ATTACHMENT 14

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October 18, 2011

JN 11335

Ellsworth Builders
26007 Northeast 27th Drive
Redmond, Washington 98053

via email tellsworth@ellsworthbuilders.com

Attention: Thomas Ellsworth

Subject: **Transmittal Letter – Geotechnical Engineering Study**
Proposed Ellsworth Estates
Northeast 100th Street at 134th Avenue Northeast
Tax Parcel #032505-9100 and Eastern Portion of Tax Parcel #032505-9050
Redmond, Washington

Dear Mr. Ellsworth:

We are pleased to present this geotechnical engineering report for the Ellsworth Estates subdivision to be constructed in Redmond. The scope of our services consisted of exploring site surface and subsurface conditions, and then developing this report to provide recommendations for general earthwork and design criteria for foundations, retaining walls, subsurface drainage, and sloe stability. This work was authorized by your acceptance of our proposal, P-8188, dated July 19, 2011

The attached report contains a discussion of the study and our recommendations. Please contact us if there are any questions regarding this report, or for further assistance during the design and construction phases of this project.

Respectfully submitted,

GEOTECH CONSULTANTS, INC.

Marc R. McGinnis, P.E.
Principal

cc: **Land Development Advisors**, LLC
via email landdevadvisors@comcast.net

MRM: jyb

GEOTECHNICAL ENGINEERING STUDY
Proposed Ellsworth Estates
Northeast 100th Street at 134th Avenue Northeast
Tax Parcel #032505-9100 and Eastern Portion of Tax Parcel #032505-9050
Redmond, Washington

This report presents the findings and recommendations of our geotechnical engineering study for the site of the proposed Ellsworth Estates to be located in Redmond.

Based on the provided information from Land Development Advisors, LLC, we expect that the vacant property will be divided into seven single-family lots. These lots will be located on the western approximately one-half of the property. The new road providing access from Northeast 100th Street will extend through the center of the property and then turn west near the southern lots to dead-end at the western property line. Tract B for a potential storm vault and open space will occupy the area between the new street and the eastern property line on the southern of the two tax parcels. To the north of this, the eastern portion of the site has been designated as an NGPE tract. This natural growth protection easement tract appears related to the small stream that extends through the eastern side of the property. No grading information for the proposed project was available at the time of this report. However, considering the relatively flat nature of the area in which the homes and street will be constructed, we do not expect large cuts and fills for the development.

If the scope of the project changes from what we have described above, we should be provided with revised plans in order to determine if modifications to the recommendations and conclusions of this report are warranted.

SITE CONDITIONS

SURFACE

The property is situated along the southern side of Northeast 100th Street and is roughly centered on the intersection with 134th Avenue Northeast, a street that extends to the north. Tax Parcel 032505-9100 is the larger of the two parcels and covers the northern approximately 301 feet of the entire property. This portion of the site is relatively open, with tall grass, low underbrush, and blackberry vines covering most of the ground surface. Trees of varying sizes are scattered around the perimeter of this parcel. The eastern 180 to 190 feet of the southern parcel (Tax Parcel 032505-9050), which is also included in the planned development, contains similar vegetation. This portion of the site has apparently been used in the past for storage of some building and landscape materials used by the residence (9730 - 132nd Avenue Northeast) that occupies the western portion of that tax parcel.

The ground surface over the entire site generally slopes gently down toward the east. Along the eastern property line is a shallow ravine that trends downward toward the south and which carries water discharged near the northeastern corner of the site both by the open ditches along Northeast 100th Street and a 24-inch culvert that extends under this street from the north. The ravine is quite shallow along the northern one-half of the site, becoming broader and deeper to the south of that. The steep sideslopes of the ravine do not become taller than 10 feet until close to the southeastern corner of Tax parcel 03505-9100. The bottom of this ravine exposes dense, native, gravelly silty sand that is consistent with the glacial till soils typically found in the area. The bottom of the ravine is not deeply incised, confirming the dense nature of the underlying soil. We saw no indications of recent instability of the slopes along the ravine during our visits to the property.

The parcels around the site have all been developed with single-family homes. The property immediately to the south of the site is a landscaped rear yard area that does not contain any structures.

SUBSURFACE

The subsurface conditions on the property were explored by excavating 12 test pits at the approximate locations shown on the Site Exploration Plan, Plate 2. These test pits were conducted on October 14, 2011 using a small tracked excavator to limit disturbance of the existing vegetation. Our exploration program was based on the proposed construction, anticipated subsurface conditions and those encountered during exploration, and the scope of work outlined in our proposal.

Soil Conditions

The test pits all found very consistent subsurface conditions. Beneath the surface vegetation and topsoil was native soil consisting of loose, weathered, gravelly, silty sand. No obvious fill was encountered in any of the test pits. The native sand is generally fine-grained. At a depth of 2 to 3 feet, the native soil became less weathered (more gray in color) and medium-dense, and became unweathered and dense to very dense at a depth of 3 to 4 feet. This dense to very dense soil has been glacially-compressed and is locally referred to as glacial till. It was very difficult to excavate more than a few feet into the glacial till.

Although our explorations did not encounter cobbles or boulders, they are often found in glacial till soils such as this.

Groundwater Conditions

No groundwater or wet soil conditions were observed in the test pits. Even though the test pits were conducted at the end of summer, the preceding fall and winter had been unusually rainy throughout the Puget Sound. As a result, it is somewhat surprising to find no indications of shallow groundwater, which is often perched on top of the dense to very dense soils.

Considering our observations, it appears that there is a low potential for large volumes of groundwater to be found within the explored area during most years. However, this can change with recent weather patterns, and we expect that at least isolated zones of groundwater will be encountered following wet weather.

The stratification lines on the logs represent the approximate boundaries between soil types at the exploration locations. The actual transition between soil types may be gradual, and subsurface conditions can vary between exploration locations. The logs provide specific subsurface information only at the locations tested. The relative densities and moisture descriptions indicated on the test pit logs are interpretive descriptions based on the conditions observed during excavation.

The compaction of test pit backfill was not in the scope of our services. Loose soil will therefore be found in the area of the test pits. If this presents a problem, the backfill will need to be removed and replaced with structural fill during construction.

CONCLUSIONS AND RECOMMENDATIONS

GENERAL

THIS SECTION CONTAINS A SUMMARY OF OUR STUDY AND FINDINGS FOR THE PURPOSES OF A GENERAL OVERVIEW ONLY. MORE SPECIFIC RECOMMENDATIONS AND CONCLUSIONS ARE CONTAINED IN THE REMAINDER OF THIS REPORT. ANY PARTY RELYING ON THIS REPORT SHOULD READ THE ENTIRE DOCUMENT.

The test pits that were conducted for this study encountered medium-dense to dense, native soils within approximately 2 to 3 feet of the existing ground surface. The proposed houses and potential detention vault can be supported on these competent native soils using conventional foundations. Where necessary, properly-compacted structural fill can be placed over the medium-dense to dense soils to reach the design foundation subgrade elevations. It is important that the geotechnical engineer verify that adequate bearing soil are reached before placing any structural fill. Even though they become dense and glacially-compressed, the silty soils can become disturbed in wet conditions, particularly when subjected to foot traffic. As a result, it is often prudent to cover the excavated footing subgrade with a thin layer of clean crushed rock to protect them during the placement of foundation forms and reinforcing steel. Where tree stumps are removed beneath future structures, the resulting hole should be backfilled with quarry spalls or railroad ballast rock.

It will be important that topsoil and loose native soil be removed from potential slab and pavement areas. Interior drainage consisting of a layer of gravel and perforated pipes should be provided beneath the vapor retarder/barrier in the house crawl spaces, and for other below-grade areas such as basements. This is intended to collect subsurface water that may bypass the perimeter footing drains.

Based on our observations and the encountered soil conditions, it is our professional opinion that the potential for deep-seated instability on the steep ravine slopes along the eastern side of the site is low. Under the City of Redmond codes the steeper-than-40 percent slopes on the east side of the site would meet their criteria as a landslide hazard where the steep portion is over 10 feet in height. This generally only occurs on the southernmost of the two parcels. The prescriptive minimum buffer required by Redmond code is 50 feet under RCDG 20.D14.60-020(2). However, their code does allow a reduction of the buffer to a minimum of 15 feet where it can be demonstrated that the reduction will protect the proposed development from the landslide hazard. We confirmed this by conducting a slope stability analysis. Utilizing a program called WinStabl, we analyzed the steep slope for potential failure extending into the dense soil under both static conditions with perched groundwater, and seismic conditions. Copies of this slope stability analysis, which revealed safety factors in excess of 3.0 for static conditions, and 2.0 for seismic conditions are attached to the end of this report. While the potential for instability within the dense soil is negligible, it is possible that the looser, near-surface soils may erode or slide on the taller, steeper portions of the slope in the future. This is a common consideration on any steep slope and a risk that exists whether or not the proposed development is constructed. In order to prevent the proposed development from adversely impacting slope stability, we recommend the following:

- Maintain a minimum 15-foot buffer between the top of the steep slope areas in the proposed development area.
- Construct a highly-visible temporary fence along this 15-foot buffer prior to beginning substantial site clearing and grading activities.
- Avoid placing clearing debris or fill within the 15-foot buffer and on the steep slopes themselves.
- Discharge concentrated runoff away from the steep slope areas.

The soils that underlie the subject site are generally silty and fine-grained, and become dense at a relatively shallow depth. As a result of this, the use of infiltration to dispose of storm water on the site is not appropriate.

Based on our observations, and the results of our laboratory tests, the moisture contents of the on-site soils are above the optimum moisture content necessary for the required structural fill compaction. These fine-grained, silty soils are sensitive to moisture, which makes them impossible to adequately compact when they have moisture contents even 2 to 3 percent above their optimum moisture content. The reuse of these soils as structural fill to level the site will only be successful during hot, dry weather. Aeration of each loose lift of soil will be required to dry it before the lift is compacted. Alternatively, the soil could be chemically dried by adding lime, kiln dust, or cement, provided this is allowed by responsible building department. Regardless of the method of drying, the earthwork process will be slowed dramatically. The earthwork contractor must be prepared to rework areas that don't achieve proper compaction due to high moisture content. Utility trench backfill in structural areas, such as pavements, must also be dried before it can be adequately compacted. Improper compaction of backfill in utility trenches and around control structures is a common reason for pavement distress and failures. Imported granular fill will be needed wherever it is not possible to dry the on-site soils sufficiently before compaction.

The erosion control measures needed during the site development will depend heavily on the weather conditions that are encountered. One of the most important aspects of proper erosion control is covering bare soil immediately before it can be subjected to rainfall or surface runoff. We anticipate that a silt fence will be needed around the downslope sides of any cleared areas. Rocked construction access roads should be extended into the site to reduce the amount of soil or mud carried off the property by trucks and equipment. Wherever possible, these roads should follow the alignment of planned pavements, and trucks should not be allowed to drive off of the rock-covered areas. Existing catch basins in, and immediately downslope of, the planned work areas should be protected with pre-manufactured silt socks. Cut slopes and soil stockpiles should be covered with plastic during wet weather. Following rough grading, it may be necessary to mulch or hydroseed bare areas that will not be immediately covered with landscaping or an impervious surface. As with any project, additional erosion control measures may need to be implemented to address the actual site conditions.

The drainage and/or waterproofing recommendations presented in this report are intended only to prevent active seepage from flowing through concrete walls or slabs. Even in the absence of active seepage into and beneath structures, water vapor can migrate through walls, slabs, and floors from the surrounding soil, and can even be transmitted from slabs and foundation walls due to the concrete curing process. Water vapor also results from occupant uses, such as cooking and bathing. Excessive water vapor trapped within structures can result in a variety of undesirable conditions, including, but not limited to, moisture problems with flooring systems, excessively moist air within occupied areas, and the growth of molds, fungi, and other biological organisms that may be harmful to the health of the occupants. The designer or architect must consider the potential vapor sources and likely occupant uses, and provide sufficient ventilation, either passive or mechanical, to prevent a build up of excessive water vapor within the planned structure.

We recommend including this report, in its entirety, in the project contract documents. This document should also be provided to future owners of the individual lots so that they will be aware of our findings and conclusions related to slope stability.

SEISMIC CONSIDERATIONS

In accordance with the International Building Code (IBC), the site class within 100 feet of the ground surface is best represented by Site Class Type C (Very Dense Soil and Soft Rock). The native soils have a negligible potential for seismic liquefaction because of their dense nature. As noted in the USGS website, the mapped spectral acceleration value for a 0.2 second (S_s) and 1.0 second period (S_1) equals 1.21g and 0.41g, respectively.

CONVENTIONAL FOUNDATIONS

We recommend that continuous and individual spread footings have minimum widths of 12 and 16 inches, respectively. Exterior footings should also be bottomed at least 18 inches below the lowest adjacent finish ground surface for protection against frost and erosion. The local building codes should be reviewed to determine if different footing widths or embedment depths are required. Footing subgrades must be cleaned of loose or disturbed soil prior to pouring concrete. Depending upon site and equipment constraints, this may require removing the disturbed soil by hand.

Depending on the final site grades, overexcavation may be required below the footings to expose competent native soil. Unless lean concrete is used to fill an overexcavated hole, the overexcavation must be at least as wide at the bottom as the sum of the depth of the overexcavation and the footing width. For example, an overexcavation extending 2 feet below the bottom of a 2-foot-wide footing must be at least 4 feet wide at the base of the excavation. If lean concrete is used, the overexcavation need only extend 6 inches beyond the edges of the footing.

The following allowable bearing pressures are appropriate for footings constructed according to the above recommendations:

BEARING CONDITION	ALLOWABLE BEARING PRESSURE
House Footings	2,500 psf
Vault Footings bearing at least 6 feet below grade	5,000 psf

Where: (i) psf is pounds per square foot.

A one-third increase in these design bearing pressures may be used when considering short-term wind or seismic loads. For the above design criteria, it is anticipated that the total post-construction settlement of footings founded on competent native soil, or on structural fill up to 5 feet in thickness, will be less than one inch, with differential settlements on the order of one-quarter inch in a distance of 25 feet along a continuous footing with a uniform load.

Lateral loads due to wind or seismic forces may be resisted by friction between the foundation and the bearing soil, or by passive earth pressure acting on the vertical, embedded portions of the foundation. For the latter condition, the foundation must be either poured directly against relatively level, undisturbed soil or be surrounded by level structural fill.

We recommend using the following ultimate values for the foundation's resistance to lateral loading:

PARAMETER	ULTIMATE VALUE
Coefficient of Friction	0.45
Passive Earth Pressure	300 pcf

Where: (i) pcf is pounds per cubic foot, and (ii) passive earth pressure is computed using the equivalent fluid density.

If the ground in front of a foundation is loose or sloping, the passive earth pressure given above will not be appropriate. We recommend maintaining a safety factor of at least 1.5 for the foundation's resistance to lateral loading, when using the above ultimate values.

PERMANENT FOUNDATION AND RETAINING WALLS

Retaining walls backfilled on only one side should be designed to resist the lateral earth pressures imposed by the soil they retain. The following recommended parameters are for walls that restrain level backfill:

PARAMETER	VALUE
Active Earth Pressure *	40 pcf
Passive Earth Pressure	300 pcf
Coefficient of Friction	0.45
Soil Unit Weight	135 pcf

Where: (i) pcf is pounds per cubic foot, and (ii) active and passive earth pressures are computed using the equivalent fluid pressures.

*** For a restrained wall that cannot deflect at least 0.002 times its height, a uniform lateral pressure equal to 10 psf times the height of the wall should be added to the above active equivalent fluid pressure.**

The values given above are to be used to design only permanent foundation and retaining walls that are to be backfilled, such as conventional walls constructed of reinforced concrete or masonry. It is not appropriate to use the above earth pressures and soil unit weight to back-calculate soil strength parameters for design of other types of retaining walls, such as soldier pile, reinforced earth, modular or soil nail walls. We can assist with design of these types of walls, if desired. The passive pressure given is appropriate for the depth of level structural fill placed in front of a retaining or foundation wall only. The values for friction and passive resistance are ultimate values and do not include a safety factor. We recommend a safety factor of at least 1.5 for overturning and sliding, when using the above values to design the walls. Restrained wall soil parameters should be utilized for a distance of 1.5 times the wall height from corners or bends in the walls. This is intended to reduce the amount of cracking that can occur where a wall is restrained by a corner.

The design values given above do not include the effects of any hydrostatic pressures behind the walls and assume that no surcharges, such as those caused by slopes, vehicles, or adjacent foundations will be exerted on the walls. If these conditions exist, those pressures should be added to the above lateral soil pressures. Where sloping backfill is desired behind the walls, we will need to be given the wall dimensions and the slope of the backfill in order to provide the appropriate design earth pressures. The surcharge due to traffic loads behind a wall can typically be accounted for by adding a uniform pressure equal to 2 feet multiplied by the above active fluid density. Heavy construction equipment should not be operated behind retaining and foundation walls within a distance equal to the height of a wall, unless the walls are designed for the additional lateral pressures resulting from the equipment.

Wall Pressures Due to Seismic Forces

The surcharge wall loads that could be imposed by the design earthquake can be modeled by adding a uniform lateral pressure to the above-recommended active pressure. The recommended surcharge pressure is 7**H** pounds per square foot (psf), where **H** is the design retention height of the wall. Using this increased pressure, the safety factor against sliding and overturning can be reduced to 1.2 for the seismic analysis.

Retaining Wall Backfill and Waterproofing

Backfill placed behind retaining or foundation walls should be coarse, free-draining structural fill containing no organics. This backfill should contain no more than 5 percent silt or clay particles and have no gravel greater than 4 inches in diameter. The percentage of particles passing the No. 4 sieve should be between 25 and 70 percent. If the native soils are used as backfill, and can be adequately compacted, a minimum 12-inch width of free-draining gravel should be placed against the backfilled retaining walls.

The purpose of these backfill requirements is to ensure that the design criteria for a retaining wall are not exceeded because of a build-up of hydrostatic pressure behind the wall. The top 12 to 18 inches of the backfill should consist of a compacted, relatively impermeable soil or topsoil, or the surface should be paved. The ground surface must also slope away from backfilled walls to reduce the potential for surface water to percolate into the backfill.

It is critical that the wall backfill be placed in lifts and be properly compacted, in order for the above-recommended design earth pressures to be appropriate. The wall design criteria assume that the backfill will be well-compacted in lifts no thicker than 12 inches. The compaction of backfill near the walls should be accomplished with hand-operated equipment to prevent the walls from being overloaded by the higher soil forces that occur during compaction. The section entitled ***General Earthwork and Structural Fill*** contains additional recommendations regarding the placement and compaction of structural fill behind retaining and foundation walls.

The above recommendations are not intended to waterproof below-grade walls, or to prevent the formation of mold, mildew or fungi in interior spaces. Over time, the performance of subsurface drainage systems can degrade, subsurface groundwater flow patterns can change, and utilities can break or develop leaks. Therefore, waterproofing should be provided where future seepage through the walls is not acceptable. This typically includes limiting cold-joints and wall penetrations, and using bentonite panels or membranes on the outside of the walls. There are a variety of different waterproofing materials and systems, which should be installed by an experienced contractor familiar with the anticipated construction and subsurface conditions. Applying a thin coat of asphalt emulsion to the outside face of a wall is not considered waterproofing, and will only help to reduce moisture generated from water vapor or capillary action from seeping through the concrete. As with any project, adequate ventilation of basement and crawl space areas is important to prevent a build up of water vapor that is commonly transmitted through concrete walls from the surrounding soil, even when seepage is not present. This is appropriate even when waterproofing is applied to the outside of foundation and retaining walls. We recommend that you contact a specialty consultant if detailed recommendations or specifications related to waterproofing design, or minimizing the potential for infestations of mold and mildew are desired.

SLABS-ON-GRADE

Even where the exposed soils appear dry, water vapor will tend to naturally migrate upward through the soil to the new constructed space above it. This can affect moisture-sensitive flooring, cause imperfections or damage to the slab, or simply allow excessive water vapor into the space above the slab. All interior slabs-on-grade should be underlain by a capillary break or drainage layer consisting of a minimum 4-inch thickness of gravel or crushed rock that has a fines content (percent passing the No. 200 sieve) of less than 3 percent and a sand content (percent passing the No. 4 sieve) of no more than 10 percent. This capillary break/drainage layer is not necessary if an underslab drainage system is installed.

As noted by the American Concrete Institute (ACI) in the *Guides for Concrete Floor and Slab Structures*, proper moisture protection is desirable immediately below any on-grade slab that will be covered by tile, wood, carpet, impermeable floor coverings, or any moisture-sensitive equipment or products. ACI also notes that vapor *retarders*, such as 6-mil plastic sheeting, have been used in the past, but are now recommending a minimum 10-mil thickness. A vapor retarder is defined as a material with a permeance of less than 0.3 perms, as determined by ASTM E 96. It is possible that concrete admixtures may meet this specification, although the manufacturers of the admixtures should be consulted. Where vapor retarders are used under slabs, their edges should overlap by at least 6 inches and be sealed with adhesive tape. The sheeting should extend to the foundation walls for maximum vapor protection. If no potential for vapor passage through the slab is desired, a vapor *barrier* should be used. A vapor barrier, as defined by ACI, is a product with a water transmission rate of 0.01 perms when tested in accordance with ASTM E 96. Reinforced membranes having sealed overlaps can meet this requirement.

EXCAVATIONS AND SLOPES

Excavation slopes should not exceed the limits specified in local, state, and national government safety regulations. Temporary cuts to a depth of about 4 feet may be attempted vertically in unsaturated soil, if there are no indications of slope instability. However, vertical cuts should not be made near property boundaries, or existing utilities and structures. Based upon Washington Administrative Code (WAC) 296, Part N, the upper, looser soil at the subject site would generally be classified as Type B. We recommend that temporary cuts in these soils, which extended to depth of 4 to 5 feet, be no steeper than 1:1 (Horizontal:Vertical). The underlying dense to vern dense soils would be classified as Type A, and could be temporarily cut at a 0.75:1 (H:V) inclination.

The above-recommended temporary slope inclinations are based on the conditions exposed in our explorations, and on what has been successful at other sites with similar soil conditions. It is possible that variations in soil and groundwater conditions will require modifications to the inclination at which temporary slopes can stand. This is especially possible if the site earthwork occurs following an extended period of wet weather.

Temporary cuts are those that will remain unsupported for a relatively short duration to allow for the construction of foundations, retaining walls, or utilities. Temporary cut slopes should be protected with plastic sheeting during wet weather. It is also important that surface water be directed away from temporary slope cuts. Large gravel or boulders should be knocked out of the cut faces before covering them with plastic. The cut slopes should also be backfilled or retained as soon as possible to reduce the potential for instability. Please note that loose soil can cave suddenly and without warning. Excavation, foundation, and utility contractors should be made especially aware of this potential danger. These recommendations may need to be modified if the area near the potential cuts has been disturbed in the past by utility installation, or if settlement-sensitive utilities are located nearby.

All permanent cuts into native soil should be inclined no steeper than 2:1 (H:V). Fill slopes should not be constructed with an inclination greater than 2.5:1 (H:V). To reduce the potential for shallow sloughing, fill must be compacted to the face of these slopes. This can be accomplished by overbuilding the compacted fill and then trimming it back to its final inclination. Adequate compaction of the slope face is important for long-term stability and is necessary to prevent excessive settlement of patios, slabs, foundations, or other improvements that may be placed near the edge of the slope.

Water should not be allowed to flow uncontrolled over the top of any temporary or permanent slope. All permanently exposed slopes should be seeded with an appropriate species of vegetation to reduce erosion and improve the stability of the surficial layer of soil.

DRAINAGE CONSIDERATIONS

Foundation drains should be used where (1) crawl spaces or basements will be below a structure, (2) a slab is below the outside grade, or (3) the outside grade does not slope downward from a building. Drains should also be placed at the base of all earth-retaining walls. These drains should be surrounded by at least 6 inches of 1-inch-minus, washed rock and then wrapped in non-woven, geotextile filter fabric (Mirafi 140N, Supac 4NP, or similar material). At its highest point, a perforated pipe invert should be at least 6 inches below the bottom of a slab floor or the level of a crawl space, and it should be sloped for drainage. All roof and surface water drains must be kept separate from the foundation drain system. A typical drain detail is attached to this report as Plate 10. For the best long-term performance, perforated PVC pipe is recommended for all subsurface drains.

As discussed in the ***General*** section, drainage inside the building's footprint should also be provided where (1) a crawl space will slope or be lower than the surrounding ground surface, (2) an excavation encounters significant seepage, or (3) an excavation for a building will be close to the expected high groundwater elevations.

As a minimum, a vapor retarder, as defined in the ***Slabs-On-Grade*** section, should be provided in any crawl space area to limit the transmission of water vapor from the underlying soils. Also, an outlet drain is recommended for all crawl spaces to prevent a build up of any water that may bypass the footing drains.

No groundwater was observed during our field work. However, if seepage is encountered in an excavation, it should be drained from the site by directing it through drainage ditches, perforated pipe, or French drains, or by pumping it from sumps interconnected by shallow connector trenches at the bottom of the excavation.

The excavation and site should be graded so that surface water is directed off the site and away from the tops of slopes. Water should not be allowed to stand in any area where foundations, slabs, or pavements are to be constructed. Final site grading in areas adjacent to buildings)should slope away at least 2 percent, except where the area is paved. Surface drains should be provided where necessary to prevent ponding of water behind foundation or retaining walls.

PAVEMENTS

The pavement section of the new road may be supported on competent, native soil on structural fill placed over suitable native soils. Because the site soils are silty and moisture sensitive, we recommend that the pavement subgrade is in a non-yielding condition at the time of paving. This is best assessed by a proof-roll using a loaded dump truck. Granular structural fill or geotextile fabric may be needed to stabilize soft, wet, or unstable areas. In most instances where unstable subgrade conditions are encountered, an additional 12 inches of granular structural fill will stabilize the subgrade, except for very soft areas where additional fill could be required. The subgrade should be evaluated by Geotech Consultants, Inc., after the site is stripped and cut to grade. Recommendations for the compaction of structural fill beneath pavements are given in the section entitled ***General Earthwork and Structural Fill***. The performance of site pavements is directly related to the strength and stability of the underlying subgrade.

The pavement for the new street will be subjected to both heavy and light loads. As a result, we recommend that it consist of a minimum of 3 inches of asphalt concrete (AC) over 6 inches of crushed rock base (CRB) or 4 inches of asphalt treated base (ATB).

The pavement section recommendations and guidelines presented in this report are based on our experience in the area and on what has been successful in similar situations. As with any pavements, some maintenance and repair of limited areas can be expected as the pavement ages. Cracks in the pavement should be sealed as soon as possible after they become evident, in order to reduce the potential for degradation of the subgrade from infiltration of surface water. For the same reason, it is also prudent to seal the surface of the pavement after it has been in use for several years. To provide for a design without the need for any maintenance or repair would be uneconomical.

GENERAL EARTHWORK AND STRUCTURAL FILL

All building and pavement areas should be stripped of surface vegetation, topsoil, organic soil, and other deleterious material. The stripped or removed materials should not be mixed with any materials to be used as structural fill, but they could be used in non-structural areas, such as landscape beds.

Structural fill is defined as any fill, including utility backfill, placed under, or close to, a building, behind permanent retaining or foundation walls, or in other areas where the underlying soil needs to support loads. All structural fill should be placed in horizontal lifts with a moisture content at, or near, the optimum moisture content. The optimum moisture content is that moisture content that results in the greatest compacted dry density. The moisture content of fill is very important and must be closely controlled during the filling and compaction process.

The allowable thickness of the fill lift will depend on the material type selected, the compaction equipment used, and the number of passes made to compact the lift. The loose lift thickness should not exceed 12 inches. We recommend testing the fill as it is placed. If the fill is not sufficiently compacted, it can be recompacted before another lift is placed. This eliminates the need to remove the fill to achieve the required compaction. The following table presents recommended relative compactions for structural fill:

LOCATION OF FILL PLACEMENT	MINIMUM RELATIVE COMPACTION
Beneath footings,slabs, or walkways	95%
Filled slopes and behind retaining walls	90%
Beneath pavements	95% for upper 12 inches of subgrade; 90% below that level

Where: Minimum Relative Compaction is the ratio, expressed in percentages, of the compacted dry density to the maximum dry density, as determined in accordance with ASTM Test Designation D 1557-91 (Modified Proctor).

The ***General*** section should be reviewed for considerations related to the reuse of on-site soils. Structural fill that will be placed in wet weather should consist of a coarse, granular soil with a silt or clay content of no more than 5 percent. The percentage of particles passing the No. 200 sieve should be measured from that portion of soil passing the three-quarter-inch sieve.

LIMITATIONS

The conclusions and recommendations contained in this report are based on site conditions as they existed at the time of our exploration and assume that the soil and groundwater conditions encountered in the test pits are representative of subsurface conditions on the site. If the subsurface conditions encountered during construction are significantly different from those observed in our explorations, we should be advised at once so that we can review these conditions and reconsider our recommendations where necessary. Unanticipated soil conditions are commonly encountered on construction sites and cannot be fully anticipated by merely taking soil samples in test pits. Subsurface conditions can also vary between exploration locations. Such unexpected conditions frequently require making additional expenditures to attain a properly constructed project. It is recommended that the owner consider providing a contingency fund to accommodate such potential extra costs and risks. This is a standard recommendation for all projects.

This report has been prepared for the exclusive use of Ellsworth Builders and their representatives for specific application to this project and site. Our conclusions and recommendations are professional opinions derived in accordance with current standards of practice within the scope of our services and within budget and time constraints. No warranty is expressed or implied. The scope of our services does not include services related to construction safety precautions, and our recommendations are not intended to direct the contractor's methods, techniques, sequences, or procedures, except as specifically described in our report for consideration in design. Our services also do not include assessing or minimizing the potential for biological hazards, such as mold, bacteria, mildew and fungi in either the existing or proposed site development.

ADDITIONAL SERVICES

Geotech Consultants, Inc. should be retained to provide geotechnical consultation, testing, and observation services during construction. This is to confirm that subsurface conditions are consistent with those indicated by our exploration, to evaluate whether earthwork and foundation construction activities comply with the general intent of the recommendations presented in this report, and to provide suggestions for design changes in the event subsurface conditions differ from those anticipated prior to the start of construction. However, our work would not include the supervision or direction of the actual work of the contractor and its employees or agents. Also, job and site safety, and dimensional measurements, will be the responsibility of the contractor.

During the construction phase, we will provide geotechnical observation and testing services when requested by you or your representatives. Please be aware that we can only document site work we actually observe. It is still the responsibility of your contractor or on-site construction team to verify that our recommendations are being followed, whether we are present at the site or not.

The following attachments complete this report:

Plate 1	Vicinity Map
Plate 2	Site Exploration Plan
Plates 3 - 8	Test Pit Logs
Plate 9	Grain-Size Analyses
Plate 10	Typical Footing Drain Detail
Appendix	Results of Slope Stability Analyses

We appreciate the opportunity to be of service on this project. If you have any questions, or if we may be of further service, please do not hesitate to contact us.

Respectfully submitted,

GEOTECH CONSULTANTS, INC.

Marc R. McGinnis, P.E.
Principal

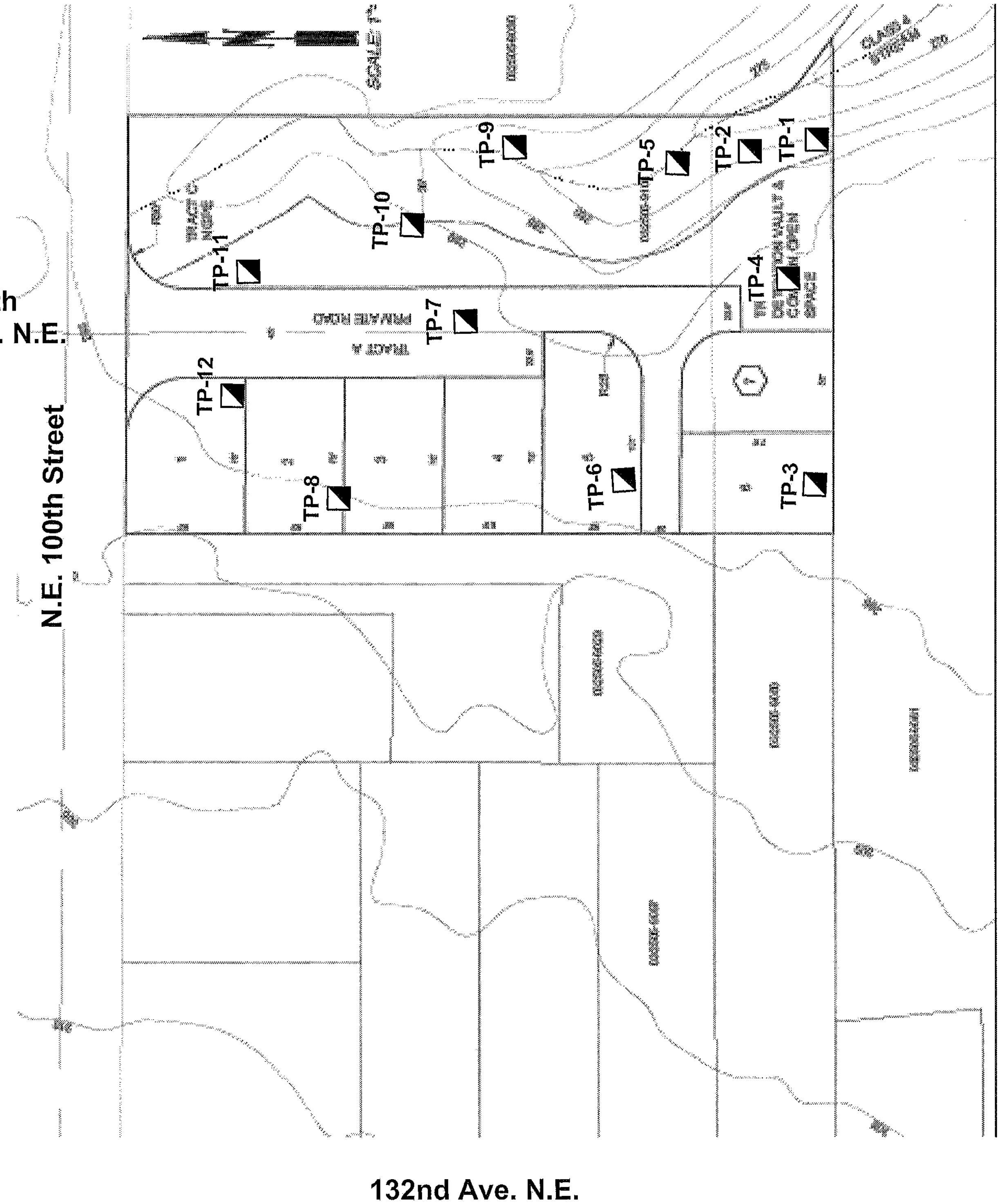
MRM: jyb

GEOTECH
CONSULTANTS, INC.

VICINITY MAP

N.E. 100th Street at 134th Ave. N.E.
Redmond, Washington

Job No:	Date:		Plate:
11335	Oct. 2011		1



Legend:

◪ Test Pit location

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SITE EXPLORATION PLAN

N.E. 100th Street at 134th Ave. N.E.
Redmond, Washington

Job No:	Date:		Plate:
11335	Oct. 2011		2

~~ATTACHMENT 14~~

TEST PIT 1

Depth (ft.)	Moisture Content (%)	Water Table	USCS	Description
			SM	Wood and deadfall over 1 foot of topsoil and roots, then Light-brown, slightly silty SAND with gravel,fine- to medium-grained, damp loose -becomes light-gray, medium-dense -becomes gray and dense to very dense (Glacial Till)
5				
10				

* Test Pit terminated at 5.5 feet on October 14, 2011.
* No groundwater seepage was observed during excavation.
* No caving observed during excavation.

TEST PIT 2

Depth (ft.)	Moisture Content (%)	Water Table	USCS	Description
			SM	Wood and deadfall over 1 foot of topsoil, then Light-gray to brown, slightly silty SAND with gravel, fine- to medium-grained, damp, loose -becomes gray, more silt, dense (Glacial Till)
5				
10				

* Test Pit terminated at 6.0 feet on October 14, 2011.
* No groundwater seepage was observed during excavation.
* No caving observed during excavation.

GEOTECH
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TEST PIT LOG

N.E. 100th Street at 134th Ave. N.E.
Redmond Washington

Job	Date:	Logged by:	Plate:
11335	October 2011		3

TEST PIT 3

Depth (ft.) | Moisture Content (%) | Water Table | USCS | *Description*

SM

Wood and deadfall over 4- to 6-inches of topsoil, then
Reddish-brown, silty SAND with gravel, fine- to medium-grained, damp, loose

-becomes light brown, medium-dense

- becomes mottled with light gray, dense (Glacial Till)

-becomes gray, very dense

5

10

*** Test Pit terminated at 8 feet on October 14, 2011**
*** No groundwater seepage was observed during excavation.**
*** No caving observed during excavation.**

TEST PIT 4

Depth (ft.) | Moisture Content (%) | Water Table | USCS | *Description*

SM

Wood and deadfall over 4- to 6-inches of topsoil, then
Reddish-brown, silty SAND with gravel, fine- to medium-grained, damp, loose

-becomes light gray-brown mottled with orange, medium-dense

-becomes dense (Glacial Till)

-becomes light graydense to very dense

5

10

*** Test Pit terminated at 5.5 feet on October 14, 2011**
*** No groundwater seepage was observed during excavation.**
*** No caving observed during excavation.**

GEOTECH
CONSULTANTS, INC.

TEST PIT LOG

N.E. 100th Street at 134th Ave. N.E.
Redmond Washington

Job	*Date:*	*Logged by:*	*Plate:*
11335	October 2011		4

TEST PIT 5

Depth (ft.)	Moisture Content (%)	Water Table	USCS	Description
			SM	One to 2 feet of organic silt topsoil and roots over Light-tan to brown, silty SAND with gravel, fine- to medium-grained, damp, medium-dense -becomes light-gray, dense (Glacial Till) -becomes all gray, dense to very dense

Depth scale: 5, 10

* **Test Pit terminated at 6.5 feet on October 14, 2011**
* **No groundwater seepage was observed during excavation.**
* **No caving observed during excavation.**

TEST PIT 6

Depth (ft.)	Moisture Content (%)	Water Table	USCS	Description
			SM	Wood and deadfall over 6-inches of topsoil, then Light-brown to reddish-brown mottled with light-gray, silty SAND with gravel, fine- to medium-grained, damp, loose -becomes light gray, medium-dense -becomes gray, dense (Glacial Till)

Depth scale: 5, 10

* **Test Pit terminated at 4.5 feet on October 14, 2011**
* **No groundwater seepage was observed during excavation.**
* **No caving observed during excavation.**

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TEST PIT LOG

N.E. 100th Street at 134th Ave. N.E.
Redmond Washington

Job	Date:	Logged by:	Plate:
11335	October 2011		5

ATTACHMENT 14

TEST PIT 7

Depth (ft.) | Moisture Content (%) | Water Table | USCS | *Description*

SM

Six to 8 inches of Topsoil over
Light-brown to orange-brown, silty SAND with gravel, fine- to medium-grained, damp to moist, loose
-becomes light-gray mottled with orange, medium-dense

-becomes gray to light-gray, dense (Glacial Till)

5

*** Test Pit terminated at 7 feet on October 14, 2011**
*** No groundwater seepage was observed during excavation.**
*** No caving observed during excavation.**

10

TEST PIT 8

Depth (ft.) | Moisture Content (%) | Water Table | USCS | *Description*

SM

Four to 6 inches of Topsoil over
Light-brown to orange-brown, silty SAND with gravel, fine- to medium-grained, damp to moist, loose
-becomes light-gray mottled with some orange, medium-dense

-becomes gray and dense (Glacial Till)

-becomes very dense

5

*** Test Pit terminated at 6 feet on October 14, 2011**
*** No groundwater seepage was observed during excavation.**
*** No caving observed during excavation.**

10

GEOTECH
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TEST PIT LOG

N.E. 100th Street at 134th Ave. N.E.
Redmond Washington

Job	Date:	Logged by:	Plate:
11335	October 2011		6

~~ATTACHMENT 14~~

TEST PIT 9

Depth (ft.)	Moisture Content (%)	Water Table	USCS	*Description*
0–5			SM	Wood and deadfall over 4 to 6 inches of topsoil, then Light-brown to orange-brown, silty SAND with gravel, fine- to medium-grained, damp to moist, loose -becomes light-gray mottled with some orange, medium-dense -becomes gray, dense (Glacial Till)

*** Test Pit terminated at 5 feet on October 14, 2011**
*** No groundwater seepage was observed during excavation.**
*** No caving observed during excavation.**

TEST PIT 10

Depth (ft.)	Moisture Content (%)	Water Table	USCS	*Description*
0–6			SM	Six to 8 inches of Topsoil over Light-brown to orange-brown, silty SAND with gravel, fine- to medium-grained, damp to moist, loose -becomes light-gray mottled with some orange, medium-dense -becomes gray and dense (Glacial Till)

*** Test Pit terminated at 6 feet on October 14, 2011**
*** No groundwater seepage was observed during excavation.**
*** No caving observed during excavation.**

GEOTECH
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TEST PIT LOG

N.E. 100th Street at 134th Ave. N.E.
Redmond Washington

Job	*Date:*	*Logged by:*	*Plate:*
11335	October 2011		7

TEST PIT 11

Depth (ft.)	Moisture Content (%)	Water Table	USCS	Description
			SM	Six to 8 inches of Topsoil over Brown to orange-brown, silty SAND with gravel, fine- to medium-grained, moist, loose
				-becomes light-gray mottled with some orange, medium-dense
5				-becomes gray and dense (Glacial Till)
10				

* **Test Pit terminated at 6 feet on October 14, 2011**
* **No groundwater seepage was observed during excavation.**
* **No caving observed during excavation.**

TEST PIT 12

Depth (ft.)	Moisture Content (%)	Water Table	USCS	Description
			SM	Six to 8 inches of Topsoil over Brown to orange-brown, silty SAND with gravel, fine- to medium-grained, moist, loose
	14.9%			-becomes light-gray mottled with orange, medium-dense
	13.9%			-becomes gray and dense (Glacial Till)
5				
10				

* **Test Pit terminated at 7 feet on October 14, 2011**
* **No groundwater seepage was observed during excavation.**
* **No caving observed during excavation.**

GEOTECH
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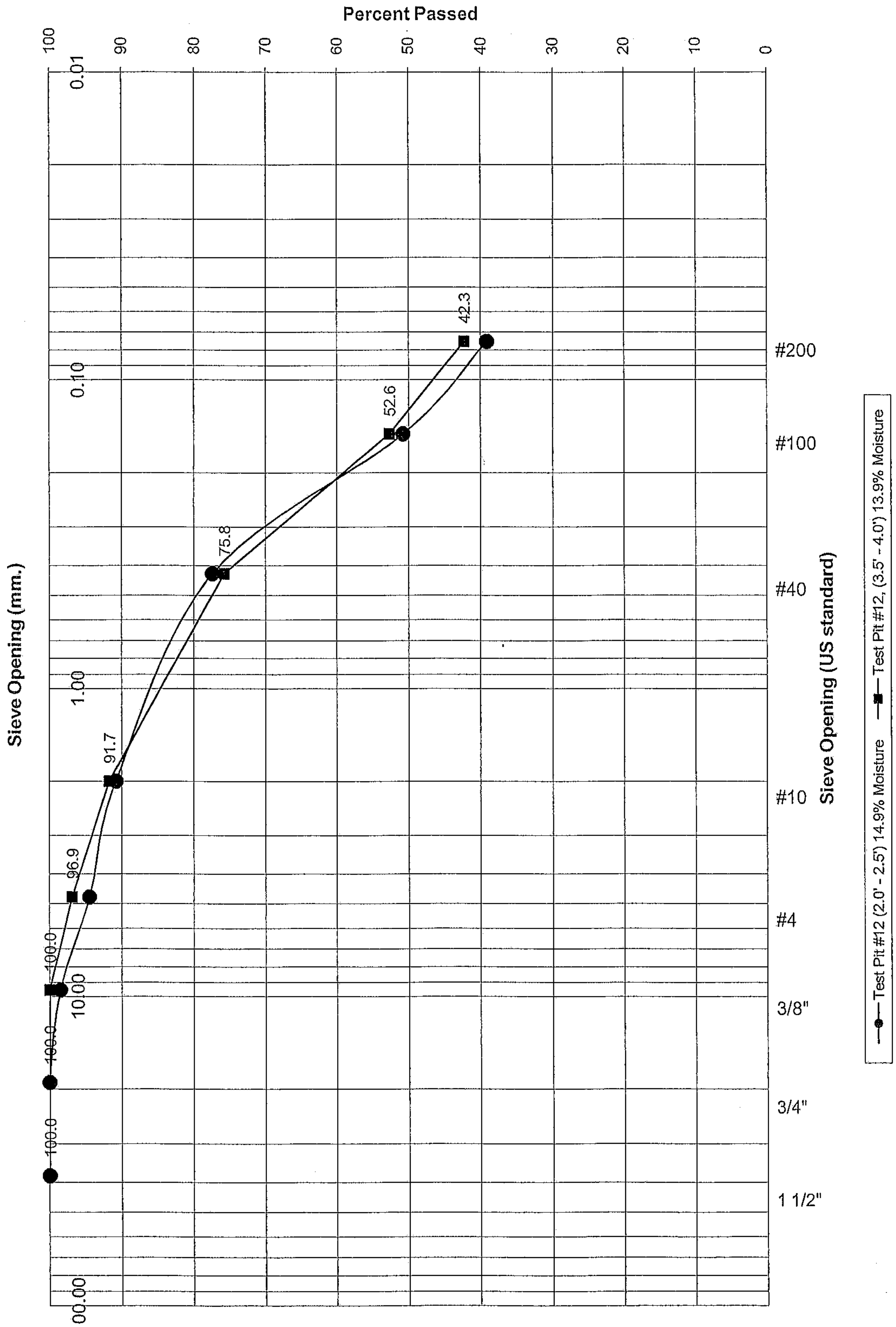
TEST PIT LOG

N.E. 100th Street at 134th Ave. N.E.
Redmond Washington

Job	Date:	Logged by:	Plate:
11335	October 2011		8



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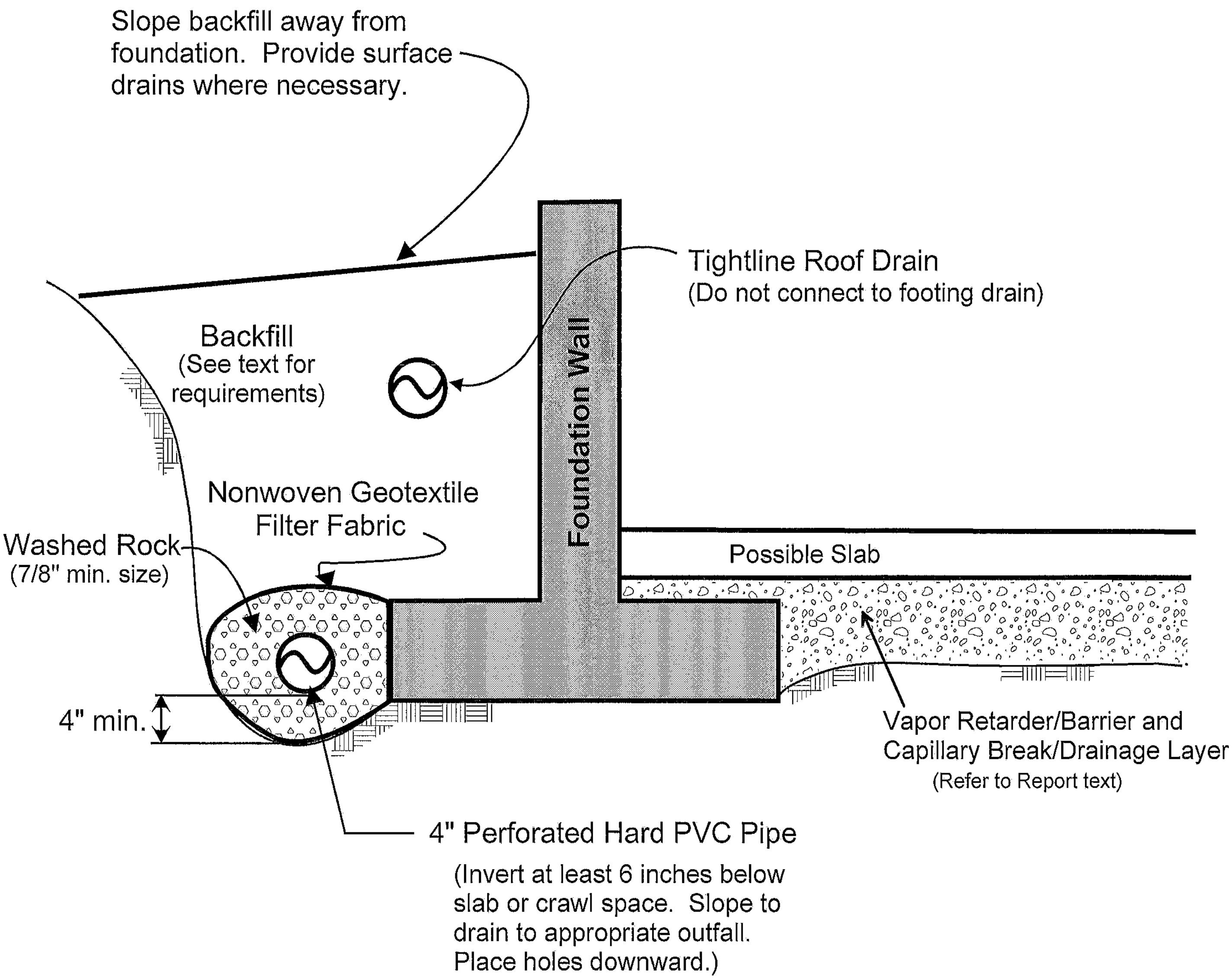
GRAIN SIZE ANALYSES

N.E. 100th Street at 134th Ave. N.E.
Redmond, Washington

Job No:	Date:		Plate:
11335	Oct. 2011		9



NOTES:

(1) In crawl spaces, provide an outlet drain to prevent buildup of water that bypasses the perimeter footing drains.

(2) Refer to report text for additional drainage, waterproofing, and slab considerations.

GEOTECH
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FOOTING DRAIN DETAIL

N.E. 100th Street at 134th Ave. N.E.
Redmond, Washington

Job No:	Date:		Plate:
11335	Oct. 2011		10

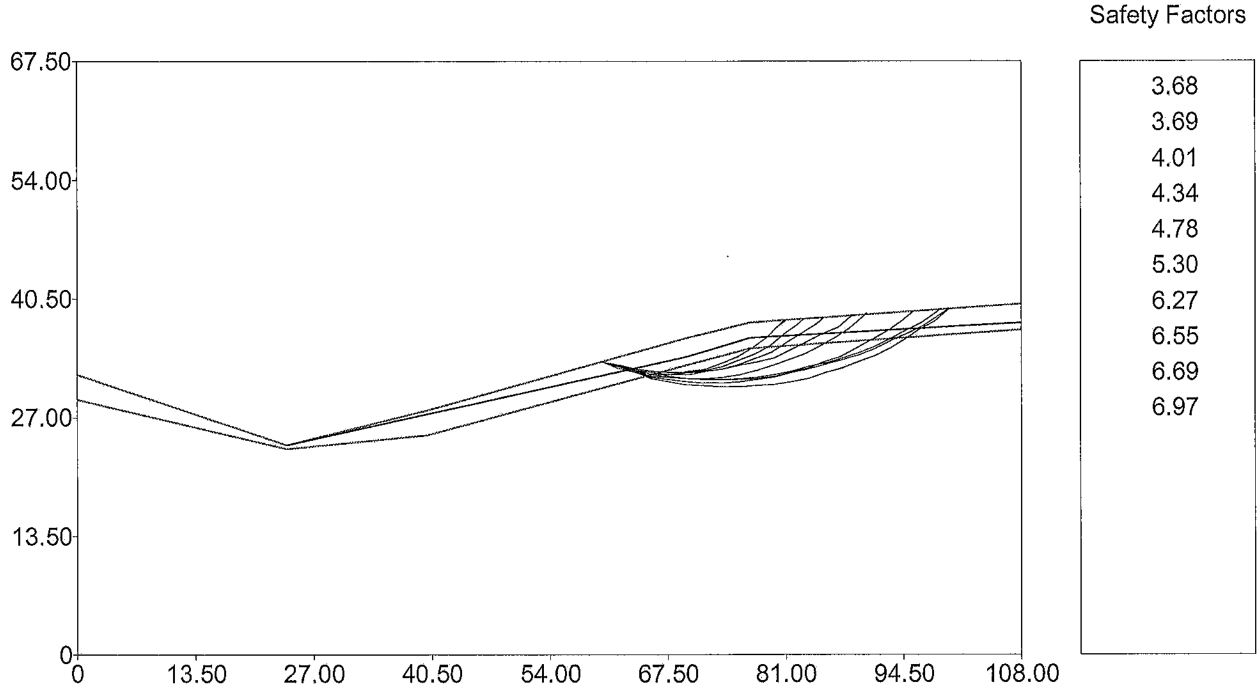
Results of Slope Stability Analyses

Proposed Ellsworth Estates
N.E 100th Street at 134th Ave. N.E.
Redmond, Washington

GEOTECH CONSULTANTS, INC.

ATTACHMENT 14

Static Conditions



Profile.out
** PCSTABL6 **

by
Purdue University

modified by
Peter J. Bosscher
University of Wisconsin-Madison

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

PROBLEM DESCRIPTION

BOUNDARY COORDINATES

5 Top Boundaries
10 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	32.00	24.00	24.00	1
2	24.00	24.00	40.00	28.00	1
3	40.00	28.00	69.70	36.00	1
4	69.70	36.00	77.00	38.00	1
5	77.00	38.00	108.00	40.00	1
6	0.00	29.00	24.00	23.50	2
7	24.00	23.50	40.00	25.00	2
8	40.00	25.00	69.70	33.00	2
9	69.70	33.00	77.00	35.00	2
10	77.00	35.00	108.00	37.00	2

ISOTROPIC SOIL PARAMETERS

2 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	135.0	0.0	28.0	0.00	0.0	1
2	140.0	145.0	0.0	45.0	0.00	0.0	0

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 4 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	24.00	24.00
2	69.70	34.00
3	77.00	36.00
4	108.00	38.00

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.

10 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 1 Points Equally Spaced
Along The Ground Surface Between X = 60.00 ft.
and X = 60.00 ft.

Each Surface Terminates Between X = 80.00 ft.
and X = 100.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = 20.00 ft.

2.00 ft. Line Segments Define Each Trial Failure Surface.

Restrictions Have Been Imposed Upon The Angle Of Initiation.
The Angle Has Been Restricted Between The Angles Of -20.0
And -10.0 deg.

Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Examined. They Are Ordered - Most Critical
First.

* * Safety Factors Are Calculated By The Modified Janbu Method * *

Failure Surface Specified By 13 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	60.00	33.39
2	61.89	32.73
3	63.84	32.29
4	65.83	32.05
5	67.83	32.02
6	69.82	32.20
7	71.78	32.60
8	73.68	33.20
9	75.52	34.00
10	77.25	34.99
11	78.88	36.16
12	80.37	37.50
13	81.06	38.26

*** 3.684 ***

Failure Surface Specified By 13 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	60.00	33.39
2	61.88	32.72
3	63.83	32.26
4	65.82	32.01
5	67.82	31.98
6	69.81	32.17
7	71.77	32.57
8	73.67	33.18
9	75.50	34.00
10	77.22	35.01
11	78.83	36.20
12	80.30	37.56
13	80.90	38.25

*** 3.691 ***

Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	60.00	33.39
2	61.90	32.76
3	63.85	32.31
4	65.83	32.05
5	67.83	31.97
6	69.83	32.07
7	71.81	32.36
8	73.75	32.82
9	75.65	33.47

10	77.47	34.28
11	79.21	35.26
12	80.86	36.40
13	82.39	37.68
14	83.10	38.39

*** 4.005 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	60.00	33.39
2	61.92	32.81
3	63.87	32.38
4	65.85	32.11
5	67.85	31.99
6	69.85	32.03
7	71.84	32.23
8	73.81	32.58
9	75.74	33.09
10	77.63	33.74
11	79.46	34.54
12	81.23	35.48
13	82.91	36.56
14	84.51	37.76
15	85.39	38.54

*** 4.342 ***

Failure Surface Specified By 17 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	60.00	33.39
2	61.94	32.91
3	63.91	32.54
4	65.89	32.30
5	67.89	32.17
6	69.89	32.17
7	71.89	32.29
8	73.87	32.53
9	75.84	32.88
10	77.78	33.36
11	79.69	33.95
12	81.57	34.65
13	83.39	35.47
14	85.16	36.39
15	86.88	37.42
16	88.53	38.56
17	88.79	38.76

*** 4.780 ***

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	60.00	33.39
2	61.90	32.77
3	63.84	32.28
4	65.81	31.92
5	67.79	31.68
6	69.79	31.57
7	71.79	31.60
8	73.79	31.75
9	75.77	32.03
10	77.72	32.44
11	79.65	32.98
12	81.54	33.64
13	83.38	34.42
14	85.17	35.32
15	86.89	36.33
16	88.54	37.45
17	90.12	38.68
18	90.33	38.86

*** 5.296 ***

Failure Surface Specified By 20 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	60.00	33.39
2	61.89	32.74
3	63.82	32.20
4	65.77	31.77
5	67.74	31.44
6	69.73	31.22
7	71.73	31.11
8	73.73	31.11
9	75.73	31.21
10	77.72	31.42
11	79.69	31.75
12	81.64	32.17
13	83.57	32.71
14	85.47	33.34
15	87.32	34.08
16	89.14	34.92
17	90.91	35.86
18	92.62	36.89
19	94.28	38.01
20	95.86	39.22

*** 6.269 ***

Failure Surface Specified By 22 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	60.00	33.39
2	61.93	32.86
3	63.88	32.42
4	65.85	32.07
5	67.83	31.80
6	69.82	31.62
7	71.82	31.52
8	73.82	31.51
9	75.82	31.58
10	77.81	31.75
11	79.80	31.99
12	81.77	32.33
13	83.72	32.75
14	85.66	33.25
15	87.57	33.84
16	89.46	34.51
17	91.31	35.26
18	93.13	36.09
19	94.91	36.99
20	96.66	37.98
21	98.35	39.03
22	98.90	39.41

*** 6.554 ***

Failure Surface Specified By 22 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	60.00	33.39
2	61.93	32.86
3	63.88	32.42
4	65.85	32.06
5	67.83	31.78
6	69.82	31.59
7	71.82	31.48
8	73.82	31.45
9	75.82	31.51
10	77.81	31.66
11	79.80	31.88
12	81.77	32.20
13	83.73	32.59
14	85.68	33.07
15	87.60	33.62
16	89.49	34.26
17	91.36	34.98
18	93.19	35.78
19	94.99	36.65
20	96.75	37.60

21	98.47	38.62
22	99.78	39.47

*** 6.687 ***

Failure Surface Specified By 23 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	60.00	33.39
2	61.88	32.71
3	63.79	32.12
4	65.73	31.63
5	67.69	31.24
6	69.67	30.94
7	71.66	30.75
8	73.66	30.65
9	75.66	30.64
10	77.66	30.74
11	79.65	30.94
12	81.63	31.23
13	83.59	31.62
14	85.53	32.11
15	87.44	32.69
16	89.32	33.37
17	91.17	34.14
18	92.98	35.00
19	94.74	35.94
20	96.45	36.98
21	98.11	38.09
22	99.71	39.29
23	99.95	39.48

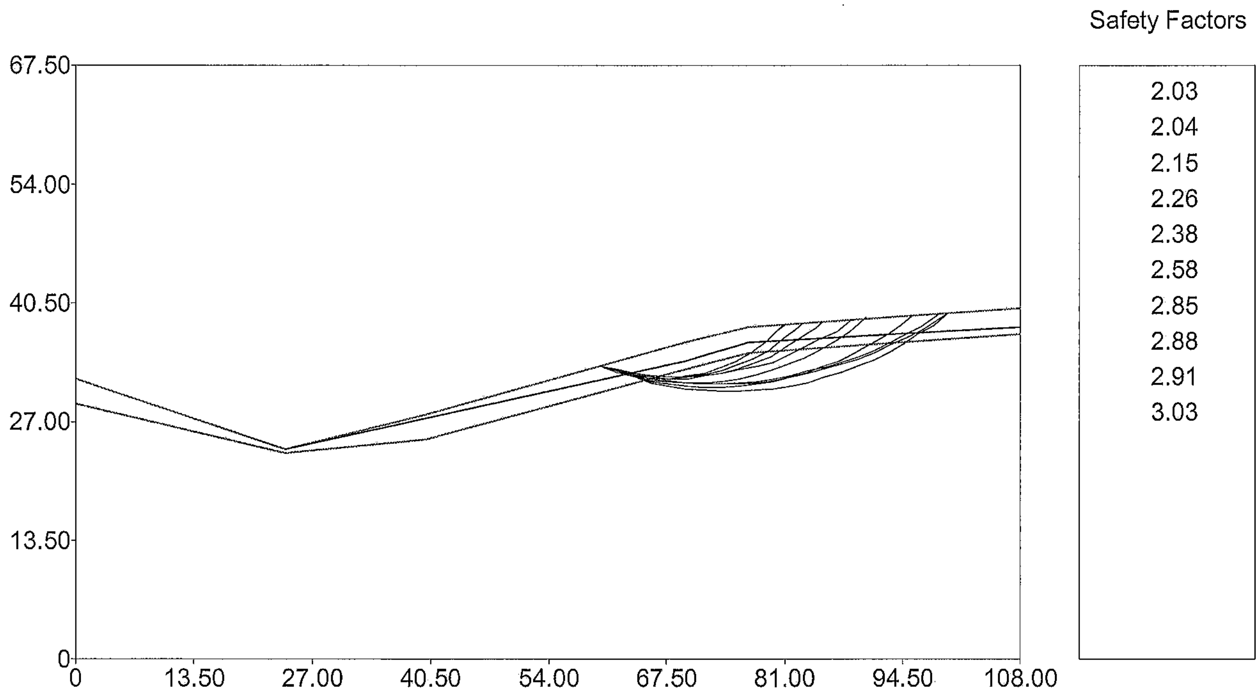
*** 6.968 ***

```
              Y           A     X     I     S          F     T

               0.00      13.50     27.00     40.50     54.00     67.50

  X      0.00 +---------+---------+*--*-----+---------+---------+
              -
              -
              -
              -
              -
        13.50 +
              -
              -
              -
              -
              -             **
  A     27.00 +
```

```
               -
               -
               -
               -
               -
X      40.50  +               * *
               -
               -
               -
               -
               -
I      54.00  +
               -
               -
               -                      1
               -                     1
               -                    01
S      67.50  +                     61
               -                    6*W *
               -                    61
               -                    731
               -                    751*W*
               -                    76431
       81.00  +                     076431
               -                    076543
               -                     976544
               -                     07 655
               -                      977 6
               -                      087
F      94.50  +                         87
               -                        087
               -                         08
               -
               -
               -
T     108.00  +                         *W *
```

ATTACHMENT 14

Seismic Conditions



Profile.out
** PCSTABL6 **

by
Purdue University

modified by
Peter J. Bosscher
University of Wisconsin-Madison

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

PROBLEM DESCRIPTION

BOUNDARY COORDINATES

5 Top Boundaries
10 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	32.00	24.00	24.00	1
2	24.00	24.00	40.00	28.00	1
3	40.00	28.00	69.70	36.00	1
4	69.70	36.00	77.00	38.00	1
5	77.00	38.00	108.00	40.00	1
6	0.00	29.00	24.00	23.50	2
7	24.00	23.50	40.00	25.00	2
8	40.00	25.00	69.70	33.00	2
9	69.70	33.00	77.00	35.00	2
10	77.00	35.00	108.00	37.00	2

ISOTROPIC SOIL PARAMETERS

2 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	135.0	0.0	28.0	0.00	0.0	1
2	140.0	145.0	0.0	45.0	0.00	0.0	0

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 4 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	24.00	24.00
2	69.70	34.00
3	77.00	36.00
4	108.00	38.00

A Horizontal Earthquake Loading Coefficient
Of0.180 Has Been Assigned

A Vertical Earthquake Loading Coefficient
Of0.000 Has Been Assigned

Cavitation Pressure = 0.0 psf

A Critical Failure Surface Searching Method, Using A Random
Technique For Generating Circular Surfaces, Has Been Specified.

10 Trial Surfaces Have Been Generated.

10 Surfaces Initiate From Each Of 1 Points Equally Spaced
Along The Ground Surface Between X = 60.00 ft.
and X = 60.00 ft.

Each Surface Terminates Between X = 80.00 ft.
and X = 100.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = 20.00 ft.

2.00 ft. Line Segments Define Each Trial Failure Surface.

Restrictions Have Been Imposed Upon The Angle Of Initiation.
The Angle Has Been Restricted Between The Angles Of -20.0
And -10.0 deg.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Janbu Method * *

Failure Surface Specified By 13 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	60.00	33.39
2	61.89	32.73
3	63.84	32.29
4	65.83	32.05
5	67.83	32.02
6	69.82	32.20
7	71.78	32.60
8	73.68	33.20
9	75.52	34.00
10	77.25	34.99
11	78.88	36.16
12	80.37	37.50
13	81.06	38.26

*** 2.030 ***

Failure Surface Specified By 13 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	60.00	33.39
2	61.88	32.72
3	63.83	32.26
4	65.82	32.01
5	67.82	31.98
6	69.81	32.17
7	71.77	32.57
8	73.67	33.18
9	75.50	34.00
10	77.22	35.01
11	78.83	36.20
12	80.30	37.56
13	80.90	38.25

*** 2.038 ***

Failure Surface Specified By 14 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)

1	60.00	33.39
2	61.90	32.76
3	63.85	32.31
4	65.83	32.05
5	67.83	31.97
6	69.83	32.07
7	71.81	32.36
8	73.75	32.82
9	75.65	33.47
10	77.47	34.28
11	79.21	35.26
12	80.86	36.40
13	82.39	37.68
14	83.10	38.39

*** 2.151 ***

Failure Surface Specified By 15 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	60.00	33.39
2	61.92	32.81
3	63.87	32.38
4	65.85	32.11
5	67.85	31.99
6	69.85	32.03
7	71.84	32.23
8	73.81	32.58
9	75.74	33.09
10	77.63	33.74
11	79.46	34.54
12	81.23	35.48
13	82.91	36.56
14	84.51	37.76
15	85.39	38.54

*** 2.260 ***

Failure Surface Specified By 17 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	60.00	33.39
2	61.94	32.91
3	63.91	32.54
4	65.89	32.30
5	67.89	32.17
6	69.89	32.17
7	71.89	32.29
8	73.87	32.53
9	75.84	32.88

10	77.78	33.36
11	79.69	33.95
12	81.57	34.65
13	83.39	35.47
14	85.16	36.39
15	86.88	37.42
16	88.53	38.56
17	88.79	38.76

*** 2.376 ***

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	60.00	33.39
2	61.90	32.77
3	63.84	32.28
4	65.81	31.92
5	67.79	31.68
6	69.79	31.57
7	71.79	31.60
8	73.79	31.75
9	75.77	32.03
10	77.72	32.44
11	79.65	32.98
12	81.54	33.64
13	83.38	34.42
14	85.17	35.32
15	86.89	36.33
16	88.54	37.45
17	90.12	38.68
18	90.33	38.86

*** 2.581 ***

Failure Surface Specified By 20 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	60.00	33.39
2	61.89	32.74
3	63.82	32.20
4	65.77	31.77
5	67.74	31.44
6	69.73	31.22
7	71.73	31.11
8	73.73	31.11
9	75.73	31.21
10	77.72	31.42
11	79.69	31.75
12	81.64	32.17
13	83.57	32.71

14	85.47	33.34
15	87.32	34.08
16	89.14	34.92
17	90.91	35.86
18	92.62	36.89
19	94.28	38.01
20	95.86	39.22

*** 2.852 ***

Failure Surface Specified By 22 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	60.00	33.39
2	61.93	32.86
3	63.88	32.42
4	65.85	32.07
5	67.83	31.80
6	69.82	31.62
7	71.82	31.52
8	73.82	31.51
9	75.82	31.58
10	77.81	31.75
11	79.80	31.99
12	81.77	32.33
13	83.72	32.75
14	85.66	33.25
15	87.57	33.84
16	89.46	34.51
17	91.31	35.26
18	93.13	36.09
19	94.91	36.99
20	96.66	37.98
21	98.35	39.03
22	98.90	39.41

*** 2.882 ***

Failure Surface Specified By 22 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	60.00	33.39
2	61.93	32.86
3	63.88	32.42
4	65.85	32.06
5	67.83	31.78
6	69.82	31.59
7	71.82	31.48
8	73.82	31.45
9	75.82	31.51
10	77.81	31.66

11	79.80	31.88
12	81.77	32.20
13	83.73	32.59
14	85.68	33.07
15	87.60	33.62
16	89.49	34.26
17	91.36	34.98
18	93.19	35.78
19	94.99	36.65
20	96.75	37.60
21	98.47	38.62
22	99.78	39.47

*** 2.914 ***

Failure Surface Specified By 23 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	60.00	33.39
2	61.88	32.71
3	63.79	32.12
4	65.73	31.63
5	67.69	31.24
6	69.67	30.94
7	71.66	30.75
8	73.66	30.65
9	75.66	30.64
10	77.66	30.74
11	79.65	30.94
12	81.63	31.23
13	83.59	31.62
14	85.53	32.11
15	87.44	32.69
16	89.32	33.37
17	91.17	34.14
18	92.98	35.00
19	94.74	35.94
20	96.45	36.98
21	98.11	38.09
22	99.71	39.29
23	99.95	39.48

*** 3.026 ***

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           Y           A     X     I     S          F     T

              0.00      13.50     27.00     40.50     54.00     67.50

 X      0.00  +---------+---------+*--*-----+---------+---------+
              -
              -
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                -
                -
                -
        13.50 +
                -
                -
                -
                -
                -                   **
A       27.00 +
                -
                -
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                -
                -
X       40.50 +                       *  *
                -
                -
                -
                -
                -
I       54.00 +
                -
                -                                 1
                -                                1
                -                               01
S       67.50 +                                 61
                -                               6*W  *
                -                               61
                -                               731
                -                               751*W*
                -                               76431
        81.00 +                                 076431
                -                               076543
                -                                976544
                -                                07 655
                -                                 977 6
                -                                 087
F       94.50 +                                     87
                -                                   087
                -                                    08
                -
                -
                -
T      108.00 +                                     *W  *
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GEOTECH
CONSULTANTS, INC.

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(425) 747-5618 FAX (425) 747-8561

August 19, 2013

JN 11335

Ellsworth Builders
26007 Northeast 27th Drive
Redmond, Washington 98053

Attention: Thomas Ellsworth

Subject: **Geotechnical Evaluations of Potential Landslide Hazard Related to Proposed Sanitary Sewer Extension**
Ellsworth Property
134XX Northeast 100th Street
Redmond, Washington

Reference: Geotechnical Engineering Study, *same site and project; Geotech Consultants, Inc.; October 18, 2011*

Dear Mr. Ellsworth: *via email: tellsworth@ellsworthbuilders.com*

This letter presents our geotechnical assessment of the landslide hazard related to the proposed sanitary sewer extension to be constructed in the southeastern corner of the subject property. Based on drawings provided by Land Development Advisors, and our discussions with Jon Nelson of Land Development Advisors, we understand that a sanitary sewer pipe is to be installed through a new easement in the southeastern corner of the subject property. This extension will serve the proposed short-plat. The new pipe would extend across the eastern side of the adjacent southern lot to connect to an existing sanitary sewer manhole located on the next property to the south of that. Three new manholes would be installed along the alignment of the new sewer. These manholes would extend to 8 to 10 feet below the existing grade, and the new sanitary sewer pipe between the manholes would be 7 to 8 feet below the ground surface. This new sanitary sewer outfall would generally be located at least 15 feet away from the steep eastern slope, except for a small section around Manhole #2 in the center of the new sewer line.

Based on the test pits excavated for our geotechnical engineering study, dense glacial till lies above the level of the planned sewer line and manholes. As a result, both the new sewer pipes and the manholes will be buried within the dense glacial till. As referenced in our geotechnical engineering study, the glacial till is not susceptible to instability. Therefore, the potential for future instability that would adversely impact the new sewer extension is negligible. Any shallow movement within the loose, near-surface soils would not damage the sewer pipes or manholes.

In order to prevent the sewer from adversely impacting slope stability, we recommend the following:

1. Prevent the excavated trench for the new sewer and manholes from extending closer than 5 feet to the top of the steeper-than-40 percent slope.
2. Bear the manholes and the new sewer pipe within the dense glacial till.
3. Utilize trench boxes to minimize the width of the trenches and the excavations around the manholes.
4. Backfill around the manholes and over the entire depth of the sewer trenches using

excavated silty sand soil compacted to at least 90 percent of the maximum Modified Proctor (ASTMD-1557) Dry Density. This will minimize the potential that subsurface water could follow the trench line of the new sewer.

Please contact us if you have any questions regarding this letter, or if we can be of further assistance.

Respectfully submitted,

GEOTECH CONSULTANTS, INC.

8/19/13

Marc R. McGinnis, P.E.
Principal

cc: **Land Development Advisors**
via email: landdevadvisors@comcast.net

MRM: jyb