Taylor Yard and Los Angeles River

Preliminary Groundwater and Surface Water Study

A Report to

The California Coastal Conservancy

and

The Los Angeles and San Gabriel Rivers Watershed Council

The RIVER PROJECT

MILLER BROOKS Environmental, Inc.

CALIFORNIA STATE UNIVERSITY FULLERTON

March 2002

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PRELIMINARY GROUNDWATER AND SURFACE WATER STUDY

LOS ANGELES RIVER AT TAYLOR YARD
LOS ANGELES, CALIFORNIA

A REPORT TO
THE CALIFORNIA COASTAL CONSERVANCY AND
THE LOS ANGELES AND SAN GABRIEL RIVERS WATERSHED COUNCIL

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EXECUTIVE SUMMARY

In 2001, the Los Angeles and San Gabriel Rivers Watershed Council (LASGRWC), with funding from the California Coastal Conservancy under Proposition 204, selected The River Project, under the fiscal sponsorship of Friends of the River, to conduct this study of groundwater and surface water of the Los Angeles River at Taylor Yard. Primary consultants to the project include Miller Brooks Environmental and California State University, Fullerton.

Taylor Yard is the largest undeveloped patch of land along the Los Angeles River south of the Sepulveda Basin. It is located on the eastern bank of the Los Angeles River and comprises approximately 244 acres, of which 62 acres remain in operation as a railroad maintenance facility (the "Active Yard"). Two studies conducted in the 1990s identified Taylor Yard as having potential value for habitat restoration and as a recreational facility in addition to flood storage improvement. In 1993, a conceptual study funded by the California Department of Water Resources indicated that a multiple-use objective project including flood storage, recreational facilities and habitat restoration was feasible from an engineering and environmental standpoint.

In 1998, the Coastal Conservancy had directed separate Proposition 204 funds to conduct a feasibility study of potential multiple-objective options for Taylor Yard. Two of the objectives of the feasibility study were to identify opportunities and constraints related to habitat restoration, and develop alternatives that provide a mixture of habitat types, recreational opportunities and flood storage improvement. Four alternatives were developed for possible implementation on the Active Yard portion of Taylor Yard. Each of the alternatives has the potential to modify the surface and/or groundwater characteristics at Taylor Yard and the adjacent Los Angeles River.

It was acknowledged that a focused study of probable sources of existing groundwater contamination and the development of a model were needed, but outside the scope of the Coastal Conservancy feasibility study. With this need in mind, The River Project proposed to conduct a comprehensive environmental records review and to develop a groundwater model to evaluate the potential opportunities and constraints related to each alternative. The model provides a means to understand the existing (current) groundwater and surface water conditions at Taylor Yard and the Los Angeles River, and will eventually be used to predict what each alternative's influence may be on the surface/groundwater system.

Taylor Yard is located within a reach of the Los Angeles River known as the "Narrows", which lies between the San Fernando Valley and the Los Angeles Coastal Plain. Generally, the Los Angeles River is highly modified, having been lined with concrete along most of its length by the US Army Corps of Engineers from the 1930s to the 1960s. However, there are three remaining stretches of "soft-bottomed" river, one of which is the seven-mile stretch encompassing the Narrows. This circumstance provides the possibility of groundwater interaction with surface water in such a way that contaminants could move to the surface (if the river is 'gaining') or move to the aquifer (if the river is 'losing'). Development of the model, along with its associated calibration data, was intended to provide an understanding of these dynamics in this reach.

Taylor Yard is also located within the San Fernando Valley Groundwater Basin (SFVGWB) within the Upper Los Angeles River Area. The San Fernando Valley study area includes four National Priority List

(NPL) sites. The contaminants of concern are volatile organic compounds (VOCs), predominantly trichloroethene and tetrachloroethene. These solvents are used by many industries in the valley and have found their way into the groundwater through improper use, storage, and disposal practices.

The project's environmental records review identified numerous facilities with potential to impact soil and groundwater at Taylor Yard and in the Los Angeles River. Analytical results of the groundwater monitoring events on Taylor Yard itself show no detected concentrations of total petroleum hydrocarbons (TPH) in the wells at Taylor Yard. VOCs were detected at levels above the Maximum Contaminant Levels (MCLs) listed for those compounds by the Environmental Protection Agency. In general, concentrations of PCE and TCE in excess of the MCLs were encountered in groundwater beneath the Active Yard, Diesel Shop and along the northeast property boundary.

Both field and historic information were collected and used in the construction of the groundwater model of the Taylor Yard aquifer system. Details concerning the computer model were presented to the LASGRWC on February 20, 2002 (see Appendix E). Results of the calibrated model indicate that a communication between the river and the associated aquifer system does exist. In the very upper portion of the aquifer, the model demonstrates that the river is gaining (groundwater is moving into the river). However, with an increase in depth (vertically downward in the flow model), the groundwater moves through the system with little to no effect on or from the surface waters. Due to the dynamics of the system that was modeled, conditions can change with time.

The data collection period was short in duration and occurred during an atypically dry year. A longer water level monitoring period could include seasonal changes that affect the groundwater flow over time. Changes in river bottom elevation and sediment type plays a large role in the interaction of river water with the groundwater aquifer. A longer monitoring period, more information on the deeper soil types (deep well data are currently not available) and more information on the average river bottom morphology/elevation will allow the model to be updated to replace many of the assumptions now used.

This model provides a base for understanding the existing (current) groundwater and surface water conditions at Taylor Yard and the Los Angeles River. It can eventually be utilized for determining the potential stresses or modifications each alternative (developed in the feasibility study) may have on the hydrological system. By including the parameter of a specific modification into the model, the system reactions can be predicted. This can allow for the identification of potential problems and/or benefits associated with any regime modification.

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LOS ANGELES, CALIFORNIA

1.0 INTRODUCTION

This report documents the results of a preliminary groundwater and surface water study for the portion of the Los Angeles River along Taylor Yard (Figures 1 and 2) in Los Angeles, California. The objectives of the work activities summarized in this report were to evaluate the potential for offsite contribution to subsurface contamination of soil/groundwater and to collect subsurface parameters to establish a baseline groundwater water flow model. In 2001, the California Coastal Conservancy (SCC) directed Proposition 204 funds to the Los Angeles and San Gabriel Rivers Watershed Council (LASGRWC), under whose administration the project proponents received a grant to conduct this study. The first phase of the study is summarized in the *Environmental Records Review* (Appendix A) completed by Miller Brooks Environmental (MBE) in July 2001, which includes an evaluation of the potential for offsite contribution to subsurface contamination at Taylor Yard. The second phase is summarized in *Groundwater Model Presentation* and *Model Report* (Appendices E & F) completed by California State University Fullerton in March 2002, which includes results of a baseline MOD-FLOW groundwater model of the Taylor Yard site.

1.1 BACKGROUND OF THE STUDY

Taylor Yard is an active railroad maintenance facility located on the eastern bank of the Los Angeles River and comprises approximately 244 acres. As part of a feasibility study to improve flood control along the river in 1986, the US Army Corps of Engineers (USACE) and the Los Angeles County Department of Public Works (LACDPW) considered using Taylor Yard as a flood storage facility. Initial analysis indicated that a detention basin at Taylor Yard would provide significant flood protection improvements only for downtown Los Angeles, but at that time, flood protection improvements were needed in the lower reaches of the Los Angeles River. Therefore, Taylor Yard was not considered in further flood storage studies by the USACE. Two studies conducted in the 1990s identified Taylor Yard as having potential value for habitat restoration and as a recreational facility in addition to flood storage improvement. In 1993, a conceptual study funded by the California Department of Water Resources indicated that a multiple-use objective project including flood storage, recreational facilities and habitat restoration was feasible from an engineering and environmental standpoint. Since completion of the study, the area of Taylor Yard available for implementing such a project has been decreased by development from 174 acres in 1993 to 101.7 acres (Everest, 2002).

In 1998, the SCC had directed $250,000 in Proposition 204 funds to conduct a feasibility study of potential multiple-objective options for Taylor Yard. Two of the objectives of the feasibility study were to identify opportunities and constraints related to habitat restoration, and develop alternatives that provide a mixture of habitat types, recreational opportunities and flood storage improvement. Four alternatives were developed for implementation on the Active Yard portion of Taylor Yard (Everest, 2002):

- Alternative 1: Optimize Flood Storage – provide significant flood storage and riparian (natural river) habitat.
- Alternative 2: Optimize Habitat Diversity – provide biologically diverse floodplain, riparian habitat and some flood storage.
- Alternative 3: Optimize Upland Habitat – provide significant upland riparian fringe habitat with minimal soil excavation.
- Alternative 4: Naturalize River Edge (remove river levee) – restore portion of historical floodplain thereby naturalizing the river's edge, providing riparian habitat, and increasing the floodway width.

Each of the alternatives listed above has the potential to modify the surface and/or groundwater characteristics at Taylor Yard and the adjacent Los Angeles River. For example, a specific alternative may increase the amount of groundwater infiltration (due to flood storage or increased irrigation requirements) or modify the river morphology. Further, each of the alternatives had the potential to create a primary or secondary interaction with contaminated groundwater and previous studies had not provided information sufficient to determine its source(s), how it was migrating or whether (or which) contaminants might be present at surface elevations.

It was acknowledged that a focused study of probable sources of groundwater contamination and development of a model were needed, but outside the scope of the SCC feasibility study. In this context, The River Project in collaboration with MBE, proposed under the LASGRWC grant to conduct a comprehensive environmental records review and to develop a groundwater model to evaluate the potential opportunities and constraints related to each alternative. This model provides a means to understand the existing (current) groundwater and surface water conditions at Taylor Yard and the Los Angeles River, and will eventually be used to predict what each alternative's influence may be on the surface/groundwater system. By including the parameters of a specific modification into the model, the system reactions can be predicted. This will allow for the identification of potential problems and/or benefits associated with each alternative.

1.2 SITE DESCRIPTION AND HISTORICAL USE

Taylor Yard has been used as a rail yard since the 1890s. Activities on the property have included locomotive and refrigeration car maintenance and washing, diesel service and maintenance, fueling, car storage and switching, equipment storage, and the operation of utility department shops for electrical, mechanical and plumbing works. Generally, chemical usage at Taylor Yard included acids, paint, waste oil, gasoline, and chlorinated solvents (Environmental Resources Management [ERM], 2000a).

In the late 1980's, rail operations were confined to the Active Yard parcel only (Figure 2), and soils on the surrounding parcels were remediated to residential standards in order to facilitate their sale.

Features presently within the Active Yard include two turntables, at least four above-ground storage tanks (ASTs), two stormwater ponds, a service track area, locomotive wash, industrial wastewater pre-treatment plant (IWPP), and a diesel shop area. The Active Yard is zoned for industrial use (Industrial Compliance [IC], 1992).

As part of environmental investigations conducted by others on Taylor Yard, the Active Yard portion of the property was divided into four study areas (Figure 2). For ease of discussion, these areas will be referred to in this section to describe the features, and current and historic uses of the Active Yard. The study areas and the features are as follows:

Study Area 1 – Service Track

The Service Track Area consists of approximately 14.2 acres and is occupied by the Locomotive Wash, North Turntable, Service Track, active tracks north of the Service Track, and the manual wash area adjacent to the North Turntable. Cargo trains are washed and serviced in this area. Operations in this area include diesel service and maintenance, fueling, journal box oil and engine lube oil replacement, and sand hopper refilling. Manual washing of locomotive parts is conducted adjacent to the North Turntable, and discharge is conducted to the IWPP (Terranext, 1996).

The IWPP was constructed west of the Service Track Area and south of the North Turntable in 1953. Prior to the IWPP, the area contained stormwater retention basins. During construction of the IWPP, three of the retention basins were lined with concrete. The largest basin was divided into two smaller ponds, for a total of four ponds (Ponds #1 through #4). Treated wastewater was discharged into the City of Los Angeles sanitary sewer. In 1991, two of the four stormwater ponds were excavated and backfilled with clean imported fill (IC, 1992).

Study Area 2 – South Turntable/River Road

The South Turntable Area consists of approximately 11.5 acres, and includes the present South Turntable, Mechanical Office Building, and Old Locomotive Wash Area. The South Turntable occupies the location of the former roundhouse, an enclosed facility for the servicing and maintenance of locomotives. The roundhouse was in operation from the 1900s through 1950s. The roundhouse was removed between 1957 and 1968; however, the turntable remained in use (Terranext, 1996).

Study Area 3 - Diesel Shops

The Diesel Shops Area consists of approximately 12 acres and historically supported the majority of the repair and rework activities at the yard. This area includes the machine shop, former tunnel wash, tracks exiting the diesel shops, and a section of active track underlain by the pollution control system (PCS). The tunnel wash is an enclosed steam-cleaning facility that is no longer used. Steam cleaning is now performed outside, and north, of the tunnel wash. The discharge from the cleaning area is diverted to the IWPP (Terranext, 1996).

Study Area 4 – Former Debris Pile Area

This area is located at the south entrance to Taylor Yard and consists of approximately 4.8 acres. Much of this area has been excavated to a depth of 25 feet for pipeline rerouting and overpass construction. In addition, a debris pile was removed in 1993. Until the mid-1950s, service tanks were located in this area. Two aboveground Bunker "C" oil tanks and one underground storage tank (UST) with indeterminate contents were located in the Former Debris Pile Area between 1957 and 1968 (Terranext, 1996).

1.3 GEOLOGIC AND HYDROGEOLOGIC CONDITIONS

Taylor Yard is located on the U.S. Department of the Interior, Geological Survey (USGS) Topographic Maps (7.5-minute series) for the Los Angeles Quadrangle dated 1966 and photorevised in 1981. Elevations at Taylor Yard range from approximately 335 feet above mean sea level (MSL; National Geodetic Vertical Datum [NGVD]) at the south end to 380 feet above MSL at the north end, with a general topographic gradient to the west. The Active Yard has an average elevation of 355 feet above MSL.

Taylor Yard is located on the eastern boundary of the Los Angeles River within a reach of the river known as the "Narrows", which lies between the San Fernando Valley and the Los Angeles Coastal Plain (Figure 3). The Narrows portion of the river is a steep-sided valley approximately five miles in length, located on the southeast portion of the San Fernando Valley, between the Elysian Hills and Santa Monica Mountains to the west and the Repetto Hills to the east (Metropolitan Water District of Southern California [MWDSC], 1987).

The Narrows consists of an alluvium-filled valley resulting from the erosion of surrounding hills and alluvial fans and the subsequent deposition of these sediments by the ancestral Los Angeles River. The water-bearing alluvium within the Narrows is Quaternary in age and is underlain by non water-bearing bedrock of Tertiary age. Soil overlying bedrock in the Narrows consists primarily of highly permeable sand and gravel with a maximum thickness of approximately 200 feet. Structural features in the vicinity include the Raymond Fault, which transects the Narrows 0.75 miles northwest of Taylor Yard, and the Elysian Park Anticline crossing the southernmost portion of the yard (California Department of Water Resources [CDWR], 1961).

Results of environmental investigations conducted at Taylor Yard to date indicate that subsurface soils in the Active Yard generally consist of fill material extending from the ground surface to a depth of approximately seven feet below ground surface (bgs), and sands and silty sands with minor discontinuous clayey sands extending from seven to 35 feet bgs. These sediments are underlain by gravelly sand and generally coarse-grained sediments from 35 to 44 feet bgs. Below 44 feet bgs, the coarse sand and gravel content increases with depth to 100 feet bgs (maximum depth of investigation). Cobble layers of varying thickness are also found below 55 feet. Clay or silt zones of less than five feet in thickness were observed between 60 and 70 feet bgs (ERM, 2000a).

Taylor Yard is located within the San Fernando Valley Groundwater Basin (SFVGWB) within the Upper Los Angeles River Area (ULARA). The ULARA encompasses all the watershed of the Los Angeles River and its tributaries above a point in the river designated as Los Angeles County Department of Public Works Gauging Station F-57C-R, near the junction of the Los Angeles River and the Arroyo Seco, just to the south of Taylor Yard. Groundwater in the Narrows occurs under unconfined conditions, with a regional gradient to the south-southeast. Significant groundwater is present beneath Taylor Yard, primarily in the Gaspur Aquifer, which is a water-bearing zone of coarse sediments approximately 120 feet in thickness, located at the base of the Quaternary sediments (CDWR, 1961; City of Los Angeles vs. City of San Fernando et al, 2000).

Generally, the Los Angeles River is highly modified, having been lined with concrete along most of its length by the USACE from the 1930s to the 1960s. There are three remaining stretches of "soft-bottomed" river: the Sepulveda Basin, the Glendale Narrows and the Long Beach Estuary. Through the Glendale Narrows area, the soft-bottom stretch extends for about seven miles with concrete banks and derrick stones providing stability beneath a cobbled and sandy bed. The upper reaches of the river carry urban runoff and flood flows from the San Fernando Valley (California Regional Water Quality Control Board [CRWQCB], 1994).

The SFVGWB consists of the eastern portion of the San Fernando Valley and the entire Verdugo Basin. The Basin encompasses approximately 112,000 acres of alluvial valley fill deposits and provides enough water to serve approximately 600,000 people (City of Los Angeles vs. City of San Fernando et al, 2000). The San Fernando Valley study area includes four National Priority List (NPL) sites. The NPL is the Environmental Protection Agency's (EPA's) list of the most serious uncontrolled or abandoned hazardous waste sites identified for possible long-term remedial response. The NPL sites in the San Fernando Valley study are as follows: Area #1 North Hollywood, Area #2 Crystal Springs, Area #3 Verdugo, and Area #4 Pollock. Taylor Yard is within Area #4, which covers approximately 5,829 acres in the southeastern part of the San Fernando Valley and is located in and adjacent to the cities of Los Angeles and Glendale. Groundwater contamination in the SFVGWB is linked to historic and current industrialization in the San Fernando Valley. The contaminants of concern are volatile organic compounds (VOCs), predominantly trichloroethene (TCE), and tetrachloroethene (PCE). These solvents are used by many industries in the valley and have found their way into the groundwater through improper use, storage, and disposal practices. The SFVGWB Superfund sites were added to the NPL in 1986 and contain areas where concentrations of VOCs (TCE and PCE) in groundwater are above the federal drinking water standards. In some of the wells the groundwater contamination is so severe that they have essentially been taken out of commission (Environmental Data Resources, Inc. [EDR], 2001).

The City of Los Angeles Department of Water and Power (LADWP) Pollock Wells Treatment Plant was placed into service in March of 1999. The facility is located in the at the north of Taylor Yard within the Narrows area and restores the use of two existing Pollock production wells by treating the groundwater with liquid-phase granular activated carbon (GAC). The GAC removes VOCs from the groundwater, then the supply is chlorinated and blended with imported supplies to reduce nitrate concentrations within the groundwater (City of Los Angeles vs. City of San Fernando et al, 2000).

A factor affecting hydrologic conditions in the Los Angeles Narrows has been the increasing releases of reclaimed waters. Releases from the Los Angeles-Glendale Plant were started in 1976-77 and from the Tillman Plant in 1985-86. These large year-round releases tend to keep the alluvium of the Narrows area full, even in dry years (City of Los Angeles vs. City of San Fernando et al, 2000).

Based on data collected in 1999 and 2000, the general groundwater flow direction beneath Taylor Yard is to the south-southeast, with depths to groundwater ranging from 20 to 35 feet bgs (ERM, 2000b).

1.4 GROUNDWATER MONITORING

A groundwater monitoring program at Taylor Yard was implemented in October 1994. The sampling program is conducted in accordance with the requirements of the Department of Toxic Substances Control (DTSC) Enforceable Agreement (Docket #HSA89-90-006). There are currently 30 onsite and three offsite wells included in the monitoring program at Taylor Yard. Twenty-two wells are located in the Active Yard, including Wells MW-1, MW-2, MW-3, W-4, W-13, W-14C, W-15, W-17 through W-20, W-21B, W-22 through W-28, W-31, W-32, and W-33. Wells PO-VPB-05, PO-VPB-06, and PO-VPB-08 are located offsite, west of the Los Angeles River. Wells W-3, W-3A, W-7, and W-29 were abandoned. Wells W-14A and W-14B were abandoned in May 1997 and Well W-30 was abandoned in August 1999 (ERM, 2000b). Well locations at Taylor Yard are shown on Figure 2.

ERM performed quarterly groundwater monitoring activities at Taylor Yard in October 1999 and January 2000. During the October 1999 event, groundwater generally flowed toward the southeast under an average horizontal hydraulic gradient of approximately 0.0021 ft/ft across the entire yard. The average gradient for the Active Yard portion of the property was 0.0025 ft/ft. During the January 2000 event, the gradient across the entire yard was 0.0025 ft/ft and the gradient across the Active Yard was 0.0028 ft/ft (ERM, 2000b).

Between October 1992 and January 2000, groundwater elevations in each well fluctuated with time. The elevations in the wells varied by an overall average of 4.49 feet. The maximum elevation change from the previous monitoring event (February to July 1999) was 4.80 feet in W-33. The groundwater levels are affected locally by seasonal rainfall events, increasing during winter rains and decreasing throughout the rest of the year (ERM, 2000b).

Analytical results of the groundwater monitoring events show no detected concentrations of total petroleum hydrocarbons (TPH) in the wells at Taylor Yard. VOCs, inlcluding TCE, PCE, and benzene were detected at levels above the Maximum Contaminant Levels (MCLs) listed for those compounds by the EPA in the Compilation of Federal and State Drinking Water Standards and Criteria, dated June 1997. In general, concentrations of PCE and TCE in excess of the MCLs were encountered in groundwater beneath the Active Yard, Diesel Shop and along the northeast property boundary (ERM, 2000b).

The groundwater samples were further analyzed for semi-volatile organic compounds (SVOCs). SVOCs were detected in the wells at Taylor Yard, however the USEPA does not list MCLs for SVOCs. In general, SVOCs were detected along the northeast property boundary and portions of the Active Yard (ERM, 2000b).

1.5 ENVIRONMENTAL RECORDS REVIEW – 2001

In May and June 2001, MBE conducted research regarding historic property usage and documented environmental concerns at Taylor Yard and immediate vicinity in Los Angeles, California. Information regarding historic land use of Taylor Yard and surrounding properties was reviewed utilizing published reports, aerial photographs and historic maps. A regulatory agency database search report, including aerial photographs and historic topographic maps were reviewed. The purpose of this research was to identify environmental conditions associated with Taylor Yard and surrounding properties, which could have a potential negative impact on the chemical composition of groundwater and surface water of the adjacent Los Angeles River

The following is a summary of the findings at the Taylor Yard property and the adjacent Los Angeles River as it applies to this phase of the study:

- Taylor Yard consists of approximately 244 acres of land currently divided into eight parcels. The only documented historic use of the property has been as a rail yard. Land surrounding Taylor Yard has been developed for commercial and industrial use since the early 1920s.

- Properties in the vicinity of Taylor Yard, mainly concentrated to the east and northeast, are mostly large industrial and commercial businesses. The east boundary of Taylor Yard, along San Fernando Road, is largely commercial, with numerous factories with smokestacks, ASTs, and warehouse-type buildings. A set of train tracks intersects these buildings, for direct loading/unloading onto the train cars. In some cases, it is assumed that these loads then passed through Taylor Yard.

- Numerous facilities were identified on the databases searched by EDR in the vicinity of Taylor Yard. These facilities could have a potential environmental impact on the soil and groundwater at Taylor Yard and in the Los Angeles River. The following facility types were identified within one mile of Taylor Yard: 11 LUSTs; 13 generators of hazardous waste; and at least 25 active USTs. The most notable facilities in terms of proximity to Taylor Yard and the Los Angeles River, environmental impact, and database classifications include: Valley Plating Works, Inc., Nelson Nameplate Company, Hurst Graphics, Inc., and Safety Kleen Corp.

- Taylor Yard is within the SFVGWB, an area of contaminated groundwater that is on the NPL. The SFVGWB contains concentrations of TCE and PCE above the federal standard for drinking water.

- Previous environmental investigations conducted at Taylor Yard indicate that soil and groundwater beneath the Active Yard are impacted with petroleum hydrocarbons, VOCs, SVOCs, and metals. PCE and TCE have been identified at concentrations above the regulatory limits in groundwater from 40 to 100 feet bgs.

- Results of environmental investigations have revealed a lack of direct correlation between VOC-impacted soil on the Active Yard and VOC-impacted groundwater beneath the Active Yard. Therefore, the conclusion was drawn that VOCs in groundwater at Taylor Yard are in part from an offsite source or sources.

- There was no evidence of a lined bottom in the portion of the Los Angeles River adjacent to Taylor Yard. According to the USACE, the Los Angeles River through the Glendale Narrows has an unlined bottom due to upward pressure from shallow groundwater. Instead, large derrick stones provide some structural stability throughout this reach.

- Numerous drainage ditches, both manmade and natural, and pipes from Taylor Yard and the surrounding industrial areas were observed in aerial photographs draining directly into the river.

During the course of this phase of the study, MBE reviewed the ULARA Watermaster Service report for the 1998 to 1999 water year (ULARA Watermaster, 2000). The following statements were included in this report:

> "The City of Los Angeles Department of Water and Power Pollock Wells Treatment Plant was placed into service on March 17, 1999. This 3,000 gpm facility located in the Los Angeles River Narrows area restores the use of two existing Pollock production wells by treating the groundwater with Liquid-Phase Granular Activated Carbon (GAC). The GAC removes the volatile organic compounds (VOCs), the supply is chlorinated, and blended with imported supplies to reduce nitrate. Restoring the use of the Pollock wells will reduce groundwater levels in a localized area near the Los Angeles River and [eliminate excessive] rising groundwater discharges to the river, thus preserving Los Angeles' water rights of up to 3,000 acre feet per year. A total of 1,513 AF were treated in the 1998-1999 water year." (ULARA Watermaster, 2000; Pages 1-9 and 1-10)
>
> "*Pollock Wells Treatment Plant Project* – The 3,000 gpm City of Los Angeles Pollock Project was dedicated on March 17, 1999. The treatment plant restores Pollock Wells No. 4 and No. 6 to operation. The Pollock Project's focus is to reactivate the Pollack Well Field, to reduce rising groundwater flowing past gaging station F-57C-R, and to capture nearly all of the contamination upgradient of the wellfield and prevent migration of any contaminated groundwater into the Los Angels River." (ULARA Watermaster, 2000; Page 3-8)

Information concerning the complete technical documentation resulting from this portion of the study is given in Appendix A.

2.0 PROJECT REVISIONS, RESEARCH AND DATA COLLECTION

2.1 PROJECT REVISIONS

Based on results of the *Environmental Records Review*, it appeared necessary to modify the project scope. The original project outline assumed that the Los Angeles River was a "gaining river" (i.e., fed by groundwater). Therefore, the project was to include shallow subsurface sampling of the groundwater beneath the river in three locations proximal to Taylor Yard. However, the information given in the ULARA Watermaster report suggested that this sampling effort would not yield valuable information because the groundwater and surface water were perhaps not commingled or at least not at depths accessible by the proposed methodologies. The scope was therefore modified to determine the interaction between groundwater and surface water by developing a groundwater model. On August 31, 2001, the first draft of a revised proposal was submitted to the LASGRWC and the SCC for review. Subsequent discussions with the LADWP indicated that the influence of the Pollock Well Field was most likely limited to the northern boundary of Taylor Yard. Therefore, it was possible for shallow interaction between the groundwater and surface water within the Los Angeles River. However, the proposal to develop a model instead of conducting limited water sampling was maintained because of the wider application potential of the model to evaluate the alternatives described in Section 2.1, and to evaluate long-term effects for any system modification. The final draft of the revised scope was approved on November 20, 2001.

The Union Pacific Railroad Company (UPRC), owners of the Active Yard, were contacted several times by MBE during the months of December 2001 and January 2002 requesting access to existing wells along the river edge and within the Active Yard. UPRC refused any access for MBE personnel. The River Project met with DTSC management and staff and requested their assistance with the UPRC. The DTSC met with the UPRC and on January 22, 2002, made a formal request to UPRC to allow the placement of gauging equipment in specific wells at Taylor Yard. Finally on February 6, 2002, UPRC agreed to allow pressure transducers (i.e., equipment that continually measures groundwater levels) to be placed in six wells at the site.

2.2 RESEARCH AND DATA COLLECTION

In December 2001, MBE conducted research of documents at the DTSC to gain an understanding of the subsurface lithology and groundwater conditions at Taylor Yard. Groundwater models are based primarily on subsurface geology and groundwater information (water levels, chemistry, flow properties). The groundwater/surface water flow model of Taylor Yard was created using this information, specifically soil boring logs from previous investigations (for soil type to 50 feet bgs) and historic and recent groundwater monitoring data. In addition, historic precipitation data and river flow data for the Los Angeles area were reviewed. Only one permanent gauging station was found in the Los Angeles River in the vicinity of Taylor Yard; this was in operation until 1979. Data from this station were reviewed to evaluate historic conditions in the Los Angeles River.

3.0 FIELD ACTIVITIES

3.1 INSTALLATION OF SURVEY GAUGING POINTS

On December 13, 2001, six survey gauging points were installed along the eastern bank of the Los Angeles River, adjacent to Taylor Yard. The survey was conducted by W. Tom Foster Surveys, a California-licensed surveyor. The elevations and locations of the points were recorded for use during surface water gauging events. The points were placed along stretches of the river where water comes in contact with the concrete sidewall of the river, and corresponding to groundwater flow sections of monitoring wells within Taylor Yard. The surface water elevations were calculated using the survey points. These elevations were subsequently used in the groundwater model to determine the relative elevation of surface water relative to the groundwater. The survey locations are shown on Figure 2. A copy of the survey data is included in Appendix B.

3.2 SURFACE WATER ELEVATION MEASUREMENTS

On February 18, March 7, and March 12, 2002, surface elevations of the Los Angeles River were recorded using the six survey gauging points along the edge of the river bank. The water levels were recorded by taking a measuring tape from the top of the bank and measuring down to the surface of the water. Then, the angle of the bank was measured. The surface water elevations at the six points were then calculated using these data. The water measurements on February 18th and March 7th were recorded following rainfall events in the Los Angeles area. The data collected on March 12th was during what was considered to be a normal period of flow for the river (i.e., no recent precipitation to increase runoff). The river surface elevations are summarized in Table 1 and shown on Graph 1. A description of the general field procedures and copies of the field data sheets are included in Appendix C.

3.3 GROUNDWATER ELEVATION MEASUREMENTS

On February 6th, transducers were placed in Wells W-23, W-19, W-31, W-11, W-32, and W-1 at Taylor Yard (Figure 2). One additional transducer was placed in Well W-31 to measure baseline barometric pressure for the duration of the study. The transducers continuously logged the groundwater levels in these wells from February 6th through March 14th. The groundwater elevations are shown on Graphs 2 through 7. The general field procedures, along with a description of the transducers, are included in Appendix C and the baseline barometric measurements are included in Appendix D.

4.0 GROUNDWATER MODEL

A computer model of the Taylor Yard aquifer system was developed to predict the interaction of surface water with that of the local groundwater, and to be utilized for determining the potential stresses or modifications each alternative outlined in Section 2.1 may have on the hydrological system. Details concerning the computer model were presented to the LASGRWC on February 20, 2002. A copy of the presentation is included as Appendix E. The model used was *Modflow*, a U.S. Geological Survey modular finite-difference groundwater flow model. The version used for this model is *Visual Modflow 2.3* by Waterloo Hydrogeologic, Inc.

The model simulates flow in three dimensions. Flow associated with external stresses, such as wells (pumping or injection), aerial recharge (precipitation), or evapotranspiration can also be simulated. For the Taylor Yard groundwater flow model, only areal recharge and evapotranspiration were used as external stresses. The three-dimensional model of the Taylor Yard aquifer system was calibrated to conform to known basin geometry and established groundwater conditions and parameters, which included the groundwater – surface water interaction with the Los Angeles River. Because the Los Angeles River is the focal point of concern, the determination of the interaction of the river with the associated groundwater aquifer was dependent on the information (data) collected on-site. These data were used in the subject site model of the river and local groundwater. The model utilized the data as the dynamics within the riverine system changed

The domain of the model covers an approximately square region of 4,680 by 4,659 feet. First, the subject site was divided into 64 rows (running east – west) and 54 columns (running north-south) to comprise the horizontal grid coverage of the model. The model was then divided into four distinct vertical hydrostratigraphic layers. These units vary in thickness and geologic makeup. Each layer was mapped from boring log records from various reports (ERM, 1998, 1999, 2000, and 2001). The various layers were individually plotted over the subject site and then gridded for input into the model. The hydrogeologic parameters for the four distinct vertical layers of the model are explained in detail later in the report

For each layer a set of hydraulic parameters were determined. The hydraulic conductivity (K) for each layer is broken into K_x, K_y and K_z. Typically, the vertical conductivity is one to two orders of magnitude less than the horizontal conductivity. Additionally, the specific storage (S_s = volume of water that a unit volume of aquifer releases from, or takes into, storage under a unit of change in hydraulic head) and specific yield (S_y = volume of water that an unconfined aquifer releases or takes into storage per unit surface area of aquifer per unit change in the level of the water table) of the material are calculated. Because no such data exist on the sediments at Taylor Yard, it was calculated based on sediment type (Driscoll, 1986 and Fetter, 1994). The other important input for each layer was the effective porosity (or the volume of interconnected pore space through which water can flow in a geologic medium divided by the total volume of the medium) and total porosity (the volume of pore spaces in a porous geologic medium divided by the total volume of that medium) of the material comprising the various layers. This information was again found through general soil characteristics. To help in the determination of the layers, all the soil parameters in the boring logs from the subject site were analyzed. The basic soil classifications provided insight as to which values should be used for the various materials and layers.

The groundwater flow model was designed to reflect the existing geologic and hydrogeologic conditions of the subject site. The bottom of the model was designed to be bedrock at an elevation of 200 feet above mean sea level. This was done to establish the hydrological bottom boundary of the model. The depth to bedrock was determined from Bulletin 104, CDWR-Southern District. The surface elevations ranged from a 350 to 380 feet above mean sea level and were brought into the model from existing site survey data. Areas residing outside the Active Yard were set as inactive. The boundaries between active and inactive areas were designated with a general head boundary. This allowed for flow into and out of the model based on head (groundwater) fluctuations within the active area of the model to guide the overall flow. The main groundwater-influencing boundary used for this model was the Los Angeles River, which was modeled with a riverbed conductance of 0.025 ft/day (rate at which water will move into and out of the bottom of the river). This was established from a previous groundwater model conducted on the SFVGWB within the ULARA by the LADWP. To represent the SFVGWB, a river boundary condition was modeled in the first layer of the model. A river boundary condition adds or removes water from a model based on hydrologic conditions and may also affect groundwater migratory paths in varying degrees based on the physical properties of the river (river bed conductance). Head and discharge properties of the Los Angeles River were based on field measurements through the study.

Precipitation was introduced to the system based on the average rainfall for Los Angeles of 15.11 inches per year. This is based on CDWR <http://cdec.water.ca.gov> data for past 121 years. During the monitoring period, two rain events were recorded. They occurred on February 17th (0.41 inches of rain) and March 4th (0.18 inches of rain). Evapotranspiration was set at 50 inches annually with an extinction depth of 10 feet <http://wwwdpla.water.ca.gov/cimis/cimis/hq/normatbl.txt>.

Results of the calibrated MODFLOW model indicate that a communication between the river and the associated aquifer system does exist (during the timeframe of this investigation). In the very upper portion of the aquifer, the model demonstrates that the river is gaining (groundwater is moving into the river). However, with an increase in depth (vertically downward in the flow model), the groundwater moves through the system with little to no effect on or from the river system. It should be noted that the model was only calibrated to conditions that existed during the time of monitoring. Due to the dynamics of the system that was modeled, conditions can change with time. Information concerning the complete technical document resulting from this study is given in Appendix F.

5.0 FINDINGS AND CONCLUSIONS

Based on previous environmental work, historic records research, groundwater and surface water gauging data, and the groundwater model developed from the information contained within this report, the findings of this investigation are as follows:

- Groundwater in the subsurface of Taylor Yard is contaminated with VOCs and metals from both onsite and offsite sources. Onsite contributions could cease when Railroad maintenance operations stop. Offsite sources may continue to be of concern unless regulatory monitoring increases or land uses change.

- The general groundwater flow beneath Taylor Yard is to the south-southeast. Therefore land uses along San Fernando Road, in particular north of Division Street, have strong potential impact.

- Depths to groundwater at Taylor Yard generally range from 20 to 35 feet bgs. This may guide future alternative choices at the site.

- Data collected during the two surface water gauging events following rainfall showed only a slight increase in water levels in the Los Angeles River.

- Data collected in the six groundwater wells at Taylor Yard showed a slight increase in groundwater elevations following rainfall events indicating that there is communication between surface and groundwater.

- The groundwater model shows that local groundwater in the shallow aquifer generally flows toward the Los Angeles River. However, with deeper levels of the model, the groundwater flow is not upward but parallel to the river. This may suggest that the contamination in the deeper sections of groundwater is not being introduced into the river.

Based on the surface water levels in the Los Angeles River, and the groundwater levels obtained from wells on Taylor Yard, it appears that the groundwater and surface water are in communication. The groundwater model indicates that the stretch of the Los Angeles River along Taylor Yard is a gaining reach of the river during the period of study. Yet the dynamics of contaminant transport suggest that groundwater pollutants may not contribute contamination to the surface waters near Taylor Yard because of stratification in the aquifer layers. Pertinent information in this regard may be forthcoming from water quality studies recently undertaken by the South California Coastal Waters Research Project (SCCWRP) in developing a TMDL Model for the Los Angeles River.

Though the groundwater model is useful in evaluating the existing (current) conditions of the Los Angeles River and adjacent Taylor Yard area, the data collection period was short in duration and occurred during an atypically dry year. Although Taylor Yard contains many groundwater monitoring wells, most have only penetrated the uppermost portion of the aquifer. As a result, the geology at depth was generalized when creating the model. Typically, riverine areas have interbedded sediments of various hydraulic conductivities (gravels, sand, silts and clay) due to a river's course change over time. A longer water level monitoring period could include seasonal changes that affect the groundwater flow over time. Finally, the unlined bottom of the river changes with time (i.e. sand bars move). This change in river bottom elevation and sediment type plays a large role in the interaction of river water with the groundwater aquifer.

A longer monitoring period, a better understanding of the deeper soil types (i.e., information from deep wells which is currently not available), and more information on the river bottom morphology or average river bottom elevation will allow the model to be updated, thereby replacing many of the assumptions that had to be used in the absence of complete empirical data.

This model provides a base for the understanding the existing (current) groundwater and surface water conditions at Taylor Yard and the Los Angeles River, and can eventually be used to predict what each potential restoration alternative's influence may be on the surface/groundwater system. By including the parameter of a specific modification into the model, the system reactions can be predicted. This can allow for the identification of potential problems and/or benefits associated with any regime modification.

6.0 STATEMENT OF LIMITATIONS AND PROFESSIONAL CERTIFICATION

This report was prepared for the sole purpose of the Proposition 204 project for which it was designed. Any other use without the written consent of Miller Brooks Environmental, Inc. (Miller Brooks) is prohibited. The conclusions and recommendations presented herein are based solely upon the agreed upon scope of work outlined in this report. Miller Brooks makes no warranties or guarantees as to the accuracy or completeness of information provided or compiled by others. It is possible that information exists beyond the scope of this investigation. Additional information, which was not found or available to Miller Brooks at the time of writing this report, may result in modification of the conclusions and recommendations presented. This report is not a legal opinion. The services performed by Miller Brooks have been conducted in a manner consistent with the level of care ordinarily exercised by members of our profession currently practicing under similar conditions. No other warranty, expressed or implied, is made.

This investigation/project was supervised or personally conducted by the licensed professional whose signature and license number appears below.

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W. Richard Layton, Ph.D.

March 31, 2002

MILLER BROOKS ENVIRONMENTAL, INC. PROJECT NUMBER 01-442-0001-01

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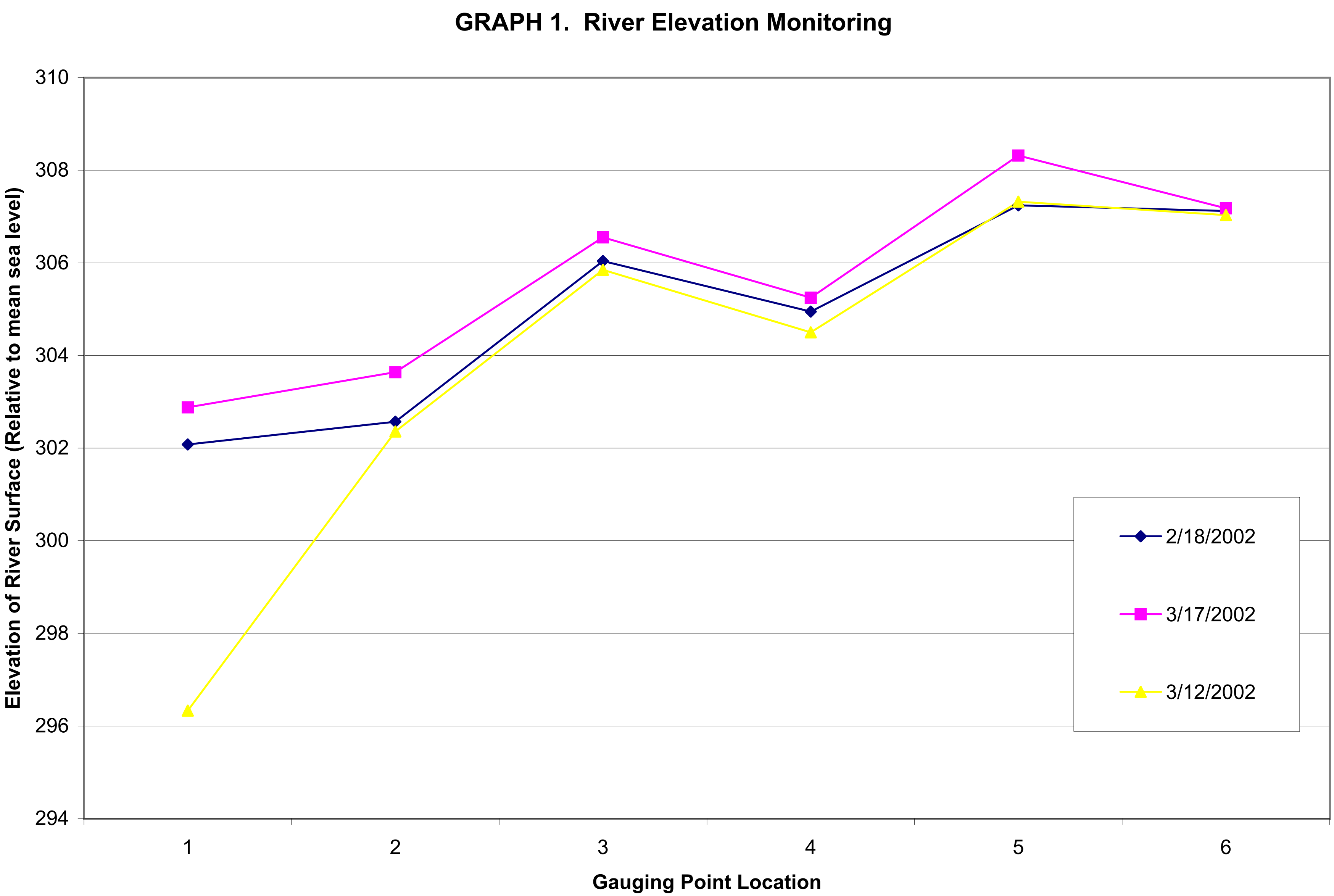
TABLE 1. LOS ANGELES RIVER SURFACE WATER ELEVATIONS

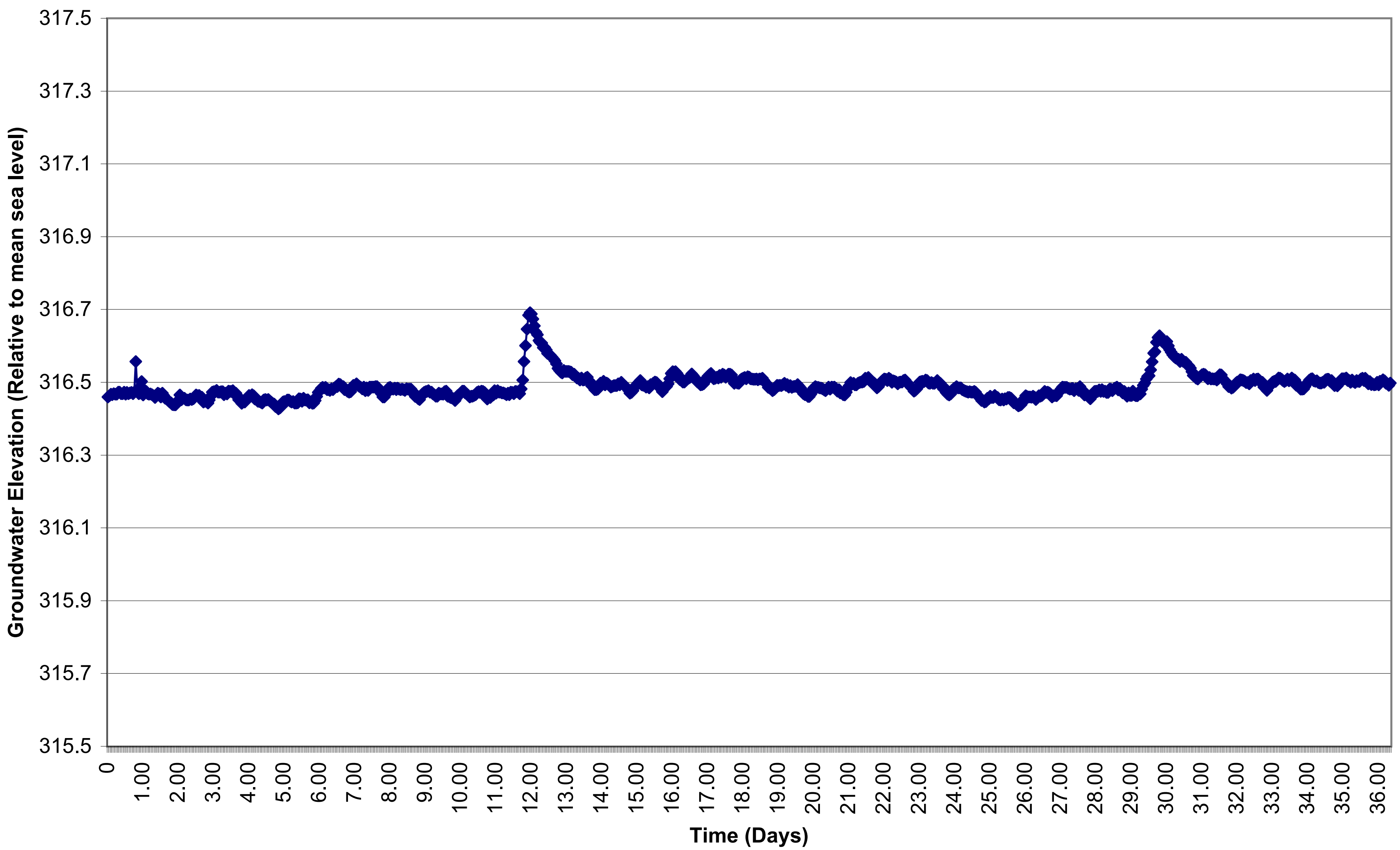
Point No.	Date	Point Elevation (ft msl)	Surface Water Elevation (ft msl)
1	2/18/2002 3/7/2002 3/12/2002	337.33	302.08 302.88 296.33
2	2/18/2002 3/7/2002 3/12/2002	338.86	302.57 303.64 302.36
3	2/18/2002 3/7/2002 3/12/2002	340.20	306.04 306.55 305.85
4	2/18/2002 3/7/2002 3/12/2002	340.95	304.95 305.25 304.50
5	2/18/2002 3/7/2002 3/12/2002	343.07	307.24 308.32 307.32
6	2/18/2002 3/7/2002 3/12/2002	345.03	307.12 307.18 307.03

Notes:
ft msl- feet relative to mean sea level

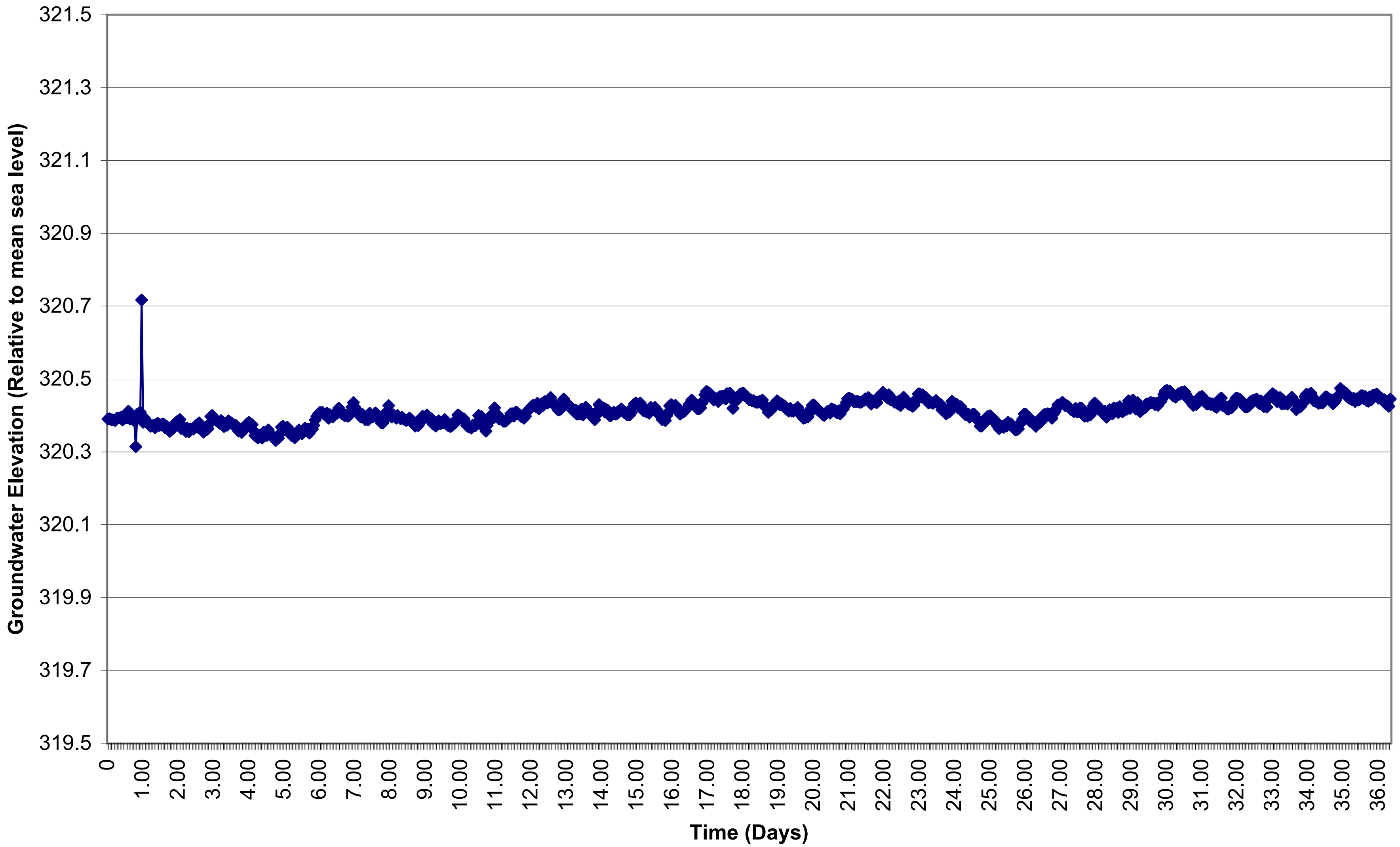


GRAPH 1. River Elevation Monitoring
Elevation of River Surface (Relative to mean sea level)
310
308
306
304
302
300
298
296
294
1
2
3
4
5
6
Gauging Point Location
2/18/2002
3/17/2002
3/12/2002

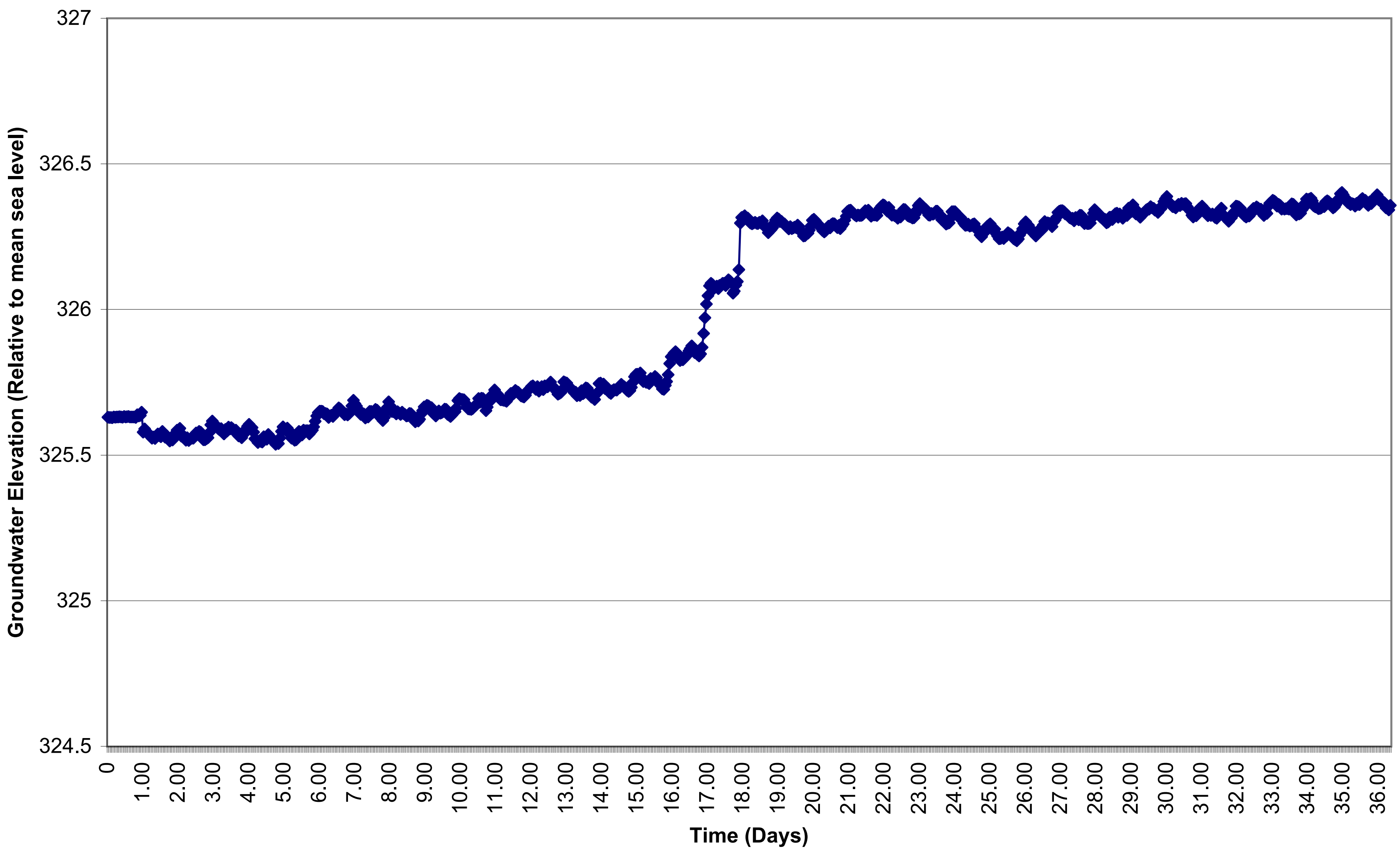
GRAPH 2. W-23 Water Levels (2/5/02 - 3/13/02)



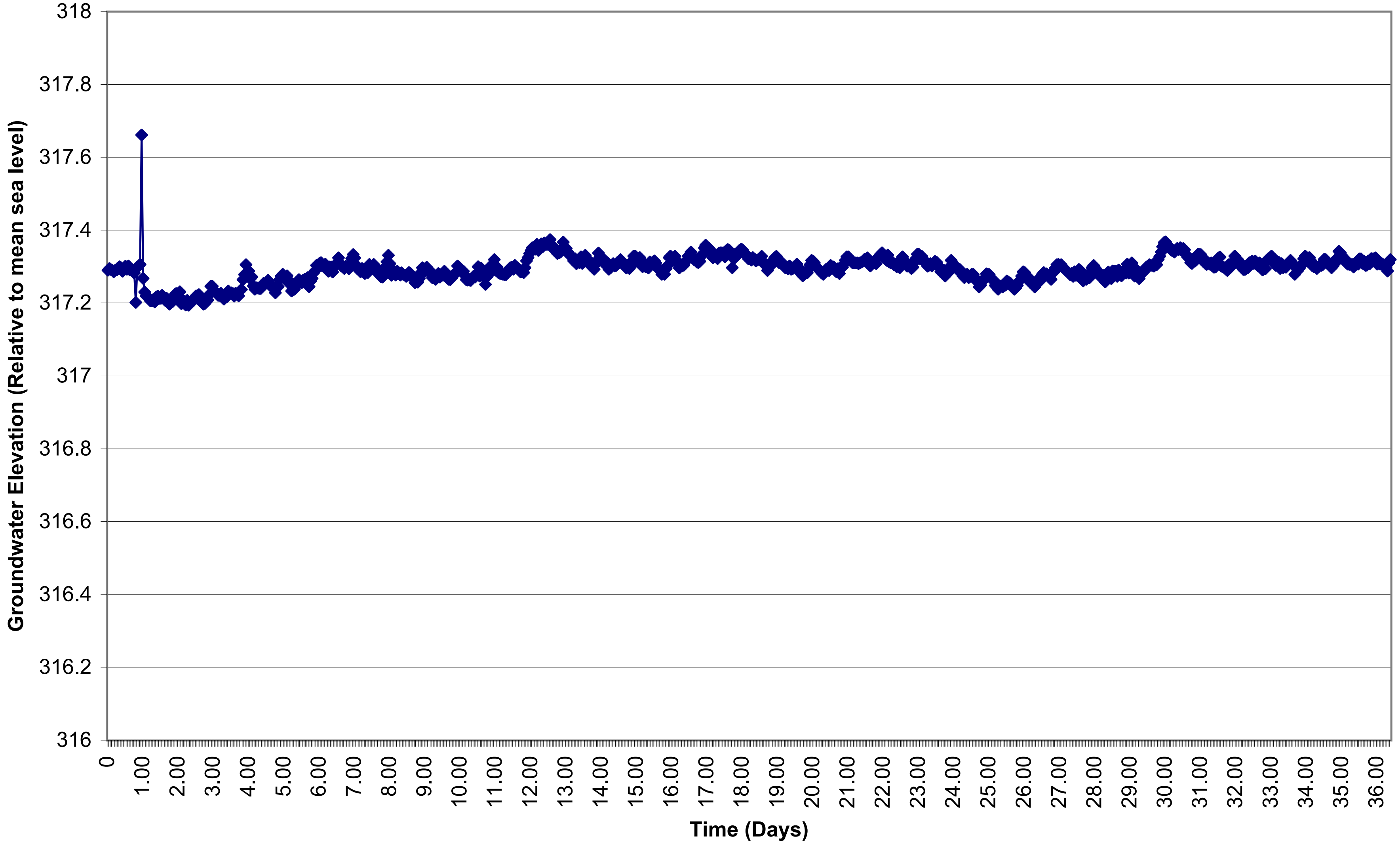
GRAPH 3. W-1 Water Levels (2/5/02 - 3/13/02)



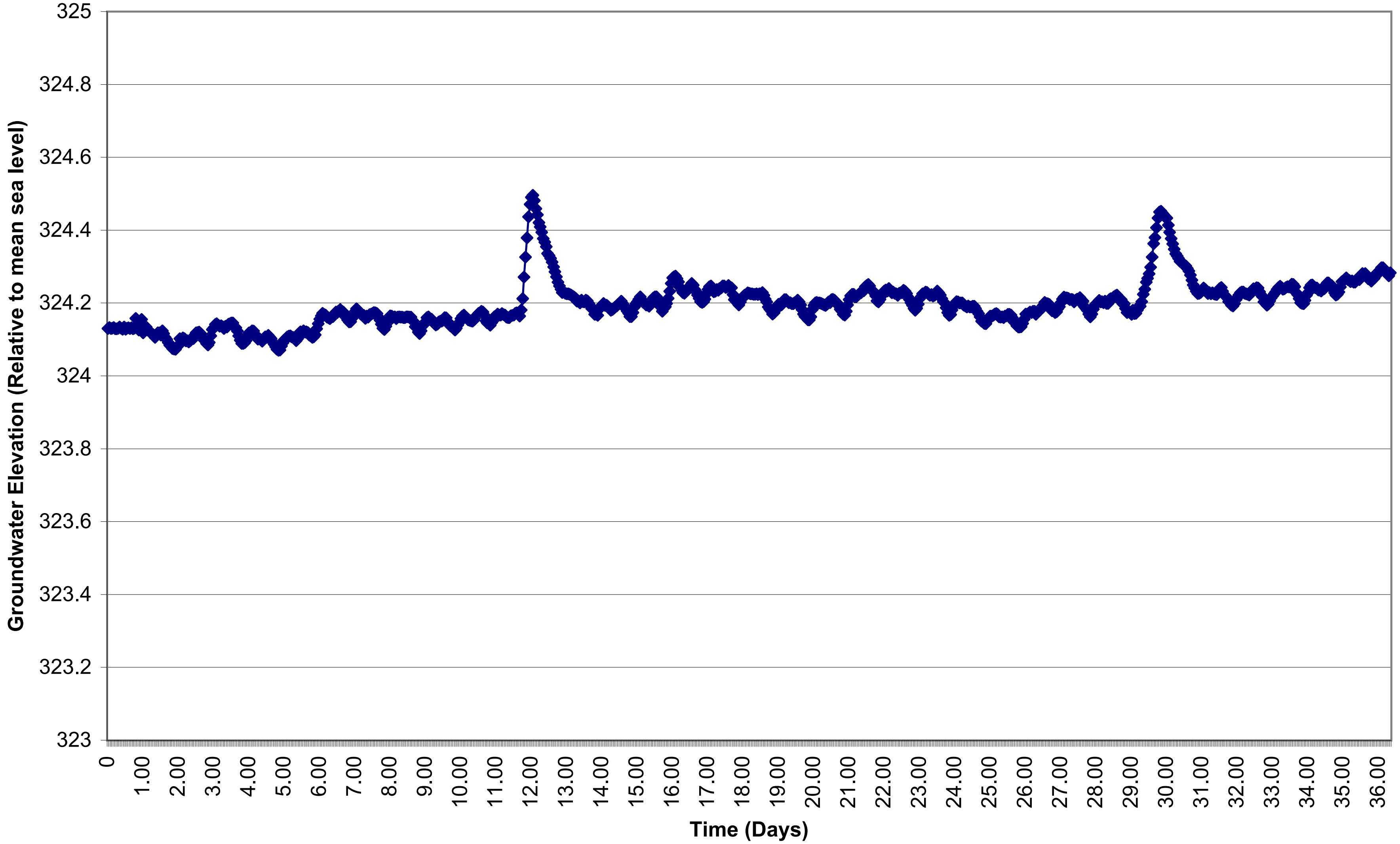
GRAPH 4. W-11 Water Levels (2/5/02 - 3/13/02)



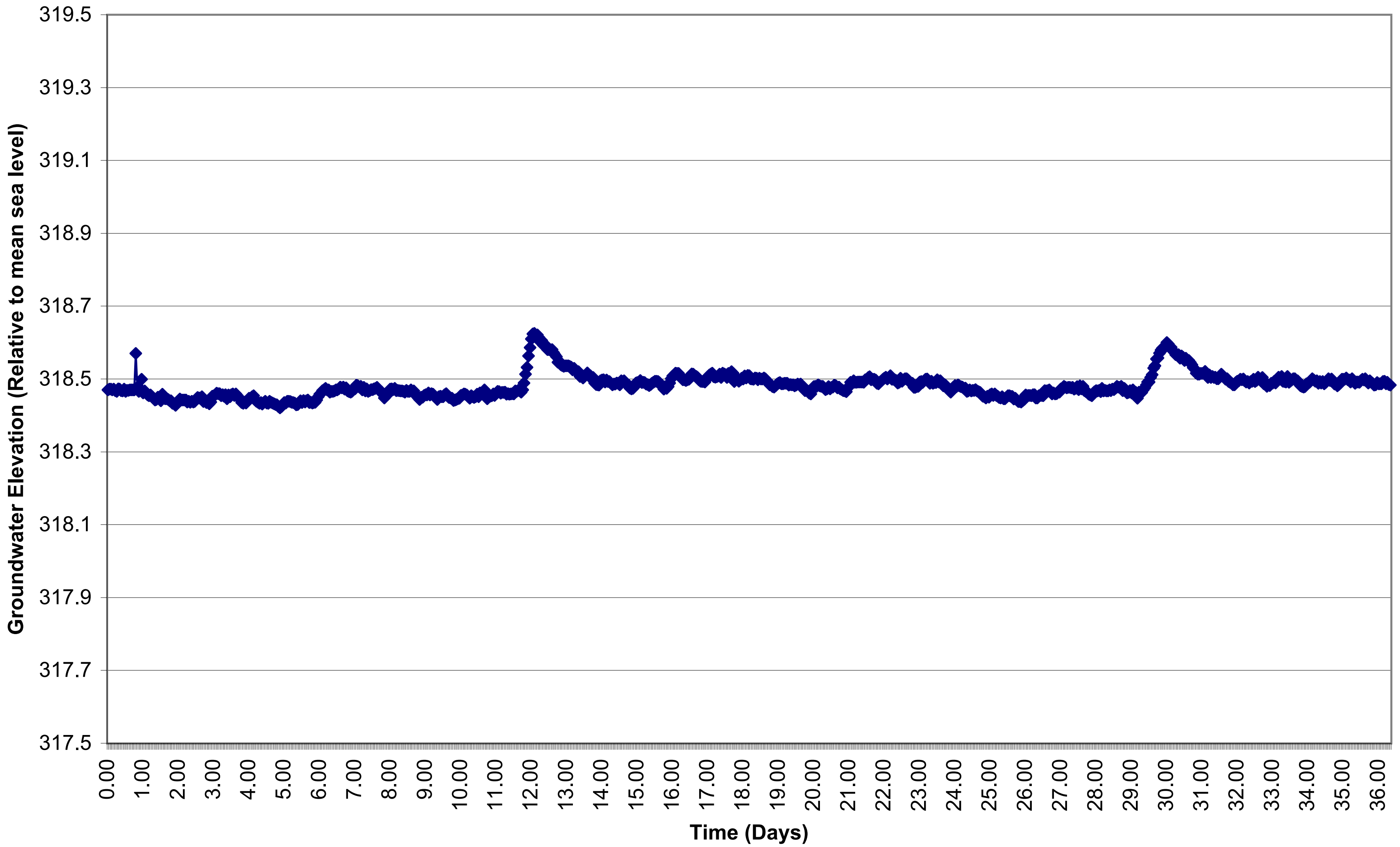
GRAPH 5. W-32 Water Levels (2/5/02 - 3/13/02)



GRAPH 6. W-31 Water Levels (2/5/02 - 2/13/02)



GRAPH 7. W-19 Water Levels (2/5/02 - 3/13/02)



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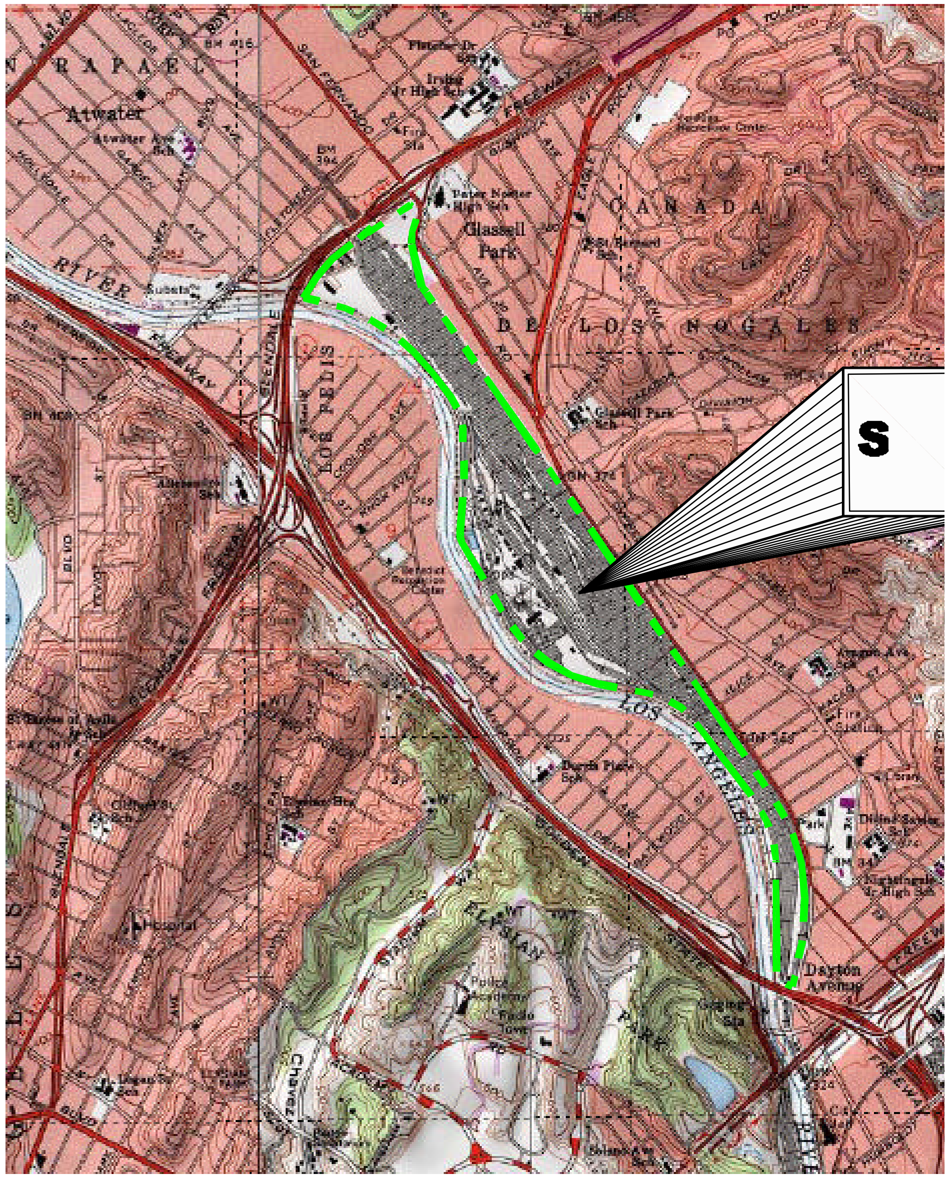

FROM: U.S. GEOLOGICAL SURVEY, 1981
QUADRANGLE: LOS ANGELES
COUNTY: LOS ANGELES
SERIES: 7.5-MINUTE QUAD

NOTE: ALL BOUNDARIES AND LOCATIONS ARE APPROXIMATE

MILLER BROOKS Environmental, Inc.	DRAWN BY: PEL DATE: 03/27/02 REVISED BY: PEL	VIC
18700 BEACH BLVD., SUITE 205 HUNTINGTON BEACH, CA. 92648 (714) 965-9161	REVISED: 04/17/02 APPROVED BY: EAR	LOS A TA
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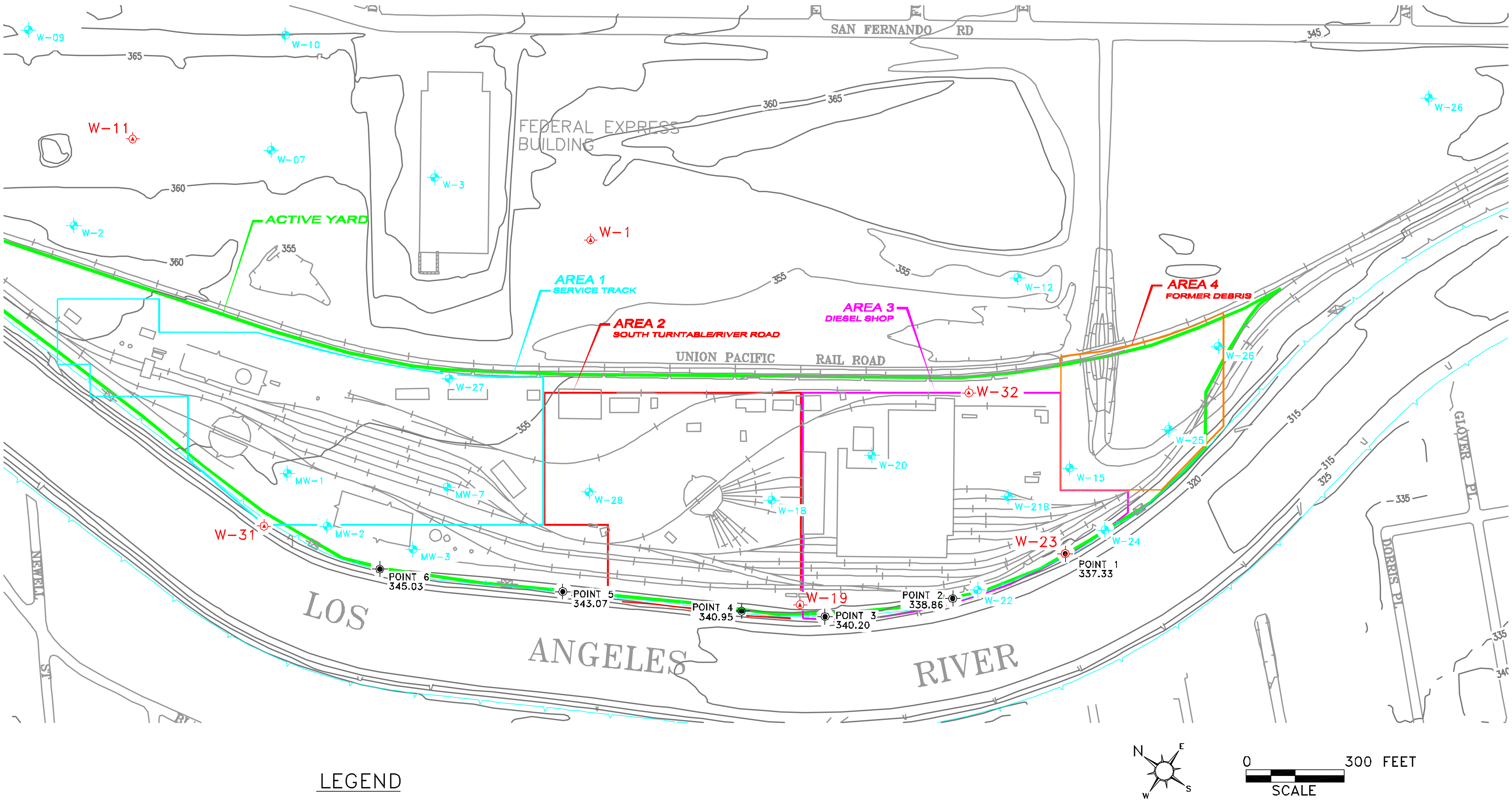

LEGEND

W-3	GROUNDWATER MONITORING WELL
W-1	GROUNDWATER MONITORING WELL WITH PRESSURE TRANSDUCER
POINT 6 345.03	SURVEY POINTS WITH ELEVATION (FEET ABOVE MEAN SEA LEVEL)
	CULVERT
315	SURFACE ELEVATION CONTOUR (FEET ABOVE MEAN SEA LEVEL)

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DATE:	03/27/02
REVISED BY:	PEL
REVISED:	04/17/02
APPROVED BY:	EAR
DATE:	04/17/02

SITE MAP
ACTIVE YARD/LOS ANGELES RIVER

LOS ANGELES RIVER AT TAYLOR YARD

FIGURE 2

FILE: K:\DWGS\THE RIVER PROJECT\SITE MAP

DATE PLOTTED: 04/17/02

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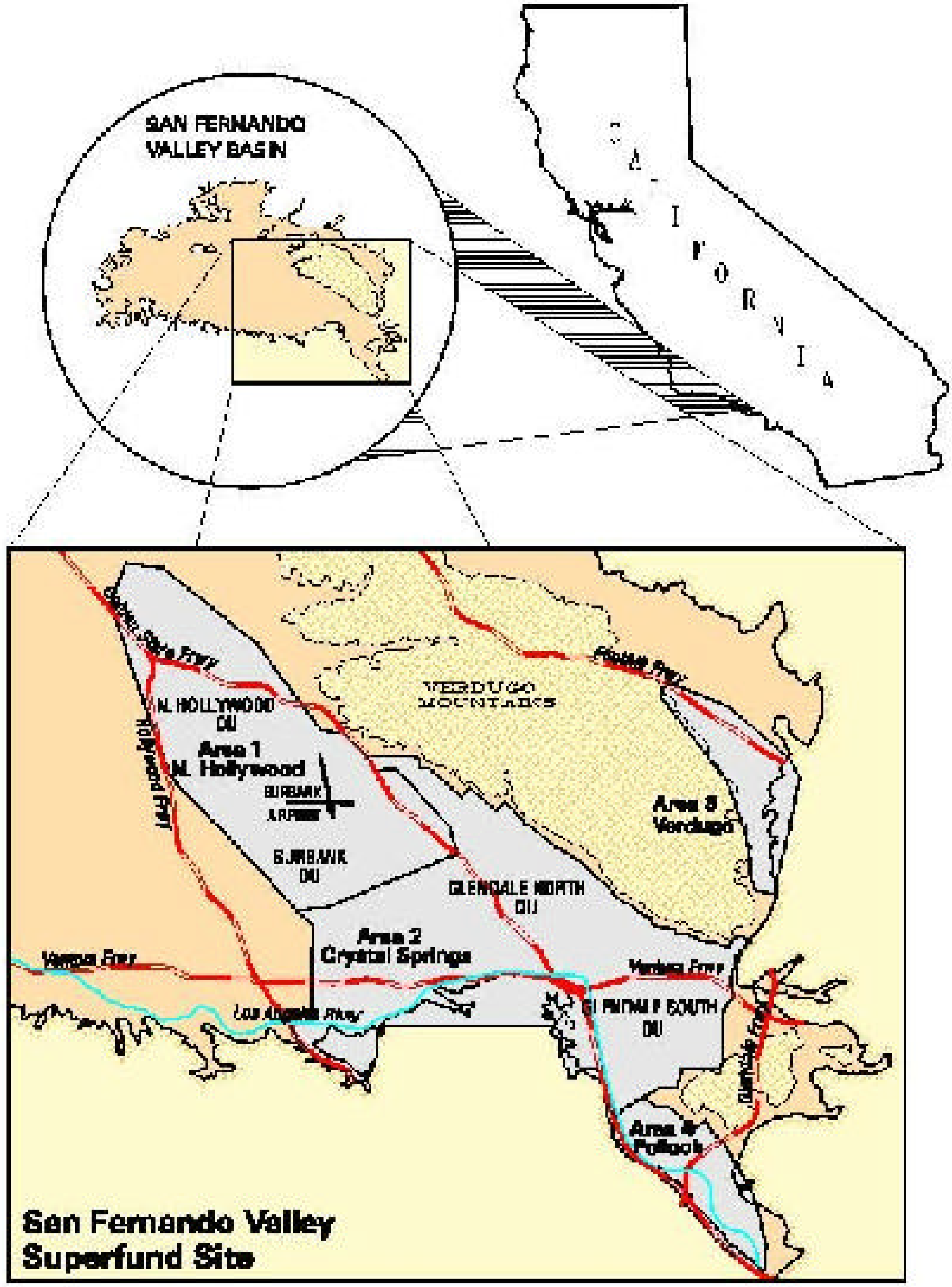

SOURCE: HTTP://WWW.EPA.GOV/REGION09/WASTE/SFUND/NPL/SANFERNANDO/LOCMAP.HTM

MILLER BROOKS Environmental, Inc.	DRAWN BY: PEL DATE: 04/16/02 REVISED BY: PEL	SAN FERNANDO VALLEY SUPERFUND SITE	FIGURE 3
18700 BEACH BLVD., SUITE 205 HUNTINGTON BEACH, CA. 92648 (714) 965-9161	REVISED: 04/17/02 APPROVED BY: EAR	LOS ANGELES RIVER AT TAYLOR YARD	
PROJECT NO. 01-442-0001-01	DATE: 04/18/02	FILE: K:\DWGS\THE RIVER PROJECT\SITE MAP DATE PLOTTED: 04/18/02	