CRITICAL AREAS EVALUATION AND PRELIMINARY GEOTECHNICAL ENGINEERING REPORT

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RGI PROJECT NO. 2015-046

CRITICAL AREAS EVALUATION AND
PRELIMINARY GEOTECHNICAL ENGINEERING REPORT

BERGSMA PROPERTY
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APRIL 1, 2015

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April 1, 2015

Mr. Jim Tosti
Windward Real Estate Services, Inc.
335 Park Place Center, Suite G119
Kirkland, Washington 98033

Subject: **Critical Areas Evaluation and Preliminary Geotechnical Engineering Report**
Bergsma Property
Southeast Newport Way and 17th Avenue Northwest
Issaquah, Washington 98072
RGI Project No. 2015-046

Dear Mr. Tosti:

As requested, The Riley Group, Inc. (RGI) has prepared this Critical Areas Evaluation and Preliminary Geotechnical Engineering Report (GER) for the above-referenced site. Our services were completed in accordance with our proposal PRP2015-072 dated March 18, 2015 and authorized by you on the same day. The information in this GER is based on our understanding of the proposed construction, and the soil and groundwater conditions encountered in the test pits completed by Geotechnical Investigation Group performed at the site on November 8, 2007.

RGI recommends the project plans and specifications be submitted for a general review so that RGI may confirm that the recommendations in this GER are interpreted and implemented properly in the construction documents. RGI also recommends that a representative of our firm be present on site during portions of the project construction to confirm that the soil and groundwater conditions are consistent with those that form the basis for the engineering recommendations in this GER.

If you have any questions or require additional information, please contact us.

Respectfully submitted,

THE RILEY GROUP, INC.

RICKY RUNQI WANG
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4/1/2015

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Executive Summary

This Executive Summary should be used in conjunction with the entire GER for design and/or construction purposes. It should be recognized that specific details were not included or fully developed in this section, and this GER must be read in its entirety for a comprehensive understanding of the items contained herein. Section 7.0 should be read for an understanding of limitations.

RGI's geotechnical scope of work included a site evaluation and review of the Slope Stability Analysis for Bergsma Plat, prepared by Geotechnical Testing Laboratory, Inc. dated December 12, 2007.

Based on our site evaluation and review of subsurface exploration analysis performed in the referenced reports, the site is suitable for development of the proposed project. The following geotechnical considerations were identified.

Soil Conditions: The majority of the site is underlain by 1 to 2 feet of loose to medium dense silty sand to sandy silt over medium dense to dense silty sand with gravel and moderately cemented silt. Areas of interbedded silt and clay and sand with gravel were also observed.

Groundwater: Groundwater seepage was not encountered during the previous field explorations.

Geological Hazard Areas: The site contains steep slopes and potential landslide hazard areas. Based on our review of the slope stability analysis and our recent site visit, the existing slopes are in stable condition. The slope buffer can be reduced to 10 feet from the top of the steep slopes. The building setback should be maintained at 15 feet from the slope buffer.

Foundations: Foundations for the proposed residences can be supported on conventional continuous and spread footings bearing on medium dense to dense native soil or new structural fill.

Slab-on-grade: Slab-on-grade floors can be supported on medium dense to dense native soil or new structural fill.

Pavements: The following flexible pavement sections are recommended:

- **Private driveway**: 2 inches of AC over 6 inches of Crushed Rock Base (CRB) over compacted subgrade
- **Public roadway**: 3 inches AC over 9 inches of CRB over compacted subgrade

1.0 Introduction

This Critical Areas Evaluation and Preliminary Geotechnical Engineering Report (GER) presents the results of the geotechnical engineering services provided for the proposed Bergsma Property in Issaquah, Washington. The purpose of this GER is to review the subsurface soils and analysis performed by others and provide an evaluation of the critical areas including erosion and landslide hazard areas and steep slope located on portions of the property. Preliminary geotechnical recommendations for the construction of 78 single-family residences and associated access roadways are also provided. Our scope of services included field evaluation and review of existing reports, and preparation of this GER.

The recommendations in the following sections of this GER are based upon our current understanding of the proposed site development as outlined below. RGI should review the proposed site grading and utility plans once they are developed in order to confirm the recommendations provided in this report are appropriate for the development as proposed. In addition, RGI requests to review the final site grading plans 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 Project Description

The site is located east of Southeast Newport Way north of the intersection with 17th Avenue Northwest in Issaquah, Washington. The approximate location of the site is shown on Figure 1. The site is currently undeveloped.

RGI understands that the client plans to purchase the site and develop it into 76 single-family residential lots. Our understanding of the project is based on the site plan prepared by PACE dated March 16, 2015.

Based on the site plan provided, access to the site will be provided by two new roadways. One roadway is shown extending from Southeast Newport Way and the other from an access tract owned by the City of Issaquah in Talus Division 5-C that also provides access to the City of Issaquah water tower. RGI expects that grading for the proposed lots and access roadways will require up to 15 feet of cut/fill to reach the final grade. Some lots may be terraced for daylight basement structures.

Based on our experience with similar construction, RGI anticipates that the proposed residential buildings will be 2- to 3-story, wood-framed structures supported on perimeter walls with bearing loads of 2 to 3 kips per linear foot, and a series of columns with a maximum load up to 100 kips. Slab-on-grade floor loading of 150 pounds per square foot (psf) are expected for garage or basement slabs.

3.0 Field Exploration and Laboratory Testing

The field exploration was performed as part of the previous slope stability analysis contained in Appendix B on November 8, 2007. The exploration program included 18 test pits to a maximum depth of 18 feet bgs. The approximate exploration locations are shown on Figure 2.

The test pit logs are included in Appendix A. Direct shear tests were performed on several samples and the results are included in Appendix A.

4.0 Site Conditions

4.1 SURFACE

The site is an irregular-shaped land, including seven tax parcels with a total area about 46 acres in size. The site is bound to the north and west by undeveloped property, to the east by Southeast Newport Way, and to the south by the Talus residential development and a water tank owned by the City of Issaquah.

The site is a vacant and covered by trees and other vegetation. The site slopes down to the north and east with an overall elevation difference of about 300 feet. The proposed development is located on the top of two ridges located on the southeastern portion of the property. The two ridges are divided by a valley with the wetland located at the base. The side slopes from the development area to the wetland are on the order of 20 to over 40 percent slopes with gradients increasing to the lower portions of the property. The majority of the developed portion of the property contains slopes in the 10 to 25 percent range. The slopes below the proposed development area are steep slopes with slope gradients over 40 percent in several areas.

4.2 GEOLOGY

Review of the *Geologic Map of King County, Washington* by Derek Booth, etc, (2002) indicates that the soil in the project vicinity consists of Transitional beds (Pleistocene) (Map Unit Qtb) in eastern portion of the site and till (Qvt) in the western portion of the site. Transitional beds include laminated to massive silt, clayey silt, and silty clay deposited in lowlands or proglacial lakes. Till is compact diamict containing subrounded to well-rounded clasts, glacially transported and deposited. The native soils encountered below the site appear to be consistent with the descriptions of the geology map.

4.3 SOILS

Based on the test pit logs provided as part of previous work completed on the site, the majority of the site is underlain by 1 to 2 feet of loose to medium dense silty sand to sandy silt over medium dense to dense silty sand with gravel and moderately cemented silt. Areas of interbedded silt and clay and sand with gravel were also observed.

More detailed descriptions of the subsurface conditions encountered are presented in the test pits are included in Appendix A.

4.4 GROUNDWATER

Groundwater seepage was not encountered during the previous field exploration to a maximum depth of 18 feet bgs. The static groundwater table is most likely deeper than the bottom of the exploration depth. However, perched seepage may be encountered above the silt layers encountered across the site.

It should be recognized that fluctuations of the groundwater table will occur due to seasonal variations in the amount of rainfall, runoff, and other factors not evident at the time the explorations were performed. In addition, perched water can develop within seams and layers contained in fill soils or higher permeability soils overlying less permeable soils following periods of heavy or prolonged precipitation.

4.5 SEISMIC CONSIDERATIONS

Based on the 2012 International Building Code (IBC), RGI recommends the follow seismic parameters in Table 1 be used for design.

Table 1 IBC Seismic Parameters

2012 IBC Parameter	Value
Site Soil Class[1]	D[2]
Site Latitude	47.54263 N
Site Longitude	122.06845 W
Maximum considered earthquake spectral response acceleration parameters (g)	S_s =1.334, S_1 =0.505
Spectral response acceleration parameters adjusted for site class (g)	S_{ms} =1.334, S_{m1} =0.757
Design spectral response acceleration parameters (g)	S_{ds} =0.889, S_{d1} =0.505

1 Note: In general accordance with the USGS *2012 International Building Code*. IBC Site Class is based on the average characteristics of the upper 100 feet of the subsurface profile.

2 Note: The *2012 International Building Code* requires a site soil profile determination extending to a depth of 100 feet for seismic site classification. The current scope of our services does not include the required 100 foot soil profile determination. Test borings extended to a maximum depth of 18 feet, and this seismic site class definition considers that hard soil continues below the maximum depth of the subsurface exploration.

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.

RGI 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 site is underlain by stiff to dense soil and a deep groundwater table, RGI considers that the possibility of liquefaction during an earthquake is minimal.

4.6 GEOLOGIC HAZARD AREAS

RGI reviewed the City of Issaquah Municipal Codes (IMC) Critical Areas Regulations. The review indicates that the site is mapped as landslide hazard area (18.10.560) and steep slope hazard area (18.10.580) due to site topography, soil conditions and slope gradients on the site. The site is subject to severe erosion and potential landslides when slopes are cleared. Based on the previous explorations and the definition contained in the IMC, only the greater than 40 percent slopes would be considered landslide hazard areas. The setbacks provided below are for slope areas greater than 40 percent.

4.6.1 SITE RECONNAISSANCE

On March 16, 2015, RGI's geotechnical engineer and geologist performed a site reconnaissance to evaluate the stability of the site slope. During our field observations, we did not find any signs such as rotating slope, tension cracks or expose slope surface indicating previous major landslide activities. No seeps or springs were observed on the slope face. However, we have found two fallen trees on the edge of the steep slope in the middle portion of the site that has causes some ground disturbance. Localized hummocky terrain was observed that may be indicative of past shallow debris flow failures. Several trees with curved trucks were observed that is consistent with surficial creep. Much of the slope is heavily vegetated with mature trees and undergrowth, reducing the potential of shallow debris flow failures. Based on our observations, the slopes appear to be stable in their current configuration and condition.

4.6.2 SLOPE STABILITY ANALYSIS

RGI reviewed the slope stability analysis performed by Geotechnical Testing Laboratory attached in Appendix A. Five cross sections through the middle of the site in the proposed development were produced to model the existing slope and the effects of the proposed development. Soil parameters were based on laboratory test results from the test pits excavated in November 2007.

The analysis indicates that safety factors of over 1.1 were obtained for the existing slope against deep-seated, rotational failures after construction under seismic condition. These safety factors met the typical requirements used in the region. The proposed development will not have any impact to slope stability if the recommendations in this report are incorporated into the project design and construction.

4.6.3 Slope Setbacks

Based on our observations and review of the slope stability analysis, the existing steep slopes are stable in their present configuration and condition. Based on section 18.10.580 of the IMC, RGI recommends that the standard 50-foot buffer be reduced to a 10-foot undisturbed buffer with the additional 15-foot building setback for slopes greater than 40 percent. Based on the topography of the site, the proposed development area is located in areas of slopes with inclinations of 10 to 25 percent with the steeper slopes located on the perimeter of the development.

5.0 Discussion and Recommendations

5.1 Geotechnical Considerations

Based on our study, the site is suitable for the proposed construction from a geotechnical standpoint. The main geotechnical concern for the development is the proximity of steep slopes and potential landslide hazards downslope of the proposed development.

In order to avoid destabilization of the slope and to reduce the potential for landslides, the site development should minimize the site disturbance and grading near the steep slope areas. RGI recommends that fills be minimized near the tops of steep slopes. The proposed buildings should be 25 feet (combination of buffer and setback) away from the top of the slopes with gradients greater than 40 percent. Surface water should be directed away from the steep slopes.

RGI recommends that foundations for the proposed building be supported on conventional spread footings bearing on medium dense/stiff native soil or new structural fill if needed. Slab-on-grade floors and pavement section can be similarly supported on medium dense/stiff native soil or structural fill.

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.

5.2 Earthwork

A grading plan was not provided at the time this report was written, however RGI expects that a significant amount of site grading will be needed to achieve building and pavement grades and excavation for utilities including storm, water, sanitary sewer, and other utilities. Once a grading plan has been prepared, RGI should review the plan for potential impacts to the steep slopes and landslide hazard areas.

Due to moisture sensitive nature of the native soils, RGI recommends earthwork take place in the dryer summer months. We do not expect significant groundwater will be encountered if the construction occurs during the dry season (June through September) but the contractor should be prepared for seepage in excavations if the construction occurs in the winter or spring months.

5.2.1 EROSION AND SEDIMENT CONTROL

Potential sources or causes of erosion and sedimentation depend on construction methods, slope length and gradient, amount of soil exposed and/or disturbed, soil type, construction sequencing and weather. The impacts on erosion-prone areas can be reduced by implementing an erosion and sedimentation control plan. The plan should be designed in accordance with applicable city and/or county standards.

RGI recommends the following erosion control Best Management Practices (BMPs):

- Scheduling site preparation and grading for the drier summer and early fall months and undertaking activities that expose soil during periods of little or no rainfall
- Establishing a quarry spall construction entrance
- Installing siltation control fencing or anchored straw or coir wattles on the downhill side of work areas
- Covering soil stockpiles with anchored plastic sheeting
- Revegetating or mulching exposed soils with a minimum 3-inch thickness of straw if surfaces will be left undisturbed for more than one day during wet weather or one week in dry weather
- Directing runoff away from exposed soils and slopes
- Minimizing the length and steepness of slopes with exposed soils and cover excavation surfaces with anchored plastic sheeting (Graded and disturbed slopes should be tracked in place with the equipment running perpendicular to the slope contours so that the track marks provide a texture to help resist erosion and channeling. Some sloughing and raveling of slopes with exposed or disturbed soil should be expected.)
- Decreasing runoff velocities with check dams, straw bales or coir wattles
- Confining sediment to the project site
- Inspecting and maintaining erosion and sediment control measures frequently (The contractor should be aware that inspection and maintenance of erosion control BMPs is critical toward their satisfactory performance. Repair and/or replacement of dysfunctional erosion control elements should be anticipated.)

Permanent erosion protection should be provided by reestablishing vegetation using hydroseeding and/or landscape planting. Until the permanent erosion protection is established, site monitoring should be performed by qualified personnel to evaluate the effectiveness of the erosion control measures. Provisions for modifications to the erosion control system based on monitoring observations should be included in the erosion and sedimentation control plan.

5.2.2 Stripping

Stripping efforts should include removal of pavements, vegetation, organic materials, and deleterious debris from areas slated for building, pavement, and utility construction. The borings encountered 6 to 12 inches of topsoil and rootmass. Deeper areas of stripping may be required in forested or heavily vegetated areas of the site.

5.2.3 Excavations

All temporary cut slopes associated with the site and utility excavations should be adequately inclined to prevent sloughing and collapse. The native soil is classified as Group B soil.

Accordingly, for excavations more than 4 feet but less than 20 feet in depth, the temporary side slopes should be laid back with a minimum slope inclination of 1H:1V (Horizontal:Vertical). If there is insufficient room to complete the excavations in this manner, or excavations greater than 20 feet in depth are planned, using temporary shoring to support the excavations should be considered.

For open cuts at the site, RGI recommends:

- No traffic, construction equipment, stockpiles or building supplies are allowed at the top of cut slopes within a distance of at least 5 feet from the top of the cut
- Exposed soil along the slope is protected from surface erosion using waterproof tarps and/or plastic sheeting
- Construction activities are scheduled so that the length of time the temporary cut is left open is minimized
- Surface water is diverted away from the excavation
- The general condition of slopes should be observed periodically by a geotechnical engineer to confirm adequate stability and erosion control measures

In all cases, however, appropriate inclinations will depend on the actual soil and groundwater conditions encountered during earthwork. Ultimately, the site contractor must be responsible for maintaining safe excavation slopes that comply with applicable OSHA or WISHA guidelines.

5.2.4 Site Preparation

RGI anticipates that some areas of loose or soft soil will be exposed upon completion of stripping and grubbing. Proofrolling and subgrade verification should be considered an essential step in site preparation. After stripping, grubbing, and prior to placement of structural fill, RGI recommends proofrolling building and pavement subgrades and areas to receive structural fill. These areas should be proofrolled under the observation of RGI and compacted to a firm and unyielding condition in order to achieve a minimum compaction level of 95 percent of the modified proctor maximum dry density as determined by the American Society of Testing and Materials D1557-09 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (ASTM D1557).

Proofrolling and adequate subgrade compaction can only be achieved when the soils are within approximately ± 2 percent moisture content of the optimum moisture content. Soils that appear firm after stripping and grubbing may be proofrolled with a heavy compactor, loaded double-axle dump truck, or other heavy equipment under the observation of an RGI representative. This observer will assess the subgrade conditions prior to filling. The need for or advisability of proofrolling due to soil moisture conditions should be determined at the time of construction. In wet areas it may be necessary to hand probe the exposed subgrades in lieu of proofrolling with mechanical equipment.

If fill is placed in areas of the site where existing slopes are steeper than 5:1 (Horizontal:Vertical), the area should be benched to reduce the potential for slippage between existing slopes and fills. Benches should be wide enough to accommodate compaction and earth moving equipment, and to allow placement of horizontal lifts of fill. A slope fill detail is shown on Figure 3.

Subgrade soils that become disturbed due to elevated moisture conditions should be overexcavated to reveal firm, non-yielding, non-organic soils and backfilled with compacted structural fill. In order to maximize utilization of site soils as structural fill, RGI recommends that the earthwork portion of this project be completed during extended periods of warm and dry weather if possible. If earthwork is completed during the wet season (typically November through May) it will be necessary to take extra precautionary measures to protect subgrade soils. Wet season earthwork will require additional mitigative measures beyond that which would be expected during the drier summer and fall months.

5.2.5 STRUCTURAL FILL

RGI recommends fill below the foundation and floor slab, behind retaining walls, and below pavement and hardscape surfaces be placed in accordance with the following recommendations for structural fill.

The suitability of excavated site soils and import soils for compacted structural fill use will depend on the gradation and moisture content of the soil when it is placed. As the amount of fines (that portion passing the U.S. No. 200 sieve) increases, soil becomes increasingly sensitive to small changes in moisture content and adequate compaction becomes more difficult or impossible to achieve. Soils containing more than about 5 percent fines cannot be consistently compacted to a dense, non-yielding condition when the moisture content is more than 2 percent above or below optimum. Optimum moisture content is that moisture that results in the greatest compacted dry density with a specified compactive effort.

Non-organic site soils are only considered suitable for structural fill provided that their moisture content is within about 2 percent of the optimum moisture level as determined by ASTM D1557. Excavated site soils may not be suitable for re-use as structural fill depending on the moisture content and weather conditions at the time of construction. If soils are stockpiled for future reuse and wet weather is anticipated, the stockpile should be protected with plastic sheeting that is securely anchored. Even during dry weather, moisture conditioning (such as, windrowing and drying) of site soils to be reused as structural fill may be required. Even during the summer, delays in grading can occur due to excessively high moisture conditions of the soils or due to precipitation. If wet weather occurs, the upper wetted portion of the site soils may need to be scarified and allowed to dry prior to further earthwork, or may need to be wasted from the site.

The native soil contains a large percentage of fines and is moisture sensitive, it may necessary to import structural fill if the construction occurs in wet season. Import structural fill should meet the gradation requirements listed in Table 2 for wet weather conditions. For dry season earthwork, the percent passing the No. 200 may be increased to 10 percent maximum or materials meeting the 2012 Washington State Department of Transportation (WSDOT) Standard Specifications for Road, Bridge, and Municipal Construction, Section 9-03.14(1) may be used.

Table 2 Structural Fill Gradation

U.S. Sieve Size	Percent Passing
4 inches	100
No. 4 sieve	75 percent
No. 200 sieve	5 percent *

*Based on minus 3/4 inch fraction.

Prior to use, an RGI representative should observe 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 as specified in Table 3. The soil's maximum density and optimum moisture should be determined by American Society of Testing and Materials D1557-09 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (ASTM D1557).

Table 3 Structural Fill Compaction ASTM D1557

Location	Material Type	Minimum Compaction Percentage	Moisture Content Range	
Foundations	On-site granular or approved imported fill soils:	95	+2	-2
Retaining Wall Backfill	On-site granular or approved imported fill soils:	92	+2	-2
Slab-on-grade	On-site granular or approved imported fill soils:	95	+2	-2
General Fill (non-structural areas)	On-site soils or approved imported fill soils:	90	+3	-2
Pavement – Subgrade and Base Course	On-site granular or approved imported fill soils:	95	+2	-2

Placement and compaction of structural fill should be observed by RGI. A representative number of in-place density tests should be performed as the fill is being placed to confirm that the recommended level of compaction is achieved.

5.2.6 CUT AND FILL SLOPES

All permanent cut and fill slopes should be graded with a finished inclination no greater than 2H:1V. 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 slopes must promote surface drainage away from the 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. All fill placed for slope construction should meet the structural fill requirements as described in Section 5.2.5.

5.2.7 WET WEATHER CONSTRUCTION CONSIDERATIONS

RGI recommends that preparation for site grading and construction include procedures intended to drain ponded water, control surface water runoff, and to collect shallow subsurface seepage zones in excavations where encountered. It will not be possible to successfully compact the subgrade or utilize on-site soils as structural fill if accumulated water is not drained prior to grading or if drainage is not controlled during construction. Attempting to grade the site without adequate drainage control measures will reduce the amount of on-site soil effectively available for use, increase the amount of select import fill materials required, and ultimately increase the cost of the earthwork phases of the project. Free water should not be allowed to pond on the subgrade soils. RGI anticipates that the use of berms and shallow drainage ditches, with sumps and pumps in utility trenches, will be required for surface water control during wet weather and/or wet site conditions.

5.3 FOUNDATIONS

Following site preparation and grading, the proposed building foundations may be supported on conventional spread footings bearing on medium dense/stiff native soil or structural fill. Where loose soils or other unsuitable soils are encountered in the proposed building footprint, they should be overexcavated and backfilled with structural fill.

Perimeter foundations exposed to 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. Finished grade is defined as the lowest adjacent grade within 5 feet of the foundation for perimeter (or exterior) footings and finished floor level for interior footings.

Table 4 Foundation Design

Design Parameter	Value
Allowable Bearing Capacity	2,500 psf[1]
Friction Coefficient	0.25
Passive pressure (equivalent fluid pressure)	250 pcf[2]
Minimum foundation dimensions	Columns: 24 inches Walls: 16 inches

1 psf = pounds per square foot
2 pcf = pounds per cubic foot

The allowable foundation bearing pressures apply to dead loads plus design live load conditions. For short-term loads, such as wind and seismic, a 1/3 increase in this allowable capacity may be used. At perimeter locations, RGI recommends not including the upper 12 inches of soil in the computation of passive pressures because it can be affected by weather or disturbed by future grading activity. The passive pressure value assumes the foundation will be constructed neat against competent soil or backfilled with structural fill as described in Section 5.2.5. The recommended base friction and passive resistance value includes a safety factor of about 1.5.

With spread-footing foundations designed in accordance with the recommendations in this section, maximum total and differential post-construction settlements of 1 inch and 1/2 inch, respectively, should be expected.

5.4 Retaining Walls

We expect that retaining walls will be necessary to provide grade changes for the access roadways and residence foundations. We recommend RGI review the location of retaining walls once a grading plan has been developed.

5.4.1 Cast-in-Place Walls

For basement walls and detention vaults, RGI recommends cast-in-place concrete walls be used. The magnitude of earth pressure development on retaining walls will partly depend on the quality of the wall backfill. RGI recommends placing and compacting wall backfill as structural fill. Wall drainage will be needed behind the wall face. A typical retaining wall drainage detail is shown on Figure 4.

With wall backfill placed and compacted as recommended, and drainage properly installed, RGI recommends using the values in the following table for design.

Table 5 Retaining Wall Design

Design Parameter	Value
Allowable Bearing Capacity	2,500 psf
Active Earth Pressure (unrestrained walls)	35 pcf
At-rest Earth Pressure (restrained walls)	50 pcf

For seismic design, an additional uniform load of 7 times the wall height (H) for unrestrained walls and 14H for restrained walls should be applied to the wall surface. Friction at the base of foundations and passive earth pressure will provide resistance to these lateral loads. Values for these parameters are provided in Section 5.3.

5.4.2 Segmental Retaining Walls

RGI understands that cuts and fills will be used to provide site grades and retaining walls will be necessary in some areas. For fill areas, RGI recommends using segmental retaining walls. A typical segmental retaining wall includes the Keystone wall system which is a proprietary retaining wall system. The system is used to rest 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.

For preliminary planning purposes, the detail shown on Figure 5 and geogrid reinforcing schedule shown on Figure 6 may be used. We recommend RGI review the location and potential surcharge loading to segmental walls. These walls typically require a separate building permit. RGI can provide design plans for the permitting and construction of these walls.

5.4.3 ROCKERIES

Rockeries may be used on the site for grade changes, however, rockeries are not retaining walls and do require periodic maintenance. RGI can provide supplemental information for the construction of rockeries once the location and height of the walls has been determined. Generally, we don't recommend rockery more than 8 feet in height to be used. A general rockery section detail is included on Figure 7. Rockeries should be constructed by an experienced rockery contractor in accordance with Associated Rockery Contractors (ARC) guidelines or the City of Issaquah standards.

5.5 SLAB-ON-GRADE CONSTRUCTION

Once site preparation has been completed as described in Section 5.2, suitable support for slab-on-grade construction should be provided. Immediately below the floor slab, RGI recommends placing a 4-inch-thick capillary break layer of clean, free-draining pea gravel, washed rock, or crushed rock that has less than 5 percent passing the U.S. 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-millimeter-thick plastic membrane should be placed on a 4-inch-thick layer of clean gravel or rock. For the anticipated floor slab loading, we estimate post-construction floor settlements of ¼- to ½-inch.

5.6 DRAINAGE

Subsurface and subsurface drainage systems will be necessary at the site and special consideration should be taken to ensure the drainage is directed away from the top of the steep slopes on the site. The preliminary plans provided did not include locations for collection and storage of surface or subsurface water. RGI should review the drainage plans once developed to confirm drainage is routed appropriately and storm water collection areas will not have an adverse effect on the steep slope areas.

5.6.1 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, RGI recommends providing a minimum drainage gradient of 3 percent for a minimum distance of 10 feet from the building perimeter. In paved locations, a minimum gradient of 1 percent should be provided unless provisions are included for collection and disposal of surface water adjacent to the structure.

5.6.2 SUBSURFACE

RGI recommends installing perimeter foundation drain as shown on Figure 8. The retaining wall drains, perimeter foundation drain, 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.

5.6.3 INFILTRATION

At the time of performing this study, RGI does not aware of any infiltration systems are being considered for the on-site disposal of storm water run-off. Based on the soil encountered, the native soil is not suitable for infiltration.

5.7 UTILITIES

Utility pipes should be bedded and backfilled in accordance with American Public Works Association (APWA) specifications. For site utilities located within the right-of-ways, bedding and backfill should be completed in accordance with City of Issaquah specifications. At a minimum, trench backfill should be placed and compacted as structural fill, as described in Section 5.2.5. 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 ASTM D1557. The onsite excavated soil is not suitable for being used as structural fill. Imported structural fill is needed for trench backfill as recommended in Section 5.2.5.

5.8 PAVEMENTS

Pavement subgrades should be prepared as described in Section 5.2 of this GER and as discussed below. Regardless of the relative compaction achieved, the subgrade must be firm and relatively unyielding before paving. This condition should be verified by proofrolling with heavy construction equipment or hand probe by inspector.

With the pavement subgrade prepared as described above, RGI recommends the following pavement sections for private driveway areas and street paved with flexible asphalt concrete surfacing.

- **For private driveways**: 2 inches of asphalt concrete (AC) over 6 inches of crushed rock base (CRB) over compacted subgrade;
- **For public roadways**: 3 inches of asphalt concrete (AC) over 9 inches of CRB over compacted subgrade or follow the City of Issaquah's special requirement about roadway.

The asphalt paving materials used should conform to the Washington State Department of Transportation (WSDOT) specifications for Hot Mix Asphalt Class 1/2 inch and CRB surfacing. If concrete driveway is preferred, the following section can be used.

- **For concrete driveways**: 5 inches of concrete over 4 inches of CRB over compacted subgrade

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 and reducing their supporting capability.

For optimum pavement performance, surface drainage gradients of no less than 2 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.

6.0 Additional Services

RGI is available to provide further geotechnical consultation throughout the design phase of the project. RGI should review the grading and utilities plans in order to verify that earthwork and foundation recommendations in this report are appropriate and provide supplemental recommendations as necessary.

RGI should be contracted to provide geotechnical engineering and construction monitoring services during. 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. RGI can provide an estimate for these services once the construction plans and schedule have been developed.

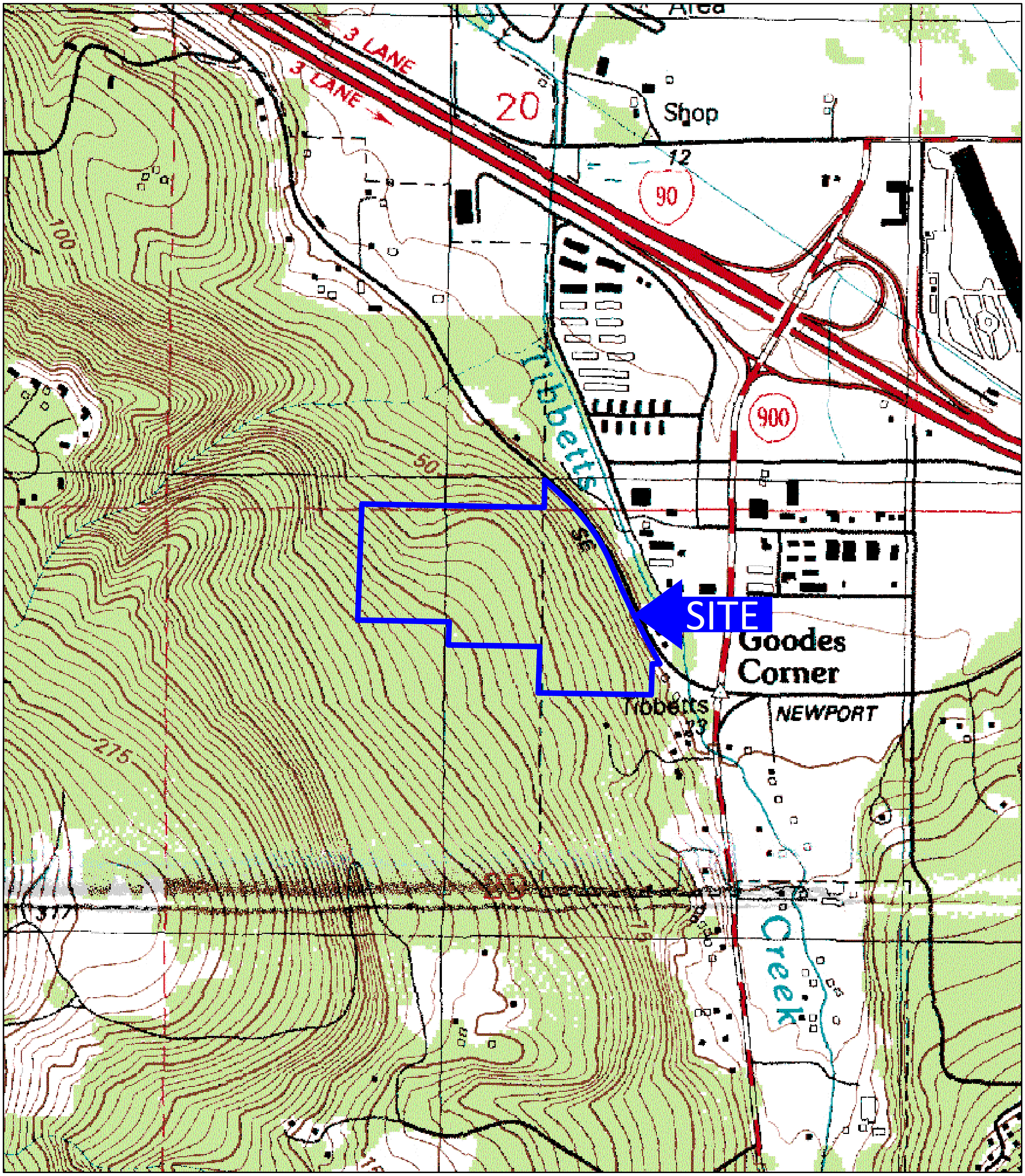
7.0 Limitations

This GER is the property of RGI, Windward Real Estate Services, Inc. and their designated agents. Within the limits of the scope and budget, this GER was prepared in accordance with generally accepted geotechnical engineering practices in the area at the time this report was issued. This GER is intended for specific application to the Bergsma Property at the southwest corner of Southeast Newport Way and 17th Avenue Northwest in Issaquah, Washington, and for the exclusive use of Windward Real Estate Services, Inc. and its authorized representatives. No other warranty, expressed or implied, is made. Site safety, excavation support, and dewatering requirements are the responsibility of others.

The scope of services for this project does not include either specifically or by implication any environmental or biological (for example, mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials, or conditions. If the owner is concerned about the potential for such contamination or pollution, we can provide a proposal for these services.

The analyses and recommendations presented in this GER are based upon review of the previous explorations on the site by Geotechnical Investigations Group. Variations in soil conditions can occur, the nature and extent of which may not become evident until construction. If variations appear evident, RGI should be requested to reevaluate the recommendations in this GER prior to proceeding with construction.

It is client's responsibility to see that all parties to the project, including the designers, contractors, subcontractors, are made aware of this GER in its entirety. The use of information contained in this GER for bidding purposes should be done at the contractor's option and risk.



USGS, 1983, Bellevue South, Washington
7.5-Minute Quadrangle

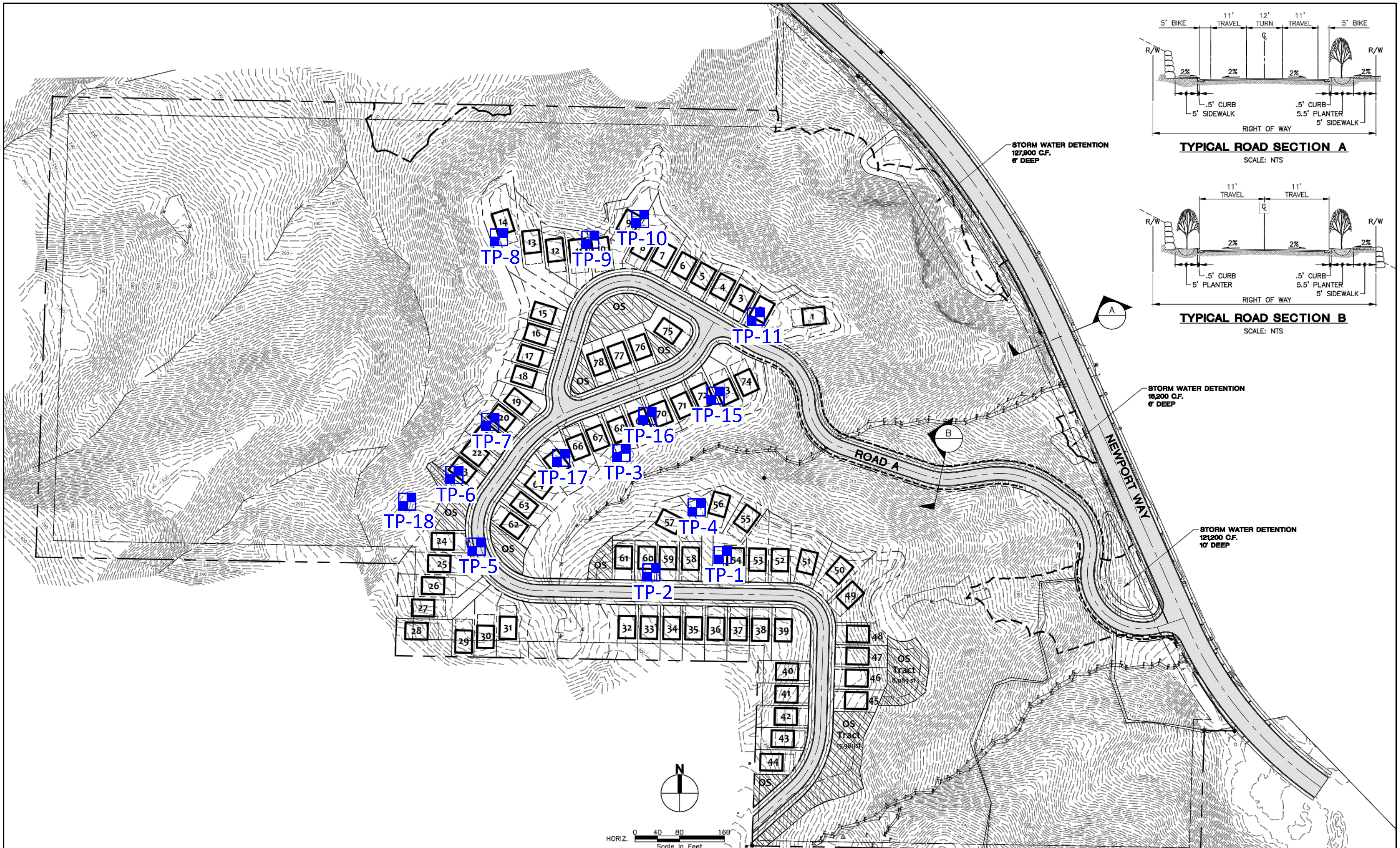
Approximate Scale: 1"=1000'

0 500 1000 2000

N

RILEYGROUP
Corporate Office
17522 Bothell Way Northeast
Bothell, Washington 98011
Phone: 425.415.0551
Fax: 425.415.0311

Bergsma Property		Figure 1
RGI Project Number 2015-046	Site Vicinity Map	Date Drawn: 04/2015
Address: Southeast Newport Way and 17th Avenue Northwest, Issaquah, Washington 98072		



= Test Pit Location by Geotechnical Investigations Group
Drawn from Pace an Engineering Services Company, Bergsma Issaquah.

Approximate Scale: 1"=250'
0 125 250 500
N

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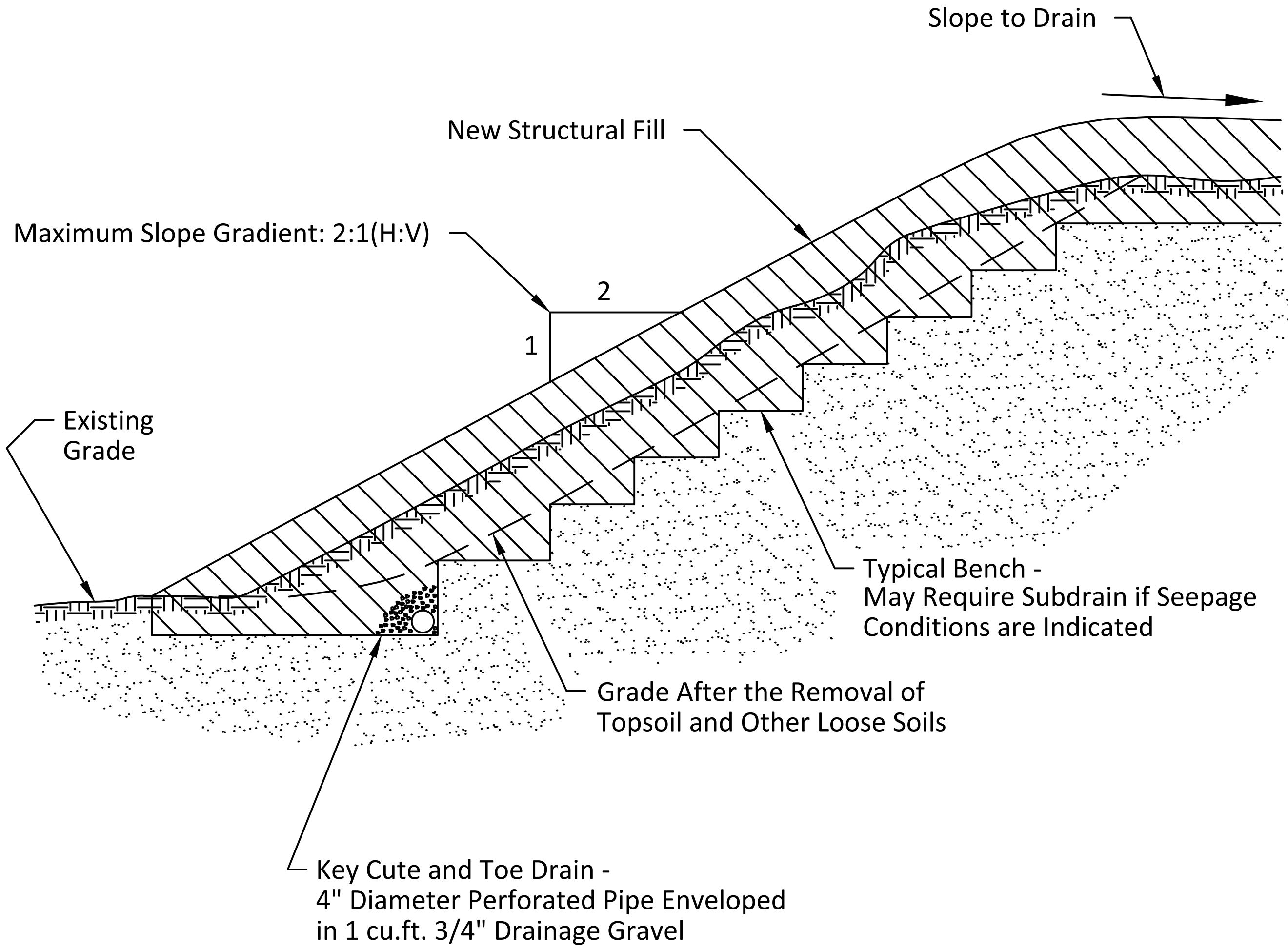
Bothell, Washington 98011
Phone: 425.415.0551
Fax: 425.415.0311

Bergsma Property		Figure 2
RGI Project Number 2015-046	Geotechnical Exploration Plan	Date Drawn: 04/2015
Address: Southeast Newport Way and 17th Avenue Northwest, Issaquah, Washington 98072		



Notes

1. Slope should be stripped of topsoil and unsuitable soils prior to placing any fill.
2. "Benches" should be a minimum of 6 feet wide.
3. "Key" should be minimum 2 feet deep and 6 feet wide, extending the full length of the slope face.
4. Final slope face should be densified by compaction.
5. Plant or hydroseed slope face to reduce erosion potential.
6. All structural fill should be compacted to 95% of soils maximum dry density per ASTM D-698 (standard proctor).

Not to Scale

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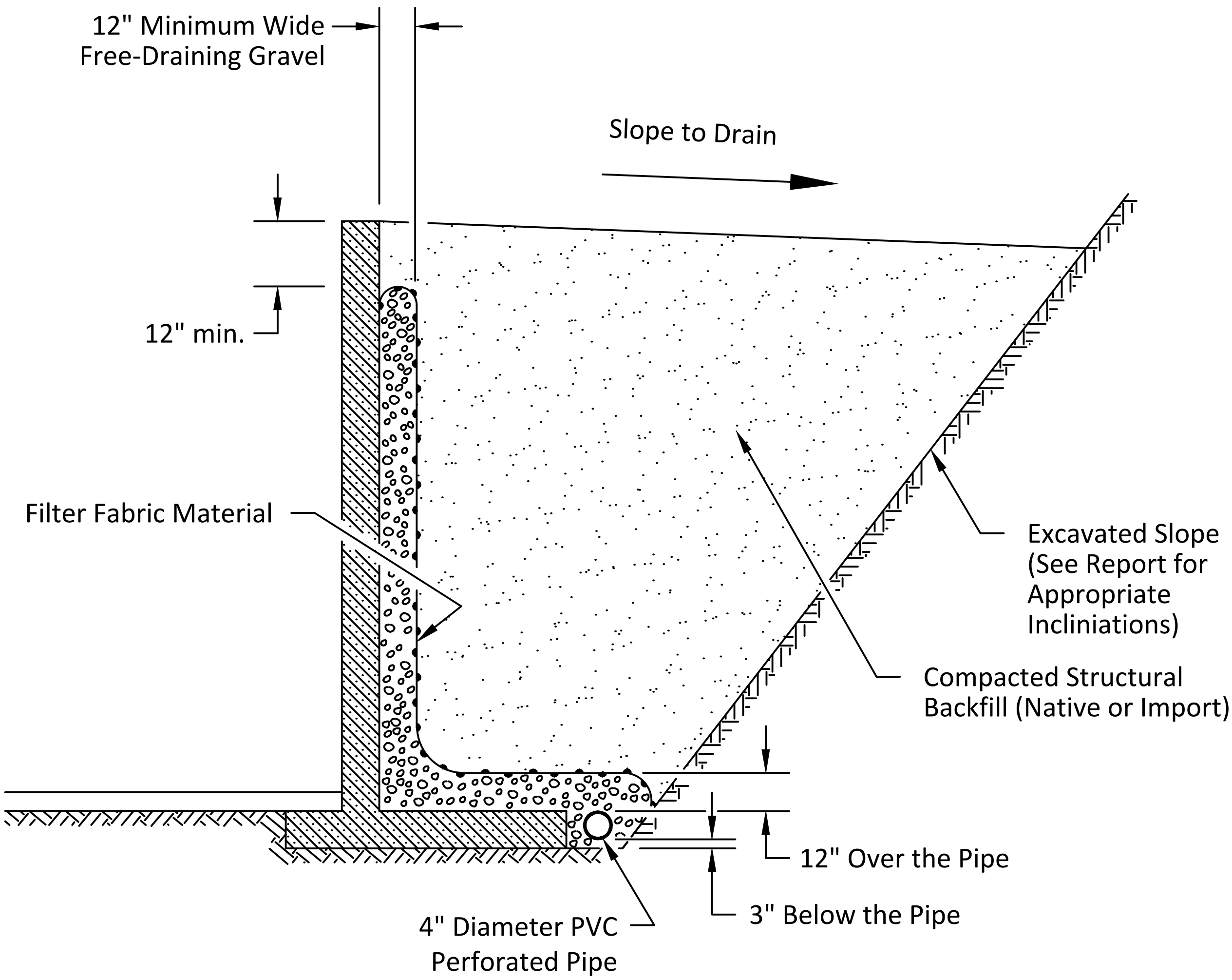
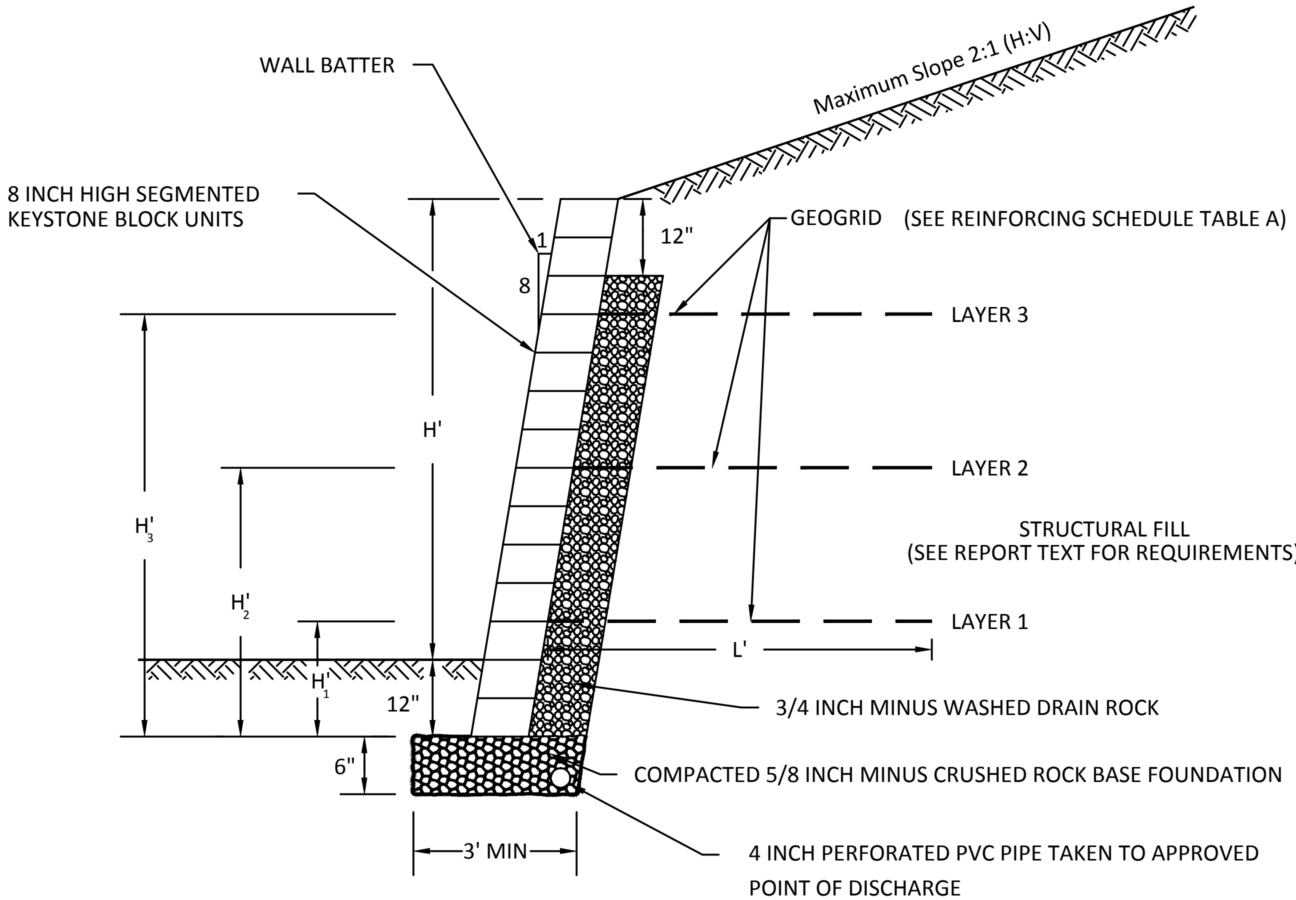
Bothell, Washington 98011
Phone: 425.415.0551
Fax: 425.415.0311

Bergsma Property		Figure 3
RGI Project Number 2015-046	General Slope Fill Detail	Date Drawn: 04/2015
Address: Southeast Newport Way and 17th Avenue Northwest, Issaquah, Washington 98072		



Not to Scale

RILEYGROUP Corporate Office 17522 Bothell Way Northeast Bothell, Washington 98011 Phone: 425.415.0551 Fax: 425.415.0311	Bergsma Property	Figure 4
	RGI Project Number 2015-046 — Retaining Wall Drainage Detail	Date Drawn: 04/2015
	Address: Southeast Newport Way and 17th Avenue Northwest, Issaquah, Washington 98072	



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.
3. MAXIMUM ALLOWABLE HEIGHT OF SLOPE BEHIND WALL : 5 FEET.

Not to Scale

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Phone: 425.415.0551
Fax: 425.415.0311

Bergsma Property		Figure 5
RGI Project Number 2015-046	Keystone Wall Retaining Wall Section	Date Drawn: 04/2015
Address: Southeast Newport Way and 17th Avenue Northwest, Issaquah, Washington 98072		

Wall Height - 4 feet (Mirafi 5T or equivalent)

Layer No.	Length (L) (feet)	Height (H) (feet)
1	4.0	2.0

Wall Height - 6 feet (Mirafi 5T or equivalent)

Layer No.	Length (L) (feet)	Height (H) (feet)
1	4.5	2.0
2	4.5	4.0

Wall Height - 8 feet (Mirafi 7T or equivalent)

Layer No.	Length (L) (feet)	Height (H) (feet)
1	6.0	2.0
2	6.0	4.0
3	6.0	6.0

Wall Height - 10 feet (Mirafi 7T or equivalent)

Layer No.	Length (L) (feet)	Height (H) (feet)
1	7.5	2.0
2	7.5	4.0
3	7.5	6.0
4	7.5	8.0

Wall Height - 12 feet (Mirafi 7T or equivalent)

Layer No.	Length (L) (feet)	Height (H) (feet)
1	9.0	2.0
2	9.0	4.0
3	9.0	6.0
4	9.0	8.0
5	9.0	10.0

Wall Height - 14 feet (Mirafi 7T or equivalent)

Layer No.	Length (L) (feet)	Height (H) (feet)
1	11.0	2.0
2	11.0	4.0
3	11.0	6.0
4	11.0	8.0
5	11.0	10.0
6	11.0	12.0

Notes:
1. Grid length (L) measured from back of block unit;
2. Grid height (H) measured from top of crushed rock pad foundation.

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Bothell, Washington 98011
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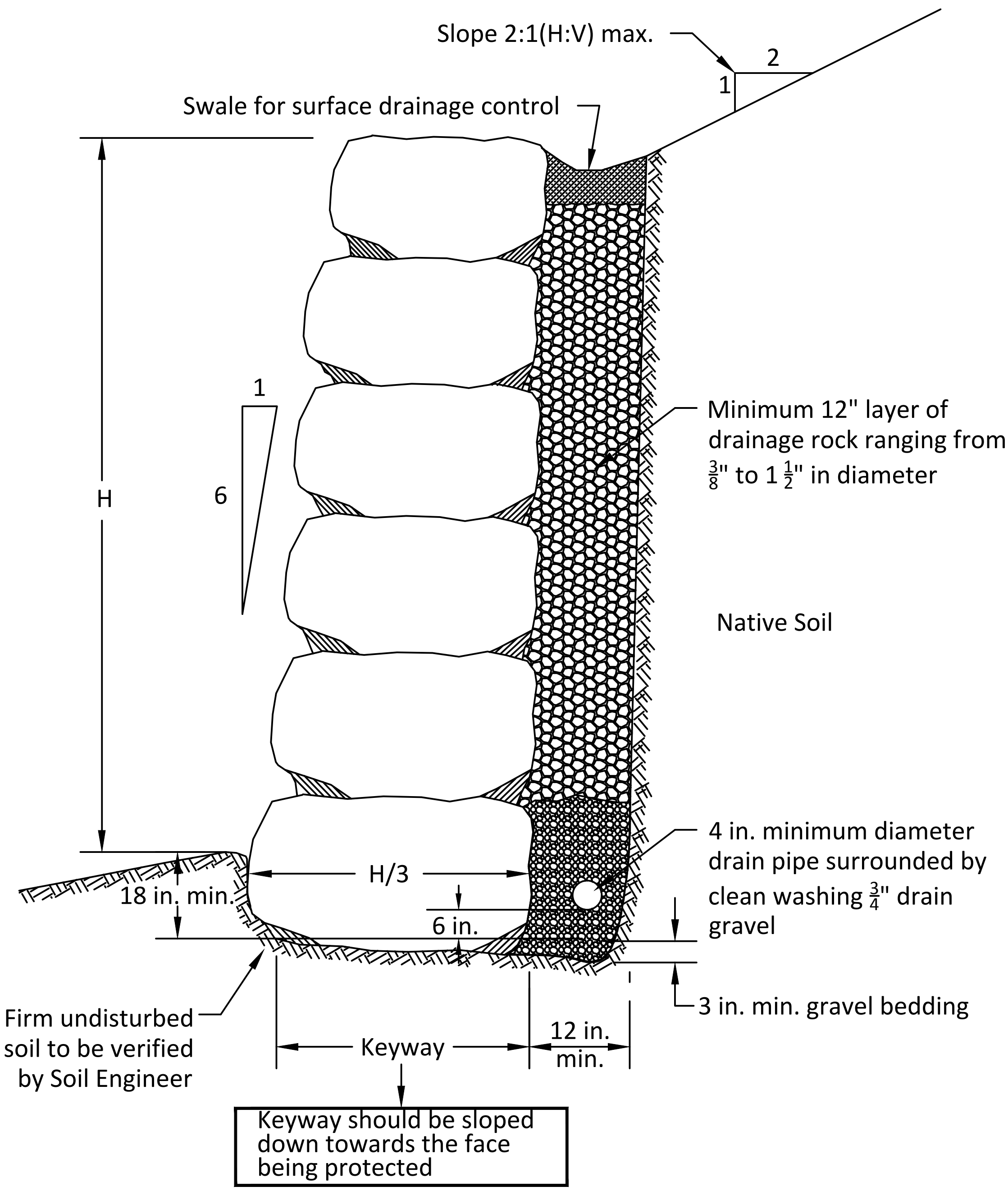
Bergsma Property		Figure 6
RGI Project Number 2015-046	Geogrid Reinforcing Schedule	Date Drawn: 04/2015
Address: Southeast Newport Way and 17th Avenue Northwest, Issaquah, Washington 98072		



Not to Scale

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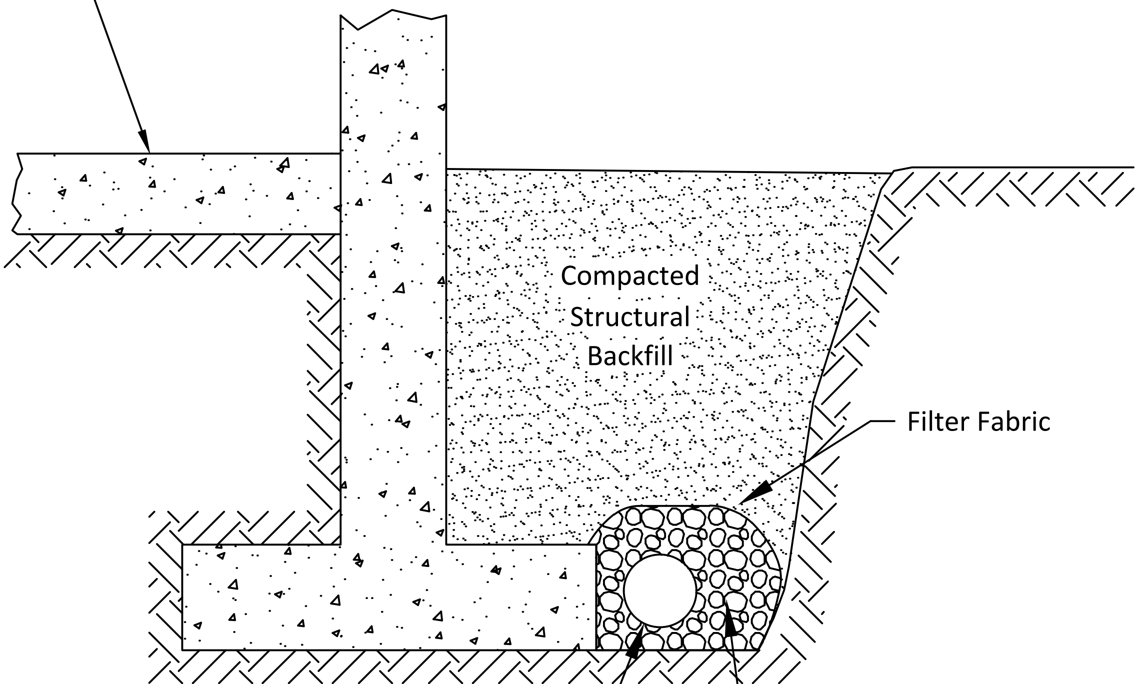
17522 Bothell Way Northeast
Bothell, Washington 98011
Phone: 425.415.0551
Fax: 425.415.0311

Bergsma Property		Figure 7
RGI Project Number 2015-046	Rockery Section Detail	Date Drawn: 04/2015
Address: Southeast Newport Way and 17th Avenue Northwest, Issaquah, Washington 98072		



Not to Scale

RILEYGROUP Corporate Office 17522 Bothell Way Northeast Bothell, Washington 98011 Phone: 425.415.0551 Fax: 425.415.0311	Bergsma Property		Figure 8
	RGI Project Number 2015-046	Typical Footing Drain Detail	Date Drawn: 04/2015
	Address: Southeast Newport Way and 17th Avenue Northwest, Issaquah, Washington 98072		

APPENDIX A
GEOTECHNICAL TESTING LABORATORY SLOPE STABILITY ANALYSIS

The field exploration was performed by Geotechnical Investigations Group on November 8, 2007. The exploration includes 18 test pits to a maximum depth of 18 feet bgs. The test pit locations are shown on Figure 2.

The slope stability analysis was performed by Geotechnical Testing Laboratory using the explorations from Geotechnical Investigations Group on December 12, 2007. Five cross sections through the middle of the proposed development were performed. The safety factors meet standard design requirements. Based on the analyses, the slope is currently stable condition and will remain stable after construction. The detailed analyses and the test pit logs are attached.

Bergsma Plat

Issaquah, Washington

GeoTechnical Testing Laboratory

Geotechnical Testing Laboratory, Inc.
10011 Blomberg Street SW
Olympia, WA 98512
Phone#: (360) 754-4612
Fax#: (360) 754-4848

Columbia Basin Laboratory, Inc.
127 4th Street
Soap Lake, WA 98851
Phone#: (509) 246-9193
Fax#: (509) 246-9183

www.GeoTechnicalTestingLab.com

GEOTECHNICAL TESTING LABORATORY

MDZ CONSTRUCTION
10307 41ST TRAIL SE
OLYMPIA, WASHINGTON 98513

RE:	SLOPE STABILITY ANALYSIS
TOWNSHIP SECTION RANGE:	SECTION 29, TOWNSHIP 24N, RANGE 6E
SITE INFORMATION:	BERGSMA PLAT ISSAQUAH, WASHINGTON
GPS LOCATION:	N47° 32.587' W122° 04.176'
REPORT DATE:	12/12/2007

Mr. Zblewski:

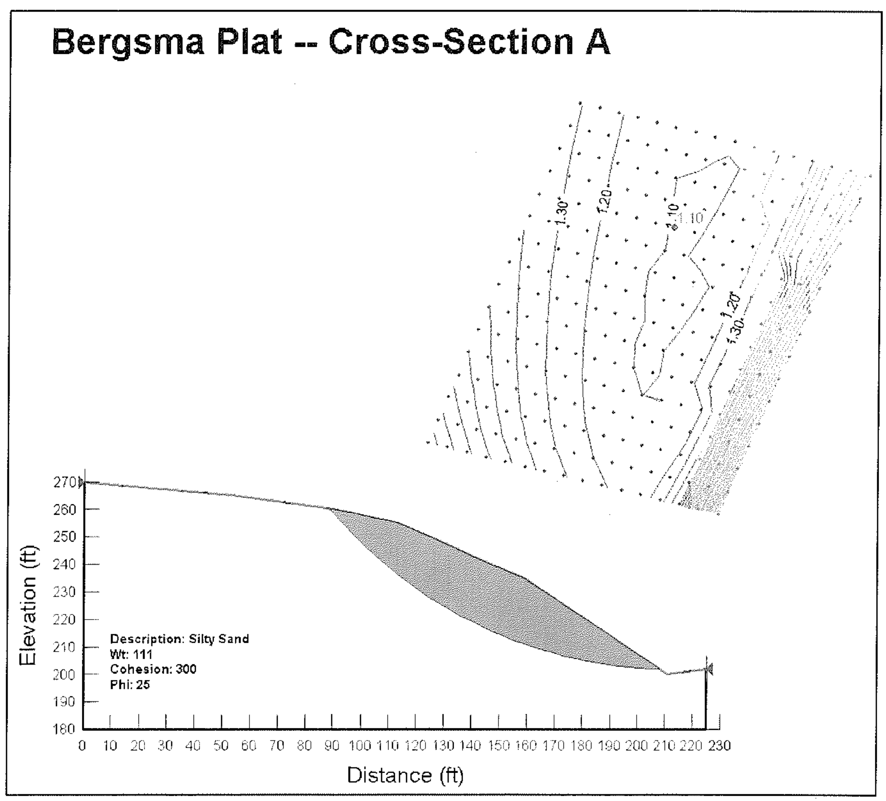
As per your request, we have conducted a slope stability investigation of the above referenced site. The proposed lots were analyzed to determine the general slope stability of the existing slopes.

Using the existing contour site plan, critical slope profiles were generated. Five cross-sections were used to generate the slope model. Test pits, collected samples, and laboratory tests provided the geologic parameters. Of the material collected, the weakest material parameters were utilized in the slope models, thus creating a conservative model.

Groundwater was not encountered during the exploration. Backhoe test pits unearthed silty sand over gravelly silty sand. Lacking near site well logs, the material encountered was assumed beyond the depths of exploration. The trees along the vegetated slopes are straight and vertical. No signs of landsliding were observed on or near the site.

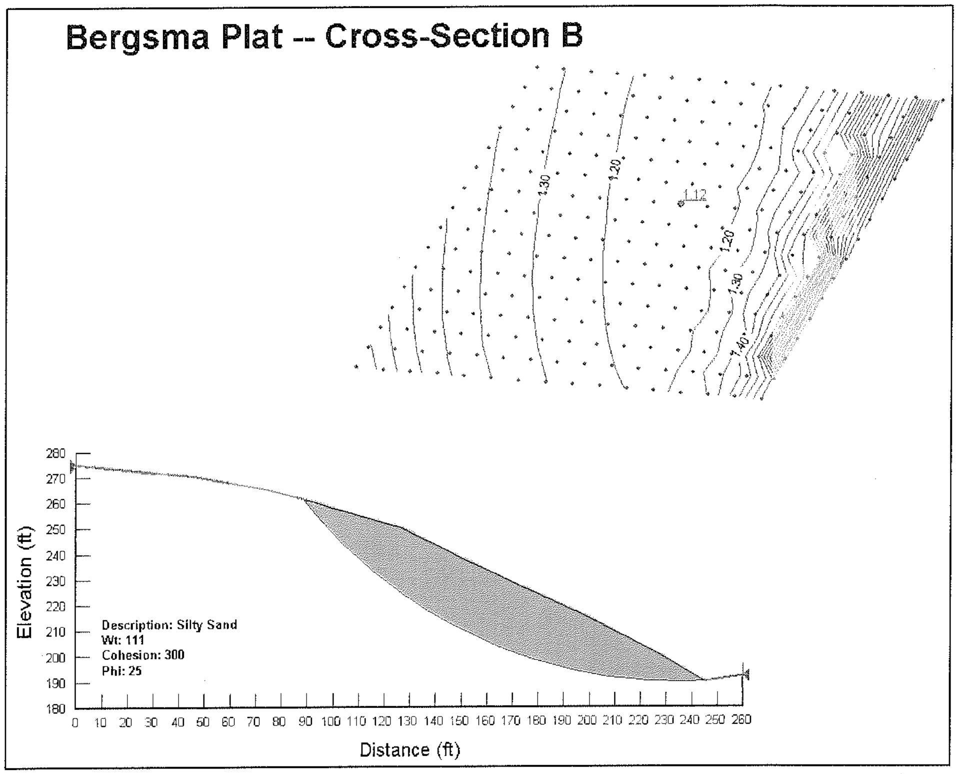
The models were evaluated under static and dynamic conditions. The following figures illustrate the results of the five dynamic slope models, see attached site plan. Ideally, the factor of safety should be greater than 1.0 for dynamic conditions.

The figure (right) reveals the results of the dynamic slope model for section "A." The minimum dynamic factor of safety is equal to 1.1. The failure surface does not intersect the building location at the top of the slope.

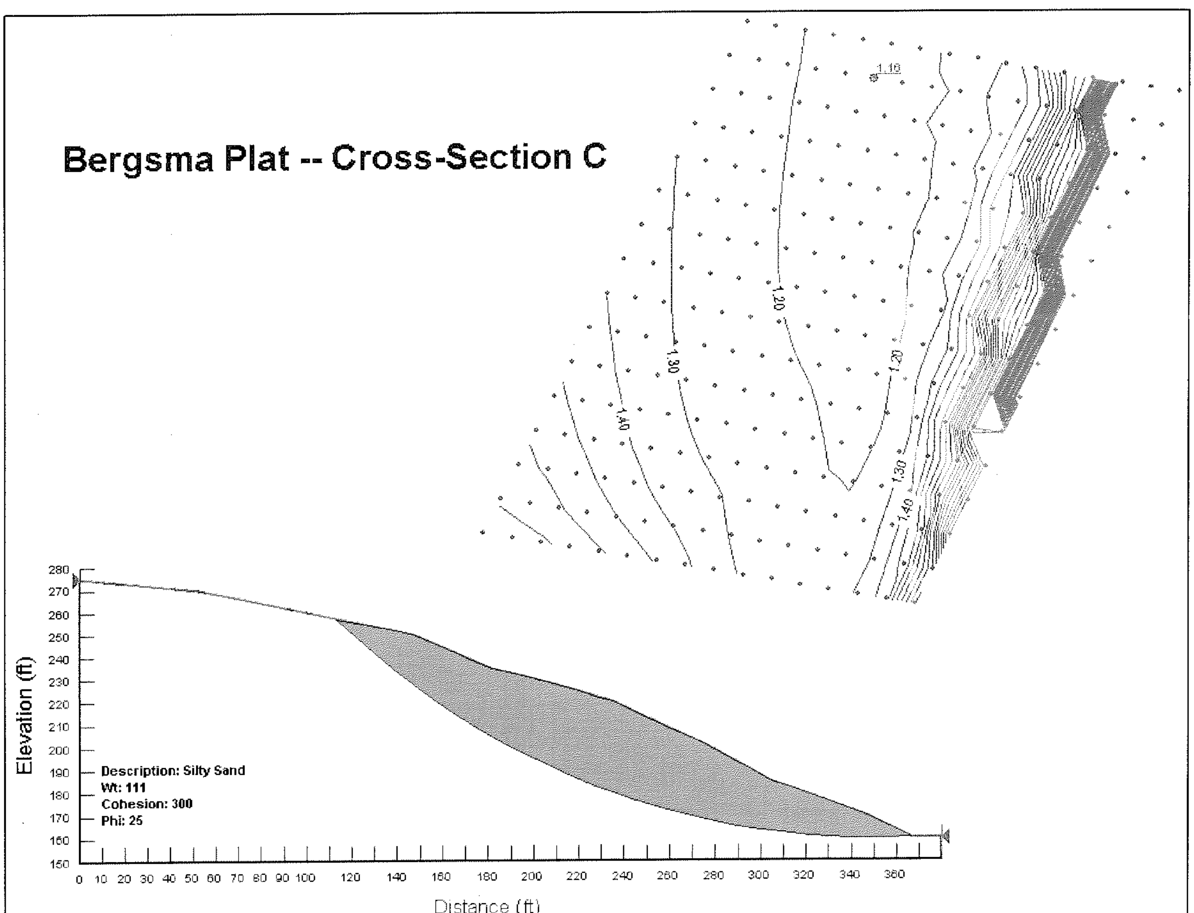


10011 Blomberg Street SW, Olympia, WA 98512
Phone #: (360) 754-4612 Fax #: (360) 754-4848

The figure (right) reveals the results of the dynamic slope model for section "B." The minimum dynamic factor of safety is equal to 1.12. The failure surface does not intersect the building location at the top of the slope.

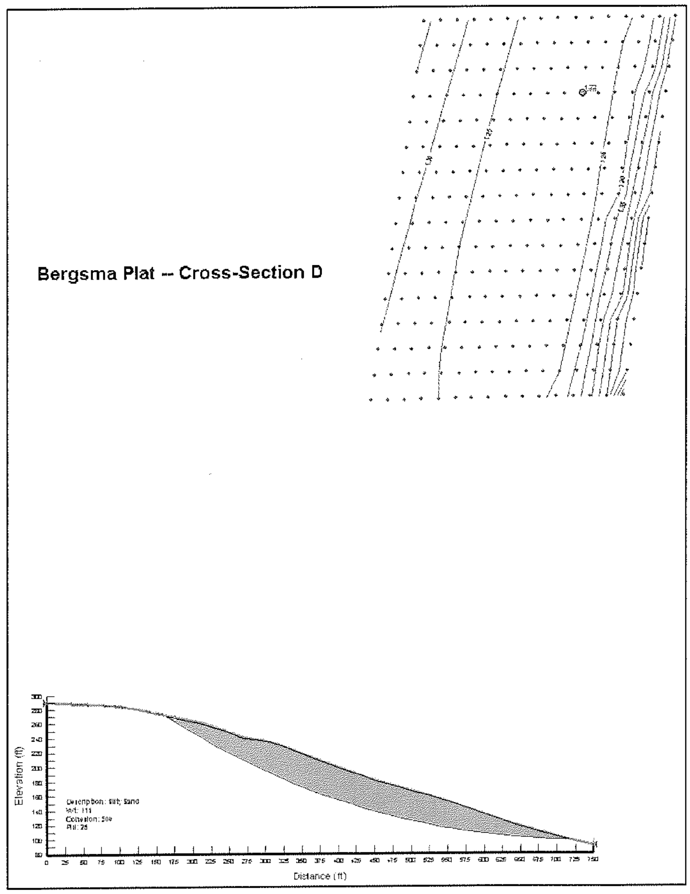


The figure (below) illustrates the results of the dynamic slope model for section "C." The minimum dynamic factor of safety is equal to 1.16. The failure surface does not intersect the building location at the top of the slope.

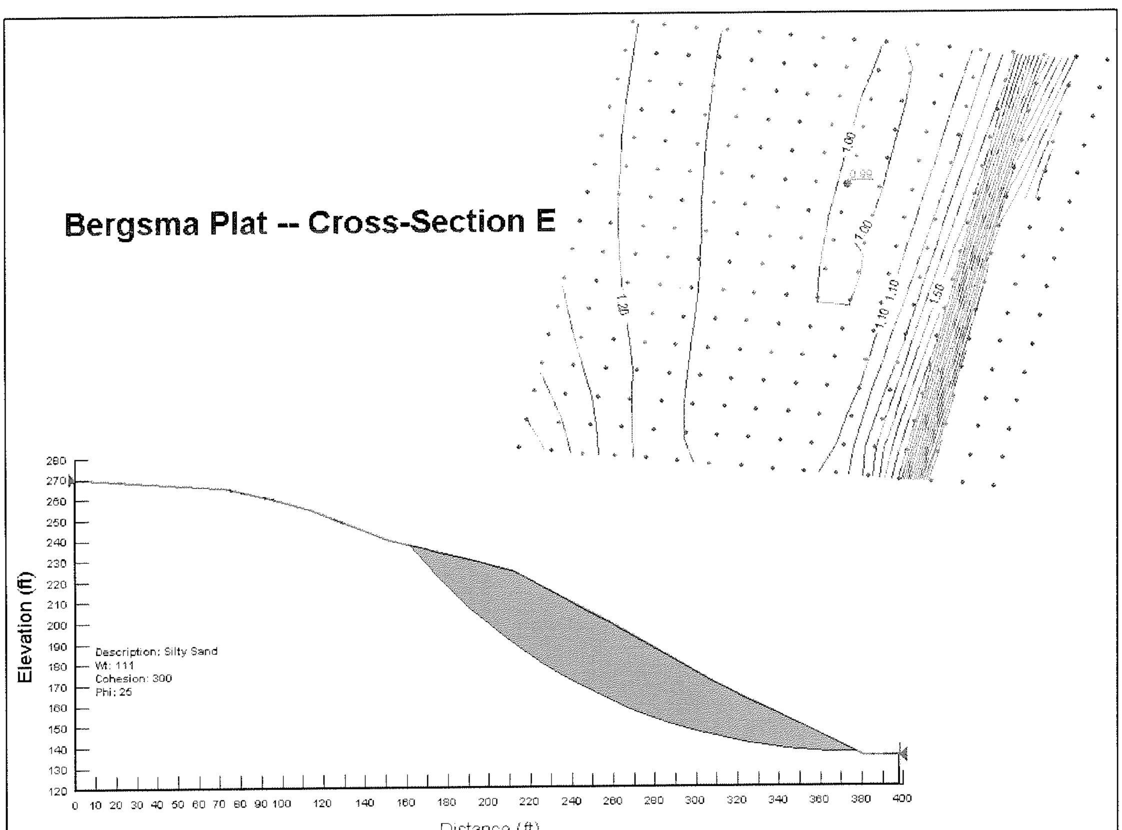


10011 Blomberg Street SW, Olympia, WA 98512
Phone #: (360) 754-4612 Fax #: (360) 754-4848

The figure (right) reveals the results of the dynamic slope model for section "D." The minimum dynamic factor of safety is equal to 1.22. The failure surface does not intersect the building location at the top of the slope.



The figure (below) exposes the results of the dynamic slope model for section "A." The minimum dynamic factor of safety is equal to 0.99. The failure surface does intersect the building location at the top of the slope.



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Phone #: (360) 754-4612 Fax #: (360) 754-4848

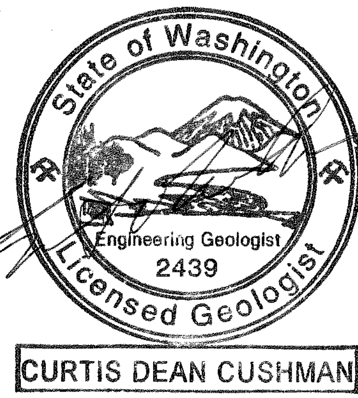
Results of the dynamic slope models indicate the overall site is "safe" under the existing conditions. If final grading or road construction alters the slope faces, re-evaluation of the new conditions may be prudent. If seepage or water bearing layers is encountered during road construction, a revised slope model should be evaluated.

We would be pleased to continue our role as geotechnical consultants during the project implementation. We appreciate this opportunity to be of service to you and we look forward to working with you in the future. If you have any questions concerning the above items, the procedures used, or if we can be of any further assistance, please call us at the phone number listed below.

Respectfully Submitted,
GEOTECHNICAL TESTING LABORATORY

Curtis D. Cushman, L.G., L.E.G.
Senior Engineering Geologist

EXPIRES 8-3-2018 SIGNED 3-13-2018



Bergsma Short Plat
Source Material from test pits in gravel pit
Intended Application: Infiltration Pond

Darcy's Law k=QL/Ath

k= coefficient of permeability
Q= quantity of water discharged
L= distance between manometers
A= cross-sectional area of specimen
t= total time of discharge
h= difference in head on manometers

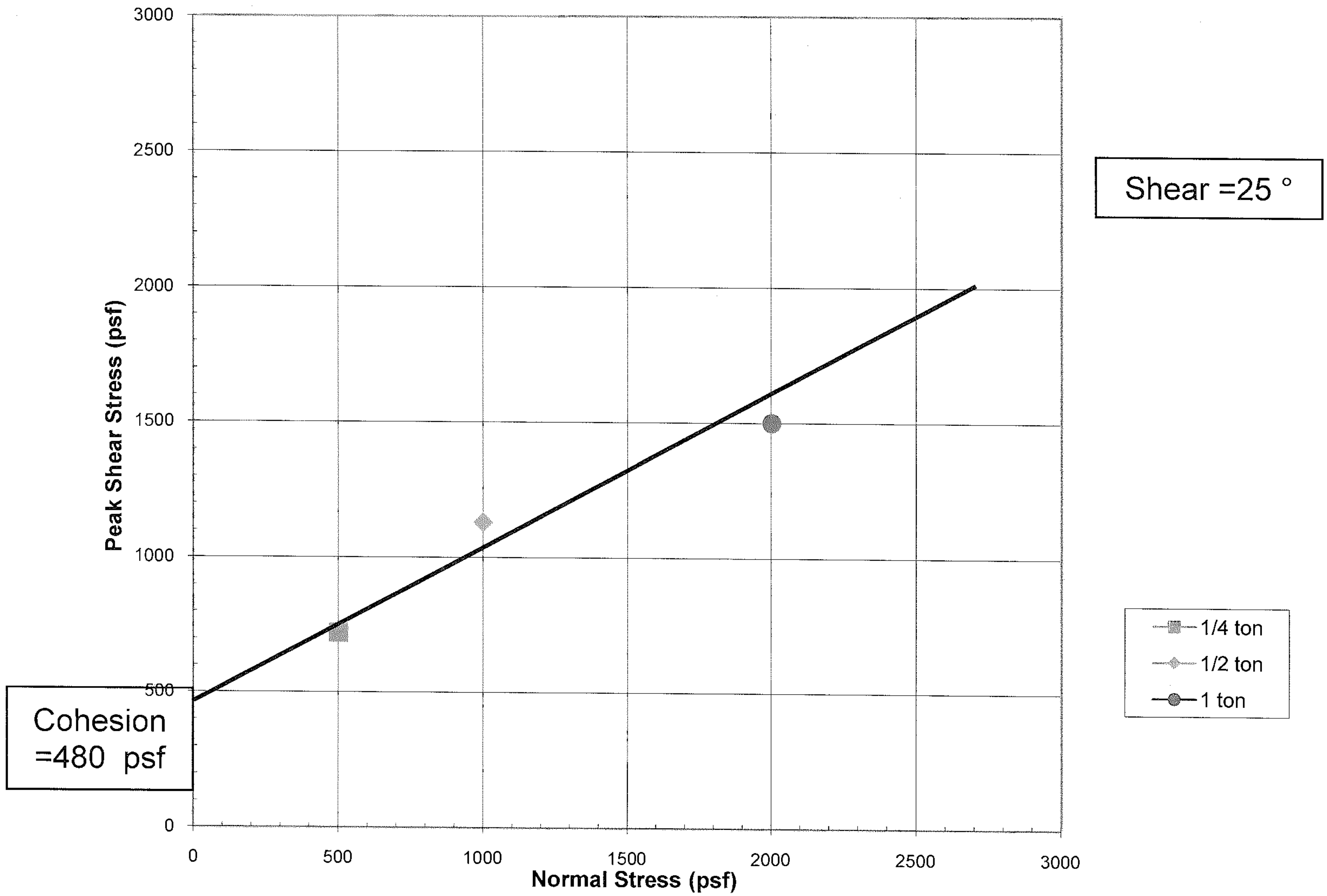
Test Pit 1		english	units	metric	units		
	Q			145	cm^3		
	L	5.75	inches	14.605	cm		
	A	12.57143	inches^2	81.1	cm^2		
	t	1	minutes	1	minutes		
	h	49.5	inches	132.1	cm		
	k=	0.197672335	cm/minute			0.008368129	in/min
						60	
		60				0.50208773	in/hr
						12.05010552	in/day
		0.003294539	cm/sec				

Test Pit 2		english	units	metric	units		
	Q			232.81	cm^3		
	L	5.75	inches	14.605	cm		
	A	12.57143	inches^2	81.1	cm^2		
	t	1	minutes	1	minutes		
	h	49.5	inches	133.4	cm		
	k=	0.314287066	cm/minute			0.013304819	in/min
						60	
		60				0.798289147	in/hr
						19.15893953	in/day
		0.005238118	cm/sec				

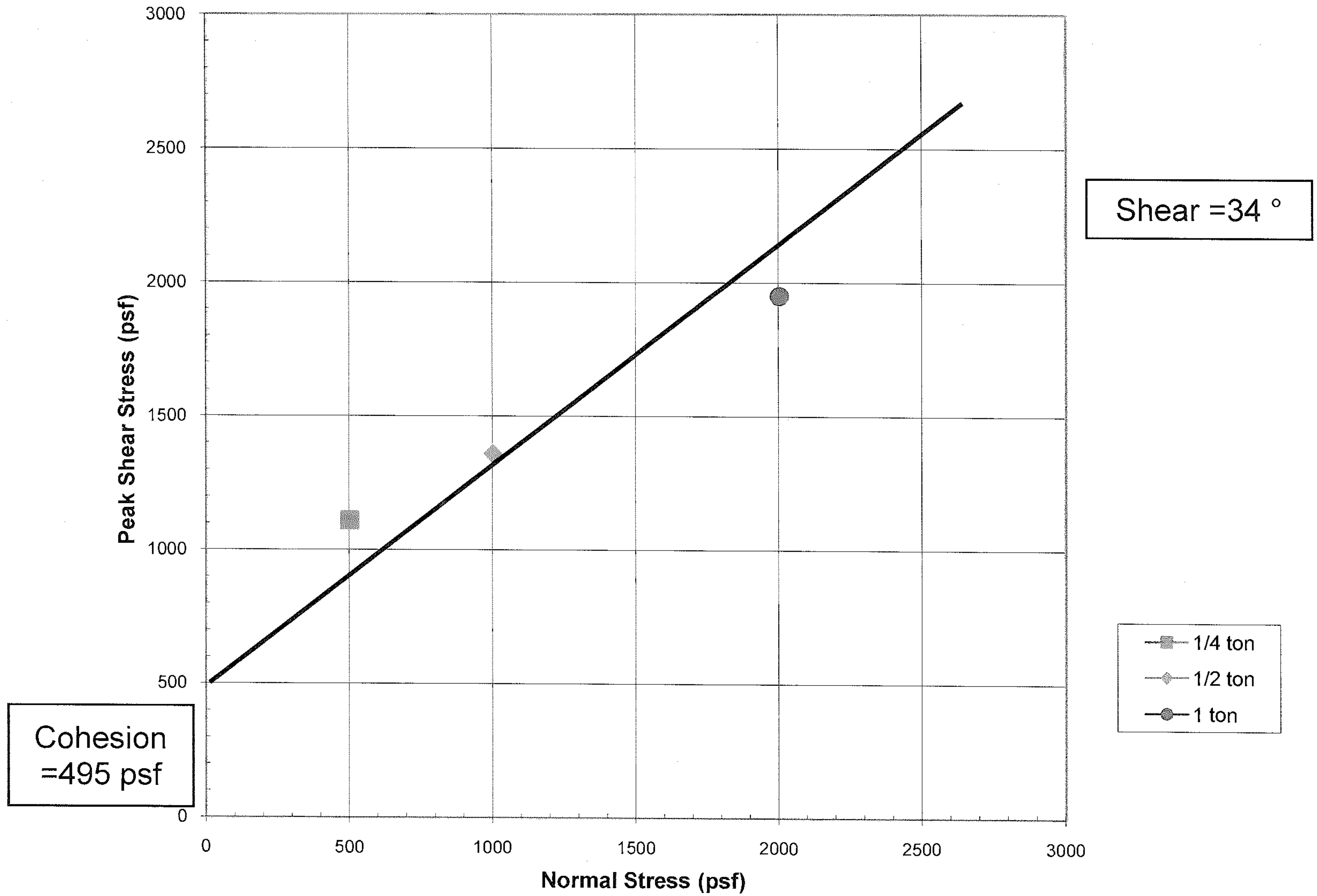
Test Pit 3		english	units	metric	units		
	Q			127.3	cm^3		
	L	5.75	inches	14.605	cm		
	A	12.57143	inches^2	81.1	cm^2		
	t	1	minutes	1	minutes		
	h	49.5	inches	134.6	cm		
	k=	0.170319373	cm/minute			0.007210187	in/min
						60	
		60				0.432611209	in/hr
						10.38266901	in/day
		0.002838656	cm/sec				

Test Pit 4		english	units	metric	units		
	Q			115.18	cm^3		
	L	5.75	inches	14.605	cm		
	A	12.57143	inches^2	81.1	cm^2		
	t	1	minutes	1	minutes		
	h	49.5	inches	135.9	cm		
	k=	0.152629445	cm/minute			0.006461313	in/min
						60	
						9.304290957	in/day
		0.002543824	cm/sec				

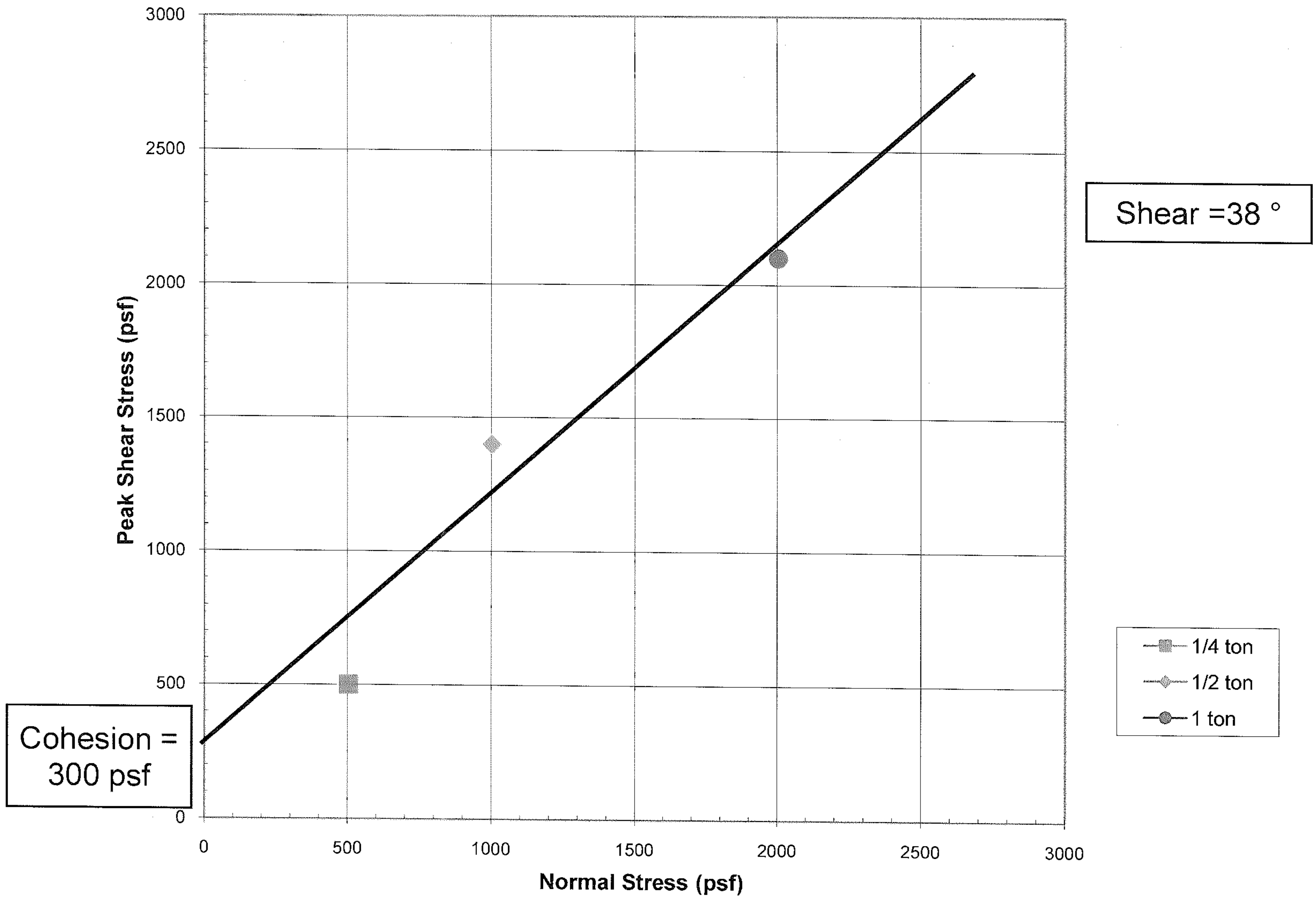
Peak Shear Stress vs. Normal Stress



Peak Shear Stress vs. Normal Stress



Peak Shear Stress vs. Normal Stress



SHEAR TEST

GEOTECHNICAL TESTING LABORATORY

Date:

Project ID:
Sample ID: TP 17
Sample Description:
Sample Number: 1813

Peak Shear Stress vs. Normal Stress

Sample Test	Shear Force	Normal Force	Shear Stress	Normal Stress	Shear Stress	Normal stress
	lb	lb	lb/sqin	lb/sqin	psf	psf
1/4 ton	22.5	28.91	3.47	4.45	500.0	500
1/2 ton	49.6	50.31	7.64	7.75	1100.0	1000
1 ton	72.1	90.06	11.11	13.88	1600.0	2000

Shear Angle =
Cohesion =

GEOTECHNICAL TESTING LAB

Date: 11/8/2007 GPS Location **File #:**

Field Test Pit : 1 N47° 32.558' W122° 04.107' **Client:** MDZ Construction

Type of hole: Backhoe **Depth Excavated:** 18 Feet

Depth (in)	Field Description	Change in Soils	horiz	high water level	roots	color	tex-ture	% org.	% clay	Liqd Lmt	Plas Lmt	Plas Indx	struc-ture	mott-ling	cemen-tation	Loading Rate gal/ft^2/day	Soil Textural Classification
1	Brown gravelly silty sand		A		cm	brown											
2																	
3																	
4																	
5																	
6																	
7	Light grayish brown silty					lt gray											
8	sand			Not encountered		brown											
9	Moist gray silt					Gray											
10																	
11																	
12																	
13																	
14																	
15																	
16																	
17																	
18																	

GEOTECHNICAL TESTING LAB

Date: 11/8/2007 | GPS Location | **File #:**
Field Test Pit : 2 | N47° 32.553 | W122° 04.137 | **Client:** MDZ Construction
Type of hole: Backhoe | **Depth Excavated:** 12 Feet

Depth (in)	Field Description	Change in Soils	horiz	high water level	roots	color	Texture	Structure	Mottling	Cementation	Soil Textural Classification
1	Brown gravelly silty sand		A	Not encountered	cm	brown	Sa	SG		Not Present	
2											
3											
4											
5	Light grayish brown silty					lt gray	Sa-Si	Mas		Mod	
6	sand					brown					
7	Moist gray silt					Gray	Si	Mas		Mod	
8											
9											
10											
11											
12											

GEOTECHNICAL TESTING LAB

Date: 11/8/2007 | GPS Location | **File #:**

Field Test Pit : 3 | N47° 32.578 W122° 04.146 | **Client:** MDZ Construction

Type of hole: Backhoe | **Depth Excavated:** 12 Feet

Depth (in)	Field Description	Change in Soils	horiz	high water level	roots	color	Texture	Structure	Mottling	Cementation	Soil Textural Classification
1	Brown loamy silt		A	Not encountered	cm	brown	Sa	SG		Not Present	
2											
3	Moist gray silt					Gray	Si	Mas		Mod	
4											
5											
6											
7											
8											
9											
10											
11											
12											

GEOTECHNICAL TESTING LAB

Date: 11/8/2007 GPS Location **File #:**
Field Test Pit : 4 N47° 32.572 W122° 04.117 **Client:** MDZ Construction
Type of hole: Backhoe **Depth Excavated:** 12 Feet

Depth (in)	Field Description	Change in Soils	horiz	high water level	roots	color	Texture	Structure	Mottling	Cementation	Soil Textural Classification
1	Brown gravelly silty sand		A	Not encountered	cm	brown	Sa	SG		NP	
2					ff						
3	Silty sand with some				NP	Lt brown	Si-Sa-Gr	SG		NP	
4	gravel				NP						
5					NP						
6					NP						
7					NP						
8					NP						
9					NP						
10					NP						
11	Moist gray silt				NP	Gray	Si	Mas		Mod	
12					NP						

GEOTECHNICAL TESTING LAB

Date: 11/8/2007
Field Test Pit : 5
Type of hole: Backhoe

GPS Location
N47° 32.557 W122° 04.703

File #:
Client: MDZ Construction
Depth Excavated: 8 Feet

Depth (in)	Field Description	Change in Soils	horiz	high water level	roots	color	Texture	Structure	Mottling	Cementation	Soil Textural Classification
1	Light brown loam sand		A		cm	brown	Sa	SG		NP	
2					ff				distinct		
3	Interbedded clay and sand				NP	Lt brown	Si-Sa-Gr	SG		NP	
4				Not encountered	NP						
5					NP						
6					NP						
7					NP						
8					NP						

GEOTECHNICAL TESTING LAB

Date: 11/8/2007
Field Test Pit : 6
Type of hole: Backhoe

GPS Location
N47° 32.582 W122° 04.223

File #:
Client: MDZ Construction
Depth Excavated: 6 Feet

Depth (in)	Field Description	Change in Soils	horiz	high water level	roots	color	Texture	Structure	Mottling	Cementation	Soil Textural Classification
1	Light brown loam sand		A	Not encountered	cm	brown	Sa	SG		NP	
2					ff				distinct		
3	Interbedded clay and sand				NP	Lt brown	Si-Sa-Gr	Mas		NP	
4					NP						
5					NP						
6					NP						

GEOTECHNICAL TESTING LAB

Date: 11/8/2007
Field Test Pit : 7
Type of hole: Backhoe

GPS Location
N47° 32.598 W122° 04.207

File #:
Client: MDZ Construction
Depth Excavated: 10 Feet

Depth (in)	Field Description	Change in Soils	horiz	high water level	roots	color	Texture	Structure	Mottling	Cementation	Soil Textural Classification
1	Light brown loam sand		A	Not encountered	cm	brown	Sa	SG		NP	
2					ff						
3					NP						
4	Moist gray silt				NP		Cl-Si	Mas			
5											
6											
7					NP						
8					NP						
9											
10											

GEOTECHNICAL TESTING LAB

Date: 11/8/2007 | GPS Location | **File #:**
Field Test Pit : 8 | N47° 32.652 | W122° 04.204 | **Client:** MDZ Construction
Type of hole: Backhoe | **Depth Excavated:** 12 Feet

Depth (in)	Field Description	Change in Soils	horiz	high water level	roots	color	Texture	Structure	Mottling	Cementation	Soil Textural Classification
1	Sand with gravel		A	Not encountered	cm	brown	Sa	SG		NP	
2					cf						
3					cf						
4					NP						
5					NP						
6					NP						
7					NP						
8					NP						
9					NP						
10					NP						
11					NP						
12					NP						

GEOTECHNICAL TESTING LAB

Date: 11/8/2007
Field Test Pit : 9
Type of hole: Backhoe

GPS Location
N47° 32.656 W122° 04.164

File #:
Client: MDZ Construction
Depth Excavated: 10 Feet

Depth (in)	Field Description	Change in Soils	horiz	high water level	roots	color	Texture	Structure	Mottling	Cementation	Soil Textural Classification
1	Gravelly sand loam		A		cm	brown	Gr-Sa-Lm	SG		NP	
2					cf						
3	Moist gray silt			Not encountered	cf	Gray					
4					NP						
5					NP						
6					NP						
7					NP						
8					NP						
9					NP						
10					NP						

GEOTECHNICAL TESTING LAB

Date: 11/8/2007 | GPS Location | **File #:**

Field Test Pit : 10 | N47° 32.658 W122° 04.143 | **Client:** MDZ Construction

Type of hole: Backhoe | **Depth Excavated:** 12 Feet

Depth (in)	Field Description	Change in Soils	horiz	high water level	roots	color	Texture	Structure	Mottling	Cementation	Soil Textural Classification
1	Gravelly sand loam		A	Not encountered	cm	brown	Gr-Sa-Lm	SG		NP	
2					cf						
3	Moist gray silt				cf	Gray					
4					NP						
5					NP						
6					NP						
7					NP						
8					NP						
9					NP						
10											
11											
12					NP						

GEOTECHNICAL TESTING LAB

Date: 11/8/2007 | GPS Location | **File #:**

Field Test Pit : 11 | No Reception | **Client:** MDZ Construction

Type of hole: Backhoe | **Depth Excavated:** 12 Feet

Depth (in)	Field Description	Change in Soils	horiz	high water level	roots	color	Texture	Structure	Mottling	Cementation	Soil Textural Classification
1	Sandy Loam		A	Not encountered	cm	Reddish Brown	Sa-Lm	SG		NP	
2					cf						
3	Gravelly sand				cf	Light gray brown	Gr-Sa	Sg			
4					NP						
5					NP						
6	Moist gray silt				NP	Gray	Si	Mas		Mod	
7					NP						
8					NP						
9					NP						
10											
11											
12	Boulders				NP						

GEOTECHNICAL TESTING LAB

Date: 11/8/2007	GPS Location	**File #:**
Field Test Pit : 12	No Reception	**Client:** MDZ Construction
Type of hole: Backhoe	Near Creek on Slope Road (at bottom)	**Depth Excavated:** 6 Feet

Depth (in)	Field Description	Change in Soils	horiz	high water level	roots	color	Texture	Structure	Mottling	Cementation	Soil Textural Classification
1	Sandy Loam		A	Not encountered	cm	Reddish	Sa-Lm	SG		NP	
2					cf	Brown					
3	Gray Silt				cf	Gray	Si	Mas		Mod	
4					NP						
5					NP						
6					NP						

GEOTECHNICAL TESTING LAB

Date: 11/8/2007 | GPS Location | **File #:**
Field Test Pit : 13 | No Reception | **Client:** MDZ Construction
Type of hole: Backhoe | Slope Road (1/2 way up road) | **Depth Excavated:** 6 Feet

Depth (in)	Field Description	Change in Soils	horiz	high water level	roots	color	Texture	Structure	Mottling	Cementation	Soil Textural Classification
1	Gravelly sand		A	Not encountered	cm	Reddish Brown	Sa-Lm	SG		NP	
2					cf						
3					cf						
4	Gray Silt				NP	Gray	Si	Mas		Mod	
5					NP						
6					NP						

GEOTECHNICAL TESTING LAB

Date: 11/8/2007 | GPS Location | **File #:**

Field Test Pit : 14 | N47° 32.629' | W122° 04.092 | **Client:** MDZ Construction

Type of hole: Backhoe | Slope Road (Crest) | **Depth Excavated:** 6 Feet

Depth (in)	Field Description	Change in Soils	horiz	high water level	roots	color	Texture	Structure	Mottling	Cementation	Soil Textural Classification
1	Gravelly sand		A	Not encountered	cm	Reddish Brown	Sa-Lm	SG		NP	
2					cf						
3					cf						
4					NP						
5	Gray Silt				NP	Gray	Si	Mas		Mod	
6					NP						

GEOTECHNICAL TESTING LAB

Date: 11/8/2007 | GPS Location | **File #:**
Field Test Pit : 15 | N47° 32.605' W122° 04.109' | **Client:** MDZ Construction
Type of hole: Backhoe | **Depth Excavated:** 8 Feet

Depth (in)	Field Description	Change in Soils	horiz	high water level	roots	color	Texture	Structure	Mottling	Cementation	Soil Textural Classification
1	Gravelly sand		A	Not encountered	cm	Reddish	Sa-Lm	SG		NP	
2					cf	Brown					
3	Gray brown silty sand				cf	Gray	Si-Sa	Sg		Mod	
4					NP	Brown					
5					NP						
6											
7											
8											

GEOTECHNICAL TESTING LAB

Date: 11/8/2007
Field Test Pit : 16
Type of hole: Backhoe

GPS Location
N47° 32.599' W122° 04.140'

File #:
Client: MDZ Construction
Depth Excavated: 10 Feet

Depth (in)	Field Description	Change in Soils	horiz	high water level	roots	color	Texture	Structure	Mottling	Cementation	Soil Textural Classification
1	Gravelly sand		A	Not encountered	cm	Brown	Sa-Lm	SG		NP	
2	Fine grained sand with silt				cf	Grayish brown	Sa-Si	Mas		Mod	
3					cf						
4					NP						
5					NP						
6											
7											
8											
9											
10											

GEOTECHNICAL TESTING LAB

Date: 11/8/2007 GPS Location **File #:**

Field Test Pit : 17 N47° 32.587' W122° 04.176' **Client:** MDZ Construction

Type of hole: Backhoe **Depth Excavated:** 12 Feet

Depth (in)	Field Description	Change in Soils	horiz	high water level	roots	color	Texture	Structure	Mottling	Cementation	Soil Textural Classification
1	Forest Duff		A	Not encountered	cm	Brown	Sa-Lm	SG		NP	
2	Clay				cf	Grayish brown	Sa-Si	Mas		Mod	
3					cf						
4					NP						
5					NP						
6											
7											
8											
9											
10											
11											
12	Interbedded silt and clay					Gray	Si-Cl	Mas		Mod	

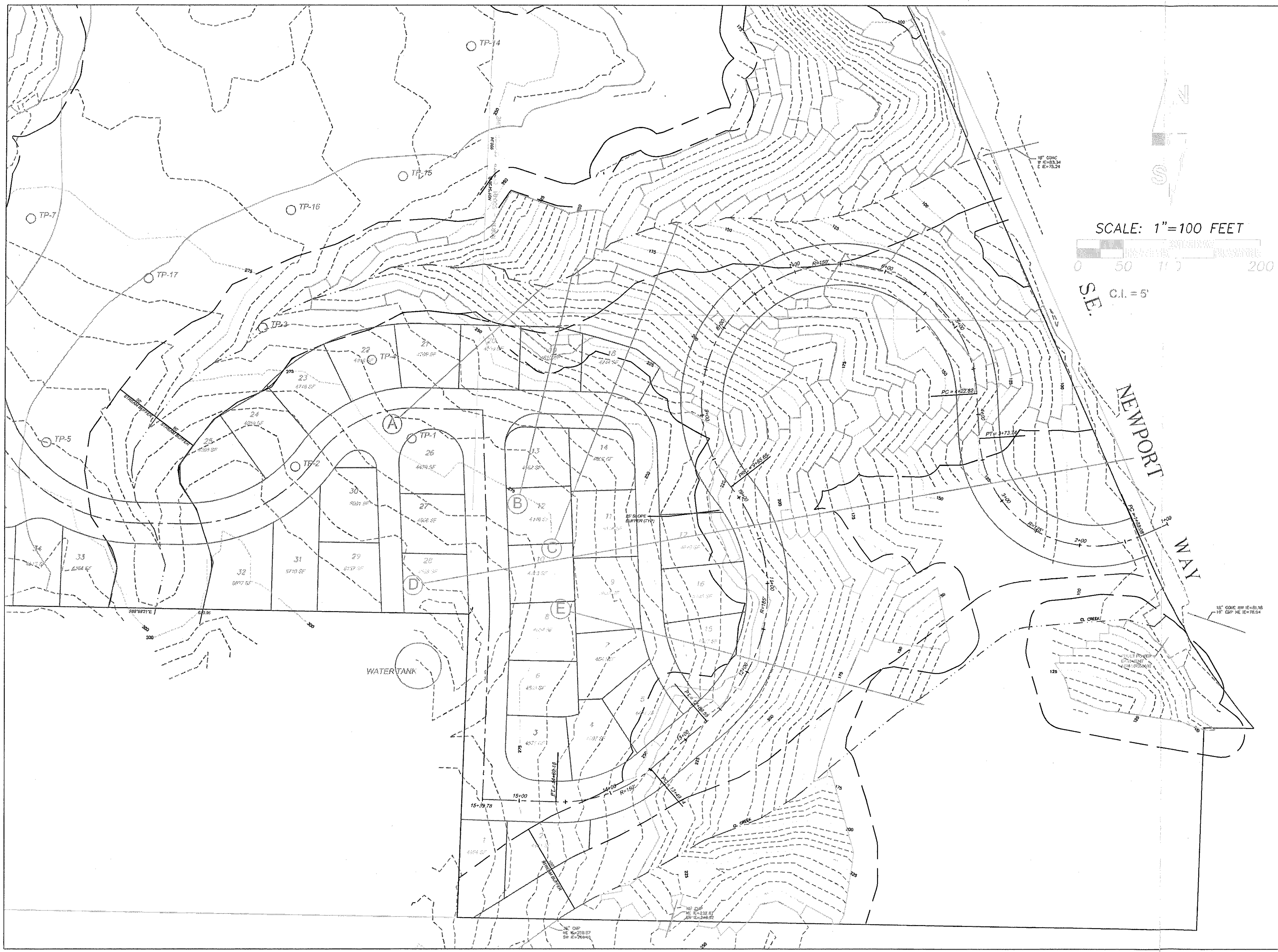
GEOTECHNICAL TESTING LAB

Date: 11/8/2007 GPS Location **File #:**

Field Test Pit : 18 N47° 32.569' W122° 04.260' **Client:** MDZ Construction

Type of hole: Backhoe **Depth Excavated:** 12 Feet

Depth (in)	Field Description	Change in Soils	horiz	high water level	roots	color	Texture	Structure	Mottling	Cementation	Soil Textural Classification
1	Forest Duff		A	Not encountered	cm	Brown	Sa-Lm	SG		NP	
2	Silty clay (dry)				cf	Grayish brown	Si-Cl	Mas		Mod	
3					cf						
4					NP						
5					NP						
6											
7											
8											
9											
10											
11											
12	Gravelly sand (shot gravel)					Gray	Si-Cl	Mas		Mod	



Geotechnical Testing Laboratory

Geotechnical Services
QA/QC Services
Testing Services

10011 Blomberg St. SW
Olympia, WA 98512
Phone: (360) 754-4612
Fax: (360) 754-4848

Date: 12/11/2007
Designed by: Tri-County Land Surv.
Drawn by: Tri-County Land Surv.
Edited by: LEVINE
Dwg#: 12-11-07-111

PROJECT NAME:
BERGSMA PLAT
NEWPORT WAY
ISSAQUAH, WASHINGTON
PARCELS 2024069017,
2924069010, 2924069009,
2924069008, 2924069013,
2924069003, & 2924069004

Revisions:
12-11-2007

SCALE: 1 inch = 100 feet

SITE PLAN

RILEYGROUP

December 8, 2015

Mr. Jim Tosti
Windward Real Estate Services, Inc.
335 Park Place Center, Suite G119
Kirkland, Washington 98033

Subject: **Review of Preliminary Plans and Variance Requests**
Bergsma Property
Southeast Newport Way and 17th Avenue Northwest
Issaquah, Washington 98072
RGI Project No. 2015-046

References: 1. Critical Areas Evaluation and Preliminary Geotechnical Engineering Report for Bergsma Property, prepared by The Riley Group, Inc. dated April 1, 2015

2. Preliminary Grading and Drainage Plan of Bergsma Subdivision (C3.0), prepared by PACE dated November 11, 2015

3. Draft Variance and Deviation Request for Bergsma Preliminary Plat, Windward Development for the City of Issaquah, undated

Dear Mr. Tosi:

As requested, The Riley Group, Inc. (RGI) has evaluated the steep slope on the site and prepared a preliminary geotechnical report on April 1, 2015 (Reference 1). A preliminary grading and drainage plan (Reference 2) and variance and deviation request (Reference 3) have been prepared. RGI has been requested to review the plan and request to make sure that the geotechnical recommendations have been incorporated into the project design. This letter presents the result of our review and additional recommendations.

Project Description

The client plans to develop a 46-acre property into 76 single-family residential lots. Based on the referenced site plan, access to the site will be provided by two new roadways designated Road A and Road D. Road A is shown extending from Southeast Newport Way and Road D is from an access tract owned by the City of Issaquah that also provides access to the City of Issaquah water tower.

Variance Requests

The major geotechnical related requests for variance are:

- Variance Request 1 - Lots 1 to 11 requesting the removal of the berms on the top of the steep slope and redefining the top of slope based on the grading plan.
- Variance Request 3 – Perimeter setback and buffer reduction on selected lots.

- Variance Request 4 - Road A require traversing the 40 percent or greater slopes and cuts and fills to reach the final grade. The roadway will need to be designed with retaining structures to minimize the impacts to critical areas and a deviation is also requested to reduce the roadway width.
- Variance Request 5 - A stormwater detention vault is propped to be constructed along Newport Way Northwest within areas with slopes up to 40 percent with small areas greater than 40 percent.

Review of Variance Requests

Based on our review of the preliminary grading plan, the variance request and our understanding of the site soils, in our professional opinion the site is suitable for the proposed construction from a geotechnical standpoint. Our comments related to the specific variances follows:

- Variance Request 1 – The removal of the berm on the top of the slope and redefine the top of slope will improve the stability of the slope on the rear of the lots. The berm removal on the top of the slope will not affect the slope stability. RGI also recommended the buildings be 25 feet (combination of buffer and setback) away from the top of the slopes with gradients greater than 40 percent.
- Variance Request 3 – The reduction of the perimeter setbacks will reduce the grading necessary on the proposed plat and reduce the impact to critical areas including slopes.
- Variance Request 4 – Road A construction will require additional exploration, design and analysis to ensure a safe completed roadway; however; based on our experience with similar soils and construction, the construction of this roadway through the steep slope is possible and can be designed to minimize impacts to the critical and provide for a safe completed roadway.
- Variance Request 5 – The proposed vault construction on Newport Way will also require additional exploration, analysis, and design recommendation to provide safe working conditions during the construction of the vault and stable slopes following completion of the vault; however; based on the expected soil conditions, the construction of the vault and final grading to provide stable slope is feasible with proper construction methods and geotechnical oversight during construction.

Deviation Requests

The deviation requests are related to reduction of the roadway widths for Roads A through D. The reduction of the required roadway widths will reduce the impacts to critical areas and overall improve the stability of the proposed grading by reducing the required cuts and fills for the development.

Plan Review

Our review indicates that the referenced plan and document are prepared in consistent with the recommendations in the geotechnical report with the variance and deviation requests to reduce the impacts on the critical areas and the grading required to for the development. Based on our review the impact of proposed development on slope stability can be adequately mitigates provided the geotechnical recommendations are incorporated in the final design and construction specifications.

Additional Services

RGI should complete the additional explorations after the variances and deviations are granted and provide additional geotechnical recommendations for the construction of the proposed vault and Road A. RGI should also review the final plans and provide geotechnical monitoring during the earthwork activities during grading and construction of the development.

If you have any questions regarding this report or require additional information, please call us at (425) 415-0551.

Sincerely yours,

THE RILEY GROUP, INC.

12/8/2015

Ricky R. Wang, PhD, PE
Principal Engineer