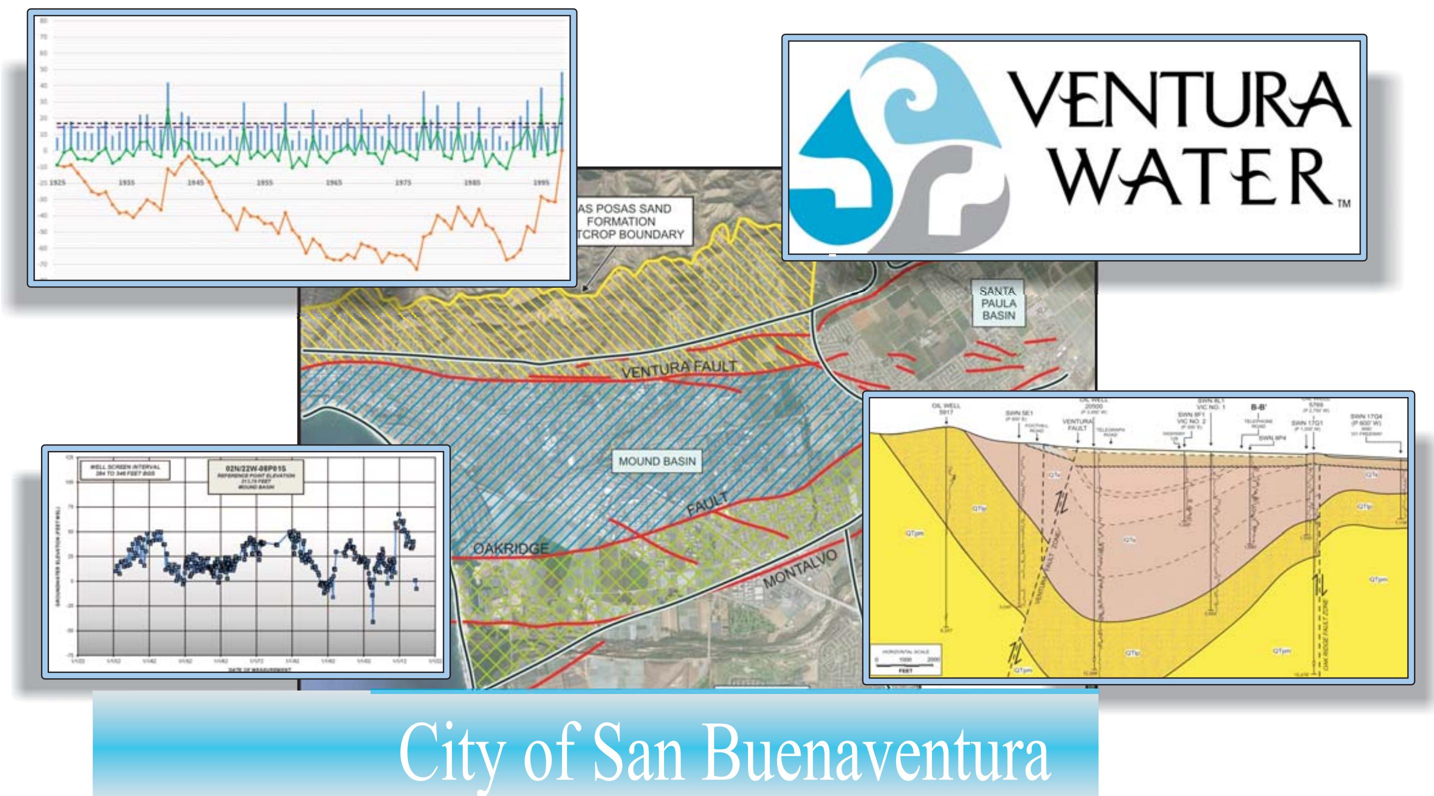
HOPKINS GROUNDWATER CONSULTANTS, INC.

PRELIMINARY HYDROGEOLOGICAL STUDY

MOUND BASIN
GROUNDWATER CONDITIONS
AND
PERENNIAL YIELD STUDY

Prepared for:
City of San Buenaventura

March 2020



HOPKINS
GROUNDWATER
CONSULTANTS, INC.
THE WATER RESOURCE SPECIALISTS

March 13, 2020
Project No. 01-009-11B

City of San Buenaventura
Ventura Water
Post Office Box 99
Ventura, California 93002-0099

Attention: Ms. Susan Rungren
General Manager, Ventura Water

Subject: *Preliminary Hydrogeological Study, Mound Basin Groundwater Conditions and Perennial Yield Study,* prepared for: City of San Buenaventura, dated March 2020.

Dear Ms. Rungren:

We are pleased to submit this report summarizing the findings and conclusions developed from the subject Mound Basin conditions and perennial yield study. The study concludes based on available data that the Mound Basin is likely capable of providing an average annual perennial yield in the range of 6,700 to 7,400 acre-feet per year.

We trust this report provides a sufficient summary of the hydrogeological conditions in the Mound Groundwater Basin to facilitate the City's future water supply planning efforts. If you have any questions, please give us a call.

Sincerely,

HOPKINS GROUNDWATER CONSULTANTS, INC.

REGISTERED GEOLOGIST
CURTIS J. HOPKINS
EG NO. 1800
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

Curtis J. Hopkins
Principal Hydrogeologist
Certified Hydrogeologist HG 114
Certified Engineering Geologist EG 1800

Copies Submitted: Six (6) Bound Copies
One (1) Electronic Copy

CONTENTS

FIGURES

TABLES

PLATES

APPENDICES

FORWARD

The City of San Buenaventura (City) has historically undertaken studies to understand the natural resources it relies on to provide potable water for its municipal water system customers. The Mound Subbasin (Mound Basin or Basin) is one of the five major sources of drinking water supply the City has utilized for decades and has historically provided 10% to 25% of its total supply on an annual basis since 1982. The availability and reliability of this crucial source of water has been assessed periodically by the City for this very reason.

This study of the Basin was conceptually developed for the purpose of updating the City's previous groundwater conditions studies that were conducted in 1996 and 1997 (Fugro, 1996 & 1997) and in which the operational yield of the Basin was reviewed. The study was to support water supply planning efforts by the City in which the Mound Basin groundwater resource is a vital supply. Upon initiation of data collection and analysis, and report review, we recognized that the United Water Conservation District (UWCD) preliminary report of the Basin dated May 2012, had roughly defined the hydrogeology of the Basin. A component of this study was to develop an independent interpretation of the complex hydrogeologic framework of the Basin to better understand the recharge and movement of groundwater within the Basin.

While work was being initiated, the State of California passed the Sustainable Groundwater Management Act (SGMA) in 2014 which assigned a rating that was designated to each groundwater basin officially identified in the Department of Water Resources (DWR) Bulletin 118. The Mound Subbasin is part of the Santa Clara River Groundwater Basin and was originally designated as having a Medium priority. In 2015, the DWR began to release draft guidelines for groundwater management plan (GMP) preparation and continued to finalize guideline sections and release new draft guideline section up through 2018. It was recognized by the City that the scope of this study was not designed or budgeted to accomplish the majority of the comprehensive data collection, analysis, and presentation required for the assessment of the sustainability criteria identified in the legislation, however, it could still be useful and contribute to the Groundwater Sustainability Plan (GSP) study.

This study provides a preliminary compilation of; a) a hydrogeologic model of the Basin, b) available land use data, and c) hydrological data that are used to assess basin responses to groundwater recharge and pumping and approximate its perennial/operational yield. During the course of this study, the 25-year base period over which SGMA designated study for GSP development was defined as 1986 to 2015. In addition, the Mound Subbasin boundary was modified to include or exclude areas that fell between basin boundaries or should be included in adjacent basin boundaries. In February 2019, DWR released the final basin boundary modifications for the Mound Basin. The data sets were modified as necessary in this study to use the official Basin boundary for the analyses.

INTRODUCTION

Presented in this report is a summary of hydrogeologic conditions of the Mound Groundwater Basin (Mound Basin or Basin) that were used to estimate the average perennial or operational yield of the Basin. The Mound Basin is identified by the State as a Subbasin of the larger Santa Clara River Valley Groundwater Basin (SCRVGB). This report constitutes a preliminary review of the Basin perennial yield and is provided to assist in ongoing groundwater resource planning and Basin management being conducted by the City of San Buenaventura (City). The Mound Basin boundaries were historically defined by the California Department of Water Resources (DWR) based on available hydrogeologic information and recently modified in March 2019 (DWR, 2019) as part of the Mound Basin Groundwater Sustainability Agency's efforts to align the boundary lines with the adjacent basin boundary lines that were established through legislation or litigation. The present Mound Basin boundary is shown on Plate 1 – Mound Basin Boundary Map.

The purpose of this preliminary hydrogeological study is to provide a technical review of data and available information in order to summarize basin conditions and supplement previous estimates of the Mound Basin perennial or operational yield. The scope of the analysis includes:

- Review well logs to define the hydrogeology of the Basin and better understand sources of recharge
- Review historical records of Basin groundwater production
- Review available water level and water quality data
- Correlate Basin responses to pumping stresses
- Estimate Basin perennial yield

This report includes technical data that are provided as appendices and include; Appendix A – Hydrogeologic Cross-Sections, Appendix B – Fence Diagrams, Appendix C- Rainfall Data, Appendix D – Groundwater Hydrographs, Appendix E – Groundwater Production Data, Appendix F – Water Quality Data, Appendix G – Groundwater Elevation Measurements, Appendix H – Mound Basin Surficial Recharge, and Appendix I – Mound Basin Water Budget.

Data Sources

This study relies on readily available data and technical documents that characterize the Mound Basin. Apart from the list of references included at the end of this report, there are a number of data sources that were relied upon to provide the technical data required for analysis. Table 1 – Data Sources lists these specific sources of technical data that were used for this study.

Table 1 - Data Sources

Data Type	Source
Precipitation and Evaporation	Ventura County Watershed Protection District Hydrologic Data Server (Hydrodata) http://vcwatershed.net/hydrodata/ California Irrigation Management Information System (CIMIS) – part of DWR
Streamflow	Ventura County Watershed Protection District Hydrologic Data Server (Hydrodata) http://vcwatershed.net/hydrodata/ U.S. Geological Survey
Groundwater Production and Imported Water Supplies	United Water Conservation District City of San Buenaventura
Groundwater Levels	Ventura County Watershed Protection District United Water Conservation District
Groundwater Quality	Ventura County Watershed Protection District United Water Conservation District
Well Geophysical Logs	Ventura County Watershed Protection District California Division of Oil, Gas, and Geothermal Resources
Spatial Feature Layers (GIS)	Ventura County Farm Bureau, Southern California Association of Governments (SCAG), United Water Conservation District

FINDINGS

Basin Description

The Mound Basin has been utilized as a source of groundwater supply for overlying land uses since the late 1800's. The land uses that rely on Basin groundwater have changed over time and have notably changed from mostly agricultural practices to municipal and industrial (M&I or urban) land uses.

The Mound Basin has been the subject of numerous investigations that includes:

- California Department of Public Works, Division of Water Resources, Bulletin No. 46, Ventura County Investigation, 1933

- California State Water Resources Board (SWRB), Bulletin No. 12, Ventura County Investigation, October 1953, Revised April 1956
- John F. Mann Jr., Preliminary Report on the Mound Basin, January 1958 and A Plan for Ground Water Management, September 1959
- Turner, J., Ventura County Water Resources Management Study Aquifer Delineation in the Oxnard Calleguas Area, Ventura County, 1975
- Mukae, M. and Turner, J., Ventura County Water Resources Management Study, Geologic Formations, Structures and History in the Santa Clara-Calleguas Area, 1975
- Turner, J., and Mukae, M., Ventura County Water Resources Management Study, Effective Base of Fresh Water Reservoir in the Oxnard-Calleguas Area, 1975

In DWR Bulletin No. 46, the Mound Basin was originally included within the Montalvo Basin and the Oxnard Plain Basin. These previous Basin boundaries are shown on Plate 2 – Historical Groundwater Basin Boundary Map, and are the original attempt to delineate the basins based on available subsurface geology from boreholes that had been drilled up to that time, water level data showing changes from one area to another, and water quality differences. Subsequent modifications to the local groundwater basin boundaries in SWRB Bulletin No. 12 removed the Montalvo Basin and delineated the Mound Basin and the Oxnard Forebay Basin, and accordingly modified the Oxnard Plain Basin. As originally defined, the Mound Basin covered approximately 12,300 acres with topography varying in elevation from sea level up to approximately 400 feet above sea level (SWRB, 1953). Surface water drainage channels cross the Basin and flow southward to the Santa Clara River and the Pacific Ocean. The Mound Basin is one of six subbasins that comprise the SCRVGB. The Mound Basin and the Oxnard Plain Basin are the only two subbasins within the SCRVGB that border the coastline; the Oxnard Plain Basin is impacted by seawater intrusion. The slightly revised Basin boundaries in DWR Bulletin No. 118 indicated the Mound Basin covered approximately 14,800 acres (23.1 square miles). As shown in Plate 1, the current basin boundary, as modified by DWR in 2018 covers an approximate area of 13,865 acres (21.7 square miles) (DWR, 2019).

The northern Basin boundary is the extent of the San Pedro Formation (base of the Las Posas Sand) outcrop in the Ventura Foothills. The southern boundary of the basin parallels the Santa Clara River and is coincident with the Fox Canyon Groundwater Management Agency boundary, which includes the Oxnard Forebay and Oxnard Plain Groundwater Basins. The eastern boundary is the adjudicated boundary of the adjacent Santa Paula Basin which is hydrogeologically delineated by the Country Club Fault zone. The western boundary is coincident with the present shoreline and inland ocean water ways in the Ventura Marina and Ventura Keys along with the topographic drainage divide that defines the adjacent Lower Ventura River Groundwater Basin.

Hydrogeology

The Mound Basin lies within the Transverse Ranges geologic province where mountain ranges and basins have a primarily east-west orientation contrary to the general north/northwest-south/southeast orientation of the mountain ranges over most of the state. The Mound Basin is located within an east/west trending syncline (Ventura Syncline) that plunges westward under the ocean. The surface trace of syncline axis is approximately coincident with the location of State Highway 126. The deepest portion of the Basin is estimated at a depth of approximately 4,000 feet below ground surface (bgs). The Oakridge Fault is a steep south-dipping, left-lateral reverse fault.

The surface geology within and adjacent to the Mound Basin boundary has been mapped by numerous sources including the California Geological Survey (CGS, 2008) and United States Geological Survey Thomas W. Dibblee, Jr. (Dibblee, 1988), which are provided for reference as Plate No. 3 – California Geological Survey Geologic Map and Plate No. 4 – Thomas W. Dibblee, Jr. Geologic Map.

The San Pedro Formation has an outcrop area of approximately 4,400 acres (SWRB, 1953), which traverses the Ventura foothills all along the northern side of the Basin. The San Pedro Formation correlates with both the Saugus Formation and the underlying Los Posas Sand as described by Dibblee. The San Pedro Formation extends westward from the Mound Basin and underlies the alluvium at the mouth of the Ventura River within the Lower Ventura River Basin, and continues westerly where it outcrops offshore. Although some of the Mound Basin aquifer zones extend offshore and are in direct contact with seawater, the coastline is assigned as the western boundary of Mound Basin. The western boundary extends northward up to where the coastline defines the Lower Ventura River Basin boundary. At that location, the northwestern most portion of the Mound Basin is delineated by a topographic divide separating it from the Lower Ventura River Basin. The Santa Clara River runs along the southern boundary of the Basin where it has historically been defined by structures associated with the Oakridge Fault zone that include the McGrath Fault and the Montalvo Anticline.

For this study, the geology defined by Dibblee was utilized in combination with borehole geologic and geophysical data to construct subsurface cross-sections that show a vertical profile of the geologic strata. Plate 5 – Hydrogeologic Cross-Section Location Map shows the approximate location of the hydrogeologic cross-sections constructed for this study along with the location of historical oil wells and water wells that provided data. Plates 6 through 15 – Hydrogeologic Cross-Section A-A' through J-J', respectively, show the interpretation of subsurface geologic data across the Basin and include traces of the borehole geophysical data that were used for correlation. These cross-sections were constructed with a vertical exaggeration of 3:1.

Cross-sections constructed without a vertical exaggeration are included in Appendix A as Plates A2 to A10. Table A1 – Summary of Wells Used in Cross-Section Construction identifies the specific wells that were used for this effort. The 1:1 scale Mound Basin cross-sections were subsequently used to construct Fence Diagrams that provide geologic contact elevation control between the available data points and develop a three-dimensional view of the Basin. A compilation of these diagrams is included in Appendix B with multiple angles of view on the subsurface structures in the Basin.

In order to correlate the lithology defined by the borehole geophysical data in the Mound Basin with the aquifer designations assigned in the Oxnard Plain Subbasin, these data were adjusted for elevation and overlain on the historical interpretation (Turner, 1975). Plate 16 – Historical Hydrogeological Cross-Section Location Map shows the approximate location of the cross-section that was constructed across the Mound Basin and extended into the Oxnard Plain (Turner, 1975). Plate 17 – Historical Hydrogeologic Cross-Section with Electric Log Traces shows the designated aquifer zones along with an overlay of the borehole geophysical traces for the wells used to define the hydrogeology and construct the subsurface profile.

Using these designations, it is clear that the Saugus and Los Posas Sand Formations comprise the majority of the water-bearing materials in the Mound Basin which correlate with the Hueneme and Fox Canyon Aquifers in the Oxnard Plain. In the Mound Basin, the older alluvium is comprised primarily of relatively fine-grained silt and clay materials that were likely deposited as streams flowed out of the Ventura Foothills and created the alluvial fans we see today. Some coarser grained deposits of marine and alluvial origin exist toward the base of the older alluvium and form an upper aquifer zone that is believed comparable to the Mugu Aquifer.

As shown in the hydrogeologic cross-sections, the Basin is divided by 2 major fault zones; the Ventura Fault and the Oakridge Fault. The formation of these faults has to some extent cross-cut the geologic layers that form the major aquifer zones in the Basin. The amount of impedance to groundwater flow across these structures is not well understood. However, with hundreds of feet of offset, there must be some effect on groundwater flow. For this reason, we have divided the Basin into the 3 subareas, the North Mound Basin Subarea, the Central Mound Basin Subarea, and the South Mound Basin Subarea, shown on Plate 18 – Mound Basin Subareas.

Local Climate Data

Rainfall Data. Rainfall data collected by the County of Ventura are available for five stations within the Mound Basin. Information for those stations is summarized in Table 2 – Summary of Mound Basin Rainfall Gauges. Plate 19 – PRISM Data and Rain Gauge Location

Map shows the location of the rain gauges in the Basin and in the Ventura Foothills. A comparison of the rain gauge data and available PRISM data for the 30-year-period of 1981 to 2010 is shown on Plate 19 for comparison. As shown for Rain Gauge 066, the PRISM value of 16.24 inches per year (in/yr) compares well with the gauge average of 16.09 in/yr.

Table 2 – Summary of Mound Basin Rainfall Gauges

Station No. Description	General Location	Lat. / Long.	Data Range	Status	Average / Median Rainfall[1] (in/yr)
006 Del Mar Ranch	Telephone Road, East Basin	Not available	1925 - 1998	Inactive	16.3 / 14.4
066 Downtown Ventura	West Basin	34.2811 -119.2917	1873 - 2016	Active	15.2 / 14.1
167 Hall Canyon	Central Basin	34.2805 -119.2595	1957 - 2016	Active	15.8 / 13.3
216 Ventura Marina	West Basin	34.2521 -119.2659	1965 - 2016	Active	14.7 / 12.9
222 Ventura Govt. Center	Central Basin	34.2673 -119.2112	1926 - 2016	Active	15.6 / 13.3

[1] – Average/median rainfall values are for the entire data range listed in column 4, *Data Range*

As shown in the *Average/Median Rainfall* column, all five rain gauges in the Mound Basin have similar estimated average and median rainfall values based on data recorded during their respective time periods. As summarized above and presented graphically on the graphs provided in Appendix C, the average and median rainfall values in the Mound Basin range from 14.7 to 16.3 inches per year and 12.9 to 14.4 inches per year, respectively. Gauge 006 in the eastern portion of the Basin is inactive, with the last readings taken in 1998. Data from Gauge 006 were utilized to evaluate consistency with overall trends but were not utilized in the base period analyses due to lack of data post-1998.

Evaluation/Trends. Gauge 066, located in downtown Ventura, has the longest continuous rainfall data record, extending from 1873 through 2016, a period of 143 years. As depicted on the attached plot for Gauge 066, the cumulative departure from the average rainfall exhibits several periods of above and below average rainfall over the data range as summarized in Table 3 – Rainfall Periods, Gauge 066 Downtown Ventura.

Overall, wet and dry cycle trends range from about 6 to 33 years in length with a net positive or negative change of the cumulative departure from average ranging from -97 to 79 inches. Average annual gain or loss over the periods of change range from 2 to 6 inches/year. Within these cycle trends, there were dry cycle periods with rain years above the average and wet cycle periods with rain years below the average, but the overall trend during the periods was positive or negative. The longest dry period trend, 33 years spanning from 1945 to 1977, included 25 years of below average rainfall with 8 intermittent years near the average or above.

Table 3 – Rainfall Periods, Gauge 066 Downtown Ventura

Period	Period Length (years)	Above / Below Average	Cumulative Rainfall Gain or Loss (inches)	Average Annual Gain or Loss (inches/year)
1873 - 1893	20	Above	+40	+ 2
1894 - 1904	11	Below	-40	- 4
1905 - 1918	14	Above	+79	+ 5.6
1919 - 1934	16	Below	-45	- 2.8
1935 - 1944	10	Above	+36	+ 3.6
1945 - 1977	33	Below	-97	- 2.9
1978 - 1983	6	Above	+38	+ 6
1984 - 1990	7	Below	-29	- 4
1990 - 2006	16	Above	+62	+ 4
2007 - 2016	10	Below	-40	- 4

Hydrologic Base Period

Selecting a hydrologic base period for a basin yield analysis requires an understanding of the variables that can affect the key components of the hydrologic budget that is being used to understand the potential perennial yield of a groundwater basin. The perennial yield of a basin for the purpose of this study is defined as the amount of water that can be withdrawn from an aquifer on a sustained basis without exceeding the natural replenishment rate (AWWA, 2010). The ideal hydrologic base period over which the water budget or water balance is calculated must include a sufficient accounting of the equation components for the accuracy desired. While rainfall records extend back to the 1870's, groundwater production records in the Mound Basin only extend back to 1979. As many other sources of water have been used in the Basin, differentiating the amount and application of these sources would not likely be accurate. Also, the beginning and ending of a hydrologic base period should have similar climatic conditions whereby it does not begin in a drought period and end in a wet cycle or vice versa. Consideration should also be given to any other major changes in land use, stream flow, or sewer system installation, etc. that potentially could significantly affect components of the water budget equation. After review of these issues, this study has chosen to use the 1985 to 2015 base period (see Plate C1) which covers 3 decades of time during which groundwater production was reported and it begins and ends with nearly the same cumulative departure from the average rainfall recorded at 3 of 4 different gauging stations.

The cumulative departure values for 1985 rainfall are identified on the plates contained in Appendix C. As shown on Plate C3, the short record for rainfall at Station No. 216 began in 1965 during an extended dry period. Consequently, the calculated cumulative departure in 1985 was 21.9 inches above the recorded average. However, 1991 to 2015 appear to be a better base period for data comparison with this rainfall record. Rain Gauge Station No. 006 measurements ended in 1995 and its period of record does not cover the last 20 years that are of interest for this study.

Land Use

Land uses within the Mound Basin have changed over time and, at present, primarily consist of undeveloped land in the Ventura Foothills, municipal, industrial, commercial, residential, and agricultural land uses in the lower lying areas. Plate 20 – Land Use Zoning Map shows the type of zoning presently assigned to parcels within the Basin. This map shows that a significant portion of the Basin has been zoned for municipal and industrial (M&I) uses (commercial, industrial, transportation, and residential land uses, etc.) that cover approximately 9,823 acres within the Basin. Most of this acreage (9,224 acres) has been developed and was converted from agricultural uses that previously used groundwater. Some of this development extended up into the foothills where the land was undeveloped prior to the M&I uses being established.

Plate 21 – Agricultural Crop Type Map shows the type of crops that are being grown on the existing agricultural land in the Basin. Over the last 3 decades, a significant amount of tree crops has been replaced with row crops and berries. Plate 22 – Undeveloped Area Map shows the areas within the Ventura Foothills that are zoned for specific land uses but are presently undeveloped. The designation of the types of land uses in this portion of the Basin along with their calculated acreage are shown on Plate 23 – Land Use Zoning in Undeveloped Area Map. Table 4 – Mound Basin Land Use Acreage combines the information provided by these evaluations of assessor parcel map information within the Mound Basin.

Proportionally M&I land uses cover approximately 66.5% of the Basin (9,224 acres), agricultural uses cover approximately 16.6% (2,302 acres), and undeveloped land in the foothills includes approximately 16.9% (2,339 acres).

Table 4 – Mound Basin Land Use Acreage

LAND USE	ZONED ACREAGE	UNDEVELOPED ACREAGE	DEVELOPED ACREAGE
AGRICULTURE	4,041.64	1,739.73	2,301.91
COMMERCIAL	1,036.16	6.14	1,030.02
EDUCATION	353.61	0	353.61
INDUSTRIAL	485.89	0	485.89
OPEN SPACE	1,020.91	144.39	876.52
RESIDENTIAL	3,953.30	53.30	3,900.00
UTILITIES	158.27	20.66	137.61
MILITARY	5.02	0	5.02
VACANT	514.81	375.25	139.56
TRANSPORTATION	128.82	0	128.82
FREEWAYS AND MAJOR ROADS	2,092.05	0	2,092.05
WATER	74.45	0	74.45
TOTAL	13,864.93	2,339.47	11,525.46

Groundwater Conditions

Groundwater level data collected since the early 1900’s has been compiled by the Ventura County Watershed Protection District (VCWPD) and the United Water Conservation District (UWCD) from wells that are accessible for sounding. Over the years, additional wells have been added to the list of wells being measured routinely to observe groundwater level fluctuations. Water level hydrographs of wells in the Mound Basin are included in Appendix D – Groundwater Hydrographs. Many of these hydrographs show that the water level data sets are relatively short and have been collected over the last 2 decades. Plate 24 – Groundwater Level Monitoring Wells and Long-Term Hydrographs shows the distribution of wells within the Basin that have been used to obtain groundwater levels and the location of the 6 wells that provide the long-term data sets that extend back as far as 1931. In 1996, the number of wells monitored for water levels increased to 13, and in 2009, the monitoring well network grew to include 19 wells.

The hydrographs show a wide fluctuation in groundwater elevation in response to changes in climatic conditions between wet and dry periods with groundwater level elevation changes at some locations of over 100 feet. Seasonal fluctuations in groundwater elevations are generally in the range of 10 to 20 feet. Plates 25 to 28 – Groundwater Elevation Contour Maps April 1990, October 1990, April 1998 and October 1998, respectively provides groundwater level contours based on available data during very dry and wet climatic conditions. Plates 29 and 30 – Groundwater Elevation Data Maps April 2015 and October 2015 show the availability of data in recent years from a greater number of wells which does not indicate a clear gradient or direction of flow. As shown in the eastern portion of the Central Subarea, there are wells located relatively close to each other that have groundwater elevations down around sea level and upwards of 50 to 60 feet above sea level. These data also indicate a significant difference between the water levels observed in the Central Subarea versus those observed in the South Subarea (see Plate 30) even though they may have similar depths of construction.

Information for the Marina Park, Camino Real Park, and Ventura Community Park monitoring wells were assembled to develop an understanding of why these data are showing substantially different water levels within such close proximity. The Mound Basin monitoring wells water levels have been manually measured on a monthly basis. A comparison of the three monitoring wells installed by the City for Basin monitoring and management is shown in Table 5 – Comparison of Monitoring Well Information. All three of the well clusters are located in the Central Subarea of the Basin. As shown in Table 5, the wells are constructed to varying depths and penetrate aquifer zones that lie within different geologic formations. For this comparison, the groundwater elevations for spring and fall of 2015 were provided. The groundwater elevations range between -6.45 feet below sea level and 145.92 feet above sea level. It is notable that the seasonal variation between spring and fall readings is very small and ranged between a rise of 2.54 feet to a decline of 2.83 feet.

The data in Table 5 also indicate that depressed water levels are in the deeper aquifer zones that are located in the central and western portions of the Mound Basin Central Subarea where greater pumping occurs. This comparison also indicates that comparably constructed shallow wells in the same geologic formation at the Marina Park and Camino Real Park see different conditions. The shallow semi-confined zone at Camino Real Park has the highest water level elevation of any well monitored in the Basin and the water table is located at a depth of approximately 18 feet below ground surface. In contrast, the shallow confined aquifer zone at Marina Park has a water level elevation equal to approximately 22 feet above ground surface. Historical data indicate the shallow Marina Park monitoring well is an artesian well with water levels above ground surface at all times (see Plate D2).

Future Basin management efforts should consider the geologic structures within the Basin and target specific aquifer zones within the different geologic formations when selecting or designing facilities to expand the monitoring well network. An effort to contour the water levels in wells that are designated based on the specific aquifer zones that they monitor may provide a better comparison of groundwater elevations and flow directions within the discrete confined aquifer zones in the Basin. These wells may need to be constructed at considerably variable depths because faulting and folding has significantly deformed the fresh water-bearing aquifers within the Basin.

Table 5 – Comparison of Monitoring Well Information

WELL LOCATION (REFFERENCE POINT ELEVATION IN FEET)	STATE WELL NUMBER	WELL SCREEN DEPTH (FEET)	GEOLOGIC FORMATION	GROUNDWATER ELEVATION (FEET)		2015 SEASONAL CHANGE (FEET)
				APRIL 2015	OCTOBER 2015	
MARINA PARK (8.73)	02N23W15JO3	170-240	Upper Qoa	30.56	30.91	0.35
CAMINO REAL PARK (164.06)	02N22W07MO3	210-280	Upper Qoa	145.92	145.55	-0.37
MARINA PARK (8.73)	02N23W15JO2	480-660	Lower Qoa/QTs	-2.25	-4.77	-2.52
CAMINO REAL PARK (164.06)	02N22W07MO2	710-780	Lower Qoa	-2.31	-2.48	-0.17
VENTURA COMMUNITY PARK (244)	02N22W09LO4	480-510	Upper QTs	67.34	69.88	2.54
MARINA PARK (8.73)	02N23W15JO1	970-1070	Lower QTs	-3.62	-6.45	-2.83
CAMINO REAL PARK (164.06)	02N22W07MO1	1200-1280	Lower QTs	-0.98	-1.46	-0.48
VENTURA COMMUNITY PARK (244)	02N22W09LO3	890-950	Lower QTs	53.73	55.25	1.52

Qoa – Older Alluvium, QTs – Saugus Formation

The amount and direction of flow across the basin boundaries between the Mound Basin and the Oxnard Forebay and Oxnard Plain Basins is variable and appears to change between wet and dry climatic conditions. A comparison of water levels in wells near the Basin boundary is provided in Appendix D (see Plates D17 and D18). This comparison does not provide a clear direction of flow, but appears to indicate that groundwater flows from the Mound Basin during dry weather periods and perhaps into the Mound Basin during wet weather periods.

In 2011, UWCD instrumented 4 wells in the Mound Basin with pressure transducers to obtain a more continuous record of groundwater level changes. Three of the transducers were installed in the Central Subarea and one was installed in the South Subarea (02N23W24G01).

Hydrographs of these data are included in Appendix D as Plates D20 and D21. As shown, these data reflect local pumping interference, seasonal water level changes and trends that occur during changing climatic conditions.

Seawater Intrusion

As of the early 1900's, the City operated several wells located in the southeastern portion of the Lower Ventura River Groundwater Subbasin and the northwestern most portion of the Mound Basin (Lippincott, 1934). These wells provided inferior quality water compared to the surface water provided by the Ventura River. Production of these wells for a City supply along with other agricultural wells in the Mound Basin resulted in prolonged periods of time where groundwater levels were depressed below sea level. City planning efforts relocated pumping further inland and to the south in response to the depressed water level conditions. The Buenaventura Golf Course Well Nos. 1, 2, and 3 were constructed in the late 1950's along the northern boundary of the Oxnard Plain Basin and supplied water to the eastern and central portions of the City. Victoria Well No. 1 was constructed in 1975 in the Central Mound Basin Subarea eliminating the operation of all coastal wells.

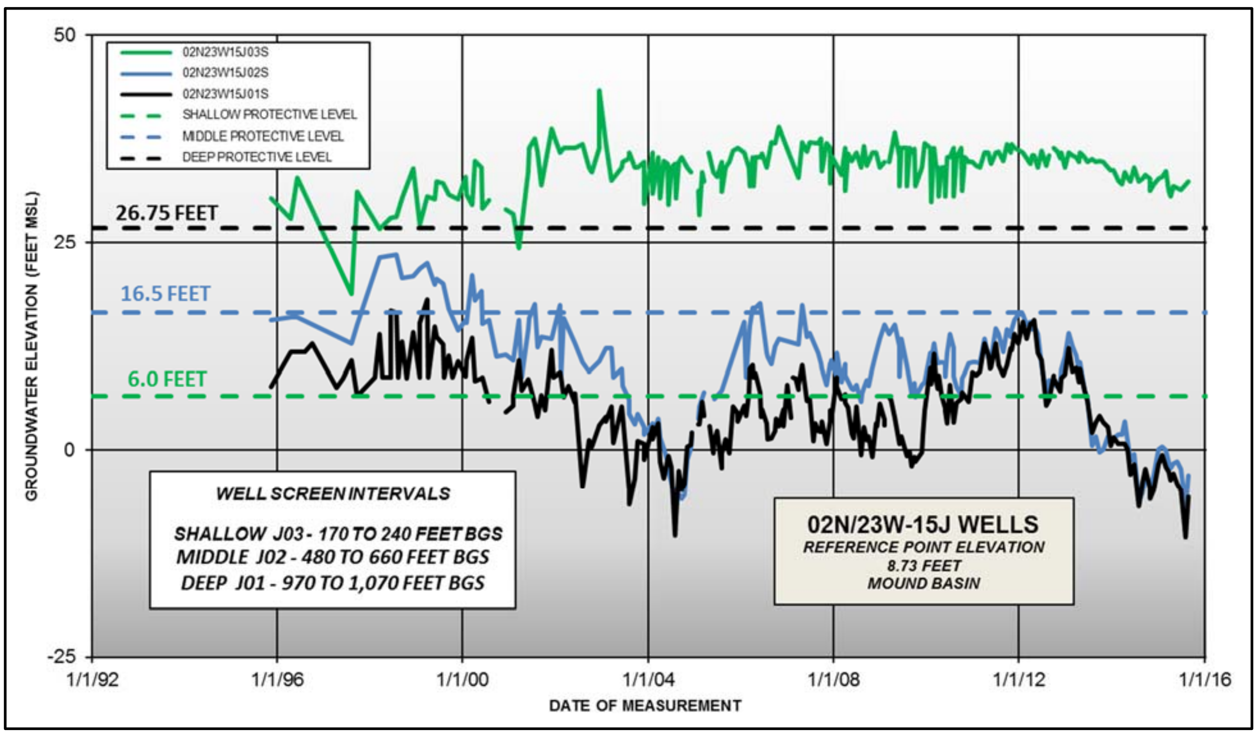
The coastal municipal wells that augmented supply from the Ventura River during the dry seasons and dry years, were subsequently destroyed when Lake Casitas was constructed. The Lake Casitas supplemental source of supply provided water for the western service area of the City replacing the need for wells in that coastal area of the City. In spite of the depressed coastal water levels, there was no reported occurrence of seawater intrusion during the historical operation of the coastal City wells.

The City well located at the Olivas Adobe (02N23W24G01) has water level measurements that date back to 1962 (see Plate 24, and Plate D3). These data indicate that on numerous occasions the water levels at this location were at or below sea level. With a well screen interval that produces from aquifers located between the depths of 742 and 927 feet below ground surface, the protective water level for the lower aquifer zones is approximately 23 feet above sea level. At this elevation, the fresh water head can overcome the salt water density and prevent landward movement. We see from historical data that between 1969 and 1984, water levels in the aquifer system had maintained protective conditions. However, since 1984, water levels have only risen to protective levels a couple times and were only maintained for brief periods of time (see Plate 24).

Figure 1 – Marina Park Monitoring Wells Hydrographs shows the water level data provided by these wells since 1996. These wells discretely monitor aquifer zones between 170 and 1,070 feet below ground surface. As shown, the shallow monitoring well is artesian and has water level elevations that are generally 25 to 35 feet above sea level. This shallow aquifer protects the underlying deeper aquifer zones from vertical infiltration of seawater as long as the head is maintained above an elevation of 6 feet. Figure 1 shows the protective elevations required for the

middle and deep monitoring wells of 16.5 feet and 26.75 feet above mean sea level (AMSL) respectively, compared to historical water level measurements. As shown, the groundwater levels in these 2 wells are generally above sea level, but not above the protective elevations for their well depths. This condition indicates that where these zones extend offshore beyond where they are covered by the shallow aquifer, seawater could potentially enter and move landward. It is also interesting to note that after 2010, the groundwater elevation in the middle aquifer zone declined and closely tracks the deeper aquifer zone. This is likely a function of the new agricultural wells constructed directly inland of this location where the wells were screened across both zones and apply pumping stresses equally.

Figure 1 – Marina Park Monitoring Wells Hydrographs



Groundwater Production

The production of groundwater from the Mound Basin for overlying land uses has varied considerably over time. Records of groundwater production reported to UWCD are included in Appendix E – Groundwater Production Data, and indicate that since 1979 when annual reporting of groundwater pumping began, annual production has ranged between 1,760 acre-feet per year (afy) to 10,222 afy. The average annual production from the Basin over the entire 37 years of record is 6,684 afy. Since 1985, the lowest annual production rate was 4,619 af and occurred in 2011. Over the 1985 to 2015 base period, the annual average production volume is 7,161 afy.

Figure 2 – Annual Average Groundwater Production 1985 to 2015 shows a bar chart of historical production data over the base period. The average annual balance was 4,050 afy agricultural usage and 3,110 afy for municipal and industrial uses.

Figure 2 – Annual Average Groundwater Production 1985 to 2015

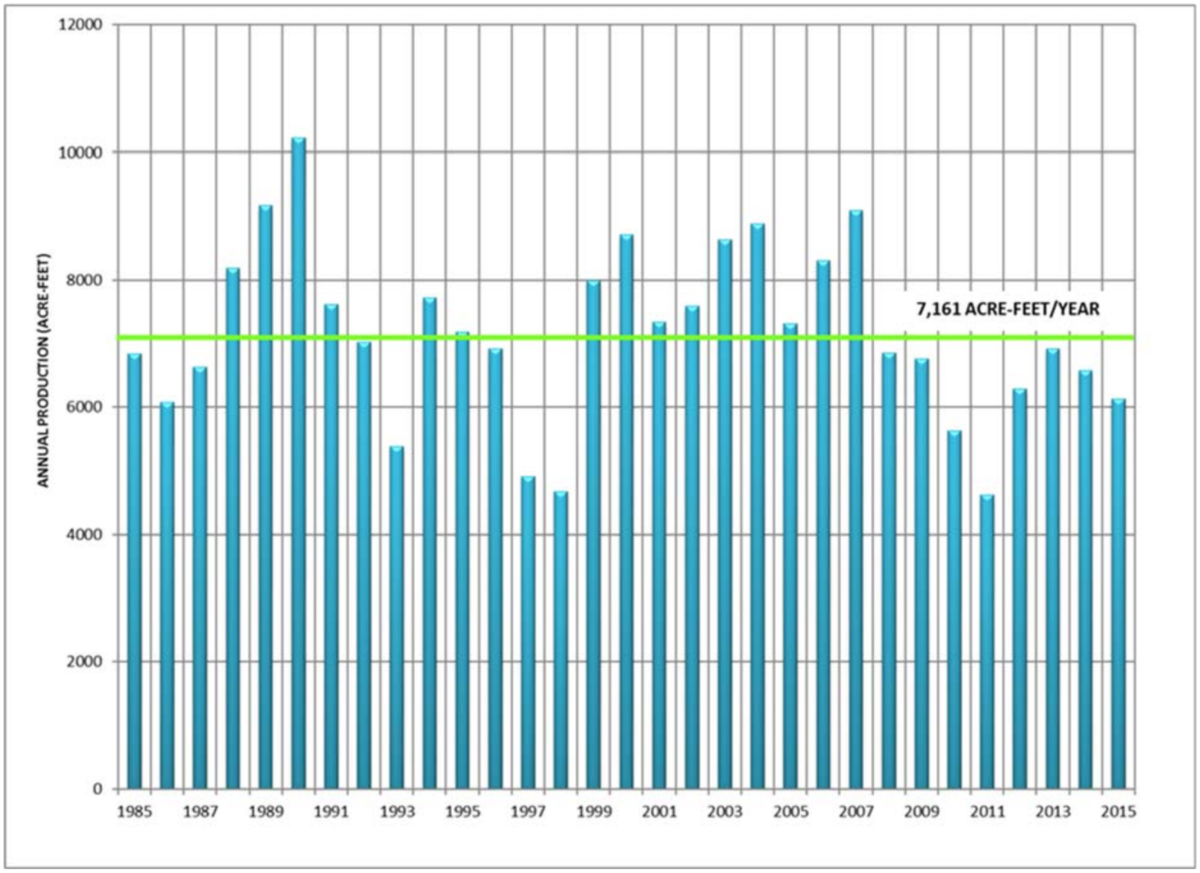


Plate 31 – Active Production Wells Location Map (2000) shows the location of wells that have been active within the Basin since the year 2000. As indicated, the wells are concentrated within the South Mound Basin Subarea or the southern half of the Central Mound Basin Subarea. These areas are largely coincident with remaining agricultural land uses (see Plate 21). The majority of groundwater production in the Basin is concentrated in the Central Mound Basin Subarea away from the potential sources of recharge along the northern and southern Basin boundaries. The Central Mound Basin Subarea has provided an average of 5,167 afy since 1979 while the South Mound Basin Subarea has yielded an average of 1,516 afy. During the 1985 to 2015 base period, production in the Central Mound Basin Subarea was an annual average of 5,587 afy (78 percent of the Basin total) and production was an average of 1,574 afy in the South Mound

Basin Subarea (22 percent of the Basin total). There are no active wells and therefore no reported groundwater production within the North Mound Basin Subarea.

Water Quality

The quality of water in the Mound Basin is highly variable, but is generally characterized as fair to poor for most overlying land uses based on the concentration of total dissolved solids (TDS). The groundwater produced from wells in the Mound Basin predominantly has a calcium sulfate chemical character. Historical groundwater quality data are provided in Appendix F for all the wells with available data. Because available records include the results of multiple samples obtained from many of the wells, the average of all historical data for chemical constituents in each well is provided for comparison along with the number of samples that were available for each well (see Table F1). Table 6 – Comparison of Monitoring Well Water Quality Data provides the average of historical concentrations for the select constituents provided for the 3 monitoring well clusters located in the Basin. Plate 32 – Wells With Water Quality Data Location Map shows the location of all the wells where water quality samples have been obtained since 1985.

Table 6 – Comparison of Monitoring Well Water Quality Data

WELL LOCATION	STATE WELL NUMBER	WELL SCREEN DEPTH (FEET)	TDS (MG/L)	Ca (MG/L)	Mg (MG/L)	Na (MG/L)	HCO3 (MG/L)	SO4 (MG/L)	Cl (MG/L)
MARINA PARK	02N23W15JO3	170-240	3,293	322	233	371	1,150	1,486	98
MARINA PARK	02N23W15JO2	480-660	919	132	38	103	291	383	44
MARINA PARK	02N23W15JO1	970-1070	1,284	170	46	168	375	519	84
CAMINO REAL PARK	02N22W07MO3	210-280	4,638	590	238	491	606	2,012	439
CAMINO REAL PARK	02N22W07MO2	710-780	946	125	41	109	357	342	57
CAMINO REAL PARK	02N22W07MO1	1200-1280	1,087	134	43	145	347	438	73
VENTURA COMMUNITY PARK	02N22W09LO4	480-510	6,294	524	243	1,144	366	3,733	191
VENTURA COMMUNITY PARK	02N22W09LO3	890-950	1,022	120	33	157	204	462	72

As shown in Table 6, the typical range of TDS in the Mound Basin aquifer zones used for overlying beneficial land uses ranges between 919 and 1,284 milligrams per liter (mg/l). The State drinking water standards for municipal water supply systems as established by the Division of Drinking Water for select constituents are shown in Table 7 – Maximum Contaminant Level Ranges. As shown in Table 7, a water supply with a TDS value of up to 1,500 mg/l is potable and can be served in a municipal system for a temporary period of time (as approved by the State). However, while some of the groundwater produced was within the upper TDS limit for municipal drinking water supplies of 1,000 mg/l, there are no historical data to show that groundwater could be produced in the Basin that would comply with the State recommended TDS level of 500 mg/l. As shown by the yellow highlighted cells in Table 6, groundwater quality in the Basin has been found to significantly exceed the short-term maximum contaminant level for drinking water.

Table 7 – Maximum Contaminant Level Ranges

CONSTITUENT	UNITS	RECOMMENDED	UPPER	SHORT TERM
TOTAL DISSOLVED SOLIDS	MG/L	500	1,000	1,500
SPECIFIC CONDUCTANCE	μS/CM	900	1,600	2,200
CHLORIDE	MG/L	250	500	600
SULFATE	MG/L	250	500	600

Title 22, Article 16. Secondary Drinking Water Standards, Table 64449-B, Secondary Maximum Contaminant Levels, "Consumer Acceptance Contaminant Level Ranges"

Plates F1 to F3 show the calculated chemical character of each of the monitoring wells listed in Table 6. The chemical character of the water varies from a calcium-sodium-sulfate in the better-quality aquifer zones to a sodium-sulfate in the poorest quality aquifer zone sampled at the Ventura Community Park in the eastern portion of the Basin.

Groundwater quality is a function of variables that include the quality of the source water recharging the aquifer system, the materials the water flows through which contributes mineralogy, the amount of time the water is in the aquifer system, the type of bacteriological activity present, and oxidation-reduction reactions that occur as oxygen is added or removed from solution. Groundwater closest to areas where recharge occurs directly from infiltration of rainwater or rainfall runoff are typically of the highest quality (lowest TDS concentrations). Groundwater degradation is unique to the variables listed above and includes recharge from overlying land uses. Changes in the natural system that may affect water quality are also caused by extracting groundwater through wells and may include upwelling and mixing of brines from connate sources or seawater intrusion.

The California State Water Resources Control Board Resolution No. 88-63 sets forth the following policy regarding surface and groundwater and indicates that all surface and groundwater of the State are considered suitable, or potentially suitable, for municipal or domestic water supply with the exception of:

a. The TDS exceeds 3,000 mg/l (5,000 µmhos/cm, electrical conductivity);

b. Contamination exists, that cannot reasonably be treated for domestic use;

c. The source is not sufficient to supply an average sustained yield of 200 gallons per day;

This indicates that based upon Resolution No. 88-63, the groundwater sampled in all 3 of the shallow monitoring wells is degraded to a level that the water quality does not meet the TDS concentration requirement 3,000 mg/l for a potential source of drinking water. The Marina Park wells do not show an elevated level of chloride that would be indicative of seawater intrusion, however, the shallow well is impacted by elevated levels of sodium, bicarbonate, sulfate and nitrate (see Table F1) which may be indicative of an inland source of recharge from agricultural irrigation return flows. The Camino Real Park wells show water quality changes with depth and that the shallowest well is being impacted by historical land use which may include irrigation return flows and/or septic system disposal prior to the installation of the City sanitary sewer system. This inference of potential septic system impacts is supported by the elevated nitrate concentration of 172 mg/l and the proportionally high levels of sodium and chloride.

The worst quality groundwater is seen in the shallowest monitoring well at the Ventura Community Park that screens a coarse-grained aquifer between the depths of 480 to 510 feet. With a TDS concentration of over 6,000 mg/l, the groundwater has an elevated level of nitrate, sodium, and sulfate that give it a clear sodium-sulfate chemical character. The occurrence of the extremely poor-quality water is interesting because the shallower aquifer zones located between the depths of 225 and 325 feet have historically produced groundwater with TDS concentrations between 1,100 and 1,200 mg/l and presently remain suitable for overlying agricultural purposes. The source of the poor quality water is not presently understood. The only other location where groundwater with elevated TDS concentrations (8,700 to 14,600 mg/l) and a distinct sodium-sulfate chemical character have been reported is in the Saticoy area of the Santa Paula Basin (Hopkins, 2012). This could indicate contamination emanating from recharge upgradient of the Ventura Community Park location in the adjacent Santa Paula Basin or both locations are impacted by a similar source of poor-quality water.

Future efforts to establish monitoring wells in the Basin for water quality sampling should be mindful of the variability in the historical data. Well construction should be aquifer specific to capture quality changes in the multiple confined aquifer layers of the Mound Basin.

Basin Perennial Yield

The perennial or operational yield of a groundwater basin has historically been referred to as the amount of groundwater that can be pumped or extracted for beneficial overlying land uses, which is equal to the average amount of recharge to the basin over a period of time that includes one or more climatic cycles. Sustained groundwater production at rates greater than the amount of recharge is considered overdraft and will lead to a continual decline in water levels resulting in a loss of groundwater in storage.

Over time, the concept of perennial yield evolved to include considerations of undesirable results (i.e., subsidence, reduction in stream flow, etc.) that may occur as a result of pumping groundwater equal to or greater than the full amount of recharge to a basin (Bachman et al., 2005). It was this concept of undesirable results that prompted the California State Legislature to enact the Sustainable Groundwater Management Act in 2014, that subsequently required the formation of the Mound Basin Groundwater Sustainability Agency (MBGSA). The evaluation of a sustainable yield for the Mound Basin, which considers undesirable results of groundwater production, is beyond the scope of this study and will be accomplished by the MBGSA in the future as part of its Groundwater Sustainability Plan (GSP). This study, as originally intended, attempts to evaluate reported historical groundwater pumping and the corresponding changes that have occurred in the Basin over time and approximate the perennial yield of the Basin.

Methods to calculate the perennial yield of a basin include: 1) comparing annual groundwater elevation changes with changes in the annual groundwater extracted (Modified Hill Method), 2) calculating a basin water budget, 3) comparing groundwater levels over a hydrologic base period and approximating the change in groundwater in storage, and 4) constructing a calibrated computer model. The construction of a comprehensive computer model that covers the Mound Basin is being conducted by UWCD as part of its regional groundwater flow model efforts to assist the Fox Canyon Groundwater Management Agency in the development of a GSP for the Oxnard Plain Subbasin. This study will utilize, to the extent practicable, the first three methods of perennial yield estimation and incorporate preliminary findings of the draft flow model provided by UWCD for water budget calculations.

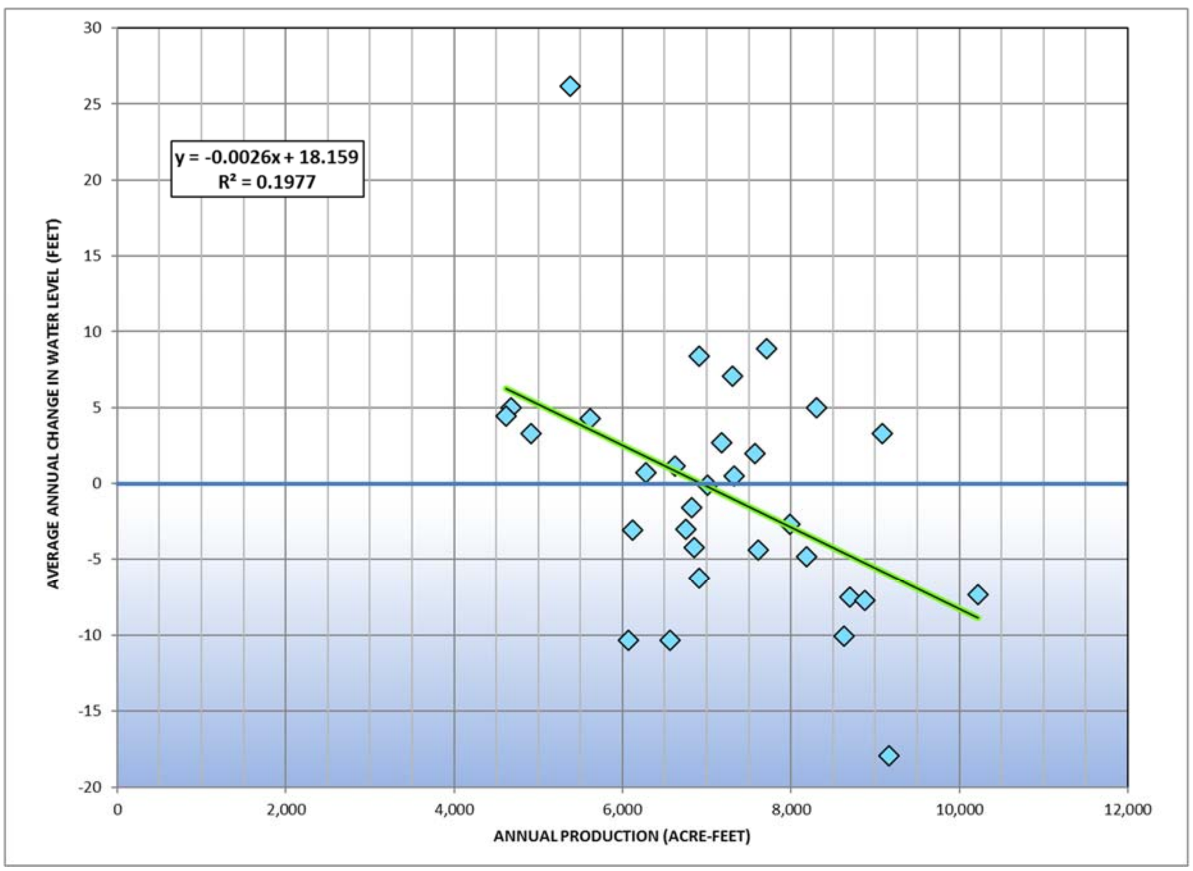
Modified Hill Method

To facilitate application of the Modified Hill Method of groundwater supply estimation, the springtime high groundwater elevation was identified in each well monitored in the Basin. Because this method relies on comparable groundwater measurements, an inherent inaccuracy occurs when the measurement frequency does not obtain the seasonal high-water level. Using the data provided, Table G1 – Annual Change in Groundwater Elevation was constructed where the change in water levels between each year was calculated. It should be noted that the data set began with 5 well measurements per year and increased to 6 in 1981. These wells were consistently monitored until 1995 when there was a lapse in well monitoring. The green shaded area of Table

G1 indicates the years where this change occurred. However, in 1996, the number of monitoring wells used to collect water level data increased to 13, and in 2009, the monitoring well network increased to include 19 wells. Most of the wells were measured annually from this point forward, however in 2015 only 15 wells were measured and could be used to calculate the annual change in average basin water levels.

Figure 3 – Annual Average Groundwater Production Versus Change in Water Levels 1985 to 2015 shows the results of this analysis using the water level data and well production data for the base period of 1985 to 2015. This comparison shows that when the average annual production is approximately 7,000 afy, the average change in groundwater levels is zero. This would suggest that for this time period, the perennial yield is approximately 7,000 afy.

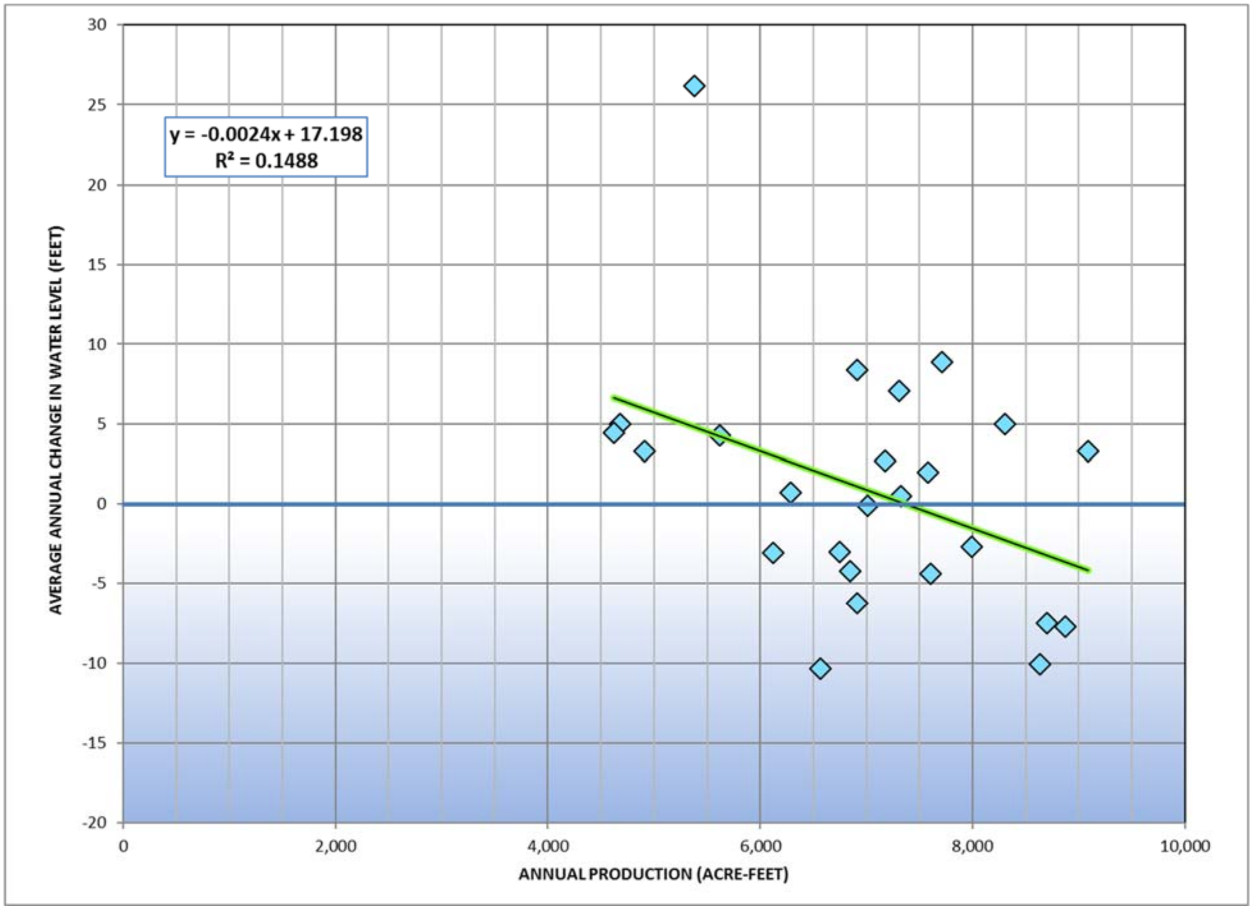
Figure 3 – Annual Average Groundwater Production Versus Change in Water Levels 1985 to 2015



For comparison, we used the 1991 to 2015 24-year base period which is potentially indicated as a valid base period by the cumulative departure from the average rainfall at Station

No. 216, for analysis (see Plate C3). Figure 4 – Annual Average Groundwater Production Versus Change in Water Levels 1991 to 2015 shows the results using these data. As indicated, the annual average groundwater production rose to approximately 7,400 afy where the trend line indicates there is no change in groundwater levels.

Figure 4 – Annual Average Groundwater Production Versus Change in Water Levels 1991 to 2015



A better prediction of basin perennial yield using this method could likely be obtained if water levels were collected monthly instead of quarterly or semiannually and if groundwater production were reported monthly or quarterly instead of semiannually. It is anticipated that under the direction of the MBGSA, the annual groundwater reporting period will change from semiannual starting at the beginning of the calendar year, and transition to a water year schedule beginning on the first of October with reporting on a monthly or quarterly basis. This will help improve the accuracy of future evaluations comparing changes in production with changes in groundwater levels.

Basin Water Budget

A review of the perennial yield of a basin using a water budget analysis compares the basin outflow (all sources of discharge including well production) to the basin inflow (which is comprised of all sources of recharge), and the observed change of groundwater in storage (as reflected in the basin groundwater elevations). For the Mound Basin, the potential sources of basin inflow/recharge include: 1) groundwater inflow from the Santa Paula Basin, Oxnard Forebay Basin and the Lower Ventura River Basin, 2) percolation from the lower reach of the Santa Clara River, 3) flow inland across the coastline from offshore aquifer units, 4) deep percolation of rainfall across the Basin, including ephemeral streams, and 5) irrigation return flows in the developed portions of the Basin. The outflow/discharge components include: 1) outflow to the Oxnard Plain Basin and the Lower Ventura River Basin, 2) discharge to the Santa Clara River, 3) outflow offshore across the coastline, and 4) groundwater production through wells. Because the groundwater in the Mound Basin is generally deeper than the root zone of plants, evapotranspiration was not included as a source of basin discharge but rather a factor in the source of recharge from rainfall and irrigation return flows.

Basin Water Balance = Inflow – Outflow + Change of Groundwater in Storage

To estimate the amount of deep percolation across the Basin from rainfall, we utilized the average monthly rainfall from the four stations in the Basin that covered the base period and adjusted the values from water year to calendar year. A summary of the calendar year precipitation data is included in Appendix C as Table C6. Using these precipitation values, we estimated the recharge from rainfall in the Basin for the 3 main land use categories that are: 1) urban (all municipal and industrial/commercial land uses), 2) agricultural (irrigated crops, not livestock grazing), and 3) undeveloped (zoned for future uses but undeveloped at this time). These rainfall recharge estimates are shown along with the assumptions used for calculation in Tables H1 to H3 and subsequently summarized for the entire Basin in Table H4. The results indicated that the total amount of rainfall recharge ranged from 589 af in 2013, to 5,309 af in 1998. The annual average recharge across the Basin is approximately 2,501 afy and consists of average annual recharge in the urbanized area of approximately 859 afy, in the agricultural portion of the Basin of approximately 771 afy, and in the undeveloped area of approximately 871 afy.

For estimation of the amount of Basin recharge provided by irrigation return flows, we used the reported annual pumping from the Basin and included estimated annual amounts of water brought in from outside the Basin for both agricultural and municipal/urban land uses. A summary of the calculations of Basin recharge from irrigation return flows is included as Table H5. Sources of urban irrigation uses other than production from the Mound Basin included water brought in from the Ventura River Watershed and the Oxnard Plain Basin.

Agricultural water sources included groundwater produced and water imported from the Farmers Irrigation Company as reported in the Santa Paula Basin annual reports (UWCD, 2016 &

2017). While there may be water imported from the Alta Mutual Water Company into the Mound Basin, we were unable to locate any published amounts for this source, so it has not been included as a source of water for agricultural irrigation in the Mound Basin. As shown in Table H5, the estimated annual average recharge from irrigation return flows in the Basin is 2,713 afy. Approximately 1,231 afy is contributed from M&I land uses and approximately 1,482 afy is estimated to be derived from agricultural land uses. The assumptions used in these estimations are included in the footnotes below Table H5 (see Appendix H).

These estimated values of rainfall and irrigation return flow recharge were subsequently utilized along with other Basin inflow and outflow component estimates that were either obtained from published sources or were assumed using reasonable hydrogeological values. The Mound Basin water budget summaries are provided in Appendix I as Tables I1 and I2. To illustrate the amount of uncertainty inherent in the components of the water budget equation for the Mound Basin, we believed it was beneficial to bracket the potential values that could be estimated using two separate analyses (see Table I1 and I2). The differences between the analyses are the amounts of groundwater inflow from the Santa Paula Basin and the amounts of groundwater inflow or outflow along the coastline.

Water Budget Scenario 1. In addition to the rainfall and irrigation return flow estimates described above, Table I1 analysis uses values of groundwater inflow to the Mound Basin estimated by the Santa Paula Basin safe yield study (DBA & RCS, 2017) along with Basin inflows and outflows estimated by the UWCD computer model for the Oxnard Plain Basin GSP. The modeled sources of recharge and discharge include the Mound Basin boundaries with the Oxnard Forebay Basin and the Oxnard Plain Basin and percolation from or discharge to the lower reach of the Santa Clara River.

The Table I1 water budget estimate shows an annual average inflow from the Santa Paula Basin of 1,750 afy, which was the cumulative estimate calculated for the Santa Paula Basin safe yield study (DBA & RCS, 2017). Because there are no additional data that would cause us to believe a greater accuracy could be achieved through analytical estimation of this value, this review adopted the calculated value from that study for the first water budget scenario.

Water Budget Scenario No. 1 uses the average annual inflow provided by the UWCD model for the Oxnard Forebay Basin of 1,890 afy (UWCD, 2018). Basin average annual inflow from the Lower Ventura River Basin was assumed to be zero because there is no monitoring to show groundwater elevations or groundwater gradients to define the direction of flow or the duration it may exist in the northwestern most portion of the Basin. It is anticipated that the ground water elevation within the Lower Ventura River Basin at the Mound Basin boundary may be on the order of 10 to 20 feet AMSL, however, historically there has not been a concerted monitoring effort to determine these groundwater conditions. When elevations in the Mound Basin are highest during wet climatic periods, it would be a reasonable inference that groundwater may flow from the Mound Basin into the Lower Ventura River Basin and when dry cycles occur, the flow may reverse.

The lower reach of the Santa Clara River crosses the Basin where the shallow sediments contain significant amounts of clay from historical lagoon or deltaic type deposits. The hydraulic head during times of river flow in this reach of the river ranges from sea level at the mouth of the river up to approximately 15 feet AMSL at the Oxnard Plain Basin boundary. While there are limited groundwater elevation data in the aquifers produced by Mound Basin wells in the vicinity of the river, average water levels in the southwestern most portion of the Basin can be seen in the long-term hydrograph for Well No. 02N23W24G01 (see Plate 24). Also, as indicated by the shallow monitoring well at Marina Park, the shallow aquifers have an artesian head which would result in upward seepage and prevent recharge from surface water sources. Because of these conditions, percolation recharge from the Santa Clara River was assumed to be zero.

Groundwater elevation data along the coastline is limited to one monitoring well location. These data were previously described in this report and indicate that the shallow aquifer(s) have a hydraulic head on the order of 25 to 35 feet above sea level and flow is in the offshore direction (see Figure 1). However, the hydraulic conductivity of these zones is unknown and will control the amount of flow that occurs. The deeper aquifer zones historically used by wells in the Basin have a relatively high hydraulic conductivity and a depressed water level which has remained almost always below the protective water levels required to overcome the density of seawater based on the aquifer depths. For this reason, the offshore equivalent freshwater head is greater than the onshore hydraulic head and is inferred to be causing onshore flow in these deeper aquifer zones in recent years. Considering the difference between shallow offshore flow and deeper onshore flow, an assumed average value of 500 afy of inflow from the coastline was included in the water budget. Sources of water that supply the inflow along the coastline in the deeper aquifer zones may include seawater that enters along the offshore outcrop. However, because historical evidence of seawater has not been detected (i.e., elevated chloride concentrations, etc.), other sources of fresh water may contribute to inflow along the coastline. These sources may include vertical leakage from overlying shallower aquifer zones with higher hydraulic heads and groundwater inflow from the Lower Ventura River Basin and Oxnard Plain Basin.

The UWCD model simulates an average annual inflow of approximately 1,890 afy from the Oxnard Forebay Basin to the Mound Basin and an annual average outflow from the Mound Basin to the Oxnard Plain Basin of approximately 1,500 afy. The computer model also simulated an average annual outflow from the Basin to the Santa Clara River in the amount of 1,170 afy. Because of a lack of data, the average annual outflow to the Lower Ventura River Basin was assumed to be zero. Because there is an assumed average annual onshore inflow at the coastline, the average annual offshore flow is zero. The annual amount of reported pumping was utilized to complete the sources of Basin outflow for the water budget estimation.

The calculated annual amounts of groundwater going into or out of storage ranged between -4,606 afy to 4,839 afy. The average annual change in the amount of groundwater in storage over the 1985 to 2015 base period was -477 afy which amounts to a total deficit of -14,779 acre-feet over the 31-year period.

Water Budget Scenario 2. In addition to the rainfall and irrigation return flow estimates described above, Table I2 analysis uses values of groundwater inflows and outflows to the Mound Basin estimated by the UWCD computer model prepared for the Oxnard Plain Basin GSP. The modeled sources of recharge and discharge include the Mound Basin boundaries with the Santa Paula Basin, Oxnard Forebay Basin, and the Oxnard Plain Basin and includes percolation from or discharge to the lower reach of the Santa Clara River.

Water Budget Scenario No. 2 uses the average annual inflows of groundwater provided by the UWCD model for the Santa Paula Basin of 3,100 afy and for the Oxnard Forebay Basin of 1,890 afy (UWCD, 2018). For the reasons previously described, Basin average annual inflow of groundwater from the Lower Ventura River Basin was assumed to be zero. The computer model also indicated that the average annual percolation recharge from the Santa Clara River was zero and the groundwater inflow from the coastline had an annual average value of zero.

Scenario No. 2 also used the average annual outflow indicated by the UWCD model at the Oxnard Plain Basin boundary of approximately 1,500 afy and the simulated average annual outflow from the Basin to the Santa Clara River of approximately 1,170 afy. The Lower Ventura River Basin average annual outflow was assumed to be zero. This analysis also used the simulated average annual outflow at the coastline of 270 afy. The annual amount of reported pumping was utilized to complete the sources of Basin outflow for the water budget estimation.

The calculated annual amounts of groundwater going into or out of storage ranged between -4,026 afy to 5,419 afy. The average annual change of groundwater in storage over the 1985 to 2015 base period was 103 afy which amounts to a total increase of groundwater in storage of 3,201 acre-feet over the 31-year period.

The results of both water budget scenarios indicate that the average annual production of 7,161 afy is either about 475 afy greater than the perennial yield or approximately 100 afy under it. However, the gross amount of assumptions required at this time to do the calculations limits the value of these conclusions. During the effort to apply this method of estimation to the perennial yield of the Mound Basin, we recognized that the availability of data to substantiate historical and existing hydrogeological conditions is sparse and that new monitoring wells will need to be installed in areas that lack data. These new wells could improve the monitoring network and produce data that will enhance the ability of the MBGSA to better manage the groundwater resources in the future.

Groundwater Level Change Over a Base Period

For this method of analysis, the water level data and groundwater extraction data for the 1985 to 2015 and 1991 to 2015 base periods were utilized. This comparison was limited by the availability of water level data in that only 6 wells were measured in both 1985 and 1991 in the entire Mound Basin. Only 4 of those wells were still being measured at the end of each observation period in 2015. Table 8 – Comparison of Water Level Data 1985 to 2015 summarizes the available data for these 4 wells at the beginning and end of the base period. As indicated, two of the wells are located in the Central Subarea and two in the South Subarea. The total depths of the wells varied from 345 feet to 927 feet and available information indicated they produced from aquifers in the older alluvium or the upper Saugus Formation.

Table 8 – Comparison of Water Level Data 1985 to 2015

<table>
<tr><th>STATE WELL NUMBER</th><th>MEASUREMENT DATE</th><th>GROUNDWATER ELEVATION (FEET ABOVE MSL)</th><th>CHANGE IN WATER LEVEL (FEET)</th><th>AVERAGE ANNUAL CHANGE (FT/YR)</th></tr>
<tr><td rowspan="3">02N22W09K04S</td><td>4/3/1985</td><td>43.69</td><td rowspan="2">-37.47</td><td rowspan="2">-1.21</td></tr>
<tr><td>3/2/2015</td><td>6.22</td></tr>
<tr><td colspan="4">CENTRAL SUBAREA / SCREEN DEPTH (?) - 548 FEET / QTs</td></tr>
<tr><td rowspan="3">02N22W08P01S</td><td>4/15/1985</td><td>40.79</td><td rowspan="2">-7.65</td><td rowspan="2">-0.25</td></tr>
<tr><td>3/18/2015</td><td>33.14</td></tr>
<tr><td colspan="4">CENTRAL SUBAREA / SCREEN DEPTH 284 - 346 FEET / LOWER Qoa/UPPER QTs</td></tr>
<tr><td rowspan="3">02N22W16K01S</td><td>2/8/1985</td><td>36.47</td><td rowspan="2">-62.76</td><td rowspan="2">-2.02</td></tr>
<tr><td>3/16/2015</td><td>-26.29</td></tr>
<tr><td colspan="4">SOUTH SUBAREA / SCREEN DEPTH 294 - 345 FEET / UPPER QTs</td></tr>
<tr><td rowspan="3">02N23W24G01S</td><td>2/13/1985</td><td>16.80</td><td rowspan="2">-16.71</td><td rowspan="2">-0.54</td></tr>
<tr><td>3/11/2015</td><td>0.09</td></tr>
<tr><td colspan="4">SOUTH SUBAREA / SCREEN DEPTH 742 - 927 FEET / UPPER QTs</td></tr>
</table>

MSL – MEAN SEA LEVEL

As shown in Table 8, the water levels in all the wells went from elevations that were above mean sea level in 1985, to elevations that ranged from 33.14 feet AMSL to -26.29 feet below mean sea level (BMSL) in 2015. The resulting declines over this base period ranged between -7.65 feet to -62.76 feet indicating a general loss of groundwater in storage. The average water level decline in the Basin using the data from these 4 wells combined is -31.15 feet over the 31-year base period which yields an average -1.01-foot per year rate of decline.

The change in volume of groundwater in storage in the Basin can be estimated over the base period by multiplying the average change in the water levels times the area of the Basin times the storage coefficient of the aquifer zones being produced.

The equation for this estimate is simply:

$$\Delta S_{GW} = \Delta h \times A \times S$$

Where: ΔS_{GW} = Change of Groundwater Volume in Storage
Δh = Change in Groundwater Elevation
A = Surface Area of the Basin
S = Average Storage Coefficient of Aquifers

The surface area of the Basin was obtained using the Basin GIS files downloaded from the DWR website and was determined to be 13,865 acres. For the purpose of this analysis, we will use a range of storage coefficients between 0.01 and 0.0001 to bracket unconfined/semi-confined aquifer conditions and confined aquifer conditions. Table 9 – Estimated Change of Groundwater in Storage 1985 to 2015 shows the resulting estimations using this method with the available groundwater elevation data.

Table 9 – Estimated Change of Groundwater in Storage 1985 to 2015

STORAGE COEFFICIENT (DIMENSIONLESS)	AVERAGE ANNUAL RATE OF STORAGE CHANGE (AFY)	TOTAL CHANGE IN STORAGE OVER THE BASE PERIOD (AF)
0.01	-139.32	-4,319
0.005	-69.66	-2,159
0.001	-13.93	-432
0.0005	-6.97	-216
0.0001	-1.39	-43

As shown in Table 9, the annual change of groundwater in storage is estimated to range between -1.4 to -140 afy. The resulting decline of groundwater in storage over the entire 31-year base period is estimated to range between -43 and -4,319 af total. This range is not unreasonable given available data and indicates the average annual production is greater than the perennial yield by an amount of up to 140 afy. A reasonable storage coefficient for a leaky confined aquifer system is 0.001. Using the corresponding annual change of groundwater in storage (14 afy) along with the average Basin production over the entire 1985 - 2015 base period (7,161 afy) the estimated perennial yield for the Basin is approximately 7,147 afy.

Repeating this same process for the 1991 to 2015 period results in the groundwater elevation changes in these same 4 wells as shown in Table 10 – Comparison of Water Level Data 1991 to 2015.

Table 10 – Comparison of Water Level Data 1991 to 2015

STATE WELL NUMBER	MEASUREMENT DATE	GROUNDWATER ELEVATION (FEET ABOVE MSL)	CHANGE IN WATER LEVEL (FEET)	AVERAGE ANNUAL CHANGE (FT/YR)
02N22W09K04S	3/21/1991	-11.31	17.53	0.70
	3/2/2015	6.22		
	CENTRAL SUBAREA / SCREEN DEPTH (?) - 548 FEET / QTs			
02N22W08P01S	4/16/1991	-3.11	39.36	1.57
	3/16/2015	36.25		
	CENTRAL SUBAREA / SCREEN DEPTH 284 - 346 FEET / LOWER Qoa/UPPER QTs			
02N22W16K01S	4/16/1991	-33.13	6.84	0.27
	3/16/2015	-26.29		
	SOUTH SUBAREA / SCREEN DEPTH 294 - 345 FEET / UPPER QTs			
02N23W24G01S	3/25/1991	-9.70	9.79	0.39
	3/11/2015	0.09		
	SOUTH SUBAREA / SCREEN DEPTH 742 - 927 FEET / UPPER QTs			

MSL – MEAN SEA LEVEL

As shown in Table 10, the water levels for all the wells went from elevations that were below sea level in 1991 to elevations that ranged from 36.25 feet AMSL to -26.29 feet BMSL in 2015. The resulting increases over this period ranged between 6.84 feet to 39.36 feet indicating a general gain of groundwater into storage. The average water level increase in the Basin from these wells combined is 18.38 feet over the 25-year period which yields an average 0.74 foot per year increase in water levels.

The change of groundwater in storage in the Basin over the 1991 to 2015 period estimated from these data is shown in Table 11 – Estimated Change of Groundwater in Storage 1991 to 2015. These values were calculated using the approximate Basin area of 13,865 acres.

Table 11 – Estimated Change of Groundwater in Storage 1991 to 2015

STORAGE COEFFICIENT (DIMENSIONLESS)	AVERAGE ANNUAL RATE OF STORAGE CHANGE (AFY)	TOTAL CHANGE IN STORAGE OVER THE 1991-2015 PERIOD (AF)
0.01	101.94	2,548
0.005	50.97	1,274
0.001	10.19	255
0.0005	5.10	127
0.0001	1.02	25

As shown in Table 11, the range of annual change of groundwater in storage is estimated at between 1 to 102 afy. The resulting increase of groundwater in storage over the entire 25-year period is estimated to range between 25 and 2,550 af total. Again, this range is not unreasonable given available data and indicates that the average annual production in the Basin is at or near the perennial yield. These data indicate the perennial yield may be greater than the average annual production over the last 25 years by an amount of up to 102 afy. Using a reasonable storage coefficient for a leaky confined aquifer system of 0.001 and the average annual Basin production over the 1991 - 2015 base period (6,996 afy) we estimate that approximately 7,006 afy is the perennial yield for the Basin.

In review, we note that Well No. 02N22W09K04 is near the eastern boundary of the Basin where a main source of Basin recharge is inflow from the Santa Paula Basin. Water levels at the west end of the Santa Paula Basin show a comparable decline over the 1985 to 2015 base period as indicated by data from Well No. 02N22W03M02 (see Plate D15). Also, Well No.

02N22W16K01 is along the Basin's southern boundary adjacent the boundary between the Oxnard Forebay and Oxnard Plain Basins. This shallow well appears to show effects of depressed levels in the adjacent basins causing groundwater to flow out of the Mound Basin (see Well Nos. 02N22W020L03 and 02N22W20K01 on Plate D14). This would indicate that the significant decline in groundwater elevation in this well may actually reflect the impacts of pumping from the adjacent basins and not be as representative of pumping within the Mound Basin.

CONCLUSIONS

Hydrologic Base Period

Selection of a hydrologic base period for groundwater basin analysis must consider the many factors previously discussed while recognizing the inexact nature of historical manual observations and measurements and the present understanding of the groundwater system. Often there are dynamics that influence the beginning and/or ending of the base period that are not obvious from data that are available within the base period. For discussion purposes, Table 12 – Well Production and Rainfall Data summarizes the reported groundwater production data for wells in the Basin along with rainfall data from Station No. 066 for the 5-year periods prior to 1985, 1991, and 2015.

We should recognize that groundwater systems can respond relatively slowly to changes in natural inflow (i.e., rainfall) and outflow components and that it can take years to see these effects develop as trends, whereas pumping impacts are relatively quick to see in a confined basin response. Table 12 shows that during the 5 years prior to 1985, the annual rainfall averaged almost 18 inches per year, which is considerably higher than the preceding 5-year averages for 1991 and 2015 where the rainfall was 10.58 and 11.64 inches per year, respectively. This is why the shorter rainfall record at Station No. 216 had a different comparison of cumulative departure than the longer-term rain gauge data sets. It also illustrates why 1991 to 2015 appeared to be a better comparison within the shorter window of time that had been observed.

In addition to the Basin water level responses to the rainfall averages are the effects from changes in groundwater production from the Basin. Groundwater production preceding 1985 reportedly averaged 4,709 afy compared to the 5-year average of 8,053 afy prior to 1991 and the 5-year average of 5,999 afy prior to 2015. This comparison indicates that while the 2015 cumulative departure for the average precipitation was comparable to the 1985 value, the preceding pumping stress within a short 5-year period was 1,290 afy (27%) greater than 1985. The average production of 7,161 afy throughout the hydrologic base period was a 52 percent increase over the pumping stress that the Basin had been experiencing prior to the beginning of the base period. One would not expect groundwater levels to return to 1985 elevations unless the pumping stress was also reduced.

Table 12 – Well Production and Rainfall Data

YEAR	PRODUCTION	RAINFALL STATION NO. 066
1980	3,818	22.33
1981	3,730	14.43
1982	5,871	14.42
1983	2,967	31.25
1984	7,158	7.52
5-YEAR AVG	**4,709**	**17.99**
1986	6,066	20.35
1987	6,626	11.92
1988	8,189	11.31
1989	9,164	4.47
1990	10,222	4.87
5-YEAR AVG	**8,053**	**10.58**
2010	5,617	23.26
2011	4,619	11.79
2012	6,282	9.4
2013	6,913	3.72
2014	6,562	10.03
5-YEAR AVG	**5,999**	**11.64**

The analytical methods used for perennial yield estimation in this study cannot account for these types of dynamics. A properly constructed and calibrated computer flow model may better handle system dynamics and produce a more accurate estimation of perennial yield. At this time, the 1985 to 2015 base period is believed adequate for the intended purpose of approximating the Mound Basin perennial yield.

Perennial Yield

Based on the results of the study analyses we concluded:

- the modified Hill Method of analysis indicated that the perennial yield of the Mound Basin may be within the range of 7,000 and 7,400 afy

- the water budget analysis is not believed sufficient based on the assumptions required for its completion; however, it indicates that an perennial yield on the order of 6,684 to 7,264 afy may be achievable

- the water level change over the 1985 to 2015 and 1991 to 2015 hydrologic base periods indicates a perennial yield value in the range of 7,147 and 7,006 afy, respectively, may be appropriate values

This analysis is believed acceptable for the purpose of the study. The difference between the low (6,684 afy) and high (7,400 afy) perennial yield estimates is approximately 716 afy which is 10 percent of the 7,161 afy reported average annual production of groundwater in the Basin from 1985 to 2015. If future study determines that Basin yields of this magnitude are causing seawater intrusion to occur, the perennial yield may not be sustainable.

The Mound Basin has a relatively small perennial yield compared to the Santa Paula Basin (25,600 AFY) and the Oxnard Plain and Oxnard Forebay Basins (85,000 AFY). This relatively small perennial yield is a result of the complex structure of the Mound Basin with boundaries that are defined by faults that impede groundwater inflow. In addition, there are no major rivers or streams that cross the Basin and contribute recharge through a course-grained alluvial riverbed. The Basin is covered with alluvial fan materials that are abundant in clay and silt materials which impede vertical infiltration of surficial recharge sources.

Groundwater exploration and development in the Mound Basin North Subarea has not been conducted in the past, presumably because the cost of drilling deeper was prohibitive and the historical agricultural water demand in the immediate area did not warrant it. If groundwater flows westward to the Lower Ventura River Basin and is discharged to the ocean, this area could provide additional supplies to augment the perennial yield of the Basin. The lack of historical drilling activity (subsurface exploration) and the absence of wells to provide water levels, water quality, and aquifer yield information create a large gap in data and prevent further refinement of groundwater conditions in the North Subarea.

CLOSURE

This report was prepared by Hopkins Groundwater Consultants, Inc. for the City of San Buenaventura. The findings, conclusions, and recommendations presented herein were prepared in accordance with generally accepted hydrogeological evaluation and planning practices. No other warranty, express or implied is made. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. Hopkins Groundwater Consultants, Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of the use of this report or any decisions made or actions taken based on this report.

REFERENCES

American Water Works Association (AWWA, 2010), *The Water Dictionary, A Comprehensive Reference of Water Terminology, Second Edition.*

Bachman, Steve et al. (Bachman et al., 2005), *California Groundwater Management, A Resource for Future Generations, Second Edition,* Groundwater Resources Association of California.

California Department of Conservation Division of Oil and Gas (1961), *California Oil Fields, West Montalvo Oil Field, McGrath Area, July-December.*

California Department of Conservation, California Oil, Gas, and Geothermal Resources (DOGGR), Well Finder, https://maps.conservation.ca.gov/doggr/wellfinder/#/-118.94276/35.22235/6.

California Department of Conservation, https://maps.conservation.ca.gov/cgs/informationwarehouse/regulatorymaps/

California Department of Conservation, https://conservation.ca.gov/cgs/maps-data/rgm/preliminary

California Department of Water Resources (1933), *Ventura County Investigation: California Department of Water Resources Bulletin 46.*

California Department of Water Resources (2003), *California's Groundwater, Bulletin 118-Update 2003,* Dated October.

California Department of Water Resources (2016), *California's Groundwater, Bulletin 118*, Interim Update in 2016.

California Department of Water Resources (1975), *Compilation of Technical Information Records for the Ventura County Cooperative Investigation, Volume 1,* Prepared by Ventura County Public Works Agency, Dated July.

California Department of Water Resources (DWR, 2019), *2018 Basin Boundary Modifications – Final,* Letter addressed to Mound Basin Groundwater Sustainability Agency, Mr. Bryan Bondy, Dated March 28.

California Department of Water Resources (DWR, 2019a), https://gis.water.ca.gov/arcgis/rest/services/Geoscientific/i08_B118_GroundwaterBasins/FeatureServer/0

California Department of Water Resources, Ventura County well locations, groundwater level data page, *http://wdl.water.ca.gov/waterdatalibrary/groundwater/index.cfm*

California Geological Survey (2003), *Ventura Quadrangle Seismic Hazard Zones Map, California*

California Geological Survey (CGS, 2008), *Geologic Map of the East Half Santa Barbara 30' x 60' Quadrangle, California.*

California State Water Resources Board (SWRB, 1953), *Bulletin No. 12 Ventura County Investigation*, (Revised April 1956), Dated October.

California State Water Resources Control Board, *Resolution No. 88-63, Adoption of Policy Entitled "Sources of Drinking Water".*

California State Water Resources Control Board (2019), *California Regulations Related to Drinking Water,* Dated April 16.

Daniel B. Stephens & Associates, Inc., and Richard C. Slade & Associates LLC (DBA & RCS 2017), *Santa Paula Basin Hydrogeologic Characterization and Safe Yield Study, Ventura County, California,* Prepared for United Water Conservation District, Dated May 25.

Dibblee, T.W. Jr. (Dibblee, 1988), *Geologic Map of the Ventura and Pitas Point Quadrangles.*

Dibblee, T.W. Jr. (1992), *Geologic Map of the Saticoy Quadrangle.*

Dudek (2019), *Draft Groundwater Sustainability Plan for the Oxnard Subbasin,* Prepared for Fox Canyon Groundwater Management Agency, Dated July.

Fugro West, Inc. (Fugro, 1996), *Calendar Year 1995 Annual Report, Mound Ground Water Basin, Ventura County, California,* Prepared for City of San Buenaventura, Dated January.

Fugro West, Inc. (Fugro, 1997), *Calendar Year 1996 Annual Report, Mound Groundwater Basin, Ventura County, California,* Prepared for City of San Buenaventura, Dated June.

Fugro West, Inc. (1997), *Final Design and Feasibility Report, Mound Well No. 1, Ventura County, California,* Prepared for City of San Buenaventura, Dated December.

Geotechnical Consultants, Inc. (1972), *Hydrogeologic Investigation of the Mound Ground Water Basin, for the City of San Buenaventura, California, unpublished consultants report prepared for the City of San Buenaventura,* Dated September 26.

Hanson, R.T. et al. (2003), *Simulation of Ground-Water/Surface-Water Flow in the Santa Clara-Calleguas Ground-Water Basin, Ventura County, California,* U.S. Geological Survey Water-Resources Investigations Report 02-4136.

Hopkins Groundwater Consultants, Inc. (2009), *Preliminary Hydrogeological Study, City of San Buenaventura Mound Well No. 2 Siting Study, Ventura, California,* Prepared for City of San Buenaventura, Dated April 29.

Hopkins Groundwater Consultants, Inc. (Hopkins, 2012), *Saticoy Groundwater Conditions Study, Ventura California,* Letter-report to Ventura Regional Sanitation District, Dated November 1.

HydroMetrics (2016), Oxnard Subbasin Groundwater Sustainability Plan, Tasks 1 – 5 Report, Basin Distribution of Precipitation, Preliminary Draft Prepared for Fox Canyon Groundwater Management Agency, Dated May.

John F. Mann Jr. and Associates (1959), *A Plan for Ground Water Management, United Water Conservation District,* Dated September.

Jones, Ronald L. (1992), *Hydrogeology of the Mound Basin,* Prepared by Water Resources Division of the Water Resources and Development Department, Ventura County Public Works Agency, Dated November.

Lippincott, J.B. (Lippincott, 1934), *Report on Future Water Supply for Ventura, California,* Dated May.

Mann, John F. Jr. (1958), *Preliminary Report on the Mound Basin,* Prepared for United Water Conservation District, Dated January 5.

Mukae, M., and Turner, J., (Mukae & Turner, 1975), *Ventura County Water Resources Management Study, Geologic Formations, Structures and History in the Santa Clara-Calleguas Area,* Prepared for Ventura County Department of Public Works Flood Control District, Dated January.

Perry, S. and Bryant, W.A., compliers (2002), Fault Number 91, Ventura Fault, in Quaternary fault and fold database of the United States: U.S. Geologic Survey website, http://earthquakes.usgs.gov/hazards/qfaults, accessed 12/23/2014.

PRISM Climate Group, Oregon State University, http://prism.oregonstate.edu, created 4 February 2004.

Southern California Association of Governments, ftp://data.scag.ca.gov/SCAG_Land_Use_2012

Staal, Gardner & Dunne, Inc. (1993), *Santa Paula and Mound Ground Water Basins, Water Level Conditions,* Prepared for City of San Buenaventura, Dated May 11.

Turner, J. (Turner, 1975), *Ventura County Water Resources Management Study, Aquifer Delineation in the Oxnard-Calleguas Area, Ventura County*, Prepared for Ventura County Department of Public Works Flood Control District, Dated January.

Turner, J., and Mukae, M. (Turner & Mukae, 1975), *Ventura County Water Resources Management Study, Effective Base of Fresh Water Reservoir in the Oxnard-Calleguas Area*, Prepared for Ventura County Department of Public Works Flood Control District, Dated January.

United States Department of Agriculture, https://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx

United States Geological Survey (1924), *Geology and Oil Resources of a part of Los Angeles and Ventura Counties, California, U.S. Geological Survey Bulletin 753.*

United States Geological Survey (1949), *Oxnard Quadrangle, California – Ventura Co. 7.5 Minute Series (Topographic) Map,* Photorevised 1967.

United Water Conservation District (2012), *Hydrogeological Assessment of the Mound Basin, United Water Conservation District Open-File Report 2012-01*, Dated May.

United Water Conservation District (2013), *Aquifer Delineation Within the Oxnard Forebay Groundwater Basin Using Surface Geophysics, Open-File Report 2013-06*, Dated June.

United Water Conservation District (UWCD, 2016), *Combined 2013 and 2014 Santa Paula Basin Annual Report,* Dated January.

United Water Conservation District (2016a), *Saline Intrusion Update, Oxnard Plain and Pleasant Valley Basins, Open-File Report 2016-04,* Dated October.

United Water Conservation District (UWCD, 2017), *2015 Santa Paula Basin Annual Report,* Dated March.

United Water Conservation District (2017a), *Groundwater and Surface Water Conditions Report – 2015, Open-File Report 2017-01*, Dated March.

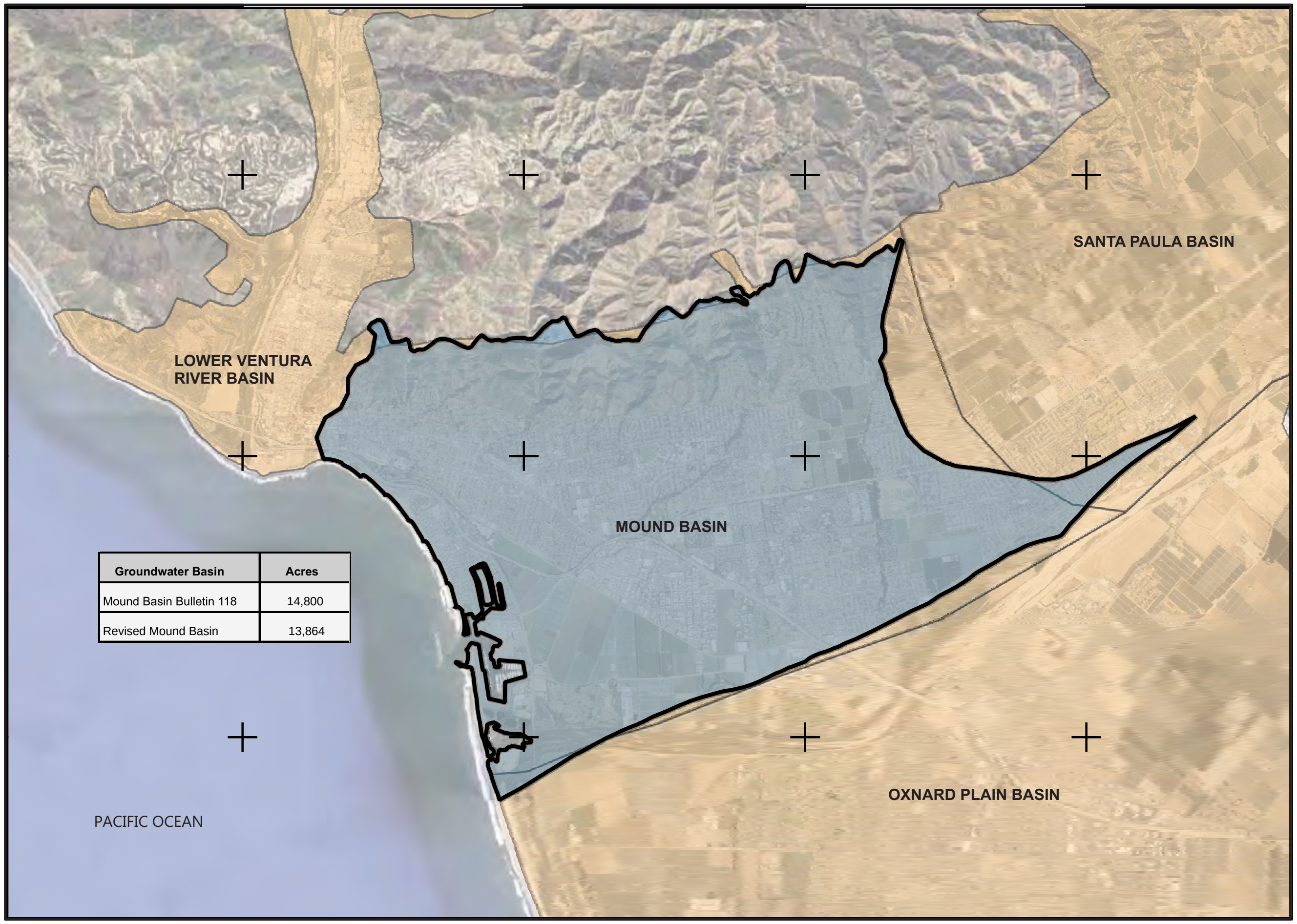
United Water Conservation District (UWCD, 2018), *Ventura Regional Groundwater Flow Model and Updated Hydrogeologic Conceptual Model: Oxnard Plain, Oxnard Forebay, Pleasant Valley, West Las Posas, and Mound Groundwater Basins, Open-File Report 2018-02,* Dated July.

Yeats, R.S. et al (1982), *Field Trip Number 3; Neotectonics of the Ventura Basin – Road Log: in Neotectonics in Southern California, Geological Society of America 78th Annual Cordilleran Section Meeting,* J.D. Cooper (Editor), Anaheim, California.

Yeats, R.S., et al (1988), *Oak Ridge fault, Ventura fold belt, and the Sisar decollement, Ventura basin, California*, Department of Geology, Oregon State University, Geology, v.16, p. 1112-1116, Dated December.

Yeats, R.S. (1988a), *Late Quaternary Slip Rates on the Oak Ridge Fault, Transverse Ranges, California – Implications for Seismic Risk: Journal of Geophysical Research, Vol. 93.*

PLATES



Groundwater Basin	Acres
Mound Basin Bulletin 118	14,800
Revised Mound Basin	13,864

LEGEND

- Revised Mound Basin boundary
- Bulletin 118 basin boundaries

N

SCALE 1" = 10,000'

0 1 2

MILES

Basemap: Google Satellite (2019).
Projection: State Plane Coordinate System, California Zone 5, NAD27, Feet.

MOUND BASIN BOUNDARY MAP

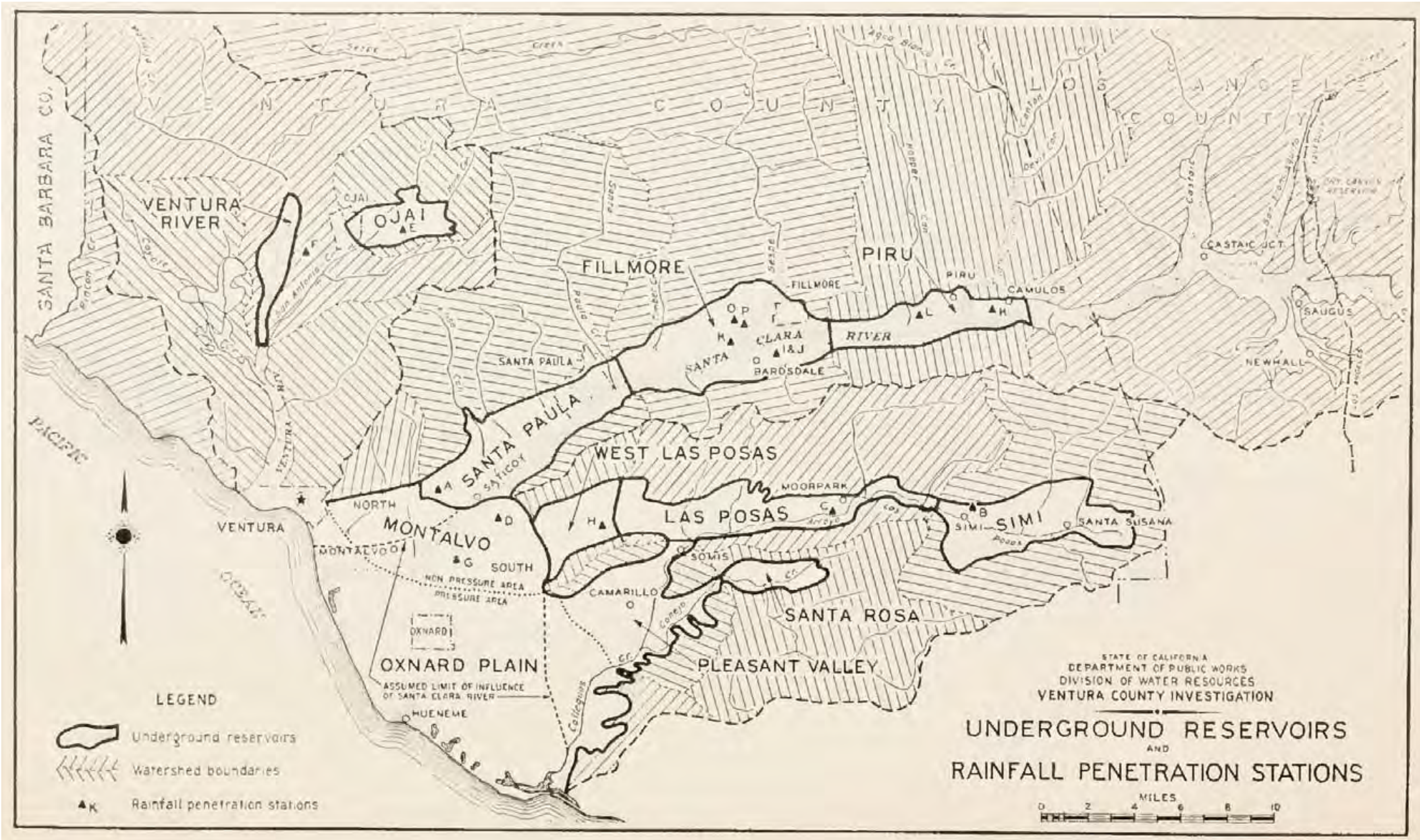
Mound Basin Study

City of San Buenaventura
Ventura, California

PLATE 1

Project No. 01-009-11B

HOPKINS GROUNDWATER CONSULTANTS



Modified from Bulletin No. 46 (1933).

HISTORICAL GROUNDWATER BASIN BOUNDARY MAP

Mound Basin Study

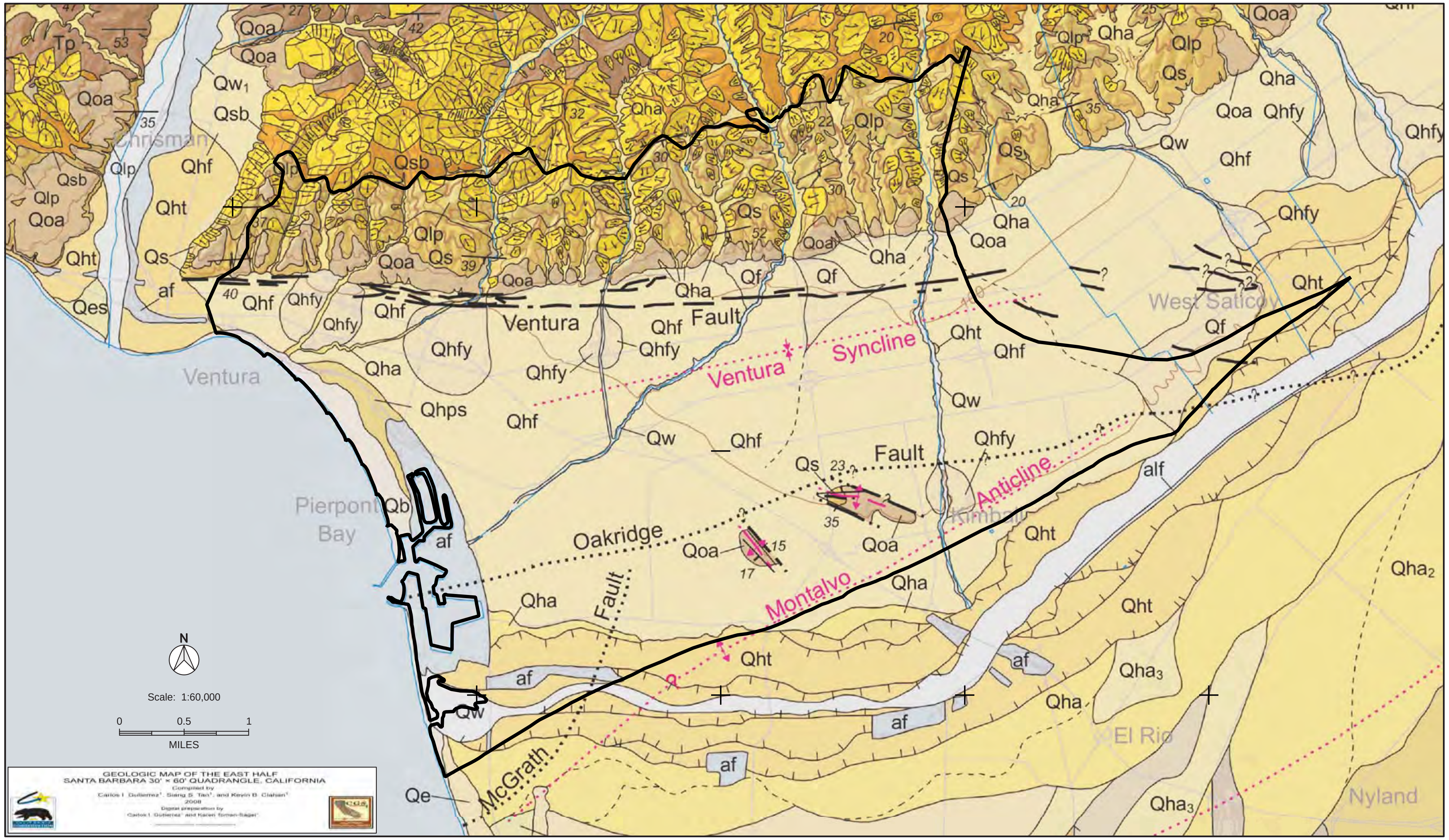
City of San Buenaventura

Ventura, California

PLATE 2

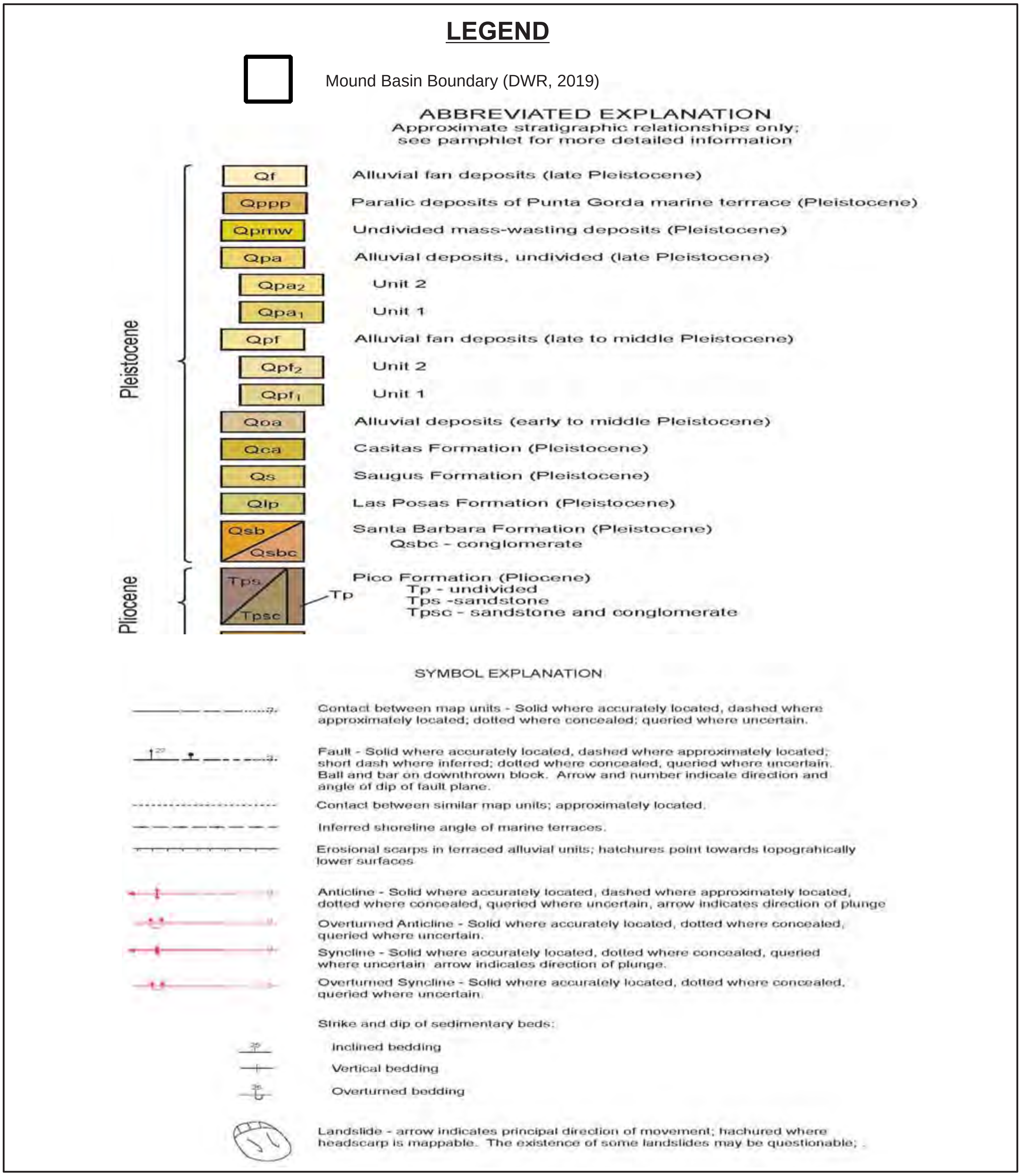
Project No. 01-009-11B

HOPKINS GROUNDWATER CONSULTANTS



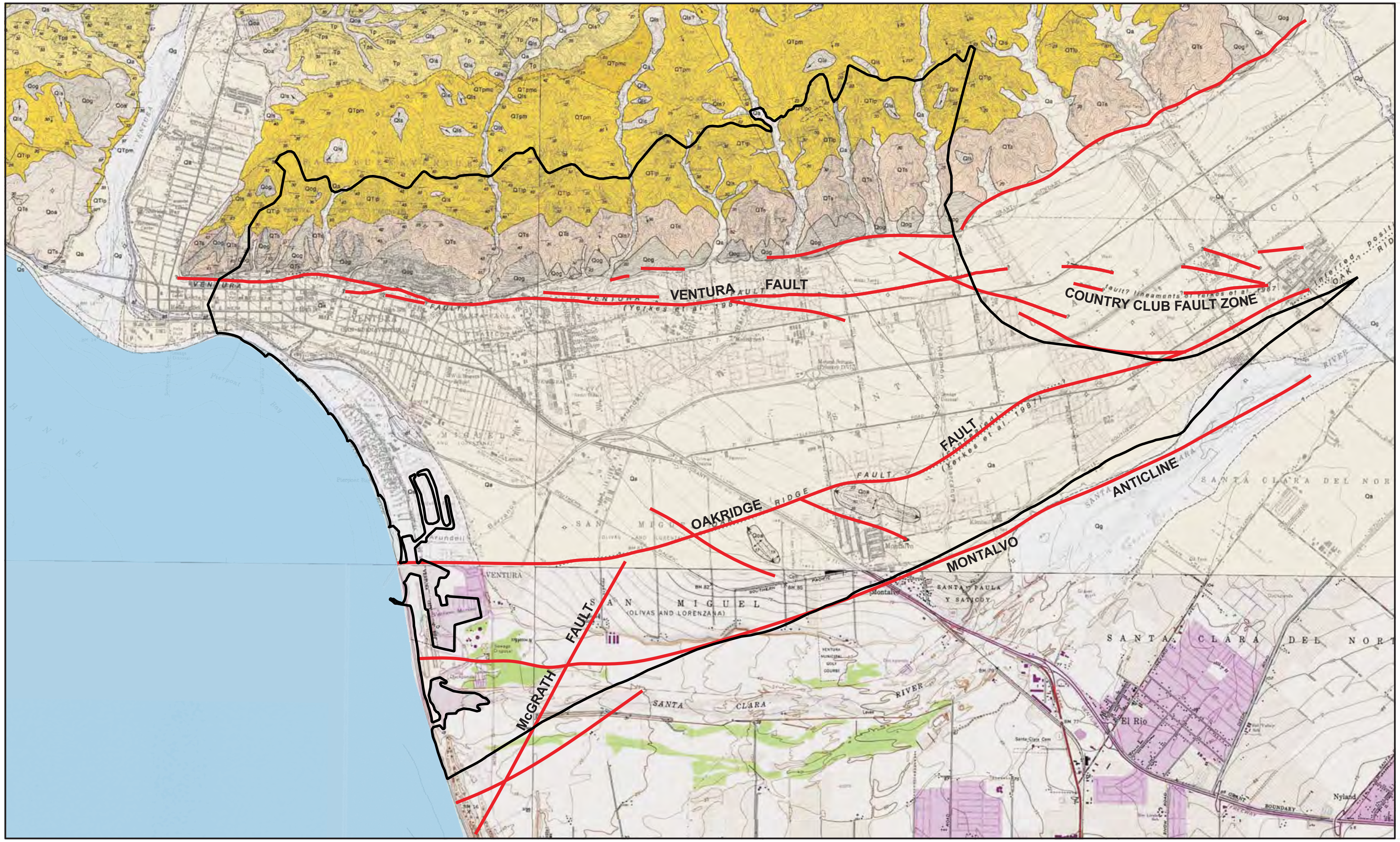
CALIFORNIA GEOLOGICAL SURVEY
GEOLOGIC MAP
Mound Basin Study
City of San Buenaventura
Ventura, California

PLATE 3



CALIFORNIA GEOLOGICAL SURVEY MAP LEGEND
Mound Basin Study
City of San Buenaventura
Ventura, California

PLATE 3A



LEGEND

- Mound Basin Boundary (DWR, 2019)
- Fault
- **Qa** - Alluvium - silt, sand and gravel of valley floodplain areas
- **Qog** - Older Dissected Surficial Sediments - cobble-boulder fan gravel and fanglomerate deposits composed largely of sandstone detritus
- **Qts** - Saugus Formation - weakly consolidated alluvial deposits: gray to tan boulder-cobble-pebble gravel of mostly sandstone and some siliceous shale detritus in light brown sandy matrix
- **Qtlp** - Las Posas Sand - weakly indurated, soft, tan to yellowish-brown fossiliferous shale and hard sandstone
- **Qtpm** - Pico Formation - Mudpit Claystone Member (Santa Barbara Formation), massive to vaguely bedded soft gray claystone or mudstone

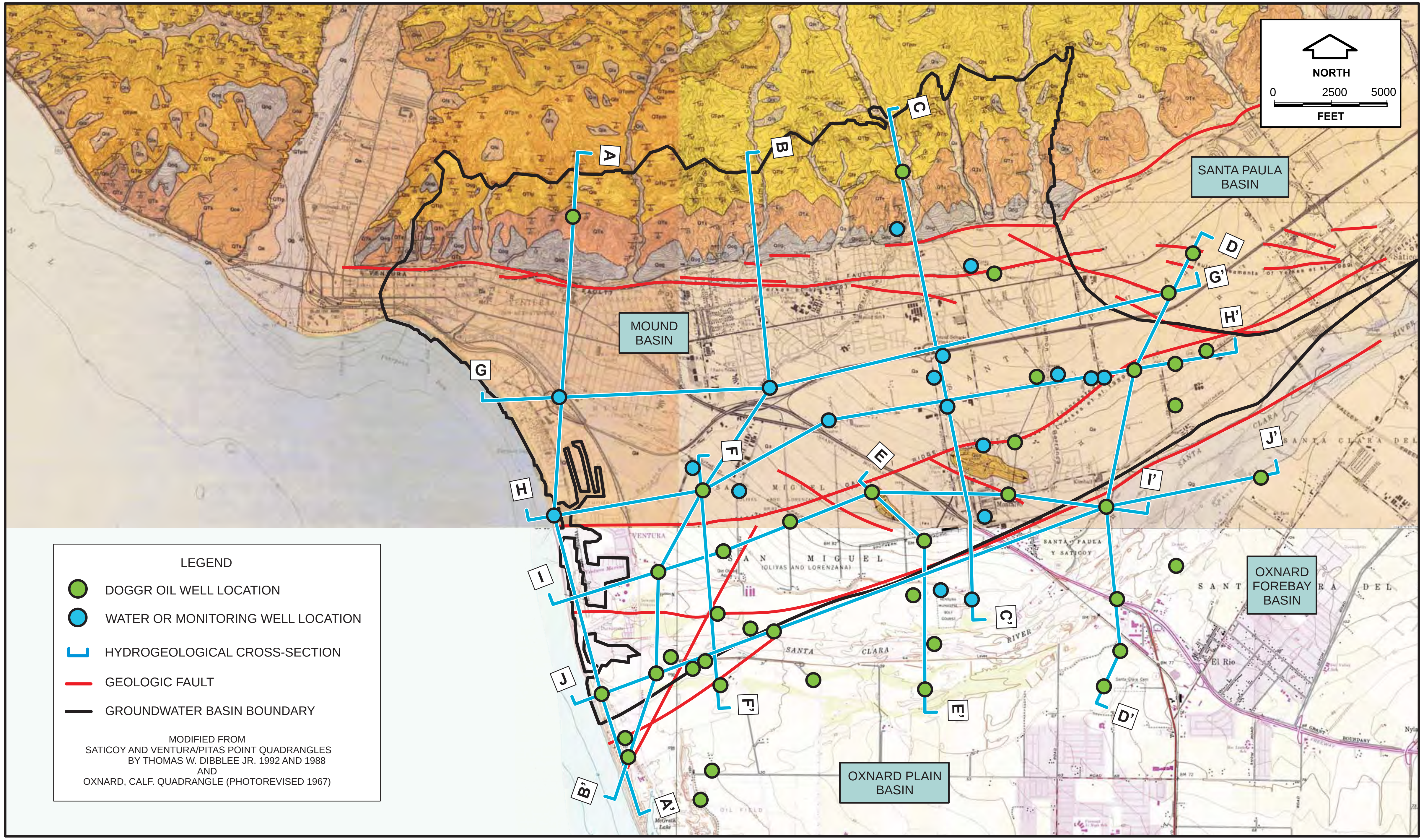
N

Scale: 1:60,000

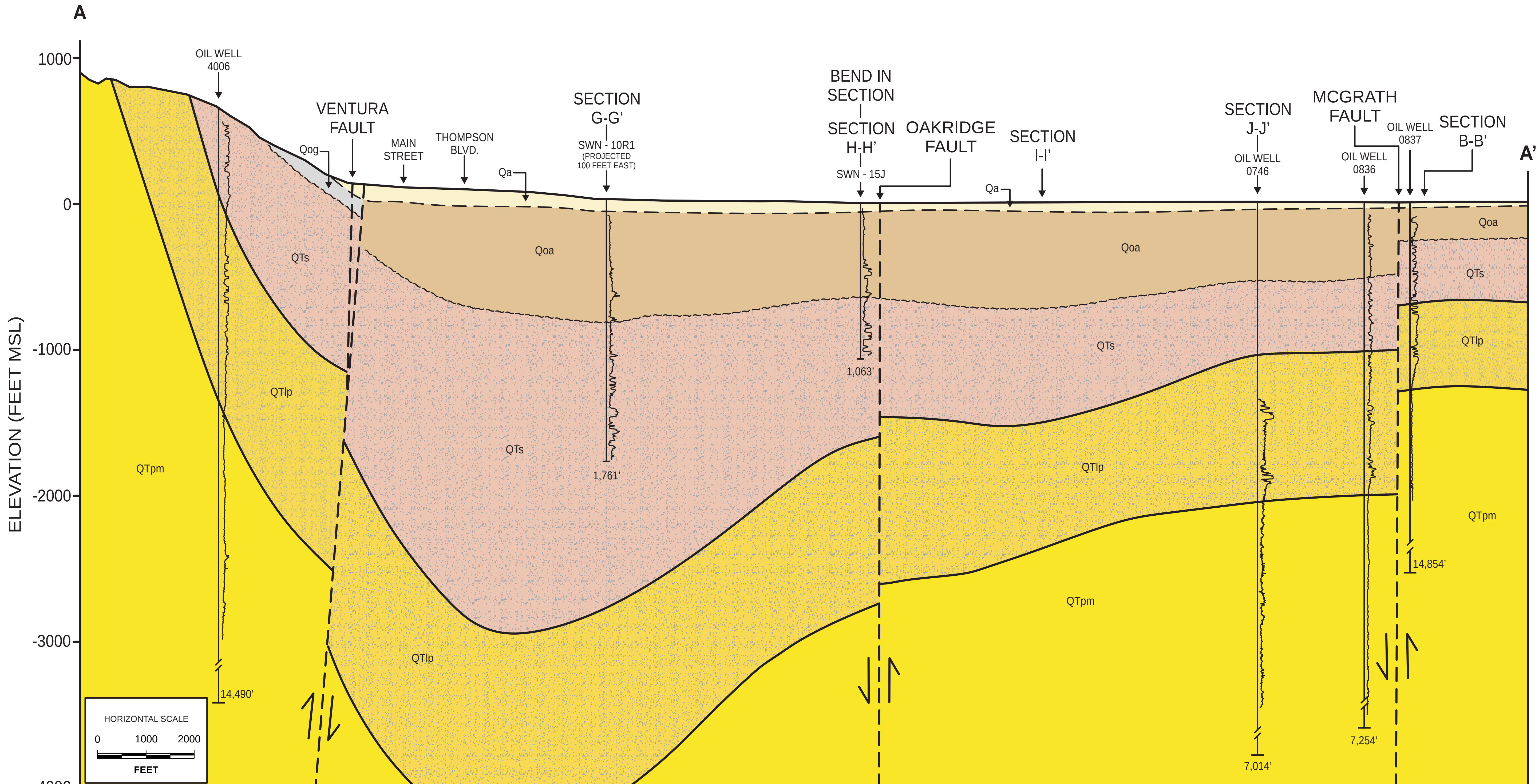
0 0.5 1
MILES

MODIFIED FROM
SATICOY AND VENTURA/PITAS POINT QUADRANGLES
BY THOMAS W. DIBBLEE JR. 1992 AND 1988
AND
OXNARD, CALF. QUADRANGLE (PHOTOREVISED 1967)

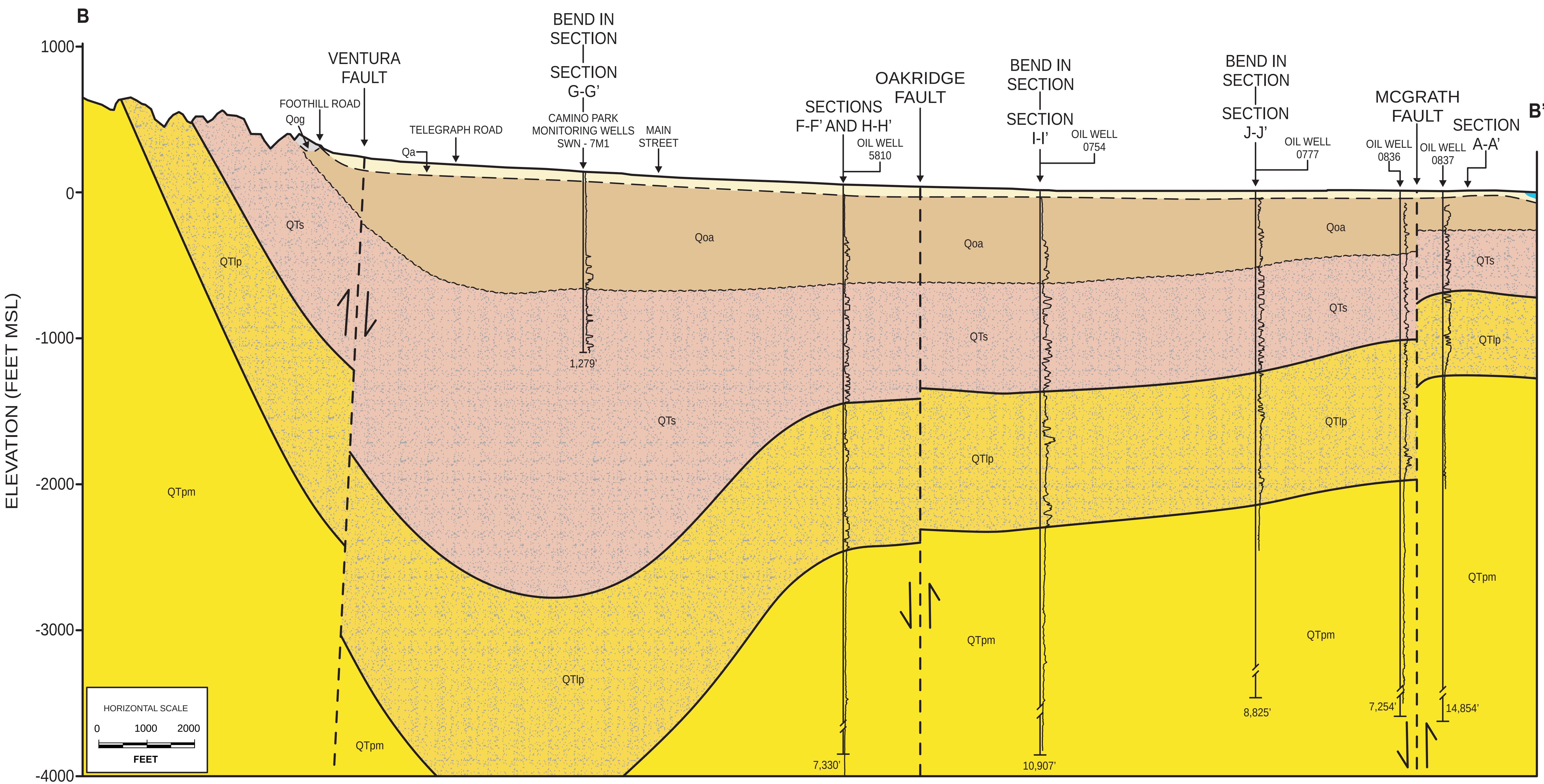
THOMAS W. DIBBLEE JR.
GEOLOGIC MAP
Mound Basin Study
City of San Buenaventura
Ventura, California



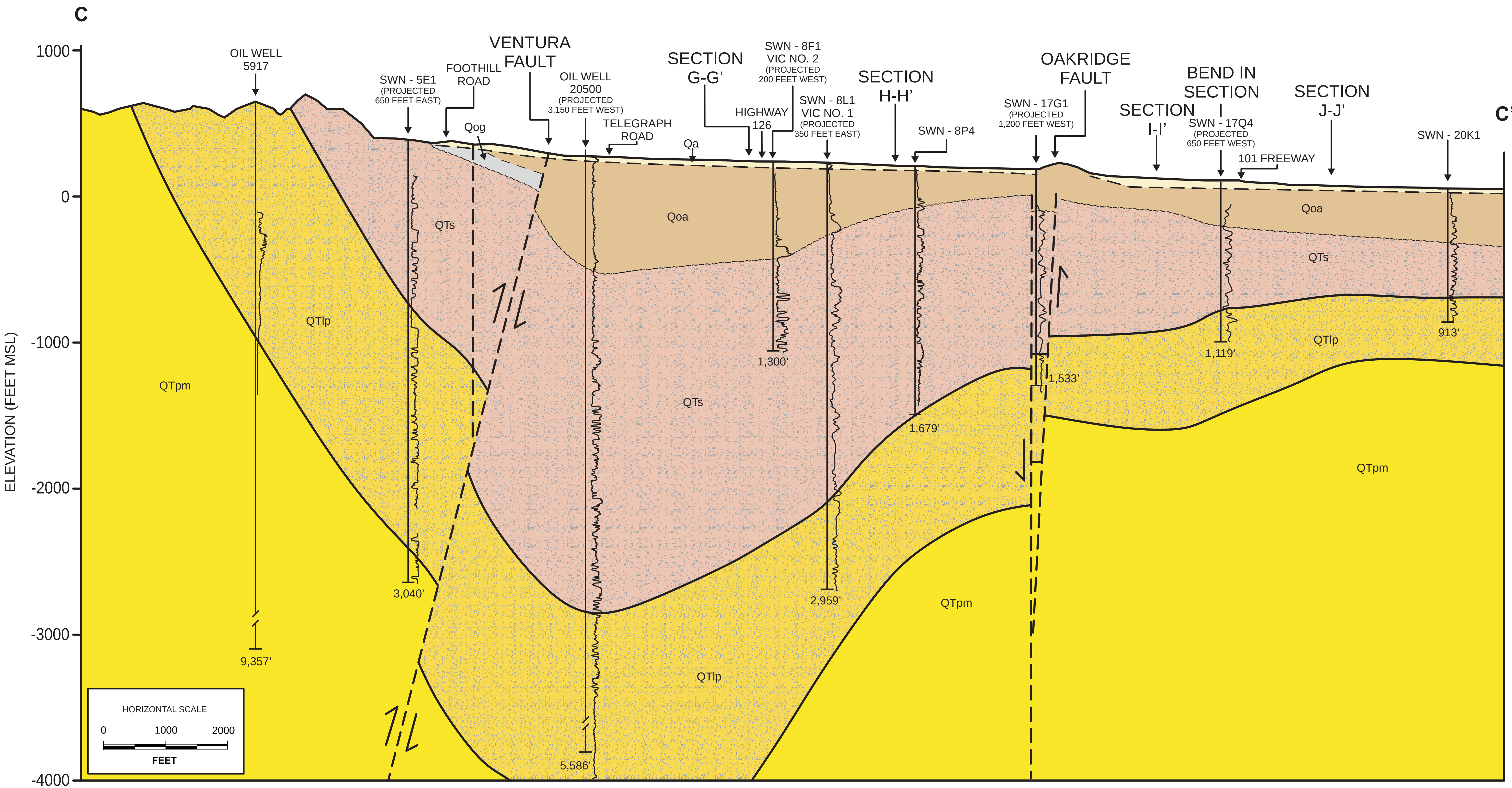
HYDROGEOLOGIC CROSS-SECTION
LOCATION MAP
Mound Basin Study
City of San Buenaventura
Ventura, California



HYDROGEOLOGIC CROSS-SECTION A-A'
Mound Basin Study
City of San Buenaventura
Ventura, California

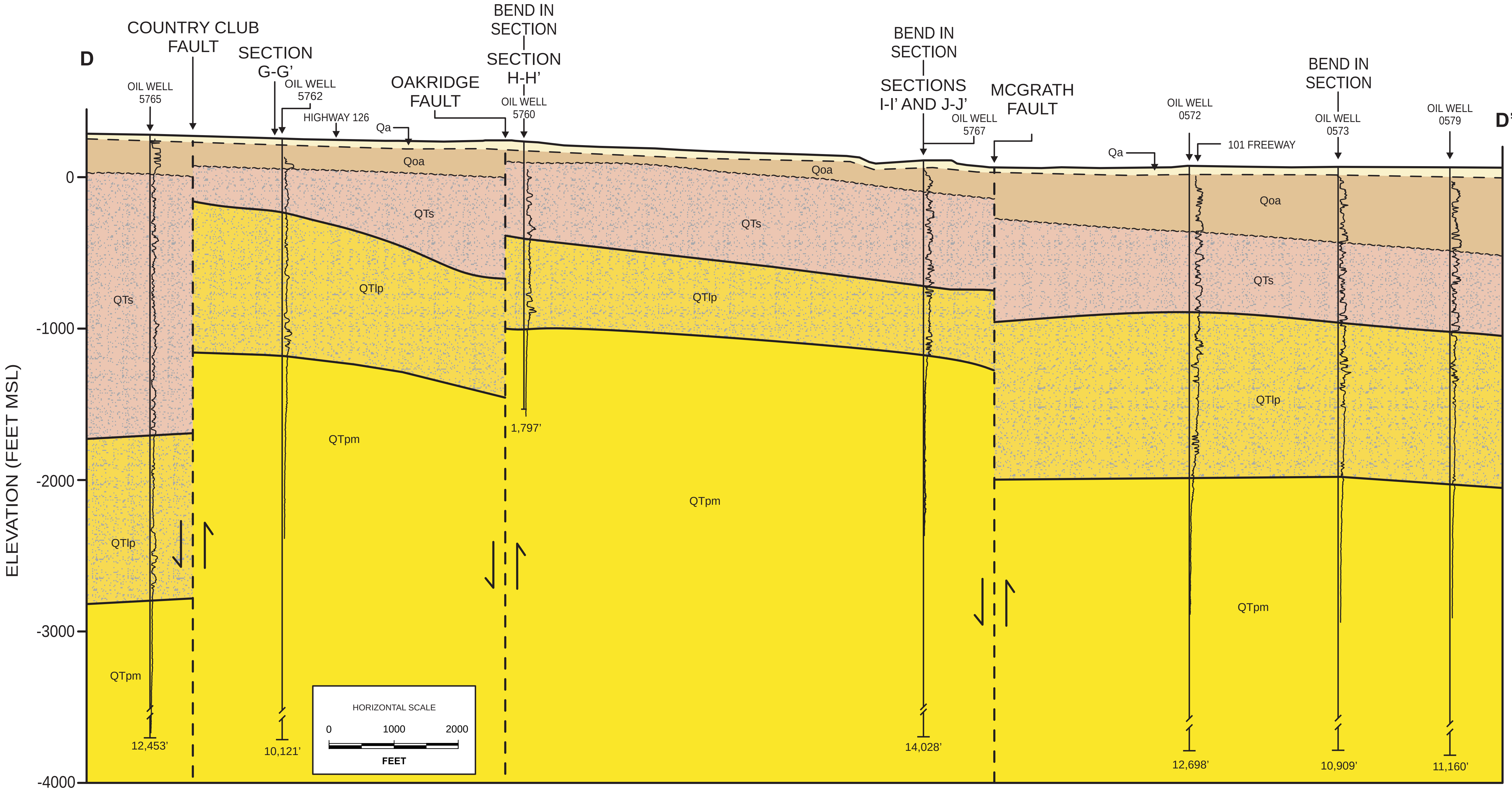


HYDROGEOLOGIC CROSS-SECTION B-B'
Mound Basin Study
City of San Buenaventura
Ventura, California



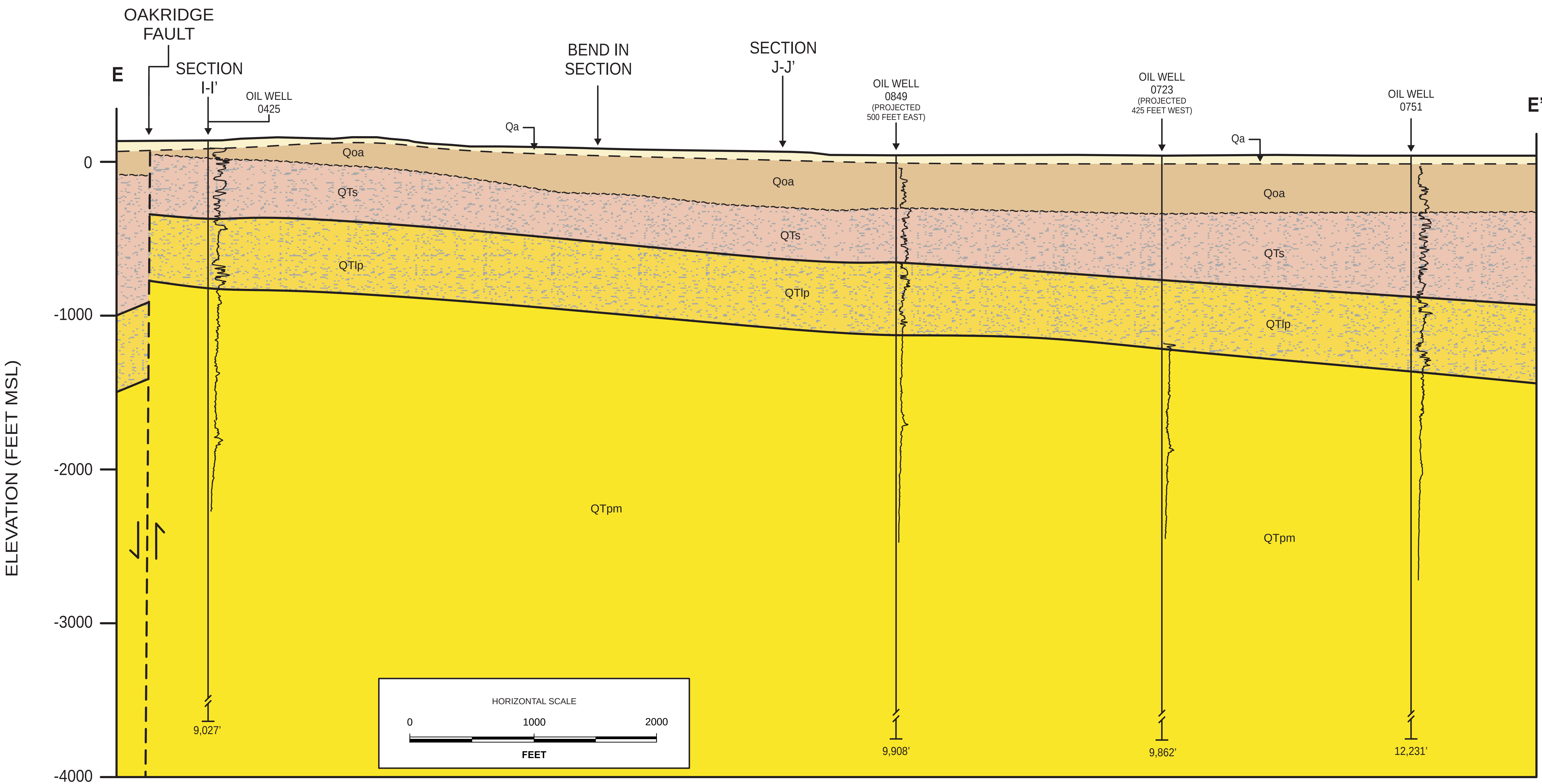
HYDROGEOLOGIC CROSS-SECTION C-C'
Mound Basin Study
City of San Buenaventura
Ventura, California

PLATE 8



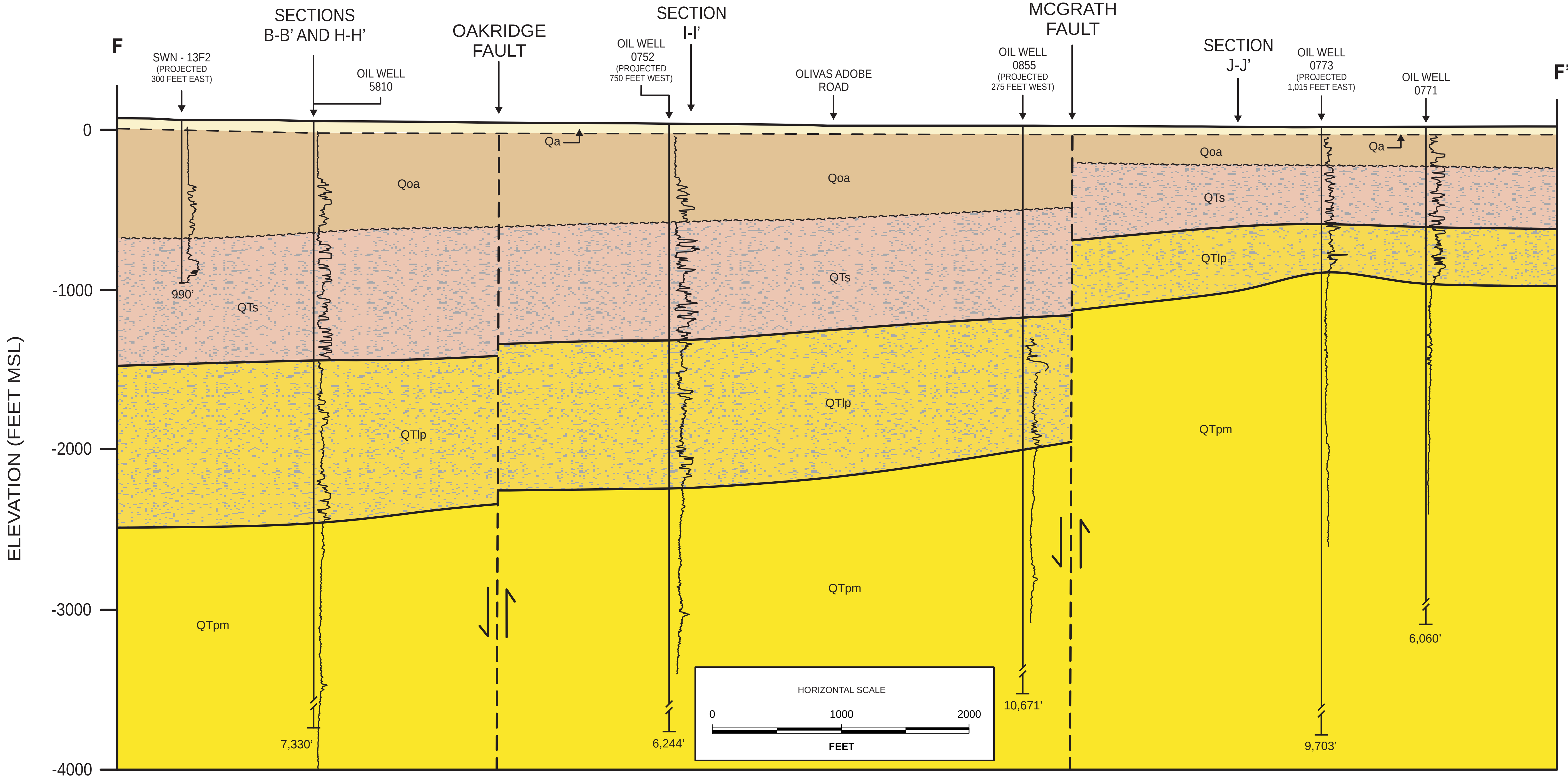
HYDROGEOLOGIC CROSS-SECTION D-D'
Mound Basin Study
City of San Buenaventura
Ventura, California

PLATE 9



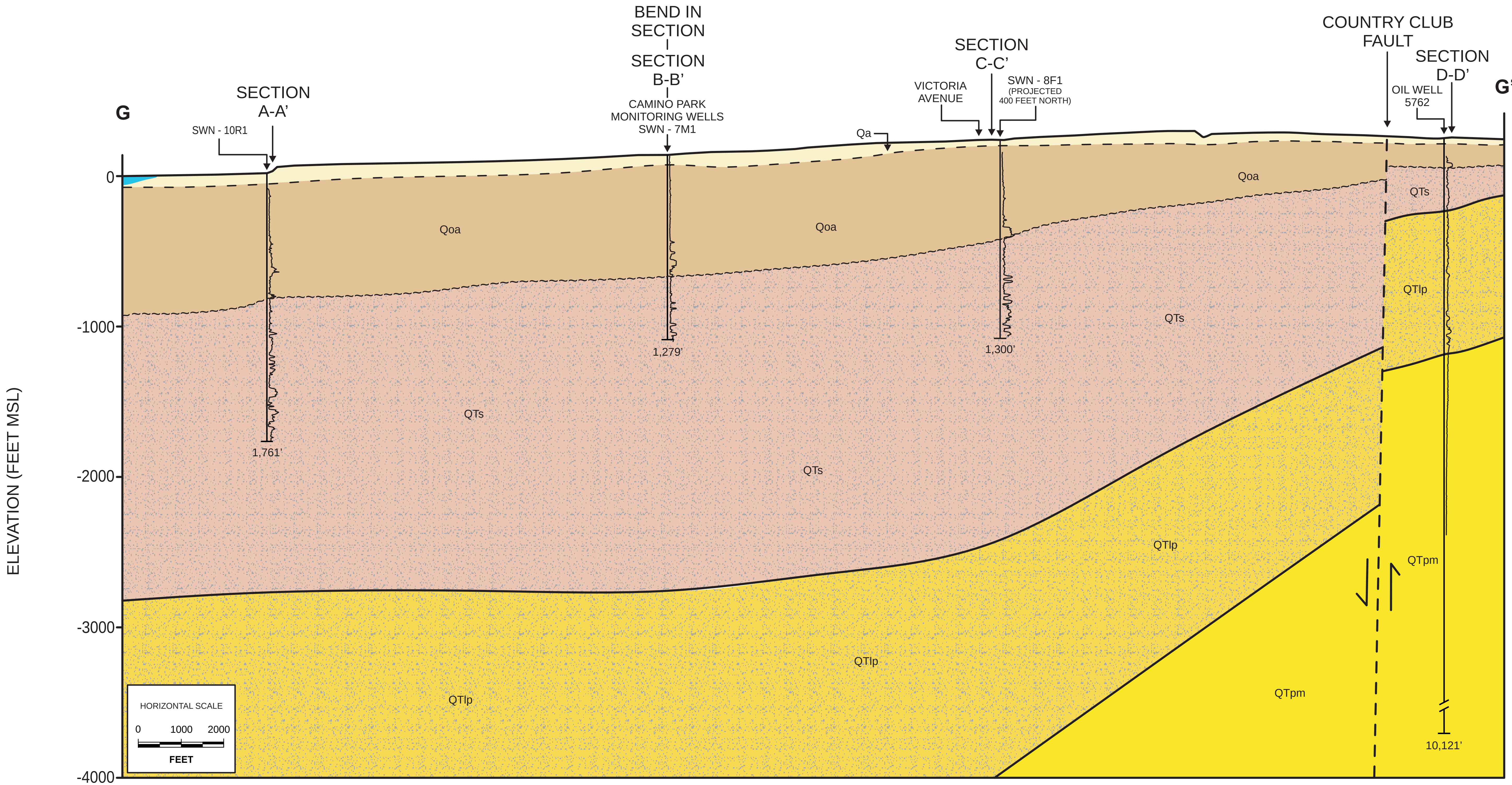
HYDROGEOLOGIC CROSS-SECTION E-E'
Mound Basin Study
City of San Buenaventura
Ventura, California

PLATE 10



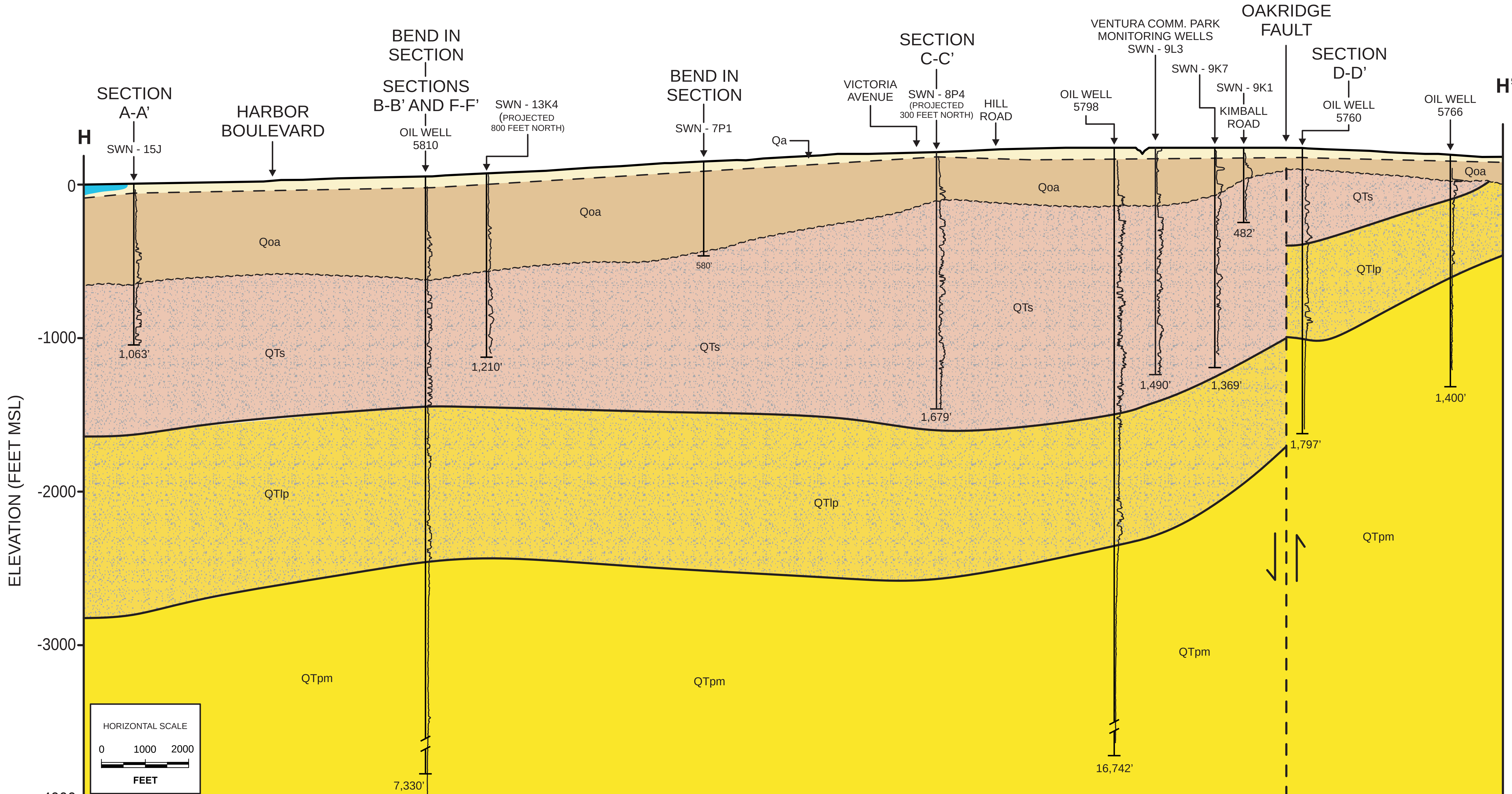
HYDROGEOLOGIC CROSS-SECTION F-F'
Mound Basin Study
City of San Buenaventura
Ventura, California

PLATE 11



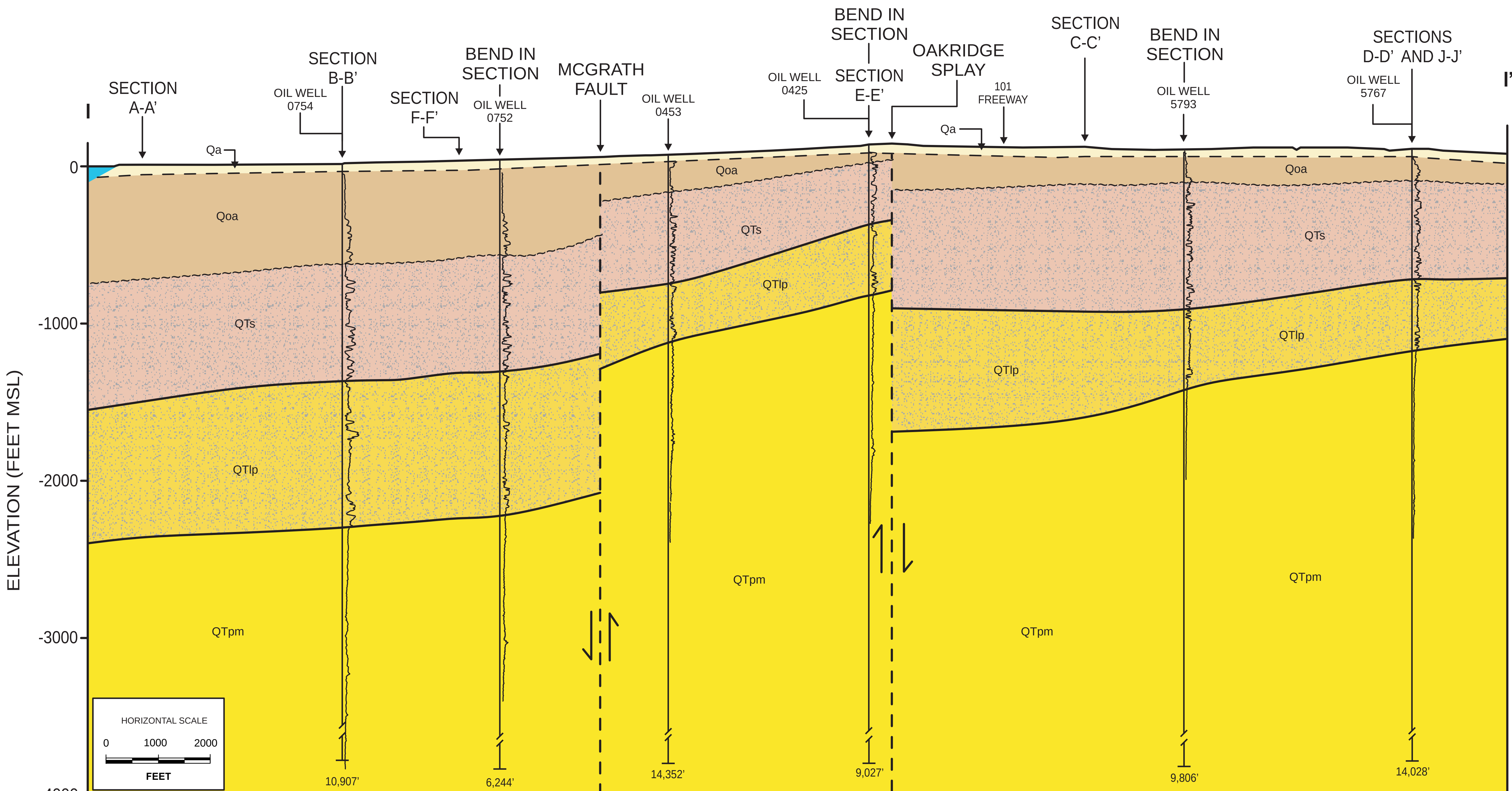
HYDROGEOLOGIC CROSS-SECTION G-G'
Mound Basin Study
City of San Buenaventura
Ventura, California

PLATE 12

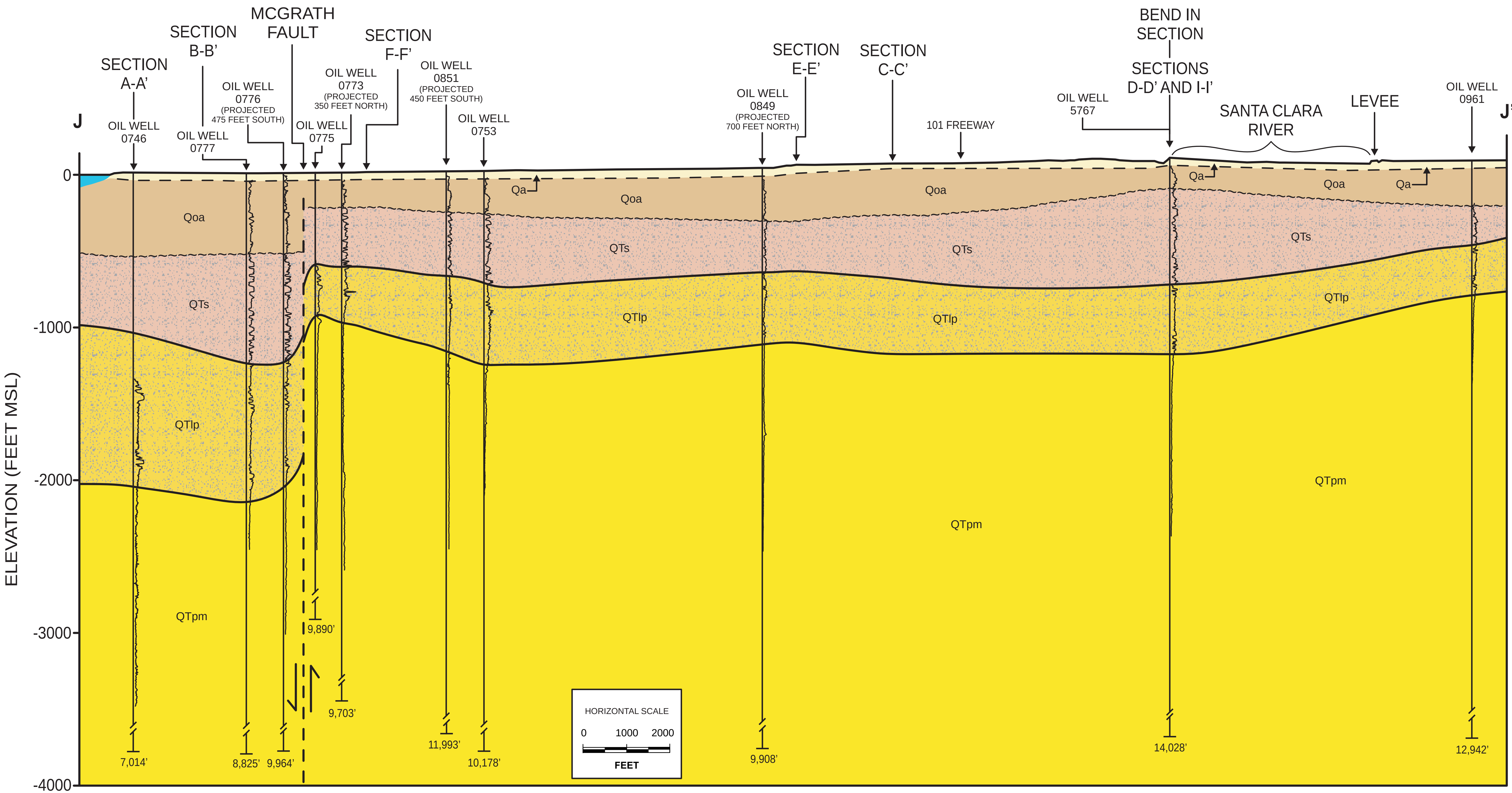


HYDROGEOLOGIC CROSS-SECTION H-H'
Mound Basin Study
City of San Buenaventura
Ventura, California

PLATE 13



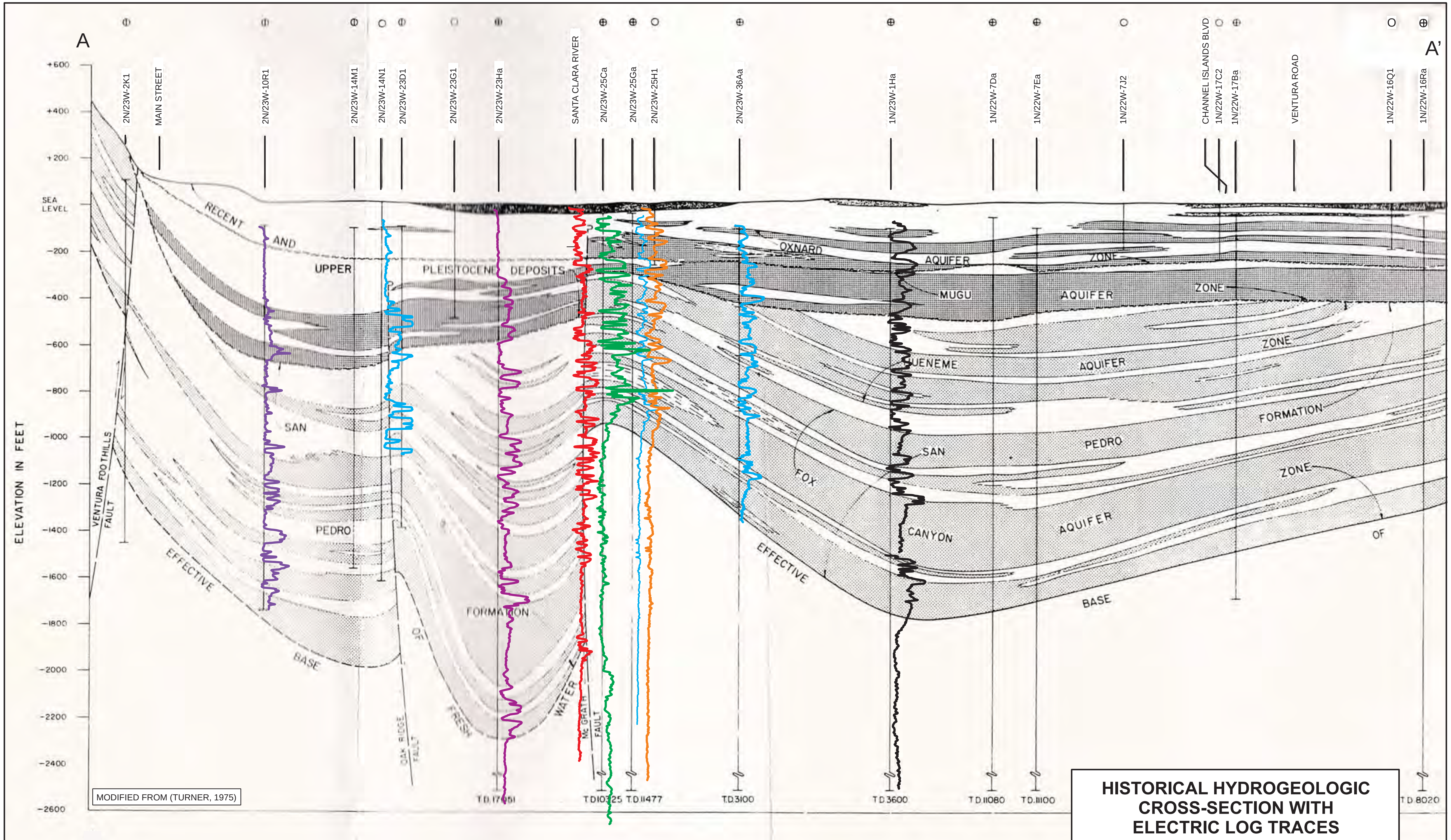
HYDROGEOLOGIC CROSS-SECTION I-I'
Mound Basin Study
City of San Buenaventura
Ventura, California



HYDROGEOLOGIC CROSS-SECTION J-J'
Mound Basin Study
City of San Buenaventura
Ventura, California

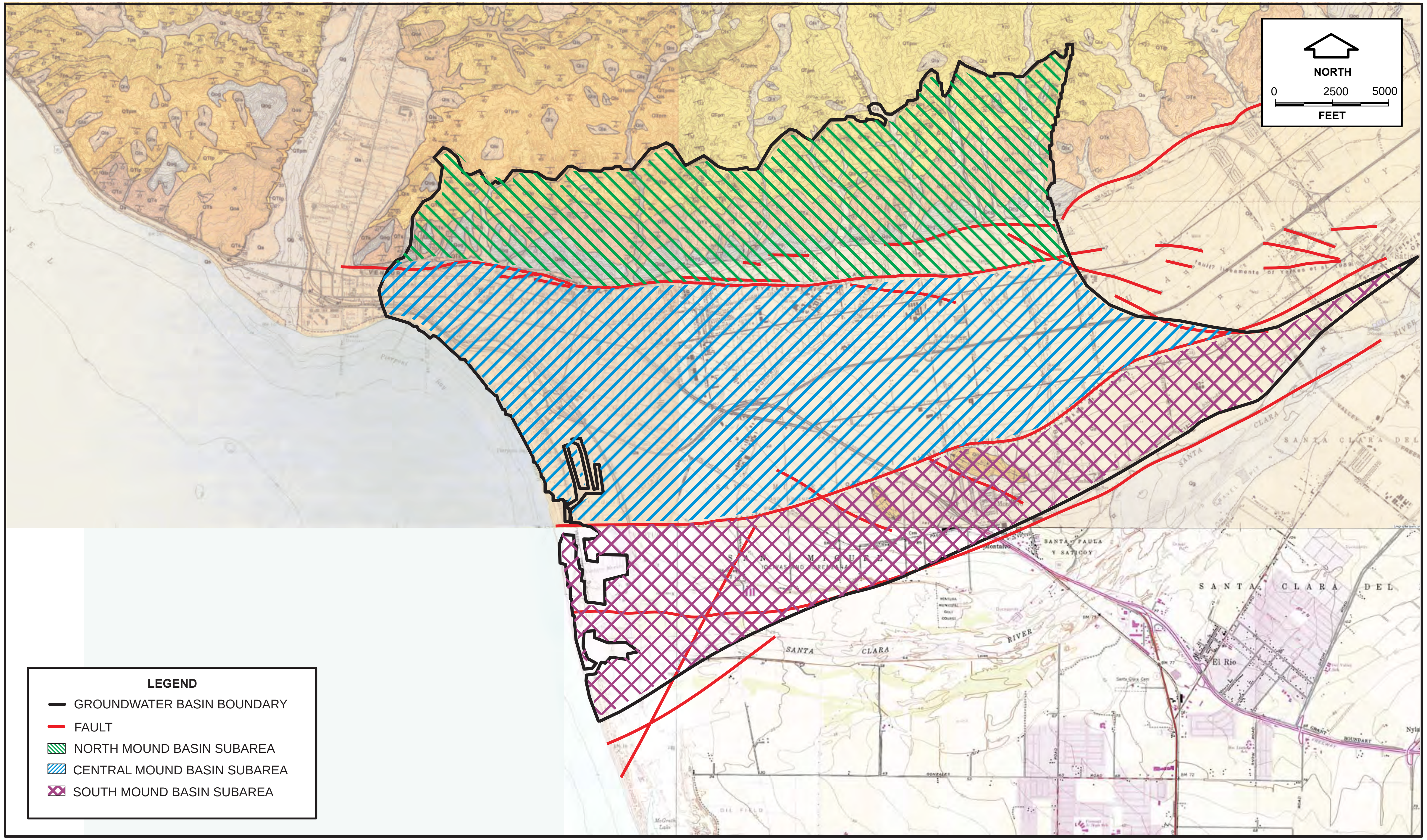
PLATE 15

HISTORICAL HYDROGEOLOGICAL CROSS-SECTION
LOCATION MAP
Mound Basin Study
City of San Buenaventura
Ventura, California



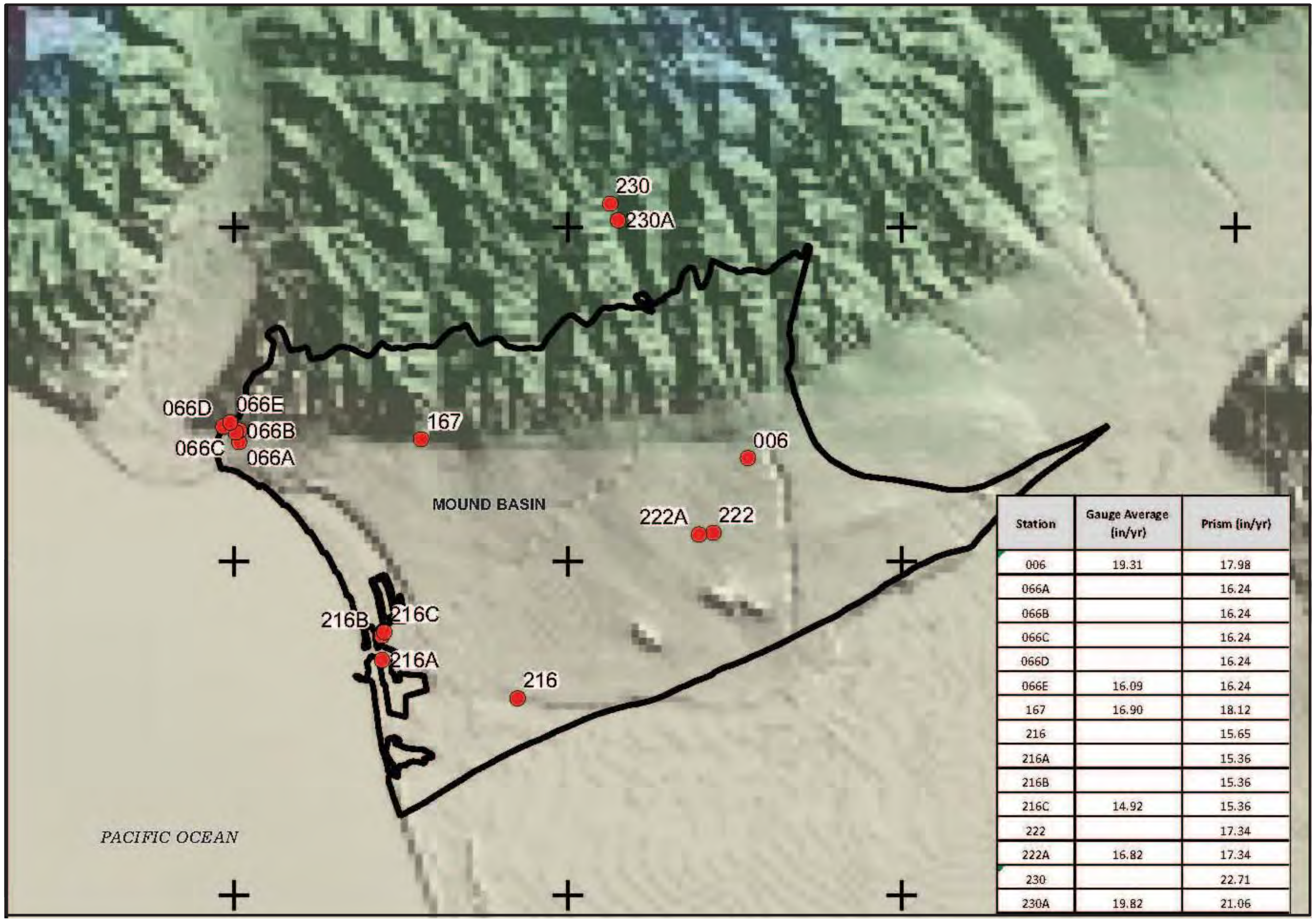
HISTORICAL HYDROGEOLOGIC CROSS-SECTION WITH ELECTRIC LOG TRACES
Mound Basin Study
City of San Buenaventura
Ventura, California

PLATE 17



MOUND BASIN SUBAREAS
Mound Basin Study
City of San Buenaventura
Ventura, California

PLATE 18



Station	Gauge Average (in/yr)	Prism (in/yr)
006	19.31	17.98
066A		16.24
066B		16.24
066C		16.24
066D		16.24
066E	16.09	16.24
167	16.90	18.12
216		15.65
216A		15.36
216B		15.36
216C	14.92	15.36
222		17.34
222A	16.82	17.34
230		22.71
230A	19.82	21.06

LEGEND

Revised Mound Basin boundary

Annual Precipitation (in/yr)

- 12 - 14
- 14 - 16
- 16 - 18
- 18 - 20
- 20 - 22
- 22 - 24
- 24 - 26
- > 26
- No data

N

SCALE 1" = 10,000'

0 1 2

MILES

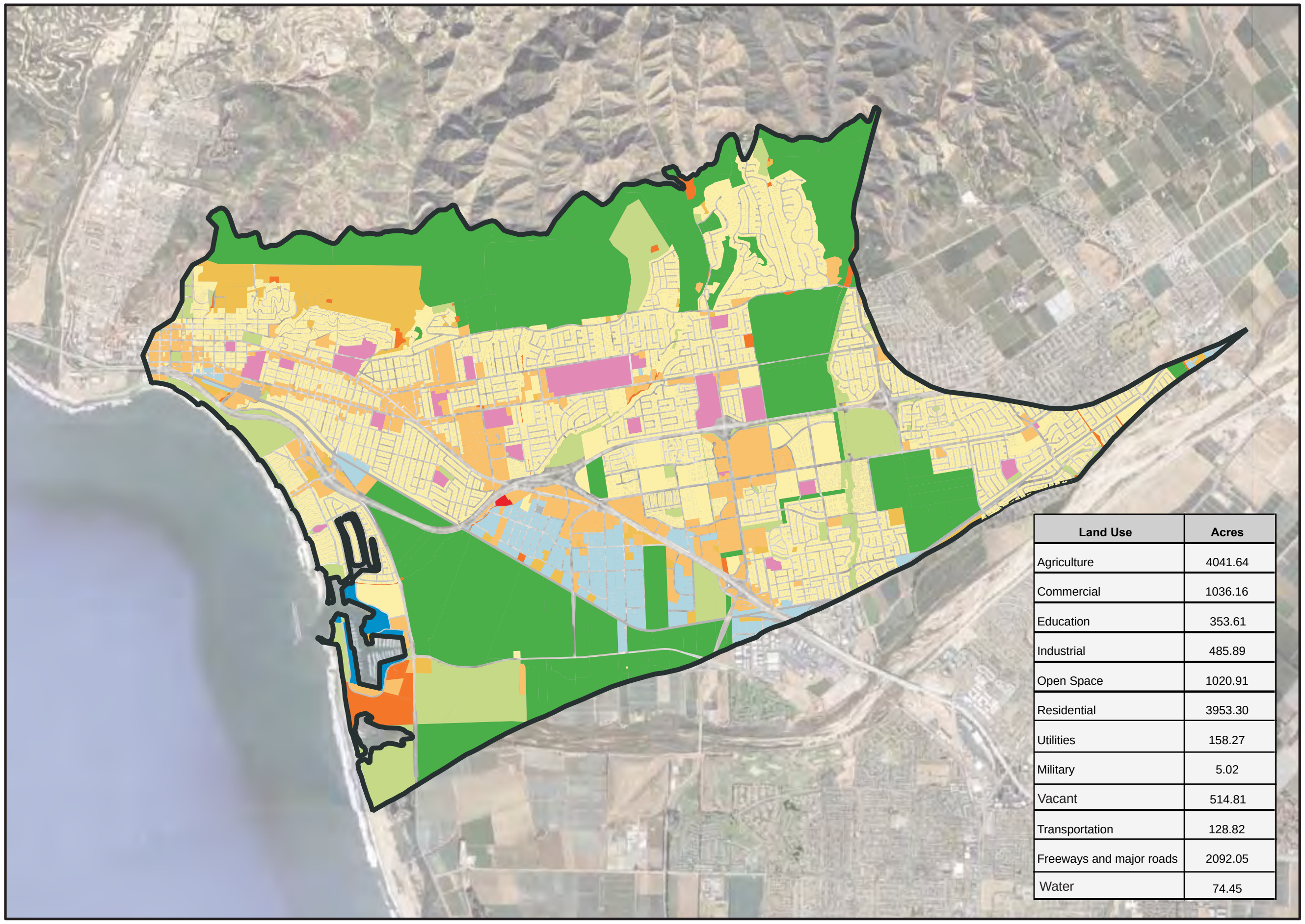
Basemap: 30-year normal precipitation (1981 - 2010) from PRISM Climate Group, Oregon State University.
Rainfall Data: 30-year average (1981 - 2010).
Projection: State Plane Coordinate System, California Zone 5, NAD27, Feet.

PRISM DATA AND RAIN GAUGE LOCATION MAP

Mound Basin Study

City of San Buenaventura
Ventura, California

HOPKINS GROUNDWATER CONSULTANTS



Land Use	Acres
Agriculture	4041.64
Commercial	1036.16
Education	353.61
Industrial	485.89
Open Space	1020.91
Residential	3953.30
Utilities	158.27
Military	5.02
Vacant	514.81
Transportation	128.82
Freeways and major roads	2092.05
Water	74.45

LEGEND

Revised Mound Basin boundary

Land Use

- Agriculture
- Commercial
- Education
- Industrial
- Open Space
- Residential
- Utilities
- Military
- Vacant
- Transportation
- Freeways and major roads
- Water

N

SCALE 1" = 8,000'

0 1 2

MILES

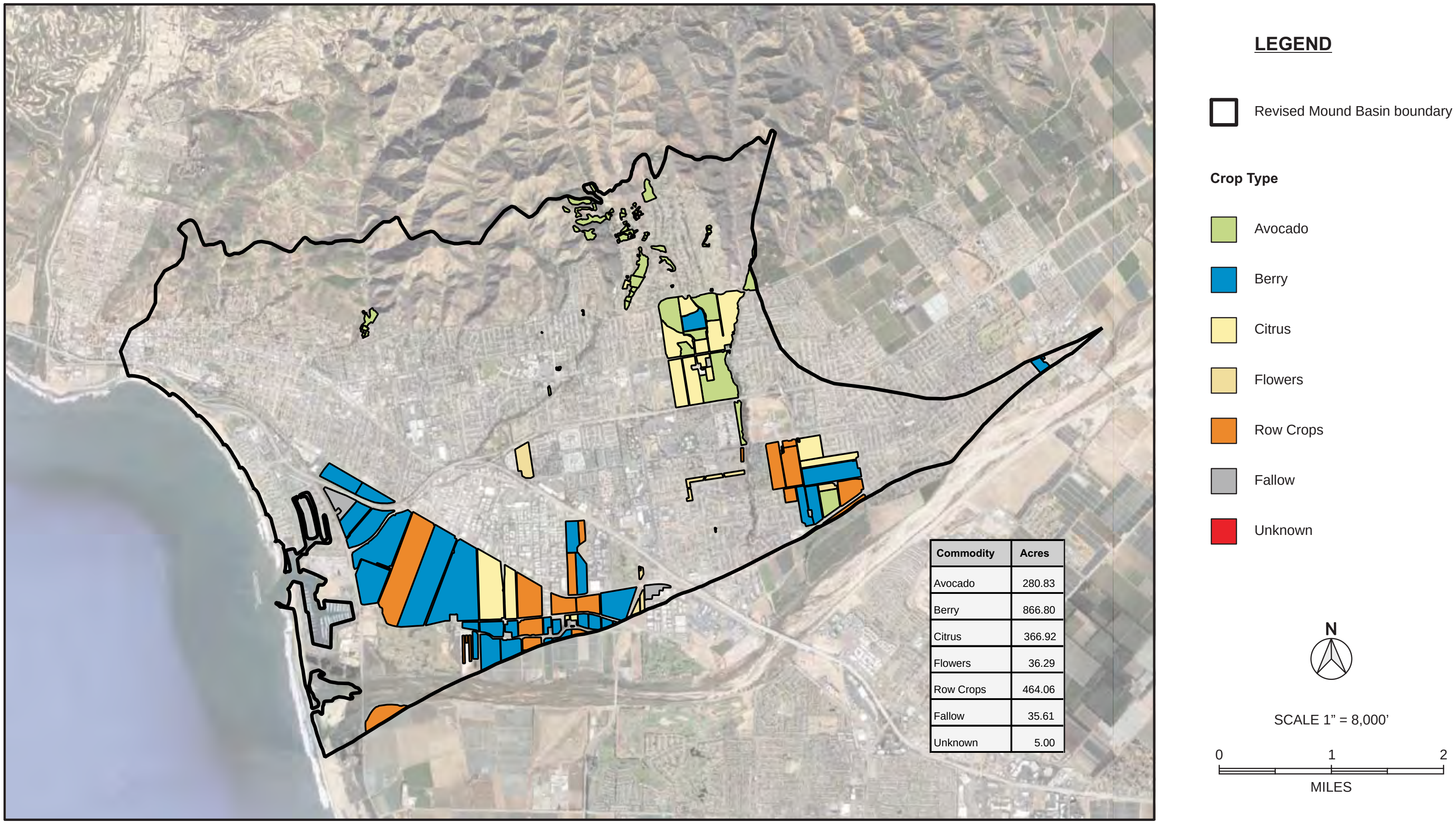
Basemap: Google Satellite (2019).
Projection: State Plane Coordinate System, California Zone 5, NAD27, Feet.

LAND USE ZONING MAP
Mound Basin Study
City of San Buenaventura
Ventura, California

PLATE 20

Project No. 01-009-11B

HOPKINS GROUNDWATER CONSULTANTS



Commodity	Acres
Avocado	280.83
Berry	866.80
Citrus	366.92
Flowers	36.29
Row Crops	464.06
Fallow	35.61
Unknown	5.00

Basemap: Google Satellite (2019).
Projection: State Plane Coordinate System, California Zone 5, NAD27, Feet.

AGRICULTURAL CROP TYPE MAP
Mound Basin Study
City of San Buenaventura
Ventura, California

PLATE 21

Project No. 01-009-11B

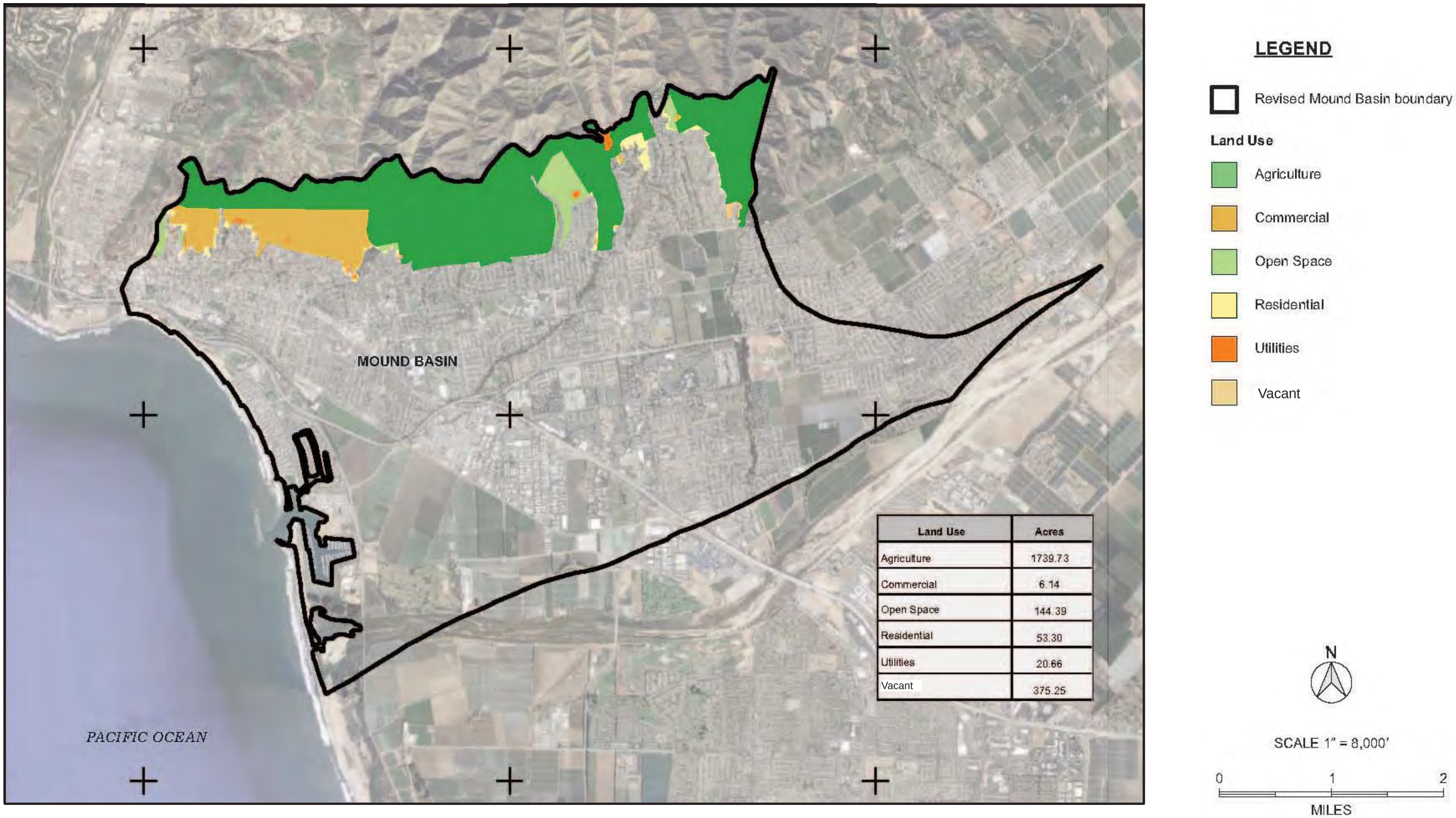
HOPKINS GROUNDWATER CONSULTANTS

UNDEVELOPED AREA MAP
Mound Basin Study
City of San Buenaventura
Ventura, California

PLATE 22

Project No. 01-009-11B

HOPKINS GROUNDWATER CONSULTANTS



Land Use	Acres
Agriculture	1739.73
Commercial	6.14
Open Space	144.39
Residential	53.30
Utilities	20.66
Vacant	375.25

LAND USE ZONING IN UNDEVELOPED AREA MAP

Mound Basin Study

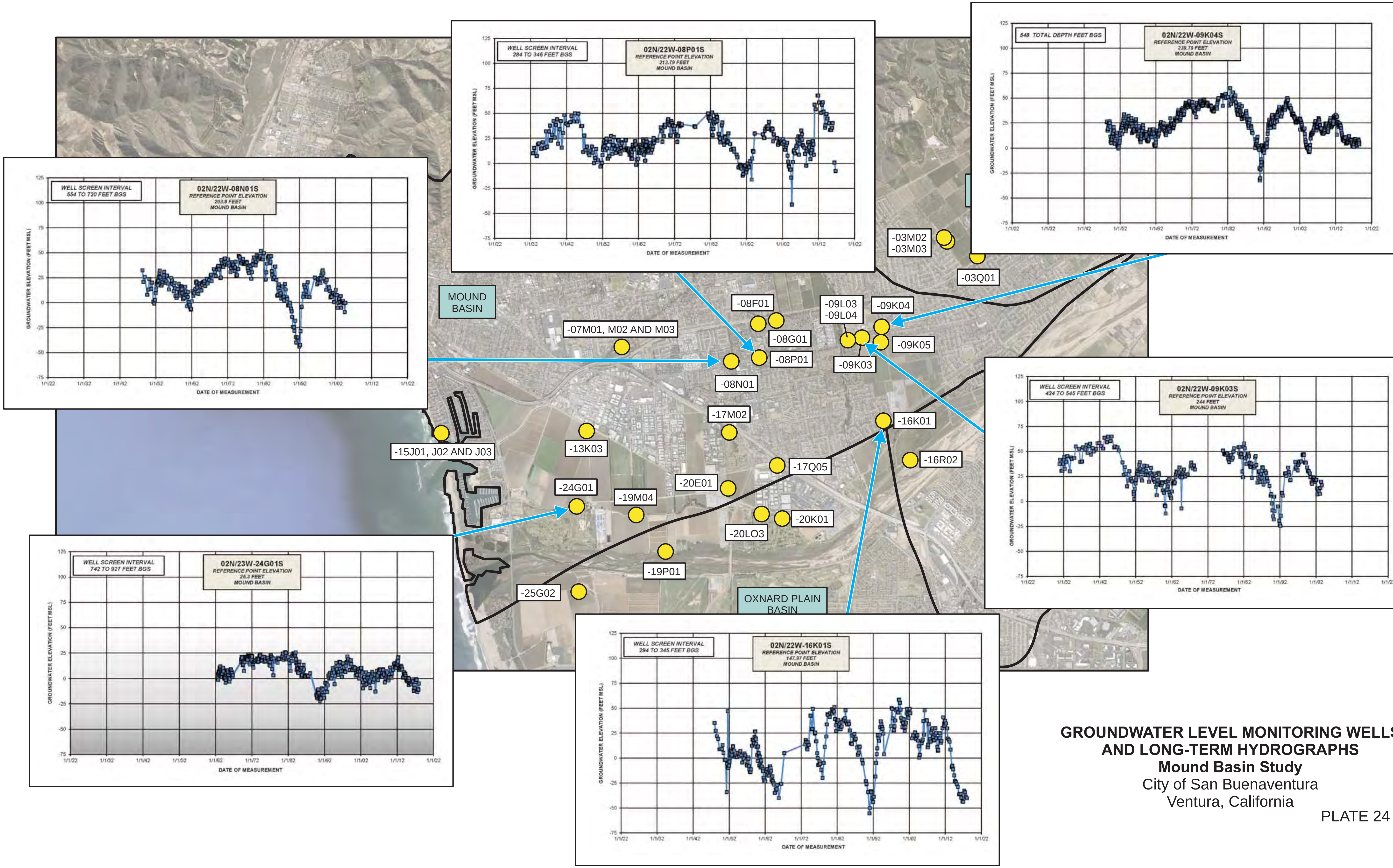
City of San Buenaventura

Ventura, California

PLATE 23

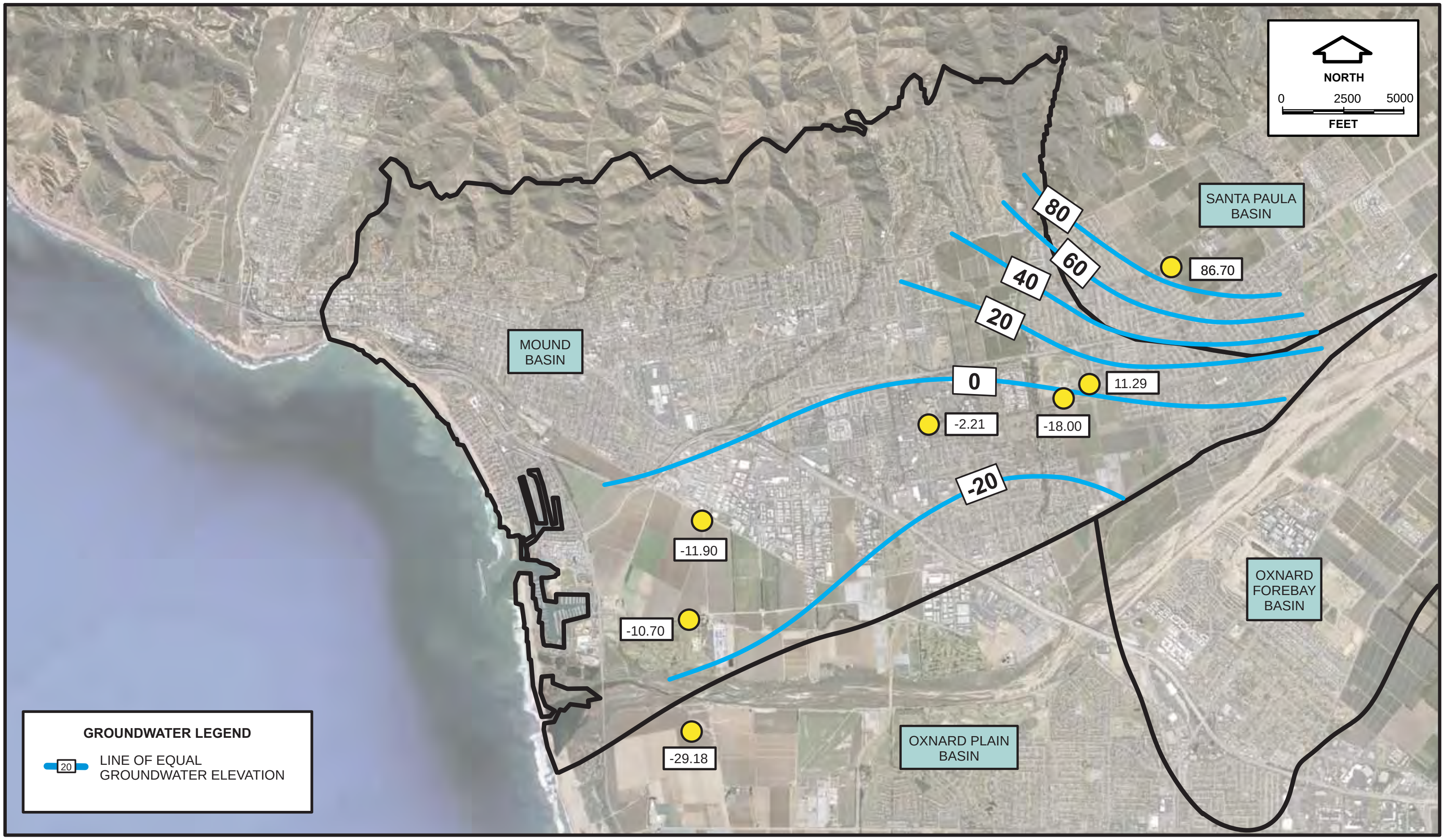
Project No. 01-009-11B

HOPKINS GROUNDWATER CONSULTANTS



GROUNDWATER LEVEL MONITORING WELLS AND LONG-TERM HYDROGRAPHS
Mound Basin Study
City of San Buenaventura
Ventura, California

PLATE 24



APRIL 1990

GROUNDWATER ELEVATION CONTOUR MAP

Mound Basin Study

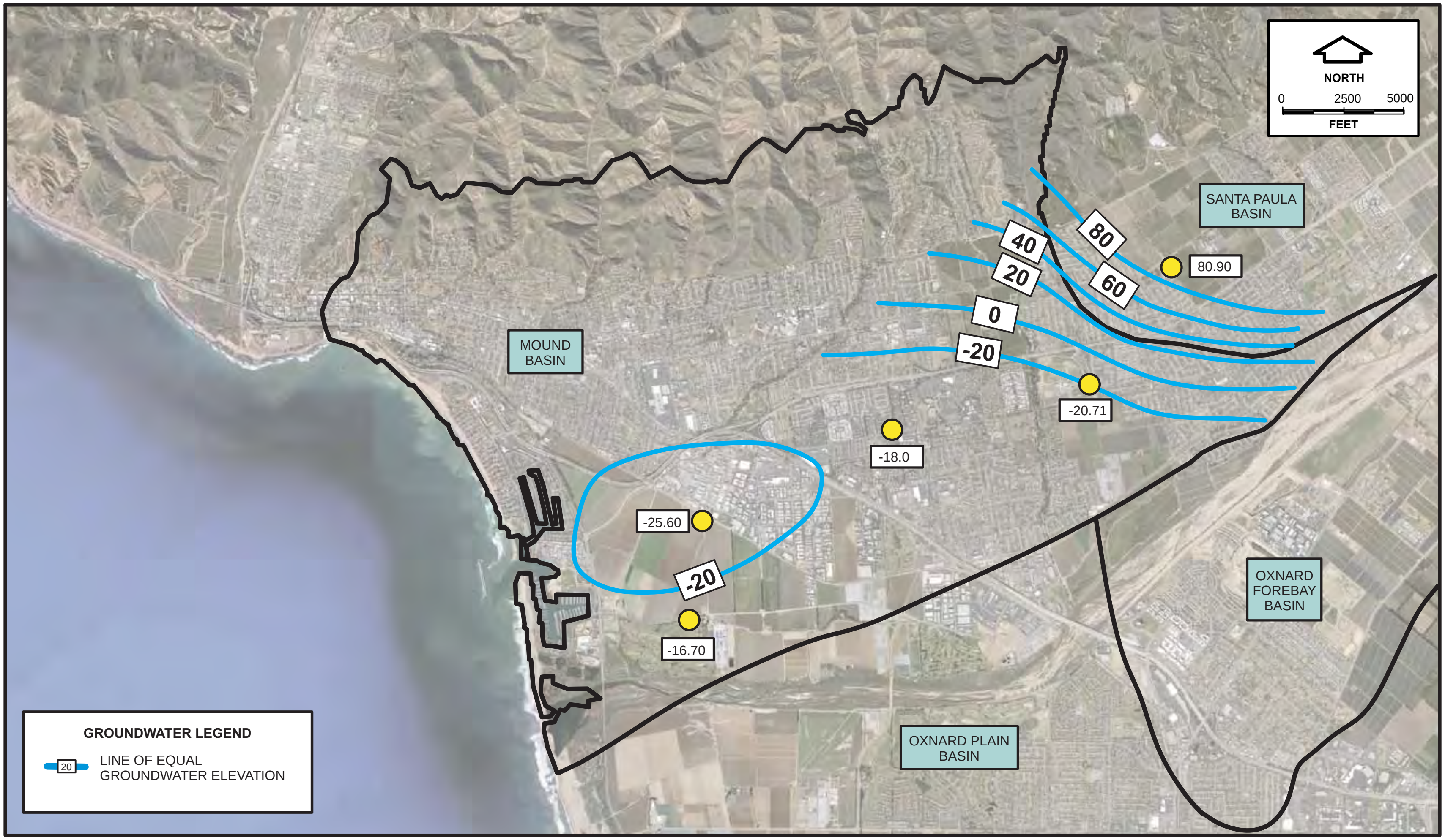
City of San Buenaventura

Ventura, California

PLATE 25

Project No. 01-009-11B

HOPKINS GROUNDWATER CONSULTANTS

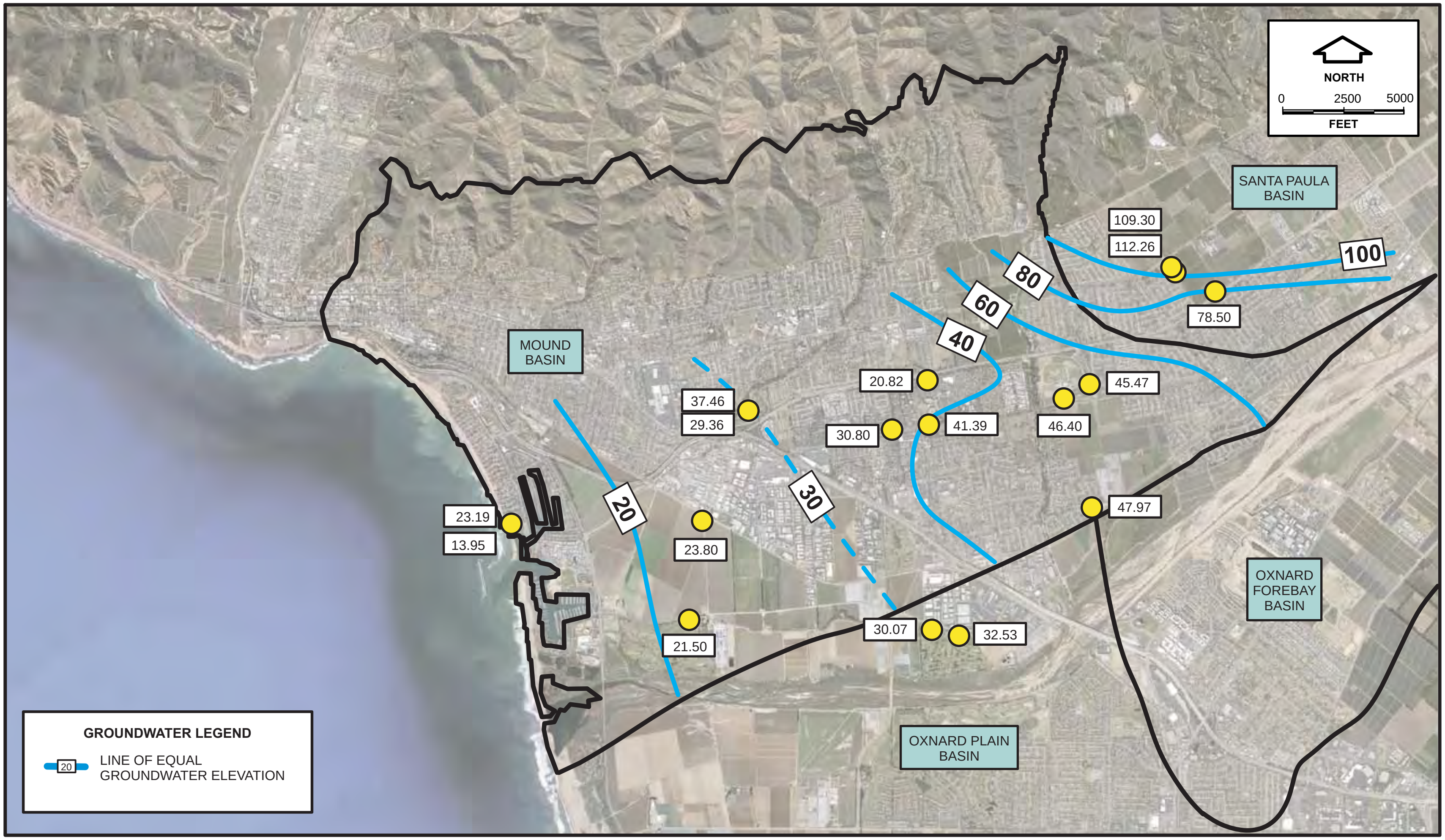


OCTOBER 1990
GROUNDWATER ELEVATION CONTOUR MAP
Mound Basin Study
City of San Buenaventura
Ventura, California

PLATE 26

Project No. 01-009-11B

HOPKINS GROUNDWATER CONSULTANTS

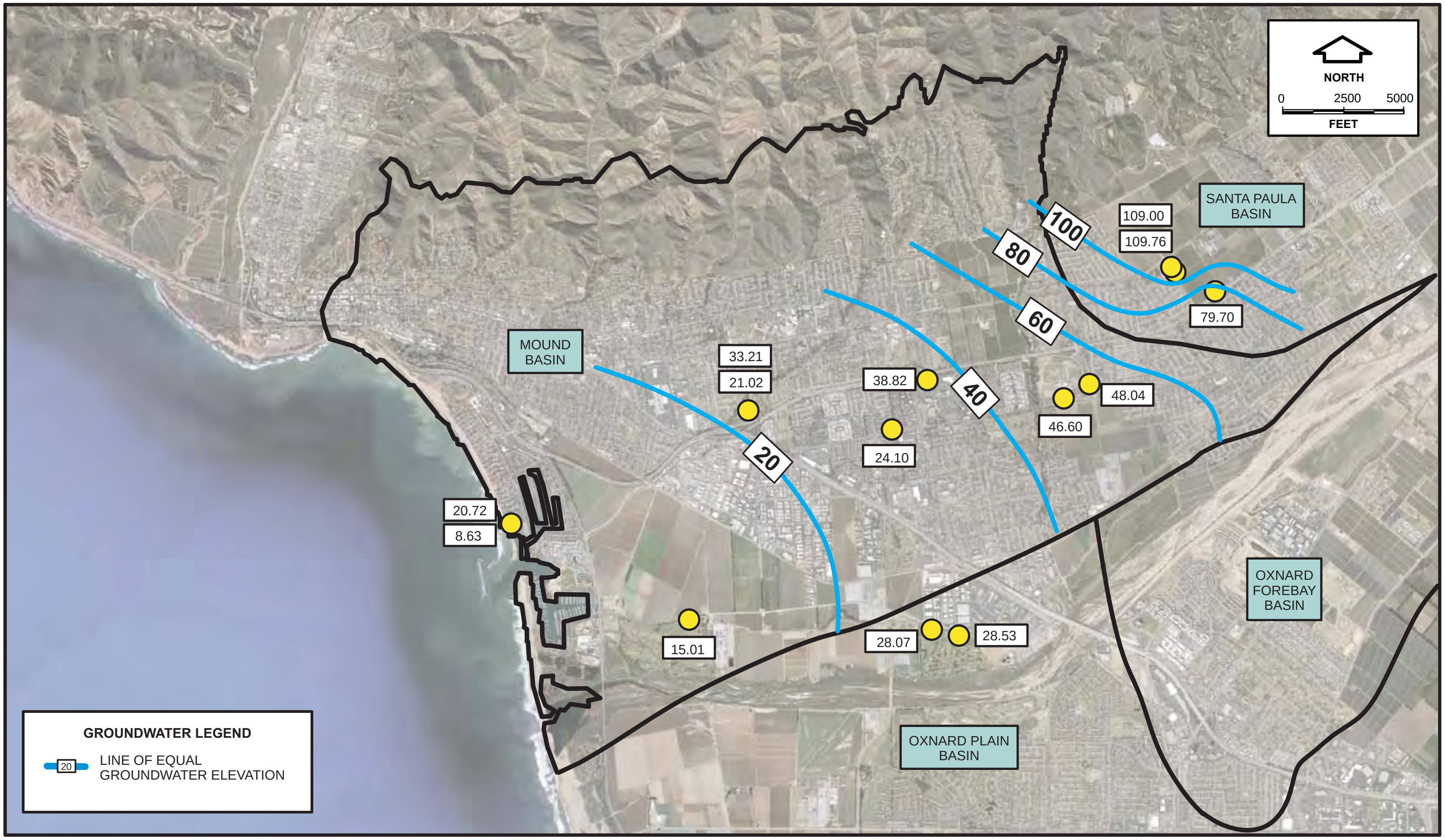


APRIL 1998
GROUNDWATER ELEVATION CONTOUR MAP
Mound Basin Study
City of San Buenaventura
Ventura, California

PLATE 27

Project No. 01-009-11B

HOPKINS
GROUNDWATER CONSULTANTS



OCTOBER 1998

GROUNDWATER ELEVATION CONTOUR MAP

Mound Basin Study

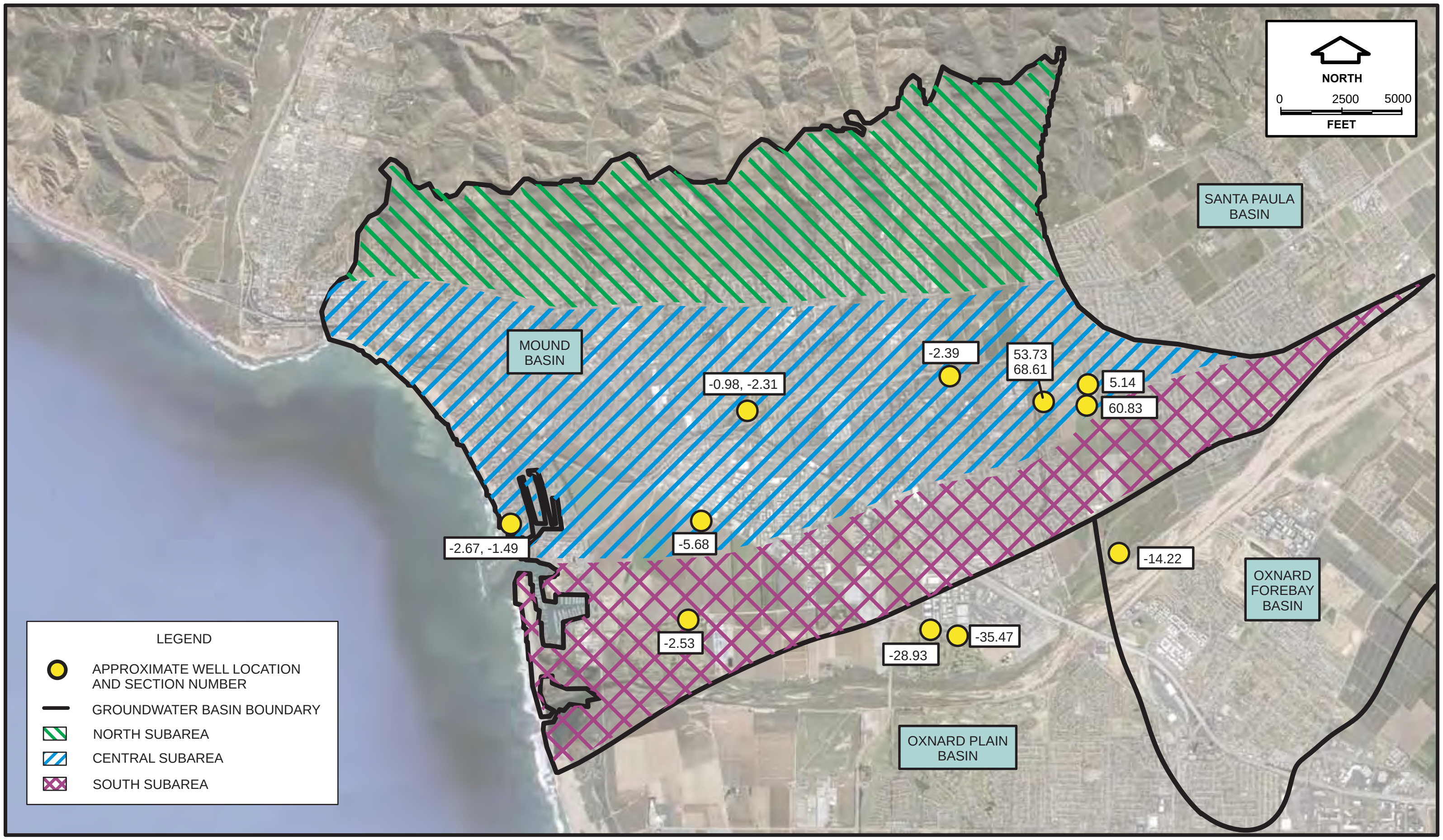
City of San Buenaventura

Ventura, California

PLATE 28

Project No. 01-009-11B

HOPKINS GROUNDWATER CONSULTANTS

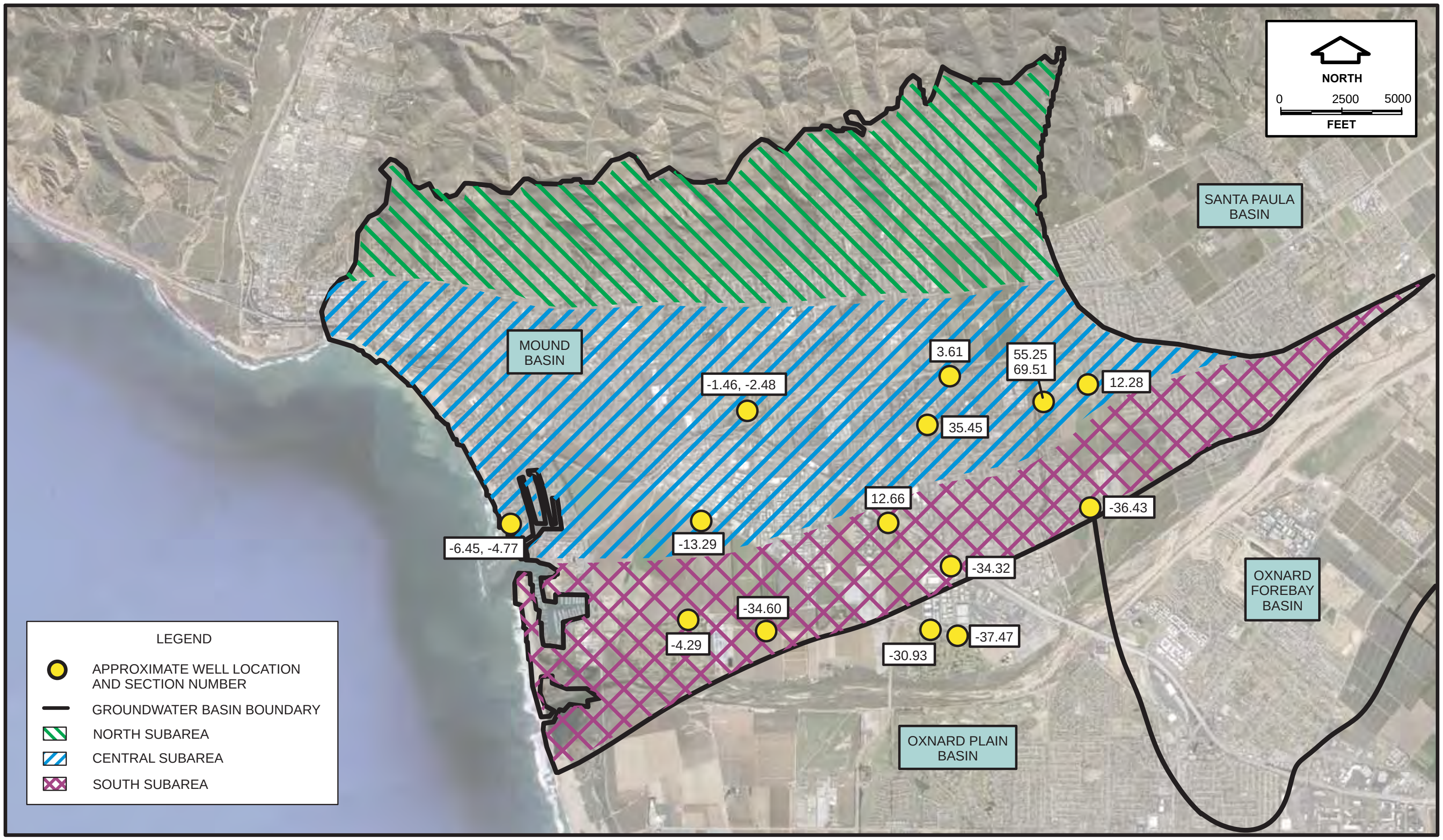


APRIL 2015
GROUNDWATER ELEVATION DATA MAP
Mound Basin Study
City of San Buenaventura
Ventura, California

Project No. 01-009-11B

HOPKINS GROUNDWATER CONSULTANTS

PLATE 29

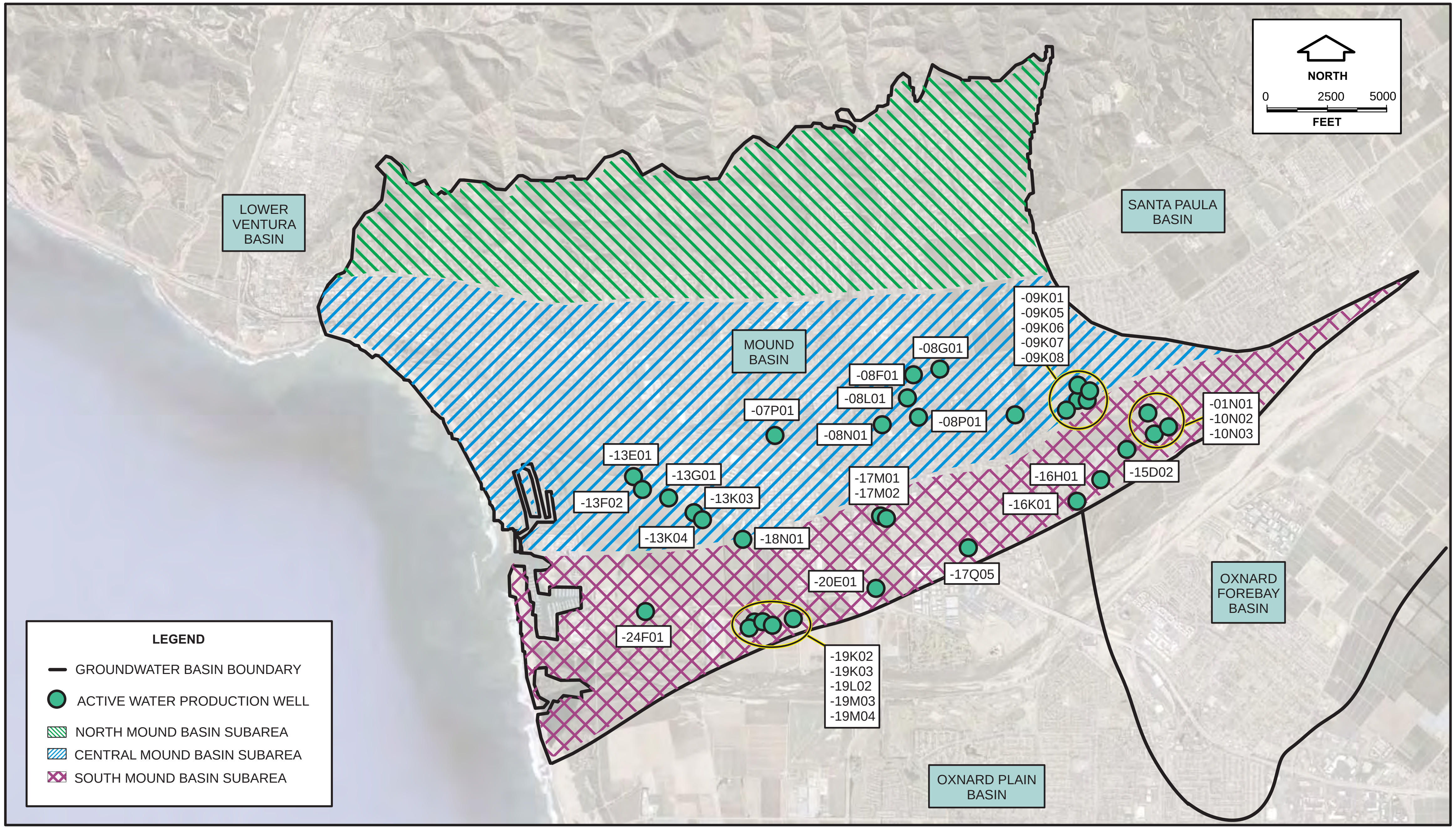


OCTOBER 2015
GROUNDWATER ELEVATION DATA MAP
Mound Basin Study
City of San Buenaventura
Ventura, California

PLATE 30

Project No. 01-009-11B

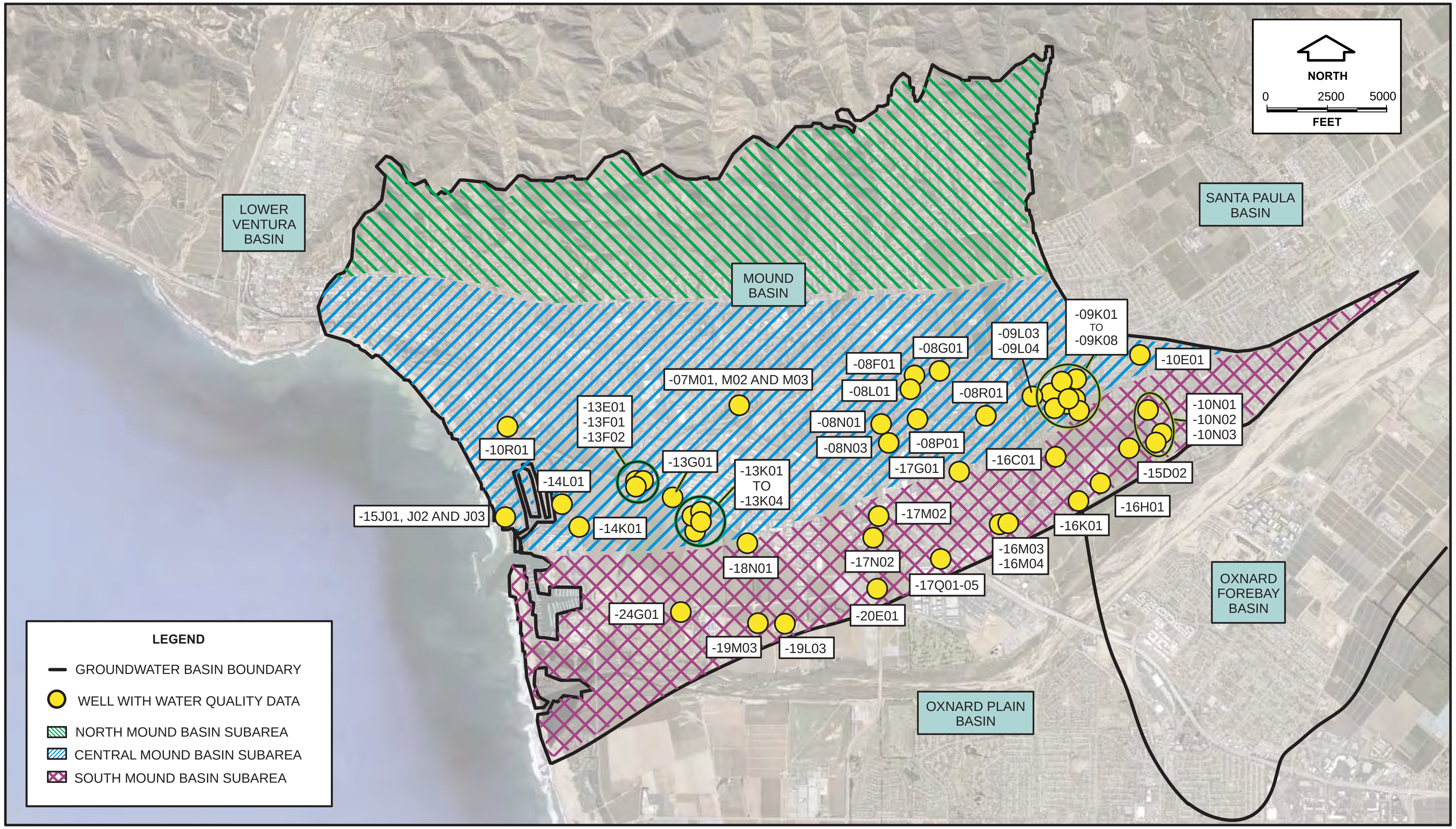
HOPKINS
GROUNDWATER CONSULTANTS



ACTIVE PRODUCTION WELLS
LOCATION MAP (2000)
Mound Basin Study
City of San Buenaventura
Ventura, California

PLATE 31

HOPKINS
GROUNDWATER
CONSULTANTS



WELLS WITH WATER QUALITY DATA
LOCATION MAP
(Since 1985)
Mound Basin Study
City of San Buenaventura
Ventura, California

PLATE 32

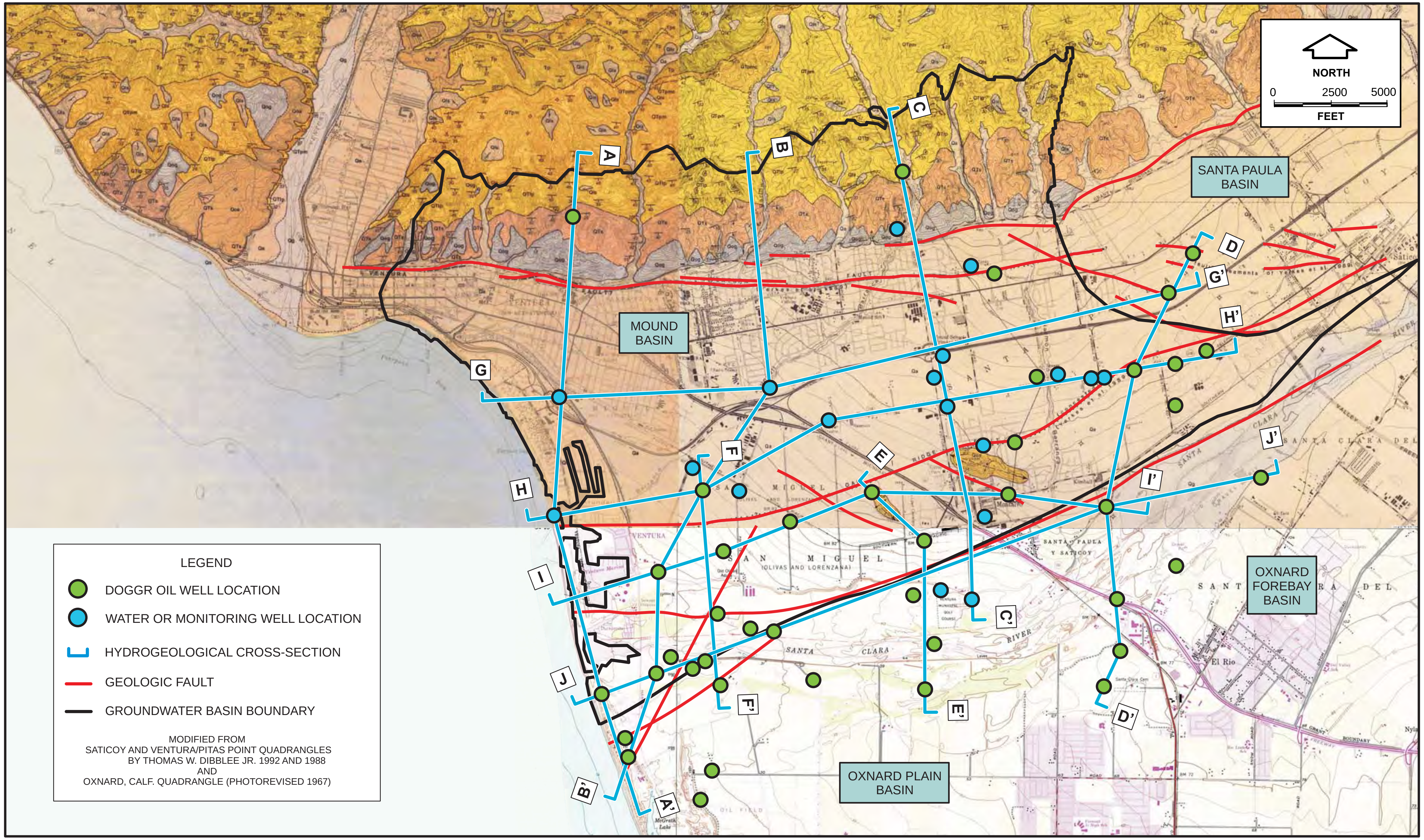
APPENDIX A
HYDROGEOLOGIC CROSS-SECTIONS

Table A1 – Summary of Wells Used in Cross-Section Construction

APINUMBER	OPERATOR	LEASE	WELL_NO	TWN	RGE	SEC
11100572	Chevron U.S.A. Inc.	H M Borchard	3-1	02N	22W	21
11100573	Chevron U.S.A. Inc.	H. O. Borchard	1	02N	22W	21
11100579	Chevron U.S.A. Inc.	Std-Western Gulf H.M. Borchard	3-2	02N	22W	28
11100723	Arco Oil and Gas Co.	Bailard-Mee	1	02N	22W	20
11100746	ExxonMobil Corp.	McGrath	1	02N	23W	26
11100746	ExxonMobil Corp.	McGrath	1	02N	23W	26
11100751	Chevron U.S.A. Inc.	Bailard-Mee	1	02N	22W	29
11100752	Chevron U.S.A. Inc.	Borchard Community	1	02N	23W	24
11100753	Chevron U.S.A. Inc.	Hearst	39-1	02N	23W	24
11100753	Chevron U.S.A. Inc.	Hearst	39-1	02N	23W	24
11100754	Chevron U.S.A. Inc.	Maxwell	1	02N	23W	24
11100754	Chevron U.S.A. Inc.	Maxwell	1	02N	23W	24
11100771	Berry Petroleum Co	McGrath 4	73-17	25	02N	23W
11100772	Berry Petroleum Co	McGrath 4	74-19A	25	02N	23W
11100773	Berry Petroleum Co	McGrath 4	82-5	25	02N	23W
11100775	Chevron U.S.A. Inc.	McGrath	92-16	25	02N	23W
11100776	Berry Petroleum Co	McGrath 4	102-7	02N	23W	25
11100777	Chevron U.S.A. Inc.	McGrath 4	113-18	02N	23W	26
11100793	Berry Petroleum Co	McGrath 4	1311	02N	23W	35
11100849	Chevron U.S.A. Inc.	Union National Bank of Ventura	1	02N	22W	20
11100851	Chevron U.S.A. Inc.	Ventura County Mortgage Corp.	59-1	02N	23W	24
11104006	Chevron U.S.A. Inc.	V.L. & W.	C-5	02N	23W	2
11105760	ExxonMobil Corp.	Edwin L. Gardner II et UX	1	02N	22W	10
11105761	ExxonMobil Corp.	L.A. Gisler & Blalock-Eddy Ro	1	02N	22W	3
11105762	ExxonMobil Corp.	Louise A. Gisler, et al	1	02N	22W	3
11105762	ExxonMobil Corp.	Louise A. Gisler, et al	1	02N	22W	3
11105765	ExxonMobil Corp.	Paul J. Levans, Jr.	1	02N	22W	3
11105766	ExxonMobil Corp.	Thomas A Proctor	1	02N	22W	10
11105767	Deuel Petroleum Calif, Inc	Montalvo Ranch	1	02N	22W	16
11105776	Shell Western E. & P. Inc.	Sharp	1	10	02N	22W
11105788	Chevron U.S.A. Inc.	Saticoy-Citrus	1	02N	22W	10
11105793	Chevron U.S.A. Inc.	Thorpe	1	02N	22W	17
11105798	Mobil Expl. & Prod. N.A., Inc.	Limoneira	1	02N	22W	9
11105810	Chevron U.S.A. Inc.	Humble-Maxwell	1	02N	22W	13
11105917	Seaboard Oil & Gas Company	Sexton	1	03N	22W	31
11120425	Wainoco Oil & Gas Co.	McGrath	1	02N	22W	18
11120500	Wainoco Oil & Gas Co.	Limoneira	1	02N	22W	5
11120807	Tiger Oil Company	Utsuki-Burns	1	02N	22W	20
11120961	Chevron U.S.A. Inc.	Hertel-Woolsey	1	02N	22W	14
21100836	Chevron U.S.A. Inc.	State	A-4	02N	23W	26
21100837	Chevron U.S.A. Inc.	State	B-6	02N	23W	26
21100837	Chevron U.S.A. Inc.	State	B-6	02N	23W	26

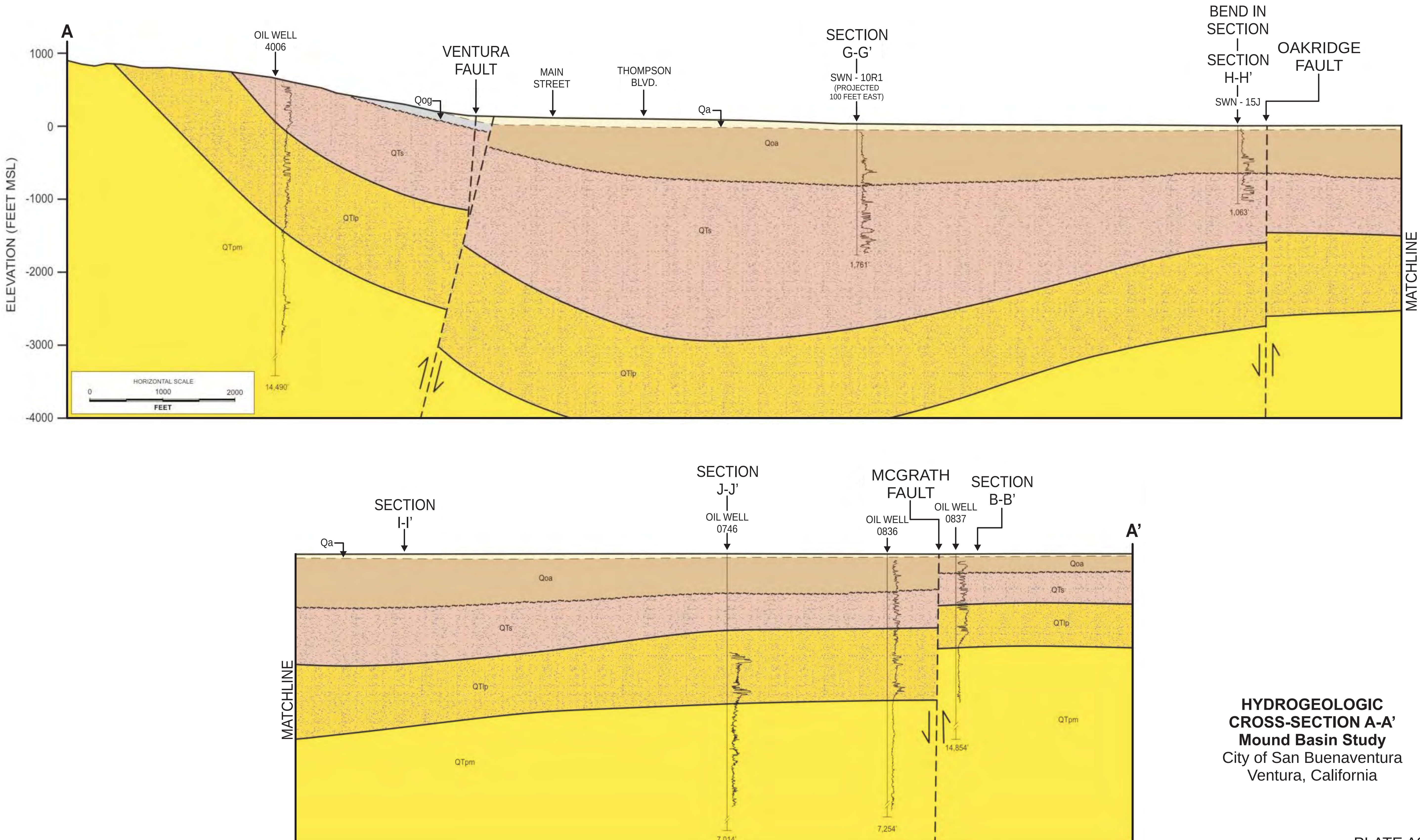
Table A1 (Continued)

WATER WELL ELECTRIC LOGS	
STATE WELL NO.	NAME/USE
2N/23W-15J01	MARINIA PARK MONITORING WELL NOS.1-3
2N/22W-07M01	CAMINO PARK MONITORING WELL NOS.1-4
2N/22W-07P01	AGRICULTURAL WELL
2N/22W-05E01	TESTHOLE
2N/22W-08F01	CITY - VICTORIA NO. 2
2N/22W-08L01	CITY - VICTORIA NO. 1
2N/22W-08P04	TESTHOLE
2N/22W-17G01	DESTROYED
2N/22W-17Q04	DESTROYED
2N/22W-20K01	CITY - GOLF COURSE NO. 6
2N/22W-09LO3 - 4	SPORTS PARK MONITORING WELL NOS.1-2
2N/22W-09KO7	AGRICULTURAL WELL
2N/22W-09KO8	AGRICULTURAL WELL

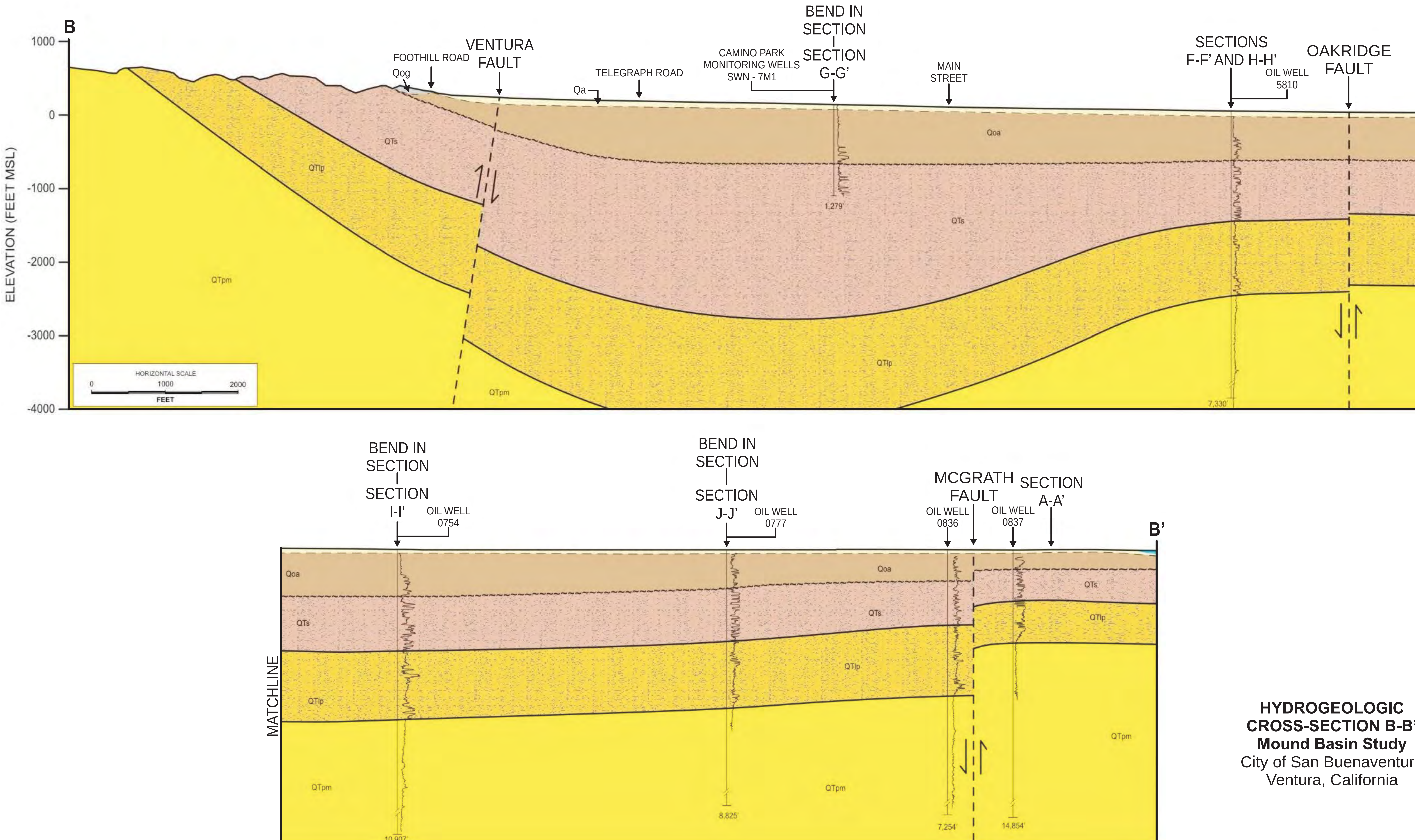


HYDROGEOLOGIC CROSS-SECTION
LOCATION MAP
Mound Basin Study
City of San Buenaventura
Ventura, California

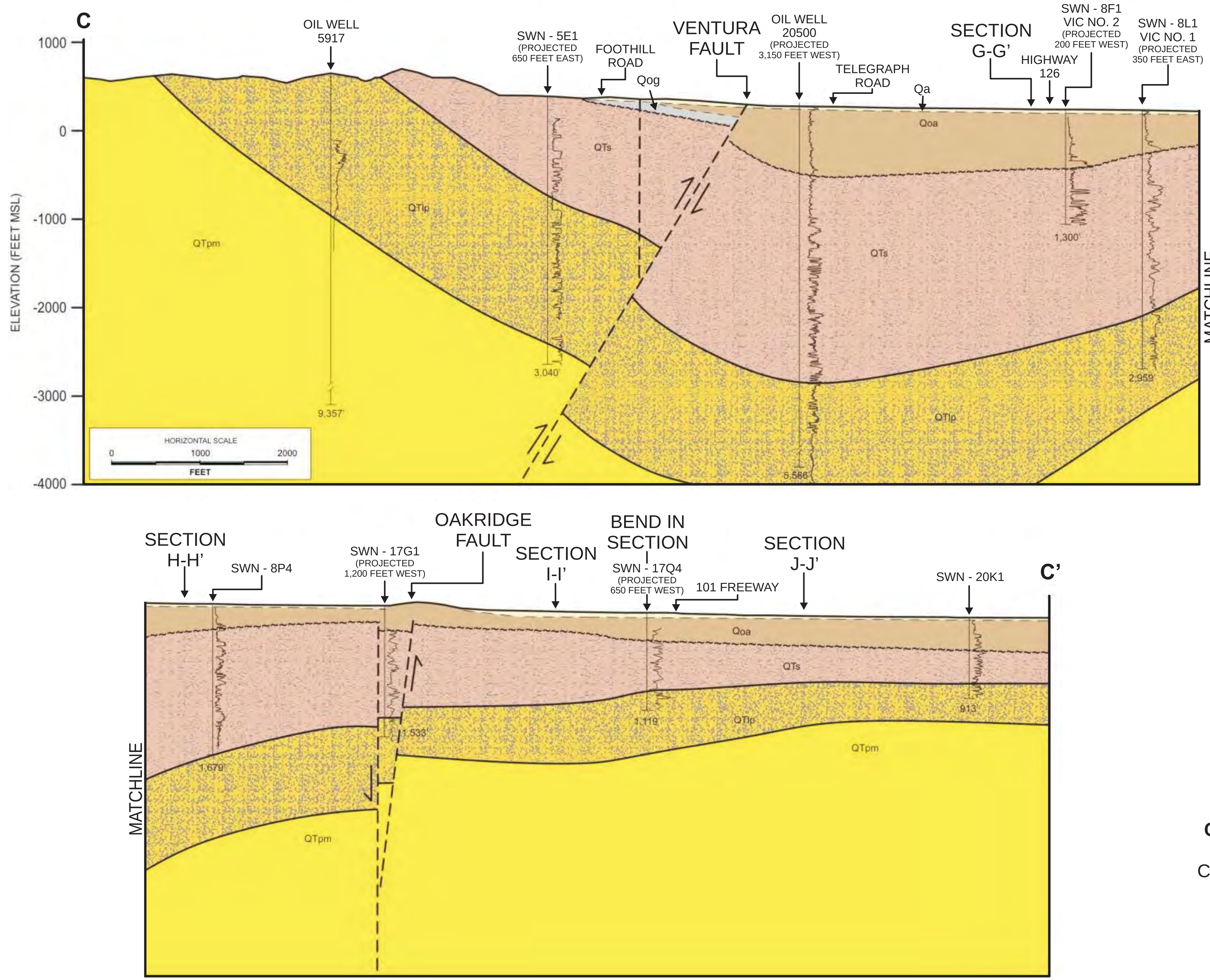
PLATE A1



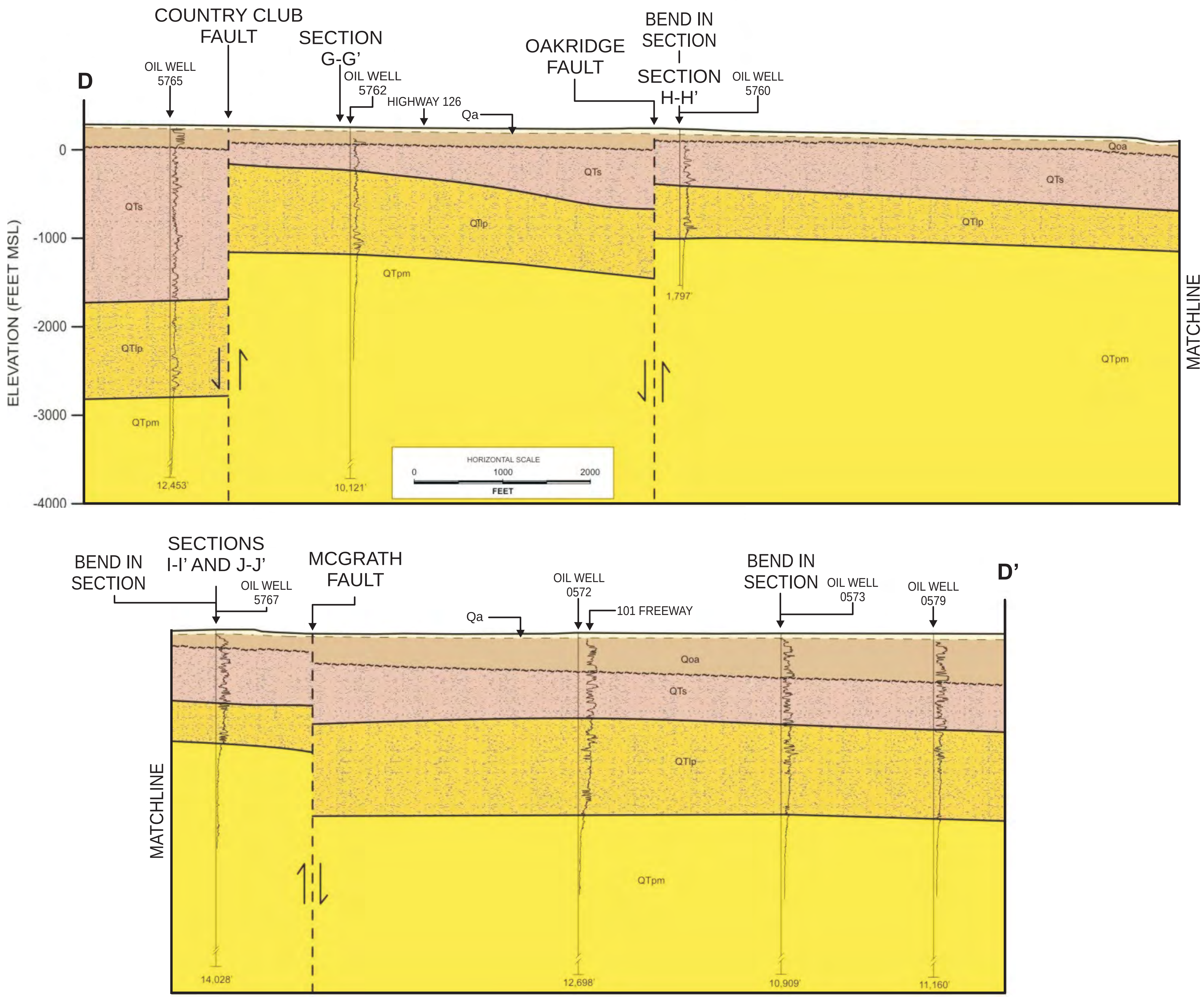
HYDROGEOLOGIC CROSS-SECTION A-A'
Mound Basin Study
City of San Buenaventura
Ventura, California



HYDROGEOLOGIC
CROSS-SECTION B-B'
Mound Basin Study
City of San Buenaventura
Ventura, California

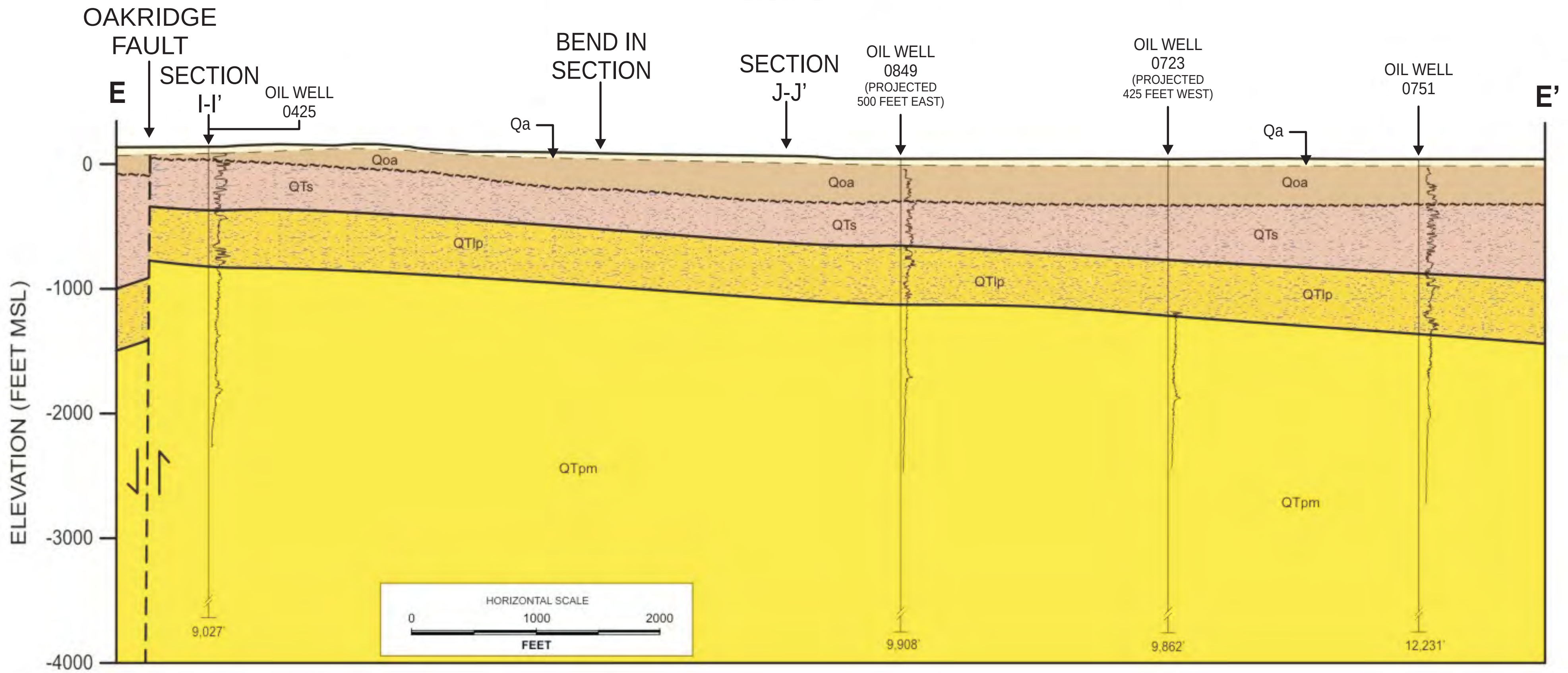


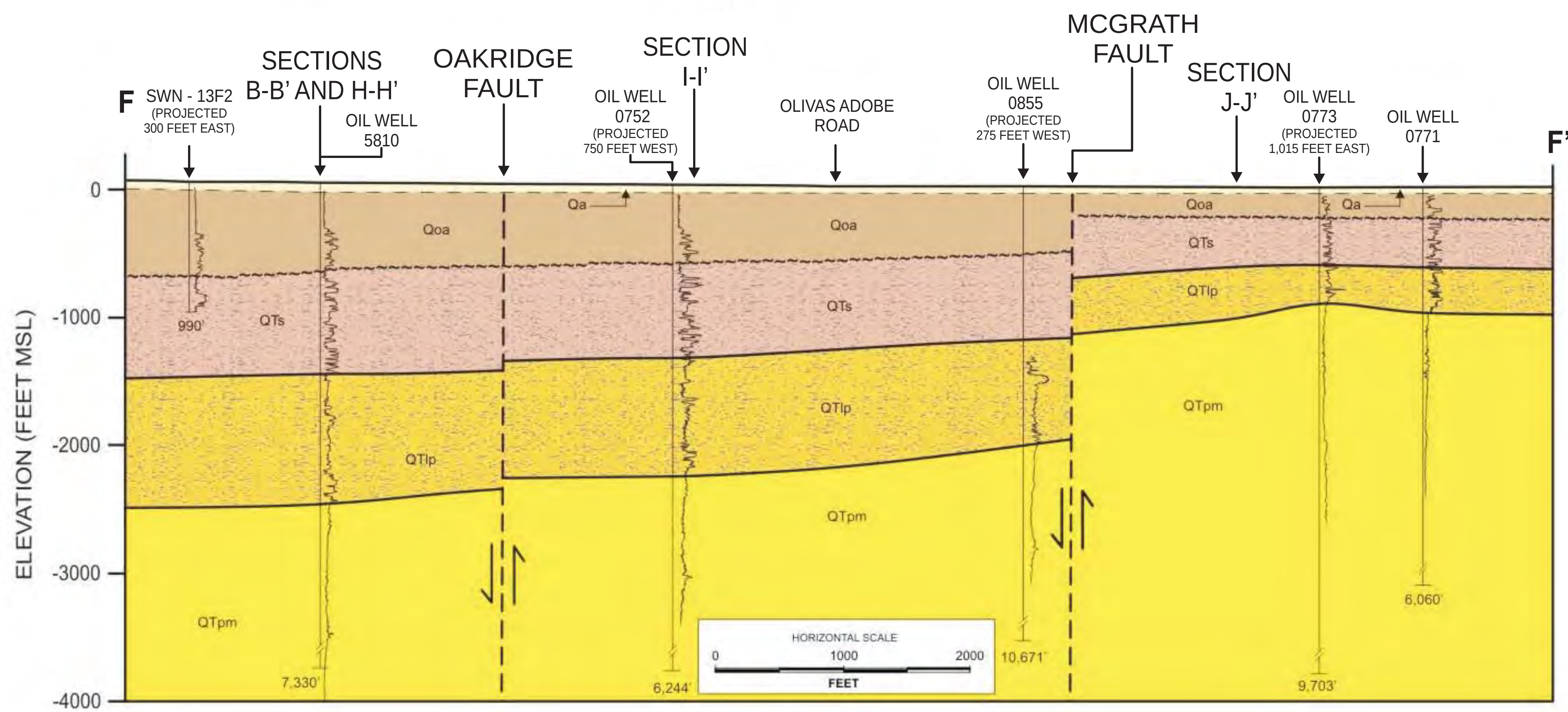
HYDROGEOLOGIC
CROSS-SECTION C-C'
Mound Basin Study
City of San Buenaventura
Ventura, California



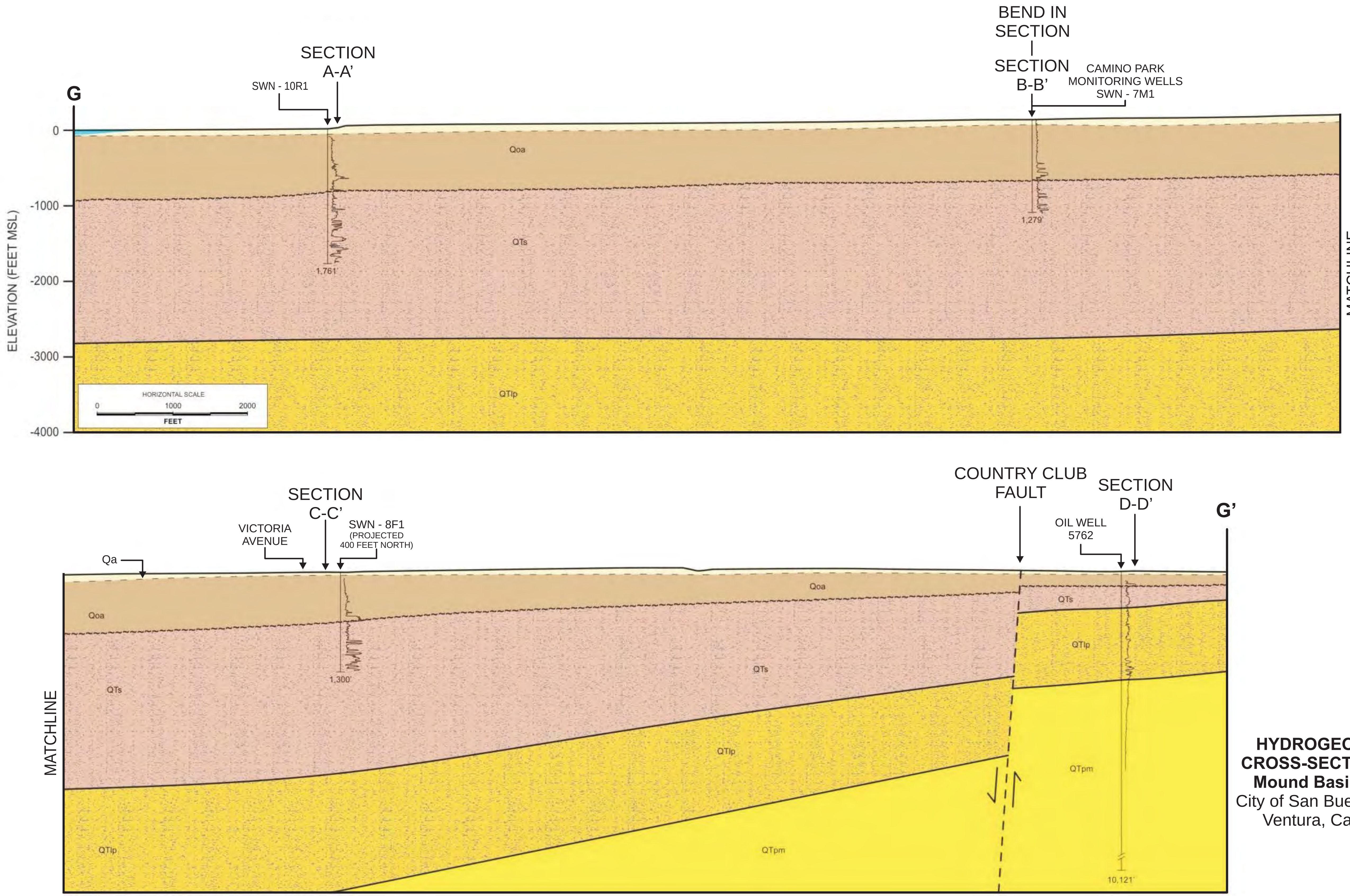
HYDROGEOLOGIC CROSS-SECTION D-D'
Mound Basin Study
City of San Buenaventura
Ventura, California

PLATE A5



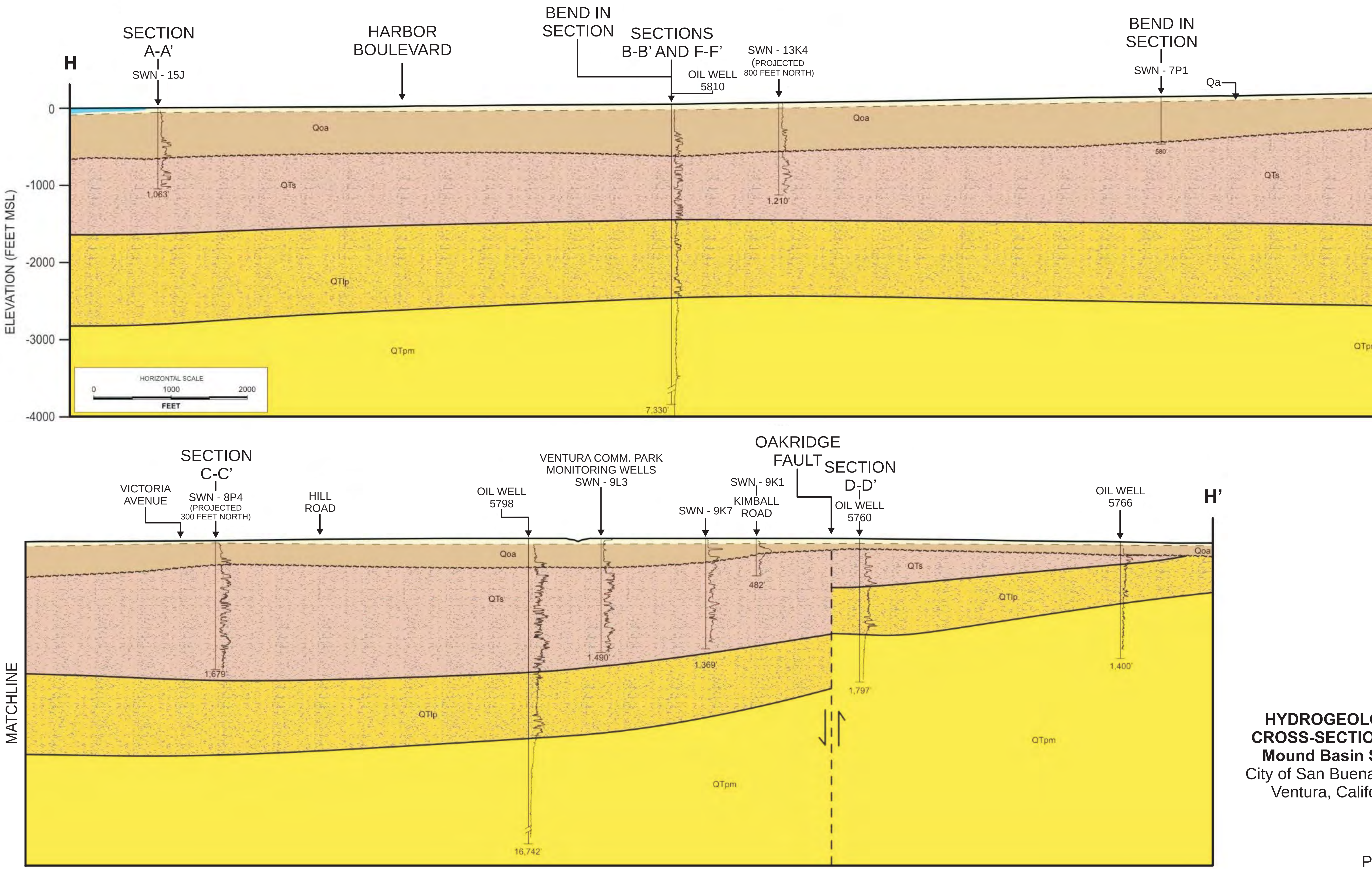


HYDROGEOLOGIC CROSS-SECTIONS E-E' AND F-F'
Mound Basin Study
City of San Buenaventura
Ventura, California



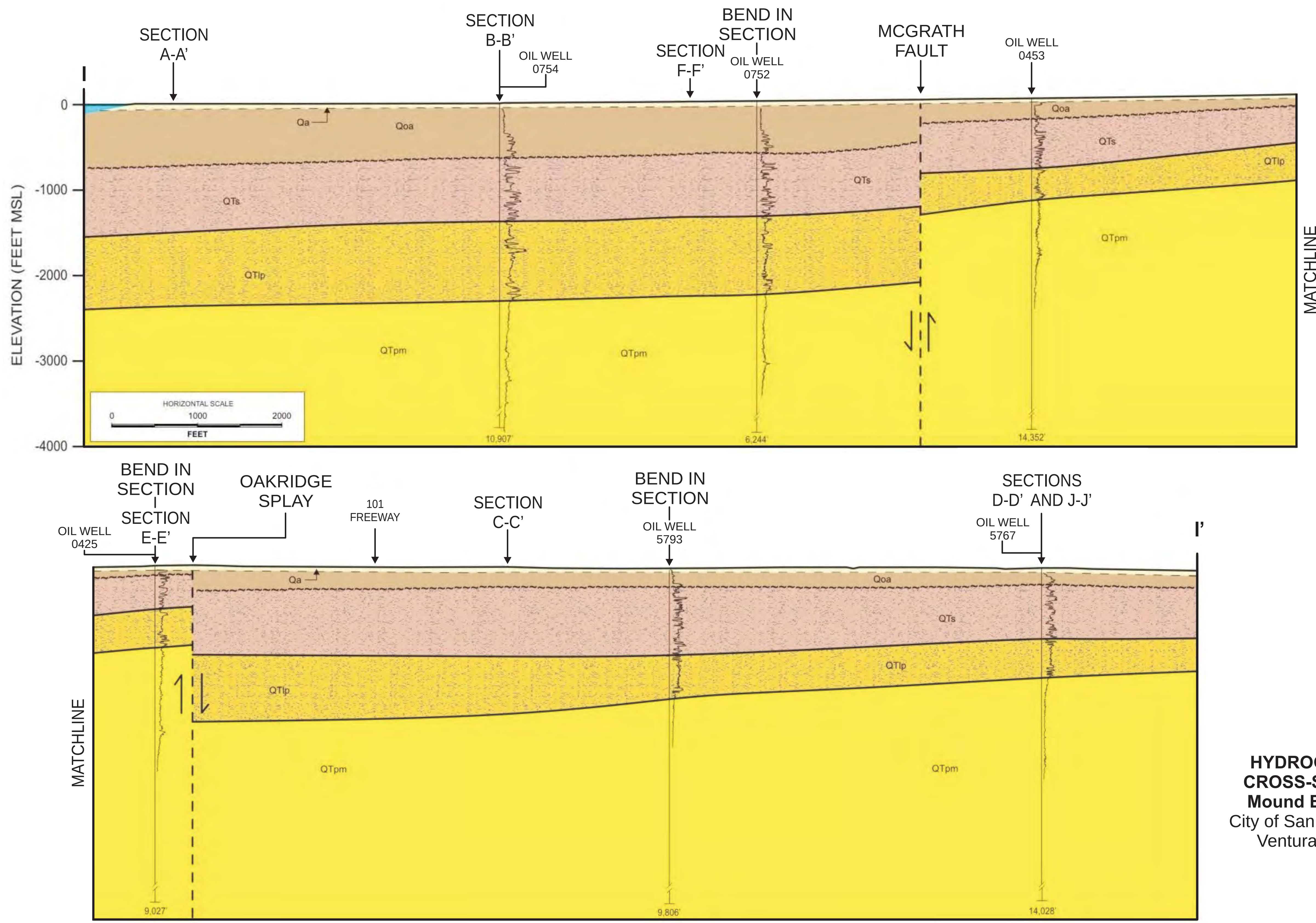
HYDROGEOLOGIC CROSS-SECTION G-G'
Mound Basin Study
City of San Buenaventura
Ventura, California

PLATE A7



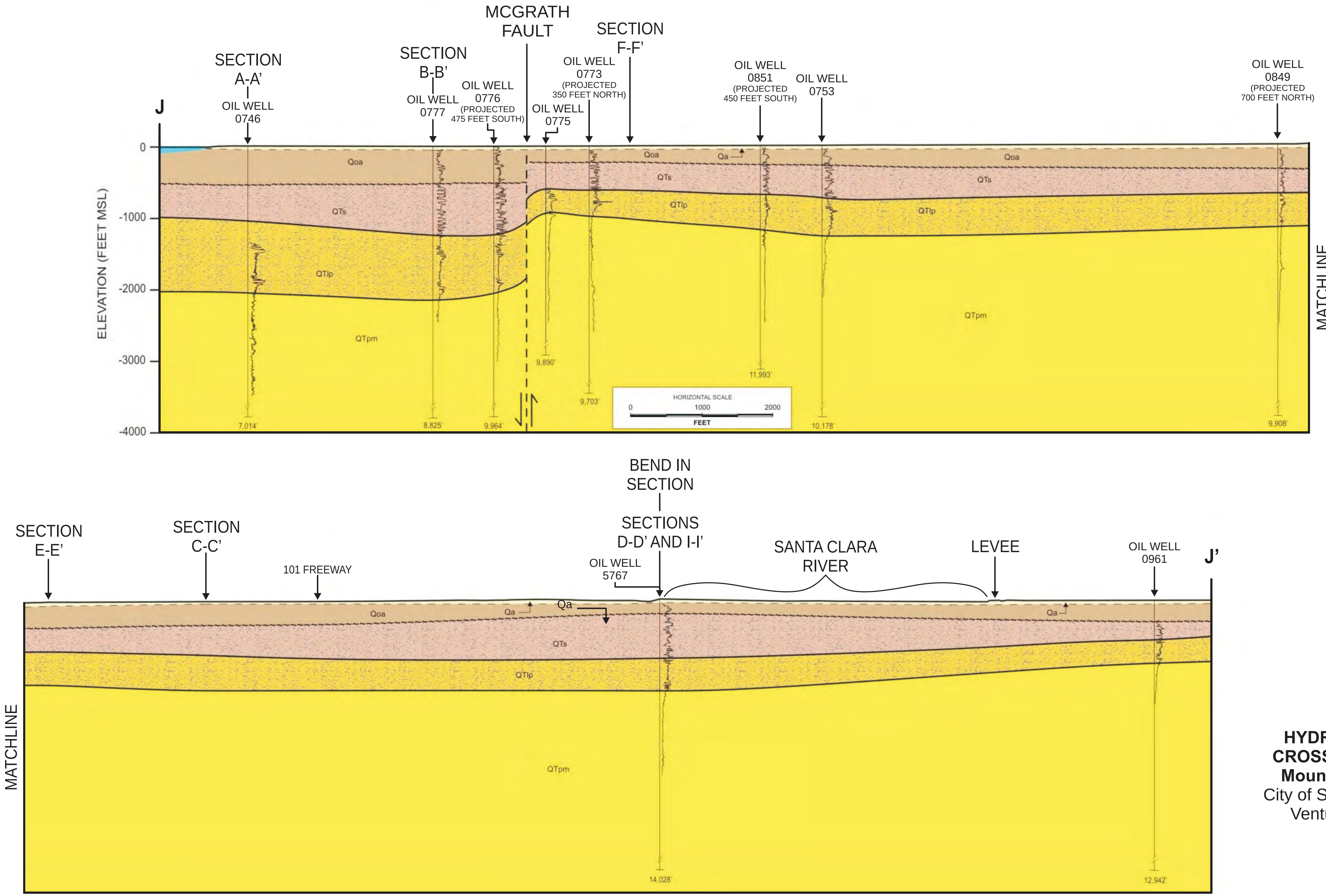
HYDROGEOLOGIC CROSS-SECTION H-H'
Mound Basin Study
City of San Buenaventura
Ventura, California

PLATE A8



HYDROGEOLOGIC CROSS-SECTION I-I'
Mound Basin Study
City of San Buenaventura
Ventura, California

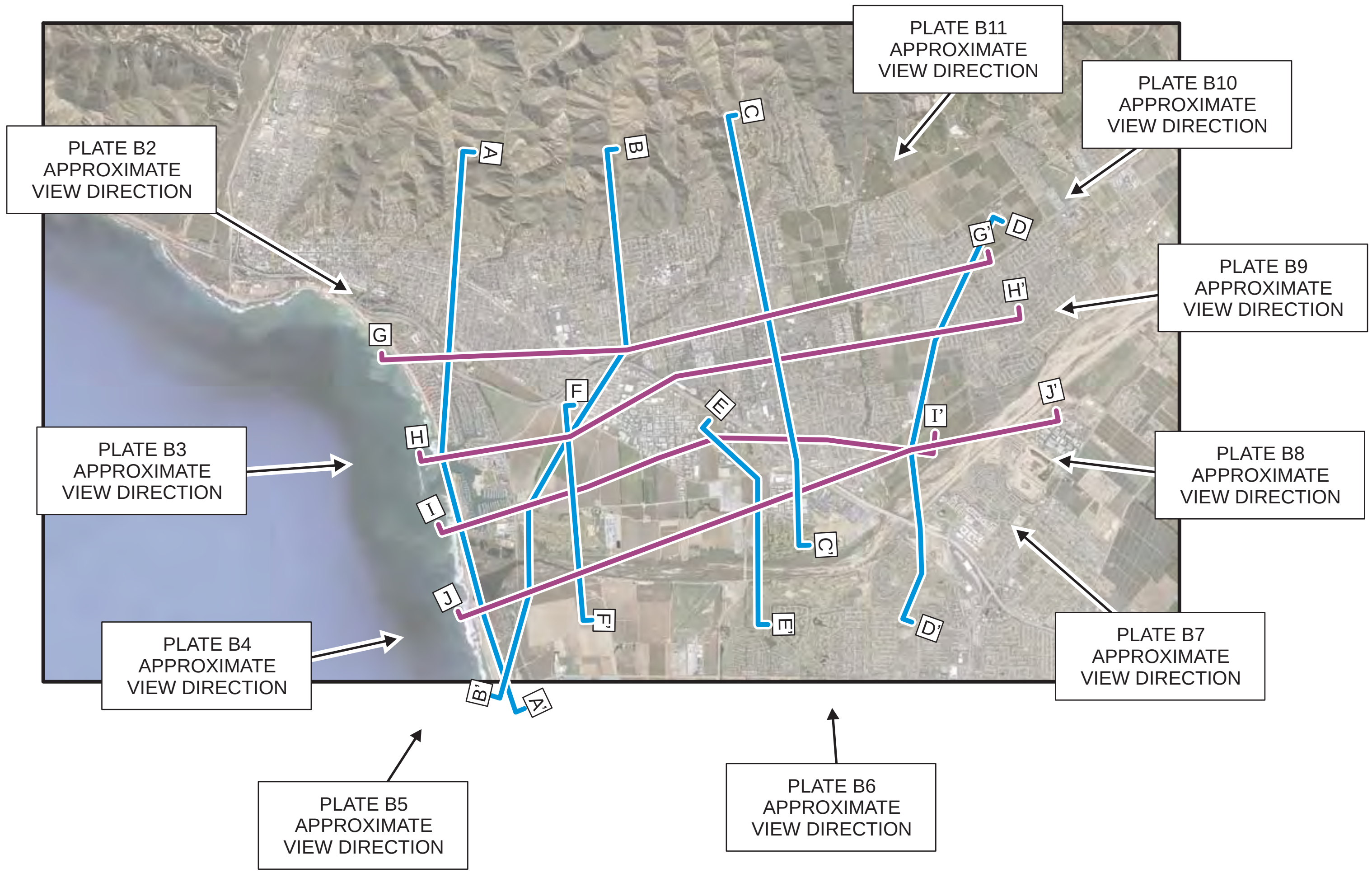
PLATE A9



HYDROGEOLOGIC
CROSS-SECTION J-J'
Mound Basin Study
City of San Buenaventura
Ventura, California

PLATE A10

APPENDIX B
FENCE DIAGRAMS



FENCE DIAGRAM REFERENCE MAP

Mound Basin Study

City of San Buenaventura
Ventura, California

HOPKINS
GROUNDWATER CONSULTANTS

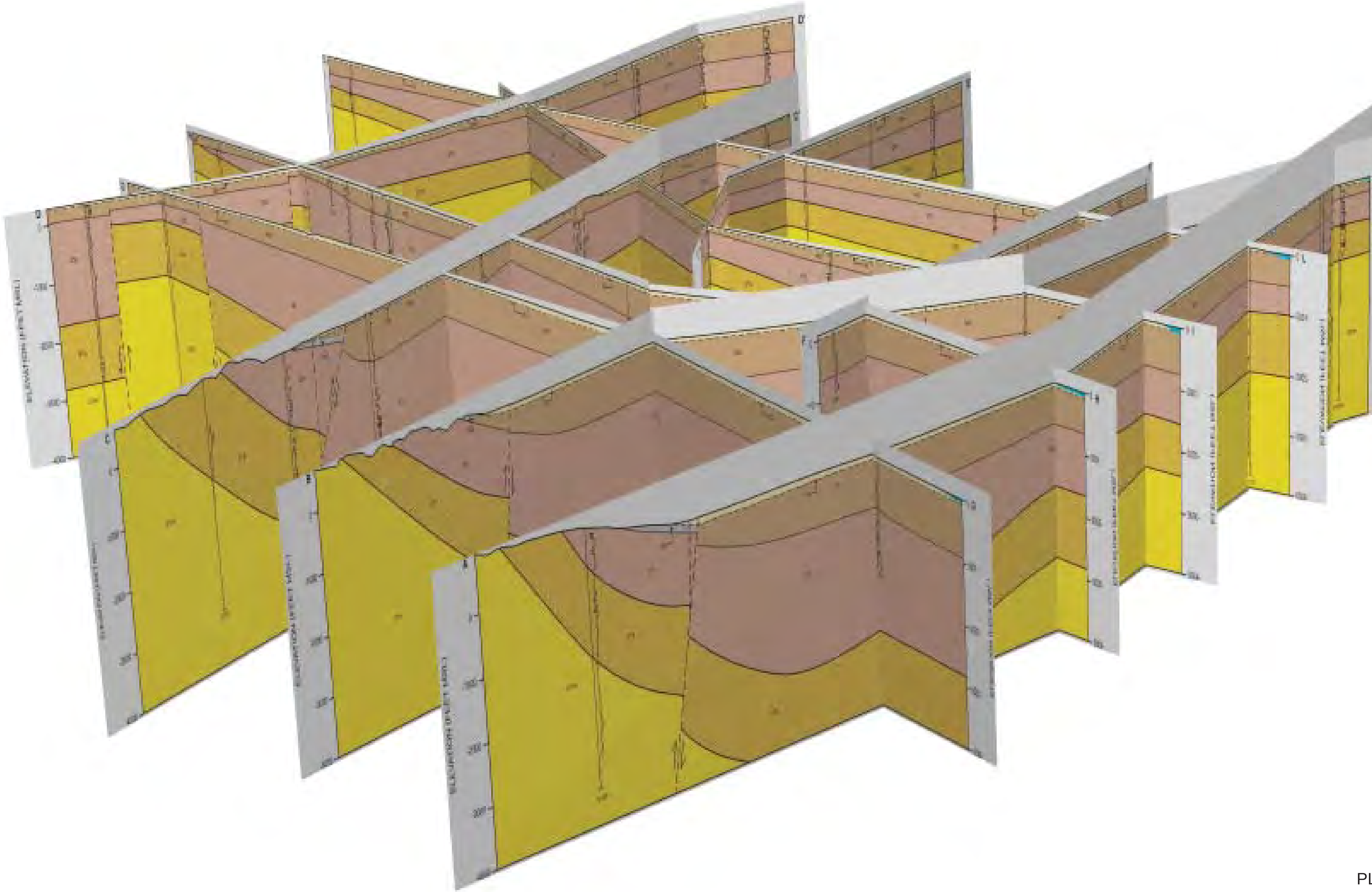


PLATE B2

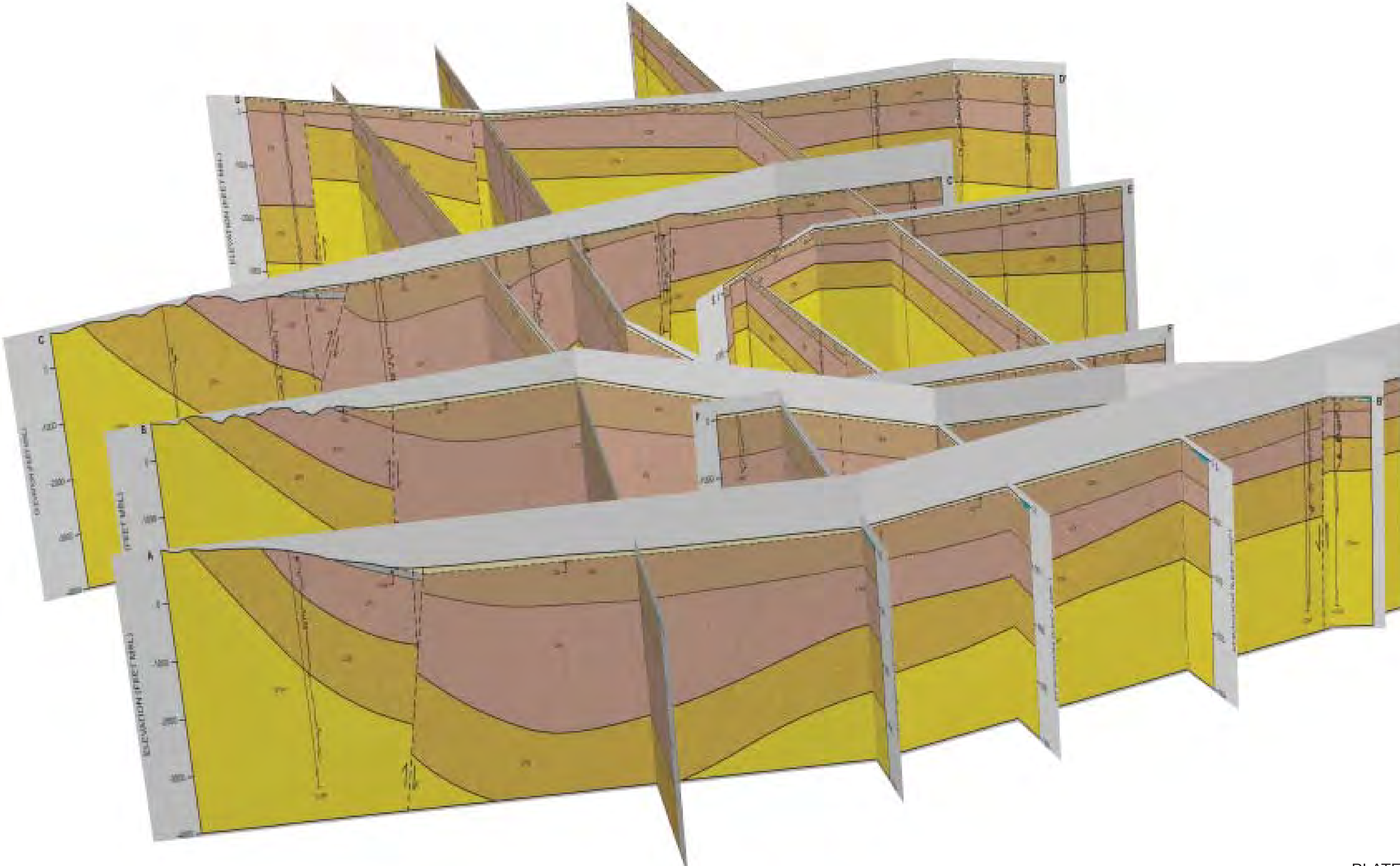


PLATE B3

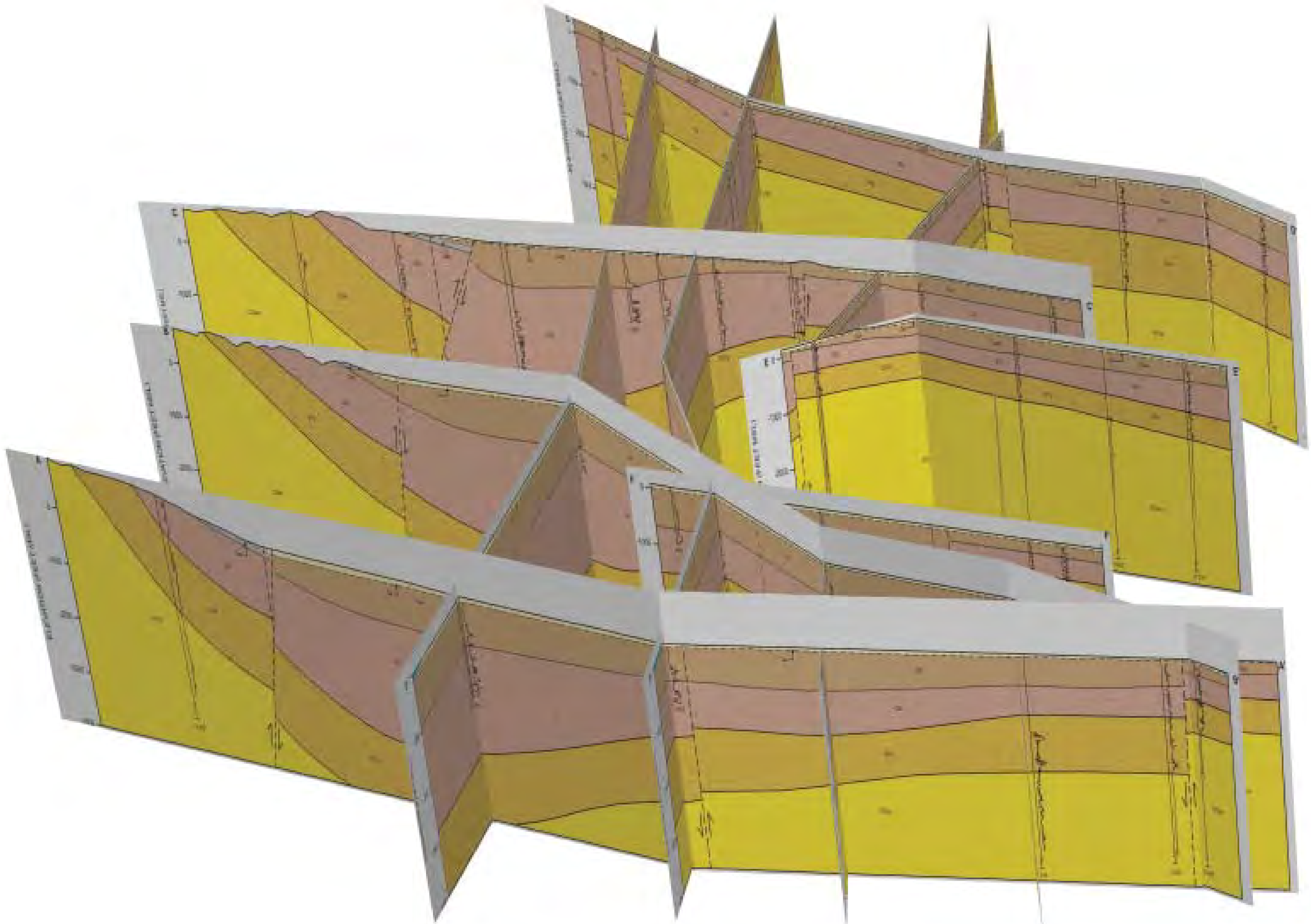


PLATE B4

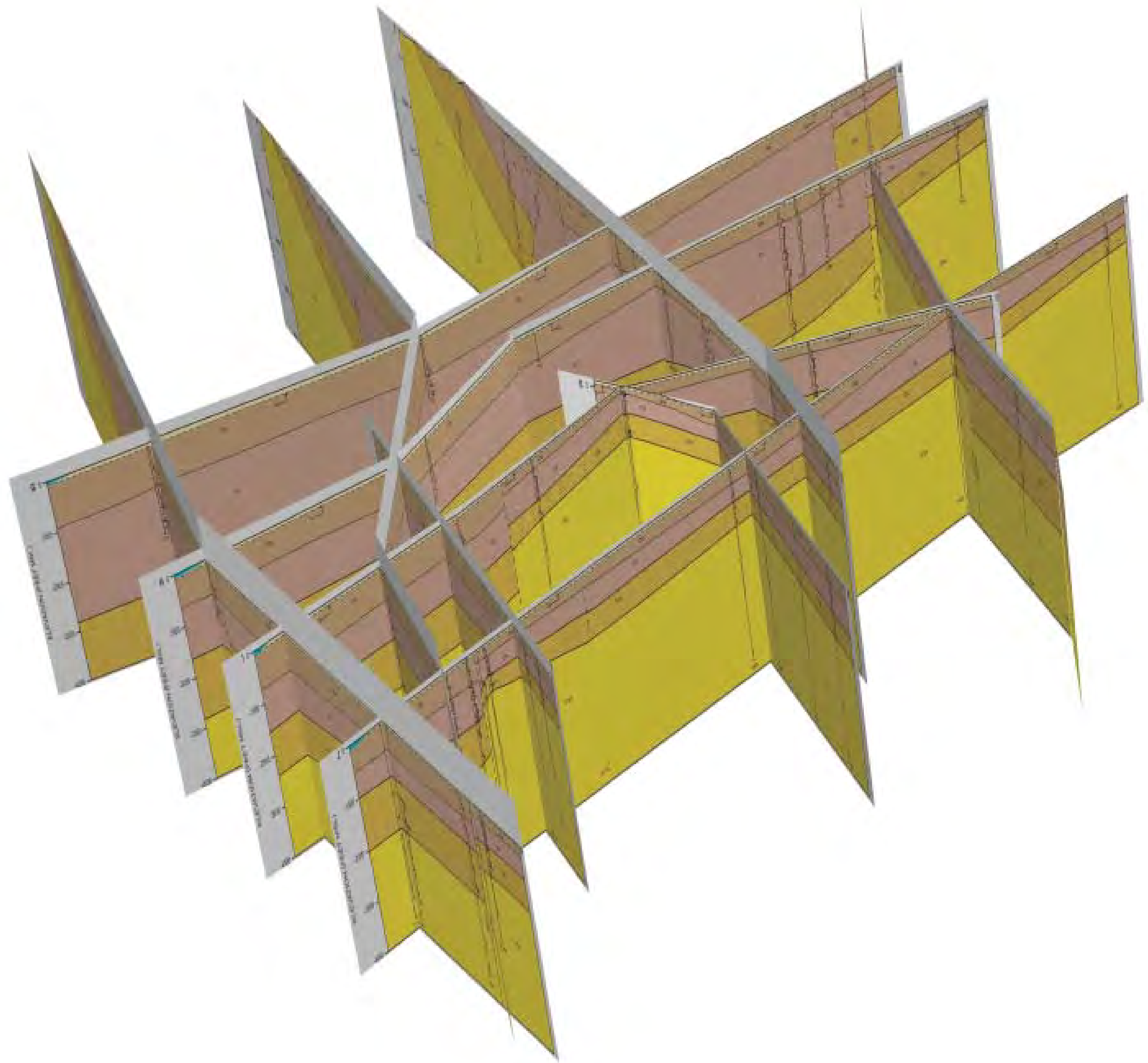


PLATE B5

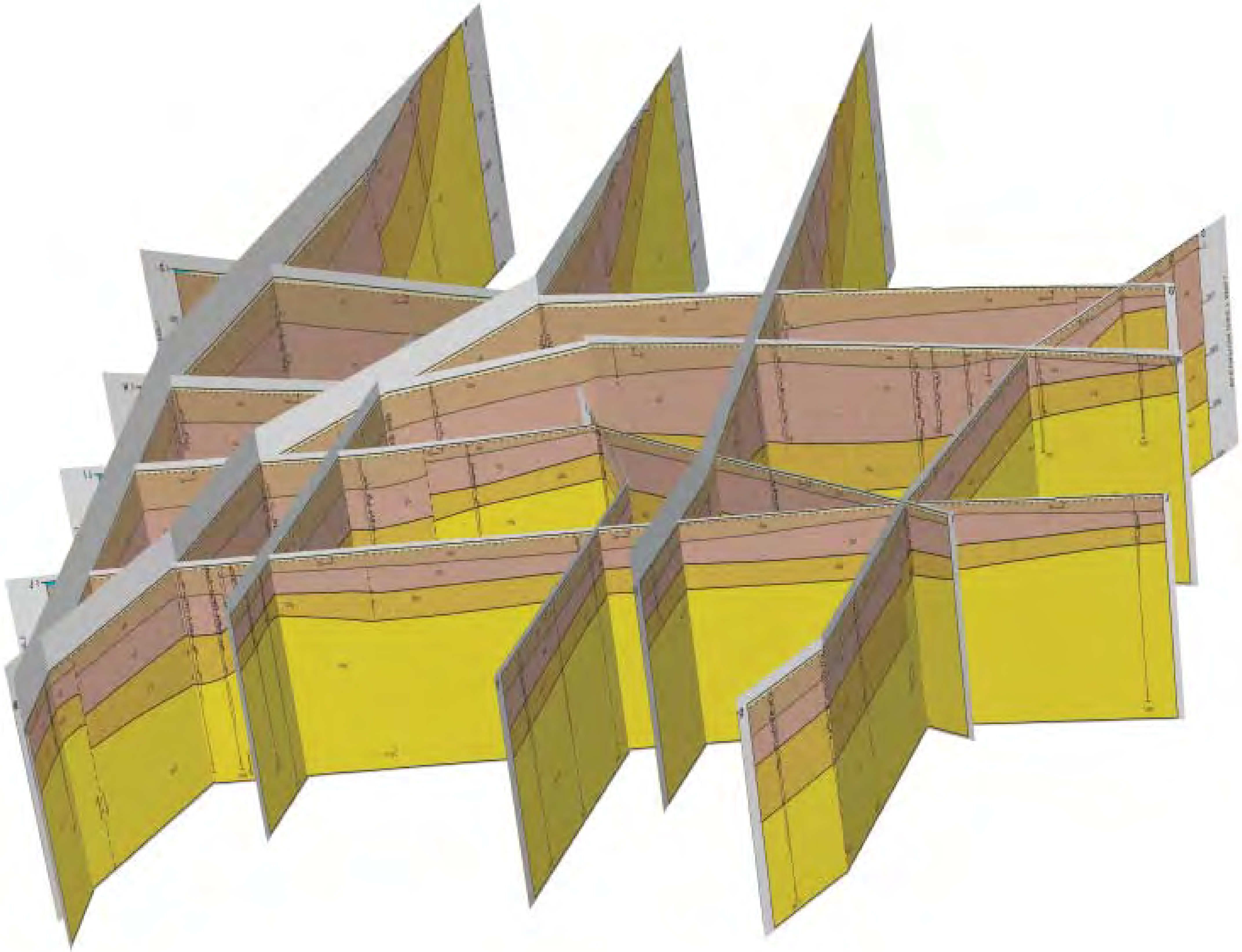


PLATE B6

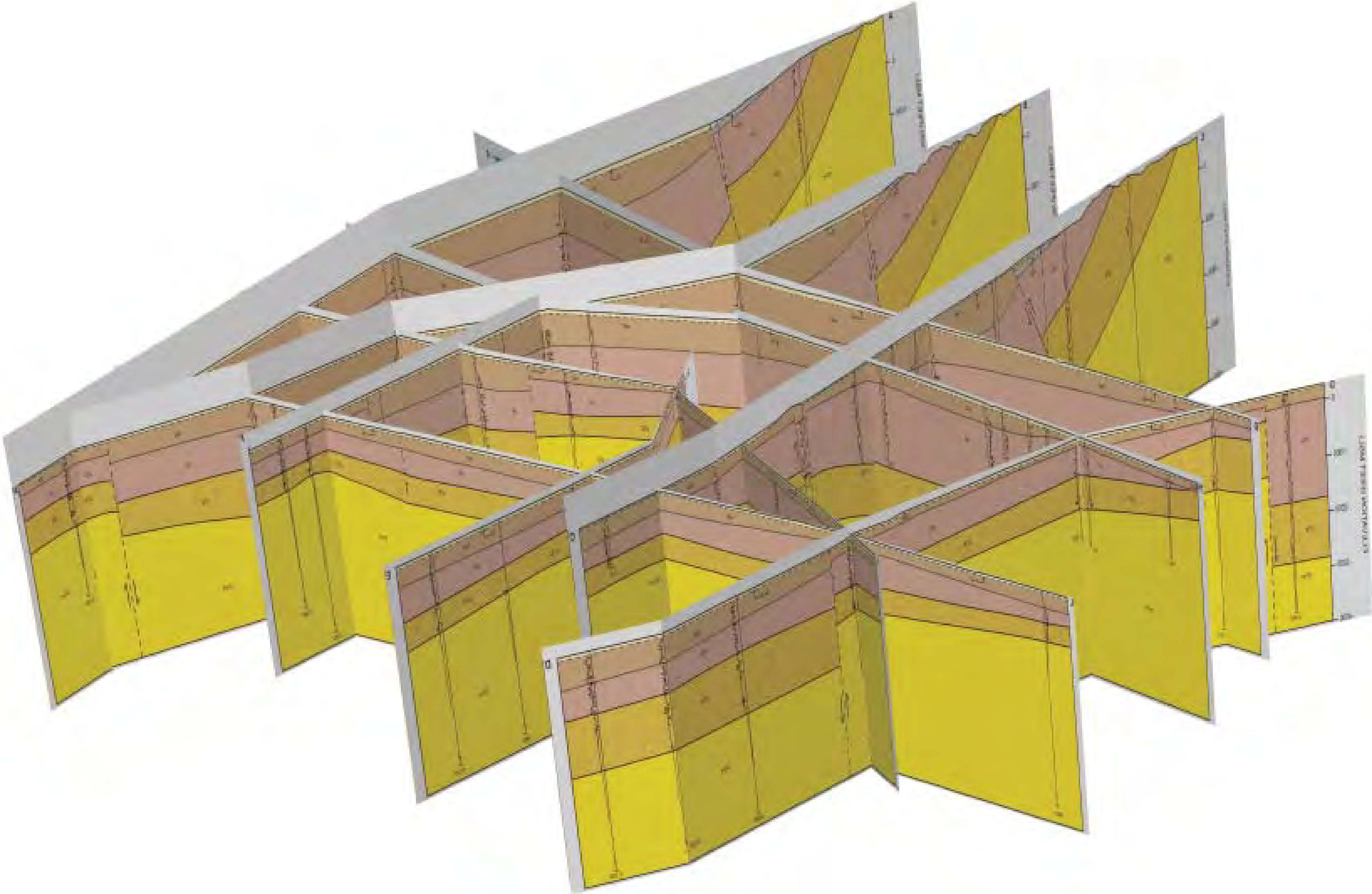


PLATE B7

HOPKINS
GROUNDWATER
CONSULTANTS

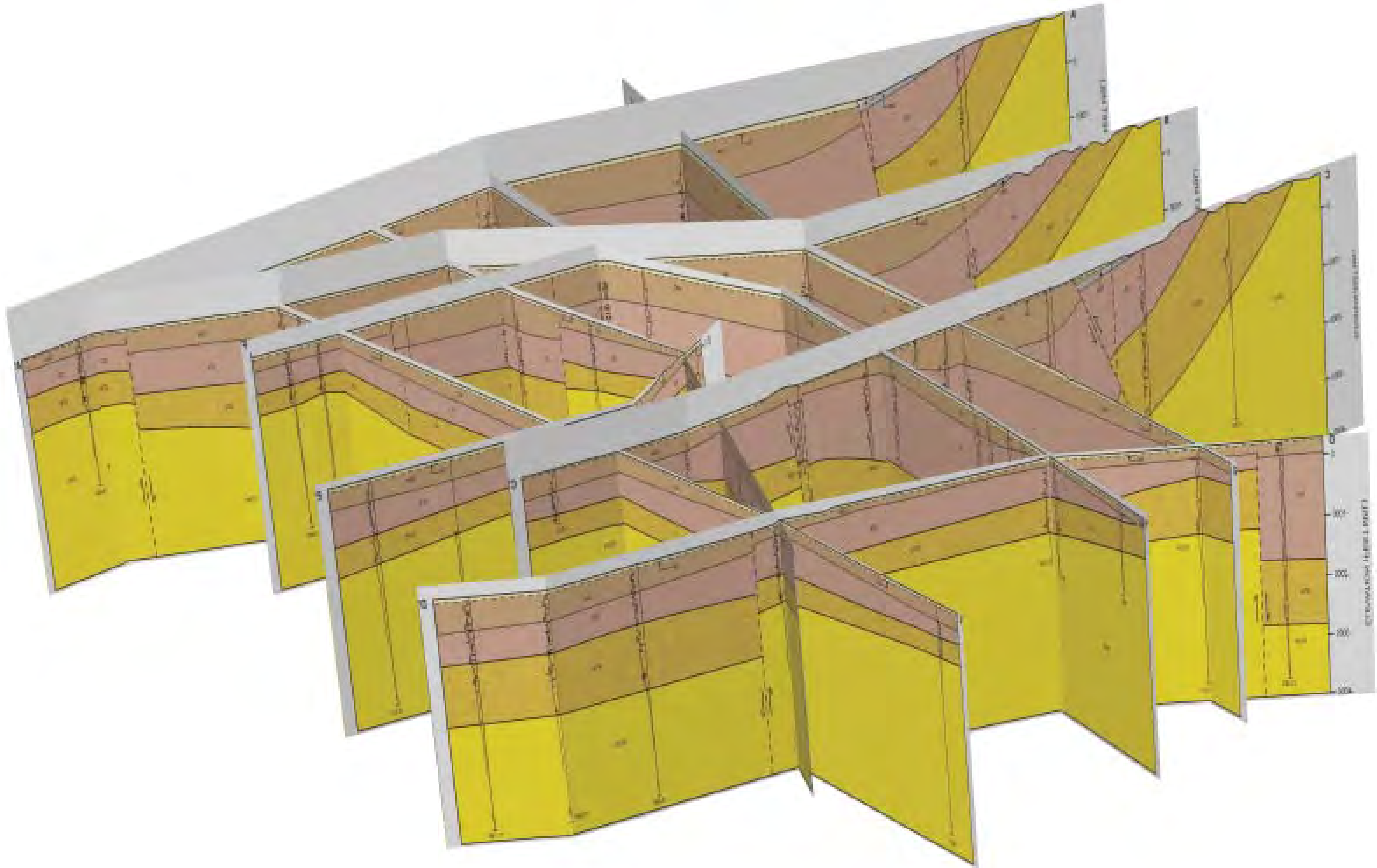
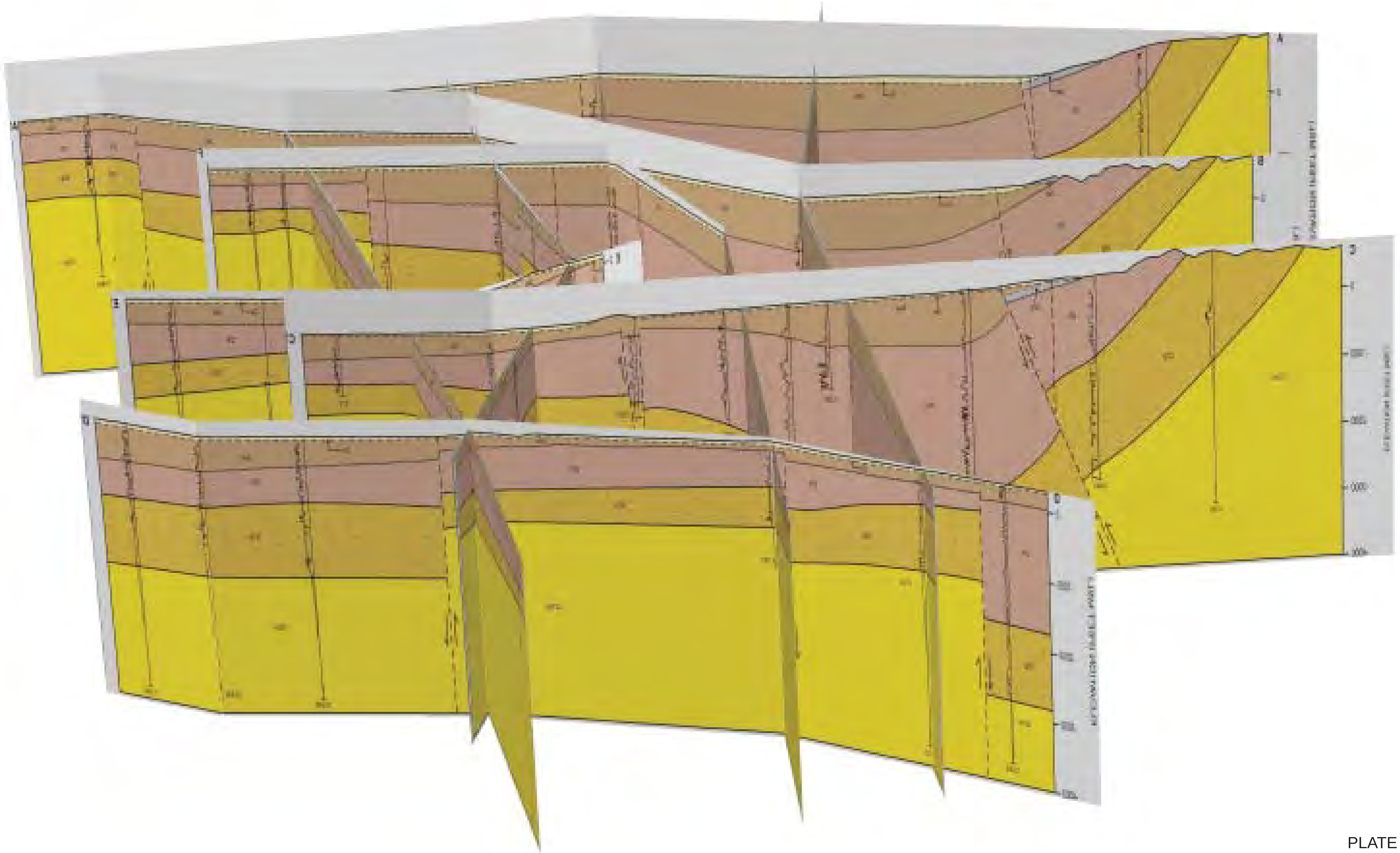
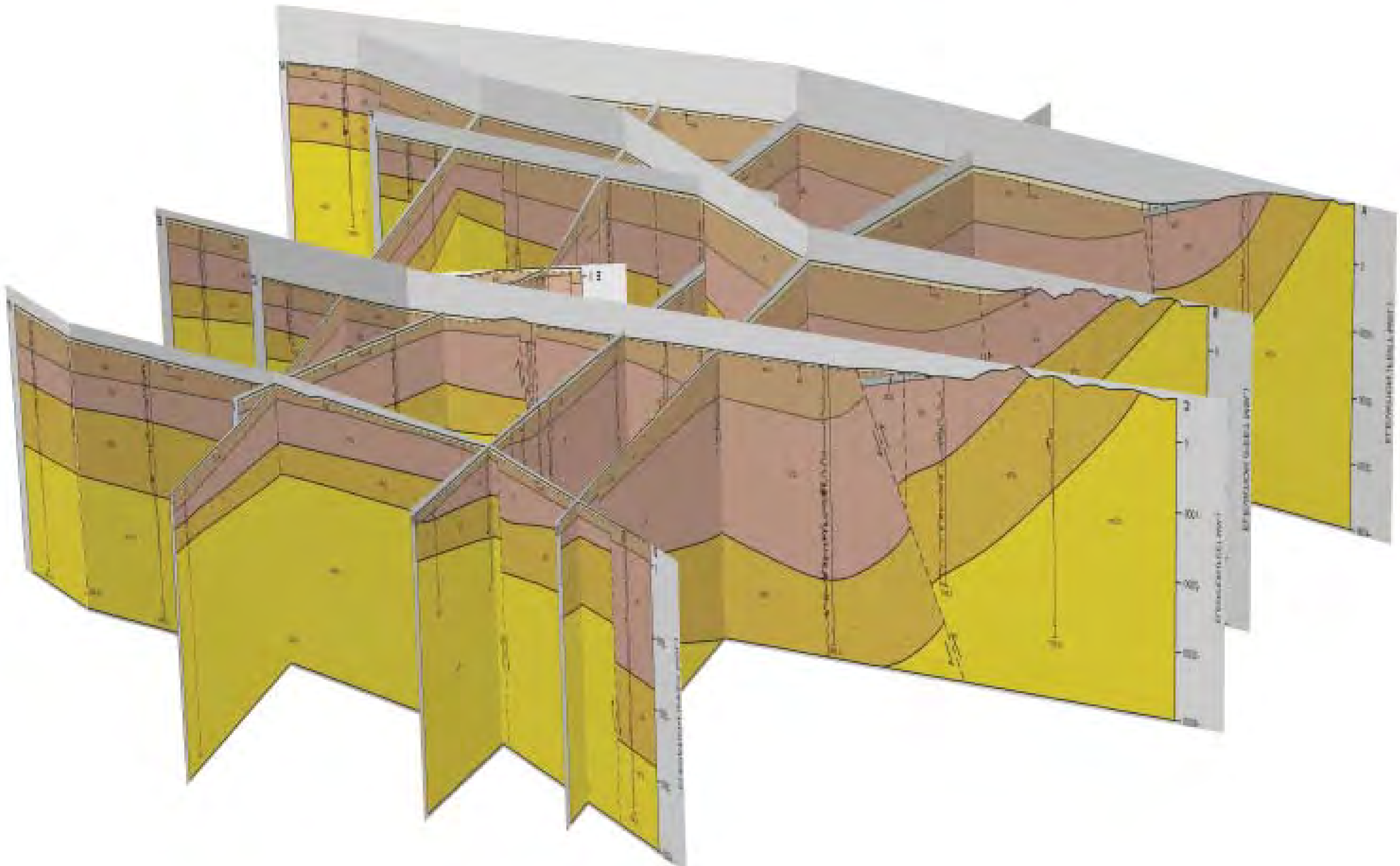


PLATE B8



HOPKINS GROUNDWATER CONSULTANTS



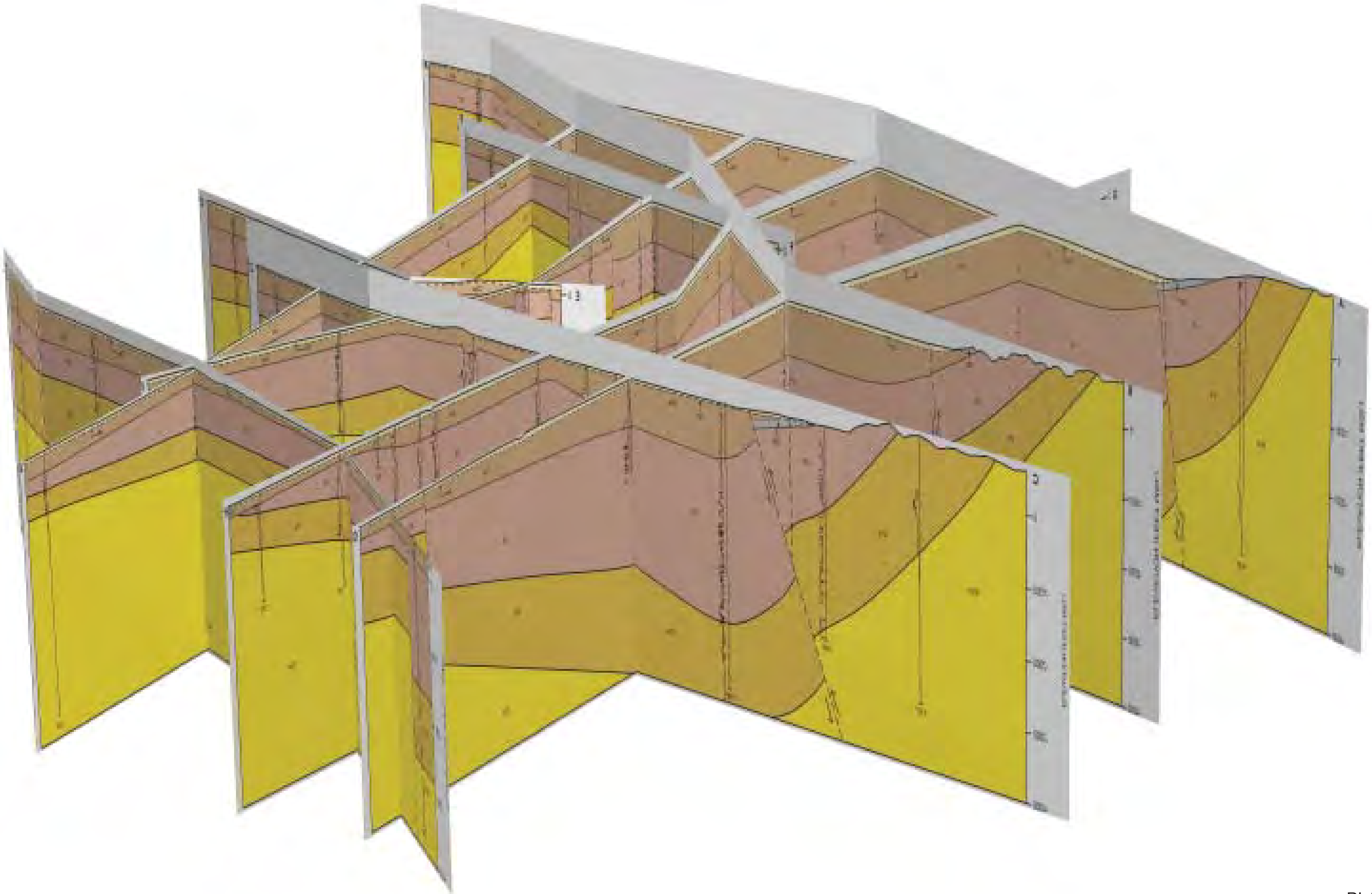


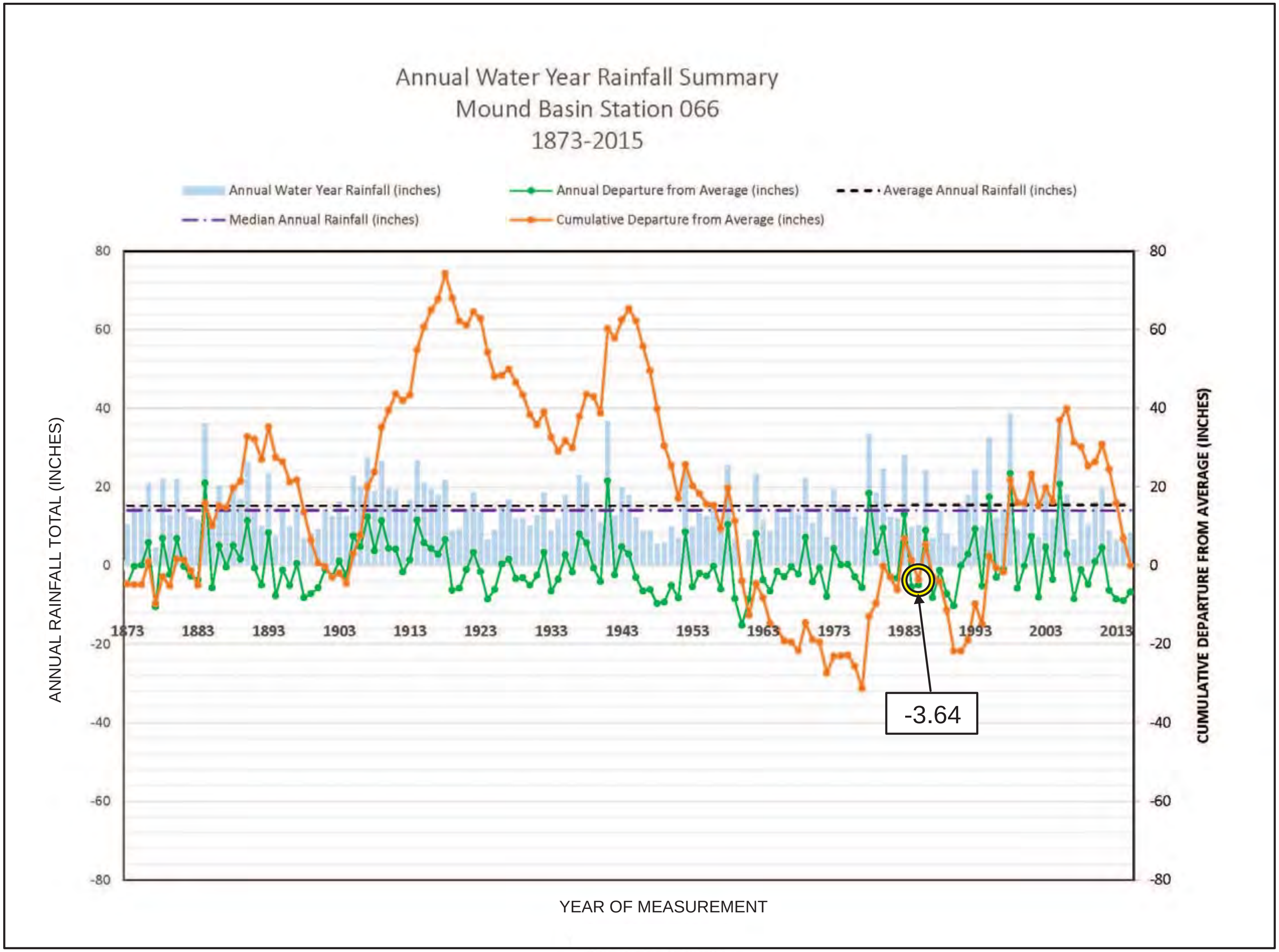
PLATE B11

APPENDIX C
RAINFALL DATA

Table C1 – Annual Rainfall Data by Water Year 1985 to 2015

WATER YEAR	ANNUAL PRECIPITATION (INCHES)				STATISTICS		
	STA 066	STA 222	STA 216	STA 167	AVE	MIN	MAX
1985	10.24	11.84	10.61	11.88	11.14	10.24	11.88
1986	24.13	25.15	20.66	23.69	23.41	20.66	25.15
1987	7.05	7.50	6.33	7.94	7.21	6.33	7.94
1988	13.92	13.22	11.83	13.23	13.05	11.83	13.92
1989	7.94	8.23	7.17	8.24	7.90	7.17	8.24
1990	4.88	5.62	3.88	4.80	4.80	3.88	5.62
1991	15.15	16.92	15.29	17.09	16.11	15.15	17.09
1992	18.02	20.34	17.62	21.10	19.27	17.62	21.10
1993	24.44	28.76	20.17	25.87	24.81	20.17	28.76
1994	9.99	11.68	9.37	11.18	10.56	9.37	11.68
1995	32.60	31.72	28.12	34.22	31.67	28.12	34.22
1996	12.12	12.79	11.58	13.32	12.45	11.58	13.32
1997	14.17	14.75	12.78	14.84	14.14	12.78	14.84
1998	38.65	42.54	35.25	42.09	39.63	35.25	42.54
1999	9.39	10.33	9.10	10.48	9.83	9.10	10.48
2000	15.10	17.11	14.99	17.48	16.17	14.99	17.48
2001	22.59	22.79	19.69	22.75	21.96	19.69	22.79
2002	7.15	6.41	5.42	7.03	6.50	5.42	7.15
2003	19.85	19.00	19.80	19.83	19.62	19.00	19.85
2004	11.64	10.73	11.04	10.75	11.04	10.73	11.64
2005	35.93	34.64	29.35	34.54	33.62	29.35	35.93
2006	18.11	16.64	17.23	17.24	17.31	16.64	18.11
2007	6.66	5.75	5.31	5.80	5.88	5.31	6.66
2008	14.07	12.77	12.19	13.26	13.07	12.19	14.07
2009	10.39	9.33	10.09	10.42	10.06	9.33	10.42
2010	16.16	16.82	16.01	17.20	16.55	16.01	17.20
2011	19.68	19.70	19.04	19.85	19.57	19.04	19.85
2012	8.86	9.49	9.46	9.69	9.38	8.86	9.69
2013	6.58	5.80	6.15	6.70	6.31	5.80	6.70
2014	6.21	6.14	6.24	6.62	6.30	6.14	6.62
2015	8.38	9.15	8.57	9.41	8.88	8.38	9.41

ALL READINGS IN INCHES

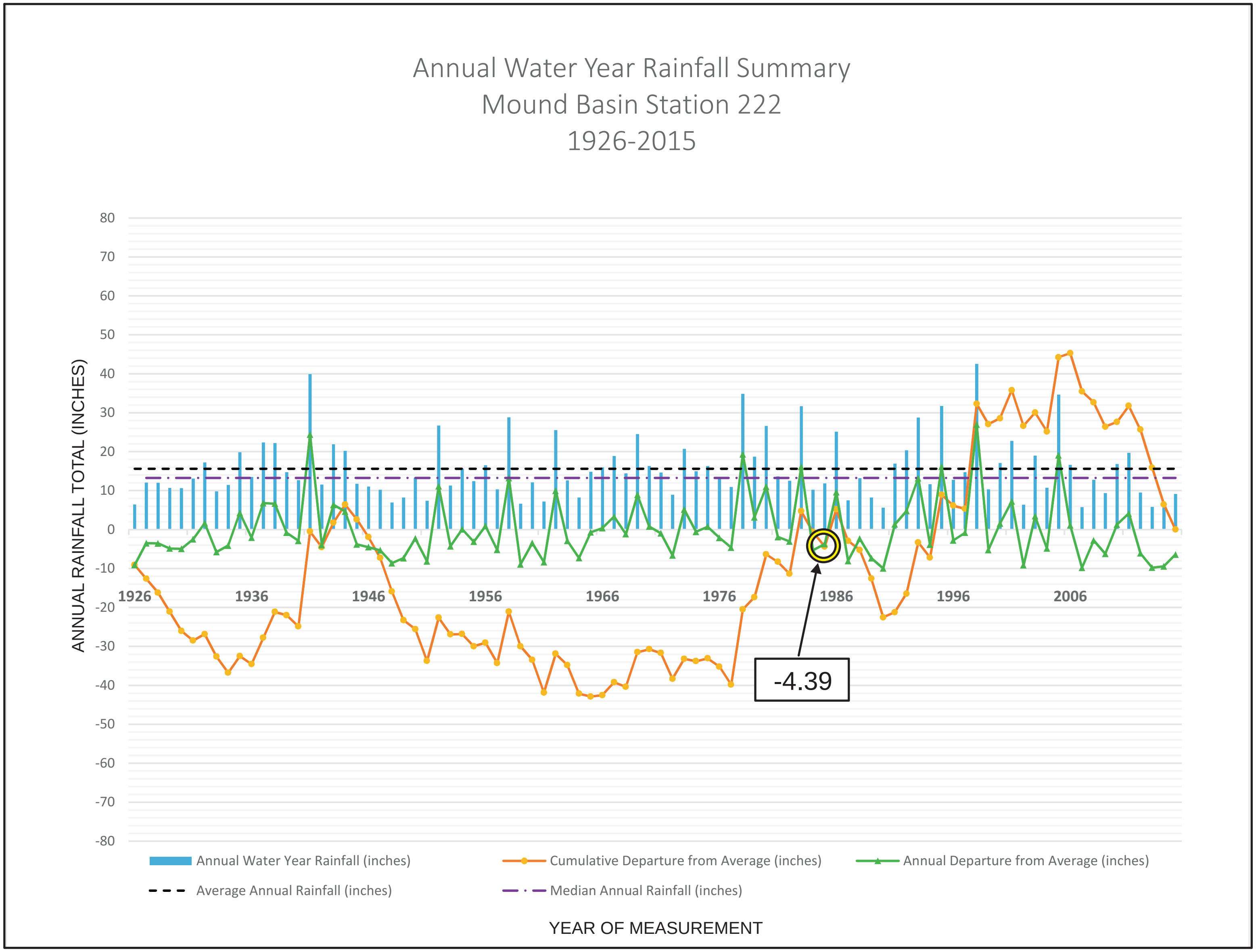


Project No. 01-009-11B

HOPKINS GROUNDWATER CONSULTANTS

PLATE C1

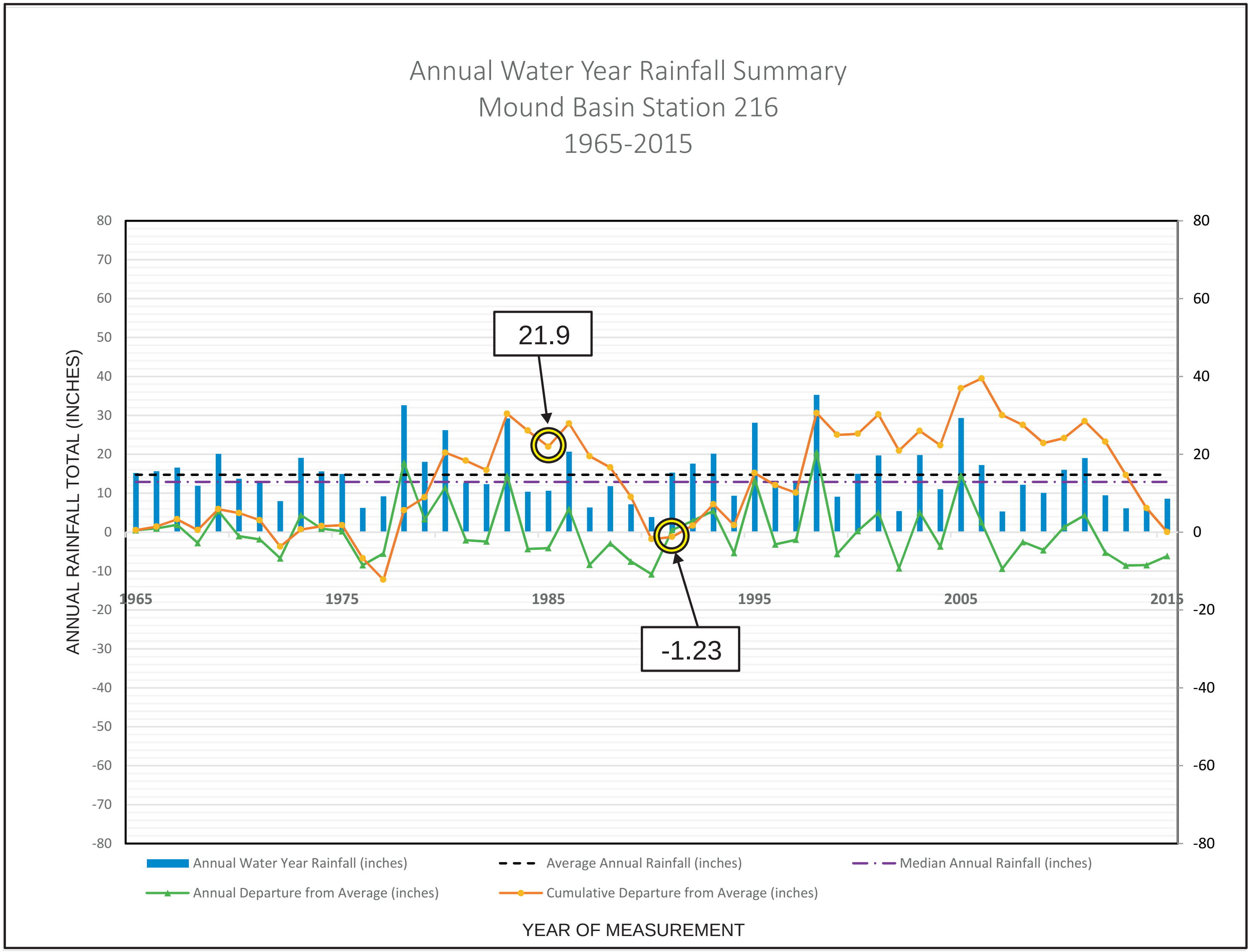
Project No. 01-009-11B



HOPKINS GROUNDWATER CONSULTANTS

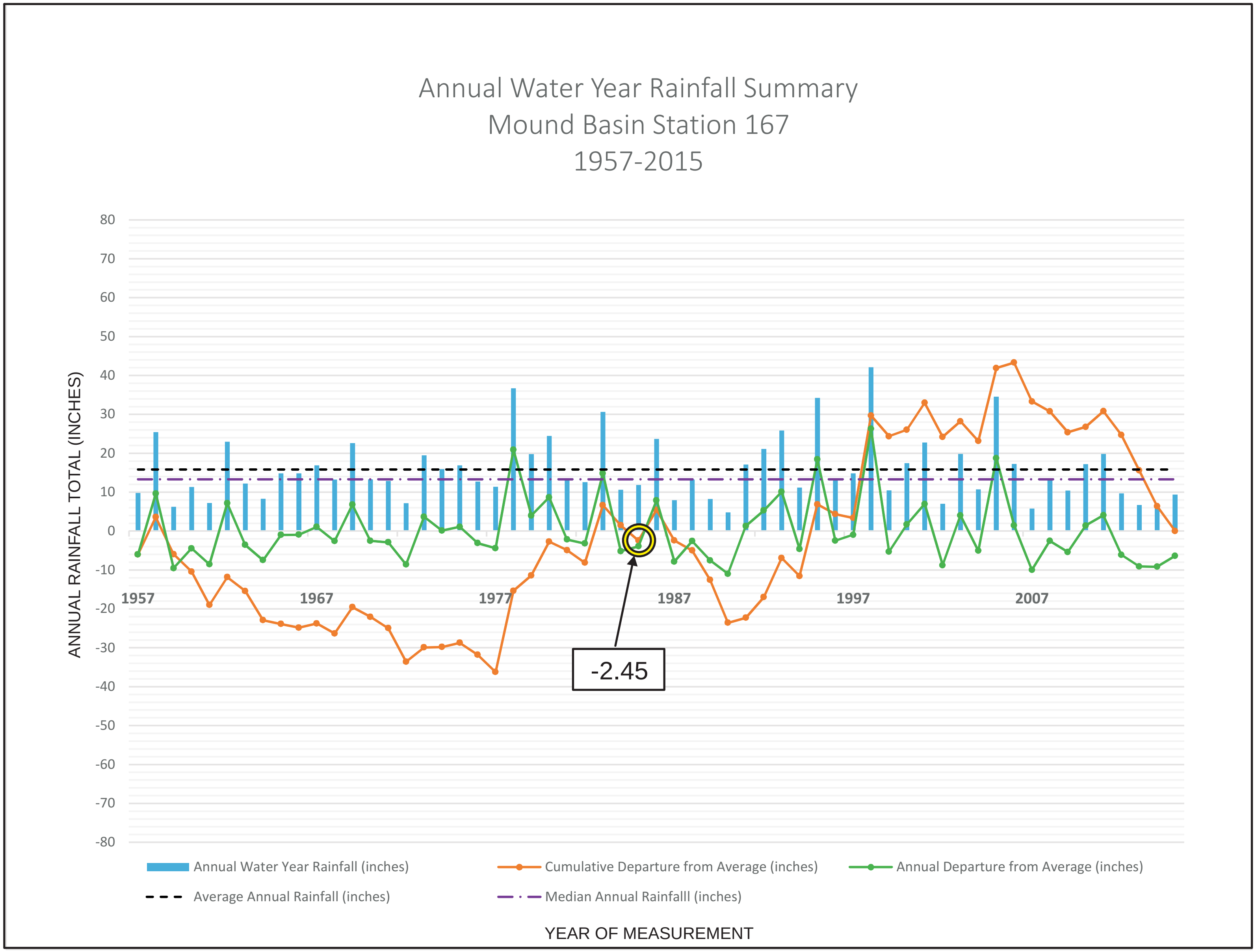
PLATE C2

Project No. 01-009-11B



HOPKINS GROUNDWATER CONSULTANTS

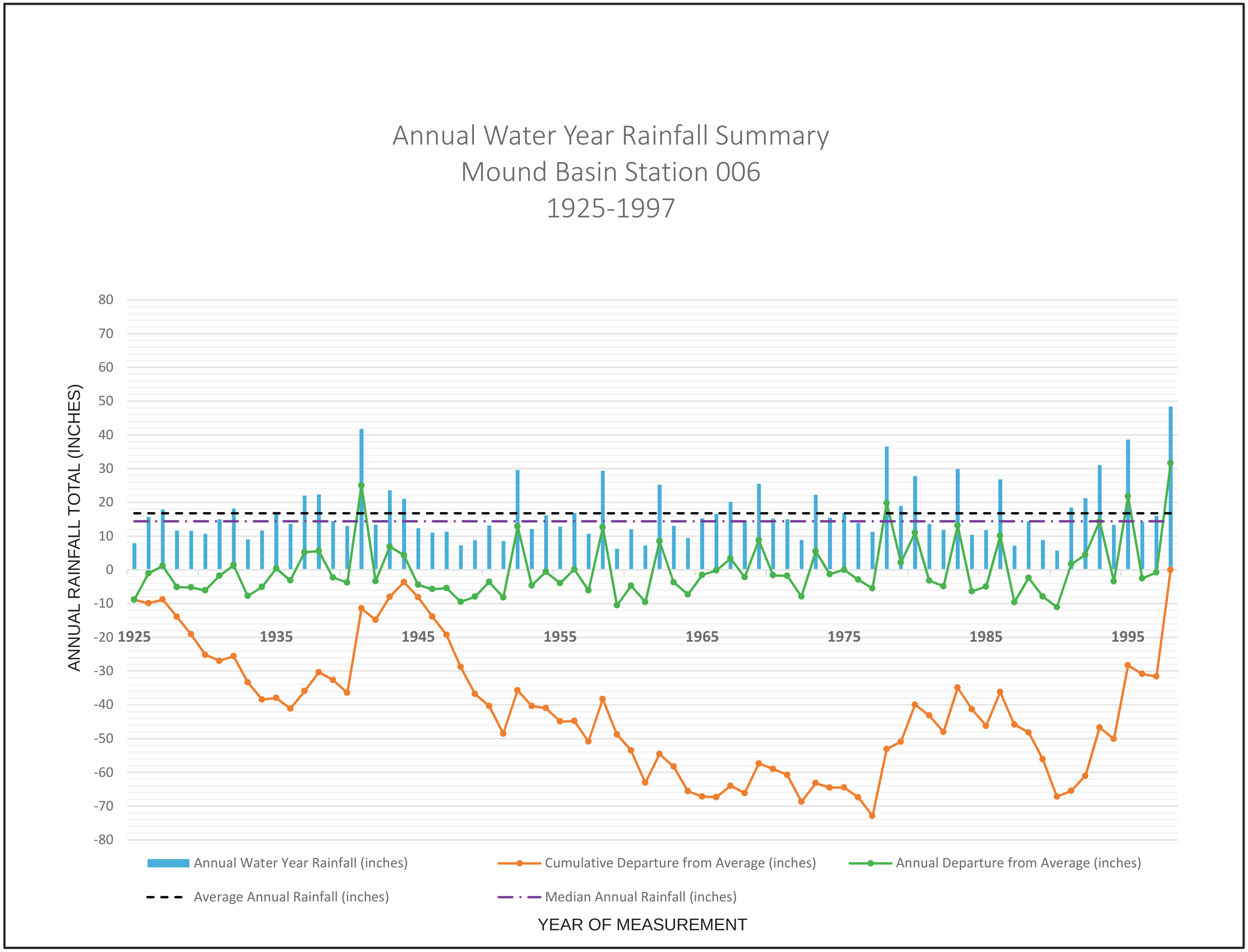
PLATE C3



Project No. 01-009-11B

HOPKINS GROUNDWATER CONSULTANTS

PLATE C4



Project No. 01-009-11B

PLATE C5

HOPKINS
GROUNDWATER CONSULTANTS

Table C2 – Annual Rainfall Data by Calendar Year 1985 to 2015
Rainfall Station 066

CALENDAR YEAR	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC	YEAR
1985	0.90	1.49	1.27	0.00	0.00	0.00	0.00	0.00	0.04	0.47	4.17	0.67	9.01
1986	3.64	7.17	4.71	2.20	0.00	0.00	0.00	0.00	1.10	0.00	1.28	0.25	20.35
1987	1.33	1.98	2.08	0.04	0.00	0.04	0.05	0.00	0.00	1.69	1.28	3.43	11.92
1988	2.25	2.06	0.39	2.55	0.00	0.19	0.02	0.00	0.06	0.01	0.77	3.01	11.31
1989	0.44	2.58	0.81	0.14	0.14	0.00	0.00	0.00	0.04	0.15	0.17	0.00	4.47
1990	2.10	1.43	0.00	0.07	0.82	0.00	0.00	0.00	0.14	0.00	0.27	0.04	4.87
1991	1.01	2.22	11.52	0.00	0.00	0.08	0.00	0.01	0.00	0.09	0.13	3.26	18.32
1992	2.06	7.79	4.42	0.05	0.02	0.00	0.20	0.00	0.00	1.37	0.00	3.94	19.85
1993	6.99	7.14	4.29	0.00	0.10	0.61	0.00	0.00	0.00	0.11	0.56	1.36	21.16
1994	0.39	4.76	2.03	0.32	0.29	0.00	0.00	0.00	0.17	1.36	1.57	1.00	11.89
1995	16.08	1.26	9.18	0.48	1.28	0.39	0.00	0.00	0.00	0.00	0.15	2.55	31.37
1996	1.47	5.21	1.87	0.71	0.16	0.00	0.00	0.00	0.00	1.50	2.40	5.20	18.52
1997	5.01	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.65	6.18	13.90
1998	3.05	18.91	3.69	1.71	2.24	0.04	0.00	0.00	0.18	0.00	0.76	0.59	31.17
1999	2.02	0.83	2.92	2.12	0.01	0.06	0.00	0.00	0.08	0.00	0.84	0.00	8.88
2000	1.73	7.17	2.27	3.02	0.00	0.00	0.00	0.00	0.07	1.40	0.00	0.01	15.67
2001	7.29	5.44	6.68	1.62	0.10	0.01	0.02	0.02	0.00	0.31	3.01	1.68	26.18
2002	0.88	0.48	0.39	0.11	0.22	0.00	0.00	0.01	0.06	0.01	5.81	3.80	11.77
2003	0.02	4.49	3.25	0.77	1.62	0.06	0.01	0.00	0.01	0.00	2.51	1.72	14.46
2004	0.73	5.97	0.70	0.00	0.00	0.00	0.01	0.00	0.00	5.57	0.18	7.11	20.27
2005	10.53	8.12	2.97	0.88	0.35	0.00	0.00	0.00	0.22	1.29	0.72	0.64	25.72
2006	3.00	2.50	3.82	4.94	1.17	0.00	0.00	0.03	0.00	0.08	0.18	1.21	16.93
2007	2.44	1.38	0.09	1.04	0.00	0.00	0.00	0.00	0.24	0.26	0.16	2.20	7.81
2008	9.64	1.71	0.00	0.05	0.02	0.00	0.00	0.00	0.03	0.13	2.11	2.36	16.05
2009	0.42	4.83	0.42	0.07	0.04	0.00	0.00	0.00	0.01	1.41	0.00	2.61	9.81
2010	5.92	3.75	0.33	1.87	0.15	0.03	0.07	0.00	0.02	2.27	0.86	7.99	23.26
2011	0.54	3.06	4.20	0.08	0.48	0.14	0.00	0.03	0.03	1.25	1.82	0.16	11.79
2012	1.58	0.09	1.74	2.15	0.03	0.01	0.01	0.00	0.02	0.02	1.21	2.54	9.40
2013	0.87	0.30	1.03	0.19	0.30	0.08	0.02	0.01	0.01	0.00	0.62	0.29	3.72
2014	0.00	3.40	1.71	0.15	0.00	0.01	0.00	0.03	0.00	0.00	1.21	3.52	10.03
2015	1.26	0.36	0.19	0.23	0.64	0.18	0.35	0.00	0.44	0.18	0.02	0.19	4.04

ALL READINGS IN INCHES

Table C3 – Annual Rainfall Data by Calendar Year 1985 to 2015
Rainfall Station 222

CALENDAR YEAR	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC	YEAR
1985	1.12	1.88	1.40	0.00	0.00	0.00	0.00	0.00	0.03	0.57	4.02	0.65	**9.67**
1986	3.58	8.16	4.94	1.94	0.01	0.00	0.00	0.00	1.28	0.00	1.27	0.21	**21.39**
1987	1.89	1.96	2.04	0.04	0.02	0.00	0.03	0.00	0.04	1.49	0.96	3.34	**11.81**
1988	2.26	1.30	0.50	3.12	0.00	0.24	0.00	0.00	0.01	0.00	0.97	2.96	**11.36**
1989	0.44	2.74	0.87	0.08	0.12	0.00	0.00	0.00	0.05	0.40	0.54	0.00	**5.24**
1990	1.91	1.89	0.00	0.06	0.78	0.00	0.00	0.00	0.04	0.00	0.46	0.10	**5.24**
1991	0.84	2.61	12.78	0.00	0.00	0.11	0.00	0.01	0.01	0.16	0.16	3.64	**20.32**
1992	2.27	8.87	4.88	0.10	0.01	0.00	0.25	0.00	0.00	1.77	0.00	4.34	**22.49**
1993	8.21	9.09	4.63	0.00	0.09	0.63	0.00	0.00	0.00	0.21	0.74	1.56	**25.16**
1994	0.41	5.51	2.13	0.42	0.31	0.00	0.00	0.00	0.39	0.34	1.45	1.08	**12.04**
1995	16.49	1.03	9.12	0.57	1.23	0.41	0.00	0.00	0.00	0.00	0.18	2.46	**31.49**
1996	1.39	6.47	1.19	0.86	0.24	0.00	0.00	0.00	0.00	1.46	2.74	5.52	**19.87**
1997	4.88	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.00	2.39	7.59	**15.01**
1998	3.30	21.93	2.69	1.68	2.46	0.02	0.00	0.00	0.48	0.04	0.99	0.69	**34.28**
1999	2.40	0.70	2.76	2.39	0.00	0.15	0.00	0.00	0.21	0.00	1.06	0.00	**9.67**
2000	1.82	8.76	2.50	2.92	0.00	0.00	0.00	0.00	0.05	1.07	0.00	0.02	**17.14**
2001	6.52	7.62	6.58	0.92	0.04	0.00	0.02	0.00	0.00	0.28	3.01	1.17	**26.16**
2002	1.11	0.39	0.29	0.08	0.04	0.00	0.00	0.00	0.04	0.00	4.78	3.66	**10.39**
2003	0.00	5.09	3.32	0.73	1.38	0.04	0.00	0.00	0.00	0.00	1.55	1.40	**13.51**
2004	0.57	6.54	0.67	0.00	0.00	0.00	0.00	0.00	0.00	4.37	0.08	6.03	**18.26**
2005	11.10	9.08	2.73	0.80	0.25	0.00	0.00	0.00	0.20	1.20	0.60	0.45	**26.41**
2006	2.81	2.68	3.21	4.15	1.54	0.00	0.00	0.00	0.00	0.12	0.12	0.89	**15.52**
2007	2.23	0.87	0.02	1.23	0.00	0.00	0.00	0.00	0.27	0.18	0.18	2.41	**7.39**
2008	8.28	1.57	0.01	0.03	0.06	0.00	0.00	0.05	0.00	0.06	2.34	1.94	**14.34**
2009	0.30	4.11	0.43	0.08	0.02	0.04	0.00	0.00	0.01	1.79	0.00	2.48	**9.26**
2010	6.20	4.29	0.36	1.52	0.11	0.00	0.03	0.00	0.04	2.35	0.74	8.27	**23.91**
2011	0.41	2.54	4.68	0.04	0.49	0.14	0.00	0.00	0.04	1.51	1.71	0.23	**11.79**
2012	1.46	0.05	2.33	2.14	0.04	0.00	0.01	0.00	0.01	0.02	1.01	2.32	**9.39**
2013	0.98	0.14	0.88	0.14	0.21	0.03	0.04	0.01	0.02	0.01	0.53	0.43	**3.42**
2014	0.01	3.87	1.15	0.11	0.00	0.00	0.00	0.02	0.01	0.00	0.98	3.92	**10.07**
2015	1.31	0.57	0.47	0.24	0.38	0.14	0.28	0.00	0.86	0.67	0.02	0.25	**5.19**

ALL READINGS IN INCHES

Table C4 – Annual Rainfall Data by Calendar Year 1985 to 2015
Rainfall Station 167

CALENDAR YEAR	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC	YEAR
1985	1.04	2.07	1.25	0	0	0	0	0	0.02	0.47	3.71	0.55	**9.11**
1986	3.37	7.2	5.04	2.2	0	0	0	0	1.15	0	1.25	0.23	**20.44**
1987	2.25	2.13	1.96	0.07	0.01	0.01	0.03	0	0	1.62	1.2	3.27	**12.55**
1988	2.21	1.46	0.58	2.86	0	0.01	0	0	0.02	0	0.86	3.01	**11.01**
1989	0.45	2.7	0.83	0.17	0.19	0	0	0	0.03	0.2	0.22	0	**4.79**
1990	1.88	1.58	0	0.05	0.78	0	0	0	0.09	0	0.34	0.04	**4.76**
1991	1.02	2.52	12.88	0	0	0.15	0	0	0.14	0.1	0.17	3.63	**20.61**
1992	2.23	9.21	5.44	0.09	0	0	0.23	0	0	2.02	0	3.89	**23.11**
1993	7.23	7.24	4.74	0	0.11	0.63	0.01	0	0	0.13	0.54	1.44	**22.07**
1994	0.43	5.51	2.15	0.4	0.38	0	0	0	0.2	0.83	1.49	1.15	**12.54**
1995	17.33	1.24	10.21	0.55	0.94	0.48	0	0	0	0	0.15	2.54	**33.44**
1996	1.73	5.99	1.95	0.78	0.18	0	0	0	0	1.42	2.65	5.32	**20.02**
1997	5.29	0.11	0	0	0	0	0	0.04	0.01	0	3.21	7.02	**15.68**
1998	2.82	21.08	3.36	2.02	1.96	0.02	0	0	0.6	0	1.11	0.62	**33.59**
1999	2.37	0.87	2.96	2.37	0.01	0.11	0	0	0.06	0	1.07	0	**9.82**
2000	1.91	8.89	2.31	3.18	0.01	0.03	0	0	0.08	1.35	0	0.01	**17.77**
2001	6.55	6.61	6.67	1.39	0.15	0.01	0.01	0	0	0.29	3.33	1.4	**26.41**
2002	0.96	0.4	0.36	0.08	0.11	0	0.01	0.02	0.07	0	5.52	3.35	**10.88**
2003	0.01	5.38	3.19	0.89	1.39	0.09	0.01	0	0	0	2.17	1.32	**14.45**
2004	0.58	6.02	0.66	0	0	0	0	0	0	5.83	0.15	6.07	**19.31**
2005	10.02	8.16	2.9	0.89	0.29	0	0	0.01	0.22	1.18	0.79	0.58	**25.04**
2006	2.81	2.51	3.25	4.17	1.91	0.01	0	0.03	0	0.09	0.17	0.98	**15.93**
2007	2.13	1.12	0.07	1.09	0	0	0	0	0.15	0.21	0.16	2.34	**7.27**
2008	8.9	1.52	0.02	0.05	0.05	0	0	0.01	0	0.14	1.96	2.25	**14.9**
2009	0.47	4.94	0.47	0.1	0.03	0.06	0	0	0	1.62	0	3.01	**10.7**
2010	6.08	3.97	0.35	1.91	0.16	0.02	0.08	0	0	2.12	1.06	8.47	**24.22**
2011	0.56	2.72	4.12	0.08	0.51	0.15	0	0.01	0.05	1.45	1.82	0.18	**11.65**
2012	1.64	0.09	2.09	2.33	0.05	0.01	0.01	0.01	0.01	0.02	1.39	2.82	**10.47**
2013	0.86	0.22	0.96	0.18	0.19	0.05	0.01	0	0	0	0.61	0.37	**3.45**
2014	0.02	3.5	1.84	0.26	0	0	0	0.02	0	0	1.41	3.79	**10.84**
2015	1.3	0.38	0.39	0.3	0.81	0.19	0.27	0	0.57	0.37	0.02	0.21	**4.81**

ALL READINGS IN INCHES

Table C5 – Annual Rainfall Data by Calendar Year 1985 to 2015
Rainfall Station 216

CALENDAR YEAR	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC	YEAR
1985	0.97	1.74	1.07	0.00	0.00	0.00	0.00	0.05	0.02	0.53	3.86	0.53	**8.77**
1986	2.77	5.72	3.82	2.51	0.00	0.01	0.00	0.00	0.91	0.00	1.17	0.22	**17.13**
1987	1.90	0.94	2.05	0.05	0.00	0.00	0.00	0.00	0.00	1.66	1.10	2.53	**10.23**
1988	1.83	1.06	0.56	2.81	0.00	0.24	0.00	0.00	0.04	0.00	0.61	2.68	**9.83**
1989	0.33	2.36	0.80	0.17	0.19	0.00	0.00	0.00	0.03	0.15	0.12	0.00	**4.15**
1990	1.53	1.20	0.01	0.08	0.70	0.00	0.00	0.04	0.05	0.00	0.35	0.04	**4.00**
1991	0.65	2.75	11.23	0.01	0.00	0.19	0.00	0.02	0.05	0.12	0.07	3.68	**18.77**
1992	1.92	7.53	4.05	0.04	0.01	0.01	0.19	0.00	0.00	0.66	0.00	3.07	**17.48**
1993	6.23	5.41	4.32	0.00	0.08	0.38	0.02	0.00	0.00	0.14	0.44	1.66	**18.68**
1994	0.27	3.79	2.10	0.40	0.39	0.00	0.00	0.00	0.18	0.65	1.26	0.95	**9.99**
1995	13.68	1.47	8.54	0.55	0.71	0.31	0.00	0.00	0.00	0.00	0.14	2.03	**27.43**
1996	1.22	5.52	1.87	0.71	0.09	0.00	0.00	0.00	0.00	0.96	2.36	4.69	**17.42**
1997	4.71	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.65	6.78	**14.20**
1998	2.45	17.05	2.55	1.55	1.60	0.00	0.00	0.00	0.62	0.00	1.11	0.50	**27.43**
1999	1.87	0.66	2.66	2.24	0.00	0.06	0.00	0.00	0.00	0.00	0.86	0.00	**8.35**
2000	1.41	7.29	2.17	3.13	0.00	0.00	0.00	0.00	0.13	1.26	0.00	0.00	**15.39**
2001	6.18	5.51	5.71	1.03	0.00	0.00	0.00	0.00	0.00	0.33	2.66	1.31	**22.73**
2002	0.65	0.27	0.06	0.00	0.07	0.00	0.00	0.00	0.07	0.00	6.25	3.57	**10.94**
2003	0.08	4.37	2.92	0.60	2.01	0.00	0.00	0.00	0.00	0.00	2.43	1.50	**13.91**
2004	0.57	5.87	0.67	0.00	0.00	0.00	0.00	0.00	0.00	3.87	0.68	4.61	**16.27**
2005	8.80	7.50	2.54	0.91	0.21	0.00	0.00	0.00	0.23	1.53	0.48	0.79	**22.99**
2006	2.70	2.50	3.76	4.22	1.25	0.00	0.00	0.00	0.00	0.08	0.17	0.23	**14.91**
2007	2.37	1.18	0.09	1.17	0.00	0.00	0.00	0.00	0.02	0.20	0.19	1.97	**7.19**
2008	7.85	1.87	0.00	0.05	0.03	0.00	0.00	0.00	0.03	0.10	2.02	1.92	**13.87**
2009	0.40	5.12	0.34	0.08	0.02	0.06	0.01	0.00	0.02	1.04	0.00	2.46	**9.55**
2010	5.94	4.35	0.37	1.57	0.17	0.01	0.04	0.01	0.05	2.32	1.03	7.91	**23.77**
2011	0.54	2.38	4.03	0.06	0.54	0.16	0.00	0.04	0.03	1.41	1.80	0.20	**11.19**
2012	1.87	0.05	1.89	2.16	0.02	0.00	0.00	0.01	0.05	0.02	1.40	2.21	**9.68**
2013	0.88	0.12	1.03	0.17	0.25	0.03	0.02	0.00	0.02	0.00	0.52	0.40	**3.44**
2014	0.00	3.72	1.49	0.08	0.00	0.00	0.00	0.03	0.00	0.01	1.28	3.73	**10.34**
2015	1.21	0.35	0.28	0.19	0.30	0.17	0.27	0.00	0.78	0.38	0.02	0.15	**4.10**

ALL READINGS IN INCHES

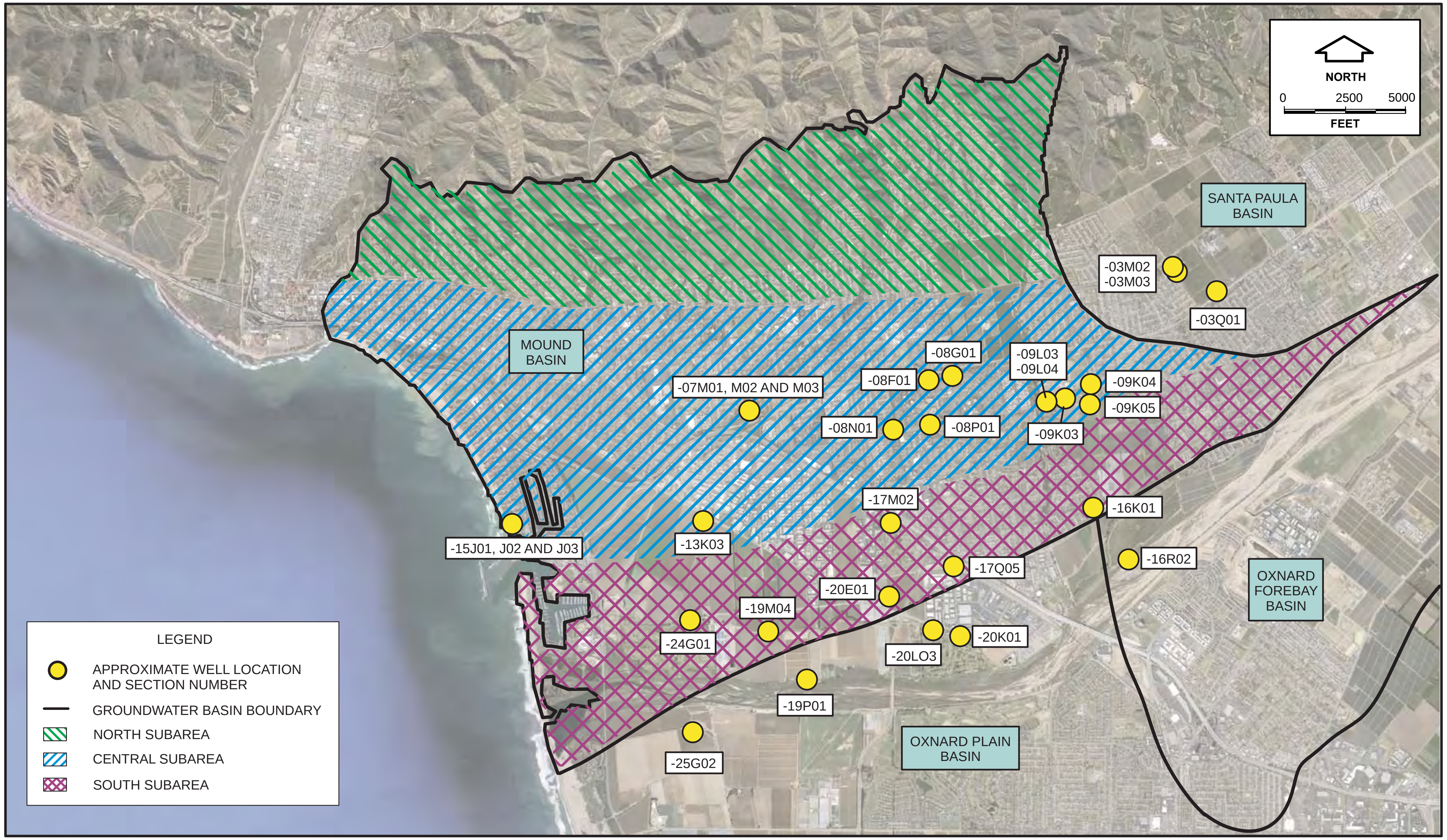
Table C6 – Annual Rainfall Data by Calendar Year 1985 to 2015

CALENDAR	ANNUAL PRECIPITATION (INCHES)				STATISTICS		
YEAR	STA 066	STA 222	STA 216	STA 167	AVE	MIN	MAX
1985	9.01	9.67	8.77	9.11	9.14	8.77	9.67
1986	20.35	21.39	17.13	20.44	19.83	17.13	21.39
1987	11.92	11.81	10.23	12.55	11.63	10.23	12.55
1988	11.31	11.36	9.83	11.01	10.88	9.83	11.36
1989	4.47	5.24	4.15	4.79	4.66	4.15	5.24
1990	4.87	5.24	4.00	4.76	4.72	4.00	5.24
1991	18.32	20.32	18.77	20.61	19.51	18.32	20.61
1992	19.85	22.49	17.48	23.11	20.73	17.48	23.11
1993	21.16	25.16	18.68	22.07	21.77	18.68	25.16
1994	11.89	12.04	9.99	12.54	11.62	9.99	12.54
1995	31.37	31.49	27.43	33.44	30.93	27.43	33.44
1996	18.52	19.87	17.42	20.02	18.96	17.42	20.02
1997	13.90	15.01	14.20	15.68	14.70	13.90	15.68
1998	31.17	34.28	27.43	33.59	31.62	27.43	34.28
1999	8.88	9.67	8.35	9.82	9.18	8.35	9.82
2000	15.67	17.14	15.39	17.77	16.49	15.39	17.77
2001	26.18	26.16	22.73	26.41	25.37	22.73	26.41
2002	11.77	10.39	10.94	10.88	11.00	10.39	11.77
2003	14.46	13.51	13.91	14.45	14.08	13.51	14.46
2004	20.27	18.26	16.27	19.31	18.53	16.27	20.27
2005	25.72	26.41	22.99	25.04	25.04	22.99	26.41
2006	16.93	15.52	14.91	15.93	15.82	14.91	16.93
2007	7.81	7.39	7.19	7.27	7.42	7.19	7.81
2008	16.05	14.34	13.87	14.90	14.79	13.87	16.05
2009	9.81	9.26	9.55	10.70	9.83	9.26	10.70
2010	23.26	23.91	23.77	24.22	23.79	23.26	24.22
2011	11.79	11.79	11.19	11.65	11.61	11.19	11.79
2012	9.40	9.39	9.68	10.47	9.74	9.39	10.47
2013	3.72	3.42	3.44	3.45	3.51	3.42	3.72
2014	10.03	10.07	10.34	10.84	10.32	10.03	10.84
2015	4.04	5.19	4.10	4.81	4.54	4.04	5.19

ALL READINGS IN INCHES

APPENDIX D
GROUNDWATER HYDROGRAPHS

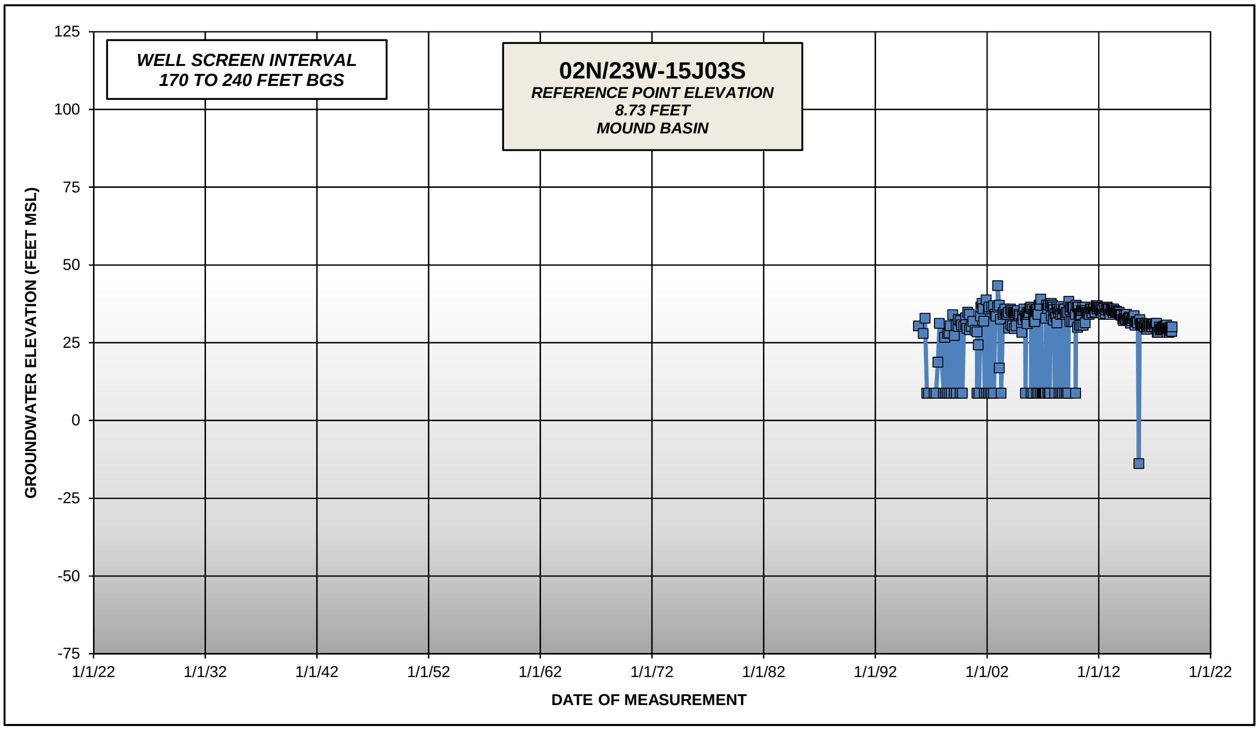
TABLE D1 - WELLS WITH CURRENT WATER LEVEL DATA WITHIN MOUND BASIN			
	STATE WELL NUMBERS	**SCREEN DEPTH (FEET)**	**FORMATION**
NORTH SUBAREA	NO CURRENT WELLS	NA	NA
CENTRAL SUBAREA	02N23W15J01S	970-1070	Lower QTs
	02N23W15J02S	480-660	Lower Qoa/QTs
	02N23W15J03S	170-240	Upper Qoa
	02N23W13K03S	800-1200	QTs
	02N22W07M01S	1200-1280	Lower QTs
	02N22W07M02S	710-780	Lower Qoa
	02N22W07M03S	210-280	Upper Qoa
	02N22W08F01S	580-1180	Lower Qoa/QTs
	02N22W08G01S	580-650	Qoa
	02N22W08P01S	284-346	Lower Qoa/QTs
	02N22W08N01S	554-720	QTs
	02N22W09L03S	890-950	Lower QTs
	02N22W09L04S	480-510	Upper QTs
	02N22W09K03S	424-545	QTs
	02N22W09K04S	? - 548	QTs
	02N22W09K05S	625-1455	Lower Qoa/QTs
SOUTH SUBAREA	02N23W24G01S	742-927	Upper QTs
	02N22W19M04S	343-493	Lower Qoa/QTs
	02N22W20E01S	462-818	Lower Qoa/QTs
	02N22W17Q05S	360-478	QTs
	02N22W16K01S	294-345	QTs

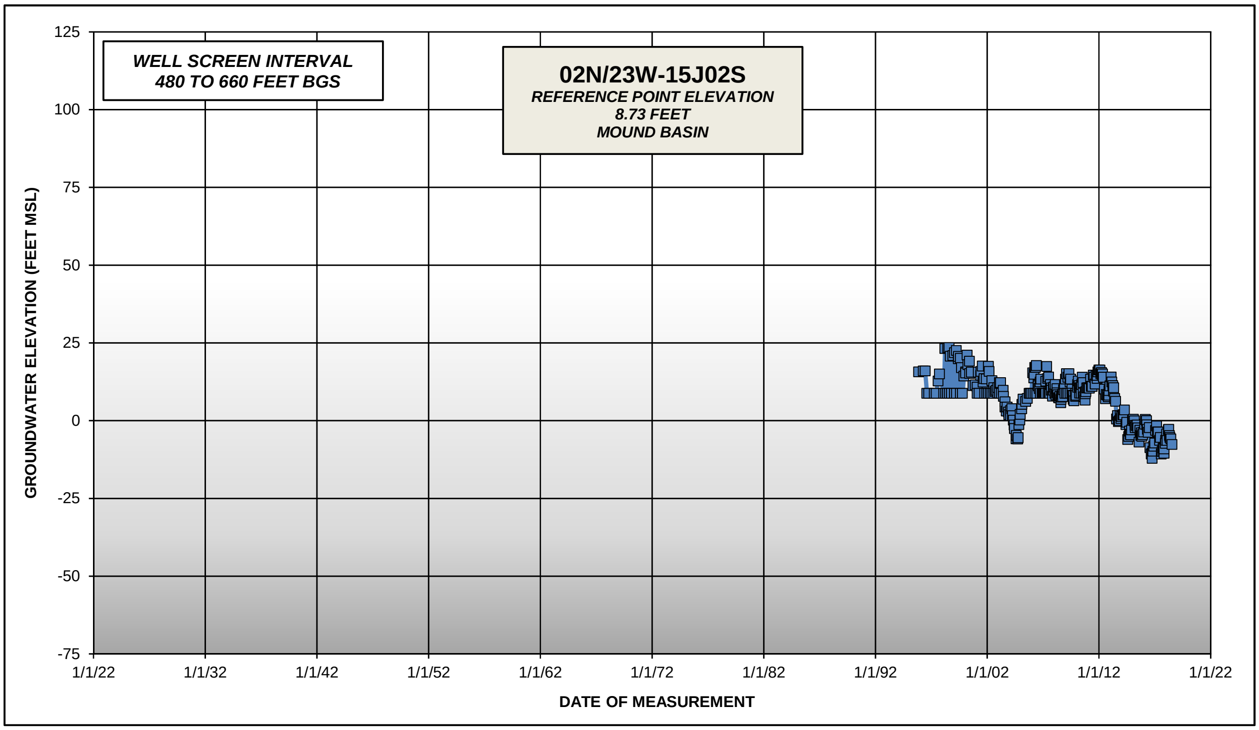


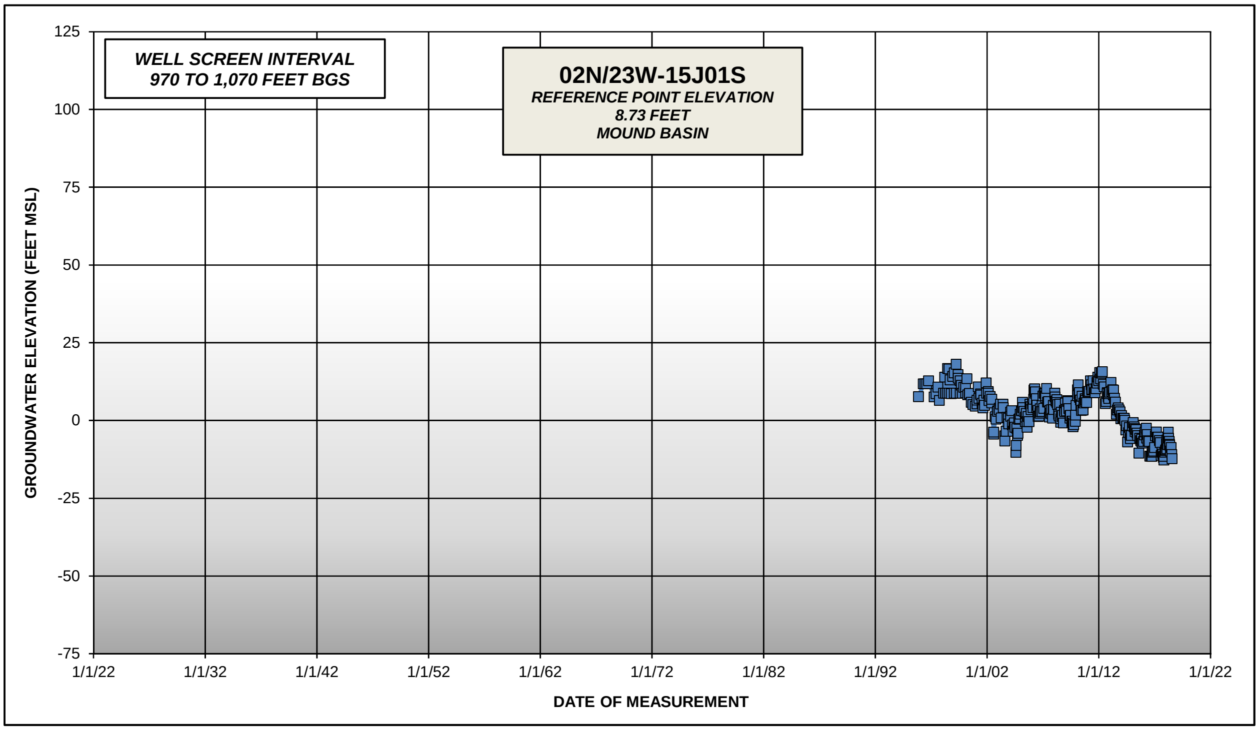
GROUNDWATER DATA WELL LOCATION MAP
Mound Basin Study
City of San Buenaventura
Ventura, California

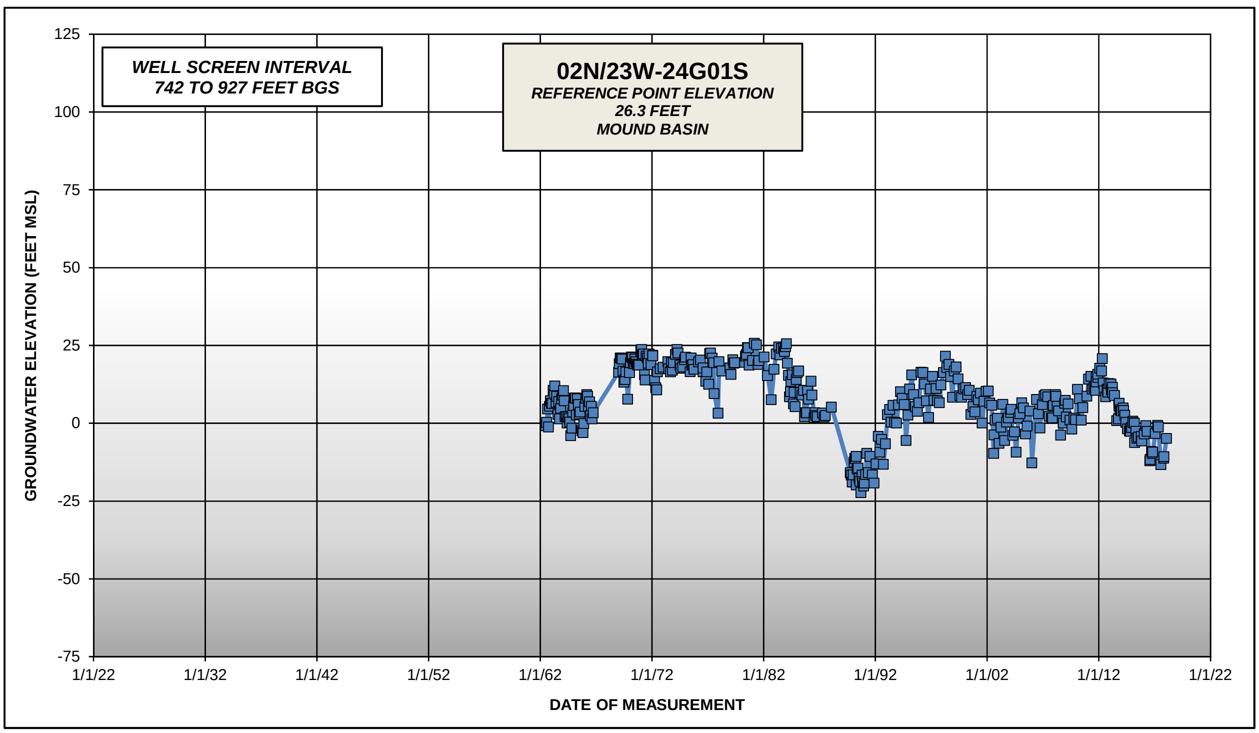
PLATE D1

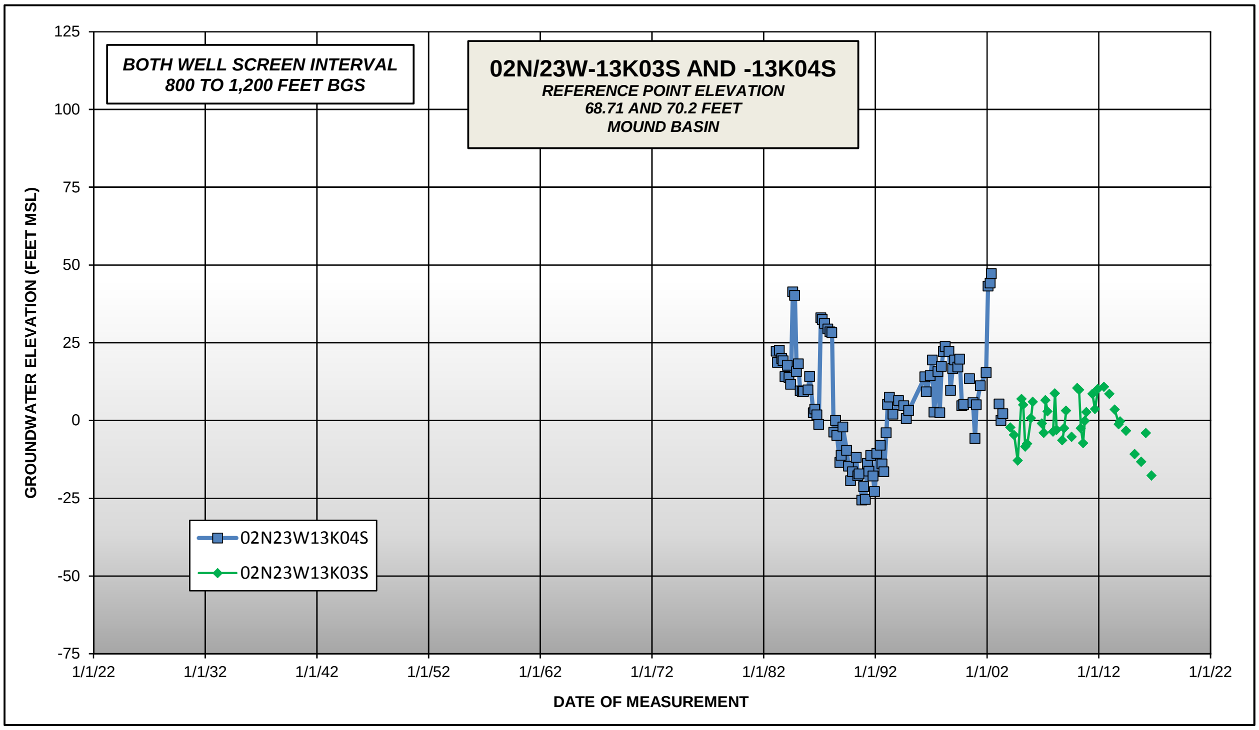
MOUND BASIN

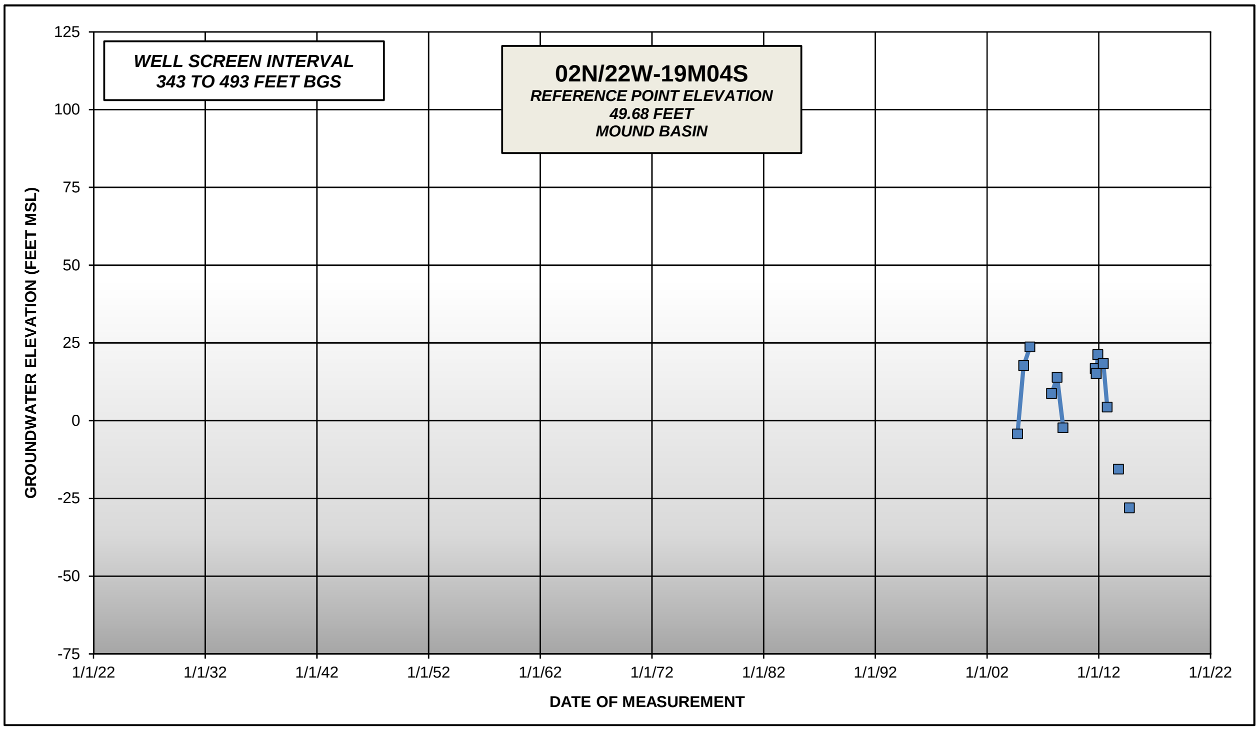

WELL SCREEN INTERVAL
170 TO 240 FEET BGS
02N/23W-15J03S
REFERENCE POINT ELEVATION
8.73 FEET
MOUND BASIN
GROUNDWATER ELEVATION (FEET MSL)
125
100
75
50
25
0
-25
-50
-75
1/1/22
1/1/32
1/1/42
1/1/52
1/1/62
1/1/72
1/1/82
1/1/92
1/1/02
1/1/12
1/1/22
DATE OF MEASUREMENT

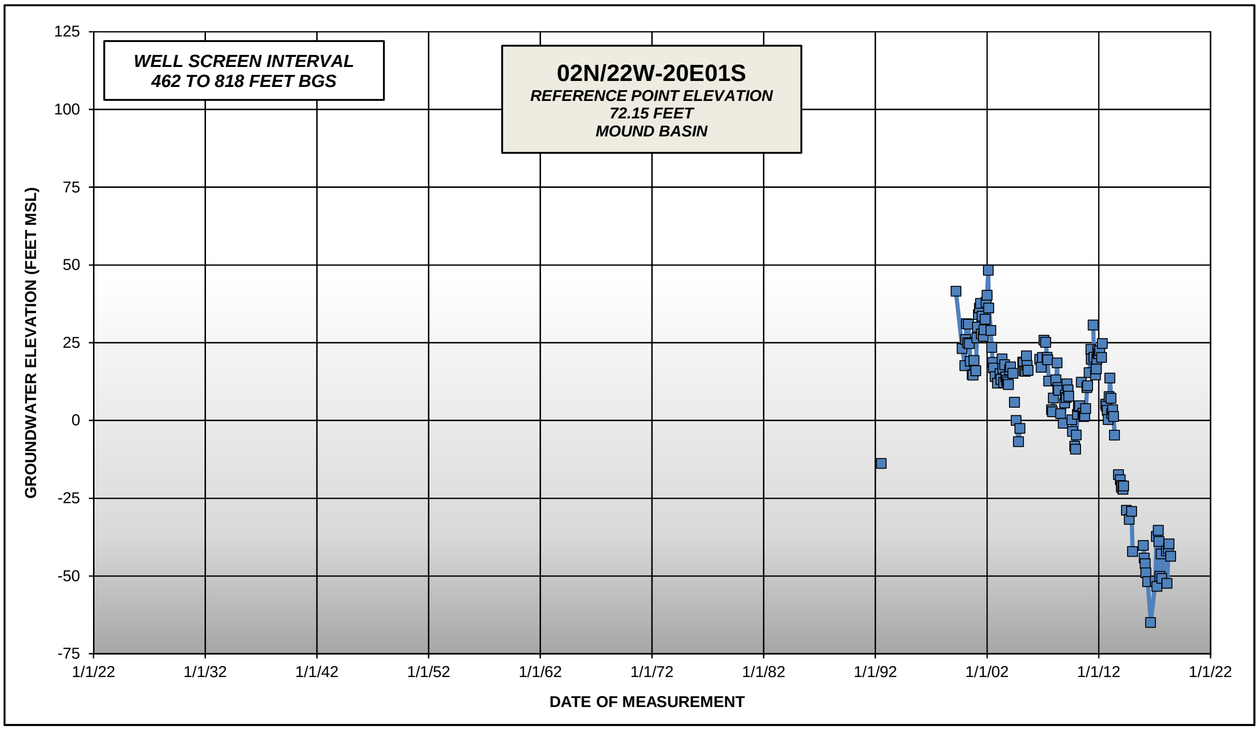

WELL SCREEN INTERVAL
480 TO 660 FEET BGS
02N/23W-15J02S
REFERENCE POINT ELEVATION
8.73 FEET
MOUND BASIN
GROUNDWATER ELEVATION (FEET MSL)
125
100
75
50
25
0
-25
-50
-75
1/1/22
1/1/32
1/1/42
1/1/52
1/1/62
1/1/72
1/1/82
1/1/92
1/1/02
1/1/12
1/1/22
DATE OF MEASUREMENT

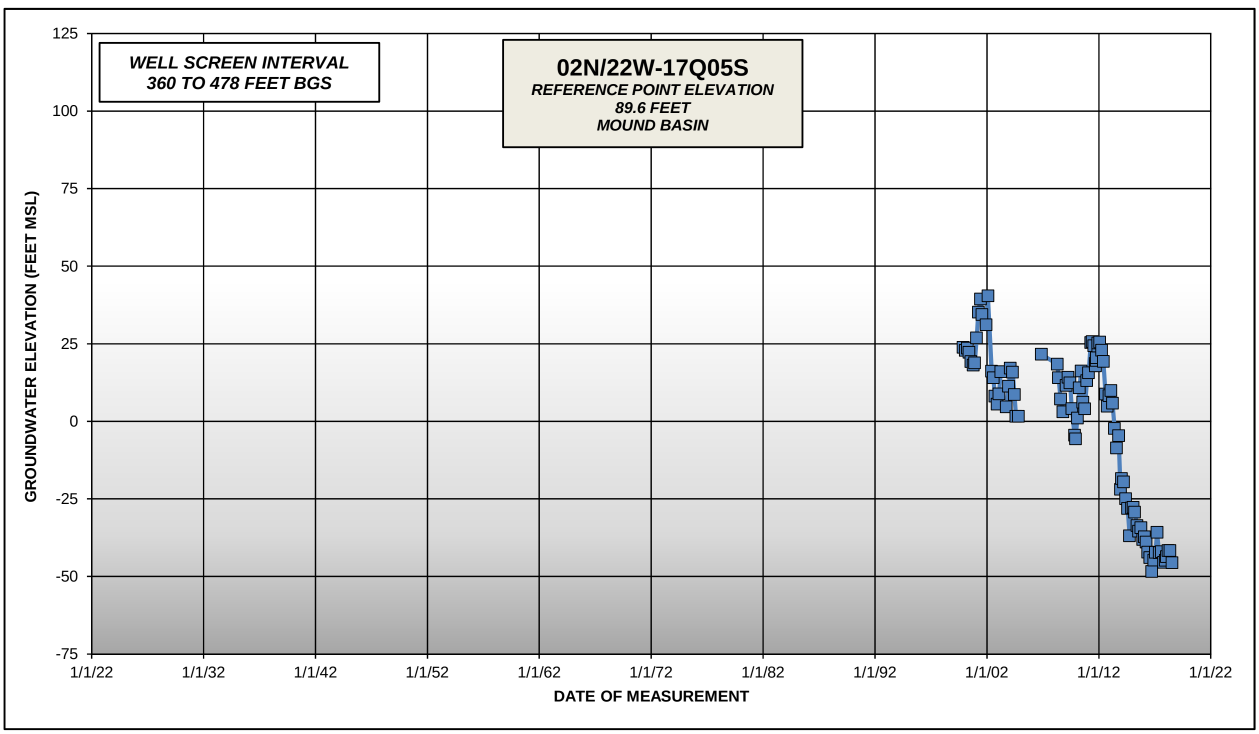

WELL SCREEN INTERVAL
970 TO 1,070 FEET BGS
02N/23W-15J01S
REFERENCE POINT ELEVATION
8.73 FEET
MOUND BASIN
GROUNDWATER ELEVATION (FEET MSL)
125
100
75
50
25
0
-25
-50
-75
1/1/22
1/1/32
1/1/42
1/1/52
1/1/62
1/1/72
1/1/82
1/1/92
1/1/02
1/1/12
1/1/22
DATE OF MEASUREMENT

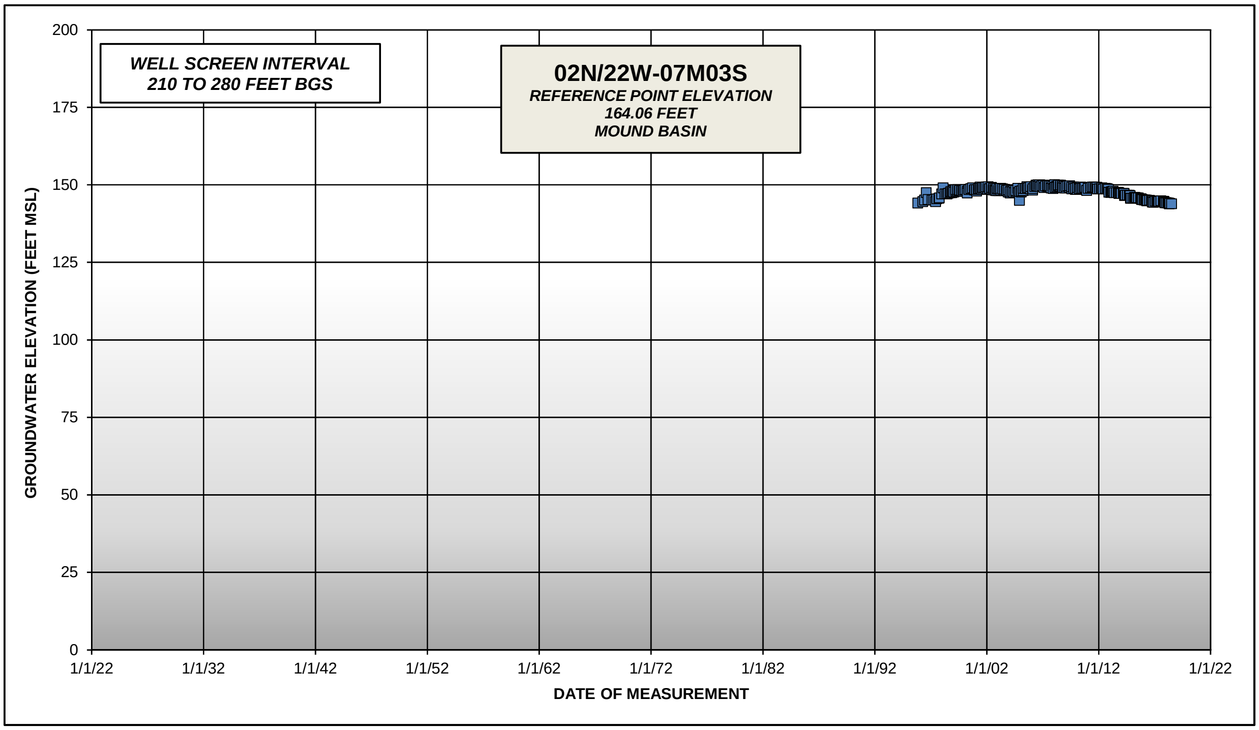

WELL SCREEN INTERVAL
742 TO 927 FEET BGS
02N/23W-24G01S
REFERENCE POINT ELEVATION
26.3 FEET
MOUND BASIN
GROUNDWATER ELEVATION (FEET MSL)
125
100
75
50
25
0
-25
-50
-75
1/1/22
1/1/32
1/1/42
1/1/52
1/1/62
1/1/72
1/1/82
1/1/92
1/1/02
1/1/12
1/1/22
DATE OF MEASUREMENT

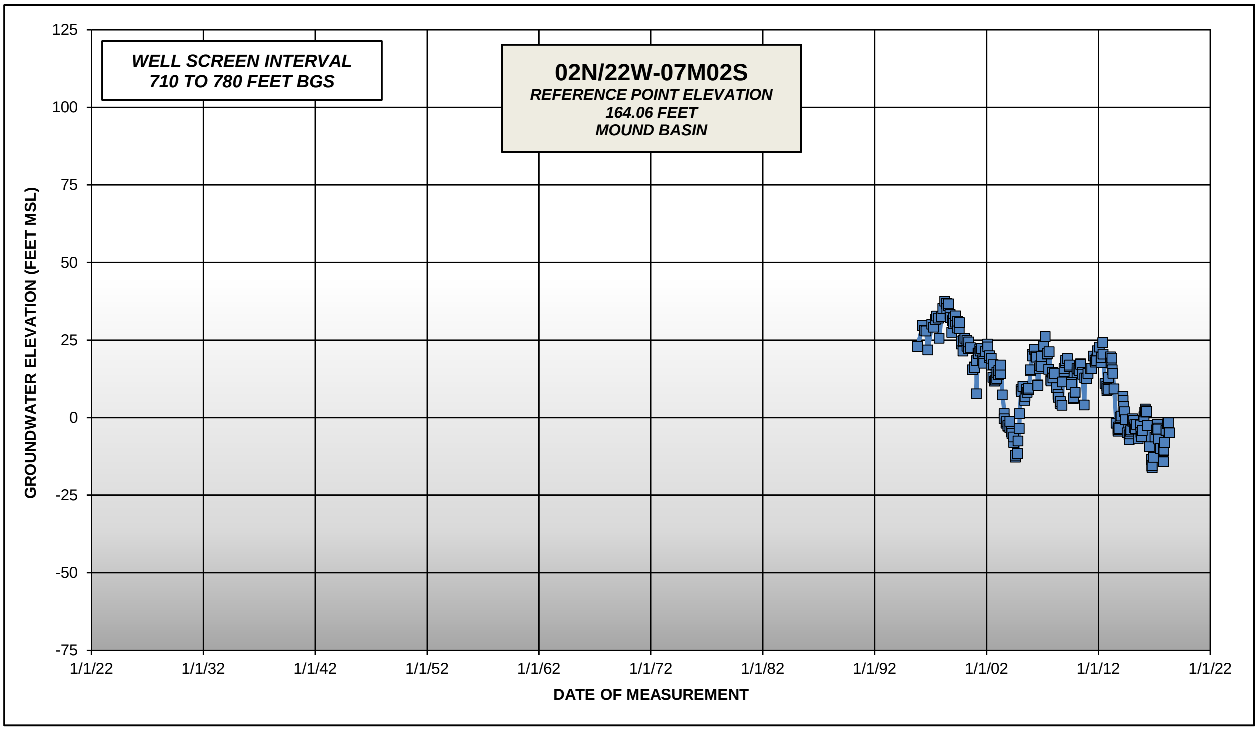

BOTH WELL SCREEN INTERVAL
800 TO 1,200 FEET BGS
02N/23W-13K03S AND -13K04S
REFERENCE POINT ELEVATION
68.71 AND 70.2 FEET
MOUND BASIN
02N23W13K04S
02N23W13K03S
GROUNDWATER ELEVATION (FEET MSL)
DATE OF MEASUREMENT
125
100
75
50
25
0
-25
-50
-75
1/1/22
1/1/32
1/1/42
1/1/52
1/1/62
1/1/72
1/1/82
1/1/92
1/1/02
1/1/12
1/1/22

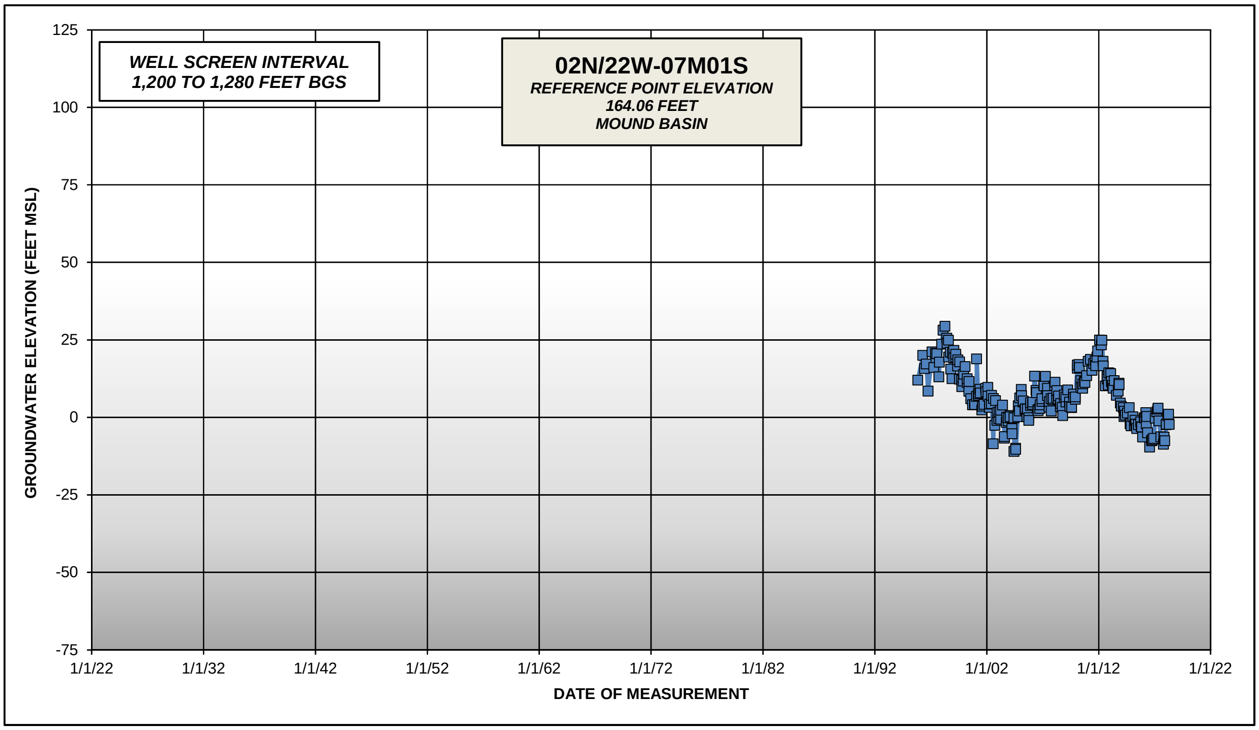

WELL SCREEN INTERVAL
343 TO 493 FEET BGS
02N/22W-19M04S
REFERENCE POINT ELEVATION
49.68 FEET
MOUND BASIN
GROUNDWATER ELEVATION (FEET MSL)
DATE OF MEASUREMENT
125
100
75
50
25
0
-25
-50
-75
1/1/22
1/1/32
1/1/42
1/1/52
1/1/62
1/1/72
1/1/82
1/1/92
1/1/02
1/1/12
1/1/22

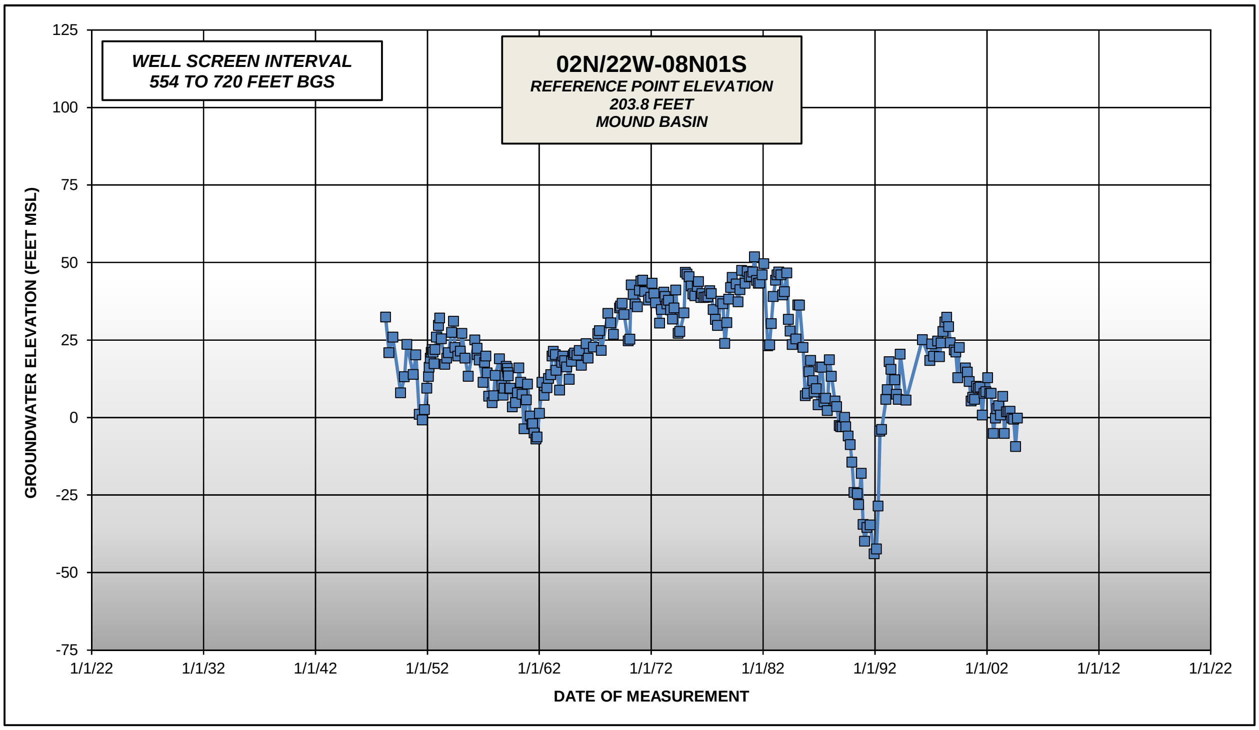

WELL SCREEN INTERVAL
462 TO 818 FEET BGS
02N/22W-20E01S
REFERENCE POINT ELEVATION
72.15 FEET
MOUND BASIN
GROUNDWATER ELEVATION (FEET MSL)
125
100
75
50
25
0
-25
-50
-75
1/1/22
1/1/32
1/1/42
1/1/52
1/1/62
1/1/72
1/1/82
1/1/92
1/1/02
1/1/12
1/1/22
DATE OF MEASUREMENT

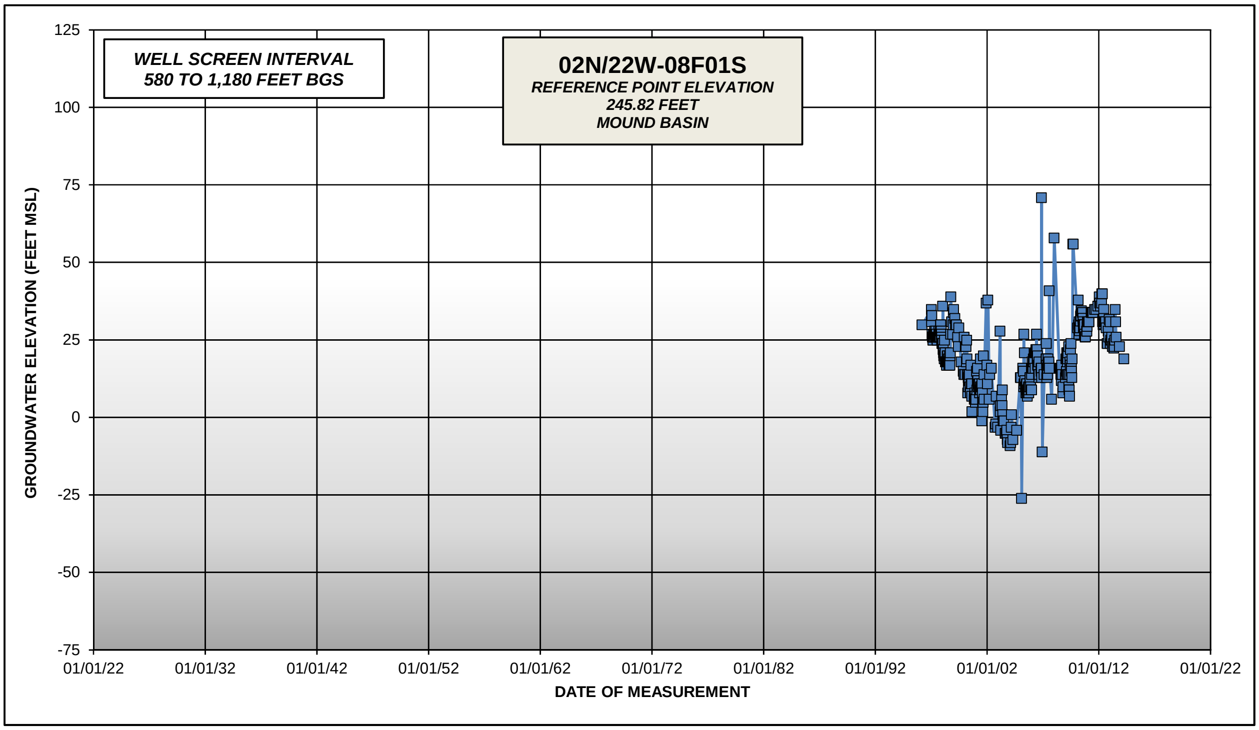

WELL SCREEN INTERVAL
360 TO 478 FEET BGS
02N/22W-17Q05S
REFERENCE POINT ELEVATION
89.6 FEET
MOUND BASIN
GROUNDWATER ELEVATION (FEET MSL)
125
100
75
50
25
0
-25
-50
-75
1/1/22
1/1/32
1/1/42
1/1/52
1/1/62
1/1/72
1/1/82
1/1/92
1/1/02
1/1/12
1/1/22
DATE OF MEASUREMENT

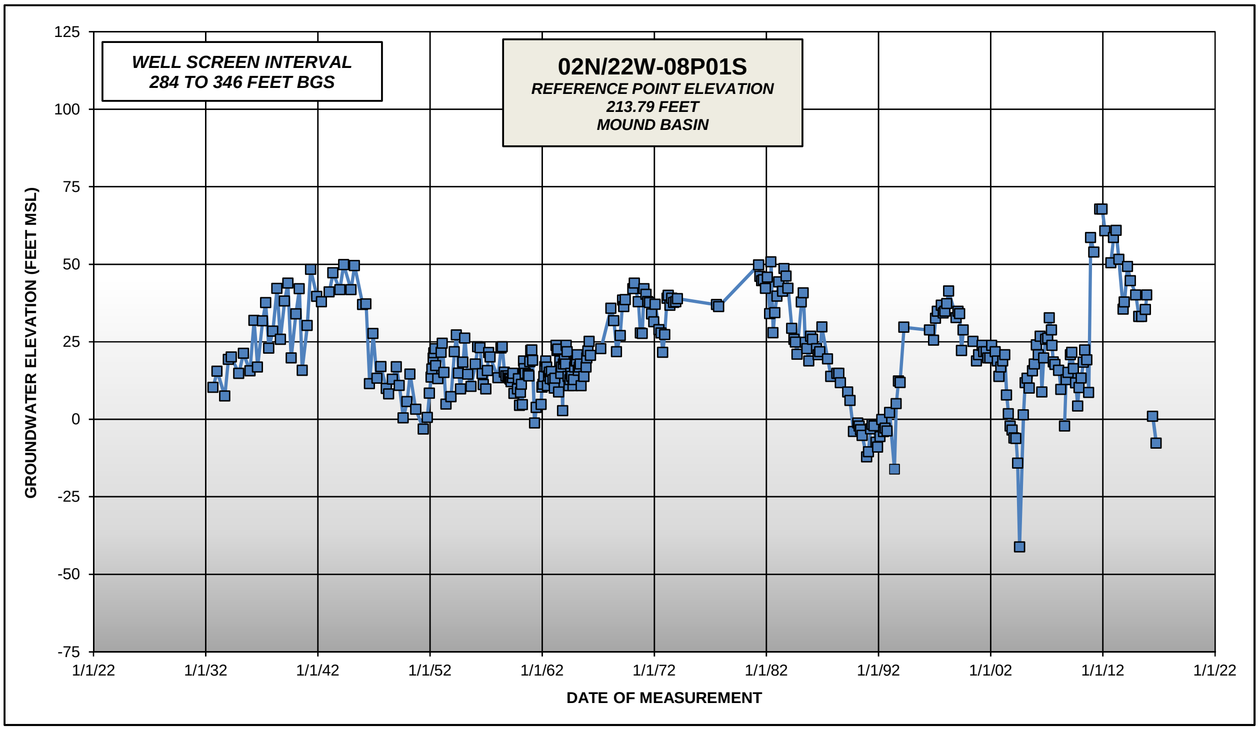

WELL SCREEN INTERVAL
210 TO 280 FEET BGS
02N/22W-07M03S
REFERENCE POINT ELEVATION
164.06 FEET
MOUND BASIN
GROUNDWATER ELEVATION (FEET MSL)
200
175
150
125
100
75
50
25
0
1/1/22
1/1/32
1/1/42
1/1/52
1/1/62
1/1/72
1/1/82
1/1/92
1/1/02
1/1/12
1/1/22
DATE OF MEASUREMENT

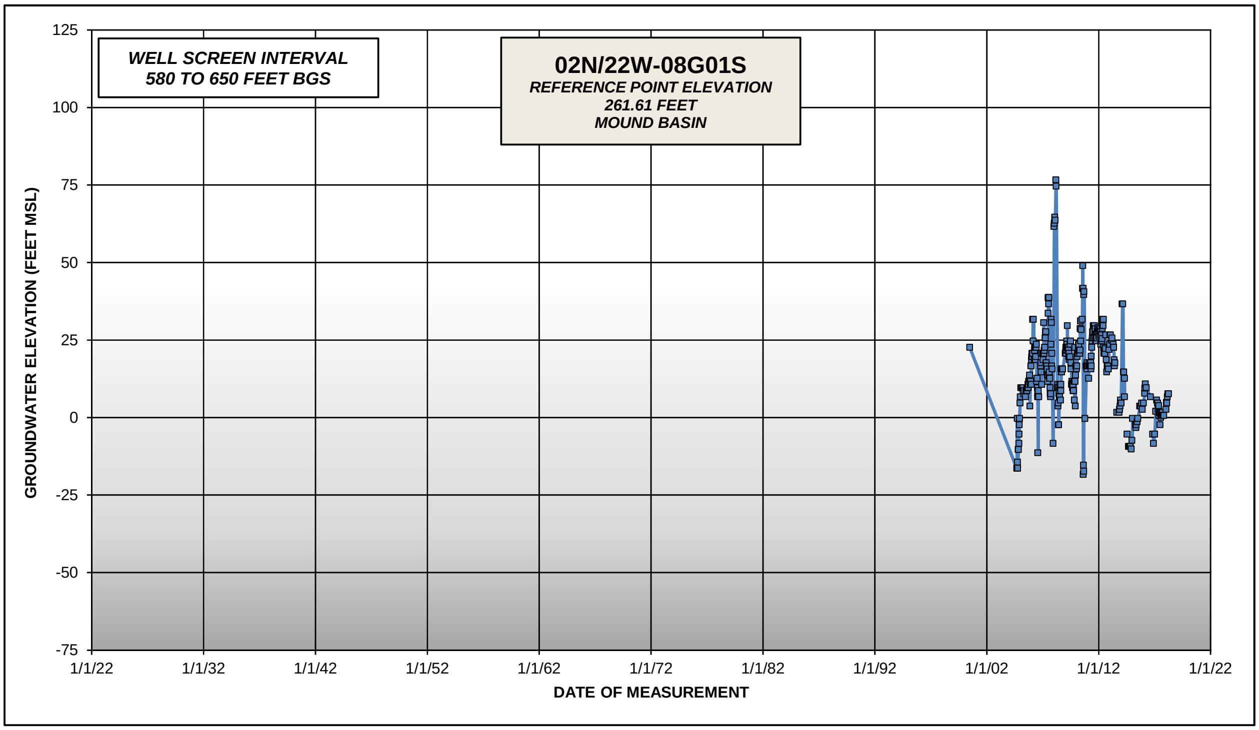

WELL SCREEN INTERVAL
710 TO 780 FEET BGS
02N/22W-07M02S
REFERENCE POINT ELEVATION
164.06 FEET
MOUND BASIN
GROUNDWATER ELEVATION (FEET MSL)
125
100
75
50
25
0
-25
-50
-75
1/1/22
1/1/32
1/1/42
1/1/52
1/1/62
1/1/72
1/1/82
1/1/92
1/1/02
1/1/12
1/1/22
DATE OF MEASUREMENT

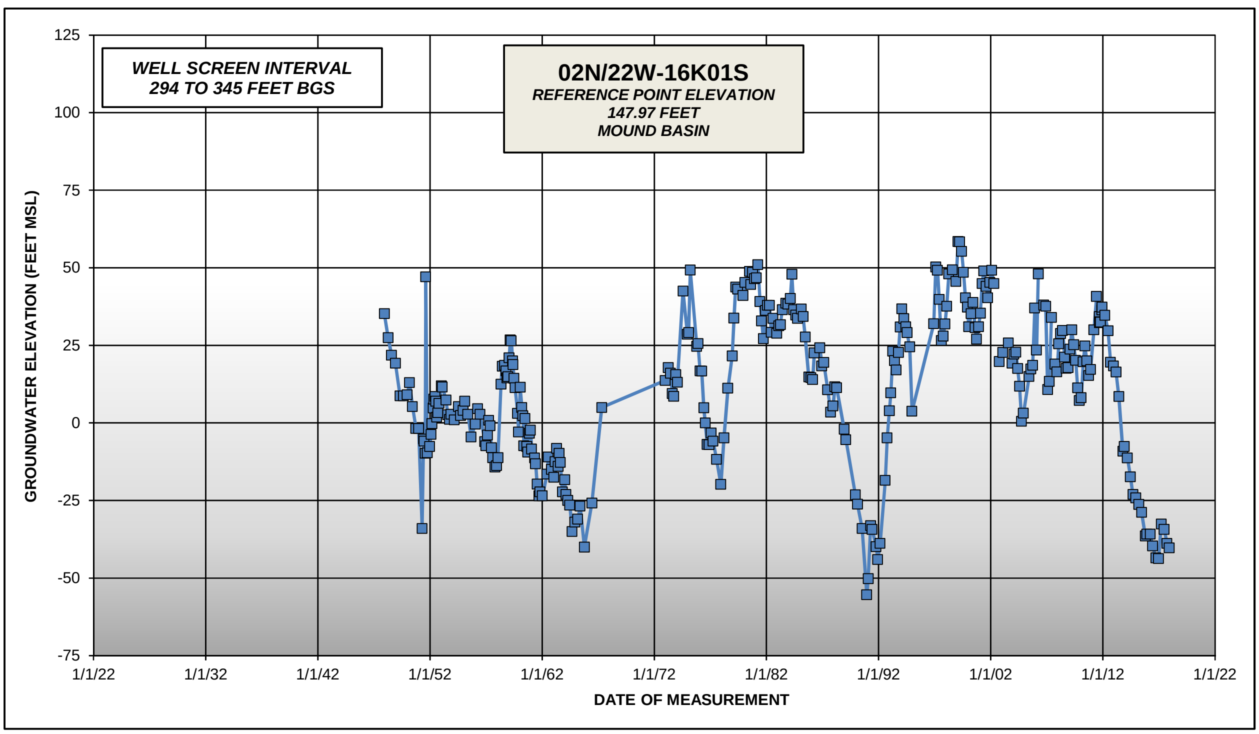

WELL SCREEN INTERVAL
1,200 TO 1,280 FEET BGS
02N/22W-07M01S
REFERENCE POINT ELEVATION
164.06 FEET
MOUND BASIN
GROUNDWATER ELEVATION (FEET MSL)
125
100
75
50
25
0
-25
-50
-75
1/1/22
1/1/32
1/1/42
1/1/52
1/1/62
1/1/72
1/1/82
1/1/92
1/1/02
1/1/12
1/1/22
DATE OF MEASUREMENT

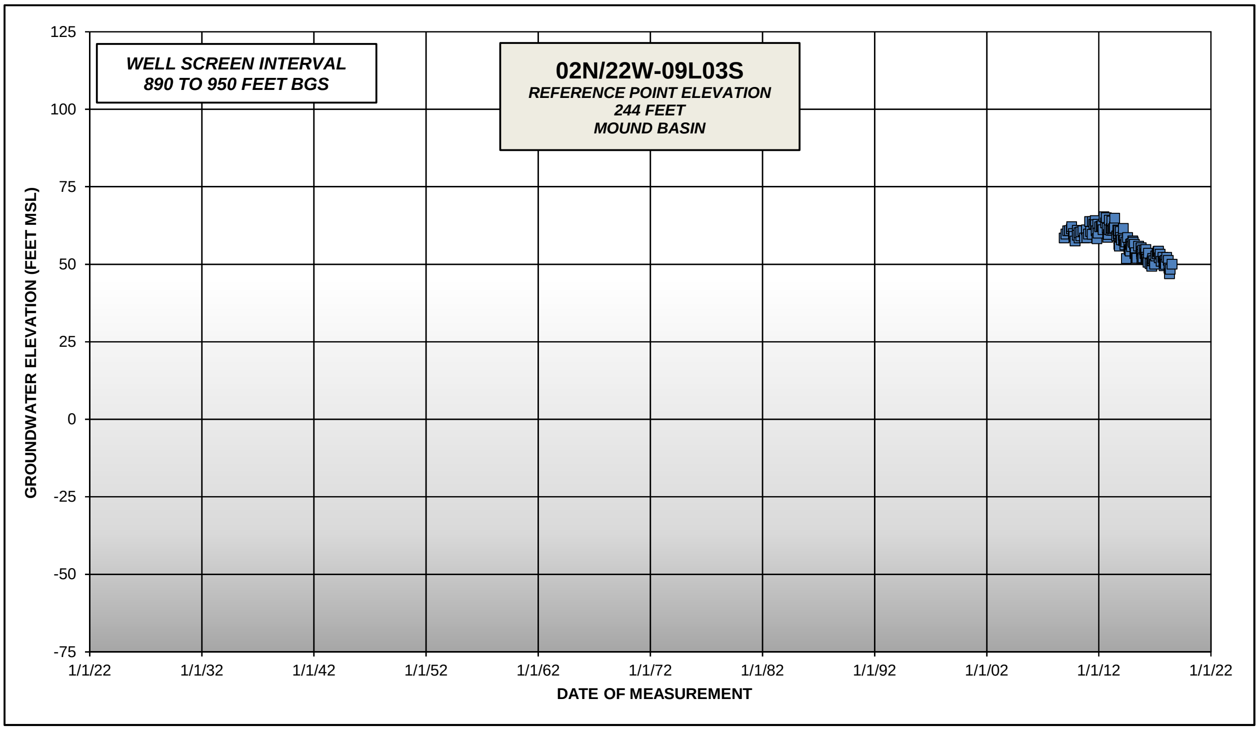

WELL SCREEN INTERVAL
554 TO 720 FEET BGS
02N/22W-08N01S
REFERENCE POINT ELEVATION
203.8 FEET
MOUND BASIN
GROUNDWATER ELEVATION (FEET MSL)
125
100
75
50
25
0
-25
-50
-75
1/1/22
1/1/32
1/1/42
1/1/52
1/1/62
1/1/72
1/1/82
1/1/92
1/1/02
1/1/12
1/1/22
DATE OF MEASUREMENT

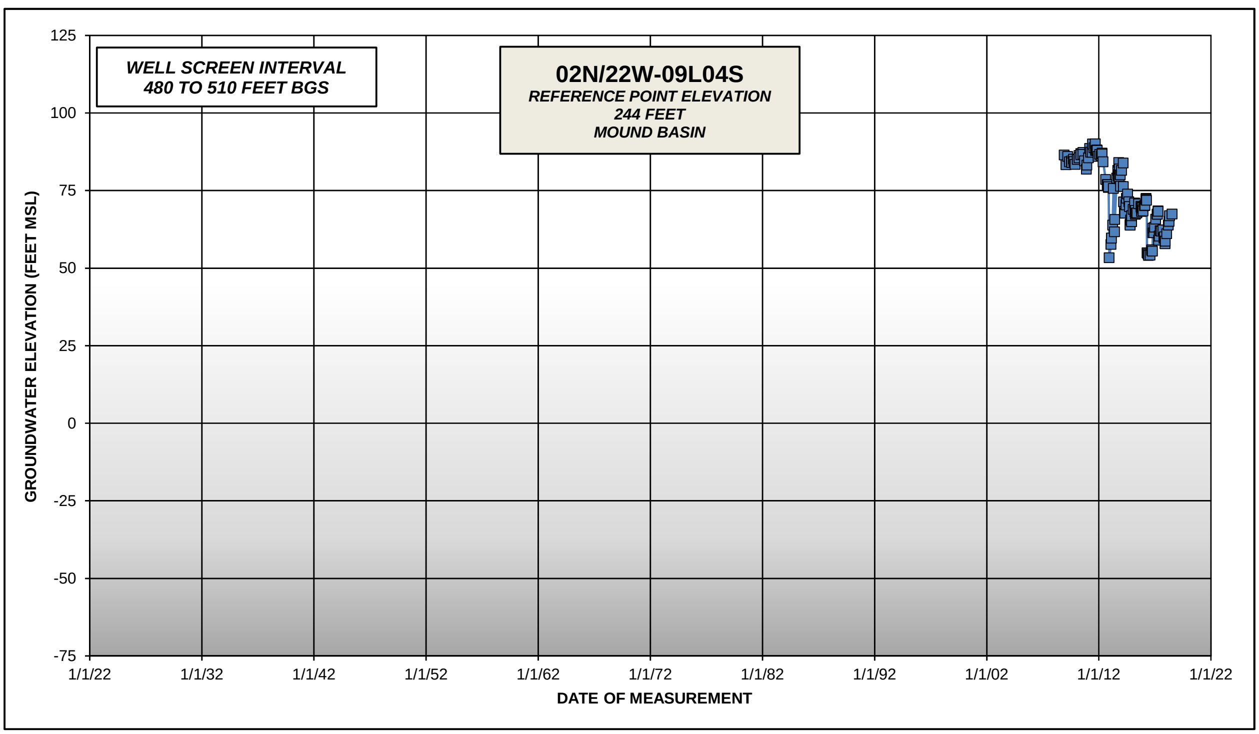

WELL SCREEN INTERVAL
580 TO 1,180 FEET BGS
02N/22W-08F01S
REFERENCE POINT ELEVATION
245.82 FEET
MOUND BASIN
GROUNDWATER ELEVATION (FEET MSL)
125
100
75
50
25
0
-25
-50
-75
01/01/22
01/01/32
01/01/42
01/01/52
01/01/62
01/01/72
01/01/82
01/01/92
01/01/02
01/01/12
01/01/22
DATE OF MEASUREMENT

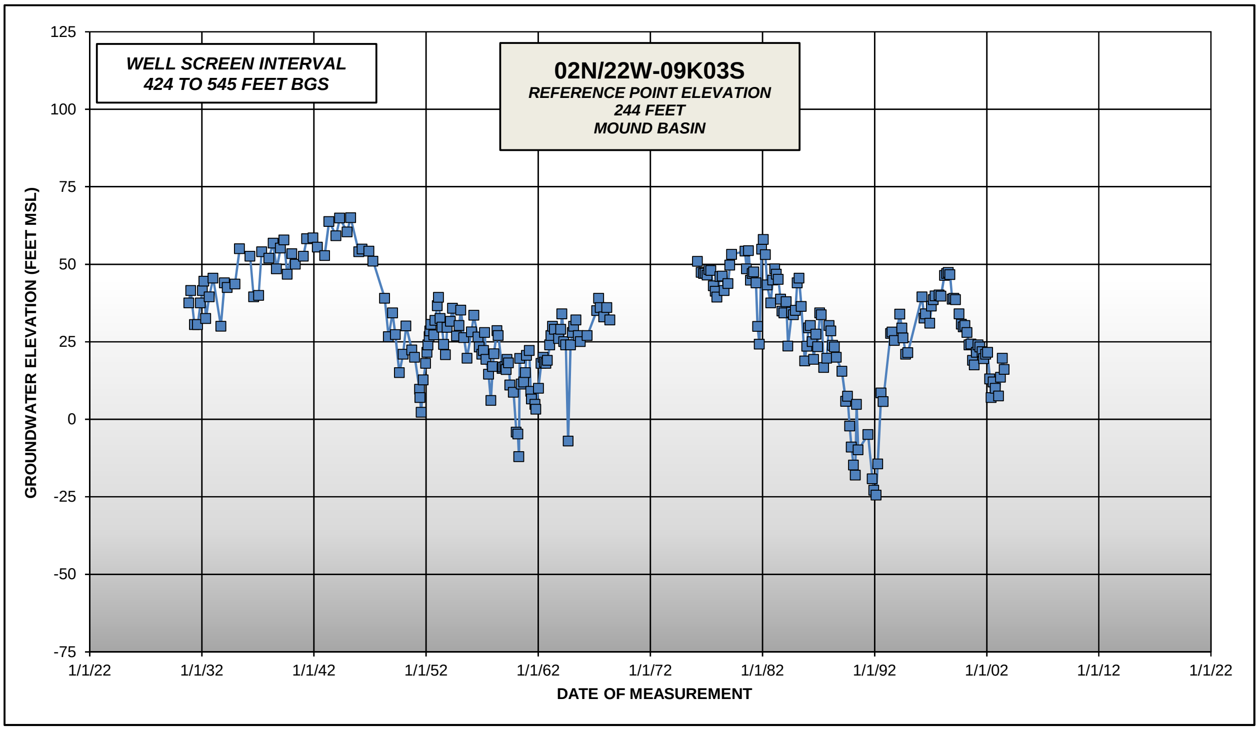

WELL SCREEN INTERVAL
284 TO 346 FEET BGS
02N/22W-08P01S
REFERENCE POINT ELEVATION
213.79 FEET
MOUND BASIN
GROUNDWATER ELEVATION (FEET MSL)
125
100
75
50
25
0
-25
-50
-75
1/1/22
1/1/32
1/1/42
1/1/52
1/1/62
1/1/72
1/1/82
1/1/92
1/1/02
1/1/12
1/1/22
DATE OF MEASUREMENT

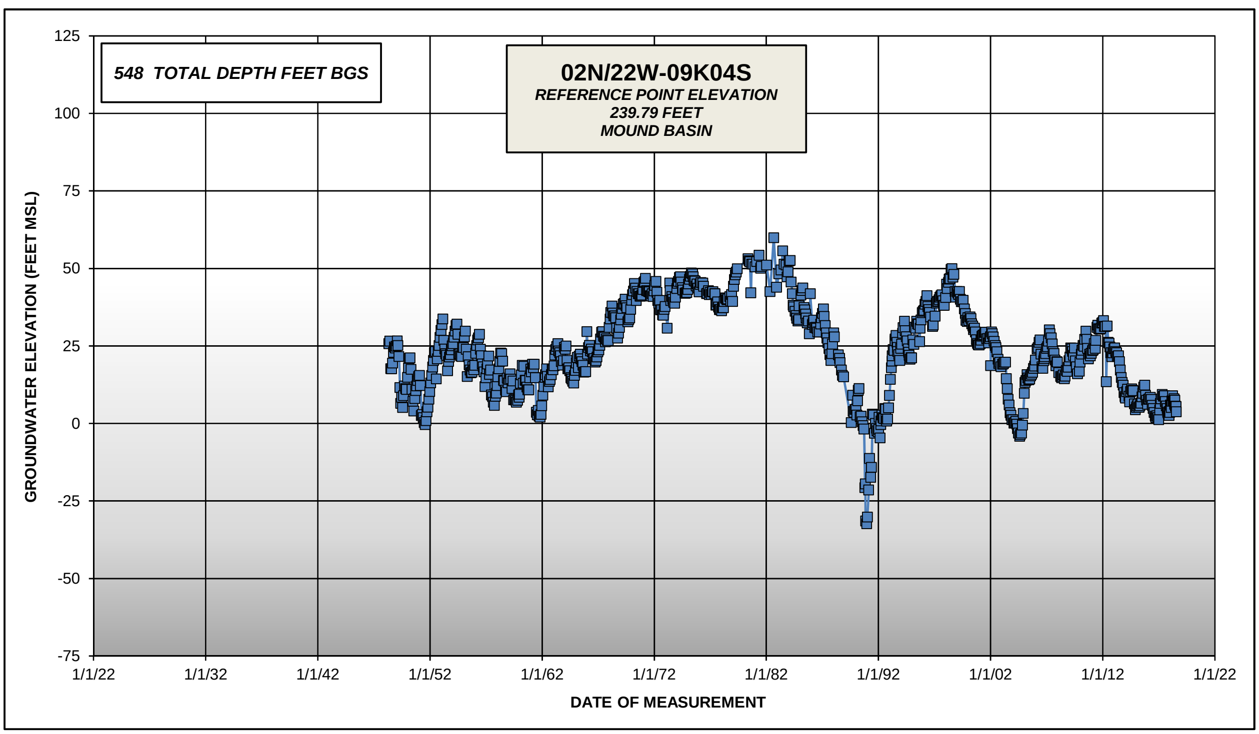

WELL SCREEN INTERVAL
580 TO 650 FEET BGS
02N/22W-08G01S
REFERENCE POINT ELEVATION
261.61 FEET
MOUND BASIN
GROUNDWATER ELEVATION (FEET MSL)
125
100
75
50
25
0
-25
-50
-75
1/1/22
1/1/32
1/1/42
1/1/52
1/1/62
1/1/72
1/1/82
1/1/92
1/1/02
1/1/12
1/1/22
DATE OF MEASUREMENT

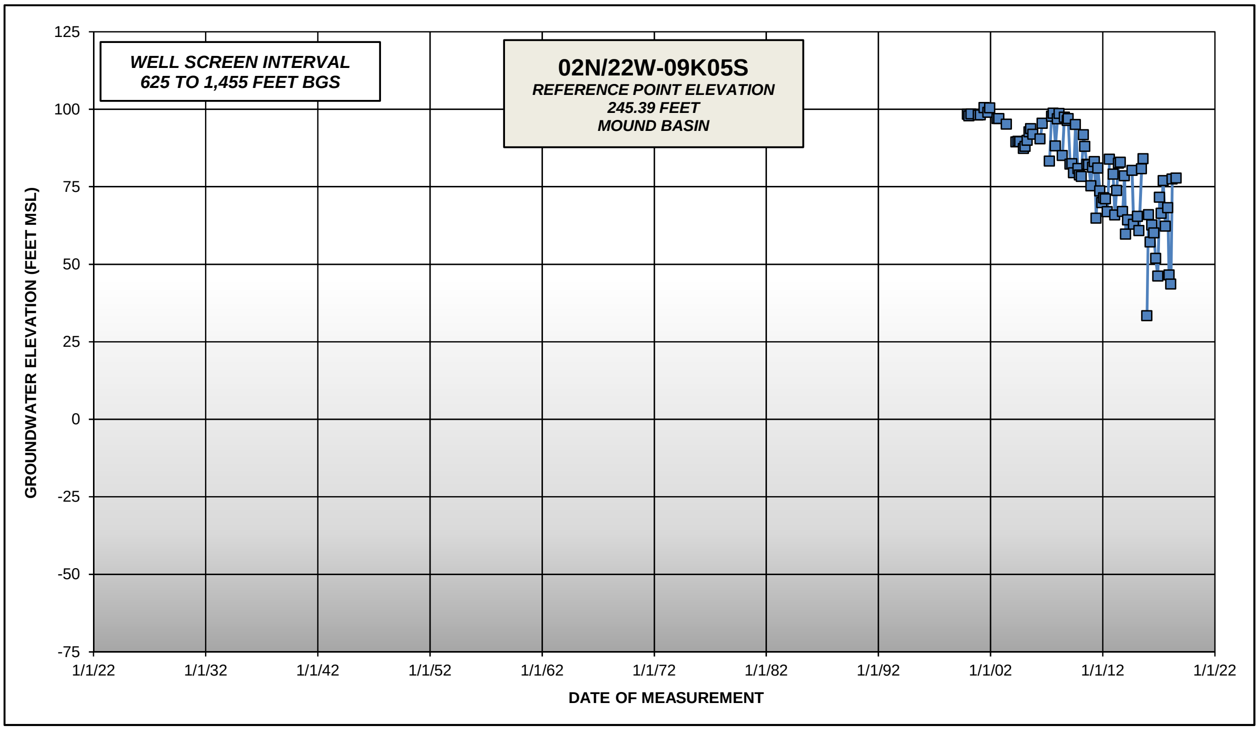

WELL SCREEN INTERVAL
294 TO 345 FEET BGS
02N/22W-16K01S
REFERENCE POINT ELEVATION
147.97 FEET
MOUND BASIN
GROUNDWATER ELEVATION (FEET MSL)
125
100
75
50
25
0
-25
-50
-75
1/1/22
1/1/32
1/1/42
1/1/52
1/1/62
1/1/72
1/1/82
1/1/92
1/1/02
1/1/12
1/1/22
DATE OF MEASUREMENT


WELL SCREEN INTERVAL
890 TO 950 FEET BGS
02N/22W-09L03S
REFERENCE POINT ELEVATION
244 FEET
MOUND BASIN
GROUNDWATER ELEVATION (FEET MSL)
125
100
75
50
25
0
-25
-50
-75
1/1/22
1/1/32
1/1/42
1/1/52
1/1/62
1/1/72
1/1/82
1/1/92
1/1/02
1/1/12
1/1/22
DATE OF MEASUREMENT

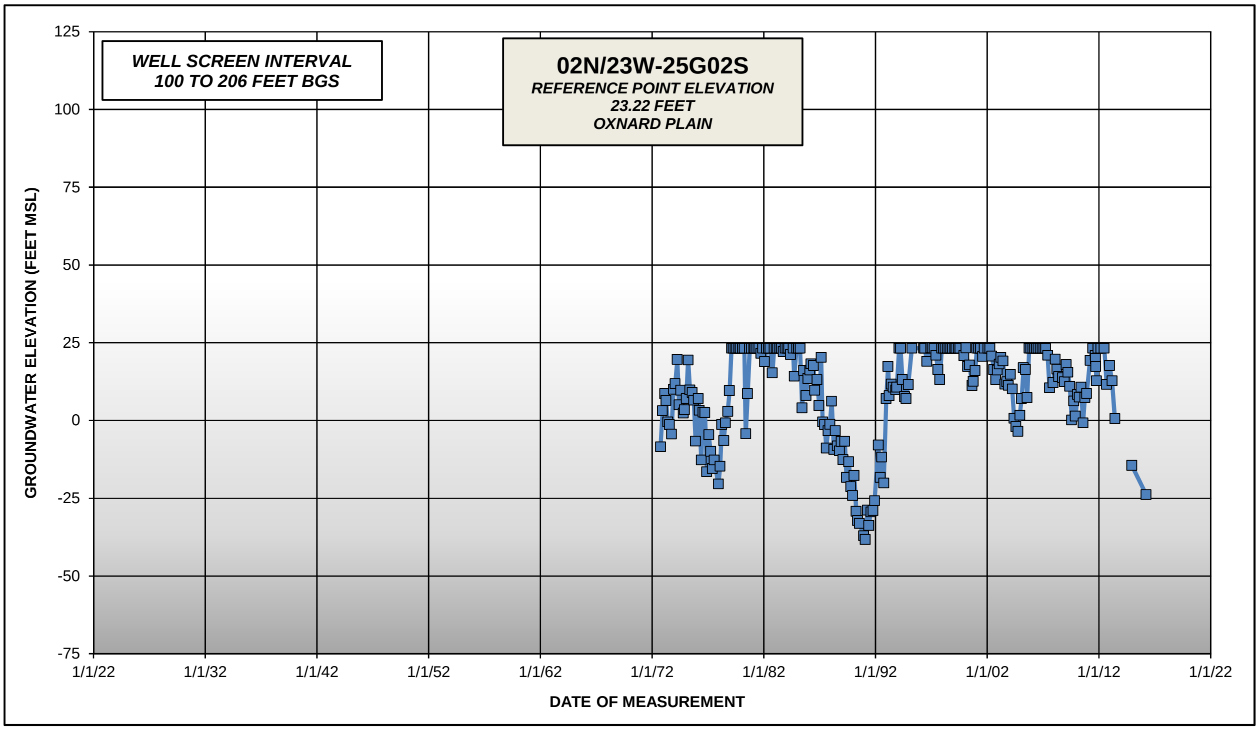

WELL SCREEN INTERVAL
480 TO 510 FEET BGS
02N/22W-09L04S
REFERENCE POINT ELEVATION
244 FEET
MOUND BASIN
GROUNDWATER ELEVATION (FEET MSL)
125
100
75
50
25
0
-25
-50
-75
1/1/22
1/1/32
1/1/42
1/1/52
1/1/62
1/1/72
1/1/82
1/1/92
1/1/02
1/1/12
1/1/22
DATE OF MEASUREMENT

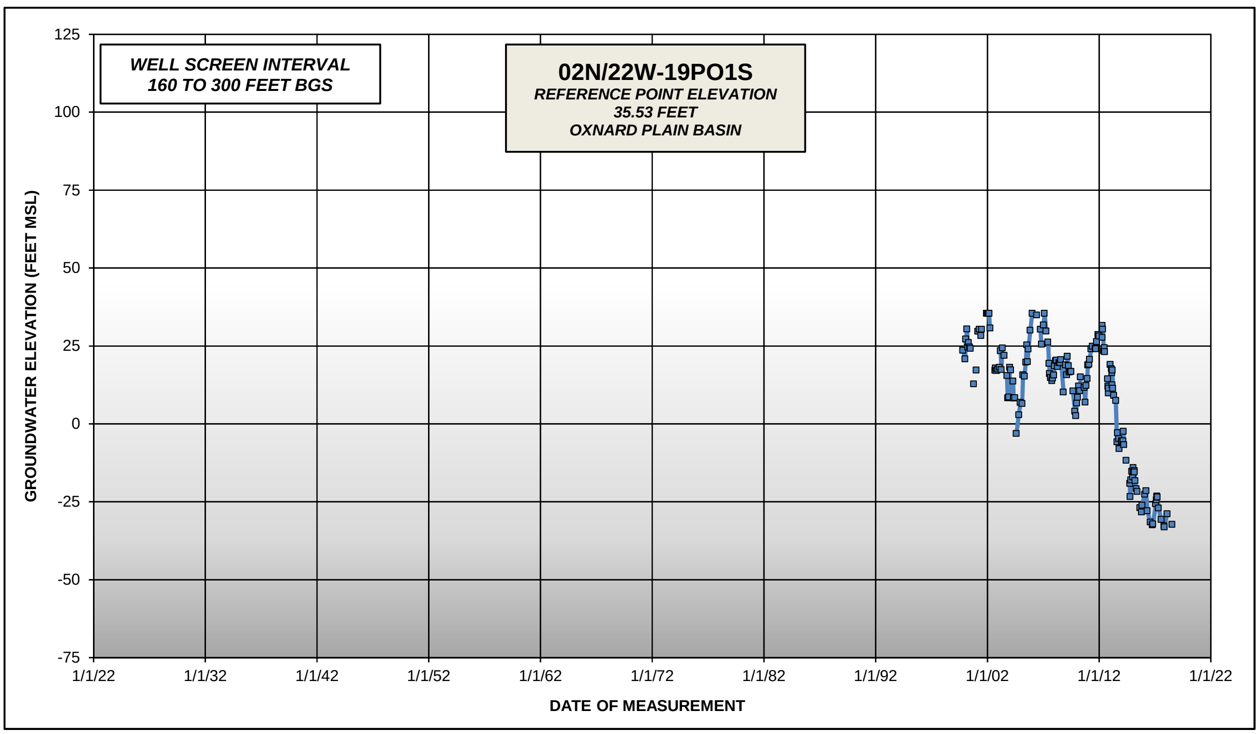

WELL SCREEN INTERVAL
424 TO 545 FEET BGS
02N/22W-09K03S
REFERENCE POINT ELEVATION
244 FEET
MOUND BASIN
GROUNDWATER ELEVATION (FEET MSL)
125
100
75
50
25
0
-25
-50
-75
1/1/22
1/1/32
1/1/42
1/1/52
1/1/62
1/1/72
1/1/82
1/1/92
1/1/02
1/1/12
1/1/22
DATE OF MEASUREMENT

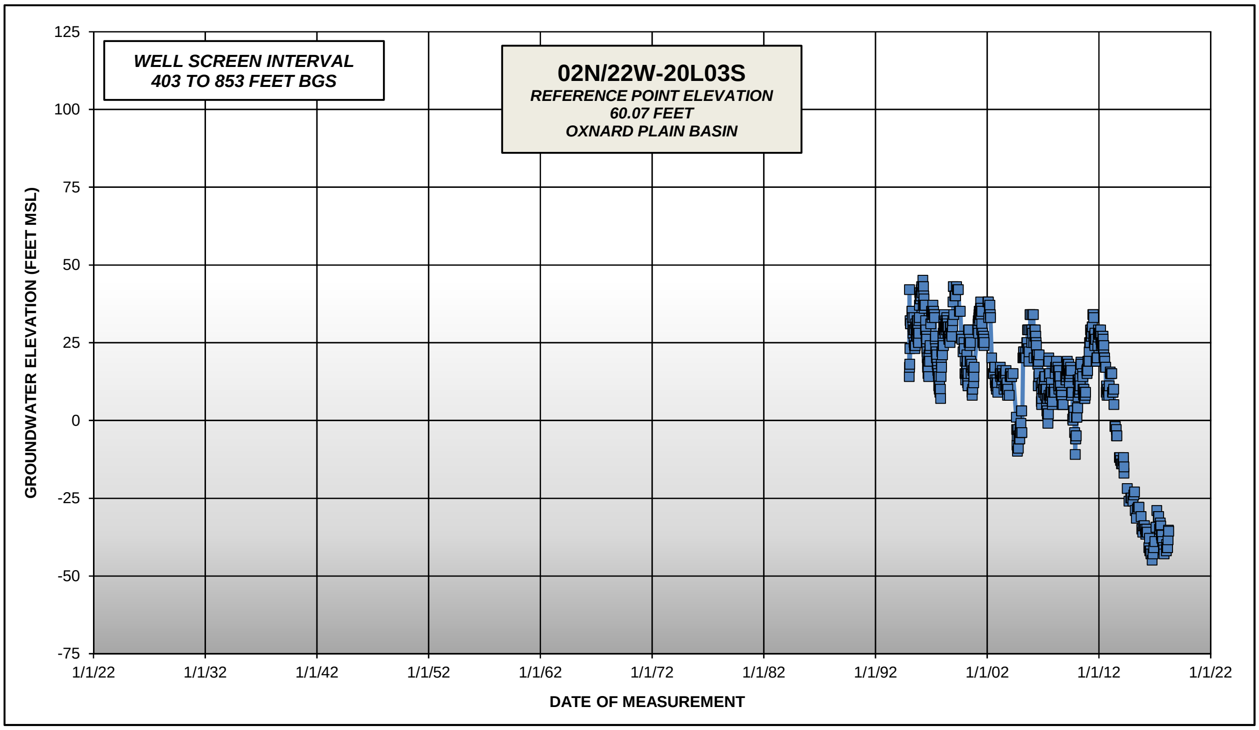

548 TOTAL DEPTH FEET BGS
02N/22W-09K04S
REFERENCE POINT ELEVATION
239.79 FEET
MOUND BASIN
GROUNDWATER ELEVATION (FEET MSL)
125
100
75
50
25
0
-25
-50
-75
1/1/22
1/1/32
1/1/42
1/1/52
1/1/62
1/1/72
1/1/82
1/1/92
1/1/02
1/1/12
1/1/22
DATE OF MEASUREMENT

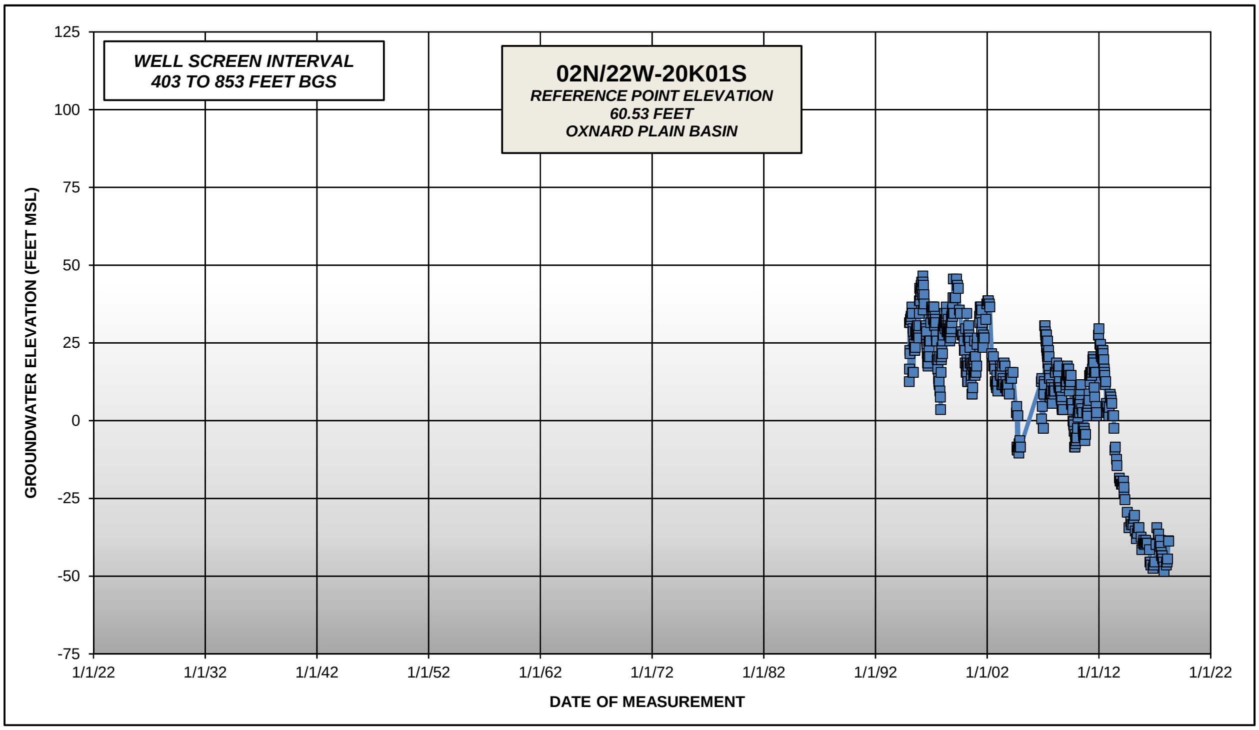

WELL SCREEN INTERVAL
625 TO 1,455 FEET BGS
02N/22W-09K05S
REFERENCE POINT ELEVATION
245.39 FEET
MOUND BASIN
GROUNDWATER ELEVATION (FEET MSL)
125
100
75
50
25
0
-25
-50
-75
1/1/22
1/1/32
1/1/42
1/1/52
1/1/62
1/1/72
1/1/82
1/1/92
1/1/02
1/1/12
1/1/22
DATE OF MEASUREMENT

OXNARD PLAIN BASIN

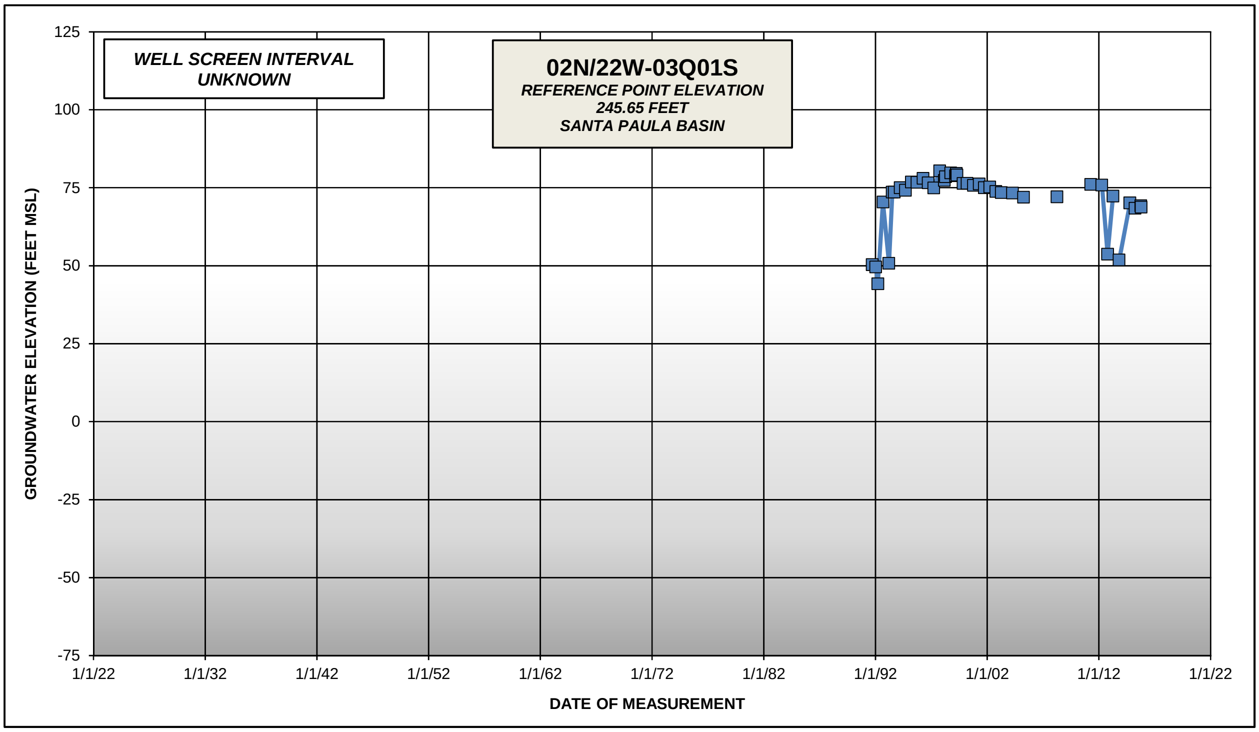

WELL SCREEN INTERVAL
100 TO 206 FEET BGS
02N/23W-25G02S
REFERENCE POINT ELEVATION
23.22 FEET
OXNARD PLAIN
GROUNDWATER ELEVATION (FEET MSL)
125
100
75
50
25
0
-25
-50
-75
1/1/22
1/1/32
1/1/42
1/1/52
1/1/62
1/1/72
1/1/82
1/1/92
1/1/02
1/1/12
1/1/22
DATE OF MEASUREMENT

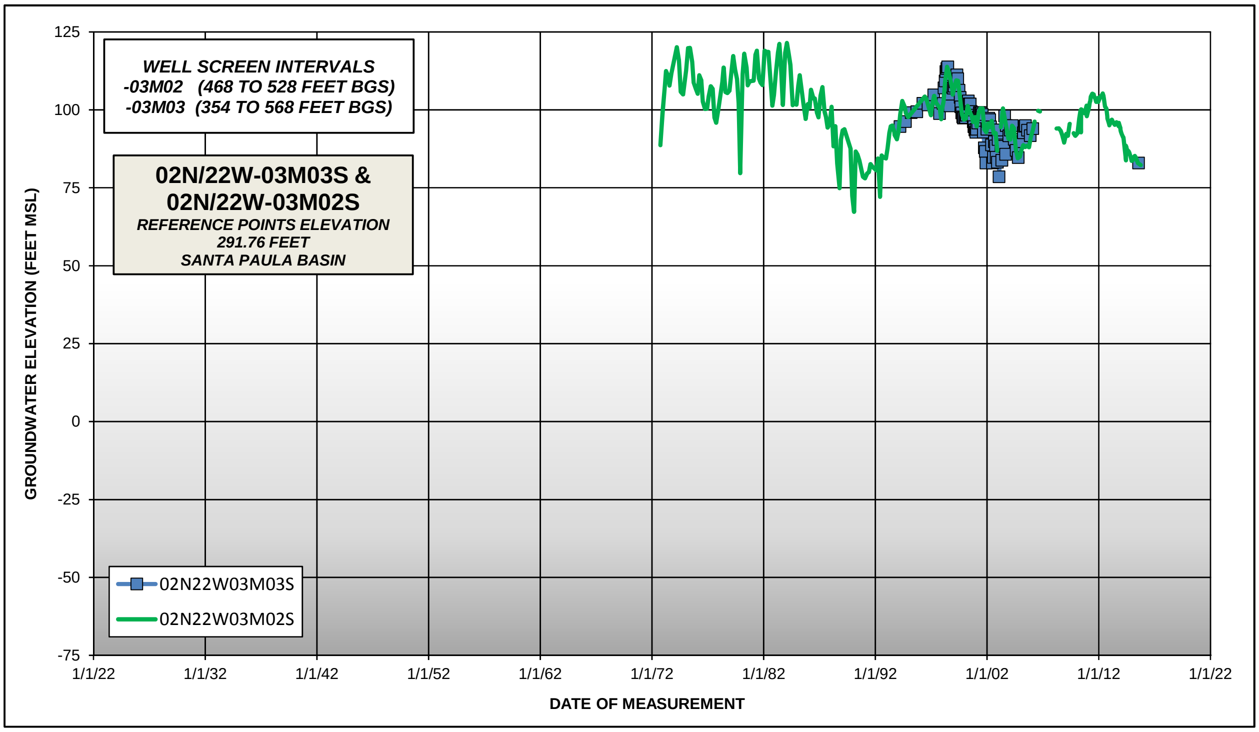

WELL SCREEN INTERVAL
160 TO 300 FEET BGS
02N/22W-19PO1S
REFERENCE POINT ELEVATION
35.53 FEET
OXNARD PLAIN BASIN
GROUNDWATER ELEVATION (FEET MSL)
125
100
75
50
25
0
-25
-50
-75
1/1/22
1/1/32
1/1/42
1/1/52
1/1/62
1/1/72
1/1/82
1/1/92
1/1/02
1/1/12
1/1/22
DATE OF MEASUREMENT


WELL SCREEN INTERVAL
403 TO 853 FEET BGS
02N/22W-20L03S
REFERENCE POINT ELEVATION
60.07 FEET
OXNARD PLAIN BASIN
GROUNDWATER ELEVATION (FEET MSL)
125
100
75
50
25
0
-25
-50
-75
1/1/22
1/1/32
1/1/42
1/1/52
1/1/62
1/1/72
1/1/82
1/1/92
1/1/02
1/1/12
1/1/22
DATE OF MEASUREMENT

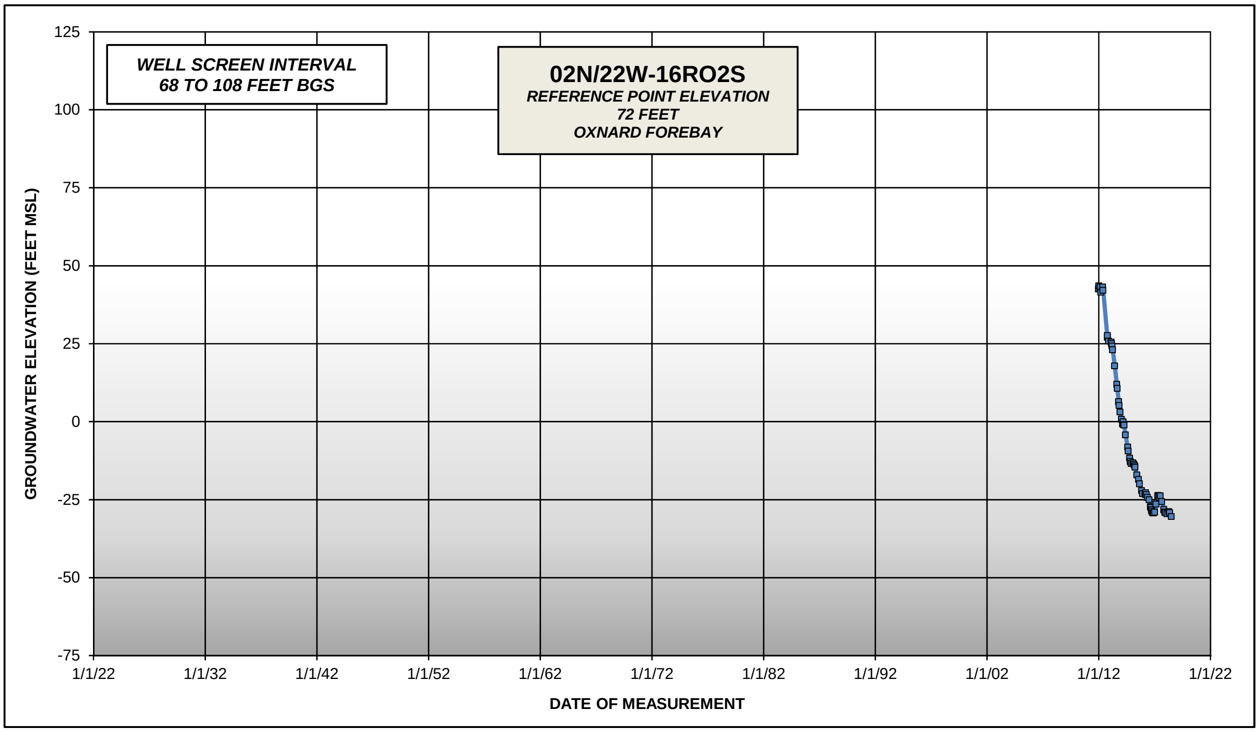

WELL SCREEN INTERVAL
403 TO 853 FEET BGS
02N/22W-20K01S
REFERENCE POINT ELEVATION
60.53 FEET
OXNARD PLAIN BASIN
GROUNDWATER ELEVATION (FEET MSL)
125
100
75
50
25
0
-25
-50
-75
1/1/22
1/1/32
1/1/42
1/1/52
1/1/62
1/1/72
1/1/82
1/1/92
1/1/02
1/1/12
1/1/22
DATE OF MEASUREMENT

SANTA PAULA BASIN

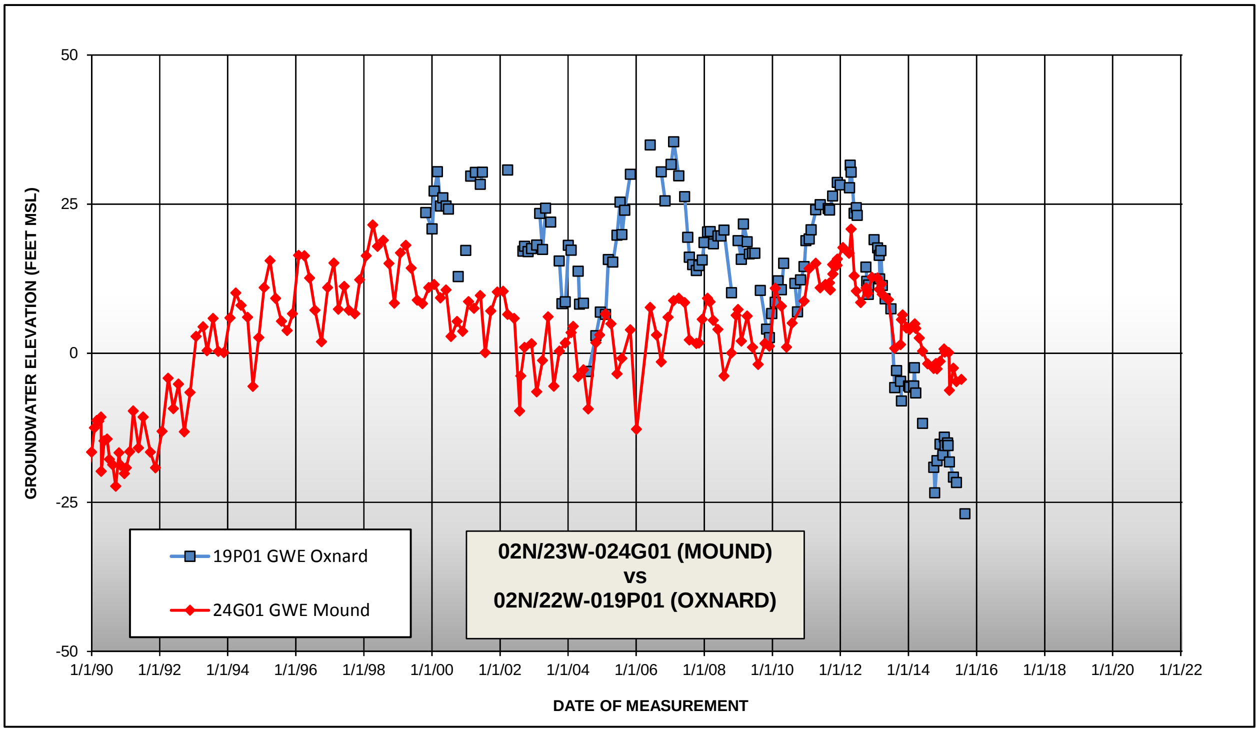

WELL SCREEN INTERVAL
UNKNOWN
02N/22W-03Q01S
REFERENCE POINT ELEVATION
245.65 FEET
SANTA PAULA BASIN
GROUNDWATER ELEVATION (FEET MSL)
125
100
75
50
25
0
-25
-50
-75
1/1/22
1/1/32
1/1/42
1/1/52
1/1/62
1/1/72
1/1/82
1/1/92
1/1/02
1/1/12
1/1/22
DATE OF MEASUREMENT

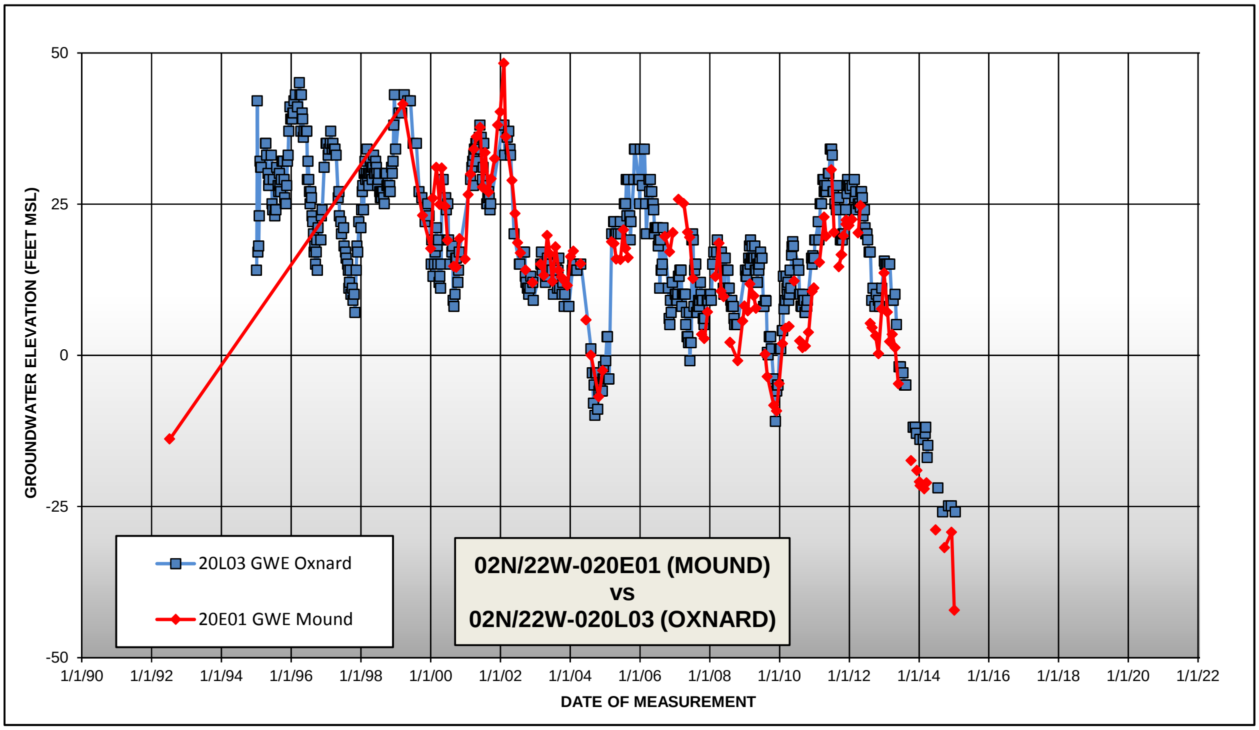

WELL SCREEN INTERVALS
-03M02 (468 TO 528 FEET BGS)
-03M03 (354 TO 568 FEET BGS)
02N/22W-03M03S &
02N/22W-03M02S
REFERENCE POINTS ELEVATION
291.76 FEET
SANTA PAULA BASIN
02N22W03M03S
02N22W03M02S
GROUNDWATER ELEVATION (FEET MSL)
125
100
75
50
25
0
-25
-50
-75
1/1/22
1/1/32
1/1/42
1/1/52
1/1/62
1/1/72
1/1/82
1/1/92
1/1/02
1/1/12
1/1/22
DATE OF MEASUREMENT

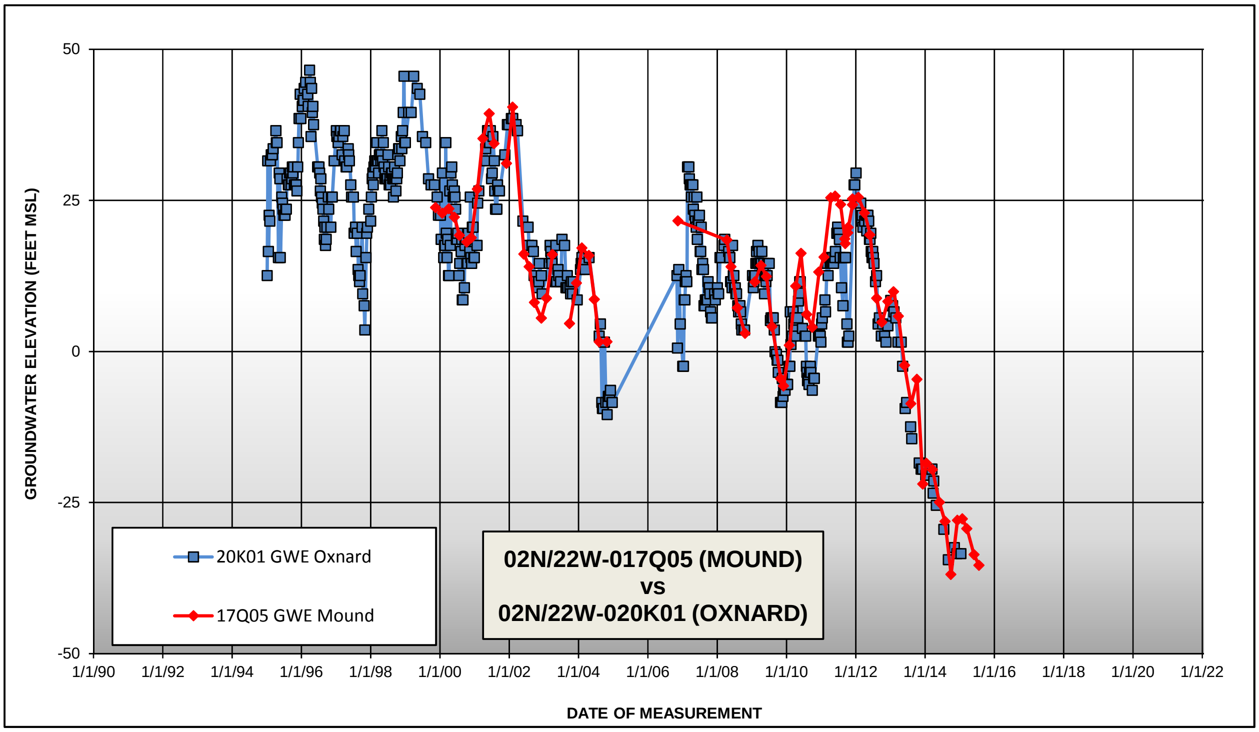
OXNARD FOREBAY BASIN

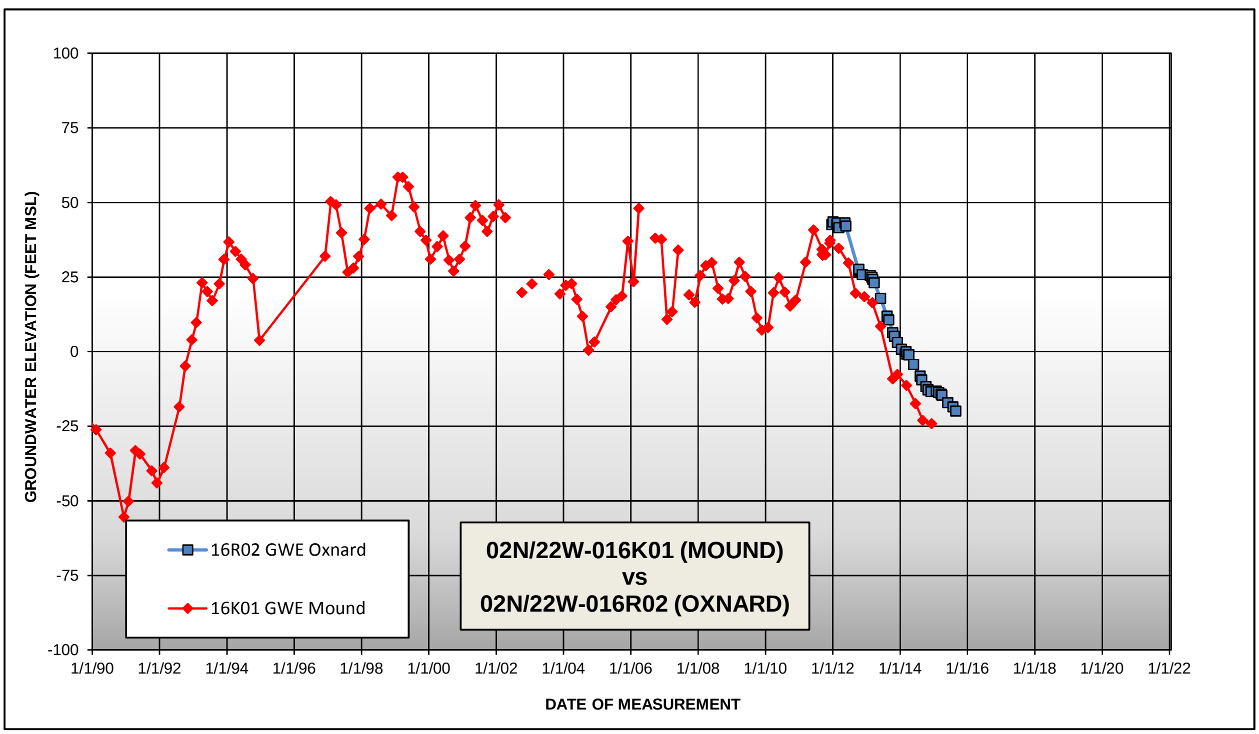

WELL SCREEN INTERVAL
68 TO 108 FEET BGS
02N/22W-16RO2S
REFERENCE POINT ELEVATION
72 FEET
OXNARD FOREBAY
GROUNDWATER ELEVATION (FEET MSL)
125
100
75
50
25
0
-25
-50
-75
1/1/22
1/1/32
1/1/42
1/1/52
1/1/62
1/1/72
1/1/82
1/1/92
1/1/02
1/1/12
1/1/22
DATE OF MEASUREMENT

SOUTHERN BASIN
BOUNDARY HYDROGRAPHS

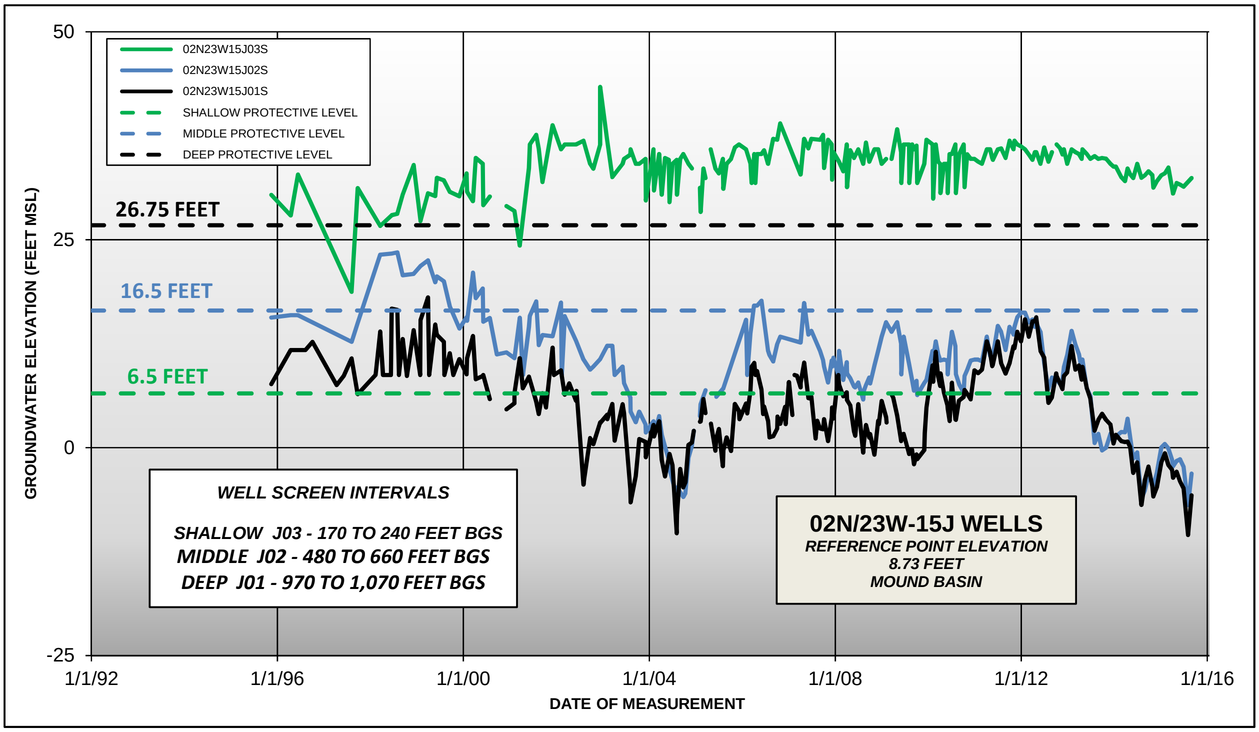

GROUNDWATER ELEVATION (FEET MSL)
50
25
0
-25
-50
1/1/90
1/1/92
1/1/94
1/1/96
1/1/98
1/1/00
1/1/02
1/1/04
1/1/06
1/1/08
1/1/10
1/1/12
1/1/14
1/1/16
1/1/18
1/1/20
1/1/22
DATE OF MEASUREMENT
19P01 GWE Oxnard
24G01 GWE Mound
02N/23W-024G01 (MOUND)
vs
02N/22W-019P01 (OXNARD)


GROUNDWATER ELEVATION (FEET MSL)
50
25
0
-25
-50
1/1/90
1/1/92
1/1/94
1/1/96
1/1/98
1/1/00
1/1/02
1/1/04
1/1/06
1/1/08
1/1/10
1/1/12
1/1/14
1/1/16
1/1/18
1/1/20
1/1/22
DATE OF MEASUREMENT
20L03 GWE Oxnard
20E01 GWE Mound
02N/22W-020E01 (MOUND)
vs
02N/22W-020L03 (OXNARD)

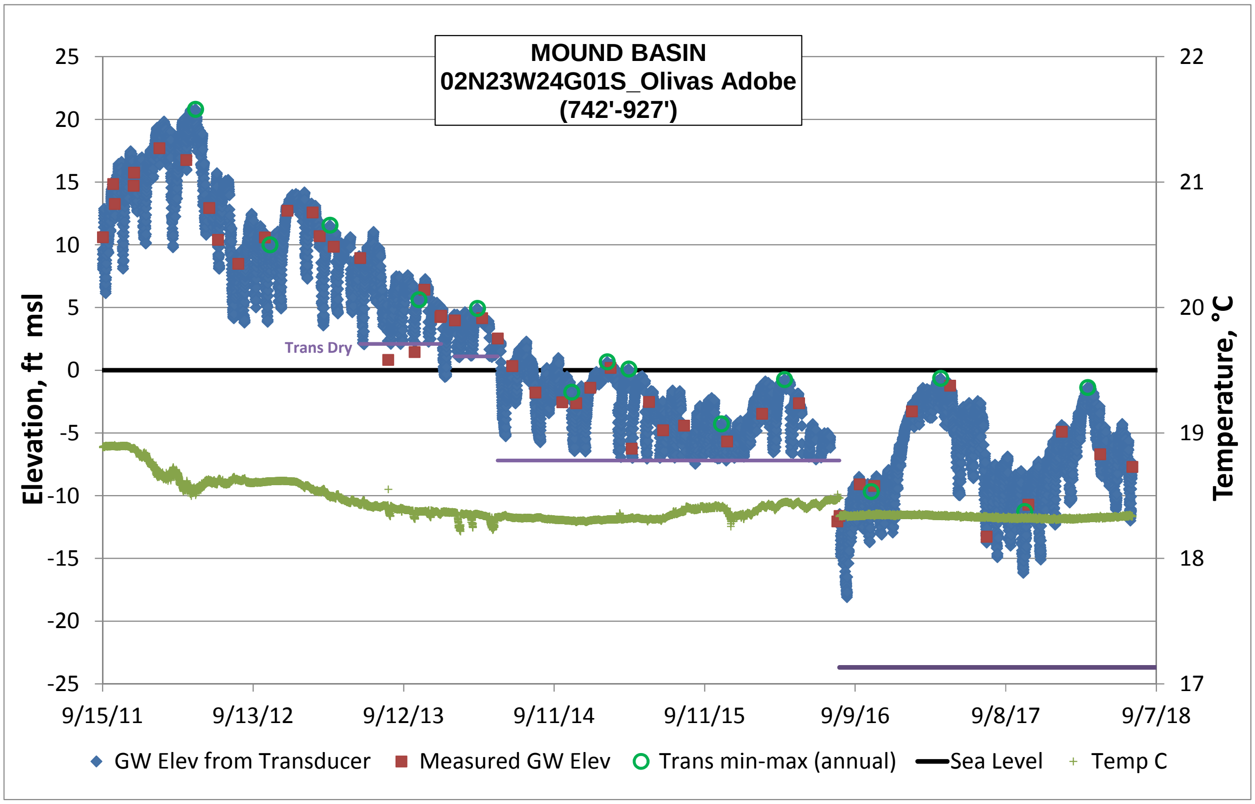

50
25
0
-25
-50
GROUNDWATER ELEVATION (FEET MSL)
1/1/90
1/1/92
1/1/94
1/1/96
1/1/98
1/1/00
1/1/02
1/1/04
1/1/06
1/1/08
1/1/10
1/1/12
1/1/14
1/1/16
1/1/18
1/1/20
1/1/22
DATE OF MEASUREMENT
20K01 GWE Oxnard
17Q05 GWE Mound
02N/22W-017Q05 (MOUND)
VS
02N/22W-020K01 (OXNARD)

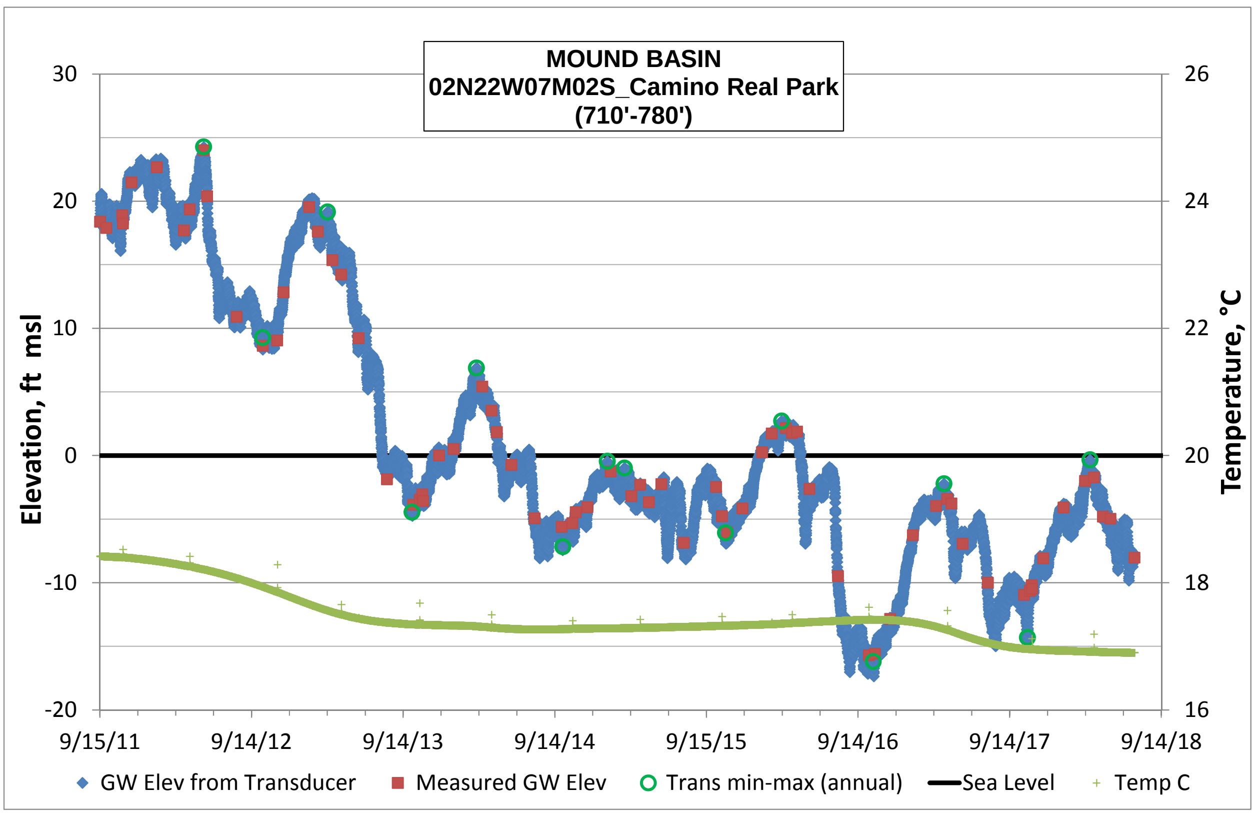

100
75
50
25
0
-25
-50
-75
-100
GROUNDWATER ELEVATION (FEET MSL)
1/1/90
1/1/92
1/1/94
1/1/96
1/1/98
1/1/00
1/1/02
1/1/04
1/1/06
1/1/08
1/1/10
1/1/12
1/1/14
1/1/16
1/1/18
1/1/20
1/1/22
DATE OF MEASUREMENT
16R02 GWE Oxnard
16K01 GWE Mound
02N/22W-016K01 (MOUND)
VS
02N/22W-016R02 (OXNARD)

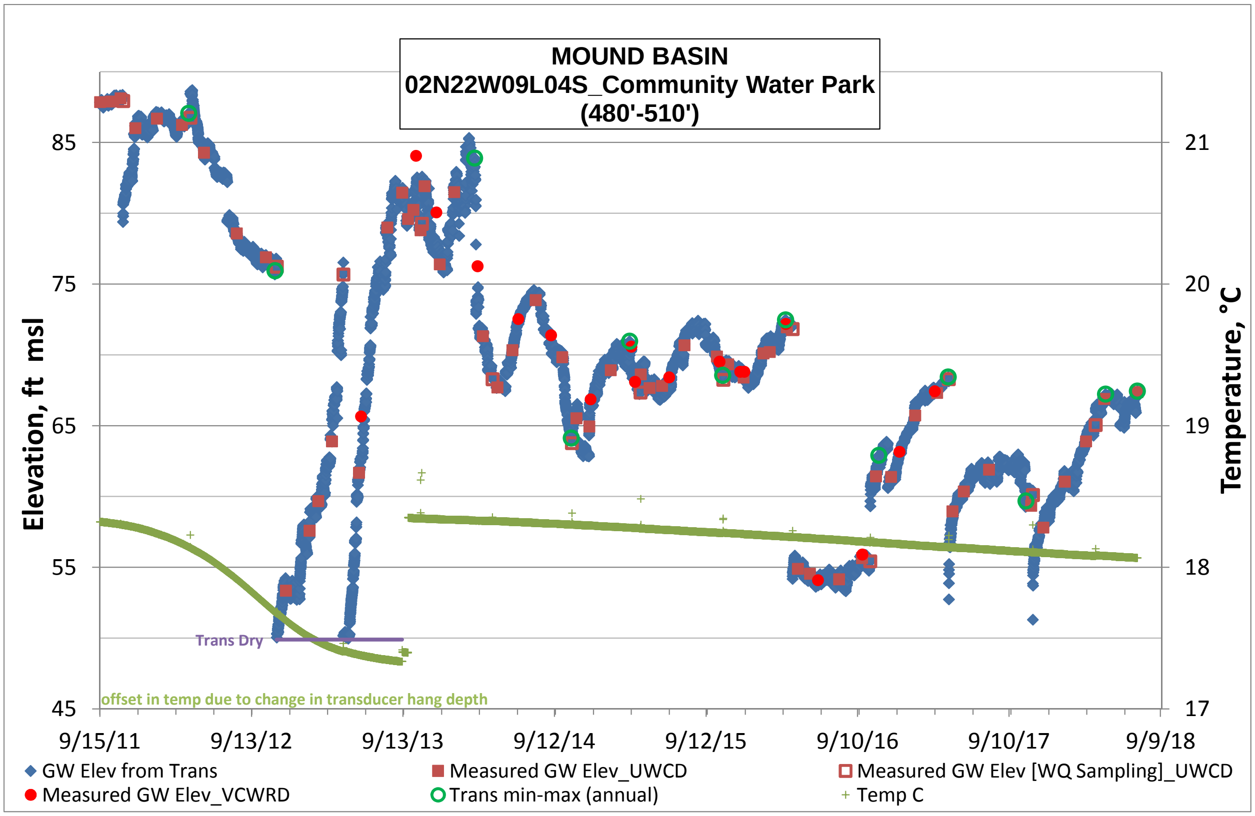
COASTLINE BASIN
BOUNDARY HYDROGRAPHS

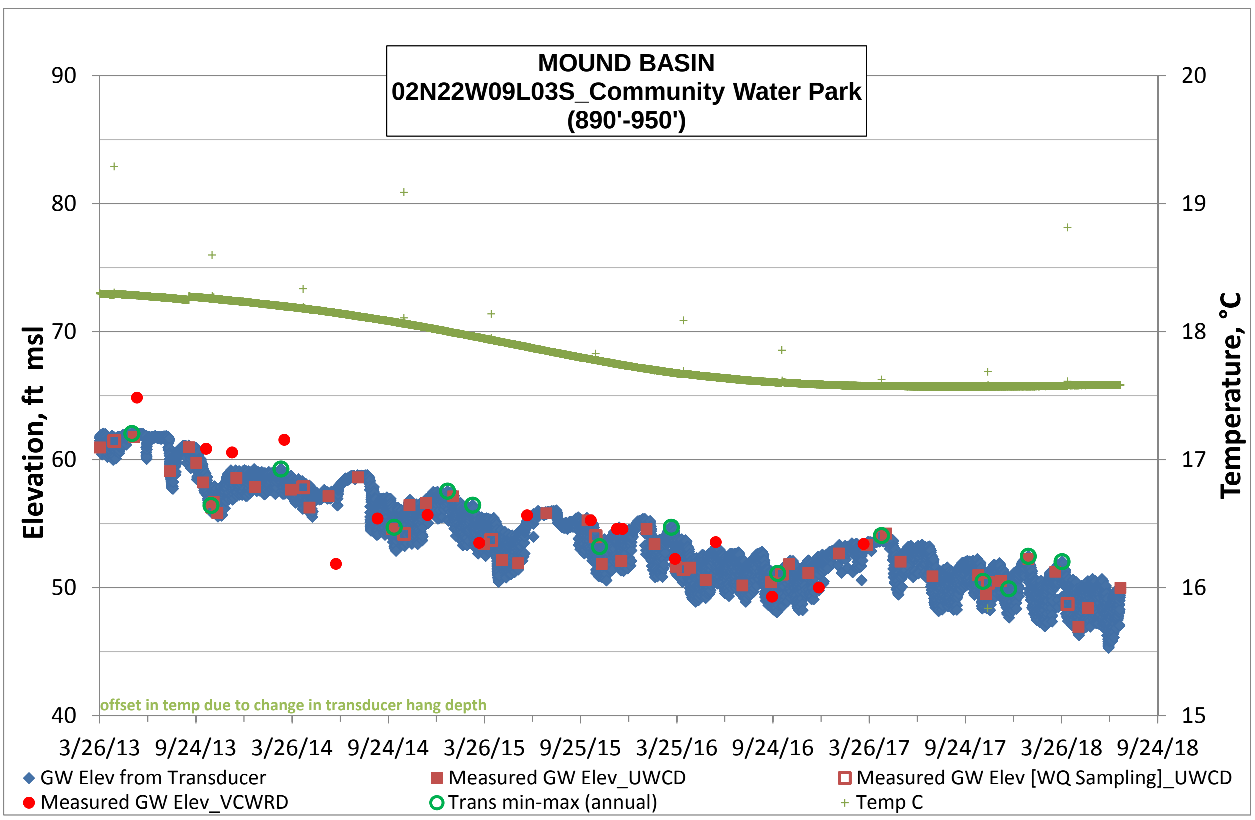

50
25
0
-25
GROUNDWATER ELEVATION (FEET MSL)
02N23W15J03S
02N23W15J02S
02N23W15J01S
SHALLOW PROTECTIVE LEVEL
MIDDLE PROTECTIVE LEVEL
DEEP PROTECTIVE LEVEL
26.75 FEET
16.5 FEET
6.5 FEET
WELL SCREEN INTERVALS
SHALLOW J03 - 170 TO 240 FEET BGS
MIDDLE J02 - 480 TO 660 FEET BGS
DEEP J01 - 970 TO 1,070 FEET BGS
02N/23W-15J WELLS
REFERENCE POINT ELEVATION
8.73 FEET
MOUND BASIN
1/1/92
1/1/96
1/1/00
1/1/04
1/1/08
1/1/12
1/1/16
DATE OF MEASUREMENT

PRESSURE TRANSDUCER HYDROGRAPHS


MOUND BASIN
02N23W24G01S_Olivas Adobe
(742'-927')
Elevation, ft msl
Temperature, °C
Trans Dry
9/15/11
9/13/12
9/12/13
9/11/14
9/11/15
9/9/16
9/8/17
9/7/18
GW Elev from Transducer
Measured GW Elev
Trans min-max (annual)
Sea Level
Temp C


MOUND BASIN
02N22W07M02S_Camino Real Park
(710'-780')
Elevation, ft msl
Temperature, °C
9/15/11
9/14/12
9/14/13
9/14/14
9/15/15
9/14/16
9/14/17
9/14/18
GW Elev from Transducer
Measured GW Elev
Trans min-max (annual)
Sea Level
Temp C


MOUND BASIN
02N22W09L04S_Community Water Park
(480'-510')
Elevation, ft msl
Temperature, °C
85
75
65
55
45
21
20
19
18
17
Trans Dry
offset in temp due to change in transducer hang depth
9/15/11
9/13/12
9/13/13
9/12/14
9/12/15
9/10/16
9/10/17
9/9/18
GW Elev from Trans
Measured GW Elev_UWCD
Measured GW Elev [WQ Sampling]_UWCD
Measured GW Elev_VCWRD
Trans min-max (annual)
Temp C


MOUND BASIN
02N22W09L03S_Community Water Park
(890'-950')
Elevation, ft msl
Temperature, °C
90
80
70
60
50
40
20
19
18
17
16
15
offset in temp due to change in transducer hang depth
3/26/13
9/24/13
3/26/14
9/24/14
3/26/15
9/25/15
3/25/16
9/24/16
3/26/17
9/24/17
3/26/18
9/24/18
GW Elev from Transducer
Measured GW Elev_UWCD
Measured GW Elev [WQ Sampling]_UWCD
Measured GW Elev_VCWRD
Trans min-max (annual)
Temp C

APPENDIX E
GROUNDWATER PRODUCTION DATA

Table E1 – Mound Basin Annual Production

YEAR	AGRICULTURAL CENTRAL ZONE	AGRICULTURAL SOUTHERN ZONE	TOTAL AGRICULTURAL	MUNICIPAL CENTRAL ZONE	MUNICIPAL SOUTHERN ZONE	TOTAL MUNICIPAL	ANNUAL BASIN TOTAL
1979	1,117.27	637.67	1,754.94	4.53	0.50	5.03	**1,759.97**
1980	2,209.86	1,533.90	3,743.76	73.32	1.00	74.32	**3,818.08**
1981	2,107.17	1,440.77	3,547.94	180.71	1.00	181.71	**3,729.65**
1982	2,389.31	1,438.32	3,827.63	2,042.23	1.00	2,043.23	**5,870.86**
1983	1,707.40	949.01	2,656.41	309.89	1.00	310.89	**2,967.30**
1984	2,841.72	1,299.14	4,140.86	3,015.82	1.00	3,016.82	**7,157.68**
1985	3,076.93	1,336.84	4,413.77	2,381.39	31.16	2,412.55	**6,826.32**
1986	2,286.46	980.71	3,267.17	2,758.58	40.63	2,799.21	**6,066.38**
1987	2,834.31	1,039.31	3,873.62	2,722.21	29.86	2,752.07	**6,625.69**
1988	2,612.93	1,555.08	4,168.01	3,919.82	100.70	4,020.52	**8,188.53**
1989	3,351.67	1,671.58	5,023.25	4,101.59	39.33	4,140.92	**9,164.17**
1990	3,948.03	1,899.84	5,847.87	4,365.57	8.39	4,373.96	**10,221.83**
1991	3,152.15	1,611.09	4,763.24	2,837.87	6.56	2,844.43	**7,607.67**
1992	2,441.98	1,529.81	3,971.79	3,007.44	33.30	3,040.74	**7,012.53**
1993	2,414.72	1,683.82	4,098.54	1,253.80	27.61	1,281.41	**5,379.95**
1994	2,769.87	1,751.66	4,521.53	3,174.87	13.29	3,188.16	**7,709.69**
1995	3,135.30	1,850.75	4,986.05	2,169.30	18.00	2,187.30	**7,173.35**
1996	2,264.58	1,824.15	4,088.73	2,789.06	32.98	2,822.04	**6,910.77**
1997	2,625.88	2,020.37	4,646.25	213.20	53.01	266.21	**4,912.46**
1998	2,251.57	1,589.65	3,841.22	801.89	35.07	836.96	**4,678.18**
1999	2,184.60	1,824.24	4,008.84	3,954.50	24.20	3,978.70	**7,987.54**
2000	2,335.64	1,797.85	4,133.49	4,564.10	5.79	4,569.89	**8,703.38**
2001	1,878.80	1,443.58	3,322.38	4,002.00	1.00	4,003.00	**7,325.38**
2002	2,321.30	1,517.21	3,838.51	3,720.50	18.40	3,738.90	**7,577.41**
2003	2,010.40	1,050.70	3,061.10	5,558.73	10.20	5,568.93	**8,630.03**
2004	2,649.14	1,435.70	4,084.84	4,772.80	17.30	4,790.10	**8,874.94**
2005	1,873.00	1,716.10	3,589.10	3,716.20	3.70	3,719.90	**7,309.00**
2006	2,332.81	1,821.40	4,154.21	4,101.90	48.70	4,150.60	**8,304.81**
2007	3,302.43	2,234.75	5,537.18	3,520.60	30.17	3,550.77	**9,087.95**
2008	2,108.30	1,257.70	3,366.00	3,481.30	2.40	3,483.70	**6,849.70**
2009	2,779.48	1,490.70	4,270.18	2,480.40	0.00	2,480.40	**6,750.58**
2010	2,941.80	904.60	3,846.40	1,685.00	85.94	1,770.94	**5,617.34**
2011	2,109.97	984.65	3,094.62	1,424.17	100.36	1,524.53	**4,619.15**
2012	2,058.22	1,319.40	3,377.62	2,795.34	109.16	2,904.50	**6,282.12**
2013	2,001.44	1,438.44	3,439.88	3,313.59	159.40	3,472.99	**6,912.87**
2014	1,891.73	1,367.44	3,259.17	3,219.99	82.99	3,302.98	**6,562.15**
2015	2,111.36	1,562.59	3,673.95	2,324.03	125.57	2,449.60	**6,123.55**
1979-2015 ANNUAL AVERAGE	**2,444.04**	**1,481.37**	**3,925.41**	**2,723.20**	**35.15**	**2,758.35**	**6,683.76**
1985-2015 ANNUAL AVERAGE	**2,517.96**	**1,532.64**	**4,050.60**	**3,068.77**	**41.78**	**3,110.55**	**7,161.14**

Table E2 – Mound Basin Annual Production by Subarea

YEAR	AGRICULTURAL CENTRAL ZONE	MUNICIPAL CENTRAL ZONE	TOTAL CENTRAL SUBAREA	AGRICULTURAL SOUTHERN ZONE	MUNICIPAL SOUTHERN ZONE	TOTAL SOUTH SUBAREA	ANNUAL BASIN TOTAL
1979	1,117.27	4.53	1,121.80	637.67	0.50	638.17	**1,759.97**
1980	2,209.86	73.32	2,283.18	1,533.90	1.00	1,534.90	**3,818.08**
1981	2,107.17	180.71	2,287.88	1,440.77	1.00	1,441.77	**3,729.65**
1982	2,389.31	2,042.23	4,431.54	1,438.32	1.00	1,439.32	**5,870.86**
1983	1,707.40	309.89	2,017.29	949.01	1.00	950.01	**2,967.30**
1984	2,841.72	3,015.82	5,857.54	1,299.14	1.00	1,300.14	**7,157.68**
1985	3,076.93	2,381.39	5,458.32	1,336.84	31.16	1,368.00	**6,826.32**
1986	2,286.46	2,758.58	5,045.04	980.71	40.63	1,021.34	**6,066.38**
1987	2,834.31	2,722.21	5,556.52	1,039.31	29.86	1,069.17	**6,625.69**
1988	2,612.93	3,919.82	6,532.75	1,555.08	100.70	1,655.78	**8,188.53**
1989	3,351.67	4,101.59	7,453.26	1,671.58	39.33	1,710.91	**9,164.17**
1990	3,948.03	4,365.57	8,313.60	1,899.84	8.39	1,908.23	**10,221.83**
1991	3,152.15	2,837.87	5,990.02	1,611.09	6.56	1,617.65	**7,607.67**
1992	2,441.98	3,007.44	5,449.42	1,529.81	33.30	1,563.11	**7,012.53**
1993	2,414.72	1,253.80	3,668.52	1,683.82	27.61	1,711.43	**5,379.95**
1994	2,769.87	3,174.87	5,944.74	1,751.66	13.29	1,764.95	**7,709.69**
1995	3,135.30	2,169.30	5,304.60	1,850.75	18.00	1,868.75	**7,173.35**
1996	2,264.58	2,789.06	5,053.64	1,824.15	32.98	1,857.13	**6,910.77**
1997	2,625.88	213.20	2,839.08	2,020.37	53.01	2,073.38	**4,912.46**
1998	2,251.57	801.89	3,053.46	1,589.65	35.07	1,624.72	**4,678.18**
1999	2,184.60	3,954.50	6,139.10	1,824.24	24.20	1,848.44	**7,987.54**
2000	2,335.64	4,564.10	6,899.74	1,797.85	5.79	1,803.64	**8,703.38**
2001	1,878.80	4,002.00	5,880.80	1,443.58	1.00	1,444.58	**7,325.38**
2002	2,321.30	3,720.50	6,041.80	1,517.21	18.40	1,535.61	**7,577.41**
2003	2,010.40	5,558.73	7,569.13	1,050.70	10.20	1,060.90	**8,630.03**
2004	2,649.14	4,772.80	7,421.94	1,435.70	17.30	1,453.00	**8,874.94**
2005	1,873.00	3,716.20	5,589.20	1,716.10	3.70	1,719.80	**7,309.00**
2006	2,332.81	4,101.90	6,434.71	1,821.40	48.70	1,870.10	**8,304.81**
2007	3,302.43	3,520.60	6,823.03	2,234.75	30.17	2,264.92	**9,087.95**
2008	2,108.30	3,481.30	5,589.60	1,257.70	2.40	1,260.10	**6,849.70**
2009	2,779.48	2,480.40	5,259.88	1,490.70	0.00	1,490.70	**6,750.58**
2010	2,941.80	1,685.00	4,626.80	904.60	85.94	990.54	**5,617.34**
2011	2,109.97	1,424.17	3,534.14	984.65	100.36	1,085.01	**4,619.15**
2012	2,058.22	2,795.34	4,853.56	1,319.40	109.16	1,428.56	**6,282.12**
2013	2,001.44	3,313.59	5,315.03	1,438.44	159.40	1,597.84	**6,912.87**
2014	1,891.73	3,219.99	5,111.72	1,367.44	82.99	1,450.43	**6,562.15**
2015	2,111.36	2,324.03	4,435.39	1,562.59	125.57	1,688.16	**6,123.55**
1979-2015 ANNUAL AVERAGE	**2,444.04**	**2,723.20**	**5,167.24**	**1,481.37**	**35.15**	**1,516.52**	**6,683.76**
1985-2015 ANNUAL AVERAGE	**2,517.96**	**3,068.77**	**5,586.73**	**1,532.64**	**41.78**	**1,574.42**	**7,161.14**

APPENDIX F
WATER QUALITY DATA

Table F1 – Average Historical Water Quality Data

STATE WELL NUMBER	NUMBER OF SAMPLES	TDS (mg/l)	eC (mS/cm)	Ca (mg/l)	Mg (mg/l)	K (mg/l)	Na (mg/l)	HCO_3 (mg/l)	SO_4 (mg/l)	Cl (mg/l)	N (mg/l)
02N22W07M01S	46	1,087	1,481	134	43	5	145	347	438	73	5
02N22W07M02S	46	946	1,285	125	41	5	109	357	342	57	7
02N22W07M03S	47	4,638	5,182	590	238	24	491	606	2,012	439	172
02N22W07P01S	7	2,241	2,639	312	97	9	205	371	1,112	104	35
02N22W08F01S	135	1,424	1,844	179	58	6	173	344	656	85	3
02N22W08G01S	80	1,832	2,269	235	75	7	207	335	914	87	14
02N22W08L01S	143	1,512	1,829	199	58	6	185	335	692	88	6
02N22W08N01S	15	1,201	1,642	142	56	5	164	379	524	81	4
02N22W08N03S	1	2,264	2,973	344	102	10	274		1,221	150	97
02N22W08P01S	8	1,742	2,121	256	73	7	173	304	886	90	22
02N22W08R01S	3	1,970	2,363	267	82	5	197	322	925	114	67
02N22W09J01S	1	1,566	1,937	192	63	6	190	228	819	74	5
02N22W09K01S	1		2,390	220	71	6	234	310	1,080	94	24
02N22W09K02S	5		1,945	177	57	3	160	340	615	72	15
02N22W09K03S	23	1,633	1,743	171	53	8	153	325	581	71	7
02N22W09K04S	3	1,103		219	65		154	301	712	107	
02N22W09K05S	14	1,051	1,469	127	22	4	172	226	469	71	2
02N22W09K07S	5	1,132	1,456	133	23	5	174	204	530	64	1
02N22W09K08S	2	1,430	1,860	175	55	7	189	290	640	69	7
02N22W09L02S	2	1,254	1,562	153	46	5	154		482	73	
02N22W09L03S	7	1,022	1,397	120	33	5	157	204	462	72	
02N22W09L04S	7	6,294	6,653	524	243	15	1,144	366	3,733	191	118
02N22W09M01S	3		3,012	341	124		295	364	1,365	147	91
02N22W09N02S	1	1,604	1,994	211	67	5	183		773	88	60
02N22W10E01S	1		1,565	150	42		158	280	545	69	
02N22W10N01S	1	812	1,160	129	31	5	92		312	41	
02N22W10N02S	8	1,264	1,953	195	64	6	173	291	776	72	22
02N22W10N03S	1		1,970	181	57	5	199	300	670	59	19
02N22W11C02S	2	926	1,265	107	22	4	154		475	53	2
02N22W11C03S	11	737	1,118	55	13	3	171	232	273	66	3
02N22W15D02S	5	1,292	1,611	162	55	5	152	279	598	67	15
02N22W16C01S	1	1,315	1,890	170	60		175		695	65	
02N22W16H01S	2	1,085	1,501	139	45	7	125	261	487	59	9
02N22W16K01S	55	1,045	1,429	129	44	4	135	266	471	56	11
02N22W17G01S	2	1,095	1,511	150	38	5	143		511	81	1
02N22W17L01S	1	2,444	3,090	354	100		284		1,320	175	57
02N22W17M02S	4		1,748	172	47	6	171	330	570	106	
02N22W17N02S	8	1,121	1,598	153	44	5	131	337	475	82	3
02N22W17Q01S	67	1,280	1,702	147	52	5	139	264	542	62	31
02N22W17Q02S	1	1,188	1,320	135	48	5	122		411	56	
02N22W17Q03S	1		1,350							51	
02N22W17Q04S	5	1,111	2,095	207	59	6	197	230	701	122	161
02N22W17Q05S	15	2,462	2,786	308	94	8	252	287	1,152	163	78

Table F1 – Average Historical Water Quality Data (continued)

STATE WELL NUMBER	NUMBER OF SAMPLES	TDS (mg/l)	eC (mS/cm)	Ca (mg/l)	Mg (mg/l)	K (mg/l)	Na (mg/l)	HCO_3 (mg/l)	SO_4 (mg/l)	Cl (mg/l)	N (mg/l)
02N22W18H03S	1	1,380									46
02N22W18N01S	15	1,102	1,471	124	51	5	142	249	480	72	1
02N22W19G01S	2	965	1,265	129	40	6	112		428	50	3
02N22W19J01S	6	1,079	1,428	145	40	5	126	294	479	56	1
02N22W19J02S	13	2,190	2,189	248	75	7	181	242	871	129	52
02N22W19J03S	5		1,470	149	43	5	125	262	518	58	2
02N22W19K02S	1	1,520	1,745	194	63	5	165		638	108	61
02N22W19L01S	5	1,162	1,566	142	45		135	321	496	59	
02N22W19L03S	1		2,652	336	95	9	208	281	1,080	172	100
02N22W19M03S	1	1,050	1,450	147	39	5	123	316	465	54	
02N22W20B01S	1	2,474	2,820	346	92	7	241		1,095	191	163
02N23W10R01S	19			157	46	9	148	342	493	69	5
02N23W13E01S	4	1,039	1,580	139	46	8	118	311	431	66	3
02N23W13F01S	12	1,158	1,554	145	47	5	154	364	471	72	2
02N23W13F02S	3	1,223	1,523	146	39	5	147	367	453	66	
02N23W13G01S	1	1,610	1,910	217	64	7	168	320	750	78	3
02N23W13J01S	1	1,260	1,780							103	
02N23W13K01S	4		2,053	198	68	5	176	360	673	110	69
02N23W13K02S	7	1,493	1,711	147	61	6	176	374	557	84	1
02N23W13K03S	7	1,185	1,884	203	60	6	180	353	717	89	18
02N23W13K04S	11	1,209	1,622	156	46	6	159	355	503	76	12
02N23W14B01S	7		1,282	130	45	16	105	253	407	58	
02N23W14K01S	75	1,118	1,553	147	42	10	159	387	450	75	3
02N23W14L01S	49	1,147	1,598	154	46	5	154	396	463	73	5
02N23W14M01S	30		1,531	145	48	7	161	357	495	77	2
02N23W14N01S	5			142	43		148	355	517	75	4
02N23W14Q01S	5		1,252	130	38		130	300	388	45	
02N23W15J01S	71	1,284	1,696	170	46	5	168	375	519	84	2
02N23W15J02S	71	919	1,243	132	38	5	103	291	383	44	2
02N23W15J03S	71	3,293	3,862	322	233	18	371	1,150	1,486	98	17
02N23W23C01S	19			154	42	10	140	365	457	68	
02N23W23E01S	1	3,205	3,859	166	262	14	446	753	1,669	112	1
02N23W23G01S	1	927	1,226	129	37	4	106	271	399	46	
02N23W23H02S	2			165	48		167	328	521	81	
02N23W24F01S	1	2,412	3,010	400	101	8	218	292	1,260	170	8
02N23W24G01S	58		1,718	158	47	5	135	334	430	71	8
02N23W24J02S	25		1,596	186	60	23	151	295	636	83	10
02N23W24K01S	56		1,374	173	54	22	135	315	556	70	37
02N23W24K02S	17		2,576	276	87	3	234	340	956	145	61

Well Number: 02N23W15J01S
Well Name: MARINA PARK (DEEP)
Date:

Constituent	mg/l	meq/l	%	anion/cation%
Ca	170	8.48	21.7%	**43.1%**
Mg	46	3.79	9.7%	**19.2%**
Na	168	7.31	18.7%	**37.1%**
K	5	0.13	0.3%	**0.6%**
CO3+HCO3	375	6.15	15.7%	**31.8%**
SO4	519	10.81	27.7%	**55.8%**
Cl	84	2.37	6.1%	**12.2%**
NO3	2	0.03	0.1%	**0.2%**
EC	1,711			
TDS	1,284			
Total		39.06	100.0%	

Chemical Character (Type)
Calcium-Sodium-Sulfate

Well Number: 02N23W15J02S
Well Name: MARINA PARK (MIDDLE)
Date:

Constituent	mg/l	meq/l	%	anion/cation%
Ca	132	6.59	23.2%	**46.0%**
Mg	38	3.13	11.0%	**21.8%**
Na	103	4.48	15.8%	**31.3%**
K	5	0.13	0.5%	**0.9%**
CO3+HCO3	291	4.77	16.8%	**34.0%**
SO4	383	7.97	28.1%	**56.9%**
Cl	44	1.24	4.4%	**8.9%**
NO3	2	0.03	0.1%	**0.2%**
EC	1,243			
TDS	919			
Total		28.34	100.0%	

Chemical Character (Type)
Calcium-Sodium-Sulfate

Well Number: 02N23W15J03S
Well Name: MARINA PARK (SHALLOW)
Date:

Constituent	mg/l	meq/l	%	anion/cation%
Ca	322	16.07	15.4%	**31.0%**
Mg	233	19.18	18.3%	**37.0%**
Na	371	16.14	15.4%	**31.1%**
K	18	0.46	0.4%	**0.9%**
CO3+HCO3	1,150	18.85	18.0%	**35.7%**
SO4	1,486	30.94	29.6%	**58.6%**
Cl	98	2.76	2.6%	**5.2%**
NO3	17	0.27	0.3%	**0.5%**
EC	3,862			
TDS	3,293			
Total		104.67	100.0%	

Chemical Character (Type)
Magnesium-Sodium-Calcium-Sulfate

MARINA PARK MONITORING WELLS
CHEMICAL CHARACTER OF WATER QUALITY DATA
HISTORICAL AVERAGE
Mound Basin Study
City of San Buenaventura
Ventura, California

PLATE F1

Well Number: 02N22W07M01S
Well Name: CAMINO PARK (DEEP)
Date:

Constituent	mg/l	meq/l	%	anion/cation%
Ca	134	6.69	19.9%	**40.1%**
Mg	43	3.54	10.5%	**21.2%**
Na	145	6.31	18.8%	**37.9%**
K	5	0.13	0.4%	**0.8%**
CO3+HCO3	347	5.69	16.9%	**33.6%**
SO4	438	9.12	27.1%	**53.8%**
Cl	73	2.06	6.1%	**12.2%**
NO3	5	0.08	0.2%	**0.5%**
EC	1,481			
TDS	1,087			
Total		33.61	100.0%	

Chemical Character (Type)

Calcium-Sodium-Sulfate

Well Number: 02N22W07M02S
Well Name: CAMINO PARK (MIDDLE)
Date:

Constituent	mg/l	meq/l	%	anion/cation%
Ca	125	6.24	21.4%	**43.1%**
Mg	41	3.37	11.6%	**23.3%**
Na	109	4.74	16.3%	**32.7%**
K	5	0.13	0.4%	**0.9%**
CO3+HCO3	357	5.85	20.1%	**39.8%**
SO4	342	7.12	24.4%	**48.5%**
Cl	57	1.61	5.5%	**10.9%**
NO3	7	0.11	0.4%	**0.8%**
EC	1,285			
TDS	946			
Total		29.17	100.0%	

Chemical Character (Type)

Calcium-Sodium-Sulfate-Bicarbonate

Well Number: 02N22W07M03S
Well Name: CAMINO PARK (SHALLOW)
Date:

Constituent	mg/l	meq/l	%	anion/cation%
Ca	590	29.44	21.3%	**41.5%**
Mg	238	19.59	14.2%	**27.6%**
Na	491	21.36	15.5%	**30.1%**
K	24	0.61	0.4%	**0.9%**
CO3+HCO3	606	9.93	7.2%	**14.8%**
SO4	2,012	41.89	30.4%	**62.5%**
Cl	439	12.38	9.0%	**18.5%**
NO3	172	2.77	2.0%	**4.1%**
EC	5,182			
TDS	4,638			
Total		137.98	100.0%	

Chemical Character (Type)

Calcium-Sodium-Sulfate

CAMINO PARK MONITORING WELLS
CHEMICAL CHARACTER OF WATER QUALITY DATA
HISTORICAL AVERAGE
Mound Basin Study
City of San Buenaventura
Ventura, California

Well Number: 02N22W09L03S
Well Name: COMMUNITY SPORTS PARK (DEEP)
Date:

Constituent	mg/l	meq/l	%	anion/cation%
Ca	120	5.99	19.5%	**38.2%**
Mg	33	2.72	8.9%	**17.3%**
Na	157	6.83	22.3%	**43.6%**
K	5	0.13	0.4%	**0.8%**
CO3+HCO3	204	3.34	10.9%	**22.3%**
SO4	462	9.62	31.4%	**64.2%**
Cl	72	2.03	6.6%	**13.5%**
NO3	0	0.00	0.0%	**0.0%**
EC	1,397			
TDS	1,022			
Total		30.65	100.0%	

Chemical Character (Type)

Sodium-Calcium-Sulfate

Well Number: 02N22W09L04S
Well Name: COMMUNITY SPORTS PARK (SHALLOW)
Date:

Constituent	mg/l	meq/l	%	anion/cation%
Ca	524	26.15	14.0%	**27.2%**
Mg	243	20.00	10.7%	**20.8%**
Na	1,144	49.76	26.6%	**51.7%**
K	15	0.38	0.2%	**0.4%**
CO3+HCO3	366	6.00	3.2%	**6.6%**
SO4	3,733	77.72	41.5%	**85.4%**
Cl	191	5.39	2.9%	**5.9%**
NO3	118	1.90	1.0%	**2.1%**
EC	6,653			
TDS	6,294			
Total		187.30	100.0%	

Chemical Character (Type)

Sodium-Sulfate

COMMUNITY SPORTS PARK MONITORING WELLS
CHEMICAL CHARACTER OF WATER QUALITY DATA
HISTORICAL AVERAGE
Mound Basin Study
City of San Buenaventura
Ventura, California

APPENDIX G
GROUNDWATER ELEVATION MEASUREMENTS

TABLE G1 - ANNUAL CHANGE IN GROUNDWATER ELEVATION

WELL ID	1978	CHANGE	1979	CHANGE	1980	CHANGE	1981	CHANGE	1982	CHANGE	1983	CHANGE	1984	CHANGE	1985	CHANGE	1986	CHANGE
02N22W07M01S																		
02N22W07M02S																		
02N22W07M03S																		
02N22W08F01S																		
02N22W08G01S																		
02N22W08L01S																		
02N22W08P01S							49.79	1.00	50.79	-2.20	48.59	-19.30	29.29	11.50	40.79	-15.00	25.79	-6.30
02N22W09K03S	46.2	7.00	53.2	1.00	54.2	-6.70	47.5	10.50	58	-9.50	48.5	-10.60	37.9	7.60	45.5	-15.30	30.2	4.10
02N22W09K04S	40.49	9.40	49.89	3.20	53.09	1.10	54.19	-3.10	51.09	4.60	55.69	-3.10	52.59	-8.90	43.69	-10.40	33.29	3.60
02N22W09K05S																		
02N22W09L03S																		
02N22W09L04S																		
02N22W16K01S	11.17	32.60	43.77	5.00	48.77	2.20	50.97	-13.10	37.87	-1.40	36.47	11.40	47.87	-11.20	36.67	-14.10	22.57	-3.10
02N22W17M02S																		
02N22W17Q05S																		
02N22W20E01S																		
02N23W13K01S	27.9	7.70	35.6	6.90	42.5	-2.50	40	-3.10	36.9									
02N23W13K03S																		
02N23W13K04S											22.6	-4.80	17.8	0.40	18.2	-4.00	14.2	18.80
02N23W15J01S																		
02N23W15J02S																		
02N23W15J03S																		
02N23W24G01S			20.4	3.90	24.3	1.40	25.7	-4.40	21.3	3.20	24.5	1.10	25.6	-8.80	16.8	-3.30	13.5	-10.20
ANNUAL AVERAGE		14.18		4.00		-0.90		-2.03		-1.06		-4.22		-1.57		-10.35		1.15

WELL ID	1987	CHANGE	1988	CHANGE	1989	CHANGE	1990	CHANGE	1991	CHANGE	1992	CHANGE	1993	CHANGE	1994	CHANGE	1995	CHANGE	1996
02N22W07M01S																			19.96
02N22W07M02S																			29.66
02N22W07M03S																			145.06
02N22W08F01S																			
02N22W08G01S																			
02N22W08L01S																	15	16.00	31
02N22W08P01S	19.49	-4.70	14.79	-6.00	8.79	-10.00	-1.21	-0.50	-1.71	1.60	-0.11	5.10	4.99	24.70	29.69				28.79
02N22W09K03S	34.3	-5.80	28.5	-13.00	15.5	-10.70	4.8	-9.70	-4.9	-9.50	-14.4	42.50	28.1	5.80	33.9				39.5
02N22W09K04S	36.89	-7.70	29.19	-20.10	9.09	2.20	11.29	-8.30	2.99	1.80	4.79	23.54	28.33	4.58	32.91	0.02	32.93	8.26	41.19
02N22W09K05S																			
02N22W09L03S																			
02N22W09L04S																			
02N22W16K01S	19.47	-7.80	11.67	-17.10	-5.43	-20.80	-26.23	-6.90	-33.13	-5.70	-38.83	61.90	23.07	13.70	36.77				31.97
02N22W17M02S																			
02N22W17Q05S																			
02N22W20E01S																			
02N23W13K01S																			
02N23W13K03S																			
02N23W13K04S	33	-4.80	28.2	-30.30	-2.1	-9.80	-11.9	-1.90	-13.8	5.80	-8	15.50	7.5	-1.10	6.4				14
02N23W15J01S																			11.73
02N23W15J02S																			15.93
02N23W15J03S																			32.83
02N23W24G01S	3.3	1.90	5.2	-21.10	-15.9	5.20	-10.7	1.00	-9.7	5.50	-4.2	8.60	4.4	5.70	10.1	5.40	15.5	0.90	16.4
ANNUAL AVERAGE		-4.82		-17.93		-7.32		-4.38		-0.08		26.19		8.90		2.71		8.39	

ALL VALUES ARE IN FEET

WELL ID	CHANGE	1997	CHANGE	1998	CHANGE	1999	CHANGE	2000	CHANGE	2001	CHANGE	2002	CHANGE	2003	CHANGE	2004	CHANGE	2005
02N22W07M01S	1.1	21.06	8.3	29.36	-7.8	21.56	-5.2	16.36	2.5	18.86	-9.19	9.67	-5.71	3.96	-3.42	0.54	8.42	8.96
02N22W07M02S	3	32.66	4.8	37.46	-4.7	32.76	-7.2	25.56	-3.5	22.06	1.58	23.64	-6.78	16.86	-18.1	-1.24	11.3	10.06
02N22W07M03S	-0.5	144.56	4.4	148.96	-0.5	148.46	0.29	148.75	0.51	149.26	0.1	149.36	-0.5	148.86	-0.7	148.16	0.7	148.86
02N22W08F01S		34.82	1	35.82	-1	34.82	-10	24.82	-6	18.82	19	37.82	-10	27.82	-27	0.82	26	26.82
02N22W08G01S																		9.61
02N22W08L01S	5	36	4	40	-9	31	-17	14	0	14	-6	8	-2	6				
02N22W08P01S	8	36.79	4.6	41.39	-6.6	34.79	-9.7	25.09	-1.3	23.79	0	23.79	-3	20.79	-27	-6.21	19.4	13.19
02N22W09K03S	0.3	39.8	7.6	47.4	-8.4	39	-8.8	30.2	-6.2	24	-2.4	21.6	-1.9	19.7				
02N22W09K04S	-0.07	41.12	8.82	49.94	-7.37	42.57	-8.2	34.37	-5.04	29.33	0.17	29.5	-9.74	19.76	-18.58	1.18	14.55	15.73
02N22W09K05S								98.49	2	100.49	-3.5	96.99	-1.86	95.13	-5.49	89.64	3.06	92.7
02N22W09L03S																		
02N22W09L04S																		
02N22W16K01S	18.3	50.27	-2.3	47.97	10.5	58.47	-19.7	38.77	10.2	48.97	0.2	49.17	-23.4	25.77	-3	22.77	-5.4	17.37
02N22W17M02S										30.04	-9.6	20.44	-6.9	13.54	0	13.54	7	20.54
02N22W17Q05S								23.6	15.75	39.35	1.05	40.4	-24.4	16	1.1	17.1		
02N22W20E01S						41.55	-10.46	31.09	6.59	37.68	10.61	48.29	-28.49	19.8	-2.58	17.22	3.53	20.75
02N23W13K01S																		
02N23W13K03S																-2.29	9.2	6.91
02N23W13K04S	5.4	19.4	4.4	23.8	-4.1	19.7	-6.3	13.4	-2.2	11.2	36	47.2	-41.9	5.3				
02N23W15J01S	-3.1	8.63	8.08	16.71	1.36	18.07	-4.66	13.41	-2.65	10.76	-1.48	9.28	-4.02	5.26	-2.09	3.17	2.68	5.85
02N23W15J02S				23.34	-0.81	22.53	-1.5	21.03	-3.46	17.57	-0.13	17.44	-5.2	12.24	-8.46	3.78	3.14	6.92
02N23W15J03S				28.11	4.33	32.44	2.39	34.83	2.78	37.61	-1.16	36.45	-1.73	34.72	1.15	35.87	0	35.87
02N23W24G01S	-1.3	15.1	6.4	21.5	-3.42	18.08	-6.58	11.5	-1.83	9.67	0.68	10.35	-4.25	6.1	-1.63	4.47	2.1	6.57
ANNUAL AVERAGE	3.28		5.01		-2.68		-7.51		0.48		2.00		-10.10		-7.72		7.05	

WELL ID	CHANGE	2006	CHANGE	2007	CHANGE	2008	CHANGE	2009	CHANGE	2010	CHANGE	2011	CHANGE	2012	CHANGE	2013	CHANGE	2014	CHANGE	2015
02N22W07M01S	4.3	13.26	-0.1	13.16	-1.86	11.3	-2.44	8.86	8.2	17.06	1.62	18.68	6.2	24.88	-10.78	14.1	-10.53	3.57	-3.43	0.14
02N22W07M02S	11.9	21.96	4.1	26.06	-12	14.06	4.9	18.96	-1.6	17.36	2.44	19.8	4.4	24.2	-4.66	19.54	-12.66	6.88	-7.33	-0.45
02N22W07M03S	1.04	149.9	-0.04	149.86	0.2	150.06	-0.4	149.66	-0.4	149.26	0.01	149.27	-0.31	148.96	-1.06	147.9	-0.67	147.23	-1.31	145.92
02N22W08F01S	0	26.82	-3	23.82	-8	15.82	7	22.82	15	37.82	-4	33.82	6	39.82	-5	34.82	-16	18.82		
02N22W08G01S	22	31.61	7	38.61	38	76.61	-47	29.61	1.5	31.11	-1.5	29.61	2	31.61	-5	26.61	10	36.61		
02N22W08L01S																				
02N22W08P01S	13.6	26.79	5.9	32.69	-16.9	15.79	5.8	21.59	0.7	22.29	31.6	53.89	6.9	60.79	0.1	60.89	-11.6	49.29	-16.15	33.14
02N22W09K03S																				
02N22W09K04S	11.18	26.91	3.21	30.12	-13.74	16.38	7.94	24.32	5.42	29.74	1.91	31.65	1.49	33.14	-8.79	24.35	-13.29	11.06	-2.53	8.53
02N22W09K05S	-2.31	90.39	7.32	97.71	0.88	98.59	-16.12	82.47	9.29	91.76	-8.64	83.12	-12.03	71.09	11.47	82.56	-18.22	64.34	16.44	80.78
02N22W09L03S								61.35	-0.4	60.95	2.8	63.75	-1.49	62.26	2.59	64.85	-3.3	61.55	-4.02	57.53
02N22W09L04S								85.95	1.3	87.25	2.7	89.95	-2.89	87.06	-11.38	75.68	8.21	83.89	-12.94	70.95
02N22W16K01S	30.6	47.97	-14	33.97	-4.2	29.77	0.2	29.97	-5.2	24.77	15.98	40.75	-6.08	34.67	-18.3	16.37	-27.7	-11.33	-14.96	-26.29
02N22W17M02S	-27	-6.46	33.1	26.64	-35.9	-9.26	4.1	-5.16	30.3	25.14	7.5	32.64	5.49	38.13	-15.91	22.22	-7.28	14.94	-5.29	9.65
02N22W17Q05S						18.4	-4.2	14.2	2	16.2	9.5	25.7	-2.82	22.88	-13.01	9.87	-28.39	-18.52	-9.19	-27.71
02N22W20E01S	-1.1	19.65	6.14	25.79	-7.24	18.55	-6.75	11.8	0.5	12.3	18.39	30.69	-5.93	24.76	-17.63	7.13	-28.07	-20.94		
02N23W13K01S																				
02N23W13K03S	-0.9	6.01	0.5	6.51	2.2	8.71	-5.6	3.11	7.3	10.41	-1.84	8.57	2.24	10.81	-7.3	3.51	-6.8	-3.29		
02N23W13K04S																				
02N23W15J01S	4.34	10.19	0.04	10.23	-2.66	7.57	-1.18	6.39	5.11	11.5	1.27	12.77	2.89	15.66	-3.44	12.22	-10.67	1.55	-2.22	-0.67
02N23W15J02S	10.74	17.66	-0.27	17.39	-5.77	11.62	3.46	15.08	-1.15	13.93	0.69	14.62	1.62	16.24	-2.2	14.04	-10.57	3.47	-3.03	0.44
02N23W15J03S	-0.11	35.76	1.38	37.14	-0.69	36.45	1.85	38.3	-1.85	36.45	-0.58	35.87	0.23	36.1	-0.23	35.87	-1.73	34.14	-0.46	33.68
02N23W24G01S	1.08	7.65	1.54	9.19	0.01	9.2	-2.98	6.22	4.64	10.86	4.19	15.05	5.75	20.8	-8.22	12.58	-7.65	4.93	-4.26	0.67
ANNUAL AVERAGE	4.96		3.30		-4.23		-3.02		4.25		4.42		0.72		-6.25		-10.36		-4.71	

APPENDIX H
MOUND BASIN SURFICIAL RECHARGE

Table H1 – Annual Urban Area Rainfall Recharge by Calendar Year 1985 to 2015

CALENDAR YEAR	AVERAGE CALENDAR RAINFALL (INCHES)	DEEP PERCOLATION (INCHES) [1]	URBAN AREA (ACRES) [2]	URBAN AREA RAINFALL RECHARGE (ACRE-FEET)
1985	9.14	2.74	9224	527
1986	19.83	5.95	9224	1,143
1987	11.63	3.49	9224	670
1988	10.88	3.26	9224	627
1989	4.66	1.40	9224	269
1990	4.72	1.42	9224	272
1991	19.51	5.85	9224	1,124
1992	20.73	6.22	9224	1,195
1993	21.77	6.53	9224	1,255
1994	11.62	3.48	9224	670
1995	30.93	9.28	9224	1,783
1996	18.96	5.69	9224	1,093
1997	14.70	4.41	9224	847
1998	31.62	9.49	9224	1,823
1999	9.18	2.75	9224	529
2000	16.49	4.95	9224	951
2001	25.37	7.61	9224	1,463
2002	11.00	3.30	9224	634
2003	14.08	4.22	9224	812
2004	18.53	5.56	9224	1,068
2005	25.04	7.51	9224	1,444
2006	15.82	4.75	9224	912
2007	7.42	2.22	9224	427
2008	14.79	4.44	9224	853
2009	9.83	2.95	9224	567
2010	23.79	7.14	9224	1,371
2011	11.61	3.48	9224	669
2012	9.74	2.92	9224	561
2013	3.51	1.05	9224	202
2014	10.32	3.10	9224	595
2015	4.54	1.36	9224	261

1 - 30 PERCENT OF ANNUAL RAINFALL BECOMES DEEP PERCOLATION

2 - 25 PERCENT OF TOTAL URBAN AREA IS PERMEABLE SURFACE

Table H2 – Annual Agricultural Area Rainfall Recharge by Calendar Year 1985 to 2015

CALENDAR YEAR	AVERAGE CALENDAR RAINFALL (INCHES)	DEEP PERCOLATION (INCHES) [1]	AGRICULTURAL AREA (ACRES) [2]	AGRICULTURAL AREA RAINFALL RECHARGE (ACRE-FEET)
1985	9.14	2.74	2302	473
1986	19.83	5.95	2302	1,027
1987	11.63	3.49	2302	602
1988	10.88	3.26	2302	563
1989	4.66	1.40	2302	241
1990	4.72	1.42	2302	244
1991	19.51	5.85	2302	1,010
1992	20.73	6.22	2302	1,074
1993	21.77	6.53	2302	1,127
1994	11.62	3.48	2302	602
1995	30.93	9.28	2302	1,602
1996	18.96	5.69	2302	982
1997	14.70	4.41	2302	761
1998	31.62	9.49	2302	1,638
1999	9.18	2.75	2302	475
2000	16.49	4.95	2302	854
2001	25.37	7.61	2302	1,314
2002	11.00	3.30	2302	569
2003	14.08	4.22	2302	729
2004	18.53	5.56	2302	960
2005	25.04	7.51	2302	1,297
2006	15.82	4.75	2302	820
2007	7.42	2.22	2302	384
2008	14.79	4.44	2302	766
2009	9.83	2.95	2302	509
2010	23.79	7.14	2302	1,232
2011	11.61	3.48	2302	601
2012	9.74	2.92	2302	504
2013	3.51	1.05	2302	182
2014	10.32	3.10	2302	535
2015	4.54	1.36	2302	235

1 - 30 PERCENT OF ANNUAL RAINFALL BECOMES DEEP PERCOLATION

2 - 90 PERCENT OF TOTAL AGRICULTURAL AREA IS PERMEABLE SURFACE

Table H3 – Annual Undeveloped Area Rainfall Recharge by Calendar Year 1985 to 2015

CALENDAR YEAR	AVERAGE CALENDAR RAINFALL (INCHES)	DEEP PERCOLATION (INCHES) [1]	UNDEVELOPED AREA (ACRES) [2]	UNDEVELOPED AREA RAINFALL RECHARGE (ACRE-FEET)
1985	9.14	2.74	2339	534
1986	19.83	5.95	2339	1,159
1987	11.63	3.49	2339	680
1988	10.88	3.26	2339	636
1989	4.66	1.40	2339	273
1990	4.72	1.42	2339	276
1991	19.51	5.85	2339	1,141
1992	20.73	6.22	2339	1,212
1993	21.77	6.53	2339	1,273
1994	11.62	3.48	2339	679
1995	30.93	9.28	2339	1,809
1996	18.96	5.69	2339	1,109
1997	14.70	4.41	2339	859
1998	31.62	9.49	2339	1,849
1999	9.18	2.75	2339	537
2000	16.49	4.95	2339	964
2001	25.37	7.61	2339	1,484
2002	11.00	3.30	2339	643
2003	14.08	4.22	2339	823
2004	18.53	5.56	2339	1,083
2005	25.04	7.51	2339	1,464
2006	15.82	4.75	2339	925
2007	7.42	2.22	2339	434
2008	14.79	4.44	2339	865
2009	9.83	2.95	2339	575
2010	23.79	7.14	2339	1,391
2011	11.61	3.48	2339	679
2012	9.74	2.92	2339	569
2013	3.51	1.05	2339	205
2014	10.32	3.10	2339	603
2015	4.54	1.36	2339	265

1 - 30 PERCENT OF ANNUAL RAINFALL BECOMES DEEP PERCOLATION

2 - 100 PERCENT OF TOTAL UNDEVELOPED AREA IS PERMEABLE SURFACE

Table H4 – Mound Basin Annual Rainfall Recharge by Calendar Year 1985 to 2015

CALENDAR YEAR	URBAN M&I (ACRE-FEET)	AGRICULTURAL (ACRE-FEET)	UNDEVELOPED (ACRE-FEET)	TOTAL RECHARGE (ACRE-FEET)
1985	527	473	534	1,535
1986	1,143	1,027	1,159	3,329
1987	670	602	680	1,952
1988	627	563	636	1,827
1989	269	241	273	783
1990	272	244	276	792
1991	1,124	1,010	1,141	3,275
1992	1,195	1,074	1,212	3,481
1993	1,255	1,127	1,273	3,655
1994	670	602	679	1,950
1995	1,783	1,602	1,809	5,194
1996	1,093	982	1,109	3,183
1997	847	761	859	2,468
1998	1,823	1,638	1,849	5,309
1999	529	475	537	1,542
2000	951	854	964	2,769
2001	1,463	1,314	1,484	4,260
2002	634	569	643	1,846
2003	812	729	823	2,365
2004	1,068	960	1,083	3,111
2005	1,444	1,297	1,464	4,205
2006	912	820	925	2,657
2007	427	384	434	1,245
2008	853	766	865	2,484
2009	567	509	575	1,651
2010	1,371	1,232	1,391	3,995
2011	669	601	679	1,949
2012	561	504	569	1,635
2013	202	182	205	589
2014	595	535	603	1,733
2015	261	235	265	762
AVE	**859**	**771**	**871**	**2,501**

Table H5 – Mound Basin Annual Irrigation Return Flow Recharge by Calendar Year 1985 to 2015

	CITY WATER USED IN MOUND BASIN					AG WATER USED IN MOUND BASIN				
CALENDAR YEAR	VENTURA RIVER	MOUND BASIN	OXNARD PLAIN BASIN	CALENDAR YEAR TOTAL	CITY IRRIGATION RETURN FLOWS	FICO IMPORTS	MOUND AG PUMPING	TOTAL AG WATER USE	AG IRRIGATION RETURN FLOWS	TOTAL BASIN RETURN FLOWS
1985	5,493	2,360	6,177	14,030	1,403	890	4,414	5,304	1,591	**2,994**
1986	7,566	2,816	5,008	15,390	1,539	890	3,267	4,157	1,247	**2,786**
1987	5,798	2,726	5,194	13,718	1,372	890	3,874	4,764	1,429	**2,801**
1988	6,804	3,932	4,917	15,653	1,565	890	4,168	5,058	1,517	**3,083**
1989	3,859	4,101	6,064	14,024	1,402	890	5,023	5,913	1,774	**3,176**
1990	3,192	4,365	5,762	13,319	1,332	890	5,848	6,738	2,021	**3,353**
1991	5,655	2,838	2,714	11,207	1,121	890	4,763	5,653	1,696	**2,817**
1992	9,874	3,086	802	13,762	1,376	890	3,972	4,862	1,459	**2,835**
1993	8,914	1,254	2,438	12,606	1,261	890	4,099	4,989	1,497	**2,757**
1994	7,561	3,175	2,714	13,450	1,345	890	4,522	5,412	1,623	**2,968**
1995	9,042	2,169	2,606	13,817	1,382	890	4,986	5,876	1,763	**3,145**
1996	7,926	2,789	2,774	13,489	1,349	890	4,089	4,979	1,494	**2,843**
1997	7,052	213	3,452	10,717	1,072	890	4,646	5,536	1,661	**2,733**
1998	8,069	802	4,312	13,183	1,318	890	3,841	4,731	1,419	**2,738**
1999	6,420	3,955	1,621	11,996	1,200	890	4,009	4,899	1,470	**2,669**
2000	6,779	4,579	2,675	14,033	1,403	890	4,133	5,023	1,507	**2,910**
2001	5,727	4,030	905	10,662	1,066	890	3,322	4,212	1,264	**2,330**
2002	5,951	3,721	1,977	11,649	1,165	890	3,839	4,729	1,419	**2,583**
2003	6,722	5,546	2,898	15,166	1,517	890	3,061	3,951	1,185	**2,702**
2004	6,118	4,773	2,391	13,282	1,328	890	4,085	4,975	1,492	**2,821**
2005	1,293	3,716	5,379	10,388	1,039	890	3,589	4,479	1,344	**2,383**
2006	2,233	4,102	5,348	11,683	1,168	890	4,154	5,044	1,513	**2,682**
2007	2,000	3,521	5,443	10,964	1,096	890	5,537	6,427	1,928	**3,025**
2008	2,711	3,481	5,517	11,709	1,171	890	3,366	4,256	1,277	**2,448**
2009	3,037	2,480	5,714	11,231	1,123	890	4,270	5,160	1,548	**2,671**
2010	3,161	1,685	5,162	10,008	1,001	890	3,846	4,736	1,421	**2,422**
2011	3,428	1,424	4,817	9,669	967	890	3,095	3,985	1,195	**2,162**
2012	3,540	2,795	5,601	11,936	1,194	890	3,378	4,268	1,280	**2,474**
2013	2,179	3,314	5,491	10,984	1,098	783	3,440	4,223	1,267	**2,365**
2014	2,947	3,220	4,565	10,732	1,073	915	3,259	4,174	1,252	**2,325**
2015	1,298	2,324	3,587	7,209	721	976	3,674	4,650	1,395	**2,116**
AVERAGE ANNUAL	**5,237**	**3,074**	**4,001**	**12,312**	**1,231**	**891**	**4,051**	**4,941**	**1,482**	**2,713**

ALL UNITS IN ACRE-FEET

ASSUMPTIONS: All Ventura River Water Imported to Mound Basin
All Mound and Oxnard Plain Production Used in Mound Basin
All Mound Basin Ag Production Used in Mound Basin
1985 TO 2012 AG Import from FICO is Average of 2013 to 2015 Reported Imports
50% M&I Water used for irrigation, 20% Deep Percolation Results
100% Ag Water used for irrigation, 30% Deep Percolation Results

APPENDIX I
MOUND BASIN WATER BUDGET

TABLE I1 - MOUND BASIN WATER BUDGET ESTIMATE USING SANTA PAULA BASIN SAFE YIELD STUDY INFLOW ESTIMATE AND OXNARD PLAIN/MOUND BASIN MODEL

Calendar Year	Basin Inflow							Basin Outflow					Total Groundwater Recharge	Total Groundwater Discharge	Groundwater Balance (Change in Storage)
	Groundwater Inflow					Rainfall	Irrigation	Groundwater Outflow				Pumping			
	Santa Paula	Oxnard Forebay	Lower Ventura River	Santa Clara River Percolation	Coastline	Precipitation Deep Percolation	Irrigation Return Flow	Oxnard Plain	Lower Ventura River	Santa Clara River Percolation	Coastline	Reported Groundwater Extractions			
Data Source	RCS	UWCD	ASSUMED	ASSUMED	ASSUMED	HGC	HGC	UWCD	ASSUMED	UWCD	ASSUMED	UWCD	CALCULATED	CALCULATED	CALCULATED
1985	1,750	1,890	0	0	500	1,535	2,994	1,500	0	1,170	0	6,826	8,669	9,496	**-827**
1986	1,750	1,890	0	0	500	3,329	2,786	1,500	0	1,170	0	6,066	10,256	8,736	**1,519**
1987	1,750	1,890	0	0	500	1,952	2,801	1,500	0	1,170	0	6,626	8,893	9,296	**-402**
1988	1,750	1,890	0	0	500	1,827	3,083	1,500	0	1,170	0	8,189	9,049	10,859	**-1,809**
1989	1,750	1,890	0	0	500	783	3,176	1,500	0	1,170	0	9,164	8,099	11,834	**-3,735**
1990	1,750	1,890	0	0	500	792	3,353	1,500	0	1,170	0	10,222	8,285	12,892	**-4,606**
1991	1,750	1,890	0	0	500	3,275	2,817	1,500	0	1,170	0	7,608	10,232	10,278	**-46**
1992	1,750	1,890	0	0	500	3,481	2,835	1,500	0	1,170	0	7,013	10,456	9,683	**774**
1993	1,750	1,890	0	0	500	3,655	2,757	1,500	0	1,170	0	5,380	10,552	8,050	**2,502**
1994	1,750	1,890	0	0	500	1,950	2,968	1,500	0	1,170	0	7,710	9,059	10,380	**-1,321**
1995	1,750	1,890	0	0	500	5,194	3,145	1,500	0	1,170	0	7,173	12,479	9,843	**2,635**
1996	1,750	1,890	0	0	500	3,183	2,843	1,500	0	1,170	0	6,911	10,166	9,581	**585**
1997	1,750	1,890	0	0	500	2,468	2,733	1,500	0	1,170	0	4,912	9,341	7,582	**1,758**
1998	1,750	1,890	0	0	500	5,309	2,738	1,500	0	1,170	0	4,678	12,187	7,348	**4,839**
1999	1,750	1,890	0	0	500	1,542	2,669	1,500	0	1,170	0	7,988	8,351	10,658	**-2,307**
2000	1,750	1,890	0	0	500	2,769	2,910	1,500	0	1,170	0	8,703	9,820	11,373	**-1,554**
2001	1,750	1,890	0	0	500	4,260	2,330	1,500	0	1,170	0	7,325	10,730	9,995	**735**
2002	1,750	1,890	0	0	500	1,846	2,583	1,500	0	1,170	0	7,577	8,570	10,247	**-1,678**
2003	1,750	1,890	0	0	500	2,365	2,702	1,500	0	1,170	0	8,630	9,207	11,300	**-2,093**
2004	1,750	1,890	0	0	500	3,111	2,821	1,500	0	1,170	0	8,875	10,072	11,545	**-1,473**
2005	1,750	1,890	0	0	500	4,205	2,383	1,500	0	1,170	0	7,309	10,727	9,979	**748**
2006	1,750	1,890	0	0	500	2,657	2,682	1,500	0	1,170	0	8,305	9,478	10,975	**-1,496**
2007	1,750	1,890	0	0	500	1,245	3,025	1,500	0	1,170	0	9,088	8,410	11,758	**-3,348**
2008	1,750	1,890	0	0	500	2,484	2,448	1,500	0	1,170	0	6,850	9,071	9,520	**-448**
2009	1,750	1,890	0	0	500	1,651	2,671	1,500	0	1,170	0	6,751	8,462	9,421	**-959**
2010	1,750	1,890	0	0	500	3,995	2,422	1,500	0	1,170	0	5,617	10,557	8,287	**2,269**
2011	1,750	1,890	0	0	500	1,949	2,162	1,500	0	1,170	0	4,619	8,251	7,289	**962**
2012	1,750	1,890	0	0	500	1,635	2,474	1,500	0	1,170	0	6,282	8,249	8,952	**-704**
2013	1,750	1,890	0	0	500	589	2,365	1,500	0	1,170	0	6,913	7,094	9,583	**-2,489**
2014	1,750	1,890	0	0	500	1,733	2,325	1,500	0	1,170	0	6,562	8,198	9,232	**-1,034**
2015	1,750	1,890	0	0	500	762	2,116	1,500	0	1,170	0	6,124	7,017	8,794	**-1,776**
Average	1,750	1,890	0	0	500	2,501	2,713	1,500	0	1,170	0	7,161	9,354	9,831	**-477**
Total	54,250	58,590	0	0	15,500	77,531	84,115	46,500	0	36,270	0	221,995	289,987	304,765	**-14,779**

Notes:

Ephemeral stream recharge is included with precipitation deep percolation

Percolation of City recycled water ponds and discharge to the estuary is assumed to flow to the Ocean and does not add appreciable recharge

Model values from UWCD from Table 4-4 Summary of Simulated Annual-Average Fows in Mound Basin

TABLE I2 - MOUND BASIN WATER BUDGET ESTIMATE USING OXNARD PLAIN/MOUND BASIN MODEL INFLOWS AND OUTFLOWS

Calendar Year	Basin Infow							Basin Outflow					Total Groundwater Recharge	Total Groundwater Discharge	Groundwater Balance (Change in Storage)
	Groundwater Inflow					Rainfall	Irrigation	Groundwater Outflow				Pumping			
	Santa Paula	Oxnard Forebay	Lower Ventura River	Santa Clara River Percolation	Coastline	Precipitation Deep Percolation	Irrigation Return Flow	Oxnard Plain	Lower Ventura River	Santa Clara River Percolation	Coastline	Reported Groundwater Extractions			
Data Source	UWCD	UWCD	ASSUMED	UWCD	ASSUMED	HGC	HGC	UWCD	ASSUMED	UWCD	UWCD	UWCD	CALCULATED	CALCULATED	CALCULATED
1985	3,100	1,890	0	0	0	1,535	2,994	1,500	0	1,170	270	6,826	9,519	9,766	**-247**
1986	3,100	1,890	0	0	0	3,329	2,786	1,500	0	1,170	270	6,066	11,106	9,006	**2,099**
1987	3,100	1,890	0	0	0	1,952	2,801	1,500	0	1,170	270	6,626	9,743	9,566	**178**
1988	3,100	1,890	0	0	0	1,827	3,083	1,500	0	1,170	270	8,189	9,899	11,129	**-1,229**
1989	3,100	1,890	0	0	0	783	3,176	1,500	0	1,170	270	9,164	8,949	12,104	**-3,155**
1990	3,100	1,890	0	0	0	792	3,353	1,500	0	1,170	270	10,222	9,135	13,162	**-4,026**
1991	3,100	1,890	0	0	0	3,275	2,817	1,500	0	1,170	270	7,608	11,082	10,548	**534**
1992	3,100	1,890	0	0	0	3,481	2,835	1,500	0	1,170	270	7,013	11,306	9,953	**1,354**
1993	3,100	1,890	0	0	0	3,655	2,757	1,500	0	1,170	270	5,380	11,402	8,320	**3,082**
1994	3,100	1,890	0	0	0	1,950	2,968	1,500	0	1,170	270	7,710	9,909	10,650	**-741**
1995	3,100	1,890	0	0	0	5,194	3,145	1,500	0	1,170	270	7,173	13,329	10,113	**3,215**
1996	3,100	1,890	0	0	0	3,183	2,843	1,500	0	1,170	270	6,911	11,016	9,851	**1,165**
1997	3,100	1,890	0	0	0	2,468	2,733	1,500	0	1,170	270	4,912	10,191	7,852	**2,338**
1998	3,100	1,890	0	0	0	5,309	2,738	1,500	0	1,170	270	4,678	13,037	7,618	**5,419**
1999	3,100	1,890	0	0	0	1,542	2,669	1,500	0	1,170	270	7,988	9,201	10,928	**-1,727**
2000	3,100	1,890	0	0	0	2,769	2,910	1,500	0	1,170	270	8,703	10,670	11,643	**-974**
2001	3,100	1,890	0	0	0	4,260	2,330	1,500	0	1,170	270	7,325	11,580	10,265	**1,315**
2002	3,100	1,890	0	0	0	1,846	2,583	1,500	0	1,170	270	7,577	9,420	10,517	**-1,098**
2003	3,100	1,890	0	0	0	2,365	2,702	1,500	0	1,170	270	8,630	10,057	11,570	**-1,513**
2004	3,100	1,890	0	0	0	3,111	2,821	1,500	0	1,170	270	8,875	10,922	11,815	**-893**
2005	3,100	1,890	0	0	0	4,205	2,383	1,500	0	1,170	270	7,309	11,577	10,249	**1,328**
2006	3,100	1,890	0	0	0	2,657	2,682	1,500	0	1,170	270	8,305	10,328	11,245	**-916**
2007	3,100	1,890	0	0	0	1,245	3,025	1,500	0	1,170	270	9,088	9,260	12,028	**-2,768**
2008	3,100	1,890	0	0	0	2,484	2,448	1,500	0	1,170	270	6,850	9,921	9,790	**132**
2009	3,100	1,890	0	0	0	1,651	2,671	1,500	0	1,170	270	6,751	9,312	9,691	**-379**
2010	3,100	1,890	0	0	0	3,995	2,422	1,500	0	1,170	270	5,617	11,407	8,557	**2,849**
2011	3,100	1,890	0	0	0	1,949	2,162	1,500	0	1,170	270	4,619	9,101	7,559	**1,542**
2012	3,100	1,890	0	0	0	1,635	2,474	1,500	0	1,170	270	6,282	9,099	9,222	**-124**
2013	3,100	1,890	0	0	0	589	2,365	1,500	0	1,170	270	6,913	7,944	9,853	**-1,909**
2014	3,100	1,890	0	0	0	1,733	2,325	1,500	0	1,170	270	6,562	9,048	9,502	**-454**
2015	3,100	1,890	0	0	0	762	2,116	1,500	0	1,170	270	6,124	7,867	9,064	**-1,196**
Average	3,100	1,890	0	0	0	2,501	2,713	1,500	0	1,170	270	7,161	10,204	10,101	**103**
Total	96,100	58,590	0	0	0	77,531	84,115	46,500	0	36,270	8,370	221,995	316,337	313,135	**3,201**

Notes:

Ephemeral stream recharge is included with precipitation deep percolation

Percolation of City recycled water ponds and discharge to the estuary is assumed to flow to the Ocean and does not add appreciable recharge

Model values from UWCD from Table 4-4 Summary of Simulated Annual-Average Fows in Mound Basin