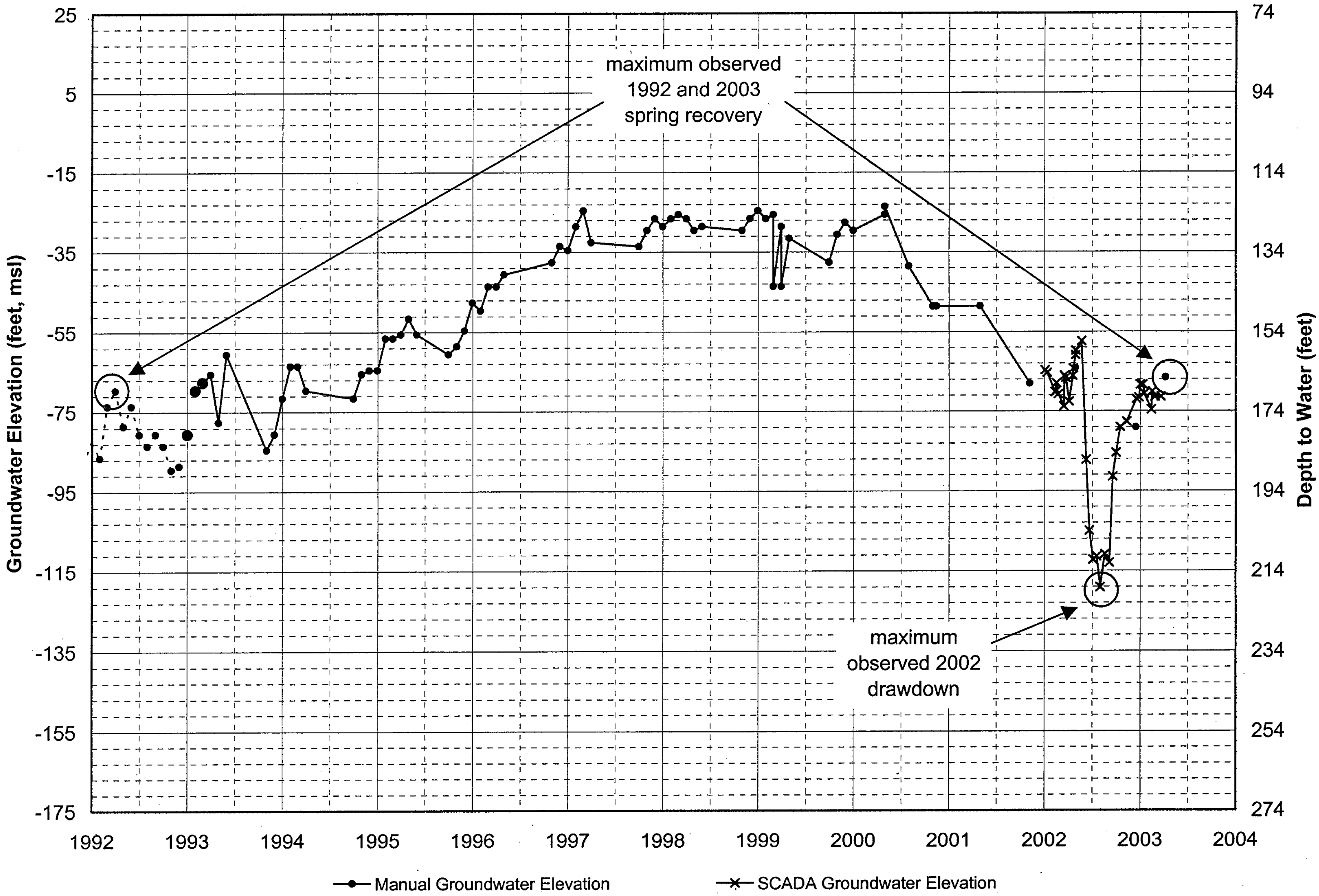
Figure 8
City of Vacaville
Groundwater Levels (Well 7), 1992-2003



zones of the Tehama Formation are comprised of extensive deposits that are less permeable than those in the basal zone. These deposits overlie the basal zone and, when excessive and prolonged water level drawdown occurs, subsurface conditions are conducive to land subsidence. Specifically, groundwater extraction that results in drawdown exceeding historical low water levels for prolonged periods can contribute to compaction of the aquifer system and inelastic (permanent) subsidence. Historical water level data that provide an indication of historical low levels (i.e., levels during peak groundwater extraction months, or typically June through September) are extremely limited prior to 2002. Because of relatively continuous pumping from closely spaced wells, water levels representing non-pumping conditions during the peak groundwater extraction months have not been collected. As shown in Figure 8, the maximum static depth to water measured with the SCADA system in 2002 provides an indicator of historical low summer levels since 1984.

Based on the 1990-1992 and 2002 pumpage, the sustainable annual pumpage from the basal zone in the Elmira well field is estimated to be on the order of about 5,600 acre-feet. As further discussed below, the total amount of sustainable pumpage can be increased through broader distribution of pumpage in the study area, rather than concentrated in the Elmira Road well field as occurred until 1997 when Well 14 came on line. However, as other groundwater sources are developed (e.g., new City wells), the influence of the additional basal zone pumpage on groundwater levels in the Elmira Road well field and elsewhere in the study area must also be considered.

III. Analysis of Future Pumping Impacts

An analytical groundwater flow model was used to provide a preliminary assessment of water level impacts from future increases in groundwater pumpage by the City of Vacaville to meet future water demands. The modeling effort included simulations of eight future pumping scenarios in which pumpage would be increased and/or redistributed within the study area. The model results provide a basis for estimating the average annual sustainable pumpage amount that could be used in conjunction with surface water to meet the City's future water demands. Application of the analytical model involved three tasks, including: 1) preparation of the data needed to develop and calibrate the model, 2) model development and calibration, and 3) design and simulation of the future pumping scenarios. The development of the analytical model and the modeling results are summarized below.

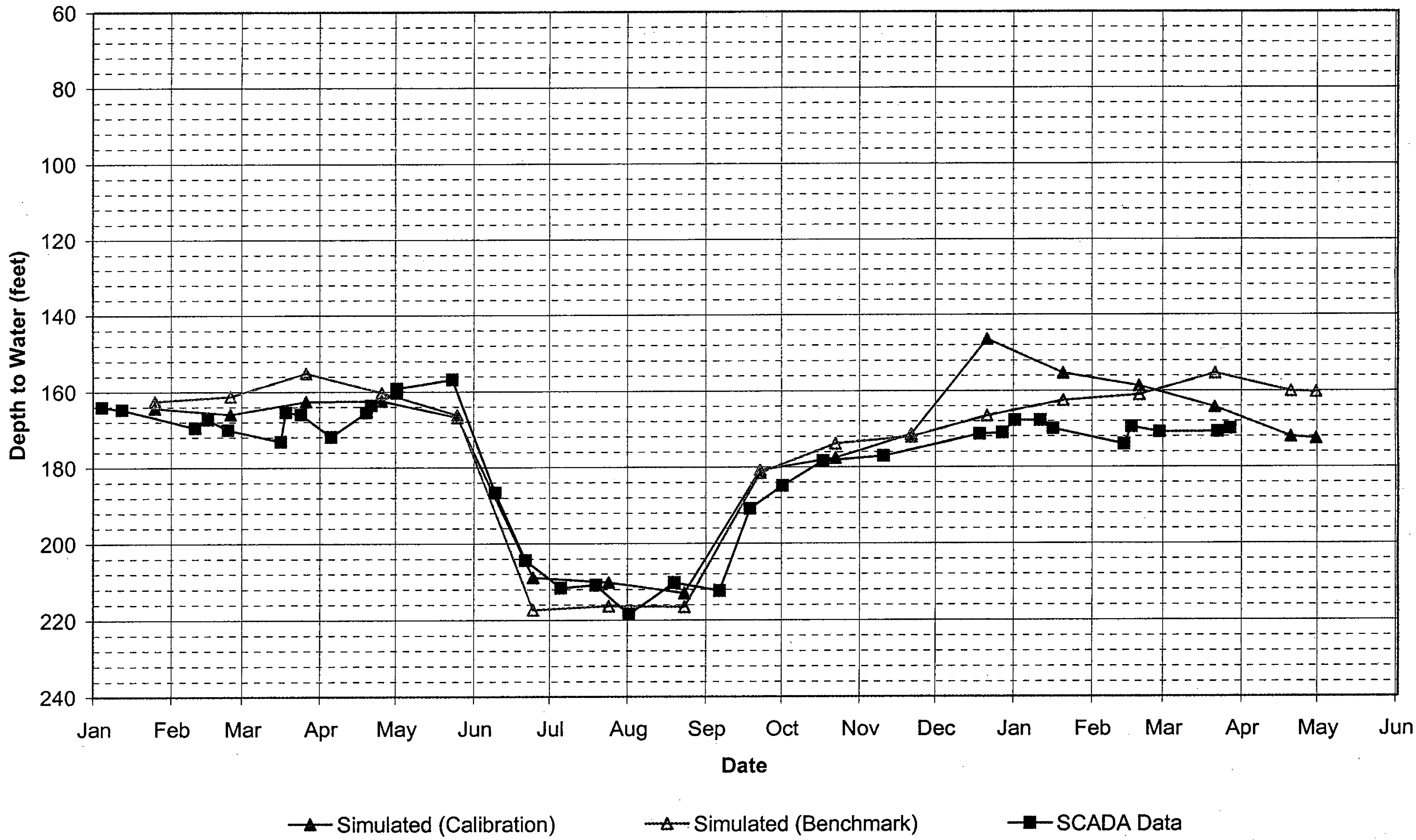
Groundwater Flow Model

The analytical model used to simulate the aquifer response to projected pumpage is based on the Hantush-Jacob (1955) equation as programmed by Walton (1985). The Hantush-Jacob equation calculates drawdown in a semi-confined (leaky) aquifer and superimposes the drawdowns to calculate the total drawdown for all the wells at specified times. Because the Hantush-Jacob model simulates vertical recharge to the underlying aquifer, it simulates recovery after pumping periods due to this same mechanism. For purposes of this model application, a no-flow boundary was incorporated to represent the English Hills fault. Details of the model development, calibration, and application for purposes of the SB 221/610 requirements are contained in the SB 221/610 Groundwater Report. Also included in that report are recommendations for additional calibration efforts prior to application of the model for future multi-year simulations.

Model Calibration and Benchmark and Future Pumping Scenarios

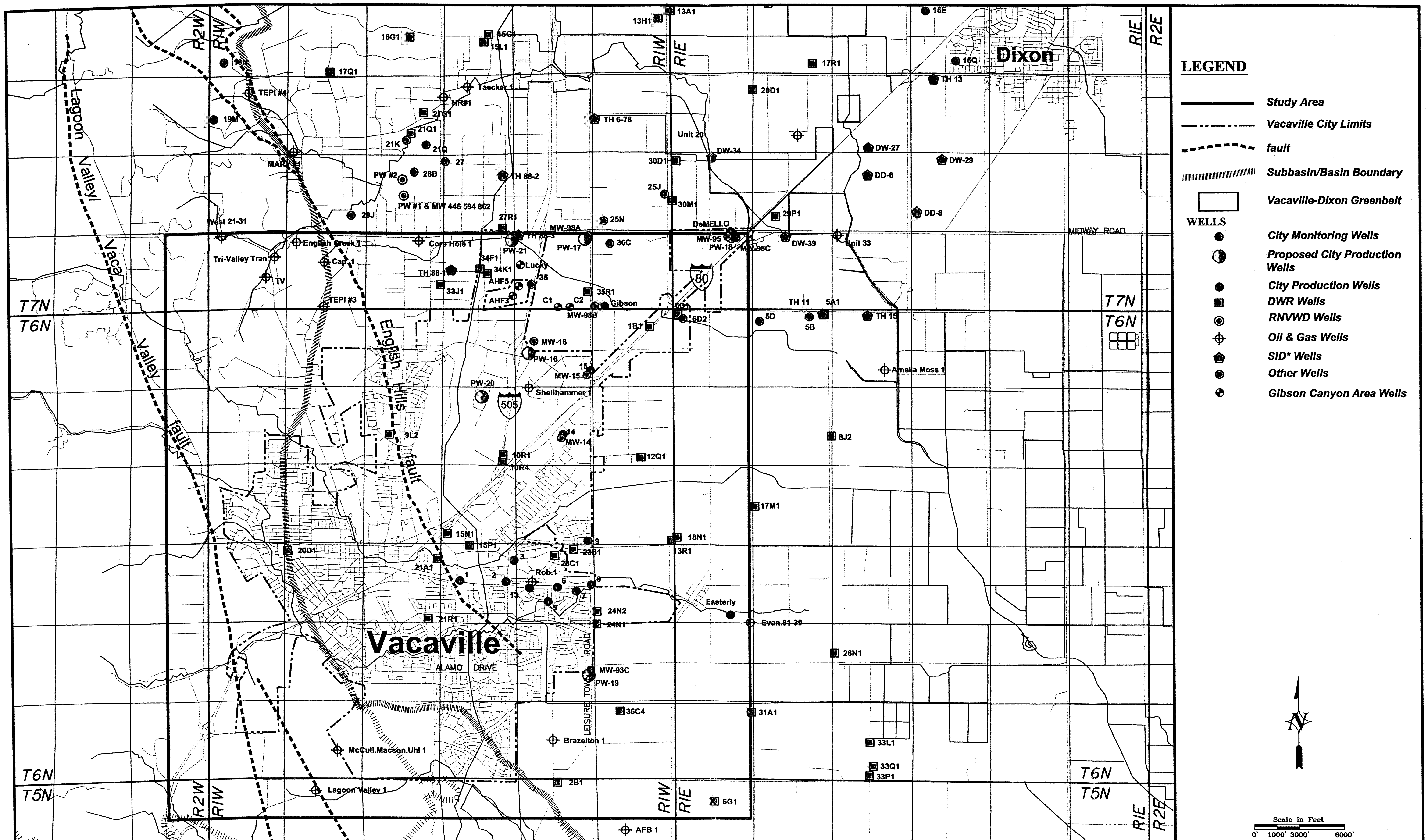
The period from January 2002 through April 2003 was selected as the model calibration period because of the relative frequency of water level measurements, the availability of data from production and monitoring wells outside of the Elmira Road well field, and the similarity to 1992 base year water levels. The 2002-2003 groundwater levels for selected study area wells and model calibration results at those locations are summarized on hydrographs included in the SB 221/610 Groundwater Report. Figure 9 in this Summary Assessment shows a representative calibration hydrograph for Well 7 in the Elmira Road well field. With the exception of the anomalous recovery at the end of 2002, the simulated drawdown and recovery show good correlation to observed values. Thus, the model is considered appropriate for assessing the potential water level impacts of projected pumpage on a year-to-year basis. The model is not currently capable of simulating multiple-year periods because it does not include recharge other than from vertical leakage contributed from overlying zones of the Tehama Formation.

Figure 9
Comparison of 2002-2003 Calibration and Benchmark Simulations
City of Vacaville Well 7



In addition to the actual January 2002 through April 2003 pumpage used for model calibration, an additional scenario was developed with the 2002 pumpage redistributed on a month-to-month basis. This is shown on Table 1 as the 2002 "benchmark" scenario. The purpose of this scenario is to provide a basis for comparison with the future pumping scenarios. The 2002 benchmark scenario was constructed so that the maximum simulated recovery would occur during the spring rather than in December, and thus would better represent actual conditions during most years. The simulated water levels for this scenario more closely match the typical annual pattern of measured water levels, in which the maximum recovery generally occurs in March or April. Figure 9 shows depths to water observed in 2002 and depths to water simulated based on both actual pumpage (the model calibration scenario) and redistributed 2002 month-to-month pumpage pattern (the 2002 benchmark scenario). The 2002 benchmark scenario results show simulated depths to water during the spring that are significantly higher than those actually observed in 2002 and 2003 (i.e., on the order of about 10 to 14 feet). These differences are expected because the redistributed pumpage is slightly greater in the summer and fall and less during the winter and spring than actually occurred in 2002-2003.

Eight future pumping scenarios were developed to evaluate the aquifer response to increased, decreased, and redistributed pumpage in the basal zone, including pumpage at new well locations (e.g., City Wells 15, 16, 17 and others). Table 1 summarizes total pumpage and pumpage by location for each scenario modeled. As shown on the table, the scenarios include not only City basal zone pumpage but also estimations of other pumpage from the basal zone, including from the RNVWD wells and wells in the Gibson Canyon area (Figure 10). The month-to-month distribution of pumpage used in the 2002 benchmark scenario was applied to the eight future pumping scenarios. The results of the 2002 benchmark scenario provided a basis for comparing and evaluating the results of the eight future pumping scenarios.



CAD FILE: G:/Projects/City of Vacaville/02-1-031/PDF'S/Figure 11.dwg CFG FILE: LSCE2500.PCP_MRG DATE: 09-02-03 11:52am

LUHDORFF & SCALMANINI
CONSULTING ENGINEERS

Figure 10
Tentative Locations for Future
City of Vacaville Groundwater Development

TABLE 1

City of Vacaville Groundwater Model Simulations
2002 and Future Pumping Scenarios
(all pumpage in acre-feet per calendar year)

Scenario	*Non-Basal*	*Basal Tehama*				*Total Basal Pumpage*[1]	*Total City Pumpage*[2]	*Total Pumpage [City + Others]*[2]	*Notes*
	City Well 1 and/or DM	Elmira Well Field	Other City Basal Zone	Gibson Canyon Area	RNVWD				
2002 Calibration	102	5,563	973	146	0	6,682	6,638	6,784	Actual pumpage during 2002
2002 Benchmark[3]	102	5,563	973	146	0	6,682	6,638	6,784	Redistributed 2002 pumpage
No. 1 - 2003a	102	3,925	973	146	38	5,082	5,000	5,184	Elmira WF + Well 14
No. 2 - 2003b	102	4,925	973	146	38	6,082	6,000	6,184	Elmira WF + Well 14
No. 3 - 2005a	362	4,638	1,000	146	38	5,822	6,000	6,184	Elmira WF + Wells 14,15
No. 4 - 2005b	362	5,638	1,000	146	38	6,822	7,000	7,184	Elmira WF + Wells 14,15
No. 5 - 2006	362	4,438	2,000	146	38	6,822	7,000	7,184	Elmira WF + Wells 14 - 17
No. 6 - 2009	362	4,638	2,500	146	38	7,322	7,500	7,684	Elmira WF + Wells 14 - 18
No. 7 - 2025	362	3,638	4,000	146	267	8,051	8,000	8,413	Elmira WF + Wells 14 - 21
No. 8 - 2025/CDY	362	4,638	4,600	146	320	9,704	9,600	10,066	Elmira WF + Wells 14 - 21

1. The amounts shown in the Total Basal Pumpage column represent the annual pumpage included in the analytical modeling analysis.
2. The Total City Pumpage and Total Pumpage columns include both non-basal and basal pumpage.
3. The 2002 Benchmark scenario is a modified 2002 simulation. The actual 2002 basal City pumpage was redistributed on a monthly basis.

IV. Model Results and Groundwater Supply Sufficiency

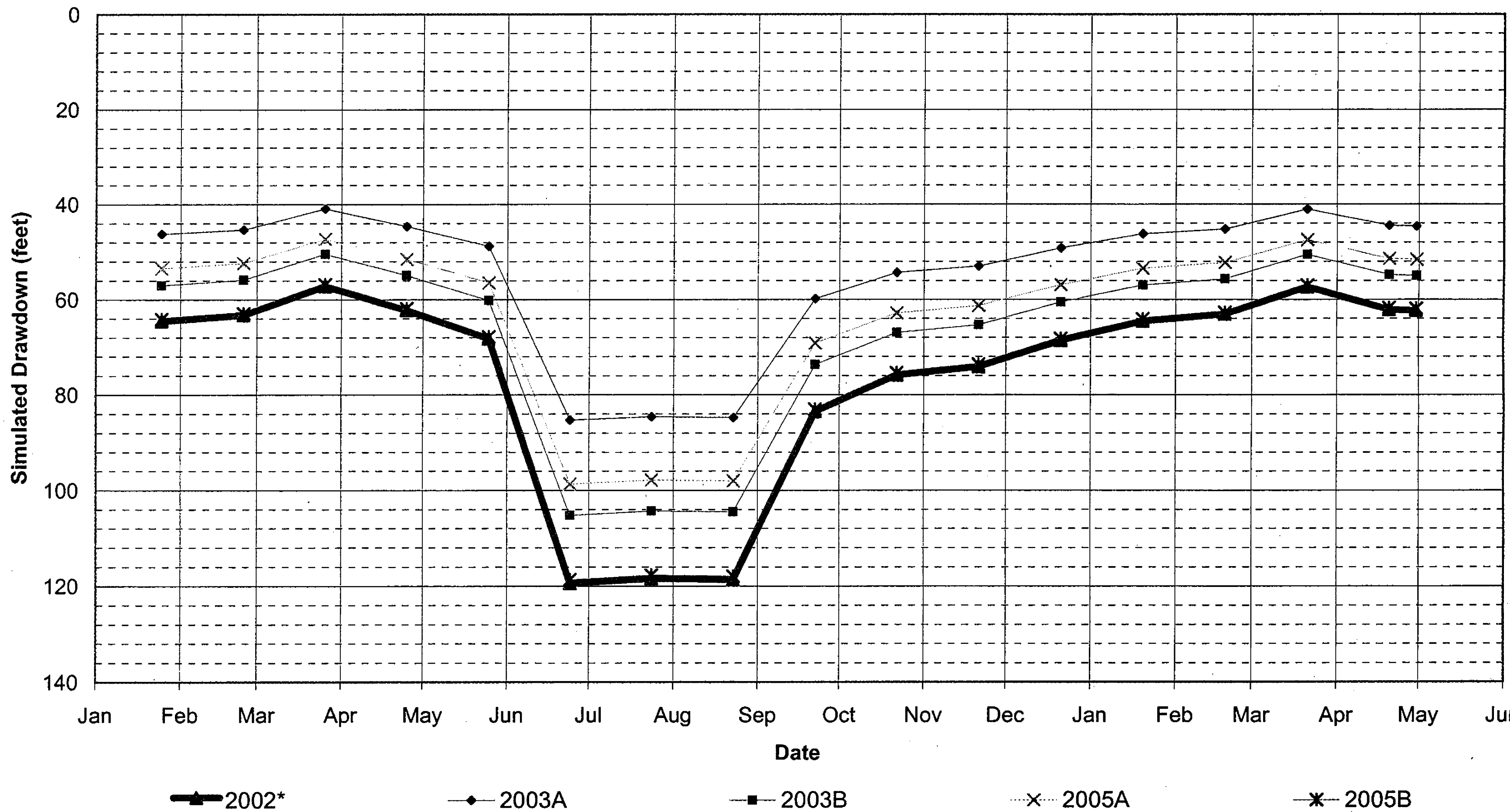
Model Results

Plots of simulated drawdown for four representative wells in the study area are shown in Figures 11-18 for the various future pumping scenarios. Each figure also displays the simulated drawdown for the 2002 benchmark scenario so that drawdowns based on current and projected pumpage volumes can be compared. Specifically, the predicted maximum drawdown and recovery for the eight future pumping scenarios are considered in relation to the maximum drawdown and recovery occurring with the 2002 benchmark scenario. The results show that groundwater levels in the Elmira Road well field for all future scenarios would be generally similar to or higher than the 2002 benchmark scenario during both summer and spring periods. This result was expected because the pumpage simulated for the Elmira Road area was similar to or less than the 2002 pumpage for all future scenarios. The opposite occurs in the northern portion of the study area, where future groundwater levels are projected to be significantly lower than 2002 levels, beginning in 2006. This is due to increased pumpage in this area including RNVWD pumpage and redistribution of City pumpage away from the Elmira Road well field to the north at the projected locations for future City Wells 16, 17, 18, and 21. Notably, the 2025 normal and single-dry year scenarios include significant additional pumpage from the RNVWD wells. Drawdown caused by this additional RNVWD pumpage is especially noticeable at RNVWD Well 1A as shown in Figure 18.

Comparison of the simulated drawdown for future pumping scenarios to the results of the 2002 benchmark scenario, and also the observed 2002-2003 groundwater level data, provides the basis for developing an estimate of the potentially sustainable annual pumpage. This comparison is particularly of interest for wells located in the Elmira Road well field where 2002-2003 groundwater levels are used to evaluate the response of the aquifer system to future pumpage. The 2002-2003 groundwater levels provide a basis for measuring the response of the aquifer system that is particularly important during single-dry and multiple-dry year periods when the City, as part of its conjunctive water management plan, increases pumpage above normal year levels. Similarly, these water levels also provide a basis for measuring the response of the aquifer system when the City offsets the increase with reduced pumpage in subsequent years. The model results also provide a basis for the recommended maximum pumpage amount for relatively short-term use, i.e., pumpage that could occur during a single-dry year condition.

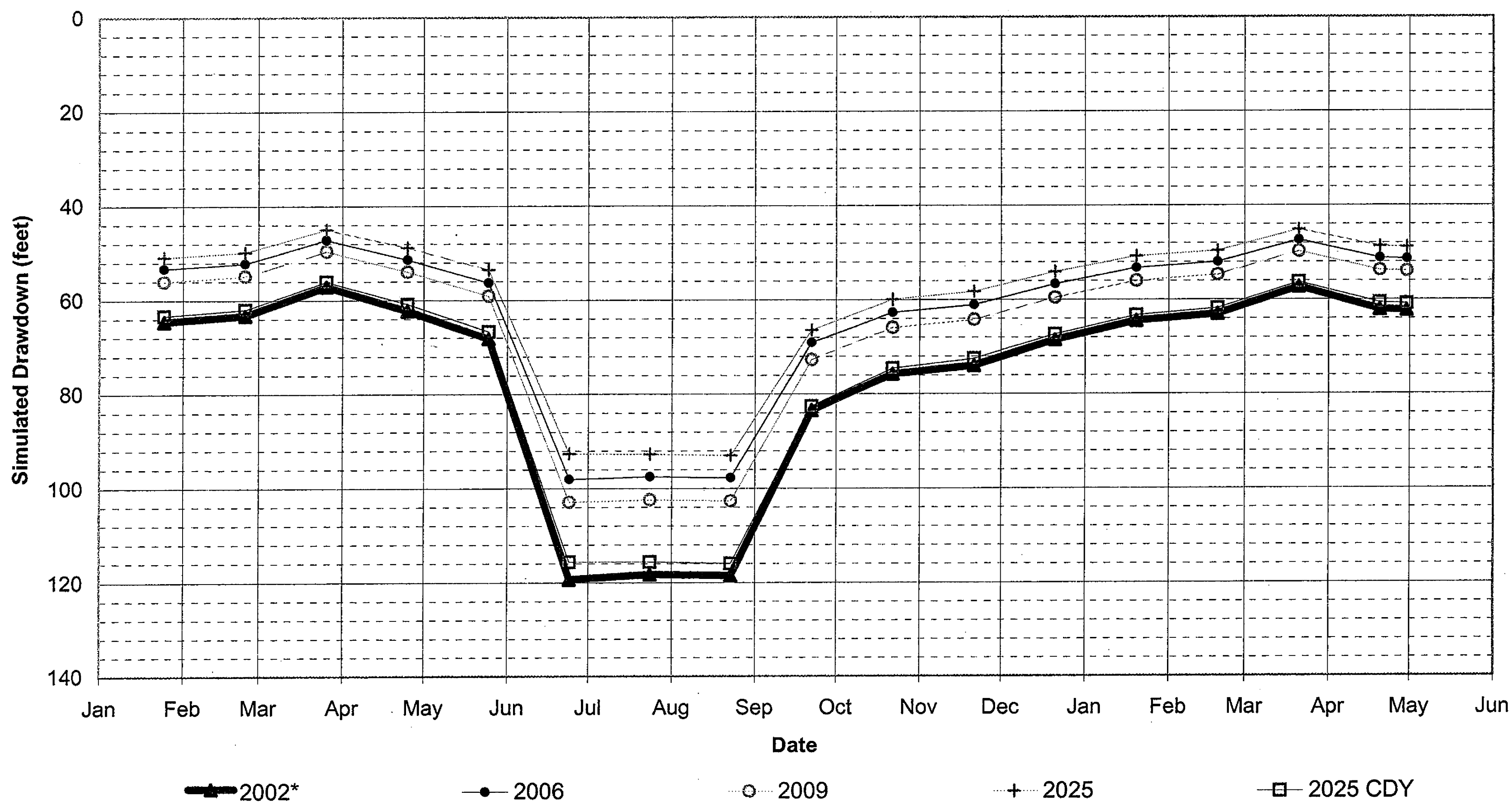
Although the model is capable of predicting drawdown during peak pumping periods with reasonable confidence, it is limited in its ability to accurately predict recovery at the end of each year. The model results show essentially complete recovery from spring-to-spring for all scenarios. As discussed above, however, the actual amount of vertical leakage into the basal zone is unknown and other forms of recharge are not simulated with the model. A multi-year calibration period would be required before a model prediction of full recovery for more than one year would be accepted. Additional water level data will be needed, especially for areas outside of the Elmira Road well field, before a model capable of multi-year simulations could be

Figure 11
Comparison of Simulated 2002 Benchmark Scenario vs. Future Scenarios
City of Vacaville Well 7



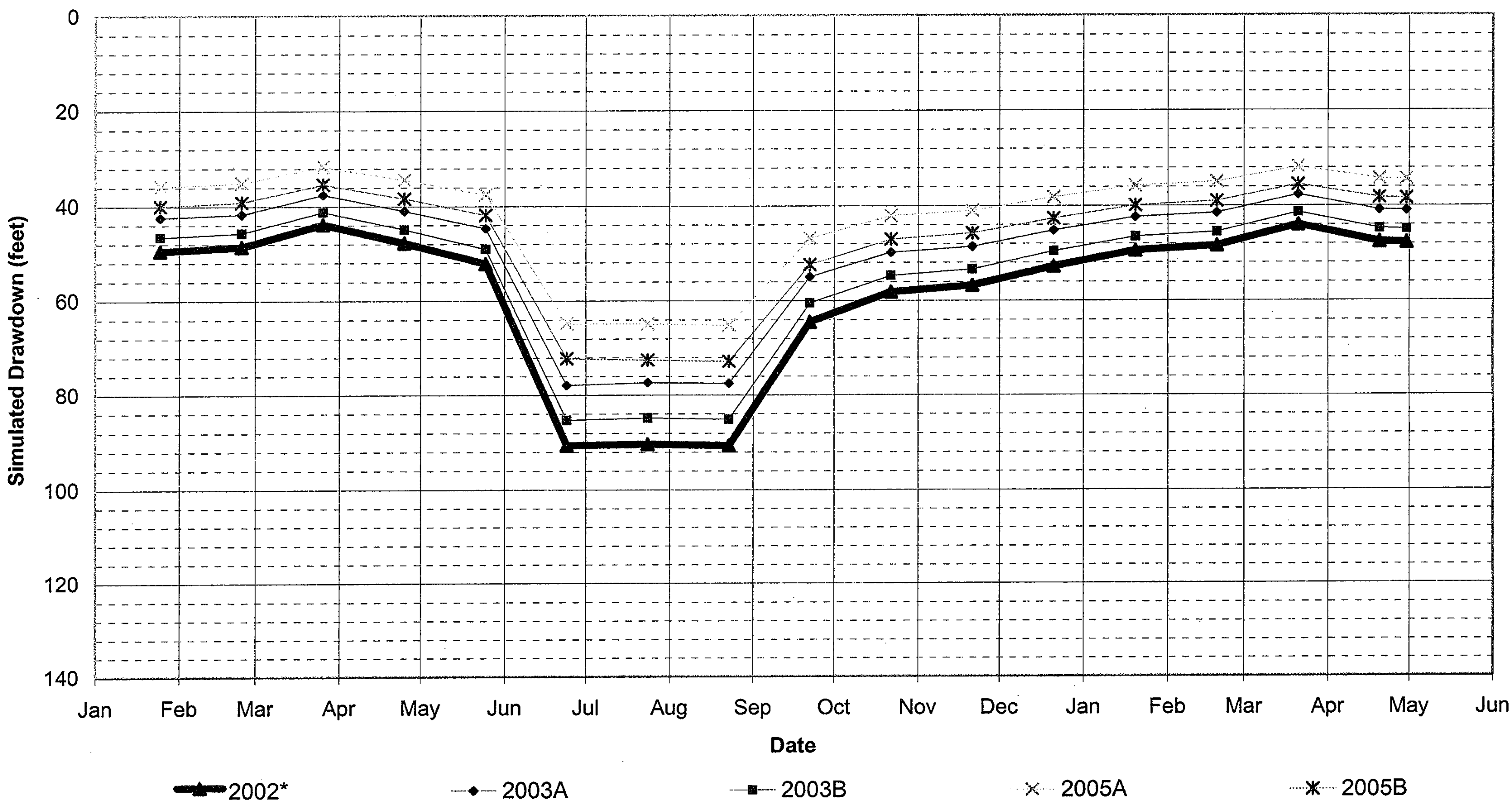
* *For comparison purposes, the 2002 series shown reflects actual total 2002 City pumpage, but does not reflect the actual month-to-month pumpage distribution. The 2002 pumpage has been reallocated on a month-to-month basis to facilitate comparison with future pumping scenarios.*

Figure 12
Comparison of Simulated 2002 Benchmark Scenario vs. Future Scenarios
City of Vacaville Well 7



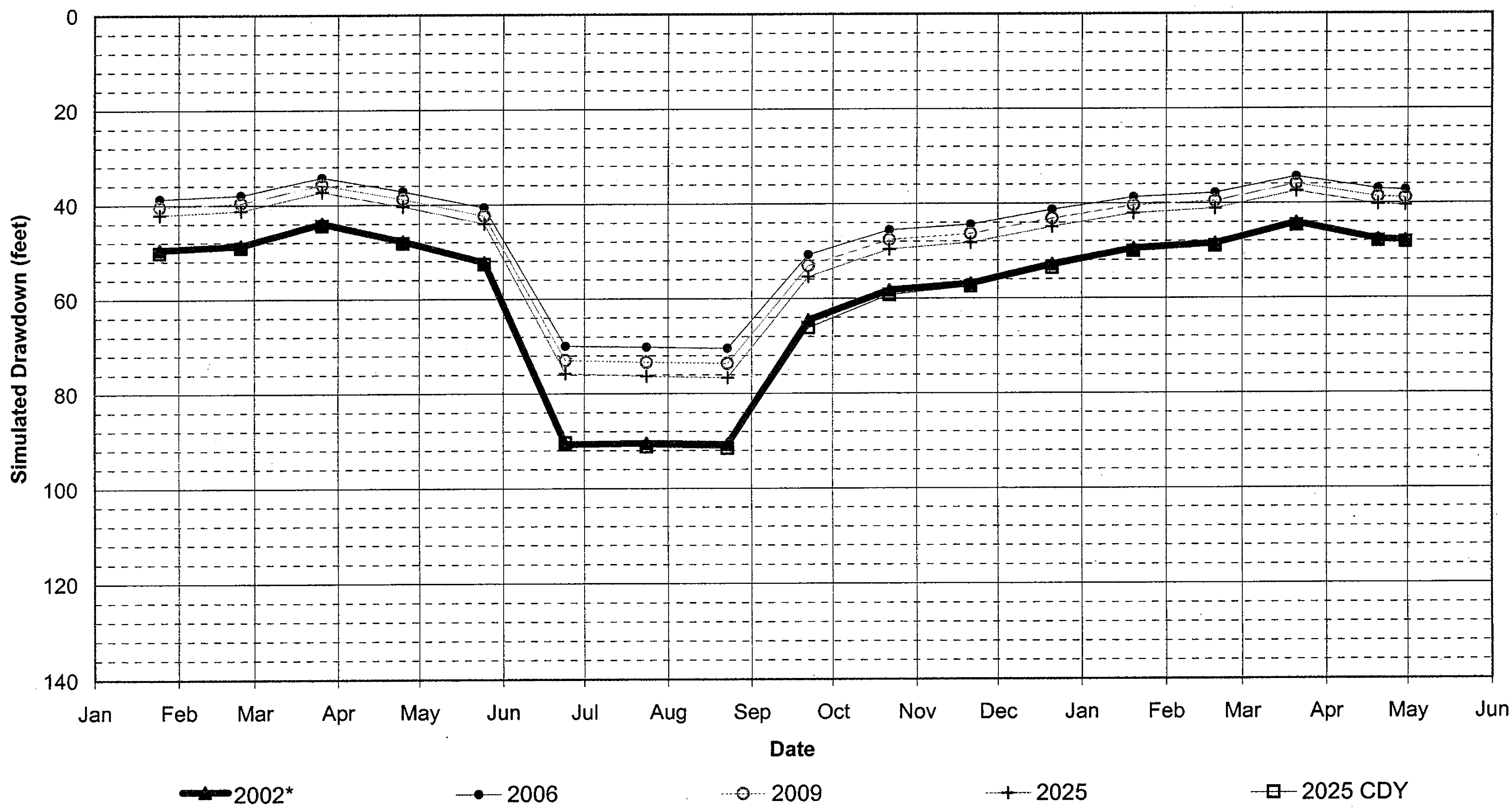
* *For comparison purposes, the 2002 series shown reflects actual total 2002 City pumpage, but does not reflect the actual month-to-month pumpage distribution. The 2002 pumpage has been reallocated on a month-to-month basis to facilitate comparison with future pumping scenarios.*

Figure 13
Comparison of Simulated 2002 Benchmark Scenario vs. Future Scenarios
City of Vacaville Well 14



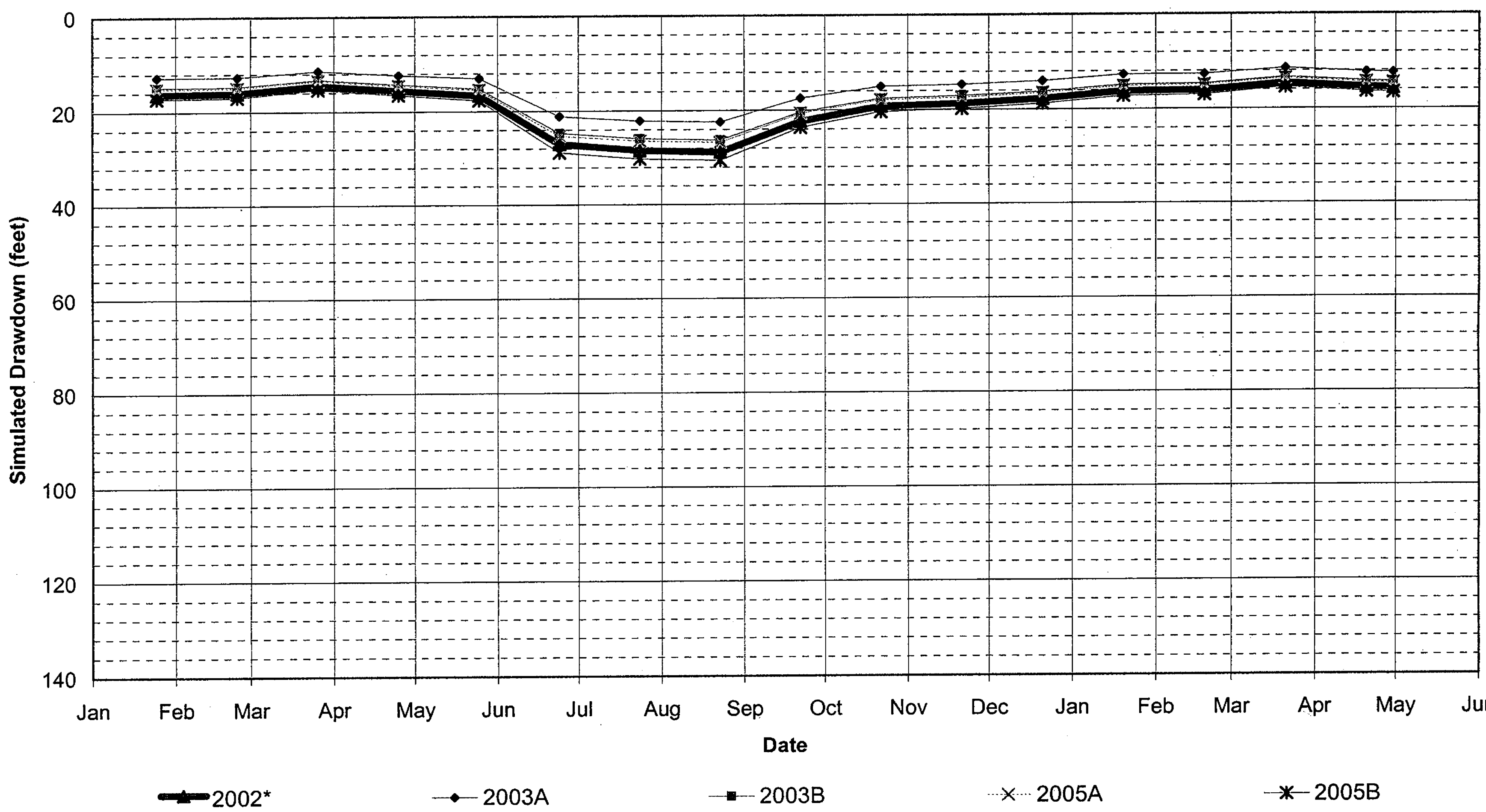
* *For comparison purposes, the 2002 series shown reflects actual total 2002 City pumpage, but does not reflect the actual month-to-month pumpage distribution. The 2002 pumpage has been reallocated on a month-to-month basis to facilitate comparison with future pumping scenarios.*

Figure 14
Comparison of Simulated 2002 Benchmark Scenario vs. Future Scenarios
City of Vacaville Well 14



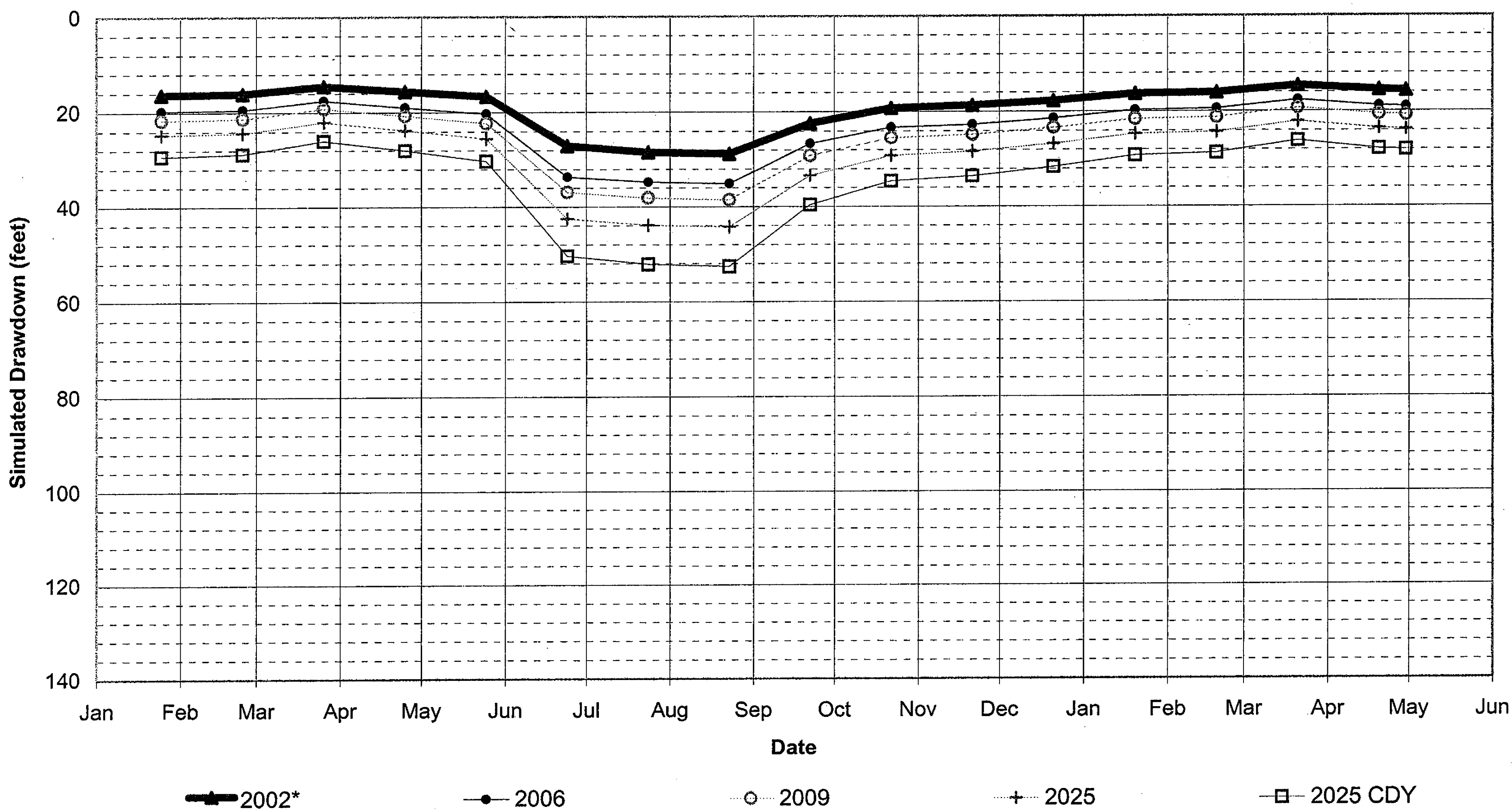
** For comparison purposes, the 2002 series shown reflects actual total 2002 City pumpage, but does not reflect the actual month-to-month pumpage distribution. The 2002 pumpage has been reallocated on a month-to-month basis to facilitate comparison with future pumping scenarios.*

Figure 15
Comparison of Simulated 2002 Benchmark Scenario vs. Future Scenarios
City of Vacaville MW98B



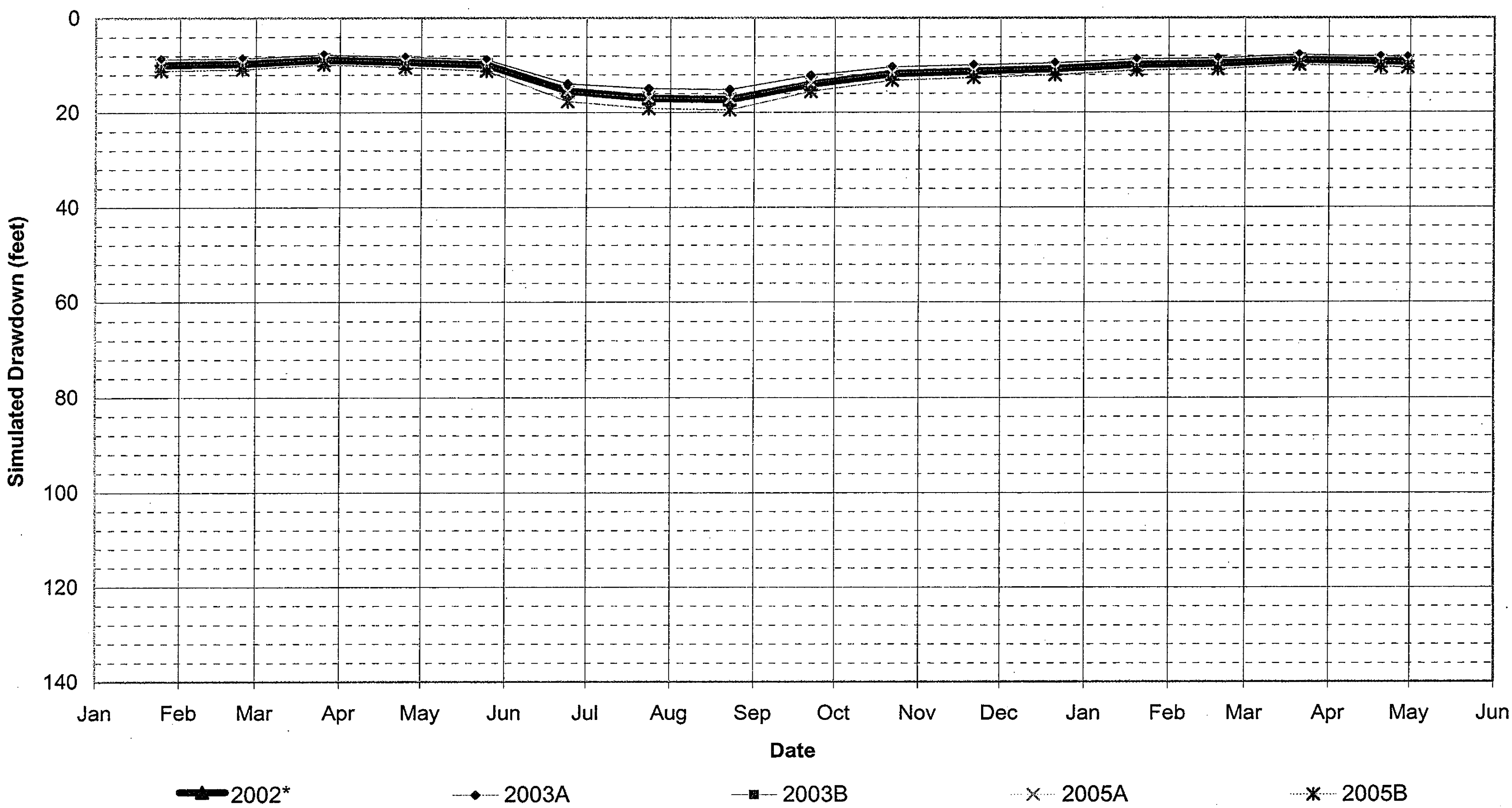
For comparison purposes, the 2002 series shown reflects actual total 2002 City pumpage, but does not reflect the actual month-to-month pumpage distribution. The 2002 pumpage has been reallocated on a month-to-month basis to facilitate comparison with future pumping scenarios.

Figure 16
Comparison of Simulated 2002 Benchmark Scenario vs. Future Scenarios
City of Vacaville MW98B



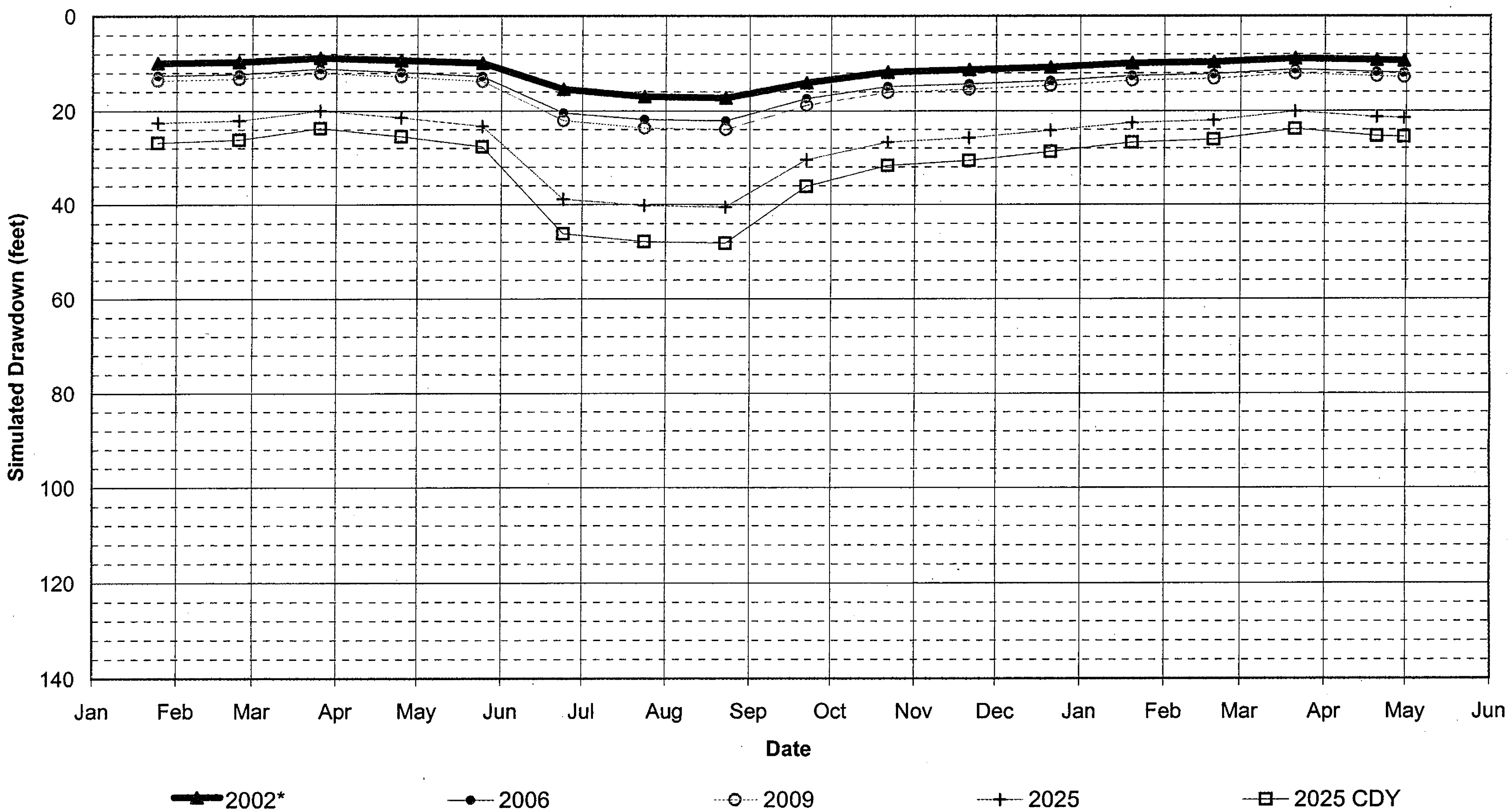
* *For comparison purposes, the 2002 series shown reflects actual total 2002 City pumpage, but does not reflect the actual month-to-month pumpage distribution. The 2002 pumpage has been reallocated on a month-to-month basis to facilitate comparison with future pumping scenarios.*

Figure 17
Comparison of Simulated 2002 Benchmark Scenario vs. Future Scenarios
RNVWD Well 1A



* *For comparison purposes, the 2002 series shown reflects actual total 2002 City pumpage, but does not reflect the actual month-to-month pumpage distribution. The 2002 pumpage has been reallocated on a month-to-month basis to facilitate comparison with future pumping scenarios.*

Figure 18
Comparison of Simulated 2002 Benchmark Scenario vs. Future Scenarios
RNVWD Well 1A



* *For comparison purposes, the 2002 series shown reflects actual total 2002 City pumpage, but does not reflect the actual month-to-month pumpage distribution. The 2002 pumpage has been reallocated on a month-to-month basis to facilitate comparison with future pumping scenarios.*

developed and calibrated. Toward this end, an expanded groundwater monitoring program is critical to future model development.

Sustainable Basal Zone Pumpage for 2005

The model results indicate that, with the present and planned location of groundwater development through 2005, annual total pumpage in an amount of about 7,200 acre-feet by the City and other pumpers in the study area could be sustained for meeting normal water year demands. As shown in Table 1, this total pumpage is comprised of groundwater extracted primarily from the basal zone, but also includes some pumpage by the City from other zones. At this amount of pumpage, spring water levels in the basal zone are anticipated to remain at or above the 1992-1993 base year and 2002-2003 water levels in the Elmira Road well field. However, as discussed above (and already understood through groundwater management actions being taken by the City), the distribution of pumpage in the basal zone is very important. It is recommended that normal-year basal zone pumpage in the Elmira Road well field be limited to not more than occurred during 1992 and 2002 (i.e., about 5,600 acre-feet). Therefore, the balance of the normal year supply from groundwater sources, or 1,600 acre-feet of additional pumpage by the City and others in 2005, would result from pumpage elsewhere in the study area. Pumpage outside the Elmira Road well field would come from Well 1, the DeMello Well, Well 14, new City wells, and the small amount of pumpage occurring by others in the study area. In 2005, the total sustainable City pumpage, including groundwater from basal and non-basal zones, is estimated to be about 7,000 acre-feet.

Basal Zone Pumpage After 2005

In future years beyond 2005, shifting pumpage to proposed City well locations sited away from the Elmira Road well field would reduce drawdown in the Elmira Road area. Similarly, management of the timing and distribution of pumpage would ensure that water levels in the basal zone remain at or above the 1992-1993 base year and 2002-2003 water levels. Managed pumpage from the basal zone would also allow the level of sustainable pumpage within the study area to be increased. However, as other groundwater sources outside the Elmira Road well field are developed, the influence of the basal zone pumpage in other areas on groundwater levels at the Elmira Road well field and elsewhere in the study area must also be considered.

The modeled basal zone pumpage of 8,051 acre-feet for the 2025 normal year scenario and 9,704 acre-feet for the 2025 single-dry year scenario include pumpage in the Elmira Road well field at a lesser amount than occurred during 1992 and 2002. Based on the model results for the 2025 normal year scenario, pumpage for future normal years appears to be sustainable at about 8,000 acre-feet for all pumpage from the basal zone in the study area. Groundwater pumpage during a normal year in 2025 for the City would equate to about 7,638 acre-feet of basal zone pumpage (Elmira Road well field, Well 14, and new Wells 15 through 21) and about 8,000 acre-feet of total City pumpage, including non-basal zone pumpage. At this time, it is suggested that the 2025 single-dry and multiple-dry year total pumpage for the City of 9,600 acre-feet (as shown in Table 1) be considered only in the context of short-term use as part of a conjunctive water management program. Until additional monitoring data are gathered outside of the Elmira Road area and water level responses to expanded groundwater development and recharge mechanisms are better understood, it is recommended that higher pumpage levels (e.g., single-dry year amount) be offset through continued conjunctive water management by reducing pumpage in wet years and allowing water levels to recover.

V. Summary

Groundwater Supply Sufficiency for 2005-2025

The model results generally show that water levels in the Elmira Road well field for all future scenarios would be similar to or higher than the 2002 benchmark scenario results during both summer and spring periods. For purposes of complying with the SB 221 and SB 610 requirements, it appears that groundwater can be used by the City on a sustained basis at an amount of about 8,000 acre-feet (including basal and non basal zone pumpage) to meet normal year demands through 2025. On a short-term basis for a single-dry year condition, basal and non-basal zone pumpage up to 9,600 acre-feet, pending the pumpage distribution, would likely result in water level drawdown comparable to that simulated with the 2002 benchmark scenario. Based on available data and the model results, annual groundwater pumpage for normal, single-dry and multiple-dry year types are summarized in Table 2.

As shown on Table 2 and described above, the total normal year sustained pumpage amount for the City is projected to increase from 7,000 acre-feet in 2005 to 8,000 acre-feet by 2025. The single-dry year pumpage increases from 8,400 acre-feet in 2005 to 9,600 acre-feet by 2025. The pumpage levels shown in Table 2 for multiple-dry years are recommended based on the available monitoring data and current understanding of the response of the aquifer system to pumping stresses. The multiple-dry year pumpage levels range from 9,000 acre-feet in 2005 to 9,600 acre-feet in 2025. The likely impact of this level of pumpage for multiple years is still unknown because the model is not currently of multi-year simulations. When pumpage at these amounts occurs over a multiple-dry year period, it is recommended that the portion of the pumpage occurring in the Elmira Road well field be limited (at least initially) to about 6,100 acre-feet, or about 10 percent above the presently identified level of sustained pumpage for that area (5,600 acre-feet). Total City pumpage for multiple-dry year periods would thus be comprised of basal pumpage from the Elmira Road area; City Wells 14, 15, and other new wells; and also non-basal pumpage from Well 1 and the DeMello well. As new City wells (Wells 16 through 21) are constructed, and more is known about the nature of the aquifer system across the study area, then the additional information (particularly information about spring water level recovery in the northern portion of the study area) will allow further analysis of pumpage levels and possibly increased pumpage during single-dry year and multiple-dry year periods.

City's Conjunctive Water Management and Monitoring Program

Maximizing the groundwater supply without causing significant impacts requires distribution of pumpage within the study area to prevent excessive water level drawdown and to ensure that persistent water level declines do not occur. Conjunctive water management of surface and groundwater has allowed groundwater levels to recover to spring 1992-1993 base year water levels. The long-term effectiveness of pumpage redistribution to the northeast portion of the study area and the rate and capacity for replenishment to occur in the basal zone are not well understood, due in part to the limited available water level data for the basal zone outside of the

Table 2
City of Vacaville
Ground-Water Supply Years 2005 – 2025
SB 610 Analysis

Water Supply Year	Normal Year (*acre-feet/year*)	Single-Dry Year (*acre-feet/year*)	Multiple-Dry Year (*acre-feet/year*)
2005	7,000	8,400	7,700
2010	7,500	9,000	9,000
2015	7,500	9,000	9,000
2020	8,000	9,600	9,600
2025	8,000	9,600	9,600

Elmira Road well field. Additional water level data and geologic characterization are needed to better understand recharge mechanisms in the northeastern area.

Although short-term pumpage by the City at amounts of 9,600 acre-feet, or possibly more, is possible during single-dry year or multiple-dry year periods, analysis of existing data indicates that this level of pumpage would cause groundwater levels to drop below the fall 2002 water level. The conjunctive water management plan previously employed by the City would be used to return groundwater levels to base year levels. Specifically, short-term pumpage occurring at increased levels to meet demand during dry years would be offset in subsequent years through a corresponding reduction in pumpage and increased utilization of surface-water supplies. A monitoring program is described in the SB 221/610 Groundwater Report that involves ongoing collection and evaluation of water level data in the study area. Continued groundwater level monitoring is important for ensuring that when pumpage is increased for multiple-dry year periods that levels, particularly in the Elmira Road well field, do not drop below historical low levels during summer months and recover to base year spring levels after the dry period is over. The amount of pumpage considered to be sustainable may change in the future as a result of ongoing evaluation of monitoring data, managed extraction from the basal zone, and continued application of conjunctive water management.

VI. References

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APPENDIX B

CITY OF VACAVILLE

WATER SUPPLY CONTRACTS

City of Vacaville
Water Contract Identification
As of December 31, 2003

Senate Bill 610 requirements include documentation identifying and quantifying water rights, and contracts and/or entitlements for water supplies. The table below lists the original surface water contract title and the corresponding annual allocations.

Contract Title	Allocations (Acre-feet/Year)
SOLANO PROJECT WATER	
Solano County Water Agency Agreement with City of Vacaville for Participating Agency Contract for Solano Project Water Service, March 9, 1999	5,600
Agreement Between the City of Vallejo and the City of Vacaville Relating to Purchase of Solano Project Water Entitlement, April 25, 2000	150
Vacaville/Solano Irrigation District Master Water Agreement, May 25, 1995	10,050
STATE WATER PROJECT WATER	
Solano County Flood Control and Water Conservation District (SCFCWCD) Member Unit Contract for Water Service for City of Vacaville from North Bay Aqueduct, December 19, 1963. Subsequent revisions and amendments to contract between Solano County Water Agency (formerly SCFCWCD) and City of Vacaville dated 1979, 1985 (2 amendments), 1987, and 1991	6,100
Kern County Water Agreement - Second Amendment to the Member Unit Contract dated October 22, 1985, Between the Solano County Water Agency and the City of Vacaville, August 10, 2000	2,878
SETTLEMENT WATER	
Settlement Agreement Among the Department of Water Resources of the State of California, the Solano County Water Agency, and the Cities of Fairfield, Vacaville and Benicia for Purposes of Water Supply, May 19, 2003	9,320

APPENDIX C

SOLANO PROJECT WATER SUPPLY AVAILABILITY

SOLANO PROJECT WATER SUPPLY AVAILABILITY

SP M&I Allocations

TABLE DEVELOPMENT

To determine Solano Project water supply availability, the City considers historical availability of water supplies going back to the first SP deliveries in 1959.

A.The Department of Water Resources Sacramento Valley 40/30/30 Index is used for setting the hydrologic yeartypes for the Solano Project region.

B. Based on definitions for normal, single dry, and multiple dry year conditions, as outlined in the City's adpoted Urban Water Management Plan, actual Solano Project deliveries are identified and placed in the appropriate columns. Figures for wet years (Value 1) are omitted.

C. The columns are averaged to obtain a reliable percentage of available water supply under each of the stated conditions.

Sacramento Valley 40/30/30/ Index

Value	Yeartype
1	Wet
2	Above Normal
3	Below Normal
4	Dry
5	Critical Dry

Year	Sacramento Valley 40/30/30 Index (1)	Measured Against Full Entitlement -Numbers for Normal Year (2)	Measured Against Full Entitlement- Numbers for Single Dry Year (3)	Measured Against Full Entitlement- Numbers for Multiple Dry Years (4)
1958	1			
1959	3	1.00		
1960	4		1.00	
1961	4			
1962	3	1.00		
1963	1			
1964	4		1.00	
1965	1			
1966	3	1.00		
1967	1			
1968	3	1.00		
1969	1			
1970	1			
1971	1			
1972	3	1.00		
1973	2	1.00		
1974	1			
1975	1			
1976	5		1.00	
1977	5			
1978	2	1.00		
1979	3	1.00		
1980	2	1.00		
1981	4		1.00	
1982	1			
1983	1			
1984	1			
1985	4		1.00	
1986	1			
1987	4		1.00	1.00
1988	5			1.00
1989	4			1.00
1990	5			1.00
1991	5			
1992	5			
1993	2	1.00		

Source: City of Vacaville, Utilities Division

Average	1.00	1.00	1.00

(1) Source: CALSIM II Model Studies, May 17, 2002 & Sacramento Valley Water Year Hydrologic Classifications, November 25, 2003

(2) Normal delivery calculated based on average of yeartypes 2 & 3, above normal and below normal.

(3) Single dry year delivery calculated based on average of yeartypes 4 & 5, solitary dry/critical dry year or the first year of multiple dry/critical dry years.

(4) Multiple dry delivery calculated based on average of year types 4 & 5 for four (4) consecutive years. This is consistent with the City of Vacaville 2000 Urban Water Management Plan Update.

Revised 12/23/03
DKT/VCA 8/21/03
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APPENDIX D

STATE WATER PROJECT

WATER SUPPLY AVAILABILITY

STATE WATER PROJECT WATER SUPPLY AVAILABILITY
SWP M&I Allocations

TABLE DEVELOPMENT
The following table is based on the Department of Water Resources CALSIM II Model Studies for State Water Project Delivery Capability using the City of Vacaville's definitions for normal year, single dry year, and multiple dry years. (Reference notes (2), (3), and (4) below).
A. The Sacramento Valley 40/30/30 Index is used to identify yeartypes.
B. Based on definitions for normal, single dry, and multiple dry year conditions, as outlined in the City's adpoted Urban Water Management Plan, entitlement figures are placed in the corresponding columns for each defined year condition. Figures for wet years (Value 1) are omitted.
C. The columns are averaged to obtain a reliable percentage of available water supply under each of the stated conditions.

Sacramento Valley 40/30/30/ Index

Value	Yeartype
1	Wet
2	Above Normal
3	Below Normal
4	Dry
5	Critical Dry

Year	Sacramento Valley 40/30/30 Index (1)	2001 Level of Development Benchmark (1)	2020 Level of Development Full Entitlement (1)	2020 Full Entitlement Numbers for Normal Year (2)	2020 Full Entitlement Numbers for Single Dry Year (3)	2020 Full Entitlement Numbers for Multiple Dry Years (4)
1922	2	1.00	1.00	1.00		
1923	3	1.00	0.86	0.86		
1924	5	0.24	0.23		0.23	
1925	4	0.38	0.37			
1926	4	0.76	0.75			
1927	1	1.00	1.00			
1928	2	0.80	0.80	0.80		
1929	5	0.25	0.26		0.26	0.26
1930	4	0.71	0.72			0.72
1931	5	0.28	0.26			0.26
1932	4	0.40	0.45			0.45
1933	5	0.41	0.51			
1934	5	0.42	0.39			
1935	3	1.00	1.00	1.00		
1936	3	1.00	0.98	0.98		
1937	3	1.00	0.87	0.87		
1938	1	1.00	1.00			
1939	4	0.89	0.82		0.82	
1940	2	1.00	1.00	1.00		
1941	1	1.00	1.00			
1942	1	1.00	1.00			
1943	1	0.92	0.85			
1944	4	1.00	0.89		0.89	
1945	3	1.00	0.94	0.94		
1946	3	1.00	0.92	0.92		
1947	4	0.72	0.71		0.71	
1948	3	0.81	0.81	0.81		
1949	4	0.69	0.72		0.72	
1950	3	0.79	0.79	0.79		
1951	2	1.00	0.96	0.96		
1952	1	1.00	1.00			
1953	1	1.00	0.95			
1954	2	1.00	0.96	0.96		
1955	4	0.41	0.43		0.43	
1956	1	1.00	1.00			
1957	2	0.81	0.75	0.75		

STATE WATER PROJECT WATER SUPPLY AVAILABILITY
SWP M&I Allocations

TABLE DEVELOPMENT

The following table is based on the Department of Water Resources CALSIM II Model Studies for State Water Project Delivery Capability using the City of Vacaville's definitions for normal year, single dry year, and multiple dry years. (Reference notes (2), (3), and (4) below).

A. The Sacramento Valley 40/30/30 Index is used to identify yeartypes.

B. Based on definitions for normal, single dry, and multiple dry year conditions, as outlined in the City's adpoted Urban Water Management Plan, entitlement figures are placed in the corresponding columns for each defined year condition. Figures for wet years (Value 1) are omitted.

C. The columns are averaged to obtain a reliable percentage of available water supply under each of the stated conditions.

Sacramento Valley 40/30/30/ Index

Value	Yeartype
1	Wet
2	Above Normal
3	Below Normal
4	Dry
5	Critical Dry

Year	Sacramento Valley 40/30/30 Index (1)	2001 Level of Development Benchmark (1)	2020 Level of Development Full Entitlement (1)	2020 Full Entitlement Numbers for Normal Year (2)	2020 Full Entitlement Numbers for Single Dry Year (3)	2020 Full Entitlement Numbers for Multiple Dry Years (4)
1958	1	1.00	1.00			
1959	3	0.84	0.83	0.83		
1960	4	0.49	0.56		0.56	
1961	4	0.77	0.76			
1962	3	0.89	0.87	0.87		
1963	1	1.00	1.00			
1964	4	0.79	0.73		0.73	
1965	1	0.83	0.77			
1966	3	1.00	0.92	0.92		
1967	1	1.00	1.00			
1968	3	0.87	0.85	0.85		
1969	1	1.00	1.00			
1970	1	1.00	0.95			
1971	1	1.00	1.00			
1972	3	0.73	0.65	0.65		
1973	2	1.00	0.91	0.91		
1974	1	1.00	1.00			
1975	1	1.00	1.00			
1976	5	0.75	0.65		0.65	
1977	5	0.19	0.20			
1978	2	1.00	1.00	1.00		
1979	3	1.00	0.89	0.89		
1980	2	1.00	0.85	0.85		
1981	4	0.88	0.84		0.84	
1982	1	1.00	1.00			
1983	1	1.00	1.00			
1984	1	1.00	0.99			
1985	4	0.94	0.83		0.83	
1986	1	0.80	0.78			
1987	4	0.73	0.71		0.71	0.71
1988	5	0.23	0.23			0.23
1989	4	0.82	0.83			0.83
1990	5	0.27	0.28			0.28
1991	5	0.25	0.25			
1992	5	0.30	0.29			
1993	2	1.00	1.00	1.00		
			Average	0.89	0.64	0.47

Source: City of Vacaville, Utilities Division

(1) Source: CALSIM II Model Studies for SWP Delivery Capability Report, May 17, 2002.

(2) Normal delivery calculated based on average of yeartypes 2 & 3, above normal and below normal.

(3) Single dry year delivery calculated based on average of yeartypes 4 & 5, solitary dry/critical dry year or the first year of multiple dry/critical dry years.

(4) Multiple dry delivery calculated based on average of yeartypes 4 & 5 for four (4) consecutive years. This is consistent with the City of Vacaville 2000 Urban Water Management Plan Update.

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APPENDIX E

SUPPLEMENTAL ANALYSIS FOR SETTLEMENT WATER

IN SUPPORT OF

THE CITY OF VACAVILLE SB610 WATER

SUPPLY ASSESSMENT

Supplemental Analysis in Support of the City of Vacaville SB 610 Water Supply Assessment

PREPARED FOR: David Tompkins, P.E., Assistant Director of Public Works

PREPARED BY: Mark Leu, P.E.
Greg Eldridge, P.E.

COPIES: Richard Hunn

DATE: January 9, 2004

I. Introduction

The purpose of this technical memorandum (TM) is to provide supporting analysis to the City's SB 610 Water Supply Assessment Report for Lagoon Valley, Southtown and Rice McMurtry. Specifically, this analysis addresses the expected reliability of the water to be provided to the City in accordance with the *Settlement Agreement Among the Department of Water Resources of the State of California, Solano County Water Agency, and Cities of Fairfield, Vacaville, and Benicia for Purposes of Water Supply,* dated May 19, 2003. This water is referred to as "Settlement Water". The analysis is consistent with the *Agreement for Conveying Settlement Water Through the North Bay Aqueduct by the Department of Water Resources to the Solano County Water Agency for the Cities of Fairfield, Vacaville, and Benicia,* dated May 19, 2003.

Settlement Water is one of several sources of water that the City of Vacaville requires to meet current and future water demands. Table 1 lists all sources of Vacaville's water supply.

TABLE 1
City of Vacaville Water Sources

Water Supply Source	Water Supply Volume (acre-feet)
Solano Project – Vacaville Entitlement	5,750
Solano Project – SID Agreement	10,050
State Water Project – Vacaville Entitlement	6,100
State Water Project – KCWA Agreement	2,878
DWR – Settlement Water	9,320
Groundwater	8,000
Recycled Water	880
Total	42,978

reference: City of Vacaville, 2003.

II. Analysis Methods

To determine the expected reliability of Vacaville's Settlement Water, a supply simulation model was utilized. The reliability of Settlement Water was analyzed on an annual basis in the context of all water supply sources utilized by the City. The model used in this supplemental analysis, SOLANO_SIM, was developed for the Draft Environmental Impact Report (DEIR) for the *Cities of Fairfield, Vacaville, and Benicia Water Rights Appropriations Project* (2001). The Settlement Agreement with DWR was a result of negotiations to protests by DWR and the State Water Contractors to the area of origin water right applications filed by the Cities of Vacaville, Fairfield and Benicia.

One input to SOLANO_SIM were the State Water Project (SWP) deliveries to the NBA as simulated by CALSIM II. The CALSIM II model run was the same run used for the *State Water Project Delivery Reliability Report* (DWR 2002). The model run was published May 17, 2002 using a full SWP contract amount in every year (Model Run BST_2020D09D_FULLENTITLEMENT_5_1 [2021b Study]). The use of the recent CALSIM II results was an update to the SOLANO_SIM model runs used for the DEIR.

Simulation Modeling for Vacaville Water Supplies

SOLANO_SIM model simulation runs were performed using a monthly timestep. The model simulated the State Water Project North Bay Aqueduct (NBA), the primary conveyance facility needed to serve the cities of Vacaville, Fairfield, and Benicia.

Barker Slough Pumping Plant (BSPP) lifts water from Barker Slough into the NBA with a stated physical capacity of 175 cubic feet per second. The NBA was constructed to serve areas in Solano and Napa County. SWP Table A contract deliveries to Solano County Water Agency (purveyor to Vacaville, Fairfield, and Benicia), the Cities of Vallejo and Napa, and other contractors are simulated in SOLANO_SIM. Settlement Water is then assumed delivered through any remaining BSPP and NBA simulated conveyance capacities. The simulation model, additionally, performs tests for excess NBA capacity at 1) the Solano County Regional Water Treatment Plant, and, 2) at the turnouts to Vallejo and Napa.

SOLANO_SIM utilizes monthly distributions of the aforementioned supplies. The deliveries of water through the NBA to the three cities are premised on the 73 year output (1922 - 1994 simulation) from CALSIM II simulation results provided by DWR. Excess capacity is computed monthly to determine the physical potential to deliver settlement water to each city. Excess capacity is shared in proportion to the maximum settlement amount (Vacaville/Fairfield/Benicia - 9.32/11.80/10.50).

There is a provision in SOLANO_SIM to share and bank any unused NBA capacity between Fairfield and Vacaville as well. Any capacity not used by one of the cities can be used by the other. A running account is kept and balanced out each year.

Simulations of delivery of settlement water considers all senior users of the NBA. Deliveries are not simulated if physical capacity of the NBA has been reached in any month.

Another water delivery provision critical to evaluating the overall water supply reliability for the City of Vacaville involves the contract provision limiting SWP deliveries in a single month to 11% of the SWP contract total [12. Delivery Schedules (a) Limit on Peak Deliveries of Water]. The simulation model is consistent with this contract provision.

Standard Term 91 applies to months when the Delta is in balanced conditions and the SWP and the Central Valley Project are releasing water to meet minimum Delta water quality standards. Since Settlement Water is not available to Vacaville when Term 91 is in effect, SOLANO_SIM restricts use of that source during those months.

Analysis Model Run

The simulation of Vacaville water supply under ultimate foreseeable demand was modeled for the hydrology record 1922-1994. The SB 610 analysis is required for demands projected every five years through 2025, but this supplemental analysis utilizes a single model run using DWRs 2020 hydrology with Vacaville's ultimate foreseeable demand to determine how sources of water are utilized under the worst-case scenario.

To determine the expected reliability of Settlement Water for an entire year, it must be analyzed in conjunction with other sources utilized by the City of Vacaville. The model has a predefined priority system to determine which supplies are used within operational and physical constraints. Settlement Water is taken to meet Vacaville demands after Solano Project Water (for the DE plant), a minimum amount of groundwater pumping, SWP Vacaville contract amount, the SWP KCWA agreement water.

III. Expected Reliability of Settlement Water

The expected reliability of Settlement Water is analyzed on an annual basis within the context of all other water supplies. The simulation modeling objective is to meet the monthly Vacaville water demand with supplies other than Settlement Water in months when Term 91 is in effect. By utilizing Settlement Water in months when Term 91 is not in effect, the full annual contract amount of Settlement Water is used on an annual basis.

Table 2 shows the annual results from the SOLANO_SIM run for Vacaville's ultimate foreseeable demand, which is the buildout level of demand as analyzed in the Water Rights Appropriations Project DEIR. The tables illustrate how the Vacaville demand was nearly met in every year by using a varied mix of supplies. The model simulation results show Vacaville using the full contracted amount of Settlement Water, 9,320 acre-feet, in every year indicating the firm reliability of this supply.

TABLE 2
SOLANO_SIM Model Results on Annual Basis for Vacaville Under Ultimate Foreseeable Demand Conditions
1922-1994 Hydrology, (thousand acre-feet)

Calendar Year	Demand	Ground-water	Recycled Water	Settlement Water	SWP	Solano Project	KCWA	Total Supply
1922	40.6	7.55	0.88	9.32	6.09	15.60	1.16	40.60
1923	40.6	7.93	0.88	9.32	5.29	15.60	1.55	40.57
1924	40.6	9.27	0.88	9.32	1.53	15.60	1.44	38.04
1925	40.6	8.99	0.88	9.32	2.21	15.60	1.44	38.44
1926	40.6	7.93	0.88	9.32	4.50	15.60	1.75	39.99
1927	40.6	7.51	0.88	9.32	6.05	15.60	1.23	40.60

TABLE 2
SOLANO_SIM Model Results on Annual Basis for Vacaville Under Ultimate Foreseeable Demand Conditions
1922-1994 Hydrology, (thousand acre-feet)

Calendar Year	Demand	Ground-water	Recycled Water	Settlement Water	SWP	Solano Project	KCWA	Total Supply
1928	40.6	7.90	0.88	9.32	4.92	15.60	1.98	40.60
1929	40.6	9.27	0.88	9.32	1.69	15.60	1.44	38.20
1930	40.6	8.15	0.88	9.32	4.30	15.60	1.67	39.92
1931	40.6	9.27	0.88	9.32	1.69	15.60	1.44	38.21
1932	40.6	8.54	0.88	9.32	2.74	15.60	1.44	38.52
1933	40.6	9.03	0.88	9.32	3.07	15.60	1.44	39.34
1934	40.6	9.27	0.88	9.32	2.40	15.60	1.44	38.91
1935	40.6	7.38	0.88	9.32	5.99	15.60	1.43	40.60
1936	40.6	7.25	0.88	9.32	5.99	15.60	1.57	40.60
1937	40.6	7.64	0.88	9.32	5.32	15.60	1.84	40.60
1938	40.6	7.64	0.88	9.32	6.08	15.60	1.09	40.60
1939	40.6	7.86	0.88	9.32	5.06	15.60	1.88	40.60
1940	40.6	7.45	0.88	9.32	6.07	15.60	1.28	40.60
1941	40.6	7.64	0.88	9.32	6.10	15.60	1.06	40.60
1942	40.6	7.49	0.88	9.32	6.10	15.60	1.21	40.60
1943	40.6	7.81	0.88	9.32	5.21	15.60	1.77	40.60
1944	40.6	7.70	0.88	9.32	5.40	15.60	1.70	40.60
1945	40.6	7.48	0.88	9.32	5.71	15.60	1.61	40.60
1946	40.6	7.57	0.88	9.32	5.59	15.60	1.63	40.60
1947	40.6	8.14	0.88	9.32	4.34	15.60	1.63	39.91
1948	40.6	7.93	0.88	9.32	4.90	15.60	1.88	40.51
1949	40.6	8.28	0.88	9.32	4.40	15.60	1.44	39.92
1950	40.6	7.93	0.88	9.32	4.83	15.60	1.97	40.53
1951	40.6	7.52	0.88	9.32	5.85	15.60	1.43	40.60
1952	40.6	7.57	0.88	9.32	6.09	15.60	1.13	40.60
1953	40.6	7.49	0.88	9.32	5.79	15.60	1.52	40.60
1954	40.6	7.42	0.88	9.32	5.87	15.60	1.51	40.60
1955	40.6	8.48	0.88	9.32	2.71	15.60	1.50	38.49
1956	40.6	7.65	0.88	9.32	6.00	15.60	1.16	40.60
1957	40.6	7.93	0.88	9.32	4.61	15.60	1.99	40.34
1958	40.6	7.66	0.88	9.32	6.05	15.60	1.09	40.60

TABLE 2
SOLANO_SIM Model Results on Annual Basis for Vacaville Under Ultimate Foreseeable Demand Conditions
1922-1994 Hydrology, (thousand acre-feet)

Calendar Year	Demand	Ground-water	Recycled Water	Settlement Water	SWP	Solano Project	KCWA	Total Supply
1959	40.6	7.84	0.88	9.32	5.09	15.60	1.87	40.60
1960	40.6	8.37	0.88	9.32	3.44	15.60	1.67	39.28
1961	40.6	7.96	0.88	9.32	4.58	15.60	1.58	39.93
1962	40.6	7.72	0.88	9.32	5.30	15.60	1.78	40.60
1963	40.6	7.49	0.88	9.32	6.08	15.60	1.23	40.60
1964	40.6	7.93	0.88	9.32	4.52	15.60	2.00	40.26
1965	40.6	7.93	0.88	9.32	4.70	15.60	1.92	40.35
1966	40.6	7.68	0.88	9.32	5.60	15.60	1.52	40.60
1967	40.6	7.58	0.88	9.32	6.09	15.60	1.13	40.60
1968	40.6	7.82	0.88	9.32	5.21	15.60	1.78	40.60
1969	40.6	7.66	0.88	9.32	6.07	15.60	1.06	40.60
1970	40.6	7.55	0.88	9.32	5.75	15.60	1.51	40.60
1971	40.6	7.58	0.88	9.32	6.00	15.60	1.21	40.60
1972	40.6	7.97	0.88	9.32	3.95	15.60	2.17	39.89
1973	40.6	7.78	0.88	9.32	5.41	15.60	1.61	40.60
1974	40.6	7.59	0.88	9.32	5.99	15.60	1.21	40.60
1975	40.6	7.50	0.88	9.32	6.01	15.60	1.29	40.60
1976	40.6	8.66	0.88	9.32	4.00	15.60	2.04	40.51
1977	40.6	9.27	0.88	9.32	1.26	15.60	1.44	37.77
1978	40.6	7.82	0.88	9.32	5.87	15.60	1.12	40.60
1979	40.6	7.82	0.88	9.32	5.20	15.60	1.78	40.60
1980	40.6	7.93	0.88	9.32	4.96	15.60	1.88	40.58
1981	40.6	7.93	0.88	9.32	4.89	15.60	1.86	40.48
1982	40.6	7.74	0.88	9.32	5.81	15.60	1.25	40.60
1983	40.6	7.74	0.88	9.32	5.83	15.60	1.23	40.60
1984	40.6	7.64	0.88	9.32	5.75	15.60	1.41	40.60
1985	40.6	7.93	0.88	9.32	4.88	15.60	1.94	40.56
1986	40.6	7.93	0.88	9.32	4.58	15.60	2.02	40.33
1987	40.6	8.32	0.88	9.32	4.15	15.60	1.63	39.90
1988	40.6	9.27	0.88	9.32	1.45	15.60	1.44	37.96
1989	40.6	7.93	0.88	9.32	4.73	15.60	1.88	40.34

TABLE 2
SOLANO_SIM Model Results on Annual Basis for Vacaville Under Ultimate Foreseeable Demand Conditions
1922-1994 Hydrology, (thousand acre-feet)

Calendar Year	Demand	Ground-water	Recycled Water	Settlement Water	SWP	Solano Project	KCWA	Total Supply
1990	40.6	9.27	0.88	9.32	1.75	15.60	1.44	38.26
1991	40.6	9.27	0.88	9.32	1.49	15.60	1.44	38.00
1992	40.6	9.27	0.88	9.32	1.69	15.60	1.44	38.20
1993	40.6	7.86	0.88	9.32	5.71	15.60	1.23	40.60
1994	40.6	7.86	0.88	9.32	5.20	15.60	1.74	40.60
Min	40.6	7.25	0.88	9.32	1.26	15.60	1.06	37.77
Average	40.6	8.01	0.88	9.32	4.73	15.60	1.54	40.09
Max	40.6	9.27	0.88	9.32	6.10	15.60	2.17	40.60

While the model results in Table 2 illustrate how the full contract amount of Settlement Water is available and used each year under ultimate foreseeable demand, for any given month in a year this supply may not be available. Under the terms of the Settlement Agreement, DWR is not required to make Settlement Water available to SCWA and Vacaville when Term 91 condition is in effect. This condition typically occurs during the summer and or fall months of the year and ranges from one to five months in duration.

During these months, the simulation model indicates that Vacaville will rely on other sources of water including the SWP water. The model simulates delivery of this water while adhering to all allocated capacity rules on the NBA and SWP contract peak monthly flow constraints. Table 3 has examples of a single normal year, a single dry year, and multiple dry years averaged together. The table shows how the mix of water supply changes from year to year. Generally, months without Settlement Water delivery are months with Term 91 in effect. The water year type designations were determined by Vacaville Utilities and based on the DWR Sacramento Valley Water Year Index. The City's year type classifications are presented in Appendix C of the *SB 610 Water Supply Assessment Report for Lagoon Valley, Southtown, and Rice McMurtry* (Vacaville 2003).

The simulation modeling indicates that the Settlement Water is 100% reliable in terms of annual quantity available. However, the timing of deliveries of the Settlement Water is dependant on whether or not Term 91 is in effect. As illustrated in Table 3 below, when Term 91 is in effect, the monthly demand will be met with the other sources until Settlement Water can be used.

TABLE 3
SOLANO_SIM Model Results on Monthly Basis for Vacaville Under Ultimate Foreseeable Demand Conditions [a]
1922-1994 Hydrology, (thousand acre-feet)

	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	Total	Jan-Dec
1948 Single Normal Year, SWP Allocation 81%														
Groundwater	0.18	0.39	0.89	0.18	0.18	0.18	0.18	0.86	1.62	1.65	1.65	0.18	8.14	7.93
Recycled	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.18	0.18	0.18	0.18	0.18	0.88	0.88
Settlement Water	1.33	0.00	0.00	1.63	1.51	1.97	1.35	1.25	0.00	0.00	0.00	1.14	10.19	9.32
SWP	0.47	0.39	0.22	0.13	0.15	0.25	0.44	0.54	0.54	0.54	0.54	0.54	4.74	4.90
Solano Project	1.66	0.02	0.00	0.00	0.00	0.41	1.50	1.86	2.31	1.91	1.88	2.73	14.27	15.60
KCWA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.03	0.84	0.00	1.88	1.88
Total Supply	3.64	0.79	1.11	1.94	1.84	2.81	3.47	4.69	4.65	5.31	5.09	4.76	40.11	40.51
1976 Single Dry Year, SWP Allocation 65%														
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	Total	Jan-Dec
Groundwater	0.18	0.18	0.46	0.18	0.18	0.18	0.18	0.86	1.62	1.65	1.65	0.18	7.50	8.66
Recycled	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.18	0.18	0.18	0.18	0.18	0.88	0.88
Settlement Water	0.75	1.11	0.21	1.57	1.50	1.91	0.00	0.00	0.00	0.00	0.00	1.03	8.09	9.32
SWP	0.66	0.54	0.30	0.18	0.12	0.20	0.35	0.43	0.43	0.43	0.43	0.43	4.52	4.00
Solano Project	1.85	0.00	0.00	0.00	0.00	0.41	2.80	3.05	2.42	1.90	1.95	2.54	16.92	15.60
KCWA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.16	0.89	0.00	2.04	2.04
Total Supply	3.44	1.83	0.97	1.93	1.80	2.70	3.34	4.53	4.65	5.31	5.09	4.36	39.95	40.51
1987-1990 Multiple Dry Years, Averaged, Average SWP Allocation 51%														
	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	Total	Jan-Dec
Groundwater	0.40	0.39	0.89	0.18	0.18	0.18	0.18	0.86	1.62	1.65	1.65	0.18	8.37	8.70
Recycled	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.18	0.18	0.18	0.18	0.18	0.88	0.88
Settlement Water	1.34	0.22	0.00	1.62	1.54	2.15	0.71	0.00	0.00	0.00	0.00	1.44	9.02	9.32
SWP	0.41	0.34	0.19	0.11	0.09	0.15	0.27	0.33	0.33	0.33	0.33	0.33	3.20	3.02
Solano Project	1.31	0.27	0.00	0.00	0.00	0.26	2.23	3.16	2.52	1.86	2.63	2.05	16.30	15.60
KCWA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.29	0.30	0.00	1.60	1.60
Total Supply	3.46	1.22	1.08	1.92	1.81	2.73	3.39	4.53	4.65	5.31	5.09	4.18	39.37	39.12

[a] The model SOLANO_SIM operates on a standard Water Year, October-September. The annual results for the DWR Year, January-December, are also shown to be consistent with annual SWP and Settlement Water contract amounts.

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Appendix B

List of Acronyms and Abbreviations

APPENDIX B

LIST OF ACRONYMS AND ABBREVIATIONS

LIST OF ACRONYMS AND ABBREVIATIONS	
Acronym	Definition
AB	Assembly Bill
ABAG	Association of Bay Area Governments
ACBM	asbestos containing building material
ADWF	average dry weather flow
AH	Agricultural Hillsides
ALUC	Airport Land Use Commission
ALUCP	Airport Land Use Compatibility Plan
ANSI	American National Standards Institute
AOPA	Aircraft Owners and Pilots Association
APE	Area of Potential Effect
APNs	Assessors' Parcel Numbers
ARB	Air Resources Board
ASA	Agricultural Service Area
ASTM	American Society for Testing and Materials
ASTs	above ground storage tanks
BART	Bay Area Rapid Transit
BMPs	Best Management Practices
BP	Business Park
BP	before present
BR	Bureau of Reclamation
BV	Business Village
Cal/EPA	California Environmental Protection Agency
CalARP	California Accidental Release Prevention
Caltrans	California Department of Transportation
CAPCOA	California Air Pollution Control Officers Association
CBC	California Building Code
CC&Rs	Conditions, Covenants, and Restrictions
CCAA	California Clean Air Act
CCAF	Central California Archaeological Foundation
CCR	California Code of Regulations
CDC	California Department of Conservation
CDFG	California Department of Fish and Game
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
CESA	California Endangered Species Act
CFR	Code of Federal Regulations
CFS	calls for service
CG	General Commercial
CGS	California Geological Survey

LIST OF ACRONYMS AND ABBREVIATIONS	
Acronym	Definition
CHP	California Highway Patrol
CIP	Capital Improvement Projects
CLOMR	Conditional Letter of Map Revision
cm	centimeters
CNDDB	California Natural Diversity Data Base
CNPS	California Native Plant Society
CO	carbon monoxide
Corps	United States Army Corps of Engineers
CRHR	California Register of Historical Resources
CUPA	Certified Unified Program Agency
CVRWQCB	Central Valley Regional Water Quality Control Board
CWA	Clean Water Act
dB	decibel
dBA	A-weighted decibel scale
DE	Diatomaceous Earth
DIF	Development Impact Fee
DOT	Department of Transportation
DSOD	Division of Safety of Dams
DTSC	Department of Toxic Substance Control
DUSD	Dixon Unified School District
DWR	Department of Water Resources
EIR	environmental impact report
EPA	Environmental Protection Agency
ESAs	Environmental Site Assessments
F	Fahrenheit
FAR	Flood Area Ratio
FCAA	Federal Clean Air Act
FEMA	Federal Emergency Management Agency
FESA	Federal Endangered Species Act
FIRM	Flood Insurance Rate Map
FIRST	Family Investigative Response Services Team
FMMP	Farmland Mapping and Monitoring Program
FSUSD	Fairfield-Suisun Unified School District
gpm	gallons-per-minute
HCP	Habitat Conservation Plan
HRA	health risk assessment
HRER	Historical Resources Evaluation Report
HVAC	heating, ventilation, and air conditioning
I-80	Interstate 80
ICU	Intersection Capacity Utilization
IPM	Integrated Plant Management
KCWA	Kern County Water Agency
kV	kilovolt
kW	kilowatt
L_{eq}	L_{max}
LOMR	Letter of Map Revision
LOS	Levels of Service
M	magnitude
MACT	Maximum Achievable Control Technology

LIST OF ACRONYMS AND ABBREVIATIONS	
Acronym	Definition
mg	million gallon
mgd	million gallons per day
MLD	Most Likely Descendant
MMI	Modified Mercalli Intensity Scale
MMP	Mitigation Monitoring Plan
MND	Mitigated Negative Declaration
MRZ	mineral resource zone
M_w	Moment Magnitude
MWA	Master Water Agreement
NBA	North Bay Aqueduct
NBR	North Bay Regional
NCCP	Natural Community Conservation Plans
NEPA	National Environmental Policy Act
NESHAPS	National Emission Standards for Hazardous Air Pollutants
NFIP	National Flood Insurance Program
NO_2	nitrogen dioxide
NOI	Notice of Intent
NOP	Notice of Preparation
NO_x	nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resource Conservation Service
NRHP	National Register of Historic Places
O_3	ozone
OES	Office of Emergency Services
OS	Open Space
pc/mi/ln	passenger cars per mile per lane
PCBs	Polychlorinated biphenyl oils
PEA	Preliminary Endangerment Assessment
PF	Public Facilities
PG&E	Pacific Gas and Electric Company
PGO	Planned Growth Ordinance
PM_{10}	particulate matter less than ten microns in diameter
ppm	parts per million
PUC	Public Utilities Commission
PWWF	peak wet weather flow
R&D	research and development
RACM	regulated asbestos-containing material
RE	Residential Estates
ROG	reactive organic gases
RWQCB	Regional Water Quality Control Board
SB	Senate Bill
SCDEM	Solano County Department of Environmental Management
SCS	Soil Conservation Service
SCWA	Solano County Water Agency
SDMP	Storm Drain Master Plan
sf	square feet
SID	Solano Irrigation District
SIP	state implementation plan
SMARA	California Surface Mining and Reclamation Act of 1975

LIST OF ACRONYMS AND ABBREVIATIONS	
Acronym	Definition
SO_2	sulfur dioxide
SOI	Sphere of Influence
SPO	Special Performance Option
SRTP	Short Range Transit Plan
SVAB	Sacramento Valley Air Basin
SWMP	Storm Water Management Plan
SWP	State Water Project
SWPPP	Storm Water Pollution Prevention Plan
SWRCB	State Water Resources Control Board
TACs	toxic air contaminants
TAFB	Travis Air Force Base
T-BACT	Best Available Control Technology for Toxics
TDS	total dissolved solids
TUSD	Travis Unified School District
U.S. EPA	U.S. Environmental Protection Agency
UBC	Uniform Building Code
UFC	Uniform Fire Code
USA	Urban Service Area
USCOE	U.S. Army Corps of Engineers
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
USGA	United States Golf Association
USGS	United States Geological Survey
USTs	underground storage tanks
UWMP	Urban Water Management Plan
V/C	volume-to-capacity
VdB	vibration decibels
VEE	Visible Emissions Evaluations
VELB	Valley elderberry longhorn beetle
VUSD	Vacaville Unified School District
WDS	Waste Discharge System
WGEP	Working Group on California Earthquake Probabilities
WSAR	Water Supply Assessment Report
WTP	Water Treatment Plant
WWTP	Wastewater Treatment Plant
YSAQMD	Yolo-Solano Air Quality Management District
Source: EIP Associates, January 2000.	

Appendix C

Visual Simulations