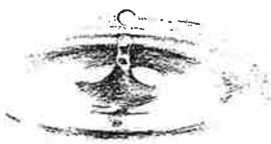
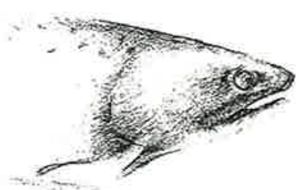
Geotechnical Engineering



Water Resources

Solid and Hazardous Waste



Ecological/Biological Sciences

Geologic Assessments

Associated Earth Sciences, Inc.

Subsurface Exploration, Geologic Hazard, and
Geotechnical Engineering Report

OIL CAN HENRY'S AUTOMOBILE LUBRICATION FACILITY

Arlington, Washington

Prepared for

Grandview North, LLC

Project No. KE05343A
May 24, 2005

SUBSURFACE EXPLORATION, GEOLOGIC HAZARD, AND GEOTECHNICAL ENGINEERING REPORT

OIL CAN HENRY'S AUTOMOBILE LUBRICATION FACILITY

Arlington, Washington

Prepared for:
Grandview North, LLC
P.O. Box 159
Arlington, Washington 98223

Prepared by:
Associated Earth Sciences, Inc.
911 5th Avenue, Suite 100
Kirkland, Washington 98033
425-827-7701
Fax: 425-827-5424

May 24, 2005
Project No. KE05343A

I. PROJECT AND SITE CONDITIONS

1.0 INTRODUCTION

This report presents the results of our subsurface exploration, geologic hazard, and geotechnical engineering study for the Oil Can Henry's automobile lubrication facility in Arlington, Washington. The location of the proposed building, the approximate locations of the explorations accomplished for this study, and other prominent site features are presented on the Site and Exploration Plan, Figure 1. In the event that any changes in the nature or design of the proposed lot layout is planned, the conclusions and recommendations contained in this report should be reviewed and modified, or verified, as necessary.

1.1 Purpose and Scope

The purpose of this study was to provide subsurface data to be used in the design and development of the subject project. Our study included a review of available geologic literature, excavation of exploration pits, and performing geologic studies to assess the type, thickness, distribution, and physical properties of the subsurface sediments and shallow ground water conditions. Geotechnical engineering studies were also conducted to assess the type of suitable foundation, allowable foundation soil bearing pressures, anticipated settlements, lateral earth pressures, floor support recommendations, and drainage considerations. This report summarizes our current fieldwork and offers development recommendations based on our present understanding of the project.

1.2 Authorization

Authorization to proceed with this study was granted by Mr. Scott Wammack of Grandview North, LLC (Grandview North). This report has been prepared for the exclusive use of Grandview North and their agents for specific application to this project. Within the limitations of scope, schedule, and budget, our services have been performed in accordance with generally accepted geotechnical engineering and engineering geology practices in effect in this area at the time our report was prepared. No other warranty, express or implied, is made.

2.0 PROJECT AND SITE DESCRIPTION

The subject site was located between 171st Street NE and 172nd Street NE west of 40th Avenue NE in Arlington, Washington. The rectangular-shaped property occupies an area of approximately 0.5 acres. The property is cleared, vacant, and relatively flat-lying. The site was Parcel 1 of the Tucson development and was bound on the north, west, and south sides by streets and on the east by a vacant lot. The parcel was covered with scrub grass and weeds.

Our understanding of the project plans is based on discussions with Mr. Wammack and with the architect, Mr. John Cole of Lundin/Cole Architects. We understand that current development plans call for the construction of an Oil Can Henry's automobile lubrication facility and associated driveway and parking areas. The location of the proposed building is depicted on the Site and Exploration Plan, Figure 1. The facility will include a below-grade lubrication pit to access the bottom side of the automobiles. The lube pit and floor slab will be of concrete construction, while the remainder of the building will use wood-frame construction.

3.0 SUBSURFACE EXPLORATION

Our field study included excavating a series of two exploration pits to gain subsurface information about the site. The various types of sediments, as well as the depths where characteristics of the sediments changed, are indicated on the exploration logs presented in the Appendix. The depths indicated on the logs where conditions changed may represent gradational variations between sediment types in the field. Our explorations were approximately located in the field relative to known site features shown on the site plan.

The conclusions and recommendations presented in this report are based, in part, on the exploration pits completed for this study. The number, locations, and depths of the explorations were completed within site and budgetary constraints. Because of the nature of exploratory work below ground, extrapolation of subsurface conditions between field explorations is necessary. It should be noted that differing subsurface conditions may sometimes be present due to the random nature of deposition and the alteration of topography by past grading and/or filling. The nature and extent of any variations between the field explorations may not become fully evident until construction. If variations are observed at that time, it may be necessary to re-evaluate specific recommendations in this report and make appropriate changes. Information obtained from an exploration boring on a lot very near this lot was also utilized, as well as the liquefaction analysis performed for the Tucson Business Park.

3.1 Exploration Pits

The exploration pits were excavated with a rubber-tired backhoe. The pits permitted direct, visual observation of subsurface conditions. Materials encountered in the exploration pits were studied and classified in the field by a geotechnical engineer from our firm. All of the exploration pits were backfilled immediately after examination and logging. Selected samples were then transported to our laboratory for further visual classification and testing, as necessary.

4.0 SUBSURFACE CONDITIONS

Subsurface conditions at the project site were inferred from the field explorations accomplished for this study, visual reconnaissance of the site, and review of applicable geologic literature. As shown on the field logs, the exploration pits generally encountered medium dense, granular glacial sediments overlain by topsoil.

4.1 Stratigraphy

Topsoil

A surficial, organic topsoil layer was encountered in both exploration pits. The thickness of the topsoil layer was approximately 8 inches. The organic topsoil is not suitable for foundation support or for use in structural fills.

Vashon Recessional Outwash

Sediments encountered below the topsoil layer consisted of medium dense, fine to medium sand with minor quantities of silt. The grain size increased to a medium to coarse sand at a depth of about 7 feet below existing ground elevation. We interpret these sediments to be representative of Vashon recessional outwash. The Vashon recessional outwash consists of sediments that were deposited by meltwater streams that emanated from the retreating glacial ice during the latter portion of the Vashon Stade of the Fraser Glaciation ending approximately 12,500 years ago. Where glacial sediments are exposed at the ground surface throughout the Puget Sound region, the upper several feet of these sediments typically become weathered. The Vashon recessional outwash sediments extended beyond the maximum depths explored of approximately 9 feet. When properly prepared, the recessional outwash will be suitable for the support of foundations.

Review of the regional geologic map titled *Distribution and Description of the Geologic Units in the Arlington West Quadrangle, Washington* by James Minard (1980) indicates that the area of the subject site is underlain by the Marysville Sand Member of the Vashon recessional outwash. Our interpretation of the sediments encountered in our explorations is in general agreement with the regional geologic map.

4.2 Hydrology

Ground water seepage was encountered in the exploration pits below depths of 6½ to 8 feet below grade. The seepage initially occurred at a depth of about 8 feet in both explorations. In EP-2, we left the exploration pit open for about 15 minutes while the ground water level stabilized at a depth of about 6½ feet below existing ground surface. No stratification was observed in the outwash and it was not clear how much fluctuation there is in the ground water level. Based on our work on other nearby projects, this is a perched water table for this area. It should be noted that the depth to ground water seepage at the site may vary in response to such factors as changes in season, precipitation, and site use. No soil discoloration or other indications of seasonal ground water level fluctuations were observed in the exploration pits.

II. GEOLOGIC HAZARDS AND MITIGATIONS

The following discussion of potential geologic hazards is based on the geologic, slope, and shallow ground water conditions as observed and discussed herein.

5.0 SEISMIC HAZARDS AND RECOMMENDED MITIGATION

Earthquakes occur in the Puget Lowland with great regularity. The vast majority of these events are small and are usually not felt by people. However, large earthquakes do occur as evidenced by the 1949, 7.2-magnitude event; the 2001, 6.8-magnitude event; and the 1965, 6.5-magnitude event. The 1949 earthquake appears to have been the largest in this region during recorded history and was centered in the Olympia area. Evaluation of earthquake return rates indicates that an earthquake of the magnitude between 5.5 and 6.0 is likely within a given 20-year period.

Generally, there are four types of potential geologic hazards associated with large seismic events: 1) surficial ground rupture; 2) seismically induced landslides; 3) liquefaction; and 4) ground motion. The potential for each of these hazards to adversely impact the proposed project is discussed below.

5.1 Surficial Ground Rupture

The nearest known fault trace to the project site is the South Whidbey Island-Lake Alice Fault located within approximately 20 miles to the southeast. No surficial faulting or earth rupture associated with the South Whidbey Island-Lake Alice Fault has been documented to date in the Snohomish County region.

5.2 Seismically Induced Landslides

The site and adjacent areas have less than 3 feet of vertical and therefore no landslide risk evaluation is warranted.

5.3 Liquefaction

Liquefaction is the temporary loss of shear strength that can occur in granular soils when they are exposed to cyclic shaking, such as that which occurs during an earthquake. In general, risk factors for liquefaction are low-density granular soil below the ground water level. We performed a liquefaction analysis using the computer program Liquefy Pro©. The program accepts user input of soil stratigraphy, density, unit weight, silt content, and water level, and calculates the risk of liquefaction. Based on density data obtained during drilling EB-1 for a previous study on the lot to the south of the subject lot, on laboratory grain size testing, on an assumed unit weight, and on a design level seismic event with a peak ground surface acceleration of 0.3g and a magnitude of 7.0, a zone between approximately 12 and 13 feet below the existing ground surface is predicted to experience liquefaction. Most of the soils from the existing ground surface to a depth of approximately 30 feet have a calculated factor of safety against liquefaction under the modeled conditions of less than 1.5. Predicted ground surface settlement during a design level seismic event is approximately 1 inch.

Based on these modeling results, the risk of liquefaction damage during a design seismic event is relatively small. Structural effects could include up to approximately 1 inch of settlement and minor cracking of flatwork and finishes. These effects would only occur during a design level seismic event, which represents an intense earthquake with a long recurrence interval in close proximity to the site. Under these conditions, the additional cost of liquefaction risk mitigation may not be warranted. We are available to recommend liquefaction risk mitigation alternatives, if desired, to reduce the potential structural impacts resulting from seismic events. Risk mitigation alternatives would include construction of the building on foundation piles with structural floor slabs.

Further analyses were performed with the placement of the proposed fill on the site to an elevation of 3 feet above the existing grade. The fill soils increase the effective overburden pressure and provide a form of mitigation to limit the calculated liquefaction-induced settlement to a range of less than 1 inch. The differential settlement calculated would be in the range of 0.5 to 1 inch for a 0.3g event. It is our opinion that by raising the site grade with the addition of fill and paving, the increased overburden pressure will reduce the risk of liquefaction-induced settlement to the lower end of the estimated range.

5.4 Ground Motion

The guidelines presented in the 2003 *International Building Code* (IBC) Section 1615 should be used in the seismic design of the project. The United States Geological Survey (USGS) Earthquake Hazards Program website was used to determine the interpolated probabilistic ground motion values in percent of gravity (g) for an interpolated probabilistic exceedence in 50 years. Using the website, the project area is submitted using latitude and longitude for a mapped spectral acceleration for short periods (0.2 seconds) of S_s = 1.06 and a mapped spectral acceleration for a 1 second period of S_1 = 0.36. Based on the results of subsurface exploration and on an estimation of soil properties at depth utilizing available geologic data, Site Class "D" in conformance with Table 1615.1.1 of the IBC may be used. These values correspond to site coefficients F_a = 1.1 and F_v = 1.7 in conformance with IBC Tables 1615.1.2(1) and 1615.1.2(2), respectively. No additional mitigation efforts beyond these guidelines are recommended.

6.0 EROSION HAZARDS AND MITIGATIONS

The Vashon recessional outwash sediments generally contain minor amounts of silt and have good permeability. Given that the site is small, relatively level, and was underlain by a permeable sand, it is our opinion that the erosion hazards are low. In order to control erosion and reduce the amount of sediment transport off the site during construction, the following recommendations should be followed.

1. Silt fencing should be placed around the perimeter. The fencing should be properly embedded and periodically inspected and maintained, as necessary, to ensure proper function.

2. A rock construction entrance should be established to minimize tracking sediment off-site.

3. If possible, construction should proceed during the drier periods of the year.

4. Areas stripped of vegetation during construction should be mulched and hydroseeded, replanted as soon as possible, or otherwise protected. During winter construction, hydroseeded areas should be covered with clear plastic to facilitate grass growth.

5. If excavated soils are to be stockpiled on the site for reuse, measures should be taken to reduce the potential for erosion from the stockpile. These could include, but are not limited to, covering the pile with plastic sheeting, the use of low stockpiles in flat areas, and the use of straw bales/silt fences around pile perimeters.

III. DESIGN RECOMMENDATIONS

7.0 INTRODUCTION

Our exploration indicates that, from a geotechnical standpoint, the parcel is suitable for the proposed development provided the risks discussed are accepted and the recommendations contained herein are properly followed. The bearing stratum is relatively shallow and spread footing foundations may be utilized. Shallow foundation support is contingent upon acceptance of the conditions discussed in the *Liquefaction* section of this report.

8.0 SITE PREPARATION

The site is essentially undeveloped, and no known structures or utilities are situated on the currently proposed automobile lubrication facility site. Any buried utilities should be removed or relocated if they are under building areas. The resulting depressions should be backfilled with structural fill as discussed under the *Structural Fill* section.

Site preparation of planned building and road/parking areas should include removal of all grass, topsoil, existing fill, and any other deleterious material. Areas where loose surficial soils exist due to grubbing operations should be considered as fill to the depth of disturbance and treated as subsequently recommended for structural fill placement.

In our opinion, stable construction slopes should be the responsibility of the contractor and should be determined during construction. For estimating purposes, however, we anticipate that temporary, unsupported cut slopes above the ground water level in the recessional outwash can be made at a maximum slope of 1.5H:1V (Horizontal:Vertical). As is typical with earthwork operations, some sloughing and raveling may occur and cut slopes may have to be adjusted in the field. In addition, WISHA/OSHA regulations should be followed at all times.

Utility excavations that penetrate up to about 1 or 2 feet below the static ground water level are expected to be feasible using conventional slip-box shoring and pumped sumps. The larger excavation for the lubrication pit that must penetrate below the ground water level will likely require some type of dewatering effort, either a well-point system or a deep sump.

The on-site soils contain about 5 percent fine-grained material that makes them slightly moisture-sensitive and subject to disturbance when wet. The contractor must use care during site preparation and excavation operations so that the underlying soils are not softened. If disturbance occurs, the softened soils should be recompacted or removed and replaced prior to continuing work. During dry site and weather conditions, site access for wheeled vehicles may be limited due to loose, sandy surface soils. Site access during either dry or wet site conditions could be facilitated by placing a layer of crushed rock or quarry spalls in access and staging areas.

If crushed rock is considered for the access and staging areas, it should be underlain by engineering stabilization fabric to maintain segregation between the underlying sand and the crushed rock. The fabric will also aid in supporting construction equipment, thus reducing the amount of crushed rock required. We recommend that at least 16 inches of rock be placed over the fabric; however, due to the variable nature of the near-surface soils and differences in wheel loads, this thickness may have to be adjusted by the contractor in the field.

9.0 STRUCTURAL FILL

It is our understanding that about 3 feet of structural fill will be placed to establish desired grades. All references to structural fill in this report refer to subgrade preparation, fill type, placement, and compaction of materials as discussed in this section. If a percentage of compaction is specified under another section of this report, the value given in that section should be used.

After stripping has been performed to the satisfaction of the geotechnical engineer/engineering geologist, the upper 12 inches of exposed ground should be compacted to a firm, non-yielding condition. Structural fill is defined as non-organic soil, acceptable to the geotechnical engineer, placed in maximum 8-inch loose lifts with each lift being compacted to 95 percent of the modified Proctor maximum density using American Society for Testing and Materials (ASTM):D 1557 as the standard. In the case of roadway and utility trench filling, the backfill should be placed and compacted in accordance with current local or county codes and standards. The top of the compacted fill should extend horizontally outward a minimum distance of 3 feet beyond the location of any perimeter footings or roadway edges supported on the fill before sloping down at an angle of 2H:1V or flatter.

The contractor should note that any proposed fill soils must be evaluated by Associated Earth Sciences, Inc. (AESI) prior to their use in fills. This would require that we have a sample of the material 72 hours in advance of filling activities to perform a Proctor test and determine its field compaction standard. Soils in which the amount of fine-grained material (smaller than the No. 200 sieve) is greater than approximately 5 percent (measured on the minus No. 4 sieve size) should be considered moisture-sensitive. Use of moisture-sensitive soil in structural fills should be limited to favorable dry weather conditions. The on-site soils generally contained small amounts of silt and are considered slightly moisture-sensitive. Construction equipment traversing the site when the soils are wet can cause disturbance. If fill is placed during wet weather or if proper compaction cannot be obtained, a select import material consisting of a clean, free-draining gravel and sand should be used. Free-draining fill consists of non-organic soil with the amount of fine-grained material (less than the U.S. No. 200 sieve size) limited to 5 percent by weight when measured on the minus No. 4 sieve fraction.

A representative from our firm should inspect the stripped subgrade and be present during placement of structural fill to observe the work and perform a representative number of in-place density tests. In this way, the adequacy of the earthwork may be evaluated as filling progresses and any problem areas may be corrected at that time. It is important to understand that taking random compaction tests on a part-time basis will not assure uniformity or acceptable performance of a fill. As such, we are available to aid the owner in developing a suitable monitoring and testing program.

10.0 FOUNDATIONS

Spread footings may be used for building support when founded on the recessional outwash deposits or approved structural fill soils that are compacted as described in the *Structural Fill* section. We recommend that an allowable bearing pressure of 2,000 pounds per square foot (psf) be utilized for design purposes, including both dead and live loads. An increase of one-third may be used for short-term wind or seismic loading. Perimeter footings should be buried at least 18 inches into the surrounding soil for frost protection; interior footings require only 12 inches burial. However, all footings must penetrate to the prescribed bearing stratum and no footing should be founded in or above loose, organic, or existing fill soils. All footings should have a minimum width of 18 inches.

Anticipated settlement of footings founded on recessional outwash or approved structural fill should be on the order of 1 inch. However, disturbed soil not removed from footing excavations prior to footing placement, could result in increased settlements. All footing areas should be inspected by AESI prior to placing concrete, to verify that the design bearing capacity of the soils has been attained and that construction conforms to the recommendations contained in this report. The governing municipality may require such inspections. Perimeter footing drains should be provided as discussed under the section on *Drainage Considerations*.

11.0 LATERAL WALL PRESSURES

All backfill behind walls or around foundation units should be placed as per our recommendations for structural fill and as described in this section of the report. Horizontally backfilled walls, which are free to yield laterally at least 0.1 percent of their height, may be designed using an equivalent fluid equal to 35 pounds per cubic foot (pcf). Fully restrained, horizontally backfilled, rigid walls that cannot yield should be designed for an equivalent fluid of 55 pcf. If parking or drive-through lanes will be adjacent to the lubrication walls, a surcharge equivalent to 2 feet of soil should be added to the wall height in determining lateral design forces.

The lateral pressures presented above are based on the conditions of a uniform backfill consisting of on-site, fine to medium sand compacted to 90 percent of ASTM:D 1557. A higher degree of compaction is not recommended as this will increase the pressure acting on the walls. Surcharges from adjacent footings, heavy construction equipment, or sloping ground must be added to the above values. Perimeter footing drains should be provided for all retaining walls as discussed under the section on *Drainage Considerations*.

It is imperative that proper drainage be provided so that hydrostatic pressures do not develop against backfilled walls. This would involve installation of a minimum, 1-foot-wide blanket drain for the full wall height to within 2 feet of final grade using imported, washed gravel against the walls. If a structure is below the water table, it must be designed for both hydrostatic uplift and lateral pressures in addition to the soil pressures.

11.1 Passive Resistance and Friction Factors

Basement wall footings/keyways cast directly against undisturbed, medium dense soils at the bottom of the excavation may be designed for passive resistance against lateral translation using an equivalent fluid equal to 250 pcf. The passive equivalent fluid pressure diagram begins at the top of the footing; however, total lateral resistance should be summed only over the depth of the actual key (truncated triangular diagram). This value applies only to footings/keyways where concrete is placed directly against the trench sidewalls without the use of forms. If footings are placed on-grade and then backfilled, the top of the compacted backfill must be horizontal and extend outward from the footing for a minimum lateral distance equal to three times the height of the backfill before tapering down to grade. With backfill placed as discussed, footings may also be designed for passive resistance against lateral translation using an equivalent fluid equal to 250 pcf and the truncated pressure diagram discussed above. Passive resistance values include a factor of safety equal to 3 in order to reduce the amount of movement necessary to generate passive resistance.

The friction coefficient for footings cast directly on undisturbed, medium dense sand may be taken as 0.3. This is an allowable value and includes a safety factor. Since it will be difficult to excavate these soils without disturbance, the soil under the footings must be recompacted to at least 95 percent of the above-mentioned standard for this value to apply.

12.0 FLOOR SUPPORT

A slab-on-grade floor may be used over structural fill or pre-rolled, medium dense natural ground compacted to at least 95 percent of the modified Proctor maximum dry density. The floor should be cast atop a minimum of 4 inches of washed pea gravel to act as a capillary break. It should also be protected from dampness by an impervious moisture barrier or otherwise sealed.

13.0 DRAINAGE CONSIDERATIONS

Ground water levels on the site are shallow and could be encountered during excavation activities. As previously stated, it will likely be necessary to perform some type of dewatering in order to create the planned cuts for the lubrication pit. Provision will need to be made in advance for where the water will be pumped to and how it will need to be treated. Since it is likely that the lower portion of the lubrication pit will be submerged, the construction should include some type of waterproofing. Possible options include paint or spray on coatings, waterproof membranes and impermeable concrete. We strongly recommend that a specialist in this type of construction be contacted to get recommendations for waterproofing as it is beyond our area of expertise.

Roof and surface water runoff should be tightlined to an appropriate storm drainage system. If desired or required, the storm water runoff could be infiltrated into the on-site, undisturbed sand. AESI is available to conduct infiltration tests into the near-surface sand to obtain an infiltration rate, or an assumed infiltration rate may be obtained by utilizing allowable rates based on the grain size distribution of the sand.

14.0 PROJECT DESIGN AND CONSTRUCTION MONITORING

At the time of this report, site grading, structural plans, and construction methods have not been finalized. We are available to provide additional geotechnical consultation as the project design develops and possibly changes from that upon which this report is based. We recommend that AESI perform a geotechnical review of the plans prior to final design completion. In this way, our earthwork and foundation recommendations may be properly interpreted and implemented in the design. This plan review is not included in the current scope of work and budget.

We are also available to provide geotechnical engineering and monitoring services during construction. The integrity of the foundation depends on proper site preparation and construction procedures. In addition, engineering decisions may have to be made in the field in the event that variations in subsurface conditions become apparent. Construction monitoring services are not part of this current scope of work. If these services are desired, please let us know and we will prepare a proposal.

We have enjoyed working with you on this study and are confident that these recommendations will aid in the successful completion of your project. Should have any questions or require further assistance, please do not hesitate to call.

Sincerely,
ASSOCIATED EARTH SCIENCES, INC.
Kirkland, Washington

Jamey S. Battermann, PE, PG, CPESC
Associate Engineer

Attachments: Figure 1: Site and Exploration Plan
Appendix: Exploration Logs

APPENDIX

Coarse-Grained Soils - More than 50%[1] Retained on No. 200 Sieve	Gravels - More than 50%[1] of Coarse Fraction Retained on No. 4 Sieve	≤5% Fines[5]	GW	Well-graded gravel and gravel with sand, little to no fines
			GP	Poorly-graded gravel and gravel with sand, little to no fines
		≥15% Fines[6]	GM	Silty gravel and silty gravel with sand
			GC	Clayey gravel and clayey gravel with sand
	Sands - 50%[1] or More of Coarse Fraction Passes No. 4 Sieve	≤5% Fines[5]	SW	Well-graded sand and sand with gravel, little to no fines
			SP	Poorly-graded sand and sand with gravel, little to no fines
		≥15% Fines[5]	SM	Silty sand and silty sand with gravel
			SC	Clayey sand and clayey sand with gravel
Fine-Grained Soils - 50%[1] or More Passes No. 200 Sieve	Silts and Clays Liquid Limit Less than 50		ML	Silt, sandy silt, gravelly silt, silt with sand or gravel
			CL	Clay of low to medium plasticity; silty, sandy, or gravelly clay, lean clay
			OL	Organic clay or silt of low plasticity
	Silts and Clays Liquid Limit 50 or More		MH	Elastic silt, clayey silt, silt with micaceous or diatomaceous fine sand or silt
			CH	Clay of high plasticity, sandy or gravelly clay, fat clay with sand or gravel
			OH	Organic clay or silt of medium to high plasticity
Highly Organic Soils			PT	Peat, muck and other highly organic soils

Terms Describing Relative Density and Consistency

	Density	SPT[2] blows/foot
Coarse-Grained Soils	Very Loose	0 to 4
	Loose	4 to 10
	Medium Dense	10 to 30
	Dense	30 to 50
	Very Dense	>50

	Consistency	SPT[2] blows/foot
Fine-Grained Soils	Very Soft	0 to 2
	Soft	2 to 4
	Medium Stiff	4 to 8
	Stiff	8 to 15
	Very Stiff	15 to 30
	Hard	>30

Test Symbols

G = Grain Size
M = Moisture Content
A = Atterberg Limits
C = Chemical
DD = Dry Density
K = Permeability

Component Definitions

Descriptive Term	Size Range and Sieve Number
Boulders	Larger than 12"
Cobbles	3" to 12"
Gravel	3" to No. 4 (4.75 mm)
Coarse Gravel	3" to 3/4"
Fine Gravel	3/4" to No. 4 (4.75 mm)
Sand	No. 4 (4.75 mm) to No. 200 (0.075 mm)
Coarse Sand	No. 4 (4.75 mm) to No. 10 (2.00 mm)
Medium Sand	No. 10 (2.00 mm) to No. 40 (0.425 mm)
Fine Sand	No. 40 (0.425 mm) to No. 200 (0.075 mm)
Silt and Clay	Smaller than No. 200 (0.075 mm)

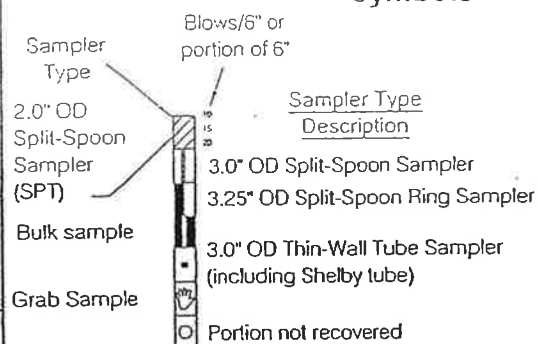
(3) Estimated Percentage

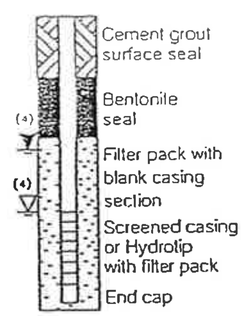
Component	Percentage by Weight
Trace	<5
Few	5 to 10
Little	15 to 25
With	- Non-primary coarse constituents: ≥ 15% - Fines content between 5% and 15%

Moisture Content

Dry - Absence of moisture, dusty, dry to the touch
Slightly Moist - Perceptible moisture
Moist - Damp but no visible water
Very Moist - Water visible but not free draining
Wet - Visible free water, usually from below water table

Symbols

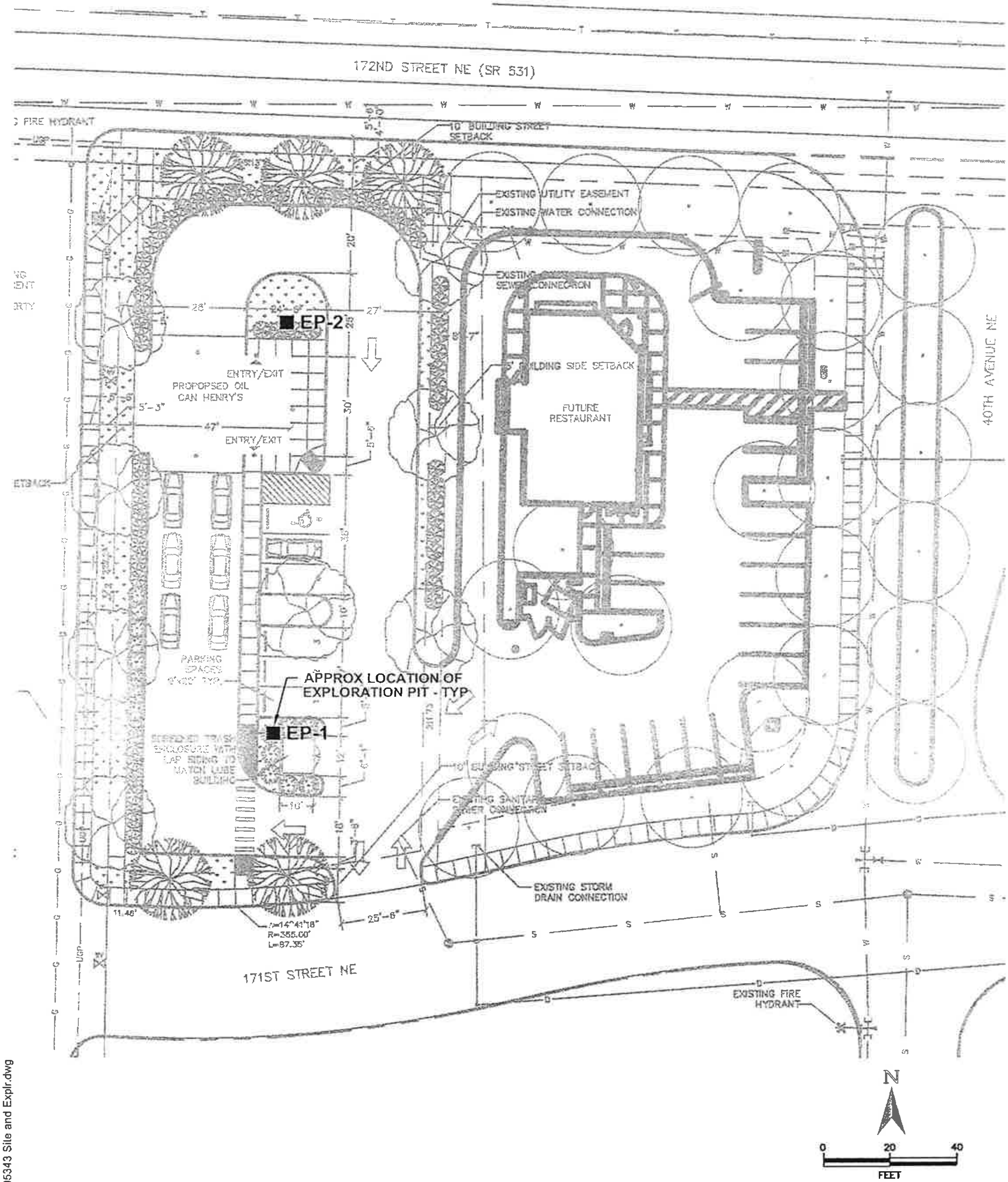




(1) Percentage by dry weight
(2) (SPT) Standard Penetration Test (ASTM D-1586)
(3) In General Accordance with Standard Practice for Description and Identification of Soils (ASTM D-2488)
(4) Depth of ground water
ATD = At time of drilling
Static water level (date)
(5) Combined USCS symbols used for fines between 5% and 15%

Classifications of soils in this report are based on visual field and/or laboratory observations, which include density/consistency, moisture condition, grain size, and plasticity estimates and should not be construed to imply field or laboratory testing unless presented herein. Visual-manual and/or laboratory classification methods of ASTM D-2487 and D-2488 were used as an identification guide for the Unified Soil Classification System.

1/02/



05343 Oil Can Henry \ 05343 Site and Expl.dwg

Associated Earth Sciences, Inc.

SITE AND EXPLORATION PLAN

OIL CAN HENRY'S
ARLINGTON, WASHINGTON

FIGURE 2

DATE 5/05

PROJECT NO. KE05343A

LOG OF EXPLORATION PIT NO. EP-1

Depth (ft)	This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplfication of actual conditions encountered. **DESCRIPTION**
	Topsoil
	Loose, damp, dark brown, loamy fine to medium SAND.
1	**Vashon Recessional Outwash**
2	Medium dense, damp to saturated with depth, light brown to gray with depth, fine to medium SAND, trace silt.
3	
4	
5	
6	
7	
8	Becomes medium to coarse SAND.
9	
10	Bottom of exploration pit at depth 9 feet Rapid ground water seepage at 8'. Caving below 7'.
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	

KCTP3 05343A.GPJ May 18, 2005

Oil Can Henry
Arlington, WA

Associated Earth Sciences, Inc.

Logged by: JSB

Approved by:

Project No. KE05343A

5/18/05

LOG OF EXPLORATION PIT NO. EP-2

This log is part of the report prepared by Associated Earth Sciences, Inc. (AESI) for the named project and should be read together with that report for complete interpretation. This summary applies only to the location of this trench at the time of excavation. Subsurface conditions may change at this location with the passage of time. The data presented are a simplification of actual conditions encountered.

Depth (ft)	DESCRIPTION
	Topsoil
	Loose, damp, dark brown, loamy fine to medium SAND.
1	**Vashon Recessional Outwash**
2	Medium dense, damp to saturated with depth, light brown to gray with depth, fine to medium SAND, trace silt.
3	
4	
5	
6	
7	
8	Becomes medium to coarse SAND.
9	
10	Bottom of exploration pit at depth 9 feet Rapid ground water seepage at 8', after 15 minutes, water level rose to 6 1/2'. Caving below 6'.
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	

KCTP3 05343A.GPJ May 18, 2005

Oil Can Henry
Arlington, WA

Associated Earth Sciences, Inc.

Logged by: JSB

Approved by:

Project No. KE05343A

5/18/05