.5 ft, msl

SWN: ARC-054 Depth: 550 Perf: 160-545



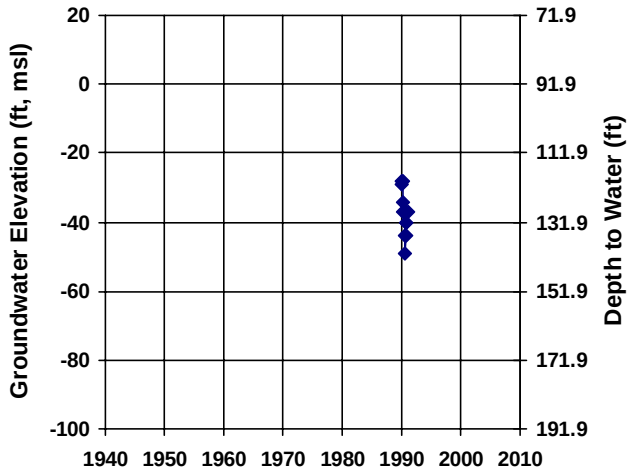
Reference Elevation: 88.6 ft, msl

SWN: ARC-055A Depth: 368 Perf: 182-358



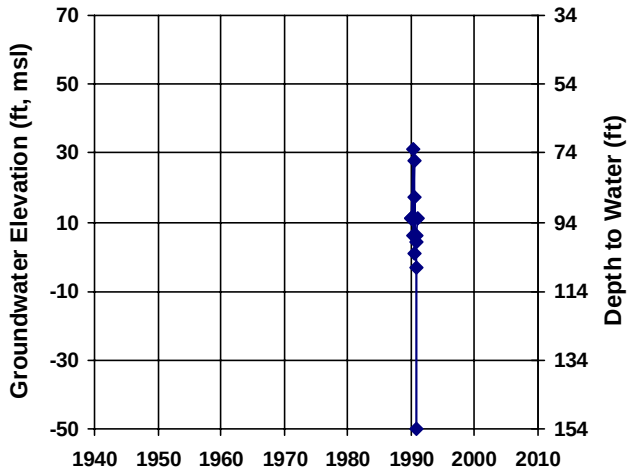
Reference Elevation: 72.5 ft, msl

SWN: ARC-056 Depth: 645 Perf: 220-640



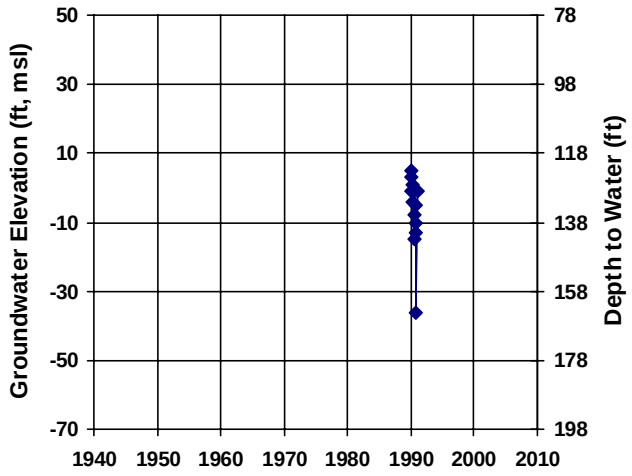
Reference Elevation: 91.9 ft, msl

SWN: ARC-057 Depth: 655 Perf: 250-650



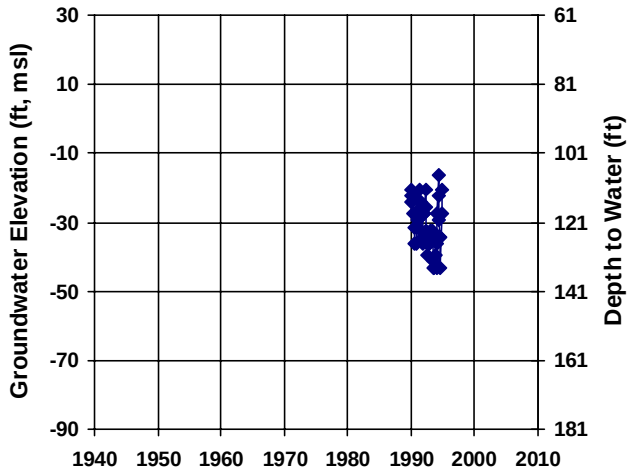
Reference Elevation: 104.0 ft, msl

SWN: ARC-059 Depth: 600 Perf: 258-600



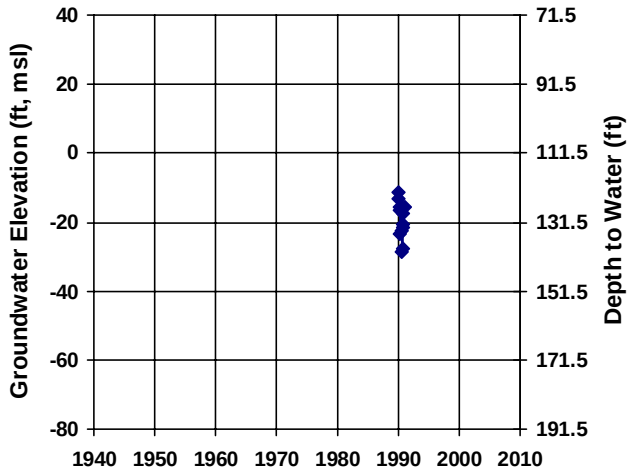
Reference Elevation: 128.0 ft, msl

SWN: ARC-060 Depth: 435 Perf: 165-430



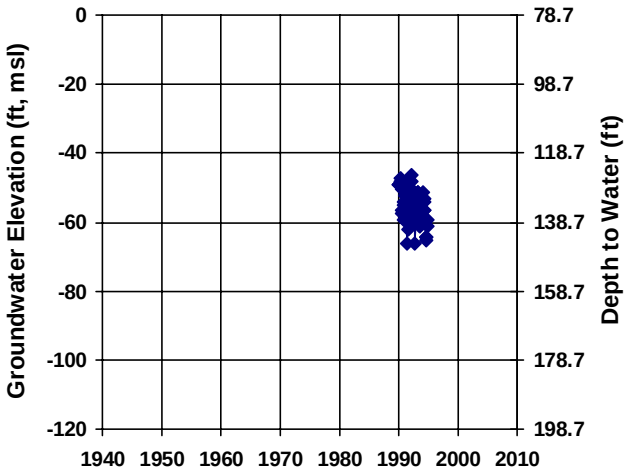
Reference Elevation: 91.0 ft, msl

SWN: ARC-064 Depth: 630 Perf: 232-616



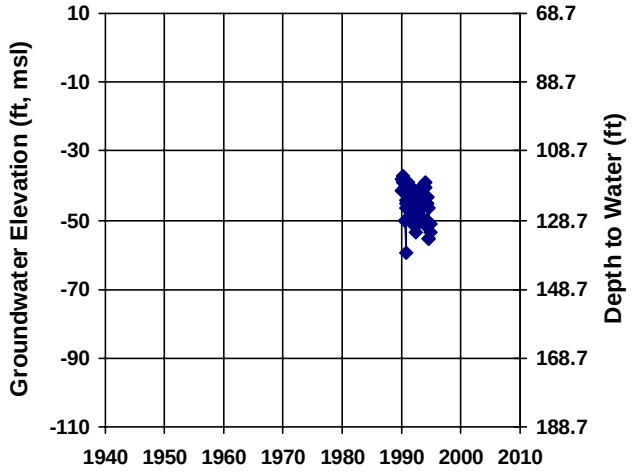
Reference Elevation: 111.5 ft, msl

SWN: ARC-065 Depth: 347 Perf: 187-342



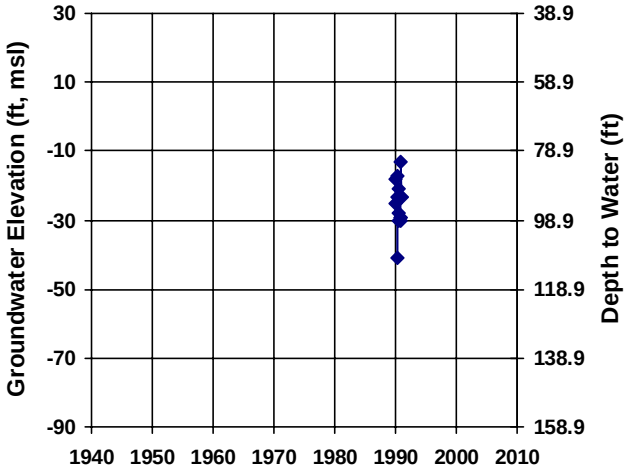
Reference Elevation: 78.7 ft, msl

SWN: ARC-066 Depth: 398 Perf: 170-393



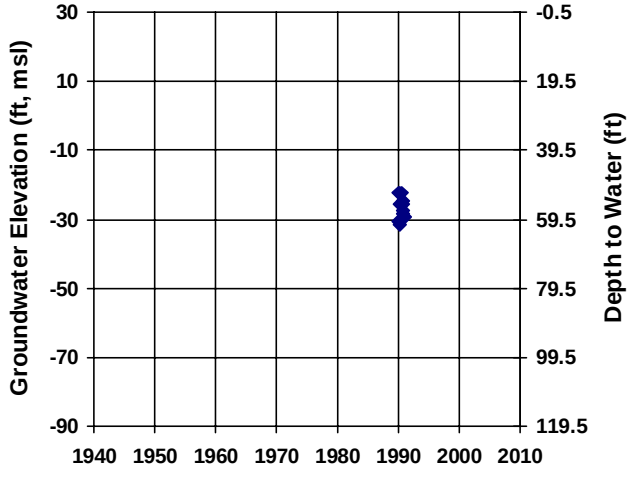
Reference Elevation: 78.7 ft, msl

SWN: ARC-067 Depth: 577 Perf: 480-570



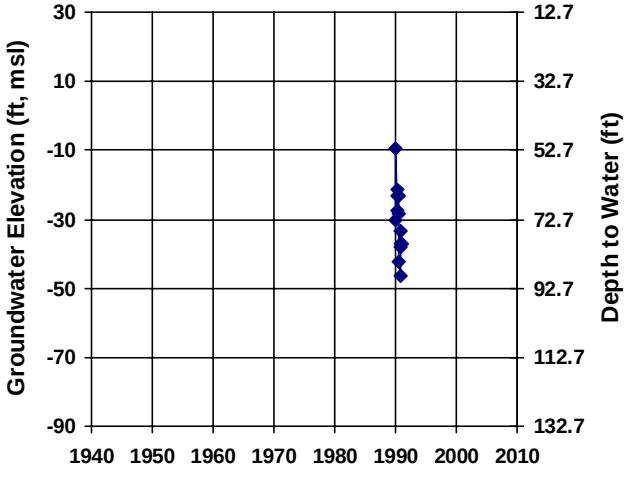
Reference Elevation: 68.9 ft, msl

SWN: ARC-068R Depth: 440 Perf: 150-230



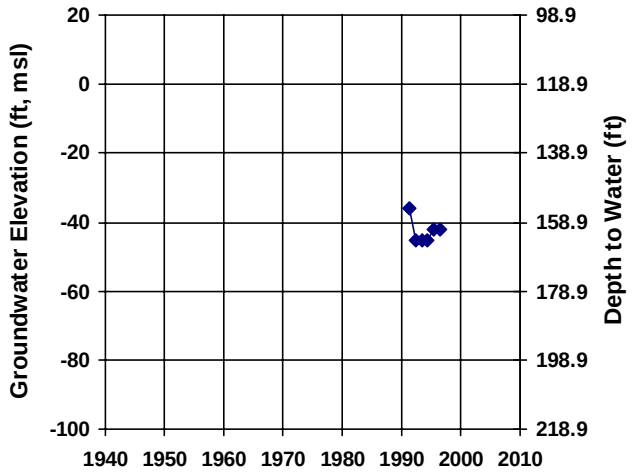
Reference Elevation: 29.5 ft, msl

SWN: ARC-069R Depth: 425 Perf: 195-425



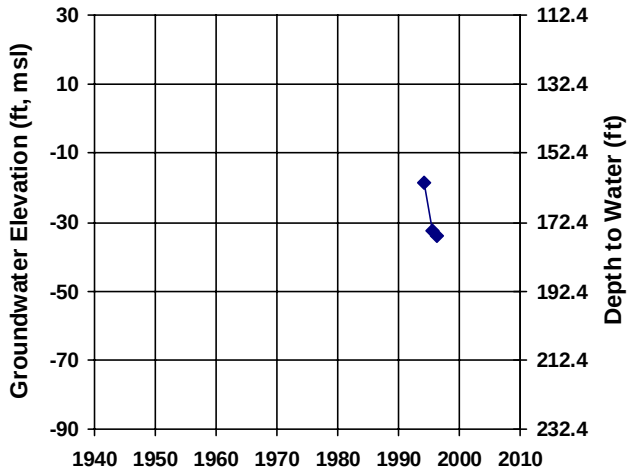
Reference Elevation: 42.7 ft, msl

SWN: CIZ-ANT-Twin Trail Depth: 436 Perf: 212-426



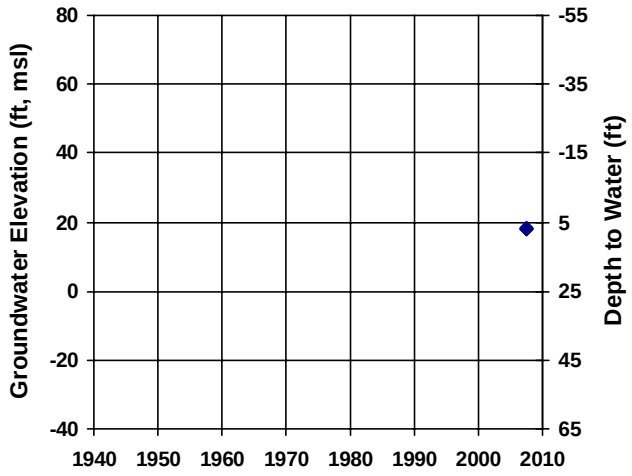
Reference Elevation: 118.9 ft, msl

SWN: CIZ-LO-Daly Depth: 500 Perf: 345-490



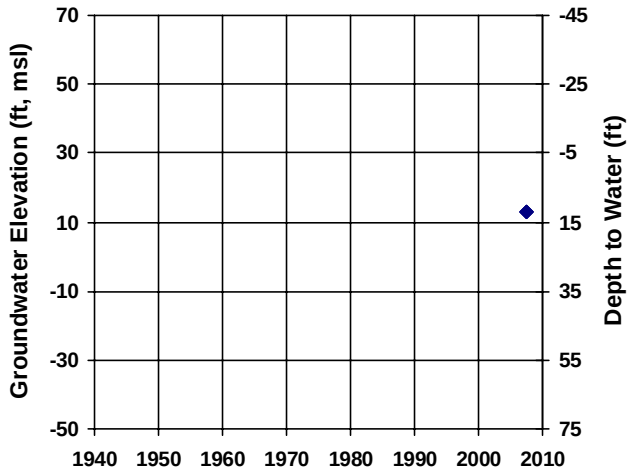
Reference Elevation: 142.4 ft, msl

SWN: Lauppe MW-245 Depth: 245 Perf: 180-235



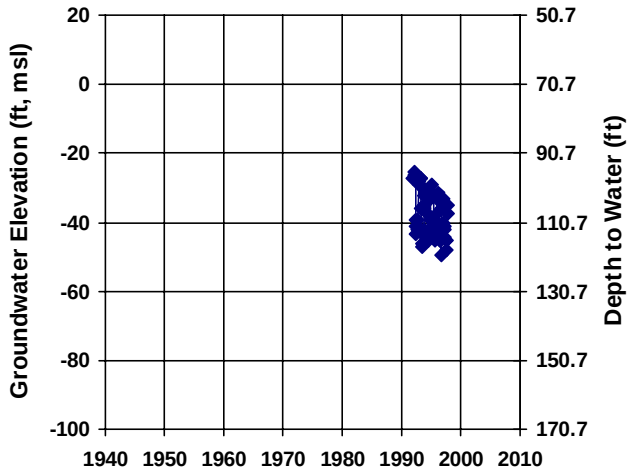
Reference Elevation: 25.0 ft, msl

SWN: Lauppe MW-440 Depth: 440 Perf: 420-430



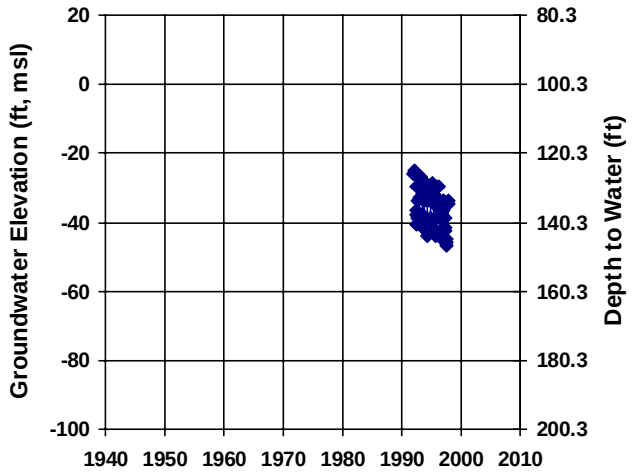
Reference Elevation: 25.0 ft, msl

SWN: NOR-001 Depth: 315 Perf: 180-309



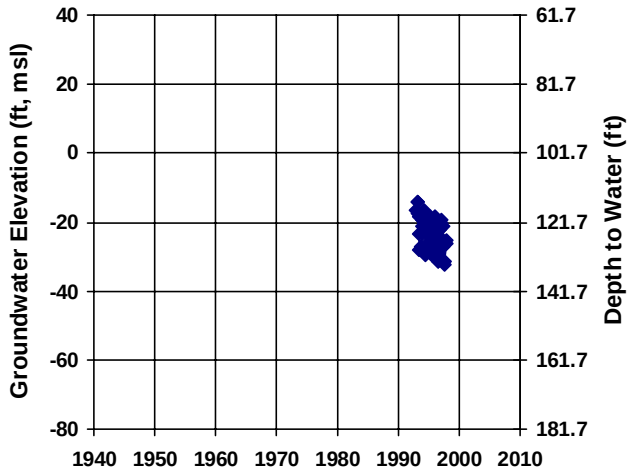
Reference Elevation: 70.7 ft, msl

SWN: NOR-003 Depth: 285 Perf: 150-285



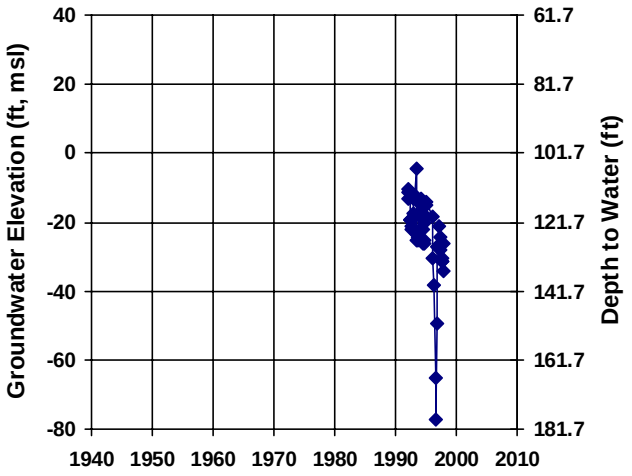
Reference Elevation: 100.3 ft, msl

SWN: NOR-006 Depth: 508 Perf: 230-497



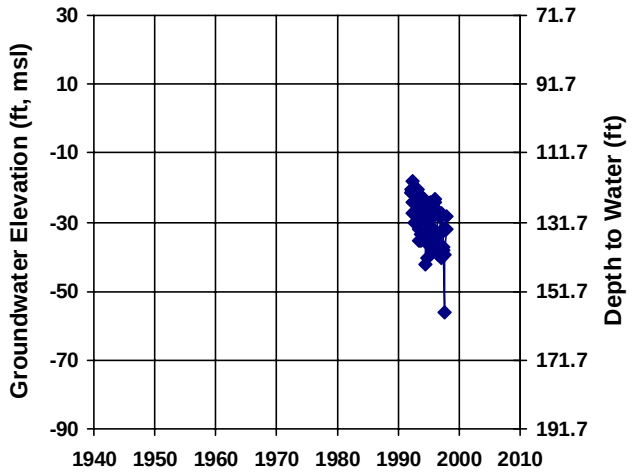
Reference Elevation: 101.7 ft, msl

SWN: NOR-007 Depth: 503 Perf: 235-469



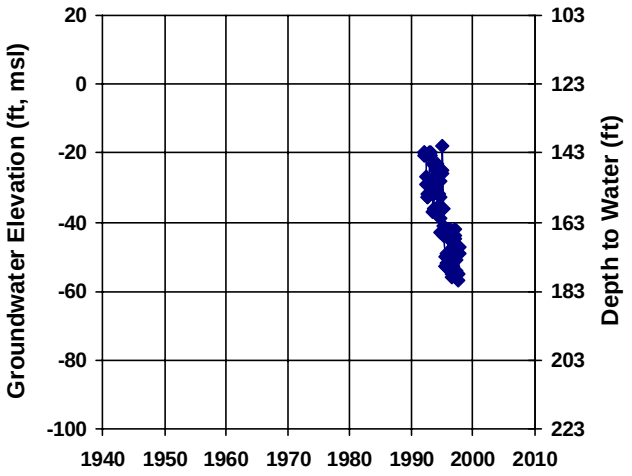
Reference Elevation: 101.7 ft, msl

SWN: NOR-009 Depth: 531 Perf: 220-520



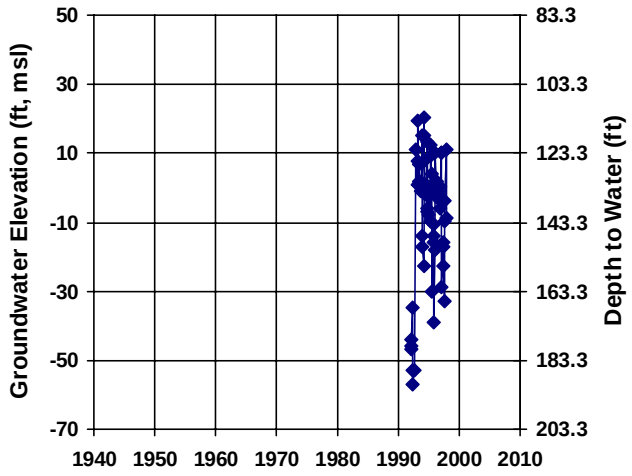
Reference Elevation: 101.7 ft, msl

SWN: NOR-010 Depth: 530 Perf: 225-525



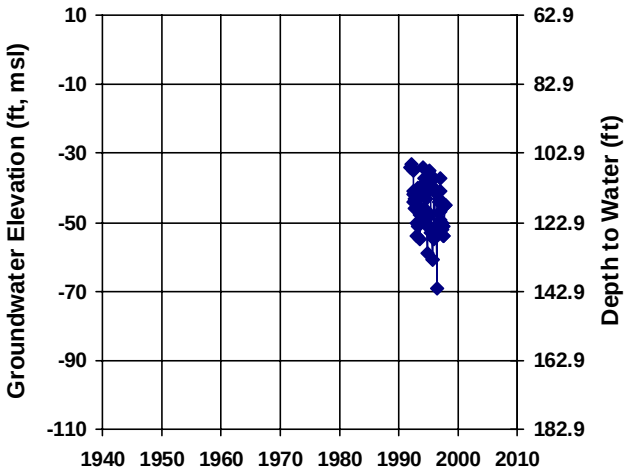
Reference Elevation: 123.0 ft, msl

SWN: NOR-011 Depth: 560 Perf: 250-560



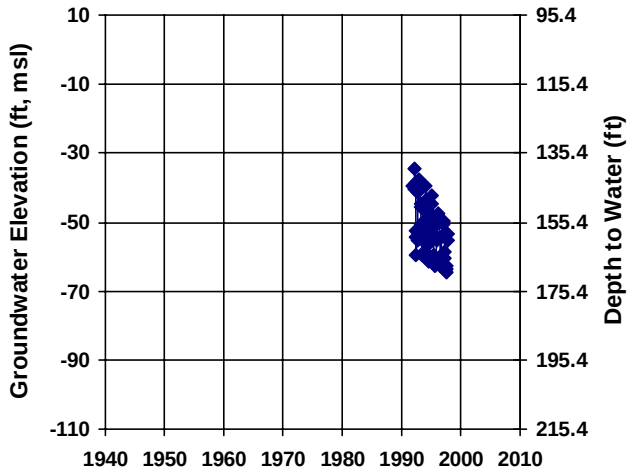
Reference Elevation: 133.3 ft, msl

SWN: NOR-014 Depth: 560 Perf: 206-490



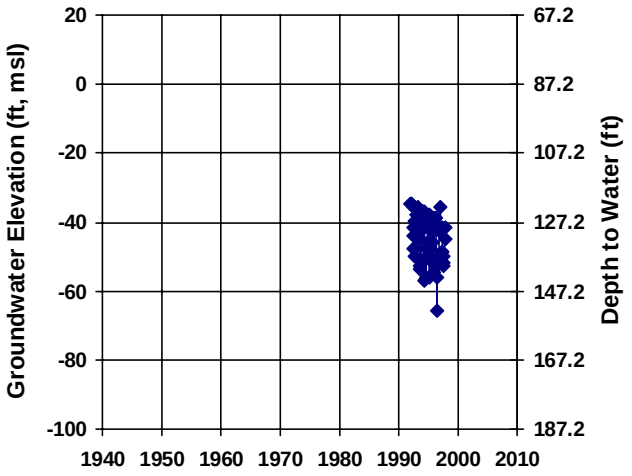
Reference Elevation: 72.9 ft, msl

SWN: NOR-015 Depth: 486 Perf: 205-481



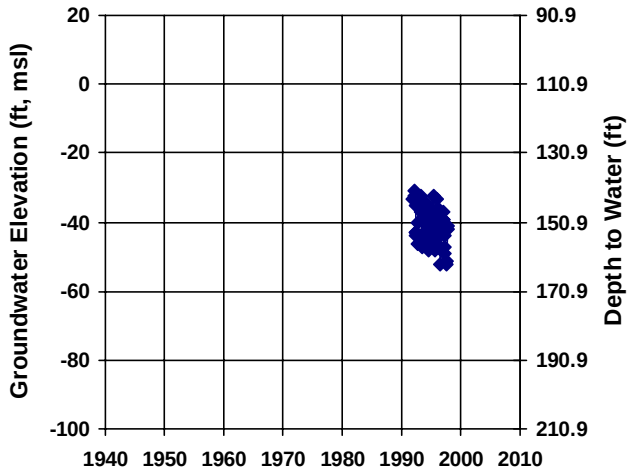
Reference Elevation: 105.4 ft, msl

SWN: NOR-017 Depth: 530 Perf: 220-520



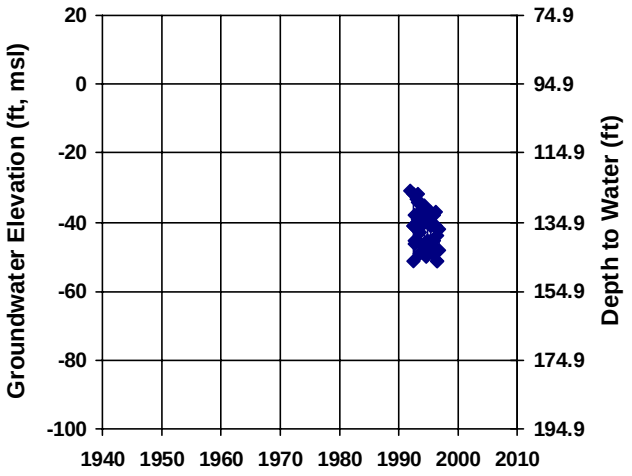
Reference Elevation: 87.2 ft, msl

SWN: NOR-020 Depth: 600 Perf: 350-590



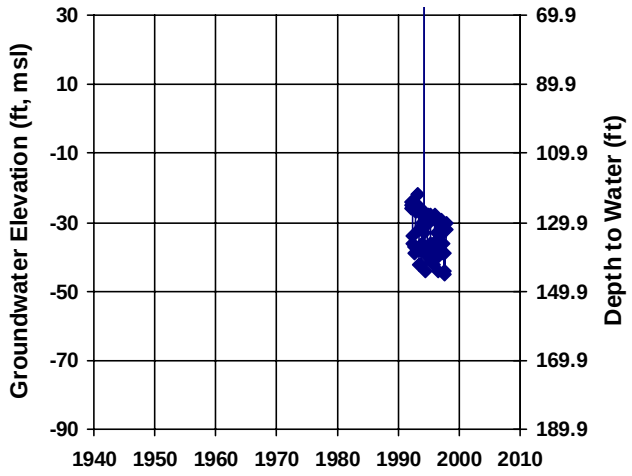
Reference Elevation: 110.9 ft, msl

SWN: NOR-021 Depth: 418 Perf: 214-413



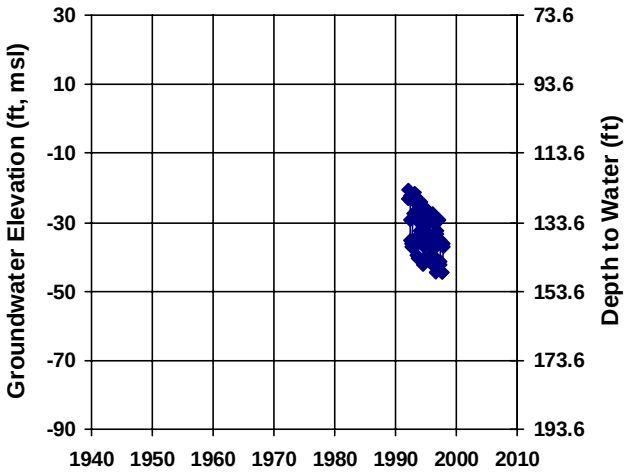
Reference Elevation: 94.9 ft, msl

SWN: NOR-022 Depth: 540 Perf: 240-540



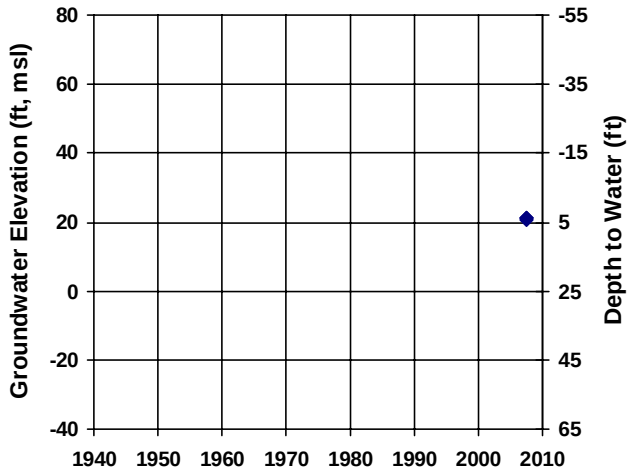
Reference Elevation: 99.9 ft, msl

SWN: NOR-023 Depth: 540 Perf: 270-540



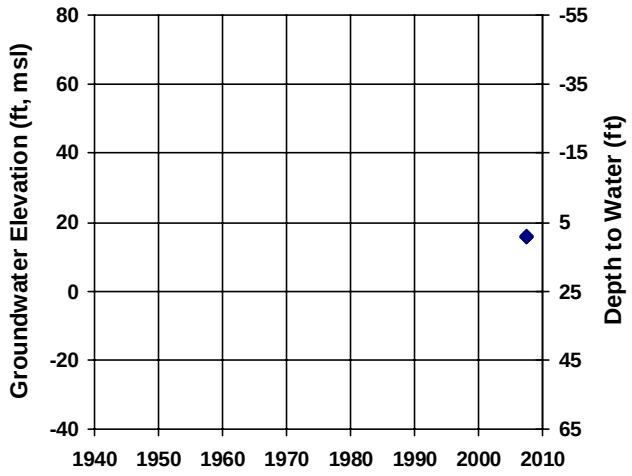
Reference Elevation: 103.6 ft, msl

SWN: Paulson MW-250 Depth: 250 Perf: 210-240



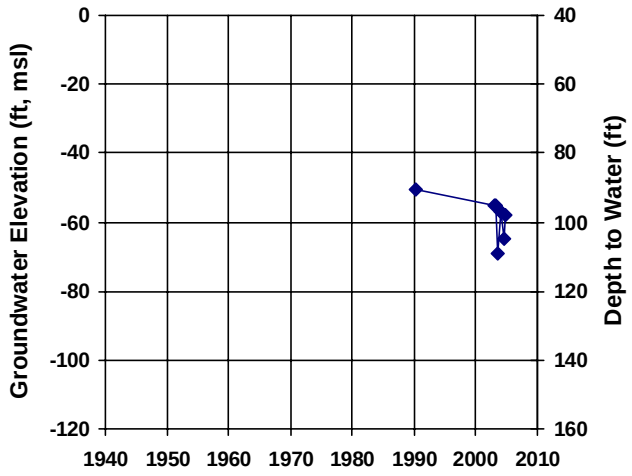
Reference Elevation: 25.0 ft, msl

SWN: Paulson MW-400 Depth: 400 Perf: 360-390



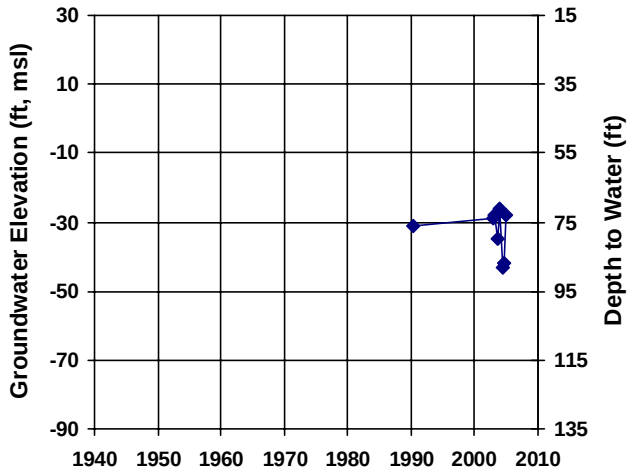
Reference Elevation: 25.0 ft, msl

SWN: RLE-002A Depth: 570 Perf: 235-510



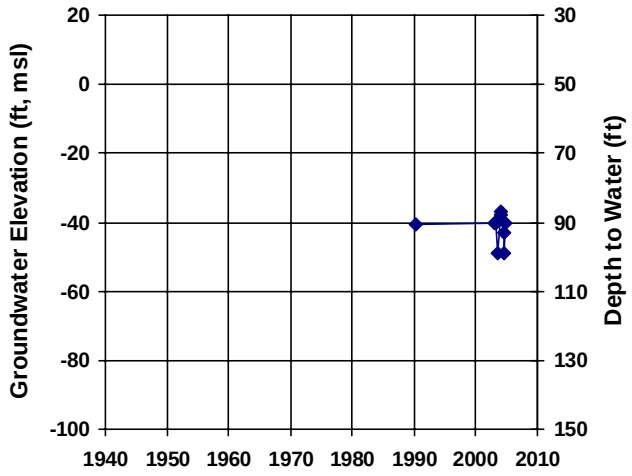
Reference Elevation: 40.0 ft, msl

SWN: RLE-003 Depth: 267 Perf: 173-197



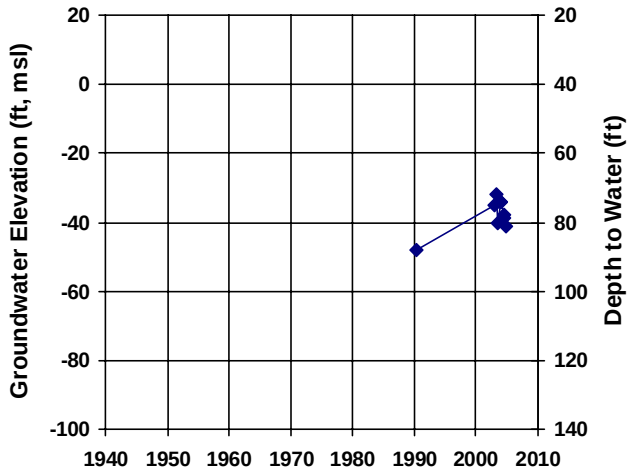
Reference Elevation: 45.0 ft, msl

SWN: RLE-004 Depth: 467 Perf: 190-451



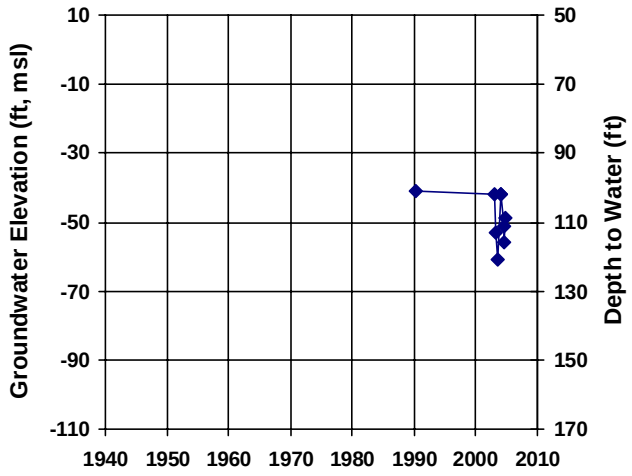
Reference Elevation: 50.0 ft, msl

SWN: RLE-005 Depth: 508 Perf: 188-490



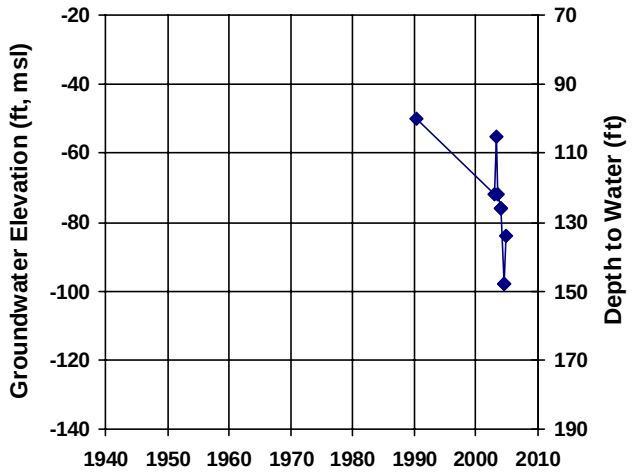
Reference Elevation: 40.0 ft, msl

SWN: RLE-006 Depth: 520 Perf: 206-495



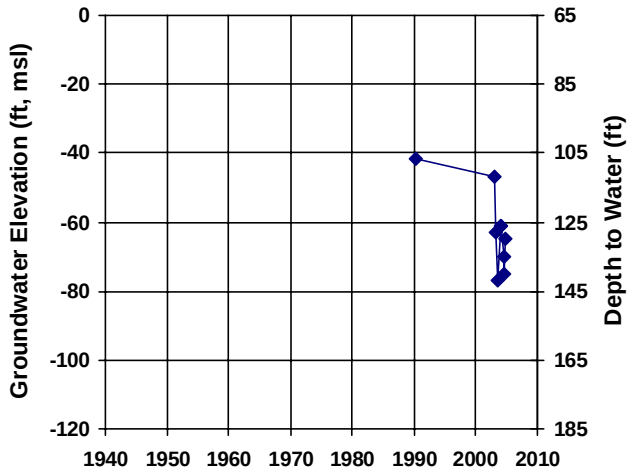
Reference Elevation: 60.0 ft, msl

SWN: RLE-007 Depth: 317 Perf: 180-301



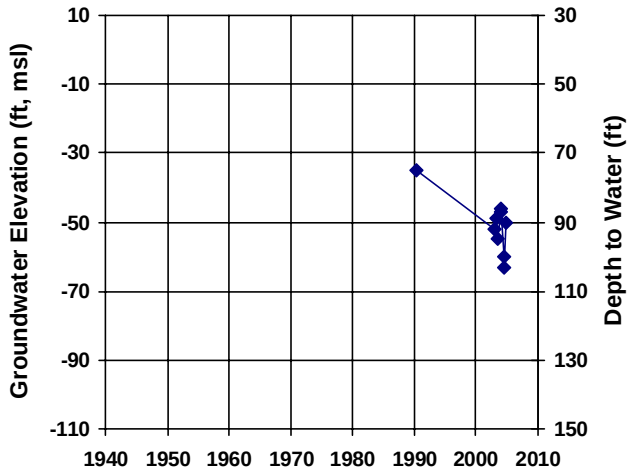
Reference Elevation: 50.0 ft, msl

SWN: RLE-008 Depth: 393 Perf: 243-385



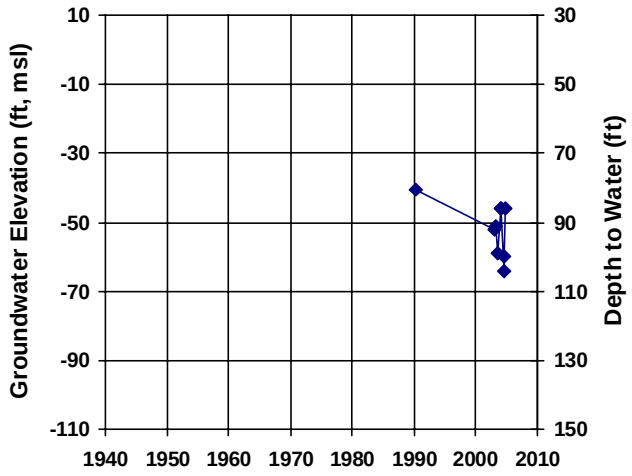
Reference Elevation: 65.0 ft, msl

SWN: RLE-009 Depth: 522 Perf: 435-526



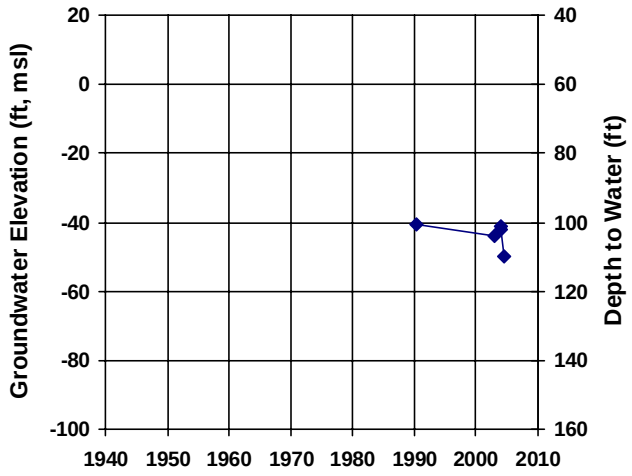
Reference Elevation: 40.0 ft, msl

SWN: RLE-010 Depth: 470 Perf: 340-349



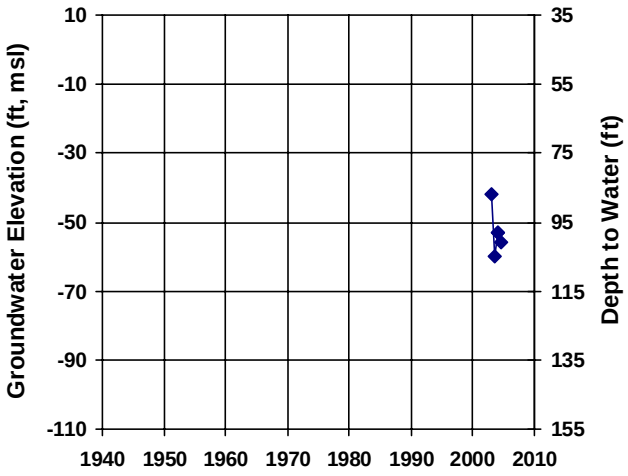
Reference Elevation: 40.0 ft, msl

SWN: RLE-011 Depth: 410 Perf: 260-410



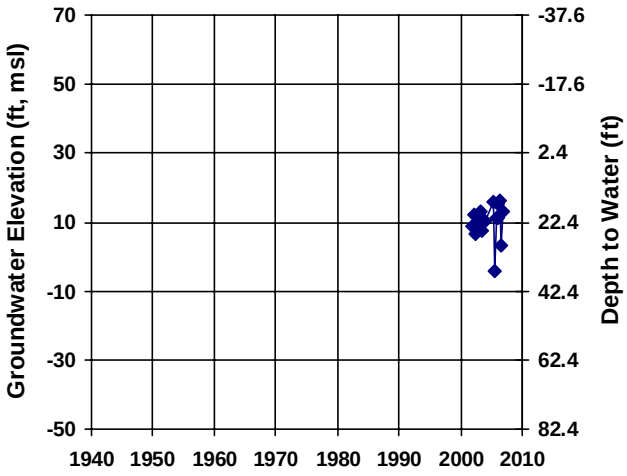
Reference Elevation: 60.0 ft, msl

SWN: RLE-012 Depth: 585 Perf: 210-580



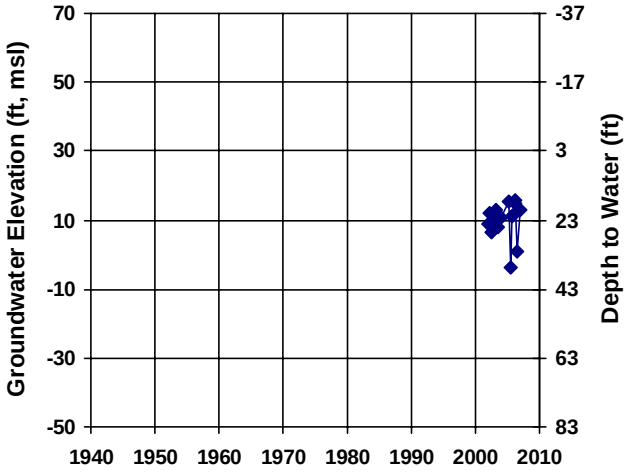
Reference Elevation: 45.0 ft, msl

SWN: T0610100025 - MW Depth: 38 Perf: NA



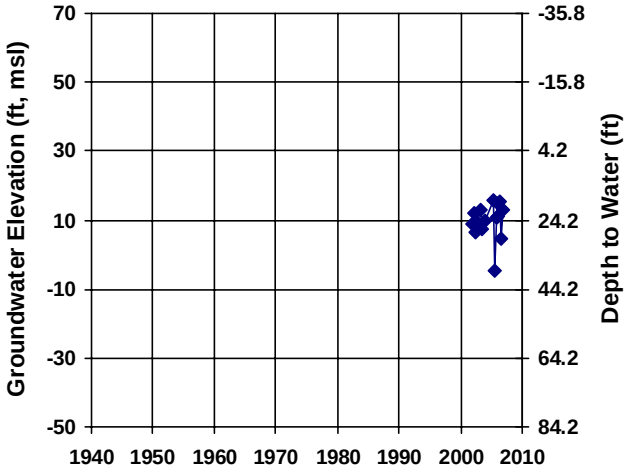
Reference Elevation: 32.4 ft, msl

SWN: T0610100025 - MW Depth: 38 Perf: NA



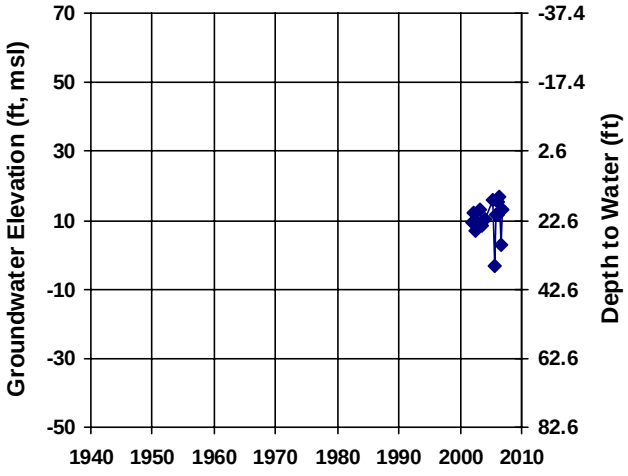
Reference Elevation: 33.0 ft, msl

SWN: T0610100025 - MW Depth: 39 Perf: NA



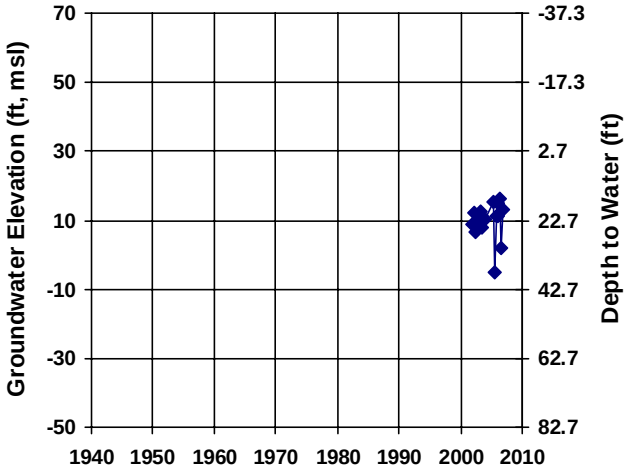
Reference Elevation: 34.2 ft, msl

SWN: T0610100025 - MW Depth: 38 Perf: NA



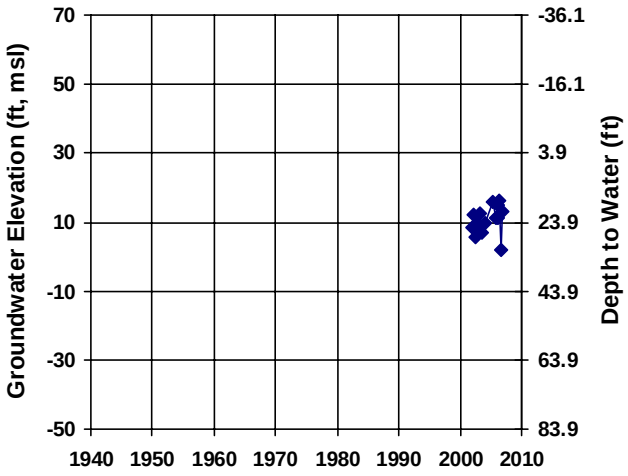
Reference Elevation: 32.6 ft, msl

SWN: T0610100025 - MW Depth: 39 Perf: NA



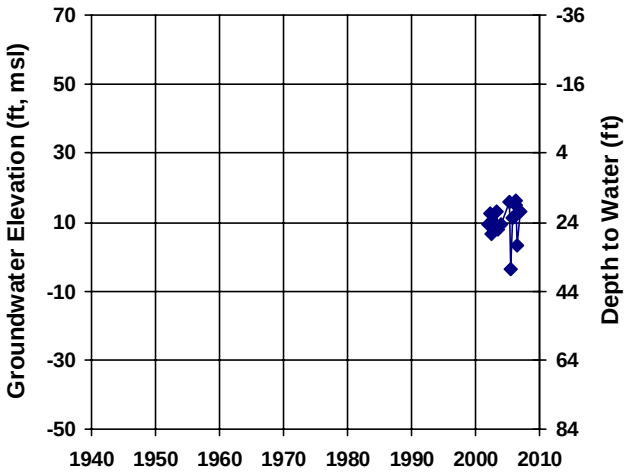
Reference Elevation: 32.7 ft, msl

SWN: T0610100025 - MW Depth: 37 Perf: NA



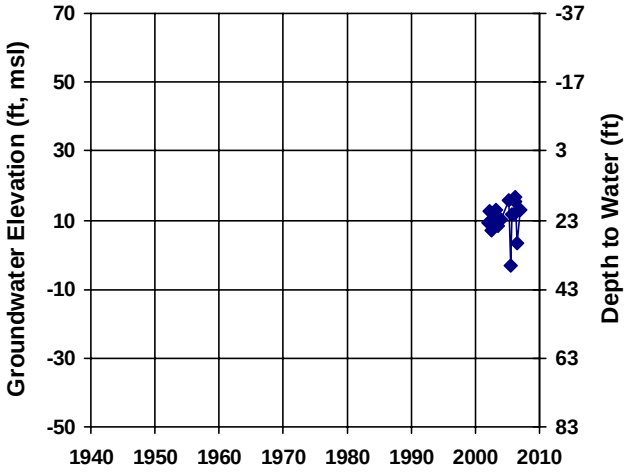
Reference Elevation: 33.9 ft, msl

SWN: T0610100025 - MW Depth: 38 Perf: NA



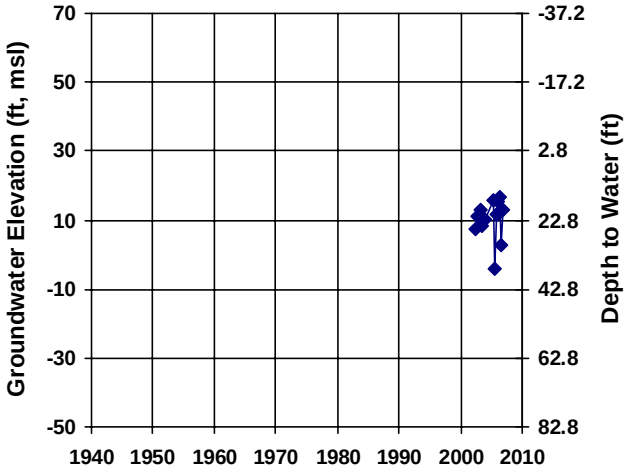
Reference Elevation: 34.0 ft, msl

SWN: T0610100025 - MW Depth: 43 Perf: NA



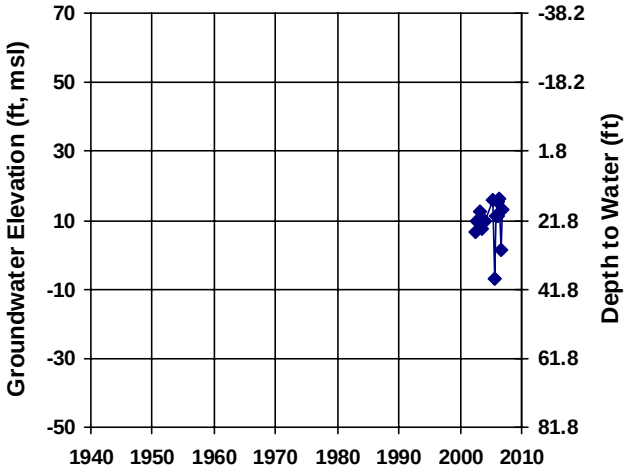
Reference Elevation: 33.0 ft, msl

SWN: T0610100025 - MW Depth: 45 Perf: NA



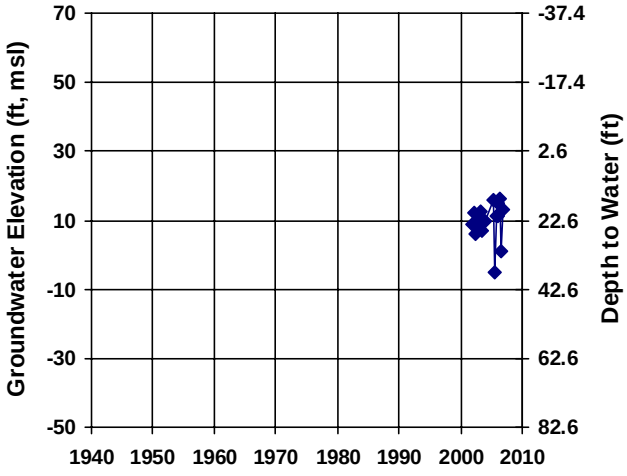
Reference Elevation: 32.8 ft, msl

SWN: T0610100025 - MW Depth: 44 Perf: NA



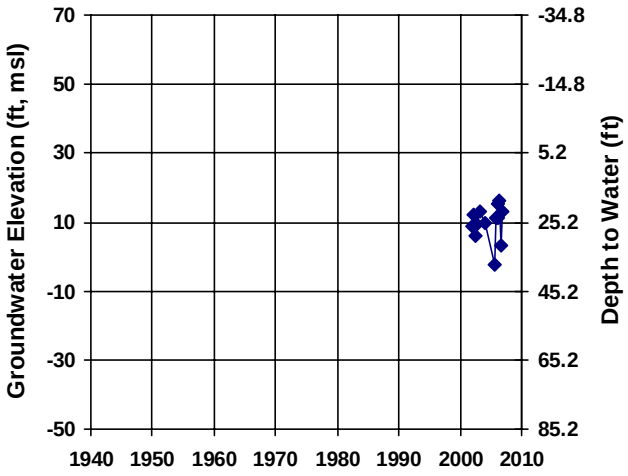
Reference Elevation: 31.8 ft, msl

SWN: T0610100025 - MW Depth: 43 Perf: NA



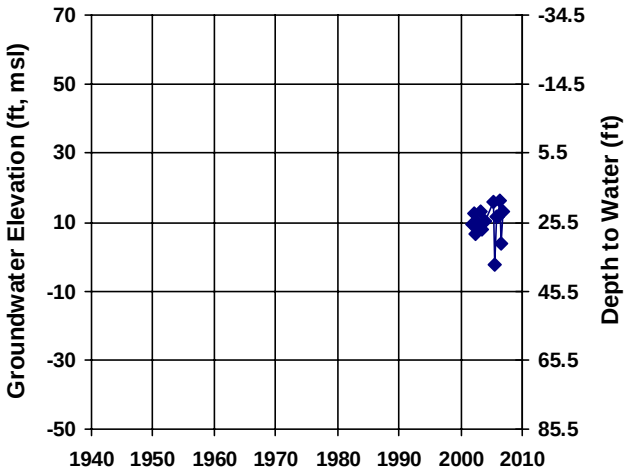
Reference Elevation: 32.6 ft, msl

SWN: T0610100025 - MW Depth: 45 Perf: NA



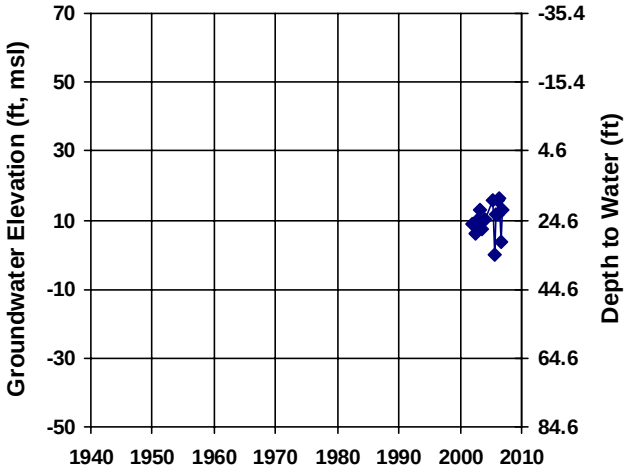
Reference Elevation: 35.2 ft, msl

SWN: T0610100025 - MW Depth: 44 Perf: NA



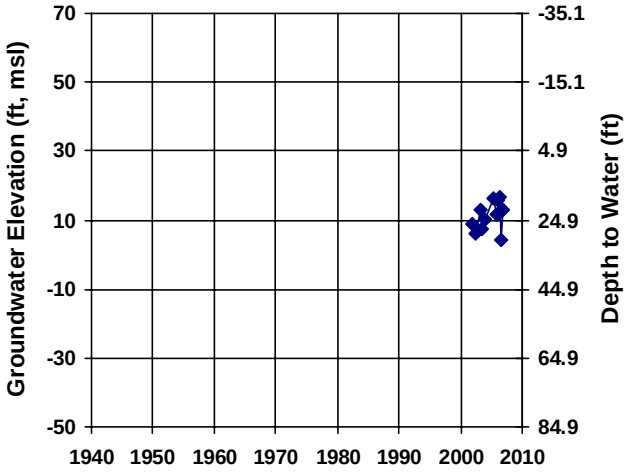
Reference Elevation: 35.5 ft, msl

SWN: T0610100025 - MW Depth: 39 Perf: NA



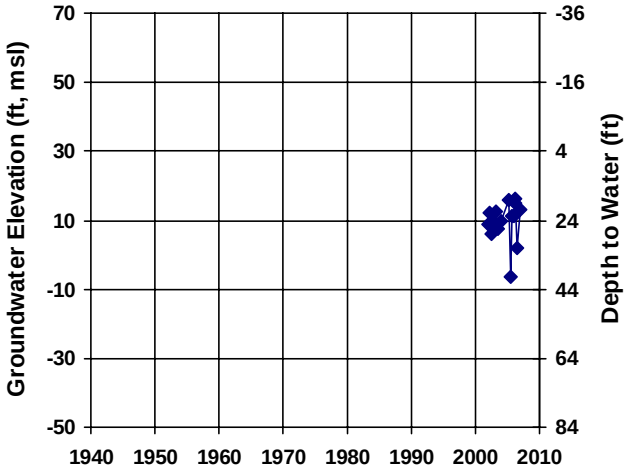
Reference Elevation: 34.6 ft, msl

SWN: T0610100025 - MW Depth: 34 Perf: NA



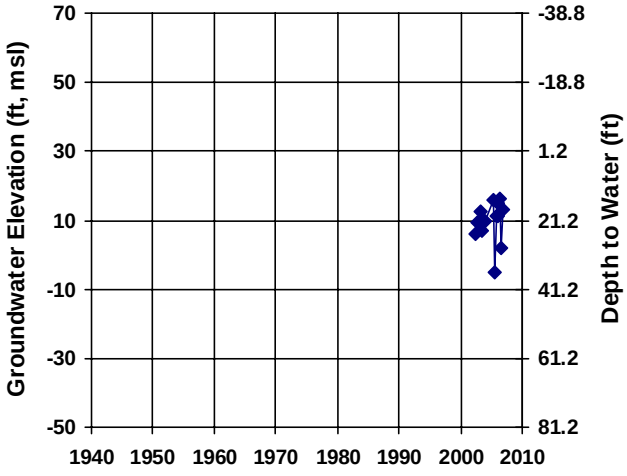
Reference Elevation: 34.9 ft, msl

SWN: T0610100025 - MW Depth: 58 Perf: NA

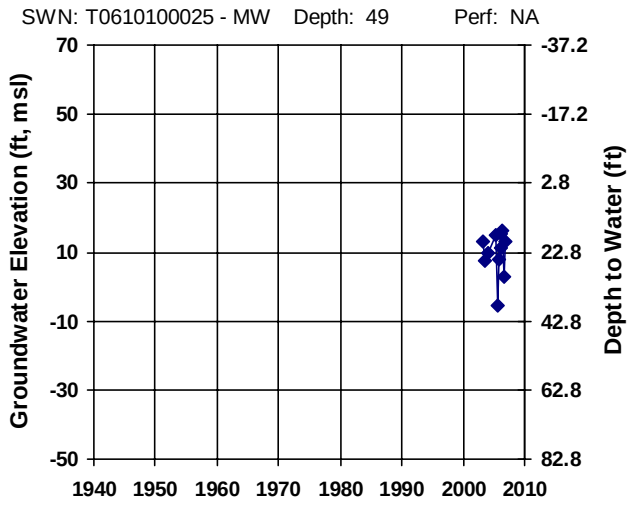


Reference Elevation: 34.0 ft, msl

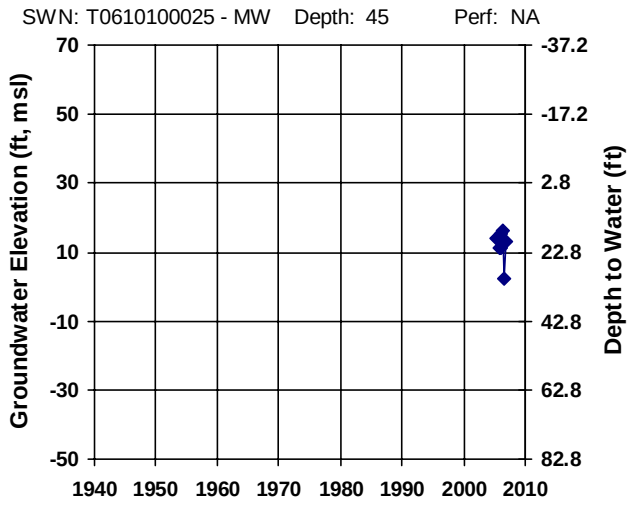
SWN: T0610100025 - MW Depth: 38 Perf: NA



Reference Elevation: 31.2 ft, msl



Reference Elevation: 32.8 ft, msl



Reference Elevation: 32.8 ft, msl

Appendix D

Summary of Northern Natomas Basin Water Quality Results-General Minerals and Trace Elements

Table 1
Summary of Northern Natomas Basin Water Quality Results: General Minerals

						General Minerals									
						Cations				Anions					
Well ID Sample Date	EC µmhos/cm	TDS mg/L	pH pH Units	Alkalinity mg/L	Hardness mg/L	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	SO_4 mg/L	Cl mg/L	CO_3 mg/L	HCO_3 mg/L	NO_3 mg/L	F mg/L
10N03E23H001M	*TD=215, Source=USGS*														
9/30/1982	842	-	7.9	-	320	54	44	86	3.2	58	33	-	-	-	0.1
10N03E26E001M	*TD=258, Source=USGS*														
9/30/1982	640	-	8.2	-	190	36	24	70	2.5	26	38	-	-	-	0.1
10N03E36N001M	*TD=160, Source=USGS*														
9/10/1982	324	-	8.2	-	110	19	15	25	1.6	27	12	-	-	-	0.1
10N04E01K001M	*TD=162, Source=USGS*														
8/7/1996	432	-	-	179	-	-	-	-	-	-	-	-	-	-	-
10N04E02A001M	*Perf: 104-152, Source=DWR WQ Library*														
8/11/1967	348	-	8.2	-	87	-	-	-	-	-	23	-	157	-	-
10N04E13F001M	*TD=50, Source=USGS*														
8/11/1997	1430	-	7.4	521	-	130	66.3	75.1	1.47	51.4	118	-	-	-	0.2
6/3/2002	1520	-	7.4	525	-	129	75	84.5	1.72	47.2	145	-	-	-	0.17
11/13/2003	1360	-	7.3	534	-	145	78.4	90.5	1.48	48.7	146	-	-	-	0.2
2/11/2004	1540	-	7.4	591	-	145	79.1	93.4	1.64	47.5	143	-	-	-	0.2
5/19/2004	1610	-	7.3	587	-	142	80.1	87.5	1.54	48.5	146	-	-	-	0.2
8/11/2004	1560	-	7.3	591	-	142	81.7	91.3	1.5	49.1	142	-	-	-	0.2
10N04E27R002M	*Perf: 745-985, Source=DWR WQ Library*														
1/9/2001	361	256	8.2	160	76	19	7	54	-	< 1	22	-	-	< 0.1	0.2
10N04E27R003M	*Perf: 470-490, Source=DWR WQ Library*														
1/9/2001	336	245	8.9	131	62	20	3	51	-	3	28	-	-	< 0.1	0.3
10N04E27R004M	*Perf: 190-210, Source=DWR WQ Library*														
1/9/2001	354	261	8.3	151	90	21	9	45	-	< 1	23	-	-	< 0.1	0.2
10N04E30A001M	*TD=155, Source=USGS*														
7/24/1969	395	-	-	-	160	25	23	41	1	31	9.5	-	-	1.6	-
8/3/1971	460	-	-	-	160	-	-	39	-	-	15	-	-	-	-
7/10/1973	440	-	-	-	160	-	-	35	-	-	15	-	-	-	-
6/18/1975	420	-	-	-	160	-	-	29	-	-	13	-	-	-	-
10N04E30F001M	*TD=NA, Source=DWR WQ Library*														
10/19/1967	785	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10N04E30H001M	*TD=NA, Source=DWR WQ Library*														
10/19/1967	410	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 1 (continued)
Summary of Northern Natomas Basin Water Quality Results: General Minerals

						General Minerals									
						Cations				Anions					
Well ID Sample Date	EC µmhos/cm	TDS mg/L	pH pH Units	Alkalinity mg/L	Hardness mg/L	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	SO_4 mg/L	Cl mg/L	CO_3 mg/L	HCO_3 mg/L	NO_3 mg/L	F mg/L
10N04E30L001M	*TD=NA, Source=DWR WQ Library*														
3/25/1965	-	436	8.2	267	59	14.4	5.6	120	7	6	116	0	325	14	0
10/19/1967	832	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10N04E30M001M	*TD=520, Source=DWR WQ Library*														
5/10/1965	-	514	7.9	249	85	19	9	125	5	0	190.5	0	304	0.5	0.2
10/19/1967	905	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10N04E31C002M	*TD=510, Source=DWR WQ Library*														
5/25/1965	-	518	8.2	247	91	22.4	9.4	150	7	20	100	0	301	1	-
10/19/1967	837	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10N04E31M001M	*Perf: 1060-1070, Source=DWR WQ Library*														
1/12/2001	1124	623	8.4	139	100	27	8	184	-	< 1	276	-	-	< 0.1	< 0.1
10N04E31M002M	*Perf: 795-805, Source=DWR WQ Library*														
1/12/2001	734	420	8.4	183	40	11	3	139	-	< 1	125	-	-	< 0.1	0.1
10N04E31M003M	*Perf: 380-400, Source=DWR WQ Library*														
1/12/2001	799	487	8.4	263	44	11	4	161	-	32	76	-	-	< 0.1	< 0.1
10N04E31M004M	*Perf: 170-190, Source=DWR WQ Library*														
1/12/2001	1149	663	8.4	353	204	39	26	187	-	61	128	-	-	< 0.1	< 0.1
10N04E32D001M	*TD=NA, Source=DWR WQ Library*														
10/19/1967	479	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10N04E36B001M	*TD=104, Source=USGS*														
8/10/1970	300	-	-	-	130	23	17	22	1.5	0.8	19	-	-	3.7	-
8/2/1972	420	-	-	-	140	-	-	24	-	-	25	-	-	-	-
6/17/1974	450	-	-	-	190	-	-	24	-	-	36	-	-	-	-
6/10/1976	565	-	-	-	250	-	-	31	-	-	44	-	-	-	-
10N05E06M002M	*TD=145, Source=USGS*														
7/15/1957	289	-	-	-	85	19	9.1	29	1.3	2.6	-	0	140	-	-
7/31/1958	-	-	-	-	85	20	8.5	27	1.1	2.3	17	0	140	-	0.3
8/4/1959	297	-	-	-	86	20	8.8	29	1.3	2.5	19	0	140	2.9	0.3
7/14/1960	284	-	-	-	84	20	8.3	28	1.1	1.2	17	0	140	2.5	0.3
8/18/1961	295	-	-	-	89	22	8.3	28	1.1	2.5	19	0	140	3.8	0.3
7/1/1962	320	-	-	-	90	24	7.3	32	0.7	1.9	18	6	140	4.5	0.2
7/8/1964	304	-	-	-	88	19	9.8	28	1.1	1.2	19	0	140	6.2	-

Table 1 (continued)
Summary of Northern Natomas Basin Water Quality Results: General Minerals

						General Minerals									
						Cations				Anions					
Well ID Sample Date	EC µmhos/cm	TDS mg/L	pH pH Units	Alkalinity mg/L	Hardness mg/L	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	SO_4 mg/L	Cl mg/L	CO_3 mg/L	HCO_3 mg/L	NO_3 mg/L	F mg/L
10N05E06M002M	*TD=145, Source=USGS*														
8/1/1965	309	-	-	-	90	-	1.8	30	-	-	19	6	130	-	-
8/31/1967	310	-	-	-	120	32	9.1	-	-	-	21	4	130	-	-
6/18/1968	310	-	-	-	92	-	-	32	-	-	26	0	140	-	-
7/23/1969	305	-	-	-	91	22	8.8	30	1.5	12	20	0	140	9.5	-
6/24/1974	305	-	-	-	94	21	10	30	0.9	2.5	22	2	140	10	-
10N05E08M001M	*TD=180, Source=USGS*														
9/30/1982	272	-	8.3	-	80	21	6.8	28	1.6	< 5	19	-	-	-	0.2
10N05E19C001M	*TD=200, Source=USGS*														
9/30/1982	290	-	8.2	-	86	22	7.6	26	1.8	5	24	-	-	-	0.2
11N03E03D003M	*TD=85, Source=USGS*														
8/2/1976	-	-	-	-	-	-	-	-	-	-	-	-	-	0.09	-
11N03E14R001M	*TD=206, Source=USGS*														
5/27/1965	1250	-	-	-	75	24	3.6	-	3.9	3	250	14	270	1	-
10/17/1966	1470	-	-	-	-	-	-	-	-	-	270	-	-	-	-
8/31/1970	960	-	-	-	150	41	11	170	4.9	9.7	190	0	300	0	-
8/10/1972	1600	-	-	-	170	-	-	220	-	-	270	0	280	-	-
7/23/1974	1050	-	-	-	130	35	11	180	4.5	8.2	200	14	260	0	-
7/9/1976	1150	-	-	-	150	-	-	200	-	-	230	0	300	-	-
11N03E15H001M	*TD=36, Source=USGS*														
8/2/1976	851	-	-	-	280	49	38	81	1.1	12	160	0	272	2.9	0.1
11N03E23B001M	*TD=52, Source=USGS*														
8/2/1976	1520	-	-	-	920	170	120	54	-	100	380	0	386	2.7	-
11N03E23R002M	*TD=180, Source=USGS*														
8/2/1976	338	-	-	-	31	7.3	3.2	93	1.2	2.2	23	0	241	0.27	0.1
11N03E24D001M	*TD=145, Source=USGS*														
7/21/1964	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	-
8/15/1965	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-
7/22/1969	-	-	-	-	-	-	-	-	-	-	-	-	-	0.4	-
7/23/1974	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3	-
9/23/1998	709	-	7.9	264	221	44	27	68	-	-	58	-	-	-	-
9/6/2000	720	421	8.2	264	225	44	28	71	1.6	24	57	-	-	0.2	-

Table 1 (continued)
Summary of Northern Natomas Basin Water Quality Results: General Minerals

						General Minerals									
						Cations				Anions					
Well ID Sample Date	EC µmhos/cm	TDS mg/L	pH pH Units	Alkalinity mg/L	Hardness mg/L	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	SO_4 mg/L	Cl mg/L	CO_3 mg/L	HCO_3 mg/L	NO_3 mg/L	F mg/L
11N03E24D001M	*TD=145, Source=USGS*														
7/30/2002	750	465	7.8	280	219	43	27	72	2	28	60	-	-	< 0.1	-
8/18/2004	804	450	7.9	265	248	48	31	74	1.9	26	61	-	-	< 0.1	-
11N03E36L001M	*TD=300, Source=USGS*														
8/2/1976	-	-	-	-	-	-	-	-	-	-	-	-	-	0.53	-
11N04E02M002M	*TD=238, Source=USGS*														
8/2/1976	-	-	-	-	-	-	-	-	-	-	-	-	-	19	-
11N04E04N001M	*TD=NA, Source=DWR WQ Library*														
2/23/2006	495	314	8	131	63	17	5	74	4.5	< 1	74	1	130	< 0.1	< 0.1
11N04E04N002M	*TD=NA, Source=DWR WQ Library*														
2/23/2006	239	156	8.2	107	58	15	5	25	2	3	9	2	105	< 0.1	< 0.1
11N04E04N003M	*TD=NA, Source=DWR WQ Library*														
2/23/2006	239	155	7.9	101	74	18	7	18	1.8	2	13	1	100	< 0.1	< 0.1
11N04E04N004M	*TD=NA, Source=DWR WQ Library*														
2/23/2006	530	324	7.7	210	202	43	23	29	2.5	24	32	1	209	0.5	< 0.1
11N04E04P001M	*Perf: 60-145, Source=USGS*														
8/2/1976	734	-	-	-	320	69	37	39	2.7	30	100	0	278	3.9	0.1
11N04E04R002M	*Perf: 84-155, Source=USGS*														
5/2/1968	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-
8/12/1971	-	-	-	-	-	-	-	-	-	-	-	-	-	9.6	-
9/1/1999	538	-	7.6	245	211	45	24	26	-	-	17	-	-	-	-
9/27/2001	569	351	8.4	263	239	48	29	30	1.1	15	21	-	-	7.4	-
9/18/2003	547	341	7.3	270	237	47	29	27	1.2	13	18	-	-	5	-
8/24/2005	497	312	7.6	239	206	43	24	26	1.2	10	14	-	-	2.6	-
11N04E09D002M	*TD=100, Source=DWR WQ Library*														
8/10/1967	373	-	8.4	-	135	-	-	-	-	-	13	4	190	-	-
11N04E09P003M	*TD=316, Source=USGS*														
8/2/1976	320	-	-	-	130	30	13	30	-	9	27	0	171	3.5	-
11N04E12C003M	*TD=175, Source=USGS*														
8/3/1976	-	-	-	-	-	-	-	-	-	-	-	-	-	13	-
11N04E13H001M	*TD=148, Source=USGS*														
5/6/1965	250	-	8.1	-	86	17	11	25	1	2	23	0	123	3	0.2

Table 1 (continued)
Summary of Northern Natomas Basin Water Quality Results: General Minerals

						General Minerals									
						Cations				Anions					
Well ID Sample Date	EC µmhos/cm	TDS mg/L	pH pH Units	Alkalinity mg/L	Hardness mg/L	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	SO_4 mg/L	Cl mg/L	CO_3 mg/L	HCO_3 mg/L	NO_3 mg/L	F mg/L
11N04E13H001M	*TD=148, Source=USGS*														
8/11/1967	266	-	8.1	-	65	-	-	-	-	-	14	-	124	-	-
9/24/1970	260	198	8	-	80	17	9.1	20	0	2.5	0.18	0	123	5.5	-
7/9/1976	-	-	-	-	-	-	-	-	-	-	-	-	-	5.8	-
11N04E14D001M	*TD=NA, Source=DWR WQ Library*														
5/6/1965	270	-	8.1	-	91	17	12	26	1	4	20	0	132	6	0.2
11N04E14P001M	*TD=150, Source=USGS*														
8/2/1976	289	232	7.4	125	120	25	13	28	1.3	5.6	25	-	-	11	0.2
11N04E23P002M	*Perf: 80-200, Source=USGS*														
4/15/1965	-	-	-	-	-	-	-	-	-	-	-	-	-	4.5	-
7/23/1974	-	-	-	-	-	-	-	-	-	-	-	-	-	9.2	-
8/2/1976	234	222	7.4	121	110	23	12	24	1	3.1	22	-	-	9.7	0.2
8/31/2000	551	335	8.3	230	210	46	23	34	1.2	5	30	-	-	13.2	-
7/30/2002	584	351	7.8	246	239	51	27	37	1.5	6	31	-	-	12.5	-
8/18/2004	644	362	7.6	249	248	55	27	39	1.5	6	31	-	-	13	-
11N04E34J001M	*TD=190, Source=USGS*														
8/3/1976	-	-	-	-	-	-	-	-	-	-	-	-	-	4.4	-
11N04E35J001M	*Perf: 20-133, Source=USGS*														
8/13/1971	-	-	-	-	-	-	-	-	-	-	-	-	-	3.2	-
9/1/1999	323	-	7.5	131	90	23	8	32	-	-	23	-	-	-	-
9/27/2001	333	203	8.2	131	104	25	10	32	1.6	4	24	-	-	3.7	-
9/18/2003	340	213	6.7	140	114	26	12	33	1.6	4	25	-	-	4.9	-
8/24/2005	335	209	7.4	131	104	25	10	30	1.5	4	24	-	-	5	-
11N04E36R001M	*TD=484, Source=USGS*														
8/2/1976	247	189	7.4	103	66	17	5.6	32	2.5	5.1	20	-	-	0.71	0.1
11N05E06Q002M	*TD=245, Source=USGS*														
9/14/1982	250	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11N05E18N001M	*TD=205, Source=USGS*														
8/3/1976	-	-	-	-	-	-	-	-	-	-	-	-	-	11	-
11N05E30J001M	*TD=430, Source=USGS*														
8/3/1976	-	-	-	-	-	-	-	-	-	-	-	-	-	5.3	-
12N03E26R001M	*Perf: 0-180, Source=USGS*														

Table 1 (continued)
Summary of Northern Natomas Basin Water Quality Results: General Minerals

						General Minerals									
						Cations				Anions					
Well ID Sample Date	EC µmhos/cm	TDS mg/L	pH pH Units	Alkalinity mg/L	Hardness mg/L	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	SO_4 mg/L	Cl mg/L	CO_3 mg/L	HCO_3 mg/L	NO_3 mg/L	F mg/L
12N03E26R001M	*Perf: 0-180, Source=USGS*														
6/13/1963	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-
6/3/1964	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5	-
7/20/1965	-	-	-	-	-	-	-	-	-	-	-	-	-	0.8	-
8/13/1974	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-
12N04E25N001M	*Perf: 68-150, Source=USGS*														
6/12/1969	-	-	-	-	-	-	-	-	-	-	-	-	-	4.3	-
8/4/1976	-	-	-	-	-	-	-	-	-	-	-	-	-	6.2	-
12N04E35R001M	*TD=76, Source=USGS*														
8/3/1976	-	-	-	-	-	-	-	-	-	-	-	-	-	6.6	-
Holt Well #1	*TD=90, Source=DPH*														
11/21/1994	500	300	7.8	-	-	-	-	-	-	27	27	-	-	13	0
12/4/1995	-	-	-	-	-	-	-	-	-	-	-	-	-	20	-
11/26/1996	-	-	-	-	-	-	-	-	-	-	-	-	-	17	-
11/12/1997	-	-	-	-	-	-	-	-	-	-	-	-	-	5.4	0.12
1/20/1999	708	481	7.8	-	-	-	-	-	-	32.9	33.9	-	-	23.5	-
10/18/2000	-	-	-	-	-	-	-	-	-	-	-	-	-	28.2	-
1/17/2001	-	-	-	-	-	-	-	-	-	-	-	-	-	28.8	0.2
7/18/2001	-	-	-	-	-	-	-	-	-	-	-	-	-	24.4	-
10/17/2001	-	-	-	-	-	-	-	-	-	-	-	-	-	32.1	-
1/11/2002	-	-	-	-	-	-	-	-	-	-	-	-	-	27	-
4/5/2002	665	415	7.9	-	-	-	-	-	-	5.6	31.4	-	-	24.9	-
7/12/2002	-	-	-	-	-	-	-	-	-	-	-	-	-	33.3	-
10/25/2002	-	-	-	-	-	-	-	-	-	-	-	-	-	25.7	-
1/15/2003	-	-	-	-	-	-	-	-	-	-	-	-	-	33.4	-
4/16/2003	-	-	-	-	-	-	-	-	-	-	-	-	-	30	-
7/16/2003	-	-	-	-	-	-	-	-	-	-	-	-	-	23.5	-
10/15/2003	-	-	-	-	-	-	-	-	-	-	-	-	-	26.6	-
1/21/2004	-	-	-	-	-	-	-	-	-	-	-	-	-	23.8	-
4/21/2004	-	-	-	-	264	52.1	32.5	46	-	-	-	-	-	22.2	-
7/21/2004	-	-	-	-	-	-	-	-	-	-	-	-	-	22.3	-
10/20/2004	-	-	-	-	-	-	-	-	-	-	-	-	-	41.8	-

Table 1 (continued)
Summary of Northern Natomas Basin Water Quality Results: General Minerals

						General Minerals									
						Cations				Anions					
Well ID Sample Date	EC µmhos/cm	TDS mg/L	pH pH Units	Alkalinity mg/L	Hardness mg/L	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	SO_4 mg/L	Cl mg/L	CO_3 mg/L	HCO_3 mg/L	NO_3 mg/L	F mg/L
Holt Well #1	*TD=90, Source=DPH*														
11/10/2004	-	-	-	-	-	-	-	-	-	-	-	-	-	26.6	-
1/19/2005	-	-	-	-	-	-	-	-	-	-	-	-	-	38.3	-
4/20/2005	-	-	-	-	-	-	-	-	-	-	-	-	-	15	-
Holt Well #2	*Perf: 350-390, Source=DPH*														
1/1/2005	-	-	-	-	-	-	-	-	-	35	-	-	-	-	-
3/8/2005	460	300	8.38	210	170	40	17	47	2.1	-	28	0	256	0	0.13
1/18/2006	-	-	-	-	-	-	-	-	-	-	-	-	-	< 0.002	-
4/19/2006	-	-	-	-	-	-	-	-	-	-	-	-	-	< 0.002	-
7/19/2006	-	-	-	-	-	-	-	-	-	-	-	-	-	2.35	-
10/18/2006	-	-	-	-	-	-	-	-	-	-	-	-	-	14.6	-
4/18/2007	-	-	-	-	-	-	-	-	-	-	-	-	-	6.78	-
Lauppe MW-1055	*Perf: 960-1045, Source=LSCE*														
5/4/2006	410	280	8.05	120	82	22	6.5	58	4.2	1.5	62	< 5	120	< 2	0.13
Lauppe MW-245	*Perf: 180-235, Source=LSCE*														
5/4/2006	280	180	8.19	140	77	20	6.4	41	1.5	1.5	15	< 5	140	< 2	0.13
Lauppe MW-440	*Perf: 420-430, Source=LSCE*														
5/4/2006	340	210	8.27	160	55	15	4.4	61	1.3	1.9	25	< 5	160	< 2	0.33
Paulson MW-250	*Perf: 210-240, Source=LSCE*														
5/10/2007	300	260	7.72	200	32	7.3	3.2	91	1.3	1.6	14	< 5	200	< 2	0.13
Paulson MW-400	*Perf: 360-390, Source=LSCE*														
5/10/2007	290	220	7.47	350	39	9.5	3.8	69	1.5	0.75	15	< 5	350	< 2	0.1
Paulson PW-1	*Perf: 188-400, Source=LSCE*														
7/10/2007	350	220	8.21	170	37	9	3.4	73	1.3	< 0.5	17	< 5	170	< 2	< 0.1
Sysco	*TD=NA, Source=DPH*														
11/29/2000	308	207	8	139	87	25.8	7.3	33.3	-	0.3	14.8	<	170	< 2	< 0.1
6/7/2002	-	-	-	-	-	-	-	-	-	-	-	-	-	< 2	-
6/18/2003	-	-	-	-	-	-	-	-	-	-	-	-	-	< 2	-
6/16/2004	-	-	-	-	-	-	-	-	-	-	-	-	-	< 2	-
6/16/2004	-	-	-	-	-	-	-	-	-	-	-	-	-	< 2	-
11/3/2004	410	233	8	170	102	26.4	8.7	33.1	< 0.1	-	1.1	< 1	207	< 2	-
11/3/2004	410	233	8	170	102	26.4	8.7	33.1	-	1.1	< 0.1	< 1	207	-	-

Table 1 (continued)
Summary of Northern Natomas Basin Water Quality Results: General Minerals

						General Minerals									
						Cations				Anions					
Well ID Sample Date	EC µmhos/cm	TDS mg/L	pH pH Units	Alkalinity mg/L	Hardness mg/L	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	SO_4 mg/L	Cl mg/L	CO_3 mg/L	HCO_3 mg/L	NO_3 mg/L	F mg/L
Sysco	*TD=NA, Source=DPH*														
4/27/2005	-	-	-	-	-	-	-	-	-	< 0.1	-	-	-	-	-
6/15/2005	-	-	-	-	-	-	-	-	-	-	-	-	-	< 2	-
6/21/2006	-	-	-	-	-	-	-	-	-	-	-	-	-	< 2	-
10/18/2006	362	191	8.1	144	101	26.3	8.6	34.9	1.6	1.2	25.6	< 1	176	< 2	-

Notes:
TD = Total Depth in feet below ground surface (bgs).
Perf = Perforated interval in feet bgs.

Table 2
Summary of North Natomas Basin Water Quality Results: Trace Elements

	Trace Elements																		
Well/Location Sample Date	**Ag µg/L**	**Al mg/L**	**As µg/L**	**B mg/L**	**Ba µg/L**	**Be µg/L**	**Cd µg/L**	**Cr µg/L**	**Cu µg/L**	**Fe mg/L**	**Hg µg/L**	**Mn µg/L**	**Ni µg/L**	**Pb µg/L**	**Sb µg/L**	**Se µg/L**	**Tl µg/L**	**Vn µg/L**	**Zn µg/L**
10N03E23H001M	***TD=215, Source=USGS***																		
9/30/1982	-	0.01	9	1.6	-	-	-	-	-	0.25	-	260	-	-	-	-	-	-	-
10N03E26E001M	***TD=258, Source=USGS***																		
9/30/1982	-	< 0.01	5	1.4	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-
10N03E36N001M	***TD=160, Source=USGS***																		
9/10/1982	-	< 0.01	20	0.26	-	-	< 1	< 1	< 1	-	< 0.1	30	-	< 1	-	< 1	-	-	10
10N04E02A001M	***Perf: 104-152, Source=DWR WQ Library***																		
8/11/1967	-	-	20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10N04E13F001M	***TD=50, Source=USGS***																		
8/11/1997	< 1	-	3	0.053	339	< 1	< 1	6	2.8	< 0.003	-	< 1	2.96	< 1	< 1	< 1	-	-	2.6
6/3/2002	< 1	< 0.001	4.9	0.053	351	< 0.06	0.03	1.1	2.4	< 0.01	-	0.8	1.01	< 0.08	0.07	0.9	< 0.04	-	4.6
11/13/2003	-	-	-	-	-	-	-	-	-	0.005	-	0.4	-	-	-	-	-	-	-
2/11/2004	-	-	-	-	-	-	-	-	-	0.004	-	0.4	-	-	-	-	-	-	-
5/19/2004	< 0.2	0.001	4.3	0.046	352	< 0.06	0.03	1.6	1.8	0.004	-	0.7	3.22	< 0.08	< 0.2	0.3	< 0.04	-	4.4
8/11/2004	-	-	-	-	-	-	-	-	-	0.005	-	0.9	-	-	-	-	-	-	-
10N04E27R002M	***Perf: 745-985, Source=DWR WQ Library***																		
1/9/2001	< 1	< 0.01	24	0.2	161	< 1	< 1	7	< 1	0.313	< 0.2	139	1	< 1	< 5	-	-	-	< 5
10N04E27R003M	***Perf: 470-490, Source=DWR WQ Library***																		
1/9/2001	< 1	0.16	18	0.2	< 50	< 1	< 1	< 5	< 1	0.07	< 0.2	8	1	< 1	< 5	-	-	-	< 5
10N04E27R004M	***Perf: 190-210, Source=DWR WQ Library***																		
1/9/2001	< 1	0.05	55	0.1	70	< 1	< 1	6	2	0.055	< 0.2	111	< 1	< 1	< 5	-	-	-	< 5
10N04E30A001M	***TD=155, Source=USGS***																		
7/24/1969	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10N04E30F001M	***TD=NA, Source=DWR WQ Library***																		
10/19/1967	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10N04E30H001M	***TD=NA, Source=DWR WQ Library***																		
10/19/1967	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10N04E30L001M	***TD=NA, Source=DWR WQ Library***																		
3/25/1965	-	-	-	-	-	-	-	-	-	0.05	-	0	-	-	-	-	-	-	-
10/19/1967	-	-	30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10N04E30M001M	***TD=520, Source=DWR WQ Library***																		

Table 2 (continued)
Summary of North Natomas Basin Water Quality Results: Trace Elements

	Trace Elements																		
Well/Location Sample Date	**Ag µg/L**	**Al mg/L**	**As µg/L**	**B mg/L**	**Ba µg/L**	**Be µg/L**	**Cd µg/L**	**Cr µg/L**	**Cu µg/L**	**Fe mg/L**	**Hg µg/L**	**Mn µg/L**	**Ni µg/L**	**Pb µg/L**	**Sb µg/L**	**Se µg/L**	**Tl µg/L**	**Vn µg/L**	**Zn µg/L**
10N04E30M001M	***TD=520, Source=DWR WQ Library***																		
5/10/1965	-	-	-	1.5	-	-	-	-	-	0.09	-	150	-	-	-	-	-	-	-
10/19/1967	-	-	50	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10N04E31C002M	***TD=510, Source=DWR WQ Library***																		
5/25/1965	-	-	-	-	-	-	-	-	-	0.38	-	8	-	-	-	-	-	-	-
10/19/1967	-	-	40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10N04E31M001M	***Perf: 1060-1070, Source=DWR WQ Library***																		
1/12/2001	< 1	< 0.01	31	0.5	244	-	< 1	9	2	0.208	< 0.2	161	-	< 1	-	-	-	-	< 5
10N04E31M002M	***Perf: 795-805, Source=DWR WQ Library***																		
1/12/2001	< 1	< 0.01	103	0.9	85	-	< 1	12	2	0.499	< 0.2	88	-	< 1	-	-	-	-	< 5
10N04E31M003M	***Perf: 380-400, Source=DWR WQ Library***																		
1/12/2001	< 1	< 0.01	52	2.2	< 50	-	< 1	17	2	0.084	< 0.2	68	-	< 1	-	-	-	-	< 5
10N04E31M004M	***Perf: 170-190, Source=DWR WQ Library***																		
1/12/2001	< 1	< 0.01	24	1.5	296	-	< 1	25	2	0.209	< 0.2	301	-	< 1	-	-	-	-	< 5
10N04E32D001M	***TD=NA, Source=DWR WQ Library***																		
10/19/1967	-	-	60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10N04E36B001M	***TD=104, Source=USGS***																		
8/10/1970	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10N05E06M002M	***TD=145, Source=USGS***																		
7/15/1957	-	-	-	-	-	-	-	-	-	0.01	-	-	-	-	-	-	-	-	-
7/31/1958	-	-	-	0.15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8/4/1959	-	-	-	0.11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7/14/1960	-	-	-	0.13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8/18/1961	-	-	-	0.12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7/1/1962	-	-	-	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7/8/1964	-	-	-	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7/23/1969	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6/24/1974	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10N05E08M001M	***TD=180, Source=USGS***																		
9/30/1982	-	< 0.01	18	0.19	-	-	-	-	-	-	-	80	-	-	-	-	-	-	-
10N05E19C001M	***TD=200, Source=USGS***																		
9/30/1982	-	< 0.01	16	0.13	-	-	-	-	-	0.03	-	90	-	-	-	-	-	-	-

Table 2 (continued)
Summary of North Natomas Basin Water Quality Results: Trace Elements

	Trace Elements																		
Well/Location Sample Date	**Ag µg/L**	**Al mg/L**	**As µg/L**	**B mg/L**	**Ba µg/L**	**Be µg/L**	**Cd µg/L**	**Cr µg/L**	**Cu µg/L**	**Fe mg/L**	**Hg µg/L**	**Mn µg/L**	**Ni µg/L**	**Pb µg/L**	**Sb µg/L**	**Se µg/L**	**Tl µg/L**	**Vn µg/L**	**Zn µg/L**
11N03E14R001M	***TD=206, Source=USGS***																		
5/27/1965	-	-	-	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8/31/1970	-	-	-	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7/23/1974	-	-	20	0.2	-	-	<	<	<	0.15	-	170	-	<	-	-	-	-	< 20
11N03E15H001M	***TD=36, Source=USGS***																		
8/2/1976	-	0.01	1	0.13	-	-	-	-	-	0.02	-	410	-	-	-	-	-	-	-
11N03E23B001M	***TD=52, Source=USGS***																		
8/2/1976	-	-	-	0.06	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11N03E23R002M	***TD=180, Source=USGS***																		
8/2/1976	-	< 0.1	7	0.26	-	-	-	-	-	< 0.01	-	70	-	-	-	-	-	-	-
11N03E24D001M	***TD=145, Source=USGS***																		
9/6/2000	-	-	-	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7/30/2002	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8/18/2004	-	-	-	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11N04E04N001M	***TD=NA, Source=DWR WQ Library***																		
2/23/2006	< 1	< 0.01	5	0.6	235	< 1	< 1	3	< 1	0.123	< 0.2	98	< 1	< 1	< 1	1	-	-	< 5
11N04E04N002M	***TD=NA, Source=DWR WQ Library***																		
2/23/2006	< 1	< 0.01	8	0.1	< 50	< 1	< 1	1	< 1	0.02	< 0.2	71	< 1	< 1	< 1	< 1	-	-	< 5
11N04E04N003M	***TD=NA, Source=DWR WQ Library***																		
2/23/2006	< 1	< 0.01	8	0.1	< 50	< 1	< 1	1	< 1	0.029	< 0.2	72	< 1	< 1	< 1	< 1	-	-	< 5
11N04E04N004M	***TD=NA, Source=DWR WQ Library***																		
2/23/2006	< 1	< 0.01	6	< 0.1	56	< 1	< 1	3	< 1	0.071	< 0.2	236	1	< 1	< 1	< 1	-	-	< 5
11N04E04P001M	***Perf: 60-145, Source=USGS***																		
8/2/1976	-	0.02	3	0.08	-	-	-	-	-	< 0.01	-	< 10	-	-	-	-	-	-	-
11N04E04R002M	***Perf: 84-155, Source=USGS***																		
9/27/2001	-	-	-	< 0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9/18/2003	-	-	-	< 0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8/24/2005	-	-	-	< 0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11N04E09D002M	***TD=100, Source=DWR WQ Library***																		
8/10/1967	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11N04E09P003M	***TD=316, Source=USGS***																		
8/2/1976	-	-	-	0.12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 2 (continued)
Summary of North Natomas Basin Water Quality Results: Trace Elements

	Trace Elements																		
Well/Location Sample Date	**Ag µg/L**	**Al mg/L**	**As µg/L**	**B mg/L**	**Ba µg/L**	**Be µg/L**	**Cd µg/L**	**Cr µg/L**	**Cu µg/L**	**Fe mg/L**	**Hg µg/L**	**Mn µg/L**	**Ni µg/L**	**Pb µg/L**	**Sb µg/L**	**Se µg/L**	**Tl µg/L**	**Vn µg/L**	**Zn µg/L**
11N04E13H001M	***TD=148, Source=USGS***																		
5/6/1965	-	-	-	0.1	-	-	-	-	-	0.05	-	-	-	-	-	-	-	-	-
8/11/1967	-	-	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9/24/1970	-	-	0	0	-	-	0	-	0	0	-	0	-	0	-	0	-	-	0
11N04E14D001M	***TD=NA, Source=DWR WQ Library***																		
5/6/1965	-	-	-	0.2	-	-	-	-	-	0.07	-	-	-	-	-	-	-	-	-
11N04E14P001M	***TD=150, Source=USGS***																		
8/2/1976	-	-	8	0.13	-	-	-	-	-	0.01	-	70	-	-	-	-	-	-	-
11N04E23P002M	***Perf: 80-200, Source=USGS***																		
8/2/1976	-	-	7	0.1	-	-	-	-	-	0	-	0	-	-	-	-	-	-	-
8/31/2000	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7/30/2002	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8/18/2004	-	-	-	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11N04E35J001M	***Perf: 20-133, Source=USGS***																		
9/27/2001	-	-	-	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9/18/2003	-	-	-	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8/24/2005	-	-	-	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11N04E36R001M	***TD=484, Source=USGS***																		
8/2/1976	-	-	22	0.39	-	-	1	0	0	0.04	< 0.5	110	-	7	-	0	-	-	-
Holt Well #1	***TD=90, Source=DPH***																		
11/21/1994	0	0.17	8.6	-	88	0	0	0	-	0	0	23	0	-	0	0	0	-	0
11/12/1997	-	< 0.05	9	-	110	< 1	< 1	< 10	-	< 0.1	< 1	60	< 10	-	< 6	< 5	< 1	-	-
1/17/2001	< 10	< 0.05	8.3	-	< 100	< 1	1.5	< 10	-	< 0.1	< 1	< 30	< 10	-	< 6	< 5	< 1	-	< 50
10/18/2001	-	-	-	-	-	-	-	2.4	-	-	-	-	-	-	-	-	-	-	-
4/21/2004	-	-	7.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Holt Well #2	***Perf: 350-390, Source=DPH***																		
3/8/2005	0	0	14	0.15	340	0	0	0	0	4.9	0	270	0	0	0	0	0	-	0
4/18/2007	-	-	17.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lauppe MW-1055	***Perf: 960-1045, Source=LSCE***																		
5/4/2006	< 10	< 0.05	4	0.46	170	< 1	< 1	< 10	< 50	0.13	< 1	170	< 10	< 5	< 6	< 5	< 1	-	< 50
Lauppe MW-245	***Perf: 180-235, Source=LSCE***																		
5/4/2006	< 10	< 0.05	4	0.19	< 100	< 1	< 1	< 10	< 50	< 0.1	< 1	55	< 10	< 5	< 6	< 5	< 1	-	< 50

Table 2 (continued)
Summary of North Natomas Basin Water Quality Results: Trace Elements

Well/Location Sample Date	Trace Elements																		
	Ag µg/L	Al mg/L	As µg/L	B mg/L	Ba µg/L	Be µg/L	Cd µg/L	Cr µg/L	Cu µg/L	Fe mg/L	Hg µg/L	Mn µg/L	Ni µg/L	Pb µg/L	Sb µg/L	Se µg/L	Tl µg/L	Vn µg/L	Zn µg/L
Lauppe MW-440	*Perf: 420-430, Source=LSCE*																		
5/4/2006	< 10	< 0.05	29	0.22	< 100	< 1	< 1	< 10	< 50	< 0.1	< 1	56	< 10	< 5	< 6	< 5	< 1	-	< 50
Paulson MW-250	*Perf: 210-240, Source=LSCE*																		
5/10/2007	< 10	< 0.05	12	0.22	< 100	< 1	< 1	< 10	< 50	< 0.1	< 1	56	< 10	< 5	< 6	< 5	< 1	-	< 50
Paulson MW-400	*Perf: 360-390, Source=LSCE*																		
5/10/2007	< 10	< 0.05	24	0.25	< 100	< 1	< 1	< 10	< 50	< 0.1	< 1	65	< 10	< 5	< 6	< 5	< 1	-	< 50
Paulson PW-1	*Perf: 188-400, Source=LSCE*																		
7/10/2007	< 10	< 0.05	14	0.21	< 100	< 1	< 1	< 10	< 50	< 0.1	< 1	47	< 10	< 5	< 6	< 5	< 1	-	< 50
Sysco	*TD=NA, Source=DPH*																		
11/29/2000	< 10	-	4.8	-	< 100	< 1	< 1	< 10	< 50	1.43	< 1	140	< 10	-	< 6	< 5	< 1	-	< 50
6/25/2001	-	-	-	-	-	-	-	-	-	0.333	-	142	-	-	-	-	-	-	-
6/7/2002	-	-	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9/13/2002	-	-	8.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12/18/2002	-	< 0.05	7.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12/18/2002	-	< 0.05	7.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6/16/2004	-	-	-	-	-	-	-	-	-	0.411	-	203	-	-	-	-	-	-	-
6/16/2004	-	-	-	-	-	-	-	-	-	0.411	-	203	-	-	-	-	-	-	-
11/3/2004	< 50	< 0.05	-	-	-	-	-	-	< 50	< 0.1	-	117	-	-	-	-	-	-	-
11/3/2004	< 10	< 0.05	-	-	-	-	-	-	11	< 0.01	-	117	-	-	-	-	-	-	< 50
4/27/2005	-	-	-	-	106	-	< 1	-	-	-	< 1	-	-	-	< 6	< 5	< 10	-	-
6/21/2006	-	-	8.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

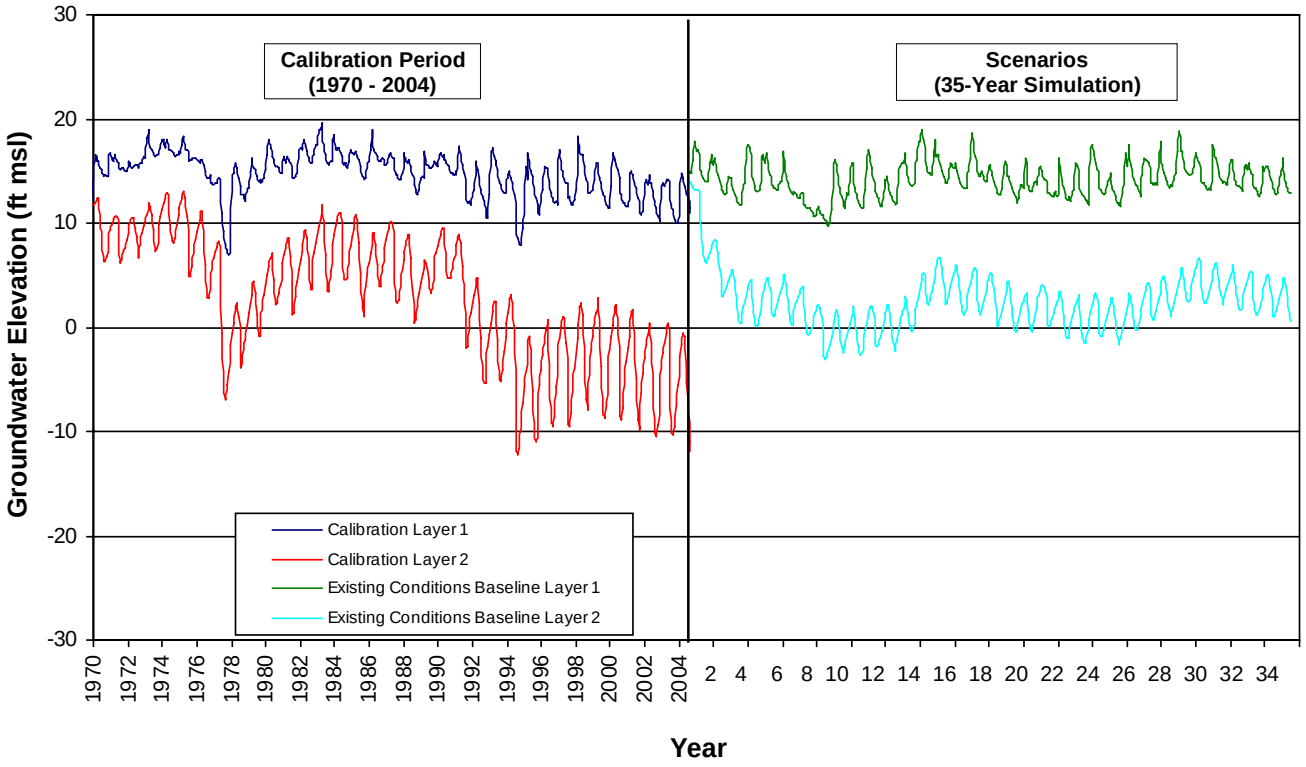
Notes:
TD = Total Depth in feet below ground surface (bgs).
Perf = Perforated interval in feet bgs.
Values shown in this table represent available data from the source; when more than one analyte result is available for the same date, then a maximum value is selected from the database (e.g. "Manganese (Total)" and "Manganese (Dissolved)" may have different values, but the maximum value will be seen on this table).

Appendix E

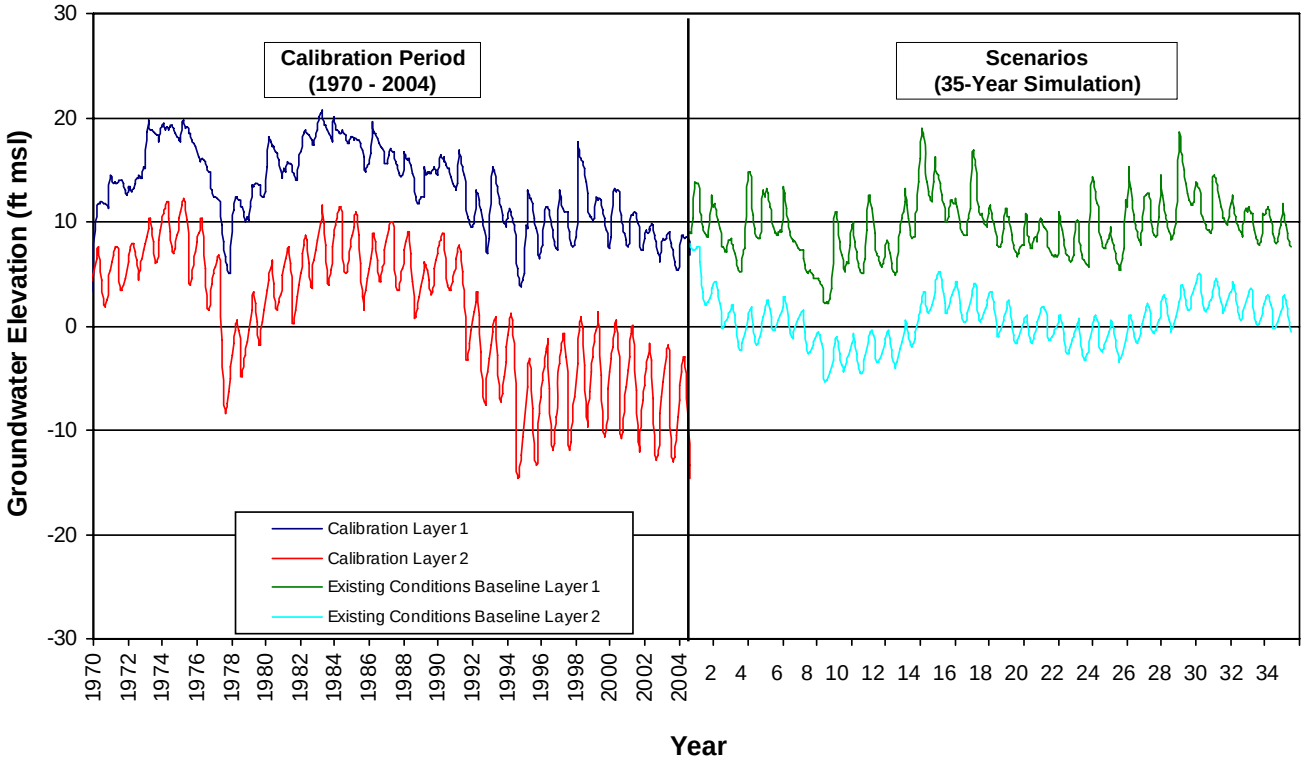
Simulated Groundwater Elevation Hydrographs for Selected Calibration Wells

Existing Conditions Baseline Layer 1 and Layer 2

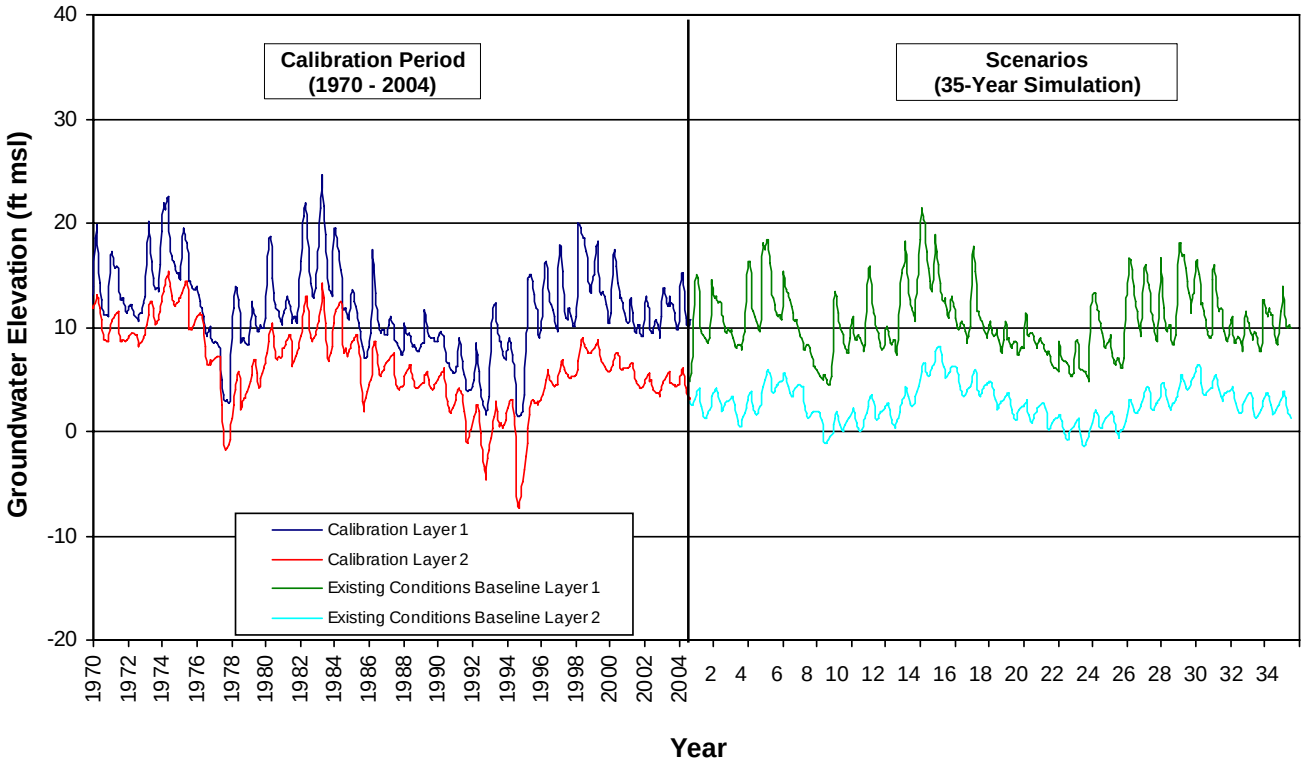
Well NAR-30 (11N04E09D002M)



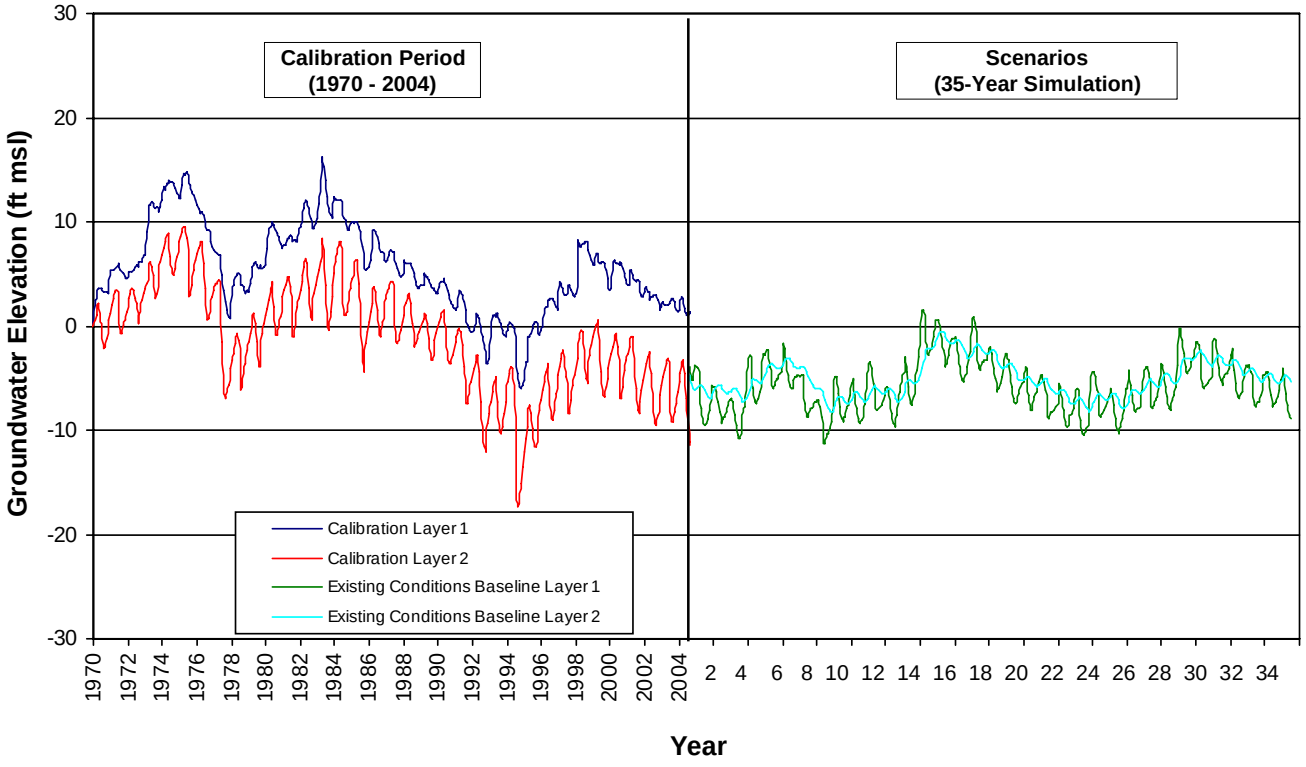
Well NAR-34 (11N04E15C001M)



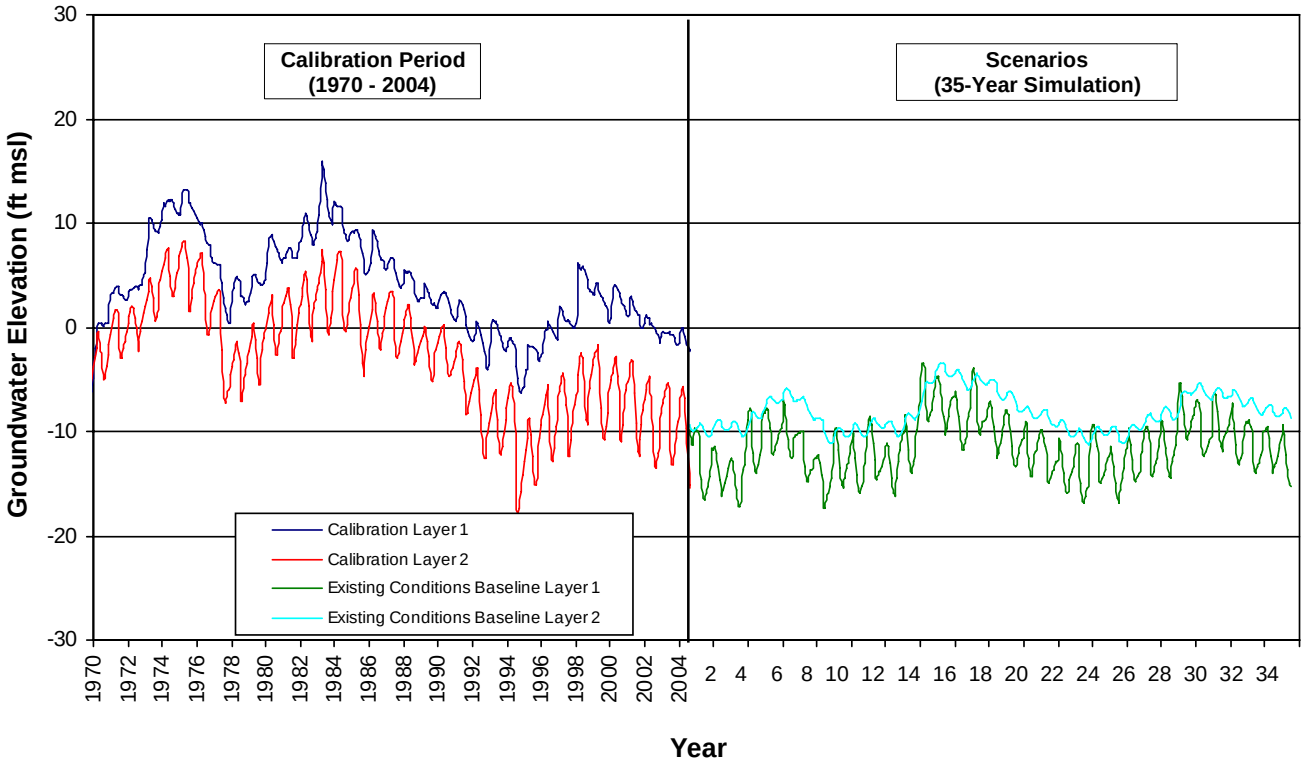
Well NAR-173 (173)



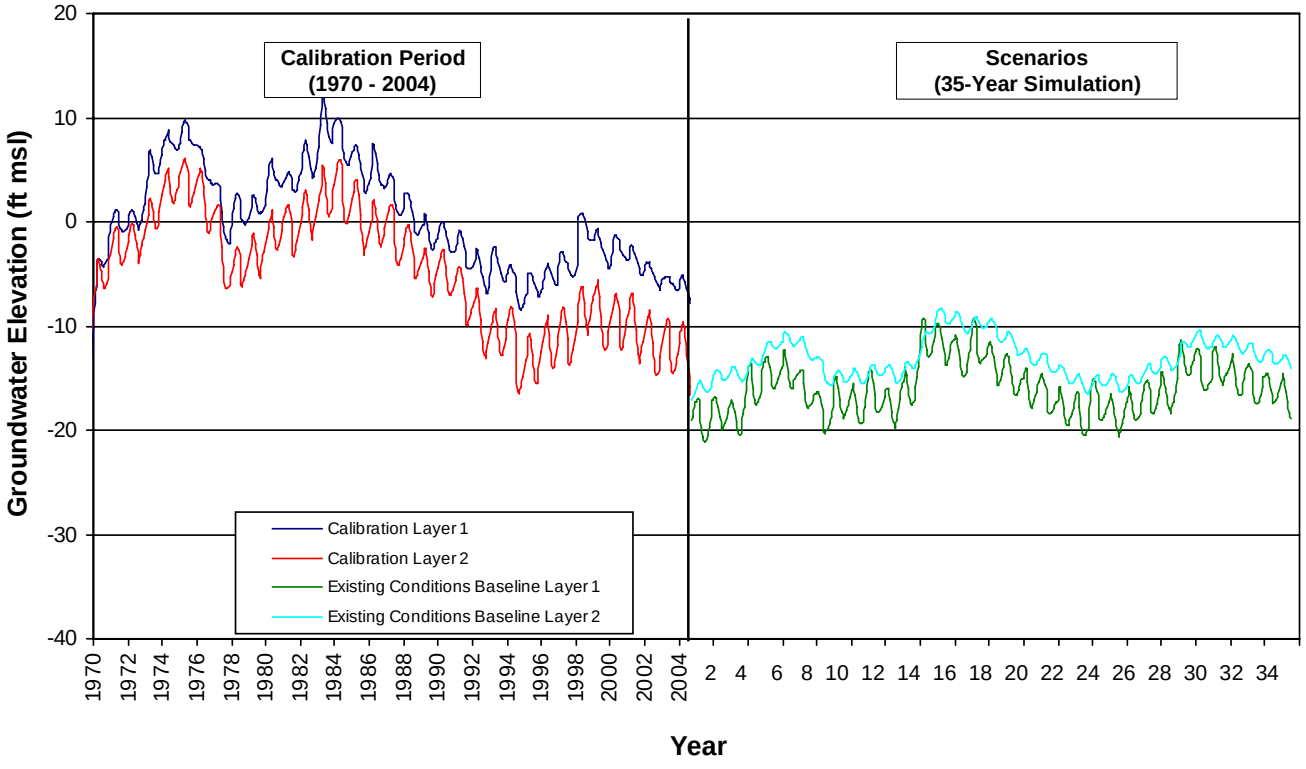
Well NAR-41 (11N04E34N001M)



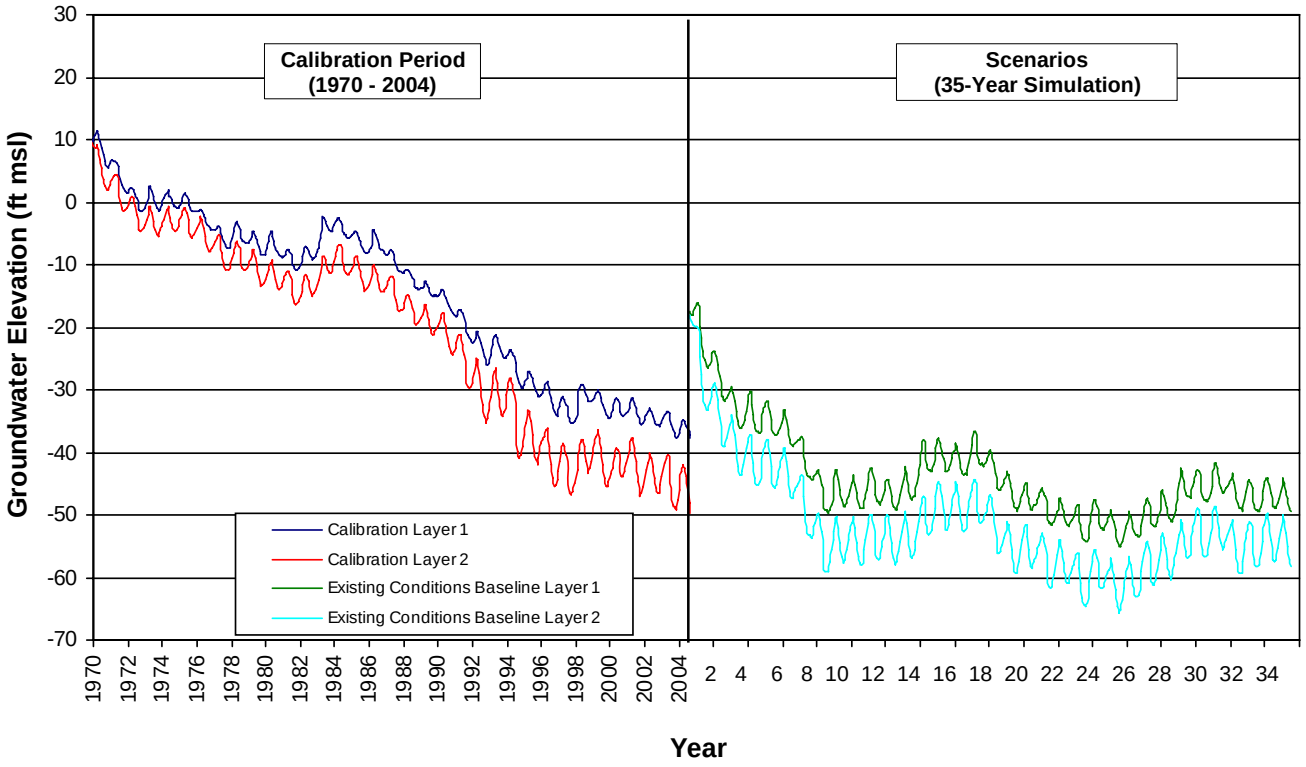
Well NAR-1 (10N04E02K001M)



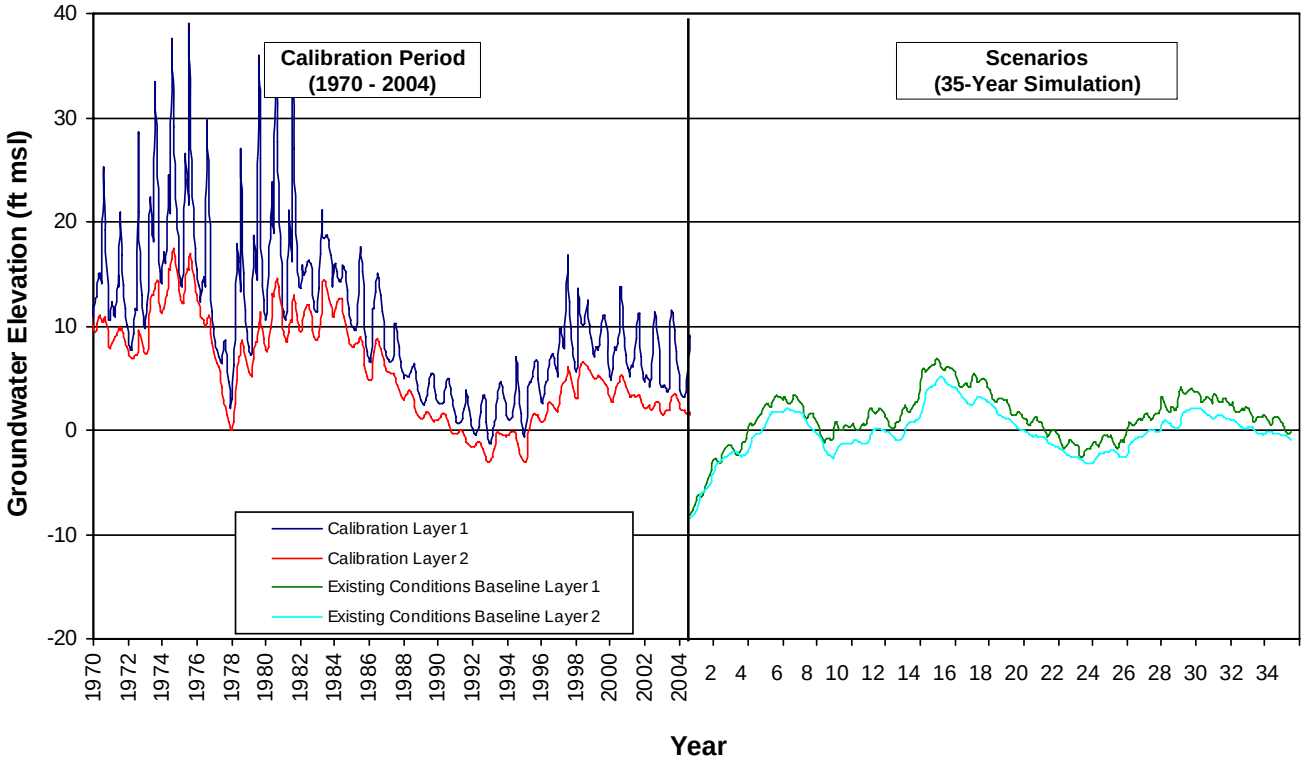
Well NAR-2 (10N04E12A001M)



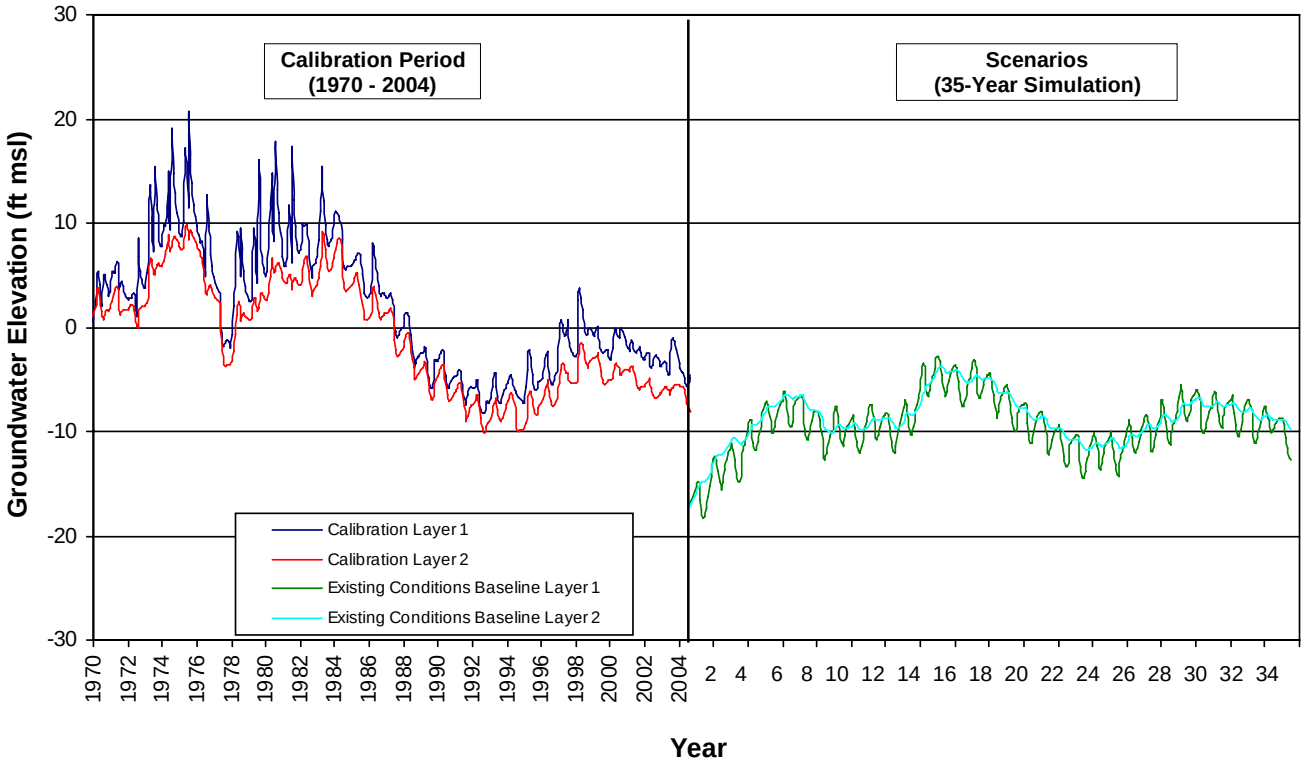
Well NAR-11 (10N06E07L001M)



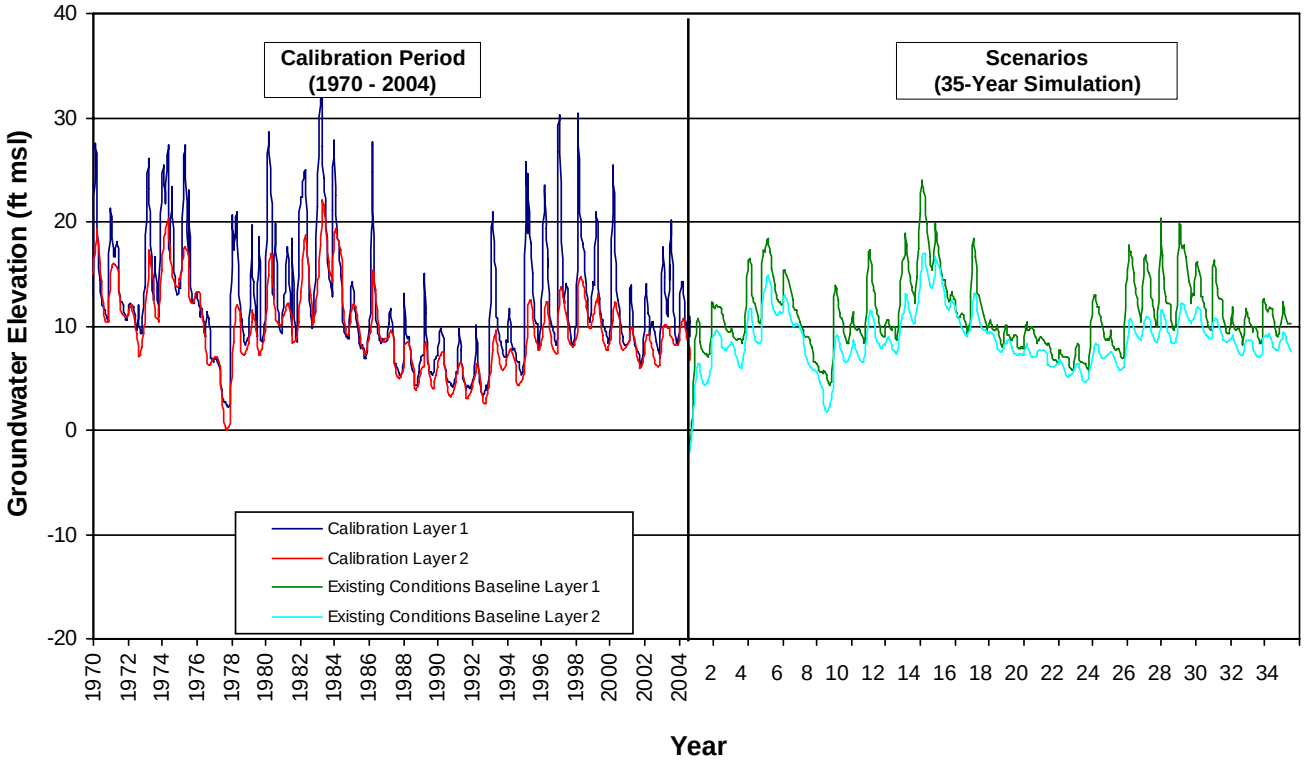
Well SAC-4 (10N04E21B002M)



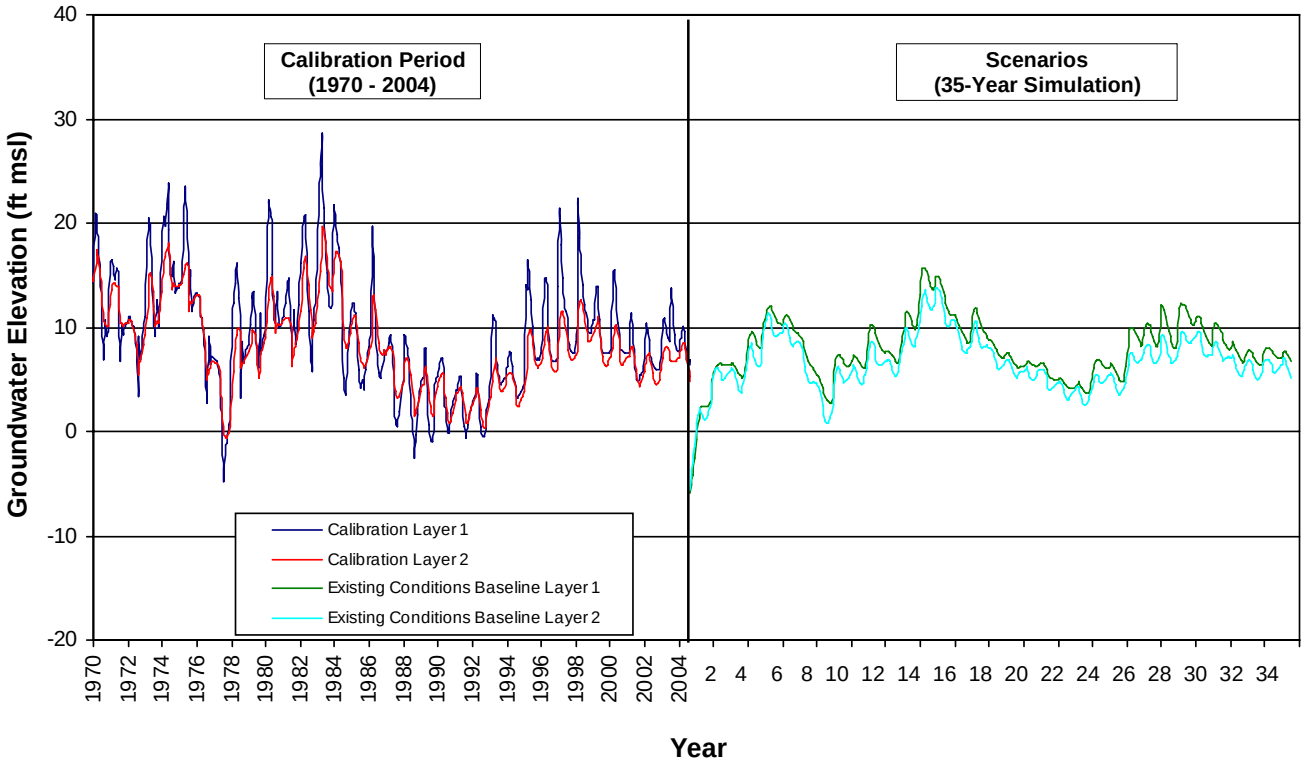
Well SAC-3 (10N04E23A001M)



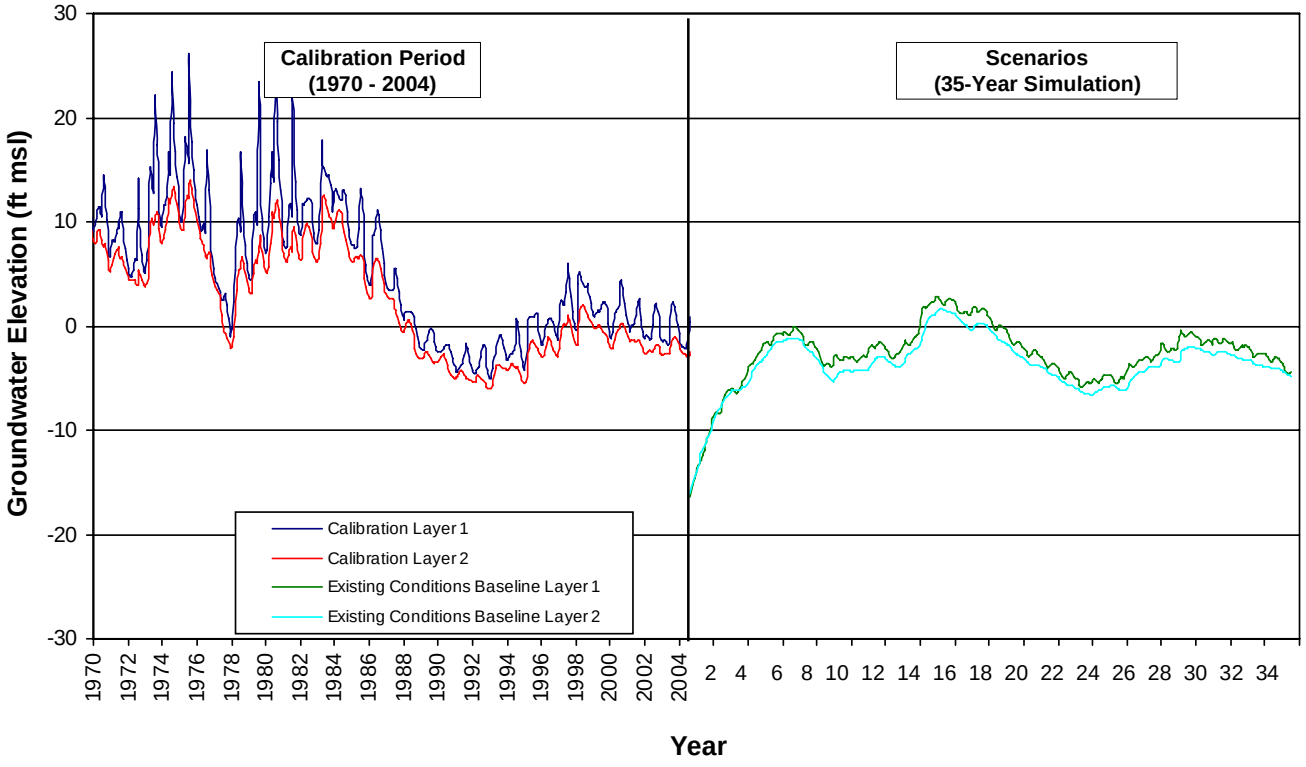
Well SAC-1 (10N03E35A001M)



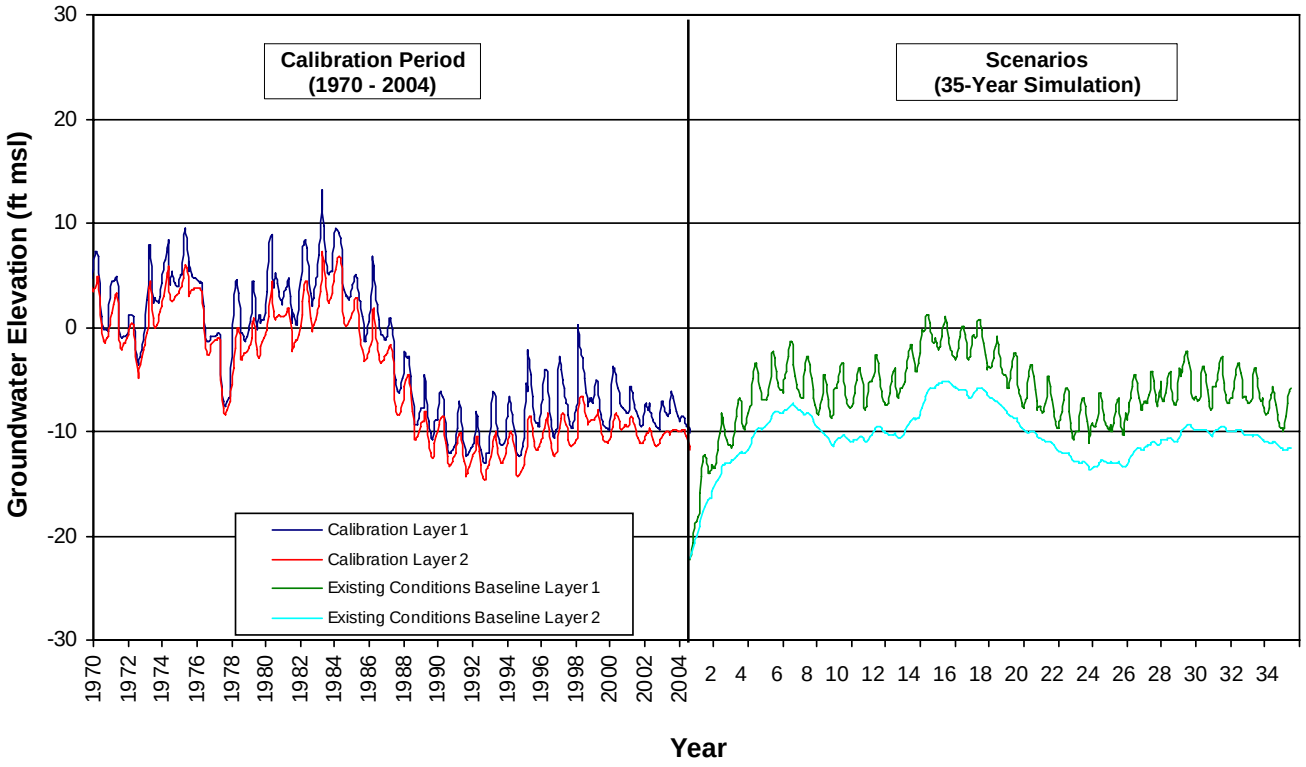
Well SAC-2 (10N04E31M004M)



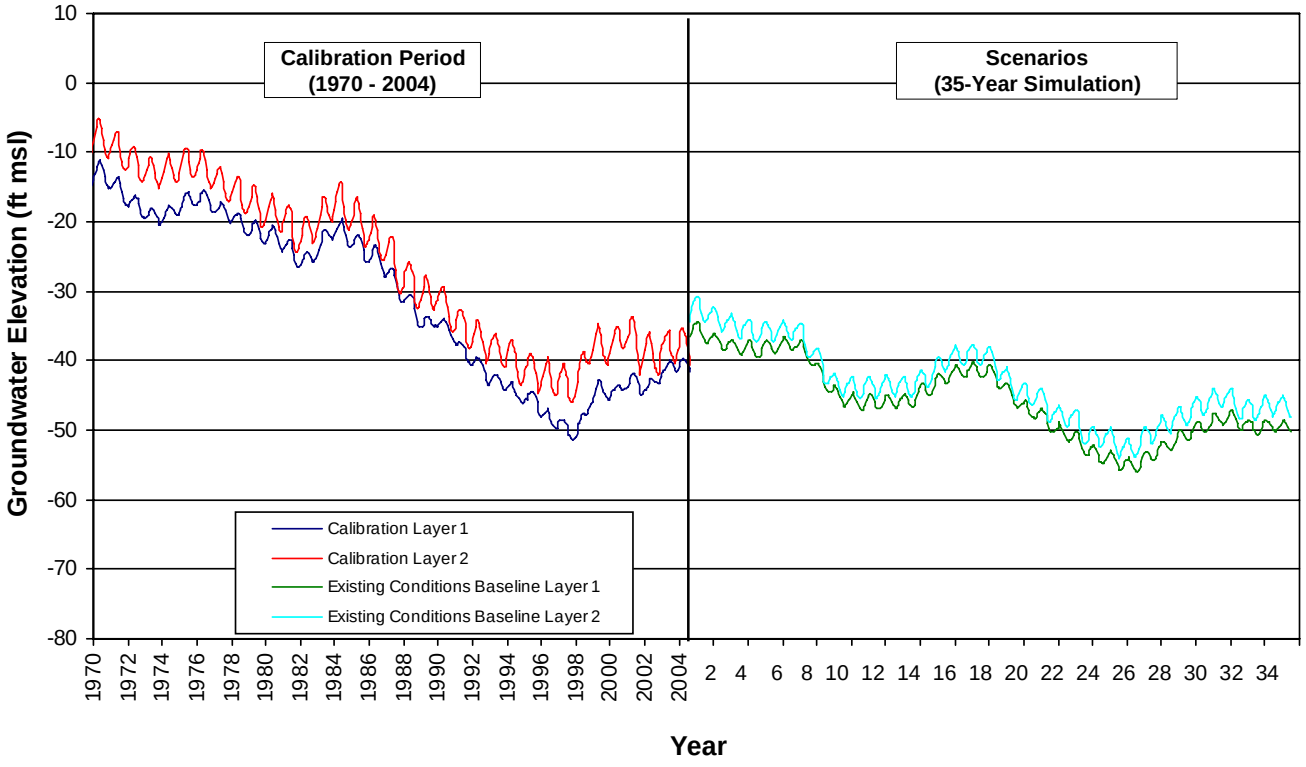
Well SAC-5 (10N04E27R004M)



Well SAC-7 (10N04E36B001M)

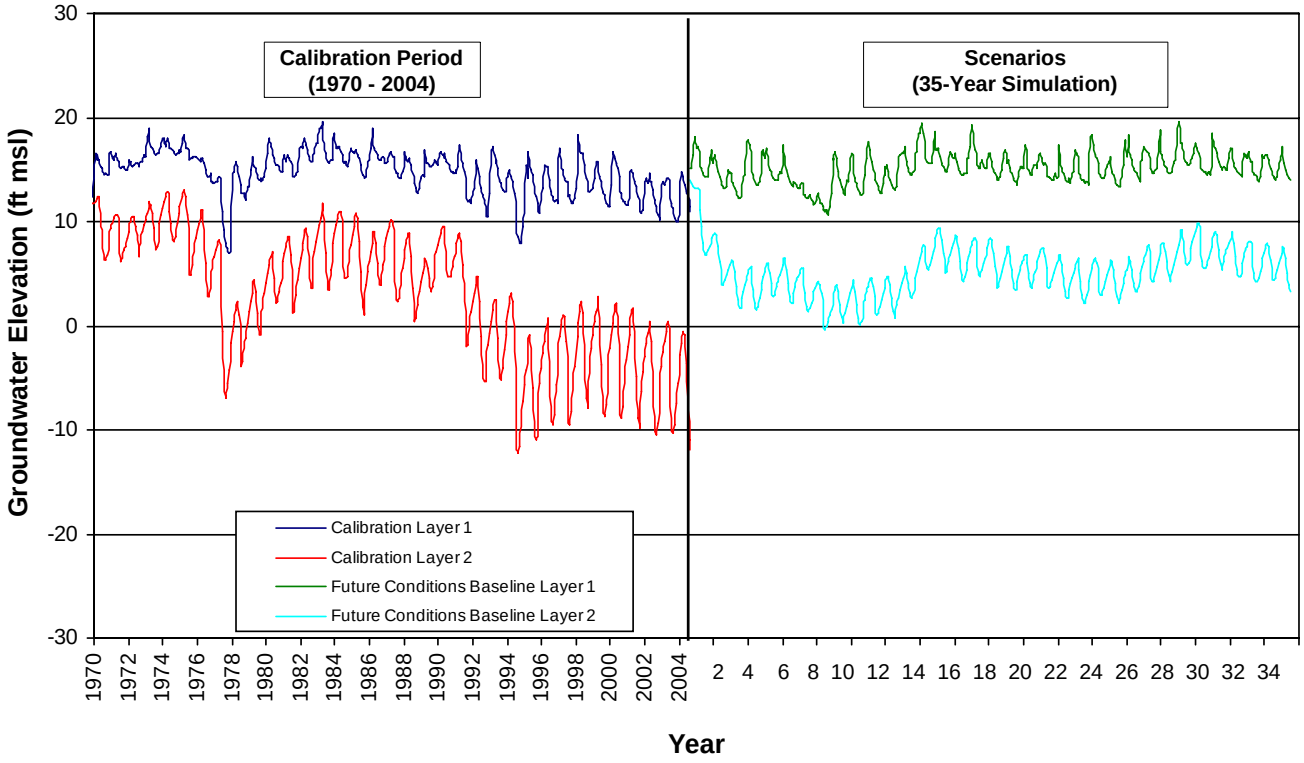


Well SAC-31 (09N05E14B001M)

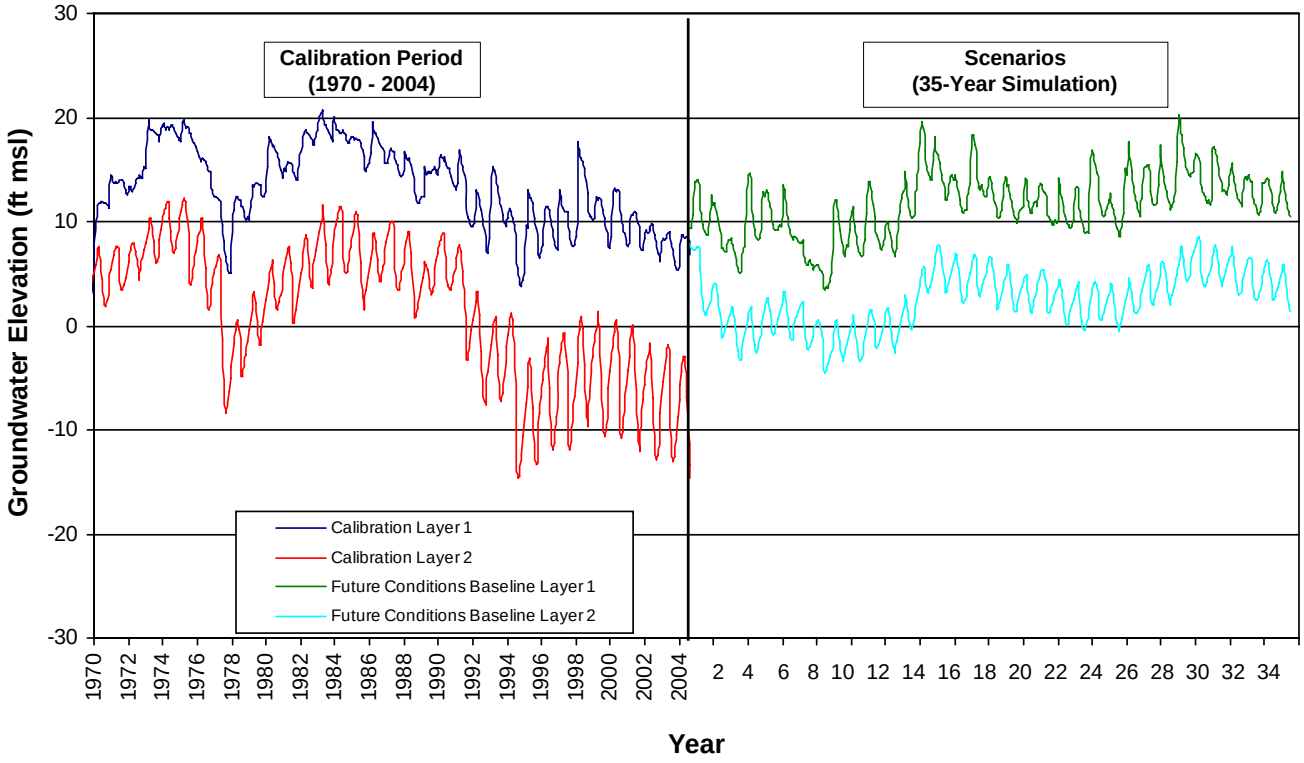


Future Conditions Baseline Layer 1 and Layer 2

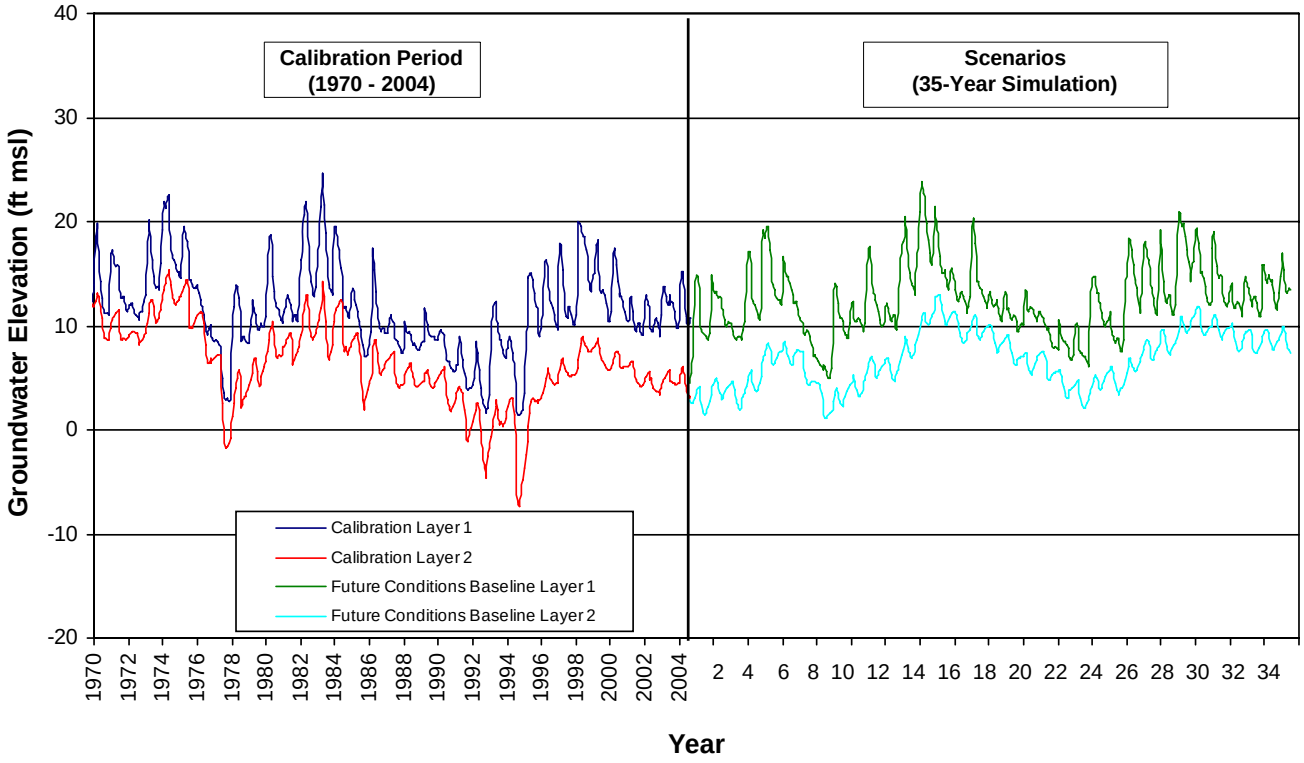
Well NAR-30 (11N04E09D002M)



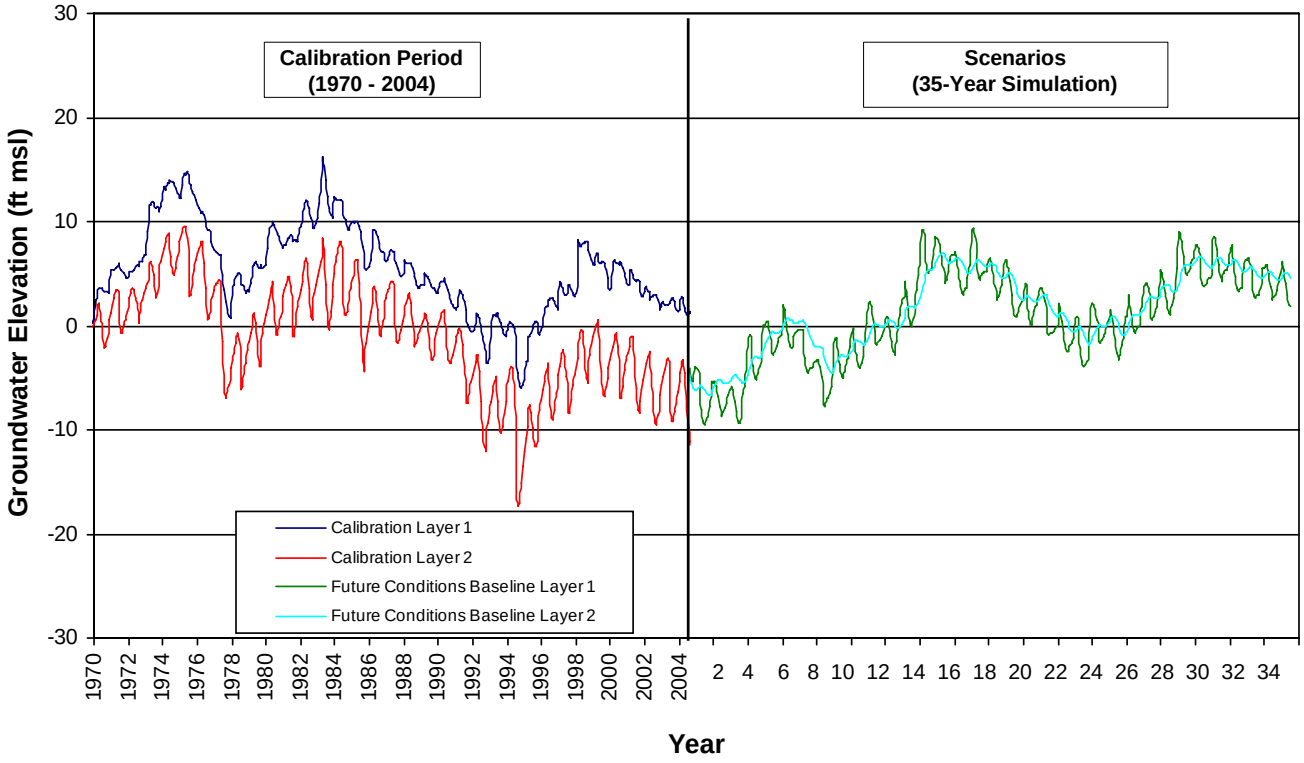
Well NAR-34 (11N04E15C001M)



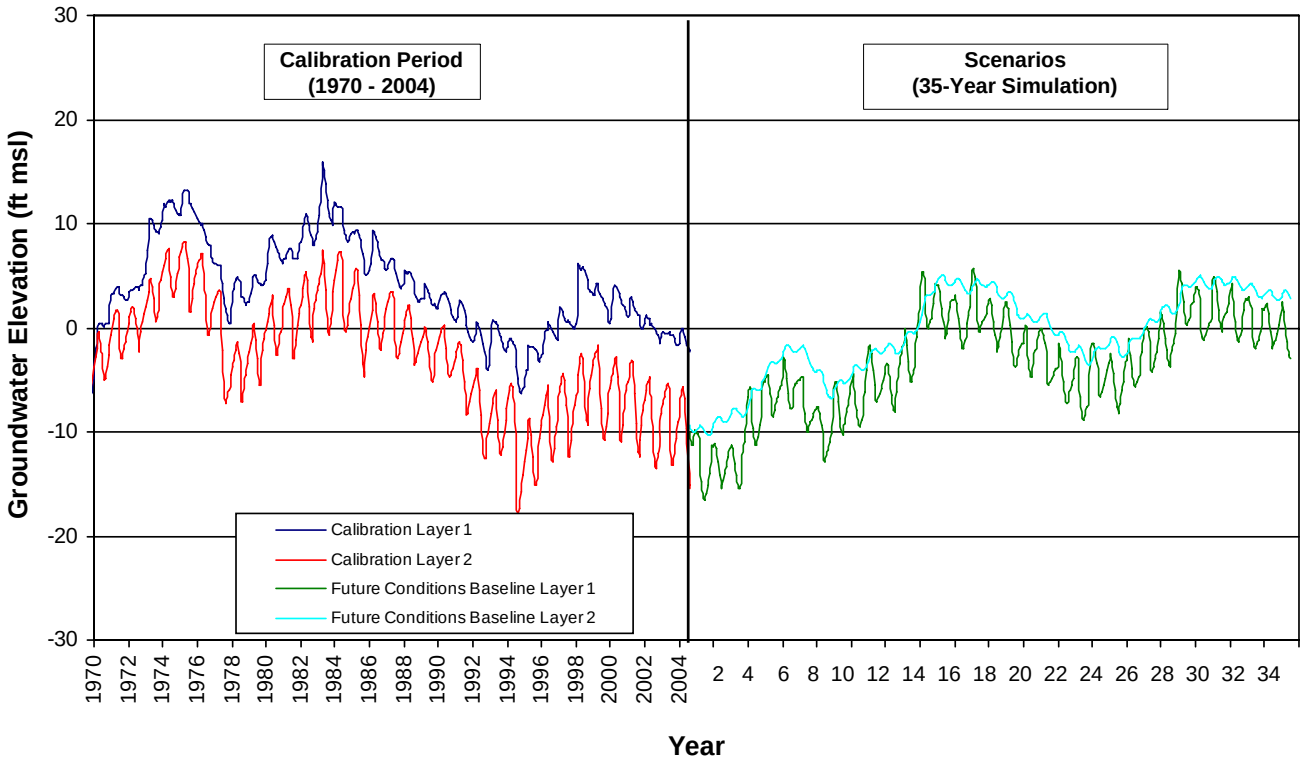
Well NAR-173 (173)



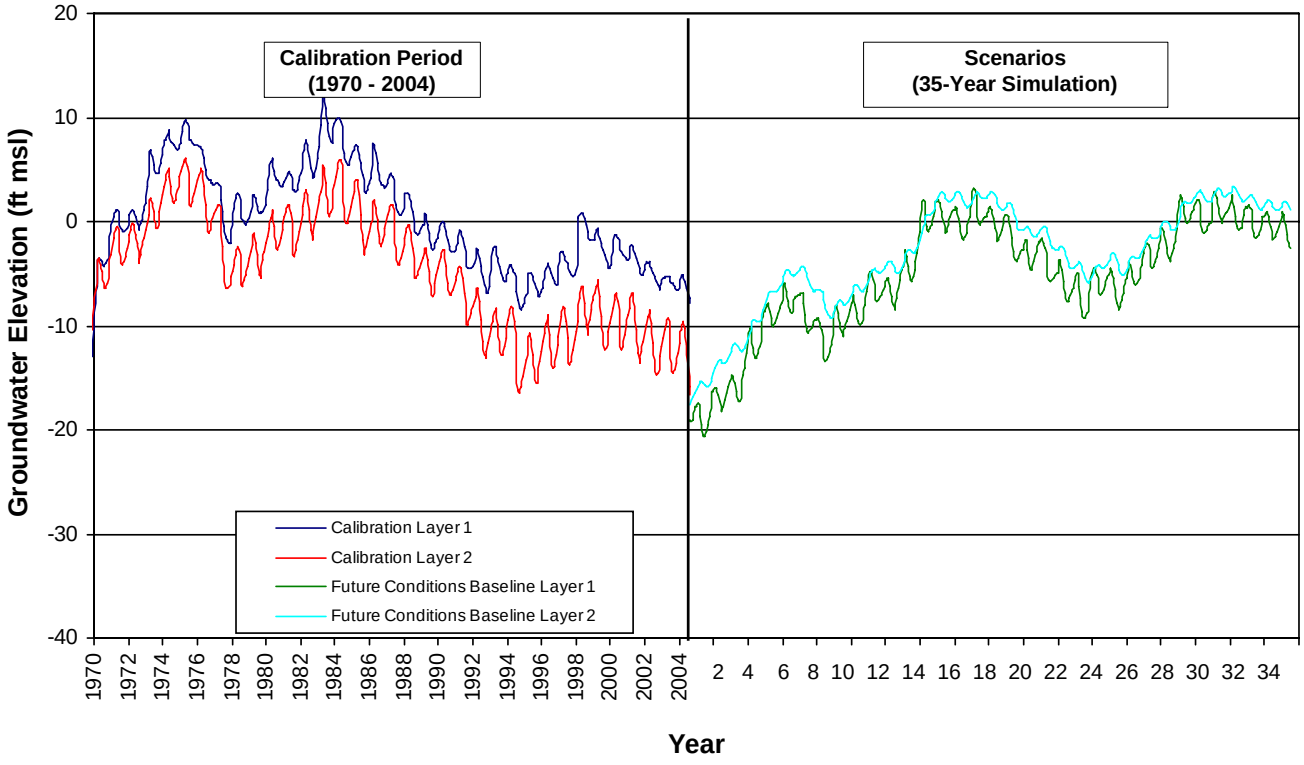
Well NAR-41 (11N04E34N001M)



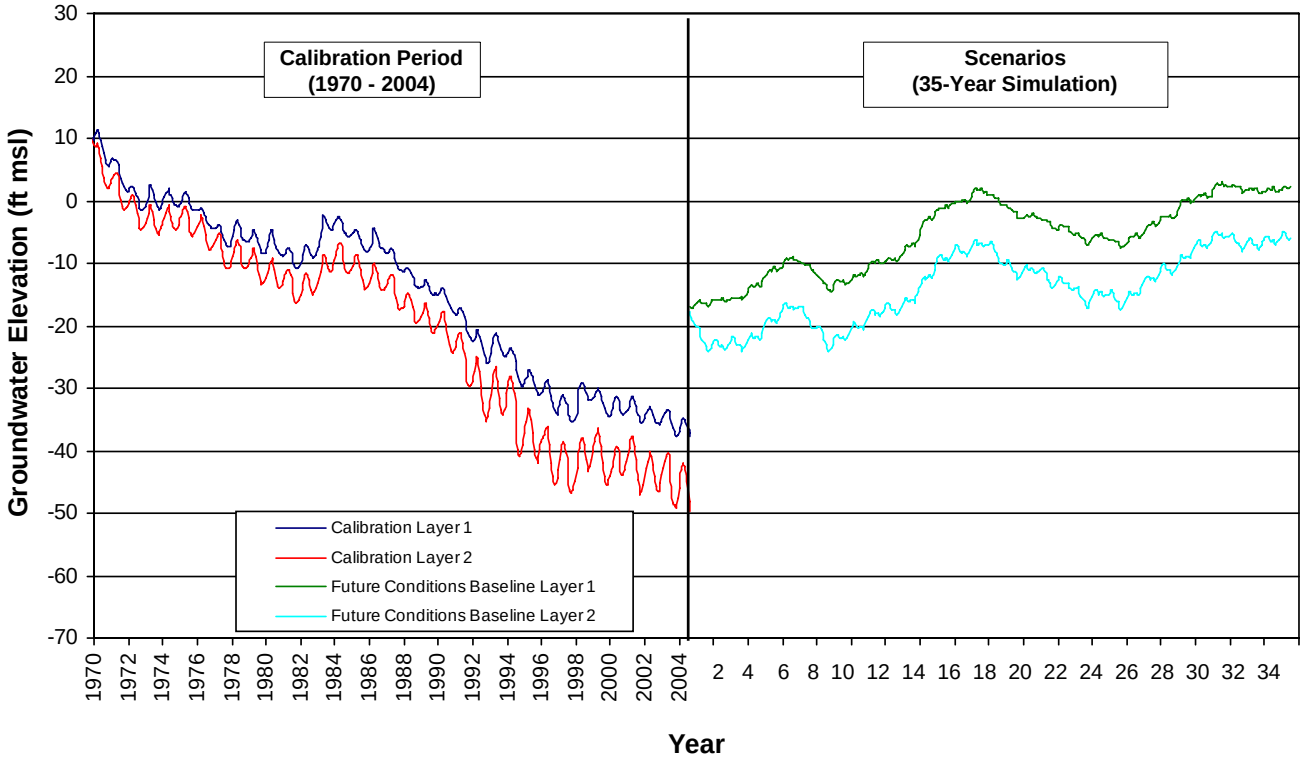
Well NAR-1 (10N04E02K001M)



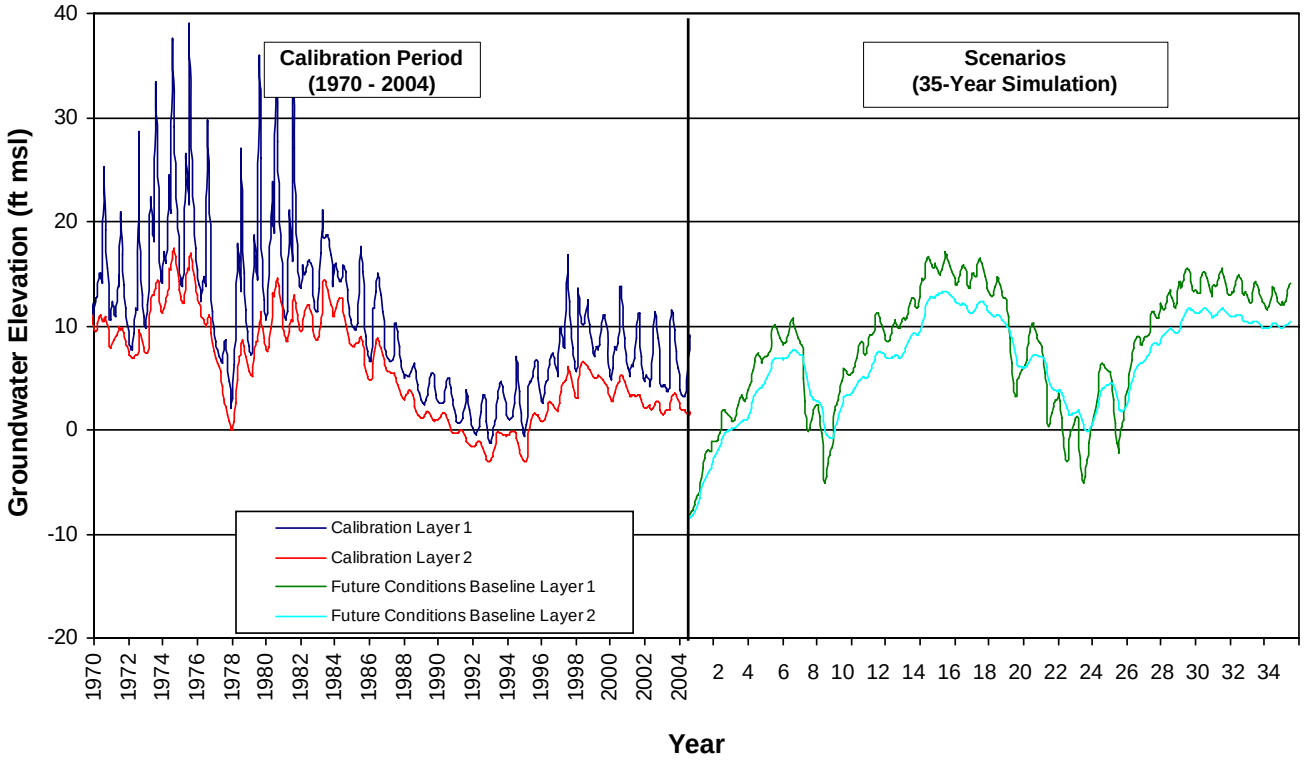
Well NAR-2 (10N04E12A001M)



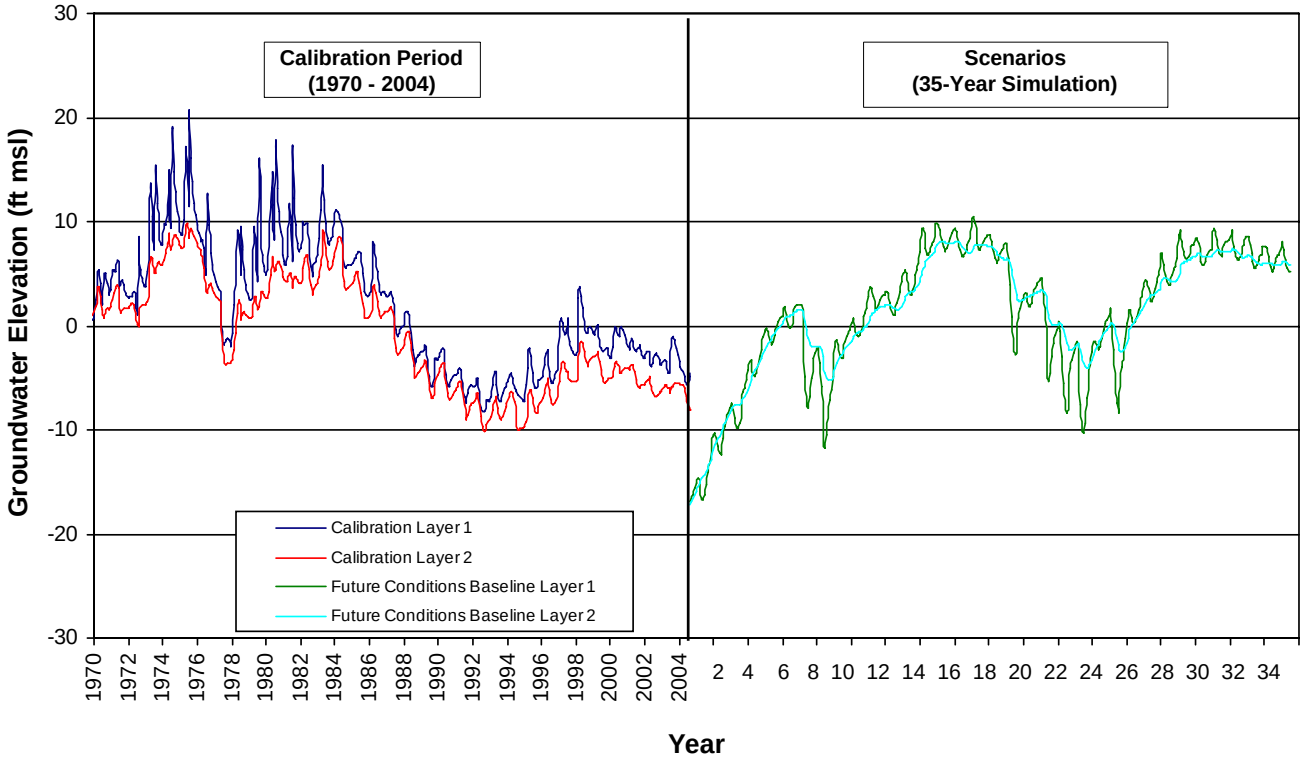
Well NAR-11 (10N06E07L001M)



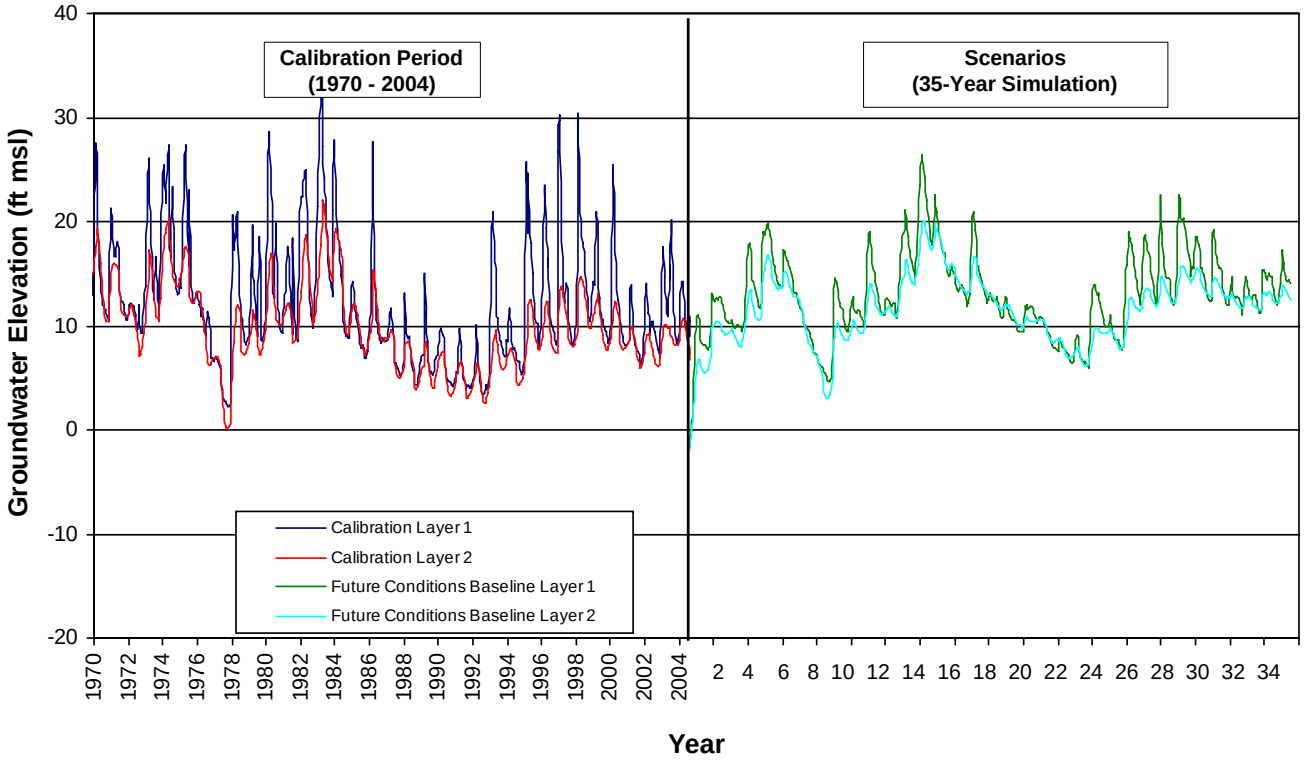
Well SAC-4 (10N04E21B002M)



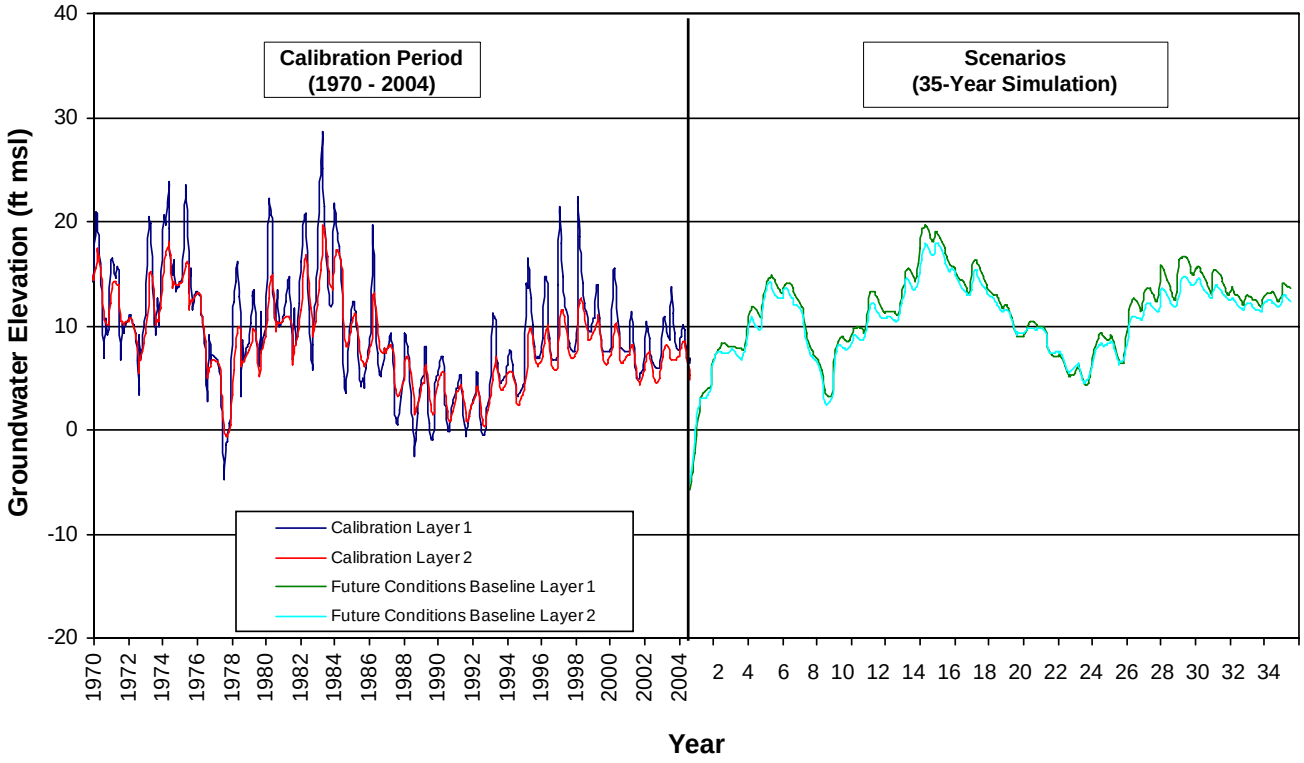
Well SAC-3 (10N04E23A001M)



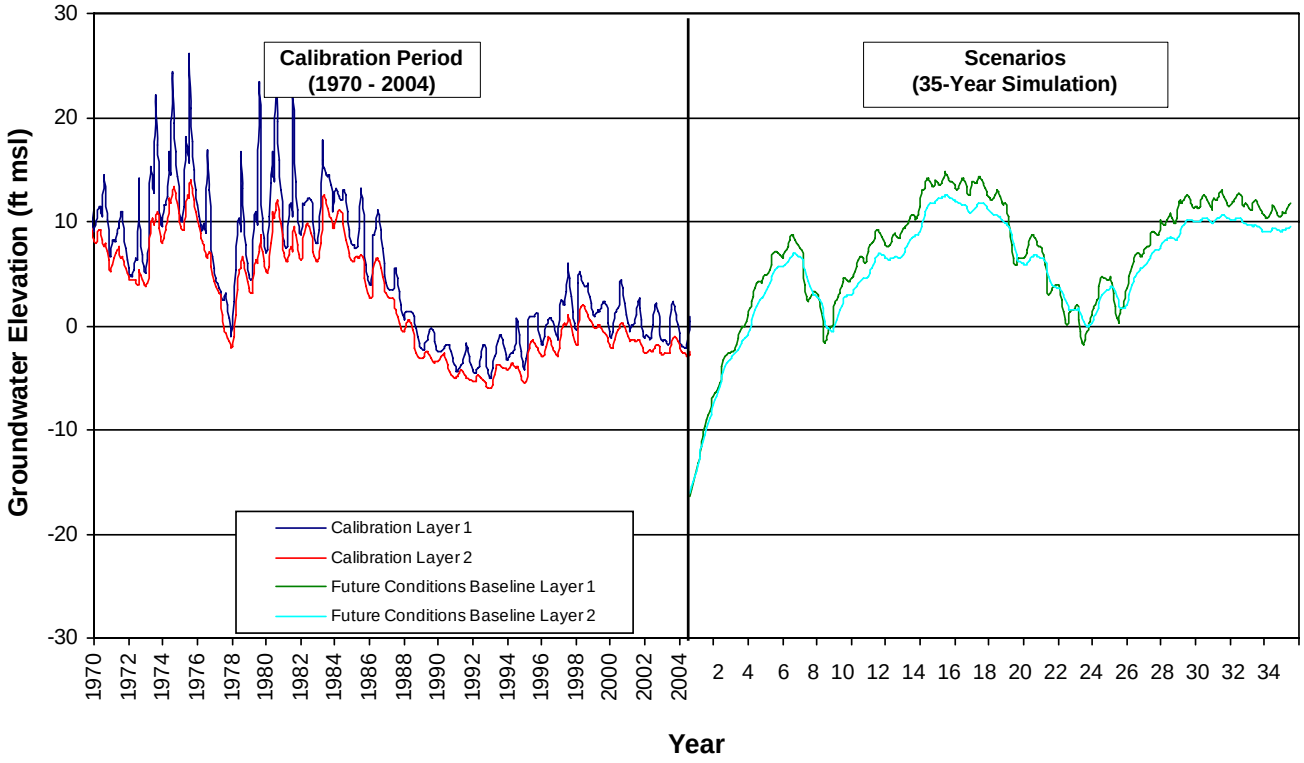
Well SAC-1 (10N03E35A001M)



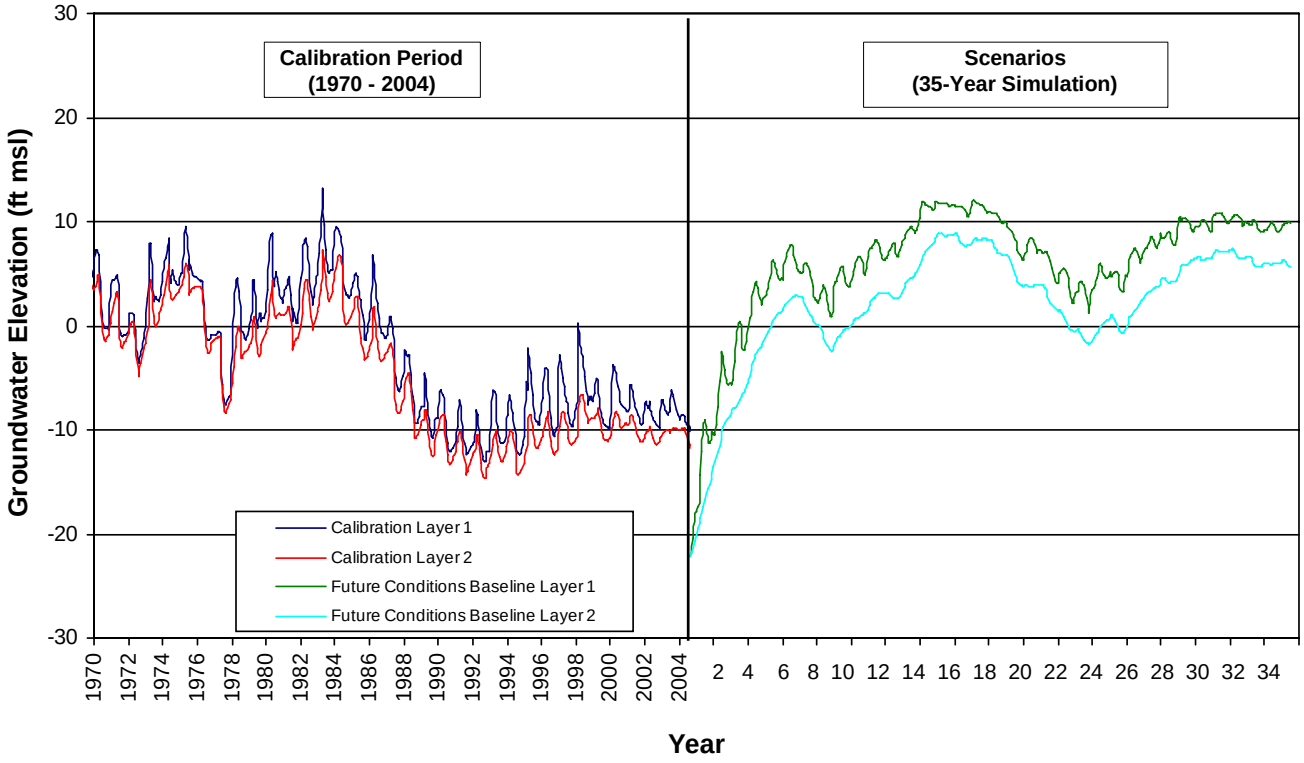
Well SAC-2 (10N04E31M004M)



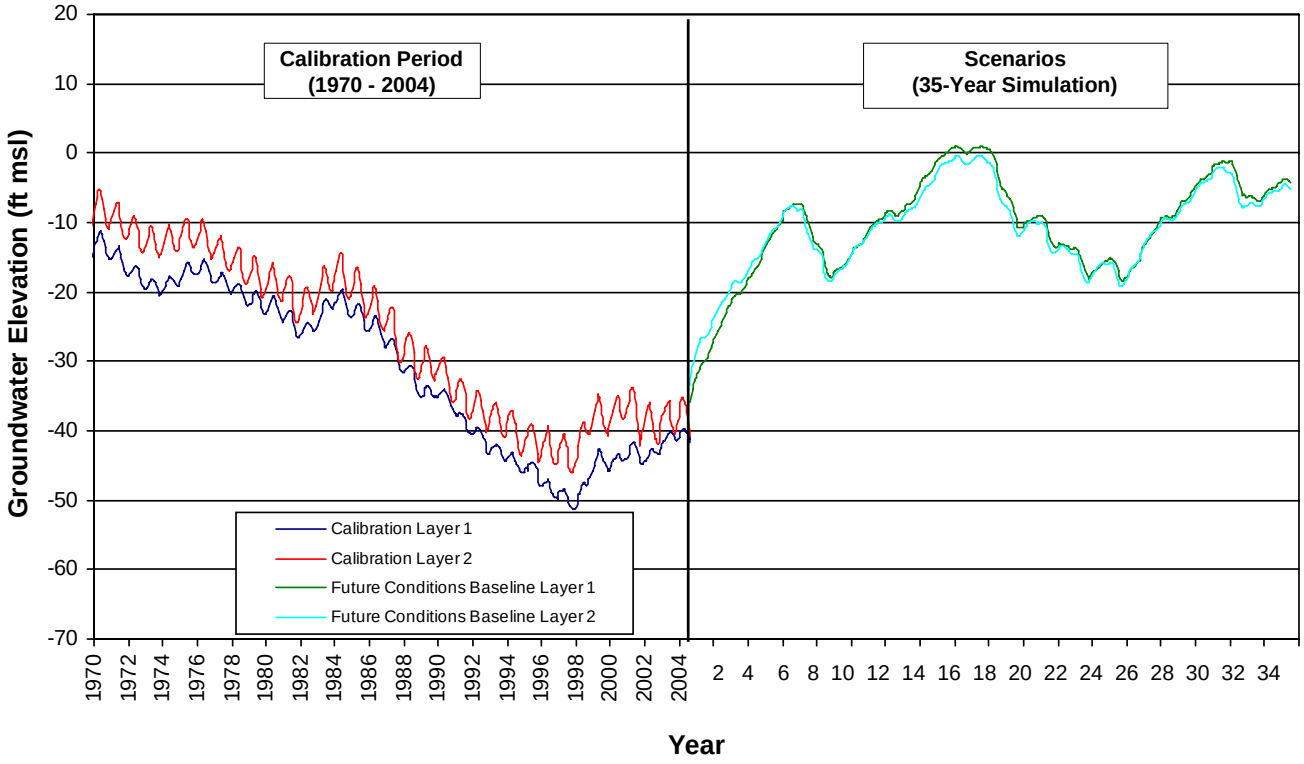
Well SAC-5 (10N04E27R004M)



Well SAC-7 (10N04E36B001M)

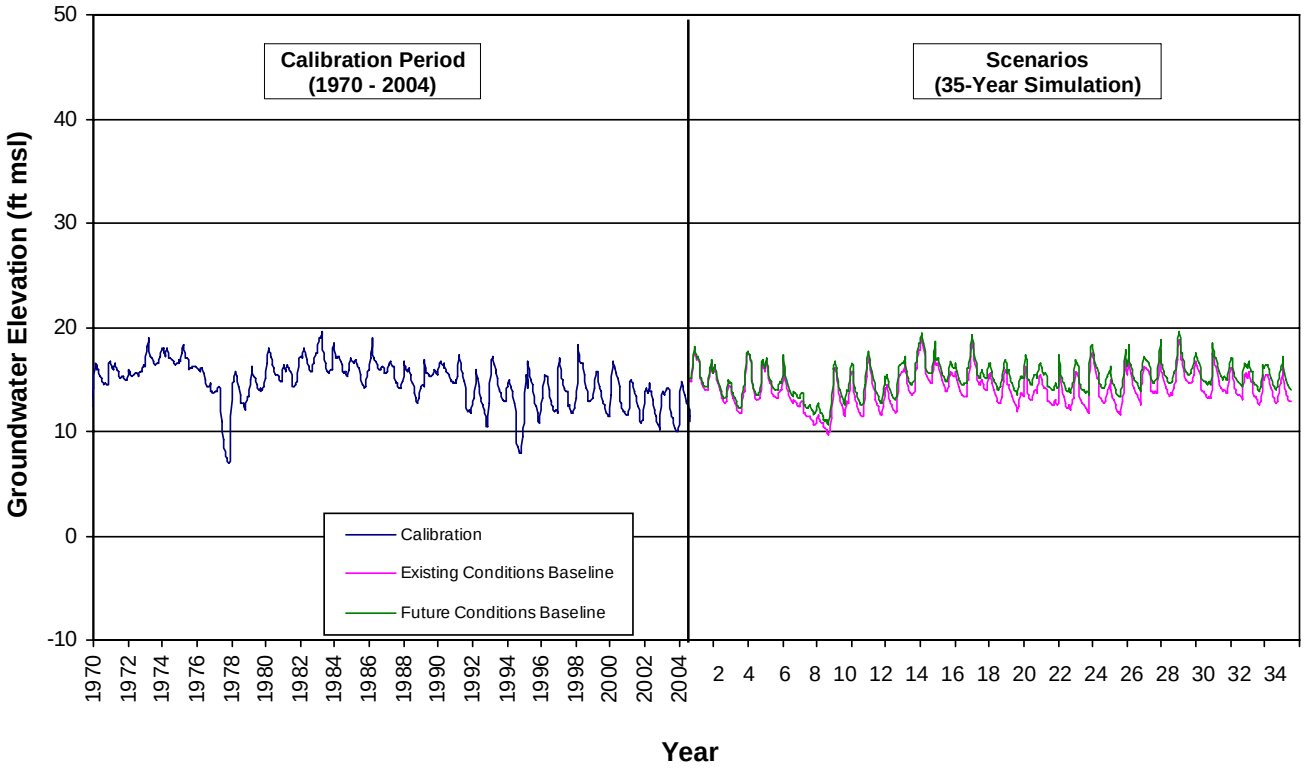


Well SAC-31 (09N05E14B001M)

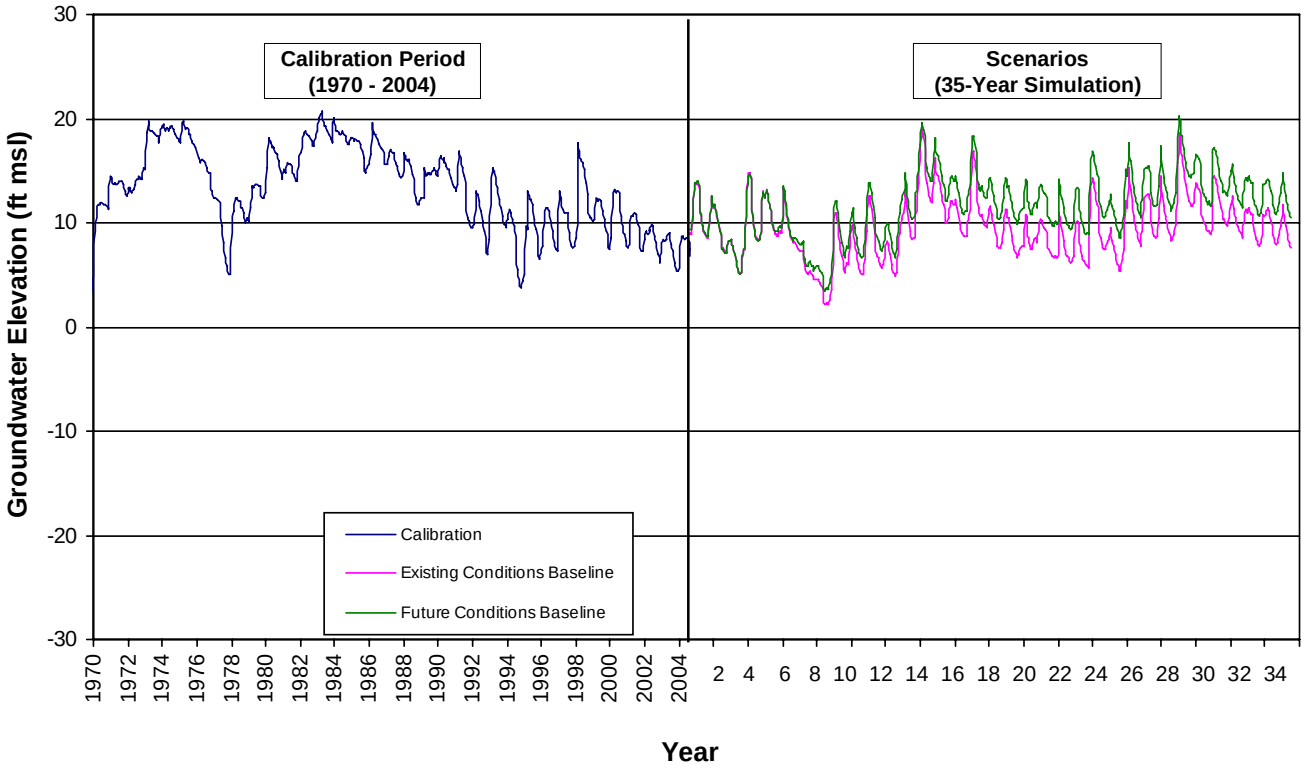


Existing and Future Conditions Baselines

Well NAR-30 (11N04E09D002M)

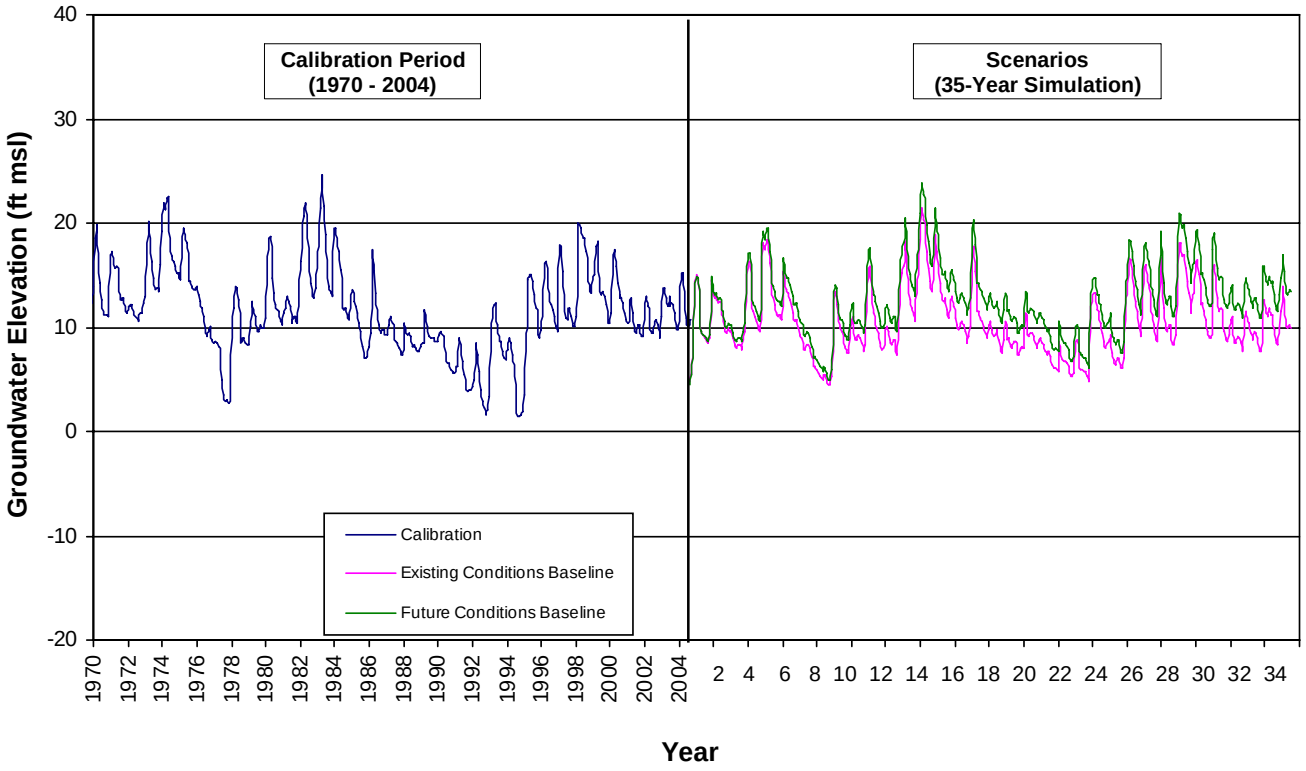


Well NAR-34 (11N04E15C001M)

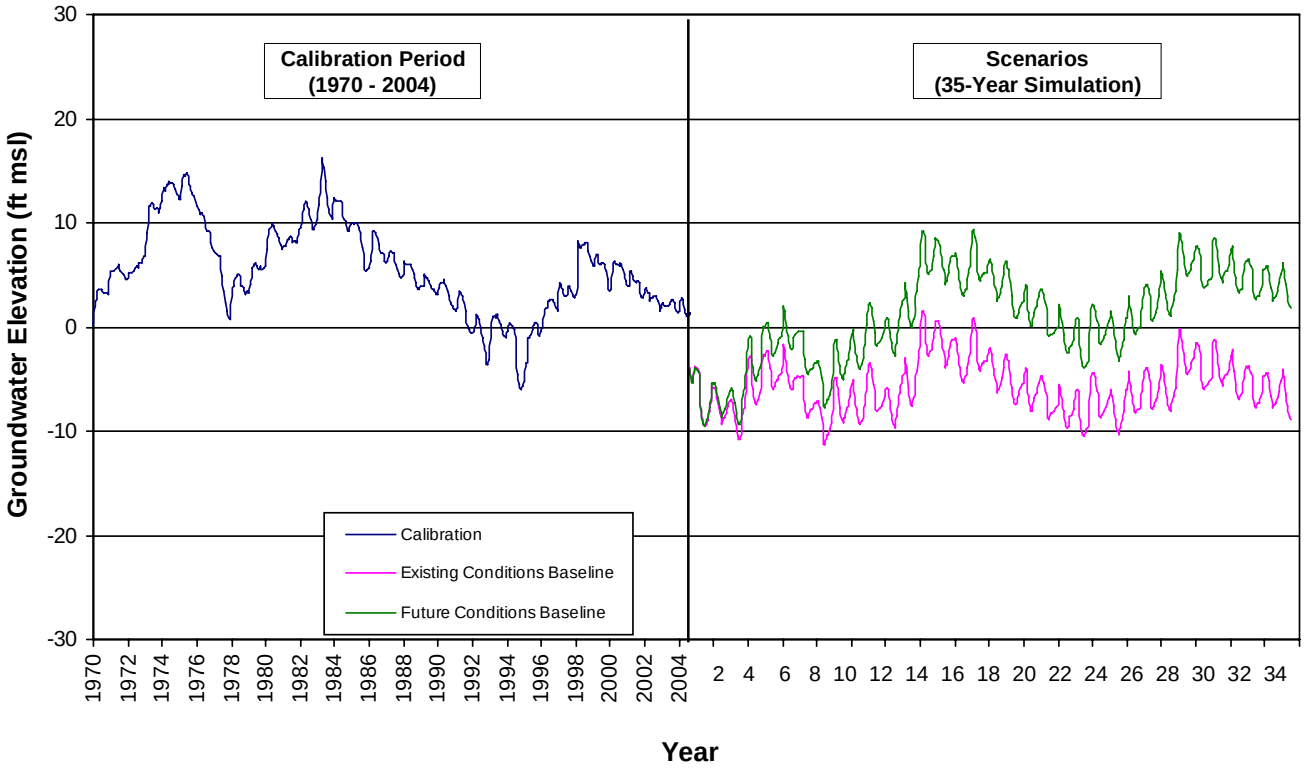


Note: All simulated groundwater elevations are for Layer 1.

Well NAR-173 (173)

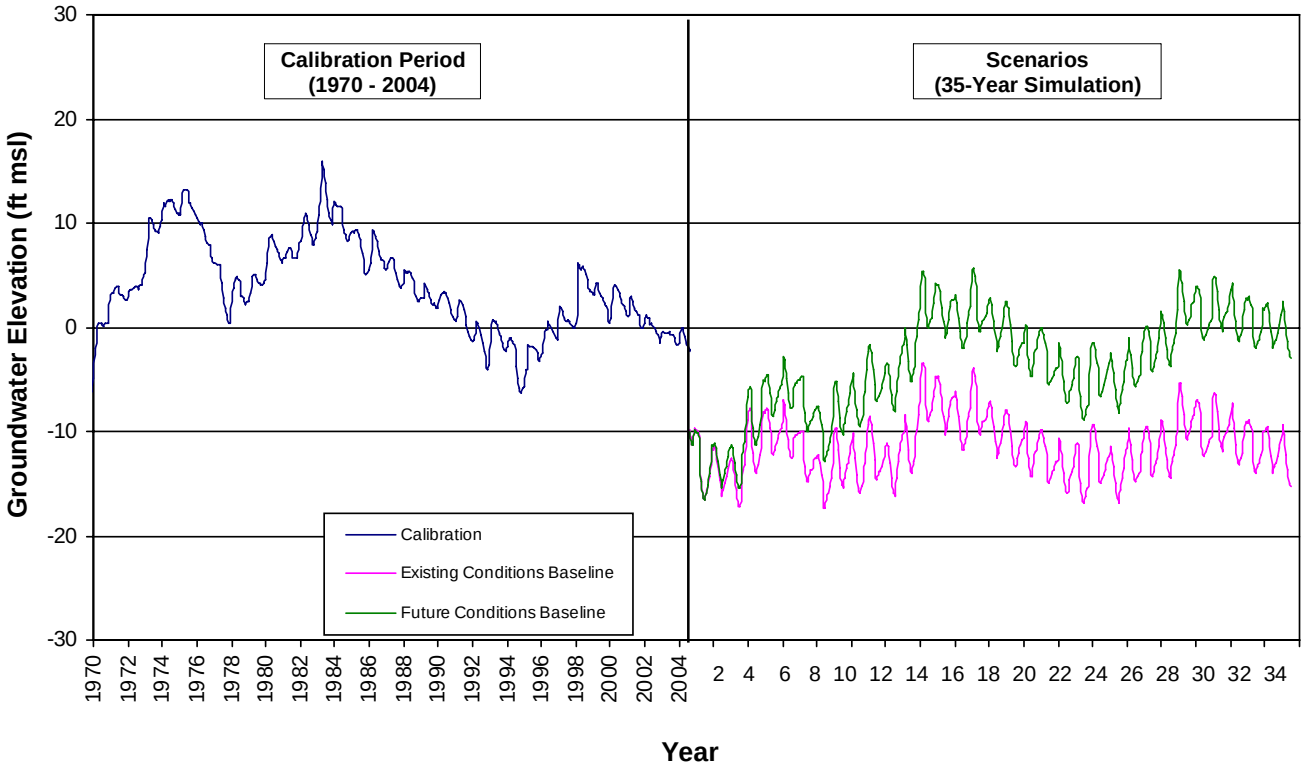


Well NAR-41 (11N04E34N001M)

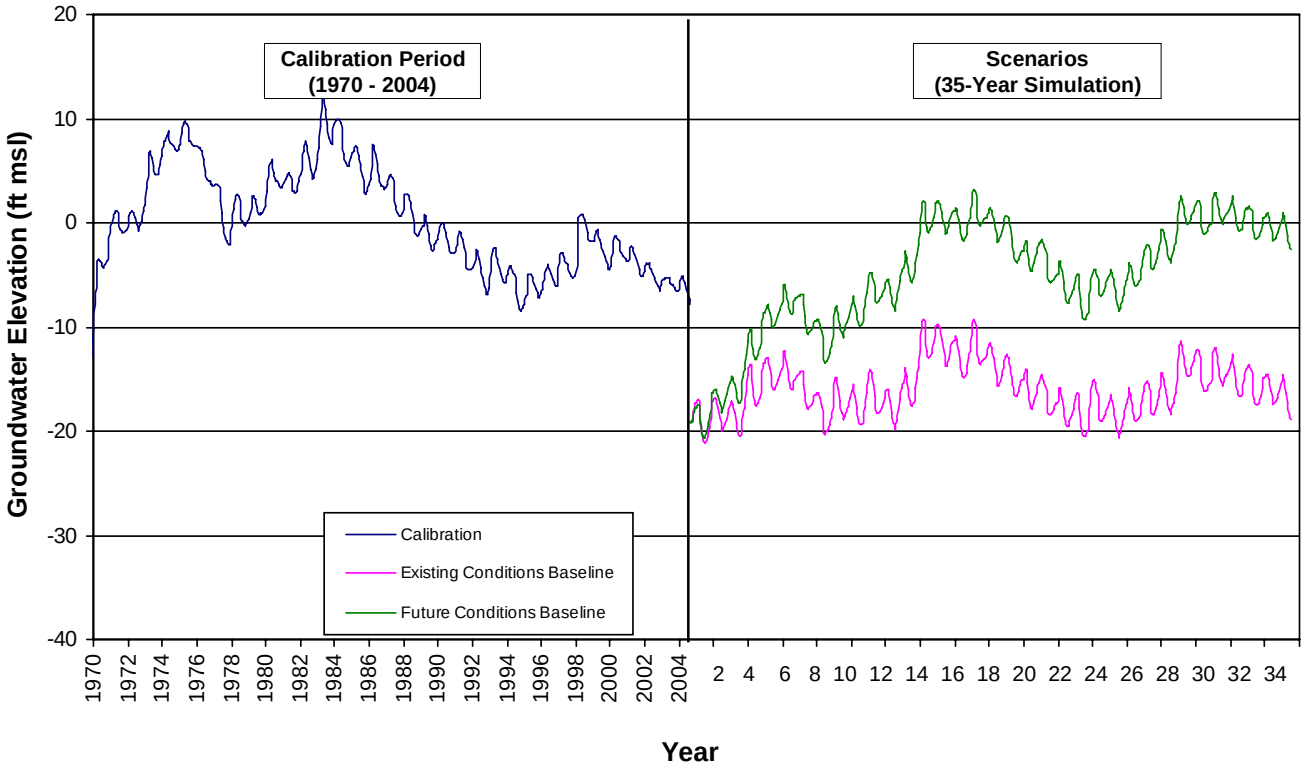


Note: All simulated groundwater elevations are for Layer 1.

Well NAR-1 (10N04E02K001M)

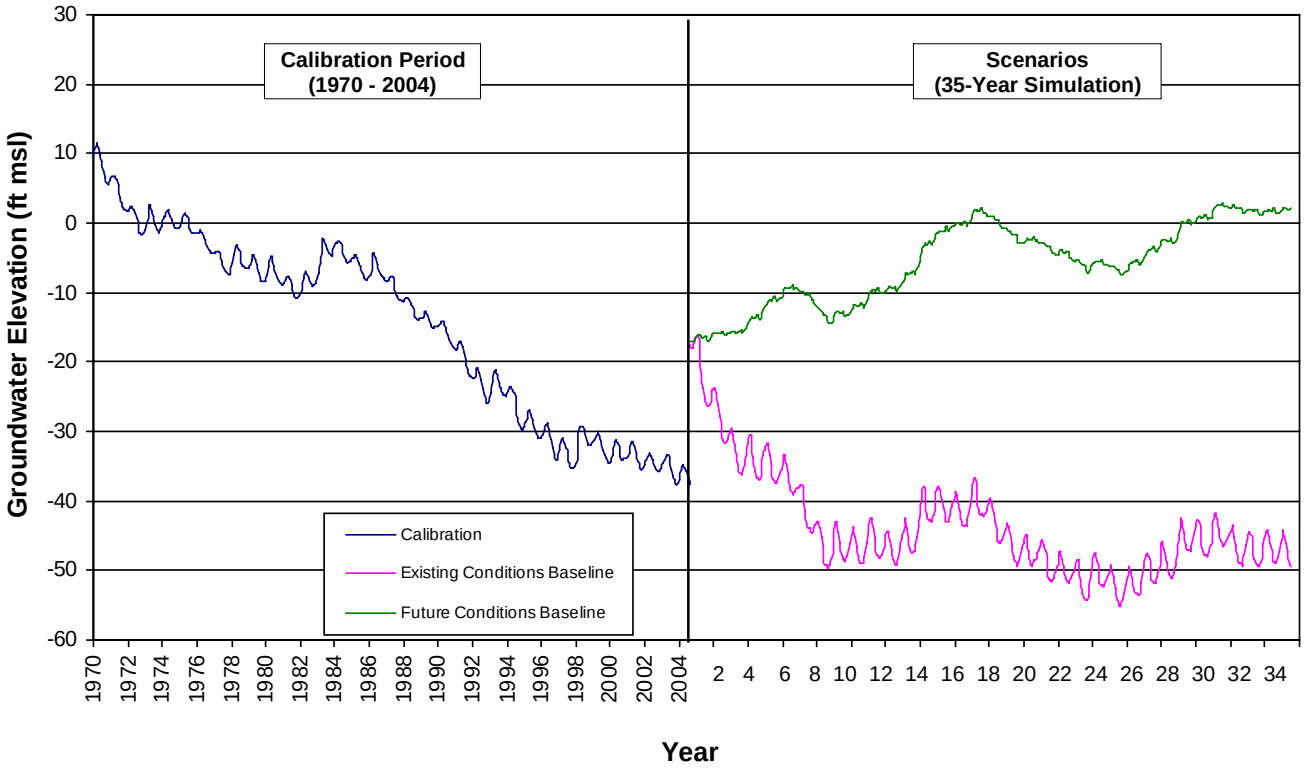


Well NAR-2 (10N04E12A001M)

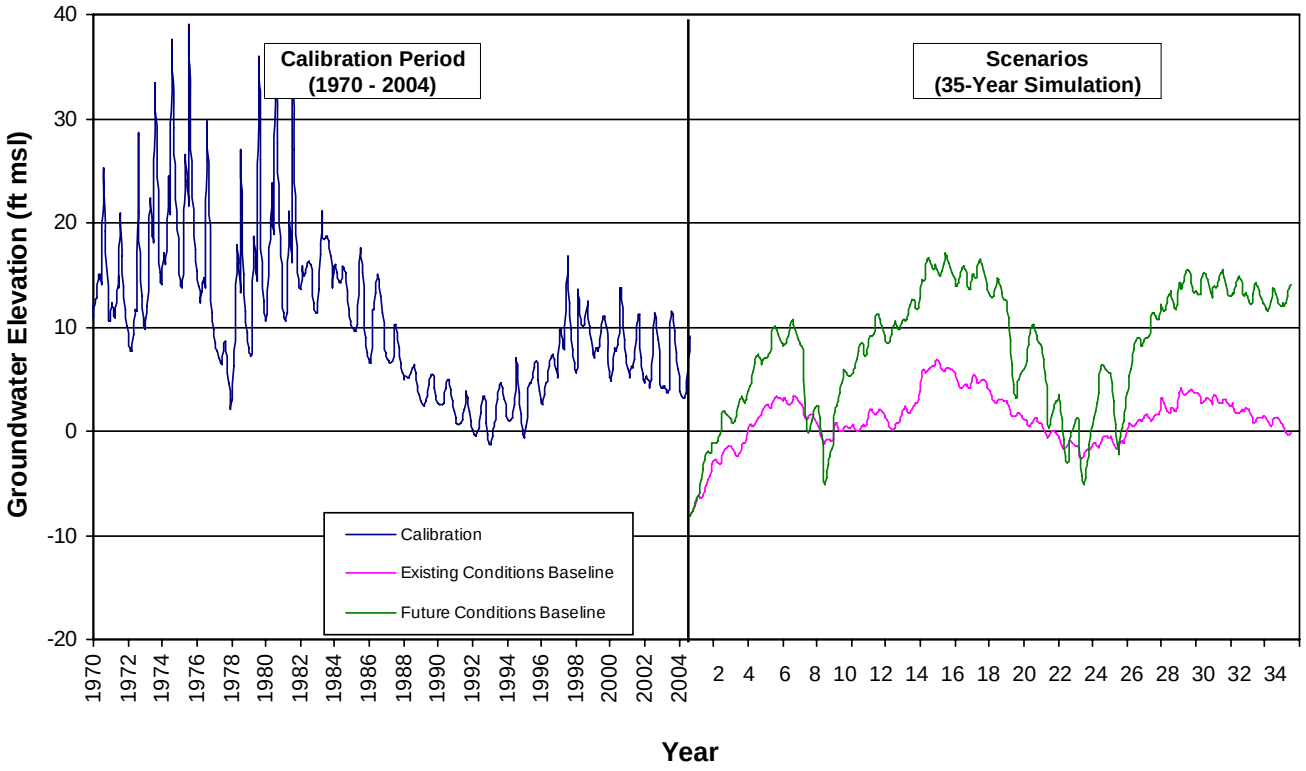


Note: All simulated groundwater elevations are for Layer 1.

Well NAR-11 (10N06E07L001M)

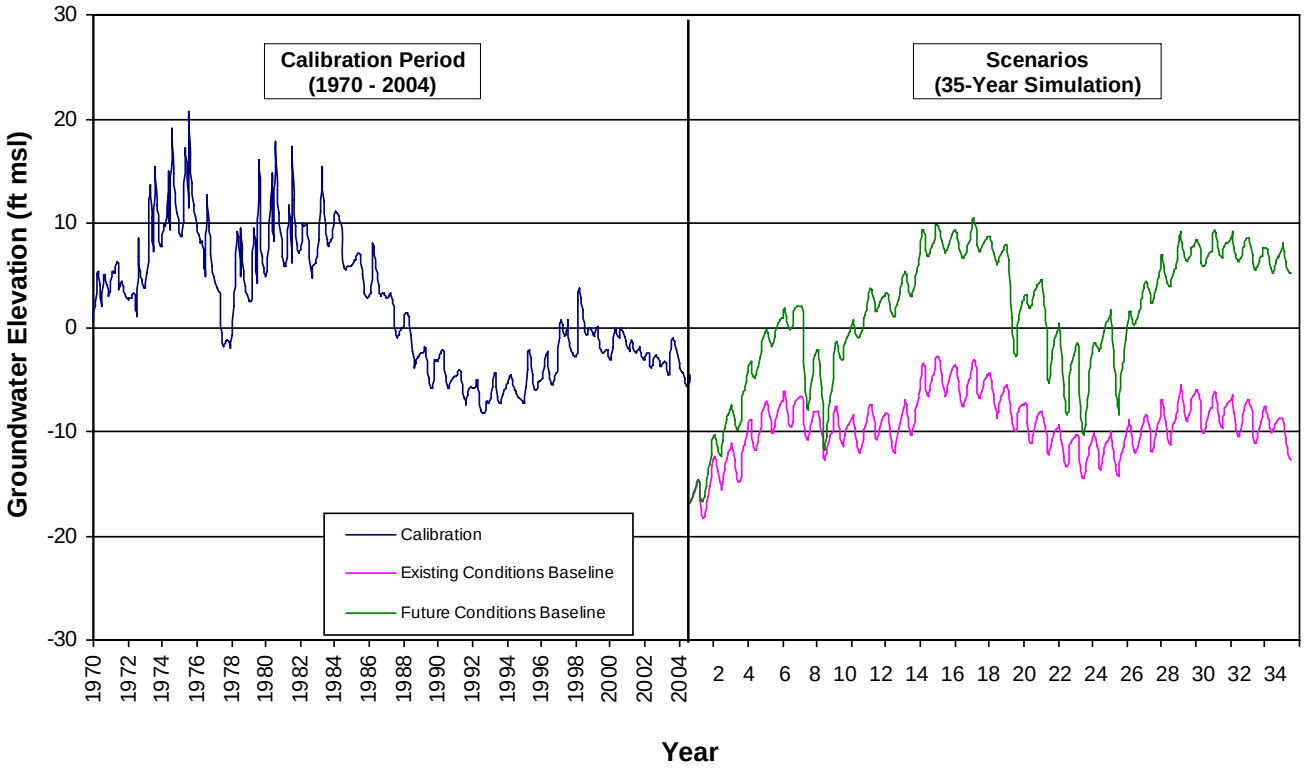


Well SAC-4 (10N04E21B002M)

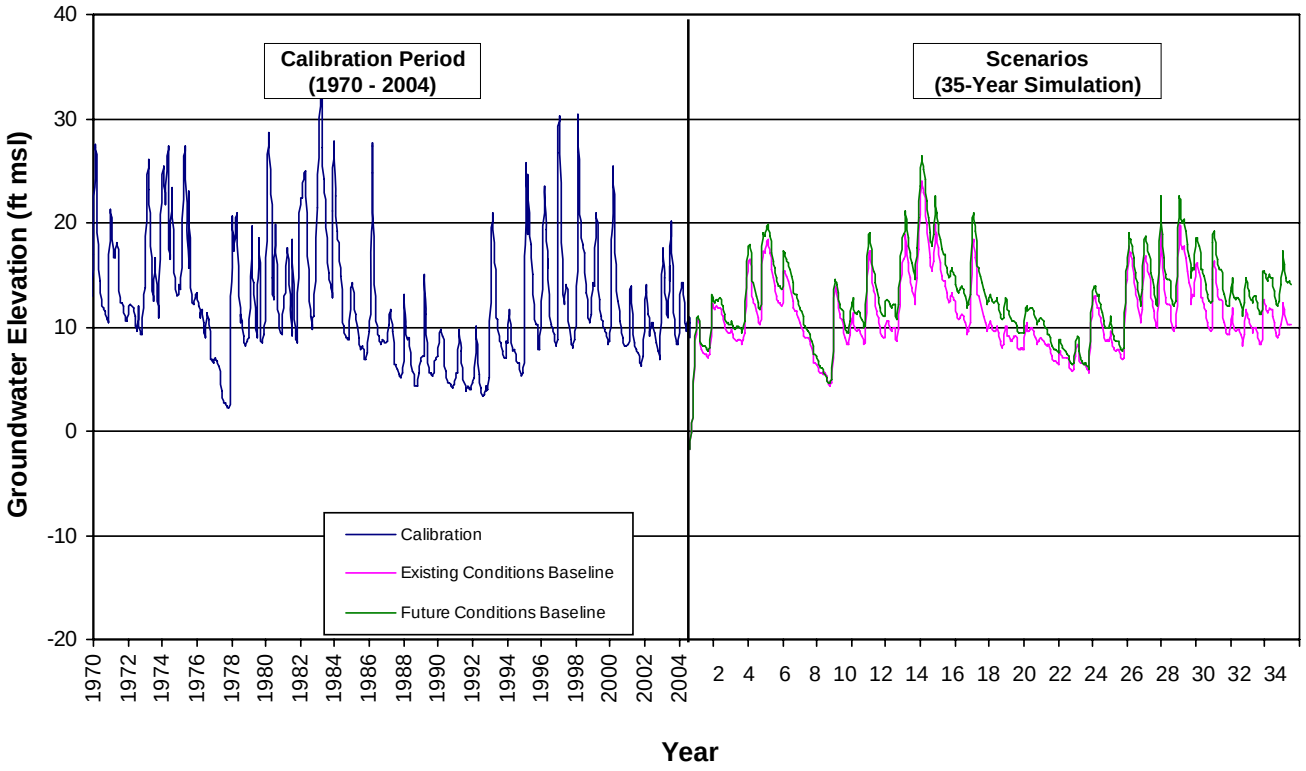


Note: All simulated groundwater elevations are for Layer 1.

Well SAC-3 (10N04E23A001M)

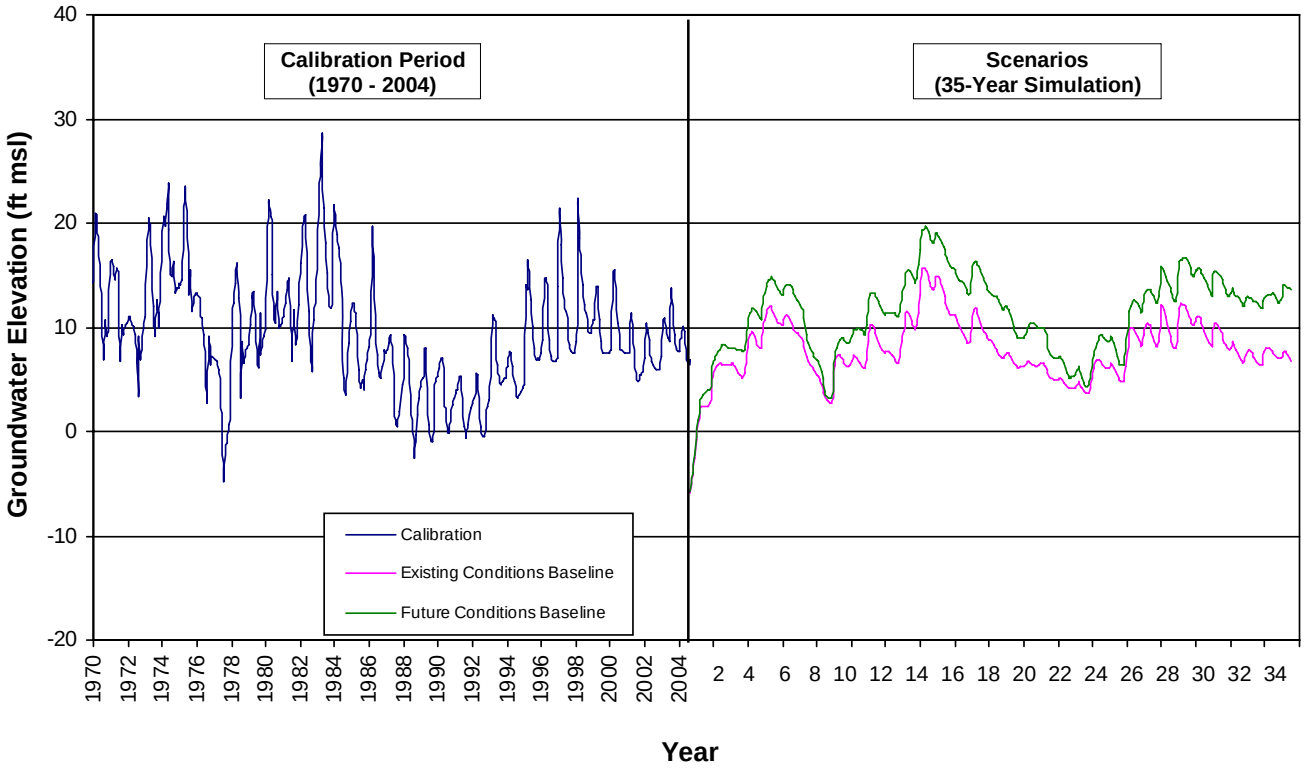


Well SAC-1 (10N03E35A001M)

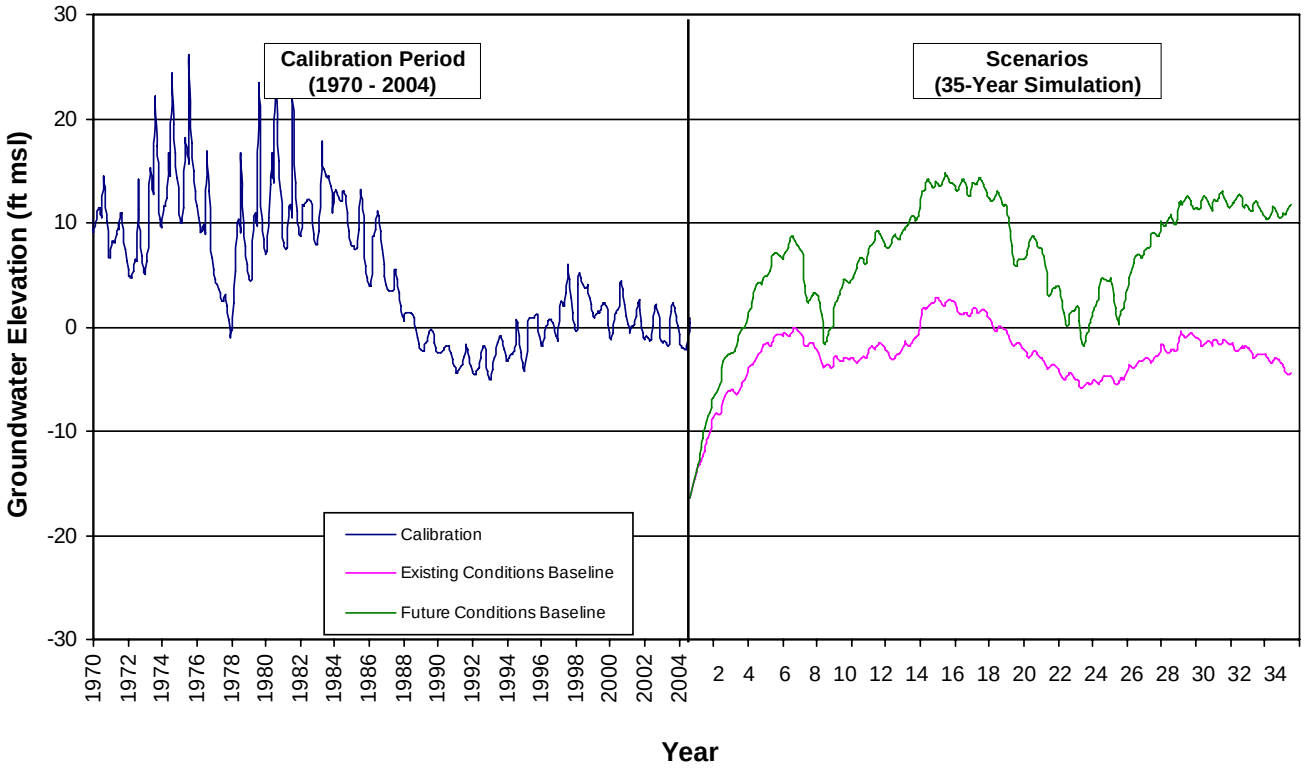


Note: All simulated groundwater elevations are for Layer 1.

Well SAC-2 (10N04E31M004M)

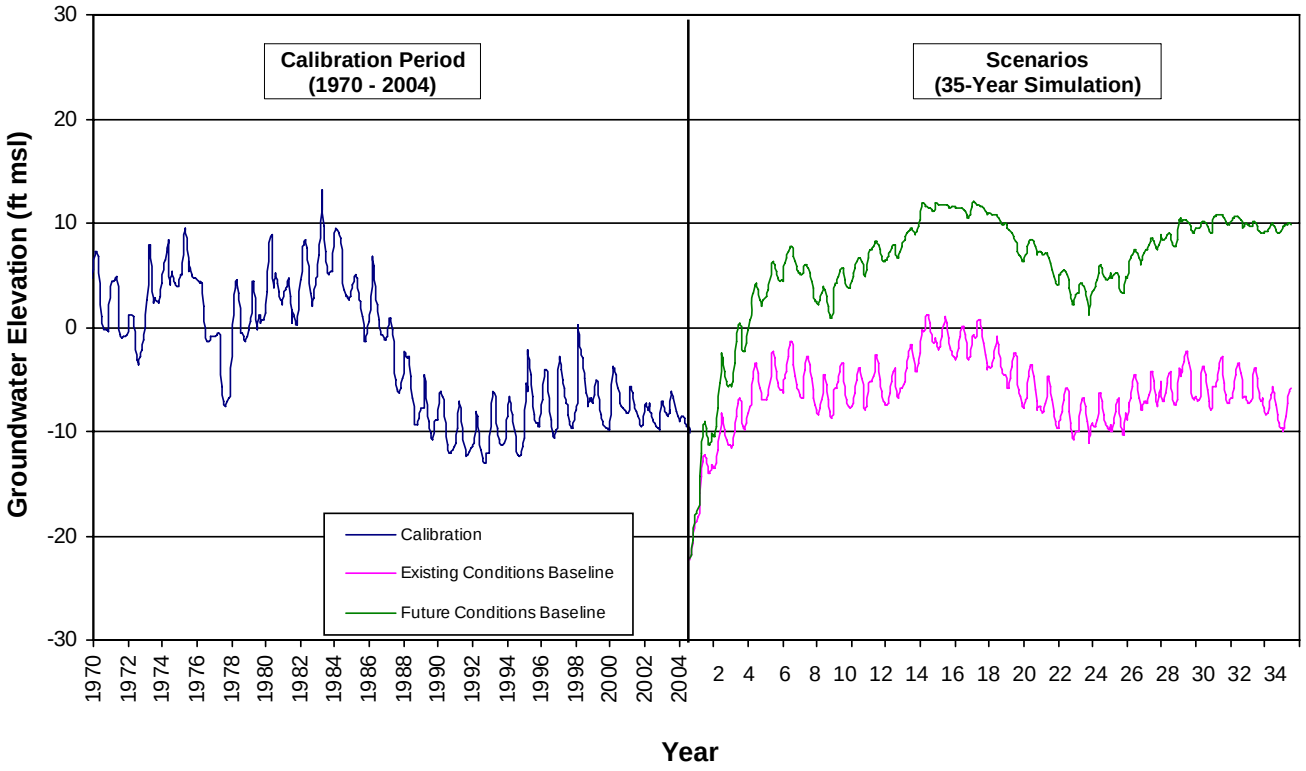


Well SAC-5 (10N04E27R004M)

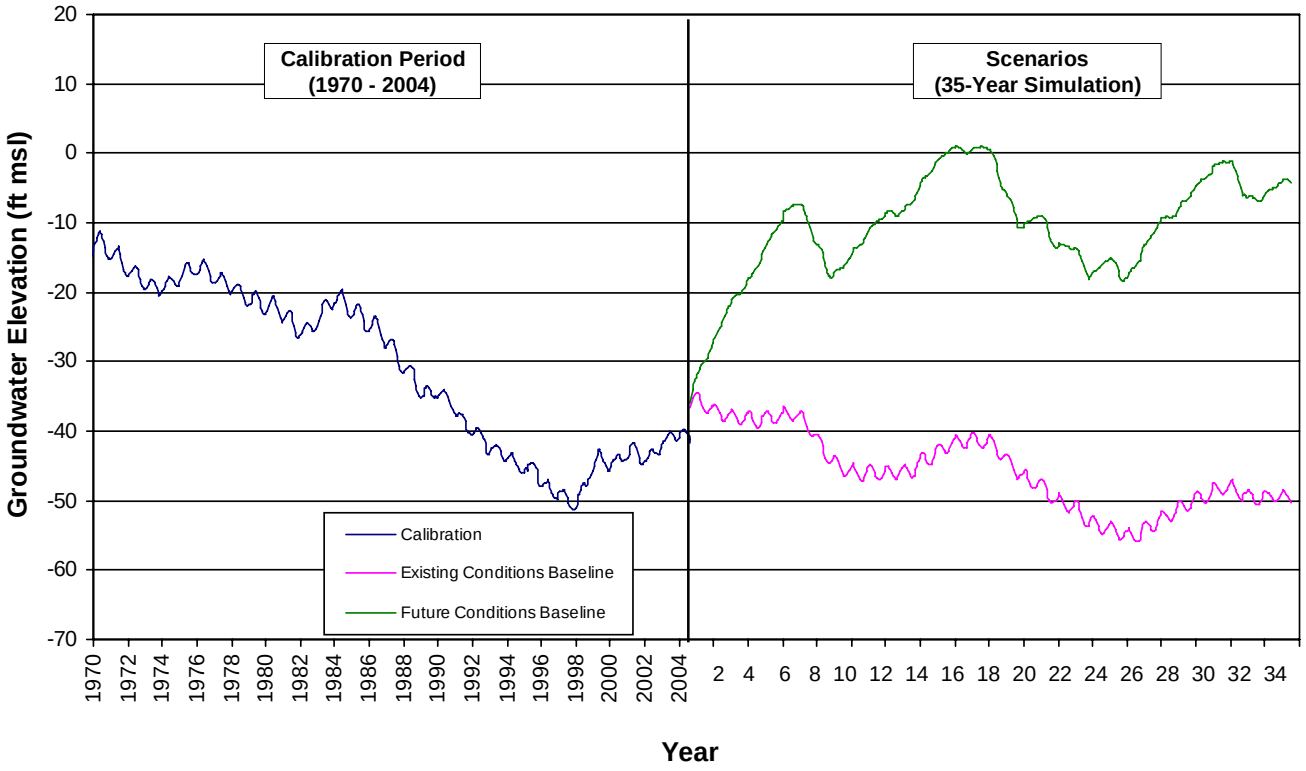


Note: All simulated groundwater elevations are for Layer 1.

Well SAC-7 (10N04E36B001M)



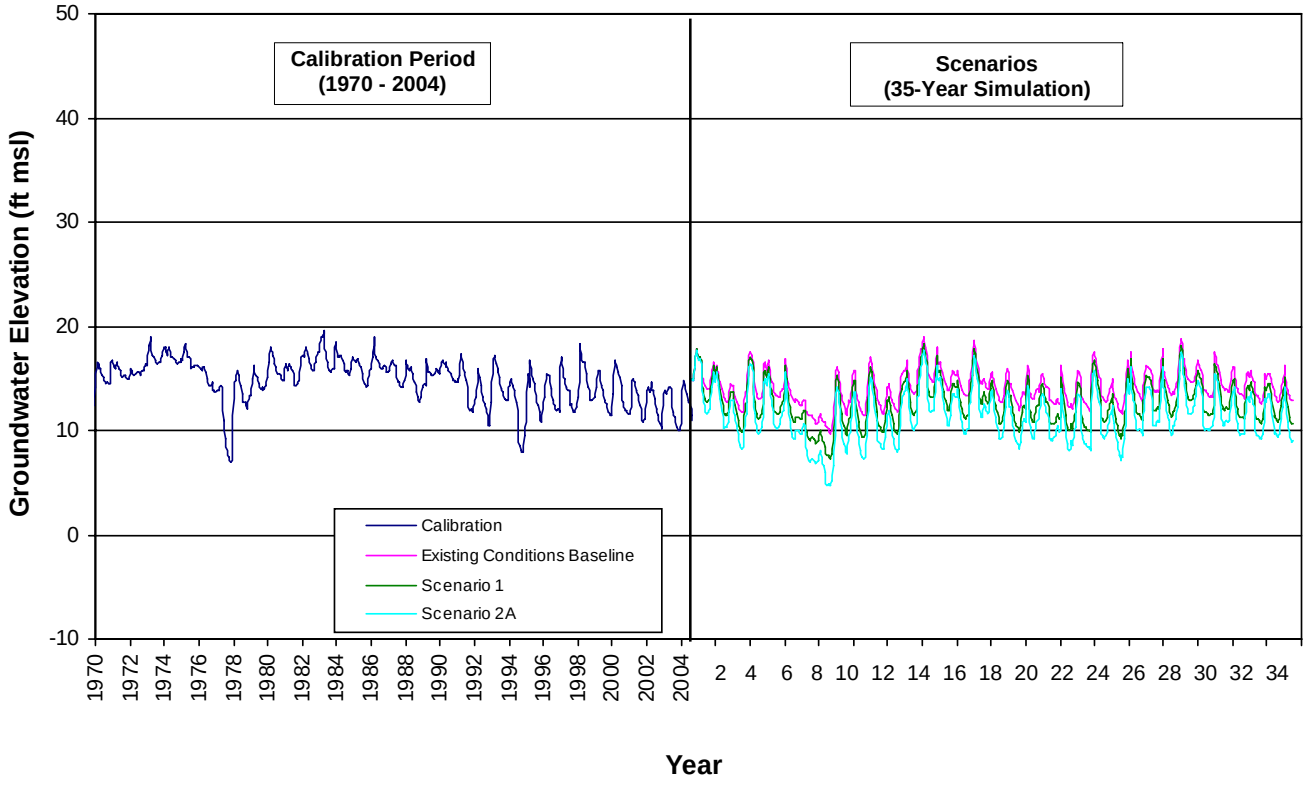
Well SAC-31 (09N05E14B001M)



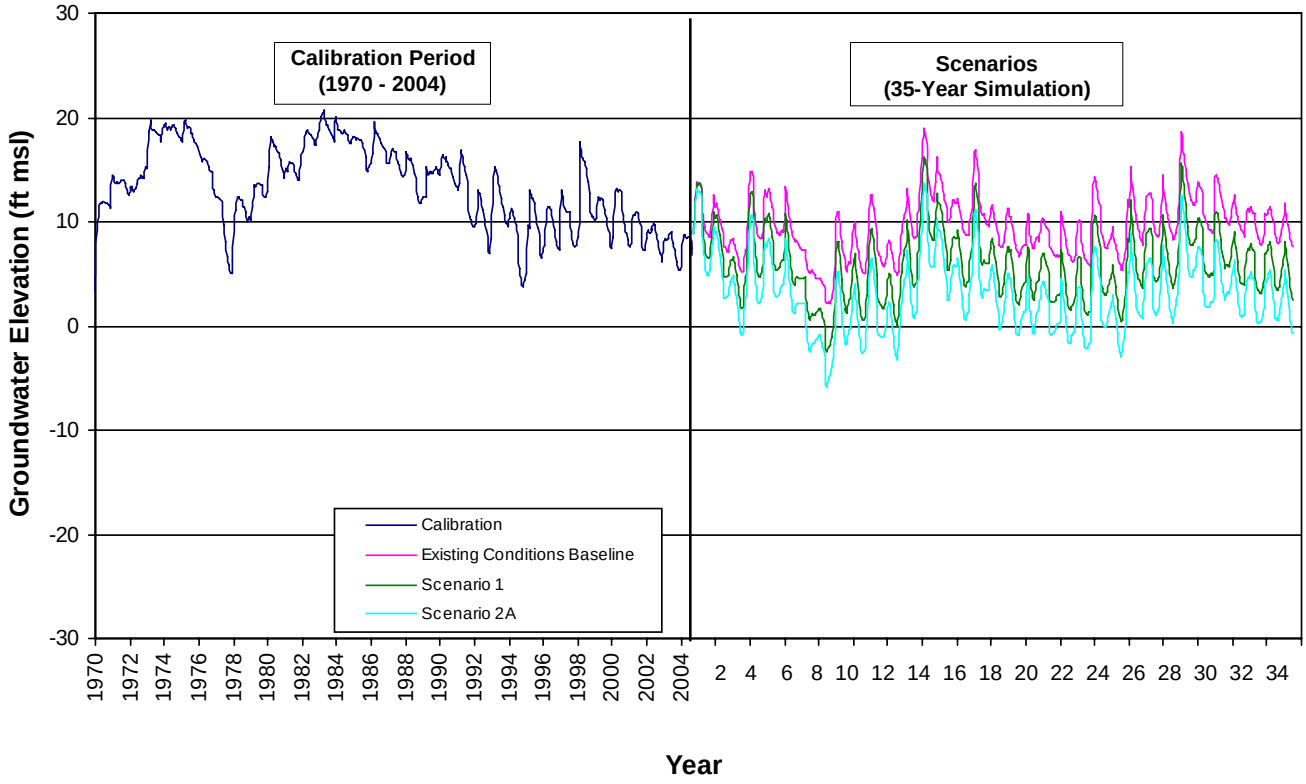
Note: All simulated groundwater elevations are for Layer 1.

Existing Conditions Baseline vs. Scenario 1 and 2A

Well NAR-30 (11N04E09D002M)

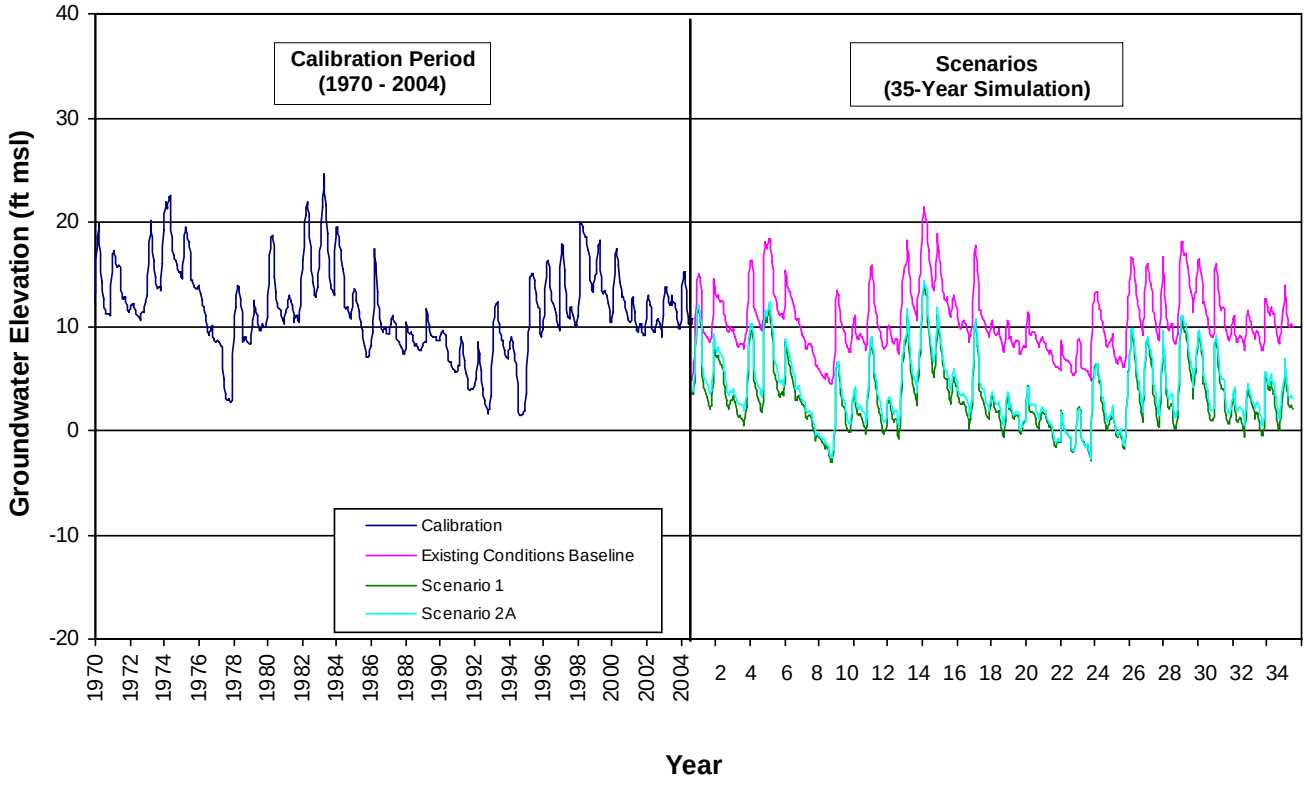


Well NAR-34 (11N04E15C001M)

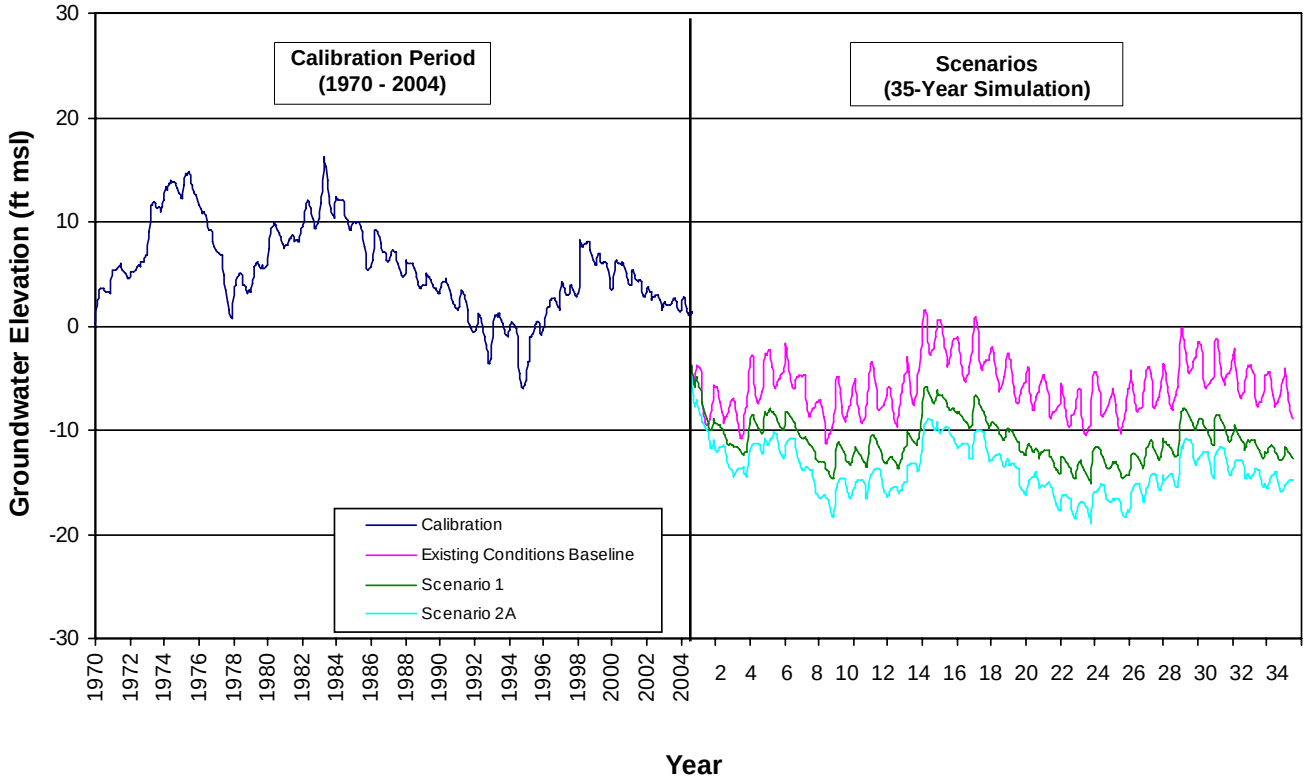


Note: All simulated groundwater elevations are for Layer 1.

Well NAR-173 (173)

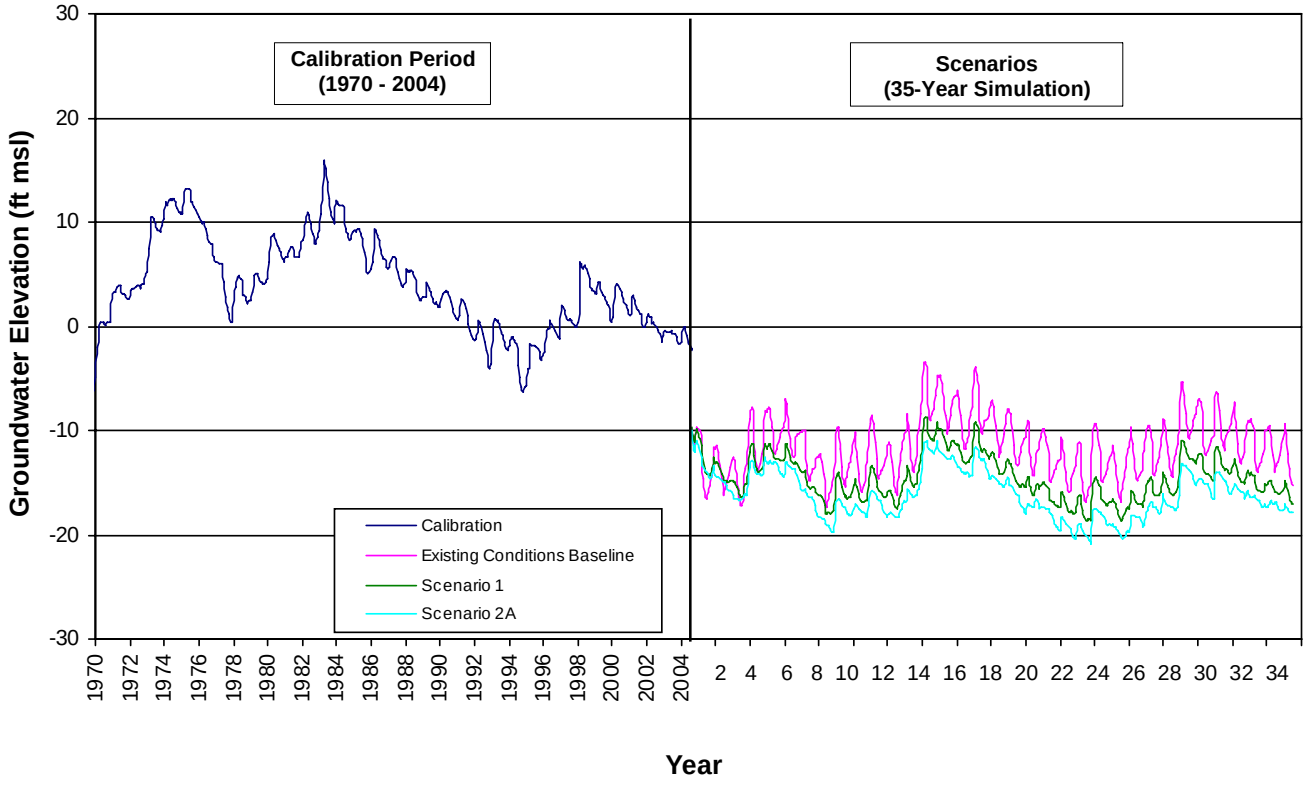


Well NAR-41 (11N04E34N001M)

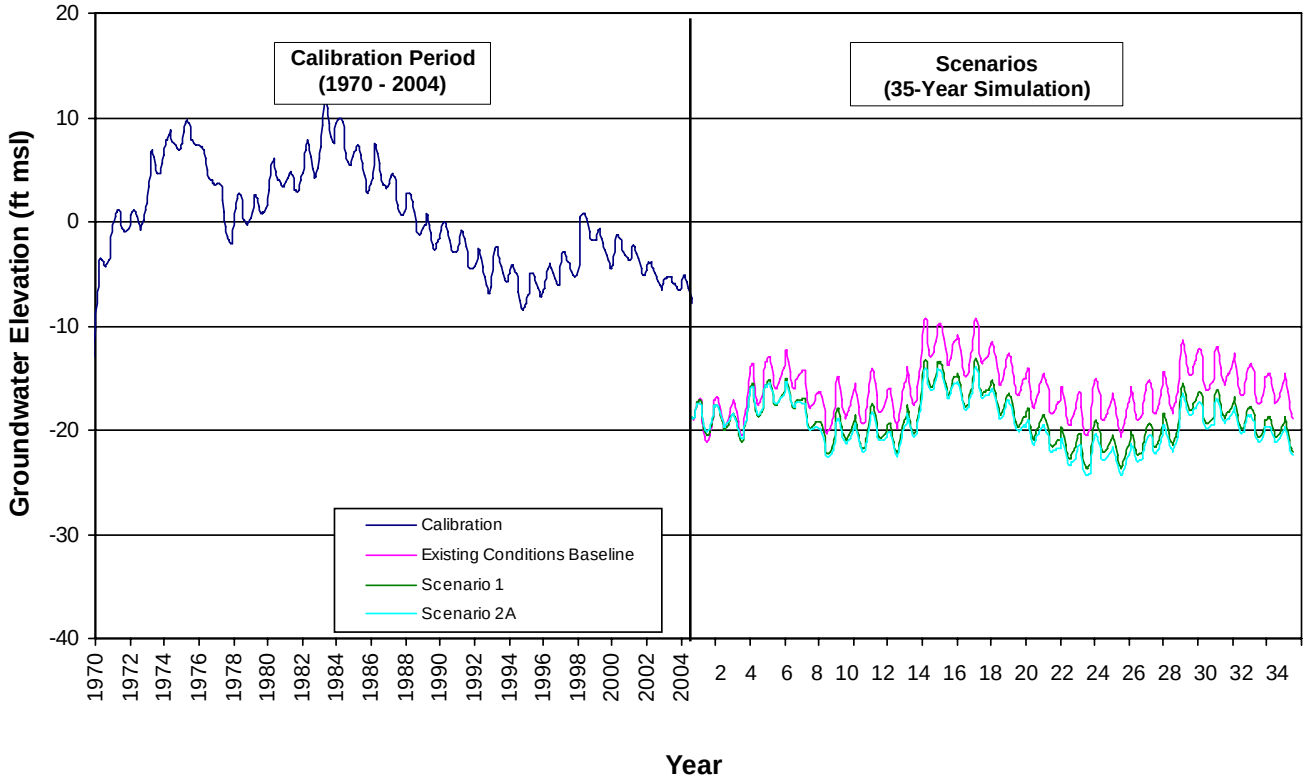


Note: All simulated groundwater elevations are for Layer 1.

Well NAR-1 (10N04E02K001M)

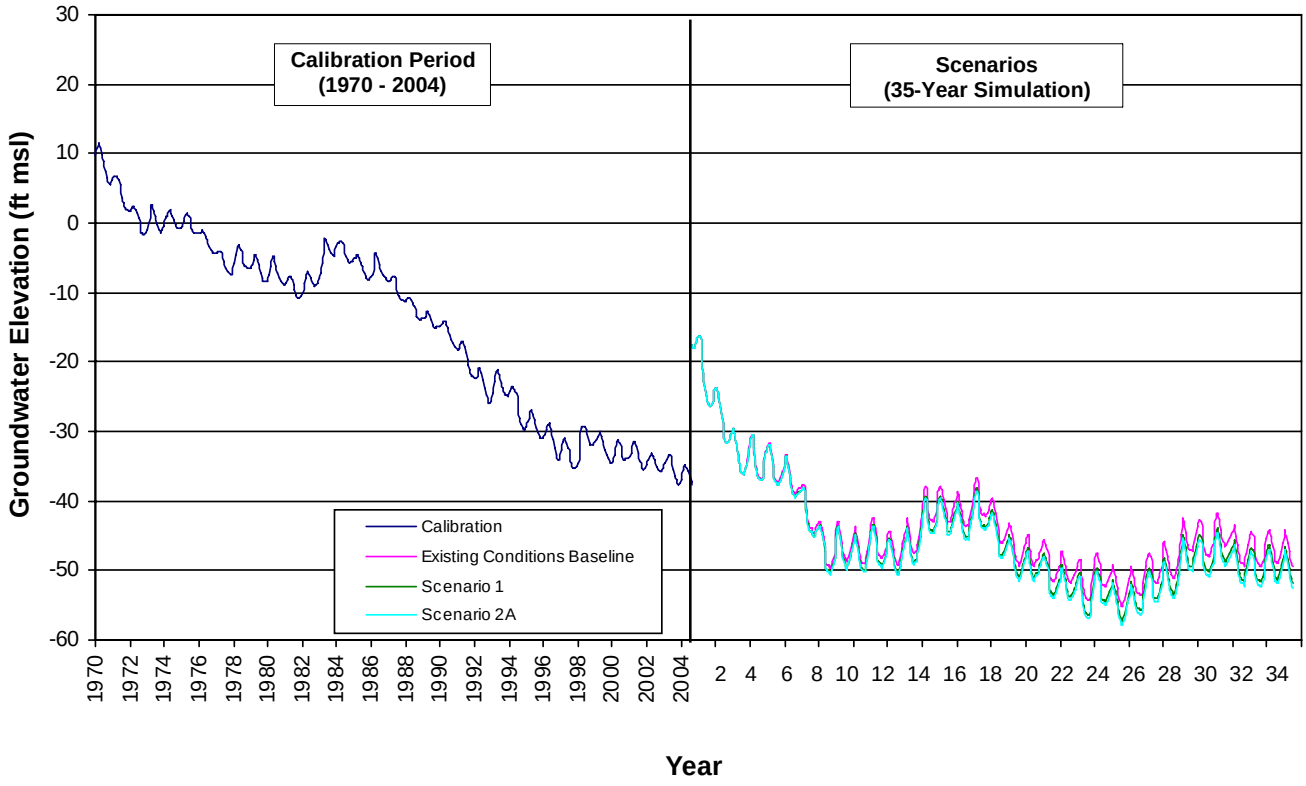


Well NAR-2 (10N04E12A001M)

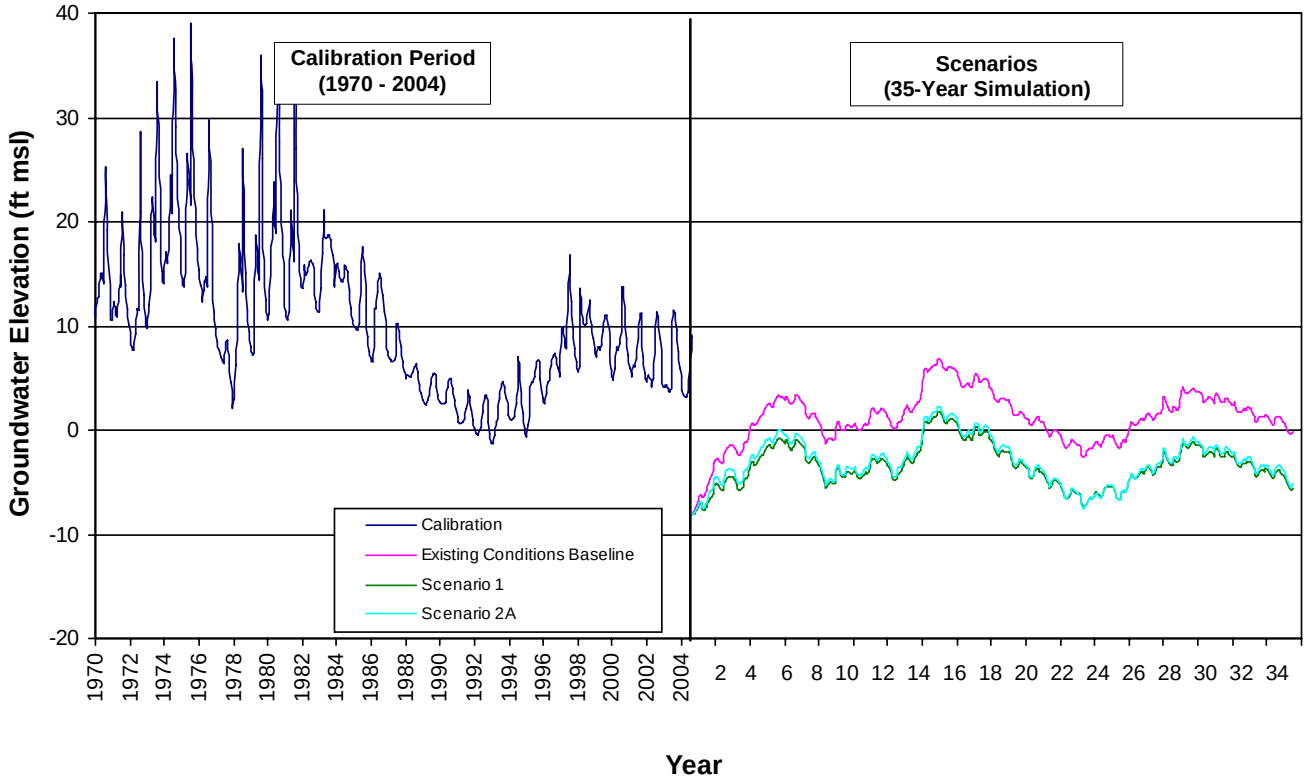


Note: All simulated groundwater elevations are for Layer 1.

Well NAR-11 (10N06E07L001M)

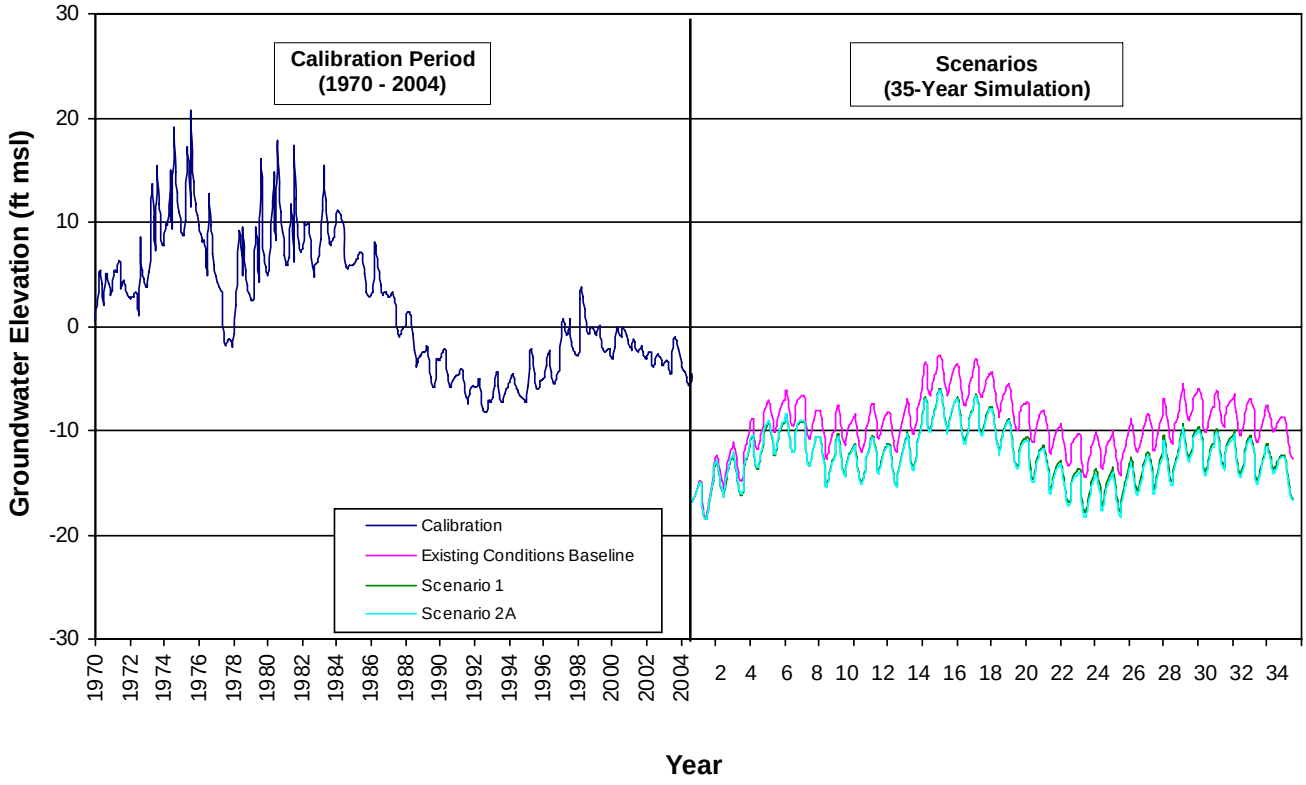


Well SAC-4 (10N04E21B002M)

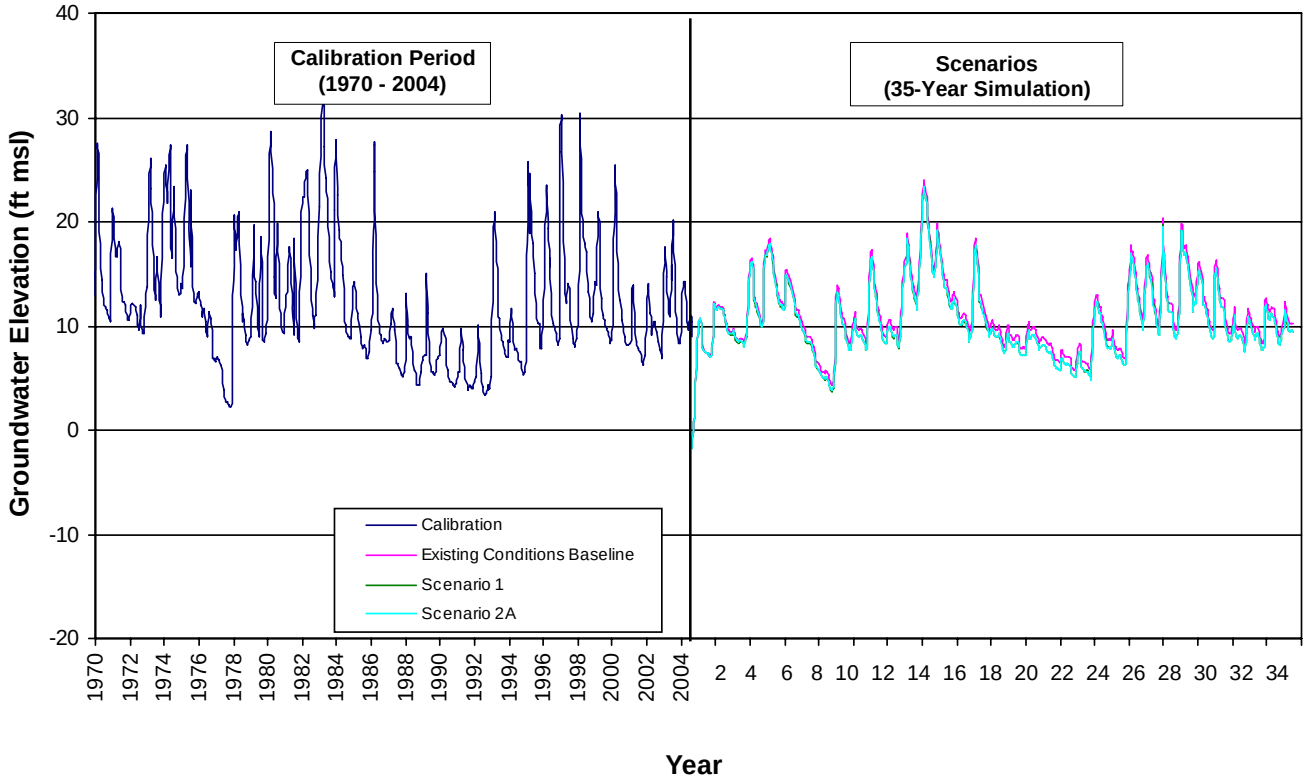


Note: All simulated groundwater elevations are for Layer 1.

Well SAC-3 (10N04E23A001M)

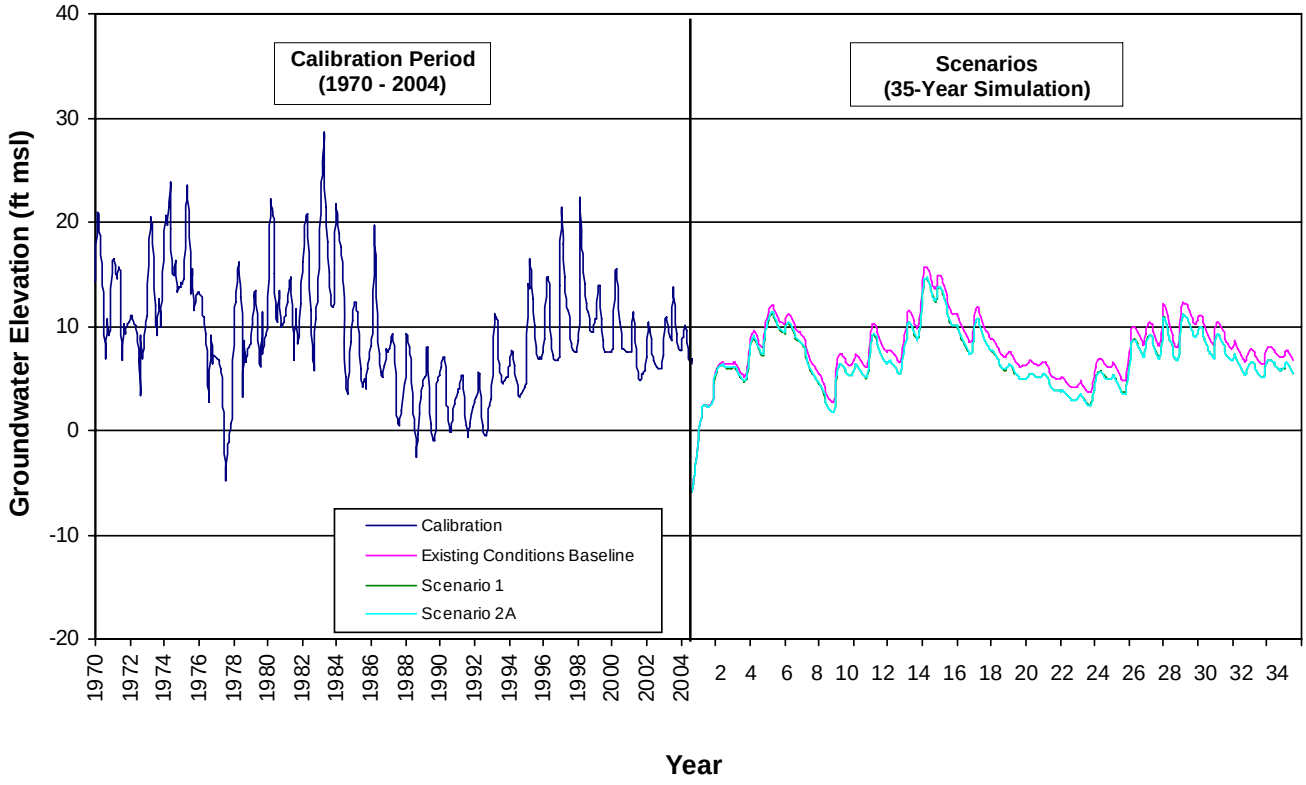


Well SAC-1 (10N03E35A001M)

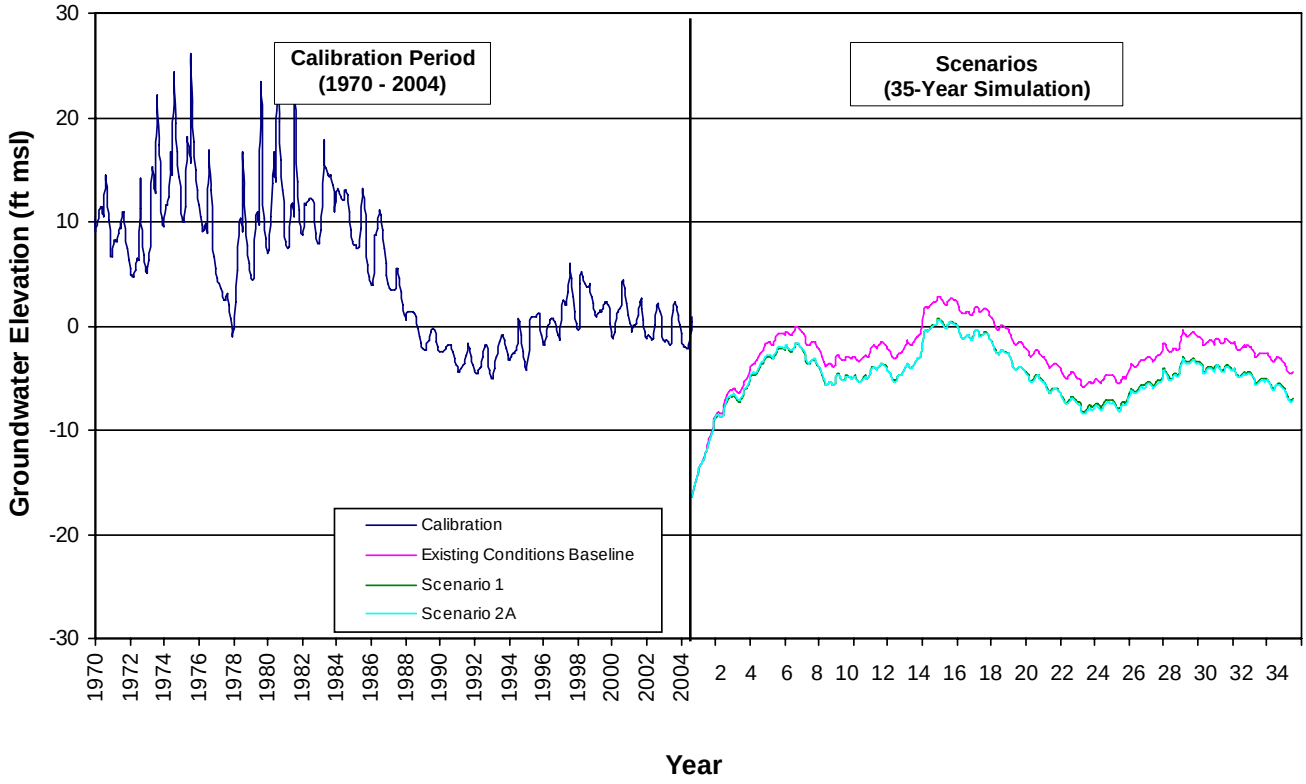


Note: All simulated groundwater elevations are for Layer 1.

Well SAC-2 (10N04E31M004M)

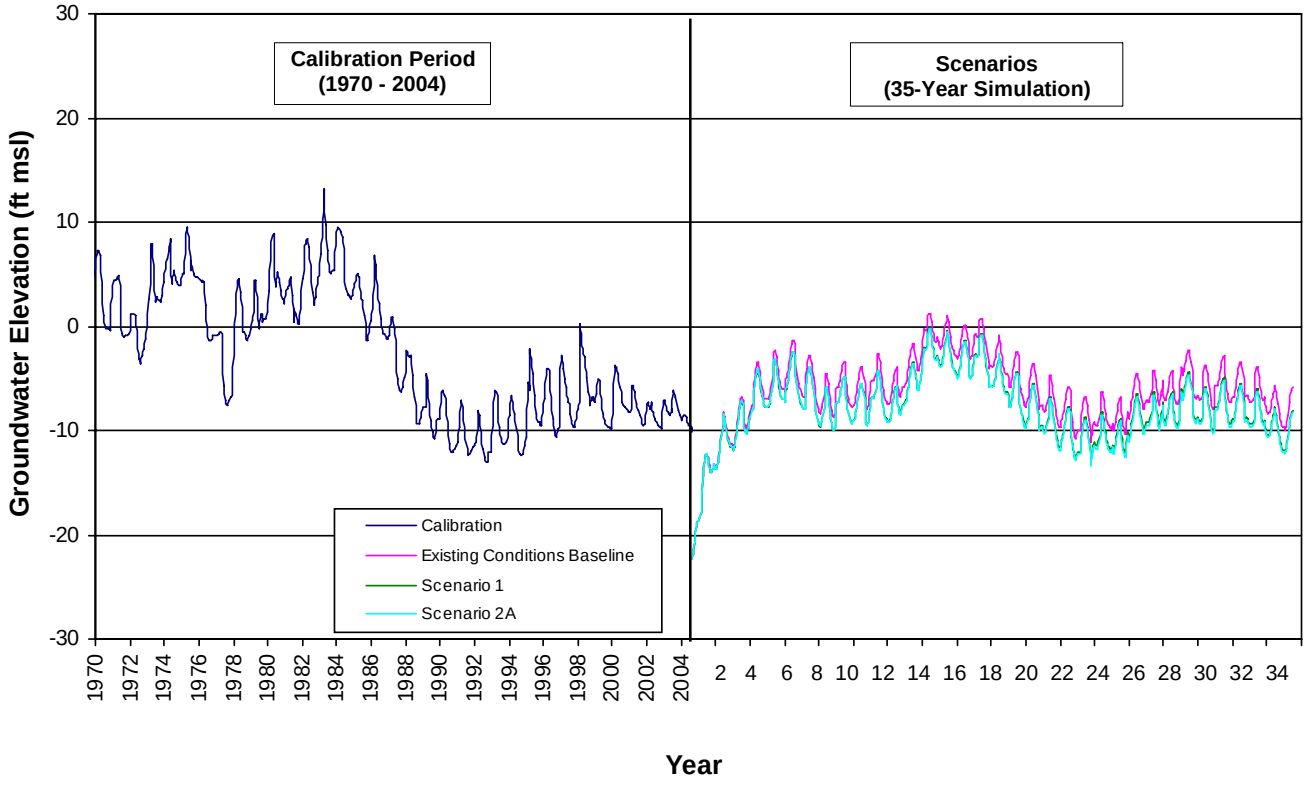


Well SAC-5 (10N04E27R004M)

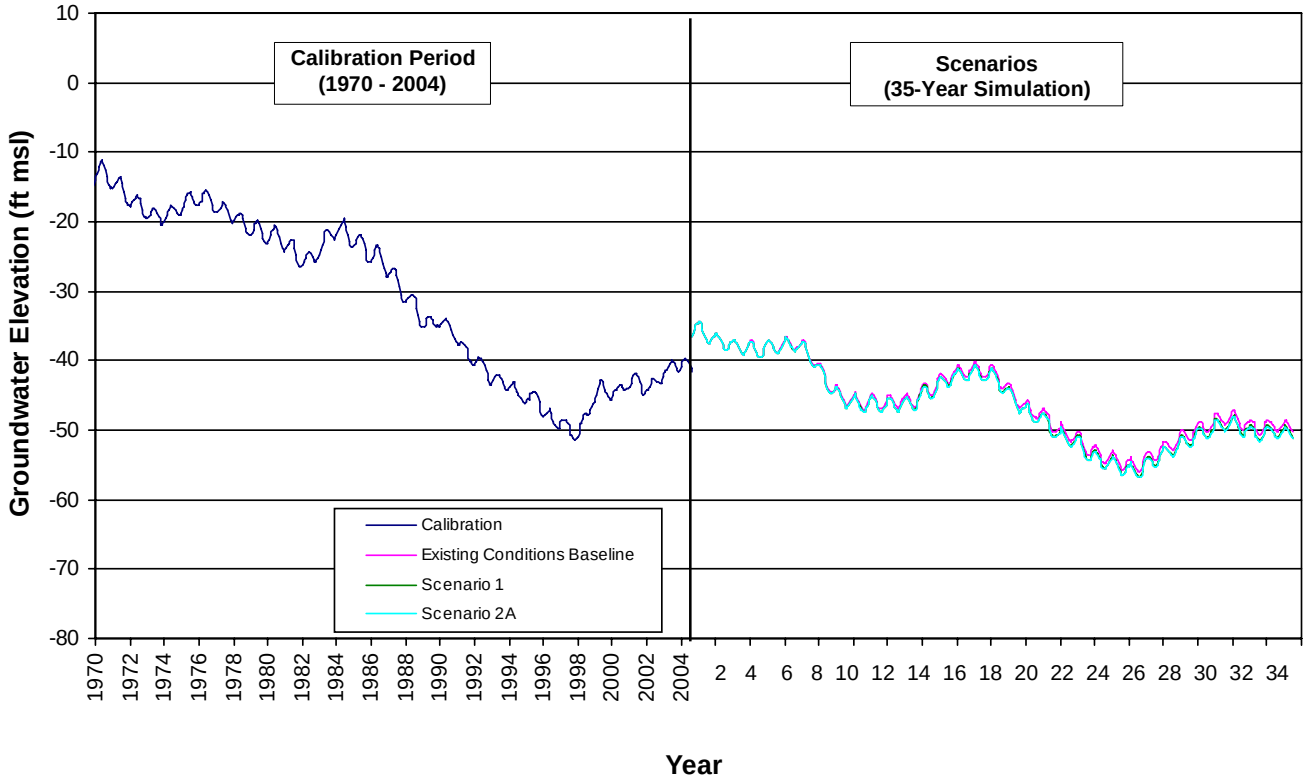


Note: All simulated groundwater elevations are for Layer 1.

Well SAC-7 (10N04E36B001M)



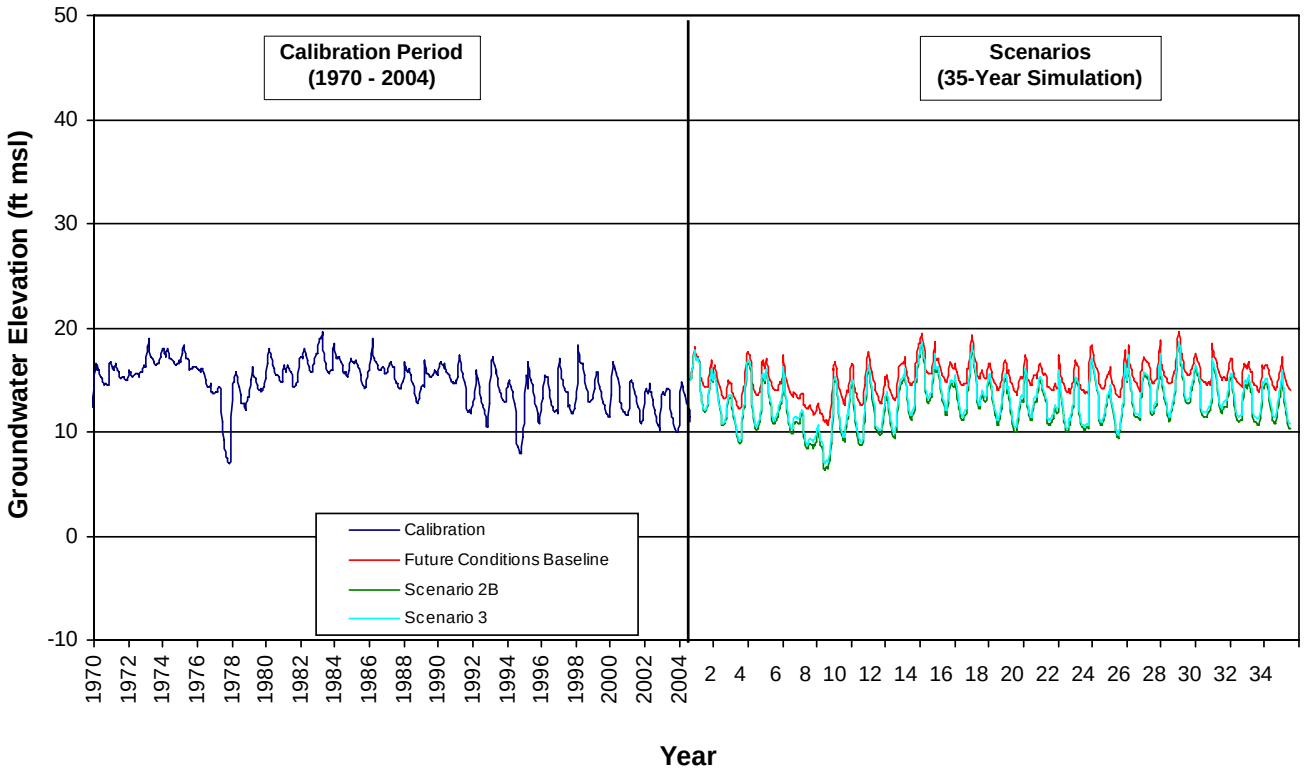
Well SAC-31 (09N05E14B001M)



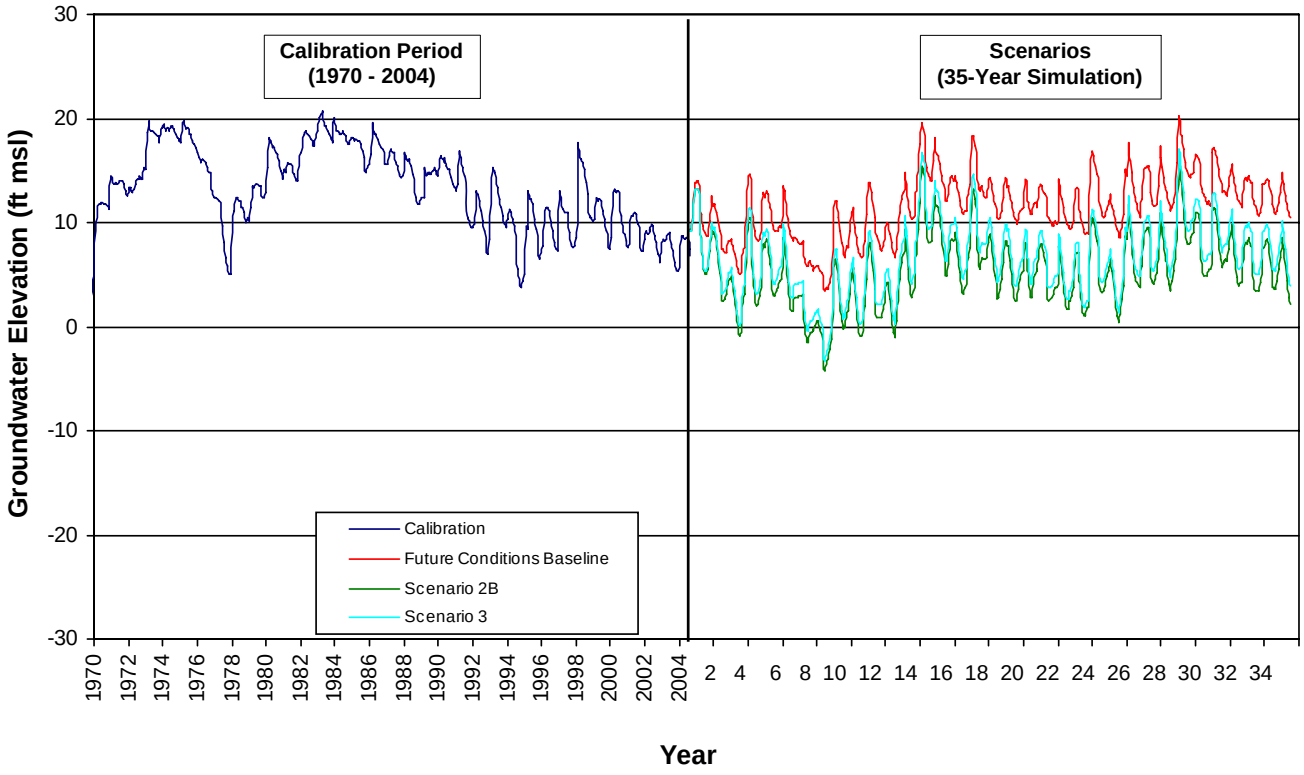
Note: All simulated groundwater elevations are for Layer 1.

Future Conditions Baseline vs. Scenarios 2B and 3

Well NAR-30 (11N04E09D002M)

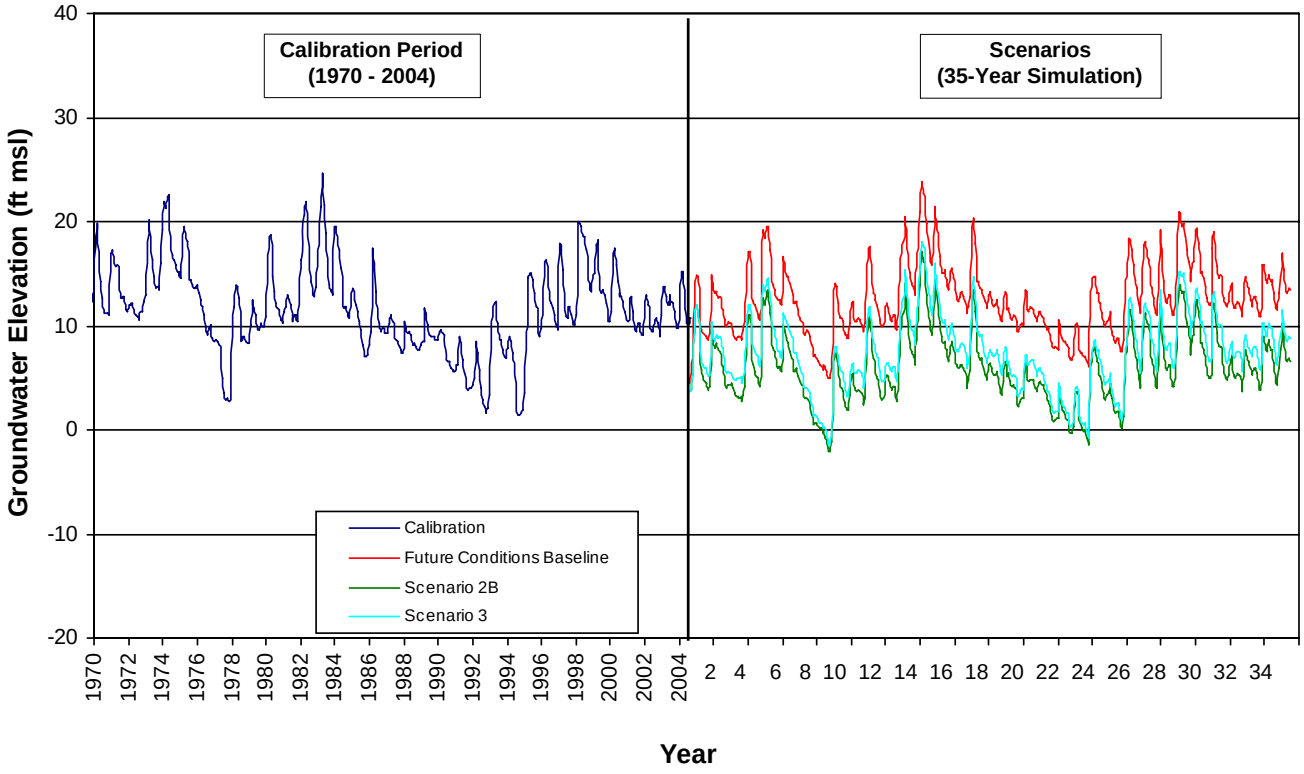


Well NAR-34 (11N04E15C001M)

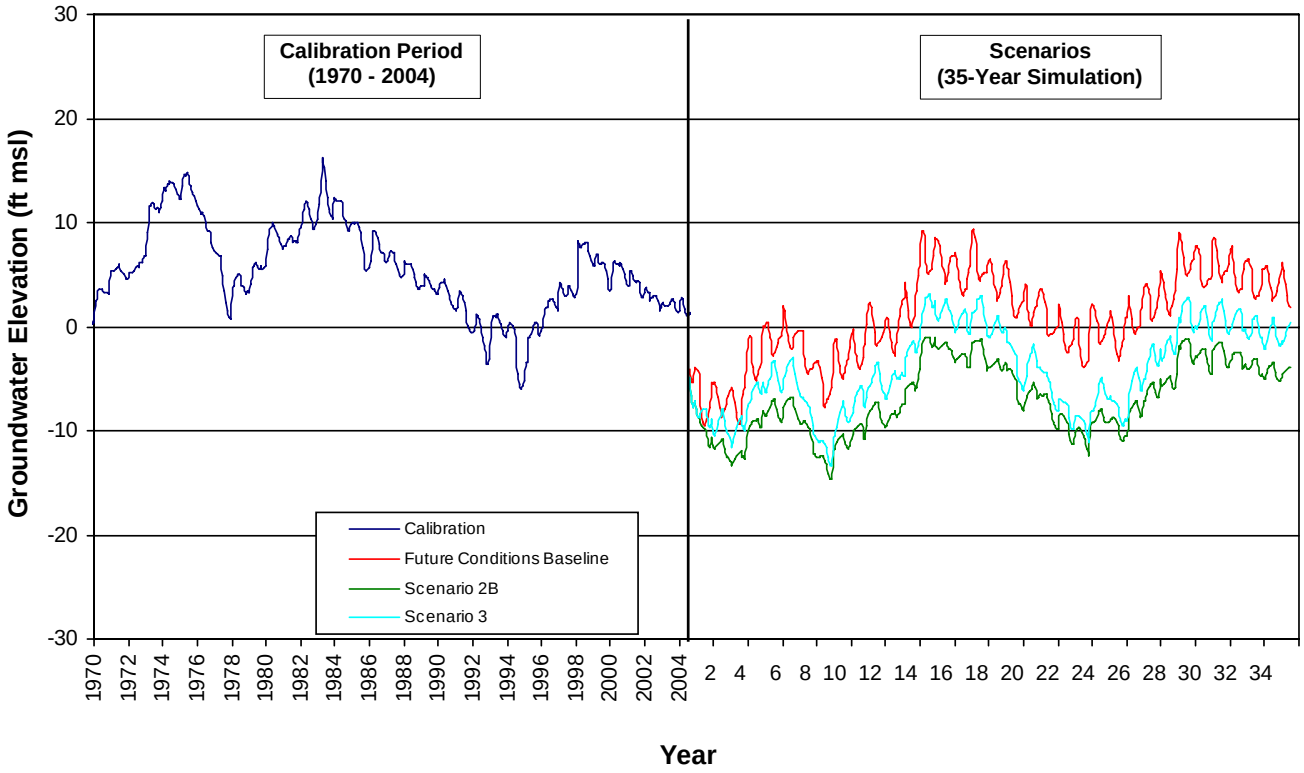


Note: All simulated groundwater elevations are for Layer 1.

Well NAR-173 (173)

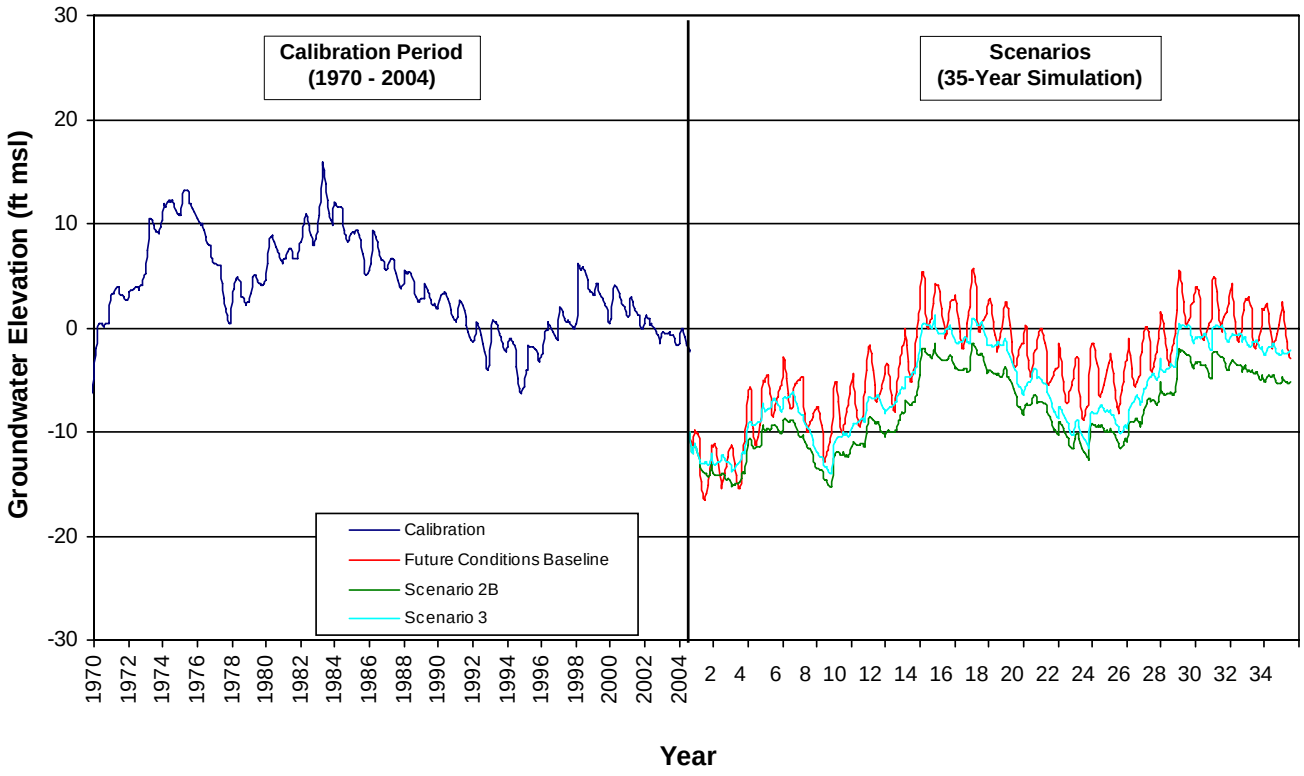


Well NAR-41 (11N04E34N001M)

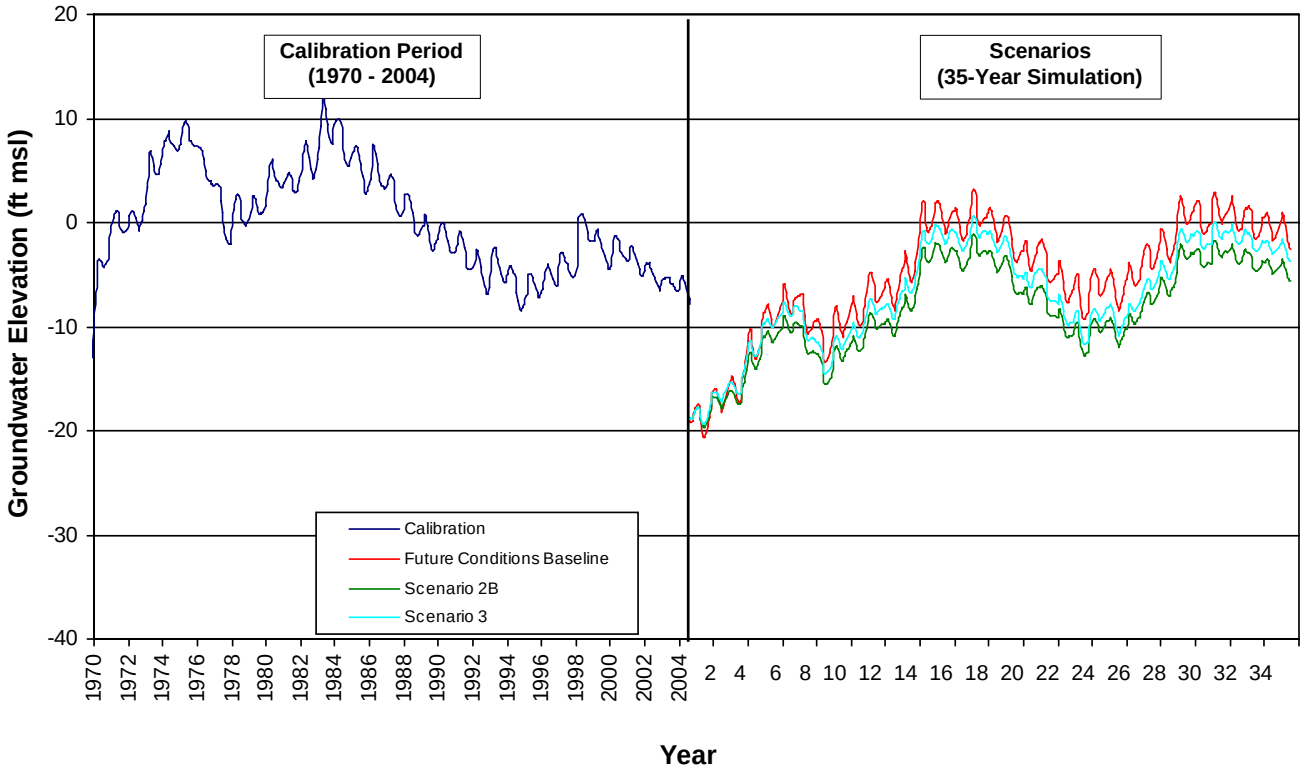


Note: All simulated groundwater elevations are for Layer 1.

Well NAR-1 (10N04E02K001M)

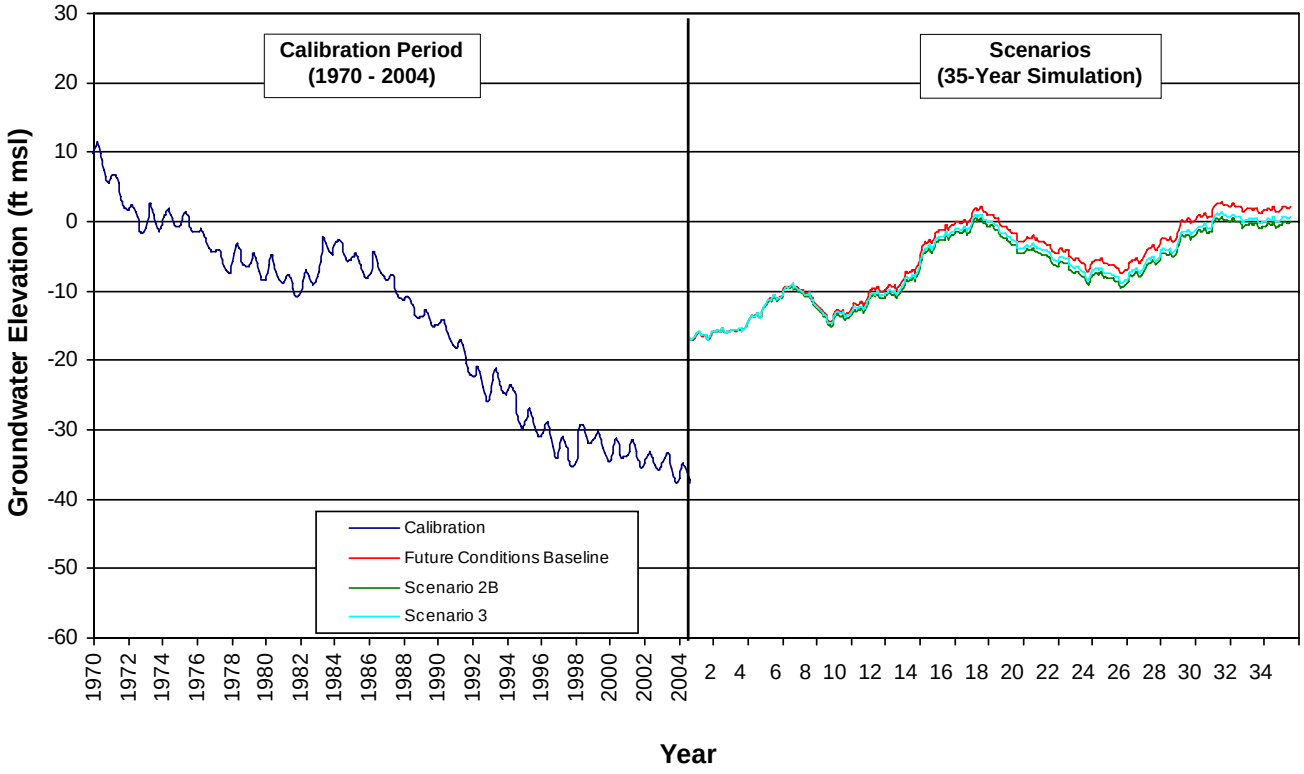


Well NAR-2 (10N04E12A001M)

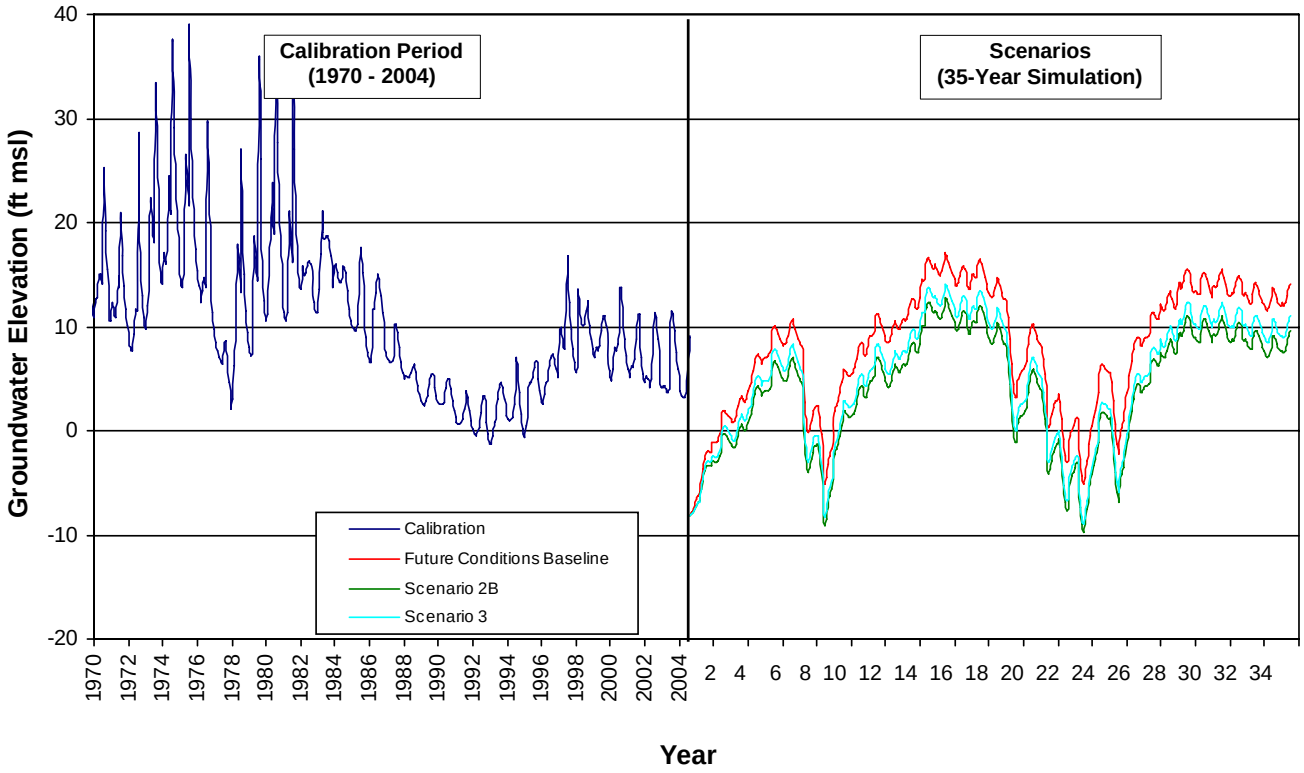


Note: All simulated groundwater elevations are for Layer 1.

Well NAR-11 (10N06E07L001M)

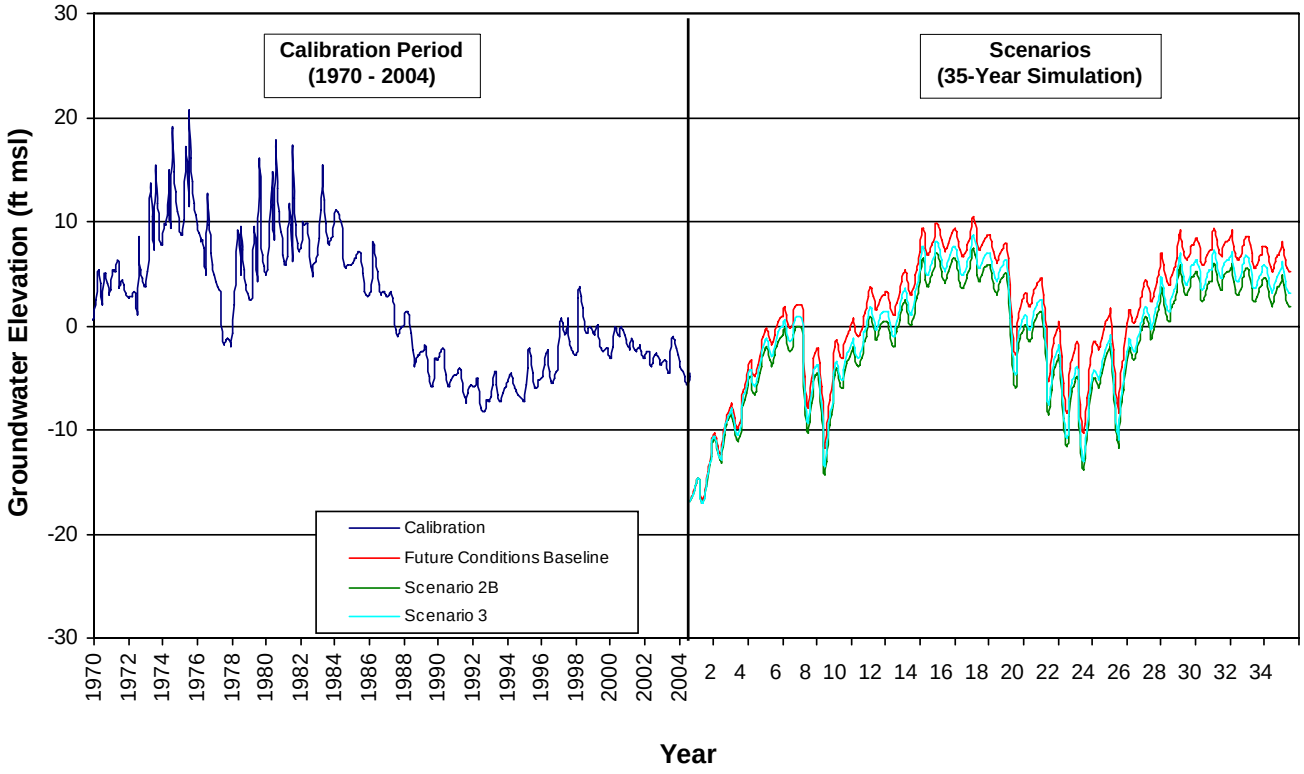


Well SAC-4 (10N04E21B002M)

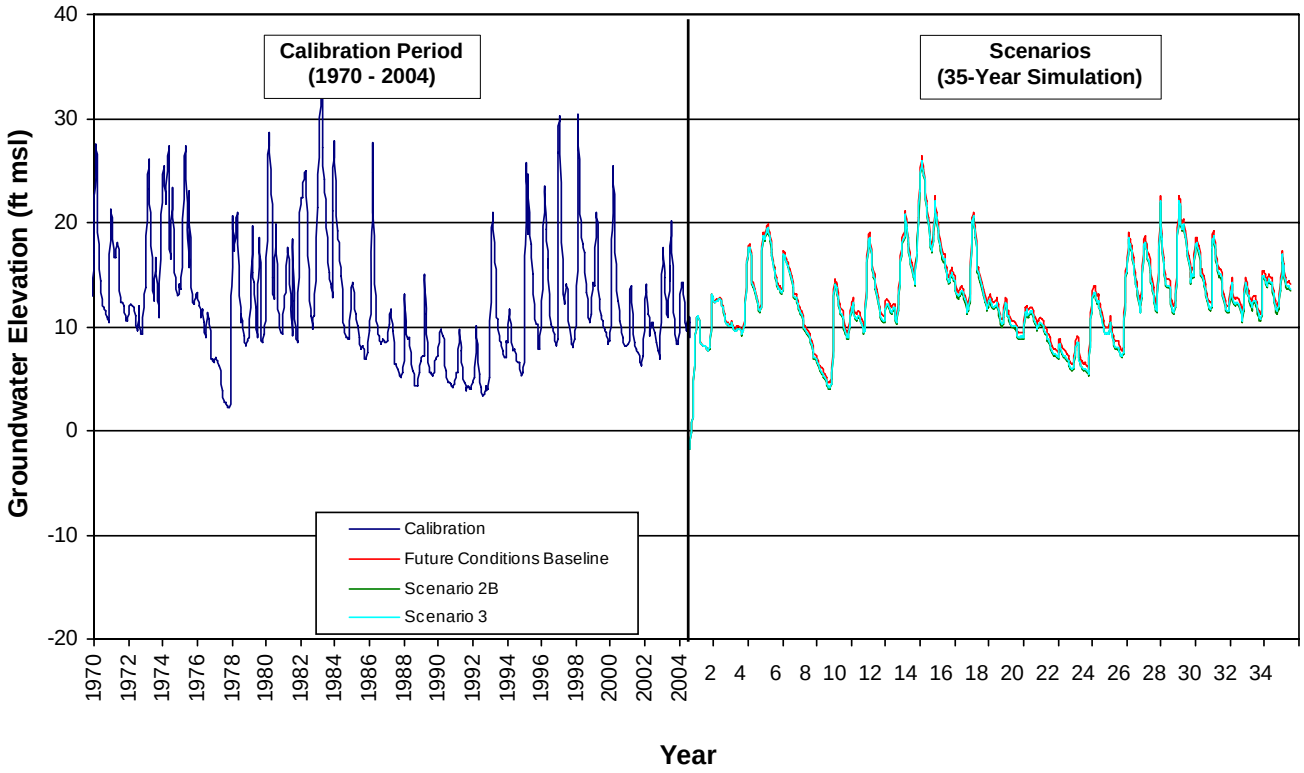


Note: All simulated groundwater elevations are for Layer 1.

Well SAC-3 (10N04E23A001M)

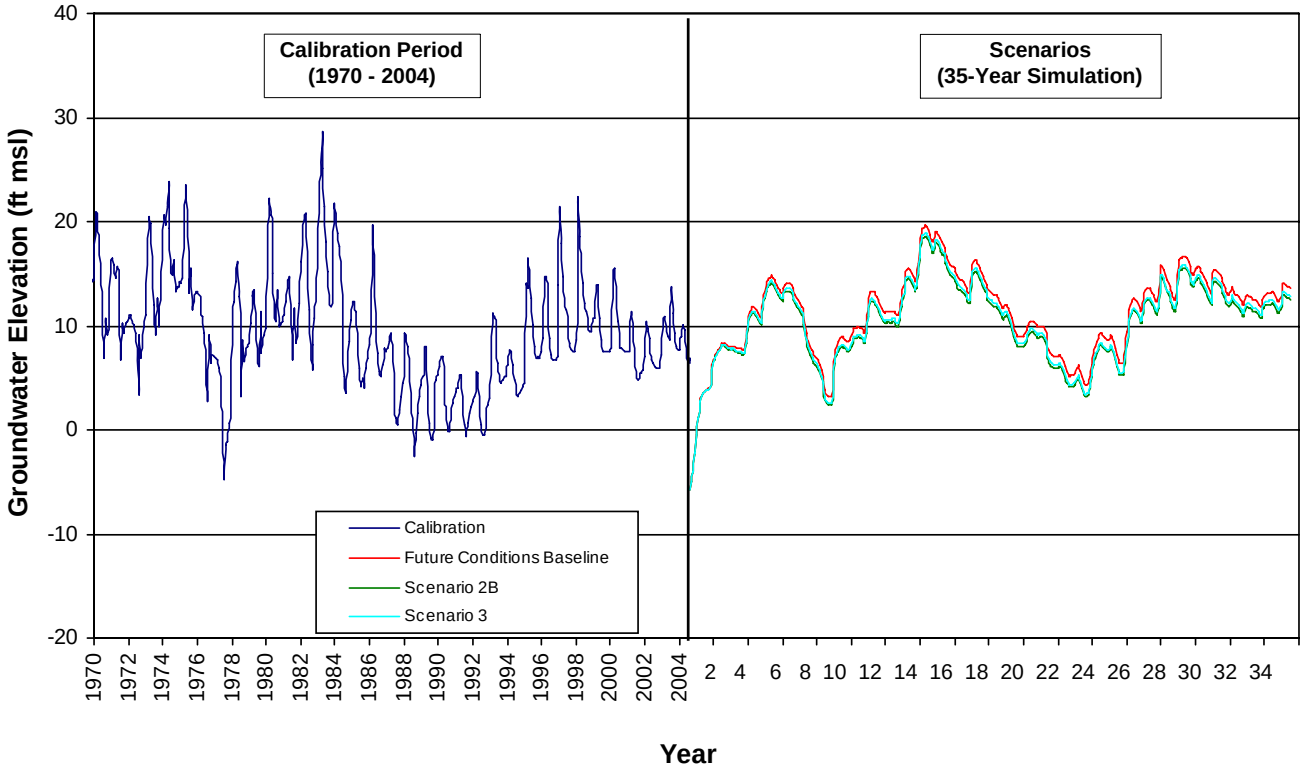


Well SAC-1 (10N03E35A001M)

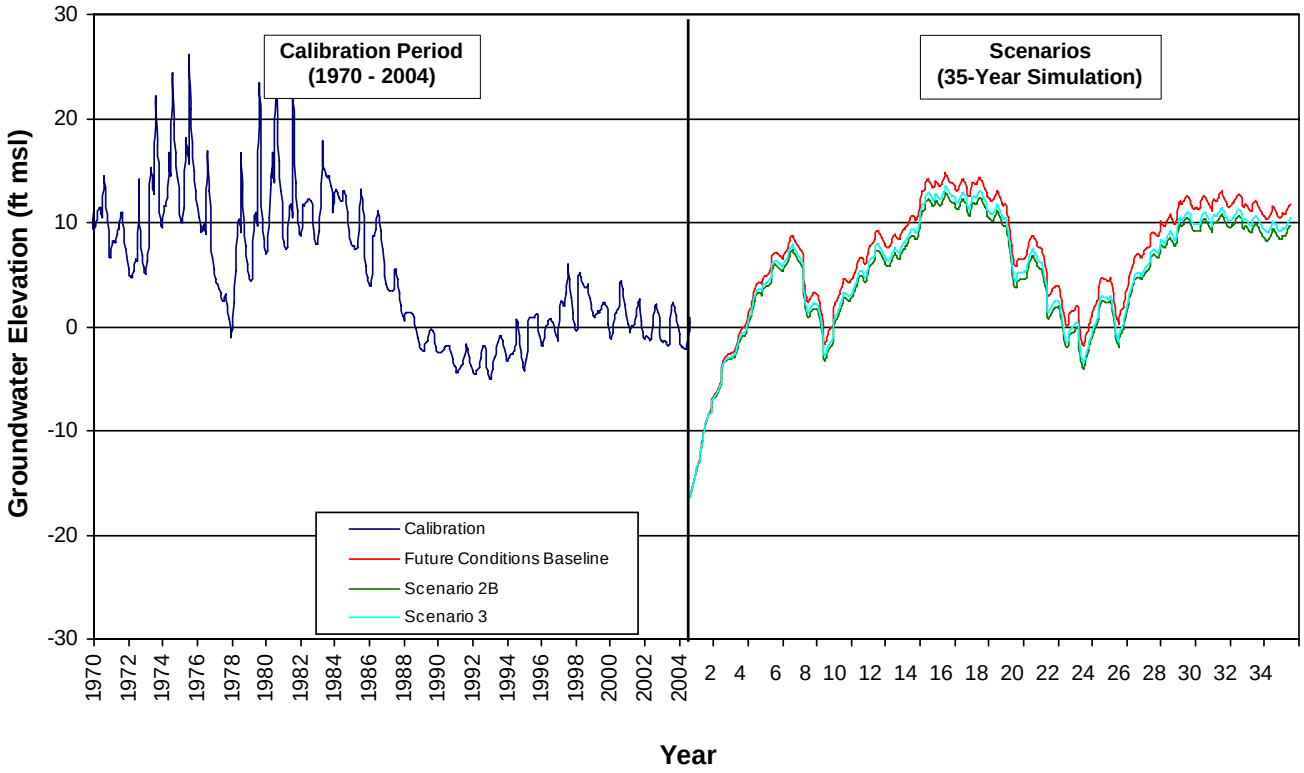


Note: All simulated groundwater elevations are for Layer 1.

Well SAC-2 (10N04E31M004M)

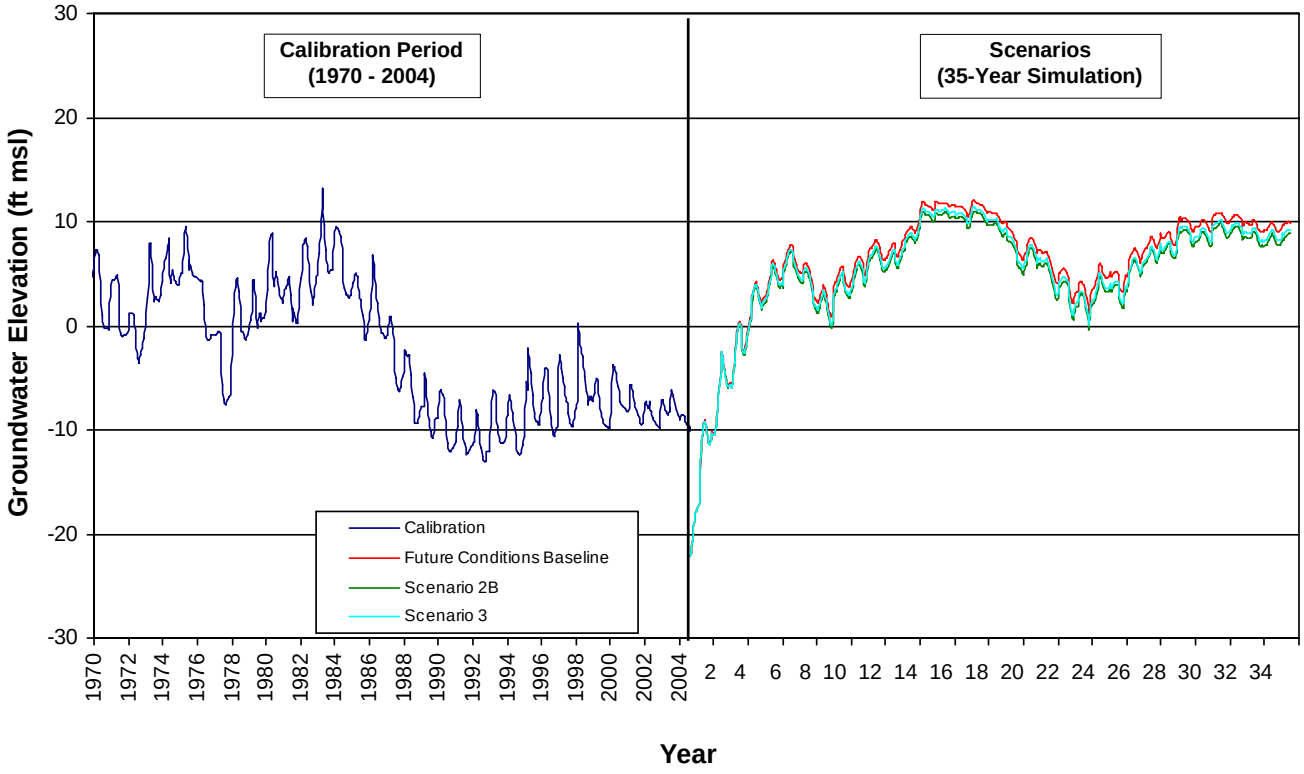


Well SAC-5 (10N04E27R004M)

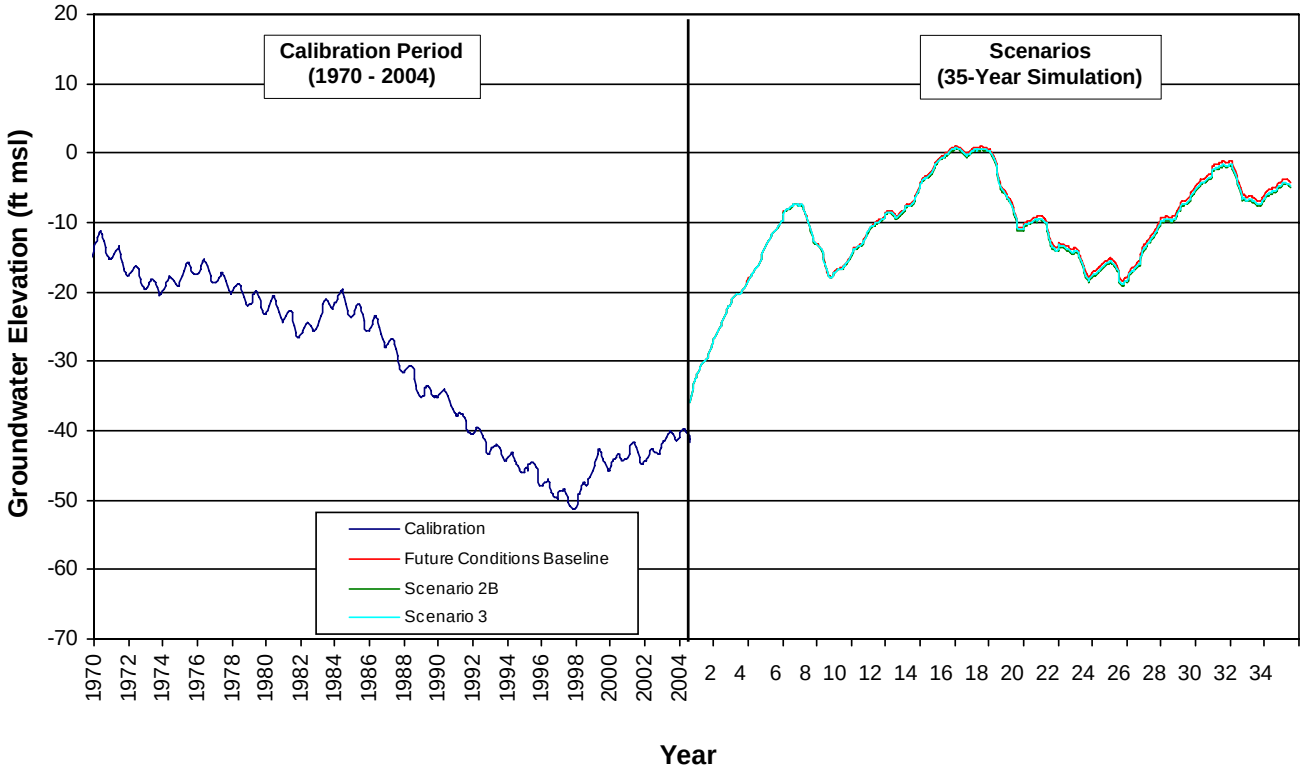


Note: All simulated groundwater elevations are for Layer 1.

Well SAC-7 (10N04E36B001M)



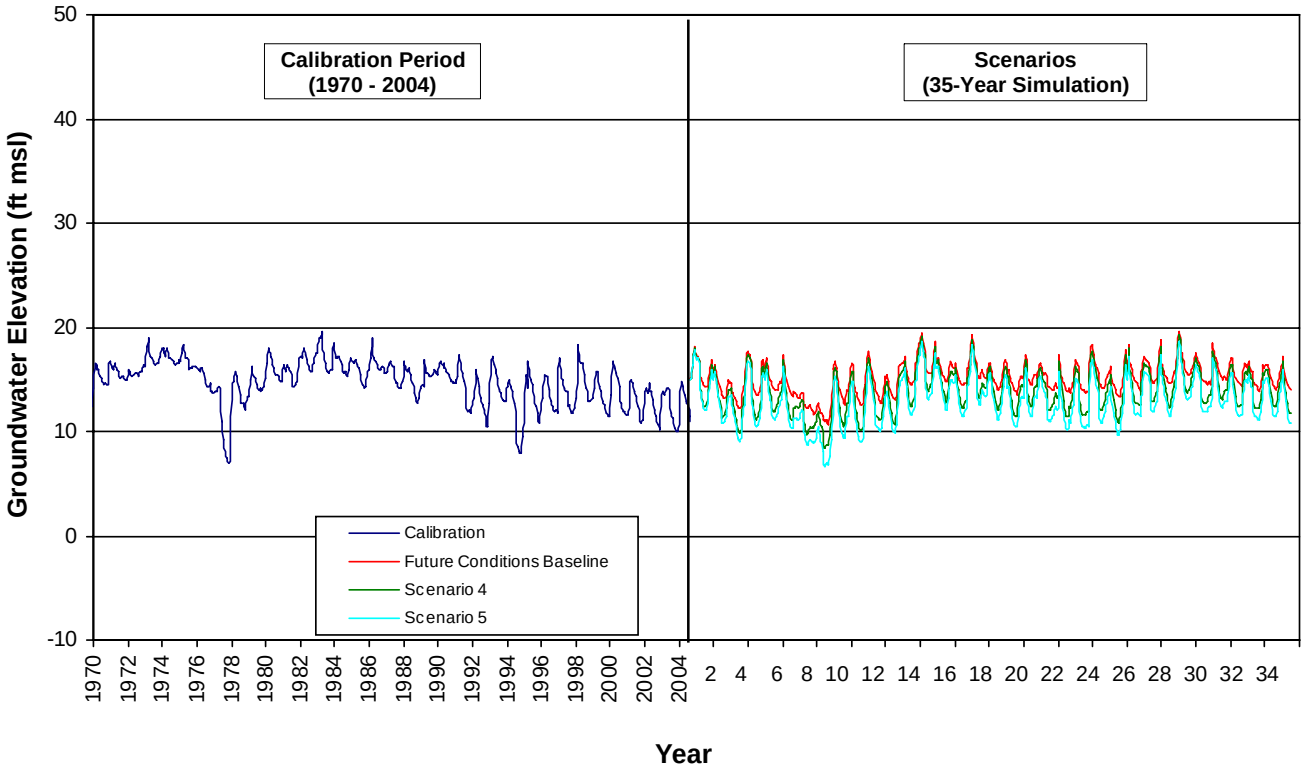
Well SAC-31 (09N05E14B001M)



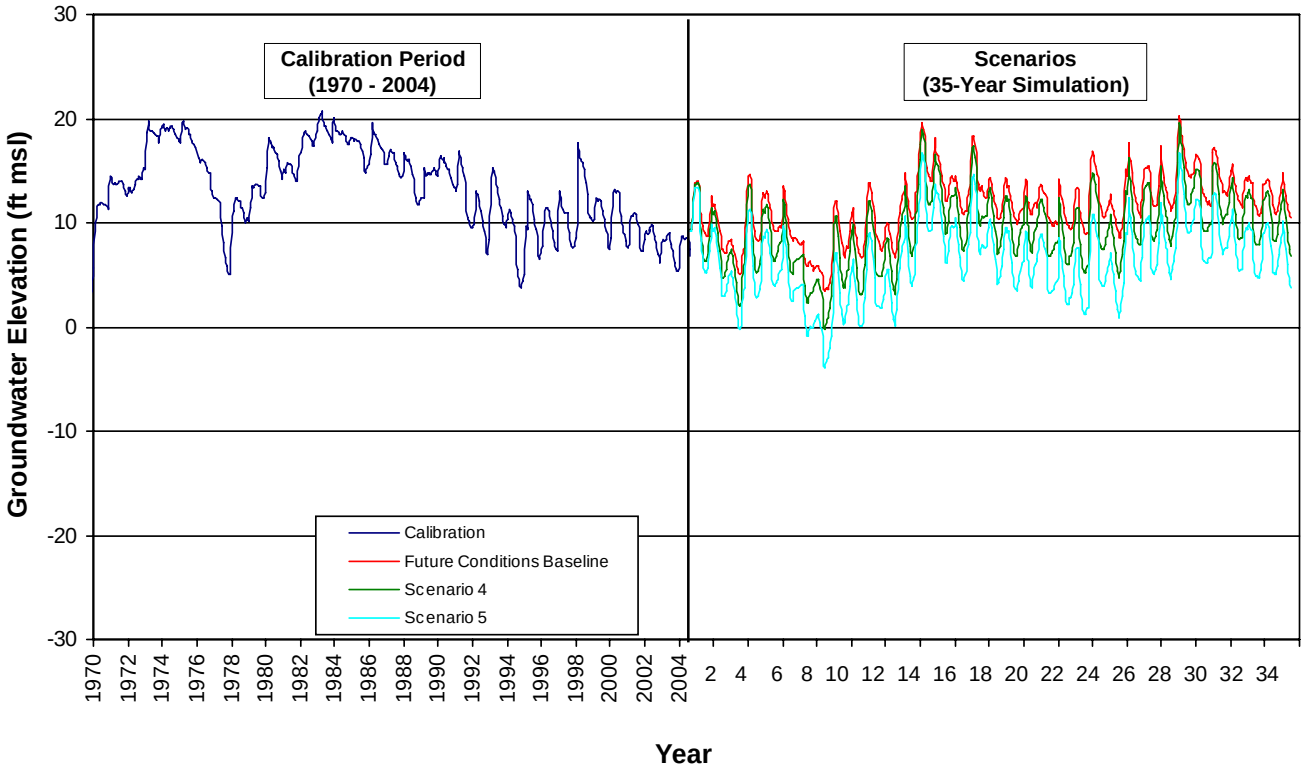
Note: All simulated groundwater elevations are for Layer 1.

Future Conditions Baseline vs. Scenarios 4 and 5

Well NAR-30 (11N04E09D002M)

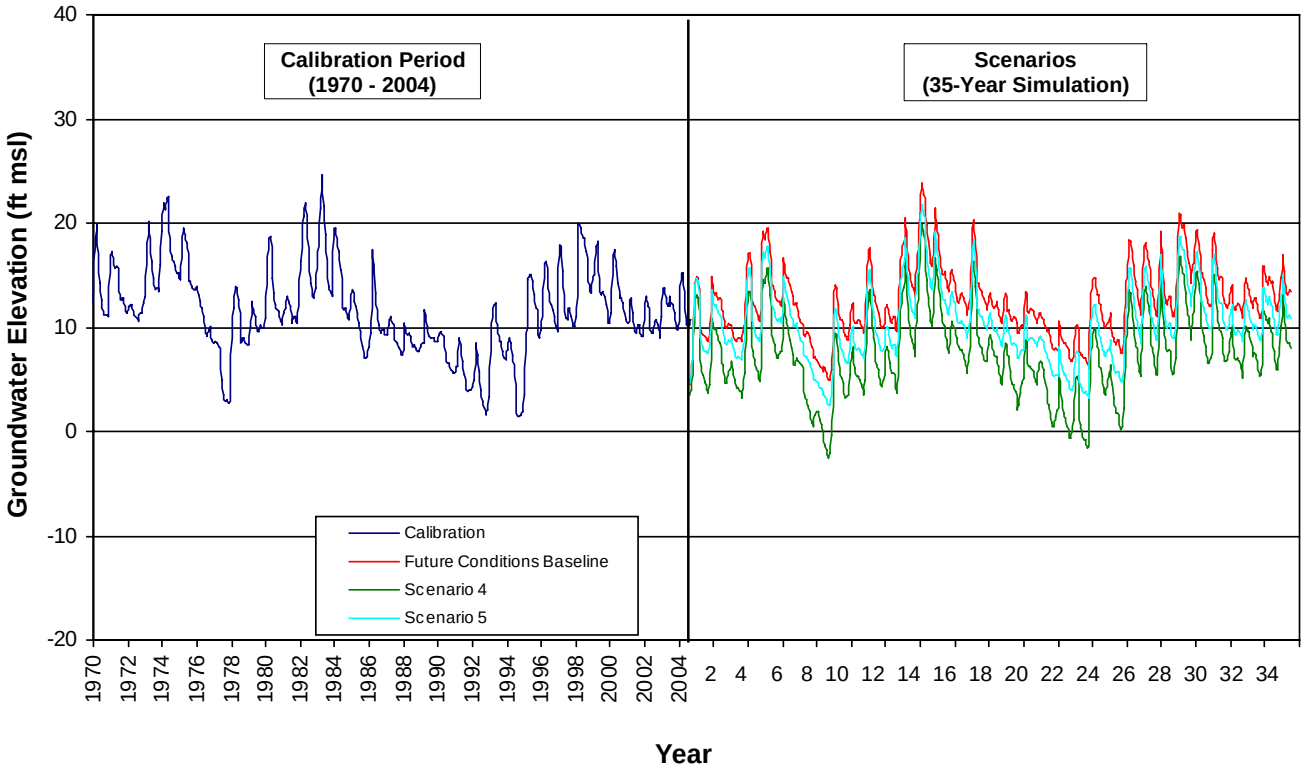


Well NAR-34 (11N04E15C001M)

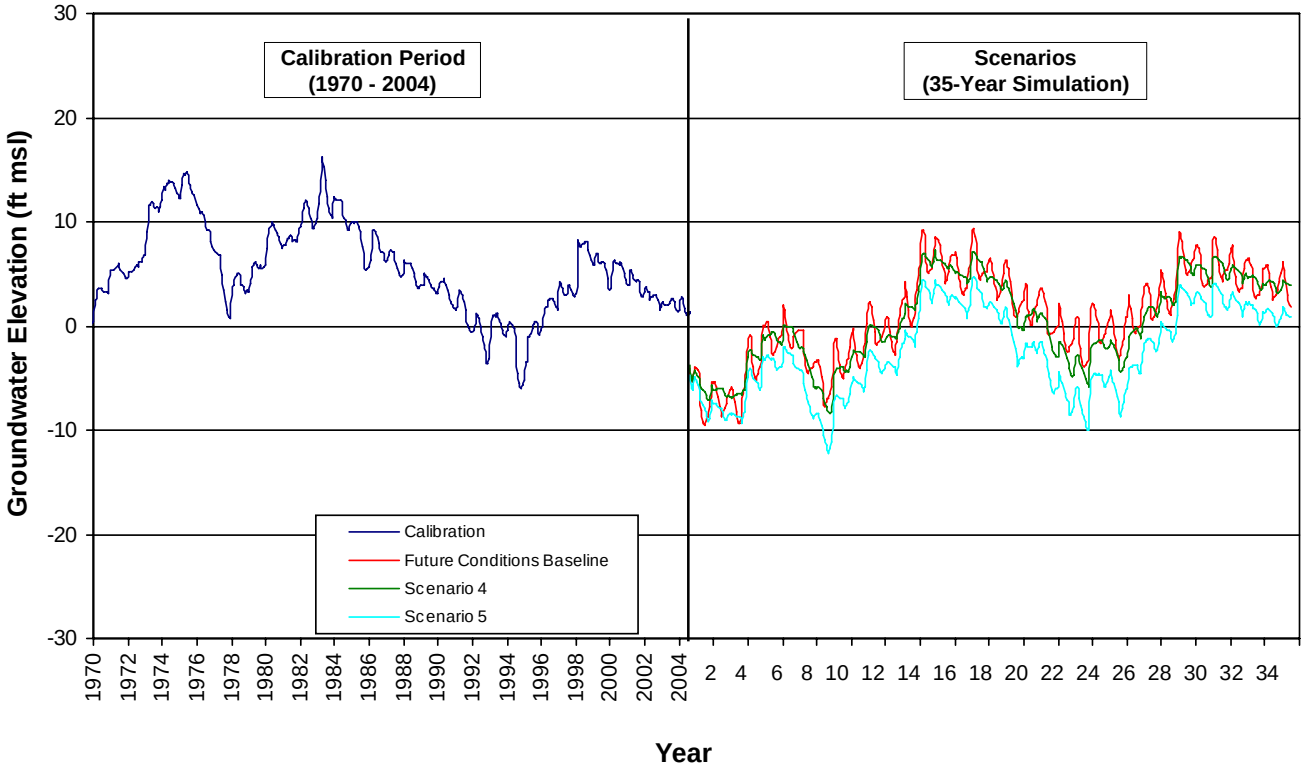


Note: All simulated groundwater elevations are for Layer 1.

Well NAR-173 (173)

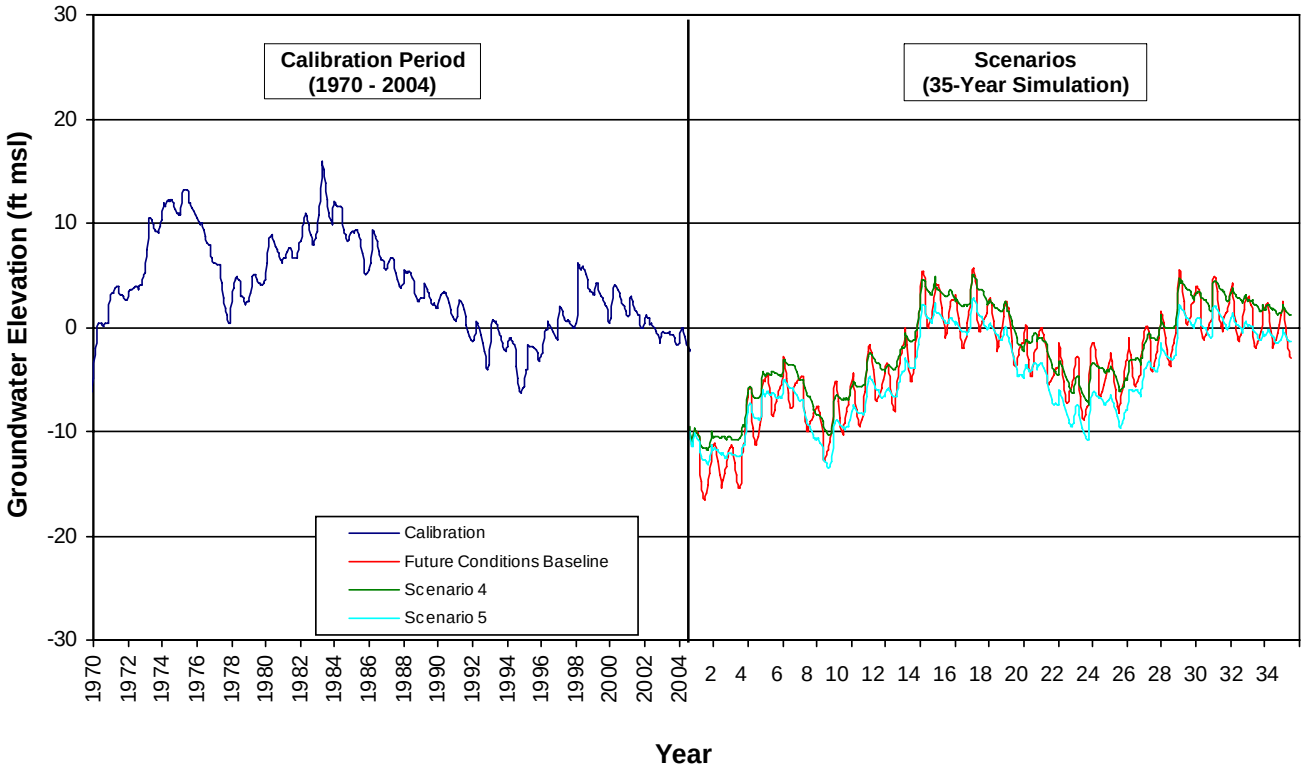


Well NAR-41 (11N04E34N001M)

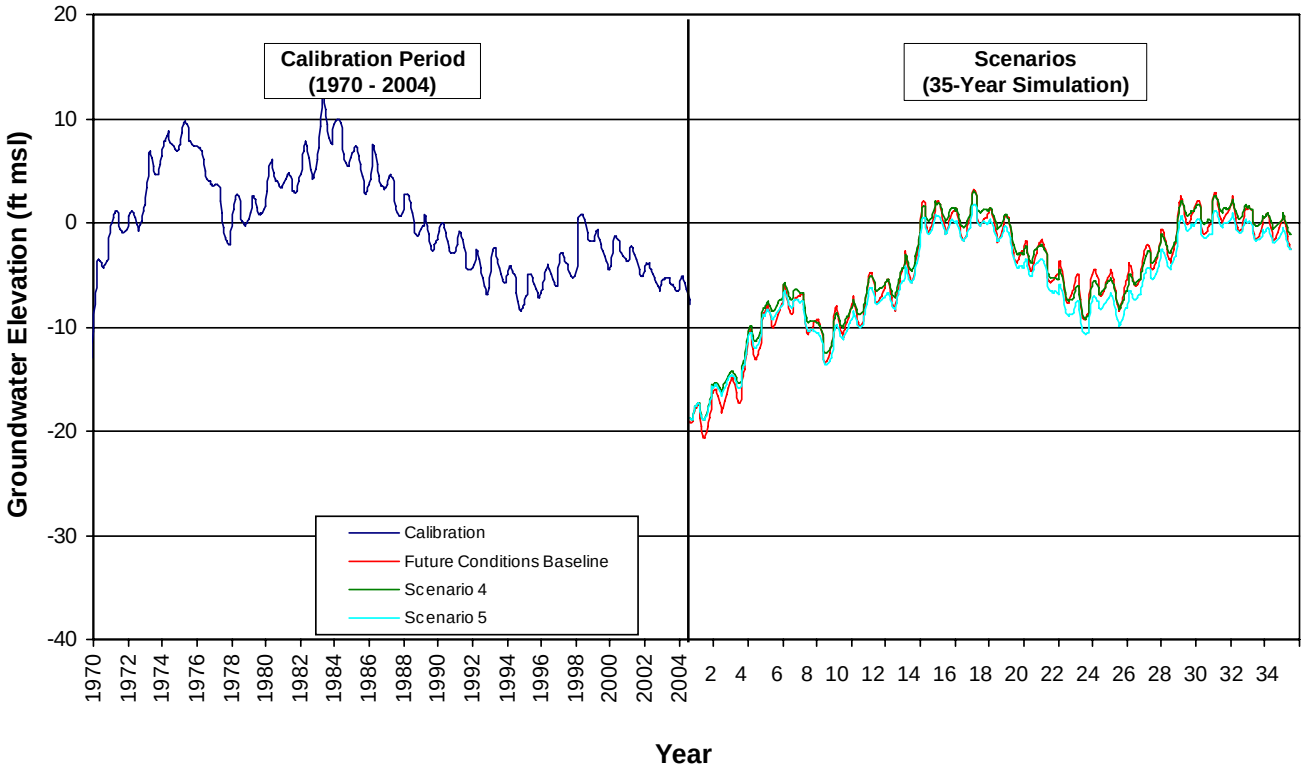


Note: All simulated groundwater elevations are for Layer 1.

Well NAR-1 (10N04E02K001M)

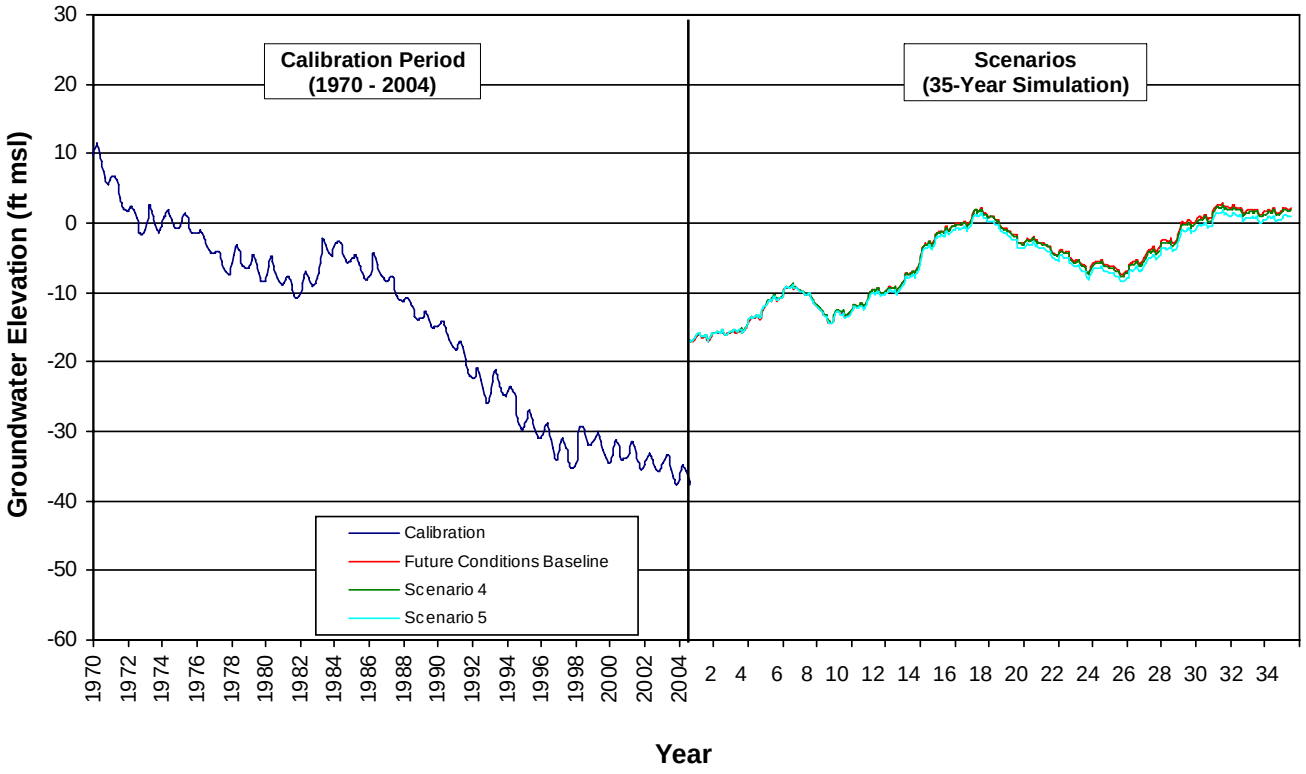


Well NAR-2 (10N04E12A001M)

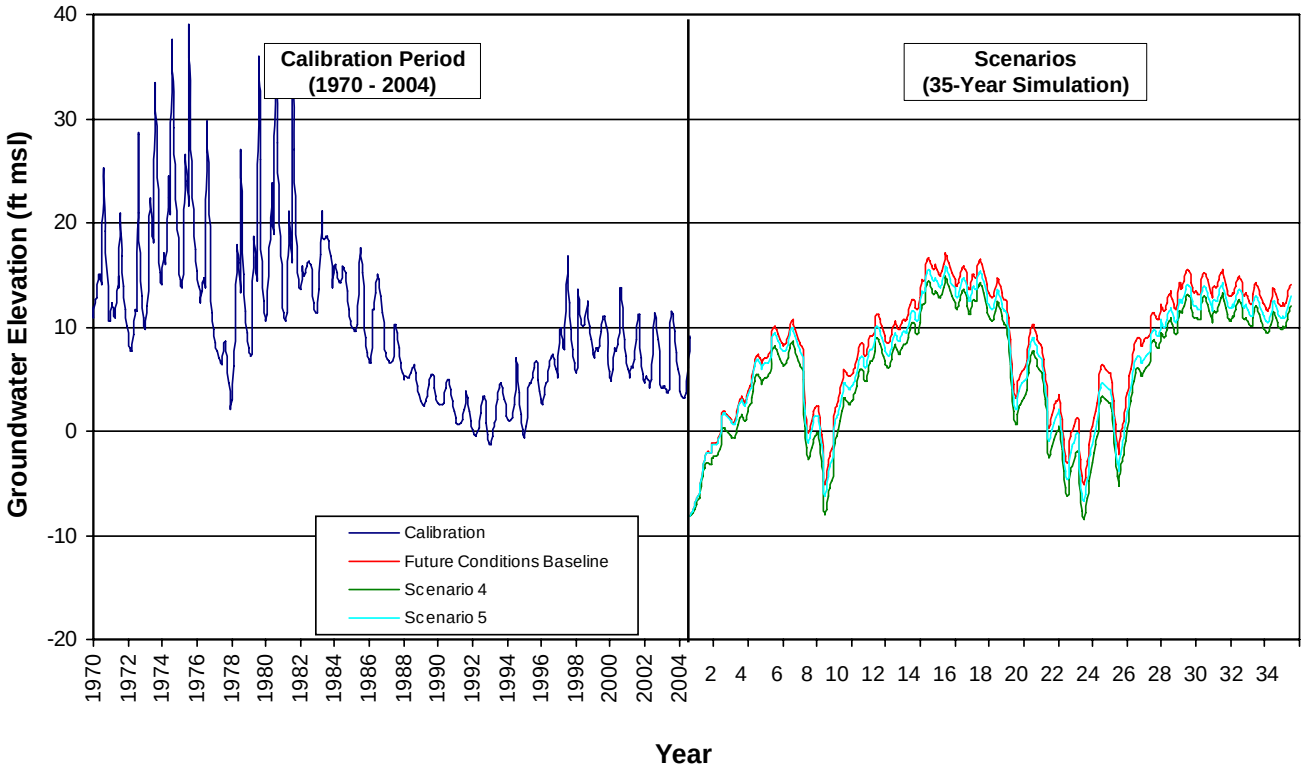


Note: All simulated groundwater elevations are for Layer 1.

Well NAR-11 (10N06E07L001M)

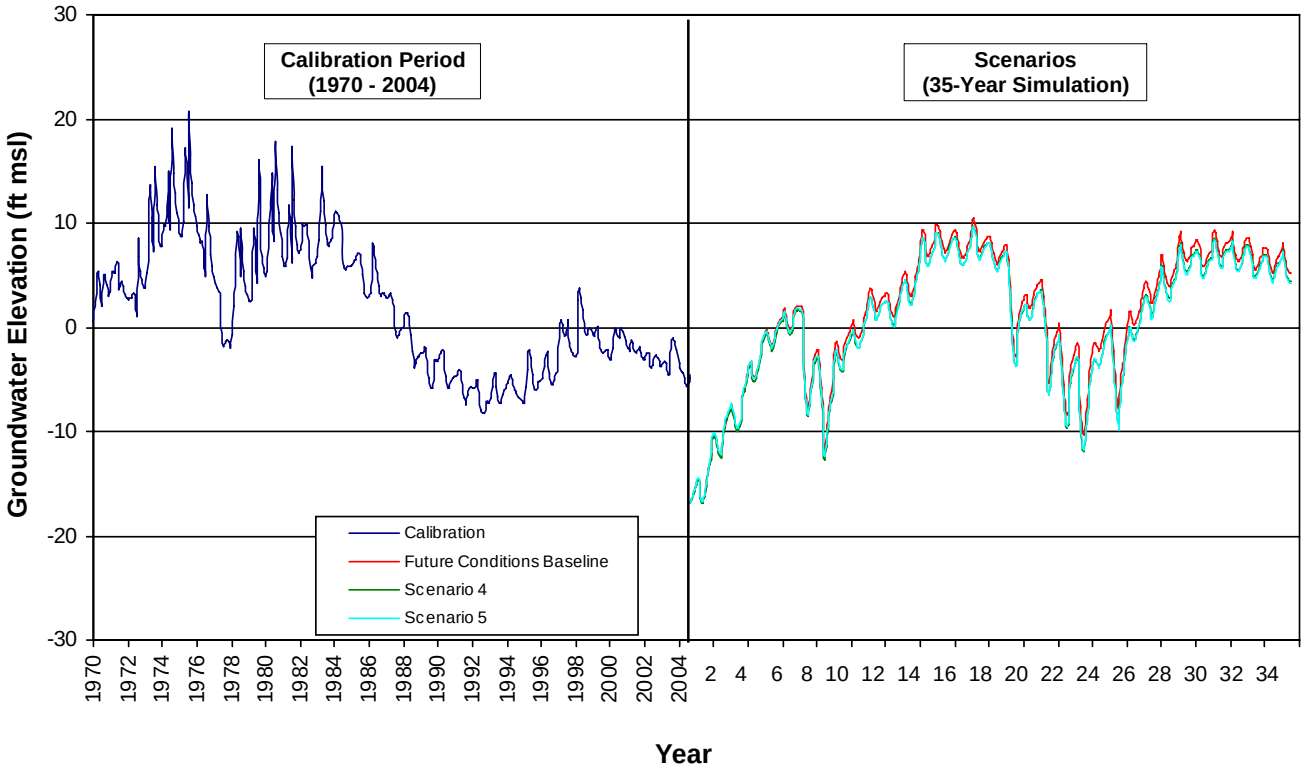


Well SAC-4 (10N04E21B002M)

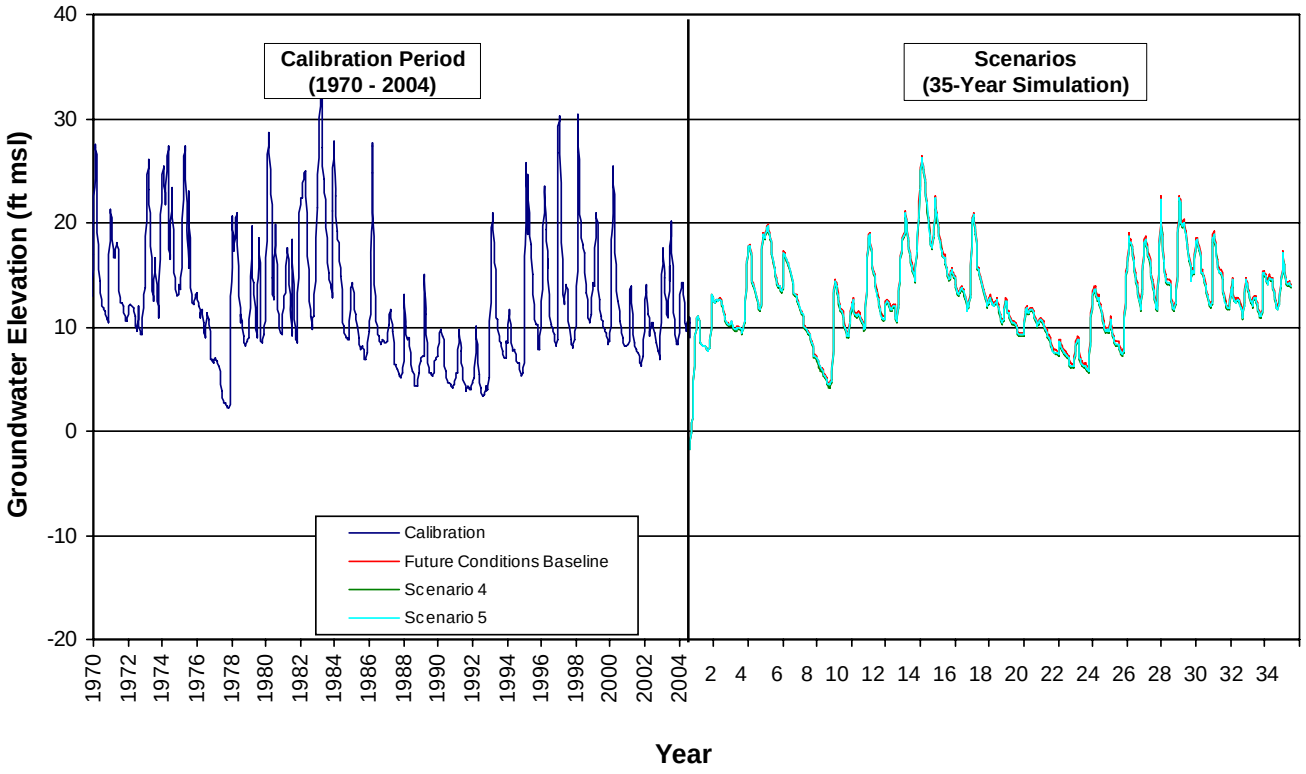


Note: All simulated groundwater elevations are for Layer 1.

Well SAC-3 (10N04E23A001M)

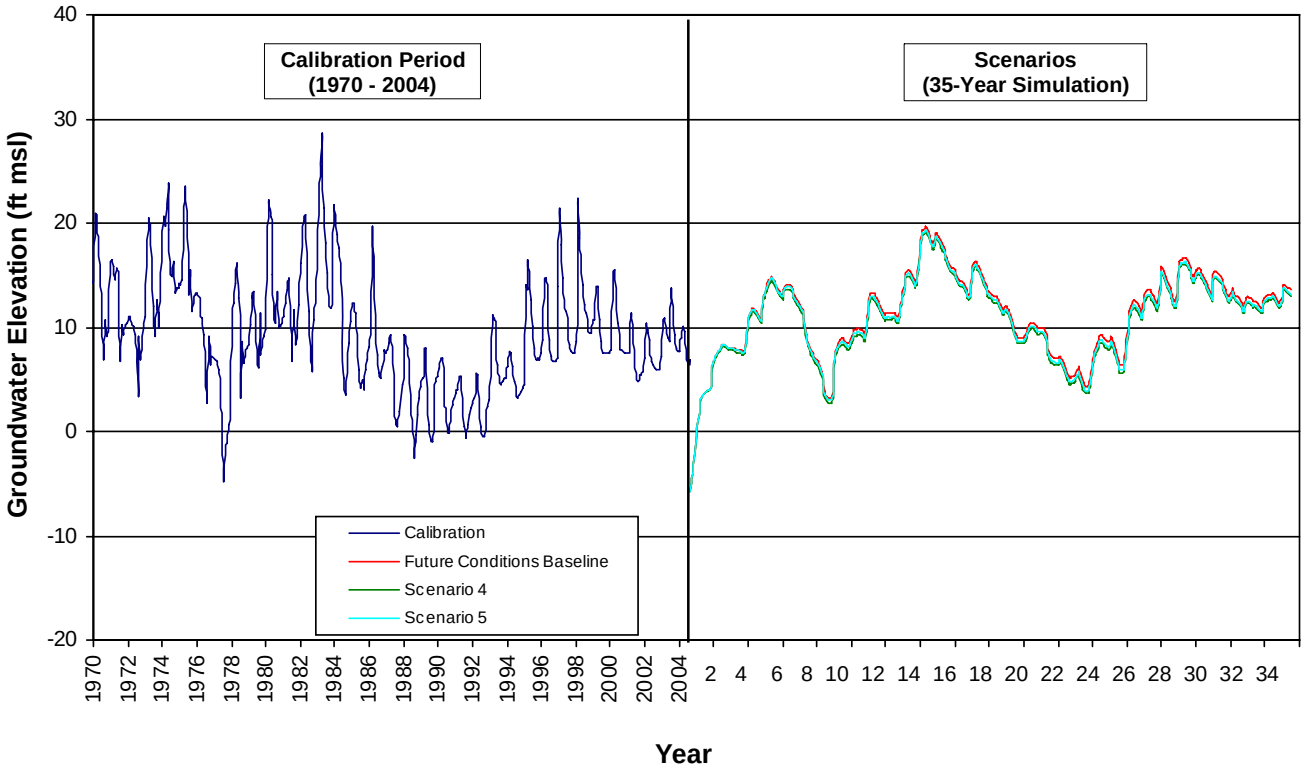


Well SAC-1 (10N03E35A001M)

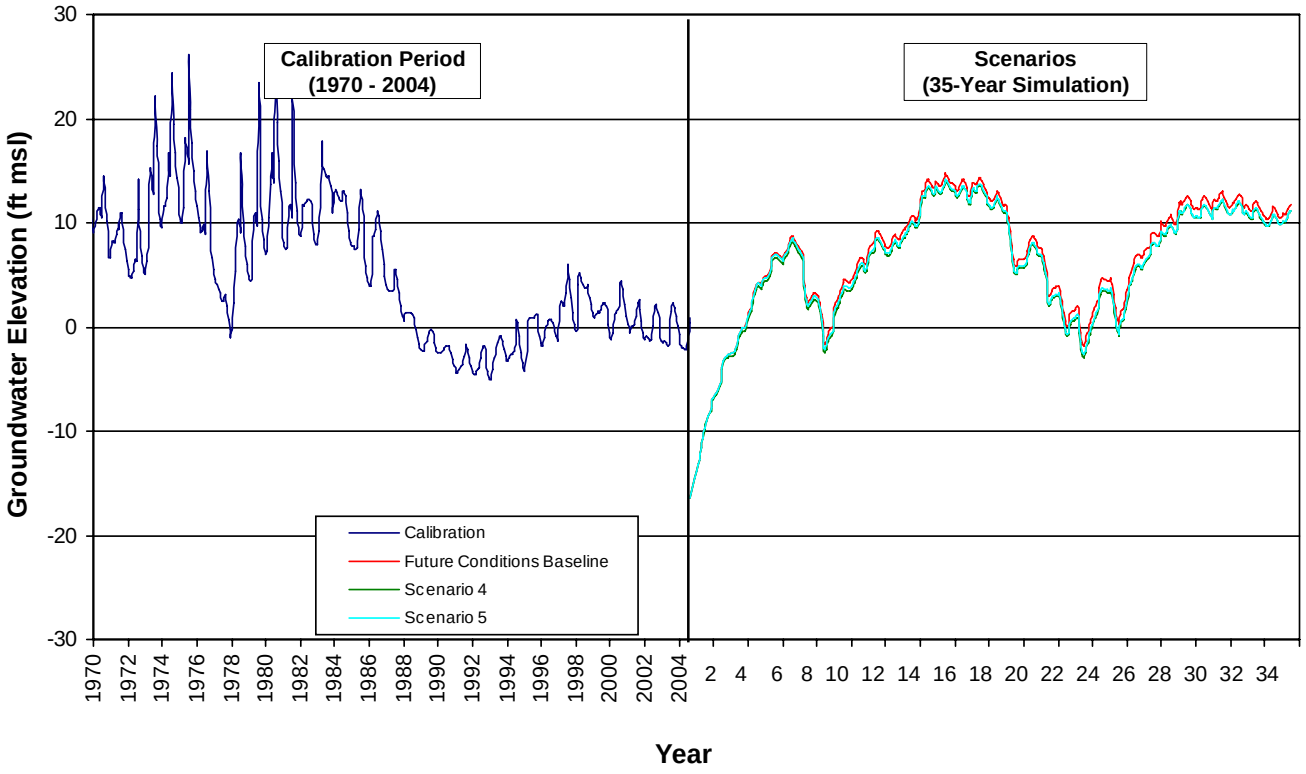


Note: All simulated groundwater elevations are for Layer 1.

Well SAC-2 (10N04E31M004M)

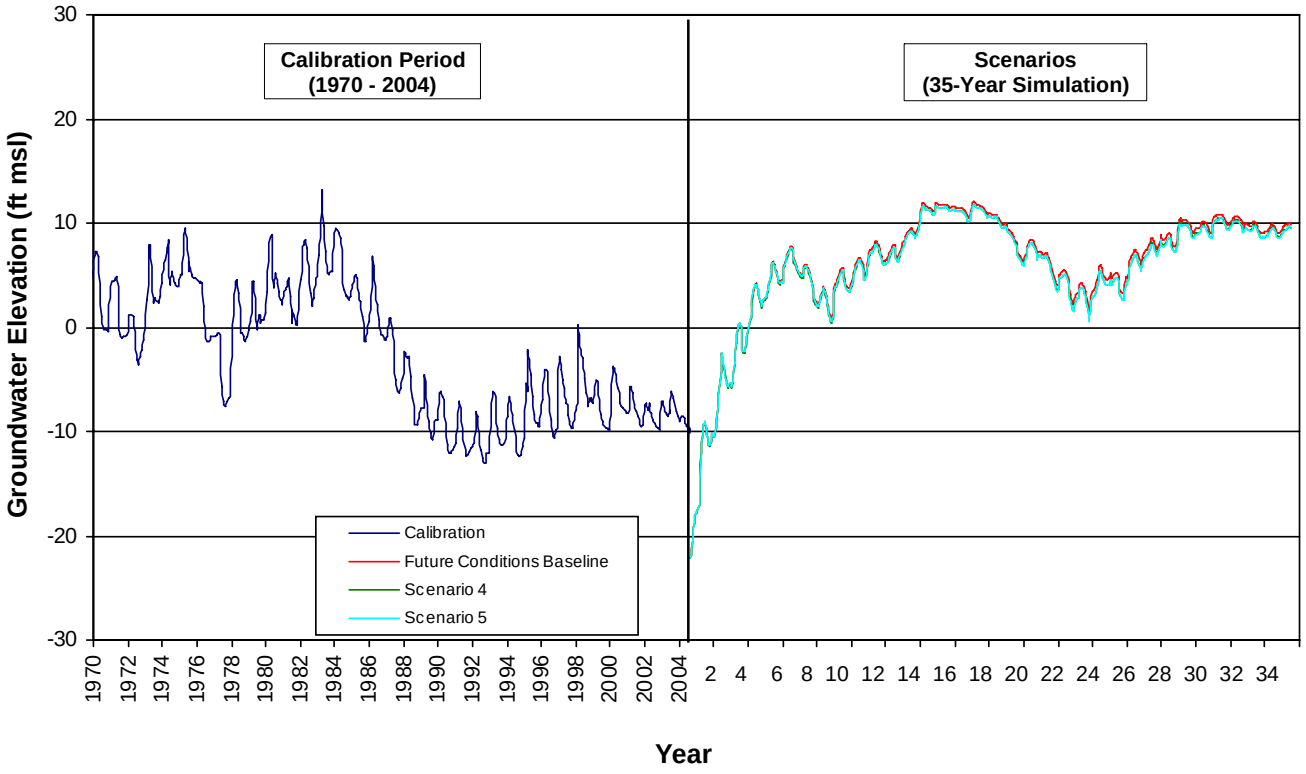


Well SAC-5 (10N04E27R004M)

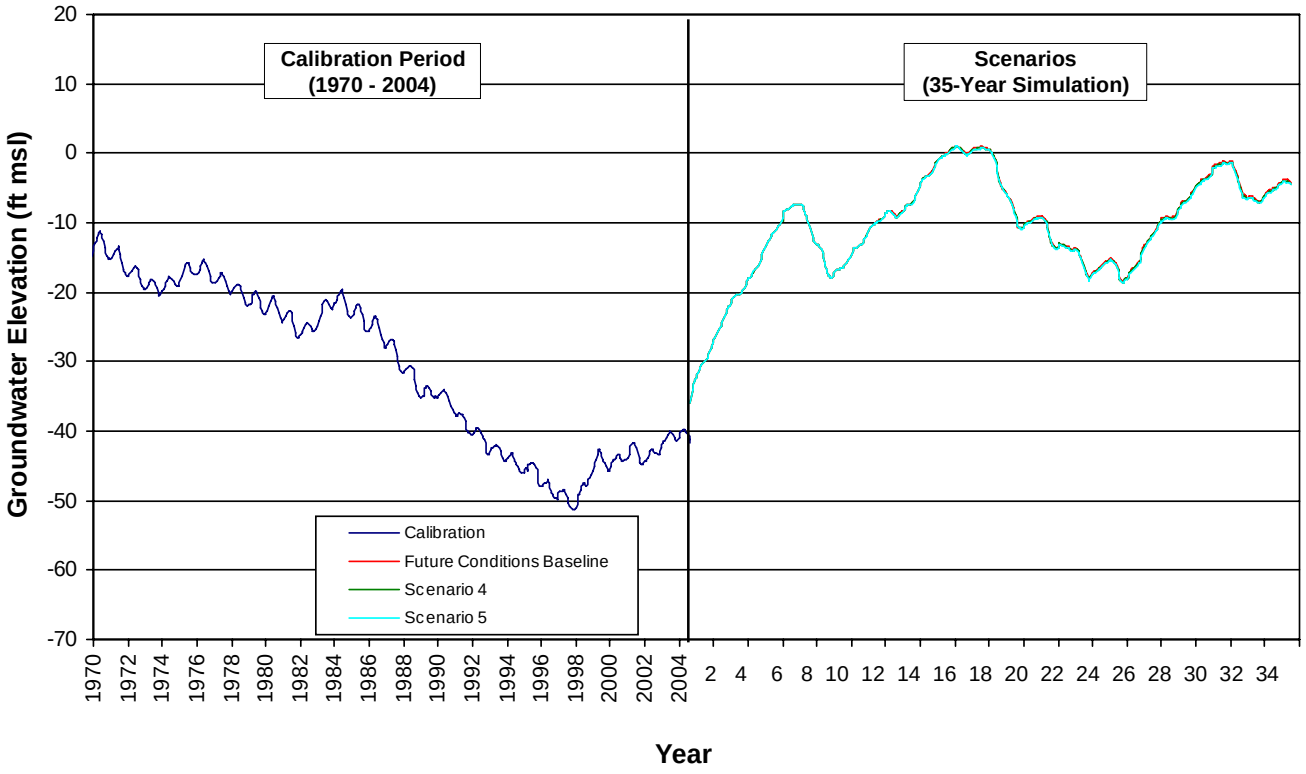


Note: All simulated groundwater elevations are for Layer 1.

Well SAC-7 (10N04E36B001M)



Well SAC-31 (09N05E14B001M)



Note: All simulated groundwater elevations are for Layer 1.

APPENDIX C

CONTRACT BETWEEN THE UNITED STATES BUREAU OF RECLAMATION AND THE NATOMAS CENTRAL MUTUAL WATER COMPANY ("RENEWAL CONTRACT")

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
Central Valley Project, California

CONTRACT BETWEEN THE UNITED STATES AND NATOMAS CENTRAL MUTUAL WATER COMPANY, DIVERTER OF WATER FROM SACRAMENTO RIVER SOURCES, SETTLING WATER RIGHTS DISPUTES AND PROVIDING FOR PROJECT WATER

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THIS CONTRACT, hereinafter referred to as "Settlement Contract," is entered into by THE UNITED STATES OF AMERICA, hereinafter referred to as the United States, made this 10th day of May, 2005, pursuant to the applicable authority granted to it generally in the Act of June 17, 1902 (32 Stat. 388), and acts amendatory or supplementary thereto, including, but not limited to, the Acts of August 26, 1937 (50 Stat. 844), as amended and supplemented, August 4, 1939 (53 Stat. 1187), as amended and supplemented, including, but not limited to, Sections 9 and 14 thereto, July 2, 1956 (70 Stat. 483), June 21, 1963 (77 Stat. 68), October 12, 1982 (96 Stat. 1263), October 27, 1986 (100 Stat. 3050), as amended, and Title XXXIV of the Act of October 30, 1992 (106 Stat. 4706), all collectively hereinafter referred to as Federal Reclamation law, and NATOMAS CENTRAL MUTUAL WATER COMPANY, hereinafter referred to as the Contractor, a corporation, acting pursuant to Sections 12003 and 12004 of the California Water Code, with its principal place of business in California;

WITNESSETH, that:

EXPLANATORY RECITALS

[1st] WHEREAS, the United States has constructed and is operating the Central Valley Project, California, for multiple purposes pursuant to its statutory authority; and

[2nd] WHEREAS, the Contractor has rights to divert, is diverting, and will continue to divert for reasonable beneficial use, water from the natural flow of the Sacramento River and tributaries thereto, that would have been flowing therein if the Central Valley Project were not in existence;

[3rd] WHEREAS, the construction and operation of the integrated and coordinated Central Valley Project has changed and will further change the regimen of the Sacramento, American, San Joaquin, and Trinity Rivers and the Sacramento-San Joaquin Delta from unregulated flow to regulated flow; and

[4th] WHEREAS, the United States has rights to divert, is diverting, and will continue to divert waters from said Rivers and said Delta in connection with the operation of said Central Valley Project; and

[5th] WHEREAS, the Contractor and the United States had a dispute over the respective rights of the parties to divert and use water from the regulated flow of the Sacramento River which threatened to result in litigation, and as a means to settle that dispute entered into Contract No. 14-06-200-885A, as revised, hereinafter referred to as the Existing Contract, which established terms for the delivery to the Contractor of Central Valley Project Water, and the quantities of Base Supply the United States and the Contractor agreed may be diverted by the Contractor from the Sacramento River pursuant to such contract; and

[6th] WHEREAS, the United States and the Contractor disagree with respect to the authority of the United States to change the quantities of Base Supply and/or Project Water

specified as available for diversion in this Settlement Contract from the quantities specified in the Existing Contract, and other issues related thereto. That dispute was the subject of litigation in a lawsuit entitled *Glenn-Colusa Irrigation District, et al. v. United States, et al.* [Civ. No. S-01-1816 GEB/JFM (E.D. Cal.)], but that litigation was dismissed, without prejudice, pursuant to a stipulation of dismissal filed by the parties thereto on August 29, 2002. Notwithstanding that dismissal, the Contractor and the United States enter into this Settlement Contract to renew the Existing Contract, pursuant to the terms of the Existing Contract, Federal Reclamation law, and the laws of the State of California; and

[7th] WHEREAS, to assure the Contractor of the enjoyment and use of the regulated flow of the said Rivers and the Delta, and to provide for the economical operation of the Central Valley Project by, and the reimbursement to, the United States for expenditures made for said Project.

NOW, THEREFORE, in consideration of the performance of the herein contained provisions, conditions, and covenants, it is agreed as follows:

DEFINITIONS

1. When used herein, unless otherwise expressed or incompatible with the intent hereof, the term:

(a) "Base Supply" shall mean the quantity of Surface Water established in Articles 3 and 5 which may be diverted by the Contractor from the Sacramento River each month during the period April through October of each Year without payment to the United States for such quantities diverted;

(b) "Basin-Wide Water Management Plan" shall mean the mutually agreeable Sacramento River Basinwide Water Management Plan, dated October 11, 2004, developed by

Glenn-Colusa Irrigation District, Maxwell Irrigation District, Natomas Central Mutual Water Company, Pelger Mutual Water Company, Princeton-Codora-Glenn Irrigation District, Provident Irrigation District, Reclamation District 108, Sutter Mutual Water Company, Anderson-Cottonwood Irrigation District, Meridian Farms Water Company, Reclamation District 1004, and the U.S. Bureau of Reclamation;

(c) "Charges" shall mean the payments for Project Water that the Contractor is required to pay to the United States in addition to the "Rates" specified in this Settlement Contract. The Contracting Officer will, on an annual basis, determine the extent of these Charges. The type and amount of each Charge shall be specified in Exhibit D;

(d) "Contract Total" shall mean the sum of the Base Supply and Project Water available for diversion by the Contractor for the period April 1 through October 31;

(e) "Critical Year" shall mean any Year in which either of the following eventualities exists:

(1) The forecasted full natural inflow to Shasta Lake for the current Water Year, as such forecast is made by the United States on or before February 15 and reviewed as frequently thereafter as conditions and information warrant, is equal to or less than 3.2 million acre-feet; or

(2) The total accumulated actual deficiencies below 4 million acre-feet in the immediately prior Water Year or series of successive prior Water Years each of which had inflows of less than 4 million acre-feet, together with the forecasted deficiency for the current Water Year, exceed 800,000 acre-feet.

For the purpose of determining a Critical Year, the computation of inflow to Shasta Lake shall be performed in a manner that considers the extent of upstream development

above Shasta Lake during the year in question, and shall be used as the full natural flow to Shasta Lake. In the event that major construction has occurred or occurs above Shasta Lake after September 1, 1963, and which has materially altered or alters the regimen of the stream systems contributing to Shasta Lake, the computed inflow to Shasta Lake used to define a Critical Year will be adjusted to eliminate the effect of such material alterations. After consultation with the State of California, the National Weather Service, and other recognized forecasting agencies, the Contracting Officer will select the forecast to be used and will make the details of it available to the Contractor. The same forecasts used by the United States for the operation of the Project shall be used to make the forecasts hereunder;

(f) "CVPIA" shall mean the Central Valley Project Improvement Act, Title XXXIV of the Act of October 30, 1992 (106 Stat. 4706);

(g) "Eligible Lands" shall mean all lands to which Project Water may be delivered in accordance with Section 204 of the Reclamation Reform Act of October 12, 1982 (96 Stat. 1263), as amended, hereinafter referred to as RRA;

(h) "Excess Lands" shall mean all lands in excess of the limitations contained in Section 204 of the RRA, other than those lands exempt from acreage limitation under Federal Reclamation law;

(i) "Full Cost Rate" shall mean that water rate described in Sections 205(a)(3) or 202(3) of the RRA, whichever is applicable;

(j) "Ineligible Lands" shall mean all lands to which Project Water may not be delivered in accordance with Section 204 of the RRA;

(k) "Landholder" shall mean a party that directly or indirectly owns or leases nonexempt land, as provided in 43 CFR 426.2;

(l) "Project" shall mean the Central Valley Project owned by the United States and managed by the Department of the Interior, Bureau of Reclamation;

(m) "Project Water" shall mean all Surface Water diverted or scheduled to be diverted each month during the period April through October of each Year by the Contractor from the Sacramento River which is in excess of the Base Supply. The United States recognizes the right of the Contractor to make arrangements for acquisition of water from projects of others than the United States for delivery through the Sacramento River and tributaries subject to written agreement between Contractor and the United States as to identification of such water which water when so identified shall not be deemed Project Water under this Settlement Contract;

(n) "Rates" shall mean the payments for Project Water determined annually by the Contracting Officer in accordance with the then current applicable water ratesetting policies for the Project, as described in subdivision (a) of Article 8 of this Settlement Contract;

(o) "Secretary" or "Contracting Officer" shall mean the Secretary of the Interior, a duly appointed successor, or an authorized representative acting pursuant to any authority of the Secretary and through any agency of the Department of the Interior;

(p) "Surface Water" shall mean only those waters that are considered as surface water under California law;

(q) "Water Year" shall mean the period commencing with October 1 of one year and extending through September 30 of the next; and

(r) "Year" shall mean a calendar year.

TERM OF SETTLEMENT CONTRACT

2. (a) This Settlement Contract shall become effective April 1, 2005, and shall remain in effect until and including March 31, 2045; Provided, that under terms and conditions mutually agreeable to the parties hereto, renewals may be made for successive periods not to exceed 40 years each. The terms and conditions of each renewal shall be agreed upon not later than one year prior to the expiration of the then existing Settlement Contract.

(b) With respect to Project Water and the portions of this Settlement Contract pertaining thereto, upon written request by the Contractor of the Secretary made not later than one year prior to the expiration of this Settlement Contract, whenever, account being taken of the amount then credited to the costs of construction of water supply works, the remaining amount of construction costs of water supply work which is properly assignable for ultimate return by the Contractor as established by the Secretary of the Interior pursuant to (3) of Section 1 of Public Law 643 (70 Stat. 483), probably can be repaid to the United States within the term of a contract under subsection 9(d) of the 1939 Reclamation Project Act (53 Stat. 1187), the relevant portions of this Settlement Contract may be converted to a contract under said subsection 9(d) upon terms and conditions mutually agreeable to the United States and the Contractor. The Secretary shall make a determination ten years after the date of execution of this Settlement Contract, and every five years thereafter, of whether a conversion to a contract under said subsection 9(d) can be accomplished pursuant to Public Law 643. Notwithstanding any provision of this Settlement Contract, the Contractor reserves and shall have all rights and benefits under Public Law 643.

WATER TO BE FURNISHED TO CONTRACTOR

3. (a) Subject to the conditions, limitations, and provisions hereinafter expressed, the Contractor is hereby entitled and authorized to divert from the Sacramento River

at the locations shown in Exhibit A, for beneficial use within the area delineated on Exhibit B, (both Exhibits are attached hereto and made a part hereof), the Contract Total designated in Exhibit A, or any revision thereof, in accordance with the monthly operating schedule required by Article 3(c) of this Settlement Contract. The quantity of any water diverted under this Settlement Contract from the Sacramento River, during the period April through October, for use on any lands delineated on Exhibit B, by the owner of such lands or otherwise shall constitute a part of the Contract Total as shown on Exhibit A and shall be subject to all the provisions of this Settlement Contract relating to such Contract Total as if such diversion were made by the Contractor.

(b) The Contractor may have acquired rights to divert water from the Sacramento River during the period April through October, that were obtained after the date of execution of the Existing Contract, or the Contractor may acquire such rights in the future. All diversions made from the Sacramento River, pursuant to such rights, during the period April through October, shall not be considered a part of the quantity of Base Supply and Project Water specified in Exhibit A; Provided, that the quantities diverted pursuant to the above rights shall be identified on the schedule submitted pursuant to Article 3(c) below, and shall not be substituted for any Base Supply or Project Water; Provided, further, that any such identified quantities of other acquired rights may be diverted by the Contractor before incurring any fee pursuant to Article 3(c)(1), below.

(c) Before April 1 and before the first day of each month thereafter when a revision is needed, the Contractor shall submit a written schedule to the Contracting Officer indicating the Contract Total to be diverted by the Contractor for agricultural and municipal and industrial purposes during each month under this Settlement Contract. The United States shall

furnish water to the Contractor in accordance with the monthly operating schedule or any revisions thereof. However, the United States recognizes the need of the Contractor to change from time to time its monthly diversions of water from the quantities shown in Exhibit A; the Contractor may make such changes, provided:

(1) that for the quantity of Base Supply diverted in excess of the monthly quantity shown in Exhibit A, and as may be reduced in accordance with Article 5(a), during June, July, August, September, or October of any Water Year, the Contractor shall be charged a rescheduling fee equal to 50 percent of the sum of the storage operations and maintenance rate and the storage capital rate components of the Project ratesetting policy.

(2) that in no event shall the total quantity scheduled for diversion by the Contractor from the Sacramento River:

(i) During the period April through October exceed the aggregate of the Contract Total for that period shown in Exhibit A or any revision thereof;

(ii) During the period July through September exceed the aggregate of the Contract Total for that period shown in Exhibit A or any revision thereof.

(d) In the event conditions warrant, the Contracting Officer reserves the right to require the Contractor to submit, at least 72 hours prior to the beginning of each weekly period, its estimate of daily diversion requirements for each such period from the Sacramento River; Provided, however, that changes during any such period may be made upon the giving of 72 hours' notice thereof to the Contracting Officer.

(e) No sale, transfer, exchange, or other disposal of any of the Contract Total designated in Exhibit A or the right to the use thereof for use on land other than that shown on Exhibit B shall be made by the Contractor without first obtaining the written consent of the Contracting Officer. Such consent will not be unreasonably withheld and a decision will be rendered in a timely manner. For short-term actions that will occur within one year or less, the decision will be rendered within 30 days after receipt of a complete written proposal. For long-term actions that will occur in a period longer than one year, the decision will be rendered within 90 days after receipt of a complete written proposal. For a proposal to be deemed complete by the Contracting Officer, it must comply with all provisions required by State and Federal law, including information sufficient to enable the Contracting Officer to comply with the National Environmental Policy Act, the Endangered Species Act, and applicable rules or regulations then in effect; Provided, that such consent does not authorize the use of Federal facilities to facilitate or effectuate the sale, transfer, exchange, or other disposal of Base Supply. Such use of Federal facilities will be the subject of a separate agreement to be entered into between the Contractor and Reclamation.

(f) For the purpose of determining whether Section 3405(a)(1)(M) of the CVPIA applies to the Contractor as a transferor or transferee of Project Water, the Contracting Officer acknowledges that the Contractor is within a county, watershed, or other area of origin, as those terms are utilized under California law.

(g) Nothing herein contained shall prevent the Contractor from diverting water during the months of November through March for beneficial use on the land shown on Exhibit B or elsewhere to the extent authorized under the laws of the State of California.

(h) The United States assumes no responsibility for and neither it nor its officers, agents, or employees shall have any liability for or on account of:

(1) The quality of water to be diverted by the Contractor;

(2) The control, carriage, handling, use, disposal, or distribution of water diverted by the Contractor outside the facilities constructed and then being operated and maintained by or on behalf of the United States;

(3) Claims of damage of any nature whatsoever, including but not limited to, property loss or damage, personal injury, or death arising out of or connected with the control, carriage, handling, use, disposal, or distribution of said water outside of the hereinabove referred to facilities; and

(4) Any damage whether direct or indirect arising out of or in any manner caused by a shortage of water whether such shortage be on account of errors in operation, drought, or unavoidable causes.

(i) In addition to the provisions of subdivision (h) of Article 3 of this Contract, if there is a shortage of Project Water because of actions taken by the Contracting Officer to meet legal obligations then, except as provided in subdivision (a) of Article 30 of this Contract, no liability shall accrue against the United States or any of its officers, agents, or employees for any damage, direct or indirect, arising therefrom.

RETURN FLOW

4. Nothing herein shall be construed as an abandonment or a relinquishment by the United States of any right it may have to the use of waste, seepage, and return flow water derived from water diverted by the Contractor hereunder and which escapes or is discharged beyond the boundaries of the lands shown on Exhibit B; Provided, that this shall not be construed as

claiming for the United States any right to such water which is recovered by the Contractor pursuant to California law from within the boundaries of the lands shown on Exhibit B, and which is being used pursuant to this Settlement Contract for surface irrigation or underground storage for the benefit of the lands shown on Exhibit B by the Contractor.

CONSTRAINTS ON THE AVAILABILITY OF WATER

5. (a) In a Critical Year, the Contractor's Base Supply and Project Water agreed to be diverted during the period April through October of the Year in which the principal portion of the Critical Year occurs and, each monthly quantity of said period shall be reduced by 25 percent.

(b) The amount of any overpayment by the Contractor shall, at its option, be refunded or credited upon amounts to become due to the United States from the Contractor under the provisions hereof in the ensuing Year. To the extent of such deficiency such adjustment of overpayment shall constitute the sole remedy of the Contractor.

INTEGRATED WATER MANAGEMENT AND PARTNERSHIPS

6. The Contractor and United States desire to work together to maximize the reasonable beneficial use of water for their mutual benefit. As a consequence, the United States and the Contractor will work in partnership and with others within the Sacramento Valley, including other contractors, to facilitate the better integration within the Sacramento Valley of all water supplies including, but not limited to, the better management and integration of surface water and groundwater, the development and better utilization of surface water storage, the effective utilization of waste, seepage and return flow water, and other operational and management options that may be identified in the future.

USE OF WATER FURNISHED TO CONTRACTOR

7. (a) The parties anticipate that, during the term of this Settlement Contract, a gradual change in the purpose of use of water will occur within the place of water use shown in Exhibit B from predominantly agricultural purposes to a mixture of municipal and industrial, wildlife habitat and agricultural purposes, and the parties agree to work cooperatively to accommodate and facilitate such change. Project Water furnished to the Contractor pursuant to this Settlement Contract may be delivered or furnished by the Contractor for agricultural or municipal and industrial purposes; Provided, however, that the Contractor shall not deliver or furnish Project Water for municipal and industrial purposes outside those areas delineated on Exhibit B, as approved for such purposes by the Contracting Officer, without the written consent of the Contracting Officer. Such consent will not be unreasonably withheld and a decision will be provided in a timely manner following completion of any environmental review required under applicable law. For purposes of this Settlement Contract, "agricultural purposes" includes, but is not restricted to, the irrigation of crops, the watering of livestock, incidental domestic use including related landscape irrigation, and underground water replenishment; and "municipal and industrial purposes" includes, but is not limited to, the watering of landscaping or pasture for animals (e.g., horses) which are kept for personal enjoyment or water delivered to landholdings operated in units of less than five acres unless the Contractor establishes to the satisfaction of the Contracting Officer that the use of Project Water is for agricultural purposes.

(b) The Contractor shall comply with requirements applicable to the Contractor in biological opinion(s) prepared as a result of a consultation regarding the execution of this Settlement Contract undertaken pursuant to Section 7 of the Endangered Species Act of 1973, as amended, that are within the Contractor's legal authority to implement. The Existing

Contract, which evidences in excess of 40 years of diversions, for agricultural uses, of the quantities of water provided for in Article 3, and the underlying water rights of the Contractor will be considered in developing an appropriate base-line for the Biological Assessment prepared pursuant to the Endangered Species Act, and in any other needed environmental review. Nothing herein shall be construed to prevent the Contractor from challenging or seeking judicial relief in a court of competent jurisdiction with respect to any biological opinion or other environmental documentation referred to in this Article.

RATE AND METHOD OF PAYMENT FOR WATER

8. (a) The Contractor shall make payments to the United States as provided in this Article for all Project Water shown in Exhibit A as follows:

(1) 75 percent of the amount shown as Project Water shall be paid for by the Contractor in each Year; and in addition

(2) the Contractor shall pay for Project Water actually diverted in excess of 75 percent of the amount shown as Project Water.

Such payments shall be at Rates and Charges established in accordance with: (i) the Secretary's then-current ratesetting policies for the Project; and (ii) applicable Reclamation law and associated rules and regulations, or policies; Provided, that if the Contractor desires to use Project Water for other than agricultural purposes the Rates and Charges set forth above will be adjusted by the Contracting Officer to the applicable Rates and Charges for such purposes; Provided, further, that to enable the Contracting Officer to compute the applicable Rates and Charges for Project Water diverted by the Contractor for other than agricultural use, including, but not limited to diversions for municipal and industrial uses and diversions for direct application to wildlife habitat (not including re-use of tailwater for habitat purposes), prior to

initiating any such diversions, the Contractor shall provide the Contracting Officer with an estimate of the annual quantities of Project Water to be diverted or furnished for such purposes through the end of the CVP repayment period as identified in the then-current ratesetting policies. The Rates and Charges applicable to the Contractor upon execution of this Settlement Contract are set forth in Exhibit D, as may be revised annually. The Secretary's ratesetting policies for the Project shall be amended, modified, or superseded only through a public notice and comment procedure. The Contracting Officer shall adjust the amount of Project Water for which payment is required to the extent of any reduction in diversions of Project Water made in accordance with the water conservation provisions of Article 29(e).

(b) The Contracting Officer shall notify the Contractor of the Rates and Charges as follows:

(1) Prior to July 1 of each Year, the Contracting Officer shall provide the Contractor an estimate of the Charges for Project Water that will be applied to the period October 1, of the current Year, through September 30, of the following Year, and the basis for such estimate. The Contractor shall be allowed not less than two months to review and comment on such estimates. On or before September 15 of each Year, the Contracting Officer shall notify the Contractor in writing of the Charges to be in effect during the period October 1 of the current Year, through September 30, of the following Year, and such notification shall revise Exhibit D.

(2) Prior to October 1 of each Year, the Contracting Officer shall make available to the Contractor an estimate of the Rates for Project Water for the following Year and the computations and cost allocations upon which those Rates are based. The Contractor shall be allowed not less than two months to review and comment on such computations and cost allocations. By December 31 of each Year, the Contracting Officer shall provide the Contractor

with the final Rates to be in effect for the upcoming Year, and such notification shall revise Exhibit D.

(c) The Contractor shall pay the United States for Project Water in the following manner:

(1) With respect to Rates, prior to May 1 of each Year, the Contractor shall pay the United States one-half the total amount payable pursuant to subdivision (a) of this Article and the remainder shall be paid prior to July 1 or such later date or dates as may be specified by the United States in a written notice to the Contractor; Provided, however, that if at any time during the Year the amount of Project Water diverted by the Contractor shall equal the amount for which payment has been made, the Contractor shall pay for the remaining amount of such water as shown in Exhibit A in advance of any further diversion of Project Water.

(2) With respect to Charges, the Contractor shall also make a payment to the United States, in addition to the Rate(s) in subdivision (c)(1) of this Article, at the Charges then in effect, before the end of the month following the month of delivery or transfer. The payments shall be consistent with the quantities of Project Water delivered or transferred. Adjustment for overpayment or underpayment of Charges shall be made through the adjustment of payments due to the United States for Charges for the next month. Any amount to be paid for past due payment of Charges shall be computed pursuant to Article 13 of this Settlement Contract.

(d) Payments to be made by the Contractor to the United States under this Settlement Contract may be paid from any revenues available to the Contractor. All revenues received by the United States from the Contractor relating to the delivery of Project Water or the delivery of non-Project Water through Project facilities shall be allocated and applied in

accordance with Federal Reclamation law and the associated rules or regulations, and the then current Project ratesetting policies for irrigation water.

(e) The Contracting Officer shall keep its accounts pertaining to the administration of the financial terms and conditions of its long-term water service and Settlement Contracts, in accordance with applicable Federal standards, so as to reflect the application of Project costs and revenues. The Contracting Officer shall, each Year upon request of the Contractor, provide to the Contractor a detailed accounting of all Project and Contractor expense allocations, the disposition of all Project and Contractor revenues, and a summary of all water delivery information. The Contracting Officer and the Contractor shall enter into good faith negotiations to resolve any discrepancies or disputes relating to accountings, reports, or information.

(f) The parties acknowledge and agree that the efficient administration of this Settlement Contract is their mutual goal. Recognizing that experience has demonstrated that mechanisms, policies, and procedures used for establishing Rates and Charges and/or for making and allocating payments, other than those set forth in this Article may be in the mutual best interest of the parties, it is expressly agreed that the parties may enter into agreements to modify the mechanisms, policies, and procedures for any of those purposes while this Settlement Contract is in effect without amendment of this Settlement Contract.

(g) For the term of this Settlement Contract, Rates under the respective ratesetting policies for the Project will be established to recover only reimbursable operation and maintenance (including any deficits) and capital costs of the Project, as those terms are used in the then current Project ratesetting policies, and interest, where appropriate, except in instances where a minimum Rate is applicable in accordance with the relevant Project ratesetting policy.

Proposed changes of significance in practices which implement the ratesetting policies for the Project will not be implemented until the Contracting Officer has provided the Contractor an opportunity to discuss the nature, need, and impact of the proposed change. The Contractor retains all rights to challenge the validity of Rates and Charges imposed pursuant to this Settlement Contract, including but not limited to operation and maintenance expenses and operation and maintenance deficits, in an appropriate administrative or judicial proceeding.

(h) Except as provided in subsection 3405(a)(1)(B) of the CVPIA, the Rates for Project Water transferred, exchanged, or otherwise disposed of, by the Contractor shall be the Contractor's Rates adjusted upward or downward to reflect the changed costs of delivery (if any) of the transferred, exchanged, or otherwise disposed of Project Water to the transferee's point of delivery in accordance with the then-current ratesetting policies for the Project. Except as provided in subsection 3407(d)(2)(A) of the CVPIA, the Charges for Project Water transferred, exchanged, or otherwise disposed of, by the Contractor shall be the Contractor's Charges specified in Exhibit D. If the Contractor is receiving lower Rates and Charges because of inability to pay and is transferring, exchanging, or otherwise disposing of Project Water to another entity whose Rates and Charges are not adjusted due to inability to pay, the Rates and Charges for transferred, exchanged, or otherwise disposed of Project Water shall be the Contractor's Rates and Charges unadjusted for ability to pay.

(i) Pursuant to the Act of October 27, 1986 (100 Stat. 3050), the Contracting Officer is authorized to adjust determinations of ability to pay every five years.

(j) Each payment to be made pursuant to subdivisions (a) and (c) of this Article shall be made at the office of the Bureau of Reclamation, MP Region: Mid-Pacific,

P.O. Box 894242, Los Angeles, CA 90189-4242, or at such other place as the United States may designate in a written notice to the said Contractor. Payments shall be made by cash transaction, wire, or any other mechanism as may be agreed to in writing by the Contractor and the Contracting Officer. In the event there should be a default in the payment of the amount due, the delinquent payment provisions of Article 13 shall apply. The Contractor shall not be relieved of the whole or any part of its said obligation by, on account of, or notwithstanding, as the case may be:

(1) Its failure, refusal, or neglect to divert 75 percent of the quantity of Project Water shown on Exhibit A;

(2) The default in payment to it by any water user of assessments, tolls, or other charges levied by or owing to said Contractor;

(3) Any judicial determination that any assessment, toll, or other charge referred to in subsection 8(c)(2) of this Settlement Contract is irregular, void, or ineffectual; or

(4) Any injunctive process enjoining or restraining the Contractor from making or collecting any such assessment, toll, or other charge referred to in subsection 8(c)(2) of this Settlement Contract.

AGREEMENT ON WATER QUANTITIES

9. (a) During the term of this Settlement Contract and any renewals thereof:

(1) It shall constitute full agreement as between the United States and the Contractor as to the quantities of water and the allocation thereof between Base Supply and Project Water which may be diverted by the Contractor from the Sacramento River for beneficial use on the land shown on Exhibit B from April 1 through October 31, which said diversion, use,

and allocation shall not be disturbed so long as the Contractor shall fulfill all of its obligations hereunder;

(2) Neither party shall claim any right against the other in conflict with the provisions of Article 9(a)(1) hereof.

(b) Nothing herein contained is intended to or does limit rights of the Contractor against others than the United States or of the United States against any person other than the Contractor; Provided, however, that in the event the Contractor, the United States, or any other person shall become a party to a general adjudication of rights to the use of water of the Sacramento River system, this Settlement Contract shall not jeopardize the rights or position of either party hereto or of any other person and the rights of all such persons in respect to the use of such water shall be determined in such proceedings the same as if this Settlement Contract had not been entered into, and if final judgment in any such general adjudication shall determine that the rights of the parties hereto are different from the rights as assumed herein, the parties shall negotiate an amendment to give effect to such judgment. In the event the parties are unable to agree on an appropriate amendment they shall, within 60 days of determining that there is an impasse, employ the services of a neutral mediator, experienced in resolving water rights disputes, to assist in resolving the impasse. The cost of the mediation will be shared equally. A failure to reach agreement on an amendment within 60 days of the end of mediation will cause the immediate termination of this Settlement Contract.

(c) In the event that the California State Water Resources Control Board or a court of competent jurisdiction issues a final decision or order modifying the terms and conditions of the water rights of either party to this Settlement Contract in order to impose Bay-Delta water quality obligations, the Contractor and the United States shall promptly meet to

455 determine whether or not to modify any of the terms of this Settlement Contract to comply with
456 the final decision or order, including, but not limited to, the applicability of the rescheduling
457 charge in Article 3(c)(1) of this Settlement Contract. If within 60 days of the date of the issuance
458 of the final decision or order the parties are not able to reach agreement regarding either the need
459 to modify this Settlement Contract or the manner in which this Settlement Contract is to be
460 modified, the parties shall promptly retain a neutral mediator, experienced in resolving water
461 right disputes, to assist the parties in resolving their dispute. The cost of the mediator shall be
462 shared equally. In the event that either of the parties to this Settlement Contract determines that
463 the parties will not be able to develop mutually-agreeable modification(s) to this Settlement
464 Contract even with the assistance of a mediator, either of the parties to this Settlement Contract
465 may attempt to resolve the impasse by seeking appropriate judicial relief including, but not
466 limited to, filing a general adjudication of the rights to the use of water in the Sacramento River
467 system. The foregoing provisions of this sub-article shall only apply to the incremental
468 obligations contained within a final decision or order of the State Water Resources Control
469 Board that reflects a modification to the obligations imposed in State Water Resources Control
470 Board Revised Water Rights Decision 1641 dated March 15, 2000, and its associated 1995 Water
471 Quality Control Plan which, taken together, will be considered the baseline for the application of
472 the provisions of this sub-article.

473 (d) In the event this Settlement Contract terminates, the rights of the parties to
474 thereafter divert and use water shall exist as if this Settlement Contract had not been entered into;
475 and the fact that as a compromise settlement of a controversy as to the respective rights of the
476 parties to divert and use water and the yield of such rights during the term hereof, this Settlement
477 Contract places a limit on the Contract Total to be diverted annually by the Contractor during the

Settlement Contract term and segregates it into Base Supply and Project Water shall not jeopardize the rights or position of either party with respect to its water rights or the yield thereof at all times after the Settlement Contract terminates. It is further agreed that the Contractor at all times will first use water to the use of which it is entitled by virtue of its own water rights, and neither the provisions of this Settlement Contract, action taken thereunder, nor payments made thereunder to the United States by the Contractor shall be construed as an admission that any part of the water used by the Contractor during the term of this Settlement Contract was in fact water to which it would not have been entitled under water rights owned by it nor shall receipt of payments thereunder by the United States from the Contractor be construed as an admission that any part of the water used by the Contractor during the term of this Settlement Contract was in fact water to which it would have been entitled under water rights owned by it.

MEASUREMENT OF WATER

10. (a) All water diverted by the Contractor from the Sacramento River will be diverted at the existing point or points of diversion shown on Exhibit A or at such other points as may be mutually agreed upon in writing by the Contracting Officer and the Contractor.

(b) All water diverted from the Sacramento River pursuant to this Settlement Contract will be measured or caused to be measured by the United States at each point of diversion with existing equipment or equipment to be installed, operated, and maintained by the United States, and/or others, under contract with and at the option of the United States. The equipment and methods used to make such measurement shall be in accordance with sound engineering practices. Upon request of the Contractor, the accuracy of such measurements will be investigated by the Contracting Officer and any errors appearing therein will be corrected.

(c) The right of ingress to and egress from all points of diversion is hereby granted to all authorized employees of the United States. The Contractor also hereby grants to the United States the right to install, operate, maintain, and replace such equipment on diversion or carriage facilities at each point of diversion as the Contracting Officer deems necessary.

(d) The Contractor shall not modify, alter, remove, or replace diversion facilities or do any other act which would alter the effectiveness or accuracy of the measuring equipment installed by the United States or its representatives unless and until the Contracting Officer has been notified with due diligence and has been given an opportunity to modify such measuring equipment in such manner as may be necessary or appropriate. In the event of an emergency the Contractor shall notify the United States within a reasonable time thereafter as to the existence of the emergency and the nature and extent of such modification, alteration, removal, or replacement of diversion facilities.

(e) The Contractor shall pay the United States for the costs to repair, relocate, or replace measurement equipment when the Contractor modifies, alters, removes, or replaces diversion or carriage facilities.

(f) Contractor and Contracting Officer shall develop a mutually agreeable surface water delivery water measurement program which shall be implemented by the Contractor, and such measurement program shall be consistent with the conservation and efficiency criteria for evaluating water conservation plans as provided in Article 29(a).

(g) All new surface water delivery systems installed within the lands delineated on Exhibit B after the effective date of this Settlement Contract shall also comply with the measurement provisions described in this Article.

(h) The Contractor shall inform the Contracting Officer on or before the 10th calendar day of each month of the quantity of Contract Total diverted or furnished for agricultural and municipal and industrial purposes during the preceding month.

RULES AND REGULATIONS

11. The parties agree that the delivery of Project Water for irrigation use or use of Federal facilities pursuant to this Settlement Contract is subject to Federal Reclamation law, including but not limited to, the Reclamation Reform Act of 1982 (43 U.S.C. 390aa et seq.), as amended and supplemented, and the rules and regulations promulgated by the Secretary of the Interior under Federal Reclamation law.

GENERAL OBLIGATION--BENEFITS CONDITIONED UPON PAYMENT

12. (a) The obligation of the Contractor to pay the United States as provided in this Settlement Contract is a general obligation of the Contractor notwithstanding the manner in which the obligation may be distributed among the Contractor's water users and notwithstanding the default of individual water users in their obligations to the Contractor.

(b) The payment of Charges becoming due hereunder is a condition precedent to receiving benefits under this Settlement Contract. The United States shall not make water available to the Contractor through Project facilities during any period in which the Contractor may be in arrears in the advance payment of water Rates due the United States. The Contractor shall not furnish water made available pursuant to this Settlement Contract for lands or parties which are in arrears in the advance payment of water rates levied or established by the Contractor.

(c) With respect to subdivision (b) of this Article, the Contractor shall have no obligation to require advance payment for water Rates which it levies.

CHARGES FOR DELINQUENT PAYMENTS

13. (a) The Contractor shall be subject to interest, administrative and penalty charges on delinquent installments or payments. When a payment is not received by the due date, the Contractor shall pay an interest charge for each day the payment is delinquent beyond the due date. When a payment becomes 60 days delinquent, the Contractor shall pay an administrative charge to cover additional costs of billing and processing the delinquent payment. When a payment is delinquent 90 days or more, the Contractor shall pay an additional penalty charge of six percent per year for each day the payment is delinquent beyond the due date.

Further, the Contractor shall pay any fees incurred for debt collection services associated with a delinquent payment.

(b) The interest charge rate shall be the greater of the rate prescribed quarterly in the Federal Register by the Department of the Treasury for application to overdue payments, or the interest rate of one-half of one percent per month prescribed by Section 6 of the Reclamation Project Act of 1939 (Public Law 76-260). The interest charge rate shall be determined as of the due date and remain fixed for the duration of the delinquent period.

(c) When a partial payment on a delinquent account is received, the amount received shall be applied, first to the penalty, second to the administrative charges, third to the accrued interest, and finally to the overdue payment.

QUALITY OF WATER

14. The operation and maintenance of Project facilities shall be performed in such manner as is practicable to maintain the quality of raw water made available through such facilities at the highest level reasonably attainable as determined by the Contracting Officer. The United States does not warrant the quality of water and is under no obligation to construct or furnish water treatment facilities to maintain or better the quality of water.

WATER AND AIR POLLUTION CONTROL

15. The Contractor, in carrying out this Settlement Contract, shall comply with all applicable water and air pollution laws and regulations of the United States and the State of California, and shall obtain all required permits or licenses from the appropriate Federal, State, or local authorities.

EQUAL OPPORTUNITY

16. During the performance of this Settlement Contract, the Contractor agrees as follows:

(a) The Contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. The Contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, or national origin. Such action shall include, but not be limited to, the following: Employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination, rates of payment or other

forms of compensation; and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices to be provided by the Contracting Officer setting forth the provisions of this nondiscrimination clause.

(b) The Contractor will, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment without discrimination because of race, color, religion, sex, or national origin.

(c) The Contractor will send to each labor union or representative of workers with which it has a collective bargaining agreement or other contract or understanding, a notice, to be provided by the Contracting Officer, advising the said labor union or workers' representative of the Contractor's commitments under Section 202 of Executive Order No. 11246 of September 24, 1965, as amended, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

(d) The Contractor will comply with all provisions of Executive Order No. 11246 of September 24, 1965, as amended, and of the rules, regulations, and relevant orders of the Secretary of Labor.

(e) The Contractor will furnish all information and reports required by said amended Executive Order and by the rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to its books, records, and accounts by the Contracting Officer and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

(f) In the event of the Contractor's noncompliance with the nondiscrimination clauses of this Settlement Contract or with any of the said rules, regulations, or orders, this Settlement Contract may be canceled, terminated, or suspended, in whole or in part, and the Contractor may be declared ineligible for further Government contracts in accordance with procedures authorized in said amended Executive Order, and such other sanctions may be imposed and remedies invoked as provided in said Executive Order, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

(g) The Contractor will include the provisions of paragraphs (a) through (g) in every subcontract or purchase order unless exempted by the rules, regulations, or orders of the Secretary of Labor issued pursuant to Section 204 of said amended Executive Order, so that such provisions will be binding upon each subcontractor or vendor. The Contractor will take such action with respect to any subcontract or purchase order as may be directed by the Secretary of Labor as a means of enforcing such provisions, including sanctions for noncompliance: Provided, however, that in the event the Contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction, the Contractor may request the United States to enter into such litigation to protect the interests of the United States.

COMPLIANCE WITH CIVIL RIGHTS LAWS AND REGULATIONS

17. (a) The Contractor shall comply with Title VI of the Civil Rights Act of 1964 (42 U.S.C. 2000d), Section 504 of the Rehabilitation Act of 1975 (P.L. 93-112, as amended), the Age Discrimination Act of 1975 (42 U.S.C. 6101, et seq.) and any other applicable civil rights laws, as well as with their respective implementing regulations and guidelines imposed by the U.S. Department of the Interior and/or Bureau of Reclamation.

(b) These statutes require that no person in the United States shall, on the grounds of race, color, national origin, handicap, or age, be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination under any program or activity receiving financial assistance from the Bureau of Reclamation. By executing this Settlement Contract, the Contractor agrees to immediately take any measures necessary to implement this obligation, including permitting officials of the United States to inspect premises, programs, and documents.

(c) The Contractor makes this agreement in consideration of and for the purpose of obtaining any and all Federal grants, loans, contracts, property discounts, or other Federal financial assistance extended after the date hereof to the Contractor by the Bureau of Reclamation, including installment payments after such date on account of arrangements for Federal financial assistance which were approved before such date. The Contractor recognizes and agrees that such Federal assistance will be extended in reliance on the representations and agreements made in this Article, and that the United States reserves the right to seek judicial enforcement thereof.

MINGLING OF CONTRACTOR'S PROJECT AND NON-PROJECT WATER

18. (a) Project Water must of necessity be transported by the Contractor to its water users by means of the same works and channels used for the transport of its non-Project Water including Base Supply. Notwithstanding such mingling of water, the provisions of Article 11 hereof shall be applicable only to Project Water, and such mingling of water shall not in any manner subject to the provisions of Article 11 hereof the Contractor's non-Project Water including Base Supply.

(b) If required in accordance with subdivision (c) of this Article, the Contractor shall install and maintain such measuring equipment and distribution facilities and maintain such records as may be necessary to determine the amounts of water delivered to Excess Lands served by the Contractor. The Contractor shall not within any month deliver to

Ineligible Lands water in excess of the non-Project Water, including Base Supply, for that month. The Contracting Officer or authorized representative shall have the right at all reasonable times to inspect such records and measuring equipment.

(c) The Contractor will not be considered in violation of the requirement that Project Water be delivered only to Eligible Lands during any month of the irrigation season that the water requirement for beneficial use on Eligible Lands for that month is equal to or in excess of the Project Water for that month as shown on Exhibit A or any revision thereof pursuant to subdivision (c) of Article 3. The water requirement for beneficial use on Eligible Lands will be determined by multiplying:

(1) the number of irrigable acres of the particular types of crops grown in that year on the acreage designated as eligible by

(2) the Unit Duties as set forth in Exhibit C attached hereto and made a part hereof, or by such other Unit Duties mutually agreed upon by the Contractor and the Contracting Officer. In order to make the computation of the water requirement for Eligible Lands, on April 1 of each Year and concurrently with its order for water for the irrigation season, the Contractor shall designate the acreage of and type of crops to be grown on its Eligible Lands that irrigation season. During any month the water requirement as above determined for crops growing on Eligible Lands during such month is equal to or in excess of the Project Water for that month as provided herein the Contractor shall not be required to measure the water delivered to Excess Lands. Any month the said water requirement is less than the amount of Project Water as provided herein, the Contractor will be required to measure water delivered to excess land in accordance with subdivision (b) hereof.

BOOKS, RECORDS, AND REPORTS

19. The Contractor shall establish and maintain accounts and other books and records pertaining to administration of the terms and conditions of this Settlement Contract, including: the Contractor's financial transactions, water supply data, and Project land and right-of-way agreements; the water users' land-use (crop census), land ownership, land-leasing and water use data; and other matters that the Contracting Officer may require. Reports thereon shall be furnished to the Contracting Officer in such form and on such date or dates as the Contracting Officer may require. Subject to applicable Federal laws and regulations, each party to this Settlement Contract shall have the right during office hours to examine and make copies of each other's books and official records relating to matters covered by this Settlement Contract.

CHANGE OF PLACE OF USE OR ORGANIZATION

20. (a) Unless the written consent of the United States is first obtained no change shall be made in the place of water use shown on Exhibit B.

(b) While this Settlement Contract is in effect, no change shall be made in the area of the Contractor as shown on its Exhibit B, by inclusion, exclusion, annexation, or detachment of lands, by dissolution, consolidation, or merger or otherwise, except upon the Contracting Officer's written consent thereto. Such consent will not be unreasonably withheld and a decision will be provided in a timely manner.

(c) In the event lands are annexed to or detached from the area of the Contractor, as provided herein, the quantity of Project Water to be diverted may be increased or decreased, as may be appropriate, pursuant to a supplemental agreement to be executed in respect thereto.

CONSOLIDATION OF CONTRACTING ENTITIES

21. Consolidation of Contractors may be approved by the Contracting Officer provided: (i) the Contracting Officer approves the form and organization of the resulting entity and the utilization by it of the Contract Total; and (ii) the obligations of the Contractors are assumed by such entity.

No such consolidation shall be valid unless and until approved by the Contracting Officer.

NOTICES

22. Any notice, demand, or request authorized or required by this Settlement Contract shall be deemed to have been given, on behalf of the Contractor, when mailed, postage prepaid, or delivered to the Area Manager, Northern California Area Office, Bureau of Reclamation, 16349 Shasta Dam Boulevard, Shasta Lake, California 96019, and on behalf of the United States, when mailed, postage prepaid, or delivered to the Board of Directors of the Natomas Central Mutual Water Company, 2601 West Elkhorn Boulevard, Rio Linda, California 95673. The designation of the addressee or the address may be changed by notice given in the same manner as provided in this Article for other notices.

ASSIGNMENT LIMITED--SUCCESSORS AND ASSIGNS OBLIGATED

23. (a) The provisions of this Settlement Contract shall apply to and bind the successors and assigns of the parties hereto, but no assignment or transfer of this Settlement Contract or any right or interest therein shall be valid until approved in writing by the Contracting Officer.

(b) The assignment of any right or interest in this Settlement Contract by either party shall not interfere with the rights or obligations of the other party to this Settlement Contract absent the written concurrence of said other party.

(c) The Contracting Officer shall not unreasonably condition or withhold his approval of any proposed assignment.

OFFICIALS NOT TO BENEFIT

24. (a) No Member of or Delegate to Congress, Resident Commissioner, or official of the Contractor shall benefit from this Settlement Contract other than as a water user or landowner in the same manner as other water users or landowners.

(b) No officer or member of the governing board of the Contractor shall receive any benefit that may arise by reason of this Settlement Contract other than as a landowner within the Contractor's Service Area and in the same manner as other landowners within the said service area.

CONTINGENT UPON APPROPRIATION OR ALLOTMENT OF FUNDS

25. The expenditure or advance of any money or the performance of any obligation of the United States under this Settlement Contract shall be contingent upon appropriation or allotment of funds. Absence of appropriation or allotment of funds shall not relieve the Contractor from any obligations under this Settlement Contract. No liability shall accrue to the United States in case funds are not appropriated or allotted.

CONFIRMATION OF SETTLEMENT CONTRACT

26. The Contractor, after the execution of this Settlement Contract, shall promptly seek to secure a decree of a court of competent jurisdiction of the State of California, if appropriate, confirming the execution of this Settlement Contract. The Contractor shall furnish the United States a certified copy of the final decree, the validation proceedings, and all pertinent supporting records of the court approving and confirming this Settlement Contract, and decreeing and adjudging it to be lawful, valid, and binding on the Contractor. This Settlement Contract shall not be binding on the United States until such final decree has been secured.

UNAVOIDABLE GROUNDWATER PERCOLATION

27. To the extent applicable, the Contractor shall not be deemed to have delivered Project Water to Excess Lands or Ineligible Lands if such lands are irrigated with groundwater that reaches the underground strata as an unavoidable result of the delivery of Project Water by the Contractor to Eligible Lands.

PRIVACY ACT COMPLIANCE

28. (a) The Contractor shall comply with the Privacy Act of 1974 (5 U.S.C. 552a) (the Act) and the Department of the Interior rules and regulations under the Act (43 CFR 2.45 et seq.) in maintaining Landholder acreage certification and reporting records, required to be submitted to the Contractor for compliance with Sections 206 and 228 of the Reclamation Reform Act of 1982 (96 Stat. 1266), and pursuant to 43 CFR 426.18.

(b) With respect to the application and administration of the criminal penalty provisions of the Act (5 U.S.C. 552a(i)), the Contractor and the Contractor's employees responsible for maintaining the certification and reporting records referenced in (a) above are considered to be employees of the Department of the Interior. See 5 U.S.C. 552a(m).

(c) The Contracting Officer or a designated representative shall provide the Contractor with current copies of the Interior Department Privacy Act regulations and the Bureau of Reclamation Federal Register Privacy Act System of Records Notice (Acreage Limitation--Interior, Reclamation-31) which govern the maintenance, safeguarding, and disclosure of information contained in the Landholder's certification and reporting records.

(d) The Contracting Officer shall designate a full-time employee of the Bureau of Reclamation to be the System Manager who shall be responsible for making decisions on denials pursuant to 43 CFR 2.61 and 2.64 amendment requests pursuant to 43 CFR 2.72. The Contractor is authorized to grant requests by individuals for access to their own records.

(e) The Contractor shall forward promptly to the System Manager each proposed denial of access under 43 CFR 2.64; and each request for amendment of records filed under 43 CFR 2.71; notify the requester accordingly of such referral; and provide the System Manager with information and records necessary to prepare an appropriate response to the requester. These requirements do not apply to individuals seeking access to their own certification and reporting forms filed with the Contractor pursuant to 43 CFR 426.18, unless the requester elects to cite the Privacy Act as a basis for the request.

WATER CONSERVATION

29. (a) Prior to the diversion of Project Water, the Contractor shall be implementing an effective water conservation and efficiency program based on the Basin-Wide Water Management Plan and/or Contractor's water conservation plan that has been determined by the Contracting Officer to meet the conservation and efficiency criteria for evaluating water conservation plans established under Federal law. The water conservation and efficiency program shall contain definite water conservation objectives, appropriate economically feasible water conservation measures, and time schedules for meeting those objectives. Continued diversion of Project Water pursuant to this Settlement Contract shall be contingent upon the Contractor's continued implementation of such water conservation program. In the event the Contractor's water conservation plan or any revised water conservation plan completed pursuant to subdivision (c) of Article 29 of this Settlement Contract have not yet been determined by the Contracting Officer to meet such criteria, due to circumstances which the Contracting Officer determines are beyond the control of the Contractor, Project Water deliveries shall be made under this Settlement Contract so long as the Contractor diligently works with the Contracting Officer to obtain such determination at the earliest practicable date, and thereafter the Contractor

immediately begins implementing its water conservation and efficiency program in accordance with the time schedules therein.

(b) The Contractor shall submit to the Contracting Officer a report on the status of its implementation of the water conservation plan on the reporting dates specified in the then existing conservation and efficiency criteria established under Federal law.

(c) At five-year intervals, the Contractor shall revise its water conservation plan to reflect the then current conservation and efficiency criteria for evaluating water conservation plans established under Federal law and submit such revised water management plan to the Contracting Officer for review and evaluation. The Contracting Officer will then determine if the water conservation plan meets Reclamation's then current conservation and efficiency criteria for evaluating water conservation plans established under Federal law.

(d) If the Contractor is engaged in direct groundwater recharge, such activity shall be described in the Contractor's water conservation plan.

(e) In order to provide incentives for water conservation, the Contractor may reduce the amount of Project Water for which payment is required under Article 8(a) in accordance with the provisions of this Article 29(e).

(1) On or before February 15 of any Water Year, the Contractor may file with Reclamation an offer to reduce Project Water use, hereinafter referred to as Offer. The Offer shall specify the maximum quantity of Project Water to be diverted by the Contractor for each month that Project Water is available for that Water Year under this Settlement Contract. The Contracting Officer shall provide the Contractor with a decision, in writing, to the Offer on or before March 15 of that Water Year. The dates specified in this Article 29(e)(1) can be changed if mutually agreed to, in writing, by the Contractor and Contracting Officer.

(2) If Reclamation accepts the Offer, the Contractor's payment obligation under Article 8(a)(1) shall be reduced to the maximum quantity of Project Water to be diverted by the Contractor as specified in the Offer. The Contractor shall not divert Project Water in excess of the quantities set forth in the Offer; Provided, however, if the Contractor's diversions of Project Water exceed the quantities set forth in the Offer, the Contractor shall pay to Reclamation the applicable Rates and Charges plus an amount equal to the applicable Rates and Charges, unadjusted for ability to pay, for each acre-foot of Project Water diverted in excess of the quantities set forth in the Offer.

(3) If Reclamation decides not to accept the Offer, the Contractor's payment obligation will remain as specified in Article 8(a)(1).

(4) The provisions of this Article 29(e) shall be in addition to and shall not affect the provisions of Article 3(e) pertaining to the sale, transfer, exchange, or other disposal of the Contract Total designated in Exhibit A.

OPINIONS AND DETERMINATIONS

30. (a) Where the terms of this Settlement Contract provide for actions to be based upon the opinion or determination of either party to this Settlement Contract, said terms shall not be construed as permitting such action to be predicated upon arbitrary, capricious, or unreasonable opinions or determinations. Both parties, notwithstanding any other provisions of this Settlement Contract, expressly reserve the right to seek relief from and appropriate adjustment for any such arbitrary, capricious, or unreasonable opinion or determination. Each opinion or determination by either party shall be provided in a timely manner. Nothing in subdivision (a) of Article 30 of this Settlement Contract is intended to or shall affect or alter the

standard of judicial review applicable under Federal law to any opinion or determination implementing a specific provision of Federal law embodied in statute or regulation.

(b) The Contracting Officer shall have the right to make determinations necessary to administer this Settlement Contract that are consistent with the provisions of this Settlement Contract, the laws of the United States and of the State of California, and the rules and regulations promulgated by the Secretary of the Interior. Such determinations shall be made in consultation with the Contractor to the extent reasonably practicable.

CONTRACTOR TO PAY CERTAIN MISCELLANEOUS COSTS

31. (a) In addition to all other payments to be made by the Contractor pursuant to this Settlement Contract, the Contractor shall pay to the United States, within 60 days after receipt of a bill and detailed statement submitted by the Contracting Officer to the Contractor for such specific items of direct cost incurred by the United States for work requested by the Contractor associated with this Settlement Contract plus indirect costs in accordance with applicable Bureau of Reclamation policies and procedures. All such amounts referred to in this Article shall not exceed the amount agreed to in writing in advance by the Contractor. This Article shall not apply to costs for routine contract administration.

(b) All advances for miscellaneous costs incurred for work requested by the Contractor pursuant to Article 31 of this Settlement Contract shall be adjusted to reflect the actual costs when the work has been completed. If the advances exceed the actual costs incurred, the difference will be refunded to the Contractor. If the actual costs exceed the Contractor's advances, the Contractor will be billed for the additional costs pursuant to Article 31 of this Settlement Contract.

WAIVER OF DEFAULT

32. The waiver by either party to this Settlement Contract as to any default shall not be construed as a waiver of any other default or as authority of the other party to continue such default or to make, do, or perform, or not to make, do, or perform, as the case may be, any act or thing which would constitute a default.

IN WITNESS WHEREOF, the parties hereto have executed this Settlement Contract as of the day and year first hereinabove written.

THE UNITED STATES OF AMERICA

APPROVED AS TO LEGAL FORM AND SUFFICIENCY
OFFICE OF REGIONAL SOLICITOR
DEPARTMENT OF THE INTERIOR

By: _____
Regional Director, Mid-Pacific Region
Bureau of Reclamation

(SEAL)

NATOMAS CENTRAL MUTUAL WATER COMPANY

By: _____
President

ATTEST:

_____
Secretary

(H:\public\Sac River Final LTRC's\2005-01-31 Natomas Central MWC Final Draft Contract with exhibits.doc)

Exhibit A

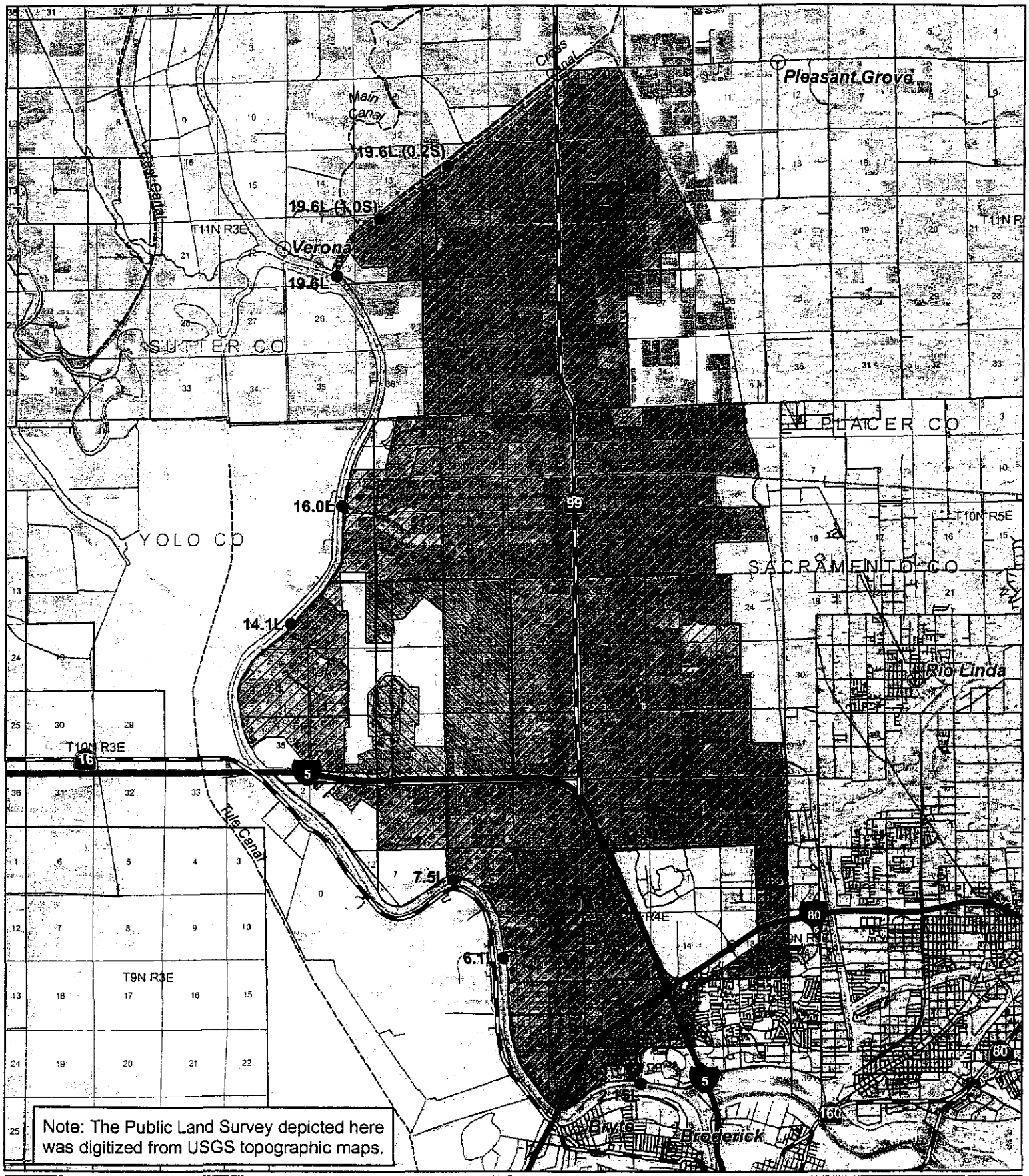
NATOMAS CENTRAL MUTUAL WATER COMPANY
Sacramento River

SCHEDULE OF MONTHLY DIVERSIONS OF WATER

	Base Supply (acre-feet)	Project Water (acre-feet)	Contract Total (acre-feet)
April	14,000	0	14,000
May	27,700	0	27,700
June	23,000	0	23,000
July	11,500	7,200	18,700
August	3,900	14,800	18,700
September	16,100	0	16,100
October	2,000	0	2,000
Total	98,200	22,000	120,200

Points of Diversion: 2.15L, 6.1L, 7.5L, 14.1L, 16.0L, 19.6L (Cross Canal 1.0S & 2.0S)

Dated: 01-31-2005



Natomas Central Mutual Water Co.

Contract No. 14-06-200-885A-R-1

Exhibit B

- Contractor's Service Area - Ag Only
- Contractor's Service Area - Ag and/or M&I
- District Boundary
- Point of Diversion

N

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

Miles
0 0.5 1 2 3

Date: 3/7/05, Revised 4/11/05
File Name: N:\districts\contracts\natomas_central\natomas_central.mxd

725-202-35

Exhibit C

NATOMAS CENTRAL MUTUAL WATER COMPANY
Sacramento River

UNIT DUTY

(In Acre-Feet Per Acre)

	Rice	Alfalfa and Irrigated Pasture	General Crops
June	1.70	0.80	0.60
July	1.80	1.00	0.70
August	1.70	0.80	0.70
September	0.50	0.60	0.40

Dated: 01-31-2005

Exhibit D

NATOMAS CENTRAL MUTUAL WATER COMPANY
Sacramento River
2005 Water Rates and Charges per Acre-Foot

	Cost of Service		Calculated Payment Capacity 1/
	Irrigation	M&I	Irrigation
COST OF SERVICE RATES:			
Capital Rate			
Storage	$4.57	$9.70	$0.00
O&M Rates:			
Water Marketing	$6.61	$3.89	$6.61
Storage	$5.93	$6.67	$5.93
Deficit Rates:			
Interest Bearing	$0.00	$0.00	$0.00
CFO/PFR Adjustment Rate 2/	$0.00	$0.00	$0.00
TOTAL	$17.11	$20.26	$12.54
RESCHEDULING FEE:	$5.59	$8.19	$5.59
FULL-COST RATES:			
Section 202(3) Rate is applicable to a Qualified Recipient or to a Limited Recipient receiving irrigation water on or before October 1, 1981.	$21.47	N/A	$21.47
Section 205(a)(3) Rate is applicable to a Limited Recipient that did not receive irrigation water on or before October 1, 1981.	$23.82	N/A	$23.82
CHARGES UNDER P.L. 102-575 TO THE RESTORATION FUND 3/			
Restoration Payments (3407(d)(2)(A))	$7.93	$15.87	$0.00

1/ Established pursuant to the Sutter, Natomas and Pelger MWC Payment Capacity Analysis dated October, 2001.

2/ Chief Financial Officer (CFO) adjustment and Provision for Replacement (PFR) expense is being distributed over a 5-year period beginning in FY 2003 for those contractors that requested those costs be deferred.

3/ These surcharges are payments in addition to the water rates and are determined pursuant to Title XXXIV of P.L. 102-575. Restoration Fund surcharges under P.L. 102-575 are on a fiscal year basis (10/1 -9/30). Contractors with ability to pay relief do not pay Restoration Fund charges for agricultural water.

BOARD OF DIRECTORS

NATOMAS CENTRAL MUTUAL WATER COMPANY

RESOLUTION NO. 2005-03-02

RESOLUTION APPROVING LONG-TERM RENEWAL OF CONTRACT BETWEEN THE UNITED STATES AND NATOMAS CENTRAL MUTUAL WATER COMPANY, DIVERTER OF WATER FROM SACRAMENTO RIVER SOURCES, SETTLING WATER RIGHTS DISPUTES AND PROVIDING FOR PROJECT WATER

WHEREAS Natomas Central Mutual Water Company (the "Company") has, since 1964, held a settlement contract with the United States Department of the Interior, Bureau of Reclamation ("Reclamation") bearing Contract No. 14-06-200-885A (the "Original Contract").

WHEREAS the Original Contract would have expired on March 31, 2004.

WHEREAS in advance of that expiration, the Company and Reclamation entered into negotiations for a long-term renewal of the Original Contract.

WHEREAS by Act of Congress, the Original Contract was extended for a period of two years, because the negotiations and related procedures had not been completed by March 31, 2004.

WHEREAS the negotiations and related procedures have now been completed, and Reclamation has presented to the Company the agreed-upon final form of renewal contract bearing Contract No. 14-06-200-885A-R1 (the "Renewal Contract").

WHEREAS the Board of Directors of the Company finds and determines that it is in the best interest of the Company to approve the Renewal Contract and to authorize the General Manager and staff of the Company to carry out any actions necessary to implement the Renewal Contract.

NOW, THEREFORE, BE IT RESOLVED that:

1. The Board of Directors of the Company hereby approves the Renewal Contract between Reclamation and the Company with the correction of Exhibit B to include the 428 acres of airport land into Natomas' contractual service area.

2. The General Manager and staff of the Company are authorized and directed to take any other action necessary to implement the terms of the Renewal Contract.

PASSED AND ADOPTED by unanimous written consent of the Board of Directors on April 21, 2005.

By _____
Dan F. Spangler
President, Board of Directors

By _____
Herb Niederberger, Jr.
Vice President, Board of Directors

By _____
Mark Enes
Secretary, Board of Directors

By _____
Jim Sopwith
Board of Directors

By _____
Doug Ose
Board of Directors

By _____
Michael George
Board of Directors

By _____
Rod Rosa
Board of Directors