the Bouwer and Rice method, the saturated thickness of the formation material contributing to the head-rise in each well was assumed to extend from the bottom of a particular screen to the top of the groundwater table. It was also assumed that the radius of the well casing used in the Bouwer and Rice formulation for the deep multi-port wells is represented by one half of the inner diameter of the Westbay® casing.

Analysis of the slug/bail test and the rising-head test data from the JPL site was accomplished by using AQTESOLV®, an aquifer design and test software program developed by the Geraghty and Miller Modeling Group (Geraghty and Miller, 1991). AQTESOLV® is an interactive computer software program that uses statistical parameter estimation methods with graphical curve matching techniques to analyze aquifer test data. AQTESOLV® supports slug/bail and the rising-head test data analyses based on the Bouwer and Rice method. The test data for the JPL monitoring wells were used as input to the AQTESOLV® program. The geometric characteristics of the wells used as additional input to AQTESOLV® are presented in Tables 3-1 and 3-2 for the shallow and deep monitoring wells, respectively. Note that for the wells that are affected by the water transfer through the well screen above the water table, the casing radius was corrected (Bouwer, 1986) to account for this increased water transfer rate (Table 3-1).

The results of the calculated hydraulic conductivities for the shallow monitoring wells are summarized in Table 3-3. It is noted that more than one estimate has been provided for some of the wells for which the aquifer tests were repeated. The hydraulic conductivity values calculated from the "slug" test data range from 2.0 ft/day (15 gpd/ft$^2$) for well MW-13 to 8.0 ft/day (60 gpd/ft$^2$) for well MW-1. The conductivity values estimated from the "bail" test data range from 2.0 ft/day (15 gpd/ft$^2$) for well MW-9 to 16.5 ft/day (123 gpd/ft$^2$) for well MW-10. These values indicate moderate to high soil permeabilities and are consistent with the typical values for medium-grained silty sands to clean sands. Once again, it should be remembered that the calculated conductivities are, in general, representative of the soil permeabilities in the locality of the well screens.

Table 3-4 summarizes the results of the hydraulic conductivity estimates in the deep monitoring wells. Up to five conductivity values have been estimated for these wells representing the formation characteristics at the five different screen intervals in each deep well. The hydraulic conductivity values range from 0.1 ft/day (0.7 gpd/ft$^2$) in well MW-11 (Screens 2 through 5) to 20.8 ft/day (156 gpd/ft$^2$) in well MW-14 (Screen 3). In general, no trend or consistent change (increase or decrease) in conductivity values with depth is observed. However, the conductivity values estimated based on well MW-11 tests are lower (about 1 order of magnitude) than the other deep wells. The reason for this lower conductivity is not readily evident in the well boring log where the formation material appears to be relatively similar to the other wells. Well MW-11 was drilled, installed, and developed using the same protocols used for the other multi-port wells (Section 2.0). No anomalies were encountered during drilling or well construction that might explain the test results.

The results of the aquifer testing presented above have shown a moderate range of variation across the JPL site. As indicated before, the slug/bail and rising-head tests provided information on the characteristics in the vicinity of the well screens. Depending on the heterogeneity of the formation material, local characteristics could vary significantly from the regional characteristics. Typically, aquifer test results can be considered most accurate for low-permeability formation material. For moderate to high permeability material (such as the formation material beneath the JPL site), the test results could be influenced by measurement errors caused by difficulty in monitoring the quick rate of recovery of water level in the wells. This quick recovery may manifest itself by fluctuations in water level data during a test, such as was observed in some of the JPL wells. These fluctuations could also represent the effects of the water drainage through the sand pack surrounding the well screens.

The factors mentioned above could affect the accuracy of the aquifer test results. The effects of these factors can not, however, be quantitatively evaluated. Considering the JPL site conditions, it is possible that the conductivity values from the aquifer tests could be some degree different from those actually present beneath JPL. However, the results from the aquifer tests are within the range expected for silty sands and sands like those present at JPL.

### 3.4.2 Groundwater Chemistry

During the OU-1/OU-3 RI, groundwater samples were analyzed for a suite of major anions and cations. The results of these analyses, along with general minerals data obtained from the CA DHS for the nearby municipal production wells, were used to evaluate the general chemistry of the groundwater around JPL and to aid in the interpretation of groundwater flow patterns. All of the JPL water chemistry analyses were performed in accordance with EPA CLP Level III protocols. The results of the water chemistry analyses are presented in the following sections.

#### 3.4.2.1 Analytical Results

During the RI, analyses used in the evaluation of the natural groundwater chemistry in JPL wells included laboratory determinations of major anions [including Cl, $SO_4$, $NO_3$, and alkalinity ($HCO_3$ and $CO_3$)], major cations (including Ca, Mg, Na, K, and Fe), and TDS. The results of the general mineral analyses from JPL wells during the RI sampling events are summarized in Table 3-5. Results of general minerals analyses from the nearby municipal wells during the RI period (1994 to 1998) are included on Table 3-6. In addition, since Colorado River water is injected by the Valley Water Company, into the aquifer, available general mineral analyses from Colorado River water is also included on Table 3-6. To more readily illustrate the major anion and cation composition of the groundwater for the RI, Stiff diagrams were prepared. The general minerals results from JPL wells for the last six (6) JPL quarterly groundwater sampling events (1996 to 1998) are presented graphically as Stiff diagrams in Appendix E. During the last six (6) events, both the JPL on-site and off-site wells were sampled together, creating sets of data from both on-site and off-site wells. As an example of the type of results obtained, the general mineral results from the most recent JPL RI water sampling event (January-February 1998) are included as Stiff diagrams in Figures 3-11, 3-12 and 3-13. All of the general minerals results, obtained from nearby municipal wells and Colorado River water, are presented as Stiff diagrams on Figure 3-14. A review of the Stiff diagrams suggests that the majority of groundwater at JPL can, in general, be divided into three general types:

Type 1: Calcium-bicarbonate groundwater. Groundwater with Ca as the dominant cation and bicarbonate ($HCO_3$) as the dominant anion.

Type 2: Sodium-bicarbonate groundwater. Groundwater with Na as the dominant cation and $HCO_3$ as the dominant anion.

Type 3: Calcium-bicarbonate/chloride/sulfate groundwater. Groundwater with Ca as the dominant cation and $HCO_3$ the dominant anion, but with relatively elevated Cl and $SO_4$ concentrations. This water type consistently has relatively higher levels of TDS than the other two general types.

In addition to the general water types above, the analytical data suggest that these water types mix, or blend with each other, creating "intermediate" water types. For example, water Types 1 and 2 can mix creating a 1+2 or a 2+1 type, where the first number indicates the general water type that is most dominant. These "intermediate" water types are best illustrated by the stiff diagrams (Figures 3-11, 3-12 and 3-13).

The locations of different water types within the JPL study area at the start and completion of the site-wide RI sampling period are illustrated in Figures 3-15 and 3-16, respectively. These figures illustrate the locations of the general water types in the three aquifer layers identified beneath JPL (as described in Sections 3.3.1 and 3.4.3). When more than one water type or blend of water types were present in an aquifer layer, the water type of the uppermost screen in an aquifer layer was used to represent that layer.

In general, water Type 1, the calcium-bicarbonate water type, is primarily found in the monitoring and production wells in and near the Arroyo Seco (Figures 3-11 to 3-16). This is the most common water type in the study area. It appears that this water type, with its relatively low concentrations of major ions (low TDS), originates as rainwater runoff from the San Gabriel Mountains and enters the JPL area through the Arroyo Seco and the spreading grounds within the Arroyo Seco. The likely source of the dominant ions in water Type 1 is calcite, as calcite is found in significant quantities in nearly all sedimentary basins and dissolves relatively rapidly to form calcium and bicarbonate ions in groundwater aquifers (Freeze and Cherry, 1979).

Water Type 2, the sodium-bicarbonate water type, along with associated blends, is typically found in the deeper well screens of both the on-site and off-site JPL multi-port wells (Figures 3-11 to 3-16). This water type (Type 2), although found deep in the aquifer, is similar to water Type 1 in that both have relatively low TDS. The only significant difference between these water types is that sodium makes up the predominant cation in Type 2, whereas calcium is the predominant cation in Type 1.

It is possible that water Type 2 is derived from water Type 1 as a result of cation exchange reactions between the groundwater and the aquifer substrata. Groundwaters with high concentrations of sodium and bicarbonate can form in soils or sediments containing significant amounts of calcite, if minerals with exchangeable sodium are present (Freeze and Cherry, 1979). The most prominent mineral in the arkosic sands and granitic cobbles/boulders of the Pacoima Formation and the Older Fanglomerate Series underlying the JPL study area is feldspar (Smith, 1986). Sodium-rich feldspars are the most common feldspar in arkosic sands and granitic rock types, providing an abundant source of sodium for cation exchange reactions.

Furthermore, calcium concentrations in fresh water aquifers are considerably influenced by cation exchange equilibia as calcium is more strongly held on mineral surfaces than is sodium (Hem, 1985; Drever, 1997). As Type 1 water migrates downward through the sediments at JPL, sodium cations are apparently exchanged, over time, for calcium in the groundwater.

Water Type 3, the calcium-bicarbonate/chloride/sulfate water type, is most prevalent in wells located "upgradient" and along the western edge of JPL (Figures 3-11 to 3-16). Some Type 3 water is also found downgradient and to the south of JPL. This water type differs from Type 1 in that it contains relatively elevated levels of chloride, sulfate, and TDS.

As shown on Figure 3-14 and Table 3-6, the Colorado River water used for injection into the aquifer upgradient of JPL by the Valley Water Company (obtained from the Metropolitan Water District Weymouth Plant) has high Cl, $SO_4$, and TDS similar to the levels used to define Type 3 water in the study area. The fact that water with relatively low TDS, Cl, and $SO_4$ is present in La Cañada Irrigation District well No. 1, located immediately upgradient of the Valley Water Company (Valley) wells (Figure 3-14), strongly suggests the presence of high Cl, $SO_4$, and TDS in the Valley wells, and wells located downgradient of the Valley wells, is the result of historical injection of Colorado River water into the Valley wells.

Overall, the types of water identified at each JPL monitoring well screen have not changed significantly with time throughout the RI. A summary of the water types identified at each JPL well screen during the OU-1/OU-3 RI is provided in Table 3-7. Those screens where the water type has slightly changed are located in areas where two or more of the general water types meet.

Based on the general water chemistry results, most groundwater within the JPL study area can be classified as "upgradient" (Type 3) water, likely the result of injection of Colorado River water into the aquifer by the Valley Water Company, or "Arroyo Seco" (Type 1) water, primarily originating at the mouth of the Arroyo Seco. These identifications are used, along with the groundwater flow directions, to help evaluate the nature and extent of groundwater contamination (see Section 4.3).

#### 3.4.2.2 Water Chemistry QA/QC Results

The quality of the water chemistry data (major anions and cations) collected during the RI was assessed using laboratory QA/QC results and geochemical calculations on the analytical results.

All water chemistry analyses were performed by the laboratory following EPA CLP Level III type protocols.

Matrix spikes, blank spikes and method blanks were used by the laboratory to determine the accuracy and precision of the analytical results and to identify any spurious results owing to laboratory procedures or equipment malfunction. In general, the matrix and blank spike recoveries fell within EPA, method specification, or laboratory determined ranges. Moreover, relative percent differences were all within the EPA-advisory limit of 20%. Therefore, all data are considered acceptable for their use in identifying general water types.

To evaluate the general quality of the RI water chemistry data, two independent geochemical quality control checks of the analytical results were performed. These checks included calculation of total ion-charge balances, and comparison of measured TDS to calculated TDS. The results of these checks are presented in Table 3-5. Charge balances are expressed as the percent difference between the sum of the equivalent weights of each of the anions and each of the cations analyzed (Freeze and Cherry, 1979). The ideal range for charge balances is $\pm 5$ percent, although charge balance errors up to $\pm 10$ percent are acceptable. TDS results can be compared to the sum of the concentrations of the major anions and cations to verify that all important water chemistry constituents have been analyzed for. The ratio between the measured TDS and a calculated TDS under ideal conditions should fall between 1.0 and 1.2 (Oppenheimer and Eaton, 1986). TDS was calculated using the laboratory-derived values for carbonate ($CO_3^{2-}$ and $HCO_3^-$), and assuming that all the nitrogen occurs as $NO_3^-$ (Hem, 1985). By convention, $HCO_3^-$ values are reported in units of calcium carbonate ($CaCO_3$), therefore, these values were multiplied by 0.4917 to yield the value for $HCO_3^-$ (Hem, 1985).

As shown on Table 3-5, the charge balances for samples analyzed for major anions and cations during the RI groundwater sampling are predominantly within the ideal range ($\pm 5$ percent). The ratio between measured and calculated TDS values for the RI water chemistry results were also predominantly within the ideal range (1.0 to 1.2). This indicates the data are acceptable for their use in identifying differences in water chemistry across the study area.

### 3.4.3 Groundwater Flow System

In an effort to evaluate groundwater flow conditions and the effect outside influences have on the aquifer beneath JPL, a variety of data were compiled. Pressure transducers installed in the JPL shallow wells and City of Pasadena's monitoring well MH-01 have been recording water levels daily during the RI period (June 1994 to March 1998). In addition, after the off-site JPL wells (MW-17 through MW-21) were installed in August 1995, hydraulic-head measurements were collected monthly from each screened interval in each JPL multi-port well. The monthly hydraulic-head data for each JPL multi-port well, along with monthly precipitation data, monthly groundwater extraction data for the nearby municipal production wells, and the amount of surface water diverted monthly by the Los Angeles County Department of Public Works to the Arroyo Seco groundwater recharge spreading basins have been compiled and are included as Appendix F.

Pursuant to a request from the regulatory agencies, the aquifer was divided into horizontal layers to facilitate the reporting of contaminant results from the multi-port wells. As discussed in Section 3.3.1 (Stratigraphy) the aquifer was divided into four layers based on depth, lithology, and the way screened intervals in the multi-port wells responded to pumping of nearby municipal production wells (see Section 3.3.1, Stratigraphy). Silt-rich intervals that inhibit the vertical flow of groundwater during periods of pumping of the nearby production wells were used to divide the aquifer. A conceptual model of the aquifer layers and associated silt-rich intervals as defined on the geologic cross-sections (Figures 3-3 through 3-7) is included on Figure 3-17. As shown on Figure 3-17, and discussed below, the silt-rich intervals are well developed off-site to the east of JPL and are absent west of JPL. Where the silt-rich intervals are present, semi-confined conditions exist, and where they are absent, unconfined conditions exist.

The following subsections contain descriptions of flow directions and gradients observed in each aquifer layer during both non-pumping and pumping scenarios encountered during the RI.

3.4.2.3 Aquifer Layer 1

Aquifer Layer 1 is equivalent to the upper portion of the Older Fanglomerate Series (Qo1-Qo4) as shown on Figures 3-3 through 3-7. This layer includes the water table and approximately the upper 75 to 100 feet of the aquifer. Water-table elevations have been recorded daily throughout the RI (June 1994 to March 1998) in the JPL shallow standpipe wells with dedicated pressure transducers. This data is summarized as hydrographs on Figure 3-18. In addition, hydraulic-head measurements have been recorded from the uppermost-screened intervals in the JPL multi-port monitoring wells on a monthly basis since the off-site multi-port wells were installed in August 1995. These hydraulic-head elevation data for multi-port well screens in Layer 1, along with monthly pumping volumes of the nearby municipal production wells, precipitation data and spreading basin recharge data are summarized on Figure 3-19. A summary of construction specifications for the nearby municipal production wells is included in Table 3-8.

As shown on Figure 3-18, the water-table elevations in the wells located at the mouth of the Arroyo Seco (MW-1, MW-9 and MW-15) are consistently higher than the water-table elevations in the other JPL wells, indicating a significant groundwater mound is present in this area. This mound is typically between 80 and 120 feet higher than the surrounding water table and is a result of groundwater recharge from the mouth of the Arroyo Seco. The mound is present year-round and is one of the most significant features of the water-table at JPL.

Throughout the RI period, the water table has fluctuated vertically up to 75 feet per year beneath JPL, primarily controlled by pumping of nearby municipal production wells and the amount of groundwater recharge from the Arroyo Seco spreading basins. As indicated on Figure 3-19, the nearby municipal production wells pump during most of the year and stop pumping for a short period of time during the "wet" season of the year. The production wells stop pumping once a year primarily for maintenance on the wells and on associated water treatment facilities. However, pumping may also be stopped, or the pumping rate lowered, based on the amount of precipitation. Production wells may stop producing during periods of increased precipitation when it is more economical to purchase water for distribution to customers than it is to pump water from the aquifer for distribution.

The City of Pasadena (Pasadena) production wells clearly have the greatest influence on water-table elevations beneath JPL. When compared to the other local water purveyors (Lincoln Avenue Water Company, Valley Water Company, La Cañada Irrigation District, Rubio Cañon Land and Water Company, and Las Flores Water Company), the Pasadena wells have the largest maximum pumping rates, are located closest to JPL and pump the longest each year. As shown on Figure 3-18, when the Pasadena wells are pumping, the water-table in the study area continuously declines until the wells are shut off. When the wells are shut off, water levels rise immediately. During the RI period (June 1994 to March 1998), the water-table was monitored through three rainy or "wet" seasons. During each of these "wet" seasons when the Pasadena wells were either shutoff or producing in a significantly reduced capacity, groundwater recharge through the Arroyo Seco spreading basins was significant enough to reverse groundwater flow to the west across most of the JPL site. As shown on Figure 3-18, a "flow reversal" has been defined as the period of time when the water-table in well MW-6 is lower than the water-table in all other shallow JPL wells on-site (except for the wells on the groundwater mound at the mouth of the Arroyo Seco, MW-1, MW-9 and MW-15). Well MH-01 is located off-site in the Arroyo Seco and is readily impacted by pumping in the Pasadena wells. When the Pasadena wells are pumping at a reduced rate, water levels in MH-01 can be drawn down, while at the same time, the groundwater flow direction can be reversed to the west across JPL. A good example of this is shown on Figure 3-18 during the winter of 1995. The water-table in MW-6 was the lowest relative to the other JPL shallow wells for approximately 16 weeks. During the winters of 1996 and 1997, the Pasadena wells were off for relatively short periods of time before being returned to full production. In 1996, the water-table in MW-6 was the lowest relative to the other JPL shallow wells for a total of 18 days and in 1997 it was the lowest for 9 days. Based on the above RI data, the relatively short amount of time groundwater may flow to the west across JPL each year, combined with the fact that contamination from JPL has not been observed in the westernmost JPL monitoring well (MW-14, Section 4.0), there does not appear to be a significant potential for contaminant migration to the west.

Between periods of time when the groundwater flow across the site was normal, or to the east, and the relatively short periods of time when the water-table in MW-6 was observed to be the lowest and flow was reversed, or to the west across the site, there were periods of "transition" during which the water table in some on-site wells were either slightly higher or lower than the water table in MW-6, depending on whether or not the flow direction was reversed or going back to normal. These periods of transition are indicated on Figure 3-18. As shown on Figure 3-18, the period of time when groundwater flow was normal, reversed, or in transition, varied from year to year.

To illustrate various configurations of the water-table (aquifer Layer 1), water-table elevation contour maps have been prepared showing a period of groundwater flow reversal across the JPL site (Figure 3-20), a period when only the Pasadena wells are pumping (Figure 3-21), and a period when all nearby municipal production wells are pumping (Figure 3-22).

It is interesting to note that a subtle "groundwater low" is shown on Figures 3-21 and 3-22 at the far northern portion of the site. As shown on these figures, the low is represented by the water-table elevation measured in well MW-7, which is 1 to 2 feet lower than the water table in nearby wells. This area of slightly "lower" groundwater is both downgradient of regional flow from the west and downgradient from the groundwater mound at the mouth of the Arroyo Seco.

During the RI, groundwater elevations were collected from both on-site and off-site wells simultaneously only after the off-site wells were installed in August 1995. Since August 1995, two short groundwater flow reversals have been observed at JPL, one in April 1996 and one in February 1997 (Figure 3-18). The April 1996 flow reversal is shown in Figure 3-20. In April 1996, the monthly round of water-level measurements was completed when the groundwater flow direction was reversed across the site from mounding beneath the spreading basins, while, at the same time the Pasadena wells, which days before had started pumping, had created a trough of depression in the Arroyo Seco. As shown on Figure 3-20, the prominent mound at the mouth of the Arroyo Seco is present and the flow direction is reversed to the west across the site at a relatively low gradient.

Flow reversals may occur during the rainy part of the year when groundwater recharge is significant and when the production wells are not pumping. These conditions were not typically present for very long. Throughout the RI, the nearby municipal production wells were pumping most of each year. Water-table scenarios, one where only the City of Pasadena wells are pumping and one where all nearby municipal wells are pumping, are represented on Figures 3-21 and 3-22, respectively. As shown on these two figures, the Pasadena wells have the greatest impact on the water-table near JPL. The pumping in the Valley Water Company, La Cañada Irrigation District, Las Flores Water Company and Rubio Cañon Land and Water Company wells does not impact the water-table at JPL. The pumping in Lincoln Avenue Well 3 has very little impact on the water table, as it does not appear to impact the water table in nearby monitoring well MW-17.

#### 3.4.3.2 Aquifer Layer 2

Aquifer Layer 2 is equivalent to the lower portion of the Older Fanglomerate Series (Qo1-Qo4) as shown on Figures 3-3 through 3-7. This layer is approximately 150 to 200 feet thick. Hydraulic-head elevation measurements have been recorded from each multi-port well screen in Layer 2 on a monthly basis since the off-site multi-port wells were installed in August 1995. These hydraulic-head elevation data, along with monthly pumping volumes of the nearby municipal production wells, precipitation data and spreading ground data are summarized on Figure 3-23.

As discussed in Section 3.3.1 on Stratigraphy, one of the criteria for defining the aquifer layers was the response of the hydraulic head in the multi-port well screens to nearby municipal well production. Well screens that showed similar amounts of "draw down" during pumping helped define the aquifer layers. Silt-rich layers located between screens that had significantly different responses to nearby pumping were inferred to inhibit the vertical migration of groundwater and create semi-confined conditions. The silt-rich interval separating aquifer Layer 2 from aquifer Layer 1 extends from the eastern edge of JPL (wells MW-4, MW-11 and MW-12) east through well MW-20 (Figure 3-17). The hydraulic head elevation monitored in Layer 2 in the remaining on-site multi-port wells (MW-14, MW-22, MW-23, and MW-24) and off-site well MW-21 is similar to the water-table elevation monitored in Layer 1 in those wells, indicating unconfined aquifer conditions exist in Layer 2 across most of the JPL site (Figure 3-17).

To illustrate various configurations of the potentiometric surface observed in aquifer Layer 2, contour maps of hydraulic-head elevations have been prepared for a period when no municipal production wells were pumping (Figure 3-24), a period when only the Lincoln Avenue Water Company was pumping (Figure 3-25), a period when only the Pasadena wells were pumping (Figure 3-26), and a period when all nearby municipal production wells were pumping (Figure 3-27). When more than one multi-port screen from a well was present in Layer 2, the hydraulic-head measurement from the uppermost screen was used to prepare the potentiometric surface maps.

As illustrated on Figure 3-24, during the short period of time each year when the nearby municipal production wells are not pumping, groundwater flow in aquifer Layer 2 is to the southeast across JPL, past the Pasadena wells, towards well MW-20 with a gradient of approximately 0.005. The groundwater mound that is so prominent at the mouth of the Arroyo Seco year-round in aquifer Layer 1 is only subtly present in aquifer Layer 2 (Figure 3-24).

Similar to aquifer Layer 1, pumping of the nearby Pasadena wells has the most significant impact on the potentiometric surface in aquifer Layer 2 near JPL. Pumping of the Lincoln Avenue Water Company Well No. 3 has little impact on aquifer Layer 2. As shown on Figure 3-25, well MW-17, located less than 500 feet away from the Lincoln well is very subtly impacted (see graph of pumping volumes and hydrographs for MW-17 in Appendix F). When the Pasadena wells are pumping, a large area of Layer 2 is influenced (Figure 3-26). As indicated on the graph of pumping volumes and hydrographs for MW-20 in Appendix F, when the Pasadena wells are pumping, Layer 2 as far downgradient as MW-20 is impacted. The area of influence in Layer 2 around the Pasadena wells during pumping appears asymmetrical, with a lower gradient to the east of the wells than to the west. This may be related to the silt-rich interval separating Layer 1 from Layer 2 that extends from well MW-20 to the eastern edge of JPL (Figure 3-17). During pumping, aquifer Layer 2 exhibits semi-confined conditions beneath this silt-rich interval where a cone of depression can expand relatively rapidly due to the relatively lower storativity (amount of water that can be produced per unit volume of aquifer per unit drawdown) of semi-confined aquifers compared to unconfined aquifers. To the west of the Pasadena wells, just past the eastern edge of JPL, the silt-rich interval is not present and unconfined conditions exist. Under unconfined conditions, a cone of depression will typically develop relatively slowly, as production is primarily a result of dewatering from gravity drainage of groundwater.

When pumping, the La Cañada Irrigation District, Valley Water Company, Rubio Cañon and Las Flores Water Company wells do not impact the potentiometric surface in Layer 2 at the JPL site (Figure 3-27). However, after reviewing the production schedules and hydrograph for MW-20 (Appendix F), it appears the Rubio Cañon wells, when pumping, can have slightly more influence on Layer 2 in MW-20 than the Pasadena wells do (Figure 3-27).

#### 3.4.2.4 Aquifer Layer 3

Aquifer Layer 3 is equivalent to the Pacoima Formation (Qp) as shown on Figures 3-3 through 3-7. This layer is approximately 200 to 300 feet thick and rests on top of the crystalline basement complex beneath the study area, with the exception of the area around MW-20 where it overlies the Saugus Formation. Hydraulic-head elevation measurements have been recorded from each multi-port well screen in Layer 3 on a monthly basis since the off-site multi-port wells were installed in August 1995. These hydraulic-head elevation data, along with monthly pumping volumes of nearby municipal production wells (Lincoln Avenue Water Company, Valley Water Company, La Cañada Irrigation District, Rubio Cañon Land and Water Company, and Las Flores Water Company), precipitation data and spreading basin data are summarized on Figure 3-28.

As shown on Figure 3-17, the silt-rich interval identified between aquifer Layers 2 and 3 extends from on-site multi-port wells MW-22 and MW-23 eastward through off-site well MW-20. Beneath the silt-rich interval, semi-confined conditions exist during pumping of the nearby municipal wells. West of this silt-rich interval, around multi-port wells MW-14 and MW-21, unconfined aquifer conditions exist in Layer 3.

To illustrate various configurations of the potentiometric surface observed in aquifer Layer 3, contour maps of hydraulic-head elevations have been prepared for a period when no municipal production wells were pumping (Figure 3-29), a period when only the Lincoln Avenue Water Company was pumping (Figure 3-30), a period when only the Pasadena wells were pumping (Figure 3-31), and a period when all nearby municipal wells were pumping (Figure 3-32). When more than one multi-port screen from a well was present in Layer 3, the hydraulic-head elevation from the uppermost screen was used to prepare the potentiometric surface maps.

As shown on Figure 3-29, during the short period of time the nearby municipal production wells are not pumping, groundwater flow in Layer 3 is to the southeast across JPL towards well MW-20. The gradient is low, averaging approximately 0.0045 near the Arroyo Seco. The groundwater mound at the mouth of the Arroyo Seco that is prominent in Layer 1, and subtly present in Layer 2, appears absent in Layer 3.

Similar to aquifer Layers 1 and 2, pumping of the Pasadena wells has a very significant impact on the potentiometric surface in aquifer Layer 3. As shown on Figure 3-31, when only the Pasadena wells are pumping, the cone of depression in the potentiometric surface extends a great distance. The cone of depression developed in Layer 3 during pumping of the Pasadena wells is much deeper, and broader than is developed in the other layers. Deeper and broader cones of depression will typically form in aquifers under confining or semi-confining conditions.

Pumping of the Lincoln Avenue Water Company well No. 3 has little impact on the hydraulic head in Layer 3 in well MW-17, located less than 500 feet away (see graph of pumping volumes and hydraulic heads for MW-17 in Appendix F). This is illustrated on Figure 3-30 with a relatively small cone of depression in the potentiometric surface around Lincoln Avenue Well No. 3.

When pumping, the La Cañada Irrigation District, Valley Water Company, Las Flores Water Company and Rubio Cañon Land and Water Company wells do not impact the potentiometric surface in Layer 3 beneath JPL (Figure 3-32).

#### 3.4.2.5 Aquifer Layer 4

Aquifer Layer 4 is equivalent to the Saugus Formation (TQs) as interpreted on Figures 3-4 and 3-5. Layer 4 is present only at the far eastern end of the study area in the bottom screen in well MW-20, is approximately 150 feet thick, and rests on crystalline basement rocks. The hydraulic-head elevation in this screen is very unique in that it is not significantly impacted by pumping of nearby municipal wells (see graph of pumping volumes and hydraulic-head elevation for MW-20 in Appendix F). The hydraulic-head elevation in Screen 5 of MW-20 is very similar to the water-table elevation monitored in the uppermost screen in MW-20. Screen 5 is isolated from the upper layers and, therefore, is not affected by pumping of the nearby municipal wells. The screen is located very deep in the aquifer and is isolated by several silt-rich intervals (Figures 3-4 and 3-5).

#### 3.4.2.6 Summary

The direction of groundwater flow and the magnitude of the groundwater gradient beneath JPL are dynamic. The aquifer is significantly affected by various natural and anthropogenic influences which include: 1) pumping from nearby municipal production wells, 2) groundwater recharge from the Arroyo Seco spreading basins, 3) seasonal groundwater recharge from precipitation, and 4) regional groundwater flow. Of these influences, pumping at the nearby City of Pasadena municipal production wells is clearly the most significant.

To facilitate reporting of contaminant results from the JPL multi-port monitoring wells, the aquifer was divided into four (4) layers. The layers are defined, whenever possible, by depth, lithology and on the response of screened intervals in the multi-port wells to pumping of nearby municipal production wells (see Section 3.3.1). Silt-rich intervals in the aquifer that appear to inhibit the vertical flow of groundwater during periods of pumping were used when possible to divide the aquifer.

The uppermost aquifer layer, Layer 1, includes the water table and approximately the upper 75 to 100 feet of the aquifer. The most significant feature of the water table is a groundwater mound, present year round at the mouth of the Arroyo Seco, that is up to 120 feet high. Pumping of the nearby City of Pasadena municipal wells and recharge from the Arroyo Seco spreading basins, primarily controls the water table at JPL, with the exception of the mound. During most of each year the Pasadena wells are pumping and groundwater flows across JPL to the southeast towards the wells. During the "wet" season of the year, typically when the Arroyo Seco spreading basins are full of rainwater runoff and groundwater recharge is occurring, the production wells are shut down for a relatively short period of time, primarily for maintenance reasons, and the groundwater flow direction can reverse, or flow to the west from the spreading basins across JPL. During the RI, these flow reversals lasted from approximately 9 days up to approximately 16 weeks. The flow reversals are complex in nature, where the duration of the reversal primarily depends on the pumping schedule of the Pasadena wells and on the amount of rainfall and associated rate of groundwater recharge in the Arroyo Seco.

Aquifer Layer 2, located immediately below aquifer Layer 1, is approximately 150 to 200 feet thick and is separated from aquifer Layer 1 by a silt-rich interval that extends from the eastern edge of JPL off-site through well MW-20. Where this silt-rich layer is present, semi-confined conditions exist in Layer 2 and where the silt-rich layer is absent, unconfined conditions are present. During the short period of time each year when the nearby municipal wells are not pumping, groundwater flows with a gentle gradient (Figure 3-24) to the southeast in Layer 2. The prominent groundwater mound at the mouth of the Arroyo Seco in Layer 1 is present in Layer 2, but is a very subtle feature. When pumping, the City of Pasadena municipal wells have a significant impact on Layer 2, where the cone of depression extends to the west across JPL past MW-22 and downgradient off-site to the east to well MW-20 (Figure 3-26).

Aquifer Layer 3, located beneath aquifer Layer 2, is approximately 200 to 300 feet thick and is present above crystalline basement rocks in the study area except for around MW-20, where it is above aquifer Layer 4. Layer 3 is separated from Layer 2 by a silt-rich interval that extends from wells MW-22 and MW-23 east through well MW-20. Similar to Layer 2, where the silt-rich interval is present, semi-confined conditions exist in Layer 3. When the nearby municipal wells are not pumping, groundwater flows with a gentle gradient to the southeast (Figure 3-29). The groundwater mound, so prominent in aquifer Layer 1, is not apparent in aquifer Layer 3. Again, similar to Layer 2, the City of Pasadena wells have a significant impact on Layer 3, where the cone of depression during pumping of the Pasadena wells extends a great distance between wells MW-22 and MW-23 at the western end of JPL to well MW-20 at the eastern end of the study area.

Aquifer Layer 4, present only at the far eastern end of the study area in screen 5 (bottom screen) in well MW-20, is approximately 150 feet thick and immediately above crystalline basement rocks. The silt-rich intervals that separate screen 5 from the other aquifer layers hydraulically isolates it from the affects municipal pumping has on the study area.

Each aquifer layer in the study area responds differently to the effects of pumping from the nearby municipal production wells. These effects vary depending on which wells are pumping and the time of year they are pumping. As the amount of precipitation, groundwater recharge, and municipal well pumping varies from year to year, so will the impacts on water levels, groundwater flow directions and groundwater gradients beneath JPL vary from year to year.

## TABLE 3-1

## AQUIFER TEST PARAMETERS USED IN AQTESOLV®
## FOR SHALLOW JPL WELLS

| Well No. | Radius of Well Borehole[1] (inches) | Screen Length (feet) | Height of Water Above Base of Screen (feet) | Radius of Well Casing (inches) | Corrected Radius[2] (inches) |
|---|---|---|---|---|---|
| MW-1 | 5.0 | 40 | 99.36 | 2 | N/A[3] |
| MW-5 | 5.5 | 50 | 45.60 | 2 | 2.30 |
| MW-6 | 5.5 | 50 | 44.56 | 2 | 2.30 |
| MW-7 | 5.5 | 50 | 40.11 | 2 | 2.30 |
| MW-8 | 5.4 | 50 | 44.76 | 2 | 2.28 |
| MW-9 | 5.4 | 50 | 51.13 | 2 | N/A |
| MW-10 | 5.4 | 50 | 47.18 | 2 | 2.28 |
| MW-13 | 4.8 | 50 | 31.34 | 2 | 2.22 |
| MW-15 | 5.0 | 50 | 49.93 | 2 | 2.24 |
| MW-16 | 5.0 | 50 | --[4] | 2 | 2.24 |

(1): Radii vary due to differences in diameters of the drilling bits used.

(2): The well casing radius is corrected by using $\sqrt{r_c^2 + (r_w^2 - r_{os}^2)\, Sy}$

where $r_c$ = casing radius, $r_w$ = borehole radius, $r_{os}$ = outside radius of well screen and
Sy = specific yield of filter pack (assumed to be 0.05).
(Bouwer, 1986)

(3): N/A: Not Applicable. Water level was above screened interval.

(4): Aquifer test could not be performed due to physical condition of well. Well is slightly deviated causing cable attached to slug to tangle with transducer cable during attempted tests.

# TABLE 3-2

## AQUIFER TEST PARAMETERS USED IN AQTESOLV® FOR DEEP JPL MULTI-PORT WELLS

| Well Number | Screen Number | Radius of Well Casing[1] (feet) | Radius of Well Borehole[2] (feet) | Screen Length (feet) | Height of Water Above Base of Screen (feet) |
|---|---|---|---|---|---|
| MW-3 | 1 | 0.0625 | 0.408 | 10 | 41.98 |
| | 2 | 0.0625 | 0.408 | 10 | 120.00 |
| | 3 | 0.0625 | 0.408 | 10 | 215.00 |
| | 4 | 0.0625 | 0.408 | 10 | 425.00 |
| | 5 | 0.0625 | 0.408 | 10 | 519.00 |
| MW-4 | 1 | 0.0625 | 0.508 | 10 | 40.00 |
| | 2 | 0.0625 | 0.508 | 10 | 128.00 |
| | 3 | 0.0625 | 0.508 | 10 | 210.00 |
| | 4 | 0.0625 | 0.508 | 10 | 280.00 |
| | 5 | 0.0625 | 0.508 | 10 | 398.00 |
| MW-11 | 1 | 0.0625 | 0.408 | 10 | 45.82 |
| | 2 | 0.0625 | 0.408 | 10 | 106.00 |
| | 3 | 0.0625 | 0.408 | 10 | 274.60 |
| | 4 | 0.0625 | 0.408 | 10 | 368.90 |
| | 5 | 0.0625 | 0.408 | 10 | 478.90 |
| MW-12 | 1 | 0.0625 | 0.508 | 10 | --[3] |
| | 2 | 0.0625 | 0.508 | 10 | 99.37 |
| | 3 | 0.0625 | 0.508 | 10 | 174.60 |
| | 4 | 0.0625 | 0.508 | 10 | 274.00 |
| | 5 | 0.0625 | 0.508 | 10 | 329.80 |
| MW-14 | 1 | 0.0625 | 0.508 | 10 | 22.53 |
| | 2 | 0.0625 | 0.508 | 10 | 91.14 |
| | 3 | 0.0625 | 0.508 | 10 | 195.70 |
| | 4 | 0.0625 | 0.508 | 10 | 269.60 |
| | 5 | 0.0625 | 0.508 | 10 | 352.50 |
| MW-17 | 1 | 0.0625 | 0.5104 | 10 | 49.06 |
| | 2 | 0.0625 | 0.5104 | 10 | 142.08 |
| | 3 | 0.0625 | 0.5104 | 10 | 234.31 |
| | 4 | 0.0625 | 0.5104 | 10 | 287.77 |
| | 5 | 0.0625 | 0.5104 | 10 | 411.86 |
| MW-18 | 1 | 0.0625 | 0.5104 | 10 | 25.99 |
| | 2 | 0.0625 | 0.5104 | 10 | 81.22 |
| | 3 | 0.0625 | 0.5104 | 10 | 162.33 |
| | 4 | 0.0625 | 0.5104 | 10 | 276.41 |
| | 5 | 0.0625 | 0.5104 | 10 | 384.73 |

**TABLE 3-2**

**AQUIFER TEST PARAMETERS USED IN AQTESOLV®
FOR DEEP JPL MULTI-PORT WELLS**

| Well Number | Screen Number | Radius of Well Casing(1) (feet) | Radius of Well Borehole(2) (feet) | Screen Length (feet) | Height of Water Above Base of Screen (feet) |
|---|---|---|---|---|---|
| MW-19 | 1 | 0.0625 | 0.5104 | 10 | 80.52 |
| | 2 | 0.0625 | 0.5104 | 10 | 132.63 |
| | 3 | 0.0625 | 0.5104 | 10 | 206.25 |
| | 4 | 0.0625 | 0.5104 | 10 | 168.99 |
| | 5 | 0.0625 | 0.5104 | 10 | 218.44 |
| MW-20 | 1 | 0.0625 | 0.5104 | 10 | 32.07 |
| | 2 | 0.0625 | 0.5104 | 10 | 193.28 |
| | 3 | 0.0625 | 0.5104 | 10 | 339.98 |
| | 4 | 0.0625 | 0.5104 | 10 | 465.93 |
| | 5 | 0.0625 | 0.5104 | 10 | 703.57 |
| MW-21 | 1 | 0.0625 | 0.5104 | 10 | 30.85 |
| | 2 | 0.0625 | 0.5104 | 10 | 101.00 |
| | 3 | 0.0625 | 0.5104 | 10 | 178.83 |
| | 4 | 0.0625 | 0.5104 | 10 | 247.32 |
| | 5 | 0.0625 | 0.5104 | 10 | 309.33 |
| MW-22 | 1 | 0.0625 | 0.5104 | 10 | 30.40 |
| | 2 | 0.0625 | 0.5104 | 10 | 102.50 |
| | 3 | 0.0625 | 0.5104 | 10 | 172.80 |
| | 4 | 0.0625 | 0.5104 | 10 | 234.00 |
| | 5 | 0.0625 | 0.5104 | 10 | 344.20 |
| MW-23 | 1 | 0.0625 | 0.5104 | 10 | 26.29 |
| | 2 | 0.0625 | 0.5104 | 10 | 101.90 |
| | 3 | 0.0625 | 0.5104 | 10 | 166.50 |
| | 4 | 0.0625 | 0.5104 | 10 | 271.60 |
| | 5 | 0.0625 | 0.5104 | 10 | 366.50 |
| MW-24 | 1 | 0.0625 | 0.5104 | 10 | 37.96 |
| | 2 | 0.0625 | 0.5104 | 10 | 126.40 |
| | 3 | 0.0625 | 0.5104 | 10 | 186.00 |
| | 4 | 0.0625 | 0.5104 | 10 | 283.30 |
| | 5 | 0.0625 | 0.5104 | 10 | 386.80 |

(1): Calculated as one half of 1.5" inner diameter of MP casing.

(2): Radii vary due to differences in the diameter of the drilling bits used.

(3): Piezometric surface too close to measurement port, test could not be performed.

## TABLE 3-3

## RESULTS OF AQUIFER TESTS IN SHALLOW JPL WELLS

| Well No. | Representative Depth Interval (ft) | Date of Test | Estimated Hydraulic Conductivity | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Slug Test | | Bail Test | | Geometric Mean | |
| | | | (ft/day) | (gpd/ft²) | (ft/day) | (gpd/ft²) | (ft/day) | (gpd/ft²) |
| MW-1 | 70-110 | 12/94 | 7.0 | 52 | -- | -- | | |
| | | | 8.0 | 60 | 5.4 | 40 | 6.7 | 50.1 |
| MW-5 | 85-135 | 12/94 | 6.9 | 52 | -- | -- | | |
| | | | 7.9 | 59 | 15.8 | 118 | 9.5 | 71.1 |
| MW-6 | 195-245 | 12/94 | 2.1 | 16 | 5.4 | 40 | | |
| | | | 2.2 | 16 | 5.5 | 41 | 3.4 | 25.4 |
| MW-7 | 225-275 | 12/94 | 7.1 | 53 | 12.3 | 92 | | |
| | | | 4.4 | 33 | 9.8 | 74 | 7.8 | 58.3 |
| MW-8 | 155-205 | 12/94 | 2.7 | 20 | -- | -- | | |
| | | | 3.7 | 27 | 5.1 | 38 | 3.7 | 27.7 |
| MW-9 | 18-68 | 12/94 | 2.1 | 16 | -- | -- | | |
| | | | 2.3 | 17 | 2.0 | 15 | 2.1 | 15.7 |
| MW-10 | 105-155 | 12/94 | 7.7 | 58 | -- | -- | | |
| | | | 5.7 | 43 | 16.5 | 123 | 9.0 | 67.3 |
| MW-13 | 180-230 | 12/94 | 2.0 | 15 | -- | -- | | |
| | | | 2.9 | 22 | 10.3 | 77 | 3.9 | 29.2 |
| MW-15 | 20.5-70.5 | 12/94 | 3.2 | 24 | 5.7 | 43 | | |
| | | | 2.9 | 21 | 6.0 | 45 | 4.2 | 31.4 |

--: denotes data was distorted and, therefore, not analyzed.

# TABLE 3-4

## RESULTS OF AQUIFER TESTS IN DEEP JPL MULTI-PORT WELLS

| Multi-Port Well Number | Screen Number | Date of Test | Well Screen Depth Interval (ft) | Estimated Hydraulic Conductivity (ft/day) | Estimated Hydraulic Conductivity (gpd/ft$^2$) |
|---|---|---|---|---|---|
| MW-3 | 1 | 2/16/90 | 170-180 | 7.6 | 56.8 |
| | 2 | 2/15/90 | 250-260 | 7.3 | 54.6 |
| | 3 | 2/15/90 | 344-354 | 0.6 | 4.5 |
| | 4 | 2/13/90 | 555-565 | 6.6 | 49.4 |
| | 5 | 2/12/90 | 650-660 | 1.8 | 13.5 |
| MW-4 | 1 | 2/26/90 | 146.8-156.8 | 7.7 | 57.6 |
| | 2 | 2/24/90 | 237.2-247.2 | 4.0 | 29.9 |
| | 3 | 2/24/90 | 319.6-329.6 | 4.6 | 34.4 |
| | 4 | 2/23/90 | 388.9-398.9 | 4.1 | 30.7 |
| | 5 | 2/22/90 | 509.4-519.4 | 3.1 | 23.2 |
| MW-11 | 1 | 12/15/92 | 140-150 | 0.5 | 3.7 |
| | 2 | 12/12/92 | 250-260 | 0.1 | 0.7 |
| | 3 | 12/8/92 | 420-430 | 0.1 | 0.7 |
| | 4 | 12/1/92 | 515-525 | 0.1 | 0.7 |
| | 5 | 12/1/92 | 630-640 | 0.1 | 0.7 |
| MW-12 | 1 | 8/16/94 | 135-145 | —(1) | —(1) |
| | 2 | 8/16/94 | 240-250 | 4.1 | 30.7 |
| | 3 | 8/16/94 | 315-325 | 3.4 | 25.4 |
| | 4 | 8/16/94 | 430-440 | 1.5 | 11.2 |
| | 5 | 8/16/94 | 546-556 | 4.7 | 35.2 |
| MW-14 | 1 | 8/17/94 | 205-215 | 2.6 | 19.4 |
| | 2 | 8/17/94 | 275-285 | 19.6 | 146.6 |
| | 3 | 8/17/94 | 380-390 | 20.8 | 155.6 |
| | 4 | 8/17/94 | 453-463 | 7.0 | 52.4 |
| | 5 | 8/17/94 | 538-548 | 5.8 | 43.4 |
| MW-17 | 1 | 8/18/95 | 246-256 | 9.3 | 69.7 |
| | 2 | 8/18/95 | 366-376 | 16.8 | 125.7 |
| | 3 | 8/18/95 | 466-476 | 0.8 | 6.0 |
| | 4 | 8/18/95 | 578-588 | 0.4 | 3.0 |
| | 5 | 8/18/95 | 723-733 | 6.1 | 45.6 |
| MW-18 | 1 | 8/17/95 | 266-276 | 3.1 | 23.2 |
| | 2 | 8/17/95 | 326-336 | 5.6 | 41.9 |
| | 3 | 8/17/95 | 421-431 | 10.8 | 80.8 |
| | 4 | 8/17/95 | 561-571 | 9.9 | 74.1 |
| | 5 | 8/21/95 | 681-691 | 2.0 | 15.0 |

# TABLE 3-4

## RESULTS OF AQUIFER TESTS IN DEEP JPL MULTI-PORT WELLS

| Multi-Port Well Number | Screen Number | Date of Test | Well Screen Depth Interval (ft) | Estimated Hydraulic Conductivity (ft/day) | Estimated Hydraulic Conductivity (gpd/ft²) |
|---|---|---|---|---|---|
| MW-19 | 1 | 8/19/95 | 240-250 | 4.3 | 32.2 |
| | 2 | 8/19/95 | 310-320 | 12.2 | 91.2 |
| | 3 | 8/19/95 | 390-400 | 1.1 | 8.2 |
| | 4 | 8/18/95 | 442-452 | 9.2 | 68.8 |
| | 5 | 8/17/95 | 492-502 | 2.9 | 21.7 |
| MW-20 | 1 | 8/18/95 | 228-238 | 11.1 | 83.0 |
| | 2 | 8/18/95 | 388-398 | 10.1 | 75.5 |
| | 3 | 8/18/95 | 558-568 | 17.2 | 128.7 |
| | 4 | 8/18/95 | 698-708 | 1.9 | 14.2 |
| | 5 | 8/18/95 | 898-908 | 2.5 | 18.7 |
| MW-21 | 1 | 8/17/95 | 86-96 | 3.5 | 26.2 |
| | 2 | 8/17/95 | 156-166 | 3.9 | 29.2 |
| | 3 | 8/17/95 | 236-246 | 4.2 | 31.4 |
| | 4 | 8/17/95 | 306-316 | 12.0 | 89.8 |
| | 5 | 8/17/95 | 366-376 | 6.2 | 46.4 |
| MW-22 | 1 | 9/5/97 | 239-249 | 1.2 | 9.0 |
| | 2 | 9/5/97 | 324-334 | 6.7 | 50.1 |
| | 3 | 9/5/97 | 384-394 | 12.3 | 92.0 |
| | 4 | 9/5/97 | 464-474 | 7.0 | 52.4 |
| | 5 | 9/5/97 | 584-594 | 15.9 | 118.9 |
| MW-23 | 1 | 8/29/97 | 170-180 | 2.4 | 17.9 |
| | 2 | 8/29/97 | 250-260 | 7.7 | 57.6 |
| | 3 | 8/29/97 | 315-325 | 2.4 | 17.9 |
| | 4 | 8/29/97 | 440-450 | 2.2 | 16.5 |
| | 5 | 8/29/97 | 540-550 | 0.2 | 1.5 |
| MW-24 | 1 | 9/4/97 | 275-285 | 2.2 | 16.5 |
| | 2 | 9/4/97 | 370-380 | 11.4 | 85.3 |
| | 3 | 9/4/97 | 430-440 | 1.5 | 11.2 |
| | 4 | 8/22/97 | 550-560 | 11.6 | 86.8 |
| | 5 | 8/22/97 | 675-685 | 2.6 | 19.4 |

(1): Piezometric head too close to measurement port, test data not analyzed.

# TABLE 3-5

## SUMMARY OF WATER-CHEMISTRY RESULTS FROM JPL GROUNDWATER MONITORING WELLS JET PROPULSION LABORATORY
(concentrations in mg/L)

| Well Number | Sampling Event | Sampling Dates | ANIONS | | | | | CATIONS | | | | | Charge Balance | Measured TDS | Measured TDS / Calculated TDS | Measured pH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Cl | $CO_3$ | $HCO_3$ | $NO_3$-N | $SO_4$ | Na | Mg | K | Ca | Fe | | | | |
| ***MW-1*** | 1 | Jun/Jul 1994 | 11 | 0.504 | 195 | 1.0 | 32 | 25 | 14 | 2.8 | 43 | <0.1 | 1.71 | 260 | 1.13 | 7.3 |
| | 2 | Nov/Dec 1994 | 13 | 0.824 | 201 | 1.3 | 33 | 26 | 14 | 5.5 | 45 | <0.1 | 1.74 | 260 | 1.07 | 7.8 |
| | 5 | Aug/Sep 1996 | 12 | 0.655 | 201 | 1.2 | 36 | 28 | 15 | 3.1 | 49 | <0.1 | 5.60 | 270 | 1.10 | 7.7 |
| | 6 | Oct/Nov 1996 | 13 | 0.849 | 207 | 1.3 | 34 | 28 | 13 | 9.7 | 42 | 0.11 | 0.76 | 260 | 1.10 | 7.8 |
| | 7 | Feb/Mar 1997 | 13 | 1.1 | 219 | 1.4 | 35 | 27 | 16 | 4.5 | 48 | <0.1 | 2.14 | 270 | 1.00 | 7.9 |
| | 8 | Jun/Jul 1997 | 17 | 1.14 | 220 | 1.5 | 41 | 25 | 16 | 3.5 | 52 | 0.1 | 0.49 | 300 | 1.10 | 7.9 |
| | 9 | Sep/Oct 1997 | 19 | 0.713 | 219 | 1.4 | 46 | 28 | 16 | 3.8 | 57 | <0.1 | 2.72 | 310 | 1.10 | 7.7 |
| | 10 | Jan/Feb 1998 | 16 | 0.713 | 219 | 1.3 | 42 | 28 | 17 | 3.6 | 43 | <0.1 | 1.62 | 280 | 1.10 | 7.7 |
| ***MW-3*** | | | | | | | | | | | | | | | | |
| Screen 1 | 1 | Jun/Jul 1994 | 9.0 | 0.299 | 183 | 0.8 | 39 | 18 | 15 | 2.6 | 44 | 0.50 | 1.42 | 240 | 1.08 | 7.4 |
| | 2 | Nov/Dec 1994 | 10.0 | 1.54 | 188 | 0.7 | 36 | 18 | 15 | 2.6 | 43 | 1.2 | 0.12 | 250 | 1.12 | 7.0 |
| | 5 | Aug/Sep 1996 | 6.6 | 1.75 | 170 | 0.6 | 28 | 18 | 14 | 2.6 | 40 | <0.1 | 5.37 | 230 | 1.20 | 8.2 |
| | 6 | Oct/Nov 1996 | 14 | 0.616 | 189 | 1.3 | 28 | 17 | 15 | 2.4 | 43 | 0.67 | 0.24 | 240 | 1.10 | 7.7 |
| | 7 | Feb/Mar 1997 | 7.4 | 0.54 | 207 | 0.8 | 38 | 18 | 16 | 2.7 | 48 | 1.7 | 1.22 | 260 | 1.10 | 7.6 |
| | 8 | Jun/Jul 1997 | 6.0 | 0.36 | 177 | 0.5 | 23 | 16 | 13 | 3.0 | 34 | 0.45 | 0.56 | 220 | 1.20 | 7.5 |
| | 9 | Sep/Oct 1997 | 7.6 | 0.473 | 183 | 0.5 | 24 | 17 | 13 | 2.5 | 41 | 0.14 | 2.22 | 240 | 1.20 | 7.6 |
| | 10 | Jan/Feb 1998 | 17 | 0.389 | 238 | 1.5 | 36 | 21 | 19 | 2.9 | 52 | 0.65 | 2.85 | 320 | 1.20 | 7.4 |
| Screen 2 | 1 | Jun/Jul 1994 | 9.4 | 1.01 | 195 | 1.2 | 34 | 19 | 16 | 2.6 | 48 | <0.1 | 3.60 | 250 | 1.08 | 7.2 |
| | 2 | Nov/Dec 1994 | 9.2 | 2.06 | 200 | 0.8 | 30 | 18 | 17 | 2.8 | 39 | 0.47 | -0.94 | 250 | 1.13 | 7.6 |
| | 5 | Aug/Sep 1996 | 11 | 9.86 | 191 | 0.8 | 33 | 20 | 16 | 2.6 | 47 | <0.1 | 4.17 | 260 | 1.20 | 8.9 |
| | 6 | Oct/Nov 1996 | 11 | 0.52 | 201 | 0.8 | 36 | 18 | 16 | 2.5 | 47 | 0.22 | 1.01 | 270 | 1.20 | 7.6 |
| | 7 | Feb/Mar 1997 | 12 | 0.32 | 195 | 0.9 | 34 | 19 | 17 | 2.6 | 51 | 0.51 | 5.79 | 260 | 1.10 | 7.4 |
| | 8 | Jun/Jul 1997 | 14 | 0.48 | 232 | 1.0 | 37 | 19 | 19 | 3.3 | 49 | 0.22 | 1.20 | 290 | 1.10 | 7.5 |
| | 9 | Sep/Oct 1997 | 13 | 0.450 | 219 | 0.9 | 37 | 19 | 16 | 2.7 | 53 | 0.17 | 0.62 | 280 | 1.20 | 7.5 |
| | 10 | Jan/Feb 1998 | 12 | 0.551 | 213 | 0.91 | 38 | 20 | 17 | 2.7 | 46 | 0.82 | 2.84 | 280 | 1.20 | 7.6 |
| Screen 3 | 1 | Jun/Jul 1994 | 17 | 3.23 | 157 | <0.1 | 7.9 | 40 | 6.8 | 3.1 | 22 | 0.89 | 2.81 | 190 | 1.06 | 8.4 |
| | 2 | Nov/Dec 1994 | 17 | 3.35 | 163 | <0.1 | 9.3 | 36 | 7.5 | 2.9 | 22 | 0.32 | -0.88 | 190 | 1.06 | 8.3 |
| | 5 | Aug/Sep 1996 | 21 | 7.38 | 143 | 0.2 | 13 | 41 | 9.4 | 3 | 21 | <0.1 | 5.88 | 190 | 1.00 | 8.9 |
| | 6 | Oct/Nov 1996 | 24 | 2.27 | 139 | <0.1 | 17 | 36 | 8.4 | 28 | 22 | 0.41 | 1.48 | 210 | 1.20 | 8.4 |
| | 7 | Feb/Mar 1997 | 29 | 7.4 | 143 | 0.1 | 19 | 40 | 11 | 3.2 | 21 | 0.17 | 2.16 | 210 | 1.00 | 8.9 |
| | 8 | Jun/Jul 1997 | 24 | 6.89 | 168 | 0.2 | 18 | 38 | 11 | 3.6 | 22 | 0.66 | 1.57 | 220 | 1.10 | 8.8 |
| | 9 | Sep/Oct 1997 | 20 | 6.64 | 162 | 0.2 | 19 | 39 | 11 | 2.9 | 21 | 0.66 | 0.81 | 230 | 1.20 | 8.8 |
| | 10 | Jan/Feb 1998 | 21 | 4.22 | 163 | 0.18 | 22 | 42 | 12 | 3.1 | 19 | 1.3 | 0.80 | 220 | 1.10 | 8.6 |
| Screen 4 | 1 | Jun/Jul 1994 | 9.3 | 5.90 | 181 | 0.3 | 18 | 50 | 8.9 | 2.3 | 19 | 0.56 | 3.02 | 200 | 0.98 | 8.6 |
| | 2 | Nov/Dec 1994 | 9.3 | 5.47 | 168 | <0.1 | 17 | 47 | 7.9 | 2.3 | 14 | 0.84 | 0.00 | 200 | 1.07 | 8.4 |
| | 5 | Aug/Sep 1996 | 9 | 3.35 | 163 | 0.3 | 17 | 51 | 8.3 | 2.2 | 17 | <0.1 | 6.85 | 210 | 1.10 | 8.5 |
| | 6 | Oct/Nov 1996 | 9.4 | 4.37 | 169 | 0.3 | 17 | 47 | 8.1 | 2.1 | 16 | 1.2 | 1.71 | 210 | 1.10 | 8.6 |
| | 7 | Feb/Mar 1997 | 10 | 5.9 | 181 | 0.4 | 17 | 49 | 9.1 | 2.2 | 17 | 0.83 | 1.74 | 190 | 0.90 | 8.7 |
| | 8 | Jun/Jul 1997 | 9.9 | 5.90 | 181 | 0.4 | 18 | 47 | 9.4 | 2.7 | 16 | 0.47 | 0.14 | 210 | 1.00 | 8.7 |
| | 9 | Sep/Oct 1997 | 9.6 | 4.37 | 169 | 0.4 | 15 | 46 | 7.9 | 2.1 | 17 | 0.30 | 2.01 | 220 | 1.20 | 8.6 |
| | 10 | Jan/Feb 1998 | 11 | 2.97 | 182 | 0.4 | 14 | 49 | 8.7 | 2.1 | 19 | 0.26 | 2.94 | 210 | 1.10 | 8.4 |
| Screen 5 | 1 | Jun/Jul 1994 | 10 | 3.60 | 139 | <0.1 | 29 | 68 | <1.0 | 1.1 | 11 | 0.19 | 2.17 | 210 | 1.08 | 8.7 |
| | 2 | Nov/Dec 1994 | 9.6 | 1.87 | 144 | <0.1 | 7.2 | 63 | <1.0 | 1.1 | 4.7 | <0.1 | -1.48 | 160 | 0.90 | 9.2 |
| | 5 | Aug/Sep 1996 | 9.2 | 4.69 | 144 | <0.2 | 20 | 70 | 1.3 | 1.2 | 8.9 | <0.1 | 8.20 | 200 | 1.10 | 8.7 |
| | 6 | Oct/Nov 1996 | 8.9 | 9.62 | 148 | <0.1 | 8.7 | 65 | <1.0 | 1.2 | 5 | 0.16 | 2.98 | 210 | 1.30 | 9.0 |
| | 7 | Feb/Mar 1997 | 9.8 | 14.4 | 140 | <0.1 | 7.6 | 68 | <1.0 | 1.2 | 4.9 | 0.19 | 6.60 | 190 | 1.10 | 9.2 |
| | 8 | Jun/Jul 1997 | 9.5 | 13.5 | 165 | <0.1 | 11 | 67 | 1.0 | 1.6 | 5.6 | 0.17 | 0.30 | 210 | 1.10 | 9.1 |
| | 9 | Sep/Oct 1997 | 9.6 | 0.189 | 146 | <0.1 | 25 | 66 | 1.1 | 1.2 | 8.6 | <0.1 | 3.47 | 230 | 1.30 | 8.8 |
| | 10 | Jan/Feb 1998 | 10 | 15 | 146 | <0.1 | 13 | 71 | -- | 1.2 | 4.7 | 0.08 | 4.69 | 220 | 1.20 | 9.2 |

# TABLE 3-5

## SUMMARY OF WATER-CHEMISTRY RESULTS FROM JPL GROUNDWATER MONITORING WELLS JET PROPULSION LABORATORY
(concentrations in mg/L)

| Well Number | Sampling Event | Sampling Dates | ANIONS Cl | $CO_3$ | $HCO_3$ | $NO_3$-N | $SO_4$ | CATIONS Na | Mg | K | Ca | Fe | Charge Balance | Measured TDS | Measured TDS / Calculated TDS | Measured pH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***MW-4*** | | | | | | | | | | | | | | | | |
| Screen 1 | 1 | Jun/Jul 1994 | 9.2 | 0.269 | 165 | 0.7 | 38 | 19 | 13 | 2.8 | 3.8 | 0.29 | 0.71 | 230 | 1.12 | 7.2 |
| | 2 | Nov/Dec 1994 | 9.4 | 0.364 | 177 | 0.5 | 37 | 18 | 13 | 2.8 | 40 | 0.72 | -0.88 | 230 | 1.09 | 6.8 |
| | 5 | Aug/Sep 1996 | 9.2 | 0.312 | 152 | 1.0 | 28 | 17 | 12 | 2.5 | 30 | <0.1 | 1.64 | 220 | 1.30 | 7.5 |
| | 6 | Oct/Nov 1996 | 14 | 0.197 | 152 | 1.1 | 29 | 17 | 13 | 2.6 | 36 | <0.1 | -1.38 | 220 | 1.20 | 7.3 |
| | 7 | Feb/Mar 1997 | 9.3 | 0.20 | 195 | 1.3 | 40 | 19 | 15 | 2.9 | 50 | 0.36 | 2.66 | 260 | 1.10 | 7.2 |
| | 8 | Jun/Jul 1997 | 10 | 0.21 | 165 | 0.9 | 26 | 17 | 12 | 3.3 | 35 | 1.50 | 0.42 | 210 | 1.10 | 7.3 |
| | 9 | Sep/Oct 1997 | 21 | 0.164 | 159 | 1.4 | 30 | 20 | 13 | 3.2 | 50 | <0.1 | 7.11 | 260 | 1.20 | 7.2 |
| | 10 | Jan/Feb 1998 | 42 | 0.14 | 213 | 4.9 | 59 | 25 | 22 | 3.5 | 60 | 0.14 | 610 | 400 | 1.20 | 7.0 |
| Screen 2 | 1 | Jun/Jul 1994 | 54 | 0.299 | 183 | 7.3 | 63 | 27 | 23 | 2.4 | 68 | <0.1 | 1.16 | 390 | 1.08 | 7.0 |
| | 2 | Nov/Dec 1994 | 66 | 0.536 | 207 | 6.3 | 64 | 32 | 25 | 2.5 | 64 | 0.36 | -2.68 | 430 | 1.12 | 7.0 |
| | 5 | Aug/Sep 1996 | 40 | 0.299 | 183 | 8.2 | 57 | 26 | 23 | 2.2 | 55 | <0.1 | 0.43 | 340 | 1.10 | 7.4 |
| | 6 | Oct/Nov 1996 | 46 | 0.188 | 183 | 7.7 | 63 | 26 | 25 | 2.4 | 60 | 4.3 | -0.73 | 380 | 1.20 | 7.2 |
| | 7 | Feb/Mar 1997 | 39 | 0.31 | 189 | 7.6 | 61 | 25 | 23 | 2.3 | 64 | 0.57 | 1.88 | 570 | 1.10 | 7.4 |
| | 8 | Jun/Jul 1997 | 55 | 0.25 | 189 | 7.8 | 64 | 25 | 25 | 2.9 | 67 | 0.67 | 0.23 | 390 | 1.10 | 7.3 |
| | 9 | Sep/Oct 1997 | 69 | 0.237 | 183 | 8.2 | 73 | 27 | 25 | 2.7 | 84 | 0.81 | 3.09 | 460 | 1.20 | 7.3 |
| | 10 | Jan/Feb 1998 | 78 | 0.2 | 195 | 9.1 | 90 | 30 | 29 | 2.6 | 65 | 0.31 | 11.77 | 500 | 1.20 | 7.2 |
| Screen 3 | 1 | Jun/Jul 1994 | 20 | 1.19 | 183 | 7.0 | 8.8 | 31 | 13 | 1.9 | 40 | 0.15 | 2.17 | 260 | 1.09 | 7.5 |
| | 2 | Nov/Dec 1994 | 19 | 1.94 | 188 | 6.8 | 8.7 | 30 | 12 | 1.8 | 38 | 0.12 | -1.05 | 240 | 1.02 | 7.4 |
| | 5 | Aug/Sep 1996 | 22 | 1.19 | 183 | 7.7 | 11 | 33 | 14 | 1.8 | 38 | 0.11 | 1.68 | 270 | 1.20 | 8.0 |
| | 6 | Oct/Nov 1996 | 23 | 0.945 | 183 | 7.7 | 11 | 32 | 14 | 1.9 | 41 | <0.1 | 2.32 | 260 | 1.20 | 7.9 |
| | 7 | Feb/Mar 1997 | 21 | 0.73 | 177 | 7.5 | 10 | 31 | 13 | 1.9 | 43 | <0.1 | 4.29 | 270 | 1.10 | 7.8 |
| | 8 | Jun/Jul 1997 | 22 | 1.31 | 201 | 7.6 | 11 | 30 | 14 | 2.3 | 42 | 0.18 | 0.75 | 270 | 1.10 | 8.0 |
| | 9 | Sep/Oct 1997 | 20 | 1.49 | 182 | 6.9 | 9.9 | 33 | 12 | 2.1 | 49 | <0.1 | 7.29 | 260 | 1.20 | 8.1 |
| | 10 | Jan/Feb 1998 | 21 | 1.44 | 176 | 7.1 | 10 | 34 | 12 | 1.9 | 35 | 0.06 | 0.60 | 270 | 1.20 | 8.1 |
| Screen 4 | 1 | Jun/Jul 1994 | 15 | 1.49 | 182 | 5.2 | 7.4 | 35 | 11 | 1.9 | 33 | 0.15 | 1.85 | 250 | 1.15 | 7.7 |
| | 2 | Nov/Dec 1994 | 14 | 1.60 | 195 | 5.0 | 7.3 | 35 | 10 | 1.8 | 31 | 0.11 | -2.35 | 220 | 1.00 | 7.6 |
| | 5 | Aug/Sep 1996 | 16 | 1.27 | 195 | 5.4 | 8.7 | 39 | 11 | 1.8 | 32 | 0.82 | 0.47 | 240 | 1.10 | 8.0 |
| | 6 | Oct/Nov 1996 | 14 | 1.49 | 182 | 4.5 | 7.9 | 38 | 11 | 1.9 | 34 | 1.3 | 5.25 | 230 | 1.10 | 8.1 |
| | 7 | Feb/Mar 1997 | 15 | 1.2 | 189 | 4.7 | 7.7 | 38 | 10 | 1.9 | 34 | 0.15 | 2.43 | 250 | 1.10 | 8.0 |
| | 8 | Jun/Jul 1997 | 14 | 2.06 | 200 | 3.9 | 7.4 | 39 | 11 | 2.4 | 28 | 0.66 | 0.85 | 220 | 1.00 | 8.2 |
| | 9 | Sep/Oct 1997 | 14 | 1.49 | 182 | 3.5 | 7.7 | 40 | 9.5 | 2.2 | 37 | 0.25 | 7.52 | 230 | 1.10 | 8.1 |
| | 10 | Jan/Feb 1998 | 15 | 1.87 | 182 | 1.0 | 7.1 | 42 | 9.7 | 2.0 | 24 | 0.45 | 0.55 | 240 | 1.20 | 8.2 |
| Screen 5 | 1 | Jun/Jul 1994 | 8.9 | 1.54 | 188 | 1.0 | 16 | 38 | 9.7 | 2.1 | 32 | 1.6 | 4.06 | 240 | 1.16 | 7.8 |
| | 2 | Nov/Dec 1994 | 9.3 | 3.72 | 181 | 0.2 | 16 | 37 | 9.2 | 2.2 | 24 | 0.47 | -0.14 | 200 | 1.04 | 8.1 |
| | 5 | Aug/Sep 1996 | 8.4 | 1.6 | 195 | 1.1 | 17 | 38 | 9.6 | 1.9 | 31 | 0.62 | 2.27 | 220 | 1.10 | 8.1 |
| | 6 | Oct/Nov 1996 | 8.2 | 1.49 | 182 | 1.0 | 16 | 37 | 9.8 | 2 | 34 | 0.26 | 6.79 | 230 | 1.20 | 8.1 |
| | 7 | Feb/Mar 1997 | 8.5 | 1.3 | 195 | 1.0 | 16 | 36 | 9.3 | 2.0 | 37 | 0.65 | 4.83 | 230 | 1.00 | 8.0 |
| | 8 | Jun/Jul 1997 | 8.8 | 1.79 | 219 | 1.0 | 17 | 35 | 10 | 2.5 | 35 | 0.87 | 1.30 | 230 | 1.00 | 8.1 |
| | 9 | Sep/Oct 1997 | 8.6 | 1.64 | 201 | 0.9 | 18 | 36 | 9.1 | 2.2 | 44 | 0.38 | 6.90 | 240 | 1.10 | 8.1 |
| | 10 | Jan/Feb 1998 | 9.0 | 1.31 | 201 | 0.99 | 19 | 38 | 9.4 | 2.0 | 34 | 0.54 | 1.77 | 250 | 1.20 | 8.0 |
| ***MW-5*** | 1 | Jun/Jul 1994 | 11 | 0.099 | 152 | 1.5 | 39 | 14 | 14 | 3.0 | 43 | 0.11 | 3.10 | 240 | 1.17 | 6.5 |
| | 2 | Nov/Dec 1994 | 22 | 0.095 | 146 | 1.3 | 54 | 14 | 15 | 2.9 | 46 | 0.43 | -0.35 | 270 | 1.16 | 6.6 |
| | 5 | Aug/Sep 1996 | 8 | 0.219 | 134 | 1.7 | 28 | 15 | 12 | 2.7 | 38 | <0.1 | 7.26 | 190 | 1.10 | 7.4 |
| | 6 | Oct/Nov 1996 | 14 | 0.065 | 159 | 1.7 | 30 | 15 | 12 | 2.8 | 38 | 0.16 | -1.77 | 200 | 1.00 | 6.8 |
| | 7 | Feb/Mar 1997 | 8.1 | 0.08 | 159 | 1.6 | 28 | 14 | 14 | 2.9 | 43 | 0.28 | 6.12 | 220 | 1.10 | 6.9 |
| | 8 | Jun/Jul 1997 | 7.5 | 0.07 | 165 | 1.6 | 30 | 14 | 12 | 2.7 | 39 | 0.28 | 0.41 | 200 | 1.00 | 6.8 |
| | 9 | Sep/Oct 1997 | 22 | 0.068 | 165 | 2.2 | 51 | 17 | 15 | 3.5 | 51 | <0.1 | 0.76 | 300 | 1.20 | 6.8 |
| | 10 | Jan/Feb 1998 | 26 | 0.070 | 171 | 2.4 | 58 | 20 | 17 | 3.4 | 39 | 0.140 | 6.51 | 290 | 1.10 | 6.8 |

# TABLE 3-5

## SUMMARY OF WATER-CHEMISTRY RESULTS FROM JPL GROUNDWATER MONITORING WELLS JET PROPULSION LABORATORY

(concentrations in mg/L)

| Well Number | Sampling Event | Sampling Dates | ANIONS Cl | $CO_3$ | $HCO_3$ | $NO_3$-N | $SO_4$ | CATIONS Na | Mg | K | Ca | Fe | Charge Balance | Measured TDS | Measured TDS / Calculated TDS | Measured pH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **MW-6** | 1 | Jun/Jul 1994 | 53 | 0.115 | 140 | 5.7 | 55 | 22 | 18 | 1.7 | 55 | 0.56 | -1.32 | 350 | 1.17 | 6.9 |
| | 2 | Nov/Dec 1994 | 84 | 0.174 | 213 | 9.0 | 100 | 27 | 31 | 2.2 | 85 | 2.8 | -3.60 | 500 | 1.05 | 7.1 |
| | 5 | Aug/Sep 1996 | 82 | 0.189 | 146 | 11 | 69 | 28 | 27 | 2 | 76 | <0.1 | 2.74 | 440 | 1.20 | 7.3 |
| | 6 | Oct/Nov 1996 | 61 | 0.201 | 195 | 7.0 | 62 | 24 | 23 | 1.8 | 65 | 0.16 | -3.71 | 410 | 1.20 | 7.2 |
| | 7 | Feb/Mar 1997 | 63 | 0.14 | 207 | 6.5 | 58 | 25 | 26 | 1.8 | 74 | 0.18 | 0.87 | 400 | 1.10 | 7.0 |
| | 8 | Jun/Jul 1997 | 92 | 0.09 | 175 | 11 | 93 | 26 | 28 | 2.1 | 80 | 0.19 | 4.65 | 470 | 1.00 | 6.9 |
| | 9 | Sep/Oct 1997 | 49 | 0.160 | 195 | 5.4 | 47 | 23 | 20 | 2.0 | 66 | <0.1 | 0.42 | 370 | 1.20 | 7.1 |
| | 10 | Jan/Feb 1998 | 79 | 0.174 | 213 | 7.8 | 89 | 28 | 32 | 2.2 | 66 | <0.1 | 6.13 | 490 | 1.10 | 7.1 |
| **MW-7** | 1 | Jun/Jul 1994 | 21 | 0.339 | 165 | 6.6 | 46 | 19 | 17 | 2.7 | 51 | 0.24 | 0.83 | 280 | 1.04 | 7.4 |
| | 2 | Nov/Dec 1994 | 20 | 0.726 | 177 | 5.5 | 36 | 18 | 16 | 2.6 | 49 | <0.1 | -0.32 | 280 | 1.10 | 7.2 |
| | 5 | Aug/Sep 1996 | 19 | 0.378 | 146 | 6.0 | 39 | 20 | 18 | 2.8 | 52 | <0.1 | 9.33 | 280 | 1.20 | 7.6 |
| | 6 | Oct/Nov 1996 | 20 | 0.364 | 177 | 5.7 | 36 | 18 | 15 | 2.6 | 47 | 0.41 | -2.10 | 250 | 1.10 | 7.5 |
| | 7 | Feb/Mar 1997 | 20 | 0.35 | 171 | 5.7 | 44 | 18 | 17 | 2.4 | 52 | 0.15 | 1.57 | 280 | 1.10 | 7.5 |
| | 8 | Jun/Jul 1997 | 24 | 0.57 | 175 | 6.5 | 48 | 17 | 17 | 2.8 | 54 | 0.16 | 1.31 | 300 | 1.10 | 7.7 |
| | 9 | Sep/Oct 1997 | 22 | 0.458 | 177 | 6.3 | 44 | 18 | 16 | 3.0 | 55 | <0.1 | 0.41 | 320 | 1.30 | 7.6 |
| | 10 | Jan/Feb 1998 | 20 | 0.52 | 158 | 6.0 | 40 | 19 | 17 | 2.8 | 36 | <0.1 | 3.87 | 260 | 1.10 | 7.7 |
| **MW-8** | 1 | Jun/Jul 1994 | 12 | 0.325 | 158 | 1.3 | 28 | 15 | 13 | 2.4 | 41 | 0.21 | 2.54 | 240 | 1.22 | 6.9 |
| | 2 | Nov/Dec 1994 | 13 | 0.648 | 158 | 2.4 | 30 | 15 | 13 | 2.4 | 41 | 0.14 | 0.39 | 230 | 1.13 | 7.0 |
| | 5 | Aug/Sep 1996 | 14 | 0.189 | 146 | 2.3 | 31 | 2.5 | 13 | 2.5 | 42 | <0.1 | 3.45 | 230 | 1.30 | 7.3 |
| | 6 | Oct/Nov 1996 | 9.5 | 0.157 | 152 | 1.7 | 26 | 15 | 12 | 2.3 | 36 | 0.38 | -1.01 | 210 | 1.20 | 7.2 |
| | 7 | Feb/Mar 1997 | 15 | 0.28 | 171 | 2.8 | 40 | 16 | 16 | 2.6 | 47 | <0.1 | 1.96 | 230 | 1.00 | 7.4 |
| | 8 | Jun/Jul 1997 | 12 | 0.50 | 195 | 1.7 | 42 | 15 | 15 | 2.7 | 49 | <0.1 | 1.34 | 260 | 1.10 | 7.6 |
| | 9 | Sep/Oct 1997 | 16 | 0.170 | 165 | 3.7 | 46 | 17 | 14 | 2.9 | 50 | 0.11 | 1.13 | 280 | 1.20 | 7.2 |
| | 10 | Jan/Feb 1998 | 15 | 0.19 | 183 | 2.3 | 39 | 18 | 16 | 2.8 | 42 | <0.1 | 1.50 | 260 | 1.10 | 7.2 |
| **MW-9** | 1 | Jun/Jul 1994 | 19 | 0.174 | 213 | <0.1 | 38 | 22 | 17 | 2.9 | 53 | <0.1 | 1.91 | 290 | 1.12 | 6.7 |
| | 2 | Nov/Dec 1994 | 24 | 0.276 | 268 | 3.1 | 84 | 26 | 25 | 3.8 | 73 | 0.185 | -1.07 | 420 | 1.10 | 6.9 |
| | 5 | Aug/Sep 1996 | 14 | 0.253 | 195 | <0.20 | 37 | 23 | 15 | 3.3 | 49 | <0.1 | 4.48 | 270 | 1.10 | 7.3 |
| | 6 | Oct/Nov 1996 | 21 | 0.428 | 262 | 1.1 | 54 | 26 | 20 | 3.8 | 61 | 0.21 | -1.50 | 350 | 1.10 | 7.4 |
| | 7 | Feb/Mar 1997 | 6.9 | 0.42 | 256 | 1.3 | 24 | 23 | 18 | 3.6 | 56 | <0.1 | 3.67 | 300 | 1.10 | 7.4 |
| | 8 | Jun/Jul 1997 | 16 | 1.34 | 260 | <0.1 | 23 | 20 | 17 | 3.3 | 57 | 0.27 | 0.29 | 290 | 1.10 | 7.9 |
| | 9 | Sep/Oct 1997 | 19 | 0.348 | 268 | <0.1 | 50 | 24 | 20 | 4 | 70 | <0.1 | 2.52 | 350 | 1.10 | 7.3 |
| | 10 | Jan/Feb 1998 | 15 | 0.224 | 274 | 5.5 | 44 | 27 | 23 | 4.2 | 64 | <0.1 | 1.11 | 360 | 1.10 | 7.1 |
| **MW-10** | 1 | Jun/Jul 1994 | 39 | 0.159 | 244 | 11 | 95 | 19 | 31 | 3.2 | 86 | <0.1 | 0.77 | 490 | 1.11 | 6.8 |
| | 2 | Nov/Dec 1994 | 105 | 0.214 | 262 | 17 | 165 | 28 | 44 | 3.3 | 110 | 0.13 | -6.73 | 680 | 1.03 | 6.9 |
| | 5 | Aug/Sep 1996 | 43 | 0.3 | 232 | 9.8 | 86 | 21 | 30 | 3 | 83 | <0.1 | 0.92 | 440 | 1.10 | 7.0 |
| | 6 | Oct/Nov 1996 | 88 | 0.129 | 250 | 15 | 130 | 26 | 38 | 3.2 | 110 | 0.26 | -2.77 | 600 | 1.10 | 6.9 |
| | 7 | Feb/Mar 1997 | 36 | 0.14 | 207 | 5.8 | 66 | 18 | 24 | 2.5 | 68 | <0.1 | 0.16 | 350 | 1.00 | 7.0 |
| | 8 | Jun/Jul 1997 | 36 | 0.20 | 195 | 5.6 | 70 | 16 | 21 | 2.7 | 66 | 0.14 | 2.36 | 360 | 1.10 | 7.2 |
| | 9 | Sep/Oct 1997 | 92 | 0.100 | 244 | 17 | 150 | 28 | 39 | 3.6 | 115 | 0.13 | 2.83 | 660 | 1.20 | 6.8 |
| | 10 | Jan/Feb 1998 | 100 | 0.17 | 262 | 18 | 160 | 33 | 49 | 3.5 | 170 | 0.14 | 9.30 | 700 | 1.00 | 7.0 |
| **MW-11** | | | | | | | | | | | | | | | | |
| Screen 1 | 1 | Jun/Jul 1994 | 16 | 2.69 | 261 | 0.7 | 40 | 40 | 19 | 3.8 | 58 | 0.58 | 5.35 | 340 | 1.07 | 7.9 |
| | 2 | Nov/Dec 1994 | 15 | 2.19 | 268 | 0.3 | 42 | 37 | 17 | 3.8 | 54 | 0.19 | 0.61 | 260 | 0.83 | 7.8 |
| | 5 | Aug/Sep 1996 | 18 | 2.04 | 249 | 0.2 | 38 | 27 | 21 | 3.5 | 48 | <0.1 | 0.00 | 300 | 1.10 | 8.1 |
| | 6 | Oct/Nov 1996 | 14 | 1.94 | 237 | 0.2 | 35 | 24 | 18 | 3.3 | 48 | 0.21 | -0.30 | 300 | 1.20 | 8.1 |
| | 7 | Feb/Mar 1997 | 16 | 1.2 | 231 | 0.5 | 38 | 25 | 19 | 3.2 | 52 | 0.19 | 2.40 | 280 | 1.00 | 7.9 |
| | 8 | Jun/Jul 1997 | 14 | 1.70 | 262 | 0.7 | 38 | 24 | 21 | 4.0 | 53 | 0.25 | 0.18 | 320 | 1.10 | 8.0 |
| | 9 | Sep/Oct 1997 | 15 | 1.94 | 237 | 0.3 | 43 | 24 | 19 | 3.7 | 59 | 0.76 | 3.76 | 330 | 1.20 | 8.1 |
| | 10 | Jan/Feb 1998 | 18 | 0.73 | 225 | 0.9 | 41 | 26 | 18 | 3.3 | 49 | 0.12 | 3.75 | 340 | 1.30 | 7.7 |

# TABLE 3-5

## SUMMARY OF WATER-CHEMISTRY RESULTS FROM JPL GROUNDWATER MONITORING WELLS JET PROPULSION LABORATORY

(concentrations in mg/L)

| Well Number | Sampling Event | Sampling Dates | ANIONS | | | | | CATIONS | | | | | Charge Balance | Measured TDS | Measured TDS / Calculated TDS | Measured pH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Cl | $CO_3$ | $HCO_3$ | $NO_3$-N | $SO_4$ | Na | Mg | K | Ca | Fe | | | | |
| Screen 2 | 1 | Jun/Jul 1994 | 15 | 4.23 | 206 | 0.3 | 37 | 27 | 17 | 3.4 | 46 | 2.0 | 3.23 | 280 | 1.10 | 8.3 |
| | 2 | Nov/Dec 1994 | 15 | 5.61 | 217 | 0.1 | 38 | 31 | 17 | 3.7 | 42 | 0.80 | 0.92 | 250 | 0.95 | 8.4 |
| | 5 | Aug/Sep 1996 | 15 | 1.69 | 207 | 0.6 | 39 | 23 | 18 | 3.1 | 39 | <0.1 | 1.63 | 260 | 1.10 | 8.1 |
| | 6 | Oct/Nov 1996 | 14 | 1.69 | 207 | 0.3 | 35 | 23 | 18 | 3.1 | 40 | 0.71 | -0.11 | 260 | 1.10 | 8.1 |
| | 7 | Feb/Mar 1997 | 13 | 1.3 | 195 | 0.7 | 34 | 22 | 17 | 2.9 | 47 | 0.38 | 4.94 | 270 | 1.10 | 8.0 |
| | 8 | Jun/Jul 1997 | 14 | 1.42 | 219 | 0.40 | 35 | 21 | 18 | 3.7 | 43 | 0.70 | 1.17 | 270 | 1.10 | 8.0 |
| | 9 | Sep/Oct 1997 | 14 | 1.64 | 201 | 0.40 | 34 | 22 | 17 | 3.4 | 50 | 0.24 | 5.44 | 270 | 1.10 | 8.1 |
| | 10 | Jan/Feb 1998 | 15 | 1.31 | 201 | 0.4 | 36 | 23 | 17 | 3.1 | 41 | 0.31 | 3.09 | 330 | 1.40 | 8.0 |
| Screen 3 | 1 | Jun/Jul 1994 | 11 | 4.48 | 218 | <0.1 | 29 | 35 | 12 | 2.7 | 51 | 0.25 | 5.99 | 260 | 1.02 | 7.8 |
| | 2 | Nov/Dec 1994 | 11 | 4.60 | 224 | <0.1 | 29 | 34 | 12 | 2.7 | 45 | 0.43 | 1.38 | 240 | 0.96 | 8.0 |
| | 5 | Aug/Sep 1996 | 12 | 2.26 | 219 | 0.2 | 28 | 28 | 14 | 2.3 | 38 | <0.1 | 2.65 | 250 | 1.10 | 8.2 |
| | 6 | Oct/Nov 1996 | 11 | 2.67 | 206 | <0.1 | 24 | 28 | 15 | 2.4 | 40 | 0.2 | -3.44 | 240 | 1.10 | 8.3 |
| | 7 | Feb/Mar 1997 | 12 | 3.2 | 194 | <0.1 | 22 | 28 | 13 | 2.3 | 42 | 0.49 | 5.33 | 230 | 1.10 | 8.4 |
| | 8 | Jun/Jul 1997 | 12 | 2.92 | 225 | 0.20 | 25 | 25 | 15 | 2.8 | 42 | 0.31 | 0.88 | 260 | 1.10 | 8.3 |
| | 9 | Sep/Oct 1997 | 12 | 2.59 | 200 | 0.20 | 25 | 26 | 13 | 2.5 | 49 | <0.1 | 6.08 | 270 | 1.20 | 8.3 |
| | 10 | Jan/Feb 1998 | 13 | 2.13 | 207 | 0.4 | 27 | 27 | 13 | 2.3 | 40 | 0.24 | 1.87 | 280 | 1.20 | 8.2 |
| Screen 4 | 1 | Jun/Jul 1994 | 10 | 4.11 | 200 | <0.1 | 21 | 28 | 12 | 2.8 | 36 | 0.61 | 0.37 | 320 | 1.50 | 8.1 |
| | 2 | Nov/Dec 1994 | 10 | 4.99 | 193 | <0.1 | 13 | 29 | 11 | 2.9 | 32 | 0.34 | 0.79 | 200 | 1.00 | 8.2 |
| | 5 | Aug/Sep 1996 | 11 | 2.59 | 200 | <0.2 | 25 | 26 | 13 | 2.4 | 34 | <0.1 | 1.85 | 230 | 1.10 | 8.3 |
| | 6 | Oct/Nov 1996 | 10 | 1.94 | 188 | <0.1 | 21 | 25 | 14 | 2.3 | 36 | 0.98 | -3.54 | 220 | 1.10 | 8.2 |
| | 7 | Feb/Mar 1997 | 11 | 3.2 | 194 | <0.1 | 19 | 24 | 13 | 2.2 | 36 | 0.95 | 0.76 | 220 | 1.10 | 8.4 |
| | 8 | Jun/Jul 1997 | 11 | 2.67 | 206 | <0.1 | 22 | 24 | 14 | 2.9 | 37 | 0.98 | 0.60 | 240 | 1.10 | 8.3 |
| | 9 | Sep/Oct 1997 | 10 | 2.52 | 194 | <0.1 | 21 | 24 | 12 | 2.6 | 46 | 1.15 | 5.77 | 240 | 1.10 | 8.3 |
| | 10 | Jan/Feb 1998 | 11 | 1.94 | 188 | <0.1 | 22 | 26 | 13 | 2.4 | 41 | 0.83 | 3.38 | 260 | 1.20 | 8.2 |
| Screen 5 | 1 | Jun/Jul 1994 | 9.1 | 2.58 | 158 | <0.1 | 18 | 49 | 2.3 | 1.4 | 24 | 0.25 | 4.55 | 190 | 1.03 | 7.9 |
| | 2 | Nov/Dec 1994 | 9.2 | 3.91 | 151 | <0.1 | 16 | 48 | 2.0 | 1.6 | 21 | 0.25 | 3.57 | 150 | 0.85 | 8.1 |
| | 5 | Aug/Sep 1996 | 11 | 1.69 | 164 | <0.2 | 19 | 48 | 2.2 | 1.1 | 22 | <0.1 | 0.15 | 180 | 1.00 | 8.2 |
| | 6 | Oct/Nov 1996 | 9.7 | 1.63 | 158 | <0.1 | 17 | 47 | 2.4 | 1.3 | 26 | 0.54 | -5.00 | 210 | 1.20 | 8.2 |
| | 7 | Feb/Mar 1997 | 11 | 2.6 | 158 | <0.1 | 18 | 47 | 2.1 | 1.1 | 24 | 0.18 | 2.23 | 200 | 1.10 | 8.4 |
| | 8 | Jun/Jul 1997 | 11 | 2.20 | 170 | <0.1 | 17 | 45 | 2.4 | 1.6 | 24 | 0.21 | 1.02 | 210 | 1.10 | 8.3 |
| | 9 | Sep/Oct 1997 | 11 | 2.05 | 158 | <0.1 | 17 | 47 | 2.0 | 1.3 | 31 | 0.17 | 7.52 | 220 | 1.20 | 8.3 |
| | 10 | Jan/Feb 1998 | 11 | 2.05 | 158 | <0.1 | 19 | 49 | 2.0 | 1.2 | 23 | 0.12 | 2.00 | 240 | 1.30 | 8.3 |
| ***MW-12*** | | | | | | | | | | | | | | | | |
| Screen 1 | 1 | Jun/Jul 1994 | 14 | 0.388 | 189 | 1.1 | 38 | 21 | 16 | 3.0 | 29 | 0.78 | -7.73 | 240 | 1.09 | 7.0 |
| | 2 | Nov/Dec 1994 | 14 | 0.26 | 201 | 1.0 | 39 | 20 | 15 | 3.1 | 48 | 1.3 | -0.22 | 240 | 0.98 | 7.2 |
| | 5 | Aug/Sep 1996 | 9.7 | 0.504 | 195 | 0.7 | 36 | 43 | 12 | 4.4 | 38 | <0.1 | 6.67 | 280 | 1.20 | 7.6 |
| | 6 | Oct/Nov 1996 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | 7 | Feb/Mar 1997 | 15 | 0.41 | 201 | 1.0 | 36 | 28 | 17 | 3.6 | 48 | 0.20 | 5.91 | 270 | 1.10 | 7.5 |
| | 8 | Jun/Jul 1997 | 8.3 | 0.52 | 201 | 0.6 | 36 | 21 | 16 | 3.8 | 40 | 1.40 | 0.00 | 240 | 1.10 | 7.6 |
| | 9 | Sep/Oct 1997(1) | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | 10 | Jan/Feb 1998 | 15 | 0.21 | 207 | 2.3 | 38 | 23 | 16 | 3.2 | 45 | 0.12 | 5.87 | 330 | 1.30 | 7.2 |
| Screen 2 | 1 | Jun/Jul 1994 | 17 | 1.22 | 237 | 2.2 | 39 | 32 | 18 | 4.5 | 36 | 1.0 | -5.80 | 270 | 0.98 | 7.2 |
| | 2 | Nov/Dec 1994 | 18 | 4.23 | 206 | 0.5 | 42 | 36 | 20 | 4.4 | 32 | 1.1 | 0.82 | 230 | 0.88 | 8.5 |
| | 5 | Aug/Sep 1996 | 14 | 0.567 | 219 | 1.7 | 40 | 26 | 17 | 3.1 | 53 | <0.1 | 3.23 | 300 | 1.10 | 7.6 |
| | 6 | Oct/Nov 1996 | 13 | 0.733 | 225 | 1.8 | 36 | 25 | 19 | 3.2 | 50 | 0.49 | 2.75 | 290 | 1.10 | 7.7 |
| | 7 | Feb/Mar 1997 | 14 | 0.58 | 225 | 1.9 | 38 | 24 | 18 | 3.1 | 57 | 0.15 | 4.11 | 310 | 1.10 | 7.6 |
| | 8 | Jun/Jul 1997 | 14 | 0.63 | 244 | 1.7 | 37 | 24 | 19 | 3.8 | 56 | 0.35 | 1.95 | 310 | 1.10 | 7.6 |
| | 9 | Sep/Oct 1997 | 15 | 0.45 | 219 | 2.0 | 41 | 24 | 17 | 3.5 | 60 | 0.67 | 4.83 | 320 | 1.20 | 7.5 |
| | 10 | Jan/Feb 1998 | 15 | 0.6 | 232 | 1.9 | 39 | 26 | 17 | 3.2 | 49 | 0.16 | 5.19 | 320 | 1.20 | 7.6 |

# TABLE 3-5

## SUMMARY OF WATER-CHEMISTRY RESULTS FROM JPL GROUNDWATER MONITORING WELLS JET PROPULSION LABORATORY

(concentrations in mg/L)

| Well Number | Sampling Event | Sampling Dates | ANIONS | | | | | CATIONS | | | | | Charge Balance | Measured TDS | Measured TDS / Calculated TDS | Measured pH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Cl | $CO_3$ | $HCO_3$ | $NO_3$-N | $SO_4$ | Na | Mg | K | Ca | Fe | | | | |
| Screen 3 | 1 | Jun/Jul 1994 | 13 | 2.26 | 219 | 1.0 | 32 | 27 | 16 | 3.2 | 33 | 1.1 | -5.80 | 270 | 1.12 | 7.5 |
| | 2 | Nov/Dec 1994 | 15 | 2.32 | 225 | 1.2 | 37 | 23 | 17 | 3.3 | 46 | 1.1 | -2.45 | 260 | 0.99 | 7.7 |
| | 5 | Aug/Sep 1996 | 16 | 1.46 | 225 | 1.2 | 34 | 25 | 14 | 2.9 | 50 | <0.1 | 1.13 | 270 | 1.10 | 8 |
| | 6 | Oct/Nov 1996 | 15 | 1.38 | 213 | 0.7 | 31 | 25 | 16 | 2.9 | 46 | 0.35 | -1.70 | 280 | 1.20 | 8 |
| | 7 | Feb/Mar 1997 | 15 | 1.1 | 213 | 1.2 | 30 | 24 | 15 | 2.9 | 57 | 0.44 | 5.80 | 290 | 1.10 | 7.9 |
| | 8 | Jun/Jul 1997 | 16 | 1.58 | 243 | 1.2 | 33 | 24 | 17 | 3.5 | 56 | 0.50 | 1.04 | 280 | 1.00 | 8.0 |
| | 9 | Sep/Oct 1997 | 18 | 1.42 | 219 | 1.2 | 35 | 24 | 15 | 3.2 | 59 | 0.47 | 3.81 | 300 | 1.10 | 8.0 |
| | 10 | Jan/Feb 1998 | 17 | 1.13 | 219 | 1.2 | 36 | 26 | 16 | 3.0 | 53 | 0.24 | 2.07 | 320 | 1.20 | 7.9 |
| Screen 4 | 1 | Jun/Jul 1994 | 13 | 1.79 | 219 | 0.8 | 34 | 28 | 14 | 2.8 | 33 | 0.29 | -7.57 | 270 | 1.13 | 7.5 |
| | 2 | Nov/Dec 1994 | 14 | 1.46 | 225 | 0.56 | 31 | 26 | 13 | 2.7 | 47 | 0.29 | -2.01 | 250 | 1.00 | 7.4 |
| | 5 | Aug/Sep 1996 | 15 | 1.5 | 231 | 1.3 | 32 | 26 | 13 | 2.3 | 52 | <0.1 | 1.12 | 260 | 1.00 | 8 |
| | 6 | Oct/Nov 1996 | 13 | 0.923 | 225 | 1.2 | 29 | 23 | 15 | 2.3 | 50 | 0.18 | -0.31 | 290 | 1.20 | 7.8 |
| | 7 | Feb/Mar 1997 | 13 | 1.5 | 225 | 1.2 | 27 | 23 | 14 | 2.3 | 58 | 0.29 | 4.07 | 270 | 1.10 | 8.0 |
| | 8 | Jun/Jul 1997 | 14 | 1.58 | 243 | 1.2 | 29 | 23 | 15 | 2.9 | 56 | 0.37 | 0.29 | 290 | 1.10 | 8.0 |
| | 9 | Sep/Oct 1997 | 14 | 1.16 | 225 | 1.3 | 31 | 23 | 13 | 2.6 | 63 | 0.28 | 4.54 | 310 | 1.20 | 7.9 |
| | 10 | Jan/Feb 1998 | 14 | 1.2 | 225 | 1.3 | 31 | 25 | 14 | 2.3 | 51 | 1.1 | 0.31 | 300 | 1.20 | 7.9 |
| Screen 5 | 1 | Jun/Jul 1994 | 12 | 3.56 | 218 | 0.4 | 28 | 46 | 11 | 3.1 | 37 | 0.40 | 2.55 | 270 | 1.08 | 7.7 |
| | 2 | Nov/Dec 1994 | 11 | 5.46 | 211 | <0.1 | 15 | 64 | 4.6 | 2.9 | 17 | 0.46 | -0.97 | 240 | 1.07 | 8.0 |
| | 5 | Aug/Sep 1996 | 13 | 1.38 | 213 | 1.0 | 19 | 40 | 10 | 2.2 | 40 | <0.1 | 3.35 | 240 | 1.00 | 8 |
| | 6 | Oct/Nov 1996 | 12 | 1.07 | 207 | 0.9 | 18 | 37 | 11 | 2.2 | 39 | <0.1 | 3.91 | 260 | 1.20 | 7.9 |
| | 7 | Feb/Mar 1997 | 11 | 1.4 | 213 | 0.9 | 17 | 36 | 11 | 2.3 | 42 | <0.1 | 4.51 | 260 | 1.10 | 8.0 |
| | 8 | Jun/Jul 1997 | 12 | 1.84 | 225 | 1.0 | 18 | 35 | 12 | 2.6 | 40 | 0.32 | 1.10 | 260 | 1.10 | 8.1 |
| | 9 | Sep/Oct 1997 | 13 | 1.74 | 213 | 1.0 | 19 | 36 | 11 | 2.4 | 46 | <0.1 | 5.46 | 260 | 1.10 | 8.1 |
| | 10 | Jan/Feb 1998 | 13 | 1.1 | 207 | 1.0 | 20 | 38 | 11 | 2.1 | 40 | 0.24 | 1.28 | 300 | 1.30 | 7.9 |
| ***MW-13*** | 1 | Jun/Jul 1994 | 24 | 0.233 | 226 | 11 | 73 | 27 | 25 | 3.3 | 71 | 0.73 | 1.18 | 420 | 1.09 | 7.1 |
| | 2 | Nov/Dec 1994 | 24 | 0.442 | 171 | 9.4 | 56 | 20 | 19 | 2.7 | 55 | 0.17 | -0.94 | 320 | 1.05 | 6.9 |
| | 5 | Aug/Sep 1996 | 24 | 0.3 | 195 | 9.9 | 66 | 26 | 23 | 2.9 | 63 | <0.1 | 2.53 | 370 | 1.20 | 7.4 |
| | 6 | Oct/Nov 1996 | 23 | 0.339 | 165 | 8.6 | 55 | 22 | 17 | 2.6 | 50 | 0.26 | -1.89 | 310 | 1.20 | 7.5 |
| | 7 | Feb/Mar 1997 | 25 | 0.33 | 158 | 9.6 | 58 | 23 | 18 | 2.5 | 54 | <0.1 | 0.48 | 310 | 1.00 | 7.5 |
| | 8 | Jun/Jul 1997 | 22 | 0.39 | 190 | 9.3 | 60 | 21 | 19 | 2.8 | 60 | 0.13 | 3.30 | 340 | 1.10 | 7.5 |
| | 9 | Sep/Oct 1997 | 38 | 0.214 | 165 | 2.9 | 66 | 23 | 19 | 3.0 | 69 | 0.37 | 6.47 | 360 | 1.20 | 7.3 |
| | 10 | Jan/Feb 1998 | 57 | 0.12 | 152 | 7.0 | 67 | 25 | 21 | 3.0 | 47 | 0.09 | 3.54 | 390 | 1.10 | 7.1 |
| ***MW-14*** | | | | | | | | | | | | | | | | |
| Screen 1 | 1 | Jun/Jul 1994 | 130 | 0.129 | 250 | 13 | 235 | 40 | 49 | 3.2 | 145 | 0.57 | -1.87 | 810 | 1.03 | 6.7 |
| | 2 | Nov/Dec 1994 | 105 | 0.639 | 311 | 16 | 185 | 43 | 49 | 3.1 | 130 | 0.52 | -2.34 | 730 | 0.99 | 6.6 |
| | 5 | Aug/Sep 1996 | 120 | 0.245 | 238 | 18 | 205 | 40 | 50 | 2.5 | 135 | 0.41 | 0.31 | 780 | 1.10 | 7.2 |
| | 6 | Oct/Nov 1996 | 115 | 0.538 | 262 | 20 | 175 | 46 | 52 | 2.9 | 135 | 0.4 | -1.95 | 790 | 1.20 | 7.5 |
| | 7 | Feb/Mar 1997 | 120 | 0.16 | 238 | 19 | 155 | 42 | 46 | 2.5 | 150 | 0.66 | 5.18 | 680 | 1.00 | 7.0 |
| | 8 | Jun/Jul 1997 | 135 | 0.13 | 250 | 19 | 225 | 42 | 49 | 3.3 | 135 | 2.30 | 4.87 | 820 | 1.00 | 6.9 |
| | 9 | Sep/Oct 1997 | 115 | 0.170 | 262 | 19 | 185 | 47 | 44 | 3.0 | 140 | 1.40 | 0.39 | 820 | 1.20 | 7.0 |
| | 10 | Jan/Feb 1998 | 130 | 0.13 | 244 | 17 | 200 | 46 | 48 | 3.2 | 160 | 0.74 | 3.70 | 830 | 1.10 | 6.9 |
| Screen 2 | 1 | Jun/Jul 1994 | 115 | 0.398 | 244 | 16 | 175 | 34 | 46 | 2.8 | 135 | 0.65 | 0.41 | 710 | 1.01 | 733 |
| | 2 | Nov/Dec 1994 | 110 | 1.74 | 268 | 14 | 165 | 35 | 49 | 2.9 | 110 | 0.30 | -3.90 | 650 | 0.97 | 7.4 |
| | 5 | Aug/Sep 1996 | 125 | 0.333 | 323 | 15 | 180 | 36 | 58 | 2.6 | 145 | 1.4 | 0.44 | 810 | 1.10 | 7.2 |
| | 6 | Oct/Nov 1996 | 110 | 1.07 | 329 | 14 | 170 | 36 | 58 | 2.8 | 135 | 0.58 | 0.76 | 760 | 1.10 | 7.7 |
| | 7 | Feb/Mar 1997 | 110 | 0.50 | 244 | 14 | 165 | 34 | 55 | 2.6 | 160 | 1.4 | 10.20 | 680 | 1.00 | 7.5 |
| | 8 | Jun/Jul 1997 | 125 | 0.29 | 354 | 15 | 190 | 35 | 56 | 3.3 | 145 | 2.30 | 3.23 | 810 | 1.00 | 7.1 |
| | 9 | Sep/Oct 1997 | 120 | 0.290 | 354 | 14 | 180 | 36 | 54 | 3.1 | 160 | 1.90 | 0.72 | 930 | 1.30 | 7.1 |
| | 10 | Jan/Feb 1998 | 110 | 0.70 | 341 | 16 | 170 | 37 | 53 | 3.0 | 160 | 0.50 | 2.19 | 840 | 1.10 | 7.5 |

# TABLE 3-5

## SUMMARY OF WATER-CHEMISTRY RESULTS FROM JPL GROUNDWATER MONITORING WELLS JET PROPULSION LABORATORY

(concentrations in mg/L)

| Well Number | Sampling Event | Sampling Dates | ANIONS | | | | | CATIONS | | | | | Charge Balance | Measured TDS | Measured TDS / Calculated TDS | Measured pH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Cl | $CO_3$ | $HCO_3$ | $NO_3$-N | $SO_4$ | Na | Mg | K | Ca | Fe | | | | |
| Screen 3 | 1 | Jun/Jul 1994 | 76 | 8.00 | 155 | 9.0 | 88 | 76 | 28 | 4.8 | 31 | 0.65 | 2.82 | 450 | 1.11 | 8.6 |
| | 2 | Nov/Dec 1994 | 73 | 3.60 | 139 | 4.0 | 91 | 52 | 32 | 4.4 | 35 | 0.12 | -1.10 | 400 | 1.00 | 8.4 |
| | 5 | Aug/Sep 1996 | 83 | 1.6 | 195 | 11 | 97 | 41 | 41 | 3.6 | 59 | 0.23 | 0.66 | 480 | 1.10 | 8.1 |
| | 6 | Oct/Nov 1996 | 85 | 1.01 | 195 | 13 | 105 | 39 | 39 | 3.2 | 73 | <0.1 | 0.40 | 530 | 1.20 | 7.9 |
| | 7 | Feb/Mar 1997 | 82 | 1.4 | 207 | 13 | 105 | 37 | 43 | 3.0 | 76 | 0.1 | 1.06 | 480 | 1.00 | 8.0 |
| | 8 | Jun/Jul 1997 | 84 | 1.22 | 237 | 13 | 100 | 37 | 42 | 4.0 | 87 | <0.1 | 1.28 | 580 | 1.10 | 7.9 |
| | 9 | Sep/Oct 1997 | 85 | 0.947 | 231 | 13 | 105 | 38 | 40 | 3.6 | 100 | <0.1 | 3.57 | 590 | 1.20 | 7.8 |
| | 10 | Jan/Feb 1998 | 87 | 0.63 | 244 | 15 | 110 | 39 | 40 | 3.2 | 106 | 0.20 | 2.87 | 590 | 1.10 | 7.6 |
| Screen 4 | 1 | Jun/Jul 1994 | 23 | 2.68 | 164 | 9.0 | 13 | 36 | 16 | 2.6 | 32 | 0.55 | 2.94 | 280 | 1.13 | 8.2 |
| | 2 | Nov/Dec 1994 | 22 | 2.78 | 170 | 9.0 | 12 | 31 | 15 | 2.4 | 33 | 0.54 | -0.58 | 270 | 1.11 | 7.9 |
| | 5 | Aug/Sep 1996 | 28 | 1.23 | 189 | 10 | 17 | 29 | 17 | 2 | 42 | 0.17 | 1.33 | 290 | 1.20 | 8.0 |
| | 6 | Oct/Nov 1996 | 25 | 0.878 | 170 | 10 | 16 | 27 | 18 | 2 | 45 | 0.12 | -4.31 | 300 | 1.30 | 7.9 |
| | 7 | Feb/Mar 1997 | 29 | 1.2 | 189 | 10 | 18 | 26 | 18 | 1.9 | 51 | 0.46 | 1.96 | 270 | 1.00 | 8.0 |
| | 8 | Jun/Jul 1997 | 29 | 1.31 | 201 | 10 | 19 | 27 | 19 | 2.6 | 54 | 0.10 | 2.52 | 320 | 1.10 | 8.0 |
| | 9 | Sep/Oct 1997 | 31 | 0.945 | 183 | 10 | 20 | 28 | 17 | 2.3 | 62 | 0.14 | 7.14 | 350 | 1.30 | 7.9 |
| | 10 | Jan/Feb 1998 | 31 | 0.95 | 183 | 10 | 22 | 29 | 18 | 2.3 | 53 | 0.18 | 3.81 | 310 | 1.10 | 7.9 |
| Screen 5 | 1 | Jun/Jul 1994 | 9.2 | 12.0 | 184 | 0.2 | 22 | 56 | 9.9 | 3.1 | 14 | 0.11 | 2.15 | 240 | 1.10 | 8.8 |
| | 2 | Nov/Dec 1994 | 8.5 | 9.55 | 185 | 0.2 | 19 | 54 | 9.0 | 2.8 | 13 | 0.18 | 0.40 | 410 | 1.97 | 8.5 |
| | 5 | Aug/Sep 1996 | 7.9 | 5.7 | 175 | 0.1 | 17 | 42 | 12 | 2.5 | 14 | 0.21 | 1.56 | 210 | 1.10 | 8.7 |
| | 6 | Oct/Nov 1996 | 7.8 | 5.7 | 175 | 0.2 | 15 | 38 | 12 | 2.4 | 19 | 0.4 | 2.82 | 200 | 1.10 | 8.7 |
| | 7 | Feb/Mar 1997 | 7.9 | 5.7 | 175 | 0.2 | 16 | 37 | 12 | 2.3 | 21 | 0.16 | 3.34 | 180 | 1.00 | 8.7 |
| | 8 | Jun/Jul 1997 | 8.5 | 7.38 | 180 | 0.2 | 15 | 35 | 13 | 2.9 | 17 | 0.20 | 0.71 | 200 | 1.10 | 8.8 |
| | 9 | Sep/Oct 1997 | 5.2 | 5.47 | 168 | 0.5 | 9.5 | 36 | 11 | 2.6 | 21 | 0.64 | 6.06 | 200 | 1.10 | 8.7 |
| | 10 | Jan/Feb 1998 | 8.6 | 4.22 | 163 | 0.3 | 17 | 37 | 13 | 2.5 | 19 | 0.89 | 5.28 | 210 | 1.10 | 8.6 |
| ***MW-15*** | 1 | Jun/Jul 1994 | 18 | 0.219 | 213 | 0.2 | 33 | 21 | 17 | 2.7 | 51 | 0.12 | 1.65 | 270 | 1.08 | 6.9 |
| | 2 | Nov/Dec 1994 | 25 | 0.276 | 268 | 3.3 | 93 | 26 | 25 | 3.6 | 75 | <0.1 | -2.09 | 440 | 1.11 | 7.2 |
| | 5 | Aug/Sep 1996 | 17 | 0.824 | 201 | 1.3 | 38 | 24 | 17 | 3.1 | 51 | <0.1 | 4.41 | 290 | 1.20 | 7.8 |
| | 6 | Oct/Nov 1996 | 23 | 0.301 | 232 | 1.3 | 48 | 23 | 18 | 3.1 | 54 | 0.12 | -2.59 | 310 | 1.10 | 7.3 |
| | 7 | Feb/Mar 1997 | 9.9 | 0.43 | 207 | 3.0 | 35 | 22 | 17 | 3.0 | 51 | <0.1 | 3.75 | 260 | 1.00 | 7.5 |
| | 8 | Jun/Jul 1997 | 14 | 0.42 | 255 | 0.4 | 26 | 21 | 17 | 3.3 | 54 | 0.15 | 0.68 | 280 | 1.10 | 7.4 |
| | 9 | Sep/Oct 1997 | 24 | 0.264 | 256 | 0.9 | 47 | 24 | 19 | 3.7 | 66 | 0.11 | 0.67 | 340 | 1.10 | 7.2 |
| | 10 | Jan/Feb 1998 | 13 | 0.251 | 244 | 4.4 | 36 | 24 | 21 | 3.4 | 53 | <0.1 | 0.73 | 300 | 1.00 | 7.2 |
| ***MW-16*** | 1 | Jun/Jul 1994 | 22 | 0.279 | 171 | 20 | 32 | 24 | 22 | 2.6 | 56 | <0.1 | 1.60 | 370 | 1.11 | 7.1 |
| | 2 | Nov/Dec 1994 | 20 | 0.476 | 146 | 18 | 24 | 21 | 17 | 2.4 | 49 | <0.1 | 0.42 | 310 | 1.08 | 7.2 |
| | 5 | Aug/Sep 1996 | 20 | 0.339 | 165 | 13 | 0.79 | 25 | 20 | 2.5 | 51 | <0.1 | 3.77 | 330 | 1.50 | 7.5 |
| | 6 | Oct/Nov 1996 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | 7 | Feb/Mar 1997 | 21 | 0.15 | 116 | 18 | 33 | 23 | 19 | 2.2 | 48 | <0.1 | 5.80 | 310 | 1.10 | 7.3 |
| | 8 | Jun/Jul 1997 | 23 | 0.45 | 175 | 12 | 42 | 21 | 19 | 2.5 | 56 | 0.13 | 0.56 | 320 | 1.10 | 7.6 |
| | 9 | Sep/Oct 1997[1] | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | 10 | Jan/Feb 1998 | 39 | 0.26 | 158 | 4.8 | 28 | 22 | 17 | 2.5 | 39 | <0.1 | 2.89 | 270 | 1.10 | 7.4 |
| ***MW-17*** | | | | | | | | | | | | | | | | |
| Screen 1 | 3 | July/Aug 1995 | 4.8 | 0.29 | 140 | 0.3 | 19 | 13 | 10 | 2.3 | 30 | <0.1 | 1.37 | 160 | 1.07 | 7.5 |
| | 4 | Dec/Feb 95/96 | 7.0 | 0.77 | 189 | 0.3 | 24 | 15 | 12 | 2.3 | 40 | 0.18 | -1.73 | 210 | 1.08 | 7.8 |
| | 5 | Aug/Sept 1996 | 5.4 | 0.33 | 158 | 0.8 | 29 | 15 | 13 | 2.2 | 33 | 0.11 | 0.44 | 200 | 1.10 | 7.5 |
| | 6 | Oct/Nov 1996 | 5.7 | 0.53 | 164 | 0.6 | 28 | 14 | 13 | 2.2 | 34 | 0.19 | 0.87 | 190 | 1.10 | 7.7 |
| | 7 | Feb/Mar 1997 | 6.1 | 0.20 | 152 | 0.6 | 27 | 13 | 12 | 1.9 | 40 | 0.08 | 4.65 | 190 | 1.10 | 7.3 |
| | 8 | Jun/Jul 1997 | 5.8 | 0.43 | 165 | 1.0 | 29 | 13 | 12 | 2.2 | 39 | 0.14 | 0.28 | 200 | 1.10 | 7.6 |
| | 9 | Sep/Oct 1997 | 5.7 | 0.238 | 146 | 0.6 | 25 | 13 | 11 | 2.1 | 36 | <0.1 | 3.11 | 180 | 1.10 | 7.4 |
| | 10 | Jan/Feb 1998 | 6.6 | 0.67 | 164 | 0.4 | 24 | 15 | 13 | 2.6 | 39 | 0.27 | 4.47 | 190 | 1.10 | 7.8 |

# TABLE 3-5

## SUMMARY OF WATER-CHEMISTRY RESULTS FROM JPL GROUNDWATER MONITORING WELLS JET PROPULSION LABORATORY

(concentrations in mg/L)

| Well Number | Sampling Event | Sampling Dates | ANIONS | | | | | CATIONS | | | | | Charge Balance | Measured TDS | Measured TDS / Calculated TDS | Measured pH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Cl | $CO_3$ | $HCO_3$ | $NO_3$-N | $SO_4$ | Na | Mg | K | Ca | Fe | | | | |
| Screen 2 | 3 | July/Aug 1995 | 9.1 | 0.70 | 171 | 0.7 | 26 | 18 | 14 | 2.1 | 38 | 0.23 | 2.19 | 210 | 1.08 | 7.8 |
| | 4 | Dec/Feb 95/96 | 7.9 | 0.98 | 189 | 0.8 | 30 | 17 | 15 | 2.4 | 33 | 0.48 | -4.40 | 240 | 1.18 | 7.9 |
| | 5 | Aug/Sept 1996 | 6.1 | 0.82 | 158 | 0.6 | 25 | 15 | 13 | 2.3 | 30 | 0.54 | 0.75 | 200 | 1.20 | 7.9 |
| | 6 | Oct/Nov 1996 | 7.3 | 2.58 | 158 | 0.8 | 28 | 17 | 17 | 2.4 | 29 | 0.28 | -2.62 | 180 | 1.00 | 8.4 |
| | 7 | Feb/Mar 1997 | 8.2 | 0.67 | 164 | 0.7 | 26 | 13 | 14 | 2.1 | 43 | 1.2 | 5.38 | 220 | 1.20 | 7.8 |
| | 8 | Jun/Jul 1997 | 8.4 | 0.66 | 160 | 0.2 | 26 | 16 | 16 | 2.7 | 25 | 0.32 | 0.89 | 200 | 1.10 | 7.8 |
| | 9 | Sep/Oct 1997 | 6.8 | 10.1 | 124 | <0.1 | 22 | 17 | 16 | 2.8 | 14 | <0.1 | 1.43 | 160 | 1.10 | 9.1 |
| | 10 | Jan/Feb 1998 | 7.7 | 10.6 | 130 | <0.1 | 25 | 16 | 18 | 3.1 | 16 | 0.65 | 2.00 | 170 | 1.10 | 9.1 |
| Screen 3 | 3 | July/Aug 1995 | 8.6 | 2.36 | 182 | <0.1 | 29 | 58 | 7.6 | 1.6 | 19 | 0.45 | 3.24 | 220 | 1.02 | 8.3 |
| | 4 | Dec/Feb 95/96 | 9.0 | 1.81 | 176 | 0.5 | 28 | 18 | 16 | 1.7 | 26 | 0.57 | -4.97 | 200 | 1.05 | 8.2 |
| | 5 | Aug/Sept 1996 | 11 | 0.70 | 171 | 1.2 | 28 | 21 | 16 | 1.9 | 32 | 0.91 | 1.56 | 210 | 1.10 | 7.8 |
| | 6 | Oct/Nov 1996 | 13 | 0.73 | 177 | 2.1 | 31 | 21 | 17 | 1.9 | 36 | 1.5 | 1.71 | 230 | 1.10 | 7.8 |
| | 7 | Feb/Mar 1997 | 14 | 0.78 | 189 | 1.8 | 31 | 20 | 18 | 1.9 | 43 | 0.43 | 3.17 | 250 | 1.10 | 7.8 |
| | 8 | Jun/Jul 1997 | 12 | 0.78 | 190 | 1.4 | 32 | 19 | 15 | 2.0 | 43 | 0.58 | 0.59 | 260 | 1.20 | 7.8 |
| | 9 | Sep/Oct 1997 | 14 | 0.800 | 195 | 1.7 | 29 | 21 | 16 | 2.0 | 43 | 0.61 | 1.26 | 240 | 1.10 | 7.8 |
| | 10 | Jan/Feb 1998 | 14 | 0.80 | 195 | 1.6 | 32 | 24 | 16 | 2.1 | 46 | 0.21 | 3.63 | 250 | 1.10 | 7.8 |
| Screen 4 | 3 | July/Aug 1995 | 12 | 2.52 | 194 | 1.4 | 34 | 52 | 11 | 1.8 | 30 | 0.32 | 3.74 | 250 | 1.02 | 8.3 |
| | 4 | Dec/Feb 95/96 | 12 | <0.1 | 255 | 2.3 | 27 | 32 | 15 | 1.7 | 44 | 0.23 | -4.13 | 270 | 1.00 | 7.9 |
| | 5 | Aug/Sept 1996 | 11 | 1.1 | 213 | 2.4 | 26 | 30 | 15 | 1.8 | 45 | 1.2 | 3.52 | 270 | 1.10 | 7.9 |
| | 6 | Oct/Nov 1996 | 12 | 1.25 | 243 | 2.1 | 26 | 32 | 15 | 1.7 | 46 | 0.14 | -0.60 | 260 | 1.00 | 7.9 |
| | 7 | Feb/Mar 1997 | 12 | 1.2 | 231 | 2.0 | 26 | 27 | 16 | 1.5 | 52 | 0.61 | 3.12 | 240 | 0.90 | 7.9 |
| | 8 | Jun/Jul 1997 | 12 | 1.59 | 245 | 2.2 | 27 | 31 | 13 | 1.8 | 51 | <0.1 | 0.50 | 280 | 1.00 | 8.0 |
| | 9 | Sep/Oct 1997 | 11 | 0.898 | 219 | 1.9 | 25 | 33 | 12 | 1.7 | 45 | 0.73 | 1.61 | 270 | 1.10 | 7.8 |
| | 10 | Jan/Feb 1998 | 12 | 1.07 | 207 | 2.3 | 29 | 33 | 13 | 1.8 | 49 | 0.26 | 5.15 | 240 | 1.00 | 7.9 |
| Screen 5 | 3 | July/Aug 1995 | 13 | 1.6 | 195 | 1.8 | 35 | 48 | 11 | 1.8 | 37 | 1.45 | 4.71 | 260 | 1.03 | 8.1 |
| | 4 | Dec/Feb 95/96 | 13 | 3.56 | 218 | 2.5 | 31 | 35 | 12 | 1.6 | 41 | 0.51 | -2.23 | 306 | 1.20 | 8.4 |
| | 5 | Aug/Sept 1996 | 12 | 1.04 | 201 | 2.2 | 28 | 35 | 14 | 1.7 | 40 | 2.3 | 3.84 | 270 | 1.20 | 7.9 |
| | 6 | Oct/Nov 1996 | 13 | 1.1 | 213 | 2.1 | 28 | 38 | 14 | 1.9 | 40 | 5.1 | 2.65 | 250 | 1.00 | 7.9 |
| | 7 | Feb/Mar 1997 | 12 | 1.8 | 219 | 1.7 | 25 | 42 | 12 | 1.7 | 40 | 2.9 | 2.97 | 240 | 1.00 | 8.1 |
| | 8 | Jun/Jul 1997 | 12 | 1.53 | 235 | 2.0 | 27 | 34 | 13 | 1.8 | 49 | 0.72 | 1.00 | 280 | 1.10 | 8.0 |
| | 9 | Sep/Oct 1997 | 11 | 1.38 | 213 | 1.9 | 26 | 34 | 12 | 1.7 | 43 | 0.82 | 1.86 | 240 | 1.00 | 8.0 |
| | 10 | Jan/Feb 1998 | 13 | 1.69 | 207 | 2.2 | 29 | 34 | 13 | 1.8 | 48 | 0.65 | 4.83 | 260 | 1.00 | 8.1 |
| ***MW-18*** | | | | | | | | | | | | | | | | |
| Screen 1 | 3 | July/Aug 1995 | 7.8 | 0.24 | 146 | 1.7 | 36 | 16 | 13 | 2.4 | 40 | 0.13 | 4.36 | 220 | 1.12 | 7.4 |
| | 4 | Dec/Feb 95/96 | 6.6 | 1.39 | 170 | 1.2 | 30 | 15 | 13 | 2.5 | 38 | 0.31 | -0.41 | 220 | 1.13 | 8.1 |
| | 5 | Aug/Sept 1996 | 15 | 0.15 | 146 | 2.9 | 32 | 15 | 14 | 2.1 | 35 | 0.05 | 1.09 | 230 | 1.20 | 7.2 |
| | 6 | Oct/Nov 1996[1] | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | 7 | Feb/Mar 1997 | 11 | 0.41 | 158 | 1.8 | 31 | 14 | 14 | 2.2 | 44 | 0.18 | 4.42 | 210 | 1.00 | 7.6 |
| | 8 | Jun/Jul 1997 | 60 | 0.30 | 185 | 6.0 | 67 | 17 | 19 | 2.9 | 61 | <0.1 | 2.16 | 340 | 1.10 | 7.4 |
| | 9 | Sep/Oct 1997[1] | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | 10 | Jan/Feb 1998[1] | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| Screen 2 | 3 | July/Aug 1995 | 12 | 0.85 | 207 | 1.0 | 38 | 18 | 18 | 2.9 | 51 | <0.1 | 2.73 | 270 | 1.09 | 7.8 |
| | 4 | Dec/Feb 95/96 | 9.8 | 1.42 | 219 | 1.0 | 39 | 19 | 15 | 2.5 | 50 | <0.1 | -1.70 | 270 | 1.08 | 8.0 |
| | 5 | Aug/Sept 1996 | 9.5 | 0.30 | 183 | 1.1 | 31 | 18 | 15 | 2.2 | 39 | 0.52 | 0.62 | 250 | 1.20 | 7.4 |
| | 6 | Oct/Nov 1996 | 11 | 0.49 | 189 | 1.3 | 35 | 18 | 16 | 2.5 | 41 | 0.25 | -0.24 | 220 | 1.00 | 7.6 |
| | 7 | Feb/Mar 1997 | 15 | 0.69 | 213 | 2.1 | 41 | 19 | 18 | 2.6 | 57 | 0.20 | 2.86 | 292 | 1.10 | 7.7 |
| | 8 | Jun/Jul 1997 | 13 | 0.27 | 205 | 1.3 | 38 | 17 | 15 | 2.7 | 50 | 0.18 | 1.20 | 240 | 1.00 | 7.3 |
| | 9 | Sep/Oct 1997 | 11 | 0.261 | 201 | 1.1 | 36 | 18 | 15 | 2.9 | 57 | 0.14 | 5.33 | 270 | 1.10 | 7.3 |
| | 10 | Jan/Feb 1998 | 12 | 1.07 | 207 | 1.2 | 37 | 20 | 17 | 3.1 | 53 | 0.31 | 4.17 | 270 | 1.10 | 7.9 |

# TABLE 3-5

## SUMMARY OF WATER-CHEMISTRY RESULTS FROM JPL GROUNDWATER MONITORING WELLS JET PROPULSION LABORATORY

(concentrations in mg/L)

| Well Number | Sampling Event | Sampling Dates | ANIONS | | | | | CATIONS | | | | | Charge Balance | Measured TDS | Measured TDS / Calculated TDS | Measured pH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Cl | $CO_3$ | $HCO_3$ | $NO_3$-N | $SO_4$ | Na | Mg | K | Ca | Fe | | | | |
| Screen 3 | 3 | July/Aug 1995 | 16 | 1.31 | 201 | 2.1 | 48 | 23 | 20 | 3.3 | 49 | 0.43 | 2.47 | 280 | 1.04 | 8.0 |
| | 4 | Dec/Feb 95/96 | 14 | 1.66 | 256 | 0.9 | 33 | 23 | 19 | 2.9 | 55 | 0.50 | 0.09 | 250 | 0.90 | 8.0 |
| | 5 | Aug/Sept 1996 | 12 | 0.75 | 231 | 0.8 | 29 | 22 | 19 | 2.8 | 47 | 0.8 | 1.64 | 290 | 1.20 | 7.7 |
| | 6 | Oct/Nov 1996 | 14 | 1.79 | 219 | 0.3 | 32 | 25 | 21 | 3.2 | 42 | 0.64 | 3.31 | 270 | 1.10 | 8.1 |
| | 7 | Feb/Mar 1997 | 13 | 1.1 | 256 | 1.1 | 33 | 21 | 20 | 2.8 | 60 | 0.28 | 2.74 | 295 | 1.10 | 7.8 |
| | 8 | Jun/Jul 1997 | 13 | 1.00 | 245 | 1.0 | 32 | 20 | 17 | 3.0 | 52 | 0.23 | 1.49 | 270 | 1.00 | 7.8 |
| | 9 | Sep/Oct 1997 | 13 | 2.13 | 207 | 0.2 | 30 | 23 | 18 | 3.4 | 46 | 0.11 | 4.96 | 270 | 1.10 | 8.2 |
| | 10 | Jan/Feb 1998 | 15 | 1.50 | 231 | 0.7 | 35 | 23 | 19 | 3.3 | 57 | 0.16 | 4.66 | 290 | 1.10 | 8.0 |
| Screen 4 | 3 | July/Aug 1995 | 14 | 2.13 | 207 | 1.2 | 50 | 41 | 16 | 2.8 | 43 | 0.14 | 3.60 | 280 | 1.02 | 8.2 |
| | 4 | Dec/Feb 95/96 | 9.8 | 2.75 | 212 | 0.6 | 30 | 37 | 11 | 1.6 | 38 | 0.22 | -0.22 | 230 | 0.98 | 8.3 |
| | 5 | Aug/Sept 1996 | 8.1 | 1.54 | 188 | 0.6 | 23 | 34 | 11 | 1.2 | 34 | 0.13 | 3.51 | 240 | 1.20 | 8.1 |
| | 6 | Oct/Nov 1996 | 8.7 | 1.44 | 176 | 0.4 | 24 | 32 | 9.7 | 1.5 | 35 | 0.15 | 4.05 | 250 | 1.30 | 8.1 |
| | 7 | Feb/Mar 1997 | 8.1 | 4.4 | 169 | 0.6 | 20 | 30 | 13 | 1.5 | 26 | 0.29 | 3.06 | 195 | 1.10 | 8.6 |
| | 8 | Jun/Jul 1997 | 9.3 | 1.40 | 215 | 0.7 | 25 | 30 | 9.9 | 1.5 | 41 | 0.38 | 1.41 | 200 | 0.90 | 8.0 |
| | 9 | Sep/Oct 1997 | 8.6 | 1.64 | 201 | 0.7 | 22 | 32 | 9.7 | 1.6 | 47 | 0.38 | 6.14 | 250 | 1.10 | 8.1 |
| | 10 | Jan/Feb 1998 | 8.8 | 1.60 | 195 | 0.7 | 23 | 34 | 10 | 1.6 | 41 | 0.26 | 4.90 | 240 | 1.10 | 8.1 |
| Screen 5 | 3 | July/Aug 1995 | 15 | 2.97 | 182 | 1.0 | 53 | 55 | 14 | 2.7 | 30 | 0.51 | 4.93 | 280 | 1.05 | 8.4 |
| | 4 | Dec/Feb 95/96 | 11 | 3.72 | 181 | 0.3 | 8.5 | 46 | 7.6 | 2.2 | 18 | 0.41 | 0.56 | 210 | 1.13 | 8.5 |
| | 5 | Aug/Sept 1996 | 10 | 8.31 | 161 | <0.1 | 5.8 | 54 | 5.7 | 1.6 | 10 | 0.09 | 4.02 | 190 | 1.10 | 8.9 |
| | 6 | Oct/Nov 1996 | 11 | 6.89 | 168 | <0.1 | 6.3 | 55 | 5.9 | 1.9 | 13 | 0.14 | 4.99 | 210 | 1.20 | 8.8 |
| | 7 | Feb/Mar 1997 | 12 | 1.9 | 182 | <0.1 | 6.5 | 50 | 5.7 | 1.6 | 18 | 0.20 | 1.56 | 200 | 1.10 | 8.2 |
| | 8 | Jun/Jul 1997 | 11 | 14.0 | 170 | 0.1 | 6.3 | 49 | 5.2 | 1.7 | 11 | 0.14 | 3.08 | 170 | 0.90 | 9.1 |
| | 9 | Sep/Oct 1997 | 10 | 13.0 | 159 | <0.1 | 5.9 | 52 | 4.6 | 1.7 | 7.7 | <0.1 | 0.65 | 180 | 1.00 | 9.1 |
| | 10 | Jan/Feb 1998 | 10 | 13.0 | 159 | 0.1 | 5.9 | 57 | 4.9 | 1.8 | 8.5 | <0.1 | 3.72 | 180 | 1.00 | 9.1 |
| ***MW-19*** | | | | | | | | | | | | | | | | |
| Screen 1 | 3 | July/Aug 1995 | 5.0 | 0.23 | 140 | 0.6 | 24 | 12 | 12 | 2.4 | 32 | <0.1 | 2.76 | 180 | 1.13 | 7.4 |
| | 4 | Dec/Feb 95/96 | 5.4 | 0.38 | 146 | 0.3 | 22 | 13 | 9.9 | 2.1 | 28 | 0.29 | -3.74 | 200 | 1.29 | 7.6 |
| | 5 | Aug/Sept 1996 | 6.6 | 0.49 | 152 | 0.5 | 23 | 14 | 13 | 2.1 | 31 | 2.7 | 1.54 | 190 | 1.20 | 7.7 |
| | 6 | Oct/Nov 1996 | 6.4 | 0.3 | 146 | 0.9 | 26 | 13 | 13 | 2.3 | 33 | 0.51 | 2.30 | 200 | 1.20 | 7.5 |
| | 7 | Feb/Mar 1997 | 6.2 | 0.31 | 152 | 0.7 | 28 | 11 | 12 | 2.4 | 42 | 0.41 | 4.61 | 210 | 1.20 | 7.5 |
| | 8 | Jun/Jul 1997 | 6.9 | 0.41 | 158 | 0.8 | 24 | 12 | 13 | 2.8 | 39 | 0.17 | 3.74 | 320 | 1.80 | 7.6 |
| | 9 | Sep/Oct 1997 | 6.1 | 0.325 | 158 | 0.8 | 23 | 12 | 12 | 2.5 | 37 | 0.62 | 1.78 | 180 | 1.00 | 7.5 |
| | 10 | Jan/Feb 1998 | 6.0 | 0.52 | 158 | 0.7 | 23 | 14 | 13 | 3.2 | 39 | 0.2 | 5.85 | 200 | 1.10 | 7.7 |
| Screen 2 | 3 | July/Aug 1995 | 40 | 0.13 | 195 | 4.6 | 66 | 17 | 28 | 2.3 | 70 | <0.1 | 4.43 | 400 | 1.18 | 7.0 |
| | 4 | Dec/Feb 95/96 | 49 | 0.16 | 195 | 5.0 | 68 | 17 | 26 | 1.8 | 64 | 0.24 | -1.92 | 360 | 1.04 | 7.1 |
| | 5 | Aug/Sept 1996 | 31 | 0.24 | 183 | 3.7 | 57 | 15 | 23 | 1.5 | 49 | 5.5 | 2.60 | 340 | 1.30 | 7.3 |
| | 6 | Oct/Nov 1996 | 44 | 0.16 | 195 | 4.5 | 63 | 16 | 25 | 1.8 | 55 | 7.2 | 4.56 | 340 | 1.10 | 7.1 |
| | 7 | Feb/Mar 1997 | 38 | 0.15 | 183 | 4.7 | 64 | 15 | 22 | 1.7 | 62 | 2.4 | -1.15 | 290 | 0.90 | 7.1 |
| | 8 | Jun/Jul 1997 | 34 | 0.20 | 195 | 4.2 | 59 | 14 | 24 | 2.3 | 51 | 0.12 | 4.60 | 480 | 1.60 | 7.2 |
| | 9 | Sep/Oct 1997 | 28 | 0.091 | 177 | 3.2 | 48 | 14 | 19 | 1.9 | 55 | <0.1 | 0.51 | 290 | 1.10 | 6.9 |
| | 10 | Jan/Feb 1998 | 67 | 0.07 | 226 | 7.3 | 92 | 19 | 34 | 3.2 | 100 | 1.6 | 4.06 | 490 | 1.10 | 6.7 |
| Screen 3 | 3 | July/Aug 1995 | 69 | 0.83 | 256 | 9.2 | 64 | 32 | 34 | 2.5 | 90 | 0.26 | 2.96 | 470 | 1.02 | 7.7 |
| | 4 | Dec/Feb 95/96 | 61 | 0.41 | 250 | 9.9 | 58 | 30 | 29 | 2.5 | 80 | 0.62 | 0.06 | 430 | 1.00 | 7.4 |
| | 5 | Aug/Sept 1996 | 65 | 0.48 | 232 | 9.8 | 59 | 30 | 32 | 2.2 | 74 | 0.75 | 1.11 | 460 | 1.20 | 7.5 |
| | 6 | Oct/Nov 1996 | 71 | 0.32 | 244 | 9.9 | 64 | 31 | 32 | 2.5 | 73 | 1.6 | -2.16 | 450 | 1.10 | 7.3 |
| | 7 | Feb/Mar 1997 | 78 | 0.43 | 262 | 11 | 74 | 28 | 35 | 2.7 | 93 | 0.24 | -0.06 | 480 | 1.00 | 7.4 |
| | 8 | Jun/Jul 1997 | 73 | 0.66 | 256 | 9.9 | 66 | 30 | 32 | 3.1 | 86 | 0.45 | 0.12 | 510 | 1.10 | 7.6 |
| | 9 | Sep/Oct 1997 | 70 | 0.251 | 244 | 9.0 | 66 | 29 | 30 | 2.6 | 86 | 0.26 | 0.68 | 460 | 1.10 | 7.2 |
| | 10 | Jan/Feb 1998 | 77 | 0.25 | 244 | 9.6 | 70 | 32 | 32 | 3.0 | 98 | 0.22 | 3.93 | 510 | 1.10 | 7.2 |

# TABLE 3-5

## SUMMARY OF WATER-CHEMISTRY RESULTS FROM JPL GROUNDWATER MONITORING WELLS JET PROPULSION LABORATORY

(concentrations in mg/L)

| Well Number | Sampling Event | Sampling Dates | ANIONS Cl | $CO_3$ | $HCO_3$ | $NO_3$-N | $SO_4$ | CATIONS Na | Mg | K | Ca | Fe | Charge Balance | Measured TDS | Measured TDS / Calculated TDS | Measured pH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Screen 4 | 3 | July/Aug 1995 | 28 | 1.10 | 213 | 4.0 | 39 | 29 | 22 | 2.1 | 54 | 0.73 | 3.74 | 320 | 1.07 | 7.9 |
| | 4 | Dec/Feb 95/96 | 28 | 1.5 | 231 | 4.1 | 38 | 28 | 20 | 2.0 | 55 | 1.20 | -0.35 | 320 | 1.05 | 8.0 |
| | 5 | Aug/Sept 1996 | 29 | 0.87 | 213 | 4.1 | 38 | 26 | 22 | 1.7 | 51 | 0.97 | 1.46 | 320 | 1.20 | 7.8 |
| | 6 | Oct/Nov 1996 | 32 | 0.75 | 231 | 4.4 | 43 | 27 | 23 | 2 | 53 | 0.8 | -1.20 | 340 | 1.10 | 7.7 |
| | 7 | Feb/Mar 1997 | 39 | 1.5 | 231 | 4.8 | 48 | 27 | 27 | 2.4 | 56 | 0.29 | -0.16 | 350 | 1.00 | 8.0 |
| | 8 | Jun/Jul 1997 | 39 | 0.83 | 256 | 5.0 | 49 | 26 | 26 | 2.7 | 72 | 2.20 | 1.91 | 390 | 1.10 | 7.7 |
| | 9 | Sep/Oct 1997 | 37 | 0.631 | 244 | 4.8 | 50 | 26 | 24 | 2.2 | 70 | 1.30 | 1.76 | 390 | 1.20 | 7.6 |
| | 10 | Jan/Feb 1998 | 42 | 0.40 | 244 | 5.2 | 55 | 27 | 26 | 2.5 | 80 | 0.50 | 4.83 | 420 | 1.10 | 7.4 |
| Screen 5 | 3 | July/Aug 1995 | 52 | 1.94 | 237 | 8.5 | 50 | 34 | 27 | 2.3 | 77 | 0.33 | 3.94 | 410 | 1.03 | 8.1 |
| | 4 | Dec/Feb 95/96 | 59 | 1.74 | 268 | 8.8 | 54 | 33 | 27 | 2.4 | 81 | 0.22 | -0.39 | 450 | 1.05 | 8.0 |
| | 5 | Aug/Sept 1996 | 60 | 1 | 244 | 8.5 | 54 | 33 | 30 | 2.2 | 73 | 0.38 | 1.46 | 480 | 1.30 | 7.8 |
| | 6 | Oct/Nov 1996 | 61 | 1.05 | 256 | 8.7 | 57 | 33 | 30 | 2.4 | 71 | 0.37 | -1.38 | 440 | 1.10 | 7.8 |
| | 7 | Feb/Mar 1997 | 74 | 1.3 | 195 | 4.2 | 53 | 36 | 27 | 2.6 | 56 | 0.29 | -0.30 | 370 | 1.00 | 8.0 |
| | 8 | Jun/Jul 1997 | 64 | 0.56 | 274 | 8.4 | 60 | 31 | 32 | 2.9 | 91 | 0.52 | 2.68 | 480 | 1.10 | 7.5 |
| | 9 | Sep/Oct 1997 | 57 | 0.853 | 262 | 6.9 | 57 | 30 | 29 | 2.4 | 84 | 1.10 | 2.32 | 450 | 1.10 | 7.7 |
| | 10 | Jan/Feb 1998 | 72 | 0.44 | 268 | 8.7 | 69 | 33 | 32 | 2.8 | 102 | 0.40 | 4.23 | 520 | 1.10 | 7.4 |
| ***MW-20*** | | | | | | | | | | | | | | | | |
| Screen 1 | 3 | July/Aug 1995 | 61 | 0.58 | 177 | 20 | 135 | 27 | 38 | 3.7 | 100 | 0.47 | 2.79 | 530 | 0.94 | 7.7 |
| | 4 | Dec/Feb 95/96 | 52 | 1.63 | 158 | 3.7 | 90 | 35 | 30 | 3.7 | 62 | 1.30 | -0.42 | 400 | 0.93 | 8.2 |
| | 5 | Aug/Sept 1996 | 64 | 0.78 | 189 | 19 | 155 | 25 | 38 | 3.9 | 96 | 1.7 | 1.82 | 560 | 1.10 | 7.8 |
| | 6 | Oct/Nov 1996(1) | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | 7 | Feb/Mar 1997 | 55 | 0.66 | 201 | 13 | 145 | 22 | 32 | 3.6 | 95 | 0.11 | -2.15 | 460 | 0.90 | 7.7 |
| | 8 | Jun/Jul 1997 | 56 | 0.65 | 200 | 15 | 140 | 22 | 32 | 3.8 | 105 | 0.44 | 0.39 | 520 | 1.00 | 7.7 |
| | 9 | Sep/Oct 1997(1) | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | 10 | Jan/Feb 1998 | 54 | 1.04 | 201 | 12 | 130 | 26 | 32 | 4.1 | 103 | 0.19 | 4.62 | 570 | 1.10 | 7.9 |
| Screen 2 | 3 | July/Aug 1995 | 19 | 2.36 | 182 | 3.0 | 39 | 32 | 17 | 2.4 | 38 | 0.41 | 1.60 | 270 | 1.07 | 8.3 |
| | 4 | Dec/Feb 95/96 | 16 | 44 | 170 | 0.3 | 42 | 77 | 11 | 1.9 | 8.4 | 0.13 | 2.61 | 260 | 1.03 | 9.6 |
| | 5 | Aug/Sept 1996 | 12 | 13 | 159 | 0.8 | 30 | 54 | 11 | 2.2 | 13 | 0.34 | 3.25 | 230 | 1.10 | 9.1 |
| | 6 | Oct/Nov 1996 | 15 | 3.35 | 163 | 2.5 | 32 | 25 | 20 | 2.2 | 29 | 0.14 | 3.29 | 230 | 1.10 | 8.5 |
| | 7 | Feb/Mar 1997 | 18 | 0.62 | 189 | 3.4 | 37 | 14 | 18 | 2.2 | 52 | 0.24 | 1.39 | 250 | 1.00 | 7.7 |
| | 8 | Jun/Jul 1997 | 13 | 14.9 | 145 | 0.2 | 29 | 41 | 11 | 2.2 | 13 | 0.32 | 1.45 | 210 | 1.10 | 9.2 |
| | 9 | Sep/Oct 1997 | 11 | 14.4 | 140 | 0.3 | 26 | 38 | 12 | 2.2 | 12 | 0.50 | 0.46 | 210 | 1.10 | 9.2 |
| | 10 | Jan/Feb 1998 | 14 | 8.45 | 130 | 0.1 | 30 | 41 | 12 | 2.2 | 13 | 0.14 | 3.73 | 220 | 1.20 | 9.0 |
| Screen 3 | 3 | July/Aug 1995 | 24 | 3.84 | 187 | 0.5 | 40 | 37 | 23 | 3.3 | 30 | 1.80 | 4.20 | 230 | 0.90 | 8.5 |
| | 4 | Dec/Feb 95/96 | 24 | 3.07 | 237 | 2.0 | 19 | 57 | 13 | 2.3 | 30 | 0.22 | -0.29 | 270 | 0.99 | 8.3 |
| | 5 | Aug/Sept 1996 | 23 | 6.29 | 193 | 1.0 | 18 | 59 | 14 | 2.5 | 18 | 0.12 | 4.44 | 250 | 1.10 | 8.7 |
| | 6 | Oct/Nov 1996 | 24 | 7.87 | 192 | 0.6 | 18 | 57 | 12 | 2.4 | 17 | 0.16 | 1.04 | 240 | 1.10 | 8.8 |
| | 7 | Feb/Mar 1997 | 30 | 26 | 203 | 1.4 | 18 | 66 | 18 | 2.8 | 11 | <0.1 | 1.53 | 240 | 0.90 | 9.3 |
| | 8 | Jun/Jul 1997 | 30 | 2.37 | 230 | 3.1 | 21 | 51 | 13 | 2.3 | 37 | 0.80 | 1.05 | 280 | 1.00 | 8.2 |
| | 9 | Sep/Oct 1997 | 25 | 5.15 | 199 | 1.1 | 18 | 55 | 12 | 2.4 | 20 | <0.1 | 0.22 | 290 | 1.20 | 8.6 |
| | 10 | Jan/Feb 1998 | 30 | 1.84 | 225 | 2.7 | 23 | 60 | 13 | 2.4 | 39 | <0.1 | 4.31 | 330 | 1.10 | 8.1 |
| Screen 4 | 3 | July/Aug 1995 | 18 | 4.99 | 193 | <0.1 | 94 | 120 | 5.4 | 1.9 | 12 | <0.1 | 4.99 | 230 | 0.95 | 8.6 |
| | 4 | Dec/Feb 95/96 | 11 | 2.13 | 164 | <0.1 | 22 | 66 | 3.5 | ND | 13 | 0.19 | 4.10 | 220 | 1.11 | 8.3 |
| | 5 | Aug/Sept 1996 | 10 | 4.06 | 157 | <0.1 | 22 | 71 | 2.4 | 1.2 | 7.1 | 0.13 | 4.71 | 210 | 1.10 | 8.6 |
| | 6 | Oct/Nov 1996 | 11 | 4.53 | 175 | <0.1 | 21 | 72 | 2.2 | 1.1 | 9.3 | 0.14 | 2.01 | 200 | 1.00 | 8.6 |
| | 7 | Feb/Mar 1997 | 10 | 8.6 | 167 | <0.1 | 20 | 69 | 2.1 | 1.0 | 8.6 | 0.21 | 1.82 | 200 | 1.10 | 8.9 |
| | 8 | Jun/Jul 1997 | 11 | 2.20 | 170 | <0.1 | 22 | 56 | 3.0 | 1.0 | 12 | 0.22 | 3.78 | 210 | 1.10 | 8.3 |
| | 9 | Sep/Oct 1997 | 10 | 5.08 | 156 | <0.1 | 17 | 58 | 2.9 | 1.1 | 10 | 0.12 | 0.76 | 190 | 1.00 | 8.7 |
| | 10 | Jan/Feb 1998 | 10 | 2.58 | 158 | 0.1 | 23 | 65 | 3.1 | 1.0 | 11 | 0.18 | 4.13 | 210 | 1.10 | 8.4 |

# TABLE 3-5

## SUMMARY OF WATER-CHEMISTRY RESULTS FROM JPL GROUNDWATER MONITORING WELLS JET PROPULSION LABORATORY

(concentrations in mg/L)

| Well Number | Sampling Event | Sampling Dates | ANIONS | | | | | CATIONS | | | | | Charge Balance | Measured TDS | Measured TDS / Calculated TDS | Measured pH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Cl | $CO_3$ | $HCO_3$ | $NO_3$-N | $SO_4$ | Na | Mg | K | Ca | Fe | | | | |
| Screen 5 | 3 | July/Aug 1995 | 8.5 | 5.9 | 181 | <0.1 | 28 | 80 | 3.0 | 1.6 | 14 | 0.24 | 7.19 | 240 | 1.06 | 8.7 |
| | 4 | Dec/Feb 95/96 | 8.5 | 6.09 | 187 | <0.1 | 24 | 69 | 2.6 | 1.7 | 17 | 0.11 | 3.53 | 232 | 1.07 | 8.7 |
| | 5 | Aug/Sept 1996 | 7.8 | 11.2 | 172 | <0.1 | 23 | 71 | 2.6 | 1.7 | 11 | 0.06 | 4.00 | 220 | 1.10 | 9.0 |
| | 6 | Oct/Nov 1996 | 8.4 | 11.2 | 172 | <0.1 | 23 | 69 | 2.2 | 1.6 | 11 | <0.1 | 2.03 | 210 | 1.00 | 9.0 |
| | 7 | Feb/Mar 1997 | 8.2 | 18 | 181 | <0.1 | 22 | 80 | 1.6 | 1.4 | 7.4 | 0.14 | 2.94 | 230 | 1.10 | 9.2 |
| | 8 | Jun/Jul 1997 | 9.1 | 19.1 | 185 | <0.1 | 23 | 71 | 1.9 | 1.6 | 8.8 | <0.1 | 2.87 | 240 | 1.10 | 9.2 |
| | 9 | Sep/Oct 1997 | 8.3 | 18.6 | 181 | <0.1 | 20 | 75 | 1.6 | 1.4 | 7.3 | <0.1 | 0.53 | 240 | 1.10 | 9.2 |
| | 10 | Jan/Feb 1998 | 8.9 | 23.2 | 179 | <0.1 | 21 | 83 | 1.6 | 1.5 | 7.1 | <0.1 | 4.29 | 230 | 1.00 | 9.3 |
| ***MW-21*** | | | | | | | | | | | | | | | | |
| Screen 1 | 3 | July/Aug 1995 | 56 | 0.15 | 189 | 14 | 81 | 28 | 30 | 2.3 | 88 | 0.21 | 4.96 | 480 | 1.09 | 7.1 |
| | 4 | Dec/Feb 95/96 | 74 | 0.42 | 207 | 18 | 105 | 32 | 33 | 2.2 | 89 | 0.16 | -2.05 | 620 | 1.20 | 7.5 |
| | 5 | Aug/Sept 1996 | 75 | 0.07 | 183 | 17 | 105 | 31 | 32 | 2.0 | 92 | 0.12 | 0.87 | 500 | 1.10 | 6.8 |
| | 6 | Oct/Nov 1996(1) | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | NA | N/A |
| | 7 | Feb/Mar 1997 | 76 | 0.21 | 207 | 14 | 105 | 28 | 32 | 2.0 | 92 | <0.1 | -1.83 | 490 | 1.00 | 7.2 |
| | 8 | Jun/Jul 1997 | 78 | 0.09 | 210 | 17 | 110 | 27 | 31 | 2.2 | 87 | <0.1 | 5.68 | 520 | 1.00 | 6.8 |
| | 9 | Sep/Oct 1997(1) | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | NA | N/A |
| | 10 | Jan/Feb 1998 | 77 | 0.10 | 189 | <0.1 | 98 | 30 | 31 | 2.3 | 65 | 0.24 | 1.04 | 530 | 1.30 | 6.9 |
| Screen 2 | 3 | July/Aug 1995 | 125 | 0.48 | 293 | 6.0 | 155 | 61 | 47 | 3.6 | 130 | 0.55 | 4.38 | 730 | 1.02 | 7.4 |
| | 4 | Dec/Feb 95/96 | 135 | 0.65 | 317 | 8.7 | 160 | 55 | 44 | 2.9 | 120 | 0.48 | -3.59 | 720 | 1.01 | 7.5 |
| | 5 | Aug/Sept 1996 | 120 | 1.25 | 305 | 5.2 | 180 | 56 | 51 | 3.4 | 120 | 0.09 | 1.07 | 810 | 1.20 | 7.8 |
| | 6 | Oct/Nov 1996 | 125 | 0.40 | 311 | 8.8 | 150 | 53 | 49 | 3.1 | 130 | 0.17 | 1.98 | 730 | 1.10 | 7.3 |
| | 7 | Feb/Mar 1997 | 130 | 0.35 | 341 | 8.0 | 145 | 54 | 46 | 2.9 | 150 | 0.11 | 3.01 | 730 | 1.00 | 7.2 |
| | 8 | Jun/Jul 1997 | 120 | 0.84 | 325 | 7.0 | 155 | 50 | 44 | 3.4 | 140 | <0.1 | 1.98 | 740 | 1.10 | 7.6 |
| | 9 | Sep/Oct 1997 | 120 | 0.557 | 341 | 7.2 | 140 | 52 | 42 | 3.5 | 125 | 0.10 | 1.22 | 820 | 1.20 | 7.4 |
| | 10 | Jan/Feb 1998 | 140 | 0.26 | 317 | 8.4 | 150 | 62 | 45 | 3.4 | 140 | <0.1 | 2.27 | 790 | 1.10 | 7.1 |
| Screen 3 | 3 | July/Aug 1995 | 105 | 0.85 | 329 | 7.9 | 97 | 44 | 42 | 3.6 | 120 | 0.80 | 2.22 | 590 | 0.97 | 7.6 |
| | 4 | Dec/Feb 95/96 | 95 | 1.60 | 310 | 9.1 | 92 | 39 | 41 | 3.3 | 115 | 1.10 | 2.35 | 610 | 1.05 | 7.9 |
| | 5 | Aug/Sept 1996 | 92 | 1.17 | 286 | 8.6 | 86 | 40 | 37 | 3.1 | 110 | 0.83 | 3.48 | 550 | 1.10 | 7.8 |
| | 6 | Oct/Nov 1996 | 91 | 0.56 | 274 | 9.4 | 85 | 37 | 37 | 3.0 | 100 | 0.54 | 1.14 | 550 | 1.10 | 7.5 |
| | 7 | Feb/Mar 1997 | 93 | 0.63 | 305 | 9.0 | 90 | 36 | 38 | 2.9 | 130 | 1.6 | 5.61 | 590 | 1.00 | 7.5 |
| | 8 | Jun/Jul 1997 | 93 | 0.45 | 305 | 9.8 | 90 | 35 | 34 | 3.2 | 98 | 0.87 | 4.62 | 580 | 1.10 | 7.4 |
| | 9 | Sep/Oct 1997 | 87 | 0.488 | 299 | 9.6 | 87 | 37 | 34 | 3.4 | 115 | 0.32 | 1.75 | 610 | 1.20 | 7.4 |
| | 10 | Jan/Feb 1998 | 92 | 0.38 | 293 | 10 | 91 | 40 | 36 | 3.2 | 120 | 1.40 | 3.85 | 610 | 1.10 | 7.3 |
| Screen 4 | 3 | July/Aug 1995 | 64 | 2.69 | 261 | 11 | 72 | 35 | 33 | 2.7 | 95 | 0.37 | 3.72 | 490 | 1.02 | 8.2 |
| | 4 | Dec/Feb 95/96 | 47 | 0.60 | 232 | 8.8 | 43 | 29 | 22 | 2.1 | 64 | <0.1 | -2.62 | 370 | 1.02 | 7.6 |
| | 5 | Aug/Sept 1996 | 67 | 0.79 | 244 | 10 | 70 | 31 | 30 | 2.5 | 86 | 0.45 | 0.92 | 470 | 1.10 | 7.7 |
| | 6 | Oct/Nov 1996 | 51 | 0.46 | 226 | 8.6 | 49 | 29 | 26 | 2.3 | 68 | 0.13 | 0.66 | 410 | 1.20 | 7.5 |
| | 7 | Feb/Mar 1997 | 38 | 0.36 | 219 | 7.8 | 29 | 25 | 20 | 2.0 | 65 | 0.91 | 1.69 | 330 | 1.00 | 7.4 |
| | 8 | Jun/Jul 1997 | 67 | 0.44 | 270 | 10 | 71 | 27 | 27 | 2.6 | 84 | <0.1 | 5.08 | 460 | 1.00 | 7.4 |
| | 9 | Sep/Oct 1997 | 55 | 0.398 | 244 | 8.6 | 55 | 29 | 25 | 2.8 | 96 | 0.23 | 5.68 | 490 | 1.30 | 7.4 |
| | 10 | Jan/Feb 1998 | 45 | 0.28 | 219 | 8.1 | 38 | 28 | 22 | 2.4 | 76 | 0.15 | 4.95 | 380 | 1.10 | 7.3 |
| Screen 5 | 3 | July/Aug 1995 | 56 | 2.38 | 231 | 8.2 | 65 | 38 | 30 | 3.3 | 69 | 1.40 | 2.13 | 410 | 0.99 | 8.2 |
| | 4 | Dec/Feb 95/96 | 56 | 1.0 | 244 | 10 | 63 | 34 | 27 | 2.7 | 66 | 4.20 | -3.81 | 440 | 1.05 | 7.8 |
| | 5 | Aug/Sept 1996 | 56 | 1.16 | 225 | 9.6 | 65 | 34 | 29 | 2.8 | 68 | 2.8 | 0.34 | 420 | 1.10 | 7.9 |
| | 6 | Oct/Nov 1996 | 56 | 0.75 | 231 | 9.7 | 64 | 33 | 30 | 2.7 | 73 | 2.1 | 1.40 | 440 | 1.10 | 7.7 |
| | 7 | Feb/Mar 1997 | 58 | 1.1 | 256 | 9.9 | 64 | 30 | 30 | 2.6 | 82 | 2.7 | 0.38 | 460 | 1.10 | 7.8 |
| | 8 | Jun/Jul 1997 | 64 | 0.52 | 255 | 11 | 76 | 29 | 28 | 2.9 | 81 | 1.50 | 4.23 | 510 | 1.10 | 7.5 |
| | 9 | Sep/Oct 1997 | 61 | 0.647 | 250 | 9.8 | 73 | 32 | 27 | 3.1 | 99 | 1.14 | 3.60 | 520 | 1.20 | 7.6 |
| | 10 | Jan/Feb 1998 | 63 | 0.80 | 244 | 10 | 75 | 35 | 30 | 3.0 | 96 | 2.10 | 4.85 | 490 | 1.00 | 7.7 |

# TABLE 3-5

## SUMMARY OF WATER-CHEMISTRY RESULTS FROM JPL GROUNDWATER MONITORING WELLS JET PROPULSION LABORATORY

(concentrations in mg/L)

| Well Number | Sampling Event | Sampling Dates | ANIONS | | | | | CATIONS | | | | | Charge Balance | Measured TDS | Measured TDS / Calculated TDS | Measured pH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Cl | $CO_3$ | $HCO_3$ | $NO_3$-N | $SO_4$ | Na | Mg | K | Ca | Fe | | | | |
| ***MW-22*** | | | | | | | | | | | | | | | | |
| Screen 1 | 9 | Sep/Oct 1997 | 92 | 0.398 | 244 | 8.7 | 120 | 30 | 37 | 3.6 | 120 | 2.00 | 3.38 | 590 | 1.10 | 7.4 |
| | 10 | Jan/Feb 1998 | 120 | 0.72 | 280 | 11 | 160 | 34 | 49 | 3.4 | 98 | 1.60 | 7.08 | 780 | 1.20 | 7.6 |
| Screen 2 | 9 | Sep/Oct 1997 | 57 | 0.551 | 213 | 9.7 | 58 | 32 | 25 | 3.1 | 69 | 0.69 | 0.21 | 400 | 1.10 | 7.6 |
| | 10 | Jan/Feb 1998 | 47 | 1.64 | 201 | 9.1 | 43 | 32 | 25 | 2.7 | 52 | 1.30 | 0.41 | 380 | 1.10 | 8.1 |
| Screen 3 | 9 | Sep/Oct 1997 | 28 | 1.19 | 183 | 8.7 | 18 | 33 | 14 | 2.3 | 46 | 0.47 | 1.64 | 290 | 1.20 | 8.0 |
| | 10 | Jan/Feb 1998 | 27 | 1.23 | 189 | 7.9 | 19 | 35 | 15 | 2.2 | 42 | 0.63 | 0.92 | 300 | 1.10 | 8.0 |
| Screen 4 | 9 | Sep/Oct 1997 | 12 | 0.878 | 170 | 4.2 | 8.2 | 28 | 9.6 | 1.9 | 35 | 0.31 | 2.70 | 230 | 1.30 | 7.9 |
| | 10 | Jan/Feb 1998 | 11 | 0.88 | 170 | 4.3 | 8.0 | 29 | 10 | 1.9 | 33 | 0.44 | 2.72 | 230 | 1.20 | 7.9 |
| Screen 5 | 9 | Sep/Oct 1997 | 11 | 4.30 | 132 | <0.1 | 57 | 73 | 3.0 | 1.8 | 11 | 1.53 | 4.14 | 260 | 1.10 | 8.7 |
| | 10 | Jan/Feb 1998 | 9.9 | 7.63 | 186 | 0.2 | 31 | 61 | 7.5 | 2.0 | 14 | 0.30 | 0.25 | 230 | 1.00 | 8.8 |
| ***MW-23*** | | | | | | | | | | | | | | | | |
| Screen 1 | 9 | Sep/Oct 1997 | 110 | 0.395 | 305 | 14 | 160 | 34 | 45 | 3.7 | 130 | 0.40 | 2.48 | 230 | 1.10 | 7.3 |
| | 10 | Jan/Feb 1998 | 120 | 0.259 | 317 | 13 | 170 | 36 | 54 | 3.5 | 180 | 1.70 | 7.09 | 810 | 1.00 | 7.1 |
| Screen 2 | 9 | Sep/Oct 1997 | 98 | 0.301 | 232 | 14 | 130 | 35 | 36 | 3.3 | 105 | 0.62 | 2.38 | 600 | 1.10 | 7.3 |
| | 10 | Jan/Feb 1998 | 100 | 0.324 | 250 | 15 | 140 | 38 | 43 | 3.6 | 69 | <0.1 | 11.05 | 680 | 1.20 | 7.3 |
| Screen 3 | 9 | Sep/Oct 1997 | 24 | 0.557 | 171 | 9.3 | 14 | 27 | 14 | 2.1 | 45 | 4.40 | 2.21 | 280 | 1.30 | 7.7 |
| | 10 | Jan/Feb 1998 | 24 | 0.914 | 177 | 9.1 | 15 | 29 | 15 | 2.1 | 40 | 0.18 | 0.11 | 290 | 1.10 | 7.9 |
| Screen 4 | 9 | Sep/Oct 1997 | 13 | 0.515 | 158 | 5.1 | 7.9 | 27 | 10 | 2.2 | 33 | 0.57 | 2.78 | 220 | 1.20 | 7.7 |
| | 10 | Jan/Feb 1998 | 12 | 5.29 | 162 | 3.6 | 7.3 | 31 | 17 | 2.4 | 24 | 0.55 | 0.86 | 220 | 1.20 | 8.7 |
| Screen 5 | 9 | Sep/Oct 1997 | 40 | 7.87 | 192 | <0.1 | 70 | 95 | 6.1 | 4.1 | 22 | 0.40 | 0.43 | 360 | 1.10 | 8.8 |
| | 10 | Jan/Feb 1998 | 38 | 31.7 | 194 | <0.1 | 43 | 117 | 3.3 | 3.9 | 6.6 | 0.30 | 2.98 | 350 | 1.00 | 9.4 |
| ***MW-24*** | | | | | | | | | | | | | | | | |
| Screen 1 | 9 | Sep/Oct 1997 | 14 | 2.13 | 164 | 2.5 | 37 | 23 | 16 | 3.3 | 39 | 0.26 | 3.69 | 250 | 1.10 | 8.3 |
| | 10 | Jan/Feb 1998 | 20 | 1.8 | 176 | 5.6 | 39 | 29 | 19 | 3.8 | 30 | 0.53 | 2.86 | 300 | 1.20 | 8.2 |
| Screen 2 | 9 | Sep/Oct 1997 | 38 | 1.75 | 170 | 2.2 | 19 | 39 | 13 | 3.4 | 38 | 0.58 | 3.60 | 280 | 1.20 | 8.2 |
| | 10 | Jan/Feb 1998 | 39 | 8.0 | 155 | 1.9 | 22 | 44 | 18 | 3.4 | 14 | 0.96 | 1.30 | 320 | 1.40 | 8.9 |
| Screen 3 | 9 | Sep/Oct 1997 | 26 | 0.616 | 189 | 1.7 | 16 | 41 | 12 | 2.4 | 39 | 0.61 | 5.40 | 280 | 1.20 | 7.7 |
| | 10 | Jan/Feb 1998 | 17 | 12.0 | 184 | 1.0 | 12 | 49 | 11 | 2.7 | 19 | 1.80 | 1.89 | 250 | 1.10 | 9.0 |
| Screen 4 | 9 | Sep/Oct 1997 | 12 | 1.23 | 189 | 2.6 | 11 | 39 | 9.5 | 2.6 | 33 | 0.37 | 4.23 | 180 | 0.90 | 8.0 |
| | 10 | Jan/Feb 1998 | 11 | 5.7 | 175 | 2.4 | 9.7 | 44 | 11 | 2.4 | 20 | 0.47 | 4.02 | 260 | 1.30 | 8.7 |
| Screen 5 | 9 | Sep/Oct 1997 | 9.0 | 1.10 | 213 | 0.9 | 23 | 40 | 8.9 | 2.3 | 43 | 4.33 | 4.23 | 210 | 0.90 | 7.9 |
| | 10 | Jan/Feb 1998 | 9.2 | 1.1 | 207 | 1.0 | 23 | 43 | 8.9 | 2.0 | 37 | 0.63 | 1.32 | 280 | 1.30 | 7.9 |

(1): No sample collected. No water at screen interval.

# TABLE 3-6

## SUMMARY OF WATER-CHEMISTRY RESULTS FROM NEARBY MUNICIPAL WATER PRODUCTION WELLS(1) AND COLORADO RIVER WATER JET PROPULSION LABORATORY

(concentrations in mg/L)

| Well | Sampling Date | ANIONS | | | | | CATIONS | | | | | TDS | pH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Cl | $CO_3$ | $HCO_3$ | N | $SO_4$ | Na | Mg | K | Ca | Fe | | |
| City of Pasadena Arroyo Well | 4/96 | 14 | <1 | 136 | – | 30 | 21 | 15 | – | 45 | <0.1 | 250 | 7.4 |
| City of Pasadena Well 52 | 4/96 | 26 | <1 | 178 | – | 37 | 34 | 16 | – | 47 | <0.1 | 302 | 7.5 |
| City of Pasadena Ventura Well | 5/96 | 54 | <1 | 197 | – | 72 | 28 | 28 | – | 81 | <0.1 | 424 | 7.5 |
| City of Pasadena Windsor Well | 4/96 | 35 | <1 | 218 | – | 41 | 35 | 19 | – | 60 | <0.1 | 347 | 7.4 |
| Lincoln Avenue Well 3 | 6/95 | 9 | <1 | 195 | – | 29 | 17 | 16 | – | 48 | <0.1 | 225 | 7.6 |
| Lincoln Avenue Well 5 | 6/95 | 12 | <1 | 209 | – | 32 | 24 | 16 | – | 49 | <0.1 | 253 | 7.7 |
| Valley Water Company Well 1 | 12/94 | 100 | .26 | 256 | – | 160 | 40 | 41 | – | 135 | <0.1 | 670 | 7.2 |
| | 6/95 | 105 | .15 | 226 | – | 190 | 46 | 44 | – | 135 | 0.17 | 650 | 7.0 |
| | 6/96 | 105 | .37 | 226 | – | 200 | 46 | 43 | – | 115 | <0.1 | 700 | 7.4 |
| | 7/97 | 110 | .12 | 293 | – | 185 | 50 | 41 | – | 135 | <0.1 | 700 | 6.8 |
| Valley Water Company Well 2 | 8/94 | 105 | 1.8 | 274 | – | 180 | 72 | 42 | – | 115 | – | 700 | 8.0 |
| | 12/94 | 110 | .22 | 274 | – | 180 | 53 | 44 | – | 140 | 0.17 | 690 | 7.1 |
| | 6/95 | 89 | .57 | 219 | – | 170 | 70 | 33 | – | 89 | <0.1 | 640 | 7.6 |
| | 6/96 | 87 | .75 | 231 | – | 170 | 82 | 34 | – | 86 | <0.1 | 630 | 7.7 |
| | 7.97 | 98 | .35 | 268 | – | 165 | 61 | 37 | – | 100 | <0.1 | 620 | 7.3 |
| Valley Water Company Well 3 | 6/95 | 92 | .42 | 256 | – | 130 | 41 | 40 | – | 110 | 0.35 | 640 | 7.4 |
| | 6/96 | 90 | .37 | 226 | – | 155 | 48 | 38 | – | 105 | 0.48 | 620 | 7.4 |
| | 7/97 | 82 | .23 | 220 | – | 150 | 55 | 30 | – | 88 | <0.1 | 600 | 7.2 |
| Valley Water Company Well 4 | 6/94 | 98 | .42 | 128 | – | 250 | 79 | 26 | – | 92 | – | 640 | 7.7 |
| | 12/94 | 87 | .34 | 262 | – | 105 | 44 | 33 | – | 115 | <0.1 | 550 | 7.3 |
| | 6/95 | 93 | .19 | 238 | – | 160 | 63 | 36 | – | 115 | 0.11 | 620 | 7.1 |
| | 6/96 | 82 | .55 | 213 | – | 150 | 58 | 33 | – | 92 | <0.1 | 600 | 7.6 |
| | 7/97 | 105 | .19 | 366 | – | 135 | 53 | 41 | – | 130 | <0.1 | 750 | 6.9 |
| La Cañada Irrigation District Well 1 | 12/94 | 30 | <1 | 195 | – | 61 | 43 | 20 | – | 40 | 0.87 | 321 | 7.7 |
| | 3/97 | 46 | <1 | 209 | – | 43 | 32 | 21 | – | 69 | 0.16 | 361 | 7.4 |
| Rubio Cañon Well 4 | 12/94 | 22 | <1 | 220 | – | 61 | 25 | 25 | – | 50 | <0.1 | 321 | 7.8 |
| Rubio Cañon Well 7 | 12/94 | 18 | <1 | 233 | – | 20 | 48 | 11 | – | 36 | <0.1 | 259 | 7.9 |
| Las Flores Water Company Well 2 | 9/94 | 40 | <1 | 212 | – | 56 | 24 | 25 | – | 67 | <0.1 | 364 | 7.4 |
| | 12/94 | 34 | <1 | 224 | – | 61 | 20 | 25 | – | 80 | <0.1 | 374 | 7.6 |
| | 12/97 | 40 | <1 | 233 | – | 78 | 24 | 25 | – | 86 | <0.1 | 410 | 7.3 |
| Colorado River Water | 1995(3) | 92 | .30 | 111 | .23 | 250 | 98 | 29 | 4.5 | 68 | <0.1 | 618 | 8.03 |
| Weymouth Plant (2) | 1996(3) | 91 | 0.10 | 114 | .21 | 244 | 96 | 28 | 4.5 | 68 | <0.1 | 611 | 8.04 |

***Notes:***

(1): Summary of data available from the CADHS between 1994 and 1998.

(2): Colorado River Water used for injection in the JPL study area comes from the Weymouth Plant where it is blended with 15% California Water Project water before distribution.

(3): Values represent annual average of discharge water from the Weymouth Plant as reported by the Metropolitan Water District (MWD).

# TABLE 3-7

## GENERAL WATER TYPES OBSERVED DURING THE OU-1/OU-3 RI AS INTERPRETED WITH STIFF DIAGRAMS JET PROPULSION LABORATORY

| Well/Screen Number | Water Type[1] | | | | | |
|---|---|---|---|---|---|---|
| | Aug/Sep 1996 | Oct/Nov 1996 | Feb/Mar 1997 | Jun/Jul 1997 | Sep/Oct 1997 | Jan/Feb 1998 |
| ***MW-1*** | Type 1 | Type 1 | Type 1 | Type 1 | Type 1 | Type 1 |
| ***MW-3*** | | | | | | |
| Screen 1 | Type 1 | Type 1 | Type 1 | Type 1 | Type 1 | Type 1 |
| Screen 2 | Type 1 | Type 1 | Type 1 | Type 1 | Type 1 | Type 1 |
| Screen 3 | Type 2 | Type 2 | Type 2 | Type 2 | Type 2 | Type 2 |
| Screen 4 | Type 2 | Type 2 | Type 2 | Type 2 | Type 2 | Type 2 |
| Screen 5 | Type 2 | Type 2 | Type 2 | Type 2 | Type 2 | Type 2 |
| ***MW-4*** | | | | | | |
| Screen 1 | Type 1 | Type 1 | Type 1 | Type 1 | Type 1 | Type 1 |
| Screen 2 | Type 1/3 | Type 1/3 | Type 1/3 | Type 1/3 | Type 1/3 | Type 3/1 |
| Screen 3 | Type 1/2 | Type 1/2 | Type 1/2/3 | Type 1/2/3 | Type 1/2/3 | Type 1/2/3 |
| Screen 4 | Type 2/1 | Type 2/1 | Type 2/1 | Type 2/1 | Type 2/1 | Type 2 |
| Screen 5 | Type 2/1 | Type 2/1 | Type 1/2 | Type 1/2 | Type 1/2 | Type 2/1 |
| ***MW-5*** | Type 1 | Type 1 | Type 1 | Type 1 | Type 1 | Type 1 |
| ***MW-6*** | Type 3/1 | Type 1/3 | Type 1/3 | Type 3/1 | Type 1/3 | Type 3/1 |
| ***MW-7*** | Type 1 | Type 1 | Type 1 | Type 1 | Type 1 | Type 1 |
| ***MW-8*** | Type 1 | Type 1 | Type 1 | Type 1 | Type 1 | Type 1 |
| ***MW-9*** | Type 1 | Type 1 | Type 1 | Type 1 | Type 1 | Type 1 |
| ***MW-10*** | Type 1/3 | Type 3/1 | Type 1/3 | Type 1/3 | Type 3 | Type 3 |
| ***MW-11*** | | | | | | |
| Screen 1 | Type 1 | Type 1 | Type 1 | Type 1 | Type 1 | Type 1 |
| Screen 2 | Type 1 | Type 1 | Type 1 | Type 1 | Type 1 | Type 1 |
| Screen 3 | Type 1 | Type 1 | Type 1 | Type 1 | Type 1 | Type 1 |
| Screen 4 | Type 1 | Type 1 | Type 1 | Type 1 | Type 1 | Type 1 |
| Screen 5 | Type 2 | Type 2 | Type 2 | Type 2 | Type 2 | Type 2 |
| ***MW-12*** | | | | | | |
| Screen 1 | Type 1/2 | Not Sampled[2] | Type 1 | Type 1 | Not Sampled[2] | Type 1 |
| Screen 2 | Type 1 | Type 1 | Type 1 | Type 1 | Type 1 | Type 1 |
| Screen 3 | Type 1 | Type 1 | Type 1 | Type 1 | Type 1 | Type 1 |
| Screen 4 | Type 1 | Type 1 | Type 1 | Type 1 | Type 1 | Type 1 |
| Screen 5 | Type 2/1 | Type 1/2 | Type 1/2 | Type 1/2 | Type 1/2 | Type 1/2 |
| ***MW-13*** | Type 1 | Type 1 | Type 1/3 | Type 1/3 | Type 1 | Type 1/3 |
| ***MW-14*** | | | | | | |
| Screen 1 | Type 3 | Type 3 | Type 3 | Type 3 | Type 3 | Type 3 |
| Screen 2 | Type 3 | Type 3 | Type 3 | Type 3 | Type 3 | Type 3 |
| Screen 3 | Type 3/1 | Type 3/1 | Type 3/1 | Type 3/1 | Type 3/1 | Type 3/1 |
| Screen 4 | Type 1 | Type 1 | Type 1/2/3 | Type 1/2/3 | Type 1/2/3 | Type 1/2/3 |
| Screen 5 | Type 2 | Type 2 | Type 2 | Type 2 | Type 2 | Type 2 |

1: General Water Types:
- Type 1: Calcium-bicarbonate groundwater
- Type 2: Sodium-bicarbonate groundwater
- Type 3: Calcium-bicarbonate/chloride/sulfate/nitrate groundwater

2: No water over screen

--: Wells not installed at time of sampling

# TABLE 3-7

## GENERAL WATER TYPES OBSERVED DURING THE OU-1/OU-3 RI AS INTERPRETED WITH STIFF DIAGRAMS JET PROPULSION LABORATORY

| Well/Screen Number | Water Type[1] | | | | | |
|---|---|---|---|---|---|---|
| | Aug/Sep 1996 | Oct/Nov 1996 | Feb/Mar 1997 | Jun/Jul 1997 | Sep/Oct 1997 | Jan/Feb 1998 |
| ***MW-15*** | Type 1 | Type 1 | Type 1 | Type 1 | Type 1 | Type 1 |
| ***MW-16*** | Type 1 | Not Sampled[2] | Type 1/3 | Type 1/3 | Not Sampled[2] | Type 1/3 |
| ***MW-17*** | | | | | | |
| Screen 1 | Type 1 | Type 1 | Type 1 | Type 1 | Type 1 | Type 1 |
| Screen 2 | Type 1 | Type 1 | Type 1 | Type 1 | Type 1 | Type 1 |
| Screen 3 | Type 1 | Type 1 | Type 1 | Type 1 | Type 1 | Type 1 |
| Screen 4 | Type 1/2 | Type 1/2 | Type 1/2 | Type 1/2 | Type 1/2 | Type 1/2 |
| Screen 5 | Type 1/2 | Type 1/2 | Type 1/2 | Type 1/2 | Type 1/2 | Type 1/2 |
| ***MW-18*** | | | | | | |
| Screen 1 | Type 1 | Not Sampled[2] | Type 1 | Type 1 | Not Sampled[2] | Not Sampled[2] |
| Screen 2 | Type 1 | Type 1 | Type 1 | Type 1 | Type 1 | Type 1 |
| Screen 3 | Type 1 | Type 1 | Type 1 | Type 1 | Type 1 | Type 1 |
| Screen 4 | Type 1/2 | Type 1/2 | Type 2/1 | Type 1/2 | Type 1/2 | Type 1/2 |
| Screen 5 | Type 2 | Type 2 | Type 2 | Type 2 | Type 2 | Type 2 |
| ***MW-19*** | | | | | | |
| Screen 1 | Type 1 | Type 1 | Type 1 | Type 1 | Type 1 | Type 1 |
| Screen 2 | Type 1/3 | Type 1/3 | Type 1/3 | Type 1/3 | Type 1/3 | Type 3/1 |
| Screen 3 | Type 3/1 | Type 3/1 | Type 3/1 | Type 3/1 | Type 3/1 | Type 3/1 |
| Screen 4 | Type 1/3 | Type 1/3 | Type 1/3 | Type 1/3 | Type 1/3 | Type 1/3 |
| Screen 5 | Type 3/1 | Type 3/1 | Type 1/3 | Type 3/1 | Type 3/1 | Type 3/1 |
| ***MW-20*** | | | | | | |
| Screen 1 | Type 3/1 | Not Sampled[2] | Type 3/1 | Type 3/1 | Not Sampled[2] | Type 3/1 |
| Screen 2 | Type 2 | Type 2/3 | Type 1 | Type 2 | Type 2 | Type 2 |
| Screen 3 | Type 2 | Type 2 | Type 2 | Type 2/1 | Type 2 | Type 2/1 |
| Screen 4 | Type 2 | Type 2 | Type 2 | Type 2 | Type 2 | Type 2 |
| Screen 5 | Type 2 | Type 2 | Type 2 | Type 2 | Type 2 | Type 2 |
| ***MW-21*** | | | | | | |
| Screen 1 | Type 3/1 | Not Sampled[2] | Type 3/1 | Type 3/1 | Not Sampled[2] | Type 3/1 |
| Screen 2 | Type 3 | Type 3 | Type 3 | Type 3 | Type 3 | Type 3 |
| Screen 3 | Type 3 | Type 3 | Type 3 | Type 3/1 | Type 3 | Type 3 |
| Screen 4 | Type 3/1 | Type 3/1 | Type 1/3 | Type 3/1 | Type 1/3 | Type 1/3 |
| Screen 5 | Type 3/1 | Type 3/1 | Type 3/1 | Type 3/1 | Type 3/1 | Type 3/1 |
| ***MW-22*** | | | | | | |
| Screen 1 | -- | -- | -- | -- | Type 3 | Type 3 |
| Screen 2 | -- | -- | -- | -- | Type 1/3 | Type 1/3 |
| Screen 3 | -- | -- | -- | -- | Type 1/2/3 | Type 1/2/3 |
| Screen 4 | -- | -- | -- | -- | Type 1/2/3 | Type 1/2/3 |
| Screen 5 | -- | -- | -- | -- | Type 2 | Type 2 |

1: General Water Types:
Type 1: Calcium-bicarbonate groundwater
Type 2: Sodium-bicarbonate groundwater
Type 3: Calcium-bicarbonate/chloride/sulfate/nitrate groundwater

2: No water over screen
--: Wells not installed at time of sampling

# TABLE 3-7

## GENERAL WATER TYPES OBSERVED DURING THE OU-1/OU-3 RI AS INTERPRETED WITH STIFF DIAGRAMS JET PROPULSION LABORATORY

| Well/Screen Number | Water Type[1] | | | | | |
|---|---|---|---|---|---|---|
| | Aug/Sep 1996 | Oct/Nov 1996 | Feb/Mar 1997 | Jun/Jul 1997 | Sep/Oct 1997 | Jan/Feb 1998 |
| ***MW-23*** | | | | | | |
| Screen 1 | -- | -- | -- | -- | Type 3 | Type 3 |
| Screen 2 | -- | -- | -- | -- | Type 3/1 | Type 3/1 |
| Screen 3 | -- | -- | -- | -- | Type 1/2/3 | Type 1/2/3 |
| Screen 4 | -- | -- | -- | -- | Type 1/2/3 | Type 2/1 |
| Screen 5 | -- | -- | -- | -- | Type 2 | Type 2 |
| ***MW-24*** | | | | | | |
| Screen 1 | -- | -- | -- | -- | Type 1 | Type 1/3 |
| Screen 2 | -- | -- | -- | -- | Type 1/2 | Type 2/3 |
| Screen 3 | -- | -- | -- | -- | Type 1/2 | Type 2 |
| Screen 4 | -- | -- | -- | -- | Type 2/1 | Type 2 |
| Screen 5 | -- | -- | -- | -- | Type 1/2 | Type 2/1 |

1: General Water Types:
- Type 1: Calcium-bicarbonate groundwater
- Type 2: Sodium-bicarbonate groundwater
- Type 3: Calcium-bicarbonate/chloride/sulfate/nitrate groundwater

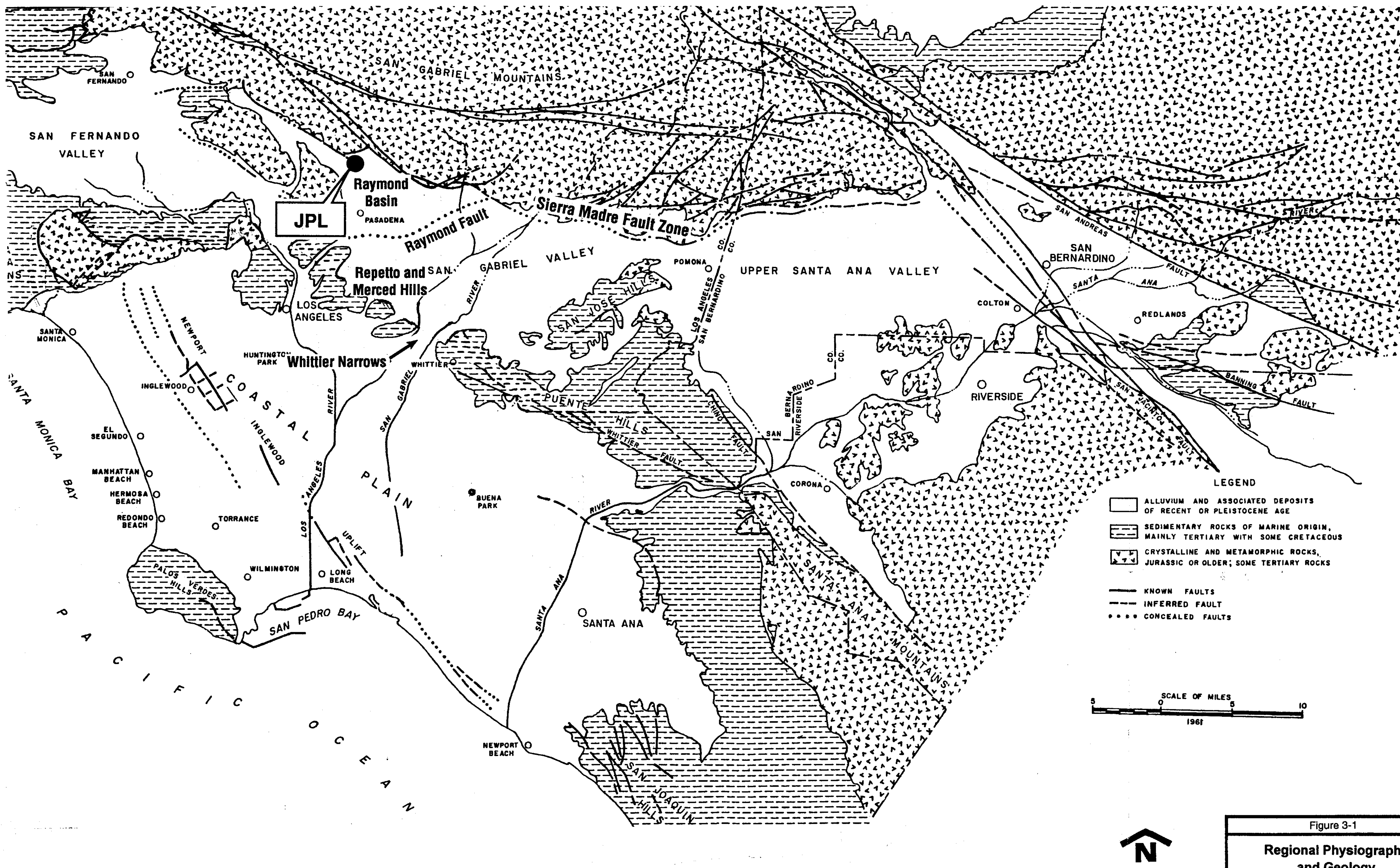
2: No water over screen

--: Wells not installed at time of sampling

## TABLE 3-8

## SUMMARY OF WELL CONSTRUCTION SPECIFICATIONS FOR NEARBY MUNICIPAL PRODUCTION WELLS JET PROPULSION LABORATORY

| Well Owner | Well | State Well Number | Year Drilled | Depth of Borehole (feet) | Depth of Casing (feet) | Diameter of Casing (inches) | Perforations (feet below top of casing) | Approximate Maximum Flow Rate (gpm) | Casing Elevation (feet above mean sea level) |
|---|---|---|---|---|---|---|---|---|---|
| City of Pasadena | Arroyo | IN/12W-05MO1 | 1930 | 668 | 660 | Originally 26". Resleeved to 20" in 1975. | 20": 224-234<br>26": 127-299, 306-331, 367-372, 398-401, 357-489, 498-503, 508-521, 538-554, 568-594, 598-624 | 2,700 gpm | 1092.71 |
| City of Pasadena | Well 52 | 1N/12W-05N02 | 1977 | 647 | 630 | 20" | 250-367, 372-630 | 2,150 gpm | 1056.76 |
| City of Pasadena | Ventura | IN/12W-05NO1 | 1924 | 473 | 468 | Originally 26". Resleeved to 20" in 1988. | 20": 220-460<br>26": 102-141, 164-218, 241-311, 410-468 | 1,800 gpm | 1069.82 |
| City of Pasadena | Windsor | IN/12W-08D08 | 1969 | 600 | 585 | 20" | 320-344, 374-384, 426-450, 474-485, 497-585 | 1,125 gpm | 1150.30 |
| Lincoln Avenue Water Company | Well 3 | IN/12W-05P01 | 1920 | 601 | 601 | 14" | 463-601 | 900 gpm | 1202.70 |
| Lincoln Avenue Water Company | Well 5 | IN/12W-05Q02 | 1971 | 588 | 586 | 10" | 390-532, 540-556 | 1,215 gpm | 1203.90 |
| Valley Water Company | Well 1 | 1N/12W-06M06 | 1914 | 432 | 432 | 16" | 155-432 | 1,000 gpm | 1161.49 |
| Valley Water Company | Well 2 | 1N/12W-06M04 | 1921 | 500 | 460 | 20" | 165-460 | 1,100 gpm | 1170.71 |
| Valley Water Company | Well 3 | 1N/12W-06M01 | 1930 | 600 | 599 | 16" | 192-599 | 1,200 gpm | 1179.22 |
| Valley Water Company | Well 4 | 1N/12W-06M09 | 1971 | 478 | 460 | 20" | 200-460 | 1,200 gpm | 1167.70 |
| La Canada Irrigation District | Well 1 | 1N/12W-06M05 | 1925 | 490 | 480 | Originally 20". Resleeved to 12" in 1980. | 12": Start at 200<br>20": 200-250, 271-273, 301-306, 331-333, 358-360, 368-376, 381-384, 390-404, 444-448, 452-465, 474-480 | 500 gpm | 1192 |
| La Canada Irrigation District | Well 6 | | | Well is currently inactive but is in the process of being rehabilitated. | | | | | |
| Rubio Cañon Land and Water Assoc. | Well 4 | 1N/12W-08W03 | 1924 | 650 | 626 | 16" | 200-387 | 1,000 gpm | 1140 |
| Rubio Cañon Land and Water Assoc. | Well 7 | 1N/12W-08M05 | 1986 | 780 | 710 | 16" | 290-510, 570-700 | 2,000 gpm | -- |
| Las Flores Water Co. | Well 2 | 1N/12W-08H02 | 1911 | 500 | 500 | 18" | Gravel bottom | 675 gpm | 1160 |




*Source: California Department Water Resources Bull No. 104. Planned Utilization of the Ground Water Basins of the Coastal Plain of L. A. County, 1961.*

Figure 3-1

**Regional Physiography and Geology**

Jet Propulsion Laboratory

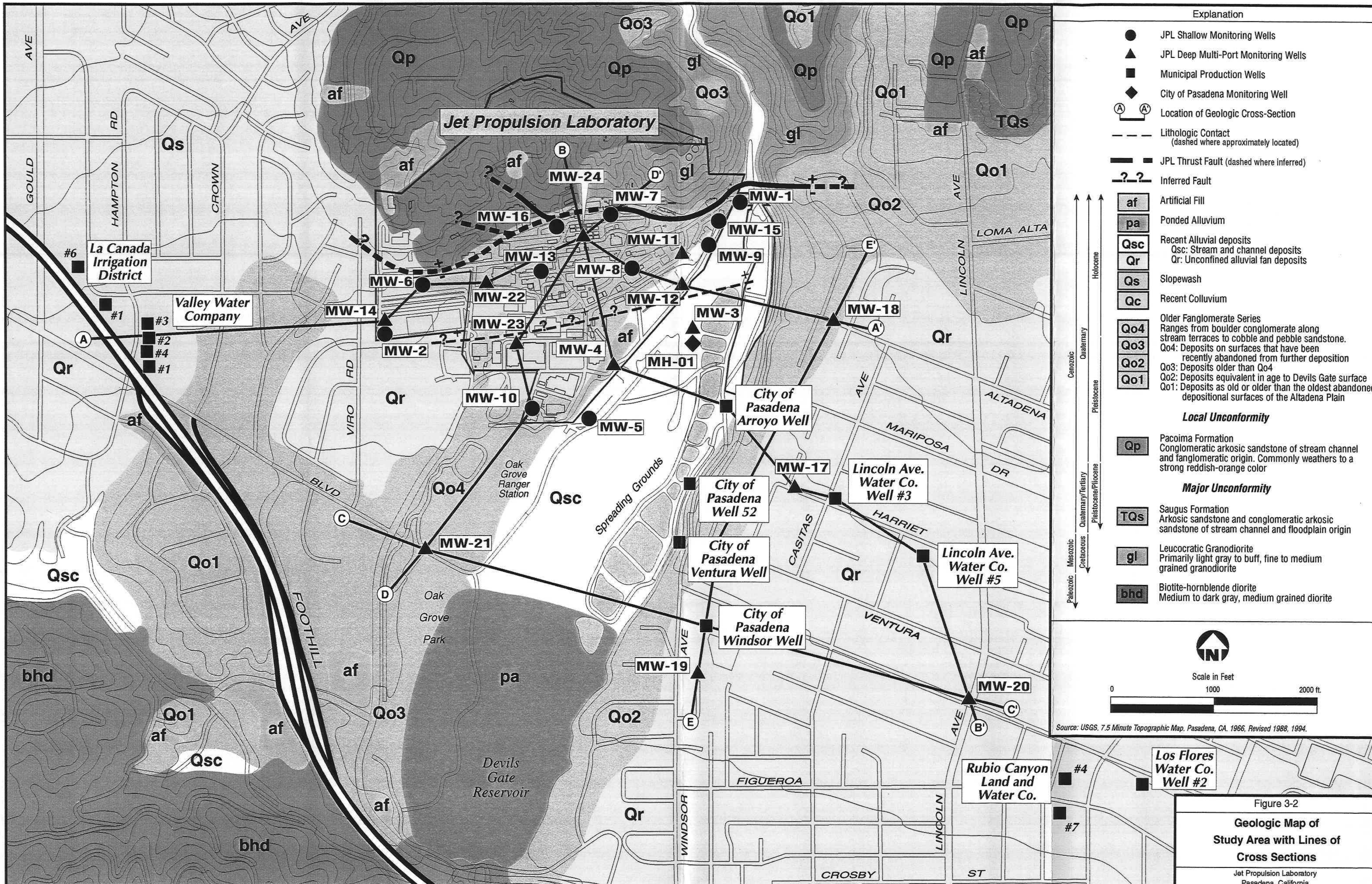



Figure 3-2
**Geologic Map of Study Area with Lines of Cross Sections**
Jet Propulsion Laboratory
Pasadena, California

1572.0245

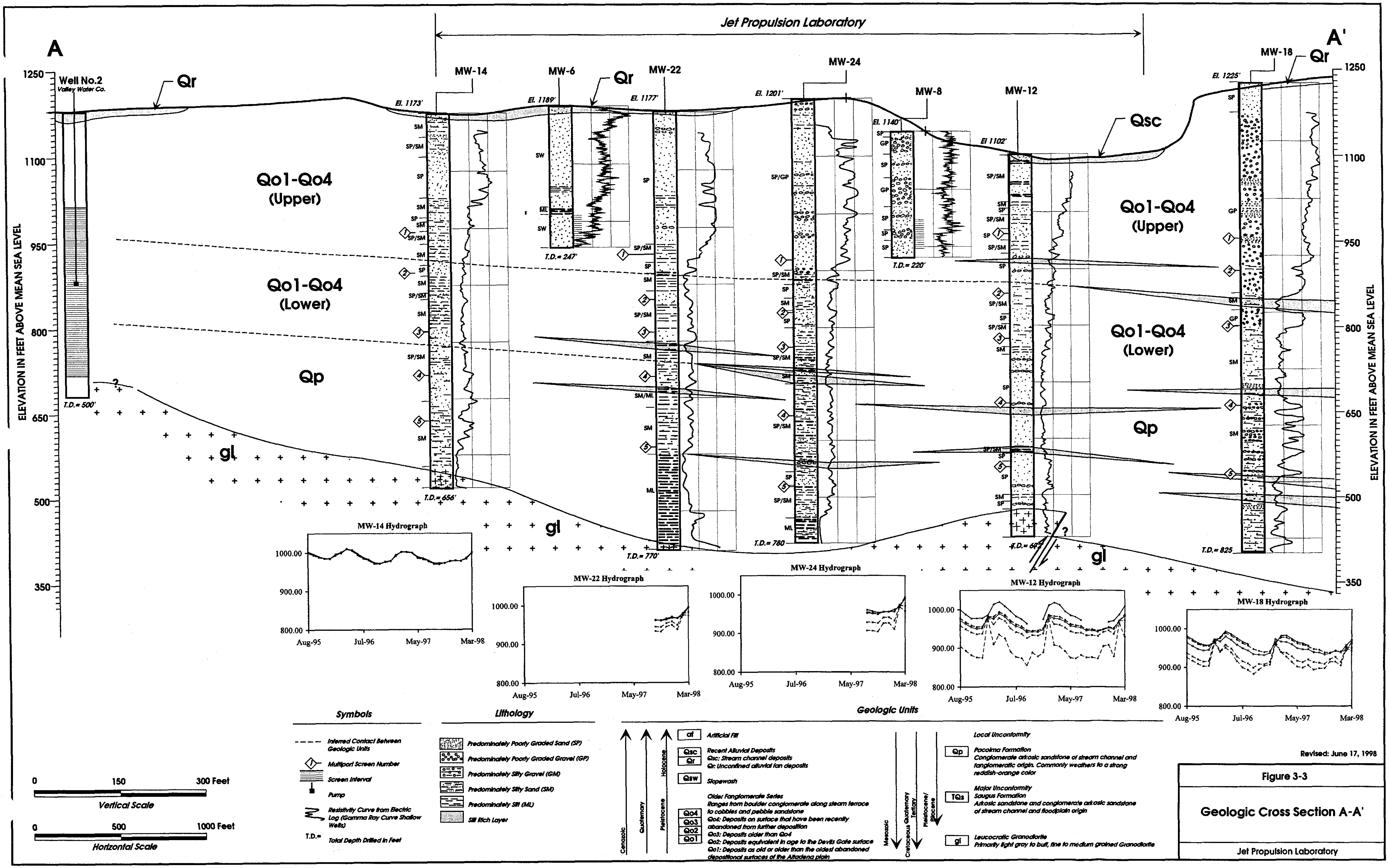



Figure 3-3

Geologic Cross Section A-A'

Jet Propulsion Laboratory

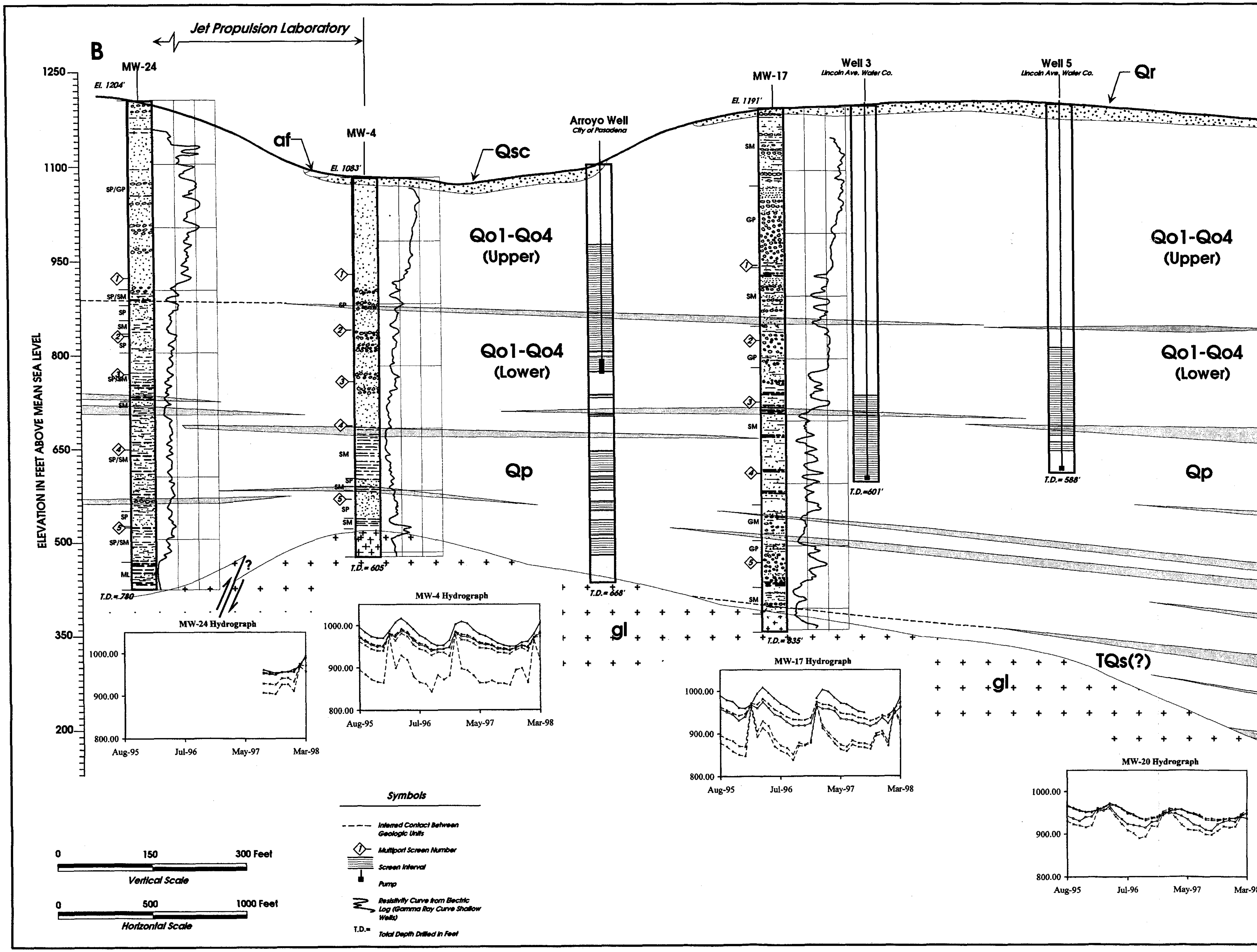



Figure 3-4

Geologic Cross Section B-B'

Jet Propulsion Laboratory

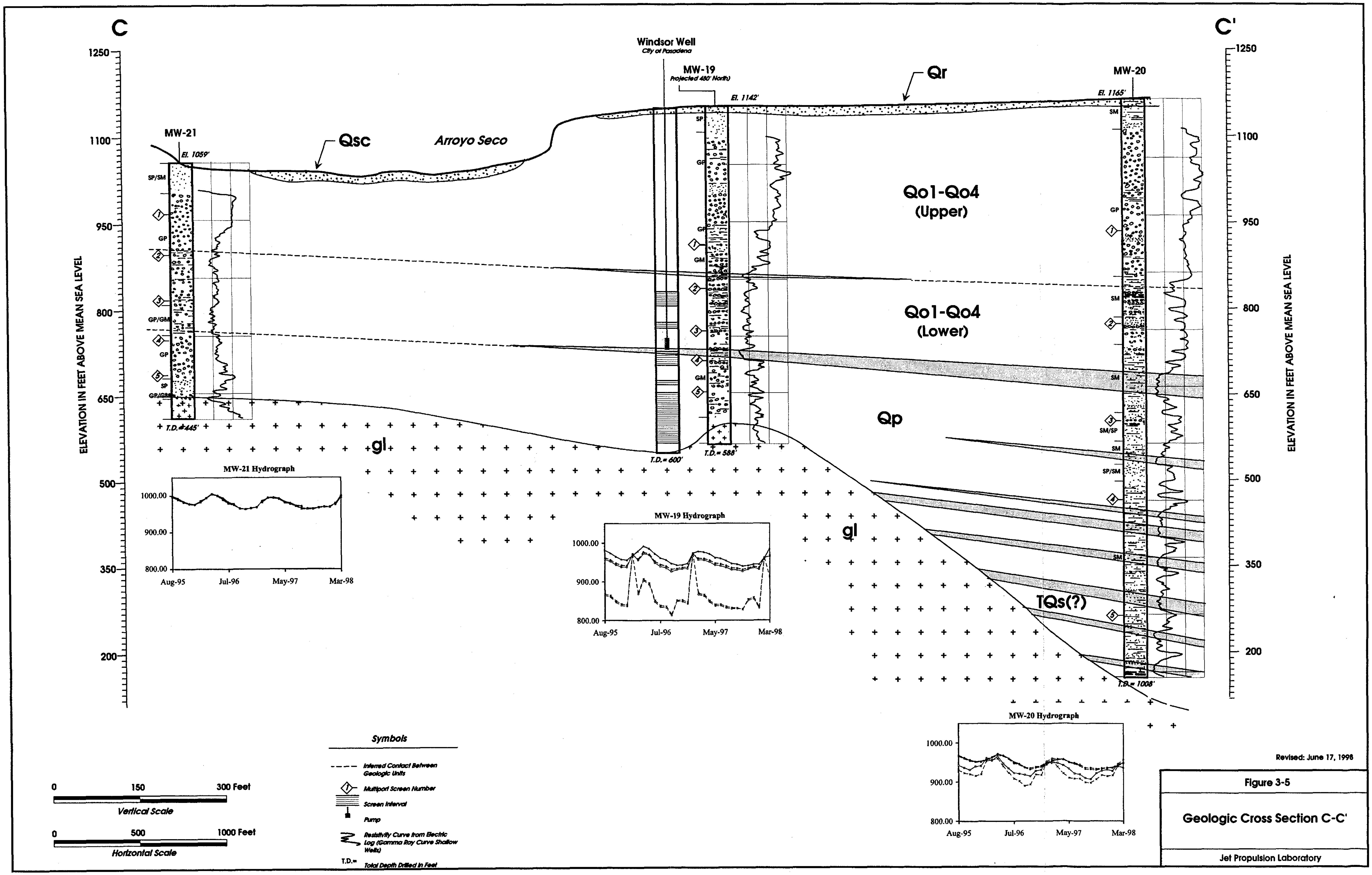



Figure 3-5

Geologic Cross Section C-C'

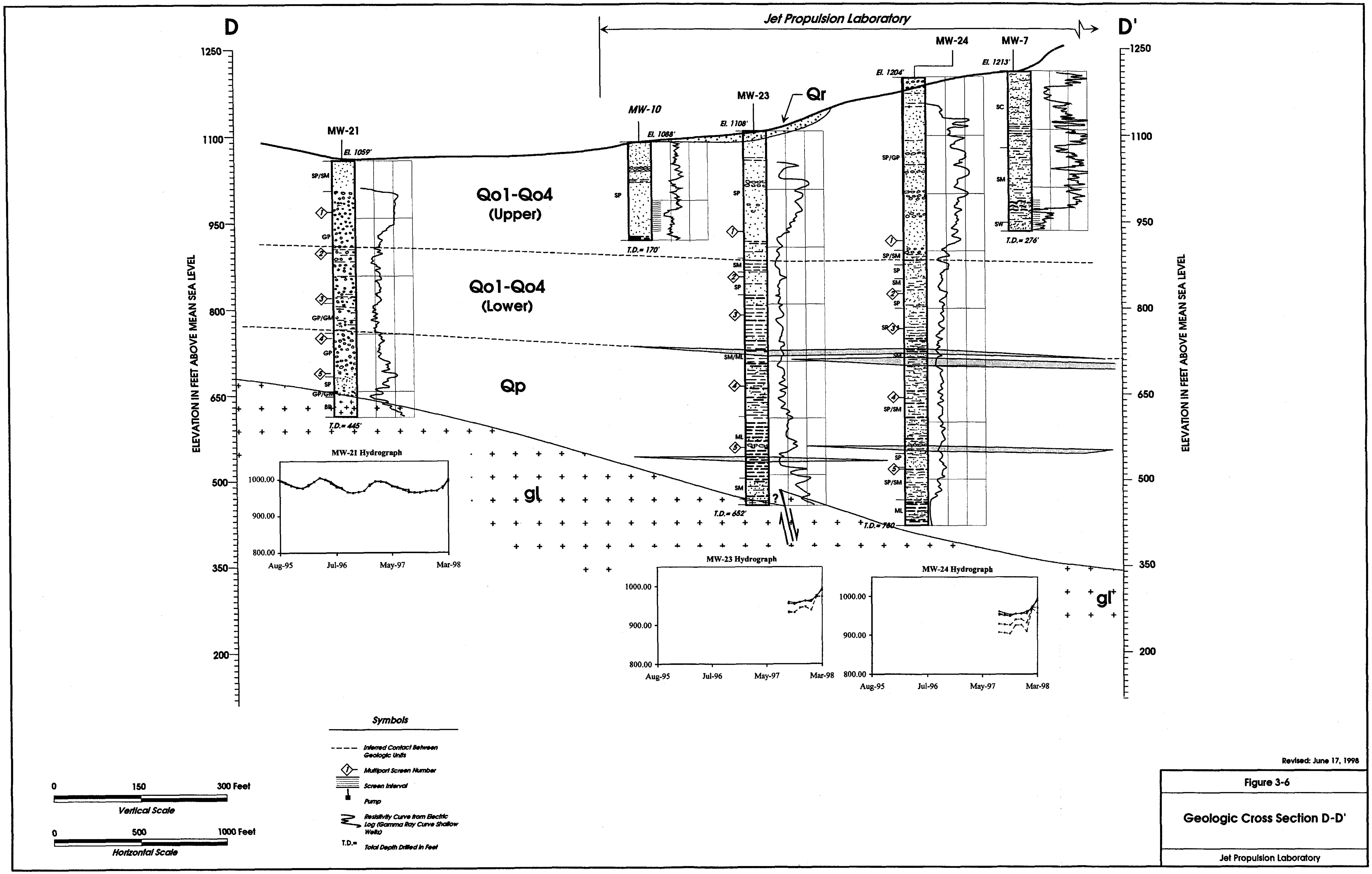
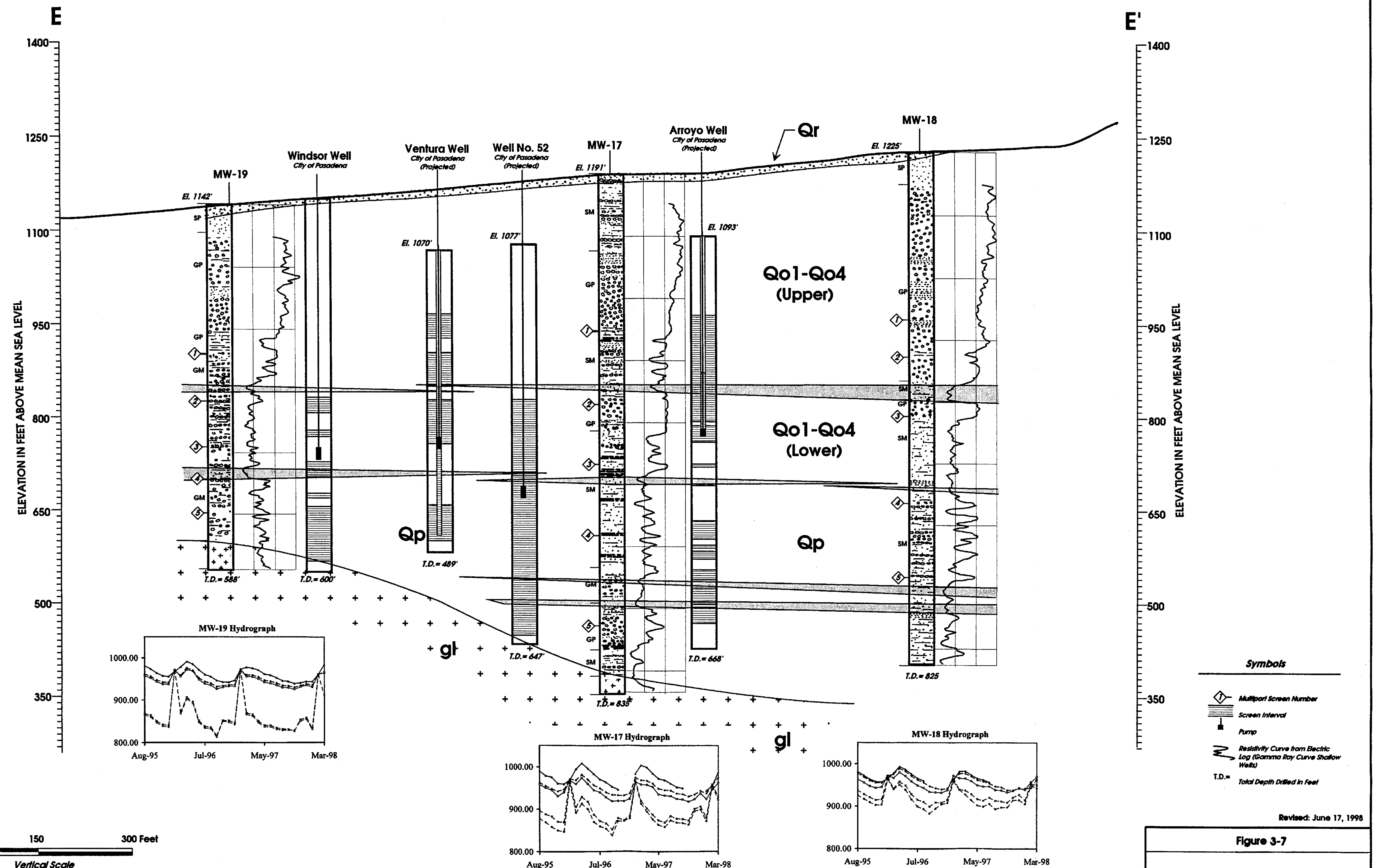



Figure 3-6

Geologic Cross Section D-D'

Jet Propulsion Laboratory




0 150 300 Feet
*Vertical Scale*

0 500 1000 Feet
*Horizontal Scale*

Revised: June 17, 1998

**Figure 3-7**

**Geologic Cross Section E-E'**

Jet Propulsion Laboratory

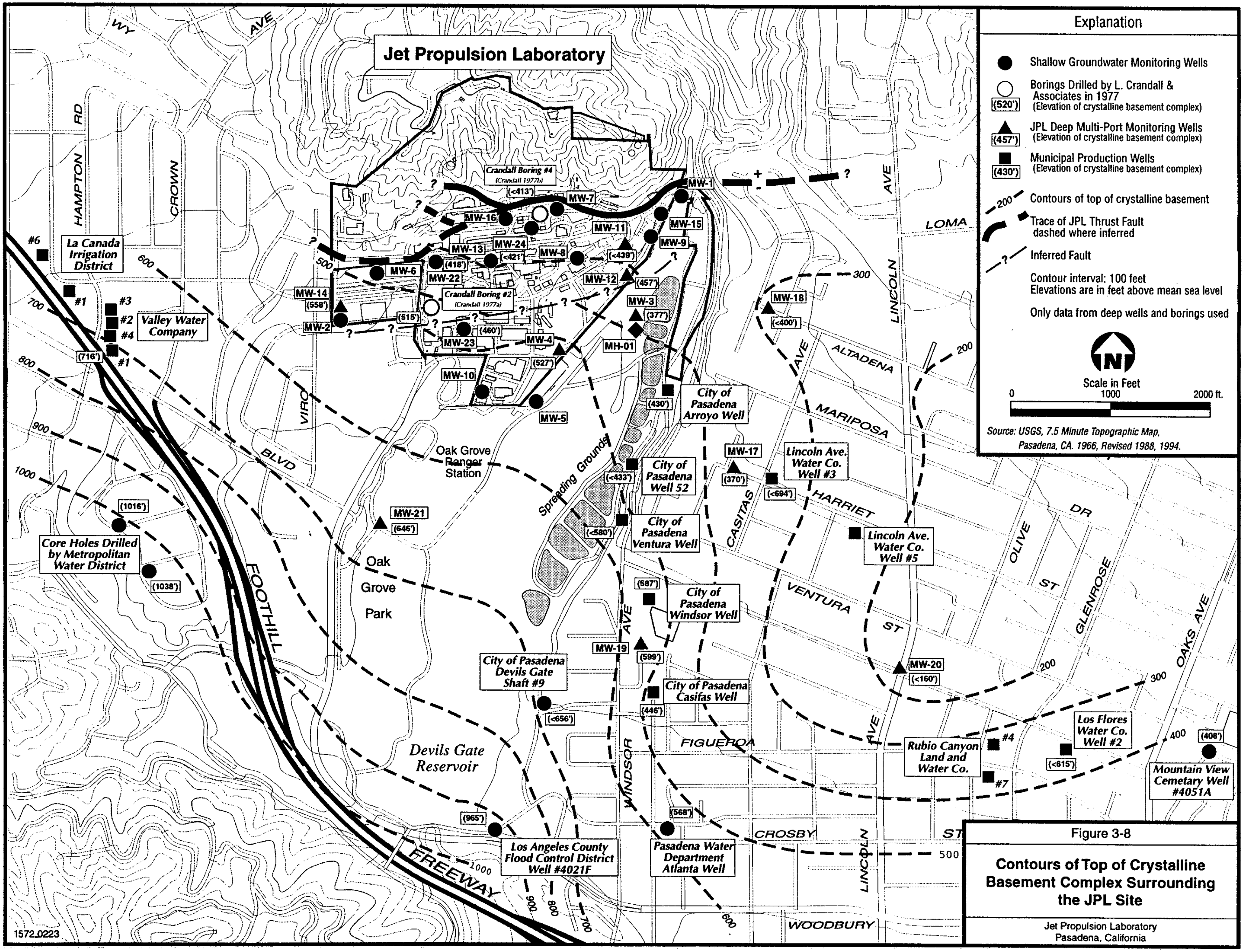
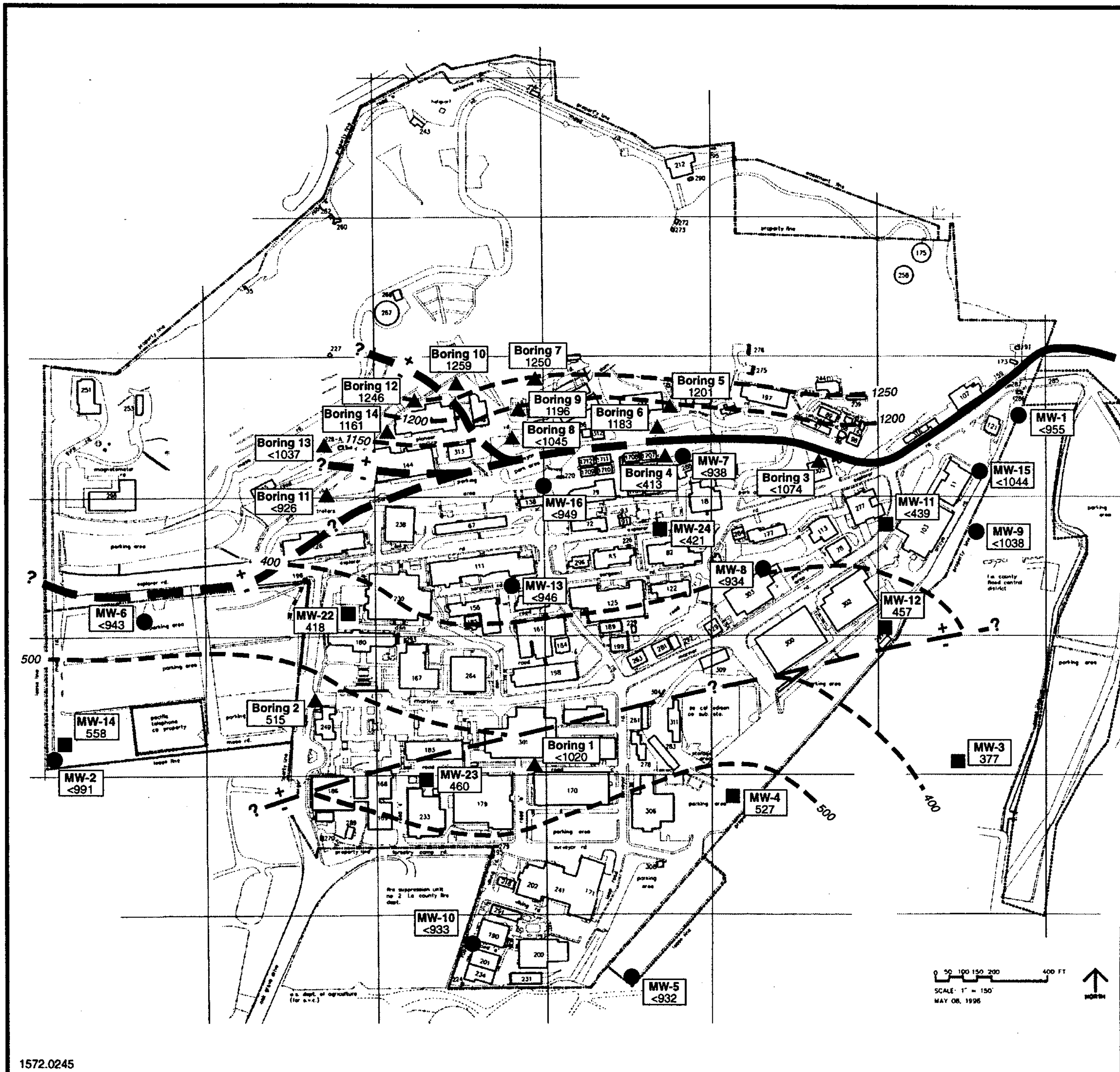



Figure 3-8

**Contours of Top of Crystalline Basement Complex Surrounding the JPL Site**

Jet Propulsion Laboratory
Pasadena, California




Explanation

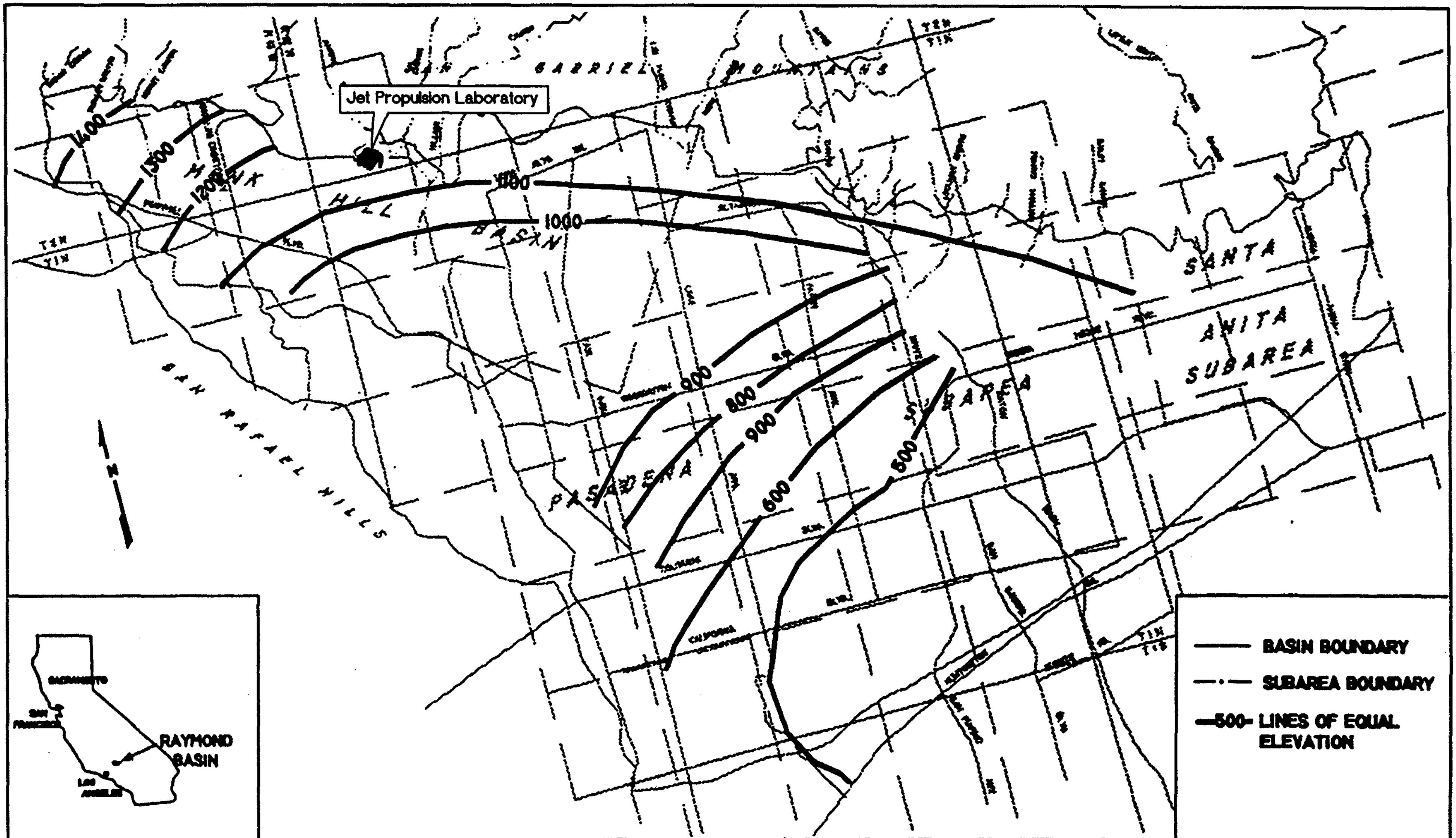
- Shallow JPL Monitoring Wells with elevation of crystalline basement complex (<913)
- Deep Multi-port JPL Monitoring Wells with elevation of crystalline basement complex (515)
- Boring drilled in 1977 by L. Crandall and Assoc. with elevation of crystalline basement complex (1250)
- Trace of JPL Thrust Fault dashed where inferred
- Trace of Inferred Fault
- Contours on top basement complex

*Note:*
*All elevations in feet above mean sea level, contour interval 100ft. (50ft. north of fault)*

Figure 3-9

**Contours on Top of Crystalline Basement Complex Beneath the JPL Site**

Jet Propulsion Laboratory
Pasadena, California




BLNK3-10.DWG

3-11-99

FIGURE 3-10

GROUNDWATER ELEVATION OF THE RAYMOND BASIN
Fall 1997

*Jet Propulsion Laboratory*
*Pasadena, California*

FOSTER WHEELER ENVIRONMENTAL CORPORATION

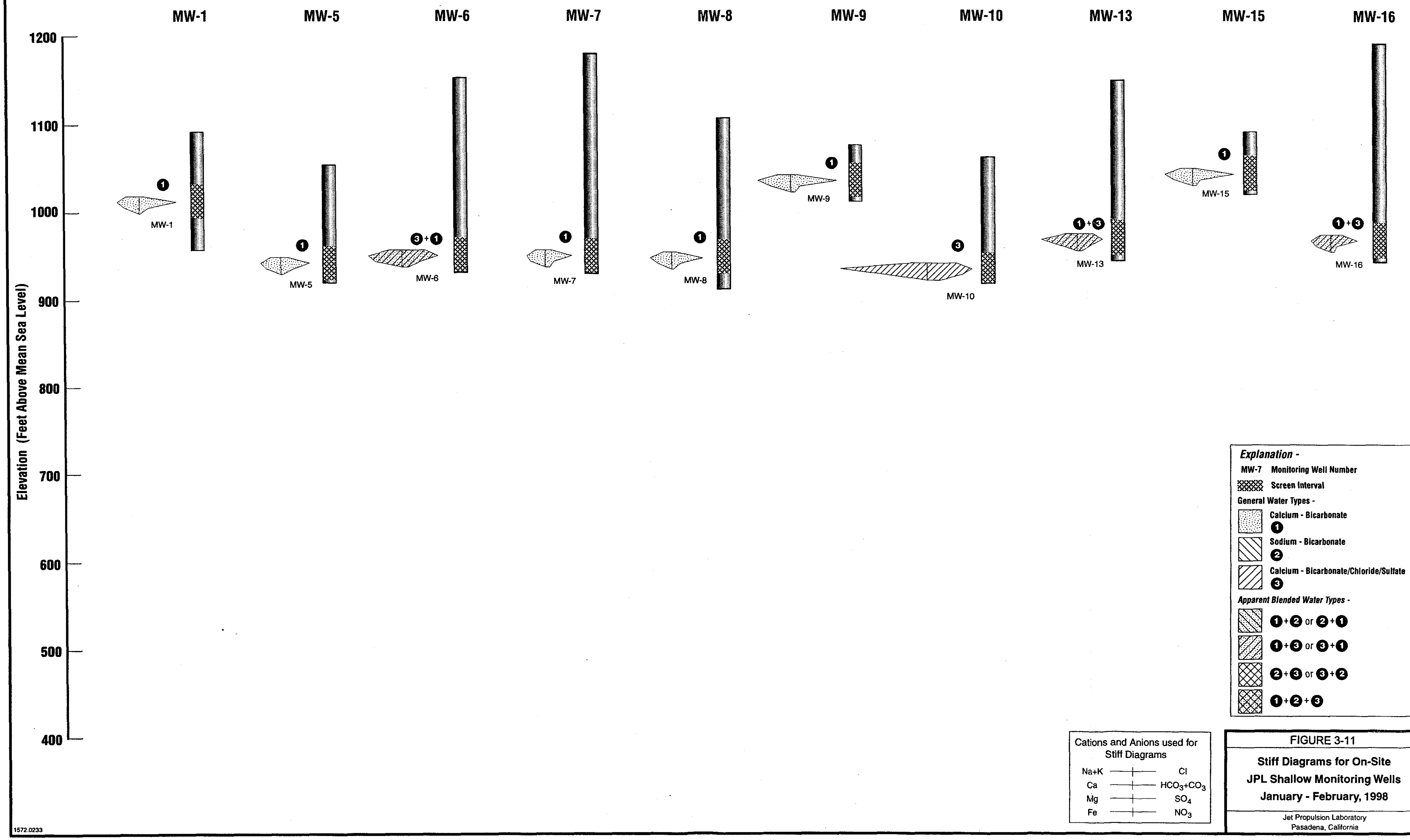



FIGURE 3-11

**Stiff Diagrams for On-Site JPL Shallow Monitoring Wells January - February, 1998**

Jet Propulsion Laboratory
Pasadena, California

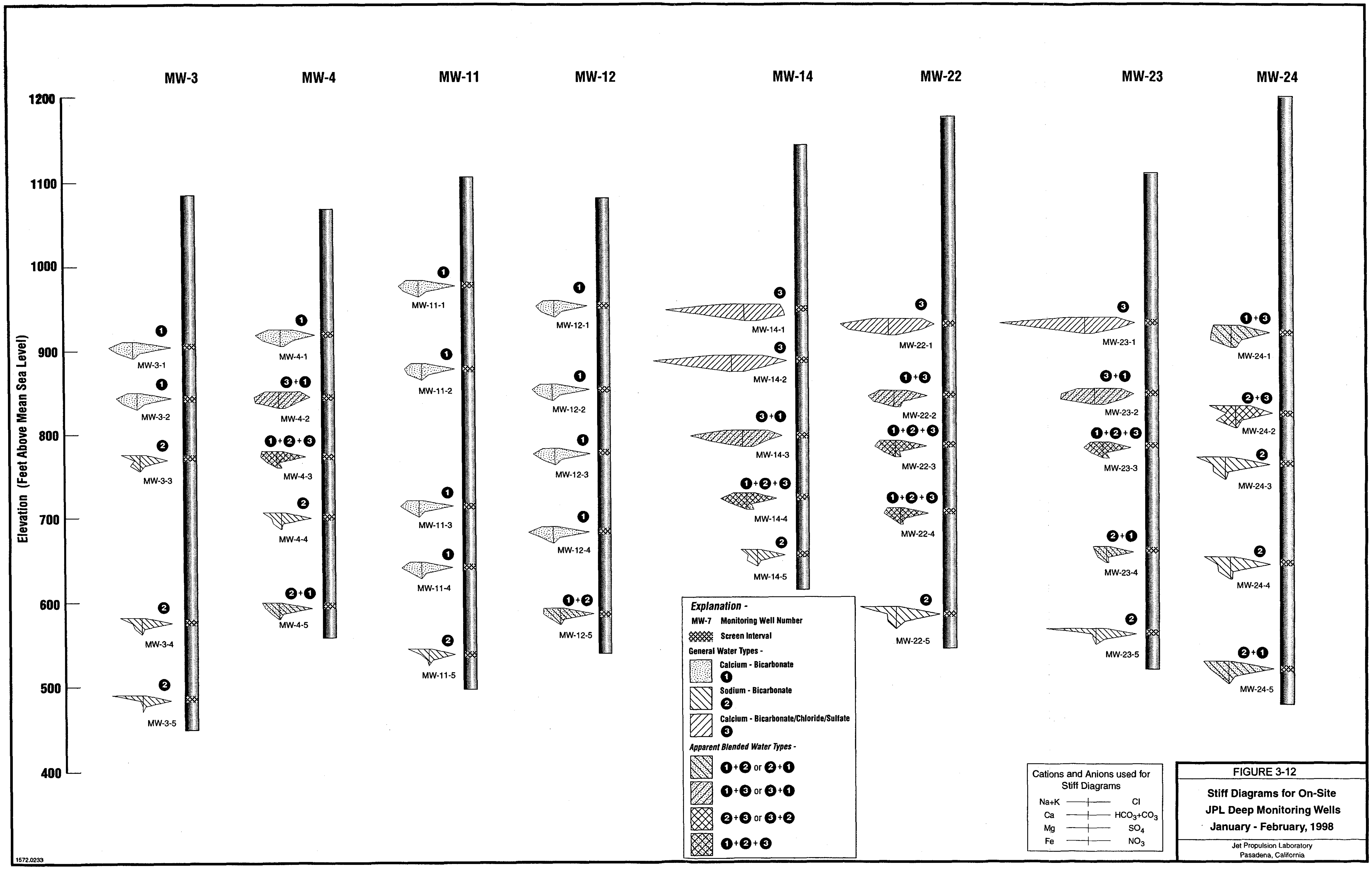



FIGURE 3-12

**Stiff Diagrams for On-Site JPL Deep Monitoring Wells January - February, 1998**

Jet Propulsion Laboratory
Pasadena, California

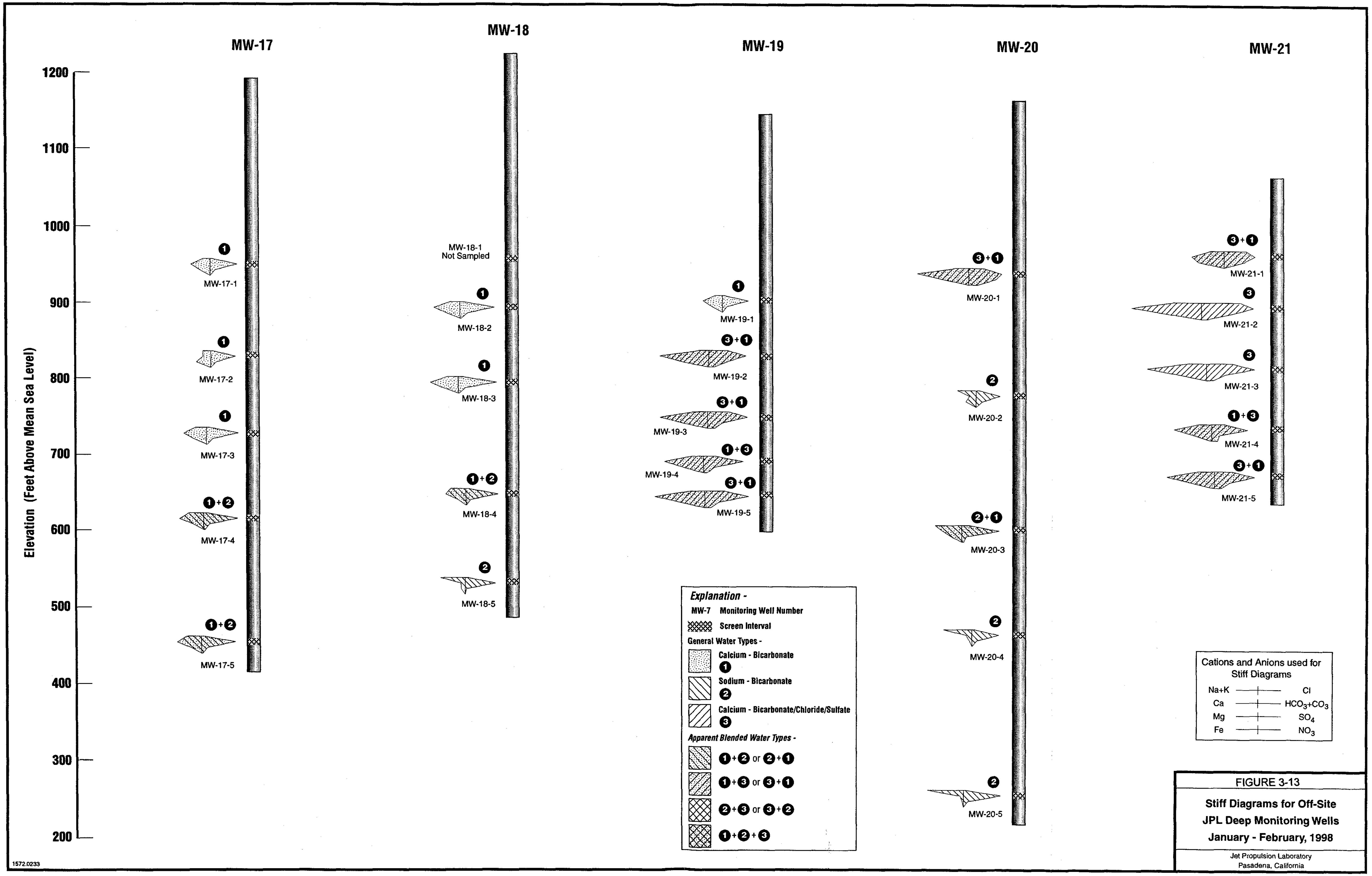



FIGURE 3-13

**Stiff Diagrams for Off-Site JPL Deep Monitoring Wells January - February, 1998**

Jet Propulsion Laboratory
Pasadena, California

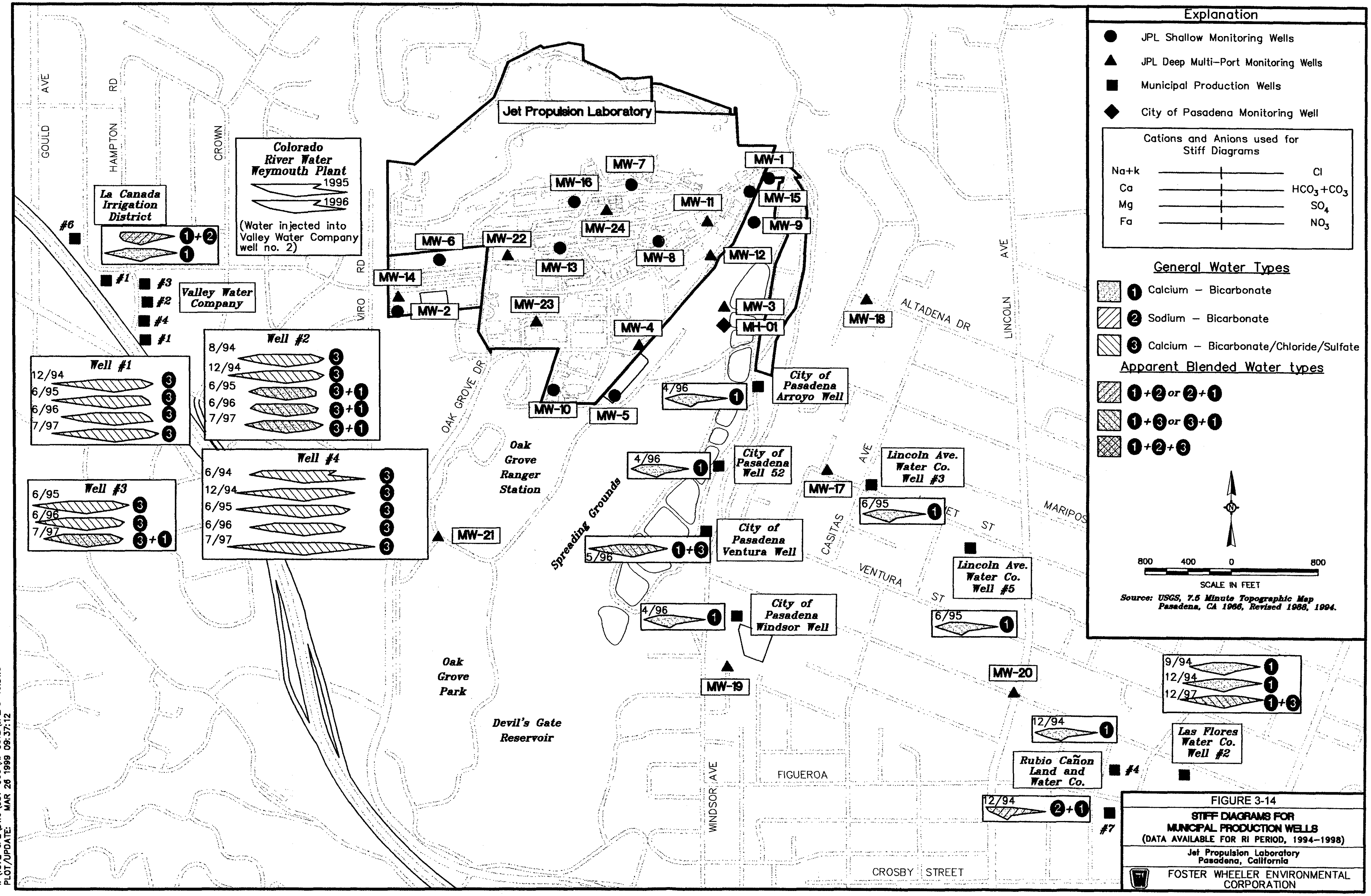



FIGURE 3-14
STIFF DIAGRAMS FOR MUNICIPAL PRODUCTION WELLS
(DATA AVAILABLE FOR RI PERIOD, 1994–1998)
Jet Propulsion Laboratory
Pasadena, California
FOSTER WHEELER ENVIRONMENTAL CORPORATION

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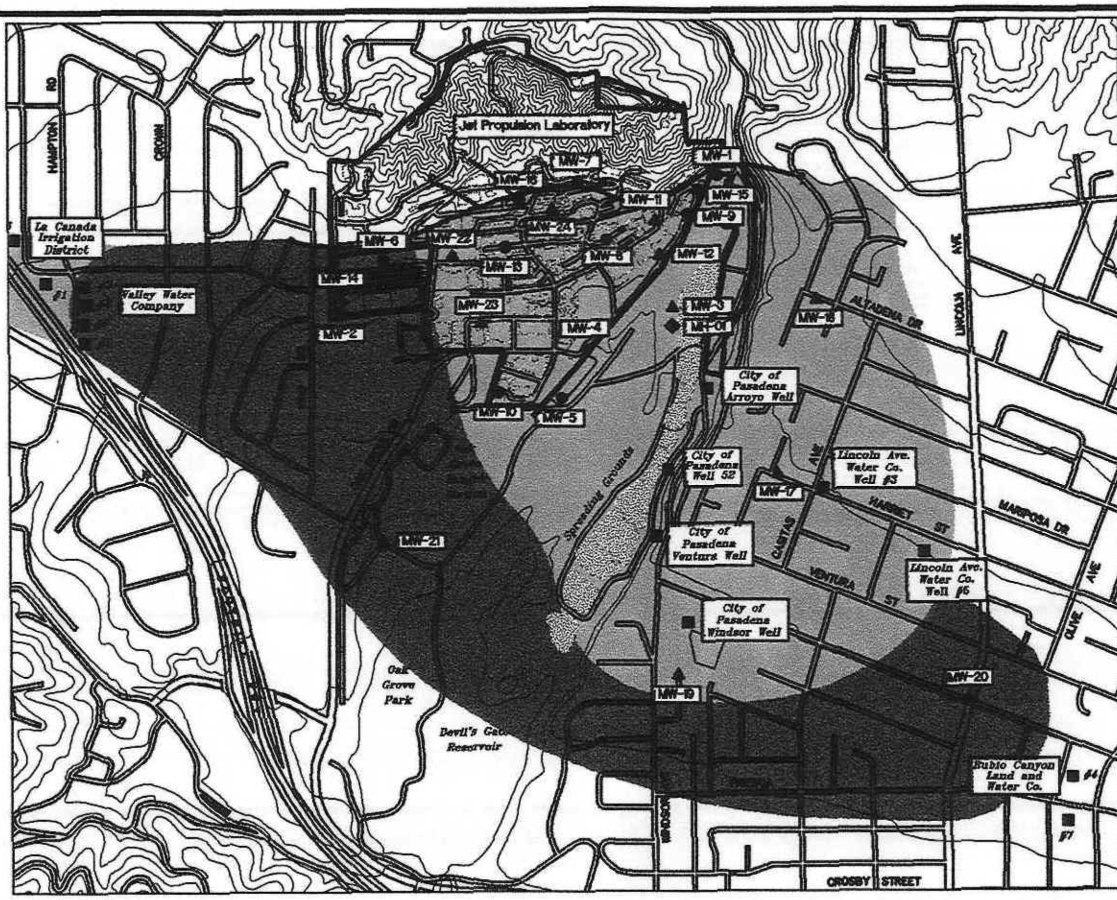
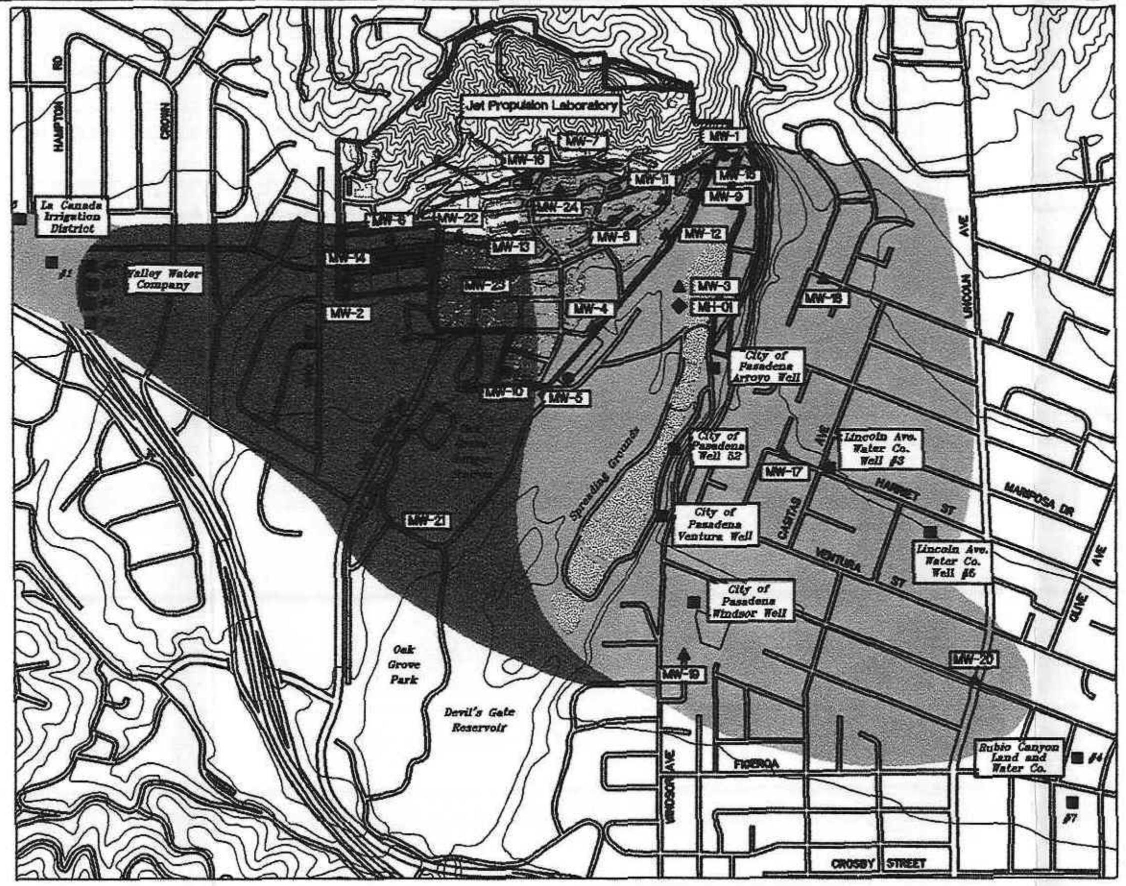
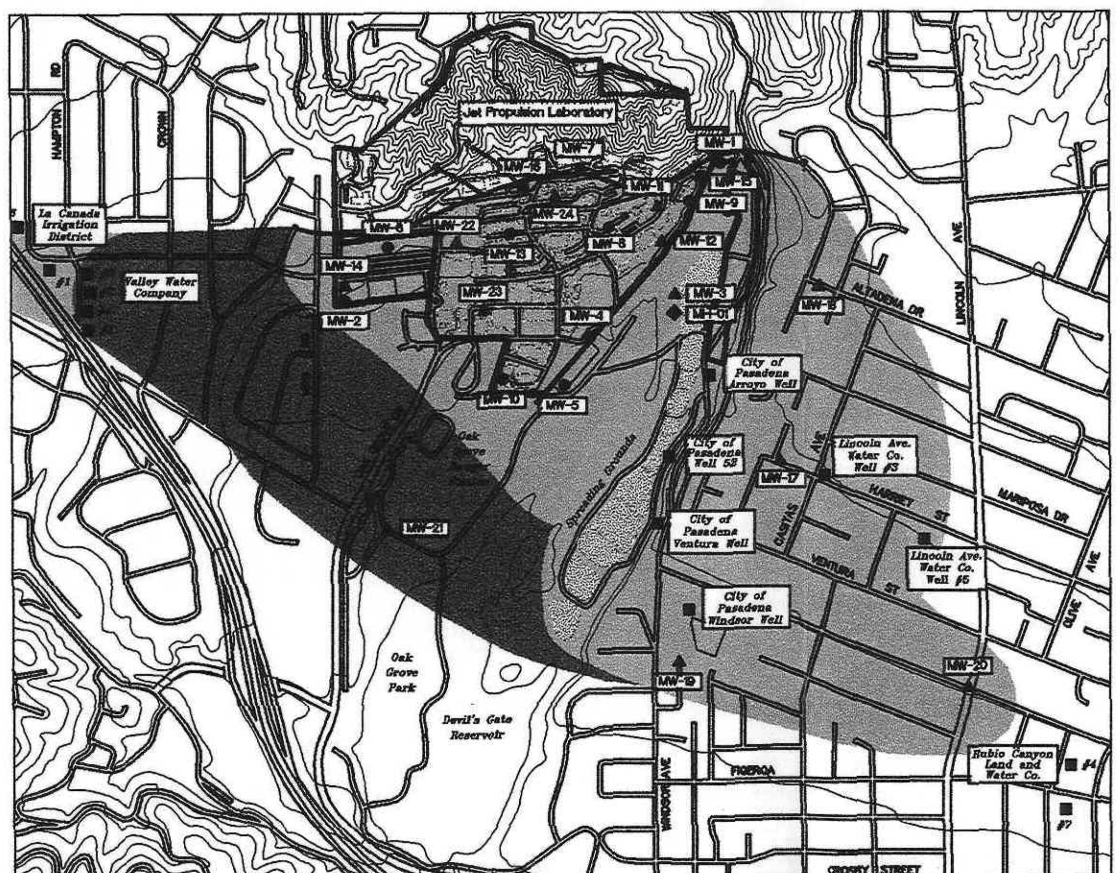



AQUIFER LAYER 1




AQUIFER LAYER 2




AQUIFER LAYER 3

## Explanation

- ● JPL Shallow Monitoring Wells
- ▲ JPL Deep Multi-Port Monitoring Wells
- ■ Municipal Production Wells
- ◆ City of Pasadena Monitoring Well
- Type 1 Waters, Including Mixtures of 1+2 and 1+3.
- Type 2 Waters, Including Mixtures of 2+1 and 2+3.
- Type 3 Waters, Including Mixtures of 3+1 and 3+2.

Note: Boundaries between water-types are not as sharp as represented. Mixing of adjacent water-types is commonly observed from 50 to 500 feet laterally around each boundary.

N

1750 875 0 1750

SCALE IN FEET

*Source: USGS, 7.5 Minute Topographic Map Pasadena, CA 1966, Revised 1988, 1994.*

FIGURE 3-15

**GENERAL WATER TYPES**
**AQUIFER LAYERS 1, 2 AND 3**
**August – September 1996**

**Jet Propulsion Laboratory**
**Pasadena, California**

FOSTER WHEELER ENVIRONMENTAL CORPORATION

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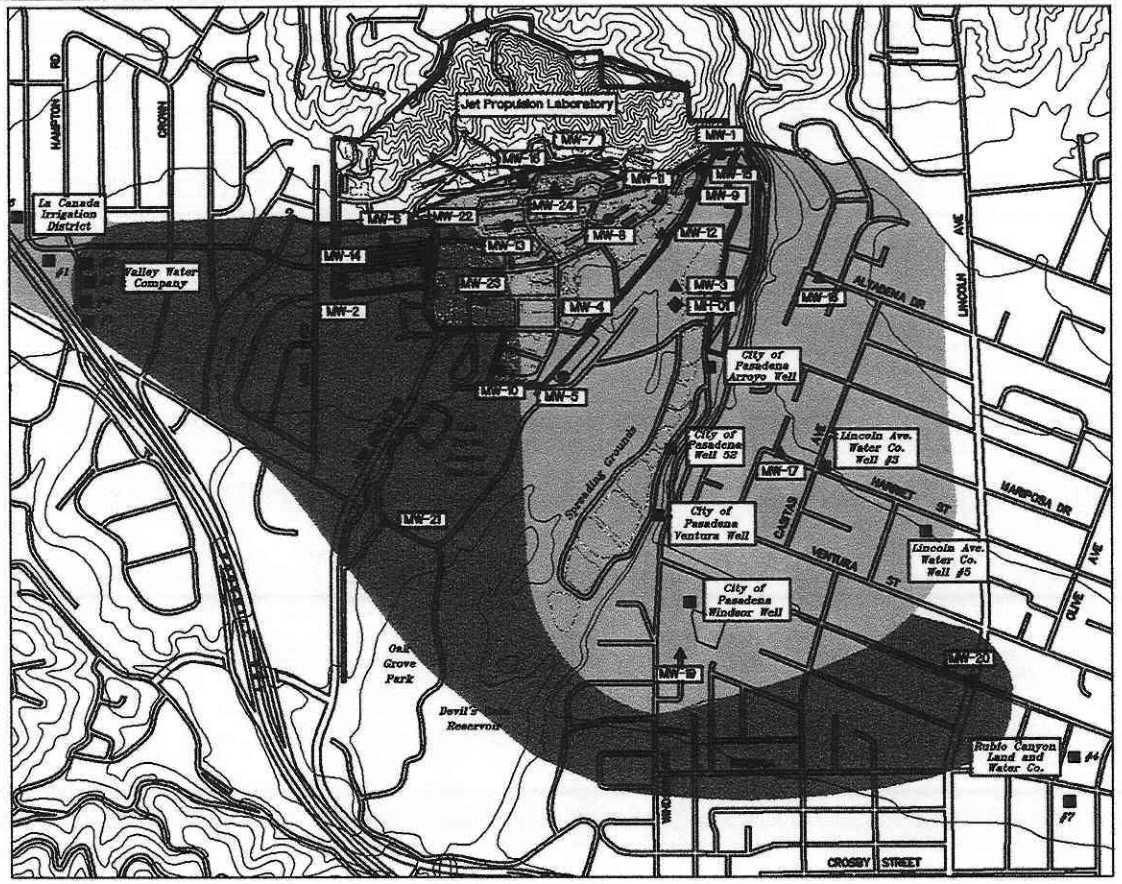
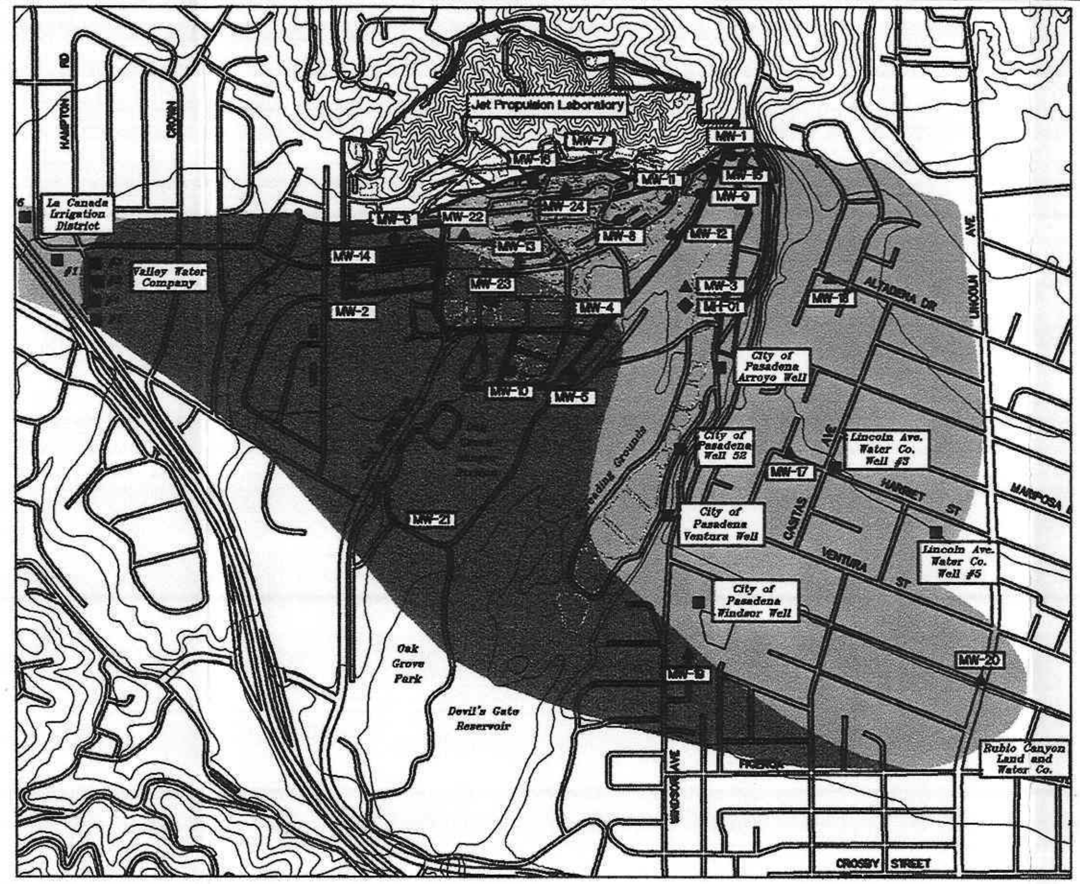
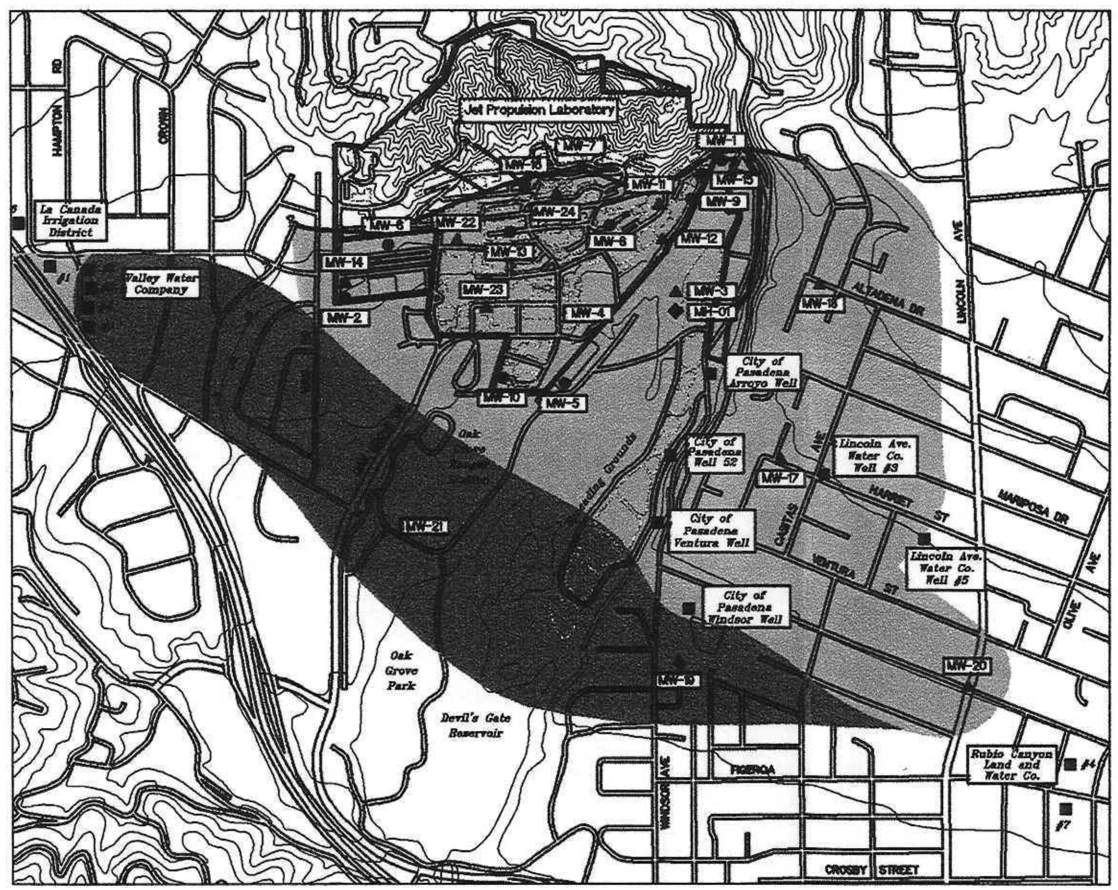
Continue




AQUIFER LAYER 1




AQUIFER LAYER 2




AQUIFER LAYER 3

**Explanation**

- ● JPL Shallow Monitoring Wells
- ▲ JPL Deep Multi–Port Monitoring Wells
- ■ Municipal Production Wells
- ◆ City of Pasadena Monitoring Well
- Type 1 Waters, Including Mixtures of 1+2 and 1+3.
- Type 2 Waters, Including Mixtures of 2+1 and 2+3.
- Type 3 Waters, Including Mixtures of 3+1 and 3+2.

Note: Boundaries between water–types are not as sharp as represented. Mixing of adjacent water–types is commonly observed from 50 to 500 feet laterally around each boundary.

N

1750 875 0 875

SCALE IN FEET

*Source: USGS, 7.5 Minute Topographic Map Pasadena, CA 1966, Revised 1988, 1994.*

FIGURE 3–16

**GENERAL WATER TYPES AQUIFER LAYERS 1, 2 AND 3**
**January – February 1998**

Jet Propulsion Laboratory
Pasadena, California

FOSTER WHEELER ENVIRONMENTAL CORPORATION

I:\1572–JPL\DWG\OU1–OU3\RI–9812\JPLF3–15.DWG
PLOT/UPDATE: MAR 29 1999 10:21:38