The Riley Group Inc.

GEOTECHNICAL ENGINEERING REPORT

Seib Property
16824 Bothell-Everett Highway
Mill Creek, Washington

Project No. 2005-038

Prepared By:

The Riley Group, Inc.
17522 Bothell Way NE, Suite A
Bothell, WA 98011

Prepared for:

Mr. David Lee
Mill Creek Commons Phase II, LLC
15921 NE 8th Street, Suite 202
Bellevue, WA 98008

April 8, 2005

SERVING THE PACIFIC NORTHWEST

Main Office: 17522 Bothell Way NE, Suite A, Bothell, WA 98011
Tel (425) 415-0551 ● Fax (425) 415-0311

The Riley Group Inc.

April 8, 2005

Mr. David Lee
Mill Creek Commons Phase II, LLC
15921 NE 8th Street, Suite 202
Bellevue, WA 98008

Subject: Geotechnical Engineering Report
Seib Property
16824 Bothell-Everett Highway
Mill Creek, Washington
Project No. 2005-038

Dear Mr. Lee:

As requested, The Riley Group, Inc. (Riley) has performed a geotechnical engineering study for the above referenced subject site. Riley understands that you are planning to develop a parcel of land on Bothell-Everett Highway in Mill Creek, Washington. The attached report presents our findings and recommendations for the geotechnical aspects anticipated for the project design and construction.

The site has been divided into two portions by Nickel Creek: the north lot and the south lot. Our field exploration indicates that the north lot is generally underlain by 4 to 5 feet of loose to medium dense silty sandy gravel with trace cobbles over medium dense to dense fine sand with some silt. The south lot is underlain by up to 2.5 feet of fill over native soil. The fill consists of loose to medium dense silty sand with gravel. The native soil consists 3 to 5 feet of medium dense to dense silty sandy gravel over stiff to very stiff silt with interbedded fine sand layers. Groundwater seepage was not encountered in any of the test pits during the field exploration. Based on the soil conditions observed, infiltration is suitable for the north lot. Since impervious soil layer was encountered in the south lot, infiltration is not recommended for the south lot. We recommend supporting the proposed buildings on conventional spread footing foundations bearing on the medium dense to dense native soil or structural fill if needed. Slab-on-grade and pavements can be similarly supported.

Riley recommends that the building setbacks should be at least 15 feet from the top of the steep slopes along Nickel Creek. The proposed development will not adversely affect slope stability if the geotechnical recommendations have been incorporated into final design and construction.

We trust the information presented is sufficient for your current needs. If you have any questions or require additional information, please call.

Sincerely yours,

THE RILEY GROUP, INC.

Chien-Lin (Johnny) Chen, P.E.
Project Engineer

Ricky R. Wang, Ph.D., P.E.
Principal Engineer

JC/RW

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1.0 PROJECT DESCRIPTION

The project site is located at 16824 Bothell-Everett Highway in Mill Creek, Washington. The approximate location of the site is shown on the Site Vicinity Map, Figure 1. The site is located to the south of a recently developed storage site. Nickel Creek divided the site into two portions: the north lot and the south lot. The north lot is currently occupied by a vacant single-family residence and the south lot is vacant.

Riley understands that the residence on the north lot will be demolished and four single story commercial buildings will be constructed on the north lot. The parking lot will connect the developed property to the north. A two-story office building and related parking lot will be built on the south lot. At the time of preparing this report, site grading and building plans were not available for our review. Based on our experience with similar construction, we anticipate that site grading will require approximately 5 to 8 feet of cut in the north lot to match the existing grade north of the site. We expect that less than 5 feet of cut/fill will be needed in the south lot. The proposed buildings will be wood-framed structures supported on perimeter walls with a bearing load of 1 to 2 kips per linear foot, and a series of columns with a maximum load of up to 75 kips. The building will be supported on slab-on-grade foundation with a uniform load of less than 200 psf.

The recommendations in the following sections of this report are based upon our current understanding of the proposed site development. If actual features vary or changes are made, we should review them in order to modify our recommendations as required. In addition, Riley requests to review the site grading plan, final design drawings and specifications when available to verify that our project understanding is correct and that our recommendations have been properly interpreted and incorporated into the project design and construction.

2.0 SCOPE OF WORK

On March 8, 2005, Riley observed excavation of 9 test pits to a maximum depth of 10 feet below ground surface (bgs). Test pits were excavated with a rubber-tired backhoe. Test pits TP-1 through TP-3 was excavated in the north lot and test pits TP-4 through TP-9 were excavated in the south lot. The approximate test pit locations are shown on Figure 2.

Using the information obtained from our subsurface exploration and laboratory testing, we performed analyses to develop geotechnical recommendations for project design and construction on the following:

- Soil and groundwater conditions
- Seismic considerations
- Site preparation and grading
- Excavations and slopes
- Foundations
- Retaining walls
- Slab-on-grade
- Drainage
- Utilities
- Pavements

3.0 SITE CONDITIONS

3.1 Surface

The subject site is an irregular-shaped area bisected by Nickel Creek. The site is bound to the north by a developed commercial property, to the east by Bothell-Everett Highway, and to the south and west by undeveloped properties.

The north lot is occupied by a vacant single-family residence with a driveway and the south lot is vacant. The north lot is 6 to 8 feet higher in elevation than the developed property to the north. The south lot is covered with bushes and is relatively flat in the proposed development area.

Nickel Creek runs though the middle of the property and has created steep slopes on both sides, with gradients of approximately 30% to 35%. The west portion of north lot slopes down to the creek with a gradient of approximately 30%. The north portion of the south lot slopes down to the creek with a slope gradient of 35%.

3.2 Soils

Our field exploration indicates that the north lot is generally underlain by 4 to 5 feet of loose to medium dense silty sandy gravel with trace cobbles over medium dense to dense fine sand with some silt. The south lot is underlain by up to 2.5 feet of fill over native soil. The fill consists of loose to medium dense silty sand with gravel. The native soil consists 3 to 5 feet of medium dense to dense silty sandy gravel over stiff to very stiff silt with interbedded fine sand layers. A boulder approximately two feet in diameter was encountered in test pit TP-5.

Riley reviewed the *Geologic Map of Surficial Deposits in Seattle 30' by 60' Quadrangle, Washington (James C. Yount, etc., 1993).* The review indicates that the soil in the project vicinity is mapped as Vashon advanced outwash deposits (Map Unit Qva), which consist of light-red brown gravel and sand and light brown to gray silt and clay, moderately- to well-sorted. These descriptions are generally similar to the findings in our field explorations except we did not encounter clay.

More detailed descriptions of the subsurface conditions encountered are presented in the Test Pit Logs included as Figures A-2 through A-4 in Appendix A. Sieve analysis was performed on selected soil samples. Grain size distribution curves are included in Figures A-5 and A-6.

3.3 Groundwater

Groundwater was not encountered during our subsurface investigation, which reached a maximum depth of 10 feet bgs. During the previously conducted field exploration of the property to the north of the site, ground water was encountered approximately 10 feet

below the finish grade along Bothell-Everett Highway. Therefore, we expect that perched groundwater may be encountered on-site over the silt layers during wet season.

Fluctuations in groundwater level should be expected on a seasonal and annual basis. The level will be highest during the extended periods of heavy seepage in the wet winter months. Given the time of the year that the field exploration was performed, Riley believes that the groundwater should be below the bottom of the excavation.

3.4 Geologic Hazards

Steep Slopes

Based on our field observations, the site and the adjacent slopes seem to be in generally stable condition. We did not find any obvious features suggesting past or recent deep-seated landslides in this area. Riley recommends that a building setback of 15 feet be used for the proposed building layout. In our opinion, the proposed development will not adversely affect slope stability if the geotechnical recommendations have been incorporated into final design and construction.

Seismic Considerations

Based on the 2003 International Building Code (IBC), the site soil is Class D (Table 1615.1.1). The earthquake spectral response acceleration at short periods (S_s) is 126%g and at 1-second period (S_1) is 43%g.

Liquefaction is a phenomenon where there is a reduction or complete loss of soil strength due to an increase in water pressure induced by vibrations from a seismic event. Liquefaction mainly affects geologically recent deposits of fine-grained sands that are below the groundwater table. Soils of this nature derive their strength from intergranular friction. The generated water pressure or pore pressure essentially separates the soil grains and eliminates this intergranular friction, thus reducing or eliminating the soil's strength.

We reviewed the results of the field and laboratory testing and assessed the potential for liquefaction of the site's soil during an earthquake. Since the groundwater level is low and the native soil is relatively dense, Riley concludes that the possibility of liquefaction during an earthquake is low.

4.0 DISCUSSION AND RECOMMENDATIONS

4.1 General

Based on our study, the site is suitable for the proposed construction from a geotechnical standpoint. Foundations for the proposed buildings can be supported on conventional spread footings bearing on medium dense to dense native soil or structural fill. However, the loose fill encountered in the south lot is not suitable for supporting the building foundations. If the loose fill is encountered below the proposed footing subgrade, it should

be overexcavated and backfilled with structural fill. Slab-on-grade and pavements can be similarly supported.

Riley recommends that the building setbacks should be at least 15 feet from the top of the steep slopes. Infiltration is suitable for disposal of storm water in the north lot. Riley does not recommend onsite infiltration to be used in the south lot.

Detailed recommendations regarding the above issues and other geotechnical design considerations are provided in the following sections. These recommendations should be incorporated into the final design drawings and construction specifications.

4.2 Site Preparation and Grading

To prepare the site for construction, the existing residential building in the north lot should be demolished and stripped. Surface stripping depths of up to 6 inches should be expected to remove the topsoil for the entire site. All remnants related to previous site construction should also be cleared and removed from the site.

Once stripping, clearing and other preparations are complete, cuts and fills can be made to establish desired building grades. We anticipate that site grading will require approximately 5 to 8 feet of cut in the north lot to match the existing grade north of the site. Prior to placing fill, we recommend proof-rolling all exposed surfaces to determine if any isolated soft and yielding areas are present. Proof-rolling should be performed in cut areas that will provide direct support for new construction.

The on-site excavated soils without organics are generally suitable for use as structural fill. However, the silt encountered on the south lot is not suitable for use as structural fill. If the site grading requires additional structural fill, we recommend importing a material that meets the grading requirements listed in Table 1.

Table 1. Structural Fill

U.S. Sieve Size	Percent Passing
Maximum aggregate size 3 inches	100
Maximum passing the No. 4 sieve	75 percent
Maximum passing the No. 200 sieve	5 percent *

*Based on minus 3/4 inch fraction.

Prior to placement, a geotechnical engineer should examine and test all materials imported to the site for use as structural fill. Structural fill materials should be placed in uniform loose layers not exceeding 12 inches and compacted to a minimum of 95 percent of the soil's maximum density, as determined by ASTM Test Designation D-1557 (Modified

Proctor). The moisture content of the soil at the time of compaction should be within about two percent of its optimum, as determined by this ASTM method.

4.3 Excavations and Fill Slopes

Excavations at the site with confined spaces, such as footings, utility vaults, and trenches, etc., must be completed in accordance with local, state, or federal requirements. Based on Occupational Safety and Health Administration (OSHA) regulations, the native soils are classified as Group C soils.

Accordingly, for excavations more than four feet but less than 20 feet in depth, the temporary side slopes should be laid back with a minimum slope inclination of 1½:1 (Horizontal: Vertical). If there is insufficient room to complete the excavations in this manner, or excavations greater than 20 feet in depth are planned, temporary shoring should be considered to support the excavations.

The permanent cut and fill slopes should be graded with a finished inclination no greater than 2:1 (Horizontal:Vertical). Upon completion of construction, the slope face should be trackwalked, compacted and vegetated, or provided with other physical means to guard against erosion. Final grades at the top of the existing slope must promote surface drainage away from the existing slope crest. Water must not be allowed to flow in an uncontrolled fashion over the slope face. If it is necessary to direct surface runoff towards the slope, it should be controlled at the top of the slope, piped in a closed conduit installed on the slope face, and taken to an appropriate point of discharge beyond the toe of the slope.

4.4 Foundations

Following site preparation and grading, the proposed building foundation can be supported on conventional spread footings bearing on medium dense to dense native soil or structural fill. The loose fill encountered in the south lot of the proposed building area is not suitable for supporting the building foundations. It should be overexcavated and backfilled with structural fill. Perimeter foundations exposed to the weather should be at a minimum depth of 18 inches below final exterior grades. Interior foundations can be constructed at any convenient depth below the floor slab.

We recommend designing foundations for a net allowable bearing capacity of 2,500 pounds per square foot (psf) for native soil and structural fill. For short-term loads, such as wind and seismic, a 1/3 increase in this allowable capacity can be used.

For designing foundations to resist lateral loads, a base friction coefficient of 0.4 can be used. Passive earth pressures acting on the side of the footing and buried portion of the foundation stem wall can also be considered for resisting lateral loads. We recommend calculating this lateral resistance using an equivalent fluid weight of 250 pounds per cubic foot (pcf). At perimeter locations, we recommend not including the upper 12 inches of soil in this computation because they can be affected by weather or disturbed by future grading activity. This value assumes the foundation will be constructed neat against competent

native soil or backfilled with structural fill as described in the Site Preparation and Grading section. The recommended passive resistance value includes a safety factor of 1.5.

With spread footing foundations as recommended in this section, maximum total and differential post-construction settlements of one inch and ½ inch, respectively, should be expected.

4.5 Retaining Walls

Based on the site topography, Riley expects that retaining walls may be required to reach the proposed final grade elevation. Riley recommends that Ultrablock walls be used in cut areas and Keystone block walls be used in fill areas for non-building walls to protect the slopes and retaining fills. As an alternative, rockeries may be used in some areas with heights less than 8 feet.

Ultrablock Walls

For protecting cuts and retaining fills, Riley recommends using an Ultrablock wall system. An Ultrablock is a precast concrete block, approximately 2.5 feet by 2.5 feet by 5 feet in size, which weighs approximately 2 tons. The Ultrablock has keys on both top and bottom to interlock each other as a stable uniform wall face. The foundation pad should consist of at least 6 inches of crushed rock on firm soil subgrade. Drainage should also be installed behind the wall face. Riley recommends a maximum wall height of 12.5 feet with a 1:8 (Horizontal: Vertical) batter. The Ultrablock wall installation should follow the manufacturer's recommendations and specifications, which can be found at www.ultrablock.com.

Keystone Block Wall

A Keystone wall, which is a proprietary retaining wall system, can be used to resist lateral earth pressures either as a gravity wall or combined with Geogrid reinforced fill. The system includes manufactured segmental block units designed to be connected to each other by fiberglass pins. We recommend installing Geogrid reinforcement in the structural fill behind the Geogrid. The Geogrid length should not be less than the height of the retaining wall face. We also recommend using granular structural fills compacted to 95 percent of the soil's maximum dry density according to ASTM D-1557. General design details for this construction are shown on Figure 3.

Rockeries

Unlike retaining walls, rockeries are not intended to function as engineered structures to resist lateral earth pressures. The primary function of rockeries is to cover exposed excavated surfaces and thereby retard the erosion process. Individual rockery heights should be limited to 8 feet against cut in dense native soil. The cut slope above the rockery should be graded with a maximum gradient of 2:1 (Horizontal: Vertical). A rockery detail is shown on the attached Figure 4.

The rockery should be constructed by an experienced rockery contractor following guidelines as published by Associated Rockery Contractors (ARC). Rockery backfill should be compacted as structural fill as recommended in the Site Preparation and Grading section. Should rockeries be selected for use on the site, Riley recommends that a geotechnical engineer be present on the site to monitor site work.

4.6 Slab-on-Grade Construction

Once site preparation has been completed as described in the Site Preparation and Grading section, suitable support for slab-on-grade construction should be provided. Riley recommends that the concrete slab be set on top of medium dense native soil or structural fill. Immediately below the floor slab, we recommend placing a four-inch thick capillary break layer of clean, free-draining sand or gravel that has less than five percent passing the No. 200 sieve. This material will reduce the potential for upward capillary movement of water through the underlying soil and subsequent wetting of the floor slab.

Where moisture by vapor transmission is undesirable, an 8 to 10-mil thick plastic membrane should be placed on a 4-inch thick layer of clean gravel. The membrane should be covered with 1 to 2 inches of clean, moist sand to guard against damage during construction and to aid in curing of the concrete.

For the anticipated floor slab loading, we estimate post-construction floor settlements of ¼- to ½-inch. For thickness design of the slab subjected to point loading from storage racks and fork lift vehicle traffic, we recommend using a subgrade modulus (Ks) of 150 pounds per square inch per inch of deflection (pci).

4.7 Drainage

Surface

Final exterior grades should promote free and positive drainage away from the building area. Water must not be allowed to pond or collect adjacent to foundations or within the immediate building area. For non-pavement locations, we recommend providing a minimum drainage gradient of three percent for a minimum distance of ten feet from the building perimeter. In paved locations, a minimum gradient of one percent should be provided unless provisions are included for collection and disposal of surface water adjacent to the structure.

Subsurface

We recommend installing perimeter foundation drains. A typical recommended drain detail is shown on Figure 5. The foundation drains and roof downspouts should be tightlined separately to an approved discharge facility. Subsurface drains must be laid with a gradient sufficient to promote positive flow to a controlled point of approved discharge.

Infiltration

Riley understands that an infiltration system is being considered for the on-site disposal of storm water run-off. Based on the native soil and groundwater conditions, Riley recommends that the proposed infiltration system be installed on the north lot. The infiltration surface should consist of clean gravels and sands with no silt layers. The minimum infiltration depth is 6 feet below finished grade. For preliminary design, an allowable infiltration rate of 2 to 3 inches per hour can be used for system design. This rate must be verified by performing an actual infiltration test before construction.

An impervious soil layer was encountered in the south lot during field exploration; therefore, onsite infiltration on the south lot will be difficult if not impossible. Riley does not recommend infiltration in the south lot.

A geotechnical engineer should observe the infiltration system installation. The infiltration surface should consist of clean sand and gravel. If isolated silt lenses or other unsuitable soils (such as cemented soil layers) are encountered, they should be overexcavated and replaced with gravel.

4.8 Utilities

Utility pipes should be bedded and backfilled in accordance with American Public Works Association (APWA) specifications. For site utilities located within the Snohomish County or City of Mill Creek right-of-ways, bedding and backfill should be completed in accordance with Snohomish County or City of Mill Creek specifications. At a minimum, trench backfill should be placed and compacted as structural fill, as described in the Site Preparation and Grading section. Where utilities occur below unimproved areas, the degree of compaction can be reduced to a minimum of 90 percent of the soil's maximum density as determined by the referenced ASTM standard. As noted, soils excavated on-site will generally be suitable for use as backfill material if the soil's moisture can be properly controlled. A boulder up to 2 feet in diameter was encountered during exploration in test pit TP-5. The contractor should be prepared to break builders if encountered.

4.9 Pavements

Pavement subgrades should be prepared as described in the Site Preparation and Grading section of this report and as discussed below. Regardless of the relative compaction achieved, the subgrade must be firm and relatively unyielding before paving. The subgrade should be proof-rolled with heavy construction equipment to verify this condition.

With the pavement subgrade prepared as described above, we recommend that the general parking area be paved with flexible pavement surface. The following pavement sections are recommended:

- **For heavy truck traffic areas**: 3 inches of asphalt concrete (AC) over 6 inches of crushed rock base (CRB); and

- **For general parking areas**: 2 inches of AC over 4 inches of CRB.

The asphalt paving materials used should conform to the Washington State Department of Transportation (WSDOT) specifications for Class B asphalt concrete and CRB surfacing.

Long-term pavement performance will depend on surface drainage. A poorly-drained pavement section will be subject to premature failure as a result of surface water infiltrating into the subgrade soils, reducing their supporting capability.

For optimum pavement performance, surface drainage gradients of no less than two percent are recommended. Also, some degree of longitudinal and transverse cracking of the pavement surface should be expected over time. Regular maintenance should be planned to seal cracks when they occur.

5.0 ADDITIONAL SERVICES

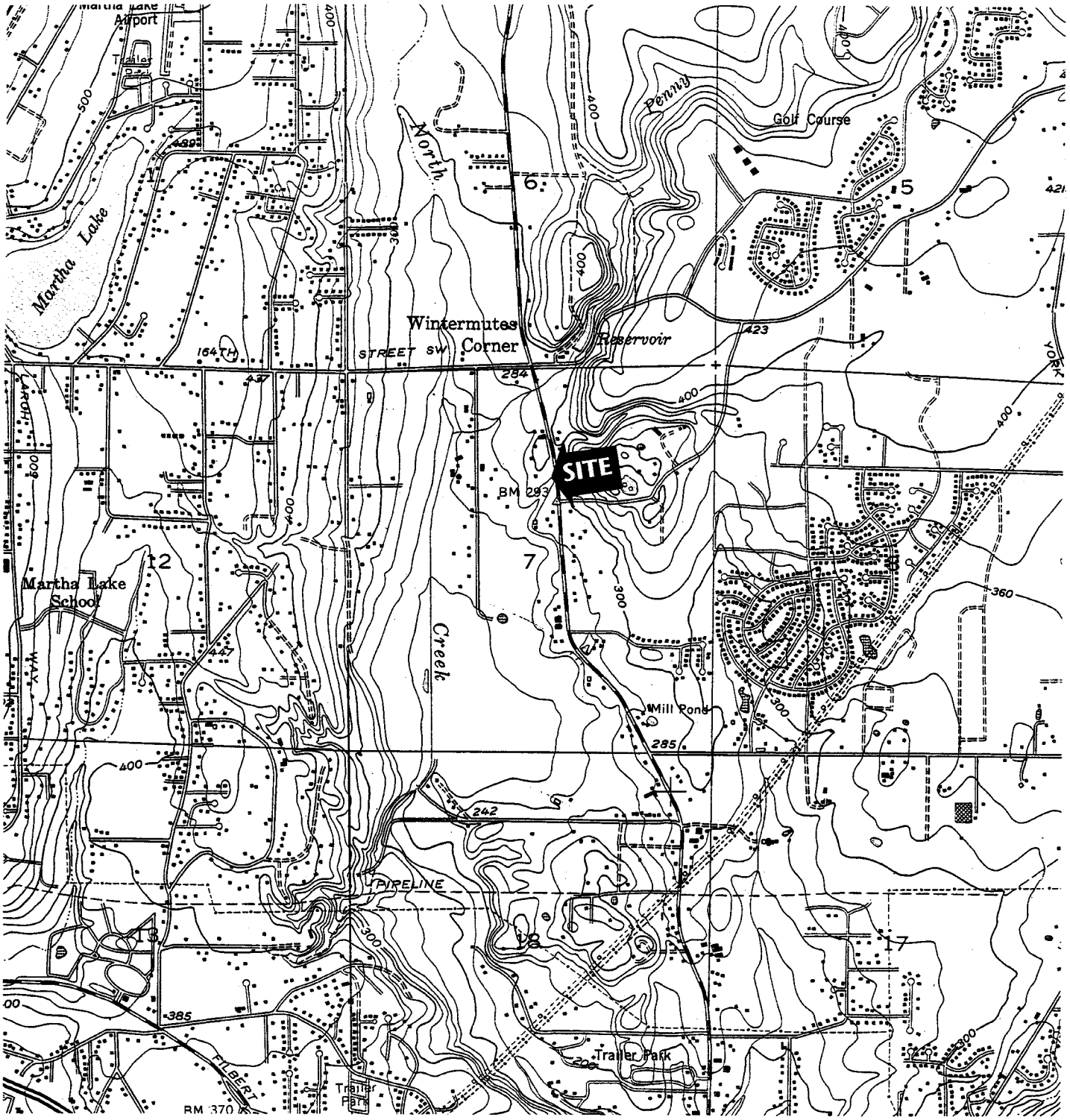
Riley is available to provide further geotechnical consultation as the project design develops. We should review the final design and specifications in order to verify that earthwork and foundation recommendations have been properly interpreted and incorporated into project design and construction.

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

6.0 LIMITATIONS

This report is the property of The Riley Group, Inc., Mill Creek Commons Phase II, LLC, and its designated agents and was prepared in accordance with generally accepted geotechnical engineering practices. This report is intended for specific application to the Seib Property in Mill Creek, Washington, and for the exclusive use of Mill Creek Commons Phase II, LLC and its authorized representatives. No other warranty, expressed or implied, is made.

The analyses and recommendations presented in this report are based upon data obtained from the test pits excavated on-site. Variations in soil conditions can occur, the nature and extent of which may not become evident until construction. If variations appear evident, The Riley Group, Inc. should be requested to reevaluate the recommendations in this report prior to proceeding with construction.



0 1/2 1 mile

approximate graphical scale

SCALE 1: 24 000
CONTOUR INTERVAL 20 FEET

USGS 7.5 MINUTE QUADRANGLE
BOTHELL, WA - PHOTOREVISED 1981

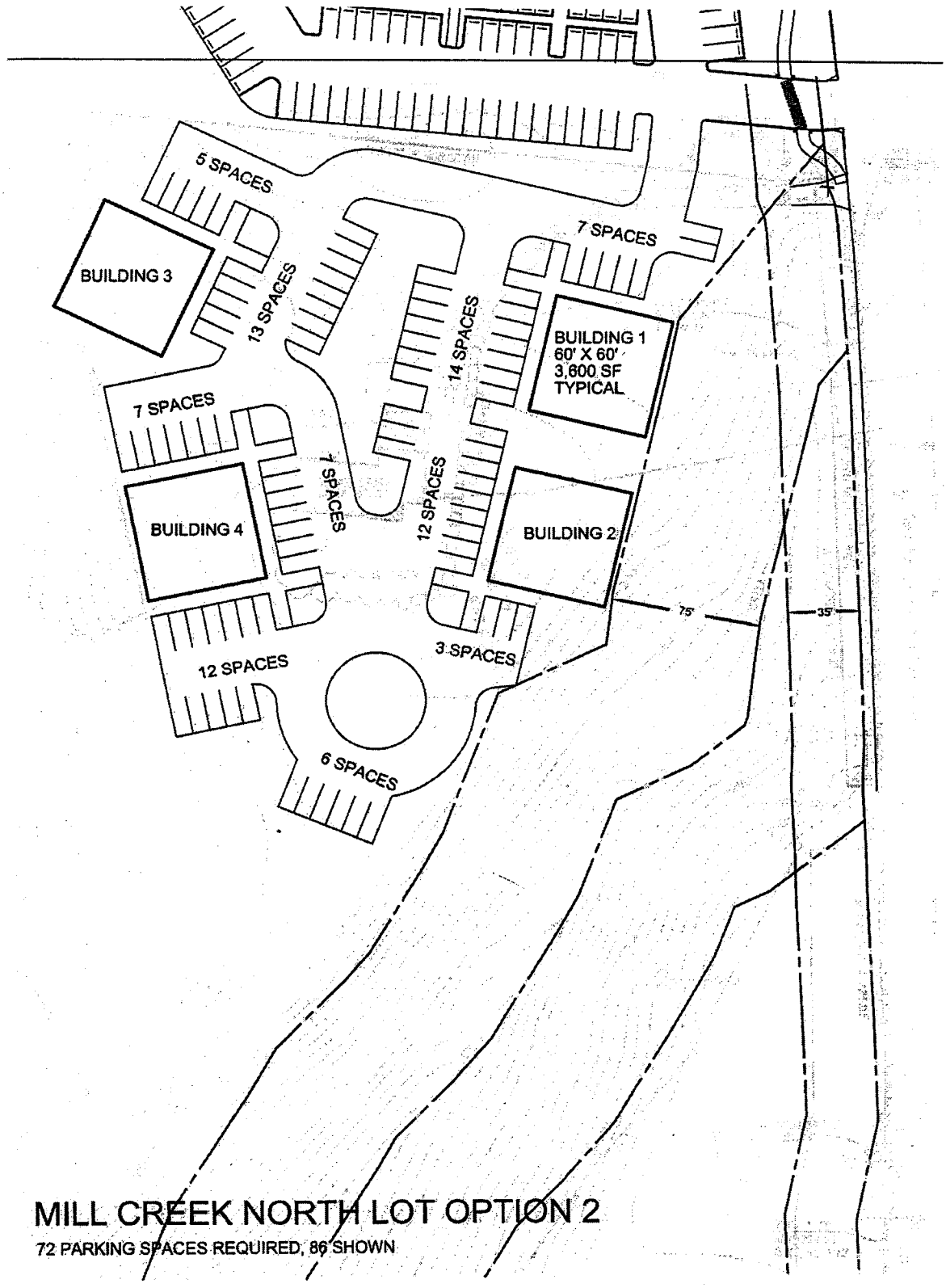
N

The Riley Group, Inc.
17522 BOTHELL WAY NE, SUITE A
BOTHELL, WASHINGTON 98011

Seib Property

Site Vicinity Map | *Figure 1*

Site Address: 16824 Bothell-Everett Hwy, Mill Creek, WA



MILL CREEK NORTH LOT OPTION 2

72 PARKING SPACES REQUIRED, 86 SHOWN

TP-1 Geotechnical test pit location excavated by The Riley Group, Inc. on March 8, 2005.

DRAWING NOT TO SCALE

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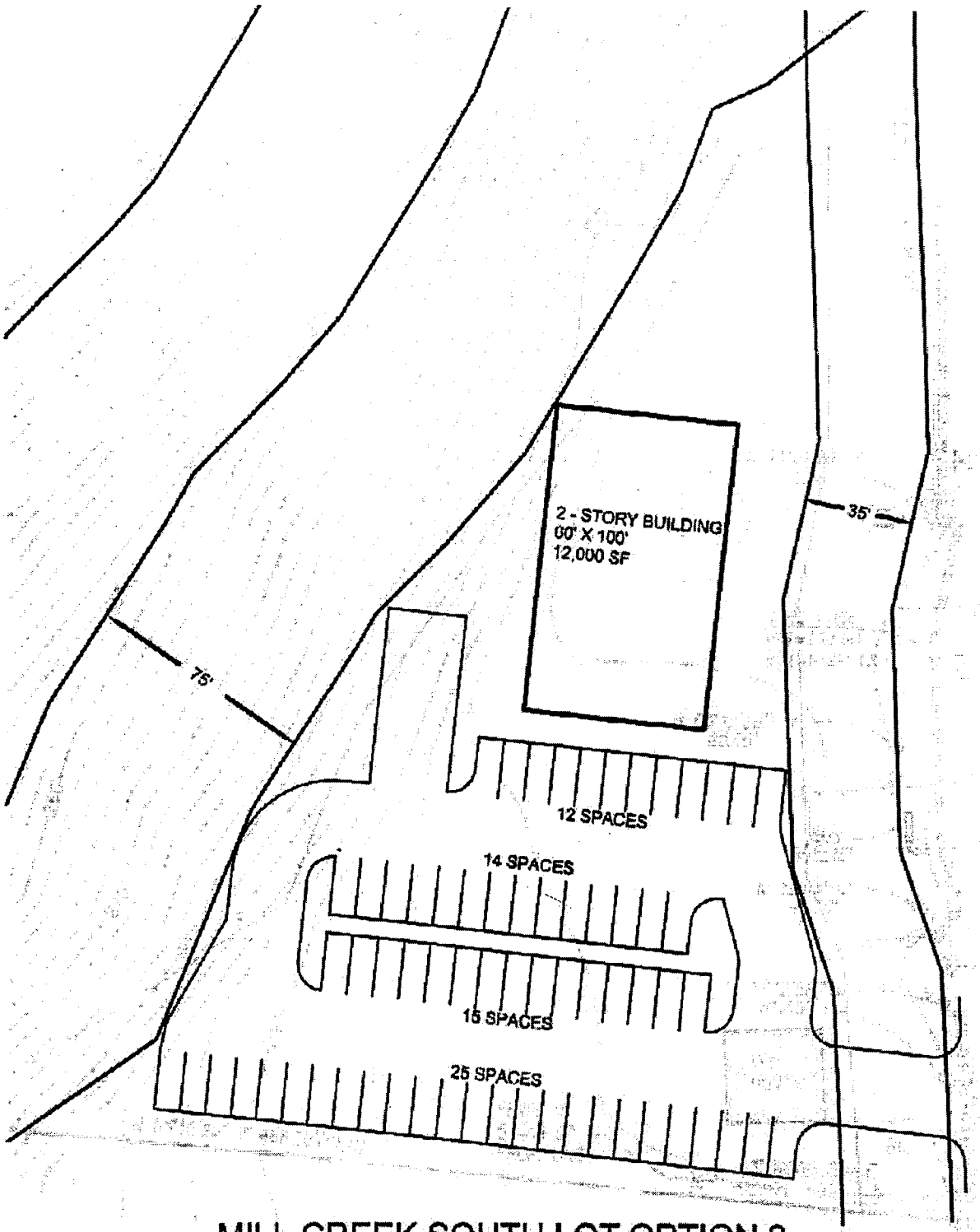
BOTHELL, WASHINGTON 98011

Seib Property - North Lot

Geotechnical Exploration Plan | *Figure 2-1*

Site Address: 16824 Bothell-Everett Hwy, Mill Creek, WA



MILL CREEK SOUTH LOT OPTION 3

60 PARKING SPACES REQUIRED, 66 SHOWN

TP-5 Geotechnical test pit location excavated by The Riley Group, Inc. on March 8, 2005.

DRAWING NOT TO SCALE

N

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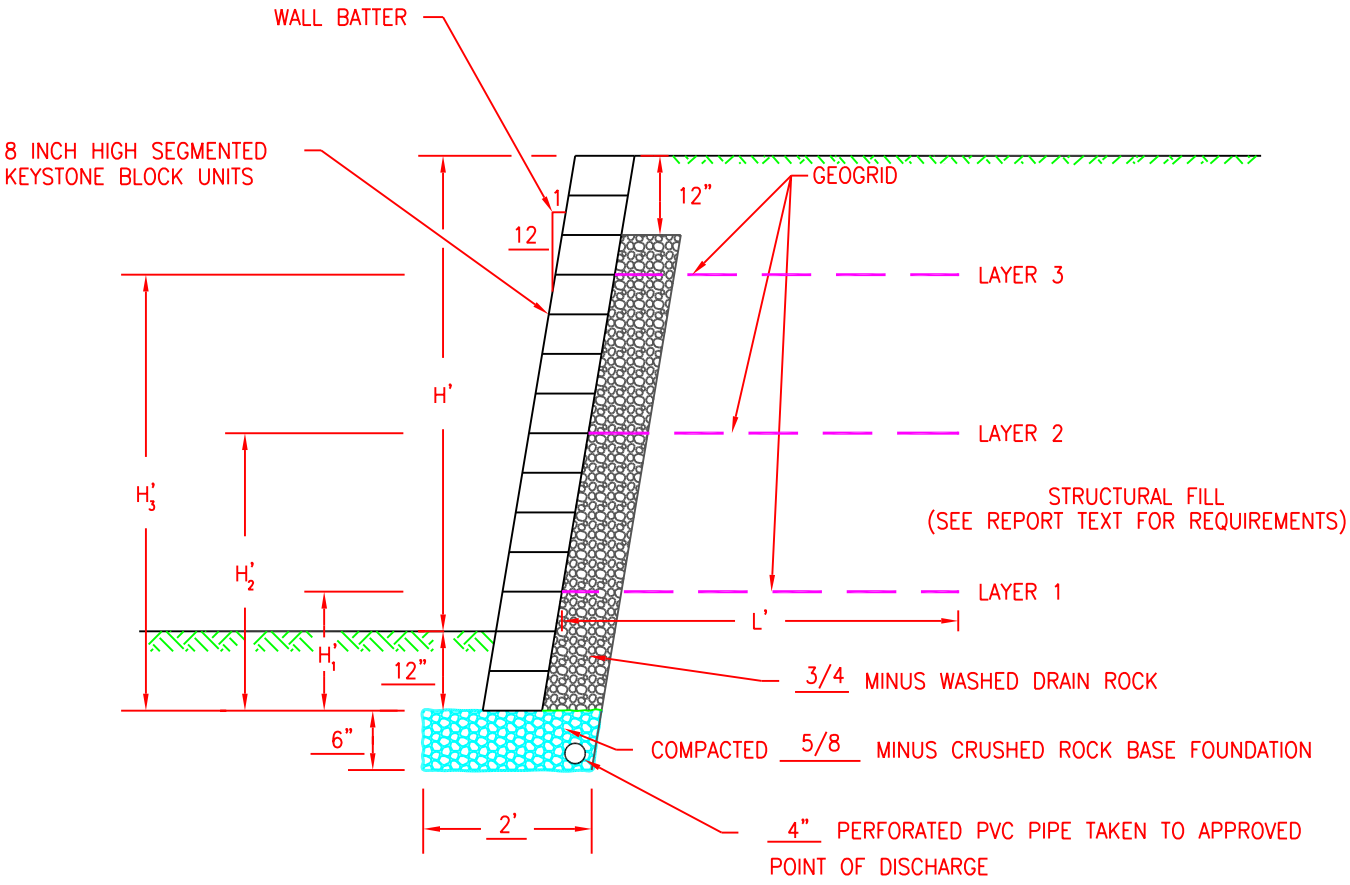
Seib Property - South Lot

Geotechnical Exploration Plan | *Figure 2-2*

Site Address: 16824 Bothell-Everett Hwy, Mill Creek, WA



NOT TO SCALE

NOTES:

1. ALL GEOGRID LAYER HEIGHTS ARE MEASURED FROM TOP OF CRUSHED ROCK BASE FOUNDATION.
2. KEYSTONE™ BLOCK CONSTRUCTION AND CONNECTION OF GEOGRID TO WALL TO BE COMPLETED PER MANUFACTURERS SPECIFICATIONS.

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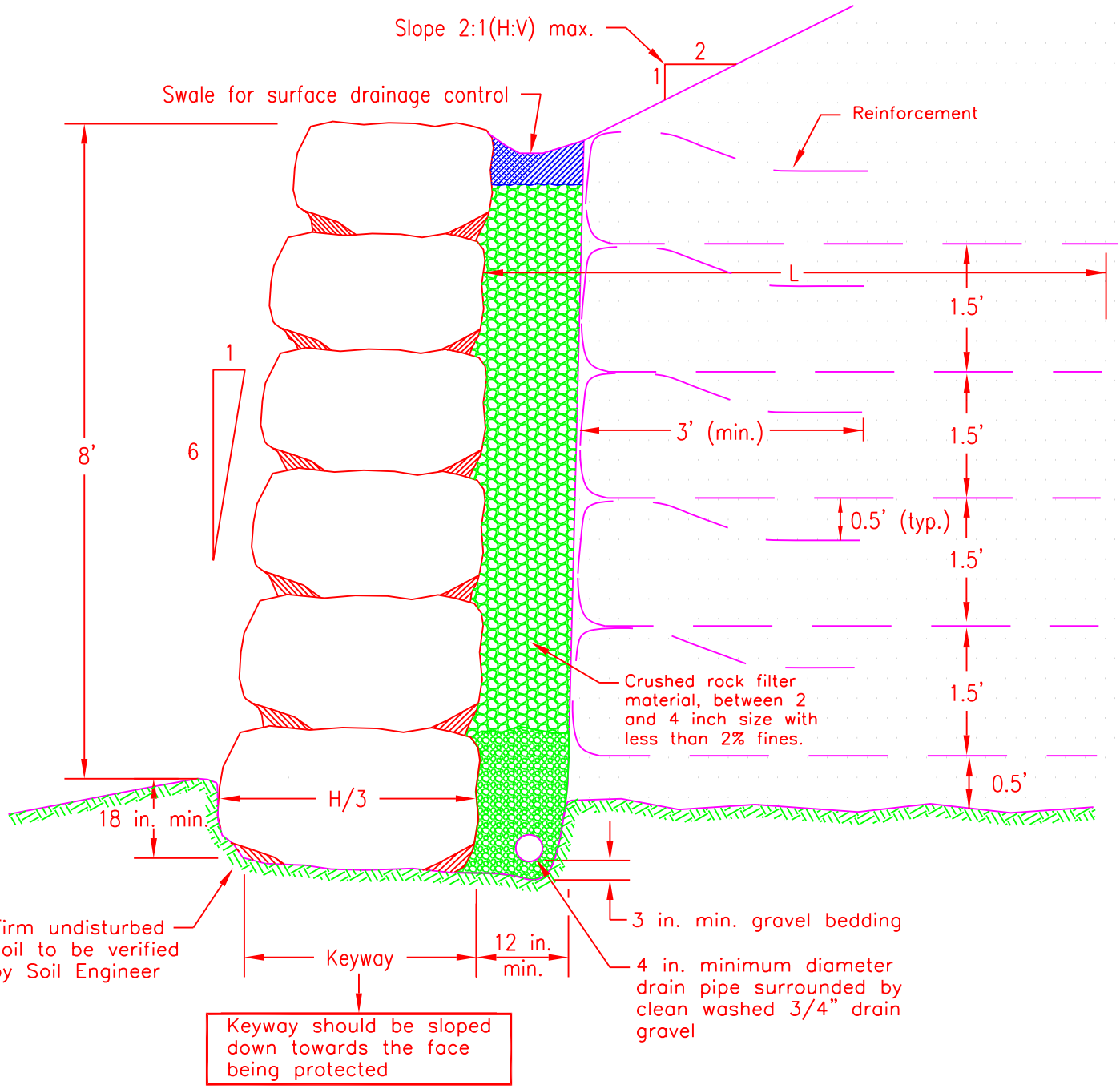
Seib Property

Keystone Wall Section | *Figure 3*

Site Address: 16824 Bothell-Everett Hwy, Mill Creek, WA



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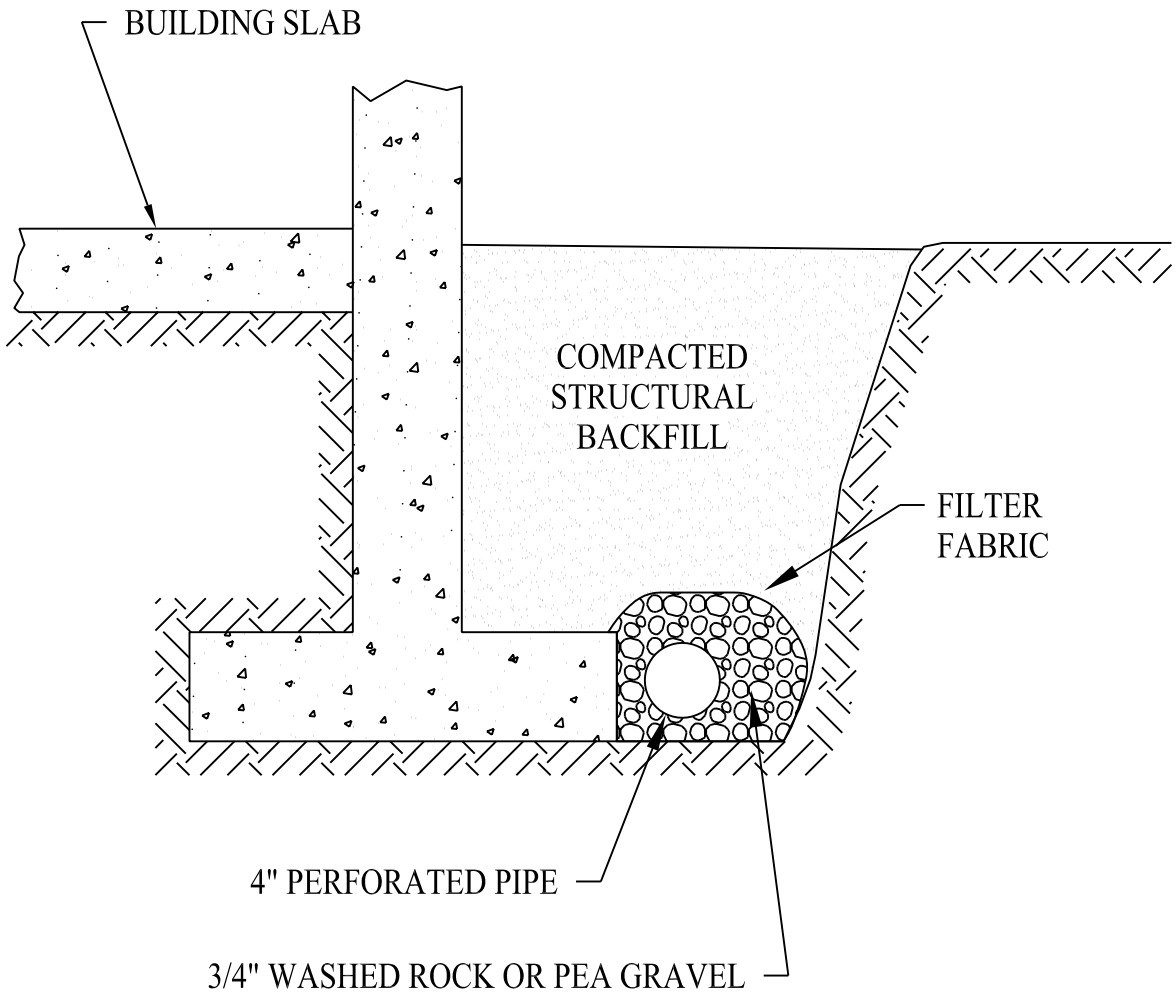
Typical Rockery Section Detail | *Figure 4*

Site Address: 16824 Bothell-Everett Hwy, Mill Creek, WA



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Seib Property

Typical Footing Drain Detail | *Figure 5*

Site Address: 16824 Bothell-Everett Hwy, Mill Creek, WA

APPENDIX A
FIELD EXPLORATION AND LABORATORY TESTING

Seib Property
16824 Bothell-Everett Highway
Mill Creek, Washington

On March 8, 2005, we performed our field exploration using a rubber-tired backhoe. We explored subsurface soil conditions at the site by excavating 9 test pits to a maximum depth of 10 feet below existing grade. The test pit locations are shown on Figure 2. The test pit locations were approximately determined by measurements from existing property lines and paved roads. The Test Pit Logs are presented on Figures A-2 through A-4.

A geologist/engineer from our office conducted the field exploration and classified the soil conditions encountered, maintained a log of each test pit, obtained representative soil samples, and observed pertinent site features. All soil samples were visually classified in accordance with the Unified Soil Classification System (USCS) described on Figure A-1.

Representative soil samples obtained from the test pits were placed in closed containers and taken to our laboratory for further examination and testing. The moisture content of typical sample was measured and is reported on the Test Pit Logs. Grain size analyses were performed on four of the samples, the results of which are shown on Figure A-5 and A-6.

MAJOR DIVISIONS				LETTER SYMBOL	TYPICAL DESCRIPTION
COARSE GRAINED SOILS	More than 50% material larger than No. 200 sieve	GRAVELS More than 50% of coarse fraction is larger than No. 4 sieve	CLEAN GRAVELS <5% fines	GW	Well-graded gravels, gravel-sand mixtures, little or no fines.
				GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines.
			GRAVELS with fines	GM	Silty gravels, gravel-sand-silt mixtures, non-plastic fines.
				GC	Clayey gravels, gravel-sand-clay mixtures, plastic fines.
		SANDS More than 50% of coarse fraction is smaller than No. 4 sieve	CLEAN SANDS <5% fines	SW	Well-graded sands, gravelly sands, little or no fines.
				SP	Poorly-graded sands or gravelly sands, little or no fines.
			SANDS with fines	SM	Silty sands, sand-silt mixtures, non-plastic fines.
				SC	Clayey sands, sand-clay mixtures, plastic fines.
FINE GRAINED SOILS	More than 50% material smaller than No. 200 sieve	SILTS AND CLAYS Liquid limits less than 50%		ML	Inorganic silts, rock flour, clayey silts with slight plasticity.
				CL	Inorganic clays of low to medium plasticity, (lean clay).
				OL	Organic silts and organic clays of low plasticity.
		SILTS AND CLAYS Liquid limits greater than 50%		MH	Inorganic silts, elastic.
				CH	Inorganic clays of high plasticity, (fat clays).
				OH	Organic clays of high plasticity.
HIGHLY ORGANIC SOILS				PT	Peat.

DEFINITION OF TERMS AND SYMBOLS

SAND or GRAVEL

Density	SPT (Blows/Foot)
Very loose	0-4
Loose	4-10
Medium dense	10-30
Dense	30-50
Very dense	>50

SILT or CLAY

Consistency	SPT (Blows/Foot)
Very soft	0-2
Soft	2-4
Medium stiff	4-8
Stiff	8-15
Very stiff	15-30
Hard	>30

- 2" Outside diameter split spoon sampler
- 2.4" Inside diameter ring sampler or Shelby tube
- ▼ Water level (date)

Tr	Torvane reading, tsf
Pp	Penetrometer reading, tsf
DD	Dry density, pcf
LL	Liquid limit, percent
PI	Plasticity index
N	Standard penetration, blows per foot

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Unified Soil Classification System | *Figure A-1*

Site Address: 16824 Bothell-Everett Hwy, Mill Creek, WA

Logged By: JC

Date: 3/8/05

Test Pit No.	Depth (ft)	Soil Description	Sample
TP-1	Surface	6" tree duff, 6" topsoil.	Depth (moisture)
	0.5 - 4	Red brown to gray brown silty sandy GRAVEL, moist, loose to medium dense, (GM).	2.5 ft (6.6%)
	4 - 10	Gray fine SAND with some silt, moist, medium dense to dense, (SM).	5 ft (6.0%) 10 ft (9.8%)
		Bottom of test pit at 10 feet. No groundwater seepage encountered.	
TP-2	Surface	12" tree duff, 8" topsoil.	
	0.5 - 4	Red brown to gray brown sandy GRAVEL with some silt and trace cobbles, moist, loose to medium dense, (GM)	2.5 ft (3.4%)
	4 - 10	Gray fine SAND with some silt, moist, medium dense to dense, (SM).	5 ft (6.3%) 10 ft (8.2%)
		Bottom of test pit at 10 feet. No groundwater seepage encountered.	
TP-3	Surface	2" thick crushed rock cover.	
	0 - 5	Brown silty sandy GRAVEL with some cobbles, moist, loose to medium dense, (GM).	2.5 ft (9.7%)
	5 - 8	Gray SAND with some gravel, silt, and cobbles, moist, medium dense, (SM).	6 ft (5.0%)
	8 - 10	Gray fine SAND with some silt, moist, medium dense, (SM).	10 ft (8.4%)
		Bottom of test pit at 10 feet. No groundwater seepage encountered.	

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Test Pit Logs | *Figure A-2*

Site Address: 16824 Bothell-Everett Highway, Mill Creek, WA

Logged By: JC

Date: 3/8/05

Test Pit No.	Depth (ft)	Soil Description	Sample
TP-4	Surface	Tree and grass covered, 4" topsoil.	Depth (moisture)
	0.5 - 4	Brown silty sandy GRAVEL, moist, loose to medium dense, (GM).	
	4 - 7	Gray fine SAND with some silt, moist, medium dense, (SM).	6 ft (6.5%)
		Bottom of test pit at 7 feet. No groundwater seepage encountered.	
TP-5	Surface	Black berry covered, 8" topsoil.	
	0.5 - 5	Brown silty sandy GRAVEL with some cobbles, one 2' diameter boulder at 2', moist, loose to medium dense, (GM)	2.5 ft (11.5%)
	5 - 7	Gray SILT with trace sand, low plasticity, moist, stiff, (ML).	6 ft (21.7%)
		Bottom of test pit at 7 feet. No groundwater seepage encountered.	
TP-6	Surface	Black berry covered, some garbage on ground.	
	0 - 2.5	Dark gray silty SAND with some gravel, moist, loose to medium dense, (Fill)	2.5 ft (11.8%)
	2.5 - 7	Brown silty sandy GRAVEL with some cobbles, trace boulders, moist, medium dense to dense, (GM).	5 ft (12.0%)
	7 - 10	Gray SILT with trace sand, low plasticity, moist, stiff to very stiff, (ML).	10 ft (28.7%)
		Bottom of test pit at 10 feet. No groundwater seepage encountered.	

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Test Pit Logs | *Figure A-3*

Site Address: 16824 Bothell-Everett Highway, Mill Creek, WA

Logged By: JC

Date: 3/8/05

Test Pit No.	Depth (ft)	Soil Description	Sample
TP-7	Surface	Grass and black berry covered.	Depth (moisture)
	0 - 1.5	Dark brown silty SAND with some gravel, moist, loose, (Fill).	
	1.5 - 5	Brown sandy GRAVEL with some silt and cobbles, moist, medium dense to dense, (GM).	2.5 ft (3.2%) 5 ft (5.0%)
	5 - 10	Gray SILT with interbedded silty fine sand layers, low plasticity, moist, stiff to very stiff, (ML).	7.5 ft (23.9%) 10 ft (26.3%)
		Bottom of test pit at 10 feet. Caving at 3 feet. No groundwater seepage encountered.	
TP-8	Surface	Black berry covered, 8" topsoil.	
	0.5 - 5.5	Brown silty sandy GRAVEL with trace cobbles, moist, medium dense to dense, (GM).	2.5 ft (3.6%)
	5.5 - 7	Gray fine SAND with some silt, moist, medium dense, (SM).	
	7 - 10	Gray SILT with some sand, low plasticity, moist, stiff, (ML).	7.5 ft (20.2%)
		Bottom of test pit at 10 feet. No groundwater seepage encountered.	
TP-9	Surface	Tree and gravel covered.	
	0 - 3	Brown silty sandy GRAVEL, moist, loose to medium dense, (GM).	2.5 ft (2.6%)
	3 - 7	Gray fine SAND with some silt, moist, medium dense, (SM).	5 ft (6.7%)
		Bottom of test pit at 7 feet. No groundwater seepage encountered.	

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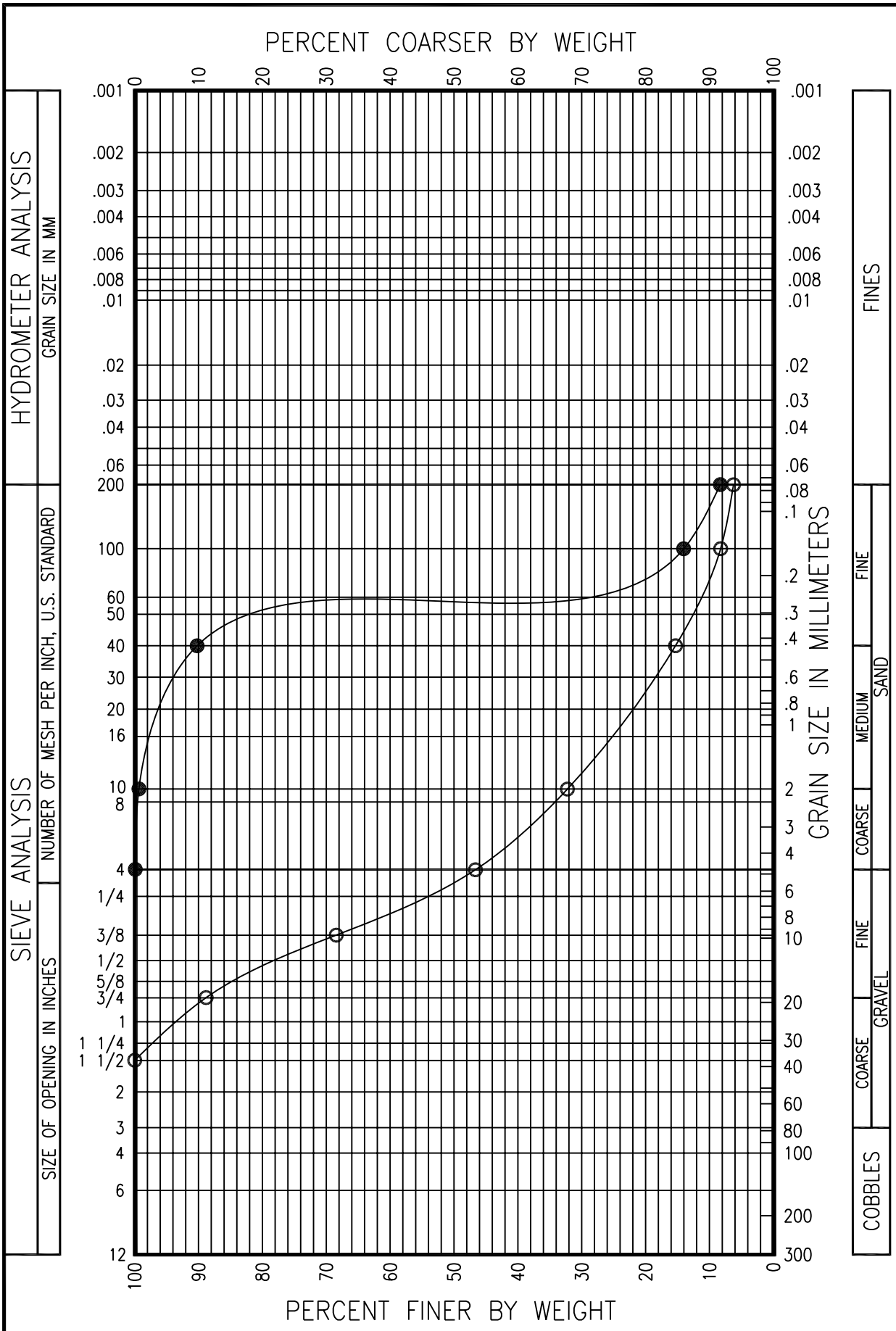
Test Pit Logs | *Figure A-4*

Site Address: 16824 Bothell-Everett Highway, Mill Creek, WA



Key	Boring or Test Pit	Depth (ft.)	USCS	Description	Moisture Content (%)	LL	PL
○	TP-3	2.5	GM	Sandy GRAVEL with some silt	9.7		
●	TP-3	10	SM	SAND with some silt	8.4		

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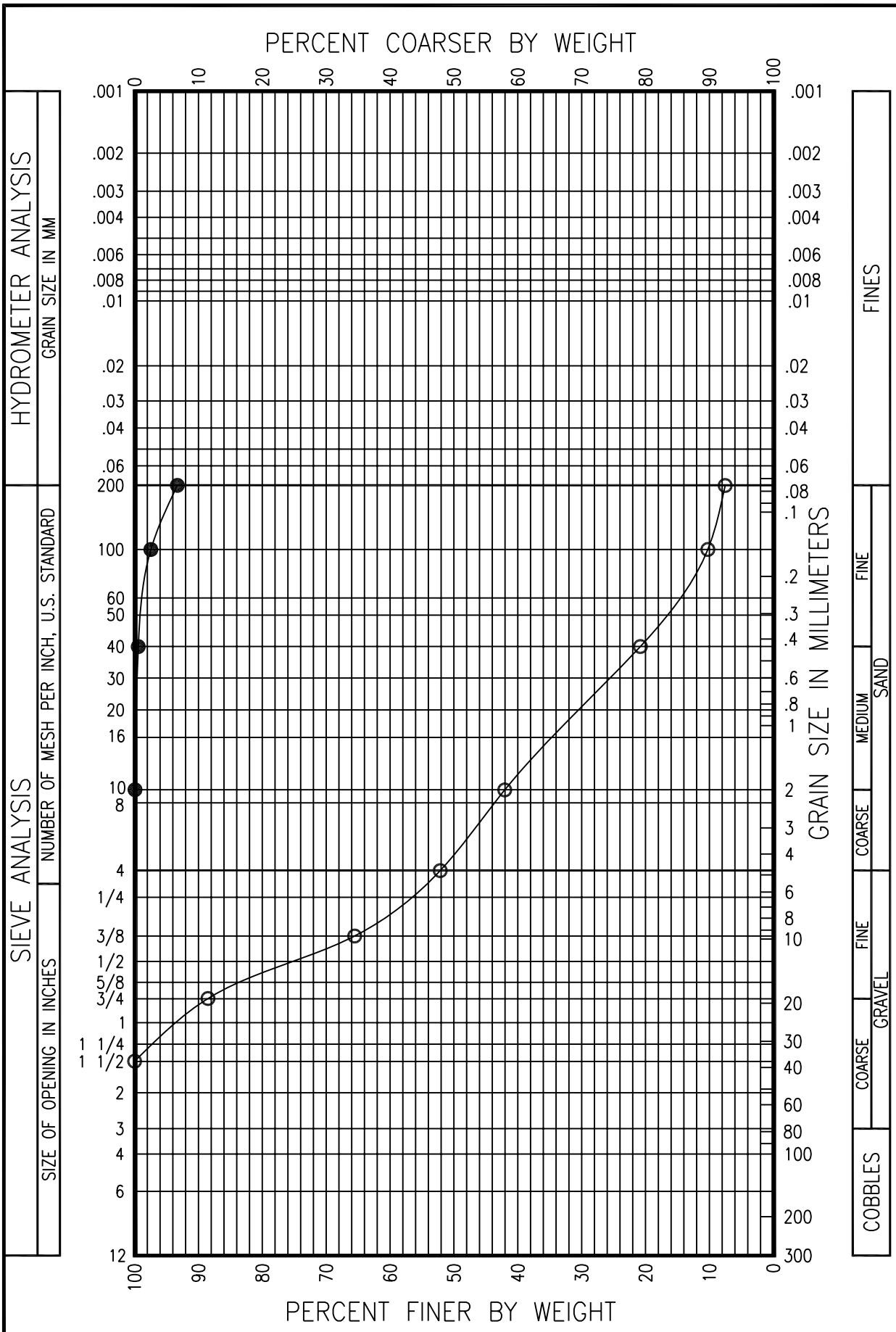
Grain Size Analysis | *Figure A-5*

Site Address: 16824 Bothell-Everett Hwy, Mill Creek, WA



Key	Boring or Test Pit	Depth (ft.)	USCS	Description	Moisture Content (%)	LL	PL
○	TP-6	2.5	GM	Sandy GRAVEL with some silt	11.8		
●	TP-6	10	ML	SILT with trace sand	28.7		

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Grain Size Analysis | *Figure A-6*

Site Address: 16824 Bothell-Everett Hwy, Mill Creek, WA