Report
Geotechnical Engineering Study
Proposed Convention Center Expansion
Option 2 Site
Spokane, Washington

September 25, 2002

for
Spokane Public Facilities District

September 25, 2002

Spokane Public Facilities District
Spokane Arena
West 720 Mallon Avenue
Spokane, Washington 99201

Attention Kevin Twohig
Executive Director

We are pleased to present four copies of our "Report, Geotechnical Engineering Study, Proposed Convention Center Option 2 Site, Spokane Washington." Our services were conducted in general accordance with the scope of services described in our May 28, 2002 proposal, which was authorized the same date by Spokane Public Facilities District No. 02-07

We appreciate the opportunity to be of service to you. If you have questions regarding the contents of this report or require additional information, please contact us.

Yours very truly,

GeoEngineers, Inc.

Allen B. Gifford, P.E.
Principal

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EXECUTIVE SUMMARY

The Convention Center Expansion Option 2 Site is located in downtown Spokane, Washington along the south side of the Spokane River. The proposed project will consist of a one- to two-story above ground structure and a basement level for parking. Total expansion floor space is on the order of 170,000 square feet.

Currently, the site is mostly paved with asphalt concrete and used for hotel and restaurant parking. Historical data shows the site was formerly part of a large railroad switch yard and prior to that contained railroad track, commercial and public buildings and residential structures. General geology in the project vicinity typically includes river gravels overlying basalt rock. Old construction fill is also present in this area.

The site slopes from south to north and has about 6 to 7 feet of elevation difference in this direction. It is relatively level in the east west directions. The Option 2 Site property ownership includes the City of Spokane and three others.

The subsurface explorations program included making 18 borings, installing a groundwater monitoring well, drilling and sampling about 255 lineal feet, making 64 drive sampling attempts, recovering 53 soil samples, conducting 81 lineal feet of rock drilling including 54 lineal feet of rock coring. We also monitored water levels in three existing previously installed on-site wells.

Four general subsurface units were encountered during exploration. These include debris fill, granular fill, native sand and gravel, and basalt rock. Debris fill, was encountered in about 25 percent of the borings. It consisted of a sand and gravel matrix with construction debris that included concrete slabs, concrete and brick rubble, asphalt, and open-graded cobbles. Granular fill, was also encountered in nearly all of the borings. It consisted of loose to medium dense sand and gravel with cobbles, occasional boulders and variable silt. Native sand and gravel was also encountered in most borings. It consisted of loose to very dense sand and gravel with variable silt. Basalt rock was encountered in all but one of the borings that refused in cobbles. Rock was encountered at depths ranging from about 2 to 17 feet below ground surface. The rock was typically dark gray and very hard.

Groundwater was encountered at depths ranging from about 5 to 8 feet in the borings closest to the river. We estimated this was about the same elevation as the river surface.

It is our opinion that the proposed convention center expansion project can be designed and constructed generally as envisioned at the Option 2 Site. We recommend that new foundation loads bear on competent basalt rock. This can be accomplished using spread footings, piers or drilled shafts. Floor slabs can be supported on-grade over thoroughly proof compacted on site soil and structural fill.

REPORT
GEOTECHNICAL ENGINEERING STUDY
PROPOSED CONVENTION CENTER EXPANSION OPTION 2 SITE
SPOKANE, WASHINGTON
FOR THE
SPOKANE PUBLIC FACILITIES DISTRICT

INTRODUCTION

This report presents the results of our geotechnical engineering study to support foundation design for the proposed Option 2 Site Convention Center Expansion. The project site is located in downtown Spokane, Washington as shown on the Vicinity Map, Figure 1. Also, see Photo 1. The proposed site layout is shown on the Site Plan - General, Figure 2. Current property ownership is shown on the Site Plan – Property Owners, Figure 3.

We understand the Option 2 Site is one of two sites being considered by the Spokane Public Facilities District (SPFD) for the proposed Convention Center Expansion project. The other proposed location, the Option 3 Site, is the subject of a separate geotechnical report. The Phase I and Limited-Phase II Environmental Assessment for the Option 2 Site is also the subject of a separate companion report. The purpose of this geotechnical report and its companion Phase I and Limited Phase II Environmental report is to assist the SPFD in evaluating the final convention center expansion location.

The main structure for the proposed new complex will likely have a 120,000 to 175,000 square-foot building footprint area and one level of below grade parking. Column loads are expected to be in the 1,000 kip range. We anticipate that ground floors will consist of concrete slabs-on-grade.

SCOPE OF SERVICES

The purpose of our services was to provide site specific geotechnical information to allow the SPFD to select the best site for constructing the Convention Center Expansion and to provide sufficient technical information to allow the project to proceed through design. The scope of services for the study are presented in our proposal dated May 28, 2002 to Integrus Architecture. Authorization was provided by SPFD PO No. 02-07 contract dated May 28, 2002.

Our specific scope of services included:

1. Review existing available geotechnical data.
2. Conduct geophysical testing to help locate top of rock.
3. Drill exploratory borings to sample soil and core bedrock.
4. Sample subsurface materials at 2 1/2 to 5 foot depth intervals in general accordance with ASTM procedures.
5. Conduct laboratory index and strength testing on recovered soil and rock samples.
6. Conduct engineering analyses for excavation shoring, and foundation design and construction and provide a summary engineering report.

SITE CONDITIONS

GENERAL

We explored site conditions by visual reconnaissance, drilling 18 new borings and reviewing 38 previous site explorations. Approximate locations of new and previous borings are shown on the Site Plan – Current and Previous Exploration, Figure 4. Eleven of the new borings, (B-201 through B-207, B-207A, B-210, B-211 and B-212), were made using a hollow-stem auger drill rig. Seven, (B-208, B-209, MW-213, B-214, B-214A, B-215, B-215A), were made using an air-rotary drill rig. A new monitoring well was installed at MW-213. Previously installed monitoring wells (MW-SH02, MW-SH19 and MW-SH20) were identified, located and sampled. Results from the previously installed wells and MW-213 were used in our analysis of site groundwater conditions. Descriptions of the field exploration equipment and procedures, and logs of the borings are included in Appendix A. Logs of previous borings are included in Appendix C.

Soil conditions encountered in the explorations were classified in general accordance with the American Society for Testing and Materials (ASTM) D 2488. Apparent rock strength and degree of weathering were evaluated using the International Society of Rock Mechanics (ISRM) methods.

Laboratory testing was performed on selected soil and rock samples recovered from the borings. These included percent fines and moisture content determinations and rock point load index and, rock specific gravity tests. Rock point load index test results were used to estimate rock strength for developing bearing capacity recommendations. Results from the percent fines and moisture content tests were used to characterize soils and to evaluate their suitability for reuse as structural fill. We also performed corrosion testing including pH, soluble sulfates, and resistivity to evaluate soil corrosivity. These tests were done under subcontract with SVL Analytical, Inc. Descriptions of the laboratory test results are included in Appendix B.

Our study included reviewing results of 38 previous site explorations. These included test pits and borings made by AGRA in 1995, Lambert in 1993, AGI in 1992, and the Washington State Department of Transportation in 1988. Approximate locations of the previous borings are shown on Figure 4. Logs of previous explorations are included in Appendix C.

Aquila Geosciences, Inc performed a seismic refraction survey at the site. Refraction lines were oriented approximately as shown on Figure 3. Results of the survey provide an estimate of the depth to rock and its compression wave velocity. Wave velocity data was used to estimate the rippability of rock for excavation purposes and to help characterize subsurface conditions for seismic design. A copy of the Seismic Refraction Survey dated July 24, 2002 is included in Appendix D.

SURFACE CONDITIONS

The approximately 6-acre site is located in downtown Spokane just east of the existing Convention Center and along the south side of the Spokane River as shown on Figure 1. Also see Photo 1. Division Street and Spokane Falls Boulevard bound the east and south sides of the site. Several existing structures including the Agricultural Trade Center, the Doubletree Hotel, and the

Azteca Restaurant are located west of the proposed project area. CI Shenanigans Restaurant is located on the north side of the project site.

The site is generally level with a slight slope down to the north. The total change in elevation is about 6 to 7 feet north-south but it is practically level in the east-west direction. The north edge drops abruptly down about 7 to 8 feet to the Spokane River. The east end of the site butts against a 10 to 30 foot high cast-in-place concrete retaining wall along Division Street.

The parking area pavements are deteriorated. Shallow potholes, surface depressions, rutting, cracking and patching are prevalent throughout the site. Parts of the surface have been overlayed with new asphalt. The parking area includes a number of light standards. Six large metal shipping containers are located on the south side of the site. Numerous medium to large, 20- to 30-foot-high deciduous trees located in traffic islands, are present throughout the site and there is a border of grass and trees, adjacent to the Centennial Trail along the north side of the property.

Site drainage currently flows into catch basins located throughout the parking area. Based on discussions with the City of Spokane we understand these drain into the combined sanitary sewer system.

GEOLOGY

The subject site is located within the Columbia Basin also known as the Columbia Plateau. The Columbia Basin is a physiogeographic area in eastern Washington, southwestern Idaho and northern Oregon that received lava from extensive volcanic events that occurred during the Miocene age (13 to 16 million years ago). The lava created a layered basalt formation with interbeds of fine-grained soils known as the Columbia River Basalt Group. This unit, which covers approximately 36 percent of Washington State, derived from four major volcanic events. The formation has a maximum thickness of about 16,000 feet.

The Columbia River Basalt's are overlain by coarse-grained sediments deposited by what is known as the Glacial Lake Missoula Flood. The flood occurred approximately 15,000 years ago, toward the end of the ice age. At that time, an ice lobe advanced south into Idaho, damming the Clark Fork River near the Montana border. The ice dam periodically gave way, releasing waters that caused unprecedented flooding into eastern Washington. Floodwaters flowed into the Spokane Valley and spread out over the Columbia Basin. The flood episodes scoured the top of the basalt and deposited hundreds of feet of sediment ranging from silt to boulder sizes throughout the Spokane area. The project site is located in an area that experienced, basalt scour, but relatively little deposition of sediment during the various flooding events.

SUBSURFACE CONDITIONS

We encountered variable subsurface conditions beneath the asphalt concrete pavement to the boring exploration depths, and characterized subsurface conditions into four general units. The pavement layer was about 2 to 3 inches thick, beneath it the units included: 1) debris fill; 2) granular fill; 3) native sand and gravel; and 3) basalt rock.

Debris fill was encountered in borings B-207A, B-208, B-210, B-214, B-215 and B-215A. It consisted of a sand and gravel matrix with construction debris that included concrete slabs, concrete and brick rubble, asphalt, and open-graded cobbles. The debris fill was encountered at variable depths and ranged from about ½ to 4 feet thick. We characterized this unit as having low to moderate strength and moderate compressibility.

Granular fill was encountered in all borings except B-211, B-212, B-214, B-215, and B-215A. It generally consisted of loose to medium dense sand and gravel with cobbles and variable silt. Silt content ranged from a trace to over 30 percent but more commonly ranged from about 9 to 14 percent. This unit was encountered just beneath the pavement to depths ranging from about 2 to 17 ½ feet. We characterized it as having low to moderate strength, moderate compressibility, and low to high moisture sensitivity.

Native sand and gravel was encountered in most of the borings beneath the pavement or below the granular fill and overlying basalt rock. It generally consisted of loose to very dense sand and gravel with cobbles and variable silt. It had less silt and was slightly cleaner than the granular fill. The silt content ranged from a trace to over 20 percent with an average of about 3 to 8 percent. We characterized the native sand and gravel soil unit as having moderate strength, low to moderate compressibility, and low to moderate moisture sensitivity.

Basalt rock was encountered in all borings except boring B-204 which refused on boulders in coarse gravel. Basalt was described as generally dark gray, massive and hard. Its fracture frequency typically ranged from 1 to 12 per foot. RQD ranged from 0 to 100 and averaged 49; total core recovery ranged from about 50 to 100 percent and averaged 94 percent. Point load index tests indicate that the approximate unconfined compressive strength of the intact basalt ranges from about 6,000 to 30,000 pounds per square inch (psi). Seismic refraction test data indicates its compression wave velocity ranges from about 12,300 to 16,000 feet per second. We characterized the basalt rock as having high strength and low compressibility.

A contour plan showing the approximate depth to rock is presented on the Site Plan - Top of Rock Contours, Figure 5. Profiles showing the top of rock and the various soil units are presented on Cross Sections A-A', B-B', C-C' and D-D', Figures 6 through 9, respectively. Estimated engineering parameters for each of the subsurface units are provided in Table 1.

TABLE 1
ENGINEERING PARAMETERS

Soil Unit	Unit Weight (pcf)	Friction Angle (degree)	Cohesion (ksi)	Unconfined Compressive Strength (ksi)	Compression Wave Velocity Vc (feet/seconds)	Elastic Modulus Es (ksf)
Debris fill	120-145	NA	0	NA	500-2,500	1,000-2,000
Granular fill	120-130	28-32	0	NA	500-2,500	1,000-2,000
Sand and gravel	125-135	30-34	0	NA	500-2,500	2,000-3,000
Basalt rock	165-170	40	6-8	12-16	12,300-16,000	1,000,000-2,000,000

GROUNDWATER

Groundwater was encountered in borings located on the north side of the site close to the river. Water was present in the granular fill and the native sand and gravel soil units at depths ranging from about 5 to 8 feet below ground surface. During exploration the river level was also about 7 feet below ground surface. Since water was used during rock coring, groundwater levels could not be determined during drilling in the basalt. Rock fractures and joint orientations suggest the rock is capable of transmitting some water.

We periodically measured groundwater levels in well MW-213, and previously installed wells MW-SH02, MW-SH19, and MW-SH20. Measurement data are presented in Table 2. The data appears to show that local levels are closely influenced by water levels in the Spokane River.

Based on discussions with Avista Corporation, we understand that the Spokane River elevation at the site is controlled by the Upper Falls Dam and Control Works, located about 1500 and 800 feet down stream, approximately as shown on Figure 1. The water elevation in the forebay of Upper Falls Dam is held constant within plus or minus 0.2 feet throughout the year except during flows that exceed very large flood events. We understand that the forebay elevation can rise by 1 to 1 1/2 feet during 80 and 100 years flood events; respectively. We anticipate a subsequent rise in groundwater at the project the site would also occur during such events.

TABLE 2
GROUNDWATER MEASUREMENTS/ELEVATIONS

	MW-213		MW-SH02		MW-SH19		MW-SH20		River
Date	Depth[1]	Elevation[2]	Depth[1]	Elevation[2]	Depth[1]	Elevation[2]	Depth[1]	Elevation[2]	Elevation[2]
6/27/02	NA	NA	NA	NA	NA	NA	NA	NA	90.5
7/2/02	6.73	89.94	7.52	90.11	9.42	90.15	9.86	90.14	NA
7/3/02	6.63	90.04	7.52	90.11	9.44	90.13	9.85	90.15	NA
7/25/02	6.54	90.13	7.50	90.13	9.44	90.13	9.86	90.14	90.1

Notes:

1. Depths measured from top of casing.
2. Elevations are referenced to the top of casing in MW-SH20, which was established as a temporary bench mark (TBM) set at Elevation 100 feet.

CONCLUSIONS AND RECOMMENDATIONS

GENERAL

Based on the results of our subsurface exploration and analyses, it is our opinion that the site can be developed generally as envisioned. We believe the proposed new building can be supported on shallow spread footing, pier or drilled shaft foundations bearing on basalt rock. Specific design and construction recommendations are presented below.

SITE PREPARATION

Initial site preparation will require removing existing pavements, walkways and landscaping from the project site. We recommend the site be cleared of debris, and surface and subsurface deleterious matter including grass, organic-rich surficial soil and roots greater than about ½ inch in diameter. If clearing activities cause excessive subgrade disturbance, additional stripping might be necessary. Disturbance to a greater depth should be expected if site preparation is accomplished during periods of wet weather when surficial soil could have a moisture content over optimum.

In our opinion, topsoil stripped from existing planting islands and border areas can be used for landscaping or other non-structural applications. However, it would not be suitable for reuse as structural fill. Stripping material which can not be used for landscaping or other non-structural purposes should be removed from the project area and properly disposed.

NOTE: Some of the on-site soils are contaminated and will require special handling during excavating and disposal. See the Phase I and Limited Phase II Environmental Site Assessment companion report.

After stripping and excavation to proposed construction grades has been accomplished, we recommend the exposed subgrade be proofrolled with a heavy (minimum 12 ton static weight) vibratory compactor, using four to six passes. Proof-compacting will help to densify the soil surface and identify any soft or loose areas that may need to be over-excavated and replaced with structural fill. Proof-compacting should be observed by a geotechnical engineer, or engineering technician from our office. If soft or loose zones are identified, these areas should be overexcavated to a depth of 2 feet or to firm bearing, whichever is less, and replaced with compacted structural fill. Structural fill required to establish proposed subgrade elevations may be placed directly on native soils prepared as recommended herein.

It is our opinion that most of the general excavating can probably be accomplished with conventional earth moving equipment. However, depending on final basement elevation and location, hoe-ramming and blasting will probably be necessary to remove shallow basalt rock. Seismic velocity data indicates ripping basalt rock is probably not possible at this site.

STRUCTURAL FILL

We recommend fill to support structures or pavements or new embankments, and for backfilling utility trenches and below grade walls adjacent to new structures, be placed as structural fill. The suitability of soil for use as structural fill will depend on its gradation and moisture content. As the amount of fines (silt- and clay-sized particles passing the U.S. No. 200 sieve) increases, soil becomes more sensitive to small changes in moisture content and adequate compaction becomes more difficult to achieve.

Excavations will encounter existing debris fill, granular fill, sand and gravel, and basalt rock. In our opinion, the on-site debris fill soil is not suitable for reuse as structural fill and should be hauled off site.

It is our opinion, that the on-site granular fill, and native sand and gravel are generally suitable for use as structural fill provided they are moisture-conditioned for compaction and free of debris, organic material, frozen soil or particles greater than 6 inches in dimension. Processing will likely be required to remove oversize material. Since much of the on-site soil contains considerable silt some of it will likely be moisture sensitive and difficult to work or adequately compact when over optimum, or if earthwork is accomplished during wet weather. Selective stockpiling to separate high and low silt content material during excavating will be helpful.

We recommend imported structural fill consist of clean, well graded sand and gravel containing less than about 10 percent fines and free of organic contaminants, frozen soil, debris, and particles greater than 4 inches in maximum dimension. For construction during wet weather, we recommend imported structural fill contain less than 5 percent fines.

We recommend that imported or reusable onsite soil used for structural fill be placed in lifts not exceeding 10 inches in loose thickness before compaction. All structural fill in building areas, and for the upper 2 feet of subgrade in pavement areas should be compacted to at least 95 percent of the maximum dry density (MDD) based on ASTM D 1557. Structural fill placed 2 feet below pavement subgrade should be compacted to at least 90 percent of the MDD. Each lift should be moisture conditioned to achieve the recommended degree of compaction. Nonstructural fill placed in landscaped areas need only be compacted to the degree required for trafficability of construction equipment.

We recommend that a GeoEngineers on site representative observe all earthwork operations. His purpose will be to confirm site preparation and fill placement, evaluate soil conditions through in-place density testing, probing, and visual observation of proofrolling to confirm compliance with the contract documents and recommendations in this report.

CUT AND FILL SLOPES

Temporary cut slopes might be necessary during excavation and grading operations. As a general guide, slopes of 1.5H:1V (horizontal to vertical) or flatter may be used for temporary cuts in the on-site soils. This assumes that all surface loads are kept a minimum distance of at least one half the depth of the cut back from the top of the slope. Flatter slopes will be necessary if surface loads are imposed above the cut a distance equal to or less than one half the cut depth. The Contractor is responsible for construction site safety and should monitor all excavation and fill slopes during construction in accordance with OSHA (Occupational Safety and Health Administration) and WISHA (Washington Industrial Safety and Health Administration) regulations.

We recommend using a maximum inclination of 2H:1V for permanent cut and fill slopes. Surface drainage should be directed away from slope faces. Some minor raveling could occur with time. All slopes should be seeded as soon as possible to encourage the development of a vegetative cover or otherwise protected.

FOUNDATION SUPPORT

General

It is our opinion that all new foundation loads should be supported on competent basalt rock. This can be accomplished by using spread footings, pier or drilled shaft foundation or a combination of these systems. Because bedrock slopes down to the north, excavations to enable foundation bearing on basalt could range from about 2 to 23 feet below existing site grade. Building structural loads could probably be supported on a combination of shallow spread footings, where the rock is shallow and there is no groundwater, and on drilled shafts where the depth to rock is deeper and may be below groundwater.

Spread Footings

For shallow spread footings or piers bearing in the top of competent basalt bedrock at this site, we recommend using a maximum net design rock bearing pressure of not more than 40 kips per square foot (ksf). All footings should have a minimum dimension of 2 feet. The design rock bearing pressure could be increased by one-third for transient loading conditions, such as those resulting from wind or earthquake forces. No structural foundations should bear on weathered basalt, existing fill soil or any other loose or unsuitable soils that may be encountered during excavation. The recommended design bearing pressure assumes that the foundations are supported on clean, hard, competent basalt rock.

We recommend that foundation preparation of rock surfaces include scaling all loose and weathered rock. Prior to placing concrete, the rock surface should be hand swept and blown free of all loose material. Bearing conditions of the prepared surface should be verified before concrete placement by an experienced geotechnical engineer, or engineering technician.

If the rock slope across the foundation bearing area is greater than 6.0 H on 1.0 V, we recommend either flattening it with chipping hammers, or anchoring the footing to the underlying rock with grouted steel dowels. If dowels are used, we recommend they have a minimum embedment of 12 inches.

We estimate that footings designed and constructed as described above will settle less than 0.25 inches. Differential settlement between adjacent footings will probably be less than 0.10 inches. Because of the elastic nature of the basalt, we expect that settlement will occur almost as the loads are applied.

Short Piers

It is our opinion that short concrete piers would be a option for supporting new building loads where rock depths ranges from about 8 to 16 feet below foundation grade. Pier excavations could be made using a large backhoe to excavate down to basalt followed by installing metal pipe casings of an appropriate diameter to act as a form. Controlled density fill or structural fill could be used for backfill around the outside of the casing. Reinforcing and concrete placement would be similar to those for drilled shafts.

We recommend piers have a minimum diameter of at least 3 feet to allow for inspection of bearing conditions. Piers bearing on sound hard basalt rock may be designed using a maximum

net design bearing pressure of 40 ksf for end bearing. They should be designed on the basis of end bearing only.

We estimate that settlement of foundation piers designed and installed as recommended herein will mostly be due to elastic shortening of the shaft and should be negligible. We estimate that the short piers will respond to lateral loads in a manner similar to drill shafts.

Drilled Shafts

In our opinion, supporting new building loads on drilled shafts particularly where rock is deep and below groundwater level, would be an appropriate alternative for this project. We recommend that drilled shafts have a minimum diameter of 3 feet to allow for inspection of bearing conditions. Shafts should bear on sound hard basalt rock and be designed using a maximum net design bearing pressure of 40 ksf for end bearing. We recommend that shafts be designed on the basis of end bearing only.

We estimate that settlement of drilled shafts designed and installed as recommended herein will mostly be due to elastic shortening of the shaft and should be negligible.

Lateral pile analyses was conducted for a 16-foot-long shaft using the computer program Lpile Plus 3.0. Results indicate that for a 3-foot-diameter shaft and limiting lateral deflection to ½ inch, it would be capable of resisting 40 kips of horizontal load at the top, respectively. The maximum bending moment would be about 175 kip feet.

Shaft Installation

We recommend the drill shaft contractor submit a detailed installation plan for review and approval by the engineer before shaft construction. The submittal should include a narrative describing the contractors' understanding of anticipated subsurface conditions, the overall construction sequence, and proposed shaft installation equipment. Details of proposed shaft excavation methods should be provided including methods to ensure shaft stability during construction. The contractor should indicate which proposed method or methods will be used. Based on the boring information it is our opinion that temporary casing will likely be necessary during shaft construction in order to maintain hole side wall stability.

The contractor should be prepared to drill through rocky fill conditions and to remove obstructions such as boulders or large cobbles that may be encountered during drilling. He should be prepared to install shafts in the wet since dewatering may not be possible.

After the design tip elevation for the shaft is established, the bottom should be cleaned of loose material before setting reinforcement and placing concrete. The geotechnical engineer should confirm bearing conditions and shaft depth before pouring concrete. For concrete placement in the wet, care must be taken to provide a positive head at all times above the bottom of the temporary casing during its removal. We recommend a minimum 5-foot head of concrete be maintained inside the casing during this process.

LATERAL RESISTANCE CRITERIA

Lateral foundation loads will be resisted by a combination of the frictional resistance between the rock and the foundations and passive resistance which can develop on the vertical face of below-grade elements of the structure as those elements move into the soil. Lateral resistance for drilled shaft and short pier foundations was discussed previously.

For concrete foundations bearing on competent basalt rock prepared in accordance with previous recommendations, sliding resistance could be estimated using a coefficient of friction of 0.45 applied to vertical dead-load forces. The allowable passive resistance on the face of footings, grade beams or other embedded foundation elements may be estimated using an equivalent fluid density of 300 pounds per cubic foot (pcf) triangular distribution. Both the above values include a factor of safety of about 1.5 and assume backfill around foundation elements consists of structural fill placed and compacted as recommended herein.

BELOW GRADE WALLS

Basement walls for the building will act as retaining walls. Retaining walls should be supported on foundations bearing on competent basalt rock and be designed and constructed as recommended previously.

Cantilever retaining walls that are allowed to yield during backfilling should be designed for lateral pressures based on an equivalent fluid density of 40 pcf. We recommend rigid retaining walls be designed using an equivalent fluid density of 65 pcf. Both these values assume the ground surface behind the wall is level for a distance of two times the wall height and that walls are fully drained to prevent development of additional hydrostatic pressure.

Fill behind retaining walls should be placed as structural fill and conform to gradation specifications provided in the previous section. Care must be taken by the contractor to avoid over compacting fill placed behind retaining walls. We recommend using hand operated compaction equipment and maximum 6-inch lifts when placing and compacting fill within 5 feet of retaining walls.

Surcharge loads are additive to lateral soil pressures. We should be consulted if surcharge loads will be located within a distance back from the top of the wall, equal to the wall height.

The recommended equivalent fluid densities are based on the assumption of free-draining conditions behind the retaining walls. This can be accomplished by placing a minimum 12-inch-thick zone of sand and gravel containing less than 5 percent fines or using a composite geotextile wall drain system such as Miradrain 6000, or equal against the wall. A perforated drainpipe should be installed at the base of the drainage zone and sloped and tightlined to an appropriate disposal point.

SEISMIC DESIGN

The 2000 International Building Code (IBC) shows the project site is located in an area with maximum credible earthquake ground motions of 0.32g and 0.10g, based on spectral responses of 0.2 and 1.0 seconds, respectively, where g is equal to the acceleration due to gravity. Our site exploration data shows the soil profile for this project would fit the description for Site Class A,

identified as "Hard Rock" having shear wave velocities greater than 5,000 feet per second. Results of the seismic refraction testing indicate that shear wave velocities in the basalt at this site exceed 6,800 feet per second.

SITE DRAINAGE

Temporary Drainage

Depending on construction elevations, some excavations will encounter groundwater, and groundwater elevations will be influenced by water levels in the Spokane River. Generally, water encountered above the river level during construction can probably be removed with sump pumps. However, water encountered in excavations that extend below river level will probably require cut off walls and large dewatering pumps or constructing in the wet. Off site disposal of groundwater will require appropriate permitting.

Groundwater

Based on discussions with the maintenance supervisor at the Doubletree Hotel we understand that the hotel basement extends about 6 to 8 feet below ground surface and that historically they have not had any groundwater problems. No sumps or pumps were provided for groundwater seepage. This information and the current groundwater depth measurements suggest that basement levels to depths of about 7 feet will not require special groundwater mitigating provisions.

If basements extend below 7 feet a permanent dewatering system will likely be necessary to keep basement areas dry. For deep basements, we recommend providing sumps, pumps and an exterior perimeter footing drain. The footing drain should be designed to flow to the sumps.

Stormwater Disposal

Because of shallow groundwater and rock conditions, in our opinion this site is not suitable for on-site stormwater disposal systems. We understand that stormwater for projects in this area is typically disposed of off-site in the City of Spokane combined sewer system.

SOIL CORROSION POTENTIAL

Test results indicate that the soil encountered at the boring locations shown on Figure 4 can be considered relatively noncorrosive, both from an electrical and a chemical standpoint. Laboratory test results are presented in Corrosion Testing, Table 3.

Laboratory testing of selected soil samples show that the soil resistivity, ranges from about 14,000 to 16,000 ohm-centimeters. Navfac-DM-5 classifies soil with resistivity greater than 10,000 ohm-centimeters as having low corrosion potential.

pH measurements show that the soil is slightly on the alkaline side of neutral; averaging about 8.1. Information in the corrosion literature characterizes soil with pH less than 8.5 as having low concrete corrosion potential.

Tests for the presence of water-soluble sulfate made to determine the potential for concrete corrosion, show sulfate concentration ranges from about 41 to 47 ppm. The 2000 IBC Table

1904.3 indicates that soil with less than 150 parts per million (ppm) has negligible corrosion potential. On this basis, it is our opinion that the soils at the project site should not be corrosive to below-grade concrete structures.

TABLE 3
CORROSION TESTING

Boring Number	Depth (feet)	Soil Classification	Resistivity (ohm-cm)	PH	Water-soluble Sulfate (as SO_4) (ppm)
B-202	1.5	SP-SM	16,000	8.1	47.2
B-206	1.0	GP	14,000	8.1	41.2

REFERENCES

Bill Ridell, Doubletree Hotel, 455-9600, 7/23/02 Phone Communication
Steve Watkins, City of Spokane, 625-6300, 7/23/02 Phone Communication
Gary Stockenger, Avista Corporation, 495-4283, 7/23/02 Phone Communication

LIMITATIONS

We prepared this report for the use of the Spokane Public Facilities District in the design of the proposed Site 2 Convention Center Expansion Project.

Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted practices in the field of geotechnical engineering in this area at the time this report was prepared. No warranty or other conditions, express or implied, should be understood.

Please refer to Appendix E, Report Limitations and Guidelines for Use for additional information pertaining to use of this report.

Respectfully submitted,

GeoEngineers, Inc.

Christopher A. Sneider, P.E.
Project Engineer

Allen B. Gifford, P.E.
Principal

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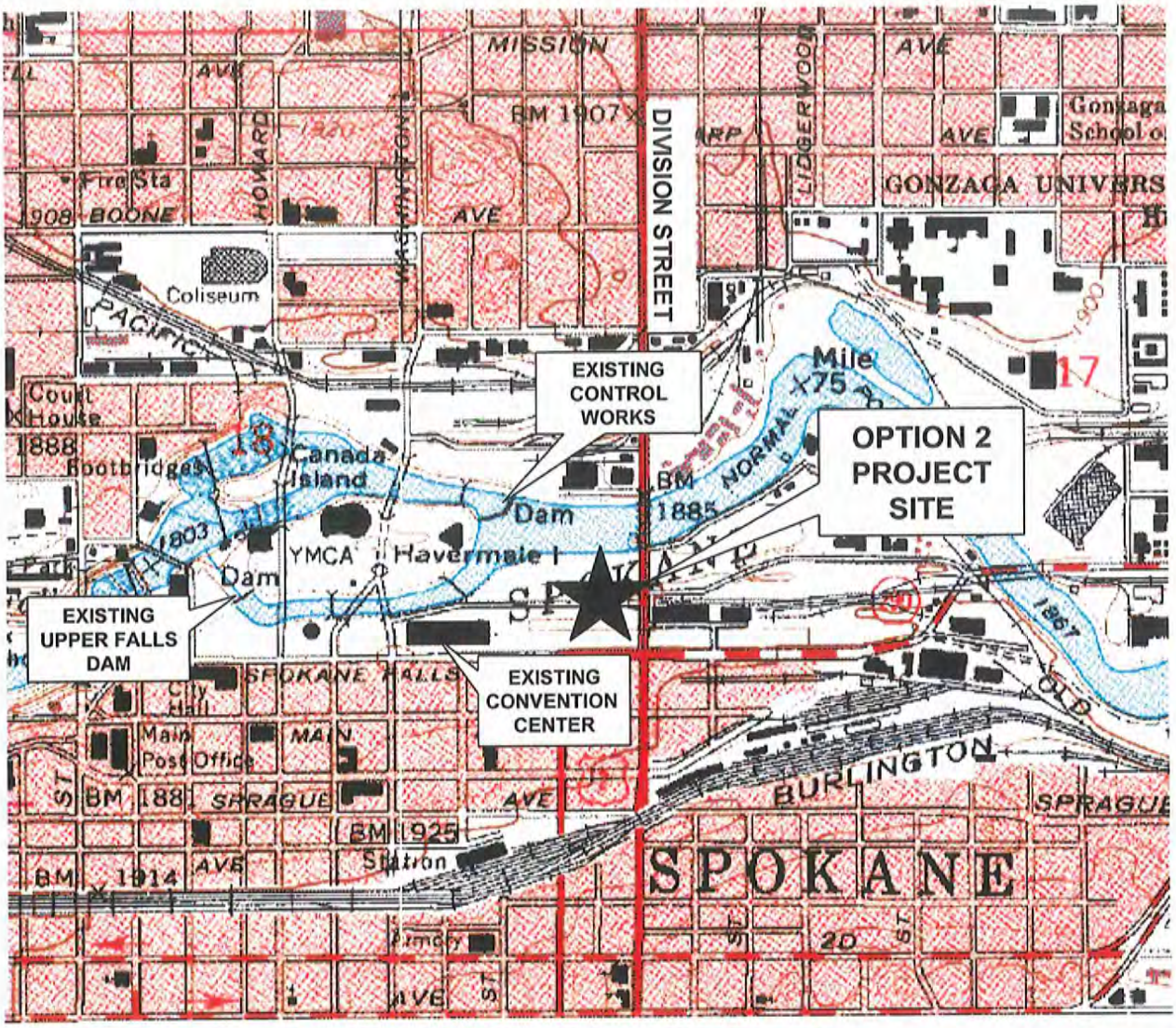
GeoEngineers

OPTION 2 - SITE PHOTO

PHOTOGRAPH 1



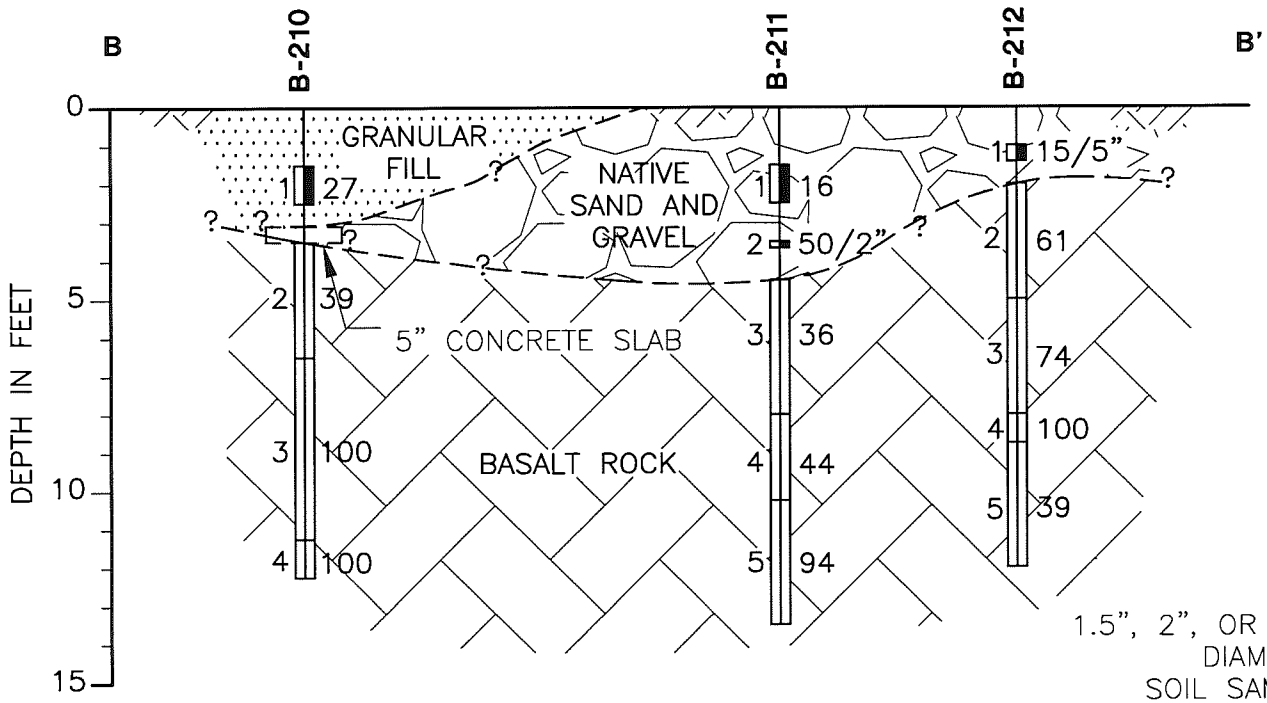
Reference; All Topo Maps "Spokane NW, WA"

Geo Engineers

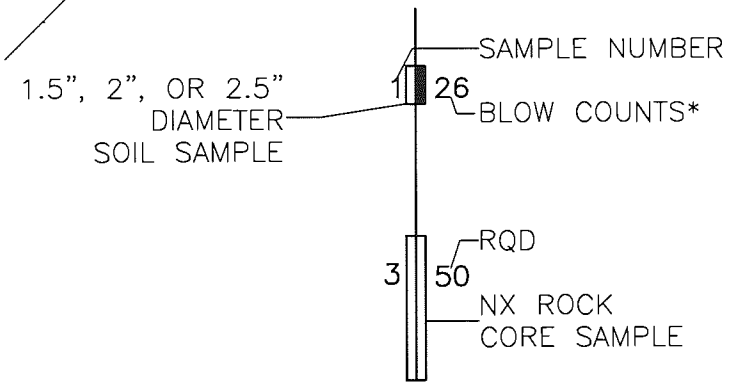
OPTION 2 - SITE VICINITY MAP

FIGURE 1

011004700:072502:CAS:RDE:ABG:dlw (011004700vm.ppt)



EXPLANATION:



SCALE:

HORIZONTAL 1"=100'
VERTICAL 1"=5'

*Note: From boring to boring, blow counts are not necessarily based on the same input energy.

Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. can not guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

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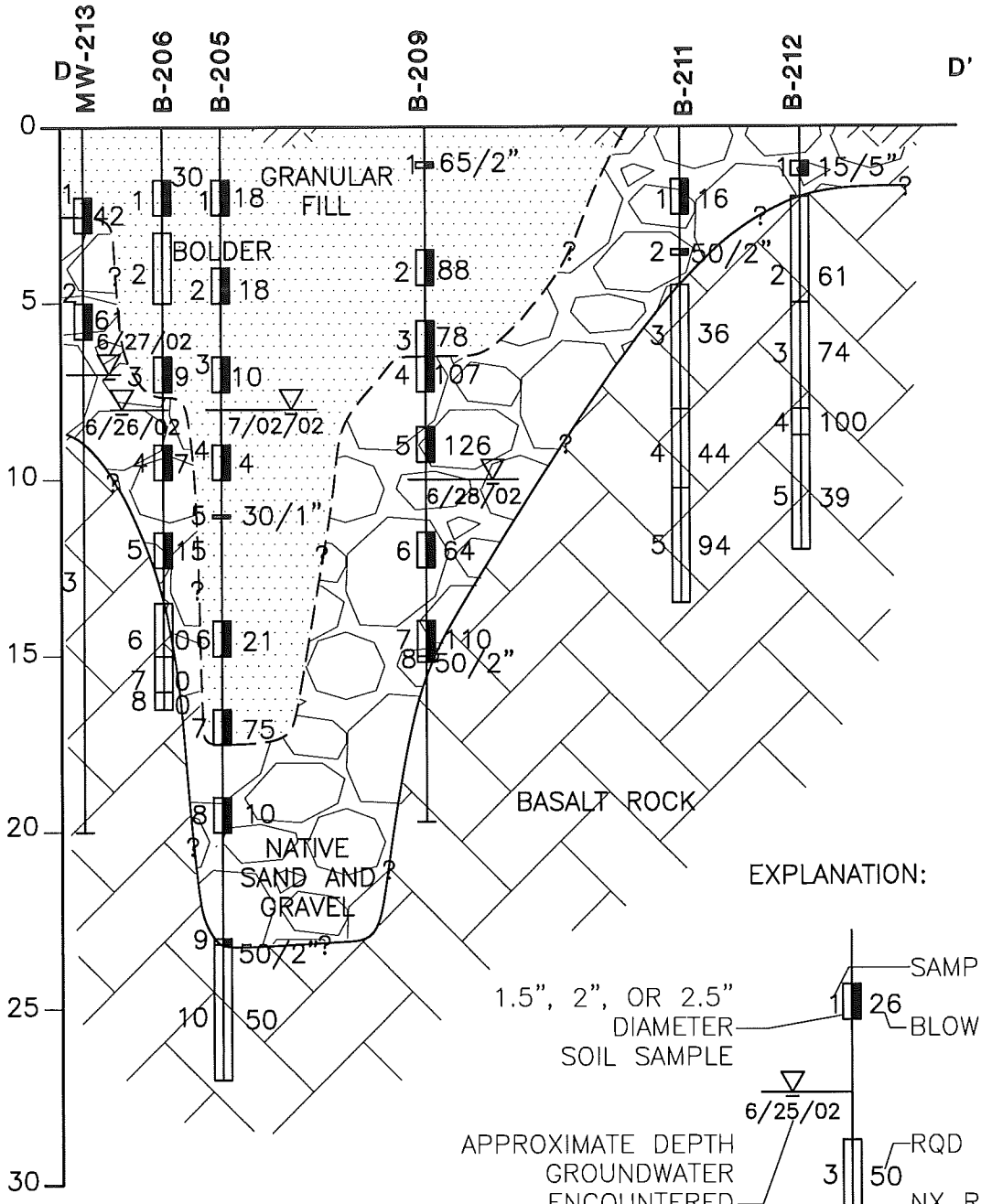
OPTION 2 - CROSS SECTION B-B'

FIGURE 7

011004700:072202

011004700BB.DWG

CAS:EAM



SCALE:

HORIZONTAL 1"=100'
VERTICAL 1"=5'

*Note: From boring to boring, blow counts are not necessarily based on the same input energy.

Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. can not guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

011004700:072202

011004700DD.DWG

CAS:EAM

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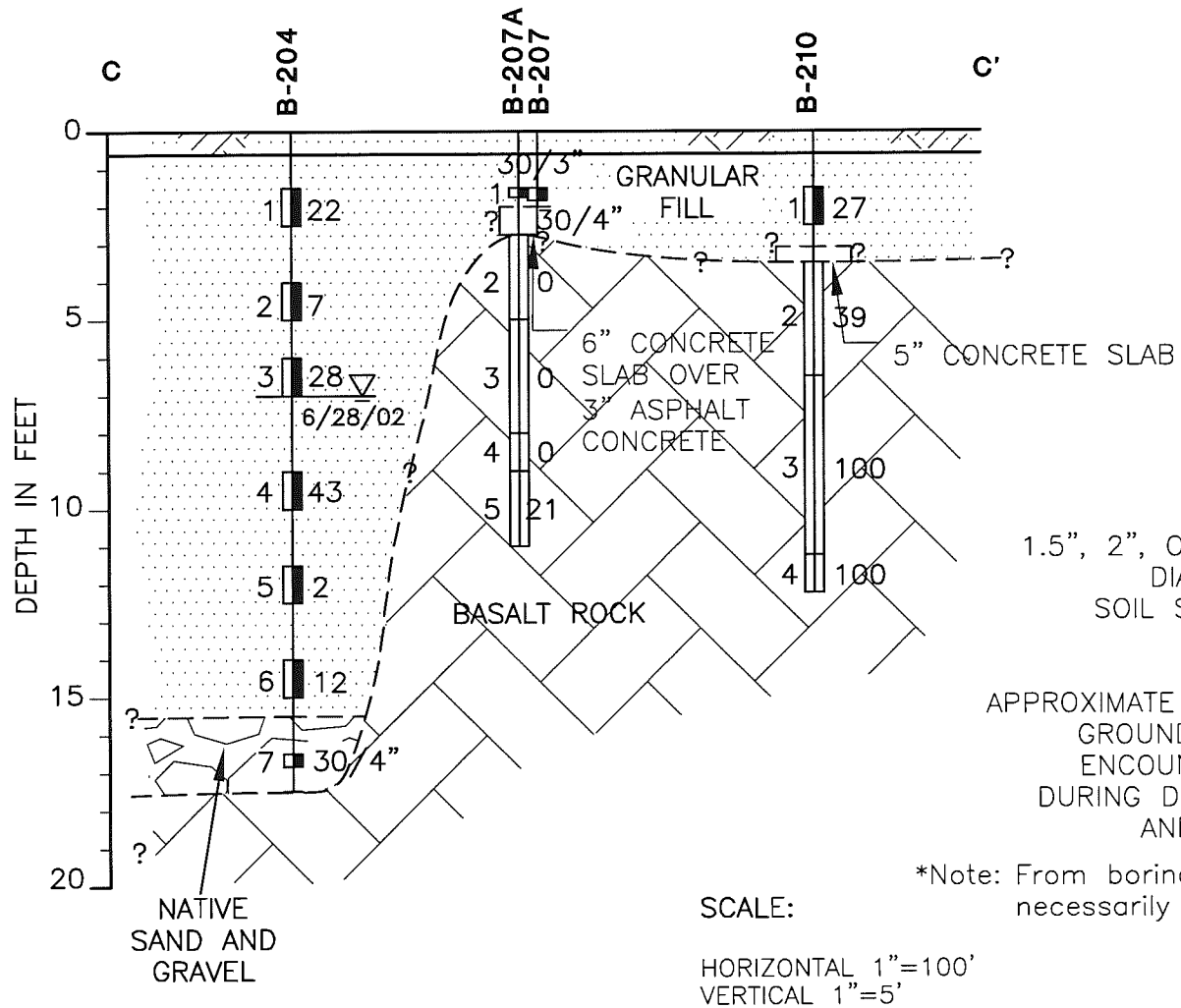
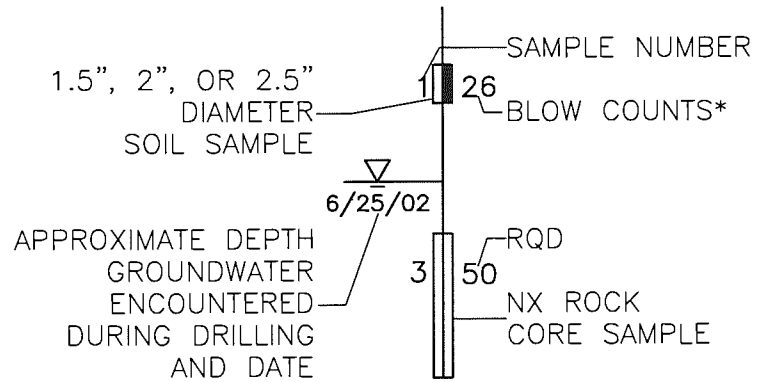
OPTION 2 - CROSS SECTION D-D'

FIGURE 9



EXPLANATION:



*Note: From boring to boring, blow counts are not necessarily based on the same input energy.

SCALE:

HORIZONTAL 1"=100'
VERTICAL 1"=5'

Notes:

1. The locations of all features shown are approximate.
2. This drawing is for information purposes. It is intended to assist in showing features discussed in an attached document. GeoEngineers, Inc. can not guarantee the accuracy and content of electronic files. The master file is stored by GeoEngineers, Inc. and will serve as the official record of this communication.

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OPTION 2 - CROSS SECTION C-C'

FIGURE 8

CAS:EAM 011004700CC.DWG 011004700:072202

APPENDIX A

SITE EXPLORATIONS

Subsurface conditions at the site were investigated on June 25 through July 3, 2002 by drilling 18 borings at the approximate locations shown in Figure 2. The borings extended to depths ranging from 2 to 27 feet below ground surface.

The subsurface explorations program included making 18 borings, installing a groundwater monitoring well, drilling and sampling about 255 lineal feet, making 64 drive sampling attempts, recovering 53 soil samples, conducting 81 lineal feet of rock drilling including 54 lineal feet of rock coring. We also monitored water levels in three existing previously installed on-site wells.

Eleven of the new borings, (B-201 through B-207, B-207A, B-210, B-211 and B-212), were made using a truck-mounted, continuous flight, hollow-stem CME-75 auger drill rig owned and operated by GeoEngineers, Inc. Seven borings, (B-208, B-209, MW-213, B-214, B-214A, B-215, B-215A), were made using an air-rotary casing advance drilling system under subcontract with Environmental West Exploration, Inc.

Representative soil samples were obtained from the borings in general accordance with ASTM D 1586, Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils, using a 2.0-inch, 2.5-inch and 3-inch outside-diameter split-spoon samplers. The samplers were driven into the soil with a 140-pound hammer free-falling 30 inches. The number of blows required to drive the sampler the last 12 inches, or other indicated distance, is recorded on the boring logs. Note: no adjustments were made to the blow counts shown on the boring logs for different sample sizes.

The borings were continuously monitored by a representative from our firm who examined and classified the soil encountered, obtained representative soil samples, observed groundwater conditions and maintained detailed logs of the explorations. Representative rock core samples were obtained using an Nx core barrel, having an approximate inside diameter of 2.5 inches. In holes drilled with the air-rotary drill rig, rock penetration rates were monitored and rock cuttings were collected to evaluate rock character.

Locations of the borings were selected based on a preliminary building site layout presented in the Phase I Site Selection Submittal dated March 11, 2002 by Integrus Architecture and a site plan based on GIS mapping from the City of Spokane. The explorations were located in the field by measuring from existing site features. Exploration locations are approximate and probably accurate to within about 5 feet horizontally.

Soil materials encountered in the explorations were classified in the field in general accordance with ASTM D 2488, the Standard Practice for Classification of Soils, Visual-Manual Procedure, summarized in Figure A-1. A key to the boring log symbols is presented in Figure A-2. Rock core recovered from the borings was classified in general accordance with the Unified Rock Classification System (URCS). Basic elements of the URCS are described in Figure A-3. Logs of the borings are provided in Figures A-4 through A-21.

Date(s) Drilled	06/25/02	Logged By	LDS	Checked By	CAS
Drilling Contractor	GeoEngineers, Inc.	Drilling Method	Hollow-Stem Auger	Sampling Methods	SPT/Nx Coring
Auger Data	7 3/4" O.D.	Hammer Data	140# hammer, 30" drop	Drilling Equipment	CME-75
Total Depth (ft)	15	Surface Elevation (ft)	NA	Station:	NA
Datum/ System	NA			Centerline Offset:	NA

Elevation feet	Depth feet	SAMPLES: Interval	Testing/No.	Recovered (in)	Blows/foot	Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Water Content %	Dry Unit Weight, lbs/ft³	OTHER TESTS AND NOTES
	0							AC	3 inches asphalt concrete			
			1		26			SP-SM	Gray fine to coarse sand with silt, gravel and cobbles (medium dense,moist) (fill)	7		93% finer than the U.S. No. 200 sieve
	5		2		10							
			3		3	▼		SM	Tan silty fine sand (very loose to loose, moist to wet) (fill)			
			4		10					28		
	10		5					BRX	Dark gray, slightly vesicular basalt, stained state pit to rebound quality with 3- to 2-dimensaionl planes of separation, unit weight not measured, (CBEO to CADO)			Rec = 100%, RQD = 50 UCC ~32 ksi Rec = 100%, RQD = 48 UCC ~ 27 ksi
			6									
			7									Rec = 80%, RQD = 0
	15								Boring completed at approximately 15 foot depth on 06/25/02 Groundwater encountered at approximately 7 1/2 foot depth during drilling			
	20											
	25											
	30											
	35											
	40											

Note: See Figure A-2 for explanation of symbols

LOG OF BORING B-201

GeoEngineers

Project: Spokane Public Facilities District - Option 2 Site
Project Location: Spokane, WA
Project Number: 0110-047-00

Figure: A-4
Sheet 1 of 1

Date(s) Drilled	06/27/02	Logged By	LDS	Checked By	CAS
Drilling Contractor	GeoEngineers, Inc.	Drilling Method	Hollow-Stem Auger	Sampling Methods	SPT/Nx Coring
Auger Data	7 3/4" O.D.	Hammer Data	140# hammer, 30" drop	Drilling Equipment	CME-75
Total Depth (ft)	23.5	Surface Elevation (ft)	NA	Station:	NA
Datum/ System	NA			Centerline Offset:	NA

Elevation feet / Depth feet	SAMPLES: Interval	Testing/No.	Recovered (in)	Blows/foot	Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Water Content %	Dry Unit Weight, lbs/ft³	OTHER TESTS AND NOTES
0	1			20			AC	4 inches asphalt concrete			
							SP-SM	Brown to gray fine to coarse sand with silt, gravel, cobbles and occasional brick fragments (medium dense, moist) (fill)			
5	2			20							
					▼		SP	Brown to gray fine to coarse sand with gravel (medium dense, wet) (fill)			
10	3			13							
							SM	Olive-green silty fine to coarse sand with gravel (medium dense, wet) (fill)			
15	4			6							
	5			21							
							GP-GM	Gray fine to coarse gravel with trace sand (medium dense, wet)			
20	6			30/3"			BRX	Gray basalt with small minor vesicles, stained state to visually fresh state, pit to rebound quality, with 3- to 2-dimensioanl planes of separation, unit weight not measured (CBEO to BADO)			UCC ~ 31 ksi Rec = 100%, RQD = 88
	7									177	UCC ~ 31 ksi
25								Boring completed at approximately 23 1/2 foot depth on 06/27/02 Groundwater encountered at approximately 8 foot depth during drilling			
30											
35											
40											

Note: See Figure A-2 for explanation of symbols

LOG OF BORING B-202

GeoEngineers

Project: Spokane Public Facilities District - Option 2 Site
Project Location: Spokane, WA
Project Number: 0110-047-00

Figure: A-5
Sheet 1 of 1

Date(s) Drilled	06/26/02	Logged By	LDS	Checked By	CAS
Drilling Contractor	GeoEngineers, Inc.	Drilling Method	Hollow-Stem Auger	Sampling Methods	SPT/Nx Coring
Auger Data	7 3/4" O.D.	Hammer Data	140# hammer, 30" drop	Drilling Equipment	CME-75
Total Depth (ft)	17	Surface Elevation (ft)	NA	Station:	NA
Datum/ System	NA			Centerline Offset:	NA

Elevation feet / Depth feet	SAMPLES: Interval	Testing/No.	Recovered (in)	Blows/foot	Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Water Content %	Dry Unit Weight, lbs/ft³	OTHER TESTS AND NOTES
0							AC	3 inches asphalt concrete			
	1			10			GP	Brown fine gravel with sand, cobbles and construction debris (loose, moist) (fill)			
	2			4			SM	Brown silty fine sand (very loose, moist to wet) (fill)			
5	3			0	▼						
	4			16			SP-SM	Brown fine to coarse sand with gravel (medium dense, wet)			
	5			49			GP	Brown fine to coarse gravel with silt and sand (dense, wet)			
10	6			33/4"			BRX	Gray slightly vesicular basalt, stained to visually fresh state, pit to rebound quality with 3- to 2-dimensaionl planes of separation, unit weight not measured (CBEO to BADO)			UCC ~ 19 ksi
15	7										Rec = 100%, RQD = 26 UCC ~ 26 ksi
								Boring completed at approximately 17 foot depth on 06/26/02			
								Groundwater encountered at approximately 5 1/5 foot depth during drilling			
20											
25											
30											
35											
40											

Note: See Figure A-2 for explanation of symbols

LOG OF BORING B-203

GeoEngineers

Project: Spokane Public Facilities District - Option 2 Site
Project Location: Spokane, WA
Project Number: 0110-047-00

Figure: A-6
Sheet 1 of 1

Date(s) Drilled	06/28/02	Logged By	LDS	Checked By	CAS
Drilling Contractor	GeoEngineers, Inc.	Drilling Method	Hollow-Stem Auger	Sampling Methods	SPT/Nx Coring
Auger Data	7 3/4" O.D.	Hammer Data	140# hammer, 30" drop	Drilling Equipment	CME-75
Total Depth (ft)	17.5	Surface Elevation (ft)	NA	Station:	NA
Datum/ System	NA			Centerline Offset:	NA

Elevation feet / Depth feet	SAMPLES: Interval	Testing/No.	Recovered (in)	Blows/foot	Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Water Content %	Dry Unit Weight, lbs/ft³	OTHER TESTS AND NOTES
0							AC	4 inches asphalt concrete			
		1		22			GP-GM	Brown to gray fine to coarse gravel with silt, sand and brick fragments (loose to dense, dry) (fill)	5		
		2		7					8		
5		3		28	▼						
		4		43							
10		5		2			SM	Gray silty fine to medium sand with occasional gravel (very loose, wet) (fill)			
		6		12							
15		7		30/4"			GP-GM	Brown fine to coarse gravel with fine to coarse sand and silt (medium dense, wet)			
								Boring terminated at approximately 17 1/2 foot depth due to auger refusal on 06/28/02			
20								Groundwater encountered at approximately 7 foot depth during drilling			
25											
30											
35											
40											

Note: See Figure A-2 for explanation of symbols

LOG OF BORING B-204

GeoEngineers

Project: Spokane Public Facilities District - Option 2 Site
Project Location: Spokane, WA
Project Number: 0110-047-00

Figure: A-7
Sheet 1 of 1

Date(s) Drilled	07/02/02	Logged By	LDS	Checked By	CAS
Drilling Contractor	GeoEngineers, Inc.	Drilling Method	Hollow-Stem Auger	Sampling Methods	SPT/Nx Coring
Auger Data	7 3/4" O.D.	Hammer Data	140# hammer, 30" drop	Drilling Equipment	CME-75
Total Depth (ft)	27	Surface Elevation (ft)	NA	Station:	NA
Datum/ System	NA			Centerline Offset:	NA

Elevation feet / Depth feet	SAMPLES: Interval	Testing/No.	Recovered (in)	Blows/foot	Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Water Content %	Dry Unit Weight, lbs/ft³	OTHER TESTS AND NOTES
0	1			18			AC	2 inches asphalt concrete			
							GP	Brown fine to medium gravel with silt, sand, cobbles and construction debris (medium dense, moist) (fill)			
	2			18			GM	Dark brown silty fine to coarse gravel with sand and cobbles (loose to medium dense, moist) (fill)			
5	3			10	▼			Becomes wet			
	4			4							
10	5			30/1"							
	6			21							
15	7			75							
							GP	Brown to gray fine to coarse gravel with sand and cobbles (loose to medium dense, wet)			
	8			10							
20							GM	Gray silty fine to coarse gravel with sand and cobbles (very dense, wet)			
	9			50/2"			BRX	Gray moderately vesicular basalt, stained to visually fresh state, pit quality with 3- to 2-dimensional planes of separation, unit weight not measured (CBEO to BBDO)			
25	10										Rec = 100%, RQD = 50
								Boring completed at approximately 27 foot depth on 07/02/02			
30								Groundwater encountered at approximately 8 foot depth during drilling			
35											
40											

Note: See Figure A-2 for explanation of symbols

LOG OF BORING B-205

GeoEngineers

Project: Spokane Public Facilities District - Option 2 Site
Project Location: Spokane, WA
Project Number: 0110-047-00

Figure: A-8
Sheet 1 of 1

Date(s) Drilled	06/26/02	Logged By	LDS	Checked By	CAS
Drilling Contractor	GeoEngineers, Inc.	Drilling Method	Hollow-Stem Auger	Sampling Methods	SPT/Nx Coring
Auger Data	7 3/4" O.D.	Hammer Data	140# hammer, 30" drop	Drilling Equipment	CME-75
Total Depth (ft)	16.5	Surface Elevation (ft)	NA	Station:	NA
Datum/ System	NA			Centerline Offset:	NA

Elevation feet / Depth feet	SAMPLES: Interval	Testing/No.	Recovered (in)	Blows/foot	Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Water Content %	Dry Unit Weight, lbs/ft³	OTHER TESTS AND NOTES
0	1			30			AC	4 inches asphalt concrete			
							GP	Gray to brown fine to coarse gravel with sand and trace silt (medium dense to dense, moist) (fill)			
5	2										
	3			9							
					▼		GP	Gray to coarse gravel with sand and trace silt (loose, wet)			
	4			7							
10	5			15							
	6						BRX	Light gray to gray moderatley vesicular basalt, stained state, pit quality with 3- to 2-dimensional planes of separation, unit weight not measured (CBEO to CBDO)		158	Rec = 78%, RQD = 0 Rec = 67%, RQD = 0 Rec = 50%, RQD = 0 ~~UCC ~ 14 ksi~~
15	7										
	8										
								Boring completed at approximately 16 1/2 foot depth on 06/26/02			
								Groundwater encountered at approximately 8 foot depth during drilling			
20											
25											
30											
35											
40											

Note: See Figure A-2 for explanation of symbols

LOG OF BORING B-206

Geo Engineers

Project: Spokane Public Facilities District - Option 2 Site
Project Location: Spokane, WA
Project Number: 0110-047-00

Figure: A-9
Sheet 1 of 1

Date(s) Drilled	07/03/02	Logged By	LDS	Checked By	CAS
Drilling Contractor	GeoEngineers, Inc.	Drilling Method	Hollow-Stem Auger	Sampling Methods	SPT/Nx Coring
Auger Data	7 3/4" O.D.	Hammer Data	140# hammer, 30" drop	Drilling Equipment	CME-75
Total Depth (ft)	2	Surface Elevation (ft)	NA	Station:	NA
Datum/ System	NA			Centerline Offset:	NA

Elevation feet	Depth feet	SAMPLES: Interval	SAMPLES: Testing/No.	SAMPLES: Recovered (in)	SAMPLES: Blows/foot	Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Water Content %	Dry Unit Weight, lbs/ft³	OTHER TESTS AND NOTES
	0							AC	2 inches asphalt concrete			
		1			30/4"			SM	Dark brown silty fine to coarse sand with gravel (medium dense, moist) (fill)			
									Boring terminated at approximately 2 foot depth due to refusal on 07/03/02			
									No groundwater encountered during drilling			
	5											
	10											
	15											
	20											
	25											
	30											
	35											
	40											

Note: See Figure A-2 for explanation of symbols

LOG OF BORING B-207

GeoEngineers

Project: Spokane Public Facilities District - Option 2 Site
Project Location: Spokane, WA
Project Number: 0110-047-00

Figure: A-10
Sheet 1 of 1

Date(s) Drilled	07/03/02	Logged By	LDS	Checked By	CAS
Drilling Contractor	GeoEngineers, Inc.	Drilling Method	Hollow-Stem Auger	Sampling Methods	SPT/Nx Coring
Auger Data	7 3/4" O.D.	Hammer Data	140# hammer, 30" drop	Drilling Equipment	CME-75
Total Depth (ft)	11	Surface Elevation (ft)	NA	Station:	NA
Datum/ System	NA			Centerline Offset:	NA

Elevation feet / Depth feet	SAMPLES: Interval Testing/No.	SAMPLES: Recovered (in)	SAMPLES: Blows/foot	Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Water Content %	Dry Unit Weight, lbs/ft³	OTHER TESTS AND NOTES
0						AC	2 inches asphalt concrete			
	1		30/3"			SM	Dark brown silty fine to coarse sand with gravel (medium dense, moist) (fill)			
						CC	6 inches concrete over 3 inches basalt			
	2					SM	Brown silty sand with gravel (medium dense, moist)			Rec = 33%, RQD = 0
5										UCC ~ 31 ksi
	3									Rec = 24%, RQD = 0
	4					BRX	Light gray moderately vesicular basalt, stained to visually fresh state, pit quality with 3- to 2-dimensaionl planes of separation, unit weight not measured (CCCO to BBCO)			Rec = 100%, RQD = 0
10	5								177	UCC ~ 6 ksi Rec = 100%, RQD = 21
							Boring completed at approximately 11 foot depth on 07/03/02			
							Groundwater not measured due to drill fluids			
15										
20										
25										
30										
35										
40										

Note: See Figure A-2 for explanation of symbols

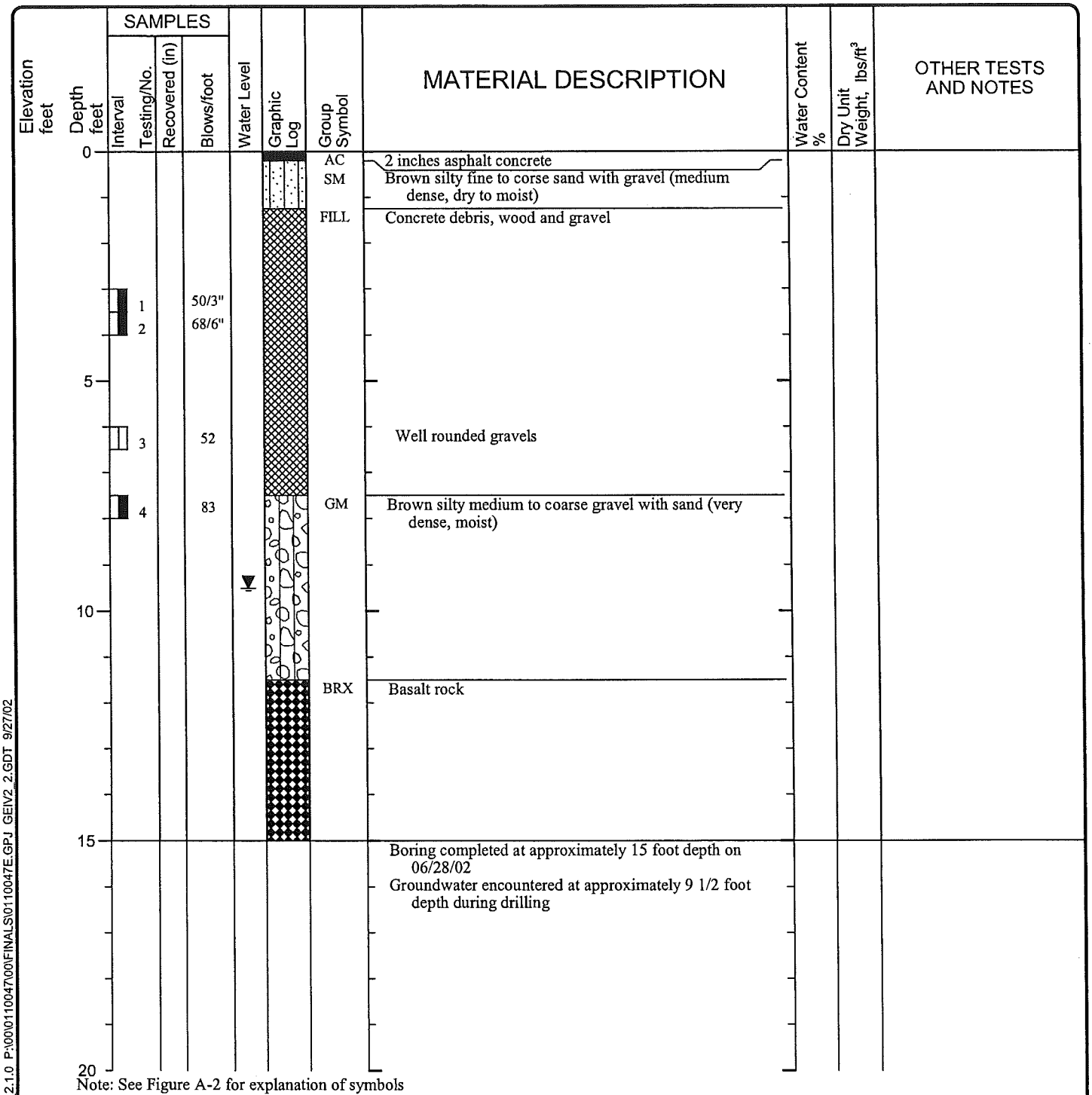
LOG OF BORING B-207A

Geo Engineers

Project: Spokane Public Facilities District - Option 2 Site
Project Location: Spokane, WA
Project Number: 0110-047-00

Figure: A-11
Sheet 1 of 1

Date(s) Drilled	06/28/02	Logged By	GDP	Checked By	MLB
Drilling Contractor	Enviornmental West	Drilling Method	Air Rotary	Sampling Methods	2.5" O.D. Split Spoon
Auger Data	NA	Hammer Data	140# hammer, 30" drop	Drilling Equipment	Schramm T300M Rota Drill
Total Depth (ft)	15	Surface Elevation (ft)	NA	Station:	NA
Datum/ System	NA			Centerline Offset:	NA



Note: See Figure A-2 for explanation of symbols

LOG OF BORING B-208

Geo Engineers

Project: Spokane Public Facilities District - Option 2 Site
Project Location: Spokane, WA
Project Number: 0110-047-00

Figure: A-12
Sheet 1 of 1

Date(s) Drilled	06/28/02	Logged By	GDP	Checked By	MLB
Drilling Contractor	Environmental West	Drilling Method	Air Rotary	Sampling Methods	2.5" O.D. Split Spoon
Auger Data	NA	Hammer Data	140# hammer	Drilling Equipment	Schramm T300M Rota Drill
Total Depth (ft)	19.7	Surface Elevation (ft)	NA	Station:	NA
Datum/ System	NA			Centerline Offset:	NA

Elevation feet	Depth feet	SAMPLES Interval	Testing/No.	Recovered (in)	Blows/foot	Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Water Content %	Dry Unit Weight, lbs/ft³	OTHER TESTS AND NOTES
	0							AC	3 inches asphalt concrete pavement over 2 inches base course			
			1		65/2"			GM	Dark brown silty gravel with sand (very dense, moist)			
			2		88			SP-SM	Brown fine to coarse gravel (very dense, dry)			
	5		3		78							
			4		107							
			5		126	▼						
	10							SP	Gray medium to coarse sand with gravel (dense, wet)			
			6		64			SM	Brown silty medium to coarse sand with gravel (very dense, wet)			
			7		110							
	15		8		50/2"			BRX	Basalt			
	20								Boring completed at approximately 19.7 foot depth on 06/28/02 Groundwater encountered at approximately 10 foot depth during drilling			
	25											

Note: See Figure A-2 for explanation of symbols

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LOG OF BORING B-209

Geo Engineers

Project: Spokane Public Facilities District - Option 2 Site
Project Location: Spokane, WA
Project Number: 0110-047-00

Figure: A-13
Sheet 1 of 1

Date(s) Drilled	06/27/02	Logged By	LDS	Checked By	CAS
Drilling Contractor	GeoEngineers, Inc.	Drilling Method	Hollow-Stem Auger	Sampling Methods	SPT/Nx Coring
Auger Data	7 3/4" O.D.	Hammer Data	140# hammer, 30" drop	Drilling Equipment	CME-75
Total Depth (ft)	12.25	Surface Elevation (ft)	NA	Station:	NA
Datum/ System	NA			Centerline Offset:	NA

Elevation feet / Depth feet	SAMPLES: Interval	Testing/No.	Recovered (in)	Blows/foot	Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Water Content %	Dry Unit Weight, lbs/ft³	OTHER TESTS AND NOTES
0							AC	5 inches asphalt concrete			
		1		27			SM	Brown-gray silty fine to coarse sand with gravel (medium dense, dry to moist) (fill)	6		14% passing the U.S. No 200 sieve
							CC	5 inches concrete			
5		2					BRX	Light gray to gray moderately vesicular basalt, stained state to visually fresh state, dent to pit quality with 3- to 2-dimensaionl palnes of separation, unit weight not measured (CCEO to BBDO)			Rec = 89%, RQD = 39 UCC ~ 25 ksi
		3									Rec = 100%, RQD = 100
10		4									Rec = 100%, RQD = 100 UCC ~ 31 ksi
								Boring completed at approximately 12.25 foot depth on 06/27/02 Groundwater not measured due to drill fluids			
15											
20											
25											
30											
35											
40											

Note: See Figure A-2 for explanation of symbols

LOG OF BORING B-210

Geo Engineers

Project: Spokane Public Facilities District - Option 2 Site
Project Location: Spokane, WA
Project Number: 0110-047-00

Figure: A-14
Sheet 1 of 1

Date(s) Drilled	07//02/02	Logged By	LDS	Checked By	CAS
Drilling Contractor	GeoEngineers, Inc.	Drilling Method	Hollow-Stem Auger	Sampling Methods	SPT/Nx Coring
Auger Data	7 3/4" O.D.	Hammer Data	140# hammer, 30" drop	Drilling Equipment	CME-75
Total Depth (ft)	13.5	Surface Elevation (ft)	NA	Station:	NA
Datum/ System	NA			Centerline Offset:	NA

Elevation feet / Depth feet	SAMPLES: Interval	Testing/No.	Recovered (in)	Blows/foot	Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Water Content %	Dry Unit Weight, lbs/ft³	OTHER TESTS AND NOTES
0							AC	2 inches asphalt concrete			
		1		16			GP	Brown to gray fine to coarse gravel with sand, cobbles and trace silt (medium dense to very dense, moist)			
		2		50/2"							
5		3					BRX	Light gray moderately vesicular basalt, stained state to visually fresh, dent quality with 3- to 2-dimensioanl planes of separation, separation to 8 feet where solids preferred breakage, unit weight not measured (CCCO to BCBO)			Rec = 100%, RQD = 36 UCC ~ 27 ksi
		4									Rec = 100%, RQD = 44
10		5								169	Rec = 100%, RQD = 94 UCC ~ 27 ksi
15								Boring completed at approximately 13 1/2 foot depth on 07/02/02 Groundwater not measured due to drill fluids			
20											
25											
30											
35											
40											

Note: See Figure A-2 for explanation of symbols

LOG OF BORING B-211

GeoEngineers

Project: Spokane Public Facilities District - Option 2 Site
Project Location: Spokane, WA
Project Number: 0110-047-00

Figure: A-15
Sheet 1 of 1

Date(s) Drilled	06/25/02	Logged By	LDS	Checked By	CAS
Drilling Contractor	GeoEngineers, Inc.	Drilling Method	Hollow-Stem Auger	Sampling Methods	SPT/Nx Coring
Auger Data	7 3/4" O.D.	Hammer Data	140# hammer, 30" drop	Drilling Equipment	CME-75
Total Depth (ft)	12	Surface Elevation (ft)	NA	Station:	NA
Datum/ System	NA			Centerline Offset:	NA

Elevation feet / Depth feet	SAMPLES: Interval	Testing/No.	Recovered (in)	Blows/foot	Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Water Content %	Dry Unit Weight, lbs/ft³	OTHER TESTS AND NOTES
0							AC	2 inches asphalt concrete			
		1		15/5"			GP	Brown fine to coarse gavel with silt, sand and cobbles (medium dense, dry to moist)			
							BRX	Gray vesicular basalt, visually fresh state, pit quality with 3- to 2-dimensioanl planes of separation, unit weight not measured (BBEO to BBDO)			UCC ~ 16 ksi
		2								171	Rec = 100%, RQD = 61
5											
		3									Rec = 100%, RQD = 74
		4									Rec = 100%, RQD = 100
10		5									Rec = 100%, RDD = 39
								Boring completed at approximately 12 foot depth on 06/25/02 Groundwater not measured due to drill fluid			
15											UCC ~ 17.3 ksi
20											
25											
30											
35											
40											

Note: See Figure A-2 for explanation of symbols

0110-047-00 GEI GTBORING 2.1.0 P:\00\0110047\00\FINALS\0110047E.GPJ GEIV2_2.GDT 9/27/02

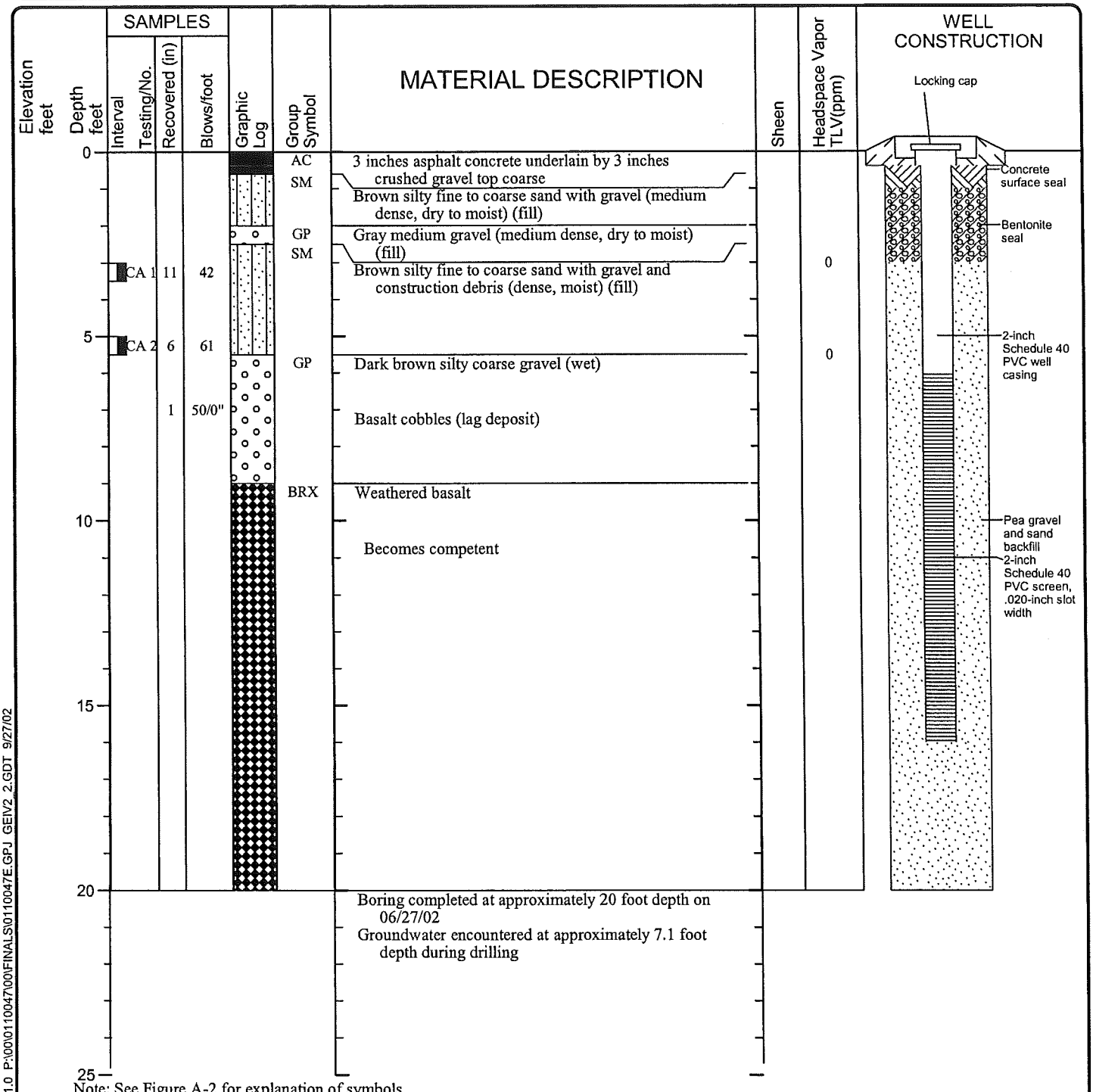
LOG OF BORING B-212

Geo Engineers

Project: Spokane Public Facilities District - Option 2 Site
Project Location: Spokane, WA
Project Number: 0110-047-00

Figure: A-16
Sheet 1 of 1

Date(s) Drilled	06/27/02	Logged By	GDP	Checked By	MLB
Drilling Contractor	Environmental West	Drilling Method	Air Rotary	Sampling Methods	3" O.D. split spoon
Total Boring Depth (ft)	20	Hammer Data	140# hammer	Drilling Equipment	Schramm T300M Rota Drill
Well Depth (ft)	16	Top of Well Elevation (ft)		Groundwater Level (ft. bgs)	7.1



Note: See Figure A-2 for explanation of symbols

LOG OF MONITORING WELL MW-213

Geo Engineers

Project: Spokane Public Facilities District - Option 2 Site
Project Location: Spokane, WA
Project Number: 0110-047-00

Figure: A-17
Sheet 1 of 1

Date(s) Drilled	06/27/02	Logged By	GDP	Checked By	MLB
Drilling Contractor	Environmental West	Drilling Method	Air Rotary	Sampling Methods	3" O.D. Split Spoon
Auger Data	NA	Hammer Data	140# hammer	Drilling Equipment	SchrammT300M Rota Drill
Total Depth (ft)	5	Surface Elevation (ft)	NM	Ground Water Level (ft. bgs)	NA
Datum/ System					

Elevation feet / Depth feet	SAMPLES: Interval	Testing/No.	Recovered (in)	Blows/foot	Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	PID Reading (ppm)	NOTES
0							AC	3 inches of asphalt concrete underlain by 3 inches crushed top coarse (fill)			
							GM	Cobbles with silt, sand and gravel (loose, dry to moist)			
		1	0	50/0"*					NS	0	
							BRX	Basalt bedrock	NS	0	
5								Boring completed at approximately 5 foot depth on 06/27/02 No groundwater encountered during drilling *Blow counts not representative because of coarse-grained nature of material			
10											
15											

Note: See Figure A-2 for explanation of symbols

LOG OF BORING B-214

Geo Engineers

Project: Spokane Public Facilities District - Option 2 Site
Project Location: Spokane, WA
Project Number: 0110-047-00

Figure: A-18
Sheet 1 of 1

Date(s) Drilled	06/27/02	Logged By	GDP	Checked By	MLB
Drilling Contractor	Environmental West	Drilling Method	Air Rotary	Sampling Methods	3" O.D. Split Spoon
Auger Data	NA	Hammer Data	140# hammer	Drilling Equipment	Schramm T300M Rota Drill
Total Depth (ft)	8	Surface Elevation (ft)	NM	Ground Water Level (ft. bgs)	NA
Datum/ System					

Elevation feet / Depth feet	SAMPLES: Interval	Testing/No.	Recovered (in)	Blows/foot	Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	PID Reading (ppm)	NOTES
0							AC	3 inches asphalt concrete underlain by 3 inches crushed gravel top coarse (fill)			
							GP	Gray brown silty gravel (very dense, dry) (fill)	SS	0	Sample EB-6A-1.0
	CA 1		11	100/6"*			SM	Brown silty fine to coarse sand with gravel (medium dense,dry) (fill)			
							BRX	Weathered basalt			
5								Competent basalt			
								Boring completed at approximately 8 foot depth on 06/27/02 No groundwater encountered during drilling *Blow counts not representative because of coarse-grained nature of material			
10											
15											

Note: See Figure A-2 for explanation of symbols

0110-047-00 GEI ENVBORING 2.1.0 P:\00\0110047\00\FINALS\0110047E.GPJ GEIV2_1.GDT 9/27/02

LOG OF BORING B-214A

Geo Engineers

Project: Spokane Public Facilities District - Option 2 Site
Project Location: Spokane, WA
Project Number: 0110-047-00

Figure: A-19
Sheet 1 of 1

Date(s) Drilled	06/27/02	Logged By	GDP	Checked By	MLB
Drilling Contractor	Environmental West	Drilling Method	Air Rotary	Sampling Methods	3" O.D. Split Spoon
Auger Data	NA	Hammer Data	140# hammer	Drilling Equipment	Schramm T300M Rota Drill
Total Depth (ft)	9	Surface Elevation (ft)	NM	Ground Water Level (ft. bgs)	NA
Datum/ System					

Elevation feet / Depth feet	SAMPLES: Interval Testing/No.	Recovered (in)	Blows/foot	Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	PID Reading (ppm)	NOTES
0						AC	3 inches asphalt concrete over 3 inches crushed gravel top coarse			
						FILL	4-inch-thick concrete slab with occasional asphalt and other construction debris (fill)			
	1	0	50/2"							
	2	0	50/0"							
5						BRX	Basalt slightly weathered Becomes competent			
10							Boring completed at approximately 9 foot depth on 06/27/02 No groundwater encountered during drilling			
15										

Note: See Figure A-2 for explanation of symbols

0110-047-00 GEI_ENVBORING_2.1.0 P:\00\0110047\00\FINALS\0110047E.GPJ GEIV2_1.GDT 9/27/02

LOG OF BORING B-215

GeoEngineers

Project: Spokane Public Facilities District - Option 2 Site
Project Location: Spokane, WA
Project Number: 0110-047-00

Figure: A-20
Sheet 1 of 1

Date(s) Drilled	06/27/02	Logged By	GDP	Checked By	MLB
Drilling Contractor	Environmental West	Drilling Method	Air Rotary	Sampling Methods	3" O.D. Split Spoon
Auger Data	NA	Hammer Data	140# hammer	Drilling Equipment	Schramm T300M Rota Drill
Total Depth (ft)	10.5	Surface Elevation (ft)	NM	Ground Water Level (ft. bgs)	NA
Datum/ System					

Elevation feet / Depth feet	SAMPLES Interval	Testing/No.	Recovered (in)	Blows/foot	Water Level	Graphic Log	Group Symbol	MATERIAL DESCRIPTION	Sheen	PID Reading (ppm)	NOTES
0							AC	3 inches asphalt concrete over 3 inches crushed gravel top coarse			
							FILL	Construction debris consisting of bricks and concrete, very little soil (dense, dry) (fill)			
		CA 1	6	66					NR	0	Sample EB-8A-1
							SM	Gray-brown silty medium to coarse sand with gravel (medium dense, moist) (fill)			
		CA 2	6	25					NR	0	Sample EB-8A-3.5
5		3	0	60/5"					NR	NR	
								Possible debris filled basement			
		4	0	50/0"			BRX	Basalt, slightly weathered	NR	NR	
								Becomes competent			
10											
								Boring completed at approximately 10 1/2 foot depth on 06/27/02 Perched groundwater encountered at approximately 7 foot depth during drilling Perched groundwater was possibly trapped in basement and disappeared once bedrock was encountered			
15											

Note: See Figure A-2 for explanation of symbols

LOG OF BORING B-215A

Geo Engineers

Project: Spokane Public Facilities District - Option 2 Site
Project Location: Spokane, WA
Project Number: 0110-047-00

Figure: A-21
Sheet 1 of 1

APPENDIX B

LABORATORY TESTING

LABORATORY TESTING

Soil samples were reexamined in our laboratory to confirm field classifications. Selected soil samples were tested to determine their natural moisture content in general accordance with ASTM D 2216, and their percent finer than the No. 200 sieve in general accordance with ASTM D 1140. Test results are indicated on the boring logs.

Rock point load index testing was performed on 15 representative rock core samples in general accordance with ASTM D 5731. This test provides a qualitative index, which can be used to estimate approximate unconfined compressive strength. We also performed six specific gravity tests in general accordance with ASTM C 127 to estimate the unit weight of the basalt. The results are presented on the boring logs.

Corrosion testing was performed on representative soil samples under subcontract to SVL Analytical, Inc. Testing included soil conductivity, pH, and soluble sulfates. Test results are presented Table 2 in the main text. The SVL Analytical, Inc. test results also are included in this appendix.

SVL ANALYTICAL, INC.
One Government Gulch ■ P.O. Box 929 ■ Kellogg, Idaho 83837-0929 ■ Phone: (208)784-1258 ■ Fax: (208)783-0891
Certificate: WA DOE NO. C074; DOH NO. 050

CLIENT : Geo Engineers
PROJECT: 0110-047-00
CLIENT SAMPLE ID: B-310/1.5
Sample Collected: 7/10/02
Sample Receipt : 7/17/02
Date of Report : 7/24/02 As Received Basis

SVL JOB: 102357
SAMPLE: 304012
Matrix: SOIL

Determination	Result	Units	Dilution	Method	Analyzed
Spec. Cond.	0.20	umhos/cm		120.1	7/18/02
pH Soil	9.94			9045	7/18/02
Sulfate, SO4	222	mg/kg		300.0	7/19/02

Reviewed By: Blake Johnson Date 7/24/02
7/24/02 14:34

SVL ANALYTICAL, INC.
Certificate: WA DOE NO. C074; DOH NO. 050
One Government Gulch ■ P.O. Box 929 ■ Kellogg, Idaho 83837-0929 ■ Phone: (208)784-1258 ■ Fax: (208)783-0891

CLIENT : Geo Engineers
PROJECT: 0110-047-00
CLIENT SAMPLE ID: GT-307/13.5-15
Sample Collected: 7/09/02
Sample Receipt : 7/17/02
Date of Report : 7/24/02 As Received Basis

SVL JOB: 102357
SAMPLE: 304011
Matrix: SOIL

Determination	Result	Units	Dilution	Method	Analyzed
Spec. Cond.	0.11	umhos/cm		120.1	7/18/02
pH Soil	8.50			9045	7/18/02
Sulfate, SO4	76.2	mg/kg		300.0	7/19/02

Reviewed By: Blake Johnson Date 7/24/02
7/24/02 14:34

APPENDIX C

PREVIOUS EXPLORATIONS

PROJECT *Red Lion/Sheraton Hotel* W.O. *21-8027* BORING NO. *BH-A*

DEPTH (feet)	SOIL DESCRIPTION Approximate ground surface elevation:	SAMPLE TYPE	SAMPLE NUMBER	BLOW COUNTS	OVM (PPM)	GROUND WATER	STANDARD PENETRATION RESISTANCE Blows per foot 0 10 20 30 40 50	TESTING
0	0-2" Asphalt Gravel							HCID
	Hand sample of gravel at three feet	X	A-2		0			
	Boring terminated at approxiamtely 3 feet Refusal at 3 feet on basalt bedrock							
5								
10								
15								
20								
25								
30								

0 10 20 30 40 50
MOISTURE CONTENT
Plastic limit — Natural — Liquid limit

LEGEND

I 2-inch OD split spoon sampler

X Grab Sample

AGRA
Earth & Environmental
539 West Sharp, Suite D
Spokane, WA 99201

Drilling started: *13 April 1995* Drilling completed: *13 April 1995* Logged by: *DCJ*

PROJECT *Red Lion/Sheraton Hotel* W.O. *21-8027* BORING NO. *BH-B*

DEPTH (feet)	SOIL DESCRIPTION Approximate ground surface elevation:	SAMPLE TYPE	SAMPLE NUMBER	BLOW COUNTS	OVM (PPM)	GROUND WATER	STANDARD PENETRATION RESISTANCE Blows per foot 0 10 20 30 40 50	TESTING
0	0-2" Roots and topsoil							
								HCID
	Very loose, moist, dark brown fine sandy SILT		B-1	4	0		▲	
5								
	Very dense, wet to saturated, brown fine SAND with trace silt		B-2	52/5"	--		▲	HCID
	Boring terminated at approxiamtely 8.8 feet Refusal on bedrock or rubble							
10								
15								
20								
25								
30								

0 10 20 30 40 50
MOISTURE CONTENT
Plastic limit — Natural — Liquid limit

LEGEND

I 2-inch OD split spoon sampler

AGRA
Earth & Environmental
539 West Sharp, Suite D
Spokane, WA 99201

Drilling started: *13 April 1995* Drilling completed: *13 April 1995* Logged by: *DCJ*

PROJECT *Red Lion/Sheraton Hotel* W.O. *21-8027* BORING NO. *BH-C*

DEPTH (feet)	SOIL DESCRIPTION Approximate ground surface elevation:	SAMPLE TYPE	SAMPLE NUMBER	BLOW COUNTS	OVM (PPM)	GROUND WATER	STANDARD PENETRATION RESISTANCE Blows per foot 0 10 20 30 40 50	TESTING
0	0-2" Asphalt/2-6" Pea gravel (FILL)							
	Boring terminated at approxiamtely 6 inches due to running into strom drain							
5								
10								
15								
20								
25								
30								

0 10 20 30 40 50
MOISTURE CONTENT
Plastic limit — Natural — Liquid limit

LEGEND

I 2-inch OD split spoon sampler

AGRA
Earth & Environmental
539 West Sharp, Suite D
Spokane, WA 99201

Drilling started: *14 April 1995* Drilling completed: *14 April 1995* Logged by: *DCJ*

PROJECT *Red Lion/Sheraton Hotel* W.O. *21-8027* BORING NO. *BH-D*

DEPTH (feet)	SOIL DESCRIPTION Approximate ground surface elevation:	SAMPLE TYPE	SAMPLE NUMBER	BLOW COUNTS	OVM READING	GROUND WATER	STANDARD PENETRATION RESISTANCE ▲ Blows per foot 0 10 20 30 40 50	TESTING
0	0-2" Asphalt							
	Dense, damp, black, silty sandy GRAVEL	X	DI		5			METALS
	Boring terminated at approxiamtely 2 feet Refusal on bedrock or rubble							
5								
10								
15								
20								
25								
30								

0 10 20 30 40 50
MOISTURE CONTENT
Plastic limit — Natural — Liquid limit

LEGEND

I 2-inch OD split spoon sampler

X Grab sample

AGRA
Earth & Environmental
539 West Sharp, Suite D
Spokane, WA 99201

Drilling started: *14 April 1995* Drilling completed: *14 April 1995* Logged by: *DCJ*

PROJECT *Red Lion/Sheraton Hotel* W.O. *21-8027* BORING NO. *BH-E*

DEPTH (feet)	SOIL DESCRIPTION Approximate ground surface elevation:	SAMPLE TYPE	SAMPLE NUMBER	BLOW COUNTS	OVM (PPM)	GROUND WATER	STANDARD PENETRATION RESISTANCE Blows per foot 0 10 20 30 40 50	TESTING
0	0-2" Asphalt Gravel Dense, damp, dark brown, silty fine sandy GRAVEL- chemical odor (FILL)	X	EI		123			8080 8010 8020
	Boring terminated at approxiamtely 3 feet Refusal on bedrock or rubble							
5								
10								
15								
20								
25								
30								

0 10 20 30 40 50
MOISTURE CONTENT
Plastic limit — Natural — Liquid limit

LEGEND

2-inch OD split spoon sampler

Grab sample

AGRA
Earth & Environmental
539 West Sharp, Suite D
Spokane, WA 99201

Drilling started: *13 April 1995* Drilling completed: *13 April 1995* Logged by: *DCJ*

PROJECT *Red Lion/Sheraton Hotel* W.O. *21-8027* BORING NO. *BH-F*

DEPTH (feet)	SOIL DESCRIPTION Approximate ground surface elevation:	SAMPLE TYPE	SAMPLE NUMBER	BLOW COUNTS	OVM (PPM)	GROUND WATER	STANDARD PENETRATION RESISTANCE ▲ Blows per foot	TESTING
0	0-2" Asphalt							
	Dense, dry, light brown, fine sandy GRAVEL	⊠	FI		0			8015
	Boring terminated at approxiamtely 2.75 feet Refusal on bedrock or rubble							
5								
10								
15								
20								
25								
30								

0 10 20 30 40 50

MOISTURE CONTENT

Plastic limit — Natural — Liquid limit

LEGEND

I 2-inch OD split spoon sampler

⊠ Grab sample

AGRA
Earth & Environmental
539 West Sharp, Suite D
Spokane, WA 99201

Drilling started: *13 April 1995* Drilling completed: *13 April 1995* Logged by: *DCJ*

PROJECT *Red Lion/Sheraton Hotel* W.O. *21-8027* BORING NO. *BH-G*

DEPTH (feet)	SOIL DESCRIPTION Approximate ground surface elevation:	SAMPLE TYPE	SAMPLE NUMBER	BLOW COUNTS	OVM READING	GROUND WATER	STANDARD PENETRATION RESISTANCE ▲ Blows per foot 0 10 20 30 40 50	TESTING
0	0-2" Asphalt Gravel (FILL)							8010 8020
5	Very loose, damp, fine sandy SILT with trace gravel		G-1					
10	Very loose, wet, brown, fine to medium SAND		G-2	▼ ATD	--			
	Boring terminated at approxiamtely 12.5 feet Refussal on bedrock or rubble							
15								
20								
25								
30								

0 10 20 30 40 50
MOISTURE CONTENT
Plastic limit — Natural — Liquid limit

LEGEND

I 2-inch OD split spoon sampler

AGRA
Earth & Environmental
539 West Sharp, Suite D
Spokane, WA 99201

Drilling started: *13 April 1995* Drilling completed: *13 April 1995* Logged by: *DCJ*

PROJECT *Red Lion/Sheraton Hotel* W.O. *21-8027* BORING NO. *BH-H*

DEPTH (feet)	SOIL DESCRIPTION Approximate ground surface elevation:	SAMPLE TYPE	SAMPLE NUMBER	BLOW COUNTS	OVM (PPM)	GROUND WATER	STANDARD PENETRATION RESISTANCE ▲ Blows per foot 0 10 20 30 40 50	TESTING
0	0-2" Asphalt Gravel							
	Dense, dry grading to damp, light brown, silty sandy GRAVEL	⊠	HI		0			8010 8020 8015
	Boring terminated at approxiamtely 3 feet Refusal on bedrock or rubble							
5								
10								
15								
20								
25								
30								

0 10 20 30 40 50
MOISTURE CONTENT
Plastic limit — Natural — Liquid limit

LEGEND

I 2-inch OD split spoon sampler

⊠ Grab sample

AGRA
Earth & Environmental
539 West Sharp, Suite D
Spokane, WA 99201

Drilling started: *14 April 1995* Drilling completed: *14 April 1995* Logged by: *DCJ*

BORING/WELL LOG

Project: Sheraton-Spokane Hotel Date: April 26, 1993
P.N: E9338 Time In: 07:15 Time Out: 10:30
Owner: River Front Associates Observer: DEI
Project Type: Drill/Sampling/Monitoring Well Weather: Cool-Clear-45°
Boring No: SH-01 Boring Location: West end property near entrance to Hotel

Depth	Moisture	Field Observations	Sample #	Description
0 -	Dry	Asphalt from surface to 4" then from 4" to 5' Sand gravel	N/A	Reddish brown to light tan in color no odor noticeable
5 -	Damp	Sampled with split spoon HNU = 1ppm	SH01-1	Sandy Gravel Brown to light Tan-white in color
9	Damp	Sampled with split spoon	SH02-1	Sand dark in color no odor -
10 -	Wet	HNU = 1ppm		Appears to be a coal seam(?)
11	Water	Water Table		Sand gravel - basalt fragments
20 -				
21	T.D.			Drilled from 19 to 21 basalt Fresh basalt fragments

BORING/WELL LOG

Project: Sheraton-Spokane Hotel Date: April 26, 1993
P.N: E9338 Time In: 11:00 Time Out: 13:00
Owner: Riverfront Associates Observer: DEL
Project Type: Drill / Sample Weather: 50° partly cloudy
Boring No: SH-02 Boring Location: East end of building - North west corner

Depth	Moisture	Field Observations	Sample #	Description
0 -	slight	Asphalt 2 - 4 " below surface	N/A	Asphalt - sand - pea gravels
5 -	damp	split spoon HNU = 10 ppm	SH02 - 1	silt - sand - gravel Tan to brown in color / No odors
8 -	wet	water table	N/A	sand gravels
10 -		Bed rock	N/A	Fresh basalt
11 -	T.D.	Bed rock		Basalt fragments fresh

BORING/WELL LOG

Project: Sheraton-Spokane Hotel Date: April 26, 1993
P.N: E9338 Time In: 14:00 Time Out: 16:00
Owner: River Front Associates Observer: DEL
Project Type: Drill / Sample Weather: Partly cloudy
Boring No: SH03 Boring Location: South east corner of property

Depth	Moisture	Field Observations	Sample #	Description
0 -	Dry	Asphalt from surface to 4"	N/A	
2 -	slight	Fill material	SH03-1	sand gravel grab sample from two feet to three feet. No discoloration or odors.
5 -	T.D.	Basalt at three		Fresh basalt fragments from three feet.
-				
-				
-				
-				

BORING/WELL LOG

Project: Sheraton-Spokane Hotel Date: 4-26-93 & 4-27-93
P.N: E9338 Time In: 16:15 Time Out: 09:30
Owner: River Front Associates Observer: DEL
Project Type: Drill / Sample Weather: Rain - clearing
Boring No: SH04 Boring Location: 4' west of SH03

Depth	Moisture	Field Observations	Sample #	Description
0 -	Dry	Asphalt from surface to Approximately 4" bgs	N/A	Asphalt to 4" then sand - gravel to 4 feet. Sand and gravel is brown to tan in color. No odors.
4 -	dry	bedrock - basalt	N/A	switched over to down hole rotary hammer
5 -				
10 -				
20 -				
25 -	moist			damp area in basalt. Seep from rock - not water table.
30 -				
40 -	T.D.			Basalt bedrock from four feet to forty feet.

BORING/WELL LOG

Project: Sheraton-Spokane Hotel Date: April 27, 1993
P.N: E9338 Time In: 10:30 Time Out: 11:00
Owner: River Front Associates Observer: DEL
Project Type: Drill Sample Weather: Partly cloudy
Boring No: SH05 Boring Location: NE property line ≈ 75 north of SH04

Depth	Moisture	Field Observations	Sample #	Description
0 -	dry to damp	Asphalt from 0 to 4" Sand gravel- from 4" Slight odor - HNU = 1ppm	N/A SH05-1	Asphalt Sand gravel - brown to tan in color No discoloration
1 -	dry to damp	Basalt - Fresh	N/A	Bed rock
3 -	T.D.	Bedrock		Fresh basalt fragments
-				
-				
-				
-				

BORING/WELL LOG

Project: Sheraton-Spokane Hotel Date: April 27, 1993
P.N: E9338 Time In: 11:30 Time Out: 12:40
Owner: River Front Associates Observer: DEL
Project Type: Drill / Sample Weather: Partly Cloudy
Boring No: SH06 Boring Location: Between TP2 & TP3

Depth	Moisture	Field Observations	Sample #	Description
0 -	Dry	Asphalt from 0 to 4 " Sand and gravel to 2'	N/A	Brown to tan sand and gravel
2 -	Dry	Sampled cuttings - material appeared dark in color had an odor of Cresoles	N/A HNU = 10 - 15 ppm	
6 -	Dry	Split spoon sample Dark colored soil slight odor	HNU = 10 - 15 ppm SH06-1	Dark brown to black soil some white fragments noted in material, could be organic.
7 -	Dry	Basalt rock	N/A	Bedrock
8.5 -	T.D.	Basalt		Bedrock
-				

BORING/WELL LOG

Project: Sheraton-Spokane Hotel Date: April 27, 1993
P.N: E9338 Time In: 13:00 Time Out: 14:00
Owner: River Front Associates Observer: DEL
Project Type: Drill / Sample Weather: Partly Cloudy
Boring No: SH-07 Boring Location: Between TP4 & TP3

Depth	Moisture	Field Observations	Sample #	Description
0 -	Dry	Asphalt from 0 to 4"	N/A	
2 -	Dry	Brown to tan sand & gravel (split spoon)	SH07-2	Sand and gravel appears to be clean no odors present at 2" to 3"
3 -	Dry	railroad tie (?) wood fragments - no odor or discoloration	HNU = 1 ppm	
4 -	Dry	Basalt rock fresh angular fragments	N/A	Boulder
5 -	Dry	Softer material sand to silt	SH7-01 HNU = 1 ppm	Brown to dark brown soil to 5.5' Grab sample from cuttings
6 -	Dry	Fresh angular basalt	N/A	Dark colored basalt - fresh angular fragments
9 -	T.D.	Basalt bedrock		

BORING/WELL LOG

Project: Sheraton-Spokane Hotel Date: April 27, 1993
P.N: E9338 Time In: 15:45 Time Out: 16:30
Owner: River Front Associates Observer: DEL
Project Type: Drill/Sample Weather: Cloudy
Boring No: SH08 Boring Location: North 50' from SH07

Depth	Moisture	Field Observations	Sample #	Description
0 -	Dry	Asphalt from 0 to 4"	N/A	Sand silt and gravel below 4"
3 -	Dry	Silt sand and gravels Split spoon sample	SH08-1 HNU = 1 ppm	Brown to tan silt sand and gravels No odors or discoloration
6 -	Dry	Conglomerate fragments and silty sand soil split spoon	SH08-2 HNU = 5 ppm	Silty to sandy soil - light brown to dark brown in color
7 -	Dry	Basalt rock fragments	N/A	Silty to sandy soil with basalt fragments (fresh)
8.5 -	T.D.	Basalt rock	N/A	Bedrock
-				
-				

BORING/WELL LOG

Project: Sheraton-Spokane Hotel Date: April 27, 1993
P.N: E9338 Time In: 16:45 Time Out: 17:30
Owner: River Front Associates Observer: DEL
Project Type: Drill / Sample Weather: Cloudy
Boring No: SH09 Boring Location: ≈ 60 to 75 feet east of SH06

Depth	Moisture	Field Observations	Sample #	Description
0 -	Dry	Asphalt from 0 to 4"	N/A	Sand and gravel from 4" To 2'
2 -	Dry	Basalt rock fragments - sand and silt Split spoon	SH09-1 HNU = 1 ppm	No odor or discoloration noted
5 -	Damp	Sand and silt Split spoon	SH09-2 HNU = 1 ppm	Upper portion of sample was dark brown to black. No odor was noted.
7.5 -	T.D.	Drilling became hard at 5.5'	N/A	Fresh basalt fragments
-				
-				

BORING/WELL LOG

Project: Sheraton-Spokane Hotel Date: April 28, 1993
P.N: E9338 Time In: 08:00 Time Out: 08:30
Owner: River Front Associates Observer: DEL
Project Type: Drill / Sample Weather: High Clouds
Boring No: SH10 Boring Location: ≈ 50' South of SH09

Depth	Moisture	Field Observations	Sample #	Description
0 -	Dry	Asphalt to 4"	N/A	
2 -	Moist	Sand - gravel Split spoon	N/A	Sand - gravel from cuttings. Split spoon only recovered rounded gravel no soil. No odor or discolor observed. Cuttings were tan to light brown in color.
5 -	Moist	Grab sample from drill cuttings	SH10-1	As above except fresh basalt rock fragments at 4.5'.
5.5 -	T.D.	No water		Fresh basalt outcrop
-				
-				

BORING/WELL LOG

Project: Sheraton-Spokane Hotel Date: April 28, 1993
P.N: E9338 Time In: 08:50 Time Out: 09:30
Owner: River Front Associates Observer: DEL
Project Type: Drill / sample Weather: High Clouds
Boring No: SH11 Boring Location: ≈ 50 feet south of SH06

Depth	Moisture	Field Observations	Sample #	Description
0 -	Dry	Asphalt from 0 to 4 "	N/A	Brown to tan silt sand gravel
2 -	Moist	Split spoon No odors	HNU = 1 ppm SH11-1	Dark brown sand - gravel. Some clay in sample. About 1%
5 -	Moist	No odors HNU = 1 ppm	N/A	Brown to tan gravels, sand & silt to 5'.
5.5 -	T.D.	Fresh basalt		Bedrock

BORING/WELL LOG

Project: Sheraton-Spokane Hotel Date: April 28, 1992
P.N: E9338 Time In: 10:05 Time Out: 11:00
Owner: River Front Associates Observer: DEL
Project Type: Drill / Sample Weather: High Clouds
Boring No: SH12 Boring Location: ≈ 50 Feet west of SH05

Depth	Moisture	Field Observations	Sample #	Description
0 -	Dry	Asphalt from 0 to 4"	N/A	
2 -	Moist	Split spoon	HNU = 2 ppm	No sample Cuttings showed tan to light brown sand gravel. No odor
5 -	Moist	Split spoon	SH12-1 HNU = 1 ppm	Brown to tan sand & gravel
8 -	Moist	Drill cuttings sampled Slight discoloration in cuttings	SH12-2	Light brown to dark brown sand-gravels with some clay.
8.5 -	T.D.			Basalt bed rock
-				

BORING/WELL LOG

Project: Sheraton-Spokane Hotel Date: April 28, 1993
P.N: E9338 Time In: 11:30 Time Out: 12:00
Owner: River Front Associates Observer: DEL
Project Type: Drill / sample Weather: Cloudy
Boring No: SH13 Boring Location: ≈ 50 feet south of SH07

Depth	Moisture	Field Observations	Sample #	Description
0 -	Dry	Asphalt from 0 to 4"	N/A	
2 -	Moist	Dark discoloration No odor	SH13-1 HNU = 2 ppm	Silt - Clay - Sand Brown to black sand silt and clay
2.5 -	Moist	Soil changed colors to more natural colors.	SH13-2 Grab	As above, except material is light brown to tan in color.
5 -	T.D.	Basalt		Bedrock
-				
-				
-				

BORING/WELL LOG

Project: Sheraton-Spokane Hotel Date: April 28, 1993
P.N: E9338 Time In: 12:00 Time Out: 12:40
Owner: River Front Associates Observer: DEL
Project Type: Drill / sample Weather: Cloudy
Boring No: SH14 Boring Location: ≈ 40 feet south of SH13 on property line

Depth	Moisture	Field Observations	Sample #	Description
0 -	Dry	Asphalt from 0 to 4"	N/A	
1 -	Moist	Sand - Silt - Clays	N/A	Brown in color no odor or discoloration
2 -	Moist	Sand - Gravels Split spoon	SH14-1	Brown to tan sand gravels with slight discoloration - no odor.
2.5 -	Dry	Fresh rock	N/A	Basalt rock fragments
3.5 -	T.D.			Basalt rock Bed rock
-				
-				

BORING/WELL LOG

Project: Sheraton-Spokane Hotel Date: April 28, 1993
P.N: E9338 Time In: 12:30 Time Out: 13:00
Owner: River Front Associates Observer: DEL
Project Type: Drill / Sample Weather: Cloudy
Boring No: SH15 Boring Location: West of TP4

Depth	Moisture	Field Observations	Sample #	Description
0 -	Dry	Asphalt from 0 to 4"	N/A	
				Brown to tan sand gravel
2 -	Moist	Split spoon	SH15-1	Brown to tan sand gravel - noted some discoloration - no odor
3 -	Moist	Fresh basalt		Basalt fragments
4 -	T.D.	bed rock		
-				
-				
-				

BORING/WELL LOG

Project: Sheraton-Spokane Hotel Date: April 28, 1993
P.N: E9338 Time In: 14:30 Time Out: 15:15
Owner: River Front Associates Observer: DEL
Project Type: Drill / Sample Weather: Cloudy & Rain
Boring No: SH16 Boring Location: ≈ 50 feet north of SH15

Depth	Moisture	Field Observations	Sample #	Description
0 -	Wet	Asphalt from 0 to 4"	N/A	
2.5 -	Moist	Split spoon	SH16-1	Gray sand - silt - no odors
4 -	Moist	Split spoon	SH16-2 HNU = 1 ppm	Gray to black sand - silt - slight discoloration - no odors
5 -	T.D.	Basalt		Bed rock
-				
-				

BORING/WELL LOG

Project: Sheraton-Spokane Hotel Date: April 28, 1993
P.N: E9338 Time In: 15:35 Time Out: 16:25
Owner: River Front Associates Observer: DEL
Project Type: Drill / Sample Weather: Cloudy
Boring No: SH17 Boring Location: ≈ 45 feet south of SH15

Depth	Moisture	Field Observations	Sample #	Description
0 -	Damp	Asphalt from 0 to 4"	N/A	
				Brown to tan sand
2 -	Moist	Split spoon	SH17-1	Dark brown to black sand - silt - clay. No odors.
3.4-	Moist	Split spoon	SH17-2	Dark brown to black clay soil. No odor.
6 -	Moist	Rock fragments		Fresh basalt
7.2 -	T.D.			Basalt bedrock
-				

BORING/WELL LOG

Project: Sheraton-Spokane Hotel Date: April 29, 1993
P.N: E9338 Time In: 08:30 Time Out: 09:10
Owner: River Front Associates Observer: DEL
Project Type: Drill / Sample Weather: Partly cloudy - Rain
Boring No: SH18 Boring Location: ≈50 north of SH08

Depth	Moisture	Field Observations	Sample #	Description
0 -	Wet	Asphalt from 0 to 4"		
1 -	Moist	No odors or discoloration	N/A	Sand gravel some silt and clay - brown to tan in color.
2 -	Moist	No odors or discoloration	N/A	Drill is bouncing having trouble penetrating. Soil is same as above.
3 -	Dry	Wood fragments	SH18-1 HNU = 1ppm	Railroad tie - sand - gravel - sand and gravel are dark colored. Some odor is present.
5 -	Moist	Split spoon	SH18-2 HNU = 1 ppm	Sand gravel are dark brown to black. No odors present.
5.5 -	Moist	Color change	N/A	Sand - gravel - silt brown to tan
6 -		Basalt fragments		Fresh angular fragments
7 -	T.D.	Basalt		Bed rock

BORING/WELL LOG

Project: Sheraton-Spokane Hotel Date: April 29, 1993
P.N: E9338 Time In: 09:45 Time Out: 11:00
Owner: River Front Associates Observer: DEL
Project Type: Drill / Sample Weather: Cloudy & Rain
Boring No: SH19 Boring Location: ≈ 80 feet east of SH18

Depth	Moisture	Field Observations	Sample #	Description
0 -	Wet	Asphalt from 0 to 4"		
1 -	Moist	Brown to tan		Sand - silt - gravel
2 -	Moist	Split spoon	SH19-1 HNU = 1 ppm	Gray to brown sand - silt - clay no odors - slight discoloration.
5 -	Moist	Split spoon	SH19-2 HNU = 1 ppm	Dark colored sand - gravel - clays
5.5 -				Soil is becoming lighter in color.
6 -	Damp			Pea gravel brown to tan in color.
8 -	Damp	Split spoon	SH19-3 HNU = 1 ppm	Brown to tan sand and gravels.
9 -	Wet	Water table		
12.5 -	T.D.	Basalt		Bed rock

BORING/WELL LOG

Project: Sheraton-Spokane Hotel Date: April 29, 1993
P.N: E9338 Time In: 11:35 Time Out: 14:20
Owner: River Front Associates Observer: DEL
Project Type: Drill / Sample Weather: Raining
Boring No: SH20 Boring Location: ≈ 50 feet east of SH19

Depth	Moisture	Field Observations	Sample #	Description
0 -	Wet	Asphalt from o to 4"		
2 -	Moist	Dark brown clay	SH20-1	Grab sample from cuttings. Sample ranges from 2 feet to 4 feet.
5 -	Moist	Split spoon	SH20-2 HNU = 1 ppm	Dark discolored soil - No odors Soil is Black in color possibly oil or grease.
9 -	Moist to Damp			Soil appears the same as above
11 -	Wet	Water table		Water is dark in color
12 -				Water is cleaner in appearance.
21 -	T.D.			Did not reach bed rock Installed monitoring well
-				

BORING/WELL LOG

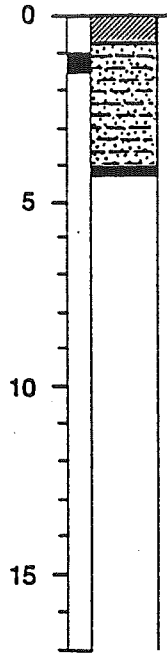
Project: Sheraton-Spokane Hotel Date: April 29, 1993
P.N: E9338 Time In: 14:35 Time Out: 15:00
Owner: River Front Associates Observer: DEL
Project Type: Drill / Sample Weather: Raining
Boring No: SH21 Boring Location: North side of Hotel near Service Entrance

Depth	Moisture	Field Observations	Sample #	Description
0 -	Wet	Asphalt 0 to 4"		
				Brown to tan sand - gravel - clay
2 -	T.D.			Hole stopped due to disturbance of meeting inside hotel.
-				
-				
-				
-				
-				

Laboratory Tests	Moisture Content	OVM	Depth	Sample

Test Pit Number 1

Date 12/10/92 Elevation



0

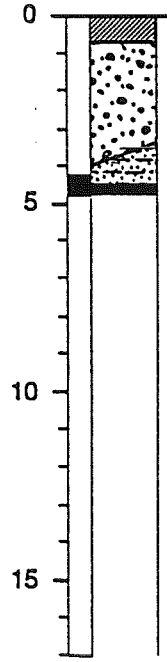
Asphaltic Concrete Pavement.

BROWN SILTY SAND (SM) medium dense, moist; fine to coarse grained, with some gravel, concrete, brick, and wood (Fill).

Groundwater not encountered during excavation.

Test Pit Number 2

Date 12/10/92 Elevation



2

Asphaltic Concrete Pavement.

BROWN GRAVELLY SAND (SW) medium dense, moist; fine to medium grained, with bricks, wood, and concrete (Fill).

Railroad ties at 4 feet.

BLACK SILTY SAND (SM) medium dense, moist; fine to medium grained, with some gravel (Fill).

Groundwater not encountered during excavation.

Applied Geotechnology Inc.

Log of Test Pit 1 and 2

Riverfront Associates/Sheraton-Spokane
Spokane, Washington

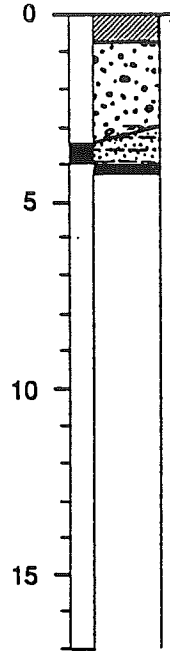
PLATE **A2**

JOB NUMBER	DRAWN	APPROVED	DATE	REVISED	DATE
15,710.001	SES	TSM	5 Feb. 93		

Laboratory Tests	Moisture Content	OVM	Depth	Sample

Test Pit Number 3

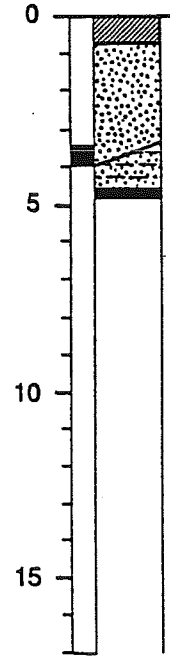
Date 12/10/92 Elevation _____



Asphaltic Concrete Pavement.
BROWN GRAVELLY SAND (SW) medium dense, moist; fine to medium grained, with brick and concrete (Fill).
Railroad Tie at 4 feet.
BLACK SILTY SAND (SM) medium dense, wet; fine to medium grained, with some gravel (Fill).

Test Pit Number 4

Date 12/10/92 Elevation _____



Asphaltic Concrete Pavement.
BROWN SAND (SP) medium dense, moist; fine to medium grained, with some gravel, cobbles, brick, and concrete (Fill).
Railroad tie at 4 feet.
LIGHT BROWN SILTY SAND (SM) medium dense, moist; fine to medium grained (Fill).

Groundwater not encountered during drilling.

Applied Geotechnology Inc.

Log of Test Pit 3 and 4

Riverfront Associates/Sheraton-Spokane
Spokane, Washington

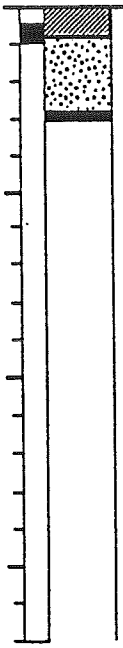
PLATE **A3**

JOB NUMBER	DRAWN	APPROVED	DATE	REVISED	DATE
15,710.001	SES	TSM	5 Feb. 93		

Test Pit Number 5

Date 12/10/92 Elevation

Laboratory Tests	Moisture Content	OVM	Depth	Sample
			0	
			5	
			10	
			15	



Asphaltic Concrete Pavement.
BROWN SAND (SP) medium dense, moist; fine to medium grained, with some gravel, brick, and concrete (Fill).
Concrete road with steel rails at 3 feet.

Groundwater not encountered during excavation.

Applied Geotechnology Inc.

Log of Test Pit 5

Riverfront Associates/Sheraton-Spokane
Spokane, Washington

PLATE
A4

JOB NUMBER	DRAWN	APPROVED	DATE	REVISED	DATE
15,710.001	SES	TSM	5 Feb. 93		

LOG OF TEST BORING

WASHINGTON STATE DEPARTMENT OF TRANSPORTATION

___ S.H. ___ S.R. 2 SECTION Trent Ave. to North River Drive Job No. L-8533

Hole No. H-5-88 Sub Section Spokane R. & BNRR O-Xing No. 2/644 Cont. Sec. 3208

Station 106+14 Offset 38' Lt. ℄ Ground El. 1872.4

Type of Boring HQ Coring Casing 42' W.T. El. 1866.5

Inspector ___ Date November 16, 1988 Sheet 1 of 2

DEPTH	BLOWS PER FT.	PROFILE	SAMPLE TUBE NOS.	DESCRIPTION OF MATERIAL
5				
	23		6 STD 13 PEN 9 1	Medium dense, gray, moist, slightly silty, fine to coarse sandy GRAVEL with cobbles. Retained 0.2'.
10				
	36		26 STD 11 PEN 25 2	No recovery. Driving around cobbles.
				SM, M.C. = 31.0%
15			STD	Very dense, gray, wet, silty, gravelly, fine to coarse SAND
	20½"		20½" PEN 3	with cobbles. Retained 0.1'.
			C-4	At 15.5' - dark gray, slightly vesicular, slightly to moderately weathered BASALT. RQD = 50%
			100% Rec.	
20				

DOT FORM 351-003 REVISED 12/79

Original to Materials Engineer
Copy to Bridge Engineer
Copy to District Administrator

Copy to ___

Hole No. H-5-88 Sub Section Spokane River BNRR Bridge 2/644 Sheet 2 of

DEPTH	BLOWS PER FT.	PROFILE	SAMPLE TUBE NOS.	DESCRIPTION OF MATERIAL
			100% C-5	Dark gray, slightly vesicular, fresh - slightly weathered BASALT. RQD = 90%
			Rec.	
				Dark gray, slightly vesicular, fresh BASALT. RQD = 100%
			C-6	
25			100%	
			Rec.	
				Dark gray, slightly vesicular, fresh BASALT. RQD = 80%
			C-7	
30			100%	
			Rec.	
				Dark gray, slightly vesicular, fresh BASALT; fractures infilled with palagonite and sand. Hydrothermally altered. RQD = 50%
			C-8	
35			100%	
			Rec.	
			C-9	Dark gray, slightly vesicular, fresh BASALT with pockets of sandstone. RQD = 75%
40			100%	
			Rec.	
				Test Boring stopped at 42.0' below ground elevation.
				This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.
45				

LOG OF TEST BORING

WASHINGTON STATE DEPARTMENT OF TRANSPORTATION

___ S.H. ___ S.R. 2 SECTION Trent Ave. to North River Drive Job No. L-8533

Hole No. H-6-88 Sub Section Spokane R. & BNRR O-Xing No. 2/644 Cont. Sec. 3208

Station 106+25 Offset 30' Rt. ℄ Ground El. 1872.0'

Type of Boring HQ Coring Casing 25' W.T. El. 1866.5

Inspector ___ Date November 17, 1988 Sheet 1 of 2

DEPTH	BLOWS PER FT.	PROFILE	SAMPLE TUBE NOS.	DESCRIPTION OF MATERIAL
				1" Asphalt, wet, slightly silty, sand, gravel, cobbles and boulders (1 ft).
			C-1	100% water loss below 2.0'
			60%	
			Rec.	
5				
				Highly fractured BASALT, slightly vesicular. Weathering in seams.
			C-2	RQD = 10%
			100%	
			Rec.	
10		? ?		
				Dark gray, slightly vesicular, slightly weathered BASALT.
			C-3	RQD = 60%
			100%	
			Rec.	
15				
				Dark, gray, slightly vesicular, fresh BASALT; healed fractures. RQD = 75%
			C-4	
			100%	
			Rec.	
20				

DOT FORM 351-003 REVISED 12/79

Original to Materials Engineer
Copy to Bridge Engineer
Copy to District Administrator

Copy to ___

Hole No. H-6-88 Sub Section Spokane River BNRR Bridge 2/644 Sheet 2 of ___

DEPTH	BLOWS PER FT.	PROFILE	SAMPLE TUBE NOS.	DESCRIPTION OF MATERIAL
				Dark, gray, slightly vesicular, fresh BASALT; healed fractures. RQD = 90%
			C-5	
			100%	
			Rec.	
25				
			C-6	
				Dark, gray, slightly vesicular, fresh BASALT; healed fractures. RQD = 90%
			100%	
			Rec.	
30				Test Boring stopped at 30.0' below ground surface
				This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.

DOT FORM 351-003A (X) REVISED 4/80

LOG OF TEST BORING

WASHINGTON STATE DEPARTMENT OF TRANSPORTATION

___ S.H. ___ S.R. 2 SECTION Trent Ave. to North River Drive Job No. L-8533

Hole No. H-7-88 Sub Section Spokane R. & BNRR O-Xing No. 2/644 -Ret. Wall Cont. Sec. 3208

Station 104+88 Offset 28' Rt. ℄ Ground El. 1872.6

Type of Boring HQ Coring Casing 20' W.T. El. Not determined

Inspector ___ Date November 17, 1988 Sheet 1 of 1

DEPTH	BLOWS PER FT.	PROFILE	SAMPLE TUBE NOS.	DESCRIPTION OF MATERIAL
			C-1	2" Asphalt; fill - slightly silty, fine to coarse sandy GRAVEL.
			80% Rec.	
5				Dark gray, moderately weathered, highly fractured BASALT. RQD = 0%
			C-2	Dark gray, slightly vesicular, partially mineralized, slightly weathered to fresh, moderately fractured BASALT. RQD = 75%
			100% Rec.	
10				
			C-3	Dark gray, vuggy and partially mineralized, fresh, vesicular BASALT. RQD = 100%
			100% Rec.	
15				
			C-4	Dark gray, vuggy and partially mineralized, fresh, vesicular BASALT. RQD = 95%
			100% Rec.	
20				Test Boring stopped at 20' below ground elevation. This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.

DOT FORM 351-003 REVISED 12/79

Original to Materials Engineer
Copy to Bridge Engineer
Copy to District Administrator

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LOG OF TEST BORING

WASHINGTON STATE DEPARTMENT OF TRANSPORTATION

____ S.H. ____ S.R. 2 SECTION Trent Ave. to North River Drive Job No. L-8533

Hole No. H-8-88 Sub Section Spokane R. & BNRR O-Xing No. 2/644-Ret. Wall Cont. Sec. 3208

Station 105+25 Offset 38' Lt. ℄ Ground El. 1873

Type of Boring HQ Coring Casing 25' W.T. El. Not Determined

Inspector ____ Date November 18, 1988 Sheet 1 of 2

DEPTH	BLOWS PER FT.	PROFILE	SAMPLE TUBE NOS.	DESCRIPTION OF MATERIAL
			STD	2" Asphalt, parking lot fill.
	25/2"		40 PEN 25/2" 1	Very dense, brown-black, moist, slightly silty, gravelly, fine to coarse SAND with cobbles. Retained 0.6'.
			25/0"	
5				
	25		4 STD 13 PEN 12 2	GW, M.C. = 13.9% Dense, brown, moist, slightly silty, fine to coarse sandy GRAVEL with cobbles.
			STD	
10	50/3"		50/3" PEN 3	No recovery.
				Dark gray, slightly vesicular, moderately weathered, highly to moderately fractured BASALT.
			C-4	
			100%	
			Rec.	RQD = 50%
15				
				Dark gray, slightly vesicular, slightly weathered to fresh BASALT.
			C-5	
			100%	RQD = 50%
			Rec.	
20				

DOT FORM 351-003 REVISED 12/79

Original to Materials Engineer
Copy to Bridge Engineer
Copy to District Administrator

Copy to ____

Hole No. H-8-88 Sub Section Spokane River BNRR Bridge 2/644 - Ret. Wall Sheet 2 of ___

DEPTH	BLOWS PER FT.	PROFILE	SAMPLE TUBE NOS.	DESCRIPTION OF MATERIAL
				Dark gray, slightly vesicular, fresh, healed fractures, BASALT.
			C-6	RQD = 100%
			100%	
			Rec.	
25				Test Boring stopped at 25.0' below ground elevation.
				This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.

DOT FORM 351-003A (X) REVISED 4/80

LOG OF TEST BORING

WASHINGTON STATE DEPARTMENT OF TRANSPORTATION

____ S.H. ____ S.R. 2 SECTION Trent Ave. to North River Drive Job No. L-8533

Hole No. H-9-88 Sub Section Spokane R. & BNRR O-Xing No. 2/644 - Ret.Wall Cont. Sec. 3208

Station 104 + 10 Offset 50' Lt. ℄ Ground El. 1875.5'

Type of Boring HQ Coring Casing HQ 20' NQ 35' W.T. El. 1866.0'

Inspector ____ Date November 18, 1988 Sheet 1 of 2

DEPTH	BLOWS PER FT.	PROFILE	SAMPLE TUBE NOS.	DESCRIPTION OF MATERIAL
	53		17 STD 37 PEN 16 1	Dense, black, brown, moist, slightly silty, fine to coarse, sandy GRAVEL with rock fragments and brick debris. Retained 1.0'.
5				
	40		12 STD 15 PEN 25 2	GW, M.C. = 12.0% Dense, dark brown, moist, slightly silty, fine to coarse sandy GRAVEL with cobbles. Retained 1.0'.
10			STD	
	25/0"		25/0" PEN 3	No recovery.
15				
	68		22 STD 35 PEN 33 4	Very dense, brown, wet, slightly silty, gravelly, fine to coarse SAND. Retained 0.4'.
20				

DOT FORM 351-003 REVISED 12/79

Original to Materials Engineer
Copy to Bridge Engineer
Copy to District Administrator

Copy to ____

Hole No. H-9-88 Sub Section Spokane River BNRR Bridge 2/644 - Ret. Wall Sheet 2 of ___

DEPTH	BLOWS PER FT.	PROFILE	SAMPLE TUBE NOS.	DESCRIPTION OF MATERIAL
	20/4"		20/4" STD PEN 25/0" 5	No recovery.
			80% C-6	Gravels and cobbles (up to 4")
25			Rec.	
				Dark gray, slightly vesicular, slightly weathered, moderately fractured BASALT.
			C-7	RQD = 75%
			100%	
			Rec.	
30				
			C-8	Dark gray, vuggy and partially mineralized, fresh BASALT.
				RQD = 75%
			100%	
			Rec.	
35				Test Boring stopped at 35.0' below ground elevation.
				This is a summary Log of Test Boring. Soil/Rock descriptions are derived from visual field identifications and laboratory test data.
40				

APPENDIX D

GEOPHYSICAL TESTING

AQUILA GEOSCIENCES, INC.

P.O. Box 544
Potlatch, Idaho 83855
(208) 875-1175

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Mr. Christopher A. Sneider, P.E.
Geotechnical Engineer
GeoEngineers-Gifford
523 East Second Avenue
Spokane, Washington 99202

Results of a Seismic Refraction Survey performed at Site 2, Proposed Spokane Convention Center Expansion, Spokane, Washington

Introduction

Aquila Geosciences, Inc., conducted a seismic refraction survey, at your request, at Site 2 of the proposed Spokane Convention Center expansion in Spokane, Washington, on Saturday, July 20, 2002. The purpose of the survey was to determine depths to basalt "bedrock" and information on the basalt seismic velocities of the basalt to aid in GeoEngineer-Gifford's site characterization. Data were collected along two traverse lines. Line 3 ran from South to North and was 460 feet long. Line 4 ran from East to West and was 380 feet long. Chris Sneider provided assistance by barricading the survey line locations, helping lay out and pick up geophones, and providing traffic control during data acquisition.

Data Acquisition

Seismic data were acquired using a Geometrics S-24 seismograph. We used a 12-pound sledge hammer beaten either directly against the asphalt pavement or against an aluminum plate as an energy source. Receivers were 10 Hz. vertical geophones spaced at 20-foot intervals. Shot point locations were selected to provide as much information about the overburden velocities as feasible given the budget, and coverage on the target refractor that would be adequate for data processing and interpretation using the Generalized Reciprocal Method (GRM) of interpreting seismic refraction data.

Data Quality

The quality of the seismic data ranges from fair to poor. Noise, particularly noise from traffic and from the Spokane River, was a constant problem during data acquisition. There was both high frequency and low frequency noise present. To mitigate the effects of this noise we used a 100 Hz. low cut filter and a 250 Hz. high

cut filter (*see footnote at end). We also placed shot points at 40 to 60 foot intervals along the seismic lines. This provided more information on overburden velocities, as well as much greater redundancy of arrival time data for the bedrock refractor. This increase in the number of arrival times from the bedrock refractor at each geophone provides a significant increase in the signal-to-noise ratio for the survey.

A second problem encountered at the site was the "pavement wave". The asphalt pavement acts as a wave guide for high frequency seismic energy. Since the seismic velocity of the asphalt is relatively high, this burst of energy tends to interfere with arrivals from the overburden. We dealt with this by basically disregarding the pavement wave and looking for a lower frequency minimum phase arrival within the pavement wave.

Results and Interpretation

The seismic refraction data were processed and interpreted using the GRM (Generalized Reciprocal Method) of Palmer (1980). The results are shown in the accompanying tables, depth profiles, and velocity plots.

We treated the subsurface as a two layer case for the purposes of the interpretation. The first, upper, layer is "overburden", probably unconsolidated alluvium or fill that is unsaturated (at shallow depths) to saturated (at greater depths). This layer has a seismic velocity ranging from approximately 500 feet/second (south end of line 3) to approximately 2,500 feet/second (central part of line 4).

The second layer is basalt. The velocity of this layer is greater than 16,000 feet/second except for the westernmost 60 feet of line 4, where it appears to be about 12,300 feet/second.

Figures 1 and 2 show the depth profiles for lines 3 and 4, respectively, while tables 1 and 2 contain tabular information on depths and velocities. There is a fair amount of topography on the basalt surface in the survey area. The depths to bedrock calculated from the seismic data are consistent with the depth information from the boreholes drilled at the site, and the two data sets together provide an internally consistent interpretation of the configuration of the bedrock surface.

One word of caution is advised regarding depths to bedrock determined from the seismic data. The arcs on the depth profiles represent the distance from the geophone to the refractor surface (basalt, in this case). These arcs are actually slices of hemispheres taken in the place of the seismic line. There is an unstated assumption in the depth profile that the topography actually occurs in the place of the seismic section. If, however, bedrock is closer to a geophone at a point to the side of the line, the slant distance from the geophone to the bedrock surface is what will be calculated. It is therefore possible for the profiles to show a shallower depth

than is actually present directly below the line.

Summary

The seismic refraction survey you requested that we perform at Site 2 of the planned Spokane Convention Center Expansion has been completed. The results of this survey are intended for use in project planning and management. We consider data derived from geophysical surveys as useful for supplementing and augmenting observations made by direct sampling techniques such as drilling or trenching. The geophysical surveys we do are intended to guide direct sampling, not replace it. Surveys are designed based on information known about the survey area prior to conducting the survey. All interpretations are opinions based on inferences from electrical measurements and the accuracy or correctness of such interpretations cannot be guaranteed. The interpretations apply only to the lines surveyed and features should not be extrapolated beyond or perpendicular to the surveyed line.

Please do not hesitate to call should you have any questions.

Sincerely,

Kent R. Johnson

Kent R. Johnson, Ph.D., P.G.
Geologist/Geophysicist

*** NOTE on filters:** The filter combination used during data acquisition at this site is rather extreme. We considered it advisable to use these filters because the noise problem was so bad. We also considered that it would be acceptable because the survey lines were short enough that phase rotations should not be a problem. The agreement between the calculated depths and the borehole information indicate this decision was justified.

Reference Cited

Palmer, D., 1980, The Generalized Reciprocal Method of Seismic Refraction Interpretation: Soc. Expl. Geophysicists, Tulsa, 104 pp.

Spokane Convention Center Expansion
Site 2
Seismic Refraction Line 3

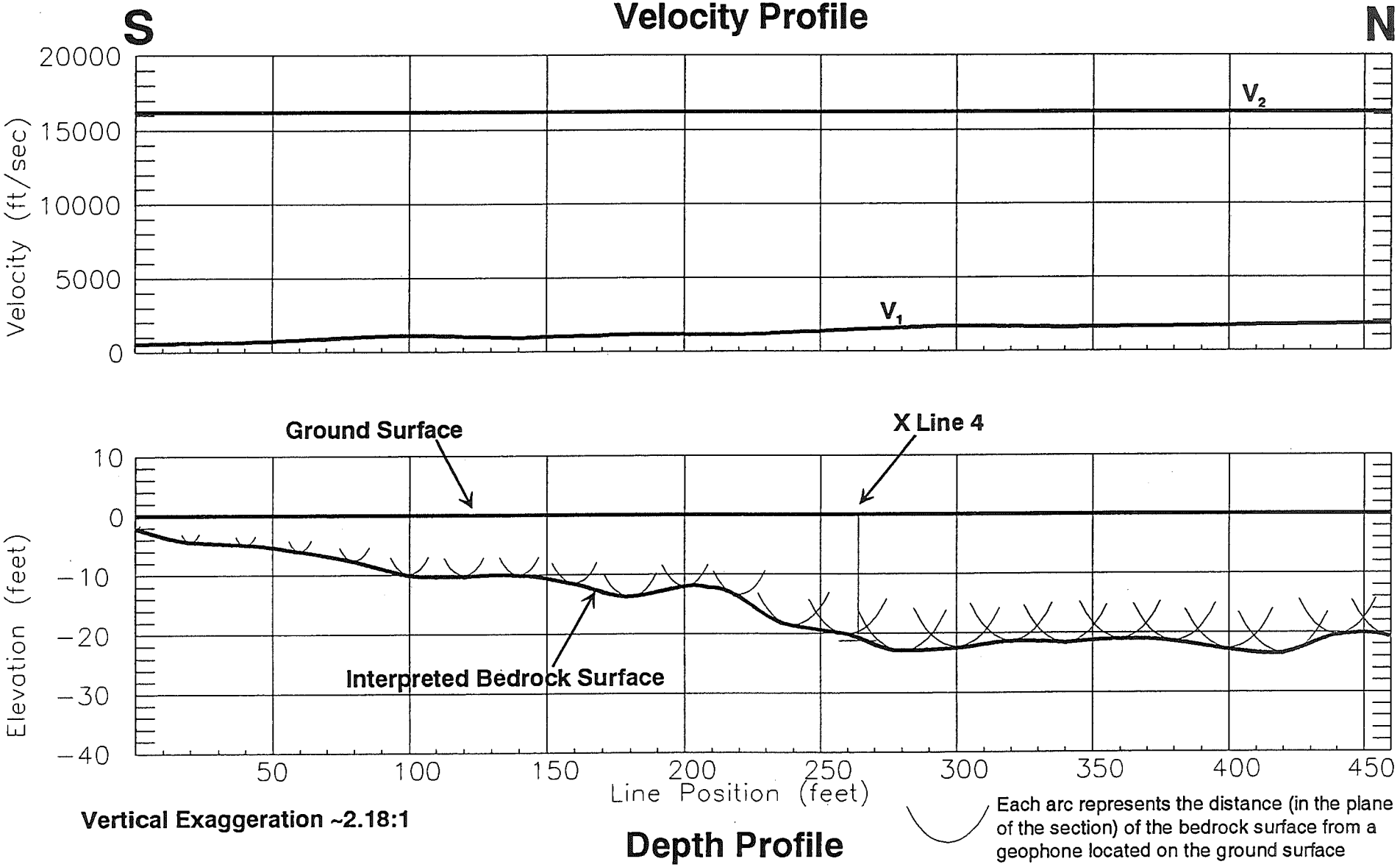

Figure 1

Spokane Convention Center Expansion
Site 2
Seismic Refraction Line 4

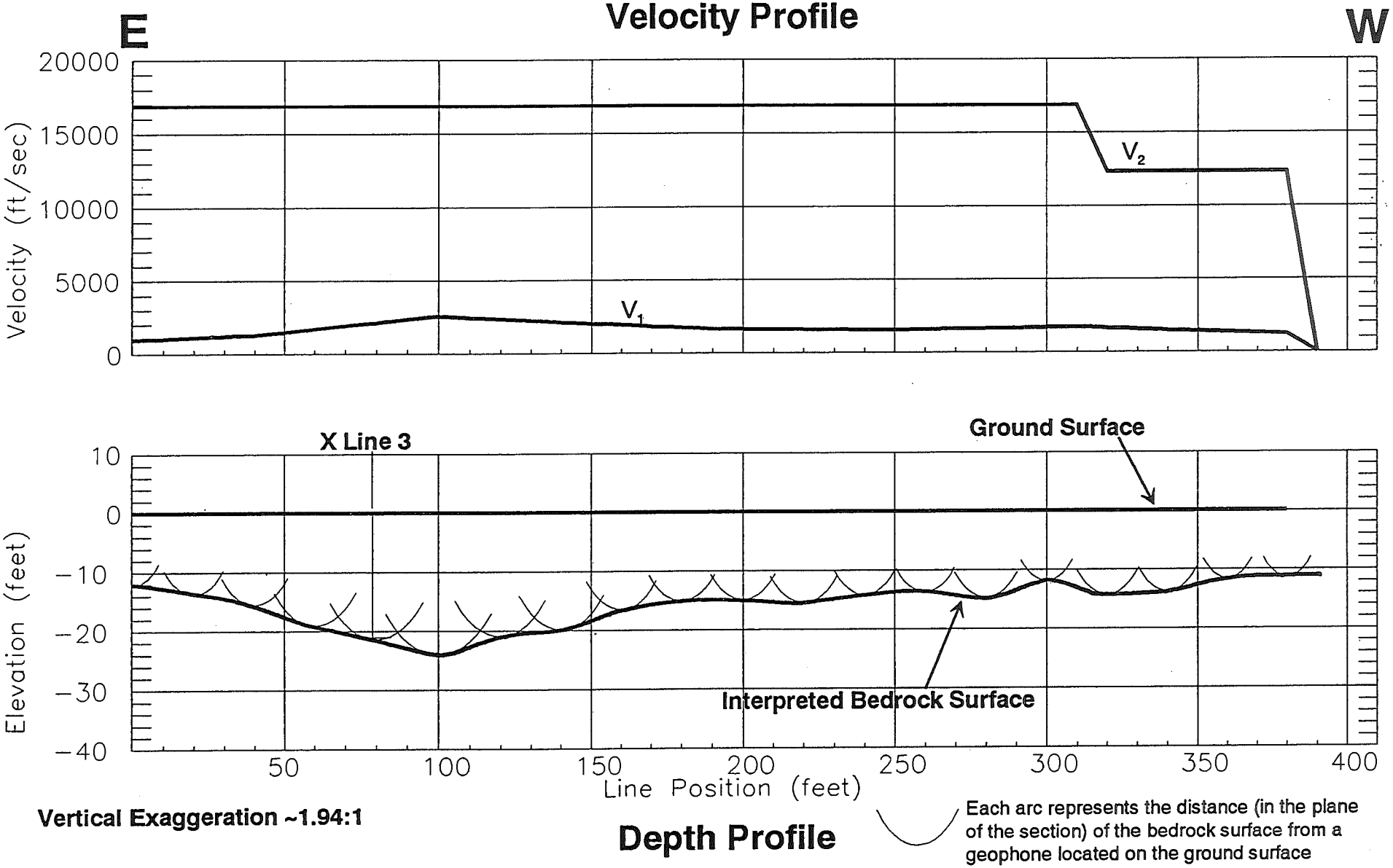

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Figure 2

TABLE 1
Line 3 Depth and Velocity Results

Station	Ground Elevation	V1 (ft/sec)	V2 (ft/sec)	Depth to Top V2
0	0	534	16,203	2.2
20	0	596	16,203	4.3
40	0	657	16,203	4.9
60	0	810	16,203	5.9
80	0	964	16,203	7.5
100	0	1,117	16,203	9.8
120	0	1,025	16,203	10.0
140	0	934	16,203	10.0
160	0	1,040	16,203	11.4
180	0	1,146	16,203	13.7
200	0	1,125	16,203	11.9
220	0	1,103	16,203	13.4
240	0	1,265	16,203	18.5
260	0	1,427	16,203	20.1
280	0	1,568	16,203	22.9
300	0	1,687	16,203	22.3
320	0	1,624	16,203	21.3
340	0	1,560	16,203	21.6
360	0	1,601	16,203	20.9
380	0	1,641	16,203	21.3
400	0	1,681	16,203	22.6
420	0	1,721	16,203	23.4
440	0	1,761	16,203	20.3
460	0	1,802	16,203	20.5

TABLE 2
Line 4 Depth and Velocity Results

Station	Ground Elevation	V1 (ft/sec)	V2 (ft/sec)	Depth to Top V2
0	0	939	16,880	12.1
20	0	1,109	16,880	13.7
40	0	1,280	16,880	15.5
60	0	1,696	16,880	19.0
80	0	2,112	16,880	21.3
100	0	2,528	16,880	24.0
120	0	2,328	16,880	20.9
140	0	2,129	16,880	19.8
160	0	1,929	16,880	16.5
180	0	1,729	16,880	15.1
200	0	1,612	16,880	14.9
220	0	1,579	16,880	15.4
240	0	1,547	16,880	14.1
260	0	1,560	16,880	13.7
280	0	1,621	16,880	14.6
300	0	1,681	16,880	11.8
320	0	1,637	12,333	14.2
340	0	1,490	12,333	13.7
360	0	1,343	12,333	11.6
380	0	1,196	12,333	11.3

APPENDIX E

REPORT LIMITATIONS AND GUIDELINES FOR USE[1]

This appendix provides information to help you manage your risks with respect to the use of this report.

GEOTECHNICAL SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES, PERSONS AND PROJECTS

This report has been prepared for use by the Spokane Public Facilities District. This report may be made available in its entirety to contractors for information only. This report is not intended for use by others, and the information contained herein is not applicable to other sites.

GeoEngineers structures our services to meet the specific needs of our clients. For example, a geotechnical or geologic study conducted for a civil engineer or architect may not fulfill the needs of a construction contractor or even another civil engineer or architect that are involved in the same project. Because each geotechnical or geologic study is unique, each geotechnical engineering or geologic report is unique, prepared solely for the specific client and project site. No one except the Spokane Public Facilities District should rely on this report without first conferring with GeoEngineers. This report should not be applied for any purpose or project except the one originally contemplated.

A GEOTECHNICAL ENGINEERING OR GEOLOGIC REPORT IS BASED ON A UNIQUE SET OF PROJECT-SPECIFIC FACTORS

This report has been prepared for the proposed Convention Center Expansion Option 2 Site. GeoEngineers considered a number of unique, project-specific factors when establishing the scope of services for this project and report. Unless GeoEngineers specifically indicates otherwise, do not rely on this report if it was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

For example, changes that can affect the applicability of this report include those that affect:

- the function of the proposed structure;
- elevation, configuration, location, orientation or weight of the proposed structure;
- composition of the design team; or
- project ownership.

If important changes are made after the date of this report, GeoEngineers should be given the opportunity to review our interpretations and recommendations and provide written modifications or confirmation, as appropriate.

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[1] Developed based on material provided by ASFE, Professional Firms Practicing in the Geosciences; www.asfe.org .

SUBSURFACE CONDITIONS CAN CHANGE

This geotechnical or geologic report is based on conditions that existed at the time the study was performed. The findings and conclusions of this report may be affected by the passage of time, by manmade events such as construction on or adjacent to the site, or by natural events such as floods, earthquakes, slope instability or groundwater fluctuations. Always contact GeoEngineers before applying a report to determine if it remains applicable.

MOST GEOTECHNICAL AND GEOLOGIC FINDINGS ARE PROFESSIONAL OPINIONS

Our interpretations of subsurface conditions are based on field observations from widely spaced sampling locations at the site. Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. GeoEngineers reviewed field and laboratory data and then applied our professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ, sometimes significantly, from those indicated in this report. Our report, conclusions and interpretations should not be construed as a warranty of the subsurface conditions.

GEOTECHNICAL ENGINEERING REPORT RECOMMENDATIONS ARE NOT FINAL

Do not over-rely on the preliminary construction recommendations included in this report. These recommendations are not final, because they were developed principally from GeoEngineers' professional judgment and opinion. GeoEngineers' recommendations can be finalized only by observing actual subsurface conditions revealed during construction. GeoEngineers cannot assume responsibility or liability for this report's recommendations if we do not perform construction observation.

Sufficient monitoring, testing and consultation by GeoEngineers should be provided during construction to confirm that the conditions encountered are consistent with those indicated by the explorations, to provide recommendations for design changes should the conditions revealed during the work differ from those anticipated, and to evaluate whether or not earthwork activities are completed in accordance with our recommendations. Retaining GeoEngineers for construction observation for this project is the most effective method of managing the risks associated with unanticipated conditions.

A GEOTECHNICAL ENGINEERING OR GEOLOGIC REPORT COULD BE SUBJECT TO MISINTERPRETATION

Misinterpretation of this report by other design team members can result in costly problems. You could lower that risk by having GeoEngineers confer with appropriate members of the design team after submitting the report. Also retain GeoEngineers to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering or geologic report. Reduce that risk by having GeoEngineers participate in pre-bid and preconstruction conferences, and by providing construction observation.

DO NOT REDRAW THE EXPLORATION LOGS

Geotechnical engineers and geologists prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering or geologic report should never be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, but recognize that separating logs from the report can elevate risk.

GIVE CONTRACTORS A COMPLETE REPORT AND GUIDANCE

Some owners and design professionals believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering or geologic report, but preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with GeoEngineers and/or to conduct additional study to obtain the specific types of information they need or prefer. A pre-bid conference can also be valuable. Be sure contractors have sufficient time to perform additional study. Only then might an owner be in a position to give contractors the best information available, while requiring them to at least share the financial responsibilities stemming from unanticipated conditions. Further, a contingency for unanticipated conditions should be included in your project budget and schedule.

CONTRACTORS ARE RESPONSIBLE FOR SITE SAFETY ON THEIR OWN CONSTRUCTION PROJECTS

Our geotechnical recommendations are not intended to direct the contractor's procedures, methods, schedule or management of the work site. The contractor is solely responsible for job site safety and for managing construction operations to minimize risks to on-site personnel and to adjacent properties.

READ THESE PROVISIONS CLOSELY

Some clients, design professionals and contractors may not recognize that the geoscience practices (geotechnical engineering or geology) are far less exact than other engineering and natural science disciplines. This lack of understanding can create unrealistic expectations that could lead to disappointments, claims and disputes. GeoEngineers includes these explanatory "limitations" provisions in our reports to help reduce such risks. Please confer with GeoEngineers if you are unclear how these "Report Limitations and Guidelines for Use" apply to your project or site.

GEOTECHNICAL, GEOLOGIC AND ENVIRONMENTAL REPORTS SHOULD NOT BE INTERCHANGED

The equipment, techniques and personnel used to perform an environmental study differ significantly from those used to perform a geotechnical or geologic study and vice versa. For that reason, a geotechnical engineering or geologic report does not usually relate any environmental

findings, conclusions or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. Similarly, environmental reports are not used to address geotechnical or geologic concerns regarding a specific project.