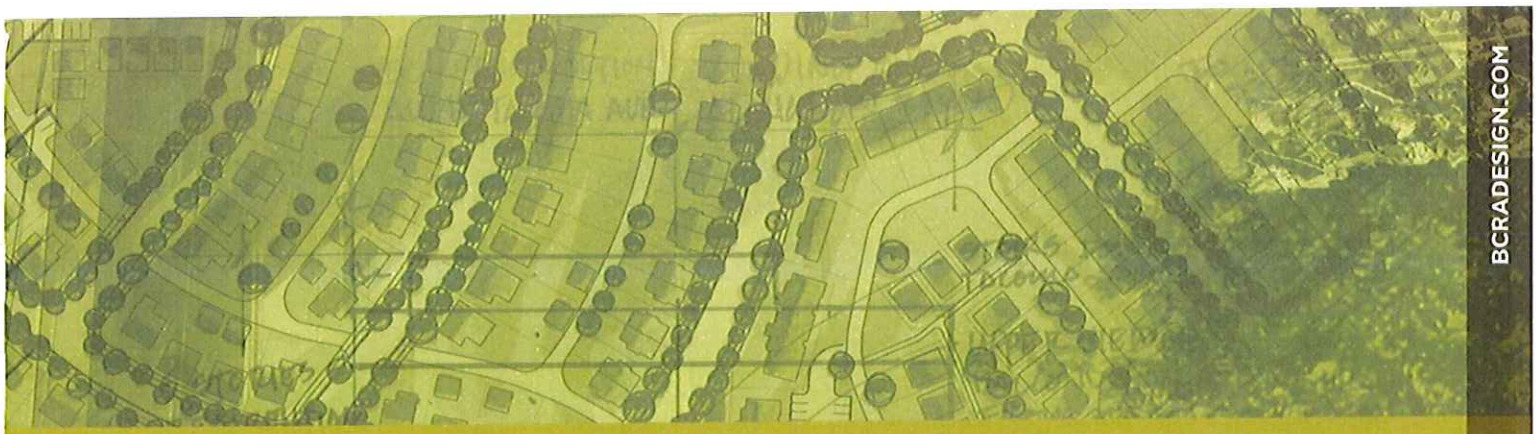

BCRADESIGN.COM

Cleanup Action Plan

28TH & PROCTOR

N 28TH ST AND N PROCTOR ST
TACOMA, WA 98405

PROCTOR INVESTORS, LLC.
6622 WOLLOCHET DR. NW
GIG HARBOR, WA 98335

REVIEWED BY BCRA

MAY 21, 2014

BCRA

ARCHITECTURE + INTERIOR SPACES
SCIENCE + ENGINEERING
PLANNING + LANDSCAPE ARCHITECTURE
VISUAL COMMUNICATION + STRATEGY

BCRA

CLEANUP ACTION PLAN

05/21/2014

PROJECT:
28th & Proctor
2720 North Proctor Street
Tacoma, WA 98407

APPLICANT:
Chris DeWald
6622 Wollochet Drive NW
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CHAPTER 1 – INTRODUCTION

This Cleanup Action Plan (CAP) presents the cleanup action to address the soil contamination on the 28th and Proctor site as a result of the Tacoma Smelter Plume (TSP). The cleanup actions selected and described for this site are designed to fulfill the requirements of the Model Toxins Control Act (MTCA), Chapter 70.105D and its regulation WAC 173-340. This report addresses the cleanup action plan requirements described in WAC 173-340-350 through WAC 173-340-390 and is prepared in general accordance with the Model Remedies found in the Tacoma Smelter Plume – Interim Action Plan dated June of 2012.

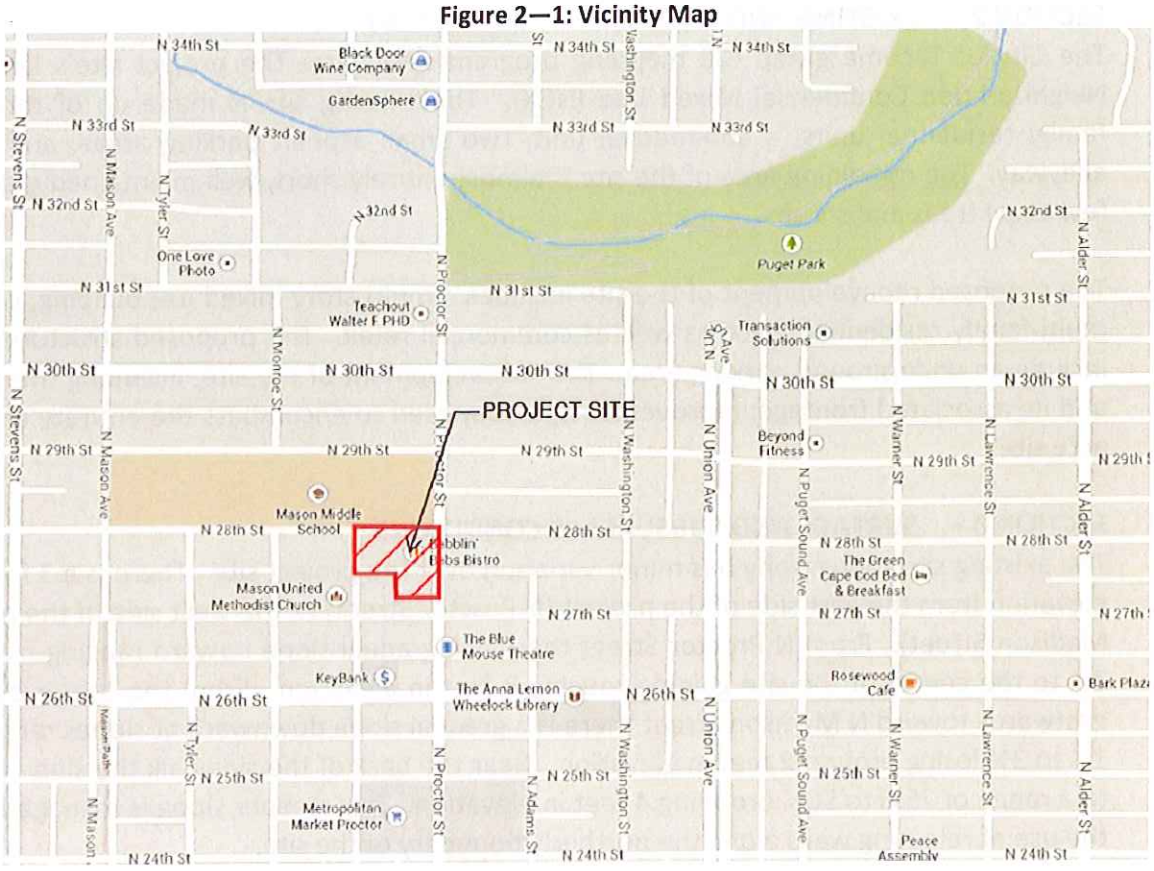
For a summary of the existing soil contamination levels please refer to the soils sampling reports by Eco Compliance dated October 1, 2013 and February 20, 2014 included in Appendix A and Appendix B of this report.

CHAPTER 2 –PROJECT OVERVIEW AND SITE HISTORY

SECTION 1 – SITE LOCATION

The 28th & Proctor Project is located at 2720 N Proctor Street in Tacoma, WA. The project site is bound by N 28th Street on the north, N Proctor Street to the east, N Madison Street to the west, and N 27th Street on the south excluding the property located on the north east corner of N 27th Street and N Madison Street. Refer to the vicinity map below.

Figure 2—1: Vicinity Map



The legal description of the project site can be found below:

Parcel A:
Lots 1 to 8, inclusive, Block 5, Grandin Addition to Tacoma, according to the plat thereof, recorded in Volume 8 of Plats, Page 97, Records of Pierce County Auditor.
Situate in the City of Tacoma, County of Pierce, State of Washington.

Parcel B:
Lots 1, 2, and 3, block 22, Lawrence Addition to the City of Tacoma, according to the plat thereof, recorded in Volume 3 of plats, Page 40, Records of Pierce County Auditor.

Together with the West 10 feet of vacated Proctor Street by operation of law, as vacated by City of Tacoma Ordinance No. 10191 and recorded under recording number 957829.
Situate in the City of Tacoma, County of Pierce, State of Washington.

Parcel C:
The North 65.47 feet of the East 75 feet of Block 11, Amended Map of Second School Land Addition, according to the plat thereof, recorded in Volume 7 of Plats, Page 79A, Records of Pierce County Auditor.
Situate in the City of Tacoma, County of Pierce, State of Washington.

SECTION 2 – EXISTING AND PROPOSED DEVELOPMENT

The City of Tacoma gMap GIS mapping program designates the project site's land use as Neighborhood Commercial Mixed Use (NCX). The existing site is made up of three single family residential units, a commercial unit, two small asphalt parking areas, and a gravel alleyway. The remaining area of the site is almost entirely short, well maintained grass with a few small trees and shrubs.

The proposed redevelopment of the site includes a multi-story mixed use building, combining multi-family residential space as well as commercial retail. The proposed structure will also include an underground parking area. The redevelopment of the site, including the structure and its associated frontage improvements, is proposed to encompass the entirety of the 1.52 acre site.

SECTION 3 – SURFACE AND SUBSURFACE CONDITIONS

The existing site topography has minor variation over the project site. There is a 3 foot loss in elevation from the east side of the project (N Proctor Street) to the west side of the project (N Madison Street). From N Proctor Street there is a gradual slope upward ranging from 1% to 2% to the center of the site gaining roughly 3 feet in elevation. From the center of the site eastwards toward N Madison Street there is a gradual slope downward at slopes ranging from 1% to 3% losing around 2 feet in elevation. Near the back of the sidewalk the slope increases to a range of 25% to 50% dropping 4 feet in elevation. This steeper slope is managed through the use of retaining walls along the northerly boundary of the site.

The existing subsurface condition of the site is generally characterized as a fill material, loose to medium dense sand with silt, underlain by glacial till, dense silty fine sand with gravel. This glacial till was generally observed between 3 and 10 feet of depth. Subsurface explorations also encountered dense to very dense sand at varying depths below the till soils that was classified as advance outwash.

Groundwater elevations around the site were determined to fluctuate with seasonal weather patterns and evidence of seasonal perched aquifers was observed. For a detailed discussion of the existing subsurface soil and groundwater conditions please refer to the geotechnical report included in Appendix C of this report.

SECTION 4 – OWNERSHIP AND LANDUSE HISTORY

The project site once contained a lubricating oil company, located in the northeast portion of the project site, and a gas station, located in the southeast portion of the site. The lubricating oil company employed the use of 2 underground storage tanks (UST). The gas station employed the use of 5 USTs onsite. The remainder of the site is composed of 3 single family homes with no underground storage tanks.

SECTION 5 – CLEANUP ACTION HISTORY

No prior cleanup actions are recorded as being completed on this site.

In February of 2014 Eco Compliance performed a remedial investigation (RI) to evaluate the nature and extent of any soil contamination found on the project site. The Tacoma Smelter Plume Interim Action Plan provides the Feasibility Study (FS) element of this project.

MR Guid. 20 4 4 0-6 6-12 duff (4 area)

CHAPTER 3 – FIELD SAMPLING AND LABORATORY TESTING

SECTION 1 – CONTAMIMANTS OF CONCERN

Geotechnical and environmental investigations of the site included the analysis of soil samples for arsenic, lead, diesel, and oil as well as gasoline, benzene ethylbenzene, toluene, and xylene in applicable areas (Eco Compliance, 2013 and 2014). Based on the results of the analysis, arsenic was the only identified contaminant of concern in the subsurface. For a detailed review of the sampling and testing done please refer to Appendix A and Appendix B of this report. Refer to Section 3 of this Chapter for a discussion on the sampling and testing related to the lead and arsenic from the TSP.

SECTION 2 – SITE CLEANUP STANDARDS

As defined in WAC 173-340-700, cleanup standards consist of cleanup levels for contaminants to soil, water, and air as well as locations at which these levels must be met.

The two contaminant level thresholds for each of the contaminants on the site can be found below.

Figure 3—1: Ecology Cleanup Standard Thresholds

Threshold	Arsenic	Lead
Arithmetic Mean	20 ppm	250 ppm
Maximum	40 ppm	500 ppm

SECTION 3 – TSP SAMPLING AND TESTING

Figure 7

For purposes of testing and analysis the site was divided into 5 decision units based on existing use. The three existing single family homes were designated as decision units 1, 3, and 4 while the empty lot (parcel 4180000170) was designated as decision unit 4 and the road frontage along North Madison Street and North 28th Street was designated as decision unit 5. Initial testing for each decision unit included a sample being taken from soil ranging from 0-6 inches in depth and another sample taken from soil ranging from 6-12 inches of depth. Each sample was composed 3 distinct and randomized locations throughout the decision unit, thus producing 30 discrete sampling locations across the 5 decision units.

For laboratory testing the samples taken from the upper 6 inches of soil were tested first for each decision unit. If contaminant levels within that decision unit were below Ecology's cleanup standard level testing for the decision unit was concluded prior to testing the samples taken from deeper soils. In two of the decision units, 3 and 4, contaminant levels were recorded in the upper six inches of the soil over Ecology's cleanup standard level.

Additional soil sampling and testing was done once the results of the initial tests were compiled. For the two decision units registering levels of contaminants above Ecology's cleanup standard level an additional 8 samples each were taken in order to increase the resolution of the contaminant spread over the decision units. Results of this test showed that decision unit 3 was the sole decision unit with contaminant concentrations above Ecology's cleanup standard level.

Figure 3—2: Soil Sampling and Testing Results Summary

Decision Unit	Arsenic Contamination Level (ppm)	Lead Contamination Level (ppm)
1	11	27
2	18	125
3	**32***	235*
4	10*	75*
5	10	15
Cleanup Standard	20	250

* Contamination levels recorded during additional soil sampling

As the above table shows the only decision unit of concern is decision unit 3. All other decision units do not require cleanup action. Specific cleanup actions and contaminant remedies are discussed in the next chapter of this report.

CHAPTER 4 – PROPOSED CLEANUP ACTION AND ALTERNATIVES CONSIDERED

The main conclusions of the RI conducted by Eco Compliance are summarized below.

- Soils tested within a 6" depth on parcel 4180000160 (Lots 4 and 5 of the Grandin Addition) were found to contain arsenic levels that are above Ecology's cleanup standard level.
- The remainder of the site, though containing hotspots of lead and arsenic contamination, was determined to not require any further environmental investigation as the incidental mixing associated with excavation and grading activities will homogenize the soils and dilute contaminants. The end result is expected to provide soils with contaminant levels below Ecology's cleanup standard level.

Figure of decision units.?

SECTION 1 – DECISION UNITS REQUIRING NO CLEANUP ACTION

Soil within decision units 1, 2, 4, and 5 were found to have contaminant levels below Ecology's cleanup standard level and therefore requires no cleanup actions.

SECTION 2 – DECISION UNITS REQUIRING CLEANUP ACTION

Soil within decision unit 3 was found to have contaminant levels above Ecology's cleanup standard level for arsenic and therefore requires cleanup action.

Due to the nature of the proposed site improvements a combination of cleanup actions may be employed onsite. As the proposed structure includes an underground parking area excavation within the building foot print will range from an estimated 7 to 15 feet. With soil excavation depth well in excess of typical excavation and removal depths it is unlikely that contamination levels at the resulting slab grade would be at or above Ecology's cleanup standard level. Soils within the top 6 inches of the excavation shall be treated as contaminated and disposed of in an appropriately permitted disposal site. All disposal of contaminated soil shall be documented. Compliance testing, as discussed below shall then be completed on the newly excavated surface. Upon confirmation that the remaining soils level of contamination are below Ecology's cleanup standard level the remainder of the soil shall be treated as uncontaminated and disposed of at the contractors discretion.

DU 3 only?

All areas or only Exposed?

Post-excavation compliance testing in the area of decision unit 3 (existing parcel 4180000160) will confirm or deny the success of the excavation and removal as a contaminant cleanup remedy technique. Compliance samples shall be taken from soils ranging in depth from 0-6 inches. At every fourth location the sample shall be taken from soils ranging in depth from 6-12 inches. The number of samples shall be determined based on the size of the area tested and shall be laid out in a grid. Laboratories testing the sample shall use methods 6010, 6020, 6200, or 7060 for arsenic and methods 6010, 6020, 6200, or 7421 for lead. All compliance testing shall be in accordance with the TSP Model Remedies Guidance.

In the event that testing indicates Ecology's cleanup standard level (refer to Section 2 of Chapter 3 for a discussion of this requirement) is met construction will proceed on the project site. In the event that the testing indicates that Ecology's cleanup standard level is not met even with the excavation and removal of soil in the affected area the project may then rely upon the second contaminant cleanup remedy technique.

In the unlikely event that excavation and removal of the contaminated soil does not meet Ecology's cleanup standard requirement, a second remedy technique that may be employed by the site is a Type 2 hard cap. As the area of the site affected with contaminants above the cleanup standard limit is entirely encompassed with the proposed structure the structures foundation may function as the hard cap. In the scenario that the contaminant level is not adequately reduced by excavating and removing the soil an environmental covenant may be completed, in accordance with Chapter 10 of the TSP Model Remedies Guidance, and construction will proceed on the project site.

SECTION 3 – IMPORTED SOILS

Should imported soils be used on the project site, they must be confirmed to contain contaminant levels below Ecology's cleanup standard level. Should any uncertainty exist over the contaminant level in the imported soils imported soils sampling and testing shall be performed in accordance with Chapter 9 of the TSP Model Remedies Guidance. This requirement does not apply to manufactured material such as gravel or sand used in drainage facilities, pipe bedding, or pavement subgrades.

SECTION 4 – GRADING AND EARTHWORK CONSIDERATIONS/BMPS

Refer to the plans for a detailed review of all erosion control, grading, and stormwater pollution prevention Best Management Practices (BMPs). Dust and erosion control BMPs for the project, during the grading and earthwork phases must be followed to prevent lead and arsenic from being transported offsite.

As excavated soil ranging from a depth of 0-6 inches will be treated as contaminated soil and disposed of accordingly no topsoil stripping within decision unit 3 will occur. Following this excavation and removal regular grading and earthwork practices may be resumed.

SECTION 5 – WORKER SAFETY

The contractor shall employ a health and safety plan in accordance with the Hazardous Waste Operations regulations in WAC 2986-843. For health and safety information specific to arsenic and lead refer to WAC 296-848 and WAC 296-155, respectively. The contractor shall also notify all workers involved in grading and earthwork of the risks involved with the exposure to the contaminants onsite.

CHAPTER 5 –SCHEDULE

A general outline of the schedule pertaining to the grading and earthwork for the 28th & Proctor site can be found below. This is a preliminary schedule since the site work and utility subcontractor has not been selected yet. The schedule will be further refined once the subcontractor has been selected.

May – July 2014: Mobilize, install TESC measures, demolish existing structures, excavate contaminated soil, and mass excavate for parking garage.

Fall 2014: Backfill parking garage excavation and make some utility connections.

Spring – Fall 2015: Finish utility connections, construct frontage improvements, pave, and stripe.

CHAPTER 6 –APPENDICIE AND REFERNCES

APPENDIX A – ECO COMPLIANCE SOIL SAMPLING REPORT, OCTOBER 2013

Eco
Compliance
Corporation

Environmental Scientists, Planners and Consultants

1823 Bremerton Ave NE
Renton, WA 98059-3954
phone (425) 271-5629
fax (425) 271-5629
www.ecocompliance.biz

October 1, 2013

Mr. Thair Jorgenson
The Rush Companies
6622 Wollochet Drive NW
Gig Harbor, Washington 98335

Re: Soil sampling results for North Proctor Street site in Tacoma.

Dear Thair:

Beginning September 11, 2013, 5 boreholes were drilled by GeoResources, LLC, at the subject North 28th Street and North Proctor Street property in Tacoma (boreholes B-1 through B-5) (Figure 1). This property consists of the following 8 tax parcels (Figure 2):

1. 4180000180
2. 4180000170
3. 4180000160
4. 4180000150
5. 4180000140
6. 5200000940
7. 5200000642
8. 7475010642.

Historically, a lubricating oil company with 2 underground storage tanks (USTs) was located along the northeast portion of the subject property (parcel number 5200000940), while a gas station with 5 USTs was located along the southeast part of the site (parcel numbers 5200000642 and 7475010642) (see Figure 2). A single-family home with an aboveground heating oil tank in the basement currently exists along the western portion of the property (parcel number 4180000180). Within the immediate area surrounding the subject property, several sites are noted as having soil and/or groundwater contamination issues (see Figure 2).

The purpose of this drilling was, among others, to collect soil samples for analysis for possible chemical contamination. The purpose of this letter is to evaluate the resulting data from the drilling and provide conclusions and recommendations as appropriate.

Figure 1. Approximate borehole locations. GeoResources, LLC. September, 2013.

N

Not to scale

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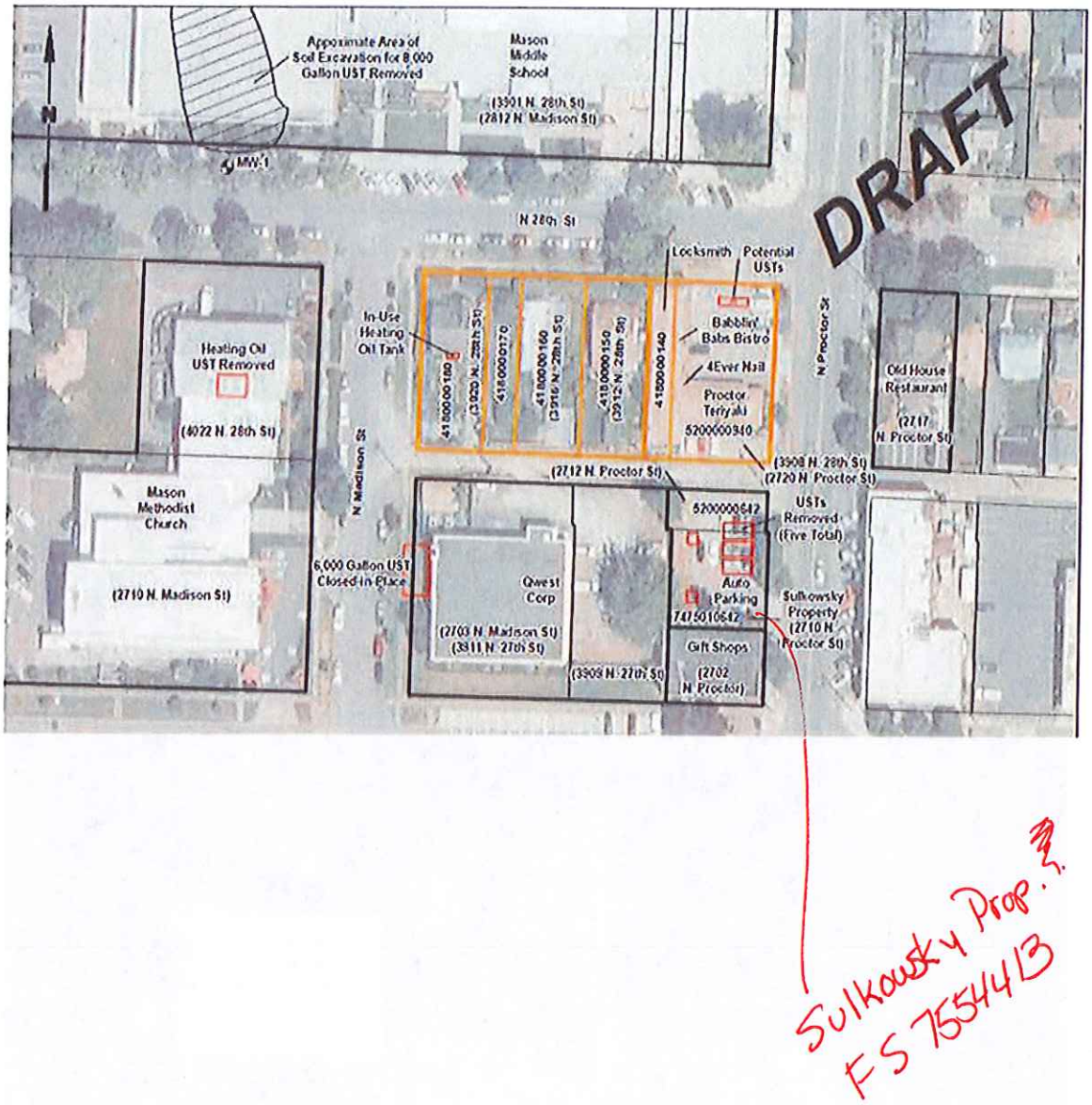
Figure 2. Subject property and tax parcels. Landau Associates.



SOIL SAMPLING AND ANALYSIS

Future development of the subject property may involve soil excavation along the northern portion of the subject property to a depth of approximately 15 feet below grade. Excavation along the southeast portion of the site may occur to approximately 7 feet below grade. Based on these estimates and observations made by GeoResources during the drilling, which included samples for structural analysis, soil samples were collected from the 5 boreholes at depths up to approximately 20 feet below grade.

All soil samples were analyzed for diesel, oil and total lead. Samples from boreholes B-1, B-2, B-3 and B-5 were also analyzed for gasoline and BETX (benzene, ethylbenzene, toluene and xylenes) compounds (see Figure 1).

Analytical results are attached and summarized below in Table 1. Table 1 also lists cleanup standards as specified by the Washington State Department of Ecology (Ecology) under their Model Toxics Control Act (MTCA) regulations (Chapter 173-340 WAC) based on unrestricted (residential) land use.

Table 1. Soil analytical results. North 28th Street and North Proctor Street, Tacoma. September, 2013.

Boring Number	Sample Number	Sample Location/ Description	Analytical Result (ppm)	MTCA Cleanup Standard (ppm)
B-1	B-1 at 7.5 feet	Parcel number 5200000940. Boring B-1. Approximately 7.5 feet below grade.	ND(5) gasoline ND(0.005) benzene ND(0.005) ethylbenzene ND(0.005) toluene ND(0.01) xylenes ND(10) diesel ND(100) oil 4 total lead	100 gasoline[a] 0.03 benzene 6 ethylbenzene 7 toluene 9 xylenes 2,000 diesel 2,000 oil 250 total lead
B-1	B-1 at 15 feet	Parcel number 5200000940. Boring B-1. Approximately 15 feet below grade.	ND(5) gasoline ND(0.005) benzene ND(0.005) ethylbenzene ND(0.005) toluene ND(0.01) xylenes ND(10) diesel ND(100) oil ND(4) total lead	100 gasoline[a] 0.03 benzene 6 ethylbenzene 7 toluene 9 xylenes 2,000 diesel 2,000 oil 250 total lead

(425) 271-5629

Table 1 (continued). Soil analytical results. North 28th Street and North Proctor Street, Tacoma. September, 2013.

Boring Number	Sample Number	Sample Location/ Description	Analytical Result (ppm)	MTCA Cleanup Standard (ppm)
B-2	B-2 at 7.5 feet	Parcel number 5200000940. Boring B-2. Approximately 7.5 feet below grade.	ND(5) gasoline ND(0.005) benzene ND(0.005) ethylbenzene ND(0.005) toluene ND(0.01) xylenes ND(10) diesel ND(100) oil ND(4) total lead	100 gasoline[a] 0.03 benzene 6 ethylbenzene 7 toluene 9 xylenes 2,000 diesel 2,000 oil 250 total lead
B-2	B-2 at 15 feet	Parcel number 5200000940. Boring B-2. Approximately 15 feet below grade.	ND(5) gasoline ND(0.005) benzene ND(0.005) ethylbenzene ND(0.005) toluene ND(0.01) xylenes ND(10) diesel ND(100) oil ND(4) total lead	100 gasoline[a] 0.03 benzene 6 ethylbenzene 7 toluene 9 xylenes 2,000 diesel 2,000 oil 250 total lead
B-3	B-3 at 2.5 feet	Parcel numbers 5200000642 and 7475010642. Boring B-3. Approximately 2.5 feet below grade.	ND(5) gasoline ND(0.005) benzene ND(0.005) ethylbenzene ND(0.005) toluene ND(0.01) xylenes ND(10) diesel ND(100) oil 11 total lead	100 gasoline[a] 0.03 benzene 6 ethylbenzene 7 toluene 9 xylenes 2,000 diesel 2,000 oil 250 total lead

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Table 1 (continued). Soil analytical results. North 28th Street and North Proctor Street, Tacoma. September, 2013.

Boring Number	Sample Number	Sample Location/ Description	Analytical Result (ppm)	MTCA Cleanup Standard (ppm)
B-3	B-3 at 7.5 feet	Parcel numbers 5200000642 and 7475010642. Boring B-3. Approximately 7.5 feet below grade.	ND(5) gasoline ND(0.005) benzene ND(0.005) ethylbenzene ND(0.005) toluene ND(0.01) xylenes ND(10) diesel ND(100) oil ND(4) total lead	100 gasoline[a] 0.03 benzene 6 ethylbenzene 7 toluene 9 xylenes 2,000 diesel 2,000 oil 250 total lead
B-3	B-3 at 20 feet	Parcel numbers 5200000642 and 7475010642. Boring B-3. Approximately 20 feet below grade.	**5,470 gasoline** ND(0.25) benzene **12.1 ethylbenzene** ND(0.25) toluene **55.6 xylenes** ND(10) diesel ND(100) oil ND(4) total lead	30 gasoline[b] 0.03 benzene 6 ethylbenzene 7 toluene 9 xylenes 2,000 diesel 2,000 oil 250 total lead
B-4	B-4 at 7.5 feet	Parcel number 4180000170. Boring B-4. Approximately 7.5 feet below grade.	ND(10) diesel ND(100) oil 7 total lead	2,000 diesel 2,000 oil 250 total lead
B-4	B-4 at 15 feet	Parcel number 4180000170. Boring B-4. Approximately 15 feet below grade.	ND(10) diesel 230 oil ND(4) total lead	2,000 diesel 2,000 oil 250 total lead

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Table 1 (continued). Soil analytical results. North 28th Street and North Proctor Street, Tacoma. September, 2013.

Boring Number	Sample Number	Sample Location/ Description	Analytical Result (ppm)	MTCA Cleanup Standard (ppm)
B-5	B-5 at 7.5 feet	Parcel number 4180000180. Boring B-5. Approximately 7.5 feet below grade.	ND(5) gasoline ND(0.005) benzene ND(0.005) ethylbenzene ND(0.005) toluene ND(0.01) xylenes ND(10) diesel ND(100) oil 5 total lead	100 gasoline[a] 0.03 benzene 6 ethylbenzene 7 toluene 9 xylenes 2,000 diesel 2,000 oil 250 total lead

ND(5) Not detected at the analytical detection limit of 5 parts-per-million (ppm).

a MTCA Method A cleanup standard for gasoline if there is no benzene detected in the sample, and the total of ethylbenzene, toluene and xylenes are less than 1% of the gasoline mixture.

b MTCA Method A cleanup standard for gasoline if there is benzene detected in the sample, or the total of ethylbenzene, toluene and xylenes is more than 1% of the gasoline mixture.

As indicated in Table 1, lead was detected in borings B-1 (7.5 feet below grade), B-3 (2.5 feet below grade), B-4 (7.5 feet below grade) and B-5 (7.5 feet below grade), but at concentrations that are below Ecology's MTCA cleanup standard based on unrestricted (residential) land use. These lead concentrations are within normal background levels for the Puget Sound region (Ecology publication number 94-115, October, 1994). There was no lead detected in other samples collected from the site.

Gasoline, ethylbenzene and xylenes were detected in boring B-3 (20 feet below grade), at concentrations that are above Ecology's cleanup standards. There was no gasoline, ethylbenzene or xylenes detected in other samples collected from the site.

Oil was detected in boring B-4 (15 feet below grade), at a concentration that is below Ecology's cleanup standard. There was no oil detected in other samples collected from the site.

There was no benzene, toluene or diesel detected in any of the soil samples collected from the subject property.

There were no samples collected from boring B-5 at depths below approximately 7.5 feet below grade due to lack of soil recovery in the drill rig's split-spoon sampler.

CONCLUSIONS AND RECOMMENDATIONS

Based on sample results as discussed herein, contaminated soil is not expected to be present in significant quantities at the subject property at the estimated 7-to-15-foot excavation depths needed for development. Some oil contamination may be encountered around boring B-4 at 15 feet below grade, while gasoline, ethylbenzene and xylene contamination may be encountered around boring B-3 if development requires soil excavation in this area to a depth of approximately 20 feet below grade.

Overall, a qualified person(s) should be available onsite to physically evaluate the soil during excavation to separate "clean" soil from soil that may contain contaminants. The petroleum contamination noted herein should have a distinctive odor. Petroleum-contaminated soil may also have a distinctive light-gray color.

If soil contamination is encountered at the subject property, it is not necessary to remove all of it. Typically, it is only necessary to remove the contamination as needed to develop the site. Any remaining contamination can usually be left in place.

Any contaminated soil excavated from the subject property should be properly disposed of. Permitted disposal facilities include Waste Management and Rabanco. Paperwork can be submitted to either of these facilities for approval for soil disposal prior to beginning development. In so doing, any contaminated soil can be loaded directly into trucks and sent to the disposal site without delay.

It is not anticipated that soil contamination around borings B-3 or B-4 would create petroleum odors within any of the occupied buildings proposed for the property. Contamination at boring B-3 is relatively deep below grade, and excavation in this area is only expected to approximately 7 feet or less. The resulting approximate 13 feet of soil buffer, and the building's concrete slab floor, should be sufficient to keep any vapors from intruding into the buildings.

The concentration of oil contamination around boring B-4 is low. Oil contamination is not particularly volatile, and its vapors would not be expected to penetrate through a concrete floor of a building.

Over time, the petroleum contamination detected at borings B-3 and B-4 will degrade naturally in the environment.

Any contamination remaining on the subject property after development should be made known to lenders and occupants. A plan should be developed to manage any such contamination in-place.

(425) 271-5629

It was a pleasure assisting you with this data evaluation. Please call me if you have any questions.

Sincerely,

ECO COMPLIANCE CORPORATION

Bill Kane

Bill Kane
President
bill@ecocompliance.biz

APPENDIX B – ECO COMPLIANCE SOIL SAMPLING REPORT, FEBRUARY 2014

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February 20, 2014

Mr. Chris DeWald
Rush Design, Inc.
6622 Wollochet Drive NW
Gig Harbor, Washington 98335

Re: Shallow soil sampling at the North Proctor Street site in Tacoma.

Dear Chris:

Beginning Friday, January 17, 2014, shallow soil samples were collected from 4 residential parcels of land located at North Proctor Street and North 28th Street in Tacoma, Washington.

Future plans call for re-development of these subject parcels. The purpose of this sampling was to determine whether the shallow onsite soil has been adversely impacted by air emissions from the former Asarco smelter in Tacoma.

According to documents published by the Washington State Department of Ecology (Ecology), the subject parcels are located in a "Level 1" area where arsenic concentrations in the soil likely exceed 20 parts-per-million (ppm) (Dirt Alert, Arsenic and Lead in Soils, Ecology publication #03-09-036). Ecology's cleanup standard for arsenic is 20 ppm based on unrestricted (residential) land use. Lead may also be present in the soil at concentrations above the cleanup standard of 250 ppm.

INITIAL SOIL SAMPLING AND ANALYTICAL RESULTS

A total of 10 soil samples were collected from unpaved, non-garden areas of each of the 4 residential parcels (sample numbers 1 through 5A). Using hand equipment, samples were collected at depths of approximately 0 – 6 inches and 6 – 12 inches below grade. Each sample was a composite of soil from 3 separate, random locations.

Samples from the 0 – 6 inch depth were analyzed for total arsenic and lead content. If either metal was detected at concentrations above Ecology's cleanup standard, then samples from the 6 – 12 inch depth were also analyzed.

Analytical results are attached and summarized below in Table 1.

Table 1. Initial shallow soil sampling results. North Proctor Street and North 28th Street site, Tacoma. January 17, 2014.

Sample Number	Sample Location/Description	Analytical Result (ppm)	Cleanup Standard (ppm)
1	3920 North 28th Street. Composite of soil from 0 – 6 inches below grade from 3 random locations within the front, side and back yards. Sandy clayey soil with some gravel.	11 arsenic 27 lead	20 arsenic 250 lead
1A	3920 North 28th Street. Composite of soil from 6 – 12 inches below grade from 3 random locations within the front, side and back yards. Sandy clayey soil with some gravel.	Not analyzed	Not applicable
2	Vacant lot between 3916 and 3920 North 28th Street. Composite of soil from 0 – 6 inches below grade from 3 random locations within the grass areas. Sandy clayey soil with some gravel.	18 arsenic 125 lead	20 arsenic 250 lead
2A	Vacant lot between 3916 and 3920 North 28th Street. Composite of soil from 6 – 12 inches below grade from 3 random locations within the grass areas. Sandy clayey soil with some gravel.	Not analyzed	Not applicable
3	3916 North 28th Street. Composite of soil from 0 – 6 inches below grade from 3 random locations within the front, side and back yards. Sandy soil with some gravel.	**29 arsenic** **268 lead**	**20 arsenic** **250 lead**
3A	3916 North 28th Street. Composite of soil from 6 – 12 inches below grade from 3 random locations within the front, side and back yards. Sandy clayey soil with some gravel.	20 arsenic 143 lead	20 arsenic 250 lead
4	3912 North 28th Street. Composite of soil from 0 – 6 inches below grade from 3 random locations within the front and side yards. Sandy clayey soil with some gravel.	**22 arsenic** 94 lead	**20 arsenic** 250 lead
4A	3912 North 28th Street. Composite of soil from 6 – 12 inches below grade from 3 random locations within the front and side yards. Clayey sandy soil with some gravel.	14 arsenic 43 lead	20 arsenic 250 lead

Figure?

(425) 271-5629

Table 1 (continued). Initial shallow soil sampling results. North Proctor Street and North 28th Street site, Tacoma. January 17, 2014.

Sample Number	Sample Location/Description	Analytical Result (ppm)	Cleanup Standard (ppm)
5	Grass strip along the side and the front of the subject parcels, along North Madison Street and North 28th Street. Composite of soil from 0 – 6 inches below grade from 3 random locations. Gravelly soil with some clay.	10 arsenic 15 lead	20 arsenic 250 lead
5A	Grass strip along the side and the front of the subject parcels, along North Madison Street and North 28th Street. Composite of soil from 6 – 12 inches below grade from 3 random locations. Sandy soil with some gravel.	Not analyzed	Not applicable

Not analyzed. Sample was not analyzed since the upper 0 – 6 inch sample did not contain arsenic or lead at concentrations above the state cleanup standards.

Not applicable. Cleanup standard is not applicable since the sample was not analyzed.

As indicated in Table 1, arsenic and lead were detected in sample numbers 1, 2 and 5 at 0 – 6 inches below grade at concentrations that are below Ecology's cleanup standards. As a result, their corresponding samples from 6 – 12 inches below grade were not analyzed.

Sample 3 contains arsenic and lead at 0 – 6 inches below grade at concentrations that are above Ecology's cleanup standards. These contaminants were also detected in Sample 3A from 6 – 12 inches below grade, but at concentrations that are below the cleanup standards.

Sample 4 contains arsenic at 0 – 6 inches below grade at a concentration that is above Ecology's cleanup standard. Arsenic was also detected in Sample 4A from 6 – 12 inches below grade, but at a concentration that is below the cleanup standard. Lead was detected in both samples at concentrations that are below the cleanup standard.

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ADDITIONAL SOIL SAMPLING AND ANALYTICAL RESULTS

Soil samples from 0 – 6 inches below grade from 3920 North 28th Street (sample 1), the vacant lot between 3920 and 3916 North 28th Street (sample 2), and the grass strip along the side and front of the subject parcels along North Madison Street and North 28th Street (sample 5) do not contain arsenic or lead at concentrations that are above Ecology's cleanup standards (see Table 1). As a result, samples from the 6 – 12 inch depths from these locations were not analyzed, and no further environmental investigation of these parcels appears necessary.

To better determine whether arsenic and/or lead concentrations detected from 0 – 6 inches below grade at 3912 and 3916 North 28th Street may be characteristic of the entire unpaved, non-garden areas of these parcels or just random "hot-spots" of contamination, additional samples were collected from these parcels on Friday, February 14, 2014 (sample numbers 3-1 and 4-1). These samples were composites of soil from 8 random locations within the front, side and back yard areas of the homes.

Analytical results are attached and summarized below in Table 2.

Table 2. Additional shallow soil sampling results. North Proctor Street and North 28th Street, Tacoma. February 14, 2014.

Sample Number	Sample Location/Description	Analytical Result (ppm)	Cleanup Standard (ppm)
3-1	3916 North 28th Street. Composite of soil from 0 – 6 inches below grade from 8 random locations within the front, side and back yards. Sandy soil with some gravel.	**32 arsenic** 235 lead	**20 arsenic** 250 lead
4-1	3912 North 28th Street. Composite of soil from 0 – 6 inches below grade from 8 random locations within the front, side and back yards. Sandy clayey soil with some gravel.	10 arsenic 75 lead	20 arsenic 250 lead

As indicated in Table 2, arsenic was detected in sample number 3-1 at 0 – 6 inches below grade at a concentration that is above Ecology's cleanup standard. Lead was also detected in this sample, but at a concentration that is below the cleanup standard.

Arsenic and lead were detected in sample number 4-1 at 0 – 6 inches below grade at concentrations that are below Ecology's cleanup standards.

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CONCLUSIONS AND RECOMMENDATIONS

Soil samples from 0 – 6 inches below grade from 3920 North 28th Street (sample 1), the vacant lot between 3920 and 3916 North 28th Street (sample 2), 3912 North 28th Street (sample 4-1), and the grass strip along the side and front of the subject parcels along North Madison Street and North 28th Street (sample 5) do not contain arsenic or lead at concentrations that are above Ecology's cleanup standards (see Tables 1 and 2). Random hot spots of contamination may exist on these parcels. However, based on sampling results, the overall soil stockpile generated from re-development of these parcels would not be expected to contain arsenic or lead at concentrations above the cleanup standards. As a result, no further environmental investigation of these parcels appears necessary. Appropriate precautions should be taken when working with the soil at these locations.

Soil samples from 0 – 6 inches below grade from 3916 North 28th Street (sample numbers 3 and 3-1) contain arsenic at concentrations that are above Ecology's cleanup standard (see Tables 1 and 2). As a result, soil from this depth and throughout the entire unpaved, non-garden areas of this parcel should be properly excavated and disposed of.

It was a pleasure assisting you with this sampling effort. Please call me if you have any questions.

Sincerely,

ECO COMPLIANCE CORPORATION

Bill Kane

Bill Kane
President
bill@ecocompliance.biz

Attachment

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: 1
SAMPLE

Lab Sample ID: XV27A
LIMS ID: 14-1087
Matrix: Soil
Data Release Authorized:
Reported: 01/29/14

QC Report No: XV27-Eco Compliance Corporation
Project: Randy

Date Sampled: 01/17/14
Date Received: 01/20/14

Percent Total Solids: 88.2%

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	LOQ	ng/kg-dry	Q
3050B	01/22/14	6010C	01/28/14	7440-38-2	Arsenic	5	11	
3050B	01/22/14	6010C	01/28/14	7439-92-1	Lead	2	27	

U-Analyte undetected at given LOQ
LOQ-Limit of Quantitation

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XV27:00008

(425) 271-5629

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: 2
SAMPLE

Lab Sample ID: XV27B
LIMS ID: 14-1083
Matrix: Soil
Data Release Authorized:
Reported: 01/29/14

QC Report No: XV27-Eco Compliance Corporation
Project: Randy

Date Sampled: 01/17/14
Date Received: 01/20/14

Percent Total Solids: 82.0%

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	LOQ	mg/kg-dry	Q
3050B	01/22/14	6010C	01/28/14	7440-38-2	Arsenic	5	18	
3050B	01/22/14	6010C	01/28/14	7439-92-1	Lead	2	125	

U-Analyte undetected at given LOQ
LOQ-Limit of Quantitation

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XV27:00009

(425) 271-5629

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: 3
SAMPLE

Lab Sample ID: XV27C
LIMS ID: 14-1089
Matrix: Soil
Data Release Authorized:
Reported: 01/29/14

QC Report No: XV27-Eco Compliance Corporation
Project: Randy

Date Sampled: 01/17/14
Date Received: 01/20/14

Percent Total Solids: 80.8%

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	LOQ	mg/kg-dry	Q
3050B	01/22/14	6010C	01/28/14	**7440-38-2**	**Arsenic**	6	**29**	
3050B	01/22/14	6010C	01/28/14	**7439-92-1**	**Lead**	2	**268**	

U-Analyte undetected at given LOQ
LOQ-Limit of Quantitation

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XV27:00010

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ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: 3A
SAMPLE

Lab Sample ID: XY04A
LIMS ID: 14-1915
Matrix: Soil
Data Release Authorized:
Reported: 02/11/14

QC Report No: XY04-Eco Compliance Corporation
Project: Randy

Date Sampled: 01/17/14
Date Received: 01/20/14

Percent Total Solids: 84.78

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	LOQ	mg/kg-dry	Q
3050B	02/05/14	6010C	02/10/14	**7440-38-2**	**Arsenic**	6	**20**	
3050B	02/05/14	6010C	02/10/14	**7439-92-1**	**Lead**	2	**143**	

U-Analyte undetected at given LOQ
LOQ-Limit of Quantitation

FORM-I

XY04 : 000007

(425) 271-5629

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: 4
SAMPLE

Lab Sample ID: XV27D
LIMS ID: 14-1090
Matrix: Soil
Data Release Authorized:
Reported: 01/29/14

QC Report No: XV27-Eco Compliance Corporation
Project: Randy

Date Sampled: 01/17/14
Date Received: 01/20/14

Percent Total Solids: 84.9%

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	LOQ	ug/kg-dry	Q
3050B	01/22/14	6010C	01/28/14	**7440-38-2**	**Arsenic**	6	**22**	
3050B	01/22/14	6010C	01/28/14	**7439-92-1**	**Lead**	2	**94**	

U-Analyte undetected at given LOQ
LOQ-Limit of Quantitation

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XV27:00011

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ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: 4A
SAMPLE

Lab Sample ID: XY04E
LIMS ID: 14-1916
Matrix: Soil
Data Release Authorized:
Reported: 02/11/14

QC Report No: XY04-Eco Compliance Corporation
Project: Randy

Date Sampled: 01/17/14
Date Received: 01/20/14

Percent Total Solids: 86.6%

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	LOQ	mg/kg-dry	Q
3050B	02/05/14	6010C	02/10/14	**7440-38-2**	**Arsenic**	6	**14**	
3050B	02/05/14	6010C	02/10/14	**7439-92-1**	**Lead**	2	**43**	

U-Analyte undetected at given LOQ
LOQ-Limit of Quantitation

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XY04 : 000285

(425) 271-5629

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: 5
SAMPLE

Lab Sample ID: XV27E
LIMS ID: 14-1091
Matrix: Soil
Data Release Authorized:
Reported: 01/29/14

QC Report No: XV27-Eco Compliance Corporation
Project: Randy

Date Sampled: 01/17/14
Date Received: 01/20/14

Percent Total Solids: 89.9%

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	LOQ	mg/kg-dry	Q
3050B	01/22/14	6010C	01/28/14	7440-38-2	Arsenic	5	10	
3050B	01/22/14	6010C	01/28/14	7439-92-1	Lead	2	15	

U-Analyte undetected at given LOQ
LOQ-Limit of Quantitation

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XV27:00012

(425) 271-5629

Chain of Custody Record & Laboratory Analysis Request

ARI Assigned Number: XV27	Turn-around Requested: Standard	Page: 1 of 1	
ARI Client Company: Eco Compliance	Phone: 425-271-5629	Date: 1-20-14	Ice Present? Y
Client Contact: Bill Kane		No. of Coolers: 1	Cooler Temps: 2.4
Client Project Name: [redacted] Randy			
Client Project #:	Samplers: Bill Kane		

Analytical Resources, Incorporated
Analytical Chemists and Consultants
4611 South 134th Place, Suite 100
Tukwila, WA 98168
206-695-6200 206-695-6201 (fax)

Sample ID	Date	Time	Matrix	No. Containers	Analysis Requested: Arsenic & lead	Notes/Comments
1	1-17-14		Soil	1	X	
1A	"	"	"	1	X	HOLD
2	"	"	"	1	X	
2A	"	"	"	1	X	HOLD
3	"	"	"	1	X	
3A	"	"	"	1	X	HOLD
4	"	"	"	1	X	
4A	"	"	"	1	X	HOLD
5	"	"	"	1	X	
5A	"	"	"	1	X	HOLD

Comments/Special Instructions	Relinquished by (Signature)	Received by (Signature)	Relinquished by (Signature)	Received by (Signature)
	Printed Name: Bill Kane	Printed Name: Jennifer Mills	Printed Name:	Printed Name:
	Company: Eco Compliance	Company: ARI	Company:	Company:
	Date & Time: 1-20-14, 9:00 Am	Date & Time: 1/20/14 900	Date & Time:	Date & Time:

XV27 : 00002

Limits of Liability: *ARI will perform all requested services in accordance with appropriate methodology following ARI Standard Operating Procedures and the ARI Quality Assurance Program. This program meets standards for the industry. The total liability of ARI, its officers, agents, employees, or successors, arising out of or in connection with the requested services, shall not exceed the invoiced amount for said services. The acceptance by the client of a proposal for services by ARI release ARI from any liability in excess thereof, not withstanding any provision to the contrary in any contract, purchase order or co-signed agreement between ARI and the Client.*

Sample Retention Policy: All samples submitted to ARI will be appropriately discarded no sooner than 90 days after receipt or 60 days after submission of hardcopy data, whichever is longer, unless alternate retention schedules have been established by work-order or contract.

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: 3-1
SAMPLE

Lab Sample ID: XZ66A
LIMS ID: 14-2644
Matrix: Soil
Data Release Authorized:
Reported: 02/19/14

QC Report No: XZ66-Eco Compliance Corporation
Project: Randy

Date Sampled: 02/14/14
Date Received: 02/17/14

Percent Total Solids: 76.1%

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	LOQ	mg/kg-dry	Q
3050B	02/18/14	6010C	02/19/14	**7440-38-2**	**Arsenic**	6	**32**	
3050B	02/18/14	6010C	02/19/14	**7439-92-1**	**Lead**	3	**235**	

U-Analyte undetected at given LOQ
LOQ-Limit of Quantitation

FORM-I

XZ66 : 00008

(425) 271-5629

ANALYTICAL RESOURCES INCORPORATED

INORGANICS ANALYSIS DATA SHEET
TOTAL METALS
Page 1 of 1

Sample ID: 4-1
SAMPLE

Lab Sample ID: XZ66B
LIMS ID: 14-2645
Matrix: Soil
Data Release Authorized:
Reported: 02/19/14

QC Report No: XZ66-Eco Compliance Corporation
Project: Randy

Date Sampled: 02/14/14
Date Received: 02/17/14

Percent Total Solids: 81.4%

Prep Meth	Prep Date	Analysis Method	Analysis Date	CAS Number	Analyte	LOQ	mg/kg-dry	Q
3050B	02/18/14	6010C	02/19/14	7440-38-2	Arsenic	6	10	
3050B	02/18/14	6010C	02/19/14	7439-92-1	Lead	2	75	

U-Analyte undetected at given LOQ
LOQ-Limit of Quantitation

FORM-I

XZ66:080809

(425) 271-5629

Chain of Custody Record & Laboratory Analysis Request

ARI Assigned Number: XZ160	Turn-around Requested: RUSH -5 day				Page: 1 of 1										
ARI Client Company: Eco Compliance	Phone: 425-271-5629				Date: 2-17-14	Ice Present? Y									
Client Contact: Bill Kane					No. of Coolers: 1	Cooler Temps: 4.2									
Client Project Name: Randy					Analysis Requested										Notes/Comments
Client Project #:	Samplers: Bill Kane				Total Arsenic and Lead										
Sample ID	Date	Time	Matrix	No Containers											
3-1	2-14-14		soil	1	X										
4-1	2-14-14		soil	1	X										
Comments/Special Instructions	Relinquished by (Signature): Bill Kane		Received by (Signature):		Relinquished by (Signature):		Received by (Signature):								
	Printed Name: Bill Kane		Printed Name: A. Volgardsen		Printed Name:		Printed Name:								
	Company: Eco Compliance		Company: ARI		Company:		Company:								
	Date & Time: 2-17-14, 9:40 Am		Date & Time: 2/17/14 940		Date & Time:		Date & Time:								

Analytical Resources, Incorporated
Analytical Chemists and Consultants
4611 South 134th Place, Suite 100
Tukwila, WA 98168
206-695-6200 206-695-6201 (fax)

(425) 271-5629

APPENDIX C – GEORESOURCES GEOTECHNICAL ENGINEERING REPORT, FEBRUARY 2014

GeoResources, LLC
5007 Pacific Hwy. E, Suite 16
Fife, Washington 98424-2649

Ph.253-896-1011
Fx.253-896-2633

February 28, 2014

Rush Design, Inc.
6622 Wollochet Drive NW
Gig Harbor, Washington 98335
(253) 858-3636

Attn: Thair Jorgenson

Geotechnical Engineering Report
Proposed Mixed Use Multi-Story development
Southwest of 28th Street & Proctor Street
Tacoma, Washington
PN: 418-0000-180, -170, -160, -150, -140
520-0000-940, -642, & 747-5010-642
Job: RushDesign.28thProctor.GR

INTRODUCTION

This report summarizes our site observations, subsurface explorations, laboratory testing and provides geotechnical recommendations and design criteria for the proposed mixed-use development located at southwest of the intersection of North Proctor Street and N 28th Street in the City of Tacoma, Washington. The site is currently developed with an existing parking area on the south, a small strip mall situated in the northeast corner of the site and by three existing single family residence on the center and west area. The general location of the site is shown on the attached Site Vicinity Map, Figure 1.

Our understanding of the project is based on our discussions with you, a review of the preliminary plans provided by you, our subsurface explorations, our September 11 and 18, 2013 site visits, and our experience in the area. We understand that the proposed development will include the construction of several multi story buildings. The proposed site configuration is illustrated on the attached Site Plan, Figure 2.

SCOPE

The purpose of our services is to evaluate the surface and subsurface conditions at the site as a basis for addressing the City of Tacoma Critical Areas Ordinance as well as addressing the potential of the site soils for supporting foundation loads and retaining walls. We have also included geotechnical recommendations and design criteria for the project. Specifically, the scope of services for this project will include the following:

1. Reviewing the available geologic, hydrogeologic and geotechnical data for the site area.
2. Exploring the subsurface conditions at the site by monitoring the drilling of five borings at selected locations across the site.
3. Addressing the appropriate geotechnical regulatory requirements for the proposed site development, per any City of Tacoma critical area ordinance requirements.

4. Determining the local groundwater depth, for dewatering and drainage design purposes, as data only.
5. Providing geotechnical recommendations for site grading including site preparation, subgrade preparation, fill placement criteria, suitability of on-site soils for use as structural fill, temporary and permanent cut and fill slopes, and drainage and erosion control measures.
6. Providing recommendations and design criteria for conventional shallow foundation and floor slab support, including allowable bearing capacity, subgrade modulus, lateral resistance values and estimates of settlement.
7. Providing recommendations and design criteria for the design of conventional subgrade/retaining walls, including backfill and drainage requirements, lateral design loads, and lateral resistance values.
8. Providing recommendations for pavement subgrade preparation.
9. Provide our opinion with regard to the feasibility of on-site stormwater infiltration/dispersal and provide an infiltration rate, if appropriate.
10. Providing appropriate IBC seismic design parameters for the proposed residential structures.

The above scope of work was summarized in our *Proposal for Geotechnical Engineering Services* dated July 12, 2013. We received authorization to proceed by you on September 11, 2013.

SITE CONDITIONS

Surface Conditions

The proposed commercial development is located in an area of mixed residential and commercial development on the Tacoma glacial upland area. The site encompasses eight tax parcels, six parcels along North 28th Street and two south of the alley along North Proctor Street. The site is bounded by North 28th Street on the north, North Proctor Street on the east, existing commercial development on the south and both mixed commercial and residential parcels and North Madison Street on the west.

As stated above, the site is situated on the Tacoma glacial upland area. The site gently slopes down to the north. Localized slopes along the west and north portion of the site have inclinations of 60 percent with up to 8 feet of relief. These areas appear to be steepened as part of the cuts for the adjacent roadways that were developed in the early 1900's. These slope areas appeared to be in a stable condition at the time of our site visit. Total topographic relief on the site is on the order of 10 feet according to the Pierce County GIS data and as observed in the field.

No evidence of slope instability or soil movement was observed at the site at the time of our site visit. No evidence of standing water, seeps, or springs was observed on the site.

Site Geology

According to the draft *Geologic Map of the Tacoma North 7.5-minute Quadrangle Pierce County, Washington* by Troost, K.G., Booth, D.B., and Borden, R.K., the site is in an area underlain by glacial till (Qvt). These glacial soils were deposited during the Vashon stade of the Fraser Glaciation, approximately 12,000 to 15,000 years ago. The glacial till consists of a heterogeneous mixture of clay, silt, sand and gravel that was deposited at the base of the continental ice mass. The glacial till and underlying units were overridden by the ice mass, and as such are considered overconsolidated, are in a very dense condition, and exhibit

high strength and low compressibility characteristics where undisturbed. An excerpt of the above reference geologic map is attached as Figure 3.

Subsurface Explorations

On September 11 and 18, 2013, a GeoResources geologist was on site and monitored the drilling of five borings, logged the subsurface conditions encountered in each boring, and obtained representative soil samples. Our borings were drilled by an independent drilling firm working under contract to GeoResources using a small track-mounted hollow-stem auger drill rig. The locations of the borings were selected by GeoResources personnel and Environmental Compliance based of our understanding of the proposed development, existing site conditions, and current site usage. Table 1, below, summarizes the approximate functional locations, surface elevations, and termination depths of our test pits, while Figure 2 depicts their approximate relative locations.

TABLE 1
APPROXIMATE LOCATIONS, ELEVATIONS, AND DEPTHS OF EXPLORATIONS

Boring Number	Functional Location	Surface Elevation (feet)	Termination Depth (feet)	Termination Elevation (feet)
B-1	Corner of strip mall, in concrete parking lot	347	21½	325½
B-2	North end of strip mall, in concrete parking lot	345	21½	323½
B-3	South of strip in asphalt parking lot	349	21½	328½
B-4	Center residence, grass lawn area	350	31½	318½
B-5	Western residence, gravel driveway off alley	350	31	319

Elevation datum: site plan with topography to be provided by BCRA

The soils encountered were visually classified in accordance with the Soil Classification System (SCS) included as Figure A-1. Representative soil samples obtained from the test pits and borings were placed in sealed plastic bags and taken to a laboratory for further examination and testing as deemed necessary. Each boring was then backfilled with a mixture of bentonite chips and soil cuttings.

Boring soil samples were obtained at 2½- to 5-foot depth intervals by means of the Standard Penetration Test (SPT) per ASTM:D-1586. This procedure consists of driving a standard 2-inch-diameter steel split-spoon sampler 18 inches into the soil with a 140-pound hammer free-falling 30 inches. The number of blows required to drive the sampler through each 6-inch interval is counted, and the total number of blows struck during the final 12 inches is recorded as the Standard Penetration Resistance, or "SPT blow count." If a total of 50 blows are struck within any 6-inch interval, the driving is stopped and the blow count is recorded as 50 blows for the actual penetration distance. The resulting Standard Penetration Resistance values indicate the relative density of granular soils and the relative consistency of cohesive soils.

Subsurface Conditions

Our borings encountered fairly uniform subsurface conditions that generally contradicted the mapped stratigraphy. In general, our borings encountered asphalt (Borings B-1 to B-3) over loose to medium dense sand with silt. These soils appeared to represent fill material in Boring B-3, from the previously located underground storage tanks within the vicinity of B-3.

Underlying the surficial soils, we observed dense silty fine sand with gravel consistent with glacial till. This till layer ranged in thickness from 3 to 10 feet but was absent in boring B-4. Dense to very dense sand was observed at varying depths below the till soils in all five of our

borings. We interpret the dense sand to be advance outwash. Table 1 summarizes the approximate thicknesses, depths, and elevations of selected soil layers.

TABLE 1
APPROXIMATE THICKNESS, DEPTHS, AND ELEVATION OF SOIL TYPES ENCOUNTERED IN EXPLORATIONS

Boring Number	Thickness of Fill or loose SAND (feet)	Thickness of silty Sand with gravel (Glacial Till) (feet)	Depth to Top of Dense Advance Sand (feet)	Elevation of Top of Dense Advance Sand (feet)
B-1	5	3	8	339
B-2	5	10	15	330
B-3	4	4*	8	341
B-4	5	NE	5	345
B-5	1½	3	4½	345½

* soils may represent glacial till soils placed as fill material
Elevation datum: site plan with topography to be provided by BCRA

The Boring Logs, included in Appendix "A", describe the vertical sequence of soils encountered at each boring location. Where a soil type changed between sample intervals, we estimated the contact depth based on drilling conditions and cuttings. Our logs also present the blow count, sample number, and approximate depth of each soil sample obtained from each borings. Where encountered, the approximate groundwater depth is depicted on the boring log. Groundwater depth estimates are typically based on the moisture content of soil samples, the wetted height on the drilling rods, and the water level measured in the borehole after the auger has been extracted.

The explorations performed as part of this evaluation indicate conditions only at the specific locations and actual conditions in other locations could vary. Furthermore, the nature and extent of any such variations would not become evident until additional explorations are performed or until construction activities have begun.

Groundwater Conditions

Evidence of mottling indicating a perched groundwater table was observed in boring B-3 intermittently within the deeper sands and in boring B-4 at a depth of 5 feet. The mottling observed in boring B-4 is located atop very dense soils. Perched groundwater typically develops when the vertical infiltration of precipitation through a more permeable soil is slowed at depth by a deeper, less permeable soil type. We anticipate that perched groundwater will develop between the upper fill and deeper glacial till or advance sand during the wetter, winter months. Based on the nature of the near surface soils, we anticipate fluctuations in the local groundwater levels will occur in response to precipitation patterns, off-site construction activities, and site utilization.

Grain Size Analysis

Geotechnical laboratory tests were performed on select samples retrieved from the borings to determine soil index and engineering properties encountered. Laboratory testing included visual soil classification, moisture content determinations, and grain size analyses. Grain size analyses tests were performed in accordance with the ASTM D:422 standard procedures. The enclosed laboratory testing sheets graphically present our test results, presented in Appendix "B".

CRITICAL AREAS

Based on the results of our subsurface explorations, site reconnaissance, subsurface explorations, and our experience in the area, it is our opinion that the site does not have a geologic hazard (landslide, steep slope, or erosion hazard) area.

Landslide Hazard Indicators – per City of Tacoma Municipal Code, Chapter 13.11

The City of Tacoma Municipal Code, Chapter 13.11 defines a landslide hazard area as an area potentially subject to landslides based on a combination of geologic, topographic, and hydrologic factors. They include areas susceptible because of any combination of bedrock, soil, slope, slope aspect, structure, hydrology, or other factors. Landslide hazard areas are identified as any area with the following characteristics:

a. Slopes steeper than 25 percent and a vertical relief of ten (10) or more feet.
b. Hillsides intersecting geologic contacts that contain impermeable soils (typically silt and clay) frequently inter-bedded with permeable granular soils (predominantly sand and gravel), or impermeable soils overlain with permeable soils.
c. Springs or groundwater seepage.
d. Any area which has exhibited movement during the Holocene epoch (from 10,000 years ago to present) or that are underlain or covered by mass wastage debris of that epoch.
e. Any area potentially unstable due to rapid stream incision stream bank erosion or undercutting by wave action.
f. Any area located on an alluvial fan presently subject to, or potentially subject to, inundation by debris flows or deposition of stream-transported sediments.
g. Any area where the slope is greater than the angle of repose of the soil.
h. Any shoreline designated or mapped as Class U, Uos, Urs, or I by the Washington Department of Ecology Coastal Zone Atlas.

The City of Tacoma Municipal Code, Chapter 13.11 uses the above referenced checklist to define a landslide hazard area. Based on our observations of the site and review of published information, the site does <u>not</u> have any of the above listed indicators. The slope areas have less than 10 feet of vertical relief and do not meet the criteria of a landslide hazard indicator. These slopes appear to have been made as a result of past site grading and construction of the adjacent roadways and as such should be exempt from imposing buffers onto the proposed development as stated in Chapter 13.11.730.B.1.i. These slopes appeared stable at the time of our site visit. No other landslide hazard area indicators were observed or mapped on the site.

Erosion Hazards – per City of Tacoma Section 13.11.720

The City of Tacoma Municipal Code, Chapter 13.11 defines erosion hazard areas as generally consisting of areas where the combination of slope and soil type makes the area susceptible to erosion by water flow, either by precipitation or by water runoff. Concentrated stormwater runoff is a major cause of erosion and soil loss. Erosion hazard critical areas include the following:

a. Areas with high probability of rapid stream incision, stream bank erosion or coastal erosion, or channel migration.
b. Areas defined by the Washington Department of Ecology Coastal Zone Atlas as one of the following soil areas: Class U (Unstable) includes severe erosion hazards and rapid surface runoff areas, Class Uos (Unstable old slides) includes areas

having severe limitations due to slope, Class Urs (Unstable recent slides), and Class I (Intermediate).

c. Any area characterized by slopes greater than 15 percent; and the following types of geologic units as defined by draft geologic USGS maps: m (modified land), Af (artificial fill), Qal (alluvium), Qw (wetland deposits), Qb (beach deposits), Qtf (tide-flat deposits), Qls (landslide deposits), Qmw (mass-wastage deposits), Qf (fan deposits), Qvr and Qvs series of geologic material types (Vashon recessional outwash and Steilacoom Gravel), and Qvi (Ice-contact deposits).
d. Slopes steeper than 25% and a vertical relief of 10 or more feet.

As indicated above, the City of Tacoma Municipal Code, Chapter 13.11 defines erosion hazard areas as generally consisting of areas where the combination of slope and soil type makes the area susceptible to erosion by water flow, either by precipitation or by water runoff. The site does not have any of the above listed criteria for and erosion hazard area. It is our opinion that the site is not located within an erosion hazard area.

Seismic Hazards

Based on our observation and the subsurface units mapped at the site, we interpret the structural site conditions to correspond to a seismic Site Class "C" in accordance with in the 2012 IBC (International Building Code) documents and ASCE 7-Chapter 20 Table 20.3-1. This is based on the likely range of equivalent SPT (Standard Penetration Test) blow counts for the soil types observed in the site area. These conditions were assumed to be representative for the conditions based on our experience in the vicinity of the site.

Liquefaction is a phenomenon where there is a reduction or complete loss of soil strength due to an increase in pore water pressure. The increase in pore water pressure is induced by seismic vibrations. Liquefaction mainly affects geologically recent deposits of loose, fine-grained sands that are below the groundwater table. Based on the density and nature of the glacially overridden soils observed to underlie the site, it is our opinion that the risk for liquefaction to occur at this site during an earthquake is negligible. Provided the design criteria listed below are followed, the proposed structure will have no greater seismic risk damage than other appropriately designed structures in the Puget Sound area.

CONCLUSIONS

Based on the results of our data review, site reconnaissance, subsurface explorations and our experience in the area, it is our opinion that the site is suitable for the proposed development. Pertinent conclusions and geotechnical recommendations regarding the design and construction of the proposed development are presented below.

Site Preparation

All structural areas on the site to be graded should be stripped of vegetation, organic surface soils, and other deleterious materials including existing structures, foundations or abandoned utility lines. Organic topsoil is not suitable for use as structural fill, but may be used for limited depths in non-structural areas. Stripping depths ranging from 4 to 12 inches should be expected to remove these unsuitable soils. Areas of thicker topsoil or organic debris may be encountered in areas of heavy vegetation or depressions.

Where placement of fill material is required, the stripped/exposed subgrade areas should be compacted to a firm and unyielding surface prior to placement of any fill. Excavations for debris removal should be backfilled with structural fill compacted to the densities described in the "**Structural Fill**" section of this report.

We recommend that a member of our staff evaluate the exposed subgrade conditions after removal of vegetation and topsoil stripping is completed and prior to placement of structural fill. The exposed subgrade soil should be proof-rolled with heavy rubber-tired equipment during dry weather or probed with a 1/2-inch-diameter steel rod during wet weather conditions.

Soft, loose or otherwise unsuitable areas delineated during proofrolling or probing should be recompacted, if practical, or over-excavated and replaced with structural fill. The depth and extent of overexcavation should be evaluated by our field representative at the time of construction. The areas of old fill material should be evaluated during grading operations to determine if they need mitigation; recompaction or removal.

Structural Fill

All material placed as fill associated with mass grading, as utility trench backfill, under building areas, or under roadways should be placed as structural fill. The structural fill should be placed in horizontal lifts of appropriate thickness to allow adequate and uniform compaction of each lift. Fill should be compacted to at least 95 percent of MDD (maximum dry density as determined in accordance with ASTM D-1557).

The appropriate lift thickness will depend on the fill characteristics and compaction equipment used. We recommend that the appropriate lift thickness be evaluated by our field representative during construction. We recommend that our representative be present during site grading activities to observe the work and perform field density tests.

The suitability of material for use as structural fill will depend on the gradation and moisture content of the soil. As the amount of fines (material passing US No. 200 sieve) increases, soil becomes increasingly sensitive to small changes in moisture content and adequate compaction becomes more difficult to achieve. During wet weather, we recommend use of well-graded sand and gravel with less than 5 percent (by weight) passing the US No. 200 sieve based on that fraction passing the 3/4-inch sieve, such as *Gravel Backfill for Walls* (WSDOT 9-03.12(2)). If prolonged dry weather prevails during the earthwork and foundation installation phase of construction, higher fines content (up to 10 to 12 percent) may be acceptable.

Material placed for structural fill should be free of debris, organic matter, trash and cobbles greater than 6-inches in diameter. The moisture content of the fill material should be adjusted as necessary for proper compaction.

Suitability of On-Site Materials as Fill

During dry weather construction, non-organic on-site soil may be considered for use as structural fill; provided it meets the criteria described above in the "**Structural Fill**" section and can be compacted as recommended. If the soil material is over-optimum in moisture content when excavated, it will be necessary to aerate or dry the soil prior to placement as structural fill. We generally did not observe the site soils to be excessively moist at the time of our subsurface exploration program.

The previously placed fill encountered at shallow depths across the site consist of a mixture of sand, silt, and gravel with asphalt and concrete. We do not anticipate that these soils will be suitable for use as structural because of their fines content and the presence of debris. The deeper advance sand is generally comparable to "common borrow" material and will be suitable for use as structural fill provided the moisture content is maintained within 2 to 3 percent of the optimum moisture level.

We recommend that completed graded-areas be restricted from traffic or protected prior to wet weather conditions. The graded areas may be protected by paving, placing asphalt-treated base, a layer of free-draining material such as pit run sand and gravel or

clean crushed rock material containing less than 5 percent fines, or some combination of the above.

Temporary Excavations

All job site safety issues and precautions are the responsibility of the contractor providing services/work. The following cut/fill slope guidelines are provided for planning purposes only. Temporary cut slopes will likely be necessary during grading operations or utility installation.

All excavations at the site associated with confined spaces, such as utility trenches and retaining walls, must be completed in accordance with local, state, or federal requirements. Based on current Washington State Safety and Health Administration (WSHA) regulations, the shallow native soils on the site would be classified as Type C soils, where as the deeper, more dense glacially consolidated soils would be classified as Type B soils.

According to WSHA, for temporary excavations of less than 20 feet in depth, the side slopes in Type C soils should be laid back at a slope inclination of 1.5H:1V (Horizontal: Vertical) or flatter from the toe to the crest of the slope. All exposed slope faces should be covered with a durable reinforced plastic membrane during construction to prevent slope raveling and rutting during periods of precipitation. These guidelines assume that all surface loads are kept at a minimum distance of at least one half the depth of the cut away from the top of the slope and that significant seepage is not present on the slope face. Flatter cut slopes will be necessary where significant raveling or seepage occurs, or if construction materials will be stockpiled along the slope crest.

Where it is not feasible to slope the site soils back at these inclinations, a retaining structure should be considered. Where retaining structures are greater than 4-feet in height (bottom of footing to top of structure) or have slopes of greater than 15 percent above them, they should be engineered per Washington Administrative Code (WAC 51-16-080 item 5). This information is provided solely for the benefit of the owner and other design consultants, and should not be construed to imply that GeoResources assumes responsibility for job site safety. It is understood that job site safety is the sole responsibility of the project contractor.

Shoring

Based on information provided by the project architect, the walls for the one-story underground parking level will be close to the property line. Because of the amount of offsite (street, sidewalk, drainage, and landscape) improvements that will be required, we understand that you plan on being able to use temporary cut slopes that extend into the right-of-way. The recommendations for temporary cut slopes were provide above. However, if the City does not allow the temporary cut slope to extend into the right-of-way, temporary shoring will likely be required. We anticipate that for one story of below ground parking, a temporary shoring wall consisting of soldier piles and lagging, would be used. However, tie-backs likely would not be required. This type of wall could also be designed as a permanent retaining wall and incorporated into the basement design, if desired, resulting in considerable less excavation and backfilling.

Temporary Shoring - Soldier Pile Wall Recommendations

A soldier pile consists of steel H-piles set in pre-augured holes and backfilled with lean or structural concrete. Lagging, consisting of treated timber or pre-cast concrete panels are placed between the H-piles and provide lateral support. Based on the height of retained soils, a soldier pile wall with wooden or composite material lagging will be suitable for this purpose.

This shoring method supports the retained soils using a system of drilled shafts in which steel beams are inserted with the shaft annulus then backfilled with concrete or grout.

The timber lagging is installed with the ends behind the beam flanges. Given existing site grades, wall heights will likely reach at least 10 feet. Where the wall height is 12 feet or less in height, designing the soldier pile shoring as a cantilevered wall should be feasible. In areas where the wall will exceed 12 feet in height, the soldier piles will likely require tie-backs or very large H-piles. Recommended design parameters for the construction of a cantilevered soldier pile wall are presented on Figure 4.

Soldier piles typically have a maximum spacing of eight feet center-to-center. The contractor should be prepared to case the drilled shafts as needed to prevent soil caving. To account for arching effects, lateral loading on the timber lagging can be reduced by 50 percent. Any gaps or voids behind the lagging should be filled in with crushed rock to maintain soil contact and; therefore, support with the lagging timber.

Foundation Support

Based on the encountered subsurface soil conditions encountered across the site, we recommend that spread footings be founded on the dense to very dense native outwash encountered at depth, or on structural fill that extends to suitable native soils. We do not recommend footings to be founded on the existing fill.

The soil at the base of the excavations should be disturbed as little as possible. All loose, soft or unsuitable material should be removed or recompacted, as appropriate. A representative from our firm should observe the foundation excavations to determine if suitable bearing surfaces have been prepared, particularly in the areas where the foundation will be situated on fill material.

We recommend a minimum width of 2 feet for isolated footings and at least 16 inches for continuous wall footings. All footing elements should be embedded at least 18 inches below grade for frost protection. Footings founded on the deeper glacial till or glacial outwash can be designed using for an allowable soil bearing capacity of 5,500 psf (pounds per square foot) for combined dead and long-term live loads. The weight of the footing and any overlying backfill may be neglected. The allowable bearing value may be increased by one-third for transient loads such as those induced by seismic events or wind loads. Foundations that bear on structural fill can be designed for a capacity of 2,500 psf.

Lateral loads may be resisted by friction on the base of footings and floor slabs and as passive pressure on the sides of footings. We recommend that an allowable coefficient of friction of 0.35 be used to calculate friction between the concrete and the underlying soil. Passive pressure may be determined using an allowable equivalent fluid density of 300 pcf (pounds per cubic foot). Factors of safety have been applied to these values.

We estimate that settlements of footings designed and constructed as recommended will be less than 1 inch, for the anticipated load conditions, with differential settlements between comparably loaded footings of 1/2 inch or less. Most of the settlements should occur essentially as loads are being applied. However, disturbance of the foundation subgrade during construction could result in larger settlements than predicted.

Subgrade/Basement Walls

Based on proposed development, we anticipate an underground, basement parking area will be used with retaining walls on the perimeter of the proposed development area. The lateral pressures acting on subgrade and retaining walls (such as basement walls) will depend upon the nature and density of the soil behind the wall. It is also dependent upon the presence or absence of hydrostatic pressure. If the walls are backfilled with granular well-drained soil, the design active pressure may be taken as 35 pcf (equivalent fluid density). Where the walls are restrained from moving, we recommend an at-rest equivalent earth pressure of 55 pcf above groundwater and 90 pcf below groundwater be used for design. We

assume a level backfill condition behind any proposed basement or subgrade wall.

Adequate drainage behind retaining structures is imperative. Positive drainage which controls the development of hydrostatic pressure can be accomplished by placing a zone of coarse sand and gravel behind the walls. The granular drainage material should contain less than 5 percent fines. The drainage zone should extend horizontally at least 18 inches from the back of the wall. The drainage zone should also extend from the base of the wall to within 1 foot of the top of the wall. The drainage zone should be compacted to approximately 90 percent of the MDD. Over-compaction should be avoided as this can lead to excessive lateral pressures. Typical wall drainage and backfilling is shown on Figure 5.

A minimum 4-inch diameter perforated or slotted PVC pipe should be placed in the drainage zone along the base and behind the wall to provide an outlet for accumulated water and direct accumulated water to an appropriate discharge location. We recommend that a nonwoven geotextile filter fabric be placed between the drainage material and the remaining wall backfill to reduce silt migration into the drainage zone. The infiltration of silt into the drainage zone can, with time, reduce the permeability of the granular material. The filter fabric should be placed such that it fully separates the drainage material and the backfill, and should be extended over the top of the drainage zone. Typical wall drainage and backfilling is shown on Figure 7.

Lateral loads may be resisted by friction on the base of footings and as passive pressure on the sides of footings and the buried portion of the wall, as described in the "**Foundation Support**" section. We recommend that an allowable coefficient of friction of 0.35 be used to calculate friction between the concrete and the underlying soil. Passive pressure may be determined using an allowable equivalent fluid density of 300 pcf (pounds per cubic foot). Factors of safety have been applied to these values.

Floor Slab Support

We anticipate that the lower level of underground parking will consist of a slabs-on-grade floor. Slab-on-grade floors should be supported on the still native soils or on structural fill prepared as described above. Areas of old fill material should be evaluated during grading activity for suitability of structural support. Areas of significant organic debris should be removed.

We recommend that floor slabs be directly underlain by a minimum 4-inch thick pea gravel or washed 5/8 inch crushed rock. This layer should be placed and compacted to an unyielding condition and should contain less than 2 percent fines.

A synthetic vapor barrier is recommended to control moisture migration through the slabs. This is of particular importance where the foundation elements are underlain by the silty till or lake sediments, or where moisture migration through the slab is an issue, such as where adhesives are used to anchor carpet or tile to the slab.

A subgrade modulus of 350 kcf (kips per cubic foot) may be used for floor slab design. We estimate that settlement of the floor slabs designed and constructed as recommended, will be 1/2 inch or less over a span of 50 feet.

Utilities

We expect that underground utilities, such as sanitary sewer, storm, and water will consist of a series of pipes, vaults, manholes, and catch basins. The utility excavations should be performed in accordance with appropriate governmental guidelines. Utility pipes should be bedded and backfilled in accordance with American Public Works Association (APWA) specifications.

We anticipate that the on-site, non-organic soils will be suitable for use as structural backfill. If import soil is used as utility trench backfill, it should consist of a material meeting

the wet weather fill recommendations provided in the **"Structural Fill"** section of this report. We recommend that utility backfill soils be compacted according to the recommendations provided in the **"Structural Fill"** section of this report.

Pavement Subgrades

Pavement subgrade areas should be prepared as previously described in the "Site Preparation" section of this report. The prepared subgrade should be evaluated by proof-rolling with a fully-loaded dump truck or equivalent point load equipment. Soft, loose or wet areas that are disclosed should be recompacted or removed, as appropriate. Over-excavated areas should be backfilled with compacted structural fill and sub-base material. The upper 2 feet of roadway subgrade should have a density of at least 95 percent of the MDD (ASTM D-1577). In areas where the subgrade soils have a high percentage of fines, such as the onsite glacial lake soils, the top 9-10 inches of the pavement section should consist of non-frost susceptible materials (HMA or less than 7% fines).

Site Drainage

All ground surfaces, pavements and sidewalks at the site should be sloped away from the structures. Surface water runoff should be controlled by a system of curbs, berms, drainage swales, and or catch basins, and conveyed to an appropriate discharge point.

We recommend that footing drains are installed for the residence in accordance with IBC 1807.4.2, and basement walls (if utilized) have a wall drain as describe above. The roof drain should not be connected to the footing drain. Figure 5 shows typical wall drainage and backfilling details. If the basement cut extends below the adjacent municipal stormwater system, a sump and pump system may be required.

Stormwater Infiltration

We understand the proposed development may include a subgrade stormwater system under the basement parking level. We have reviewed the 2012 City of Tacoma Surface Water Management Manual Volume 3 Chapter 2 & 6. We recommend that an infiltration rate be determined using the TSWMM Volume 3 Chapter 6.5.2 Table 3.7. We recommend that in-situ infiltration tests be performed at the base of the proposed stormwater system to verify the soils are infiltrating as designed.

The soils encountered at depths of 15 to 20 feet below the ground surface have fines contents of 12 to 15.5 percent. These soils have interpolated D10 values of around 0.05mm. According to Table 3.7, soils with a D_{10} value greater than or equal to 0.05 mm relates to an estimated design (long term infiltration rate) of 0.8 inches per hour. This includes a factor of safety of 2. Given the very dense nature of the sand soils at these depths we recommend and additional factor of safety of 4. A minimum factor of safety of 2 is usually applied to surface grade stormwater systems. A higher factor of safety should be considered for a below grade stormwater system as determined by the civil engineer. We recommend that we observe the excavation of the infiltration system to verify that suitable soils have been exposed. Over time, fines can migrate through the gravelly layer and result in a reduced infiltration rate or a barrier.

Appropriate design, construction, and maintenance are required to ensure the infiltration rate can be effectively maintained over time. It should be noted that special care is required during the grading and construction periods to avoid fine sediment contamination of the infiltration system. This may be accomplished by using an alternative storm water management location during construction or leaving the bottom of the systems 1 to 2 feet high, and subsequently excavating to the finished grade once the driveways are paved and landscaping is installed. All contractors working on the site (builders and subcontractors) should be advised to avoid "dirty" stormwater flowing to the site's stormwater system during construction and

landscaping of the residences. No concrete trucks should be washed or cleaned on-site.

Suspended solids could clog the underlying soil and reduce the infiltration rate for the pond. To reduce potential clogging of the infiltration systems, the infiltration system should not be connected to the stormwater runoff system until after construction is complete and the site area is landscaped, paved or otherwise protected. Temporary systems may be utilized through construction. Periodic sweeping of the paved areas will help extend the life of the infiltration system.

LIMITATIONS

We have prepared this report for use by Rush Design and members of the design team, for use in the design of a portion of this project. The data used in preparing this report and this report should be provided to prospective contractors for their bidding or estimating purposes only. Our report, conclusions and interpretations are based on data from others and limited site reconnaissance, and should not be construed as a warranty of the subsurface conditions.

Variations in subsurface conditions are possible between the explorations and may also occur with time. A contingency for unanticipated conditions should be included in the budget and schedule. Sufficient monitoring, testing and consultation should be provided by our firm 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 earthwork and foundation installation activities comply with contract plans and specifications.

The scope of our services does not include services related to environmental remediation and construction safety precautions. Our recommendations are not intended to direct the contractor's methods, techniques, sequences or procedures, except as specifically described in our report for consideration in design.

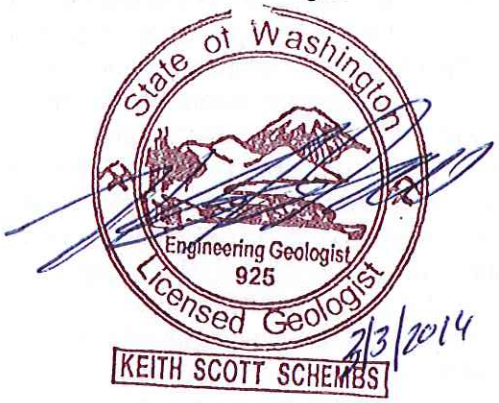
If there are any changes in the loads, grades, locations, configurations or type of facilities to be constructed, the conclusions and recommendations presented in this report may not be fully applicable. If such changes are made, we should be given the opportunity to review our recommendations and provide written modifications or verifications, as appropriate.

◆ ◆ ◆

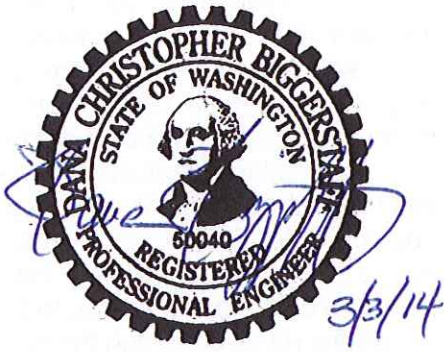
We have appreciated the opportunity to be of service to you on this project. If you have any questions or comments, please do not hesitate to call at your earliest convenience.

Respectfully submitted,
GeoResources, LLC

Renee M. Phillips
Senior Geologist

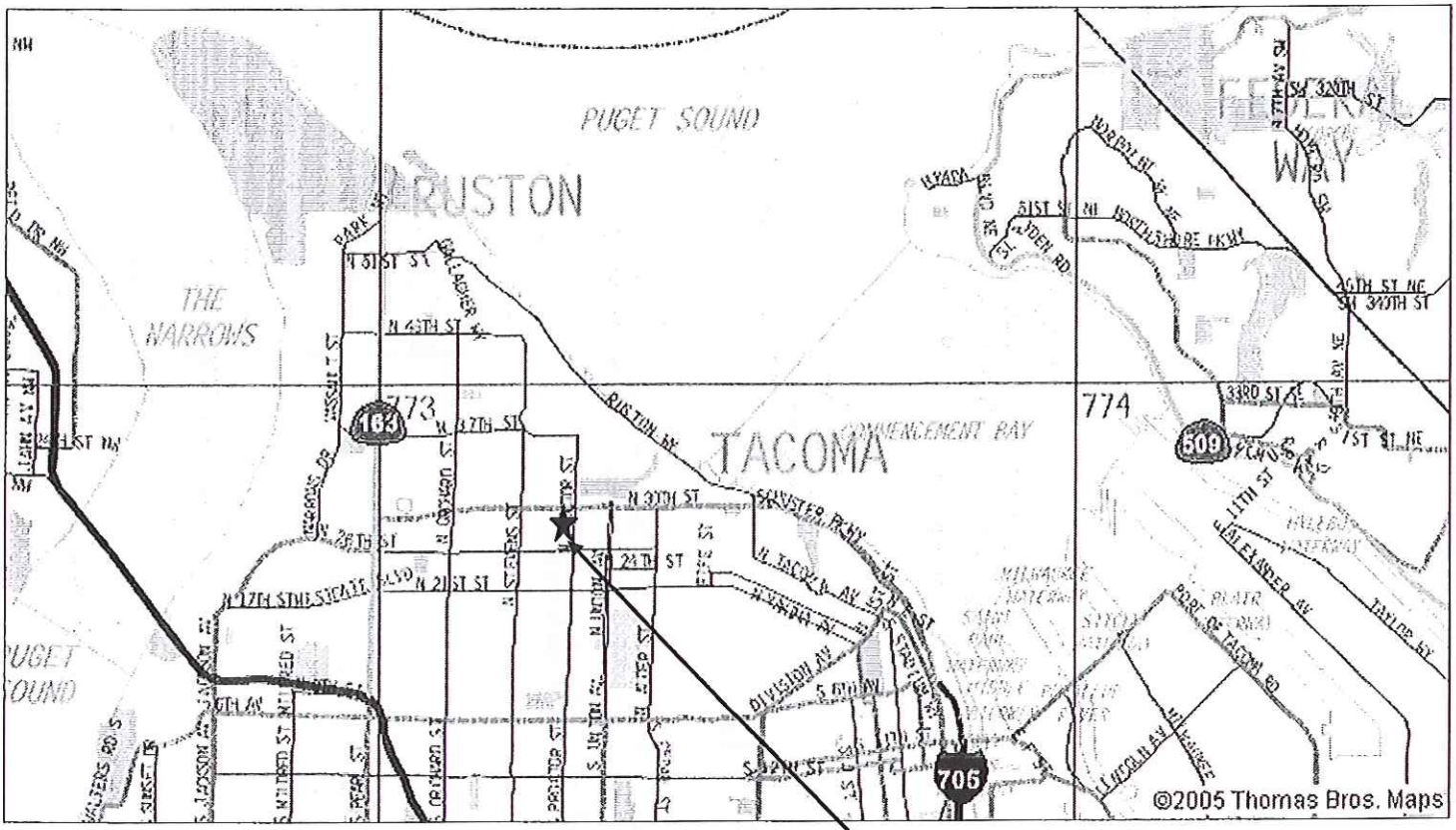


Keith Schembs, LEG
Principal



Dana C. Biggerstaff, PE
Senior Geotechnical Engineer

RMP:KSS:DCB/rmp
DocID: RushDesign.28thProctor.GR
Attachments:
Figure 1: Site Vicinity Map
Figure 2a: Site Plan
Figure 2b: Site
Figure 3: USGS Map
Figure 4: Soldier Pile Cantilever Wall
Figure 5: Typical Wall Drainage and Backfill
Appendix "A"
Figure A-1: Soil Classification System
Boring logs
Appendix "B" Laboratory Results



Approximate Site Location

Not to Scale

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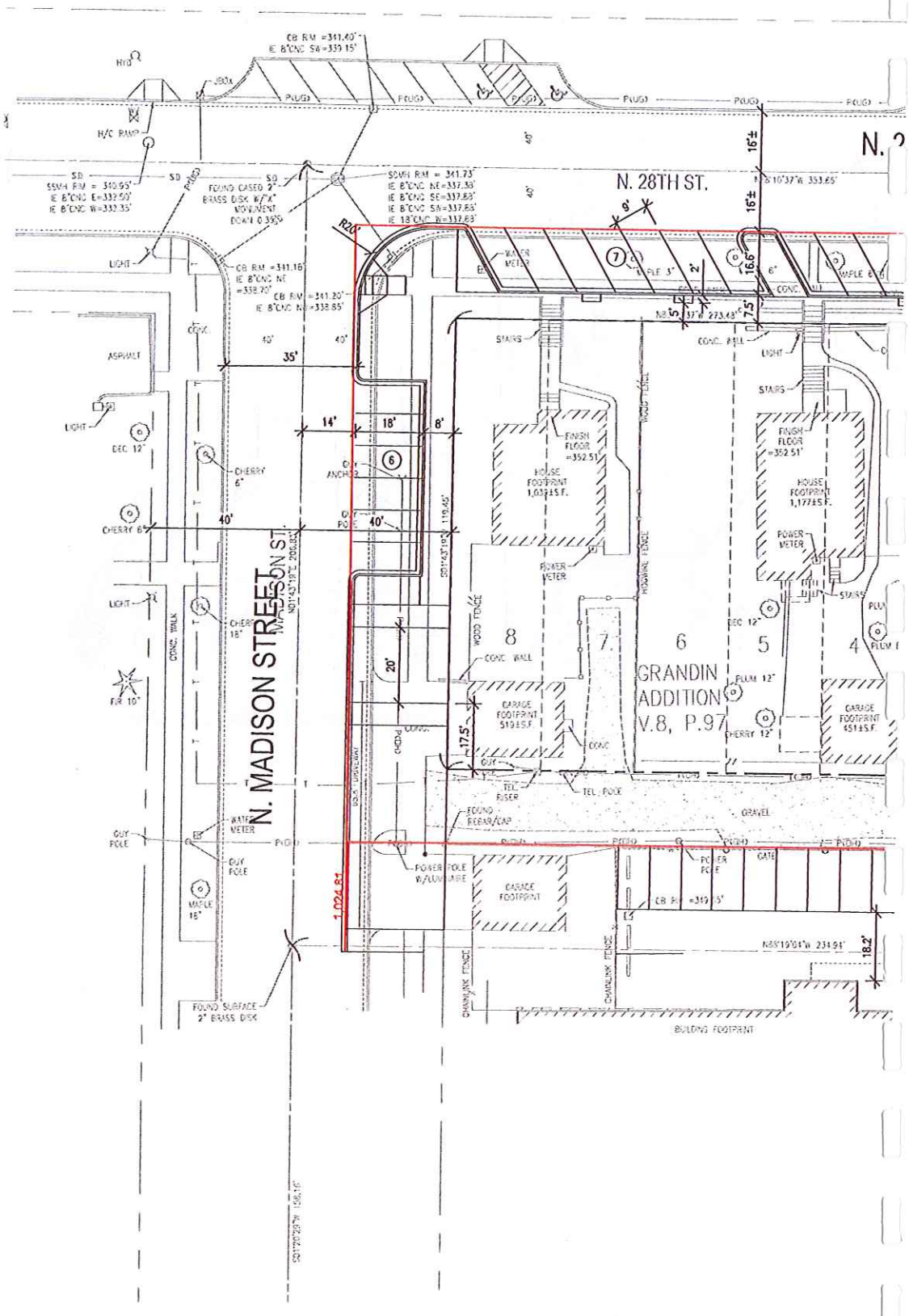
Site Vicinity Map

Proposed Mixed Use Multi-Story Development
North 28th Street & North Proctor Street
Tacoma, Washington

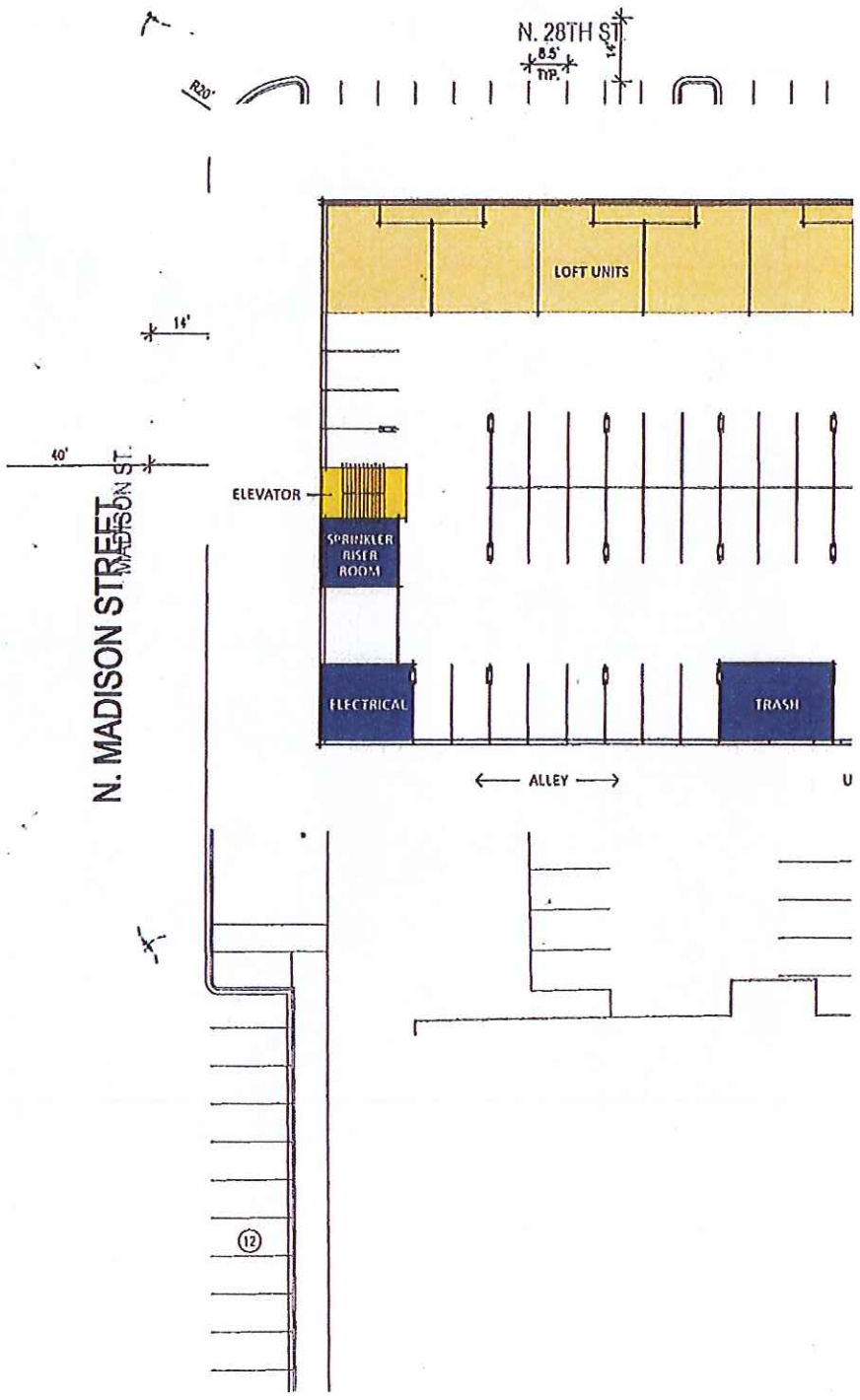
DocID: RushDesign.28thProctor.F	October 2013	Figure 1



SCALE 1"=40'

APPROXIMATE LOCATION AND NUMBER OF BORING B-1 ■

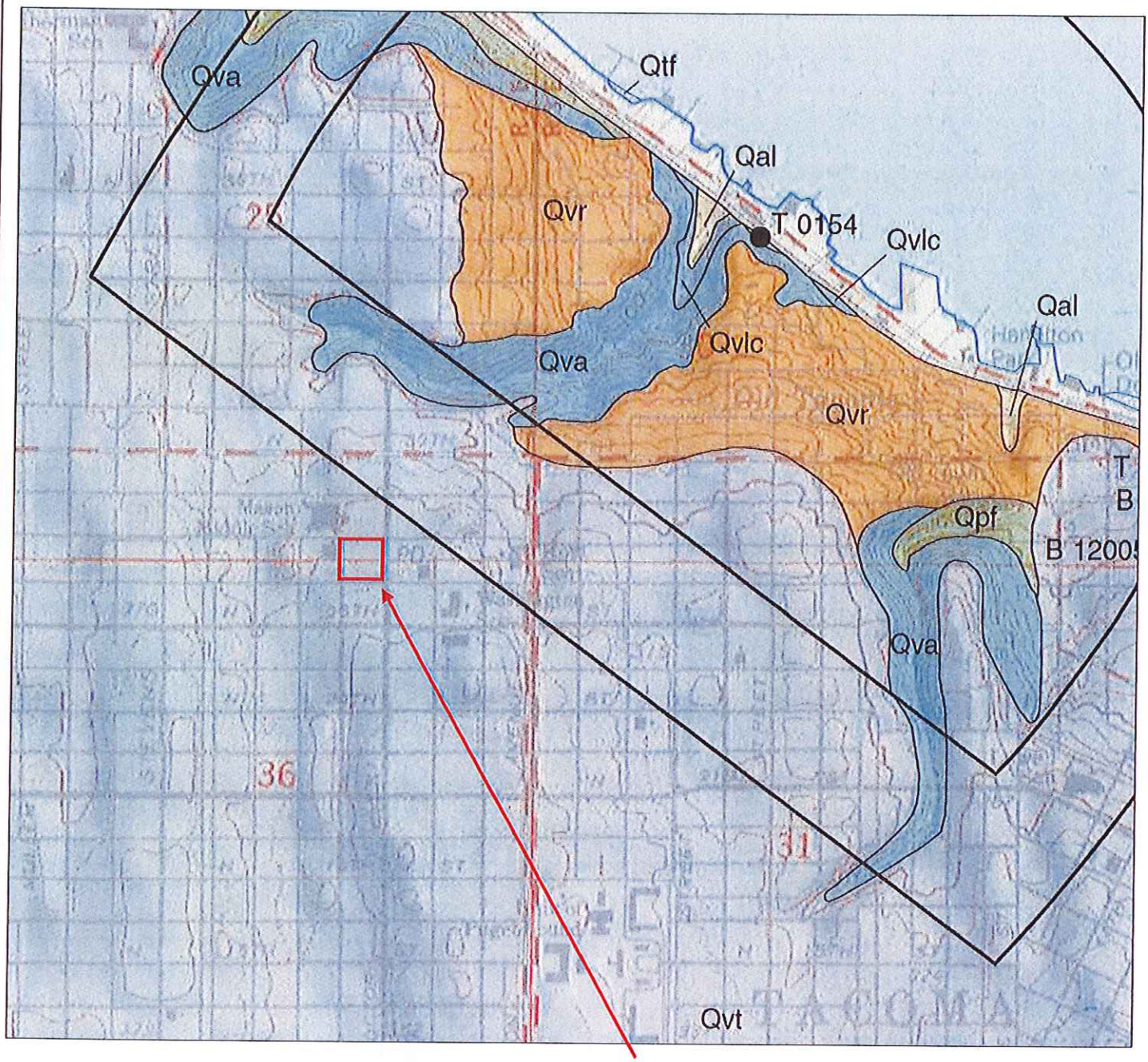
Client provided site



SCALE 1"=40'

APPROXIMATE LOCATION AND NUMBER OF BORING B-1 ■

Client provided site



Approximate Site Location

An excerpt from the draft *Geologic Map of the Tacoma North 7.5-minute Quadrangle Pierce County, Washington* by Troost, K.G., Booth, D.B., and Borden, R.K.,

Not to Scale

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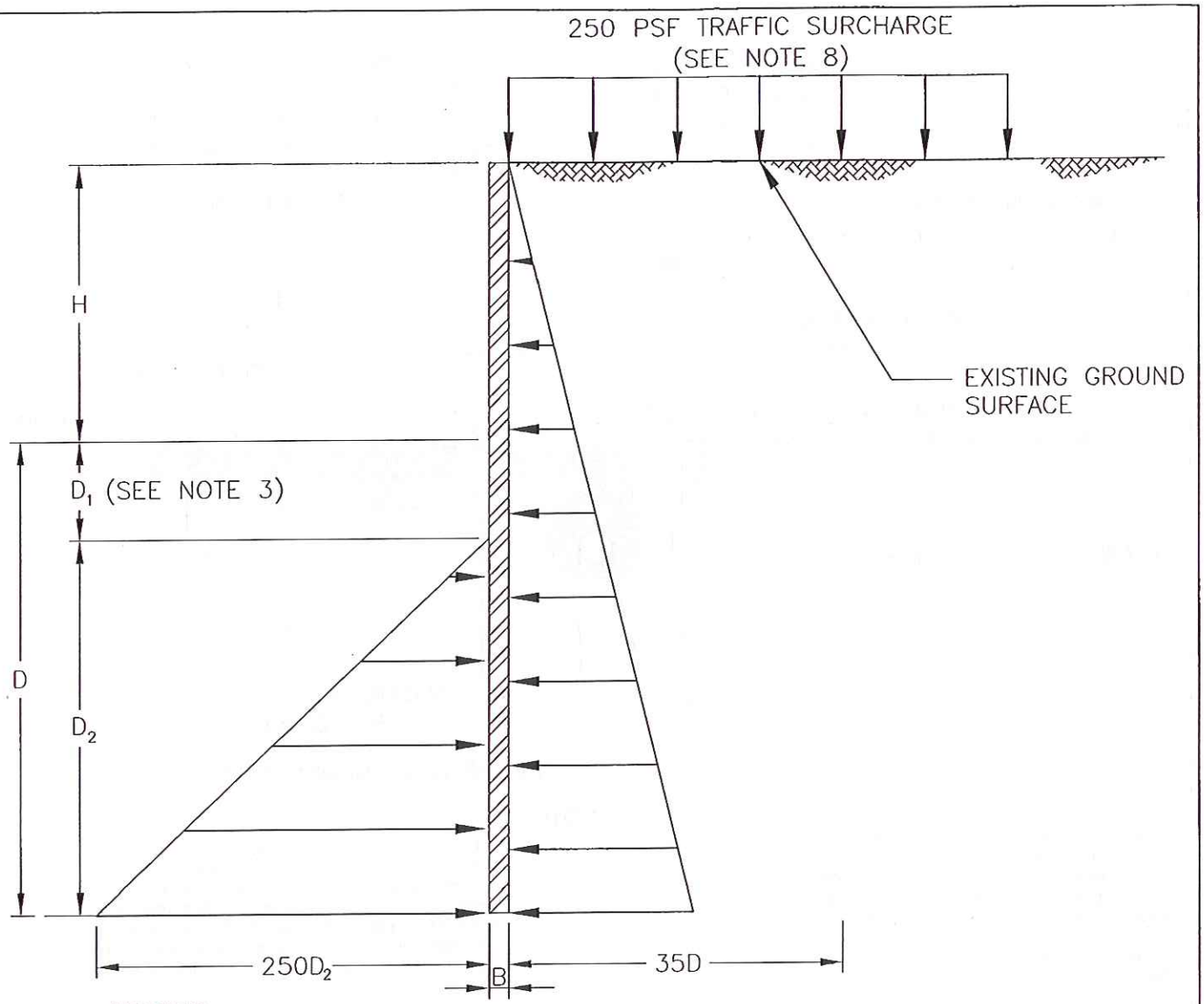
USGS Geologic Map
Proposed Mixed Use Multi-Story Development
North 28th Street & North Proctor Street
Tacoma, Washington

DocID: RushDesign.28thProctor.F	October 2013	Figure 3



Not to Scale

NOTES

1. All pressures in pounds per square foot.
2. Active pressures are assumed to act over the pile spacing above the ground line and over the pile diameter below.
3. Passive Pressures are assumed to act over twice the pile diameter below the ground line. Passive pressure from the upper 3 feet should be ignored.
4. The recommended lateral earth pressures assume that the backfill will be drained (see Figure 5) and only a parking surcharge is acting on the surface.
5. Lagging should be installed 3 feet below finished grade in front of the wall.
6. Traffic surcharge should be applied as an equivalent unformly distributed horizontal pressure of 70 psf.
7. Minimum recommended embedment = 2H+D1

LEGEND

H = Height of Wall in Feet, 8-foot Maximum

D = Depth of Wall Vertical Element embedment in Feet (see note 7)

B = Vertical Element Width

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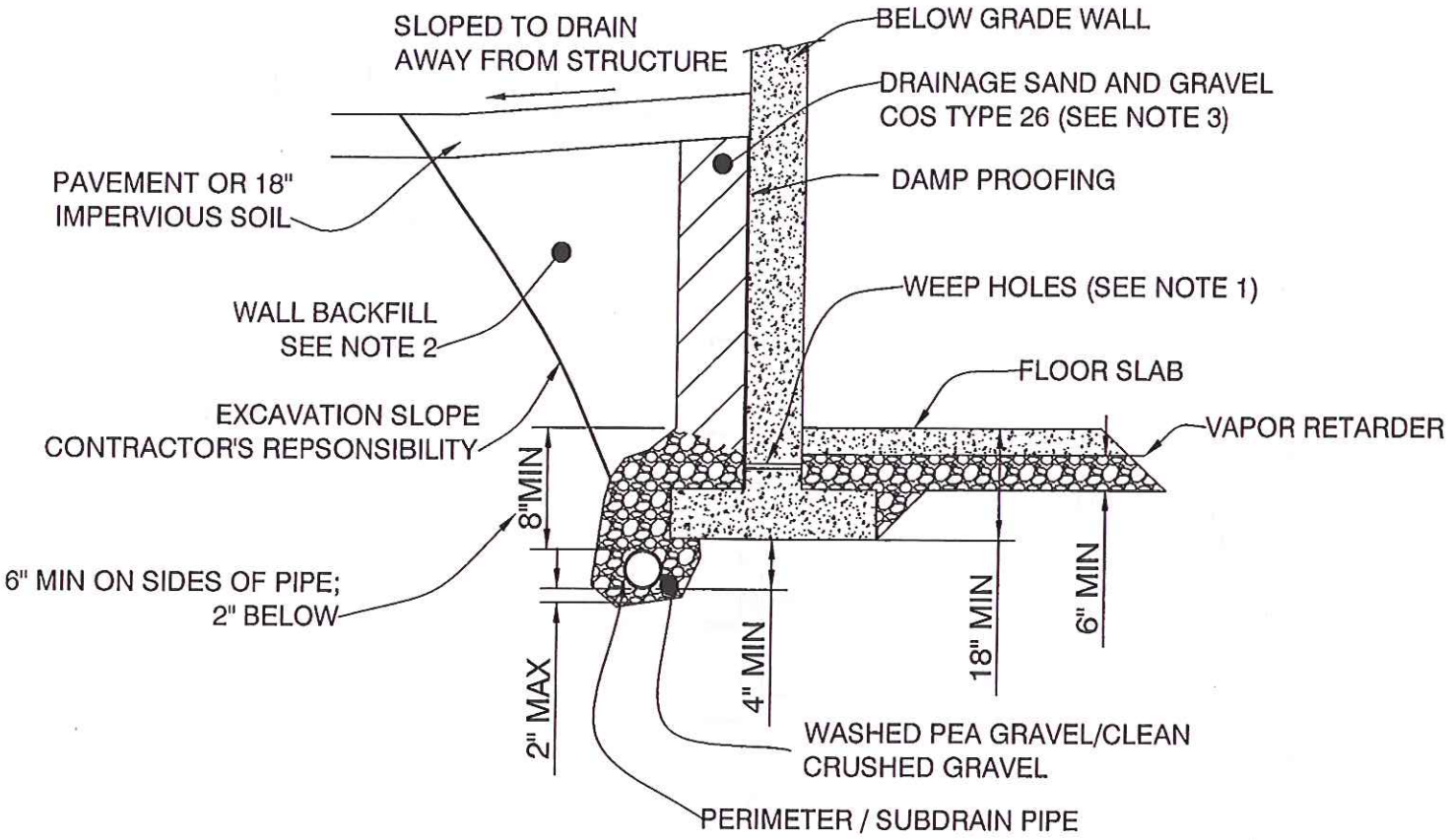
Recommended Lateral Earth Pressures
Proposed Mixed Use Development
N. 28th and N. Proctor Street
Tacoma, Washington

Doc ID: Rush.28th&Proctor.F	November, 2013	Figure 4



NOTES

1. Washed pea gravel/crushed rock beneath floor slab could be hydraulically connected to perimeter/subdrain pipe. Use of 1" diameter weep holes as shown is one applicable method. Crushed gravel should consist of 3/4" minus. Washed pea gravel should consist of 3/8" to No. 8 standard sieve.

2. Wall backfill should meet WSDOT Gravel Backfill for walls Specification 9-03-12(2).

3. Drainage sand and gravel backfill within 18" of wall should be compacted with hand-operated equipment. Heavy equipment should not be used for backfill, as such equipment operated near the wall could. increase lateral earth pressures and possibly damage the wall. The table below presents the drainage sand and gravel gradation.

4. All wall backfill should be placed in layers not e xceeding 4" loose thickness for light equipment and 8" for heavy equipment and should be densely compacted. Beneath paved or sidewalk areas, compact to at least 95% Modified Proctor maximum density (ASTM: 01557 -70 Method C). In landscaping areas, compact to 90% minimum.

5. Drainage sand and gravel may be repl aced with a geocomposite core sheet drain placed against th e wall and connected to the subdrain pipe. The geocomposite core sheet should have a minimum transmissivity of 3 .0 gallons/minute/foot when tested under a gradient of 1.0 according to ASTM 04716.

6 The subdrain should consist of 4" diameter (minimum), slotted or perforated plastic pipe meeting the requirements of AASHTO M 304; 1/8-inch maximum slot width; 3/16- to 3/8-inch perforated pipe holes in the lower half of pipe, with lower third segment unperforated for water flow; tight joints; sloped at a minimum of 6"/100' to drain; cleanouts to be provided at regular intervals.

7. Surround subdrain pipe with 8 inches (minimum) of washed pea gravel (2" below pipe) or 5/8" minus clean crushed gravel. Washed pea gravel to be graded from 3/8-inch to No.8 standard sieve.

8. See text for floor slab subgrade preparation.

Materials

Drainage Sand and Gravel

Sieve Size	% Passing by Weight
3/4"	100
No 4	28-56
No 8	20-50
No 50	3-12
No 100	0-2

3/4" Minus Crushed Gravel

Sieve Size	% Passing by Weight
3/4"	100
1/2"	75 - 100
1/4"	0 - 25
No 100	0 - 2
(by wet sieving)	(non-plastic)

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Typical Wall Drainage and Backfilling
Proposed Mixed Use Development
N. 28th and N. Proctor Street
Tacoma, Washington

Doc ID:		
Rush.28th&Proctor.F	November, 2013	Figure 5

APPENDIX A
FIELD EXPLORATION LOGS

SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP SYMBOL	GROUP NAME
COARSE GRAINED SOILS More than 50% Retained on No. 200 Sieve	GRAVEL More than 50% Of Coarse Fraction Retained on No. 4 Sieve	CLEAN GRAVEL	GW	WELL-GRADED GRAVEL, FINE TO COARSE GRAVEL
			GP	POORLY-GRADED GRAVEL
		GRAVEL WITH FINES	GM	SILTY GRAVEL
			GC	CLAYEY GRAVEL
	SAND More than 50% Of Coarse Fraction Passes No. 4 Sieve	CLEAN SAND	SW	WELL-GRADED SAND, FINE TO COARSE SAND
			SP	POORLY-GRADED SAND
		SAND WITH FINES	SM	SILTY SAND
			SC	CLAYEY SAND
FINE GRAINED SOILS More than 50% Passes No. 200 Sieve	SILT AND CLAY Liquid Limit Less than 50	INORGANIC	ML	SILT
			CL	CLAY
		ORGANIC	OL	ORGANIC SILT, ORGANIC CLAY
	SILT AND CLAY Liquid Limit 50 or more	INORGANIC	MH	SILT OF HIGH PLASTICITY, ELASTIC SILT
			CH	CLAY OF HIGH PLASTICITY, FAT CLAY
		ORGANIC	OH	ORGANIC CLAY, ORGANIC SILT
HIGHLY ORGANIC SOILS			PT	PEAT

NOTES:

1. Field classification is based on visual examination of soil in general accordance with ASTM D2488-90.
2. Soil classification using laboratory tests is based on ASTM D2487-90.
3. Description of soil density or consistency are based on interpretation of blow count data, visual appearance of soils, and or test data.

SOIL MOISTURE MODIFIERS:

Dry- Absence of moisture, dry to the touch

Moist- Damp, but no visible water

Wet- Visible free water or saturated, usually soil is obtained from below water table

GeoResources, LLC
5007 Pacific Highway East, Suite 16
Fife, Washington 98424
Phone: 253-896-1011
Fax: 253-896-2633

Soil Classification System
Proposed Mixed Use Multi-Story Development
North 28th Street & North Proctor Street
Tacoma, Washington

Project No: RushDesign.NProctorSt

Project: Proposed MultiStory Facility

Client: Rush Design

Site Location: N 28th Street & N Proctor Street

Boring Location: NE corner of site, inside corner of existing strip mall parking area

Borehole Number: B-1

Project Manager: KSS

Logged: KSS

GeoResources, LLC
5007 Pacific Hwy. E, #16
Fife, Washington 98424
(253) 896-1011

Depth (ft / m)	Depth/Elev.	Symbol	Description	Type	Blows/ft	Recovery (%)	Standard Penetration Test (blows/foot)	Water Level	Remarks
0 / 0	0		Ground Surface						
			Asphalt/Concrete						
			SP Tan fine sand with some silt, gravel (medium dense, moist)		12	100			7,9,5
	5		Gradation to silty sand with gravel (dense, moist)		38	100			12,17,21
	8		Tan SAND (medium dense, moist) to dense		38	100			13,20,18 3" CA sampler
					25	100			10,11,14
	15		Brown sandy gravel with silt (medium dense, moist) to dense		42	100			22,22,20 3" CA sampler
					29	100			17,15,14
	22		End of Borehole						

Standard Penetration Test (blows/foot): 0 10 20 30 40 50

Drilled By: Boretec, Inc.

Datum: -

Drill Method: Hollow stem auger using an EC85 trailer rig

Size: 8 inch outer diameter

Drill Date: September 11, 2013

Sampling Method: 2" outer diameter, split spoon per SPT per ASTM D1586

Project No: RushDesign.NProctorSt

Project: Proposed MultiStory Facility

Client: Rush Design

Site Location: N 28th Street & N Proctor Street

Boring Location: NE corner of site, NW corner of existing strip mall parking area

Borehole Number: B-2

Project Manager: KSS

Logged: RMP

GeoResources, LLC
5007 Pacific Hwy. E, #16
Fife, Washington 98424
(253) 896-1011

Depth (ft / m)	Depth/Elev.	Description	Type	Blows/ft	Recovery (%)	Standard Penetration Test (blows/foot)	Water Level	Remarks
0 / 0		Ground Surface						
0	0	***Asphalt/Concrete***						
1		Brown sand/silt with organics (woody roots)						
2								
3 / 1	3	***SP*** Light brown fine to medium sand (medium dense, moist)		29	100			9,9,20
4								
5	5	Gray silty fine sand with gravel, trace boulder at depth (dense to very dense, moist) (Glacial Till?/~~Fill?~~)		53	100			16,22,31
6 / 2								
7								
8				76	100			16,30,46 3" CA sampler
9								
10 / 3								3,22,17
11				39	100			
12								
13 / 4								
14								
15	15	Brown SAND (very dense, moist)		50	100			30,50/6" 3" CA sampler
16 / 5								
17								
18								
19								
20 / 6				96	100			25,46,50/4"
21								
22	22	End of Borehole						
23 / 7								
24								
25								

Drilled By: Boretec, Inc. Datum: -

Drill Method: Hollow stem auger using an EC85 trailer rig Size: 8 inch outer diameter

Drill Date: September 11, 2013 Sampling Method: 2" outer diameter, split spoon per SPT per ASTM D1586

Project No: RushDesign.NProctorSt

Borehole Number: B-3

Project: Proposed MultiStory Facility

Project Manager: KSS

Client: Rush Design

Logged: RMP

Site Location: N 28th Street & N Proctor Street

Boring Location: east portion parking area, near N Proctor Street ROW

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Fife, Washington 98424
(253) 896-1011

Depth (ft / m)	Depth/Elev.	Description	Type	Blows/ft	Recovery (%)	Standard Penetration Test (blows/foot)	Remarks
0 / 0	0	Ground Surface					
		Asphalt					
		Crushed rock over gravelly silty sand (loose, moist) (Fill Material)					
3 / 1	3	Light brown silty sand with gravel (loose, moist)		9	100		3,4,5 3" CA sampler
5 / 2		Gray silty fine sand with gravel (dense to very dense, moist) (Glacial Till?/Fill?)		30	100		11,11,19
8 / 3	8	Brown fine to medium SAND with faint mottled laminations (dense to very dense, moist)		69	100		20,30,39 3" CA sampler
11 / 4				49	100		17,22,27
16 / 5				49	100		17,25,24
18 / 6	18	as above sand (moist to wet)					Perched water level?
21 / 7	21	Gray fine to medium sand (very dense, moist)		94	100		22,44,50/4"
		End of Borehole					

Drilled By: Boretec, Inc. Datum: -

Drill Method: Hollow stem auger using an EC85 trailer rig Size: 8 inch outer diameter

Drill Date: September 11, 2013 Sampling Method: 2" outer diameter, split spoon per SPT per ASTM D1586

Project No: RushDesign.NProctorSt

Borehole Number: B-4

Project: Proposed MultiStory Facility

Project Manager: KSS

Client: Rush Design

Logged: RMP

Site Location: N 28th Street & N Proctor Street

Boring Location: NW corner of lot 4180000170, next to laurel hedge

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Fife, Washington 98424
(253) 896-1011

Depth (ft)	Depth (m)	Depth/Elev.	Symbol	Description	Type	Blows/ft	Recovery (%)	Standard Penetration Test (blows/foot)	Water Level	Remarks
				Ground Surface						
0	0	0		***Topsoil***						
2	1	2		***SP*** Light brown SAND with silt, gravel (loose, moist)		9	33			5,5,4
5	2	5		as above faint mottling (very dense, moist) (dirty Advance Outwash?)		74	50			15,29,45
8	3					50	50			35,50/5" 3" CA sampler
10	3					51	100			19,22,29
15	5	15		SAND with gravel, some silt (very dense, moist) (Advance Outwash)		50				50/5" 3" CA sampler
20	6					50	100			40,50/5"
25	7	25				50				50/5"

Standard Penetration Test (blows/foot): 0 10 20 30 40 50

Drilled By: Boretec, Inc. Datum: -

Drill Method: Hollow stem auger using an EC55 track rig Sample Size: 6 inch outer diameter

Drill Date: September 18, 2013 Sampling Method: 2" outer diameter, split spoon per SPT per ASTM D1586

Project No: RushDesign.NProctorSt

Project: Proposed MultiStory Facility

Client: Rush Design

Site Location: N 28th Street & N Proctor Street

Boring Location: NW corner of lot 4180000170, next to laurel hedge

Borehole Number: B-4

Project Manager: KSS

Logged: RMP

GeoResources, LLC
5007 Pacific Hwy. E, #16
Fife, Washington 98424
(253) 896-1011

SUBSURFACE PROFILE				SAMPLE					
Depth	Depth/Elev.	Symbol	Description	Type	Blows/ft	Recovery (%)	Standard Penetration Test (blows/foot) 0 10 20 30 40 50	Water Level	Remarks
26 8 27 28 29 9 30 31			as above SAND with some gravel, compact (very dense, moist)		50				
					88	100			25,44,44
32 33 10 34 35 36 11 37 38 39 12 40 41 42 13 43 44 45 46 14 47 48 49 15 50	32		End of Borehole						

Drilled By: Boretec, Inc. Datum: -

Drill Method: Hollow stem auger using an EC55 track rigle Size: 6 inch outer diameter

Drill Date: September 18, 2013 Sampling Method: 2" outer diameter, split spoon per SPT per ASTM D1586

Project No: RushDesign.NProctorSt

Project: Proposed MultiStory Facility

Client: Rush Design

Site Location: N 28th Street & N Proctor Street

Boring Location: SW corner of site, existing driveway near alley

Borehole Number: B-5

Project Manager: KSS

Logged: RMP

GeoResources, LLC
5007 Pacific Hwy. E, #16
Fife, Washington 98424
(253) 896-1011

Depth (ft)	Depth (m)	Depth/Elev.	Symbol	Description	Type	Blows/ft	Recovery (%)	Standard Penetration Test (blows/foot)	Water Level	Remarks
				Ground Surface						
0	0	0		Crushed rock over gravelly silty sand (Fill Material)						
2	1	2		Gray silty fine sand with gravel (dense to very dense, moist) (Glacial Till?/Fill?)		32	100			25,17,15
5	2	5		Brown SAND (dense to very dense, moist)		42	100			15,18,24
8	3					50	100			18,22,28 3" CA sampler
10	3	10				50				50/0.5" No Recovery
15	5	15		Gray silty fine sand with gravel (dense, moist) (Glacial Till?/Fill?)		50				50/1" 3" CA sampler, no recovery
20	6	21		Gray sand (very dense, moist)		77	25			21,33,44 No noticeable odor
25	7					50				50/4"

Drilled By: Boretec, Inc.

Datum: -

Drill Method: Hollow stem auger using an EC85 trailer rig Size: 8 inch outer diameter

Drill Date: September 11, 2013

Sampling Method: 2" outer diameter, split spoon per SPT per ASTM D1586

Project No: RushDesign.NProctorSt

Project: Proposed MultiStory Facility

Client: Rush Design

Site Location: N 28th Street & N Proctor Street

Boring Location: SW corner of site, existing driveway near alley

Borehole Number: B-5

Project Manager: KSS

Logged: RMP

GeoResources, LLC
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Fife, Washington 98424
(253) 896-1011

SUBSURFACE PROFILE				SAMPLE					
Depth	Depth/Elev.	Symbol	Description	Type	Blows/ft	Recovery (%)	Standard Penetration Test (blows/foot) 0 10 20 30 40 50	Water Level	Remarks
26					50				
27									
28									
29									
30					50	25			30,50/3"
31	31		End of Borehole						
32									
33									
34									
35									
36									
37									
38									
39									
40									
41									
42									
43									
44									
45									
46									
47									
48									
49									
50									

Drilled By: Boretec, Inc. Datum: -

Drill Method: Hollow stem auger using an EC85 trailer rig Size: 8 inch outer diameter

Drill Date: September 11, 2013 Sampling Method: 2" outer diameter, split spoon per SPT per ASTM D1586

APPENDIX B
LABORATORY TEST PROCEDURES AND RESULTS

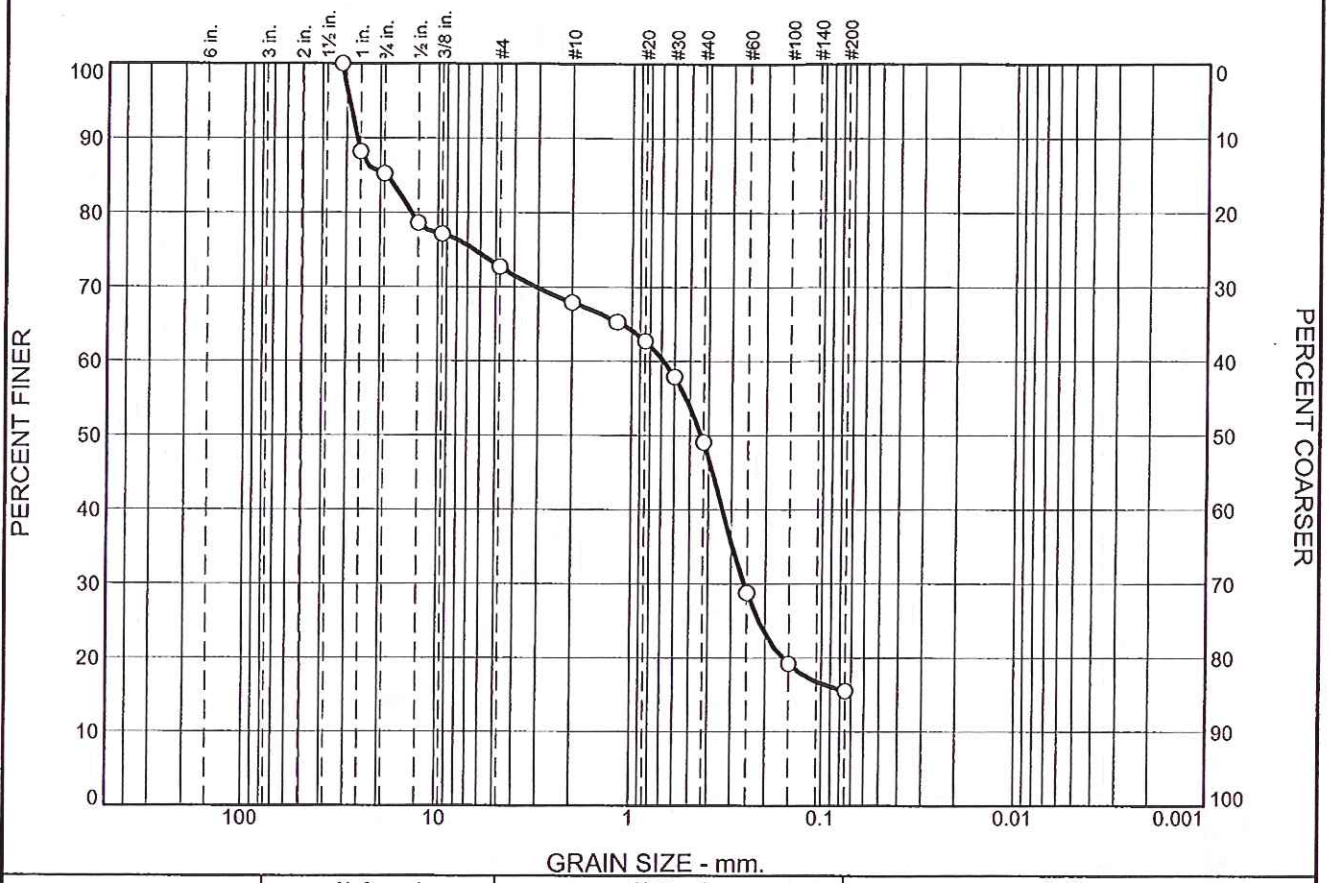
APPENDIX B
LABORATORY TESTING PROCEDURES AND RESULTS

The following paragraphs describe our procedures associated with the laboratory tests that we conducted for this project. Graphical results of certain laboratory tests are enclosed in this appendix.

Grain Size Analysis Procedures

A grain size analysis indicates the range of soil particle diameters included in a particular sample. Grain size analyses were performed on representative samples in general accordance with ASTM:D-422. The results of these tests are presented on the enclosed grain-size distribution graph (Figure A-1) and were used in soil classifications shown on the exploration logs contained in Appendix A. .

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	14.8	12.5	4.8	18.8	33.6	15.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.25	100.0		
1	88.2		
3/4	85.2		
1/2	78.6		
3/8	77.1		
#4	72.7		
#10	67.9		
#16	65.3		
#20	62.7		
#30	57.9		
#40	49.1		
#60	28.8		
#100	19.2		
#200	15.5		

* (no specification provided)

Material Description

Silty Sand with Clay and Gravel
Field Moisture = 8.48%
Project Manager: Renee Phillips

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 18.5260 D_{60}= 0.6793 D_{50}= 0.4369
D_{30}= 0.2594 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Field Moisture = 8.48%
F.M.=3.18

Sample Number: 090644 **Depth:** 15-16.5 Ft.
Location: B-1 **Date:** 10/24/2013

GeoResources, LLC

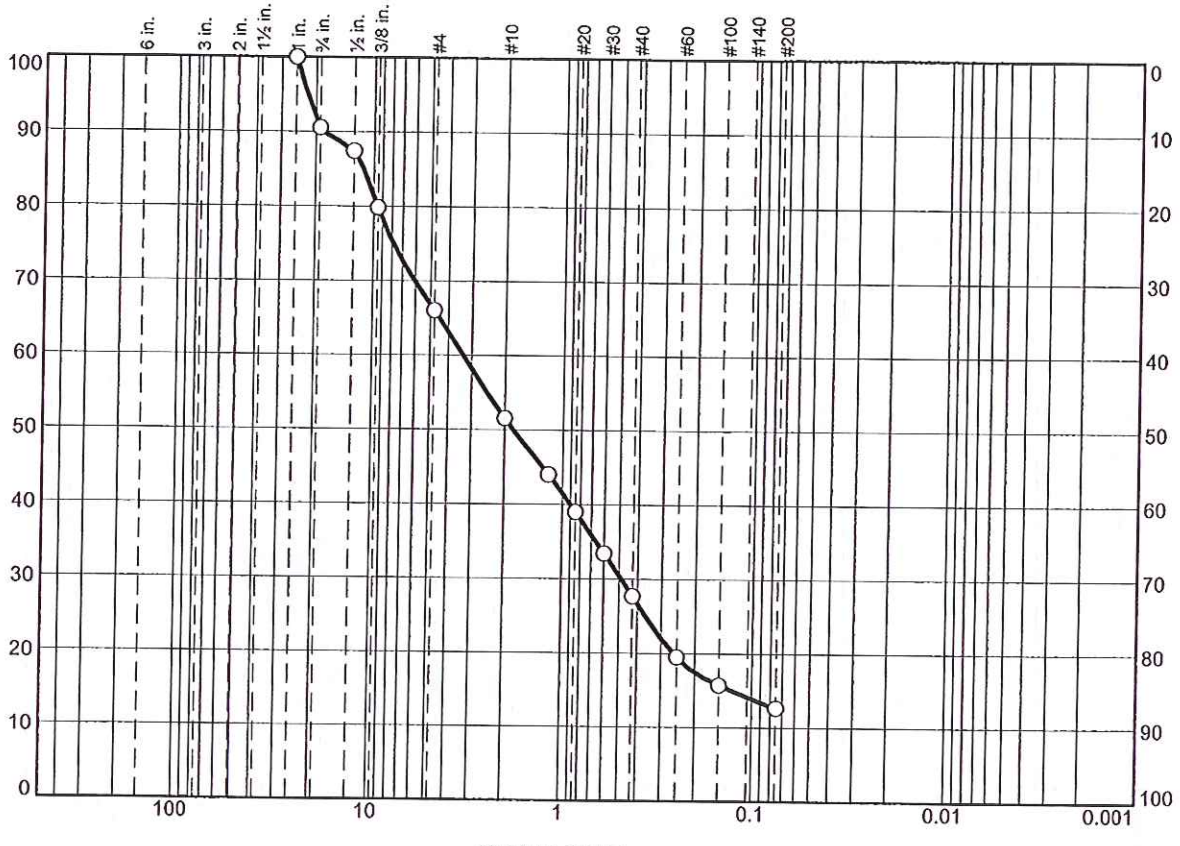
Fife, WA

Client: Rush Construction
Project: 28th & Proctor

Project No: Rush.28th&Proctor **Figure**

Tested By: Timothy Bergstrom **Checked By:** Renee Phillips

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	9.4	24.6	14.4	23.9	15.1	12.6	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1.0	100.0		
3/4	90.6		
1/2	87.4		
3/8	79.9		
#4	66.0		
#10	51.6		
#16	44.0		
#20	39.0		
#30	33.4		
#40	27.7		
#60	19.5		
#100	15.7		
#200	12.6		

* (no specification provided)

Material Description

Silty Sand with Gravel
Project Manager: Renee Phillips
Field Moisture = 7.56%

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 11.3582 D_{60}= 3.3282 D_{50}= 1.7992
D_{30}= 0.4878 D_{15}= 0.1291 D_{10}=
C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Field Moisture = 7.56%
F.M.=3.94

Sample Number: 090643 **Depth:** 20 Ft.
Location: B-2

Date: 10/24/2013

GeoResources, LLC

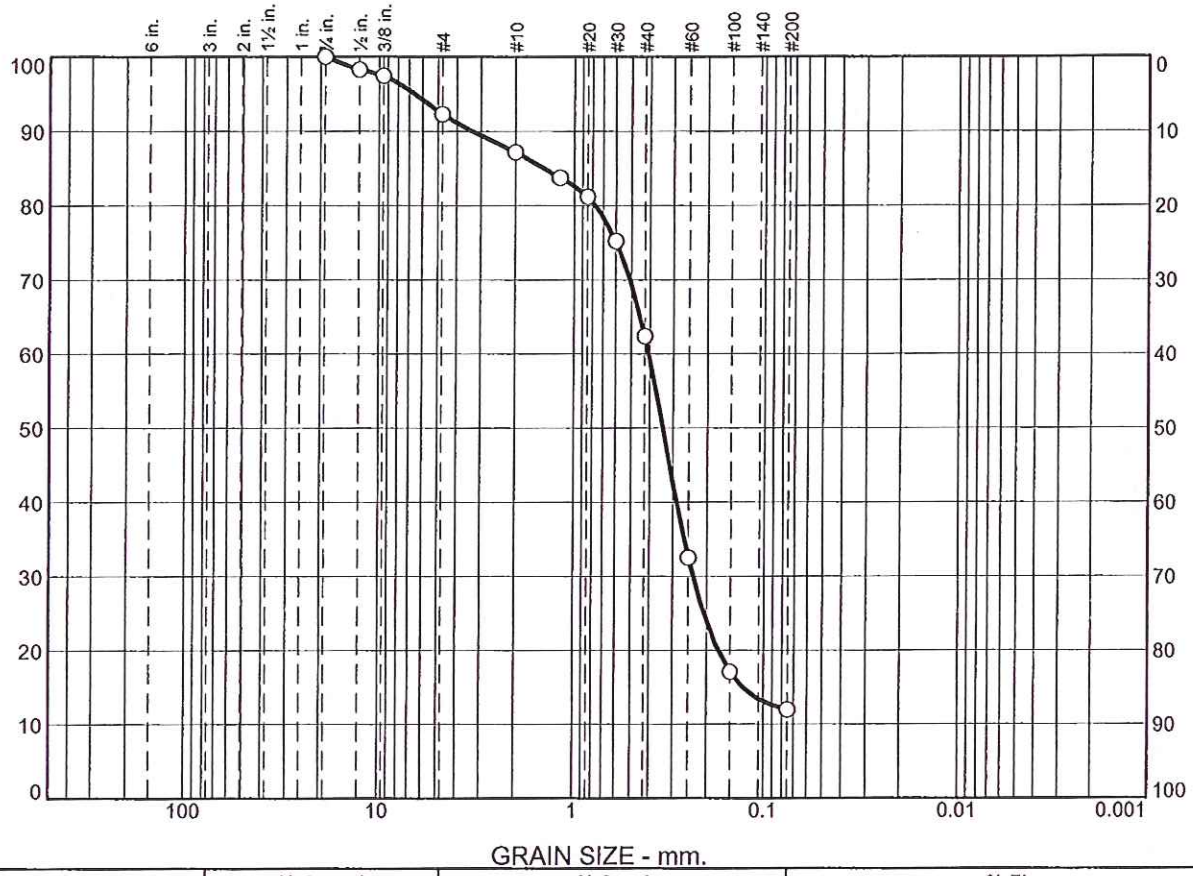
Fife, WA

Client: Rush Construction
Project: 28th & Proctor

Project No: Rush.28th&Proctor **Figure**

Tested By: Timothy Bergstrom **Checked By:** Renee Phillips

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	7.7	5.1	24.8	50.4	12.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4	100.0		
1/2	98.3		
3/8	97.4		
#4	92.3		
#10	87.2		
#16	83.8		
#20	81.2		
#30	75.2		
#40	62.4		
#60	32.5		
#100	17.1		
#200	12.0		

* (no specification provided)

Material Description

Grey Sand with Trace Gravel
Project Manager: Renee Phillips
Field Moisture = 11.97%

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 1.4225 D_{60}= 0.4058 D_{50}= 0.3408
D_{30}= 0.2368 D_{15}= 0.1285 D_{10}=
C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Field Moisture = 11.97%
F.M.=2.04

Sample Number: 090651 **Depth:** 20 Ft.
Location: B-4 **Date:** 10/24/2013

GeoResources, LLC

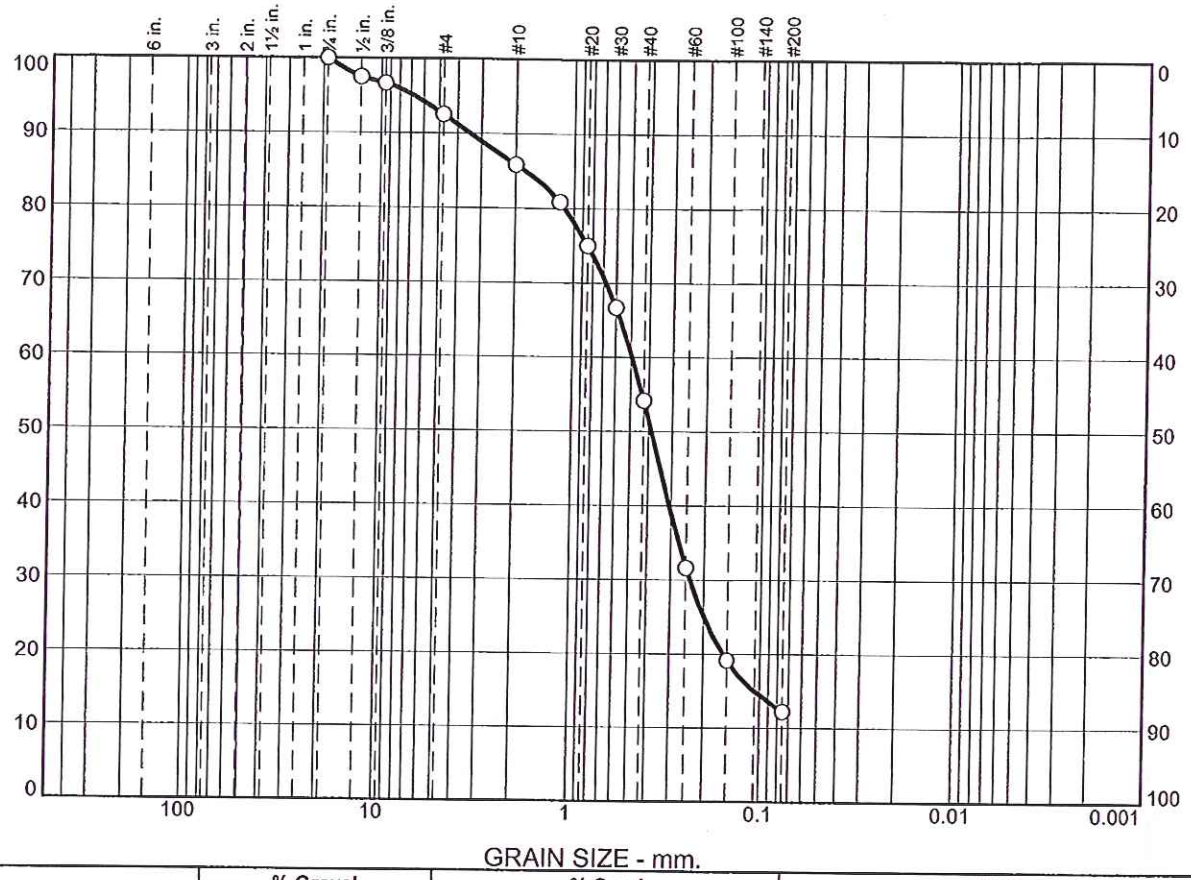
Fife, WA

Client: Rush Construction
Project: 28th & Proctor

Project No: Rush.28th&Proctor **Figure**

Tested By: Timothy Bergstrom **Checked By:** Renee Phillips

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	7.5	6.7	31.6	42.0	12.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4	100.0		
1/2	97.5		
3/8	96.7		
#4	92.5		
#10	85.8		
#16	80.8		
#20	75.0		
#30	66.7		
#40	54.2		
#60	31.7		
#100	19.2		
#200	12.2		

* (no specification provided)

Material Description

Grey Sand with Trace Gravel
Project Manager: Renee Phillips
Field Moisture = 7.50%

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 1.7852 D_{60}= 0.4921 D_{50}= 0.3860
D_{30}= 0.2382 D_{15}= 0.1066 D_{10}=
C_u= C_c=

Classification

USCS= AASHTO=

Remarks

Field Moisture = 7.50%
F.M.=2.18

Sample Number: 060652 **Depth:** 20 Ft.
Location: B-5

Date: 10/24/2013

GeoResources, LLC

Fife, WA

Client: Rush Construction
Project: 28th & Proctor

Project No: Rush.28th&Proctor **Figure**

Tested By: Timothy Bergstrom **Checked By:** Renee Phillips