RECEIVED
03/28/2019
CITY OF MONROE

Earth Solutions NW LLC

Geotechnical Engineering
Construction Observation/Testing
Environmental Services

# GEOTECHNICAL ENGINEERING STUDY
# EAGLEMONT 7 PRD
# 13202 CHAIN LAKE ROAD AND
# 13107 - 197TH AVENUE SOUTHEAST
# MONROE, WASHINGTON

**ES-3217.12**

1805 - 136th Place N.E., Suite 201 Bellevue, WA 98005
(425) 449-4704 Fax (425) 449-4711
www.earthsolutionsnw.com

**PREPARED FOR**

**MAINVUE WA, LLC**

**October 3, 2017**
**Updated July 30, 2018**

For: **Bogdan S. Tirtu, G.I.T.**
**Staff Geologist**


7/31/18

**Raymond A. Coglas, P.E.**
**Principal Engineer**

# GEOTECHNICAL ENGINEERING STUDY
# EAGLEMONT 7 PRD
# 13202 CHAIN LAKE ROAD AND
# 13107 – 197TH AVENUE SOUTHEAST
# MONROE, WASHINGTON

**ES-3217.12**

**Earth Solutions NW, LLC**
**1805 – 136th Place Northeast, Suite 201**
**Bellevue, Washington 98005**
**Phone: 425-449-4704 | Fax: 425-449-4711**
**www.earthsolutionsnw.com**

# 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

8811 Colesville Road/Suite G106, Silver Spring, MD 20910
Telephone: 301/565-2733 Facsimile: 301/589-2017
e-mail: info@asfe.org www.asfe.org

Earth Solutions NW LLC
Geotechnical Engineering, Construction
Observation/Testing and Environmental Services

October 3, 2017
Updated July 30, 2018
ES-3217.12

MainVue WA, LLC
1110 – 112th Avenue Northeast, Suite 202
Bellevue, Washington 98004

Attention: Ms. Lisa Cavell

Dear Ms. Cavell:

Earth Solutions NW, LLC (ESNW) is pleased to present this report titled "Geotechnical Engineering Study, Eaglemont 7 PRD, 13202 Chain Lake Road and 13107 – 97th Avenue Southeast, Monroe, Washington". Based on the results of our investigation, the proposed residential development is feasible from a geotechnical standpoint. Our study indicates the site is underlain primarily by competent, dense to very dense glacial till.

Proposed residential structures may be constructed on conventional continuous and spread footing foundations bearing upon competent native soil or new structural fill. In general, competent native soil suitable for support of foundations will likely be encountered beginning at depths of about one to two feet below the existing ground surface. Where loose or unsuitable soil conditions are exposed at foundation subgrade elevations, overexcavation and replacement with suitable structural fill will be necessary.

Recommendations for foundation design, site preparation, drainage, and other pertinent development aspects are provided in this study. We appreciate the opportunity to be of service to you on this project. If you have questions regarding the content of this geotechnical engineering study, please call.

Sincerely,

**EARTH SOLUTIONS NW, LLC**

For: Bogdan S. Tirtu, G.I.T.
Staff Geologist

## Table of Contents

## ES-3217.12

## Table of Contents

## Cont'd

## ES-3217.12

**GEOTECHNICAL ENGINEERING STUDY**
**EAGLEMONT 7 PRD**
**13202 CHAIN LAKE ROAD AND**
**13107 – 197TH AVENUE SOUTHEAST**
**MONROE, WASHINGTON**

**ES-3217.12**

## INTRODUCTION

### General

This geotechnical engineering study (study) was prepared for the proposed extension of the Eaglemont residential development to be completed at 13202 Chain Lake Road and 13107 – 97th Avenue Southeast, in Monroe, Washington. The purpose of this study was to provide geotechnical recommendations for the subject property. Our scope of services for completing this study included the following:

- Completing test pits for the purpose of characterizing site soil conditions;
- Laboratory testing of soil samples collected at the test pit locations;
- Conducting engineering analyses; and;
- Preparing this report.

The following documents and maps were reviewed as part of our study preparation:

- Preliminary Plat of Gilmartin, prepared by Harmsen and Associates, Inc., dated November 30, 2015;
- Preliminary Geotechnical Engineering Evaluation, prepared by Nelson Geotechnical Associates, Inc., dated August 27, 2015;
- Preliminary Eaglemont 7 Road and Drainage Plans, prepared by Barghausen Consulting Engineers, Inc., dated January 11, 2018;
- Online Web Soil Survey (WSS) resource, maintained by the Natural Resources Conservation Service under the United States Department of Agriculture;
- Snohomish County Drainage Manual (SCDM), dated January 2016;
- Snohomish County Code (SCC) Chapter 30.62B – Geologically Hazardous Areas;
- Monroe Municipal Code (MMC) Chapter 20.05 – Critical Areas;
- Snohomish County Liquefaction Susceptibility, endorsed by the Washington State Department of Natural Resources, October 2009, and;
- Geologic Map of the Monroe 7.5-minute Quadrangle, King and Snohomish Counties, Washington, by Joe D. Dragovich et al., November 2011.

## Project Description

We understand existing structural improvements will be removed, and the site will be redeveloped into a residential subdivision comprised of about 47 single-family lots, a detention vault, and related infrastructure improvements. Site ingress and egress will be provided from the west by 133rd Place Southeast and from the northeast by a new roadway extension connecting to Chain Lake Road. The subject site is comprised of two tax parcels: one is within City of Monroe jurisdiction and the other is within Snohomish County jurisdiction. We anticipate that the northern tax parcel located within Snohomish County jurisdiction will be eventually annexed into the City of Monroe.

A stormwater tract is dedicated in the northeastern property area for installation of a stormwater detention vault. Construction of the proposed stormwater detention facilities in the northeastern site area is feasible from a geotechnical standpoint. Based on our field observations, grade cuts for the detention facilities are likely to expose very dense, undisturbed glacial till. The glacial till is expected to provide excellent support for the excavations necessary to reach subgrade elevations of the proposed detention facilities.

Specific grading and building load plans were not available for review at the time of report submission; however, based on our experience with similar developments, the proposed residential structures will likely be two to three stories in height and constructed using relatively lightly loaded wood framing supported on conventional foundations. Perimeter footing loads will likely be about 1 to 2 kips per lineal foot. Slab-on-grade loading is anticipated to be approximately 150 pounds per square foot (psf).

If the above design assumptions are incorrect or change, ESNW should be contacted to review the recommendations provided in this report. ESNW should review final designs to confirm that appropriate geotechnical recommendations have been incorporated into the plans.

# SITE CONDITIONS

## Surface

The subject site is located directly southwest of the Brown Road and Chain Lake Road intersection, near the boundary between unincorporated Snohomish County and the City of Monroe, Washington. The approximate location of the subject site is depicted on Plate 1 (Vicinity Map). The property is comprised of two tax parcels (Snohomish County Parcel Numbers 280731-002-023-00 and 280730-003-013-00) totaling approximately 9 acres. The site is currently developed with a vacant, dilapidated single-family residential home with a detached barn structure in the south-central site area and several mobile homes and outdoor structures in the northern site area. The remainder of the site is undeveloped, and vegetation is comprised of trees, shrubs, and grasses.

The site is bordered to the west and south by the Eaglemont residential development and associated improvements, to the north by Chain Lake Road and a single-family residence, and to the east by a single-family residence. Existing topography across the property is gentle, with slopes of about 5 to 10 percent and topographic change of approximately 28 feet.

## Subsurface

An ESNW representative initially observed, logged, and sampled six test pits, excavated at accessible locations within Parcel 280731-002-023-00, on September 8, 2017 using a mini trackhoe and operator retaining by our firm. The test pits were completed for purposes of classifying site soils as well as characterizing groundwater conditions within accessible areas of the site. Subsequently, we returned to the site on June 28, 2018 and observed, logged, and sampled five test pits, excavated within Parcel 280730-003-013-00, using a mini trackhoe and operator retained by the client. The approximate locations of the ESNW test pits along with previous test pits completed by Nelson Geotechnical Associates, Inc. in August 2015 are depicted on Plate 2 (Test Pit Location Plan). Please refer to the test pit logs provided in Appendix A for a more detailed description of subsurface conditions. Representative soil samples collected at the test pit locations were analyzed in general accordance with Unified Soil Classification System (USCS) and United States Department of Agriculture (USDA) methods and procedures.

For clarity, all further references to subsurface soil and groundwater conditions will relate to the information collected during the ESNW subsurface explorations completed in September 2017 and June 2018. Although depicted on Plate 2 and included with the attached test pits logs, information collected by Nelson Geotechnical Associates, Inc. in August 2015 will not be referenced.

### Topsoil and Fill

Topsoil was generally encountered in the upper 4 to 12 inches below the existing ground surface (bgs) at the test pit locations where native soils were present. The topsoil was characterized by dark brown color, the presence of fine organic material, and small root intrusions. Based on our field observations, we estimate topsoil will be encountered with an average thickness of about eight inches across the site.

Fill was encountered within the northern site area where existing improvements are located. TP-101 through TP-105 encountered about one to five feet of fill prior to transitioning into native material. In general, the deepest fills were encountered abutting Chain Lake Road within TP-101, TP-102, and TP-103. The northern site area includes a benched topography indicating that cuts and fills were utilized on the property to create level pads. The fill consisted of silty sand with gravel (USCS: SM) and contained deleterious material such as plastic bottles, bricks, concrete fragments, glass fragments, asphalt, and plastic sheeting. Due to the historically undisturbed, forested state of the southern site area, we anticipate significant fill deposits will be limited to the northern site area. Where encountered during construction, existing fill containing deleterious materials should be overexcavated to native soil and replaced with structural fill directly beneath structural elements.

**Native Soil**

Underlying topsoil and fill, native soils were encountered primarily as silty sand with gravel and silty gravel with sand (USCS: SM and GM), respectively, consistent with the typical makeup of glacial till. The upper, loose to medium dense deposits may be characterized as "weathered", and the at-depth, dense to very dense deposits may be characterized as "unweathered". The unweathered glacial till was weakly cemented at the test pit locations. Native soils were observed primarily in a moist condition extending to the maximum exploration depth of approximately seven feet bgs.

**Geologic Setting**

The referenced geologic map resource identifies Vashon lodgment till ($Qgt_v$) across the site and surrounding areas. According to the geologic map resource, Vashon lodgment till is primarily grayish blue to very dark gray, dense, and includes a silt-sand matrix containing gravels and cobbles. The material is typically very dense and weakly cemented as a result of glacial overburden during placement. Distinct features of the material are compactness, ability to maintain near-vertical slopes, and a heterogenous and nonsorted internal structure resembling concrete mix.

The referenced WSS resource identifies Tokul gravelly medial loam, with slopes ranging from zero to eight percent (Map Unit Symbol: 72) across the site and surrounding areas. The Tokul series was formed in glacial till plains and is present on hillslopes in the Monroe area. Based on our field observations, native soils likely to be encountered during grading activities will be consistent with the geologic setting of Tokul-series glacial till as outlined in this section.

**Groundwater**

During our subsurface exploration completed on September 2017 and June 2018, groundwater seepage was not encountered at the test pit locations. However, perched groundwater seeps are common within glacial till depending on the time of year; as such, it is our opinion the contractor should be prepared to respond to discrete zones of perched groundwater during construction. Seepage rates and elevations fluctuate depending on many factors, including precipitation duration and intensity, the time of year, and soil conditions. In general, groundwater flow rates are higher during the winter, spring, and early summer months.

**Geologically Hazardous Areas**

The subject property was evaluated for the presence of geologically hazardous areas in general accordance with SCC 30.62B and MMC 20.05. Based on our investigation, the site is not located within, or immediately adjacent to, any geologically hazardous areas as defined by the City of Monroe or Snohomish County.

## DISCUSSION AND RECOMMENDATIONS

### General

Construction of the proposed residential development is feasible from a geotechnical standpoint. The primary geotechnical considerations associated with the proposed development include foundation support, slab-on-grade subgrade support, the suitability of using on-site soils as structural fill, and temporary excavations.

Proposed residential structures may be constructed on conventional continuous and spread footing foundations bearing upon competent native soil or new structural fill. In general, competent native soil suitable for support of foundations will likely be encountered beginning at depths of about one to two feet bgs. Where loose or unsuitable soil conditions are exposed at foundation subgrade elevations, overexcavation and replacement with suitable structural fill, will be necessary.

This study has been prepared for the exclusive use of MainVue WA, 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

Initial site preparation activities will consist of installing temporary erosion control measures, establishing grading limits, performing clearing and site stripping (as necessary), and removing existing structural elements. Subsequent earthwork activities will involve mass site grading and related infrastructure improvements.

### Temporary Erosion Control

Prior to the installation of either initial or final pavement sections, temporary construction entrances and drive lanes, consisting of at least 6 to 12 inches of quarry spalls, should be considered to minimize off-site soil tracking and to provide a stable access entrance surface. Geotextile fabric may also be placed below the quarry spalls for greater stability of the temporary construction entrance. Erosion control measures should consist of silt fencing placed around the site perimeter. Soil stockpiles should be covered or otherwise protected to reduce soil erosion. Temporary approaches for controlling surface water runoff should be established prior to beginning earthwork activities. Additional Best Management Practices (BMPs), as specified by the project civil engineer and indicated on the plans, should be incorporated into construction activities. If warranted, erosion measures may be modified during construction, as approved by the site erosion control lead.

**Stripping**

Topsoil was encountered generally within the upper 4 to 12 inches of existing grades at the test pit locations, where encountered at the surface. ESNW should be retained to observe site stripping activities at the time of construction so that the degree of required stripping may be assessed. Over-stripping should be avoided, as it is unnecessary and may result in increased project development costs. Topsoil and organic-rich soil is neither suitable for foundation support nor for use as structural fill but may be used in non-structural areas, if desired.

**Excavations and Slopes**

Excavation activities are likely to expose areas of fill transitioning into medium dense to very dense native glacial till deposits. Provided appropriate methods of sloping and shoring (as necessary) for the excavations are incorporated into the design and construction, overall stability of site excavations is anticipated to be good. Based on the soil conditions observed at the test pit locations, the following allowable temporary slope inclinations, as a function of horizontal to vertical (H:V) inclination, may be used. The applicable Federal Occupation Safety and Health Administration (OSHA) and Washington Industrial Safety and Health Act (WISHA) soil classifications are also provided:

- Areas containing groundwater seepage — 1.5H:1V (Type C)
- Areas containing fill — 1.5H:1V (Type C)
- Medium dense soil — 1H:1V (Type B)
- Dense to very dense "hardpan" soil — 0.75H:1V (Type A)

Steeper temporary slope inclinations within dense to very dense "hardpan" glacial till may be feasible based on the soil and groundwater conditions exposed within the excavations. Steeper inclinations may be considered, and must be subsequently approved by ESNW, at the time of construction.

Permanent slopes should be planted with vegetation to enhance stability and to minimize erosion and should maintain a gradient of 2H:1V or flatter. The presence of perched groundwater may cause localized sloughing of temporary slopes due to excess seepage forces. An ESNW representative should observe temporary and permanent slopes to confirm the slope inclinations are suitable for the exposed soil conditions and to provide additional excavation and slope recommendations as necessary. If the recommended temporary slope inclinations cannot be achieved, temporary shoring may be necessary to support excavations.

**In-situ and Imported Soils**

On-site glacial till soils are moderately moisture sensitive, and successful use as structural fill will largely be dictated by the moisture content at the time of placement and compaction. Remedial measures, such as soil aeration and/or cement treatment (where approved by the local jurisdiction or utility district), may be necessary as part of site grading and earthwork activities. If the on-site soils cannot be successfully compacted, the use of an imported soil may be necessary. In our opinion, a contingency should be provided in the project budget for export of soil that cannot be successfully compacted as structural fill if grading activities take place during periods of extended rainfall activity. Soils with fines contents greater than 5 percent typically degrade rapidly when exposed to periods of rainfall.

Imported soil intended for use as structural fill should consist of a well-graded, granular soil with a moisture content that is at (or slightly above) 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 (where the fines content is defined as the percent passing the Number 200 sieve, based on the minus three-quarter-inch fraction).

**Structural Fill**

Structural fill placed and compacted during site grading activities should meet the following specifications and guidelines:

- Structural fill material — Granular soils*
- Moisture content — At or slightly above optimum**
- Relative compaction (minimum) — 95 percent (Modified Proctor)
- Loose lift thickness (maximum) — 12 inches

* *Existing on-site soils may not be suitable for use as structural fill, unless the soil is at or near the optimum moisture content at the time of placement and compaction*

** *Soils shall not be placed dry of optimum and should be evaluated by ESNW during construction*

With respect to underground utility installations and backfill, local jurisdictions may dictate the soil type(s) and compaction requirements. Areas of fill or otherwise unsuitable material and debris should be removed from structural areas and replaced with structural fill. Topsoil and organic-rich soil is neither suitable for foundation support nor for use as structural fill, but where encountered, may be used in non-structural areas as desired.

## Foundations

Proposed residential structures may be supported on conventional continuous and spread footing foundations bearing on competent native soil or suitable structural fill placed on competent native soils. Competent soil suitable for foundation support will likely be encountered beginning at depths of about one to two feet bgs. Where encountered, unstable or yielding areas of the subgrades should be recompacted, or overexcavated and replaced with suitable structural fill, prior to construction of the foundations and/or slabs. Existing fill in the northern site area containing deleterious materials may require overexcavation. Provided foundations will be supported as prescribed, the following parameters may be used for design:

- Allowable soil bearing capacity — 2,500 psf
- Passive earth pressure — 350 pcf (equivalent fluid)
- Coefficient of friction — 0.40

A one-third increase in the allowable soil bearing capacity may be assumed for short-term wind and seismic loading conditions. The above passive pressure and friction values include a factor-of-safety of 1.5. With structural loading as expected, total settlement in the range of one inch and differential settlement of approximately one-half inch is anticipated. The majority of anticipated settlement should occur during construction, as dead loads are applied.

## Seismic Design

The 2015 International Building Code recognizes the American Society of Civil Engineers (ASCE) for seismic site class definitions. In accordance with Table 20.3-1 of the ASCE Minimum Design Loads for Buildings and Other Structures manual, Site Class D should be used for design.

The referenced liquefaction susceptibility map indicates the site and surrounding areas maintain very low to low liquefaction susceptibility. Liquefaction is a phenomenon where saturated and loose, sandy soils suddenly lose internal strength and behave as a fluid. This behavior is in response to increased pore water pressures resulting from an earthquake or other intense ground shaking. In our opinion, site susceptibility to liquefaction can be considered negligible. The soil relative density and the absence of a uniformly established, shallow groundwater table were the primary bases for this consideration.

## Slab-on-Grade Floors

Each slab-on-grade floor should be supported on a well-compacted, firm and unyielding subgrade. Where feasible, native soils exposed at the slab-on-grade subgrade level can likely be compacted in situ to the specifications of 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 (where the fines content is defined as the percent passing the Number 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 to be utilized, it should be a material specifically designed for use as a vapor barrier and should be installed in accordance with the specifications of the manufacturer.

## Retaining Walls

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

- Active earth pressure (yielding condition) — 35 pcf (equivalent fluid)
- At-rest earth pressure (restrained condition) — 50 pcf
- Traffic surcharge (passenger vehicles) — 70 psf (rectangular distribution)*
- Passive earth pressure — 350 pcf (equivalent fluid)
- Coefficient of friction — 0.40
- Seismic surcharge — 6H**

* *Where applicable*
** *Where H equals the retained height (in feet)*

The above design parameters are based on a level backfill condition and level grade at the wall toe. Revised design values will be necessary if sloping grades are to be used above or below retaining walls. Additional surcharge loading from adjacent foundations, sloped backfill, or other relevant loads should be included in the retaining 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 12 inches of the wall backfill may consist of a less permeable soil, if desired. A perforated drainpipe 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 3. If drainage is not provided, hydrostatic pressures should be included in the wall design.

## Drainage

Temporary measures to control surface water runoff during construction would likely involve passive elements such as interceptor trenches and sumps. ESNW should be consulted during preliminary grading activities to evaluate seepage areas and provide recommendations to reduce the potential for seepage-related instability.

Finish grades should be designed to direct surface water away from structures and slopes. The grade adjacent to buildings should be sloped away from buildings at a gradient of at least 2 percent for a horizontal distance up to 10 feet, or the maximum allowed by adjacent structures. In our opinion, foundation drains should be installed along building perimeter footings. A typical foundation drain detail is provided on Plate 4.

**Infiltration Feasibility**

As indicated in the *Subsurface* section of this report, native soils encountered at depth during our fieldwork were characterized primarily as dense to very dense glacial till. Based upon the results of USDA textural analyses performed on representative soil samples, native soils may also be classified chiefly as gravelly sandy loam. Irrespective of gravel content, fines contents within the native soil were approximately 30 to 70 percent at the tested locations.

Native glacial till should not be considered an ideal geologic feature for accommodation of infiltration facilities, especially when encountered in a dense, compact state. In general, the glacial till was observed to become weakly cemented "hardpan" at depths approaching three feet bgs. As necessary, ESNW can provide further evaluation of, and recommendations for, stormwater flow control BMPs upon request.

**SCDM On-site Stormwater Management**

SCC 30.63A.525 requires implementation of on-site stormwater BMPs for proposed developments in accordance with specified thresholds, standards, and lists. The intent of BMP implementation is to infiltrate, disperse, and retain stormwater runoff on site to the extent feasible. We understand the proposed residential development intends to add over 5,000 square feet of new hard surface and therefore must comply with Minimum Requirements (MRs) 1 through 9, as outlined on Pages 15 through 22 of Volume I of the 2016 SCDM. MR 5 concerns on-site stormwater management, and the viability of specific BMPs are to be evaluated for each type of proposed surface. The table below summarizes our evaluation of the required BMPs for MR 5, as outlined in the 2016 SCDM, from a geotechnical standpoint. It is instructed in the 2016 SCDM that BMPs are to be considered in the order listed (from top to bottom) for each surface type, and the first BMP that is determined to be viable should be used. For completeness, however, we have evaluated each listed BMP for the proposed surface types.

| BMP | Viable? | Limitations or Infeasibility Criteria |
|---|---|---|
| *Lawns and Landscaped Areas* | | |
| T5.13: Post-construction soil quality and depth (Volume V, Chapter 5) | Yes | None. No steep slopes are present on the site. |
| *Roofs* | | |
| T5.30: Full dispersion (Volume V, Chapter 5) | Yes* | No critical areas or steep slopes are present. No flooding or erosion impacts are anticipated. However, adequate vegetative flow paths are likely not available. |
| T5.10A: Downspout full infiltration systems (Volume III, Chapter 3) | No | Based on our review, depths to hardpan (or other low permeability layer) from final grade and/or bottom of facility elevation will not satisfy minimum specified by SCDM Volume III, 3.1.1. |
| T5.14A Rain Gardens and T5.14B, T7.30 Bioretention (Volume V, Chapter 7) | No | Based on our review, the minimum one foot of vertical separation from hardpan (impervious layer) would not be feasible per SCDM Volume V, 7.3. |
| T5.10B: Downspout dispersion systems (Volume III, Chapter 3) | Yes* | No flooding or erosion impacts are anticipated. However, adequate vegetative flow paths are likely not available. |
| T5.10C: Perforated stub-out connections (Volume III, Chapter 3) | Maybe | Per SCDM Volume III, 3.1.3, trench bottom must be at least one foot above seasonal water level; seasonal water level should be assumed as about one foot above unweathered till (hardpan). |
| *Other Hard Surfaces* | | |
| T5.30: Full dispersion (Volume V, Chapter 5) | Yes* | No critical areas and/or buffers are present. No flooding or erosion impacts are anticipated. However, adequate vegetative flow paths are likely not available. |
| T5.15: Permeable pavement (Volume V, Chapter 5) | No | The unweathered till (hardpan) at depths approaching three feet (existing) would restrict vertical infiltration and create saturated conditions within upper soils. Upper soils should be considered unsuitable for supporting traffic loads unless compacted to a firm and unyielding condition which would effectively create a low-permeability condition for the upper soils. |
| T5.14A Rain Gardens and T5.14B, T7.30 Bioretention (Volume V, Chapter 7) | No | Based on our review, the minimum one foot of vertical separation from hardpan (impervious layer) would not be feasible per SCDM Volume V, 7.3. |
| T5.12: Sheet flow dispersion T5.11: Concentrated flow dispersion (Volume V, Chapter 5) | Yes* | No flooding or erosion impacts are anticipated. However, adequate vegetative flow paths are likely not available. |

** Viability stated from a geotechnical standpoint and should be determined by site storm designer with respect to setbacks and flow paths*

**Preliminary Detention Vault Design**

A stormwater detention vault will be constructed along the northeastern property line. Cuts of approximately 4 to 12 feet will be necessary as part of the proposed construction. The vault foundations should be supported directly on very dense, competent glacial till. Should overexcavation(s) be necessary at the vault foundation subgrade elevations, as assessed by ESNW at the time of construction, quarry spalls should be used for grade restoration. The final vault designs must incorporate adequate buffer space from property boundaries such that temporary excavations to construct the vault structures may be successfully completed. Perimeter drains should be installed around the vaults and conveyed to appropriate discharge points. Perched groundwater seepage and related buoyancy influence is not expected to influence the vault design.

The following preliminary design parameters may be used for the vault:

- Allowable soil bearing capacity — 5,000 psf (dense glacial till)
- Active earth pressure (unrestrained) — 35 pcf
- Active earth pressure (unrestrained, hydrostatic) — 80 pcf
- At-rest earth pressure (restrained) — 50 pcf
- At-rest earth pressure (restrained, hydrostatic) — 95 pcf
- Coefficient of friction — 0.40
- Passive earth pressure — 350 pcf
- Seismic surcharge — 6H*

* *Where H equals the retained height (in feet)*

Vault retaining walls should be backfilled with free-draining material or suitable sheet drainage that extends along the height of the walls. The upper one foot of the wall backfill may consist of a less permeable soil, if desired. Perforated drainpipes should be placed along the bases of the walls and connected to an appropriate discharge location(s). If the elevations of the vault bottoms are such that gravity flow to an outlet is not possible, the portions of the vaults below the drains should be designed to include hydrostatic pressure.

ESNW should observe grading operations for the vault and confirm subgrade conditions prior to concrete forming and pouring. If the soil conditions encountered during construction differ from those anticipated, supplementary recommendations may be provided. ESNW should be contacted to review final vault designs to confirm that appropriate geotechnical parameters have been incorporated.

## Preliminary Pavement Sections

Pavement performance is largely related to the condition of the underlying subgrade. To ensure 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 to the specifications previously detailed in this report. Soft, wet, or otherwise unsuitable subgrade areas may still exist after base grading activities. Areas containing unsuitable or yielding subgrade conditions will require remedial measures, such as overexcavation and/or placement of thicker crushed rock or structural fill sections, prior to pavement.

We anticipate new pavement sections will be subjected primarily to passenger vehicle traffic. For lightly loaded pavement areas subjected primarily to passenger vehicles, the following preliminary pavement sections may be considered:

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

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

- A minimum of three inches of HMA placed over six inches of CRB, or;
- A minimum of three inches of HMA placed over four inches of ATB.

The HMA, ATB and CRB materials should conform to WSDOT and/or City of Monroe and Snohomish County Road Standards 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 has been determined. City of Monroe or Snohomish County road standards may supersede the recommendations provided in this report.

An ESNW representative should be requested to observe the subgrade conditions prior to placement of crushed rock or ATB. Supplemental recommendations for achieving subgrade stability and drainage can be provided, as necessary.

## Utility Support and Trench Backfill

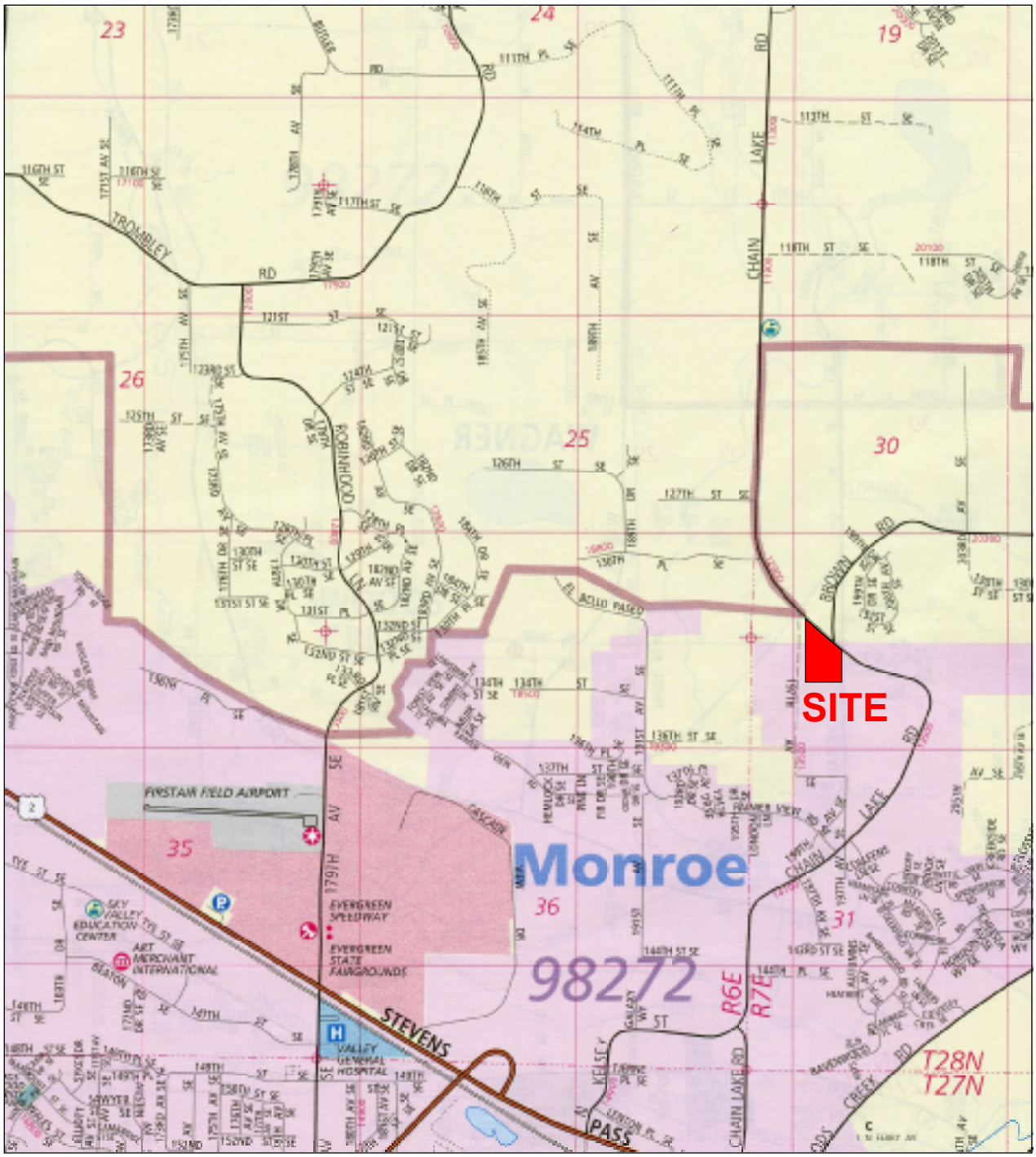
In our opinion, on-site soils will generally be suitable for support of utilities. On-site glacial till soils may be suitable for use as structural backfill throughout utility trench excavations, provided the soil is at (or slightly above) the optimum moisture content at the time of placement and compaction. Moisture conditioning of the soils may be necessary at some locations prior to use as structural fill. Each section of the utility lines must be adequately supported in the bedding material. Utility trench backfill should be placed and compacted to the specifications of structural fill as previously detailed in this report, or to the applicable specifications of the City of Monroe, Snohomish County, or other responsible jurisdiction or agency.

## LIMITATIONS

The recommendations and conclusions provided in this 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 neither expressed nor implied. Variations in the soil and groundwater conditions observed at the test pit locations may exist and may not become evident until construction. ESNW should reevaluate the conclusions provided in this study if variations are encountered.

### Additional Services

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




Reference:
Snohomish County, Washington
Map 438
By The Thomas Guide
Rand McNally
32nd Edition

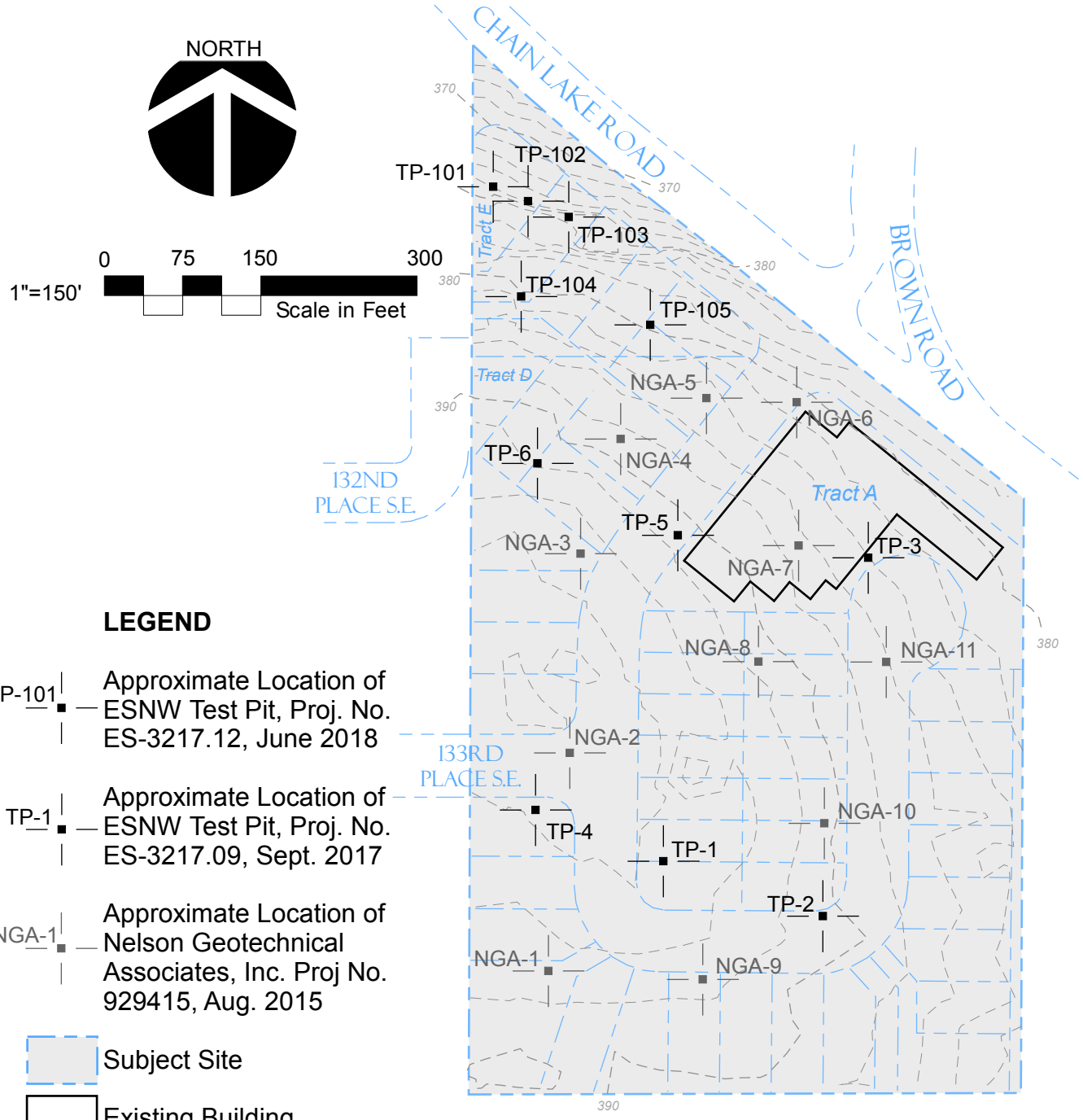
NORTH

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.

**Earth Solutions NW LLC**
Geotechnical Engineering, Construction Observation/Testing and Environmental Services

Vicinity Map
Eaglemont 7 PRD
Monroe, Washington

| | | |
|---|---|---|
| Drwn. MRS | Date 07/23/2018 | Proj. No. 3217.12 |
| Checked BST | Date July 2018 | Plate 1 |




## LEGEND

TP-101 — Approximate Location of ESNW Test Pit, Proj. No. ES-3217.12, June 2018

TP-1 — Approximate Location of ESNW Test Pit, Proj. No. ES-3217.09, Sept. 2017

NGA-1 — Approximate Location of Nelson Geotechnical Associates, Inc. Proj No. 929415, Aug. 2015

Subject Site

Existing Building

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.

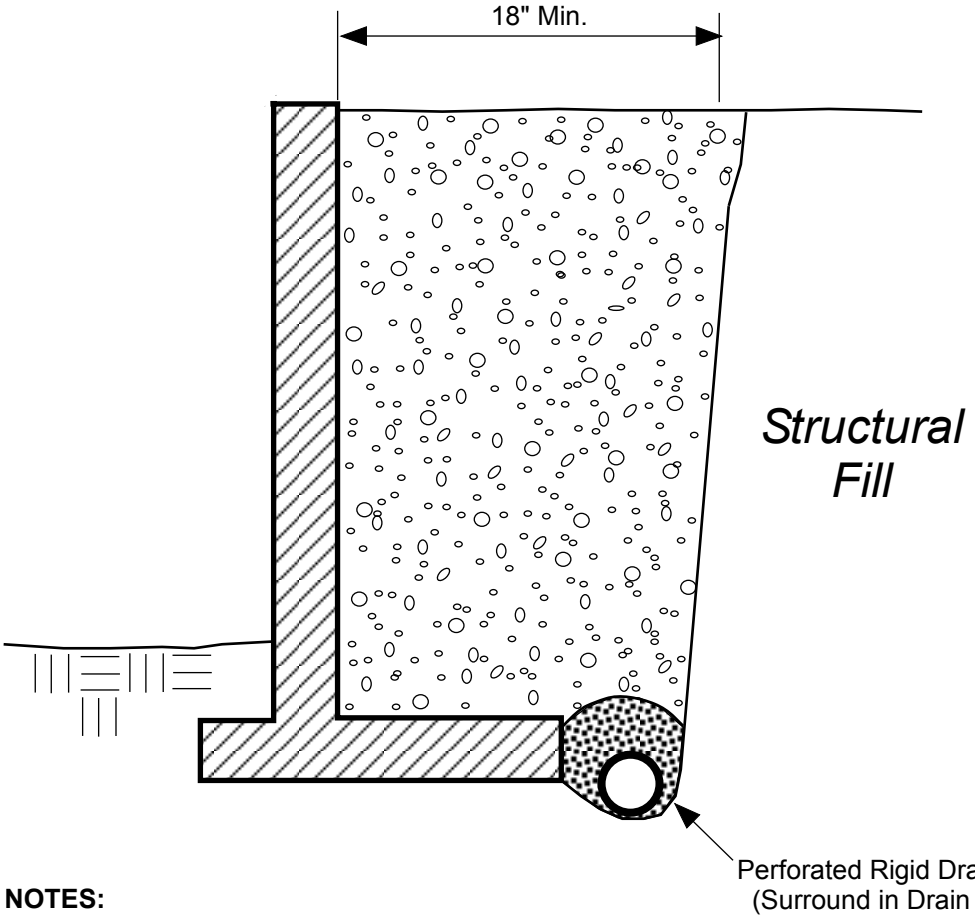
NOTE: This plate may contain areas of color. ESNW cannot be responsible for any subsequent misinterpretation of the information resulting from black & white reproductions of this plate.

Earth Solutions NW LLC

Geotechnical Engineering, Construction Observation/Testing and Environmental Services

# Test Pit Location Plan
# Eaglemont 7 PRD
# Monroe, Washington

| | | |
|---|---|---|
| Drwn. MRS | Date 07/24/2018 | Proj. No. 3217.12 |
| Checked BST | Date July 2018 | Plate 2 |




**NOTES:**

- Free-draining Backfill should consist of soil having less than 5 percent fines. Percent passing No. 4 sieve 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-inch Drain Rock.

SCHEMATIC ONLY - NOT TO SCALE
NOT A CONSTRUCTION DRAWING

**LEGEND:**

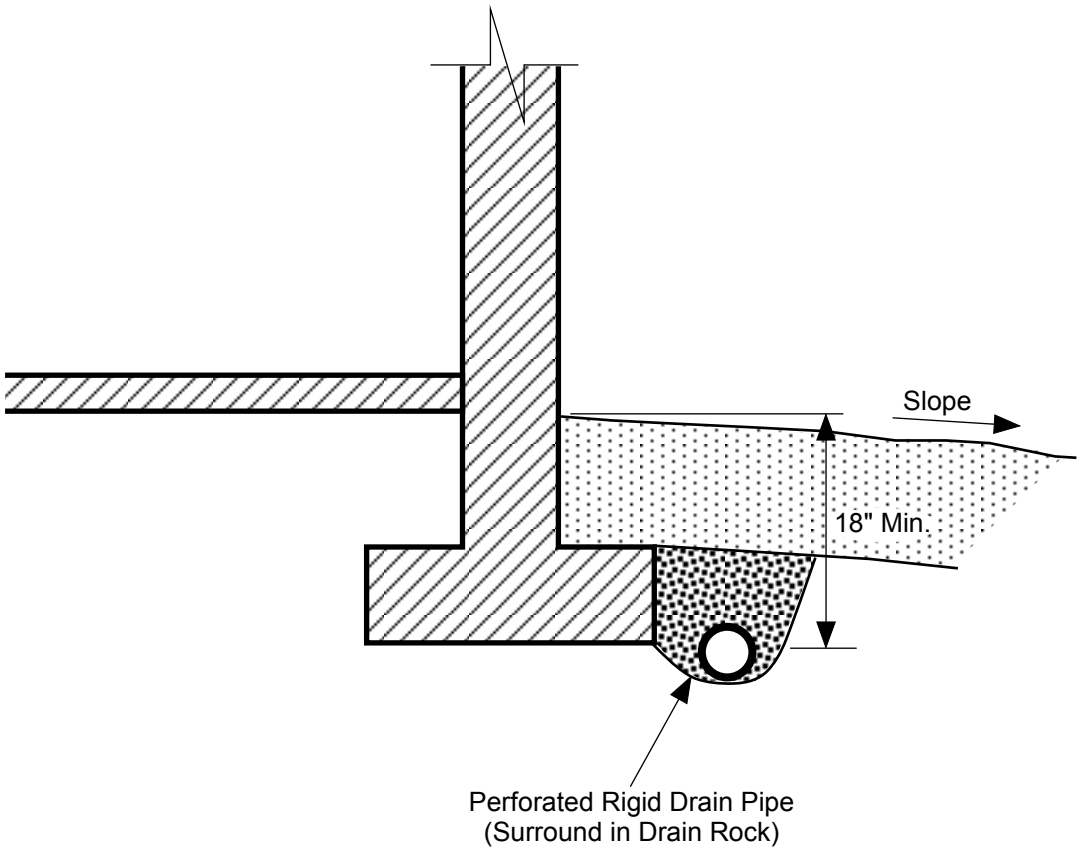
Free-draining Structural Backfill

1-inch Drain Rock

Earth Solutions NW LLC
Geotechnical Engineering Construction Observation/Testing and Environmental Services

Retaining Wall Drainage Detail
Eaglemont 7 PRD
Monroe, Washington

| | | |
|---|---|---|
| Drwn. MRS | Date 07/23/2018 | Proj. No. 3217.12 |
| Checked BST | Date July 2018 | Plate 3 |




**NOTES:**

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

SCHEMATIC ONLY - NOT TO SCALE
NOT A CONSTRUCTION DRAWING

**LEGEND:**

Surface Seal: native soil or other low-permeability material.

1-inch Drain Rock

Earth Solutions NW LLC
Geotechnical Engineering, Construction Observation/Testing and Environmental Services

Footing Drain Detail
Eaglemont 7 PRD
Monroe, Washington

| | | |
|---|---|---|
| Drwn. MRS | Date 07/23/2018 | Proj. No. 3217.12 |
| Checked BST | Date July 2018 | Plate 4 |

## Appendix A

## Subsurface Exploration
## Test Pit Logs by ESNW
## Test Pit Logs by Others

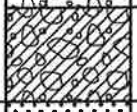
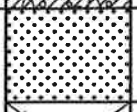
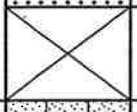
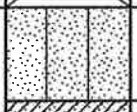
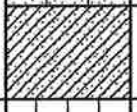
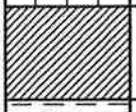
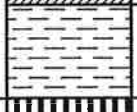
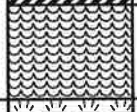
## ES-3217.12

Subsurface conditions at the subject site were explored on September 8, 2017 by excavating six test pits using a mini trackhoe and operator retained by our firm. We returned to the site on June 28, 2018 to explore subsurface conditions in the northern site area by excavating five test pits using a mini trackhoe and operator retained by the client. The approximate locations of the subsurface exploration test pits, as well as test pits previously completed by Nelson Geotechnical Associates, Inc., are illustrated on Plate 2 of this study. The subsurface test pit logs are provided in this Appendix. The test pits were advanced to a maximum depth of approximately seven feet bgs.

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 | GRAVEL AND GRAVELLY SOILS | CLEAN GRAVELS (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 |
| | MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE | GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES) |  | GM | SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES |
| | | |  | GC | CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES |
| MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE | SAND AND SANDY SOILS | CLEAN SANDS (LITTLE OR NO FINES) |  | SW | WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES |
| | | |  | SP | POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES |
| | MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE | SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES) |  | SM | SILTY SANDS, SAND - SILT MIXTURES |
| | | |  | SC | CLAYEY SANDS, SAND - CLAY MIXTURES |
| FINE GRAINED SOILS | 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 |
| MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE | 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.

Earth Solutions NW
1805 - 136th Place N.E., Suite 201
Bellevue, Washington 98005
Telephone: 425-449-4704
Fax: 425-449-4711

# TEST PIT NUMBER TP-101



**PROJECT NUMBER** ES-3712.12 **PROJECT NAME** Eaglemont 7 PRD

**DATE STARTED** 6/28/18 **COMPLETED** 6/28/18 **GROUND ELEVATION** 366 ft **TEST PIT SIZE**

**EXCAVATION CONTRACTOR** Universal Land **GROUND WATER LEVELS:**

**EXCAVATION METHOD** **AT TIME OF EXCAVATION** ---

**LOGGED BY** BST **CHECKED BY** KDH **AT END OF EXCAVATION** ---

**NOTES** Surface Conditions: brambles **AFTER EXCAVATION** ---

| DEPTH (ft) | SAMPLE TYPE NUMBER | TESTS | U.S.C.S. | GRAPHIC LOG | MATERIAL DESCRIPTION | |
|---|---|---|---|---|---|---|
| 0 | | | | | | |
| | | | Fill | | Dark brown silty SAND with gravel, loose to medium dense, moist (Fill) | |
| | | | | | -brick, concrete fragments | |
| | | | | | -glass fragments | |
| | | | | | -plastic bottles | |
| | | MC = 23.90% | | | | |
| | | | | | -increasing silt content, becomes gray | |
| | | MC = 24.70% | | | | |
| 5 | | | | 5.0 | -relic topsoil horizon | 361.0 |
| | | | ML | | Brown sandy SILT with gravel, medium dense, moist | |
| | | | | | -scattered cobbles | |
| | | | | | -becomes gray, dense, weakly cemented | |
| | | MC = 39.70% | | 7.0 | [USDA Classification: slightly gravelly LOAM] | 359.0 |
| | | Fines = 69.10% | | | Test pit terminated at 7.0 feet below existing grade. No groundwater encountered during excavation. No caving observed. | |
| | | | | | Bottom of test pit at 7.0 feet. | |

Earth Solutions NW
1805 - 136th Place N.E., Suite 201
Bellevue, Washington 98005
Telephone: 425-449-4704
Fax: 425-449-4711

# TEST PIT NUMBER TP-102



**PROJECT NUMBER** ES-3712.12 **PROJECT NAME** Eaglemont 7 PRD

**DATE STARTED** 6/28/18 **COMPLETED** 6/28/18 **GROUND ELEVATION** 364 ft **TEST PIT SIZE**

**EXCAVATION CONTRACTOR** Universal Land **GROUND WATER LEVELS:**

**EXCAVATION METHOD** **AT TIME OF EXCAVATION** ---

**LOGGED BY** BST **CHECKED BY** KDH **AT END OF EXCAVATION** ---

**NOTES** Surface Conditions: brambles **AFTER EXCAVATION** ---

| DEPTH (ft) | SAMPLE TYPE NUMBER | TESTS | U.S.C.S. | GRAPHIC LOG | MATERIAL DESCRIPTION |
|---|---|---|---|---|---|
| 0 | | | Fill | | Gray silty SAND with gravel, loose to medium dense, moist (Fill)<br>-recycled concrete, styrofoam<br>-asphalt fragments, tin can, glass fragments<br>-plastic sheeting |
| | | | | 4.5 | -relic topsoil horizon 359.5 |
| 5 | | MC = 23.60%<br>MC = 19.90% | SM | 5.0 | Brown silty SAND with gravel, medium dense, moist 359.0<br>-scattered cobbles |
| | | | | | Test pit terminated at 5.0 feet below existing grade. No groundwater encountered during excavation. No caving observed.<br>Bottom of test pit at 5.0 feet. |

Earth Solutions NW
1805 - 136th Place N.E., Suite 201
Bellevue, Washington 98005
Telephone: 425-449-4704
Fax: 425-449-4711

# TEST PIT NUMBER TP-103



**PROJECT NUMBER** ES-3712.12 **PROJECT NAME** Eaglemont 7 PRD

**DATE STARTED** 6/28/18 **COMPLETED** 6/28/18 **GROUND ELEVATION** 364 ft **TEST PIT SIZE**

**EXCAVATION CONTRACTOR** Universal Land **GROUND WATER LEVELS:**

**EXCAVATION METHOD** **AT TIME OF EXCAVATION** ---

**LOGGED BY** BST **CHECKED BY** KDH **AT END OF EXCAVATION** ---

**NOTES** Surface Conditions: brambles **AFTER EXCAVATION** ---

| DEPTH (ft) | SAMPLE TYPE NUMBER | TESTS | U.S.C.S. | GRAPHIC LOG | MATERIAL DESCRIPTION | |
|---|---|---|---|---|---|---|
| 0 | | | | | | |
| | | MC = 16.00% | Fill | | Brown silty SAND with gravel, loose to medium dense, moist (Fiil)<br>-scattered cobbles<br>-continuous concrete fragment<br>-plastic sheeting | |
| 4.0 | | | | | -relic topsoil horizon | 360.0 |
| 5 | | | SM | | Brown silty SAND with gravel, medium dense, moist<br>-scattered cobbles | |
| | | MC = 43.50% | | | | |
| 6.5 | | | | | -becomes gray, dense, weakly cemented | 357.5 |
| | | | | | Test pit terminated at 6.5 feet below existing grade. No groundwater encountered during excavation. No caving observed.<br>Bottom of test pit at 6.5 feet. | |

Earth Solutions NW
1805 - 136th Place N.E., Suite 201
Bellevue, Washington 98005
Telephone: 425-449-4704
Fax: 425-449-4711

# TEST PIT NUMBER TP-104



**PROJECT NUMBER** ES-3712.12 **PROJECT NAME** Eaglemont 7 PRD

**DATE STARTED** 6/28/18 **COMPLETED** 6/28/18 **GROUND ELEVATION** 380 ft **TEST PIT SIZE**

**EXCAVATION CONTRACTOR** Universal Land **GROUND WATER LEVELS:**

**EXCAVATION METHOD** **AT TIME OF EXCAVATION** ---

**LOGGED BY** BST **CHECKED BY** KDH **AT END OF EXCAVATION** ---

**NOTES** Depth of Topsoil & Sod 12": grass **AFTER EXCAVATION** ---

| DEPTH (ft) | SAMPLE TYPE NUMBER | TESTS | U.S.C.S. | GRAPHIC LOG | MATERIAL DESCRIPTION | |
|---|---|---|---|---|---|---|
| 0 | | | TPSL | | Dark brown TOPSOIL (Fill) | |
| | | | | | -tin can, plastic bag, glass fragments | 379.0 |
| | | | | 1.0 | Brown sandy SILT with gravel, medium dense, moist | |
| | | | | | -scattered cobbles | |
| | | | ML | | | |
| | | MC = 27.40%<br>Fines = 69.20%<br>MC = 11.40% | | | [USDA Classification: slightly gravelly LOAM] | |
| | | | | 4.5 | -becomes gray, dense to very dense, weakly cemented | 375.5 |
| | | | | | Test pit terminated at 4.5 feet below existing grade. No groundwater encountered during excavation. No caving observed. | |
| | | | | | Bottom of test pit at 4.5 feet. | |

Earth Solutions NW
1805 - 136th Place N.E., Suite 201
Bellevue, Washington 98005
Telephone: 425-449-4704
Fax: 425-449-4711

# TEST PIT NUMBER TP-105



**PROJECT NUMBER** ES-3712.12 **PROJECT NAME** Eaglemont 7 PRD

**DATE STARTED** 6/28/18 **COMPLETED** 6/28/18 **GROUND ELEVATION** 380 ft **TEST PIT SIZE**

**EXCAVATION CONTRACTOR** Universal Land **GROUND WATER LEVELS:**

**EXCAVATION METHOD** **AT TIME OF EXCAVATION** ---

**LOGGED BY** BST **CHECKED BY** KDH **AT END OF EXCAVATION** ---

**NOTES** Depth of Topsoil & Sod 18": grass **AFTER EXCAVATION** ---

| DEPTH (ft) | SAMPLE TYPE NUMBER | TESTS | U.S.C.S. | GRAPHIC LOG | MATERIAL DESCRIPTION |
|---|---|---|---|---|---|
| 0 | | | | | |
| | | | TPSL | | Dark brown TOPSOIL (Fill)<br>-glass fragments, aluminum cans<br>-lens of silty gravel with sand<br>-relic topsoil horizon |
| 1.5 | | | | | 378.5 |
| | | MC = 36.80% | SM | | Brown silty SAND with gravel, medium dense, moist<br>-scattered cobbles |
| | | MC = 21.50% | | | -becomes gray, dense to very dense, weakly cemented<br>-light iron oxide staining |
| 5 | | MC = 11.30%<br>Fines = 47.70% | | | [USDA Classification: gravelly LOAM] |
| 5.0 | | | | | 375.0 |
| | | | | | Test pit terminated at 5.0 feet below existing grade. No groundwater encountered during excavation. No caving observed.<br>Bottom of test pit at 5.0 feet. |

Earth Solutions NW
1805 - 136th Place N.E., Suite 201
Bellevue, Washington 98005
Telephone: 425-449-4704
Fax: 425-449-4711

# TEST PIT NUMBER TP-1



**CLIENT** MainVue WA, LLC
**PROJECT NAME** Gilmartin Farms
**PROJECT NUMBER** ES-3217.09
**PROJECT LOCATION** Monroe, Washington
**DATE STARTED** 9/8/17 **COMPLETED** 9/8/17
**GROUND ELEVATION** 397 ft **TEST PIT SIZE**
**EXCAVATION CONTRACTOR** NW Excavating
**GROUND WATER LEVELS:**
**EXCAVATION METHOD**
**AT TIME OF EXCAVATION** ---
**LOGGED BY** BST **CHECKED BY** RAC
**AT END OF EXCAVATION** ---
**NOTES** Depth of Topsoil & Sod 4": brambles
**AFTER EXCAVATION** ---

| DEPTH (ft) | SAMPLE TYPE NUMBER | TESTS | U.S.C.S. | GRAPHIC LOG | MATERIAL DESCRIPTION | |
|---|---|---|---|---|---|---|
| 0 | | | TPSL | | 0.4 Dark brown TOPSOIL, roots to 2' | 396.6 |
| | | | SM | | Brown silty SAND with gravel, medium dense, damp (Weathered Till)<br>-scattered cobbles to BOH | |
| | | MC = 13.60% | | | 2.0 | 395.0 |
| | | MC = 4.60%<br>Fines = 34.30% | GM | | Gray silty GRAVEL with sand, very dense, moist (Unweathered Till)<br>-weakly cemented<br>[USDA Classification: very gravelly LOAM] | |
| | | MC = 8.40% | | | | |
| 5 | | | | | | |
| | | | | | 6.0 | 391.0 |
| | | MC = 9.20% | | | Test pit terminated at 6.0 feet below existing grade. No groundwater encountered during excavation. No caving observed.<br>Bottom of test pit at 6.5 feet. | |

Earth Solutions NW
1805 - 136th Place N.E., Suite 201
Bellevue, Washington 98005
Telephone: 425-449-4704
Fax: 425-449-4711

# TEST PIT NUMBER TP-2



**CLIENT** MainVue WA, LLC
**PROJECT NAME** Gilmartin Farms
**PROJECT NUMBER** ES-3217.09
**PROJECT LOCATION** Monroe, Washington
**DATE STARTED** 9/8/17 **COMPLETED** 9/8/17
**GROUND ELEVATION** 390 ft **TEST PIT SIZE**
**EXCAVATION CONTRACTOR** NW Excavating
**GROUND WATER LEVELS:**
**EXCAVATION METHOD**
**AT TIME OF EXCAVATION** ---
**LOGGED BY** BST **CHECKED BY** RAC
**AT END OF EXCAVATION** ---
**NOTES** Depth of Topsoil & Sod 12": grass
**AFTER EXCAVATION** ---

| DEPTH (ft) | SAMPLE TYPE NUMBER | TESTS | U.S.C.S. | GRAPHIC LOG | MATERIAL DESCRIPTION |
|---|---|---|---|---|---|
| 0 | | | | | |
| | | | TPSL | | Dark brown TOPSOIL, roots to 2.5' |
| 1.0 | | | | | 389.0 |
| | | MC = 25.70% | SM | | Brown silty SAND with gravel, medium dense, damp (Weathered Till) |
| | | | | | -scattered cobbles to BOH |
| 2.5 | | | | | 387.5 |
| | | MC = 6.60% | GM | | Gray silty GRAVEL with sand, very dense, moist (Unweathered Till) |
| | | | | | -weakly cemented |
| | | MC = 12.60% | | | -light iron oxide staining |
| 4.0 | | | | | 386.0 |
| | | | | | Test pit terminated at 4.0 feet below existing grade. No groundwater encountered during excavation. No caving observed. |
| | | | | | Bottom of test pit at 4.0 feet. |

Earth Solutions NW
1805 - 136th Place N.E., Suite 201
Bellevue, Washington 98005
Telephone: 425-449-4704
Fax: 425-449-4711

# TEST PIT NUMBER TP-3



**CLIENT** MainVue WA, LLC
**PROJECT NAME** Gilmartin Farms
**PROJECT NUMBER** ES-3217.09
**PROJECT LOCATION** Monroe, Washington
**DATE STARTED** 9/8/17 **COMPLETED** 9/8/17
**GROUND ELEVATION** 384 ft **TEST PIT SIZE**
**EXCAVATION CONTRACTOR** NW Excavating
**GROUND WATER LEVELS:**
**EXCAVATION METHOD**
**AT TIME OF EXCAVATION** —
**LOGGED BY** BST **CHECKED BY** RAC
**AT END OF EXCAVATION** —
**NOTES** Depth of Topsoil & Sod 10": brambles
**AFTER EXCAVATION** —

| DEPTH (ft) | SAMPLE TYPE NUMBER | TESTS | U.S.C.S. | GRAPHIC LOG | MATERIAL DESCRIPTION | |
|---|---|---|---|---|---|---|
| 0 | | | TPSL | | Dark brown TOPSOIL, roots to 2' | |
| | | | | 0.8 | | 383.2 |
| | | | | | Brown silty SAND with gravel, medium dense, damp (Weathered Till) | |
| | | MC = 19.00% | | | -scattered cobbles to BOH | |
| | | MC = 6.90% | | | -becomes gray, moist, weakly cemented<br>-becomes dense to very dense (unweathered till) | |
| | | | SM | | | |
| 5 | | | | | -increasing cobbles | |
| | | MC = 8.80% | | | -becomes moderately cemented | |
| | | MC = 9.10%<br>Fines = 38.60% | | | [USDA Classification: gravelly sandy LOAM] | |
| | | | | 7.0 | | 377.0 |
| | | | | | Test pit terminated at 7.0 feet below existing grade. No groundwater encountered during excavation. No caving observed.<br>Bottom of test pit at 7.0 feet. | |

Earth Solutions NW
1805 - 136th Place N.E., Suite 201
Bellevue, Washington 98005
Telephone: 425-449-4704
Fax: 425-449-4711

# TEST PIT NUMBER TP-4



**CLIENT** MainVue WA, LLC
**PROJECT NAME** Gilmartin Farms
**PROJECT NUMBER** ES-3217.09
**PROJECT LOCATION** Monroe, Washington
**DATE STARTED** 9/8/17 **COMPLETED** 9/8/17
**GROUND ELEVATION** 396 ft **TEST PIT SIZE**
**EXCAVATION CONTRACTOR** NW Excavating
**GROUND WATER LEVELS:**
**EXCAVATION METHOD**
**AT TIME OF EXCAVATION** ---
**LOGGED BY** BST **CHECKED BY** RAC
**AT END OF EXCAVATION** ---
**NOTES** Depth of Topsoil & Sod 8": grass
**AFTER EXCAVATION** —

| DEPTH (ft) | SAMPLE TYPE NUMBER | TESTS | U.S.C.S. | GRAPHIC LOG | MATERIAL DESCRIPTION | |
|---|---|---|---|---|---|---|
| 0 | | | TPSL | | Dark brown TOPSOIL, roots to 2.5' | 395.4 |
| | | | | 0.6 | | |
| | | | ML | | Brown sandy SILT with gravel, medium dense, damp (Weathered Till) | |
| | | MC = 16.30% | | | -scattered cobbles to BOH | |
| | | Fines = 62.30% | | | [USDA Classification: gravelly LOAM] | 393.5 |
| | | | | 2.5 | | |
| | | MC = 6.30% | GM | | Gray silty GRAVEL with sand, very dense, moist (Unweathered Till) | |
| | | | | | -weakly cemented | |
| 5 | | | | | | |
| | | MC = 7.80% | | | | 390.0 |
| | | | | 6.0 | Test pit terminated at 6.0 feet below existing grade. No groundwater encountered during excavation. No caving observed. | |
| | | | | | Bottom of test pit at 6.0 feet. | |

Earth Solutions NW
1805 - 136th Place N.E., Suite 201
Bellevue, Washington 98005
Telephone: 425-449-4704
Fax: 425-449-4711

# TEST PIT NUMBER TP-5



**CLIENT** MainVue WA, LLC
**PROJECT NAME** Gilmartin Farms
**PROJECT NUMBER** ES-3217.09
**PROJECT LOCATION** Monroe, Washington
**DATE STARTED** 9/8/17 **COMPLETED** 9/8/17
**GROUND ELEVATION** 390 ft **TEST PIT SIZE**
**EXCAVATION CONTRACTOR** NW Excavating
**GROUND WATER LEVELS:**
**EXCAVATION METHOD**
**AT TIME OF EXCAVATION** ---
**LOGGED BY** BST **CHECKED BY** RAC
**AT END OF EXCAVATION** —
**NOTES** Depth of Topsoil & Sod 6": brambles
**AFTER EXCAVATION** —

| DEPTH (ft) | SAMPLE TYPE NUMBER | TESTS | U.S.C.S. | GRAPHIC LOG | MATERIAL DESCRIPTION | |
|---|---|---|---|---|---|---|
| 0 | | | TPSL | | Dark brown TOPSOIL, roots to 2.5' | 389.5 |
| | | MC = 15.10% | SM | | Brown silty SAND with gravel, medium dense, damp (Weathered Till)<br>-scattered cobbles to BOH | |
| | | | | | | 387.5 |
| | | MC = 4.30%<br>Fines = 32.40% | GM | | Gray silty GRAVEL with sand, very dense, moist (Unweathered Till)<br>-weakly cemented<br>[USDA Classification: very gravelly LOAM] | |
| 5 | | | | | -becomes moderately cemented | |
| | | MC = 3.60% | | | | 384.0 |
| | | | | | Test pit terminated at 6.0 feet below existing grade. No groundwater encountered during excavation. No caving observed.<br>Bottom of test pit at 6.0 feet. | |

Earth Solutions NW
1805 - 136th Place N.E., Suite 201
Bellevue, Washington 98005
Telephone: 425-449-4704
Fax: 425-449-4711

# TEST PIT NUMBER TP-6



**CLIENT** MainVue WA, LLC
**PROJECT NAME** Gilmartin Farms
**PROJECT NUMBER** ES-3217.09
**PROJECT LOCATION** Monroe, Washington
**DATE STARTED** 9/8/17 **COMPLETED** 9/8/17
**GROUND ELEVATION** 391 ft **TEST PIT SIZE**
**EXCAVATION CONTRACTOR** NW Excavating
**GROUND WATER LEVELS:**
**EXCAVATION METHOD**
**AT TIME OF EXCAVATION** —
**LOGGED BY** BST **CHECKED BY** RAC
**AT END OF EXCAVATION** —
**NOTES** Depth of Topsoil & Sod 10": brambles
**AFTER EXCAVATION** —

| DEPTH (ft) | SAMPLE TYPE NUMBER | TESTS | U.S.C.S. | GRAPHIC LOG | MATERIAL DESCRIPTION | |
|---|---|---|---|---|---|---|
| 0 | | | TPSL | | Dark brown TOPSOIL, roots to 2.5' | |
| | | | | | 0.8 | 390.2 |
| | | MC = 12.50% | SM | | Brown silty SAND with gravel, medium dense, damp (Weathered Till) | |
| | | | | | -scattered cobbles to BOH | |
| | | MC = 6.30% | | | 2.5 | 388.5 |
| | | | GM | | Gray silty GRAVEL with sand, very dense, moist (Unweathered Till) | |
| | | | | | -weakly cemented | |
| 5 | | | | | -becomes moderately cemented | |
| | | MC = 8.80% | | | 6.0 | 385.0 |
| | | | | | Test pit terminated at 6.0 feet below existing grade. No groundwater encountered during excavation. No caving observed. | |
| | | | | | Bottom of test pit at 6.0 feet. | |

# UNIFIED SOIL CLASSIFICATION SYSTEM

| MAJOR DIVISIONS | | | GROUP SYMBOL | GROUP NAME |
|---|---|---|---|---|
| COARSE - GRAINED SOILS<br><br>MORE THAN 50 % RETAINED ON NO. 200 SIEVE | GRAVEL<br><br>MORE THAN 50 % OF COARSE FRACTION RETAINED ON NO. 4 SIEVE | CLEAN GRAVEL | GW | WELL-GRADED, FINE TO COARSE GRAVEL |
| | | | GP | POORLY-GRADED GRAVEL |
| | | GRAVEL WITH FINES | GM | SILTY GRAVEL |
| | | | GC | CLAYEY GRAVEL |
| | SAND<br><br>MORE THAN 50 % OF COARSE FRACTION PASSES NO. 4 SIEVE | CLEAN SAND | SW | WELL-GRADED SAND, FINE TO COARSE SAND |
| | | | SP | POORLY GRADED SAND |
| | | SAND WITH FINES | SM | SILTY SAND |
| | | | SC | CLAYEY SAND |
| FINE - GRAINED SOILS<br><br>MORE THAN 50 % PASSES NO. 200 SIEVE | SILT AND CLAY<br><br>LIQUID LIMIT LESS THAN 50 % | INORGANIC | ML | SILT |
| | | | CL | CLAY |
| | | ORGANIC | OL | ORGANIC SILT, ORGANIC CLAY |
| | SILT AND CLAY<br><br>LIQUID LIMIT 50 % OR MORE | INORGANIC | MH | SILT OF HIGH PLASTICITY, ELASTIC SILT |
| | | | CH | CLAY OF HIGH PLASTICITY, FLAT CLAY |
| | | ORGANIC | OH | ORGANIC CLAY, ORGANIC SILT |
| HIGHLY ORGANIC SOILS | | | PT | PEAT |

NOTES:

1) Field classification is based on visual examination of soil in general accordance with ASTM D 2488-93.
2) Soil classification using laboratory tests is based on ASTM D 2488-93.
3) Descriptions of soil density or consistency are based on interpretation of blowcount data, visual appearance of soils, and/or test data.

SOIL MOISTURE MODIFIERS:

Dry - Absence of moisture, dusty, dry to the touch

Moist - Damp, but no visible water.

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

| Project Number | Leighty Development Soil Classification Chart | NELSON GEOTECHNICAL ASSOCIATES, INC. | No. | Date | Revision | By | CK |
|---|---|---|---|---|---|---|---|
| 929415 | | NGA<br>GEOTECHNICAL ENGINEERS & GEOLOGISTS | 1 | 8/5/15 | Original | DPN | LSB |
| Figure 3 | | 17311-135th Ave. NE, A-500, Woodinville, WA 98072, (425) 486-1669 / Fax 481-2510<br>Snohomish County (425) 337-1669, Wenatchee/Chelan (509) 665-7698, www.nelsongeotech.com | | | | | |

N:\2015 NGA Project Folders\9294-15 Leighty Estate Prop. Res. Development\Drafting\SC.dwg

## LOG OF EXPLORATION

| DEPTH (FEET) | USC | SOIL DESCRIPTION |
|---|---|---|
| **TEST PIT ONE** | | |
| 0.0 – 1.0 | | **TOPSOIL** |
| 1.0 – 2.5 | SM | BROWN-GRAY, SILTY FINE TO MEDIUM SAND WITH GRAVEL (MEDIUM DENSE TO DENSE, MOIST) |
| 2.5 – 4.5 | SM | GRAY, SILTY FINE TO MEDIUM SAND WITH GRAVEL AND COBBLES (VERY DENSE, MOIST) |
| | | SAMPLE WAS COLLECTED AT 2.5 FEET<br>GROUNDWATER SEEPAGE WAS NOT ENCOUNTERED<br>TEST PIT CAVING WAS NOT ENCOUNTERED<br>TEST PIT MET REFUSAL AT 4.5 FEET ON 7/27/15 |
| **TEST PIT TWO** | | |
| 0.0 – 0.5 | | **TOPSOIL** |
| 0.5 – 3.5 | SM | BROWN-GRAY, SILTY FINE TO MEDIUM SAND WITH GRAVEL (MEDIUM DENSE TO DENSE, MOIST) |
| 3.5 – 7.5 | SM | GRAY, SILTY FINE TO MEDIUM SAND WITH GRAVEL (DENSE, MOIST) |
| | | SAMPLES WERE COLLECTED AT 3.0, 3.5, AND 7.0 FEET<br>GROUNDWATER SEEPAGE WAS NOT ENCOUNTERED<br>TEST PIT CAVING WAS NOT ENCOUNTERED<br>TEST PIT WAS COMPLETED AT 7.5 FEET ON 7/27/15 |
| **TEST PIT THREE** | | |
| 0.0 – 0.5 | | **TOPSOIL** |
| 0.5 – 3.0 | SM | BROWN-GRAY, SILTY FINE TO MEDIUM SAND WITH GRAVEL (MEDIUM DENSE TO DENSE, MOIST) |
| 3.0 – 6.0 | SM | GRAY, SILTY FINE TO MEDIUM SAND WITH GRAVEL AND COBBLES (DENSE, MOIST) |
| | | SAMPLE WAS COLLECTED AT 3.0 FEET<br>GROUNDWATER SEEPAGE WAS NOT ENCOUNTERED<br>TEST PIT CAVING WAS NOT ENCOUNTERED<br>TEST PIT WAS COMPLETED AT 6.0 FEET ON 7/27/15 |
| **TEST PIT FOUR** | | |
| 0.0 – 0.5 | | **TOPSOIL** |
| 0.5 – 3.0 | SM | BROWN-GRAY, SILTY FINE TO MEDIUM SAND WITH GRAVEL (MEDIUM DENSE TO DENSE, MOIST) |
| 3.0 – 5.5 | SM | GRAY, SILTY FINE TO MEDIUM SAND WITH GRAVEL AND COBBLES<br>(DENSE TO VERY DENSE, MOIST) |
| | | SAMPLE WAS COLLECTED AT 3.0 FEET<br>GROUNDWATER SEEPAGE WAS NOT ENCOUNTERED<br>TEST PIT CAVING WAS NOT ENCOUNTERED<br>TEST PIT WAS COMPLETED AT 5.5 FEET ON 7/27/15 |
| **TEST PIT FIVE** | | |
| 0.0 – 0.5 | | **TOPSOIL** |
| 0.5 – 3.5 | SM | BROWN-GRAY, SILTY FINE TO MEDIUM SAND WITH GRAVEL (MEDIUM DENSE TO DENSE, MOIST) |
| 3.5 – 5.5 | SM | GRAY, SILTY FINE TO MEDIUM SAND WITH GRAVEL AND COBBLES<br>(DENSE TO VERY DENSE, MOIST) |
| | | SAMPLE WAS COLLECTED AT 4.5 FEET<br>GROUNDWATER SEEPAGE WAS NOT ENCOUNTERED<br>TEST PIT CAVING WAS NOT ENCOUNTERED<br>TEST PIT WAS COMPLETED AT 5.5 FEET ON 7/27/15 |

## LOG OF EXPLORATION

| DEPTH (FEET) | USC | SOIL DESCRIPTION |
|---|---|---|
| **TEST PIT SIX** | | |
| 0.0 – 1.0 | | **TOPSOIL** |
| 1.0 – 3.5 | SM | BROWN-GRAY, SILTY FINE TO MEDIUM SAND WITH GRAVEL (MEDIUM DENSE TO DENSE, MOIST) |
| 3.5 – 8.0 | SM | GRAY, SILTY FINE TO MEDIUM SAND WITH GRAVEL, COBBLES, AND IRON-OXIDE STAINING (DENSE TO VERY DENSE, MOIST) |
| | | SAMPLES WERE COLLECTED AT 2.0, 4.5, 6.0, AND 7.5 FEET<br>GROUNDWATER SEEPAGE WAS NOT ENCOUNTERED<br>TEST PIT CAVING WAS NOT ENCOUNTERED<br>TEST PIT WAS COMPLETED AT 8.0 FEET ON 7/27/15 |
| **TEST PIT SEVEN** | | |
| 0.0 – 2.5 | | DARK BROWN, SILTY FINE TO MEDIUM SAND WITH GRAVEL, DEBRIS AND ORGANICS (LOOSE, MOIST) **(FILL)** |
| 2.5 – 4.5 | SM | BROWN-GRAY, SILTY FINE TO MEDIUM SAND WITH GRAVEL (MEDIUM DENSE TO DENSE, MOIST) |
| 4.5 – 6.5 | SM | GRAY, SILTY FINE TO MEDIUM SAND WITH GRAVEL AND COBBLES (DENSE TO VERY DENSE, MOIST) |
| | | SAMPLE WAS COLLECTED AT 5.0 FEET<br>GROUNDWATER SEEPAGE WAS NOT ENCOUNTERED<br>TEST PIT CAVING WAS NOT ENCOUNTERED<br>TEST PIT WAS COMPLETED AT 6.5 FEET ON 7/27/15 |
| **TEST PIT EIGHT** | | |
| 0.0 – 1.0 | | **TOPSOIL** |
| 1.0 – 3.0 | SM | BROWN-GRAY, SILTY FINE TO MEDIUM SAND WITH GRAVEL (MEDIUM DENSE TO DENSE, MOIST) |
| 3.0 – 6.5 | SM | GRAY, SILTY FINE TO MEDIUM SAND WITH GRAVEL AND COBBLES (DENSE TO VERY DENSE, MOIST) |
| | | SAMPLES WERE COLLECTED AT 2.0 AND 5.0FEET<br>GROUNDWATER SEEPAGE WAS NOT ENCOUNTERED<br>TEST PIT CAVING WAS NOT ENCOUNTERED<br>TEST PIT WAS COMPLETED AT 6.5 FEET ON 7/27/15 |
| **TEST PIT NINE** | | |
| 0.0 – 0.5 | | **TOPSOIL** |
| 0.5 – 3.0 | SM | BROWN-GRAY, SILTY FINE TO MEDIUM SAND WITH GRAVEL (MEDIUM DENSE TO DENSE, MOIST) |
| 3.0 – 6.0 | SM | GRAY, SILTY FINE TO MEDIUM SAND WITH GRAVEL AND COBBLES (DENSE TO VERY DENSE, MOIST) |
| | | SAMPLE WAS COLLECTED AT 4.5 FEET<br>GROUNDWATER SEEPAGE WAS NOT ENCOUNTERED<br>TEST PIT CAVING WAS NOT ENCOUNTERED<br>TEST PIT WAS COMPLETED AT 6.0 FEET ON 7/27/15 |

## LOG OF EXPLORATION

| DEPTH (FEET) | USC | SOIL DESCRIPTION |
|---|---|---|
| **TEST PIT TEN** | | |
| 0.0 – 0.5 | | **TOPSOIL** |
| 0.5 – 2.5 | SM | BROWN-GRAY, SILTY FINE TO MEDIUM SAND WITH GRAVEL (MEDIUM DENSE TO DENSE, MOIST) |
| 2.5 – 6.0 | SM | GRAY, SILTY FINE TO MEDIUM SAND WITH GRAVEL AND COBBLES (DENSE TO VERY DENSE, MOIST) |
| | | SAMPLE WAS COLLECTED AT 5.5 FEET<br>GROUNDWATER SEEPAGE WAS NOT ENCOUNTERED<br>TEST PIT CAVING WAS NOT ENCOUNTERED<br>TEST PIT WAS COMPLETED AT 6.0 FEET ON 7/27/15 |
| **TEST PIT ELEVEN** | | |
| 0.0 – 0.5 | | **TOPSOIL** |
| 0.5 – 2.5 | SM | BROWN-GRAY, SILTY FINE TO MEDIUM SAND WITH GRAVEL (MEDIUM DENSE TO DENSE, MOIST) |
| 2.5 – 6.0 | SM | GRAY, SILTY FINE TO MEDIUM SAND WITH GRAVEL AND COBBLES (DENSE TO VERY DENSE, MOIST) |
| | | SAMPLE WAS COLLECTED AT 4.0 FEET<br>GROUNDWATER SEEPAGE WAS NOT ENCOUNTERED<br>TEST PIT CAVING WAS NOT ENCOUNTERED<br>TEST PIT WAS COMPLETED AT 6.0 FEET ON 7/27/15 |

# Appendix B

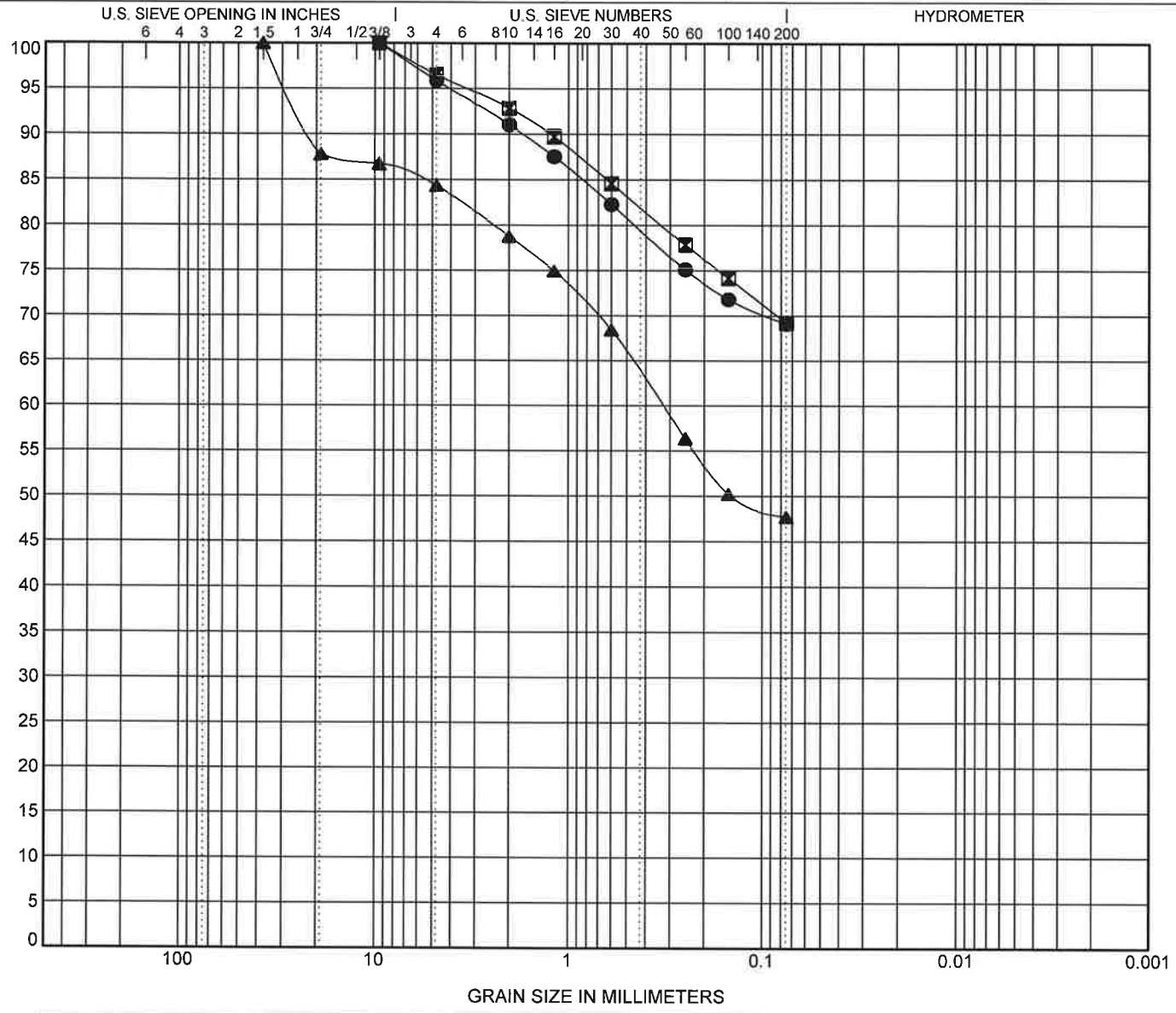
## Laboratory Test Results

## ES-3217.12

Earth Solutions NW, LLC
1805 - 136th PL N.E., Suite 201
Bellevue, WA 98005
Telephone: 425-449-4704
Fax: 425-449-4711

# GRAIN SIZE DISTRIBUTION

**PROJECT NUMBER** ES-3217.12 **PROJECT NAME** Eaglemont 7 PRD




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

| Specimen Identification | | Classification | Cc | Cu |
|---|---|---|---|---|
| ● TP-101 | 7.00ft. | USDA: Gray Slightly Gravelly Loam. USCS: ML. | | |
| ⊠ TP-104 | 4.00ft. | USDA: Brown Slightly Gravelly Loam. USCS: ML. | | |
| ▲ TP-105 | 5.00ft. | USDA: Gray Gravelly Loam. USCS: SM with Gravel. | | |

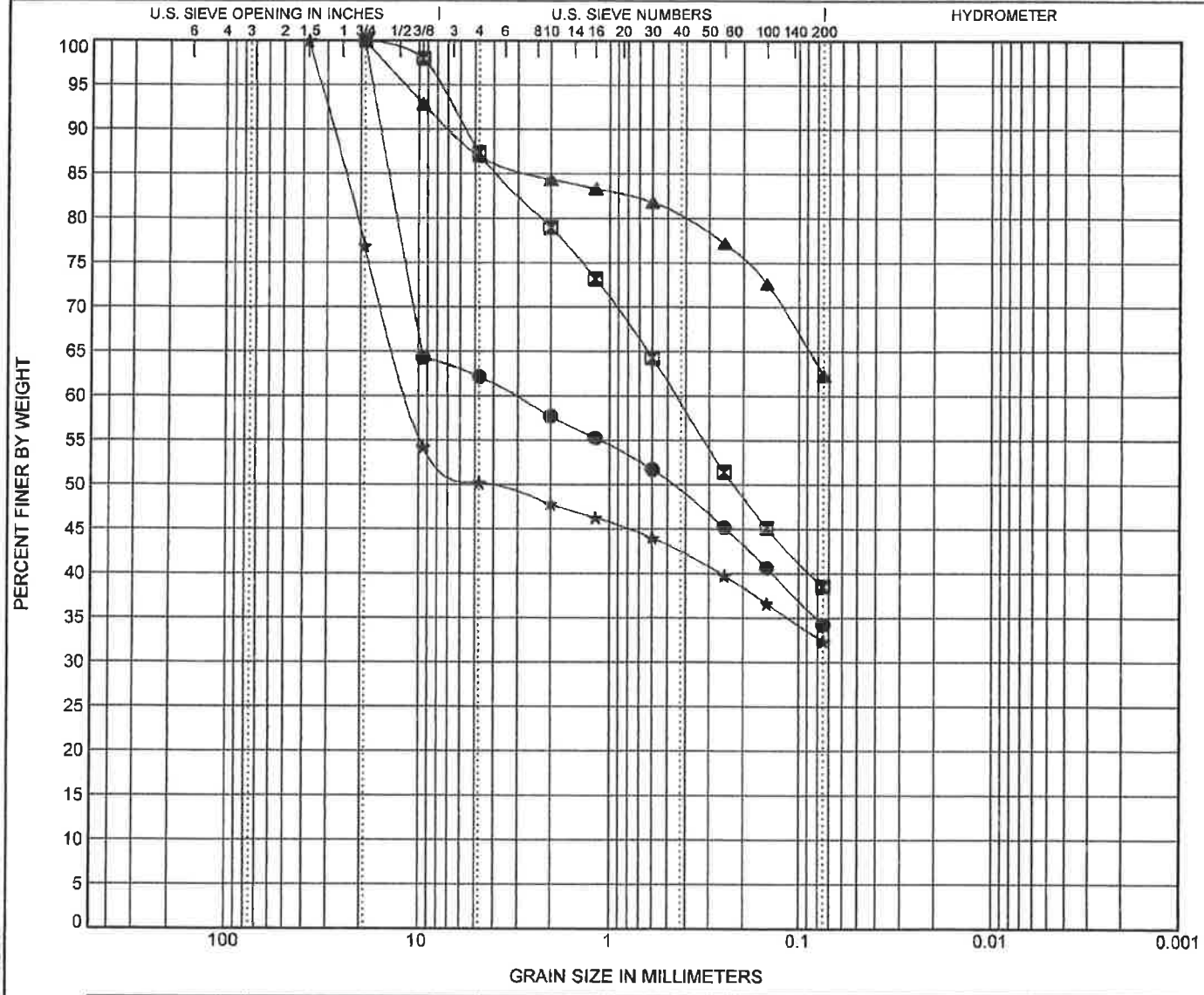
| Specimen Identification | | D100 | D60 | D30 | D10 | LL | PL | PI | %Silt | %Clay |
|---|---|---|---|---|---|---|---|---|---|---|
| ● TP-101 | 7.0ft. | 9.5 | | | | | | | 69.1 | |
| ⊠ TP-104 | 4.0ft. | 9.5 | | | | | | | 69.2 | |
| ▲ TP-105 | 5.0ft. | 37.5 | 0.327 | | | | | | 47.7 | |

Earth Solutions NW, LLC
1805 - 136th PL N.E., Suite 201
Bellevue, WA 98005
Telephone: 425-449-4704
Fax: 425-449-4711

# GRAIN SIZE DISTRIBUTION

**CLIENT** MainVue WA, LLC **PROJECT NAME** Gilmartin Farms

**PROJECT NUMBER** ES-3217.09 **PROJECT LOCATION** Monroe, Washington




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

| Specimen Identification | | Classification | Cc | Cu |
|---|---|---|---|---|
| ● TP-1 | 2.00ft. | USDA: Brown Very Gravelly Loam. USCS: GM with Sand. | | |
| ⊠ TP-3 | 7.00ft. | USDA: Gray Gravelly Sandy Loam. USCS: SM. | | |
| ▲ TP-4 | 2.00ft. | USDA: Gray Gravelly Loam. USCS: Sandy ML. | | |
| ★ TP-5 | 4.00ft. | USDA: Gray Very Gravelly Loam. USCS: GM with Sand. | | |

| Specimen Identification | | D100 | D60 | D30 | D10 | LL | PL | PI | %Silt | %Clay |
|---|---|---|---|---|---|---|---|---|---|---|
| ● TP-1 | 2.0ft. | 19 | 3.106 | | | | | | 34.3 | |
| ⊠ TP-3 | 7.0ft. | 19 | 0.448 | | | | | | 38.6 | |
| ▲ TP-4 | 2.0ft. | 19 | | | | | | | 62.3 | |
| ★ TP-5 | 4.0ft. | 37.5 | 11.343 | | | | | | 32.4 | |

GRAIN SIZE USDA ES-3217.09 GILMARTIN FARMS.GPJ GINT US LAB.GDT 9/20/17

**Report Distribution**

**ES-3217.12**

**EMAIL ONLY**

**MainVue WA, LLC**
**1110 – 112th Avenue Northeast, Suite 202**
**Bellevue, Washington 98004**

**Attention: Ms. Lisa Cavell**
**Ms. Mona Davis**