
# GEOTECHNICAL ENGINEERING STUDY
# CALVERT / ANDERSON PROPERTY
# RESIDENTIAL PLAT
# 136th AVENUE NORTHEAST
# KIRKLAND, WASHINGTON

**ES-2471**

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**PREPARED FOR**

**GGM INVESTMENTS, LLC**

**April 12, 2016**


**Scott S. Riegel, L.E.G.**
**Project Manager**




**Kyle R. Campbell, P.E.**
**Principal**


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# Important Information About Your

# Geotechnical Engineering Report

*Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.*

*The following information is provided to help you manage your risks.*

## Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you* — should apply the report for any purpose or project except the one originally contemplated.

## Read the Full Report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

## A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

## Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

## Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ—sometimes significantly—from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

## A Report's Recommendations Are *Not* Final

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final,* because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual

subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.*

## A Geotechnical Engineering Report Is Subject to Misinterpretation

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

## Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

## Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time* to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

## Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations" many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

## Geoenvironmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

## Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, a number of mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; ***none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.***

## Rely, on Your ASFE-Member Geotechncial Engineer for Additional Assistance

Membership in ASFE/The Best People on Earth exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with you ASFE-member geotechnical engineer for more information.

ASFE
The Best People on Earth

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Earth Solutions NW LLC

- Geotechnical Engineering
- Construction Monitoring
- Environmental Sciences

April 12, 2016
ES-2471

GGM Investments, LLC
9675 Southeast 36th Street, Suite 105
Mercer Island, Washington 98040

Attention: Ms. Carol Rozday

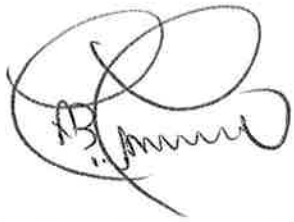
Dear Ms. Rozday:

Earth Solutions NW, LLC (ESNW) is pleased to present this report titled "Geotechnical Engineering Study, Calvert/Anderson Property Residential Plat, 136th Avenue Northeast, Kirkland, Washington". Based on the results of our study, in our opinion, the proposed residential development is feasible from a geotechnical standpoint. In general, the subject property is generally underlain by medium dense to very dense glacial deposits. Isolated areas of fill are present and addressed in this report.

Geotechnical recommendations related to the proposed site development are provided in this geotechnical engineering study. If you have any questions regarding the content of this study, please call.

Sincerely,

**EARTH SOLUTIONS NW, LLC**



FOR: Scott S. Riegel, L.E.G.
Project Manager

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**ES-2471**

## INTRODUCTION

### General

This geotechnical engineering study was prepared for the proposed construction of a residential plat located in the east Totem Lake area of Kirkland, Washington. The purpose of this study was to excavate a series of test pits at accessible areas of the subject site, perform geotechnical analyses, and develop geotechnical recommendations for the proposed site development with a focus on the feasibility of constructing a site access roadway across a section of a steep slope. Our scope of services for completing this geotechnical engineering study included the following:

- Subsurface exploration and sampling;
- Laboratory testing of soil samples;
- Engineering analysis; and,
- Preparation of this report.

The following documents and/or resources were reviewed as part of this report preparation:

- Preliminary Site Plan prepared by D.R. Strong Engineers, Inc., dated January 21, 2015;
- Kirkland Municipal Code Chapter 85 – Geologically Hazardous Areas;
- Geologic Map of King County, Booth 2006, and;
- King County USDA Soil Conservation Survey.

### Project Description

Based on preliminary project plans, 28 single-family residential lots will be created on the site. Egress will be provided via a new roadway alignment which will be accessed off 136th Avenue Northeast designated Northeast 133rd Street. A stormwater detention vault will be located in the southeastern corner of the site, within a topographic low area. The approximate location of the detention vault is depicted on Plate 2.

The Calvert property has been modified using hardscape elements such as modular block walls, rockeries and concrete retaining walls and general uncontrolled fill placement in other areas. As such, grading may be relatively extensive and could require cuts and fills of 10 to 12 feet or more to reconfigure the site.

Cuts of up to about 16 feet may be required to construct the detention vault, with the deepest cuts made along the western or up-slope side. Grading plans are being developed at this time; however, we anticipate retaining walls will be utilized along lot boundaries to accommodate the grade changes required to construct the building pads.

The proposed residential structures will consist of relatively lightly-loaded wood framing supported on conventional foundations with either crawlspaces or slab on grade floors. Based on our experience with similar developments, we anticipate wall loads on the order of 2 kips per lineal foot and slab-on-grade loading of 150 pounds per square foot (psf).

If the above design assumptions are incorrect or change, ESNW should be contacted to review the recommendations in this report, and provide supplement recommendations, if necessary.

## Surface

The subject site is located along the east side of 136th Avenue Northeast in the east Totem Lake area of Kirkland, Washington. The approximate location of the subject property is illustrated on the Vicinity Map (Plate 1). The overall site consists of three adjoining properties listed as 13224, 13236 and 13240 – 136th Avenue Northeast that total about 12.26 acres. The project area is bordered to the north by a natural drainage ravine, to the south by existing residential development, to the east by a steep slope open area that descends to the valley floor and to the west by 136th Avenue Northeast. The approximate limits of the project area and the currently proposed layout of the building lots are illustrated on the Test Pit Location Plan (Plate 2). Topography generally descends gently to the east from 136th Avenue Northeast across the property. Steep slopes are located along portion of the north and east property boundaries and are associated with a natural drainage ravine. Based on information provided by the current property owner (Calvert), grading has occurred within some areas of the ravine area including, but not limited to, constructing a crude roadway crossing the ravine and removal of sandy alluvial deposits.

## Subsurface

A representative of ESNW observed, logged and sampled six test pits in July 2012 and seven test pits in October 2015 excavated within the accessible areas of the site for purposes of assessing soil conditions and characterizing and classifying the site soils. Because the site is currently under ownership outside our client, test pit locations were primarily governed by limiting disturbance to improved areas. The approximate locations of the test pits are illustrated on the Test Pit Location Plan (Plate 2). Please refer to the test pit logs provided in appendix A for a more detailed description of the subsurface conditions.

### Topsoil

A maximum of six inches of topsoil and sod was encountered in our test pits with an average depth of about four inches.

### Fill

Fill was encountered at several test pit locations and primarily consisted of loose to medium dense silty sand (Unified Soil Classification SM). The fill contained scattered organic material and construction debris. Fill depths ranged from about four feet (TP-5) to 13 feet (TP-1). Approximate areas where non-engineered fills were placed are delineated on Plate 2. Areas of fill are also likely present near the existing structures.

Fill was encountered at test pit locations TP-105 and TP-108 extending to depths of about three and eight feet, respectively. The fill at location TP-108 consisted of medium dense silty sand and contained concrete pieces and debris near the base (seven feet below grade).

### Native Soil

The native soil consisted predominantly of medium dense to very dense silty sand with gravel (SM). Scattered cobbles were observed at some test pit locations. Relatively clean sand (SP-SM) deposits were encountered at test pit location (TP-6).

Test pits excavated on October 2015 were focused along the top of the steep slope areas. In these test pits, underlying the fill (where encountered) medium dense to very dense silty sand with gravel (SM) and sand (SP-SM) native deposits were encountered extending to the maximum termination depth of about 15 feet below existing grades.

## Groundwater

Groundwater seepage was not observed at the test pits at the time of our fieldwork (July 31, 2012 and October 21, 2015). Groundwater seepage rates and elevations fluctuate depending on many factors, including precipitation duration and intensity, the time of year, and soil conditions. In general, groundwater seepage flow rates are higher during the wetter, winter months. Therefore, groundwater seepage should be expected in site excavations, particularly in the winter and spring months. Because the predominant soil on this site is glacial till, water that is exposed during grading will be in a perched condition and will not be an established groundwater table.

## Geological Hazard Areas

We reviewed Chapter 85 of the Kirkland Zoning Code (KZC) relating to geologically hazardous areas classifications, mitigation and development standards.

**Erosion Hazard Areas KZC 85.13-2**

KZC defines Erosion hazard Areas as follows:

*Those areas containing soils which, according to the USDA Soil Conservation Service King County Soil Survey dated 1973, may experience severe to very severe erosion hazard. This group of soils includes, but is not limited to, the following when they occur on slopes of 15 percent or greater: Alderwood gravelly sand loam (AgD), Kitsap silt loam (KpD), Ragnar Indianola Association (RdE) and portions of the Everett gravelly sand loams (EvD) and Indianola Loamy fine sands (InD).*

Based on review of the USDA SCS mapping resource, the development envelope is underlain by Alderwood series (AgC) 8 – 15 percent slope soils. The steeper sloped areas off the east side of the project are mapped as Alderwood series (AgD). The steeper slopes off the north side of the site would also be classified as AgD series soils. The topographic information was used to estimate slope gradients across the development envelope of the site. We have delineated areas that meet the slope criteria for potential erosion hazard (slopes of at least 15 percent). It is important to note that the majority of these areas were created during past grading.

The site development plans include regrading much of the site and such will result in exposed soil areas. Sediment-laden surface water should not be allowed to flow over the steep slope areas to the north and east of the project envelope. In our opinion, standard erosion hazard mitigation methods will provide an adequate level of safety with respect to erosion and off-site migration/transport of soil. ESNW should review the erosion control plan to confirm adequate measures are included and to provide supplemental recommendations.

**High Landslide Hazard Areas KZC 85.13-4a**

Kirkland classifies potential landslide hazard areas as either high or moderate. High potential landslide hazard areas are defined as follows:

*Areas sloping 40 percent or greater, areas subject to previous landslide activities and areas sloping between 15 percent and 40 percent with zones of emergent groundwater or underlain by or embedded with impermeable silts or clays.*

The slopes along the north and east site boundaries meet the criteria for High Landslide Hazard where slopes are inclined at least 40 percent. These areas are delineated on the referenced plan prepared by D.R. Strong. Test pits excavated near the top of the steep slope areas revealed generally firm glacial deposits.

**Moderate Landslide Hazard Areas KZC 85.13-4b**

Moderate potential landslide hazard areas are defined as follows:

*Areas sloping between 15 percent and 40 percent and underlain by relatively permeable soils consisting largely of sand and gravel or highly competent glacial till.*

The majority of the site is underlain by competent glacial till and is stable with respect to landslide activity in the current configuration. In our opinion, construction of the residential plat will not increase the potential for landslide activity, primarily due to improved drainage and soil retention near the slope areas.

**Landslide Hazard Area Buffer and Foundation Setbacks**

Test pits excavated at the top of the steep slope ravine feature revealed dense glacial till deposits that are stable with respect to landslide activity. No conditions that would represent a potential slippage plane were observed. No signs of springs or other hydrologic conditions that might reduce slope stability were observed during our fieldwork. In our opinion a minimum building foundation setback of 15 feet from the top of slopes inclined at least 40 percent should be used for site layout. Where space is limited, foundations near the top of slope can be advanced to a depth that will provide a minimum horizontal setback of 15 feet from the face of the slope. In no case should foundations (measured from the foundation face at finish grade) be closer than 10 feet from the top of steep slope areas. Due to the presence of fill at some areas near the steep slopes (TP-1, TP-5 and TP-107), we recommend lowering grades in Lots 15-18 to accommodate the new buildings. In any case, ESNW should review the grading plan to confirm foundation setbacks are suitable for soil conditions anticipated to be exposed. Decks can be constructed off the north side of the new buildings provided the foundations are advanced at least five feet into dense undisturbed native soil and the decks are constructed to collect and convey water away from the slopes.

**Analysis of Proposal**

The current proposal includes redeveloping the properties with a residential plat, egress and associated improvements. While the density of impervious surfaces will increase, the design has been developed to control drainage and protect the steep sensitive areas around the site. In this respect, impacts to surrounding properties or sensitive areas will not increase as a result of the project.

The steeper slope areas off the north and east sides of the development envelope are sensitive and measures should be included to protect them from erosion during construction and after construction. Placing fill near the top of the steep slope areas should be avoided and grading plans should reflect this approach.

**Mitigation Measures**

Protection of the steep slope areas from erosion during construction and on a permanent basis is critical to maintain overall stability. As noted earlier, placement of fill along the top of the slopes or within the buffers should be avoided. Water should not be allowed to flow over or pond above the slopes during construction or on a permanent basis. If decks will be constructed off the north side of the homes, foundation elements should be advanced at least five feet into competent native soil and water should be captured from the deck(s) and conveyed to an approved discharge.

## DISCUSSION AND RECOMMENDATIONS

### General

Based on the results of our study, the proposed development is feasible from a geotechnical standpoint. The primary geotechnical considerations associated with the proposed development include foundation support, suitability of the on-site soils for use as structural fill, and preparation of building subgrade areas.

The soils encountered at the test pit locations generally have a high sensitivity to moisture based on the fines content of the soil. It may be possible to use excavated site native soils elsewhere within the building pads depending on the conditions at the time of placement. The suitability of using the on-site soils as structural fill should be evaluated by ESNW during construction. We understand preliminary grading plans will likely remove the majority of the existing fill areas.

The proposed residential structures can be supported on competent native soil, existing competent fill or new structural fill. We anticipate competent native and fill soil suitable for support of foundations will generally be exposed at a depth of two to four feet below existing grades. ESNW should observe conditions at the design foundation subgrade to confirm adequate conditions are exposed and to provide additional recommendations where necessary.

This study has been prepared for the exclusive use of GGM Investments, LLC and their representatives. No warranty, expressed or implied, is made. This study has been prepared in a manner consistent with the level of care and skill ordinarily exercised by other members of the profession currently practicing under similar conditions in this area.

### Site Preparation and Earthwork

Site preparation will likely include installing temporary erosion control measures and clearing limits and establishing construction entrances and removing existing structural improvements.

### Erosion Control

Temporary erosion control measures should include, at a minimum, silt fencing placed along the downslope perimeter of the construction envelope, and a construction entrance consisting of at least 12 inches of quarry spalls to minimize off-site soil tracking and to provide a firm surface. Surface water should not be allowed to flow over temporary or permanent slopes. Interceptor drains or swales should be considered for controlling surface water flow patterns. ESNW should observe the erosion control measures, and provide supplemental recommendations for minimizing erosion during construction, as necessary.

**In-situ Soils**

The soil encountered at the test pit locations generally have a high sensitivity to moisture based on the fines content of the soil. It may be possible to use excavated native soils elsewhere within the building pads depending on the conditions at the time of placement. The suitability of using the on-site soils as structural fill should be evaluated by ESNW during construction. In our opinion existing unsuitable fill should be removed from new foundation areas and grades restored with structural fill.

Compaction of site soils to the levels necessary for use as structural fill will be difficult or impossible during wet weather conditions. If the moisture content of the soil is near the optimum level, the soil can be used as structural fill. However, the stability of the compacted soil will degrade if exposed to wet weather and/or construction traffic. In our opinion, a contingency should be provided in the project budget to cover export of unsuitable fill soils.

Imported soil intended for use as structural fill within building lot areas should consist of a well graded granular soil with a maximum aggregate grain size of four inches, and a moisture content that is at or near the optimum level. During wet weather conditions, imported soil intended for use as structural fill should consist of a well graded granular soil with a fines content of 5 percent or less defined as the percent passing the #200 sieve, based on the minus three-quarter inch fraction.

**Structural Fill Placement**

Structural fill is defined as compacted soil which is devoid of organic material and deleterious debris placed in foundation, slab-on-grade, and roadway areas. Fills placed to construct permanent slopes and throughout retaining wall, and utility trench backfill areas are also considered structural fill. Soils placed in structural areas should be placed in loose lifts of 12 inches or less and compacted to a relative compaction of 90 percent, based on the maximum dry density as determined by the Modified Proctor Method (ASTM D-1557-02). In pavement areas, the upper 12 inches of the structural fill should be compacted to a relative compaction of at least 95 percent. The subgrade in pavement and slab areas must also be in a stable condition. In order to provide a stable subgrade, it may be necessary to compact more than the upper 12 inches to 95 percent.

**Fill Slope Placement**

Because the site slopes to the east across the majority of the development envelope, structural fill will likely be placed on existing sloped areas. Fill placed on slopes should be provided a keyway and level bench system prior to placement. A slope fill placement detail is provided on Plate 3. Fill should not be placed on the top of steep slope areas located along the northern development envelope.

## Excavations and Slopes

The Federal and state Occupation Safety and Health Administration (OSHA/WISHA) classifies soils in terms of minimum safe slope inclinations. Based on the soil conditions encountered during our fieldwork, the fill soils, weathered native soils and where groundwater is exposed would be classified by OSHA/WISHA as Type C. Temporary slopes over four feet in height in Types C soils should be sloped no steeper than 1.5H:1V (Horizontal:Vertical). The firm, undisturbed native deposits where no groundwater is exposed would be classified by OSHA/WISHA as Type A. Temporary slopes over four feet in height in Type A soils should be sloped no steeper than 0.75H:1V (Horizontal:Vertical). ESNW should observe temporary and permanent slopes to verify that the inclination is appropriate for the conditions exposed, and to provide additional grading recommendations, as necessary. If temporary slopes cannot be constructed in accordance with OSHA/WISHA guidelines, temporary shoring may be necessary.

Permanent slopes should maintain a gradient of 2H:1V, or flatter, and should be planted with vegetation to enhance stability and to minimize erosion.

## Foundations

The proposed residential structures can be supported on conventional spread and continuous footings bearing on competent native soil or structural fill. We anticipate competent native soil suitable for support of foundations will generally be encountered at depths of two to four feet below existing grades across much of the site; however, deeper fill was encountered near proposed Lots 14-18 and should be further evaluated by ESNW during grading. Building pad fill areas should be compacted to the specifications of structural fill previously described in this report. Where loose or unsuitable soil conditions are encountered at foundation subgrade elevations, compaction of the soils to the specifications of structural fill, or overexcavation and replacement with structural fill may be necessary.

The following parameters can be used for foundation design:

- Allowable soil bearing capacity — 2,500 psf
- Passive earth pressure — 300 pcf
- Coefficient of friction — 0.40

The passive earth pressure value provided above assumes the foundations are backfilled with structural fill. A factor-of-safety of 1.5 has been applied to these passive resistance and friction values. For short term wind and seismic loading, a one-third increase in the allowable soil bearing capacity can be assumed.

With structural loading as expected, total settlement in the range of one inch is anticipated, with differential settlement of approximately one-half inch. The majority of the settlements should occur during construction, as dead loads are applied.

## Slab-On-Grade Floors

Slab-on-grade floors for residential structures should be supported on competent native soil or structural fill. Unstable or yielding areas of the subgrade should be recompacted or overexcavated and replaced with suitable structural fill prior to construction of the slab. A capillary break consisting of a minimum of four inches of free draining crushed rock or gravel should be placed below the slab. The free draining material should have a fines content of 5 percent or less (percent passing the #200 sieve, based on the minus three-quarter inch fraction). In areas where slab moisture is undesirable, installation of a vapor barrier below the slab should be considered. If a vapor barrier is used it should consist of a material specifically designed for that use and be installed in accordance with the manufacturer's specifications.

## Seismic Considerations

The 2012 IBC recognizes ASCE for seismic site class definitions. If the project will be permitted under the 2012 IBC, in accordance with Table 20.3-1 of ASCE, Minimum Design Loads for Buildings and Other Structures, Site Class D, should be used for design.

In our opinion, liquefaction susceptibility at this site is low. Glacially consolidated soil deposits are typically not susceptible to the effects of liquefaction. The relative density of the site soils and the absence of a uniform, shallow groundwater table is the primary basis for this designation.

## Retaining Walls

Retaining walls must be designed to resist earth pressures and applicable surcharge loads. The following parameters can be used for retaining wall design:

- Active earth pressure (unrestrained condition) 35 pcf
- At-rest earth pressure (restrained condition) 55 pcf
- Traffic surcharge (passenger vehicles) 70 psf (rectangular distribution)
- Passive earth pressure 300 pcf
- Coefficient of friction 0.40
- Seismic surcharge 6H*

*Where H equals the retained height for retaining walls at least six feet in height

Additional surcharge loading from adjacent foundations, sloped backfill, or other loads should be included in the retaining wall design. Drainage should be provided behind retaining walls such that hydrostatic pressures do not develop. If drainage is not provided, hydrostatic pressures should be included in the wall design.

Retaining walls should be backfilled with free draining material that extends along the height of the wall, and a distance of at least 18 inches behind the wall. The upper one foot of the wall backfill can consist of a less permeable soil, if desired. A perforated drain pipe should be placed along the base of the wall, and connected to an approved discharge location. A typical retaining wall drainage detail is provided on Plate 4.

## Drainage

Groundwater seepage should be expected in deeper site excavations, especially at the contact between the weathered and unweathered native soils. Temporary measures to control surface water runoff and groundwater during construction would likely involve passive methods such as interceptor trenches and sumps.

Surface grades must be designed to direct water away from buildings and slopes. The grade adjacent to buildings should be sloped away at a gradient of at least 2 percent for a horizontal distance of ten feet. In our opinion, perimeter footing drains should be installed at or below the invert of the building footings. A typical footing drain detail is provided on Plate 5 of this report.

### Infiltration

Soils encountered at the majority of the test pit locations at depths typical for lot infiltration facilities consisted primarily of dense to very dense silty sand with gravel. These soils are not well-suited for infiltration.

### Detention Vault Recommendations

We anticipate a stormwater detention vault or similar stormwater facility will be constructed on the east side of the site. With respect to detention vault construction, competent native soils suitable for support of the vault foundations are anticipated to be exposed at typical vault subgrade elevation. ESNW should review the vault design to confirm the recommendations provided in this report are followed and provide supplemental recommendations if necessary. Groundwater was not observed at the test pit locations within the vault area during the exploration on October 21, 2015. As such, the presence of perched groundwater seepage should be expected in the detention vault excavations, depending on the time of year grading takes place.

With respect to temporary slopes required to construct the vault, in our opinion, the soil should be sloped at a 1H:1V inclination or flatter. ESNW should review detention vault designs, particularly with respect to location relative to sensitive site features and property lines.

A zone of free-draining rock or a sheet drain must be provided behind the vault walls. A four-inch perforated PVC drain pipe must be placed the base of the vault walls. If the drain is too low to gravity flow to an outlet, the drain (and associated drain rock or sheet drain) should be raised to a point where it can gravity flow to an outlet. The portion of the vault walls located below the drain pipe must be designed for hydrostatic pressure.

The following values can be used for design of the vault:

| | |
|---|---|
| • Allowable soil bearing capacity | 5,000 psf* |
| • Active earth pressure (yielding condition) | 35 pcf (equivalent fluid) |
| • Active earth pressure (hydrostatic) | 80 pcf |
| • At-rest earth pressure (restrained condition) | 55 pcf |
| • At-rest earth pressure (hydrostatic) | 95 pcf |
| • Traffic surcharge for passenger vehicles (where applicable) | 70 psf (rectangular distribution) |
| • Passive earth pressure | 300 pcf (equivalent fluid) |
| • Coefficient of friction | 0.40 |
| • Seismic surcharge | 6H |

* Value is for dense native soil anticipated to be exposed at depths of five feet or more below existing grades.

**Utility Support and Trench Backfill**

In our opinion, the soils observed at the test sites are generally suitable for support of utilities. Excessively loose, organic, or otherwise unsuitable soils encountered in the trench excavations should not be used for supporting utilities. In general, the on-site soils observed at the test sites should be suitable for use as structural backfill in the utility trench excavations, provided the soil is at or near the optimum moisture content at the time of placement and compaction. Moisture conditioning of the soils may be necessary at some locations prior to use as structural fill. Utility trench backfill should be placed and compacted to the specifications of structural fill provided in this report, or to the applicable specifications of Kirkland or other applicable jurisdiction or agency.

## Pavement Sections

The performance of site pavements is largely related to the condition of the underlying subgrade. To provide adequate pavement performance, the subgrade should be in a firm and unyielding condition when subjected to proofrolling with a loaded dump truck. Structural fill in pavement areas should be compacted as recommended in the "Site Preparation and Earthwork" section of this report. It is possible that soft, wet, or otherwise unsuitable subgrade areas may still exist after base grading activities. Areas of unsuitable or yielding subgrade conditions will require remedial measures such as overexcavation, cement treatment, placement of a geotextile and thicker crushed rock or structural fill sections prior to pavement.

For lightly loaded pavement areas subjected primarily to passenger vehicles, the following preliminary pavement sections can be considered:

- Two inches of hot-mix asphalt (HMA) placed over four inches of crushed rock base (CRB), or;
- Two inches of HMA placed over three inches of asphalt treated base (ATB).

For relatively high volume, heavily loaded pavements subjected to occasional truck traffic, the following preliminary pavement sections can be considered:

- Three inches of HMA placed over six inches of CRB, or;
- Three inches of HMA placed over four and one-half inches of ATB.

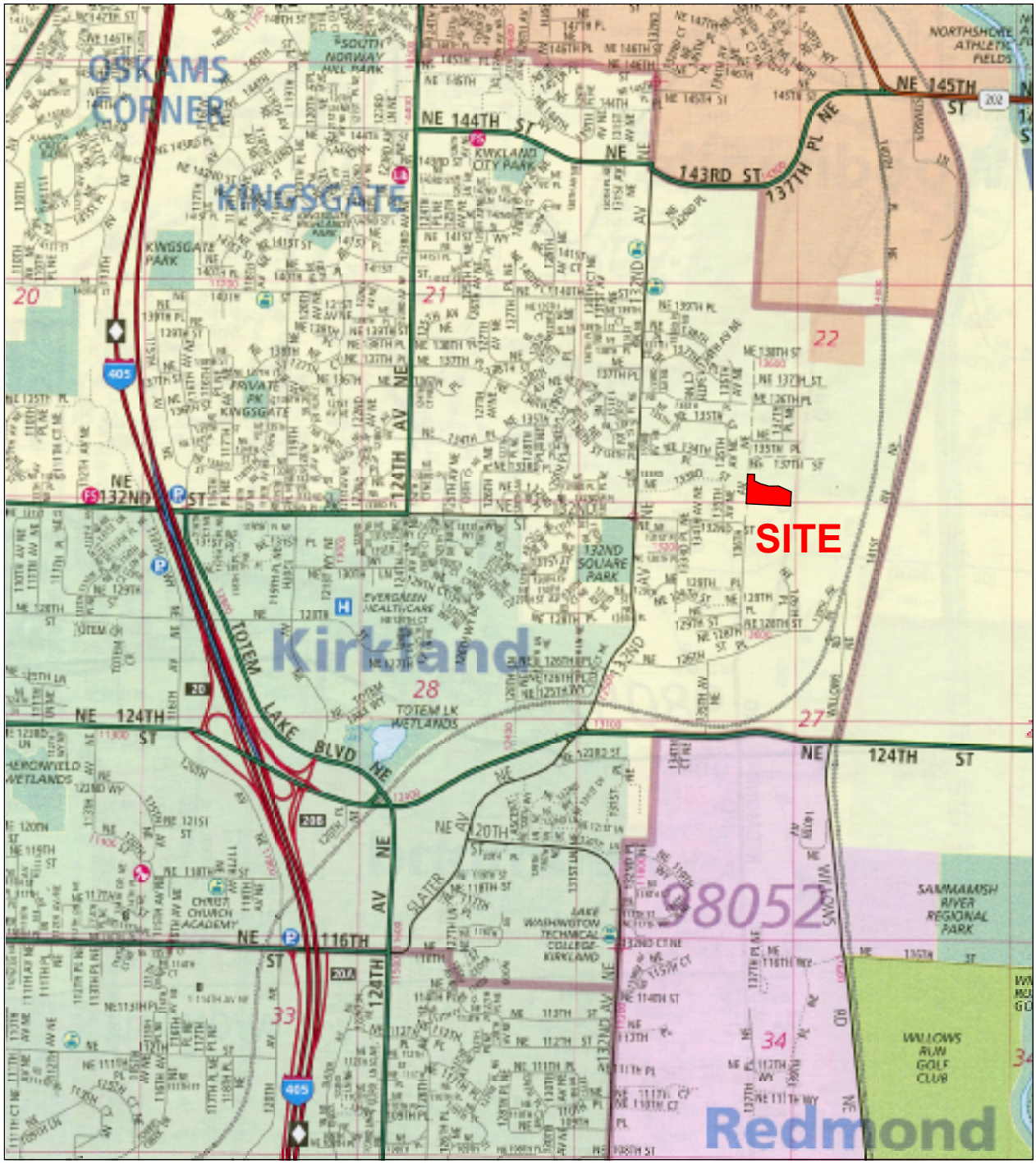
The HMA, ATB, and CRB materials should conform to WSDOT specifications. All soil base material should be compacted to at least 95 percent of the maximum dry density. Final pavement design recommendations can be provided once final traffic loading and frequency has been determined.

# LIMITATIONS

The recommendations and conclusions provided in this geotechnical engineering study are professional opinions consistent with the level of care and skill that is typical of other members in the profession currently practicing under similar conditions in this area. A warranty is not expressed or implied. Variations in the soil and groundwater conditions observed at the test sites may exist, and may not become evident until construction. ESNW should reevaluate the conclusions in this geotechnical engineering study if variations are encountered.

## Additional Services

ESNW should review the final design with respect to the geotechnical recommendations provided in this report. ESNW should also be retained to provide testing and consultation services during construction.




Reference:
King County, Washington
Map 506
By The Thomas Guide
Rand McNally
32nd Edition

NORTH

NOTE: This plate may contain areas of color. ESNW cannot be responsible for any subsequent misinterpretation of the information resulting from black & white reproductions of this plate.

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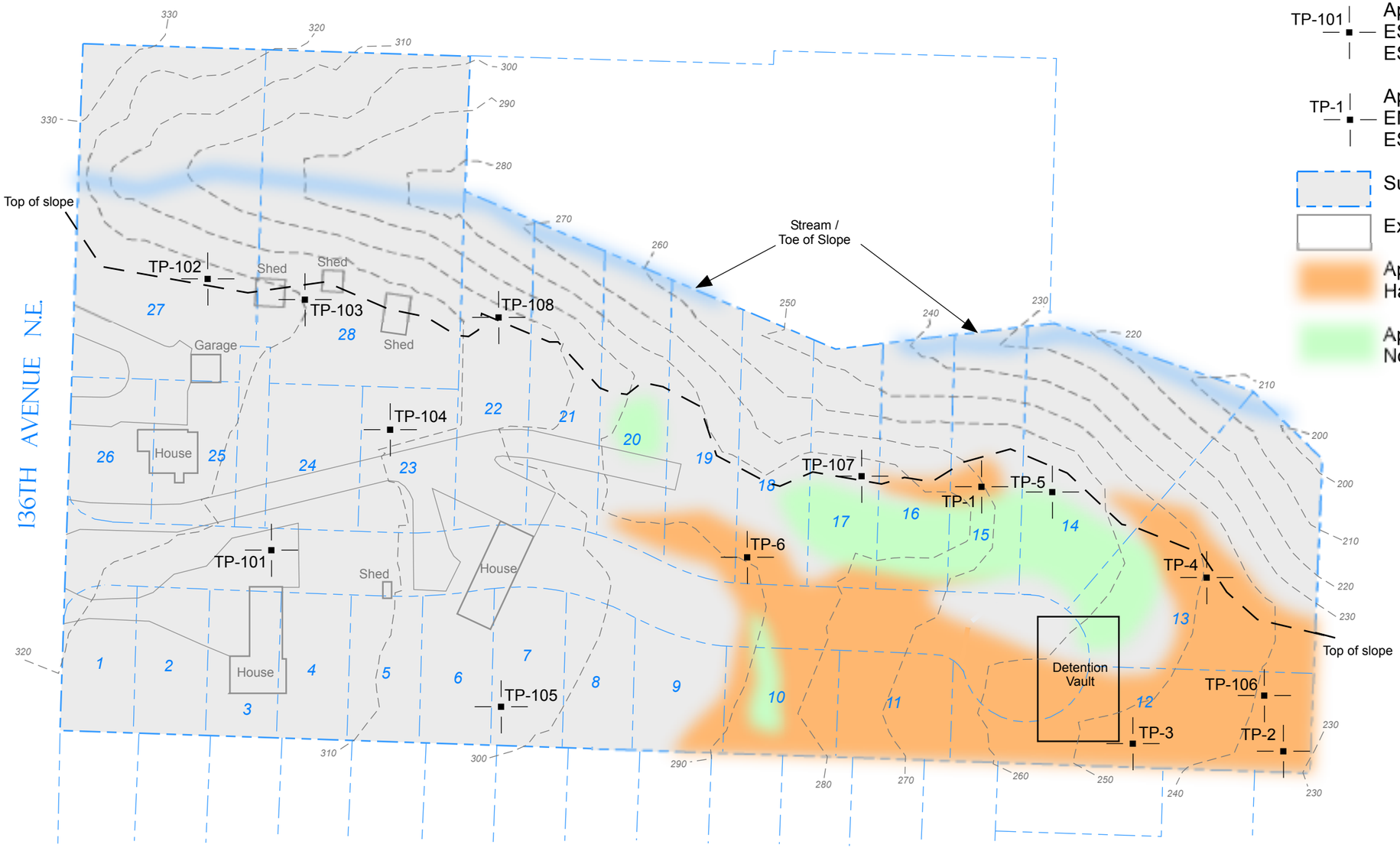
# Vicinity Map
## Calvert / Anderson Property
## King County, Washington

| | | |
|---|---|---|
| Drwn. MRS | Date 11/12/2015 | Proj. No. 2471 |
| Checked SSR | Date Nov. 2015 | Plate 1 |




**LEGEND**

TP-101 — Approximate Location of ESNW Test Pit, Proj. No. ES-2471.01, Oct. 2015

TP-1 — Approximate Location of ENSW Test Pit, Proj. No. ES-2471, Aug. 2012

Subject Site

Existing Building

Approximate Erosion Hazard Area

Approximate Area of Non-Engineered Fill

NOTE: The graphics shown on this plate are not intended for design purposes or precise scale measurements, but only to illustrate the approximate test locations relative to the approximate locations of existing and / or proposed site features. The information illustrated is largely based on data provided by the client at the time of our study. ESNW cannot be responsible for subsequent design changes or interpretation of the data by others.

NOTE: This plate may contain areas of color. ESNW cannot be responsible for any subsequent misinterpretation of the information resulting from black & white reproductions of this plate.

NORTH

1"=80'

0 40 80 160

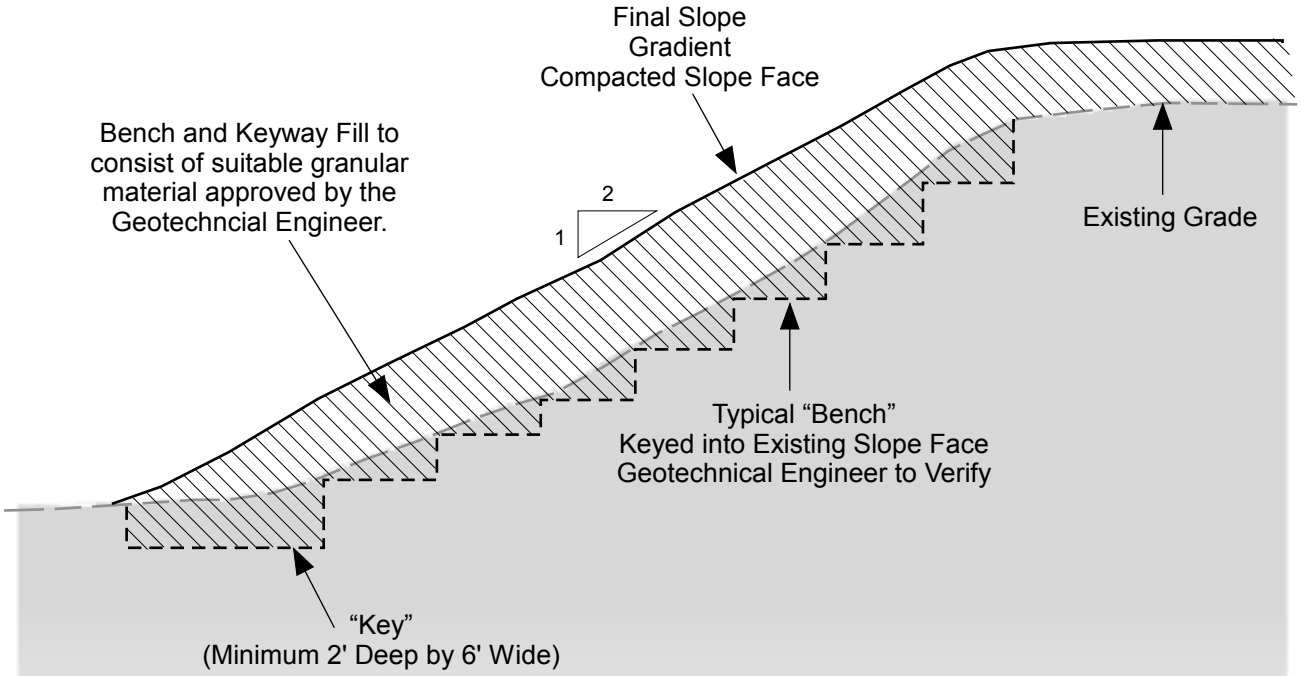
Scale in Feet

# Test Pit Location Plan
Calvert / Anderson Property
King County, Washington

Earth Solutions NW LLC
Geotechnical Engineering, Construction Monitoring and Environmental Sciences

| | |
|---|---|
| Drwn. By | MRS |
| Checked By | SSR |
| Date | 04/13/2016 |
| Proj. No. | 2471 |
| Plate | 2 |

SCHEMATIC ONLY - NOT TO SCALE
NOT A CONSTRUCTION DRAWING




**NOTES:**

- Slope should be stripped of topsoil and unsuitable materials prior to excavating Key Way or benches.
- Benches will typically be equal to a dozer blade width, approximately 8 feet, but a minimum of 4 feet.
- Final slope gradient should be 2 : 1 (horizontal : vertical).
- Final slope face should be densified by over-building with compacted fill and trimming back to shape or by compaction with dozer or roller.
- Planting or hydroseeding slope face with a rapid growth deep rooted vegetative mat will reduce erosion potential of slope area.
- Use of pegged in place jute matting or geotechnical fabric will help maintain the seed and mulch in place until the root system has an opportunity to germinate.
- Structural fill should be placed in thin loose lifts not exceeding 12 inches in thickness. Each lift should be compacted to no less than the degree specified in the "Site Preparation and Earth Work" section of this report. No additional lift should be placed until compaction is achieved.

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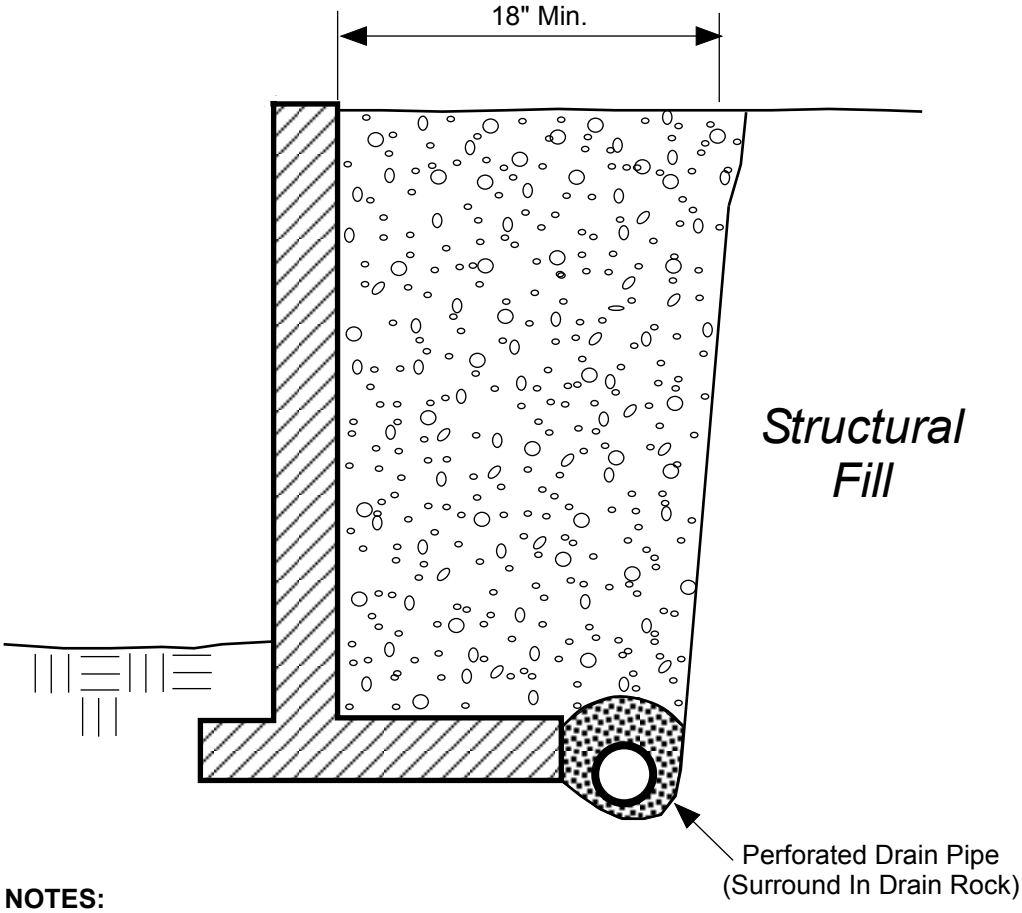
SLOPE FILL DETAIL
Calvert Properties
King County, Washington

| | | | | | |
|---|---|---|---|---|---|
| Drwn. | GLS | Date | 11/12/2015 | Proj. No. | 2471 |
| Checked | SSR | Date | Nov. 2015 | Plate | 3 |




**NOTES:**

- Free Draining Backfill should consist of soil having less than 5 percent fines. Percent passing #4 should be 25 to 75 percent.
- Sheet Drain may be feasible in lieu of Free Draining Backfill, per ESNW recommendations.
- Drain Pipe should consist of perforated, rigid PVC Pipe surrounded with 1" Drain Rock.

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**LEGEND:**

Free Draining Structural Backfill

1 inch Drain Rock

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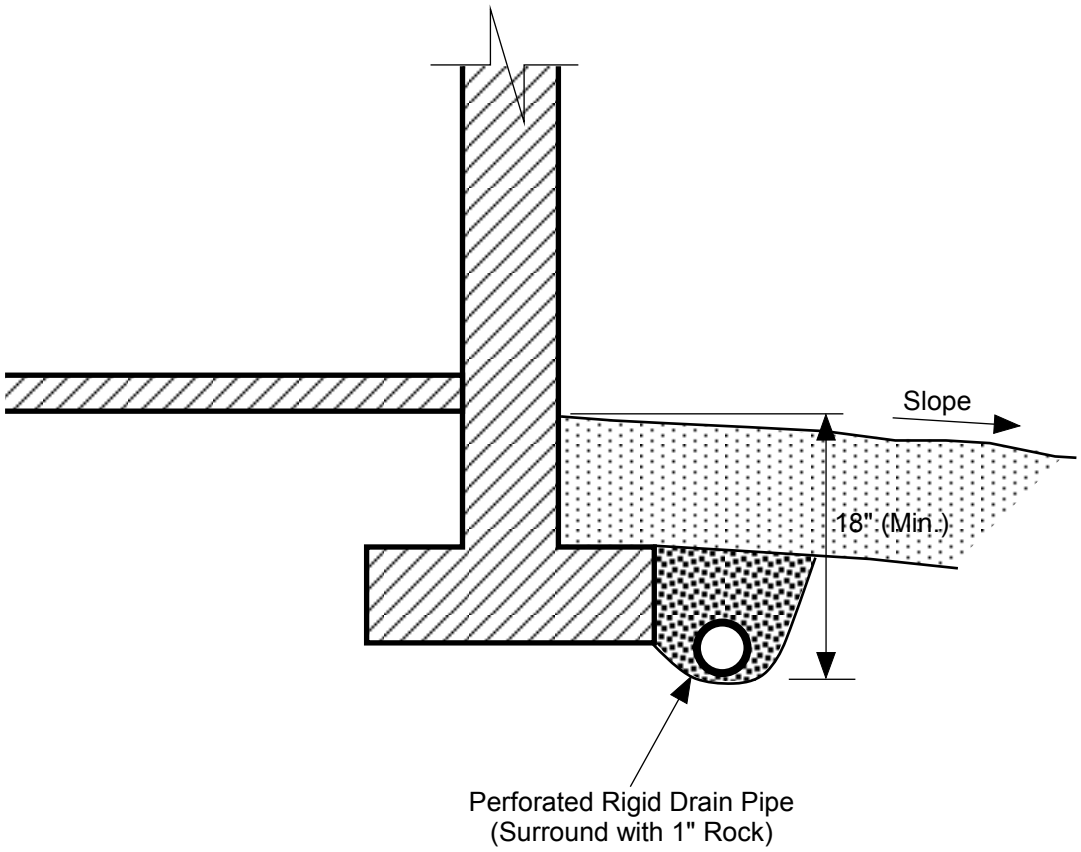
RETAINING WALL DRAINAGE DETAIL
Calvert Properties
King County, Washington

| | | | | | |
|---|---|---|---|---|---|
| Drwn. | GLS | Date | 11/10/2015 | Proj. No. | 2471 |
| Checked | SSR | Date | Nov. 2015 | Plate | 4 |




**NOTES:**

- Do NOT tie roof downspouts to Footing Drain.
- Surface Seal to consist of 12" of less permeable, suitable soil. Slope away from building.

**LEGEND:**

Surface Seal; native soil or other low permeability material.

1" Drain Rock

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FOOTING DRAIN DETAIL
Calvert Properties
King County, Washington

| | | | | | |
|---|---|---|---|---|---|
| Drwn. | GLS | Date | 11/10/2015 | Proj. No. | 2471 |
| Checked | SSR | Date | Nov. 2015 | Plate | 5 |

## Appendix A

## Subsurface Exploration

## ES-2471

The subsurface conditions at the site were explored by excavating a total of 10 test pits at the approximate locations illustrated on Plate 2. The test pit logs are provided in this Appendix. The subsurface exploration was completed on July 31, 2012 and October 21, 2015.

The final logs represent the interpretations of the field logs and the results of laboratory analyses. The stratification lines on the logs represent the approximate boundaries between soil types. In actuality, the transitions may be more gradual.

# Earth Solutions NW LLC

## SOIL CLASSIFICATION CHART

| MAJOR DIVISIONS | | | SYMBOLS | | TYPICAL DESCRIPTIONS |
|---|---|---|---|---|---|
| | | | GRAPH | LETTER | |
| COARSE GRAINED SOILS<br>MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE | GRAVEL AND GRAVELLY SOILS<br>MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE | CLEAN GRAVELS<br>(LITTLE OR NO FINES) | | GW | WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES |
| | | | | GP | POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES |
| | | GRAVELS WITH FINES<br>(APPRECIABLE AMOUNT OF FINES) | | GM | SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES |
| | | | | GC | CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES |
| | SAND AND SANDY SOILS<br>MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE | CLEAN SANDS<br>(LITTLE OR NO FINES) | | SW | WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES |
| | | | | SP | POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES |
| | | SANDS WITH FINES<br>(APPRECIABLE AMOUNT OF FINES) | | SM | SILTY SANDS, SAND - SILT MIXTURES |
| | | | | SC | CLAYEY SANDS, SAND - CLAY MIXTURES |
| FINE GRAINED SOILS<br>MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE | SILTS AND CLAYS | LIQUID LIMIT LESS THAN 50 | | ML | INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY |
| | | | | CL | INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS |
| | | | | OL | ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY |
| | SILTS AND CLAYS | LIQUID LIMIT GREATER THAN 50 | | MH | INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS |
| | | | | CH | INORGANIC CLAYS OF HIGH PLASTICITY |
| | | | | OH | ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS |
| HIGHLY ORGANIC SOILS | | | | PT | PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS |

DUAL SYMBOLS are used to indicate borderline soil classifications.

The discussion in the text of this report is necessary for a proper understanding of the nature of the material presented in the attached logs.

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# TEST PIT NUMBER TP-101



**CLIENT** GGM Investments
**PROJECT NAME** Calvert / Anderson Property
**PROJECT NUMBER** 2471
**PROJECT LOCATION** King County, Washington
**DATE STARTED** 10/21/15 **COMPLETED** 10/21/15
**GROUND ELEVATION** _____ **TEST PIT SIZE** _____
**EXCAVATION CONTRACTOR** NW Excavating
**GROUND WATER LEVELS:**
**EXCAVATION METHOD** _____
**AT TIME OF EXCAVATION** ---
**LOGGED BY** AZS **CHECKED BY** SSR
**AT END OF EXCAVATION** ---
**NOTES** Surface Conditions: gravel - 4"
**AFTER EXCAVATION** ---

| DEPTH (ft) | SAMPLE TYPE NUMBER | TESTS | U.S.C.S. | GRAPHIC LOG | MATERIAL DESCRIPTION |
|---|---|---|---|---|---|
| 0 | | MC = 7.10% | SM | | Brown silty SAND with gravel, medium dense, moist |
| | | | | | 3.0 |
| | | MC = 13.50% | SM | | Tan gray silty SAND with gravel, dense, moist |
| 5 | | | | | |
| | | MC = 10.50% | | | 7.0 |
| | | | | | Test pit terminated at 7.0 feet below existing grade. No groundwater encountered during excavation. |
| | | | | | Bottom of test pit at 7.0 feet. |

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# TEST PIT NUMBER TP-102



**CLIENT** GGM Investments
**PROJECT NAME** Calvert / Anderson Property
**PROJECT NUMBER** 2471
**PROJECT LOCATION** King County, Washington
**DATE STARTED** 10/21/15 **COMPLETED** 10/21/15
**GROUND ELEVATION** _____ **TEST PIT SIZE** _____
**EXCAVATION CONTRACTOR** NW Excavating
**GROUND WATER LEVELS:**
**EXCAVATION METHOD** _____
**AT TIME OF EXCAVATION** ---
**LOGGED BY** AZS **CHECKED BY** SSR
**AT END OF EXCAVATION** ---
**NOTES** Depth of Topsoil & Sod 12": wood chips
**AFTER EXCAVATION** ---

| DEPTH (ft) | SAMPLE TYPE NUMBER | TESTS | U.S.C.S. | GRAPHIC LOG | MATERIAL DESCRIPTION |
|---|---|---|---|---|---|
| 0 | | | TPSL | | 1.0 |
| | | MC = 6.50% | SM | | Brown silty SAND, loose to medium dense, moist |
| 5 | | | | | 6.0 |
| | | MC = 5.90% | | | Tan gray silty SAND with gravel, medium dense to dense, moist |
| | | MC = 7.90% | | | |
| 10 | | | SM | | |
| | | MC = 9.40% | | | |
| 15 | | MC = 6.90% | | | 15.0 |
| | | | | | Test pit terminated at 15.0 feet below existing grade. No groundwater encountered during excavation. |
| | | | | | Bottom of test pit at 15.0 feet. |

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# TEST PIT NUMBER TP-103



**CLIENT** GGM Investments
**PROJECT NAME** Calvert / Anderson Property
**PROJECT NUMBER** 2471
**PROJECT LOCATION** King County, Washington
**DATE STARTED** 10/21/15 **COMPLETED** 10/21/15
**GROUND ELEVATION** _____ **TEST PIT SIZE** _____
**EXCAVATION CONTRACTOR** NW Excavating
**GROUND WATER LEVELS:**
**EXCAVATION METHOD** _____
**AT TIME OF EXCAVATION** ---
**LOGGED BY** AZS **CHECKED BY** SSR
**AT END OF EXCAVATION** ---
**NOTES** Depth of Topsoil & Sod 12": wood chips
**AFTER EXCAVATION** ---

| DEPTH (ft) | SAMPLE TYPE NUMBER | TESTS | U.S.C.S. | GRAPHIC LOG | MATERIAL DESCRIPTION |
|---|---|---|---|---|---|
| 0 | | | TPSL | | 1.0 |
| | | MC = 9.70% | SM | | Brown silty SAND, loose to medium dense, moist<br>-roots |
| | | | | | 4.0 |
| 5 | | MC = 7.70% | | | Tan gray silty SAND with gravel, dense, moist |
| | | MC = 7.80% | | | |
| 10 | | | SM | | |
| | | MC = 7.70% | | | |
| 15 | | MC = 9.90% | | | 15.0 |
| | | | | | Test pit terminated at 15.0 feet below existing grade. No groundwater encountered during excavation.<br>Bottom of test pit at 15.0 feet. |

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Fax: 425-449-4711

# TEST PIT NUMBER TP-104



**CLIENT** GGM Investments
**PROJECT NAME** Calvert / Anderson Property
**PROJECT NUMBER** 2471
**PROJECT LOCATION** King County, Washington
**DATE STARTED** 10/21/15 **COMPLETED** 10/21/15
**GROUND ELEVATION** _____ **TEST PIT SIZE** _____
**EXCAVATION CONTRACTOR** NW Excavating
**GROUND WATER LEVELS:**
**EXCAVATION METHOD** _____
**AT TIME OF EXCAVATION** ---
**LOGGED BY** AZS **CHECKED BY** SSR
**AT END OF EXCAVATION** ---
**NOTES** Depth of Topsoil & Sod 2": grass
**AFTER EXCAVATION** ---

| DEPTH (ft) | SAMPLE TYPE NUMBER | TESTS | U.S.C.S. | GRAPHIC LOG | MATERIAL DESCRIPTION |
|---|---|---|---|---|---|
| 0 | | MC = 10.50% | SM | | Brown silty SAND, medium dense, moist |
| | | MC = 6.80% | | | 3.0 Tan silty SAND with gravel, dense, moist |
| 5 | | | SM | | |
| | | MC = 7.80% | | | 6.5 Test pit terminated at 6.5 feet below existing grade. No groundwater encountered during excavation. Bottom of test pit at 6.5 feet. |

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# TEST PIT NUMBER TP-105



**CLIENT** GGM Investments
**PROJECT NAME** Calvert / Anderson Property
**PROJECT NUMBER** 2471
**PROJECT LOCATION** King County, Washington
**DATE STARTED** 10/21/15 **COMPLETED** 10/21/15
**GROUND ELEVATION** _____ **TEST PIT SIZE** _____
**EXCAVATION CONTRACTOR** NW Excavating
**GROUND WATER LEVELS:**
**EXCAVATION METHOD** _____
**AT TIME OF EXCAVATION** ---
**LOGGED BY** AZS **CHECKED BY** SSR
**AT END OF EXCAVATION** ---
**NOTES** Surface Conditions: grass
**AFTER EXCAVATION** ---

| DEPTH (ft) | SAMPLE TYPE NUMBER | TESTS | U.S.C.S. | GRAPHIC LOG | MATERIAL DESCRIPTION |
|---|---|---|---|---|---|
| 0 | | MC = 12.30% | SM | | Brown silty SAND, medium dense, moist (Fill) |
| | | | | | 3.0 |
| | | MC = 11.40% | SM | | Brown silty SAND, medium dense, moist |
| 5 | | | | | 5.5 |
| | | MC = 17.00% | SM | | Tan silty SAND, dense, moist<br>-oxidation |
| | | MC = 16.70% | | | 7.0 |
| | | | | | Test pit terminated at 7.0 feet below existing grade. No groundwater encountered during excavation.<br>Bottom of test pit at 7.0 feet. |

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Fax: 425-449-4711

# TEST PIT NUMBER TP-106



**CLIENT** GGM Investments
**PROJECT NAME** Calvert / Anderson Property
**PROJECT NUMBER** 2471
**PROJECT LOCATION** King County, Washington
**DATE STARTED** 10/21/15 **COMPLETED** 10/21/15
**GROUND ELEVATION** _____ **TEST PIT SIZE** _____
**EXCAVATION CONTRACTOR** NW Excavating
**GROUND WATER LEVELS:**
**EXCAVATION METHOD** _____
**AT TIME OF EXCAVATION** ---
**LOGGED BY** AZS **CHECKED BY** SSR
**AT END OF EXCAVATION** ---
**NOTES** Depth of Topsoil & Sod 6": grass
**AFTER EXCAVATION** ---

| DEPTH (ft) | SAMPLE TYPE NUMBER | TESTS | U.S.C.S. | GRAPHIC LOG | MATERIAL DESCRIPTION |
|---|---|---|---|---|---|
| 0 | | | TPSL | | 0.5 |
| | | MC = 10.30% | SM | | Brown silty SAND, medium dense, moist<br>-roots |
| 5 | | | | | 5.0 |
| | | MC = 6.20% | SM | | Gray silty SAND with gravel, dense, moist |
| | | | | | 8.0 |
| | | | SP-SM | | Gray poorly graded SAND with silt, dense, moist |
| 10 | | MC = 9.70% | | | 10.0 |
| | | | | | Test pit terminated at 10.0 feet below existing grade. No groundwater encountered during excavation.<br>Bottom of test pit at 10.0 feet. |

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# TEST PIT NUMBER TP-107



**CLIENT** GGM Investments
**PROJECT NAME** Calvert / Anderson Property
**PROJECT NUMBER** 2471
**PROJECT LOCATION** King County, Washington
**DATE STARTED** 10/21/15 **COMPLETED** 10/21/15
**GROUND ELEVATION** _____ **TEST PIT SIZE** _____
**EXCAVATION CONTRACTOR** NW Excavating
**GROUND WATER LEVELS:**
**EXCAVATION METHOD** _____
**AT TIME OF EXCAVATION** ---
**LOGGED BY** AZS **CHECKED BY** SSR
**AT END OF EXCAVATION** ---
**NOTES** Depth of Topsoil & Sod 4": grass
**AFTER EXCAVATION** ---

| DEPTH (ft) | SAMPLE TYPE NUMBER | TESTS | U.S.C.S. | GRAPHIC LOG | MATERIAL DESCRIPTION |
|---|---|---|---|---|---|
| 0 | | | TPSL | | 0.5 |
| | | MC = 13.90% | SM | | Brown silty SAND, medium dense, moist (Fill)<br>-concrete<br>-plastic, wood, concrete, wire |
| 5 | | | | | 8.0 |
| | | MC = 7.50% | SP-SM | | Brown poorly graded SAND with silt, dense, moist |
| 10 | | | | | 11.0 |
| | | MC = 5.50% | SP | | Brown poorly graded SAND, dense, moist |
| 15 | | MC = 4.30% | | | 15.5<br>Test pit terminated at 15.5 feet below existing grade. No groundwater encountered during excavation.<br>Bottom of test pit at 15.5 feet. |

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# TEST PIT NUMBER TP-108



**CLIENT** GGM Investments
**PROJECT NAME** Calvert / Anderson Property
**PROJECT NUMBER** 2471
**PROJECT LOCATION** King County, Washington
**DATE STARTED** 10/21/15 **COMPLETED** 10/21/15
**GROUND ELEVATION** _____ **TEST PIT SIZE** _____
**EXCAVATION CONTRACTOR** NW Excavating
**GROUND WATER LEVELS:**
**EXCAVATION METHOD** _____
**AT TIME OF EXCAVATION** ---
**LOGGED BY** AZS **CHECKED BY** SSR
**AT END OF EXCAVATION** ---
**NOTES** Depth of Topsoil & Sod 4": gravel
**AFTER EXCAVATION** ---

| DEPTH (ft) | SAMPLE TYPE NUMBER | TESTS | U.S.C.S. | GRAPHIC LOG | MATERIAL DESCRIPTION |
|---|---|---|---|---|---|
| 0 | | | TPSL | | 0.5 |
| | | MC = 12.60% | SM | | Brown silty SAND, medium dense, moist |
| | | | | | 3.0 |
| | | MC = 7.10% | SM | | Tan gray silty SAND with gravel, dense, moist |
| 5 | | | | | 6.5 |
| | | MC = 8.80% | SP-SM | | Gray poorly graded SAND with silt, dense, moist |
| 10 | | | | | 10.0 |
| | | MC = 8.80% | SP | | Gray poorly graded SAND, dense, moist |
| | | MC = 15.60% | | | 13.0 |
| | | | | | Test pit terminated at 13.0 feet below existing grade. No groundwater encountered during excavation. |
| | | | | | Bottom of test pit at 13.0 feet. |

GENERAL BH / TP / WELL 2471-1.GPJ GINT US.GDT 11/12/15

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# TEST PIT NUMBER TP-1



**CLIENT** PNW Holdings, LLC
**PROJECT NAME** Calvert Properties
**PROJECT NUMBER** 2471
**PROJECT LOCATION** King County, Washington
**DATE STARTED** 7/31/12 **COMPLETED** 7/31/12
**GROUND ELEVATION** _____ **TEST PIT SIZE** _____
**EXCAVATION CONTRACTOR** Universal Land
**GROUND WATER LEVELS:**
**EXCAVATION METHOD** _____
**AT TIME OF EXCAVATION** ---
**LOGGED BY** SSR **CHECKED BY** SSR
**AT END OF EXCAVATION** ---
**NOTES** Depth of Topsoil & Sod 2": grass & brambles
**AFTER EXCAVATION** ---

| DEPTH (ft) | SAMPLE TYPE NUMBER | TESTS | U.S.C.S. | GRAPHIC LOG | MATERIAL DESCRIPTION |
|---|---|---|---|---|---|
| 0 | | | | | Brown silty SAND, loose, moist (Fill) |
| | | | | | -trace gravel |
| | | | SM | | -scattered organics |
| | | | | | -slight caving |
| | | | | | -becomes medium dense |
| | | MC = 14.00% | | | |
| 5 | | | | | 5.0 |
| | | | | | Dark gray silty SAND with gravel, medium dense, moist (Fill) |
| | | | | | -scattered organics |
| | | | | | -trace debris |
| | | MC = 16.20%<br>Fines = 29.00% | | | |
| 10 | | | SM | | |
| | | | | | 14.0 -abandoned domestic water line |
| | | | | | Brown silty SAND, medium dense, moist |
| 15 | | | SM | | |
| | | | | | 16.0 |
| | | | | | Test pit terminated at 16.0 feet below existing grade. No groundwater encountered during excavation. |
| | | | | | Bottom of test pit at 16.0 feet. |

GENERAL BH / TP / WELL 2471.GPJ GINT US.GDT 8/9/12

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1805 136th Place N.E., Suite 201
Bellevue, Washington 98005
Telephone: 425-284-3300

# TEST PIT NUMBER TP-2



**CLIENT** PNW Holdings, LLC
**PROJECT NAME** Calvert Properties
**PROJECT NUMBER** 2471
**PROJECT LOCATION** King County, Washington
**DATE STARTED** 7/31/12 **COMPLETED** 7/31/12
**GROUND ELEVATION** _____ **TEST PIT SIZE** _____
**EXCAVATION CONTRACTOR** Universal Land
**GROUND WATER LEVELS:**
**EXCAVATION METHOD** _____
**AT TIME OF EXCAVATION** ---
**LOGGED BY** SSR **CHECKED BY** SSR
**AT END OF EXCAVATION** ---
**NOTES** Depth of Topsoil & Sod 8": brambles & brush
**AFTER EXCAVATION** ---

| DEPTH (ft) | SAMPLE TYPE NUMBER | TESTS | U.S.C.S. | GRAPHIC LOG | MATERIAL DESCRIPTION |
|---|---|---|---|---|---|
| 0 | | | SM | | Brown silty SAND, loose, moist |
| | | | | | 3.5 Brown silty SAND with gravel, dense, moist |
| 5 | | | SM | | |
| | | MC = 8.50% | | | 6.0 -becomes very dense |
| | | | | | Test pit terminated at 6.0 feet below existing grade. No groundwater encountered during excavation. |
| | | | | | Bottom of test pit at 6.0 feet. |

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# TEST PIT NUMBER TP-3



**CLIENT** PNW Holdings, LLC
**PROJECT NAME** Calvert Properties
**PROJECT NUMBER** 2471
**PROJECT LOCATION** King County, Washington
**DATE STARTED** 7/31/12 **COMPLETED** 7/31/12
**GROUND ELEVATION** _____ **TEST PIT SIZE** _____
**EXCAVATION CONTRACTOR** Universal Land
**GROUND WATER LEVELS:**
**EXCAVATION METHOD** _____
**AT TIME OF EXCAVATION** ---
**LOGGED BY** SSR **CHECKED BY** SSR
**AT END OF EXCAVATION** ---
**NOTES** Depth of Topsoil & Sod 6": brambles & scotch broom
**AFTER EXCAVATION** ---

| DEPTH (ft) | SAMPLE TYPE NUMBER | TESTS | U.S.C.S. | GRAPHIC LOG | MATERIAL DESCRIPTION |
|---|---|---|---|---|---|
| 0 | | | SM | | Brown silty SAND, loose, damp<br>-becomes medium dense<br>-trace gravel |
| | | | | | 4.5 |
| 5 | | | SM | | Gray silty SAND with gravel, dense, moist<br>-trace cobbles |
| | | MC = 8.50% | | | 7.0<br>Test pit terminated at 7.0 feet below existing grade. No groundwater encountered during excavation.<br>Bottom of test pit at 7.0 feet. |

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# TEST PIT NUMBER TP-4



**CLIENT** PNW Holdings, LLC
**PROJECT NAME** Calvert Properties
**PROJECT NUMBER** 2471
**PROJECT LOCATION** King County, Washington
**DATE STARTED** 7/31/12 **COMPLETED** 7/31/12
**GROUND ELEVATION** _____ **TEST PIT SIZE** _____
**EXCAVATION CONTRACTOR** Universal Land
**GROUND WATER LEVELS:**
**EXCAVATION METHOD** _____
**AT TIME OF EXCAVATION** ---
**LOGGED BY** SSR **CHECKED BY** SSR
**AT END OF EXCAVATION** ---
**NOTES** Depth of Topsoil & Sod 8": brambles & scotch broom
**AFTER EXCAVATION** ---

| DEPTH (ft) | SAMPLE TYPE NUMBER | TESTS | U.S.C.S. | GRAPHIC LOG | MATERIAL DESCRIPTION |
|---|---|---|---|---|---|
| 0 | | | SM | | Brown silty SAND, loose, damp |
| | | | | | -becomes medium dense |
| | | | | | 4.5 |
| 5 | | MC = 10.50% | SM | | Grayish brown silty SAND with gravel, dense, moist |
| | | | | | -increase gravel content |
| 10 | | MC = 6.80%<br>Fines = 14.60% | | | 13.0 |
| | | | | | Test pit terminated at 13.0 feet below existing grade. No groundwater encountered during excavation.<br>Bottom of test pit at 13.0 feet. |

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# TEST PIT NUMBER TP-5



**CLIENT** PNW Holdings, LLC
**PROJECT NAME** Calvert Properties
**PROJECT NUMBER** 2471
**PROJECT LOCATION** King County, Washington
**DATE STARTED** 7/31/12 **COMPLETED** 7/31/12
**GROUND ELEVATION** _____ **TEST PIT SIZE** _____
**EXCAVATION CONTRACTOR** Universal Land
**GROUND WATER LEVELS:**
**EXCAVATION METHOD** _____
**AT TIME OF EXCAVATION** ---
**LOGGED BY** SSR **CHECKED BY** SSR
**AT END OF EXCAVATION** ---
**NOTES** Depth of Topsoil & Sod 2": brambles & brush
**AFTER EXCAVATION** ---

| DEPTH (ft) | SAMPLE TYPE NUMBER | TESTS | U.S.C.S. | GRAPHIC LOG | MATERIAL DESCRIPTION |
|---|---|---|---|---|---|
| 0 | | | SM | | Brown silty SAND, loose, damp (Fill) |
| | | | | | -old topsoil layer |
| | | | | 3.0 | Brown silty SAND, medium dense, moist |
| 5 | | | SM | | -trace gravel |
| | | | | | -becomes dense |
| | | MC = 9.70% | | 7.0 | Test pit terminated at 7.0 feet below existing grade. No groundwater encountered during excavation. |
| | | | | | Bottom of test pit at 7.0 feet. |

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# TEST PIT NUMBER TP-6



**CLIENT** PNW Holdings, LLC
**PROJECT NAME** Calvert Properties
**PROJECT NUMBER** 2471
**PROJECT LOCATION** King County, Washington
**DATE STARTED** 7/31/12 **COMPLETED** 7/31/12
**GROUND ELEVATION** _____ **TEST PIT SIZE** _____
**EXCAVATION CONTRACTOR** Universal Land
**GROUND WATER LEVELS:**
**EXCAVATION METHOD** _____
**AT TIME OF EXCAVATION** ---
**LOGGED BY** SSR **CHECKED BY** SSR
**AT END OF EXCAVATION** ---
**NOTES** Depth of Topsoil & Sod 3": grass
**AFTER EXCAVATION** ---

| DEPTH (ft) | SAMPLE TYPE NUMBER | TESTS | U.S.C.S. | GRAPHIC LOG | MATERIAL DESCRIPTION |
|---|---|---|---|---|---|
| 0 | | | SM | | Brown silty SAND, loose, damp (Fill) |
| | | | | 1.5 | Brown fine SAND, loose, moist |
| | | | | | -trace gravel |
| | | MC = 9.90%<br>Fines = 4.80% | | | -becomes medium dense |
| 5 | | | SP | | |
| | | MC = 8.10% | | 8.0 | Test pit terminated at 8.0 feet below existing grade. No groundwater encountered during excavation. |
| | | | | | Bottom of test pit at 8.0 feet. |

# Appendix B

# Laboratory Test Results

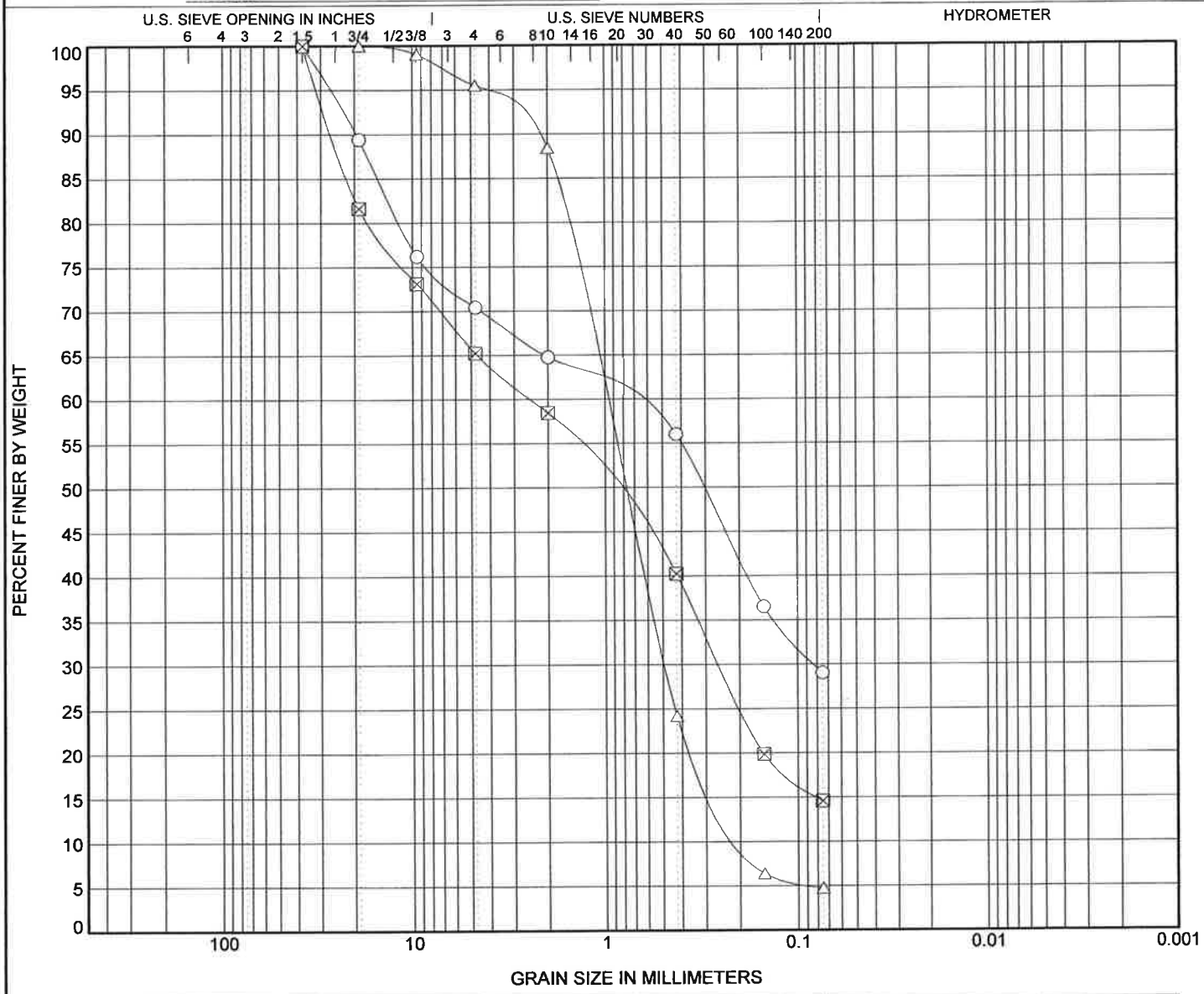
# ES-2471

# GRAIN SIZE DISTRIBUTION

Earth Solutions NW
1805 - 136th Place N.E., Suite 201
Bellevue, WA 98005
Telephone: 425-284-3300

**CLIENT** PNW Holdings LLC **PROJECT NAME** Calvert Property

**PROJECT NUMBER** ES-2471 **PROJECT LOCATION** Kirkland




| COBBLES | GRAVEL | | SAND | | | SILT OR CLAY |
|---|---|---|---|---|---|---|
| | coarse | fine | coarse | medium | fine | |

| | Specimen Identification | | Classification | LL | PL | PI | Cc | Cu |
|---|---|---|---|---|---|---|---|---|
| ○ | TP-1 | 8.0ft. | Brown silty SAND with gravel, SM | | | | | |
| ☒ | TP-4 | 13.0ft. | Brown silty SAND with gravel, SM | | | | | |
| △ | TP-6 | 4.0ft. | Brown poorly graded SAND, SP | | | | 1.28 | 5.45 |
| | | | | | | | | |
| | | | | | | | | |

| | Specimen Identification | | D100 | D60 | D30 | D10 | %Gravel | %Sand | %Silt | %Clay |
|---|---|---|---|---|---|---|---|---|---|---|
| ○ | TP-1 | 8.0ft. | 37.5 | 0.86 | 0.082 | | 29.6 | 41.4 | 29.0 | |
| ☒ | TP-4 | 13.0ft. | 37.5 | 2.439 | 0.252 | | 34.8 | 50.6 | 14.6 | |
| △ | TP-6 | 4.0ft. | 19 | 1.008 | 0.489 | 0.185 | 4.5 | 90.7 | 4.8 | |
| | | | | | | | | | | |
| | | | | | | | | | | |

GRAIN SIZE ES-2471.GPJ GINT US LAB.GDT 8/3/12

**Report Distribution**

**ES-2471**

**EMAIL ONLY**

**GGM Investments, LLC**
**9675 Southeast 36th Street, Suite 105**
**Mercer Island, Washington 98040**

**Attention: Ms. Carol Rozday**