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Operable Unit 3 Remedial Investigation Addendum Monitoring Well 26 Construction Report

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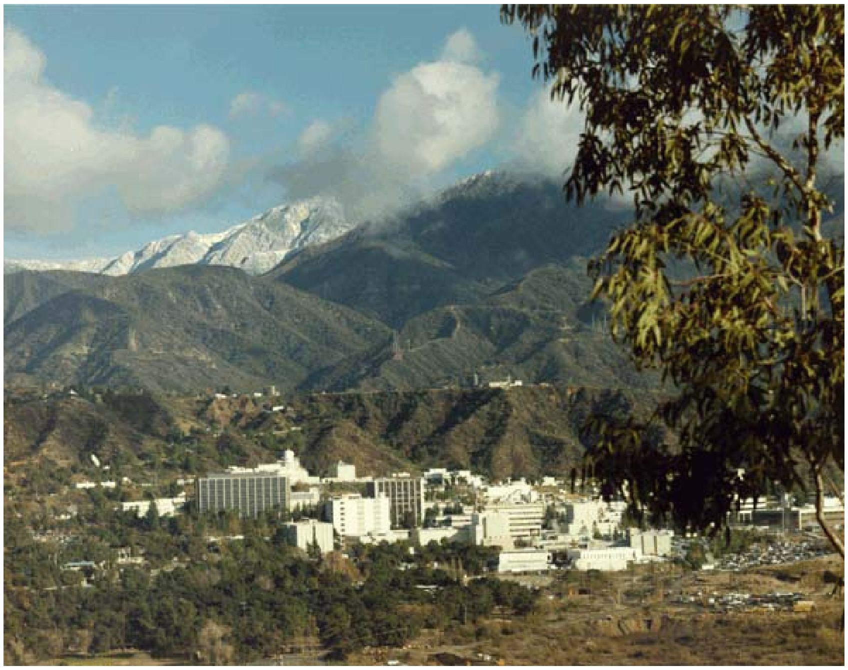

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APCL	Applied Physics and Chemistry Laboratory
asml	above mean sea level
bgs	below ground surface
Cal-EPA	California Environmental Protection Agency
CCR	California Code of Regulations
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
DEH	Department of Environmental Health
DHS	Department of Health Services
DO	dissolved oxygen
DOT	Department of Transportation
DTSC	Department of Toxic Substances Control
DVD	digital video disc
DWR	Department of Water Resources
ESP	Environmental Sampling Plan
FFA	Federal Facility Agreement
FS	Feasibility Study
IDW	investigation-derived waste
JPL	Jet Propulsion Laboratory
LCS/LCSD	laboratory control spike/laboratory control spike duplicate
MOA	Memorandum of Agreement
MP	multi-port
MS/MSD	matrix spike/matrix spike duplicate
MW	monitoring well
NAD	North American Datum
NASA	National Aeronautics and Space Administration
NAVFAC	Naval Facilities Engineering Command
NDMA	*n*-nitrosodimethylamine
NFESC	Naval Facilities Engineering Service Center
NPL	National Priorities List
O.D.	outside diameter
ORP	oxidation-reduction potential
OU-3	Operable Unit 3

PUSD	Pasadena Unified School District
PVC	polyvinyl chloride
QA/QC	quality assurance/quality control
RBMB	Raymond Basin Management Board
RDX	cyclotrimethylenetrinitramine
RI	Remedial Investigation
RPD	relative percent difference
RSD	relative standard deviation
RWQCB	Regional Water Quality Control Board
SAP	Sampling and Analysis Plan
SARA	Superfund Amendments and Reauthorization Act
SVOC	semivolatile organic compound
1,2,3-TCP	1,2,3-trichloropropane
TDS	total dissolved solids
TNT	trinitrotoluene
TPH	total petroleum hydrocarbons
USCS	Unified Soil Classification System
U.S. EPA	United States Environmental Protection Agency
VHS	Video Home System
VOC	volatile organic compound
VOA	volatile organic analysis
WDC	Water Development Corporation
%D	percent differences
%R	percent recovery

1.0 INTRODUCTION

This Construction Report for Remedial Investigation (RI) Addendum Monitoring Well (MW)-26 was prepared for the National Aeronautics and Space Administration (NASA) as part of the ongoing activities associated with the *Operable Unit 3 (OU-3) RI Addendum Work Plan* (NASA, 2004). RI Addendum activities include an additional investigation within OU-3, off-facility groundwater to evaluate the downgradient (southern) extent of chemicals that originate from the Jet Propulsion Laboratory (JPL) facility. NASA-JPL is on the National Priorities List (NPL) and subject to the provision of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) as amended by the Superfund Amendments and Reauthorization Act (SARA).

NASA is the lead federal agency for selecting, implementing, and funding remedial activities at the JPL; and Naval Facilities Engineering Command (NAVFAC) is providing technical services, including contracting, under a Memorandum of Agreement (MOA). In accordance with the Federal Facility Agreement (FFA), the United States Environmental Protection Agency (U.S. EPA), California Environmental Protection Agency (Cal-EPA), California Department of Toxic Substances Control (DTSC), and the Regional Water Quality Control Board (RWQCB) Los Angeles Region provide oversight and technical assistance. In addition, NASA is working in conjunction with the City of Pasadena, the Pasadena Unified School District (PUSD), the California Department of Health Services (DHS), and the Raymond Basin Management Board (RBMB) to implement the activities associated with the additional investigation.

This Construction Report is divided into five sections and provides details regarding the installation of groundwater monitoring well MW-26. This section discusses the objectives of the well installation and provides a brief discussion on the background of the NASA-JPL CERCLA project. Section 2.0 summarizes multi-port (MP) well installation. Section 3.0 discusses the sample analytical results from groundwater samples collected from MW-26. Section 4.0 is a summary of the well installation process and Section 5.0 provides a listing of references.

1.1 Background

Beginning in the early 1990s, an RI for on-facility (OU-1) and off-facility (OU-3) groundwater at JPL was conducted to identify the nature and extent of chemicals in groundwater. During the RI, 13 additional wells were added to the existing 11 wells in the JPL monitoring network.

The groundwater monitoring program at NASA JPL was initiated in 1996 and, prior to installation of MW-26, consisted of a network of 25 monitoring wells that are monitored on either a quarterly or annual basis (except MW-2). Sixteen wells are located on-facility and nine wells are located off-facility (Figure 1-1). Of the 25 wells, 11 are relatively shallow conventional wells with a single screened interval. The other 14 wells, including all of the off-facility monitoring wells, are relatively deep, multi-port wells that contain five screened intervals each and a Westbay® multi-port casing system that allows for simultaneous or independent monitoring of different aquifer zones.

1.2 Objectives

The objective of this report is to document the installation of a new MP groundwater monitoring well located southeast of the JPL facility (see Figure 1-1) Groundwater samples collected from this well, in conjunction with sample data collected from the existing JPL groundwater monitoring wells, will be used to achieve the objectives of the RI Addendum. This report describes the activities associated with the installation of one additional deep MP monitoring well (MW-26) and collection of initial monitoring data from this well.

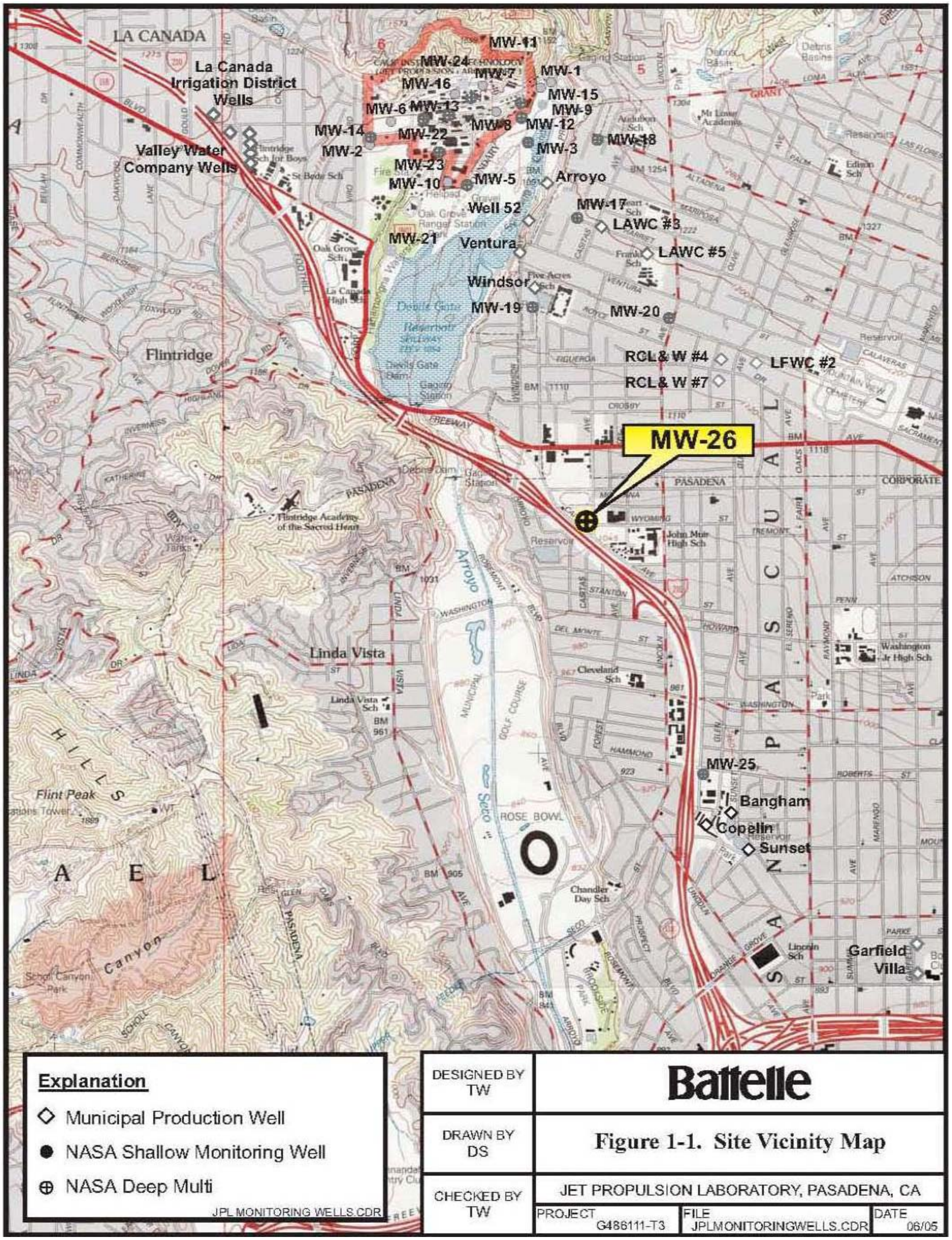

Figure 1-1. Site Vicinity Map

2.0 SUMMARY OF MULTI-PORT GROUNDWATER MONITORING WELL MW-26 INSTALLATION

An MP well was selected at this location due to the presence of stratification within the aquifer. Selection of the monitoring well location was based on groundwater analytical data from existing wells and groundwater flow patterns in OU-3 (NASA, 2004).

The well location was determined in coordination with the PUSD. To facilitate ease of access and minimize impact to private property and public right-of-way, the well was sited on PUSD property. The well is located in the southern corner of the John Muir High School parking lot near the intersection of Canada Avenue and Casitas Avenue (see Figure 2-1).

2.1 Well Permit Requirements

No state or local permits were required for MW-26 under CERCLA § 121(e)(1) and 40 Code of Federal Regulations (CFR) § 300.400(e). However, MW-26 did meet the substantive permitting requirements associated with monitoring well installation. This included requirements associated with the Los Angeles County Department of Environmental Health (DEH), City of Pasadena Building and Health Departments, RWQCB Los Angeles Region, and the California Department of Water Resources (DWR) Southern District. A copy of the well permit package submitted to the City of Pasadena Health Department is included in Appendix A.

2.2 Coordination with the Pasadena Unified School District

MW-26 is located on PUSD property and the well location was selected in coordination with PUSD personnel. In general, coordination activities associated with PUSD for this project included the following:

- Completion of appropriate City of Pasadena Department of Health well construction permitting requirements (including public notification requirements) (Appendix A).
- Utility map review and underground utility locating and clearances.
- Selection of locations for placement of construction equipment and support facilities including a temporary storage area for supplies and investigation-derived waste (IDW) at the well site.
- Coordination of drilling, well construction, waste disposal, and surveying schedules.

NASA and PUSD have executed a legal agreement that allows NASA to conduct CERCLA actions within PUSD property. This Use Agreement and Right-of-Entry for Environmental Actions requires that the scope and location of specific actions be documented by NASA and approved by PUSD as part of an Environmental Sampling Plan (ESP). The ESP was provided as Attachment B to the Use Agreement and Right-of-Entry for Environmental Actions and fulfilled the requirement of the legal agreement.

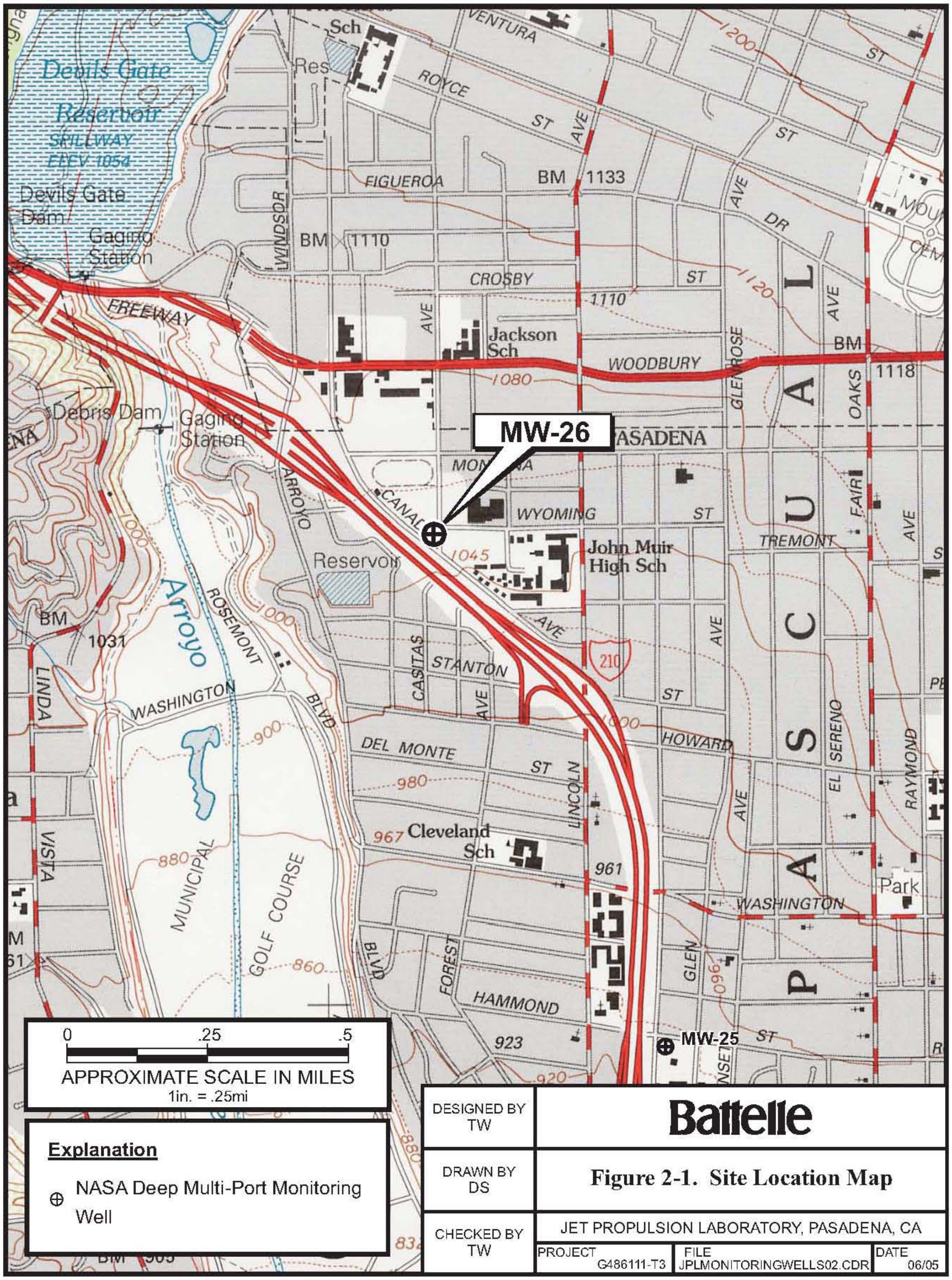

Figure 2-1. Site Location Map

2.3 Well Construction

This section describes the activities that were performed as part of well construction. Construction activities include drilling, geophysical logging, well casing installation, initial well development, MP well installation, and MP well development. These activities are similar in scope to those performed as part of NASA's regulator-approved *Final Work Plan for Performing a Remedial Investigation/Feasibility Study (RI/FS) at NASA JPL* (Ebasco, 1993). MW-26 was constructed in accordance with the requirements of the California DWR, Water Well Standards, Bulletin 74-90, and Supplement to Bulletin 74-81.

2.3.1 Drilling

MW-26 was drilled to approximately 313 feet below ground surface (bgs) using a 12.25-inch outside diameter (O.D.) mud-rotary drilling bit. Approximately 20 ft of conductor casing was set at the surface of the borehole to maintain the near-surface integrity. The conductor casing was removed after the well was constructed and backfill materials were in place. During the drilling and well construction, the drill cuttings were separated from the drilling mud using a mud shaker.

The bentonite drilling mud was monitored for weight, viscosity, and sand content with a mud scale, marsh funnel and cup, and a sand content kit, respectively. The mud weight was kept below approximately 70 pounds/cubic foot, the viscosity between 40 and 60 seconds, and the sand content at less than 4 percent. The mud properties were controlled by the driller, Water Development Corporation (WDC), to maintain the borehole stability, fluid loss, and equipment integrity. The separated mud was recycled into the drilling process and the cuttings were stored in roll-off bins until the appropriate method of disposal was determined. Drilling mud monitoring results are included on the boring log provided as Appendix B. Additional details regarding IDW storage and disposal are provided in Section 2.5.

All drilling equipment and materials including drilling bits and pipes, drilling mud components, and backfill equipment were either new or cleaned in the field using a high pressure steam cleaner. Water used during drilling and well construction activities came from a nearby PUSD water spigot. Prior to use, a water sample was collected from the spigot and analyzed for volatile organic compounds (VOCs) and perchlorate using U.S. EPA-approved methods. Analytical results from the spigot sample are included in the laboratory reports provided in Appendix C.

The drilling method described above is a standard method for the installation of environmental groundwater monitoring wells. Cross contamination between aquifer layers was minimized during the drilling process because the drilling mud in the borehole has a higher viscosity than the groundwater in the aquifer. The difference in viscosity between these media limits groundwater flow within the borehole during the drilling and well installation activities. During the well construction and development, to the extent possible, the drilling mud was removed from the well to allow the groundwater to flow into the well filter pack and casing for future sampling.

Detailed descriptions of the mud rotary process and field documentation procedure are provided in the *Final Work Plan for Performing a Remedial Investigation/Feasibility Study (RI/FS) at NASA JPL* (Ebasco, 1993).

2.3.2 Geophysical Logging

The total depth of MW-26 was determined by the on-site geologist based on the depth that crystalline bedrock was encountered. Based on an interpretation of the geophysical logs from MW-26, bedrock was encountered at approximately 248 ft bgs; however, during the drilling process, the borehole was advanced to approximately 313 ft bgs to ensure the presence of crystalline bedrock rather than a boulder or large cobbles.

Upon completion of the drilling and prior to the well installation, the borehole was logged using geophysical methods to assist the field geologist with the identification of "sand-rich" layers for the placement of well screens; borehole lithologies; water-bearing intervals; and stratigraphic correlation with existing JPL monitoring wells. Geophysical methods employed included:

- **Gamma Log**. This method records the amount of natural gamma radiation emitted by the rocks surrounding the borehole. Clay- and shale-bearing zones often emit relatively high gamma radiation because they include weathering products that include uranium and thorium.
- **Caliper Log**. This method records borehole diameter. Changes in the borehole diameter are related to well construction, such as casing or drill-bit size, and to fracturing or caving along the borehole wall. Borehole diameter is useful in interpreting the other geophysical logs because it can affect the log response of the other methods.
- **Single-Point Resistance Log.** This method records the electrical resistance from points within the borehole to an electrical ground at the surface. Typically, resistance increases with increasing grain size and decreases with increasing borehole diameter, fracture density, and dissolved-solids concentrations of the water.
- **Spontaneous-Potential Log.** This method records potentials or voltages developed between the borehole fluid and the surrounding rock and fluids. Spontaneous-potential logs can be used in the determination of lithology and water quality.

Based on the results of the geophysical logs, the depth to shallow groundwater was estimated to be approximately 126 ft bgs. However, the actual depth to groundwater measured inside of the well casing following well development was approximately 60 ft bgs. In general, the lithologies encountered during the drilling process consisted of fine- to coarse-grained sands and gravels with various percentages of silts. Additionally, cobble- and boulder-sized material was observed at various levels throughout the drilling interval. These interpretations are based on visual observations of the drill cuttings, observations of the drilling equipment, and geophysical logging results. Boring lithologic descriptions are provided on the boring log in Appendix B. The downhole geophysical logs are provided in Appendix D.

2.3.3 Well Casing Installation

The well design was based primarily on the downhole geophysical survey, bedrock depth, and water table elevations from the adjacent Sheldon municipal production well. The outer well casing consists of sections of 4-inch-diameter low carbon steel blank casing and two 10-ft-long, 4-inch-diameter stainless steel wire-wrap screens with 0.010-inch slots welded together. In order to accurately define the well construction, each section of screen and blank casing was measured before being lowered into the boring. The sections of screen and blank casing were brand new and packaged either in factory-provided cardboard boxes or shrink-wrap. The two screen depths were selected based on conditions observed during the drilling of the well, as well as conditions observed during the downhole geophysical survey. All bentonite seals and sand packs were tremied into place. The sand packs consist of No. 2/16 silica sand. A grout pump was used to circulate the drilling fluid (e.g., mud and water) out of the hole and to pump backfill materials into the boring. The backfill materials included sand, a bentonite sealing mixture consisting of sand and bentonite, and high-density, polymer-free grout. A concrete encased traffic box was installed at the well surface, after the grout seal had time to adequately set, to protect the wellhead from damage and to prevent surface water from entering the well casing. Well screen elevations are summarized in Table 2-1 and well construction details are provided in Appendix B.

Table 2-1. Summary of Well Elevation and Location Survey Data

Well Feature		Elevation (ft amsl)	Northing	Easting
Top of Casing		1059.08	1,887,624.43	6,511,824.03
Zone 1	Top	929.08		
	Bottom	919.08		
Zone 2	Top	849.08		
	Bottom	839.08		
Bottom of Casing		819.08		

asml = above mean seal level

2.3.4 Initial Well Development

Initial well development procedures began within 24 hours after the installation of the 4-inch casing. Time was important at this stage of the well construction because a large majority of the drilling mud had been removed from the borehole during well construction, and therefore, the two screened intervals were not isolated from one another to prevent mixing of water from each zone. The development procedures were conducted in order to remove residual drilling mud and fine sediments from around the well screen and to stabilize the filter pack at each screened zone. Additionally, well development was performed to create hydraulic communication between the aquifer and the new well. All development activities were recorded in a bound field logbook.

Development was initiated by bailing the residual drilling mud from the well casing. During this process, approximately 1,700 gallons of drilling mud mixed with water was removed from the well. Each screened zone was then surged for a half hour using a rubber-disc swab tool. A solution consisting of 2 gallons of Aquaclear™ and 1000 gallons of municipal water was then added to the well. Aquaclear™ is used to flocculate the drilling fluid to facilitate the removal of the drilling fluid from the formation surrounding the well. The well was then bailed to remove the remaining sediments that had accumulated in the bottom of the well. Approximately 40 gallons of additional sediment-laden water was removed from the well.

Following swabbing and bailing operations, the well was purged using a submersible pump. During the first round of purging, the entire well was purged without isolating the two screened zones. Pumping was occasionally discontinued and the pump was lowered an additional 20 to 30 ft until the bottom of the well was reached. Approximately 4,283 gallons of water was purged using this method. Each sampling interval was then isolated from the rest of the well by placing a K-packer above and below the screen of the target interval. The pump was lowered to the first well screen and pumping was initiated. Occasionally, pumping was discontinued, and the pump was raised and lowered to surge the screened zone. During the purging process, physical and chemical parameters including pH, turbidity, dissolved oxygen (DO), salinity, total dissolved solids (TDS), and oxidation-reduction potential (ORP) were monitored and recorded. Each zone was purged until the chemical and physical parameters, with the exception of turbidity, varied by approximately 10% or less over three consecutive readings. When development of the screened zone was completed, the pump was lowered to the next screened zone and the process was repeated. Approximately 6,912 gallons was pumped from Screen 1 and 5,637 gallons were pumped from Screen 2. Development logs summarizing the parameter reading and purge volumes recorded during the development and purging processes are included in Appendix E.

Following well development and prior to the installation of the Westbay® equipment, Pacific Surveys performed a downhole video survey to assess the effectiveness of the development procedures. During the video survey, a waterproof camera was lowered down the well and the images were observed on a video monitor and simultaneously captured on a Video Home System (VHS) tape and digital video disc (DVD). Based on the results of the video survey, well development was considered adequate and no additional development was required. Still images of each of the five screened zones were captured during the survey. The DVD of the video log performed on MW-26, as well as the still images of each screened zone, are included in Appendix F.

All development discharge water was stored in 21,000-gallon Baker® Tanks until the appropriate method of disposal was determined. Additional details regarding IDW storage and disposal is provided in Section 2.5.

2.3.5 Westbay® Multi-Port System Installation

After the initial well development, the MP casing system was installed within the 4-inch steel casing. The MP system is a multi-level groundwater monitoring system capable of providing isolated access to each of the two discrete, screened intervals within MW-26. The MP casing system consists of various components including 1.5-inch-diameter schedule 80 polyvinyl chloride (PVC) blank casing, PVC couplings used to connect various casing components, PVC measurement-port couplings that allow access to the aquifer for pressure measurements and water sampling, PVC pumping-port couplings that allow access to the aquifer for well purging and hydraulic conductivity testing, and nitrile rubber inflatable packers that seal the annulus between the measurement and pumping ports at each screened interval.

As part of the MP system, valved ports are located in the 4-inch steel casing opposite the well screens and isolated within the well casing by inflatable packers. The packers are located within the well casing, above and below the screened interval. From the surface, a Westbay® trained technician lowers a probe into the MP casing, locates the desired port using magnetic sensors, docks the probe at the measurement-port, and takes a pressure reading or collects a groundwater sample.

The MP system was provided and installed by certified technical representatives of Westbay® Instruments, Inc., of Vancouver, Canada. Each MP casing component arrived on-site cleaned by the manufacturer with a nonphosphate detergent solution and packed in plastic bags for transport. Before the MP system was installed in MW-26, the components were organized at the surface and partly assembled in accordance with a casing installation log. The casing installation log was used to accurately place the packers and measurement ports at the desired depths.

Table 2-2. Summary of Well Development Parameters Prior to Multi-Port Casing Installation

Screen	pH	Conductivity (μmhos)	Turbidity (NTU)	DO	Temp. (°C)	TDS	ORP	Pump Rate (gpm)	Total Volume Purged (gals.)
Screen #1(Top) (120-130 ft. bgs)									
Submersible pump in 4-inch casing	7.30	0.845	0.68	1.00	21.53	0.5	103	11.0	6,912
Screen #2 (210-220 ft. bgs)									
Submersible pump in 4-inch casing	7.44	0.831	0.52	1.89	20.26	0.5	94	11.0	5,637

The MP casing string was assembled by lowering the casing segments into the 4-inch steel casing by hand and attaching each successive segment to the adjacent coupling one at a time. Each coupling was pressure tested before it was run into the hole to verify the integrity of the system during installation. Each coupling was pressure tested using a probe with two small packers that was lowered into the casing so that the packers were located on each side of the coupling. The small packers were inflated and water was then injected under pressure into the casing opposite the coupling. If the coupling did not leak, it was lowered into the well. Once the MP casing had been placed in the well, the nitrile rubber packers between screen intervals were inflated with water, one at a time, beginning with the lowest packer, using a downhole tool designed for this purpose. After installation, several additional quality assurance/quality control (QA/QC) checks were performed. These checks included an initial pressure profile to confirm the operation of the measurement ports and observation of head differences across the packers to confirm that the packers had properly sealed the annulus. Additional details regarding the equipment and procedures used during MP casing installation and procedures for the required QA/QC checks are further described in the *Final Work Plan for Performing a Remedial Investigation/Feasibility Study at NASA JPL* (Ebasco, 1993). MP casing installation logs are provided in Appendix B.

2.3.6 Westbay® Multi-Port System Development

Following the installation of the MP casing system, a second development of the screened zones was performed. This well development was intended to remove stagnant water and residual suspended materials from the well casing remaining from the initial well development. The depth of the well and the relatively small diameter of the Westbay® MP casing system do not allow for standard well development techniques. Therefore, a specialized pump was required to purge the deep MP screens. The screen zones surrounding the MP casing sample ports were developed using an inertial lift pump from Waterra USA, Inc. of Bellingham, Washington. The inertial lift pump is small enough in diameter to fit into the MP casing and can operate at depths up to 300 ft bgs. The pump consists of a length of tubing with a foot valve. The tubing is oscillated up and down using an electrically operated lever that is placed on the top of the well. The oscillation produces a flow of water and the added benefit of gently surging the well as it is being purged.

During this development process, the tubing was lowered to each screened interval, the MP purging-port coupling was opened to expose the MP screen, and the pump was activated. At each zone, approximately three casing volumes were purged. In general, approximately 35 gallons was purged from each zone during the MP well development. Following purging at each zone, the Westbay® purging-port was closed and the MP development was considered complete. After development of both MP zones was completed, the well construction and development activities were considered complete.

All development discharge water was stored in 21,000-gallon Baker® tanks until the appropriate method of disposal was determined. Additional details regarding IDW storage and disposal are provided in Section 2.5.

2.4 Groundwater Sampling Activities

Samples were collected for analysis from MW-26 following the installation of the Westbay® MP casing. The sampling event was conducted during May 2005 as part of the ongoing NASA JPL quarterly groundwater monitoring program.

Sampling of MP systems requires specialized sampling equipment manufactured by Westbay®. This unique equipment includes a pressure profiling/sampling probe with a surface control unit. Field personnel using the Westbay® equipment are trained by Westbay® to ensure proper use. Copies of the detailed operations manuals for the pressure profiling/sampling probe are included in the *Final Field Sampling and Analysis Plan for Performing a Remedial Investigation at Operable Unit 3* (Ebasco, 1994).

The Westbay® Sampling probe and sample-collection bottles were decontaminated prior to sampling each screened interval in MW-26 according to the following procedure:

1. Each 250-mL stainless-steel sample-collection bottle is washed in a solution of nonphosphate detergent (e.g., Liquinox®).
2. Each bottle is rinsed with distilled water.
3. The interior surfaces of the Westbay® sampling probe, and the hoses and valves associated with Westbay® sampling bottles, were decontaminated by forcing several volumes of Liquinox® and distilled water through them. A final rinse with distilled water was carried out. Each of these decontamination procedures is completed using clean plastic spray bottles used only for this purpose.
4. All parts were rinsed by forcing several volumes of distilled water through them using a clean plastic squeeze bottle used only for this purpose.

Purging before sampling is not required in the MP monitoring wells because the groundwater sample is collected directly from the aquifer, thus ensuring that the groundwater sample has not been exposed to the atmosphere. Samples were collected using the Westbay® equipment, brought to the surface, and transferred to the appropriate sample containers. Groundwater samples were then placed on ice, and shipped via overnight courier to Applied Physics and Chemistry Laboratory (APCL), a California-certified laboratory in Chino, California.

2.5 Investigation Derived Waste Sampling and Disposal

The primary wastes generated during the installation, development, and sampling of MW-26 included drill cuttings mixed with drilling mud, well development water, monitoring well purge water, and decontamination rinse water.

Four Department of Transportation (DOT)-approved, 20-cubic-yard capacity roll-off bins were used to temporarily store the soil cuttings and drilling mud mixture. Grab samples of this waste were collected from each roll-off bin and placed in 8-ounce wide-mouth glass jars, capped and labeled. Once collected, IDW soil samples were placed on ice, and shipped via overnight courier to Alpha Analytical Laboratory, a California-certified laboratory in Sparks, Nevada. The samples were analyzed for VOCs and semivolatile organic compounds (SVOCs), Title 26 metals, plus strontium, cyanide, hexavalent chromium, perchlorate, and total petroleum hydrocarbons (TPH) to determine disposal options for the soil cuttings pursuant to EPA's guidance on the management of IDW (EPA, 1991 and 1992).

Water generated during the well development was temporarily stored in one 21,000-gallon Baker® tank. Grab samples of the water were collected from the Baker® tank and were placed in appropriate sampling containers, capped and labeled. Once collected, IDW water samples were placed on ice, and shipped via overnight courier to Alpha Analytical Laboratory. The samples were analyzed for VOCs and SVOCs, Title 26 metals, plus strontium, cyanide, hexavalent chromium, perchlorate, and total petroleum hydrocarbons to determine disposal options for the soil cuttings pursuant to EPA's guidance on the management of investigation-derived wastes (EPA, 1991 and 1992).

Based on the laboratory results, the solid and liquid IDW was classified as nonhazardous waste in accordance with the Code of Federal Regulations (40 CFR 261.31 to 261.33 and 261.21 to 261.24) and 22 California Code of Regulations (CCR). The nonhazardous waste manifests were signed by a NASA authorized representative. EFR Environmental of Lakeside, California, a licensed transporter, transported the waste off-site.

Soil cuttings generated during the installation of monitoring well MW-26 were disposed at the Waste Management facility in Azusa, California. The drilling fluids generated during the installation of monitoring well MW-26 were disposed at the McKittrick waste facility in McKittrick, California. Development and sampling purge water generated during the installation and initial sampling of monitoring well MW-26 was disposed of at the U.S. Filter facility in Los Angeles, California.

A summary of the analytical results for IDW samples and waste manifests for the IDW are provided in Appendix C. Complete laboratory analytical reports for IDW samples are included in Appendix C. Additional details regarding waste handling, analysis, and disposal can be found in the *Final Work Plan for Performing a Remedial Investigation/Feasibility Study (RI/FS) at NASA JPL* (Ebasco, 1993).

2.6 Well Location Survey

Following the installation of the Westbay® system in MW-26, a local subcontractor, Western States Surveying, Inc., surveyed the well location according to the North American Datum (NAD) 83 coordinate system. The results of this survey were used to create the site map provided as Figure 2-2 and the original survey map is included as Appendix G.

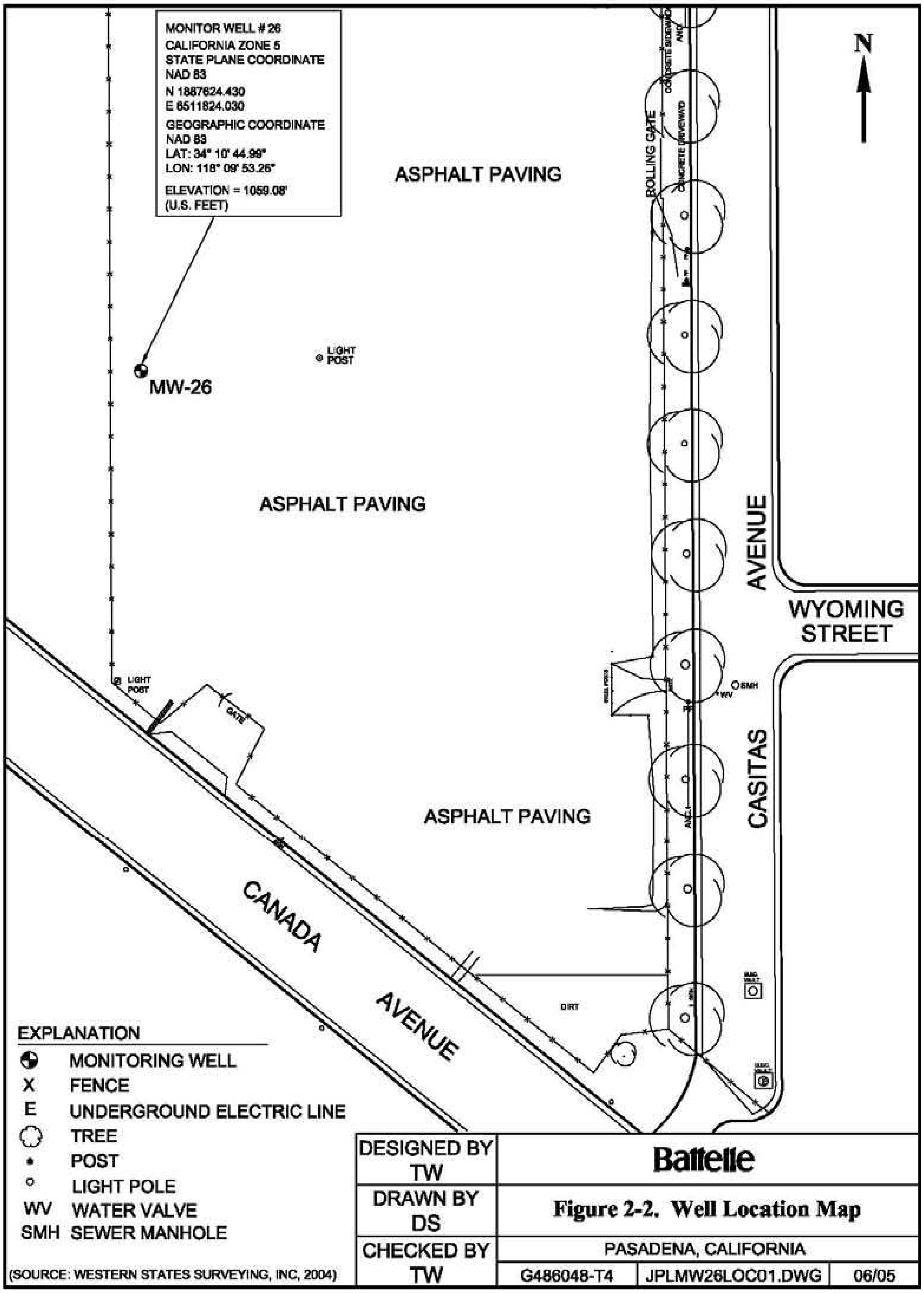

Figure 2-2. Well Location Map

3.0 SAMPLE ANALYTICAL RESULTS

This section describes the groundwater sample analytical testing methods, the analytical results, and the QA/QC program implemented during initial groundwater sampling conducted as part of the MW-26 well construction.

It is important to note that during construction and development of MP wells, a temporary mixing or homogenization effect on the local groundwater occurs. The homogenization of the groundwater near the well affects initial sampling data. The Westbay® technical staff suggests that initial groundwater sampling data be corroborated with longer term data before any significant decisions are made. For this reason, analytical results presented in this section should be considered qualitative. Data collected during future quarterly groundwater monitoring events will be used quantitatively in the RI Addendum Report.

3.1 Analytical Methods

During May 2005, one round of samples was collected from each screened interval following the installation and development of the MP System equipment. During this monitoring event, groundwater samples were collected and analyzed for VOCs with 1,2,3-trichloropropane (1,2,3-TCP), perchlorate, metals, hexavalent chromium, anions, 1,4-dioxane, *n*-nitrosodimethylamine (NDMA), trinitrotoluene (TNT) and cyclotrimethylenetrinitramine (RDX), TDS, and alkalinity by EPA Methods 524.2, 314.0 (and 8321A for confirmation purposes), 200.8, 7196A, 300.0/9056, 8270 SIM, 1625C, 8330, 160.1, and SM2320B, respectively.

Groundwater samples collected from MW-26 for this task order were analyzed by APCL, a California-certified laboratory in Chino, California. Additionally, APCL is an analytical laboratory that has successfully completed the Navy evaluation process through the Naval Facilities Engineering Service Center (NFESC). Groundwater sample results are discussed in the following sections.

IDW samples were sent to Alpha Analytical Laboratory, a California-certified laboratory in Sparks, Nevada.

3.2 Results

This section includes a summary of the chemical data pertaining to the sampling of MW-26 during May 2005. Complete analytical reports for these sampling events are included in Appendix C. A summary of the chemical constituents that were detected during the May 2005 MW-26 sampling event can be found in the analytical results table in Appendix C. During the May 2005 sampling events, VOCs were not detected in the groundwater samples collected from the two screened zones, with the exception of estimated J values of m,p-xylenes, which were detected in both zones.

Perchlorate was not detected in either screened zone using method 314.0 which has a reporting limit of 4 micrograms per liter (µg/L); however, perchlorate was detected in the upper well screen at 1.5 µg/L and the lower screen at 1.0 µg/L using the ion-specific analytical method 8321A which has a reporting limit of 0.50 µg/L. The perchlorate detections in MW-26 are well below the California Notification level of 6 µg/L.

Several metals were detected in groundwater samples from MW-26 in May 2005. Metals detected included: sodium, magnesium, potassium, calcium, total chromium, and lead. None of the metals detected in either screened zone exceeded their respective MCLs.

Concentrations of all other analytes were below the reporting limits in each zone. A summary of analytical results and complete laboratory analytical reports are provided in Appendix C. Additional details regarding groundwater conditions at the MW-26 location will be provided in the RI Addendum report and subsequent NASA-JPL quarterly groundwater monitoring reports.

3.3 Quality Assurance/Quality Control

A comprehensive QA/QC plan for groundwater monitoring has been established and is described in detail in the Sampling and Analysis Plan, which is provided as Appendix A of the *OU-3 RI Addendum Work Plan* (NASA, 2004). QA can be described as an integrated system of activities in the quality planning, assessment, and improvement to provide the project with a measurable assurance that the established standards of quality are met. QC checks, including both field and laboratory, are the specific operational techniques and activities used to fulfill the QA requirements. Proper sample acquisition and handling procedures are necessary to ensure the integrity of the analytical results.

3.3.1 Field Quality Assurance/Quality Control

The field QA/QC program for samples collected from JPL monitoring wells includes the collection of duplicate samples, equipment blanks, field blanks, and trip blanks. Groundwater sampling at MW-26 was conducted as part of a larger sampling event that included 26 wells on and near the JPL property. In all, 82 groundwater samples were collected during the sampling event. Therefore, 9 duplicate groundwater samples were collected during this sampling event. Results of the Field QA/QC samples are discussed in the following sections. Tabulated results, as well as full laboratory documentation of these samples can be found in the *Technical Memorandum, Second Quarter 2005 Groundwater Monitoring Results, National Aeronautics and Space Administration, Jet Propulsion Laboratory, Pasadena, California (Battelle, 2005).*

3.3.1.1 Field Duplicate Samples

Field duplicate samples were collected at a rate or 10% of the total number of samples during the sampling event. In all, 82 groundwater samples were collected during the quarterly sampling event. Therefore, 9 duplicate groundwater samples were collected during the sampling event. The analytical results from the original and duplicate samples were in agreement, and confirmed the presence or absence of constituents in the wells on or nearby the JPL property.

3.3.1.2 Equipment Rinsate Blanks

Equipment rinsate blanks were collected daily to ensure that non-dedicated sampling devices were decontaminated effectively. Equipment rinsate blanks are analyzed for VOCs only. The equipment rinsate blank associated with the sampling of MW-26 contained no quantifiable detections of VOCs.

3.3.1.3 Source Blanks

A source blank was collected from the spigot on the PUSD grounds (Water Source-5-3-05) to ensure that the water used during the drilling process was not a source of contamination . Several VOCs were detected in the source blank associated with the MW-26 drilling process. However, the majority of the VOC constituents detected in the source blank were trihalomethanes that are common disinfection by-products from the chlorination process used to make water potable.

A source blank was collected during the April/May 2005 quarterly groundwater monitoring event (SB-1-2Q05) to ensure that source water used during decontamination was not a source of contamination. Because one water source was used for equipment decontamination during the groundwater sampling event, one source blank sample was collected. To prepare the source blank, the volatile organic analysis (VOA) vials were filled with the source water at the same time that it was used for decontamination. Total chromium, ethylbenzene, toluene, and xylenes were detected in the source blank associated with the April/May 2005 quarterly groundwater sampling event.

3.3.1.4 Trip Blanks

Trip blanks, prepared by the laboratory, consisted of laboratory reagent water placed in 40-mL glass vials transported with the sample bottles to and from the field. One trip blank was submitted with each shipment of groundwater samples from the field to the laboratory. Trip blanks were used to identify any cross contamination of groundwater samples during transport and are analyzed if VOCs are detected in any of the groundwater samples. VOCs were detected during this round of sampling; therefore the trip blanks were analyzed. No VOCs were measured in the trip blanks accompanying the groundwater samples collected from MW-26. Complete laboratory analytical reports are provided in Appendix C. The comprehensive QA/QC plan for groundwater monitoring is described in detail in the Sampling and Analysis Plan (SAP), which is provided as Appendix A in the *OU-3 RI Addendum Work Plan* (NASA, 2004).

3.3.2 Data QC Review

A QC review of the analytical data for samples collected from well MW-26 in May 2005 was performed. Key data quality parameters were reviewed and evaluated. In this case, the quantitative criteria for assessing data quality were precision, accuracy and completeness. Precision quantifies the repeatability of a given measurement. Precision was determined by calculating the relative percent difference (RPD) between matrix spike/matrix spike duplicate (MS/MSD) pairs in the analytical laboratory. Data from repetitive analysis of calibration standards were also generated to assess the laboratory's analytical precision in terms of percent difference (%D) and relative standard deviation (RSD) of instrument response factors calculated for each analyte. Results of initial and continuing calibrations were reviewed to assess system variability in terms of RPD, %D and RSD. All samples fell within the precision acceptability limits required by the SAP (NASA, 2004).

Laboratory accuracy refers to the percentage of a known amount of analyte recovered from a given matrix. Accuracy was determined quantitatively by calculating the percent recovery (%R) from MS/MSD and for organic analytes, with surrogate compounds. Laboratory accuracy was also assessed from %R results generated from the periodic analysis of calibration check standards and laboratory control spikes/laboratory control spike duplicates (LCS/LCSD). All spiked samples fell within the percent recovery ranges required by the SAP (NASA, 2004). Completeness refers to the percentage of valid data received from actual testing done in the laboratory. Completeness for all compounds exceeded the target of 90%.

3.3.3 Data Verification

The analytical data for samples collected from well MW-26 in May 2005 along with associated laboratory QC data were reviewed by Battelle. Data were reviewed for conformance to the SAP (NASA, 2004) and generally accepted standards of data quality. The QC data generated by the analytical laboratory were specific to the analytical method and included LCS/LCSD, MS/MSD, surrogate spikes (if applicable), and method blanks. The results of the data verification indicated that the data met all analytical criteria.

4.0 SUMMARY

MW-26 was drilled and constructed at the PUSD property located north of the intersection of Canada Avenue and Casitas Avenue as part of NASA's JPL CERCLA program (NASA, 2004). MW-26 is located in the southern corner of the John Muir High School parking lot and is hydraulically downgradient from the JPL facility. This well adds to the current NASA-JPL groundwater monitoring well network. MW-26 is the fifteenth deep MP well containing multiple screened intervals and a Westbay® MP casing system.

MW-26 was drilled to the crystalline bedrock using the mud-rotary drilling technique. In general the lithologies encountered while drilling MW-26 consisted of silty and gravelly sands with occasional layers of cobbles and boulders. These lithologies appear to be relatively consistent with the lithologies observed in the nearest NASA monitoring wells, MW-19 and MW-25.

An initial round of groundwater samples were collected following installation of the MP casing system. No perchlorate was detected at concentrations above the California Notification Level of 6 µg/L. Perchlorate was detected in MW-26 screen 1 (shallow) at 1.5 µg/L and in screen 2 (deeper) at 1.0 µg/L using the ion specific method 8321A.

5.0 SELECTED REFERENCES

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