REPORT

Bo 000027
STID 6711

MAR 1 2 2001

CONSTRUCTION RISK MANAGEMENT PLAN

PHASE 1, GLEN ECHO CREEK CULVERT RECONSTRUCTION PROJECT OAKLAND, CALIFORNIA

Prepared for
Winzler and Kelley Consulting Engineers
2000 Pine Street, Suite 600
San Francisco, California 94104-2709

March 6, 2001

URS
500 12th Street, Suite 200
Oakland, California 94607

51-951273NC.00

URS

March 6, 2001
51-951273NC.00

Ms. Susan Hugo
Alameda County Health Agency
Division of Environmental Protection
1131 Harbor Bay Parkway, 2nd Floor
Alameda, California 94502

RE: Construction Risk Management Plan
Glen Echo Creek Culvert Reconstruction Project
Oakland, California

Dear Ms. Hugo:

URS Corporation (URS) is pleased to present the attached Construction Risk Management Plan to address handling of petroleum impacted soil and groundwater during the Glen Echo Creek culvert reconstruction project. This plan includes the following elements:

- Health and safety for construction workers
- Soil management
- Post excavation soil sampling
- Groundwater Management
- Dust control
- Storm water management
- Reporting requirements

The project is anticipated to begin in May of 2001. If you have any questions, please call the undersigned.

Albert P. Ridley, CEG
Environmental Task Leader

Mary Esper, P.E.
Project Manager

Attachment: Construction Risk Management Plan, Phase 1, Glen Echo Creek Culvert Reconstruction Project

URS Corporation
500 12th Street, Suite 200
Oakland, CA 94607-4014
Tel: 510.893.3600
Fax: 510.874.3268

REPORT

CONSTRUCTION RISK MANAGEMENT PLAN

PHASE 1, GLEN ECHO CREEK CULVERT RECONSTRUCTION PROJECT OAKLAND, CALIFORNIA

Prepared for
Winzler and Kelley Consulting Engineers
2000 Pine Street, Suite 600
San Francisco, California 94104-2709

March 6, 2001

URS
500 12th Street, Suite 200
Oakland, California 94607

51-951273NC.00

TABLE OF CONTENTS

TABLE OF CONTENTS

Glen Echo Creek flows through the City of Oakland, generally parallel to Broadway, and into Lake Merritt and consists of a series of closed conduits interspersed with sections of open channel. Near 29th Street, the creek enters an arch culvert and flows underground in a series of culverts, pipes and short stretches of open channel for approximately 2,700 feet until emptying into Lake Merritt. Project stationing was established with Station 0+00 at Lake Merritt. Channel hydraulics were evaluated in 1996 by Winzler & Kelly and the results indicated that the 25-year and 100-year storm events would cause short-term, but widespread flooding along certain sections of the creek. In order to reduce flooding, the Alameda County Flood Control and Water Conservation District (The District) decided to perform several improvements on the creek system.

In 1996, Woodward Clyde Consultants (now URS Corporation), completed an evaluation of the integrity of the existing arch culvert and whether the existing arch culvert should be replaced or rehabilitated (Woodward Clyde Consultants, 1996). Alameda County elected to pursue the rehabilitation option and Winzler & Kelly initiated preliminary design activities. In 1998, a geotechnical investigation was performed for both the Phase I area and a Phase II project located north of the project site near 30th Street (not included in the current project scope). The investigation included five exploratory borings, three in the Phase 1 area and two in the Phase II area (Woodward-Clyde, 1998). Two additional exploratory borings were drilled in July 1999 to further evaluate the subsurface conditions along the arch culvert and CMP (URS Greiner Woodward-Clyde, 1999). Finally, based on project changes that resulted in a new lower invert design elevation for the arch culvert, shallow soil borings were advanced in the sidewalls and invert at five stations along the arch culvert. Petroleum hydrocarbon contamination was encountered and further investigated south of 29th St. during this investigation (URS, 2000).

1.1 PROJECT DESCRIPTION

The Phase 1 project alignment extends a total distance of about 422 feet from Station 27+02 (upstream) to Station 22+80 (downstream). Starting at the upstream end of the alignment, the existing arch culvert is about 277 feet long with inside dimensions of about 8¼-feet high by 7-feet wide. Immediately downstream of the arch culvert, the creek is contained in a 103 foot section of 84-inch diameter corrugated metal pipe (CMP) that ends in a cul-de-sac near 28th St.

The current project includes enlarging the arch culvert and CMP sections, constructing transition sections on both ends and between these two sections, and numerous other supporting elements of work. For discussion purposes, the alignment is divided into five sections which, along with the envisioned construction methods, are described in this section. A box culvert contains the creek downstream of the CMP Section. With the exception of the two ends of the project, all construction will be performed using underground construction methods in order to minimize noise and disruption to the structures, roads and trees at the ground surface.

Numerous trees (eucalyptus, Douglas fir, coast live oak and pepper) are present along and around the alignment. All of the trees, and significantly, the 54-inch diameter Douglas Fir at Station 23+10, are to remain and not be disturbed during construction work. Creek water will be diverted from the open channel at the upstream end of the project into a closed pipe that will be supported inside the existing arch culvert and CMP section and discharged into the existing box culvert at the downstream end of the project.

1.1.1 RCB to CMP Transition

At the south end of the Phase 1 alignment, the 6-ft wide by 12-ft high existing Reinforced Concrete Box (RCB) transitions to an existing 84-inch diameter Corrugated Metal Pipe (CMP) culvert. This transition section extends from Station 22+80 to about Station 22+92 and will be replaced by a new concrete transition from the existing RCB to a new larger 10-ft (I.D.) diameter culvert. This section will serve as the primary means of access for the enlargement of the 10-ft diameter culvert and the arch culvert section.

1.1.2 CMP Section

The new 10-foot ID section is 103 feet long and extends from about Station 22+92 to Station 23+96. The invert of the new section is about 3 feet deeper than the existing 84-inch CMP culvert. Hand mining is recommended to remove the existing 84-inch CMP culvert. The design is based on using circular steel liner plates for the initial support of the tunnel during excavation, and providing a reinforced shotcrete final lining.

1.1.3 CMP To Arch Culvert Transition

An existing concrete transition section will be removed and a new transition will be constructed between the circular 10-ft diameter culvert and the enlarged arch culvert. Hand mining is recommended to enlarge the transition between Stations 23+96 and 23+99. The design is based on demolition of the existing structure, enlargement of the existing culvert opening and installation of a reinforced shotcrete final lining.

1.1.4 Arch Culvert Section

The existing arch culvert extends 277 feet from Station 23+99 to Station 26+76. The invert of the new arch culvert section is about 3 feet deeper than the existing culvert. The work in this section includes removal of the existing invert and subgrade materials and construction of new reinforced cast-in-place sidewalls and invert. The remaining portion of the arch culvert will be covered with 5½ inches of reinforced shotcrete and will be anchored to the walls of the existing culvert. An existing catch basin and manhole at Stations 25+86 and 26+02 respectively will be connected to the top of the new arch culvert section.

1.1.5 Transition to Existing Open Channel

A 20-ft transition section to the existing open channel extends from Station 26+76 to Station 26+96. This section consists of an open channel section sloped upward from the arch culvert (invert elevation 12.11) to the existing channel (invert elevation 14.12 ft).

1.2 PREVIOUS STUDIES

Four previous geotechnical and culvert evaluation reports have been prepared for the Glen Echo Creek project. A summary of the work performed is presented in this section.

1.2.1 Woodward-Clyde Consultants, Technical Memorandum, August, 1996

Work for this early phase of the project included a field walk through the interior of the culvert, Schmidt hammer rebound testing of concrete strength at 18 locations within the culvert, and coring the concrete walls, invert, and crown at eight locations to obtain thickness and strength data. The concrete coring and testing was performed by Testing Engineers, Inc., a subcontractor to Woodward-Clyde. Woodward-Clyde's Technical Memorandum report provides a preliminary evaluation of replacing or rehabilitating the arch portion of the Glen Echo Creek culvert.

TEI removed eight 3-inch nominal diameter cores from the culvert lining and performed compressive strength testing in accordance with ASTM C42 (dry). TEI also drilled twenty-four 3/4-inch diameter probe holes through the culvert walls to estimate the thickness of the concrete. Eight additional probe holes were drilled inside the CMP. The probe holes were advanced using a HILTI TE 54 hammer drill with a 32" long drill bit. TEI also measured the height and width of the culvert at each station where a probe hole was drilled.

1.2.2 Woodward-Clyde, Geotechnical Engineering Study, Bridge and Floor Walls, July 27, 1998

The scope of this report involved developing geotechnical data and recommendations for both the arch culvert and CMP culvert as well as two proposed bridge structures located near 30th Street.

Five exploratory borings were drilled at the project site at the approximate locations shown in the Boring Location Plan, Figure 2. Boring B-1 was drilled in 29th Street near where the arch culvert crosses the street. Boring B-2 was drilled in the carport located at the cul-de-sac on 28th Street, near the terminus of the CMP. Boring B-3 was drilled in a church parking lot situated above the arch culvert alignment, at the top of the slope approximately 30 feet east and above the 80-inch CMP centerline.

Borings 4 and 5 were drilled near the site of the planned bridges north of and outside the Phase 1 project area. Boring 4 was drilled along the creek bank on Richmond Boulevard on the north side of Glen Echo Creek. Boring 5 was drilled inside the apartment complex at Richmond Boulevard and 30th Street on the south side of Glen Echo Creek. The borings were drilled using rotary wash drilling techniques. All of the borings were approximately 40 feet deep, with the exception of Boring 3 which was drilled to a depth of approximately 70 feet. Two screened-tube piezometers were installed in Borings 1 and 2 to evaluate the groundwater levels.

Samples of the soil were recovered from the borings and transported to our Pleasant Hill laboratory for further inspection and testing. The laboratory testing program on selected samples included moisture content and unit weight, unified compressive strength, particle size analyses and Atterberg Limits. Logs of the exploratory borings were prepared based on soil classifications made in the field and on laboratory test results (see Appendix C). Piezometer construction details including the length of the screened interval and reference to an estimated ground surface elevation are also included on the logs for borings B-1 and B-2.

1.4 GROUNDWATER CONDITIONS

The piezometers installed in Borings 1 and 2 indicated groundwater levels at Elevations 6 ft and 12.5 ft, respectively, based on July 22, 1998 readings and at Elevations 14.5 ft and 12.5 ft, respectively, in January, 2001. Groundwater was encountered during drilling at Elevations 9 ft and 10.5 ft in borings MM-1 and MM-2, respectively. Groundwater was not encountered in the borings cored and sampled through the arch culvert sidewalls in May, 2000, although groundwater was present beneath the invert slab. The invert of the culvert ranges from Elevation 9.9 feet at Station 22+92 to Elevation 12.11 at Station 26+76.

1.5 ENVIRONMENTAL CONDITIONS

The soil and groundwater results were evaluated in terms of potential impact to the environment during the construction phase of the project. Therefore, the soil results for TPH, BTEX and metals have been compared to the Total Threshold Limit Concentration (TTLC), and the USEPA Preliminary Remediation Goals. There are no established regulatory guidelines for TPH gasoline, diesel and motor oil for groundwater or soil. Usually these products are regulated by their constituent BTEX compounds. Since none of these constituents were detected (see below), URS compared the soil results for TPH gas, diesel and motor to the RWQCB target level of 1,000 mg/kg. Groundwater concentrations of compounds were compared to the USEPA PRG's for tap water, and to the California maximum concentration limits (MCL's).

Groundwater analytical results from samples taken at Stations 25+34 and 25+89 are presented in Table 1. No BTEX were detected. Metals were detected in both samples. Concentrations of arsenic, barium, beryllium, cadmium, chromium, lead, nickel, thallium, and vanadium exceeded either the PRG for tap water or the California MCL's in both groundwater samples. Gasoline and TPH-diesel were detected only in sample GW02 (Station 25+34) at a concentration of 1.4 mg/L and 63 mg/L, respectively. TPH-motor oil was detected in both samples at a concentration of 0.39 mg/L in sample GW01 (Station 25+89) and at 180 mg/L in sample GW02 (Station 25+34).

Soil analytical results from samples taken at Stations 25+34 and 25+89 are presented in Table 2. No BTEX were detected and none of the metal concentrations detected in both samples were above the TTLCs. Only arsenic slightly exceeded the PRG for Industrial Soil. Gasoline was detected in sample SS02 (Station 25+34) at a concentration of 7.6 mg/kg. Diesel and motor oil were detected at a concentration of 2.4 and 9.4 mg/kg in SS01 (Station 25+89). In SSO2 (Station 25+34), diesel was detected at a concentration of 1,300 mg/kg and motor oil 2,100 mg/kg.

1.6 ANTICIPATED SUBSURFACE CONDITIONS DURING CONSTRUCTION

Glen Echo Creek culvert was constructed to contain the flow along Glen Echo Creek. It was constructed within or near the existing incised channel. It is not known whether any excavation was performed to construct the culvert, or whether the invert slab was constructed directly upon gravelly sand alluvium. Fill was placed between the sides of the culvert and the canyon slopes and over the crown of the structure to bury it. Fill may also have been placed beneath the invert slab. Due to the slope of the pre-existent creek banks, the soil borings that were drilled outside of the culvert encountered native soils at higher elevations than are present immediately adjacent to the culvert.

While five borings (borings B-1 through B-3, MM-1, and MM-2) have been drilled close to the project alignment, none of these borings penetrated the fill materials immediately adjacent to the exterior concrete surface of the arch culvert or the CMP. Only the exploratory borings cored through the arch culvert walls and invert encountered the backfill materials against the culvert, and therefore, the materials most likely to be encountered during enlargement construction. No sampling was performed behind the walls or invert of the CMP.

The borings cored through the walls of the arch culvert encountered sandy clay and silty clay fill at the upstream portion of the culvert, stations 26+55, 25+89, and 25+34. The borings cored through the walls of the downstream portion of the arch culvert encountered silty sand at stations 24+79 and 24+14. Groundwater was not encountered in the borings cored through the walls of the arch culvert.

Groundwater was encountered in each of the three borings cored through the invert of the arch culvert. Groundwater seepage into these borings caused the silty sand and sand with gravel materials exposed there to flow into the borings upon removal of the sampler. It should be anticipated that groundwater will be present within all of the excavations made for this project.

Based on the chemical analytical soil and groundwater data obtained from Stations 25+34 and 25+89, relatively low levels of petroleum related contamination should be expected. The extent of the impacted soils is not known although the soil below the invert at Station 26+55 showed no visible evidence of impact.

The Alameda County Health Agency, Division of Environmental Protection should be notified if unexpected environmental conditions are encountered during construction.

1.7 CONTAMINATED SOILS AND GROUNDWATER

The hydrocarbon-impacted soil and groundwater encountered below the arch culvert invert at Stations [redacted] and 25+89 will require special handling procedures during construction. It is envisioned that groundwater removed during construction will be discharged to the storm sewer under the provisions of a National Pollution Discharge Elimination System (NPDES) permit. Analytical testing of all groundwater removed during dewatering operations is recommended to assess whether treatment is necessary. Water that does not meet the limits set forth in the NPDES permit would need to be treated on-site prior to discharge back into the storm sewer. Impacted soils should be disposed in an appropriate land disposal facility. An alternative discharge to the sanitary sewer under permit from EBMUD may be selected by The District.

1.8 GROUNDWATER CONTROL

Saturated poorly graded cohesionless soils are expected to be present beneath the culvert alignment exhibit "flowing ground condition" during excavation. Drilling the boreholes through the cohesionless alluviums underneath the invert of the arch culvert section of this project was made difficult due to caving of the borehole walls upon removal of the soil sampler (URS 2000). The fill material, anticipated to be present along the existing culvert sidewall and crown areas are described primarily as granular soils, which are anticipated to behave as "slow to fast raveling ground" above groundwater and "flowing ground" below groundwater level.

The following groundwater control issues should be considered during construction:

- Based on a project requirement that roadway traffic or other paved areas not be impacted by the construction work, drilling and operation of dewatering system from the ground surface will not be allowed. All groundwater control work, including dewatering, will be performed by either:

1. Localized groundwater control from within the culvert; and/or
2. Horizontal drains drilled from the portal areas or from within the culvert.

- Complete dewatering of the sandy alluvium layer directly beneath the culvert invert will be impacted by the presence of relatively impermeable clayey soils within several feet below the culvert invert (see Figure 3). Although technically feasible, dewatering by widely spaced wells or drains would be difficult to achieve, either from the ground surface or from within the tunnel. The dewatering plan developed for construction should be designed based on these subsurface conditions.
- Soil and groundwater contamination is known to be present in the vicinity of the project site. To minimize the volume of groundwater that would have to be treated prior to discharge, groundwater within the project area should be isolated from that outside the project limits. A groundwater cutoff walls that extends through the granular alluviums below the creek bed at both the upstream and downstream ends of the project is recommended to reduce the volume of groundwater removed during construction dewatering. The cutoff walls should be extended a minimum of 5 feet into the underlying clayey soils to provide an effective cutoff and should extend a minimum of two feet on both sides of the crest.
- Construction will be limited to the months from April through October. This constraint offers the following:

1. It minimizes the quantity of water in the creek that needs to be collected and bypassed during culvert rehabilitation;
2. It minimizes the quantity of groundwater collection, treatment, and discharge within the project limits; and
3. During the dry months, the groundwater table is anticipated to be no more than several inches above the culvert invert. Lower groundwater table in the close proximity of the culvert reduces the potential for having to deal with "flowing ground conditions" during excavation.

- All surface water originating from all sources, including runoff, should be diverted away from the creek and portal areas, and should be collected, bypassed, and discharged separately prior to mixing with the groundwater.

Based on the above criteria and as a baseline condition, we estimate that up to 120,000 gallons of groundwater will be removed during construction.

The contractor shall develop a Health and Safety Plan (HASP) for the workers on-site. The HASP will comply with State and Federal Occupational Safety and Health Administration (OSHA) standards for hazardous waste operations, CCR, Title 8, and section 5192 and 29 CFR 1910.120 respectively. It will include the following elements.

- Worker training requirements and required certificates;
- On-site monitoring for employee exposure to volatiles from the soil;
- Ventilation measures for workers in the culverts and other job locations; and
- Odor monitoring and control procedures, if needed.

3.1 DUST CONTROL

Dust may be generated due to excavation activities, vehicle traffic, ambient wind, and loading and hauling soil to and from the stockpile area. Dust control measures to minimize on-site and off-site impacts including watering the construction traffic areas of the project, limiting vehicle speed and sweeping paved project areas will be performed to minimize potential dust generation. Vehicle tires will be cleaned prior to leaving the site, if tracking of project related dirt off site is observed. Drop heights will be minimized while loading soil into trucks. Plastic sheeting will be placed on stockpiles to reduce the potential for generating dust. Use of Best Management Practices for nuisance dust will be implemented as needed.

3.2 STORM WATER POLLUTION PREVENTION AND CONTROL

If it rains during construction, storm water pollution controls will be implemented at the site. Provisions will be made to contain and manage storm water from construction areas and stockpile areas to limit discharges to the storm water system in accordance with discharge requirements. Stockpiled soils will be covered to reduce potential runoff. Site activities to reduce potential storm water pollution will include:

- Management of hazardous materials such as fuels on site to minimize the opportunity for spills and to provide procedures and on-site equipment for clean up of spills that occur.
- Site management to control sediment leaving the site and impacting the creek.
- Treatment of rainwater collected in the secondary containment of the storage tanks and water treatment system.
- Sampling and treatment of any storm water that may contact contaminated soil, and proper handling of such water.
- Handling of Glen Echo Creek water from upstream so that it may be diverted away from direct contact with soil excavations and be directed to the downstream end of the construction area.

4.1 EXCAVATED SOIL HANDLING

Excavation and soil stockpiling will be performed in a manner that will prevent impacts to the downstream creek and surrounding areas. Soils will be stockpiled separately. Excavated soil will be analyzed using field techniques stockpiled into contaminated and uncontaminated areas, analyzed, chemically and disposed of off-site in accordance with State of California and Federal regulations. The soil stockpile areas will be provided with secondary containment and fenced and locked nightly. It is anticipated that the District will designate the undeveloped lot at the north side of 28th Street adjacent to Glen Echo Creek as the approved soil stockpile staging area (Figure 2).

The excavated soil will be separated into:1) Contaminated Soil Stockpile and, 2) Uncontaminated Soil Stockpile. Field techniques to be used to characterize the soil may include one or more of the following: visible stains, oily odor and sheen, detectable vapors above ambient background using Organic Vapor Analyzer. Both contaminated and uncontaminated soil stockpiles will be placed on plastic sheeting, and will be covered with plastic sheeting at the end of each workday for dust and/or erosion control. Preparation of a Sampling and Analysis Plan (SAP) is required in the contract documents. Inclement weather may require that soil be covered when not actively adding or removing soil. Excavated soil will be promptly disposed following laboratory testing, and remain stockpiled for a maximum of 90 days. Excavated soil will not be re-used on site.

Excavated soil shall become the property of the Contractor and shall be handled and disposed of in accordance with Section 14.10 – Handling and Disposal of Contaminated Soils and Groundwater of the Special Provisions, and the Construction Risk Management Plan specified herein.

4.1.1 Contaminated Stockpile Sampling

Sampling the contaminated soil stockpile will be performed in accordance with the requirements of the Landfill (Class II) selected by the contractor, and approved by The District, for disposal. It is anticipated that one four point composite sample will be required for each 100 cubic yards of stockpiled contaminated soil. At a minimum, the composite soil samples will be analyzed in a California Approved analytical laboratory for; Title 26 Metals using EPA Method 6010, Total Petroleum Hydrocarbon (TPH) Gasoline, Diesel and Motor Oil using EPA Method 8015M, Benzene, Toluene, Ethylbenzene, and Xylenes (BTEX) and Methyl tert-butyl ether (MTBE) using EPA Method 8015/8020M. Duplicate soil samples will be collected and analyzed for 10% of the soil samples.

4.1.2 Uncontaminated Soil Sampling

The uncontaminated soil stockpile will also be sampled in accordance with the requirements of the Landfill (Class III) selected by the contractor, and approved by The District, for disposal. A similar four point composite sample for each 100 cubic yards of stockpiled uncontaminated soil is anticipated. At a minimum, the composite soil samples will be analyzed in a California Approved analytical laboratory for Title 26 Metals, TPH Gasoline, Diesel and Motor Oil, BTEX and MTBE using the laboratory methods listed above. Duplicate soil samples will be collected and analyzed for 10% of the soil samples. The laboratory will provide quality control data as required for each analytical method.

4.1.3 Excavation Confirmation Soil Sampling

To document the potential presence of contaminated soil remaining in the bottom of the excavation, confirmation soil samples will be collected and analyzed prior to pouring the arch concrete culvert invert. At a minimum confirmation samples will be collected at 25 foot spacing along the bottom of the culvert alignment to the limit of the downstream and upstream construction area, or to a point where there is no detection of soil contamination, whichever is a smaller area. If a contaminated soil area is smaller than the 25-foot spacing, at a minimum, one confirmation sample will be collected from the bottom of the culvert alignment in that area.

4.1.4 Soil Sample Collection Methods

Soil samples will be collected in clean glass jars provided by the laboratory or clean brass soil sample liners using clean hand tools. Jars will be capped with the cap provided, and brass liners will be sealed on each end with plastic end caps. Soil containers will be labeled with a unique sample number, date, and project name. Sample containers will be placed on ice, in an ice chest for transport to the analytical laboratory using chain-of-custody procedures. The chain-of-custody forms will document the time of collection of each sample, date, and the name of the sampler. The sampler must have at least 1 year of experience collecting environmental soil samples, and meet the Health and Safety Plan requirements for training and experience.

5.1 EXCAVATION WATER HANDLING

During this construction project Glen Echo Creek flow will be diverted around the construction area. The geotechnical report (URS 2000) states that up to 120,000 gallons of groundwater will be removed during construction. A separate unit price bid will be provided by the Contractor for treatment and disposal of up to 50,000 gallons of the total quantity removed. The contractor will develop a more detailed plan should include details of the excavation de-watering, collected water storage and treatment. The contractor's water storage plans will include details for secondary containment of the tanks and piping and for handling collected rainwater in the secondary containment.

Collected groundwater from the excavations shall become the property of the Contractor and shall be handled and disposed in accordance with Section 14.10 – Handling and Disposal of Contaminated Soils and Groundwater of the Special Provisions, and the Construction Risk Management Plan specified herein.

5.1.1 Permits for Treated Water Disposal

The Alameda County Public Works Department will obtain a National Pollutant Discharge Elimination System (NPDES) permit from the California Regional Water Quality Control Board (RWQCB) for disposal of treated water via direct discharge to the creek, or storm water sewer system. As an alternate, The District may obtain a permit from the East Bay Municipal Utility District for discharge of treated water to the sanitary sewer. Contractor will coordinate with The District on timing of permit needs.

5.1.2 Water Treatment

The contractor will install a collected-water treatment system as required (possible activated carbon system), and sampling as required by permit for discharge to Glen Echo Creek. The contractor will submit test results to RWQCB on the required frequency during operations. The contractor will maintain records of testing and discharge and submit with project completion report. The anticipated RWQCB schedule for sampling, measurement and analysis is shown in Table 3. The anticipated discharge requirements to drinking water areas and surface water areas are summarized in Table 4.

It is anticipated that the RWQCB will issue NPDES discharge requirements that require toxicity testing of the effluent and that the survival of test fish in 96-hour static renewal bioassays of discharge shall be three sample moving median of 90% survival and minimum value of not less than 70% survival.

It is anticipated that the NPDES discharge requirements shall state that the discharge shall not cause the following conditions to exist in waters of the State:

1. Floating, suspended, or deposited macroscopic particulate matter or foam;
2. Bottom deposits or aquatic growth;
3. Alteration of temperature, turbidity, taste, odor, or apparent color beyond present natural background levels;

4. Visible, floating, suspended, or deposited oil or other products of petroleum origin;
5. Toxic or other delterious substances to be present in concentrations or quantities that will cause deleterious effects on aquatic biota, wildlife, or waterfowl, or which render any of these unfit for human consumption either at levels crated by the receiving waters or as a result of biological concentration;

Sampling shall be performed at the following locations (see Table 3):

1. At station I-1, at a point after groundwater extraction and immediately prior to discharge to the treatment system;
2. At station E-1, at a point after full treatment but before it joins or is diluted by any other waste stream, or body of water, or substance;
3. At station RD-1, at a point 50 feet downstream from the point of discharge into the receiving water;
4. At station RU-1, at a point 50 feet upstream from the point of discharge to the receiving water.

Measurement of the volume of treated and discharged water will be performed and recorded, either if it is a batch treatment system or if it is a continuous flow treatment system. Water samples will be collected using appropriate clean containers supplied by the analytical laboratory. Water sample containers will be sealed with caps provided, labeled with a unique number, sample date and time, and project name. Water samples will be placed on ice in an ice chest and be transported using chain-of-custody procedures to the California Approved analytical laboratory. Proper holding times must be followed for each analysis. Groundwater samples representative of the extracted groundwater should be analyzed for at least the following: Title 26 metals, TPH gasoline, diesel, and motor oil, and BTEX and MTBE, and additional tests as required by the NPDES permit.

Duplicate water samples will be collected for at least 10% of the water samples. One travel blank will be prepared and analyzed for each batch of samples or each cooler of samples. Equipment blanks will also be prepared to document the cleanliness of water sampling equipment. The laboratory will provide laboratory quality control data as required for each method.

If the alternative discharge to the sanitary sewer is permitted by EBMUD, the Contractor will install a collected-water treatment system as required, and perform sampling and chemical analyses as required to meet the EBMUD requirements.

5.1.3 Perform Sampling of Treatment System Equipment for Shutdown

The treatment equipment and tanks will be cleaned and rinsed prior to removal from the site, and the resulting rinsate will be chemically analyzed for: Title 26 metals, TPH as gasoline, diesel and motor oil, and BTEX and MTBE. Documentation of the results of cleaning will be required prior to removal from site. Records of the testing will be provided in the Project Completion Report.

6.1 RECORD KEEPING

Records for the following items will be developed and maintained, complied and supplied to Alameda County Health Agency as part of the Project Completion Report.

- Analyses conducted on the soil and water for characterization and disposal authorization
- Soil disposal manifests/shipping records
- Water treatment records
- Water disposal pumping records
- Water-treatment waste related testing and disposal records, i.e., used activated carbon
- Emergency plans contact telephone numbers are to be provided.

A copy of the Project Completion Report will be provided to the Oakland Fire Department for inclusion in the "One Stop Data Base."

6.2 REPORTING

6.2.1 Soil Excavation and Disposal

A Project Completion Report documenting the volume of soil excavation, field screening results, and the disposal of the excavated soil will be prepared. The report will include a discussion of the laboratory tests, characterization of the disposed soil, documentation of the cleanup of the stockpile area, as well as laboratory reports, manifests, and supporting information.

6.2.2 Water Removal and Disposal

As required by the NPDES Permit or the EBMUD permit, progress reports will be prepared documenting that the disposed water meets the disposal permit requirements. At the conclusion of the project, a Project Completion Report will be prepared documenting the volume of water treated and discharged, laboratory analytical results, and the shut down, cleaning and removal of the treatment system, and treatment materials.

URS, 2001, Geotechnical Report, Phase I, Glen Echo Creek Culvert Construction Project, Oakland, California: dated January 7, 2001, prepared for Winzler & Kelley, San Francisco, California.

URS, 2000, Supplement to October 11, 1999 Geotechnical Data Report, Glen Echo Creek Concrete Arch Culvert: June 26, 2000, prepared for Winzer & Kelley, San Francisco, California.

TABLE 1
GROUNDWATER ANALYTICAL RESULTS
STATIONS 25+34 AND 25+89
GLEN ECHO CREEK PROJECT
OAKLAND, CALIFORNIA

Station location	25+89	25+34	Regulatory Levels	
Sample ID	GW01	GW02	USEPA PRG Region 9 Tap Water	California MCL
Sampling Date	5/30	5/30		
Units	µg/l	µg/l	µg/l	µg/l
Gasoline C7-C12 (EPA Method 8015M)	<50	1,400	na	na
Total Extractable Hydrocarbons (EPA Method 8015M)				
Diesel (C10-C24)	<50	63,000	na	na
Motor Oil (C24-C36)	390	180,000	na	na
BTEX (EPA method 8021B)				
Benzene	<0.5	<0.5	0.386	1
Toluene	<0.5	<0.5	723	150
Ethylbenzene	<0.5	<0.5	1,340	700
Total Xylenes	<0.5	<0.5	1,430	1750
Title 26 Metals (EPA Method 6010B and 7470)				
Antimony	<60	<60	14,6	6
Arsenic	**43 (1)**	**140 (1,2)**	0.0448	50
Barium	**2300 (2)**	**5700 (1,2)**	2,560	1,000
Beryllium	3.5	**7.6 (2)**	73	4
Cadmium	**12 (2)**	**37 (1,2)**	18.3	5
Chromium	**140 (2)**	**400 (1,2)**	18.3	50
Cobalt	180	290	2,190	na
Copper	140	330	1,360	1,000
Lead	**260 (1,2)**	**500 (1,2)**	4	15
Mercury	<0.2	<0.2	11	2
Molybdenum	<20	<20	183	na
Nickel	**250 (2)**	**680 (2)**	730	100
Selenium	<5	<5	183	50
Silver	<5	<5	183	100
Thallium	**8.4 (1,2)**	**11 (1,2)**	3.29	2
Vanadium	180	**460 (1)**	256	na
Zinc	560	1000	11,000	5,000

Notes
1=exceeds USEPA PRG Region 9, Tap Water
2=exceeds Californian Maximum Contaminant Level (MCL)

Reference: URS, 2000. Glen Echo Creek Concrete Arch Culvert Supplement to October 11, 1999 Geotechnical Dta Report. July 26.

TABLE 2
SOIL ANALYTICAL RESULTS
STATIONS 25+34 AND 25+89
GLEN ECHO CREEK PROJECT
OAKLAND, CALIFORNIA

Station location		25+89	25+34	Regulatory Level	
Sample ID		SS01	SS02	TTLC	USEPA Industrial PRG
Sampling Date	Units	5/30	5/30		
Gasoline C7-C12 (EPA Method 8015M)	mg/kg	<1	7.6	na	na
Total Extractable Hydrocarbons (EPA Method 8015M)					
Diesel (C10-C24)	mg/kg	2.4	**1300 (2)**	na	1000(1)
Motor Oil (C24-C36)	mg/kg	9.4	**2100 (2)**	na	1000(1)
BTEX (EPA method 8021B)					
Benzene	µg/kg	<5.1	<5.1	na	1.36
Toluene	µg/kg	<5.1	<5.1	na	520
Ethylbenzene	µg/kg	<5.1	<5.1	na	230
Total Xylenes	µg/kg	<5.1	<5.1	na	370
Title 26 Metals (EPA Method 6010B and 7470)					
Antimony	mg/kg	<3	<3	500	749
Arsenic	mg/kg	**3.5 (3)**	2.7	500	2.99
Barium	mg/kg	67	84	1.00E+04	1.00E+05
Beryllium	mg/kg	0.35	0.33	75	3.40E+03
Cadmium	mg/kg	1.4	1.2	100	934
Chromium	mg/kg	27	26	500	4.48E+02
Cobalt	mg/kg	14	14	8.00E+03	2.86E+04
Copper	mg/kg	13	11	2.50E+03	6.96E+04
Lead	mg/kg	21	19	1.00E+03	1.00E+03
Mercury	mg/kg	0.082	0.059	20	5.62E+02
Molybdenum	mg/kg	<1	<0.99	3.50E+03	9.37E+03
Nickel	mg/kg	43	35	2.00E+03	3.75E+04
Selenium	mg/kg	0.32	<0.25	1.00E+02	9.37E+03
Silver	mg/kg	<0.25	<0.25	5.00E+02	9.37E+03
Thallium	mg/kg	0.44	0.35	700	1.69E+02
Vanadium	mg/kg	27	21	2.40E+03	1.31E+04
Zinc	mg/kg	29	27	5.00E+03	1.00E+05

Notes
TTLC= Total Threshold Limit Concentration above which the material is a hazardous waste
Industrial PRG= USEPA Region 9 Preliminary Remediation Goal for soil for an industrial exposure scenario
(1) Alameda County Health Services requires management of soil containing greater than 1,000 mg/kg TPH as motor oil, or Diesel
(2) Exceeds Alameda target level
(3) Exceeds PRG

Reference: URS, 2000. Glen Echo Creek Concrete Arch Culvert Supplement to October 11, 1999 Geotechnical Dta Report. July 26.

Table 3
Schedule for Sampling, Measurement, and Analysis

Sampling Station	1-1	E-1	RD-1
Type of sample	Grab	Grab	Grab
Flow Rate (gpm & gpd)	-	Continuous	-
Turbidity	-	D/Q	-
Fish Toxicity, 96-hr (% survival)	-	2/Y	-
pH	D/M	D/M	Q-V
Dissolved Oxygen (mg/L)	D/M	D/M	-
Temperature (°C)	D/M	D/M	-
Electrical Conductivity	D/M	D/M	-
Antimony Total (µg/l & gram/day)	D/Y	D/Q	-
Arsenic Total (µg/l & gram/day)	DiY	D/Q	-
Beryllium Total (µg/l & gram/day)	D/Y	D/Q	-
Cadmium Total (µg/l & gram/day)	D/Y	D/Q	-
Chromium Hexavalent or Total Chromium Total (µg/l & gram/day)	D/Y	D/Q	-
Copper Total (µg/l & gram/day)	D/Y	D/Q	-
Cyanide Total (µg/l & gram/day)	D/Y	D/Q	-
Lead Total (µg/l & gram/day)	D/Y	D/Q	-
Mercury Total (µg/l & gram/day)	D/Y	D/Q	-
Nickel Total (µg/l & gram/day)	D/Y	D/Q	-
Selenium Total (µg/l & gram/day)	D/Y	D/Q	-
Silver Total (µg/l & gram/day)	D/Y	D/Q	-
Thalliurn Total (µg/l & gram/day)	D/Y	D/Q	-
Zinc Total (µg/l & gram/day)	D/Y	D/Q	-
All Applicable Standard Observations	-	M	M
EPA 601 (µg/l & g/day)	Y	2/Y	V
EPA 602 (including MTBE) (µg/l & g/day)	D/M	D/M	V
EPA 625 (µg/l & g/day)	A-V	2/A-V	V
EPA 8015 as gasoline and diesel (µg/l & g/day)	D/M	D/M	V

Definitions
µg/l micro-gram per liter or parts per billion (ppb)
g/day grams per day

Types of Stations
I = Influent, E = Effluent, RD = Receiving Water Downstream, RU = Receiving Water Upstream

Frequency of Sampling
M Once each month
Q Once each Quarter
Y Once during the first week of start up; annually thereafter
2/Y Once during the first week of start up; twice per year thereafter
2/A-V Twice yearly and whenever there is a violation of benzene, toluene, ethylbenzene, or xylenes
A-V Once per year and whenever there is a violation of benzene, toluene, ethylbenzene, or xylenes
Q-V Once each Quarter and whenever there is a violation of benzene, toluene, ethylbenzene, or xylenes
V Sampling should be performed within 24 hours whenever the effluent (E-1) is in violation
D/M Once during the first and fifth day of start up; monthly thereafter
D/C Once during the first week of start up; quarterly thereafter
D/Y Once during the first week of start up; annually thereafter

Note for metals sampling and analysis:
* Metal samples shall be analyzed for total (unfiltered) constituents (Total).
* The maximum detection limits shall be: 2 µg/l for Cadmium; 0.2 µg/l for Mercury; 5 µg/l for Arsenic, Chromium VI, Copper, Lead, Nickel, Selenium, and Silver; and 10 µg/l for Antimony, Beryllium, Cyanide, Thallium, and Zinc

Table 4
Discharge Requirements

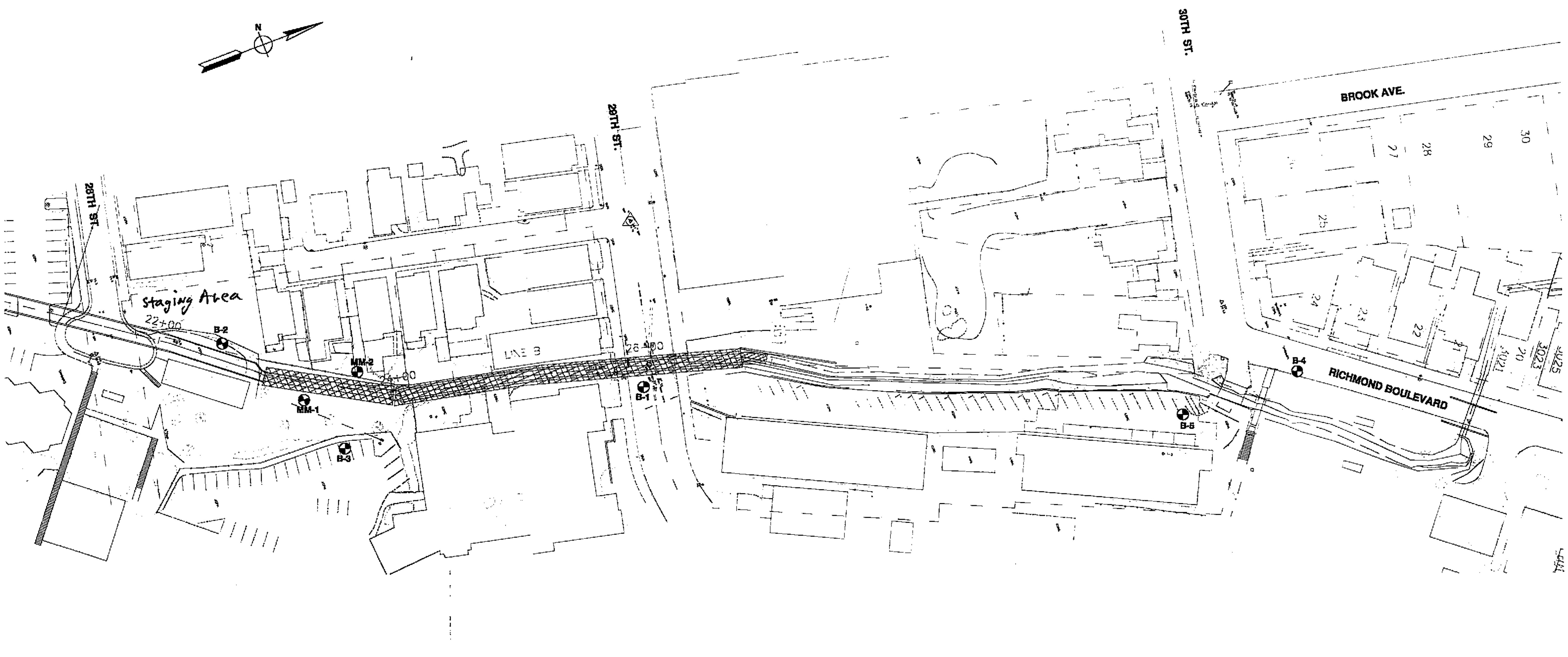
Constituents	Discharge to Drinking Water Areas (1), in ug/l	Discharge to Other Surface Water Areas (ug/l)
Purgeable Halocarbons (EPA Method 601 or equivalent)		
a) Carbon Tetrachloride	0.5	5.0
b) 1,2-Dichloroethane	0.5	5.0
c) Vinyl Chloride	0.5	5.0
d) l,l-Dichloroethane	5.0	5.0
e) l,l-Dichloroethylene	5.0	5.0
f) (cis & trans) 1,2-Dichloroethylene	5.0	5.0
g) Methylene Chloride	5.0	5.0
h) Tetrachloroethylene	5.0	5.0
i) Trichloroethylene	5.0	5.0
j) l,l,l-Trichloroethane	5.0	5.0
k) 1,1,2-Trichloroethane	5.0	5.0
l) Trichlorotriflouroethane	5.0	5.0
m) Chloroform	5.0	5.0
Purgeable Aromatics (EPA Method 602 or equivalent		
n) Benzene	1.0	5.0
o) Toluene	5.0	5.0
p) Ethylbenzene	5.0	5.0
q) Total Xylenes	5.0	5.0
r) Volatile Organic Compounds (per constituent, as identified by EPA Method 624, EPA Methods 601 and 602, or equivalent	5.0	5.0
s) Total Petroleum Hydrocarbons (as identified by modified EPA 8015 or equivalent	50.0	50.0
t) Ethylene Dibromide (as identified by EPA Method 504 or equivalent)	0.05	5.0
u) Polynuclear Aromatic Hydrocarbons (PAHs) (as identified by EPA Method 610, 625, or equivalent)	15.0	15.0
v) Base/Neutral, Acid, and Pesticide Compounds (per constituent other than PAHs, as identified by EPA Method 625 or equivalent)	5.0	5.0
(1) Drinking water areas are defined as surface waters used for municipal and domestic supply; they also include groundwater recharge areas (including recharge areas to maintain salt balance or to halt salt water intrusion into fresh water aquifers).		

Appendix B
Figures

URS	Project No.51-951273NC.00 Glen Echo Creek Culvert Oakland, CA	Zone No. 12 Project Line B VICINITY MAP	Figure 1

43-00066759.01-00012/020701/gos

GE-50



LEGEND

B-2 Exploratory Boring Location (B-2)

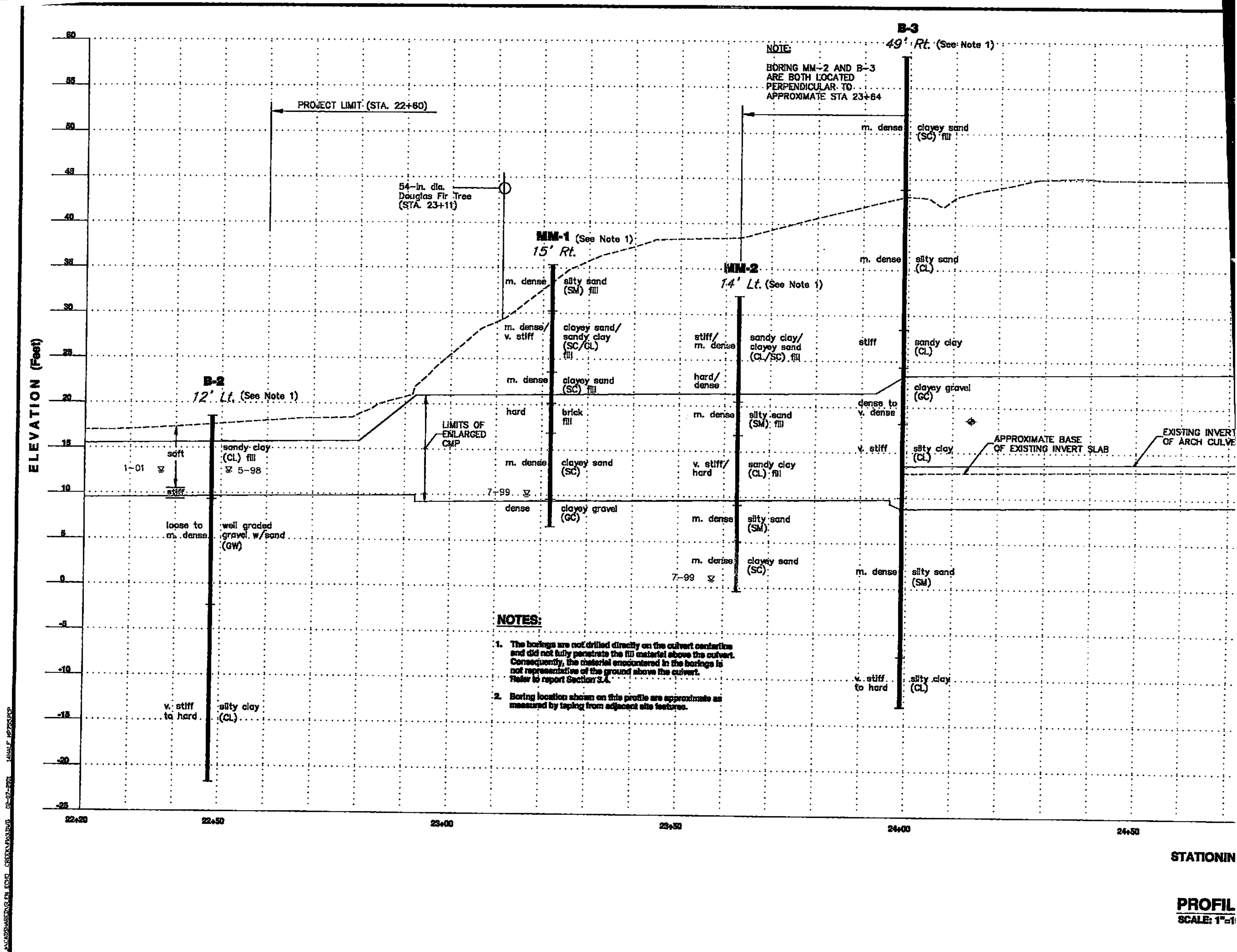
Project Alignment

40' 0 40' 80'
SCALE: 1"= 40'

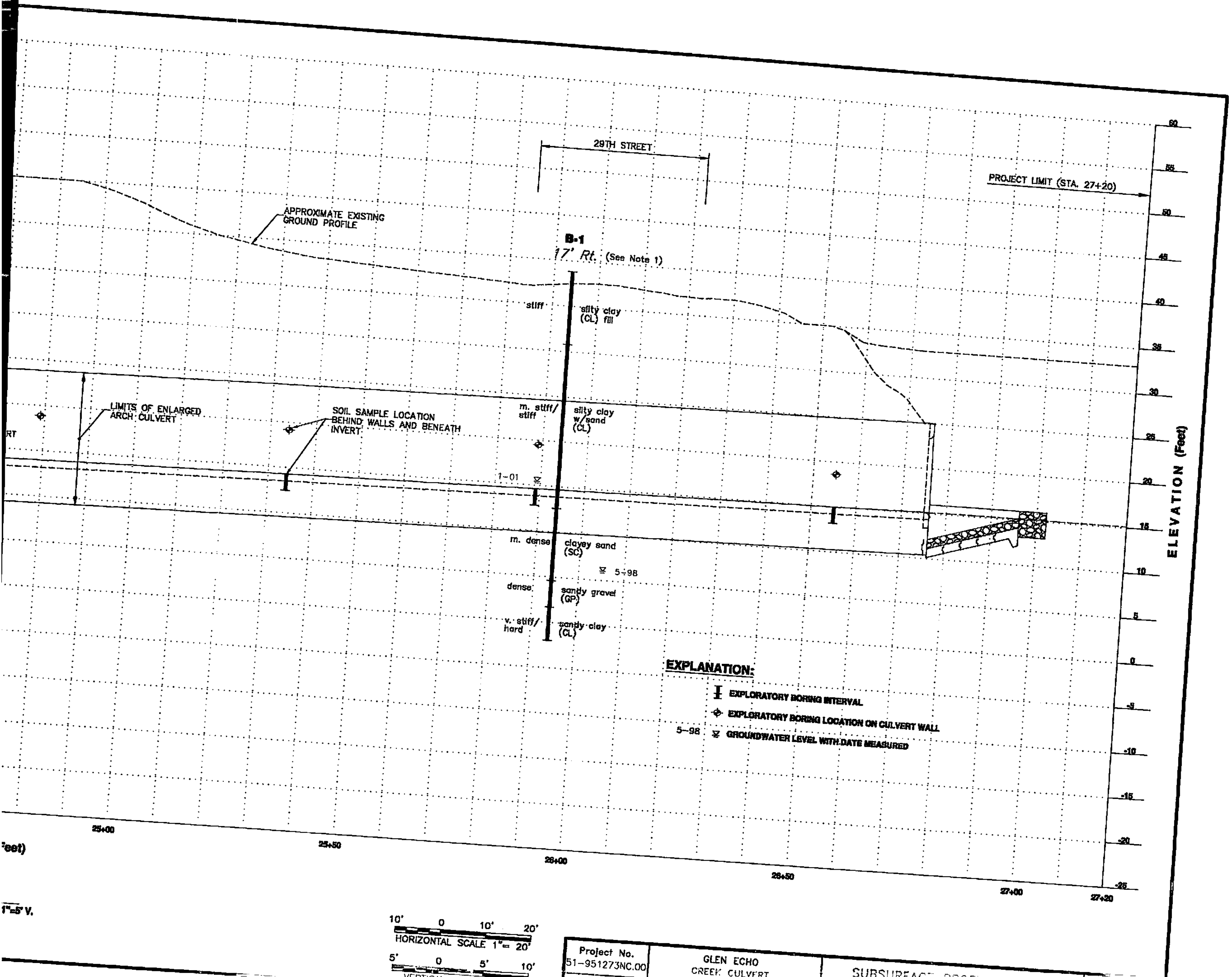
Project No. 51-951273NC.00	GLEN ECHO CREEK CULVERT OAKLAND, CA	ZONE NO.12 PROJECT LINE B BORING LOCATION PLAN	FIGURE 2
URS Corporation			

J:\GAISHARED\GLEN_ECHO_CREEK\SHEETS\FIG2.DWG 02072001

GE-51



ELEVATION (Feet)
60
55
50
45
40
35
30
25
20
15
10
5
0
-5
-10
-15
-20
-25
PROJECT LIMIT (STA. 22+60)
54-in. dia. Douglas Fir Tree (STA. 23+11)
B-2
12' Lt. (See Note 1)
soft
sandy clay (CL) fill
1-01
5-98
stiff
loose to m. dense
well graded gravel w/sand (GW)
v. stiff to hard
silty clay (CL)
LIMITS OF ENLARGED CMP
MM-1 (See Note 1)
15' Rt.
m. dense
silty sand (SM) fill
m. dense/ v. stiff
clayey sand/ sandy clay (SC/CL) fill
m. dense
clayey sand (SC) fill
hard
brick fill
m. dense
clayey sand (SC)
7-99
dense
clayey gravel (GC)
MM-2
14' Lt. (See Note 1)
stiff/ m. dense
sandy clay/ clayey sand (CL/SC) fill
hard/ dense
m. dense
silty sand (SM) fill
v. stiff/ hard
sandy clay (CL) fill
m. dense
silty sand (SM)
m. dense
clayey sand (SC)
7-99
NOTE:
BORING MM-2 AND B-3 ARE BOTH LOCATED PERPENDICULAR TO APPROXIMATE STA 23+84
B-3
49' Rt. (See Note 1)
m. dense
clayey sand (SC) fill
m. dense
silty sand (CL)
stiff
sandy clay (CL)
dense to v. dense
clayey gravel (GC)
v. stiff
silty clay (CL)
m. dense
silty sand (SM)
v. stiff to hard
silty clay (CL)
APPROXIMATE BASE OF EXISTING INVERT SLAB
EXISTING INVERT OF ARCH CULVE
NOTES:
1. The borings are not drilled directly on the culvert centerline and did not fully penetrate the fill material above the culvert. Consequently, the material encountered in the borings is not representative of the ground above the culvert. Refer to report Section 3.4.
2. Boring location shown on this profile are approximate as measured by taping from adjacent site features.
22+20
22+50
23+00
23+50
24+00
24+50
STATIONIN
PROFIL
SCALE: 1"=1


29TH STREET
PROJECT LIMIT (STA. 27+20)
APPROXIMATE EXISTING GROUND PROFILE
B-1
17' Rt. (See Note 1)
stiff
silty clay (CL) fill
LIMITS OF ENLARGED ARCH CULVERT
SOIL SAMPLE LOCATION BEHIND WALLS AND BENEATH INVERT
m. stiff/ stiff
silty clay w/sand (CL)
1-01
m. dense
clayey sand (SC)
5-98
dense
sandy gravel (GP)
v. stiff/ hard
sandy clay (CL)
EXPLANATION:
EXPLORATORY BORING INTERVAL
EXPLORATORY BORING LOCATION ON CULVERT WALL
5-98 GROUNDWATER LEVEL WITH DATE MEASURED
ELEVATION (Feet)
60
55
50
45
40
35
30
25
20
15
10
5
0
-5
-10
-15
-20
-25
25+00
25+50
26+00
26+50
27+00
27+20
1"=5' V.
10' 0 10' 20'
HORIZONTAL SCALE 1"= 20'
5' 0 5' 10'
Project No.
51-951273NC.00
GLEN ECHO
CREEK CULVERT
SUBSURFACE

Appendix C
Boring Logs

Project: Glen Echo Creek
Project Location: Oakland, California
Project Number: 951273NB

Key to Log of Boring

Sheet 1 of 1

Depth, feet	Elevation, feet	SAMPLES Type	Number	Sampling Resistance	Recovery, %	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	Unconfined Compressive Strength, psf	Liquid Limit	Plasticity Index	OTHER TESTS AND REMARKS
0							SOIL GRAPHIC AND LAYER LINES						
							solid line denotes observed contact or abrupt change in soil type						
							dashed line denotes approximate or inferred contact or gradational change in soil type						
							SAMPLE TYPES						
			1	18			Number of blows required to advance sampler 1 foot, or distance indicated	23	111	6500	47	19	21% passing No. 200 sieve
5							Modified California sample						
			2	50/6"*			asterisk (*) indicates blow count given is for initial 6-inch seating interval of sampling						
							PRIMARY SOIL GRAPHICS						
							SAND						
							SILT						
10							CLAY						
							GRAVEL						

NOTES

1. Soil classifications are based on the Unified Soil Classification System and include relative density/consistency, moisture, and color. Descriptions of formation material include color, weathering, rock strength and/or hardness, and moisture. Field descriptions have been modified to reflect results of laboratory tests where deemed appropriate.

2. Surface elevations are based on approximate locations and topographic maps.

3. Water level, where encountered, was measured at the time of drilling.

4. Laboratory test data reported in "Other Tests and Remarks" column include: percent passing the No. 200 sieve as determined by mechanical sieving or by wash on the No. 200 sieve.

5. Descriptions on these boring logs apply only at the specific boring locations and at the time the borings were made. They are not warranted to be representative of subsurface conditions at other locations or

Project: Glen Echo Creek Project Location: Oakland, California Project Number: 951273NB	Log of Boring 1 Sheet 1 of 2

Date(s) Drilled	5/22/98	Logged By	J. Fippin	Checked By	M. Freitas
Drilling Method	Rotary Wash	Drill Bit Size/Type	3-1/2-inch rotary bit	Total Depth of Borehole	42.5 feet
Drill Rig Type	Failing 1500	Drilling Contractor	Pitcher Drilling	Borehole Backfill	Piezometer installed
Groundwater Depth and Date Measured	Not measured at time of drilling	Hammer Type	Rope and cathead	Hammer Weight/Drop	140 lbs / 30 inches
Location	29th Street	Surface Elevation	39 feet (est.)	Elevation Datum	Alameda County

Depth, feet	Elevation, feet	SAMPLES Type	Number	Sampling Resistance	Recovery, %	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	Unconfined Compressive Strength, psf	Liquid Limit	Plasticity Index	OTHER TESTS AND REMARKS
0							3 inches asphalt concrete over 6 inches sandy gravel (aggregate base).						
							SILTY CLAY (CL) [Fill] Stiff, damp, dark brown with tan mottling, some brick and concrete rubble to 2 inches.						
5			1	12	80			25	95	2370			
	30						SILTY CLAY with SAND (CL) Medium stiff to stiff, damp, bluish gray with black mottling.						
10			2	6	40			26	96	2020			
							6-inch gravel lens						
15			3	10	30			27	95	1250	45	28	
	20												
20			4	10	50			29	93	1450			
25			5	14	30								
							CLAYEY SAND (SC) Medium dense, damp, dark gray, fine-grained sand, low fines content, abundant 1/8-inch roots, some weathered greenstone and red sandstone fragments.						
	10												
30													

Project:	Glen Echo Creek
Project Location:	Oakland, California
Project Number:	951273NB

Log of Boring 1

Depth, feet	Elevation, feet	SAMPLES: Type	Number	Sampling Resistance	Recovery, %	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	Unconfined Compressive Strength, psf	Liquid Limit	Plasticity Index	OTHER TESTS AND REMARKS
30			6	19	60		CLAYEY SAND (SC), medium dense, damp, dark gray, fine-grained sand, low fines content, abundant 1/8-inch roots, some weathered greenstone and red sandstone fragments (continued).						
							SANDY GRAVEL (GP) Dense, damp, red, white, and green, gravel to 1 inch.						
35			7	41	70								
							SANDY CLAY (CL) Very stiff to hard, damp, bluish gray.						
	0												
40													
			8	29	100			22	103	8040			
							Bottom of boring at 42.5 feet.						
45													
	-10												
50													
55													
	-20												
60													
65													

Project: Glen Echo Creek
Project Location: Oakland, California
Project Number: 951273NB

Log of Boring 2

Date(s) Drilled	5/21/98	Logged By	J. Fippin	Checked By	M. Freitas
Drilling Method	Rotary Wash	Drill Bit Size/Type	3-1/2-inch rotary bit	Total Depth of Borehole	41.5 feet
Drill Rig Type	Failing 1500	Drilling Contractor	Pitcher Drilling	Borehole Backfill	Piezometer installed
Groundwater Depth and Date Measured	5 feet at time of drilling	Hammer Type	Rope and cathead	Hammer Weight/Drop	140 lbs / 30 inches
Location	Carport area	Surface Elevation	17 feet (est.)	Elevation Datum	Alameda County

Depth, feet	Elevation, feet	SAMPLES Type	Number	Sampling Resistance	Recovery, %	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	Unconfined Compressive Strength, psf	Liquid Limit	Plasticity Index	OTHER TESTS AND REMARKS
0							3 inches asphalt concrete						
							SANDY CLAY (CL) [Fill] Soft, damp, grayish blue, some roots, brick fragments.						
5			1	3	0		Becomes wet						
	10												
							Becomes medium stiff to stiff						
							WELL-GRADED GRAVEL with SAND (GW) Loose to medium dense, damp, grayish blue.						
10			2	19	60								
15			3	9	60			24	100				
	0												
20			4	20	75		SILTY CLAY (CL) Very stiff to hard, damp, greenish gray with brown mottling, some fine-grained sand.	17	116	1600			
25			5	29	60								
	-10						Decreasing sand						
30													

Project: Glen Echo Creek Project Location: Oakland, California Project Number: 951273NB	**Log of Boring 2** Sheet 2 of 2

Depth, feet	Elevation, feet	SAMPLES Type	Number	Sampling Resistance	Recovery, %	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	Unconfined Compressive Strength, psf	Liquid Limit	Plasticity Index	OTHER TESTS AND REMARKS
30			6	33	90		SILTY CLAY (CL), very stiff to hard, damp, greenish gray with brown mottling, trace to little fine-grained sand (continued).						
35			7	30	70								
	-20												
40			8	52									
							Bottom of boring at 41.5 feet.						
45													
	-30												
50													
55													
	-40												
60													
65													

Project: Glen Echo Creek
Project Location: Oakland, California
Project Number: 951273NB

Log of Boring 3

Date(s) Drilled	5/20/98	Logged By	J. Fippin	Checked By	M. Freitas
Drilling Method	Rotary Wash	Drill Bit Size/Type	3-1/2-inch rotary and tricone bits	Total Depth of Borehole	71.5 feet
Drill Rig Type	Failing 1500	Drilling Contractor	Pitcher Drilling	Borehole Backfill	Grout with 6-inch asphalt cold patch
Groundwater Depth and Date Measured	Not measured at time of drilling	Hammer Type	Rope and cathead	Hammer Weight/Drop	140 lbs / 30 inches
Location	Church parking lot	Surface Elevation	58.5 feet (est.)	Elevation Datum	Alameda County

Depth, feet	Elevation, feet	Samples: Type	Samples: Number	Samples: Sampling Resistance	Samples: Recovery, %	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	Unconfined Compressive Strength, psf	Liquid Limit	Plasticity Index	OTHER TESTS AND REMARKS
0							1-1/2 inches asphalt concrete over 6 inches sandy gravel (aggregate base).						
							CLAYEY SAND (SC) (Fill) Medium dense to dense, dry, brown with white mottling, some brick and concrete pieces.						
5			1	20	80			10	96	1660			
	50						Increasing debris (rubble, concrete, bricks)						
10			2	69/9"	70			14	109	1030			
15			3	18	80		SILTY SAND (SM) Medium dense, damp, reddish brown, fine-grained, some organics (very fine roots throughout).	13	104				21% passing No. 200 sieve
	40												
20			4	17	90								
25			5	16	80			14	111	1250			
	30						SANDY CLAY (CL) Stiff, damp, bluish gray with black mottling, low plasticity fines, fine-grained sand.						
30													

Project: Glen Echo Creek
Project Location: Oakland, California
Project Number: 951273NB

Log of Boring 3

Depth, feet	Elevation, feet	SAMPLES: Type	SAMPLES: Number	SAMPLES: Sampling Resistance	SAMPLES: Recovery, %	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	Unconfined Compressive Strength, psf	Liquid Limit	Plasticity Index	OTHER TESTS AND REMARKS
30			6	22	100		SANDY CLAY (CL), stiff, damp, bluish gray with black mottling, low plasticity fines, fine-grained sand (continued).	24	98	2130			
							CLAYEY GRAVEL (GC) Dense to very dense, damp, dark gray, gravel to 1/4 inch.						
35			7	82/11.5"	75								
	20												
40			8	39	60								
							SILTY CLAY (CL) Very stiff, damp, reddish brown with black mottling, low plasticity fines, some fine-grained sand.	20	109	4980			92% passing No. 200 sieve
							Becomes less mottled; decreasing sand						
45			9	27	100			29	94	6100			
	10						SILTY SAND (SM) Medium dense, damp, reddish brown, fine-grained.						
50			10	35	90								
55													
	0												
60			11	41				25	100	3450			
65													

Project: Glen Echo Creek Project Location: Oakland, California Project Number: 951273NB	Log of Boring 3 Sheet 3 of 3

Depth, feet	Elevation, feet	SAMPLES Type	Number	Sampling Resistance	Recovery, %	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	Unconfined Compressive Strength, psf	Liquid Limit	Plasticity Index	OTHER TESTS AND REMARKS
65							SILTY SAND (SM), medium dense, damp, reddish brown, fine-grained (continued).						
							SILTY CLAY (CL) Very stiff to hard, damp, bluish gray.						
	-10												
70			12	46									
							Bottom of boring at 71.5 feet.						
75													
	-20												
80													
85													
	-30												
90													
95													
	-40												
100													

Project: Glen Echo Creek
Project Location: Oakland, California
Project Number: 951273NB

Log of Boring 4

Date(s) Drilled	5/18/98 and 5/21/98	Logged By	J. Flppin	Checked By	M. Freitas
Drilling Method	Rotary Wash	Drill Bit Size/Type	3-1/2-inch rotary bit	Total Depth of Borehole	41.5 feet
Drill Rig Type	Failing 1500	Drilling Contractor	Pitcher Drilling	Borehole Backfill	Grout with 6-inch asphalt cold patch
Groundwater Depth and Date Measured	9.5 feet at time of drilling	Hammer Type	Rope and cathead	Hammer Weight/Drop	140 lbs / 30 inches
Location	Richmond Boulevard	Surface Elevation	25 feet (est.)	Elevation Datum	Alameda County

Depth, feet	Elevation, feet	SAMPLES Type	Number	Sampling Resistance	Recovery, %	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	Unconfined Compressive Strength, psf	Liquid Limit	Plasticity Index	OTHER TESTS AND REMARKS
0							3 inches asphalt concrete						
							SILTY CLAY (CL) Soft to medium stiff, damp, red.						
							SANDY CLAY (CL) Medium stiff to stiff, damp, gray with reddish brown mottling.						
5	20		1	15	75			21	105	1500			
							SILTY, CLAYEY SAND with GRAVEL (SC-SM) Dense, damp, gray and black.						
10			2	64	60			12	125	2280			14% passing No. 200 sieve
15	10		3	47	60		Becomes medium dense to dense; increasing gravel	13	120				
							CLAYEY GRAVEL (GC) Dense, damp, gray and black, gravel to 1/4 inch.						
20			4	58	75								11% passing No. 200 sieve
							SILTY CLAY (CL) Stiff, damp, gray with brown mottling, some fine-grained sand, some organics.						
25	0		5	21	75			32	90	3500			
30													

Project: Glen Echo Creek	Log of Boring 4
Project Location: Oakland, California	Sheet 2 of 2
Project Number: 951273NB	

Depth, feet	Elevation, feet	SAMPLES Type	Number	Sampling Resistance	Recovery, %	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	Unconfined Compressive Strength, psf	Liquid Limit	Plasticity Index	OTHER TESTS AND REMARKS
30			6	32	100		SILTY CLAY (CL), stiff, damp, gray with brown mottling, some fine-grained sand, some organics (continued).						
35	-10		7	41	90			25	100	2650			
40			8	55									
							Bottom of boring at 41.5 feet.						
45	-20												
50													
55	-30												
60													
65	-40												

Project: Glen Echo Creek **Project Location:** Oakland, California **Project Number:** 951273NB	**Log of Boring 5** Sheet 1 of 2

Date(s) Drilled	5/18/98	Logged By	J. Fippin	Checked By	M. Freitas
Drilling Method	Rotary Wash	Drill Bit Size/Type	3-1/2-inch rotary bit	Total Depth of Borehole	41.5 feet
Drill Rig Type	Failing 1500	Drilling Contractor	Pitcher Drilling	Borehole Backfill	Grout with 6-inch asphalt cold patch
Groundwater Depth and Date Measured	Not measured at time of drilling	Hammer Type	Rope and cathead	Hammer Weight/Drop	140 lbs / 30 inches
Location	Apartment parking lot	Surface Elevation	30 feet (est.)	Elevation Datum	Alameda County

Depth, feet	Elevation, feet	SAMPLES Type	Number	Sampling Resistance	Recovery, %	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	Unconfined Compressive Strength, psf	Liquid Limit	Plasticity Index	OTHER TESTS AND REMARKS
0	30						6 inches concrete						
							GRAVELLY CLAY (CL) Medium stiff, damp, light brown.						
							SILTY SAND (SM) Dense, damp, reddish brown with red, gray, and white mottling, some sandstone fragments.						
5			1	35	100			10	107	650			15% passing No. 200 sieve
							SANDY CLAY (CL) Stiff to very stiff, damp, gray with reddish brown mottling, low plasticity fines, fine-grained sand.						
10	20		2	44	60			19	118	1440			
							Decreasing fines, increasing sand and fine gravel						
15			3	29	30								
20	10		4	23	50								
							SILTY CLAY (CL) Very stiff to hard, damp, gray.	33	89	6000			
25			5	31	60								
30	0												

Project: Glen Echo Creek
Project Location: Oakland, California
Project Number: 951273NB

Log of Boring 5

Depth, feet	Elevation, feet	SAMPLES: Type	SAMPLES: Number	SAMPLES: Sampling Resistance	SAMPLES: Recovery, %	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	Unconfined Compressive Strength, psf	Liquid Limit	Plasticity Index	OTHER TESTS AND REMARKS
30	0		6	40	75		SILTY CLAY (CL), very stiff to hard, damp, gray (continued).	29	97	9210			
35			7	30	100								
40	-10		8	35	100								
							Bottom of boring at 41.5 feet.						
45													
50	-20												
55													
60	-30												
65													

Proje . ה Creek
Project Locat... ...land, California
Project Number: 51-951273NB.00

Key to Log of Boring

Elevation feet	Depth, feet	SAMPLES Type	Number	Sampling Resistance	Recovery, %	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	Unconfined Compressive Strength, psf	REMARKS AND OTHER TESTS
1	2	3	4	5	6	7	8	9	10	11	12

COLUMN DESCRIPTIONS

1 **Elevation:** Elevation in feet referenced to mean sea level (MSL) or site datum.

2 **Depth:** Depth in feet below the ground surface.

3 **Sample Type:** Type of soil sample collected at depth interval shown; sampler symbols are explained below.

4 **Sample Number:** Sample identification number.

5 **Sampling Resistance:** Number of blows required to advance driven sampler 12 inches beyond first 6-inch interval, or distance noted, using a 140-lb hammer with a 30-inch drop.

6 **Recovery:** Percentage of driven sample length recovered; "NA" indicates data not recorded.

7 **Graphic Log:** Graphic depiction of subsurface material encountered; typical symbols are explained below.

8 **Material Description:** Description of material encountered; may include color, moisture, grain size, and density/consistency.

9 **Water Content:** Water content of soil sample measured in laboratory, expressed as percentage of dry weight of specimen.

10 **Dry Unit Weight:** Dry density of soil sample measured in laboratory, expressed in pounds per cubic feet (pcf).

11 **Unconfined Compressive Strength:** Unconfined compressive strength of soil sample measured in laboratory, expressed in psf.

12 **Remarks and Other Tests:** Comments and observations regarding drilling or sampling made by driller or field personnel. Other field and laboratory test results, using the following abbreviations:

CONS	One-dimensional consolidation test
LL	Liquid limit (Atterberg Limits test), percent
PI	Plasticity index (Atterberg Limits test), percent

TYPICAL MATERIAL GRAPHIC SYMBOLS

SAND (SP/SW)
Silty SAND
Clayey SAND
CLAY (CL)
Silty CLAY (CL)
SILT (ML)
CLAY (CH)
Silty CLAY (CH)
SILT (MH)
GRAVEL (GP/GW)
Brick
Topsoil

TYPICAL SAMPLER GRAPHIC SYMBOLS

Modified California (2.5-inch OD)
Standard Penetration Test (SPT)
Shelby Tube
California (3-inch OD)
Pitcher Tube
Rock Core Barrel

OTHER GRAPHIC SYMBOLS

First water encountered at time of drilling and sampling (ATD)

Static water level measured in boring at specified time after drilling

Change in material properties within a lithologic stratum

Inferred contact between strata or gradational change in lithology

GENERAL NOTES

1. Soil classifications are based on the Unified Soil Classification System. Descriptions and stratum lines are interpretive; actual lithologic changes may be gradual. Field descriptions may have been modified to reflect results of lab tests.
2. Descriptions on these logs apply only at the specific boring locations and at the time the borings were advanced. They are not warranted to be representative of subsurface conditions at other locations or times.

Report: GEO_10R1_OAK_KEY; File: GLENECHO.GPJ; 8/24/99

URS Greiner Woodward Clyde

Figure A-1

GE-100

Project: Glen Echo Creek **Project Location:** Oakland, California **Project Number:** 51-951273NB.00	# Log of Boring MM-1

Date(s) Drilled	7/29/99	Logged By	J. Fippin	Checked By	M. Freitas
Drilling Method	Solid Flight Auger	Drill Bit Size/Type	3-1/2-inch auger bit	Total Depth of Borehole	29.0 feet
Drill Rig Type	Minuteman	Drilling Contractor	Access Drilling	Approximate Surface Elevation	~~Not available~~ 36
Groundwater Level and Date Measured	Approx. 26 feet ATD	Sampling Method(s)	Modified California	Hammer Data	Safety hammer, 140 lbs, 30-inch drop
Borehole Backfill	Drill cuttings	**Location**	Uphill of tree near carport on 28th Street; refer to site plan		

Elevation feet	Depth, feet	SAMPLES Type	Number	Sampling Resistance, blows / foot	Recovery, %	Graphic Log	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	Unconfined Compressive Strength, psf	REMARKS AND OTHER TESTS
	0						6 inches of topsoil (removed to make drill pad)				
			1-1	18	100		SILTY SAND (SM) [Fill] Medium dense, slightly moist, light brown mottled with dark brown, fine-grained, with decomposed brick, abundant roots, organic odor				
	5		1-2	19	100			6.2	103	2035	24%<#200 sieve
			1-3	20	100		CLAYEY SAND to SANDY CLAY (SC/CL) [Fill] Medium dense / very stiff, dry, dark brown, fine-grained sand, some brick fragments	10.0	92	755	
	10		1-4	12	100			9.1	95		
			1-5	11	100		CLAYEY SAND (SC) [Fill] Medium dense, moist, light brown and dark brown, with weathered siltstone and sandstone fragments				23%<#200 sieve Approximate crown of new tunnel
20	15		1-6	50/2.5"	10		Brick; intact and hard; difficult drilling				
	20		1-7	34	50		CLAYEY SAND (SC) Medium dense, moist, gray mottled with light brown, fine-grained, some roots				
			1-8	11	100			23.5	99	1130	26%<#200 sieve
10 9	25						CLAYEY GRAVEL (GC) Dense to very dense, wet, gray and brown, gravel to 1 inch, with coarse-grained sand				Approximate invert of new tunnel
			1-9	64	90						17%<#200 sieve
	30						Bottom of boring at 29.0 feet				
	35										

Report: GEO_10B1_OAK; File: GLENECHO.GPJ; 8/24/99

Figure A-2

URS Greiner Woodward Clyde

GE-101

Project: Glen Echo Creek Project Location: Oakland, California Project Number: 51-951273NB.00	Log of Boring MM-2 Sheet 1 of 1

Date(s) Drilled	7/30/99	Logged By	J. Fippin	Checked By	M. Freitas
Drilling Method	Solid Flight Auger	Drill Bit Size/Type	3-1/2-inch auger bit	Total Depth of Borehole	32.0 feet
Drill Rig Type	Minuteman	Drilling Contractor	Access Drilling	Approximate Surface Elevation	~~Not available~~ 42
Groundwater Level and Date Measured	Approx. 31.5 feet ATD	Sampling Method(s)	Modified California, SPT	Hammer Data	Safety hammer, 140 lbs, 30-inch drop
Borehole Backfill	Drill cuttings	Location	Refer to site plan		

Elevation feet	Depth, feet	SAMPLES: Number	SAMPLES: Sampling Resistance, blows / foot	SAMPLES: Recovery, %	MATERIAL DESCRIPTION	Water Content, %	Dry Unit Weight, pcf	Unconfined Compressive Strength, psf	REMARKS AND OTHER TESTS
	0				6 inches of topsoil (removed to make drill pad)				
		2-1	18	80	SANDY CLAY to CLAYEY SAND (CL/SC) [Fill] Stiff / medium dense, dry, light brown, with weathered claystone and sandstone fragments, roots, organic odor				
		2-2	23	90	Abundant highly weathered sandstone cobbles				
	5								
		2-3	37	100	Becomes hard / dense	7.5	114		Highly weathered sandstone in sampler.
	10	2-4	49	100					
		2-5	18	100	SILTY SAND (SM) [Fill] Medium dense, moist, dark brown, fine-grained, organic odor	9.4	106	3150	40%<#200 sieve
	15	2-6	21	100	SANDY CLAY (CL) [Fill] Very stiff to hard, moist, dark brown, with weathered rock and concrete fragments				Approximate crown of new tunnel
		2-7	28	90					
	20					13.3	117	13030	60%<#200 sieve
		2-8	23	100	Becomes mottled with gray, red, and light brown	12.4	115	7905	
	25	2-9	11	60	SILTY SAND (SM) Medium dense, moist, light brown mottled with red, fine-grained				Difficult drilling; possible concrete piece at bottom of fill. 14%<#200 sieve
		2-10	12	100	CLAYEY SAND (SC) Medium dense, moist, red-brown mottled with gray and brown				43%<#200 sieve Approximate invert of new tunnel
	30	2-11	17	100	Becomes wet ▽	17.9	113	1585	
10					Bottom of boring at 32.0 feet				
	35								