ENGINEERED DRAINAGE REPORT

of

25th Avenue Shared Access Widening
1730 & 1638 25th Avenue NW
OLYMPIA, WA

for

Tom Schrader
6526 Turnberry Lane SE
Olympia, WA 98501

by

THE LAND DEVELOPER’S
ENGINEERED SOLUTION
A Division of THE LAND DEVELOPER, LLC

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I. PROJECT OVERVIEW

There is an existing shared access drive that is paved with approximately 8-12 feet of paving throughout the length of the drive. As part of the construction of two new single family homes it is required to improve the access to meet a minimum of 12’ paved width. The attached plans show the extent of the roadway widening along 25th Avenue. The proposal includes the widening the upper portion of roadway utilizing approximately 368 sf of addition asphalt. This stormwater will utilize the existing forested understory for dispersion where it will flow overland until it is infiltrated. The lower portion of road widening includes an area of approximately 3,881 sf of addition paving. This stormwater will flow into a roadside bioretention area with an underdrain that will direct stormwater to existing discharges to the Puget Sound. The total new impervious coverage for the road widening is 4,249 sf. Therefore, the project only needs to address core requirements 1-5 and list number 1. Most of the project is located within right of way, the rest is located in existing or proposed easements.

This project discharges to the Puget Sound and is therefore exempt for LID requirements however LID elements will be utilized for this project.

Lawn and landscaped areas:

Post-Construction Soil Quality and Depth in accordance with BMP LID.02 in Chapter 2 of Volume V. This option is proposed to be utilized for this project.

Other Hard Surfaces:

The upper portion will utilize roadside sheet flow dispersion per BMP LID.06. The lower portion of road widening includes an area of approximately 3,881 sf of addition paving. This stormwater will flow into a roadside 2’ wide bioretention swale with under-drain that will direct stormwater to existing discharges to the Puget Sound.

See Appendix B for Basin Map and Site Plan.
II. EXISTING CONDITIONS

The subject site consists of a single developed and undeveloped lots and right of way. The site topography generally slopes from the west to east. Offsite stormwater generally sheet flows onto the property along the western property line flows through the site and discharges along the eastern property line along the existing private access drive. Stormwater along 25th Avenue NW flows along south and west side of the roadway in an existing ditch. Stormwater flows down to the east to a number of culverts located on 25th Avenue where it flows under the street into a culvert that discharges at the beach at the Budd Inlet. The property is vegetated with a variety of trees, grass and shrubs.

Per NRCS mapping Thurston County, the soil on-site for the western portion of the site is Alderwood gravely sandy loam, with remaining of the site being Dystric Xerochrepts, 60 to 90 percent slopes.

The project does not appear to be located in an aquifer recharge area or wellhead protection area as defined by the Thurston County Health Department, the EPA or by the city. There are no known basin plans for the area.

A Geotechnical report was prepared by Materials Testing & Consulting, Inc. dated February 26, 2019 was prepared. The conclusion was that the proposed project is recommended within the critical areas listed.

III. STORMWATER MANAGEMENT MINIMUM REQUIREMENTS

This project is required to meet minimum requirements one through five. The minimum requirements are:

1. Preparation of Stormwater Site Plan
2. Construction Stormwater Pollution Prevention
3. Source Control of Pollution
4. Preservation of Natural Drainage Systems and Outfalls
5. Onsite Stormwater Management

Addressing these five requirements, it is anticipated that the proposed project will have little or no adverse effects on the downstream and surrounding hydrology. Each of the minimum requirements is discussed below.

Minimum Requirement #1: Preparation of Stormwater Site Plan

This Abbreviated Stormwater Site Plan is submitted as part of the 25th Avenue access road widening project to meet this requirement.
Minimum Requirement #2: Construction Stormwater Pollution Prevention

A Stormwater Pollution Prevention Plan (SWPPP) was developed to address erosion and sediment control anticipated during construction. The SWPPP will address all thirteen elements as required by the Department of Ecology. The SWPPP is attached in appendix F.

Minimum Requirement #3: Source Control of Pollution

The homeowner will receive a copy of the Pollution Source Control Program as found in the Stormwater Maintenance Plan in Section VII below. The Source Control Program describes Best Management Practices (BMPs) for household products, automotive maintenance, pesticides, fertilizers and remodeling.

Minimum Requirement #4: Preservation of Natural Drainage Systems and Outfalls

The site topography generally slopes from the west to east. Offsite stormwater generally sheet flows onto the property along the western property line flows through the site and discharges along the eastern property line along the existing private access drive. Stormwater along 25th Avenue NW flows along south and west side of the roadway in an existing ditch. Stormwater flows down to the east to a number of culverts located on 25th Avenue where it flows under the street into a culvert that discharges at the beach at the Budd Inlet.

All natural drainage ways generally appear to be preserved.

Minimum Requirement #5: Onsite Stormwater Management, Including Easements and Setbacks

This project discharges to the Puget Sound and is therefore exempt for LID requirements however LID elements will be utilized for this project.

Lawn and landscaped areas:

Post-Construction Soil Quality and Depth in accordance with BMP LID.02 in Chapter 2 of Volume V. This option is proposed to be utilized for this project.

Other Hard Surfaces:

The upper portion will utilize roadside sheet flow dispersion per BMP LID.06. The lower portion of road widening includes an area of approximately 3,881 sf of addition paving. This stormwater will flow into a roadside 2’ wide bioretention swale with under-drain that will direct stormwater to existing discharges to the Puget Sound.

See Appendix B for Basin Map and Site Plan.

There are existing and proposed easements required for the roadway alignment and widening. All setback requirements appear to be met with this project.
APPENDIX A – Drainage & Erosion Control Plans
SECTION 3, TOWNSHIP 18 N, RANGE 2 W, WM

NEW PAVING TO DRAIN TO EXISTING FOREST UNDER-STORY SOILS ALONG DRIVE MEETING AMENDED SOIL CRITERIA

WIDEN EXISTING ROAD TO 20' FOR 1ST 40'

EXISTING EDGE OF ASPHALT

DISPERSE INTO THE EXISTING FOREST UNDER-STORY SOILS ALONG DRIVE

ROW (TYP)
SECTION 3, TOWNSHIP 18 N, RANGE 2 W, WM

ROW (TYP) 26.00'
ROW (TYP) 25.00'
ROW (TYP) 50.00'
ROW (TYP) 25.00'

ASPHALT TURNOUT

10' AMENDED SOIL DISPERSION AREA

EXISTING ASPHALT ROADWAY

EXISTING EDGE OF ASPHALT

EX ROAD VARIES

ROW (TYP) 25.00'

WIDEN EXISTING ROAD TO 12'

SCALE: 1" = 20 FEET

THE LAND DEVELOPER'S ENGINEERED SOLUTION
5737 LINDERSON WAY SW
TUMWATER, WA 98501
PO BOX 4420, TUMWATER, WA 98501
(360) 890-4806
E-MAIL: erik@thelanddeveloper.com
END BIoretENTION SWALE WITH UNDER-DRAIN; BEGIN ASPHALT WEDGE CURB

ROW (TYP)

ASPHALT WEDGE CURB FLOW LINE

ROW (TYP)

EX CENTERLINE OF EX ROADWAY

ROW (TYP)

EXISTING ASPHALT TO BE REMOVED

1" HDPE WATER SERVICE

EXISTING ROAD WIDTH VARIES

EDGE OF EXISTING ASPHALT

1" SPACING BETWEEN SERVICES

2" PVC SEWER FORCE MAIN

GAS SERVICE LINE

EXISTING ROAD TO 12' FOR TURNOUT

1' SPACING BETWEEN SERVICES

ROW (TYP)

3/4" WATER METER

PROPOSED RESIDENCE

SITE ADDRESS 1730

PARCEL # 63902100100

FIRST FLOOR: 67.00

BASEMENT ELEV: 47.00

50' OHWM SETBACK

PROPOSED GARAGE

FF: 57.00

EONE GRINDER PUMP OR EQUAL

EXISTING ASPHALT TO BE REMOVED

EXisting ROAD TO 12' FOR TURNOUT

1" HDPE WATER SERVICE

INSTALL GRASS PAVE PER DETAIL

WIDEN EXISTING ROAD TO 12' FOR TURNOUT

EXISTING ASPHALT TO BE REMOVED

2" PVC SEWER FORCE MAIN

GAS SERVICE LINE

EXISTING ROAD Width VARIES

EDGE OF EXISTING ASPHALT

1" SPACING BETWEEN SERVICES

ROW (TYP)

EXISTING ASPHALT TO BE REMOVED

EX CENTERLINE OF EX ROADWAY

ROW (TYP)

ASPHALT WEDGE CURB FLOW LINE

ROW (TYP)
SECTION 3, TOWNSHIP 18 N, RANGE 2 W, WM

PROPOSED RESIDENCE
SITE ADDRESS: 1638
PARCEL #: 83002000400
1ST FLOOR: 56.00
BASEMENT ELEV: 46.00

EX. 20' ACCESS AND
UTILITY EASEMENT

20' x 50' LONG TURNOUT
AREA

EXISTING ASPHALT TO
BE REMOVED
2' WIDE

BIORETENTION
SWALE WITH
UNDER-DRAIN PER
DETAIL 4/8

INSTALL GRASS PAVE
PER DETAIL
2' WIDE

EDGE OF EXISTING
ASPHALT

EXISTING ROAD
WIDTH VARIES

1' SPACING
BETWEEN SERVICES

PROPOSED GARAGE
FF: 56.00

PROPOSED 30'
ROW

50' OHWM SETBACK

PROPOSED RESIDENCE

EONE GRINDER PUMP
OR EQUAL

EDGE OF EXISTING
ASPHALT

EXISTING ASPHALT TO
BE REMOVED

2" PVC SEWER
FORCE MAIN

1/4" WATER METER
1" HDPE WATER
SERVICE

EXISTING ROAD
WIDTH VARIES

1" HDPE WATER
SERVICE

25' TRANSITION
ZONE

GAS SERVICE LINE

25' TRANSITION
ZONE

ROW (TYP)

ROW (TYP)

ROW (TYP)

ROW (TYP)

ROW (TYP)

ROW (TYP)

ROW (TYP)
PROPOSED ROW
ROW (TYP)
EXISTING ROAD
WIDTH VARIES
EDGE OF EXISTING ASPHALT
EXISTING GAS SERVICE LINE, APPROX LOCATION
EXTEND 12' ROAD & GAS PIPE LINE TO 1626 25TH AVE
EXISTING GAS SERVICE LINE, APPROX LOCATION
ROW (TYP)
SECTION 3, TOWNSHIP 18 N, RANGE 2 W, WM

**ROAD SECTION DETAIL**

- **EXISTING GRADE**: 12.0'
- **EXISTING DRIVEWAY**: WIDTH VARIES
- **EXISTING ASPHALT**: 3" HMAC
- **EXISTING BASE**: 2" CSTC OVER 8" CSBC
- **COMPACTED SUBGRADE**:
- **BIORETENTION SWALE WITH UNDER-DRAIN PER DETAIL 4**
  - 3/4" TO 1-1/2" CRUSHED WASHED DRAIN ROCK
  - 8" HDPE; UPPER 1/2 PERF

**PROPOSED TURNOUT ROADWAY SECTION**

- **EXISTING GRADE**: 20.0'
- **TURNOUT AREA**: 9'±
- **ROADWAY**: 11'±
- **PROPOSED ROADWAY WIDENING**: 1.5'
- **ASPHALT WEDGE CURB**:
- **HYDROSEED GRASS MIX**:

**BIORETENTION SWALE W/ UNDER-DRAIN**

- **EXISTING GRADE**: 2.0'
- **FILTER FABRIC**:
- **8" HDPE; UPPER 1/2 PERF 3/4" TO 1-1/2" CRUSHED WASHED DRAIN ROCK**:
- **12" AMENDED SOIL**:
- **PAVEMENT PER PLAN**
APPENDIX B – Reserved
APPENDIX C – Compost Amended Soil Details
Purpose

The purpose of this design guide is to summarize in one location the requirements for Post-Construction Soil Quality and Depth (BMP LID.02) using the 2009 Drainage Design and Erosion Control Manual for Thurston County (DDECM). Post Construction Soil Quality and Depth requirements and applications are found in several locations within the DDECM including:

- Volume I, Section 2.4.6, Minimum Requirement #5: Onsite Stormwater Management
- Volume I, Section 4.2, Step-by-Step BMP Selection Process
- Volume I, Appendix C, Engineer's Construction Inspection Report Form
- Volume II, Section 3.1.8, BMP C120: Temporary and Permanent Seeding
- Volume V, Chapter 2, Low Impact Development
- Volume V, Section 2.1.2, LID.02 Post-Construction Soil Quality and Depth
- Volume V, Section 2.1.3, LID.03 Reduce Effective Impervious Area of Roads, Shared Accesses, Alleys, Sidewalks, Driveways, and Parking Areas.
- Volume V, Section 2.2.3, LID.06 Sheet Flow Dispersion
- Volume V, Section 2.2.4, LID.07 Concentrated Flow Dispersion
- Volume V, Section 2.2.8, LID.11 Full Dispersion
- Volume V, Section 2.2.10, LID.13 Rural Road Engineered Dispersion
- Volume V, Appendix C, Table C-8, Maintenance Checklist for Compost Amended Soil for Post-Construction Soil Quality and Depth (BMP LID.02) and Compost-Amended Vegetated Filter Strip (BMP BF.06)

In addition to references in the 2009 DDECM, this BMP makes extensive reference to the document “Guidelines and Resources for Implementing Soil Quality and Depth BMP T5.13 in WDOE Stormwater Management Manual for Western Washington.” This design guide incorporates applicable elements of that document. The document can be downloaded at www.soilsforsalmon.org or www.buildingsoil.org.

Applicability

Minimum Requirement #5, Onsite Stormwater Management, requires projects to employ onsite stormwater management BMPs to infiltrate, disperse, and retain stormwater runoff onsite to the maximum extent feasible. All projects required to comply with Minimum Requirement #5 shall implement BMP LID.02 to restore soil quality and depth to all new lawn and landscape areas or areas to be restored to native vegetation.

Minimum Requirement #5 and BMP LID.02 is required for projects that:

1. Create 2,000 square feet or more of impervious surface; or.

2. Have 7,000 square feet or more of land disturbing activity.

Projects that propose to manage all site stormwater through BMP LID.11, Full Dispersion, are not required to implement BMP.02.
Redevelopment projects that meet criteria requiring retrofitting the existing site to current stormwater standards would be required to implement BMP LID.02 for all existing and newly created lawn or landscape areas to the maximum extent practicable.

**Benefits of BMP LID.02**

Naturally occurring, undisturbed soil and vegetation provides important stormwater functions that are largely lost when development removes the native soil and vegetation and replaces it with minimal topsoil and sod or landscaping. Implementation of BMP LID.02 reestablishes a minimum soil quality and depth in an attempt to restore the beneficial functions lost during development.

**Special Requirements**

In designated Well Head Protection Areas of a public water system with over 1,000 connections, compost used shall be comprised entirely of vegetative materials only. No biosolids or animal manure components shall be contained within the compost.

On poorly draining sites being considered for turf establishment consider alternatives to planting a lawn or reduce the ratio of compost to be incorporated into the soil to a ratio of no more than 30 percent by volume.

In some instances, steep slopes on a project site, even if not disturbed by the project may have sparse native soils and vegetation (e.g. an area previously under heavy tree canopy but now exposed due to removal of adjacent trees). In this case the area should be amended by planting deep rooting vegetation and soil amendments applied with a pit application at least twice as wide as the root ball of the vegetation being planted, using a 50/50 mix of compost and soil.

The objective of this BMP is to restore soil quality to all non-impervious disturbed areas of a project site. Some areas may not be suitable for soil amendment such as engineered structural fill or slopes, stormwater facilities, etc. and the recommendations of the civil or geotechnical engineer should be followed for surface treatment of those areas.

**Design Process**

Prepare a Soil Management Plan (SMP) for the project (see Submittal Requirements) using the following steps:

1. Review site Landscape Plans and Grading Plans and identify areas to receive which type of soil treatment option (1 through 4).
   i. **Option 1**: Leave undisturbed native vegetation and soil and protect from compaction during construction.
   ii. **Option 2**: Amend existing site topsoil or subsoil at “pre-approved” default rates, or at custom rates based on tests of the soil and amendment.
   iii. **Option 3**: Stockpile existing topsoil during grading and replace it prior to planting. Stockpiled topsoil must also be amended if needed to meet the organic matter or depth requirements.
   iv. **Option 4**: Import topsoil mix of sufficient organic content and depth to meet requirements.

*Note:* For small projects submitting abbreviated drainage plans it is recommended that “pre-approved” default amendment rates and/or imported top soil mix be used to simplify the compliance with this BMP and avoid costly soils testing and hiring of a soils professional.
2. **Step 2:** Evaluate existing and anticipated post-construction soil conditions for the project and factor this into the selection of amendment options.
   a. Identify compaction of subgrade. Dig down 12 inches below finished grade and use a shovel or penetrometer to determine compaction.
   b. Assess condition of native areas that are to remain undisturbed and whether any amendment to soils or enhanced plantings should be provided.
   c. Assess soil conditions in each area to be cut, filled or otherwise disturbed and establish scarification and amendment recommendations for each area.

3. **Step 3:** Select Amendment Options
   a. Identify where each amendment option will be applied and outline these areas on the SMP site plan (or Abbreviated Drainage Plan) and on the SMP form.
   b. Assign each area an identifying number or letter on the SMP site plan and SMP form.

4. **Step 4:** Identify sources for compost, topsoils, and other organic materials for amendment and mulch. Obtain test results for materials and provide with SMP.

5. **Step 5:** Calculate Amendment, Topsoil and Mulch Volumes on SMP Form.

6. **Step 6:** Complete Soil Management Site Plan by delineating what soil treatment will be provided for each area identified on the plans. Assign unique identifier. Specifications for soil amendment can be shown on the face of the plan or a separate specification sheet can be provided.

7. **Step 7:** Complete Soil Management Plan Form, fill in appropriate information for each area (using same area identifier as provided on the SMP Site Plan). Attach soil test results, product test results, etc.

8. **Step 8:** If applicable, prepare specifications for soil management. An example specification in APWA or CSI format is provided in the “Soils for Salmon” reference document at [www.soilsforsalmon.org](http://www.soilsforsalmon.org) or [www.buildingsoil.org](http://www.buildingsoil.org).

**Design Elements**

**Soil Quality**

Areas subject to post-construction soil quality requirements shall use soils that are amended to meet the following requirements:

- Minimum organic matter content of 10 percent dry weight for planting beds and 5 percent for turf areas.
- pH from 6.0 to 8.0 or matching the pH of the original undisturbed soils.
- A minimum topsoil layer depth of 8 inches except where tree roots limit the depth of incorporation of amendments.
- Subsoils below the topsoil layer scarified at least 4 inches with some incorporation of the upper material to avoid stratified layers.
- Planting beds shall be mulched with 2 inches of organic material.

**Soil Amendment Rates**

Site soils may be amended using a “default” amendment rate or a calculated custom rate as determined by a qualified professional. A custom rate might be considered where existing site soils can be easily amended to meet specifications. The default amendment rate is more appropriate for small projects or where site soils are generally unsuitable for cost-
effective amendment to meet standards. This section will not address custom rate calculations and if this method is considered, a soils professional should be retained to analyze soils and propose custom amendment rates.

The default amendment rate for soils depends on whether the area will be landscaped or whether lawn/turf will be installed and whether existing site topsoil will be amended in place or stockpiled topsoil will be replaced prior to amendment. If the default amendment methods described below are used with materials meeting specifications described below then it is presumed that the soil quality targets described above will be met. Each of these four scenarios are described as follows:

1. **Existing in place soils amended for planting beds (landscaping):**
   - Scarify or rototill subgrade to 8 inches depth except within the dripline of trees to be retained.
   - Place 3 inches of compost and rototill into 5 inches of soil.
   - Rake area smooth and remove large rocks (>2 inches in diameter).
   - Plant landscaping plants as required.
   - Mulch planting bed with 2 inches of organic mulch except immediately around plants.

2. **Existing in place soils amended for lawn/turf.**
   - Scarify or rototill subgrade to 8 inches depth except within the dripline of trees to be retained.
   - Place 1.75 inches of compost and rototill into 6.25 inches of soil.
   - Water or roll to compact to approximately 85% of maximum dry density.
   - Rake to level and remove surface woody debris and rocks greater than 1 inch in diameter.
   - Seed or sod per recommendations of seed/sod provider.

3. **Stockpiled soils replaced and amended for planting beds (landscaping)**
   - Stockpile and cover existing topsoil removed during grading with a weed barrier material that sheds moisture yet allows air transmission. This will prevent the destruction of soil organisms essential to functioning topsoil.
   - If sufficient volume of stockpiled topsoil exists to provide for a settled depth of 8 inches (approximately 9.5 inches loose) after replacement and the existing topsoil can be verified to meet soil quality criteria (may require testing), then compost amendment is not required.
   - If replaced topsoil plus compost will amount to less than 12 inches scarify or rototill subgrade to depth needed to achieve 12 inches of loosened soil after topsoil and amendment are placed. Do not scarify within the dripline of trees to be retained.

   For example: if there is only enough stockpiled topsoil to place 3-inches and an additional 3-inches of compost is placed, then the subgrade should be
scarified to a depth of 6-inches prior to replacement of topsoil and compost amendment.

- Replace stockpiled topsoil and spread uniformly over the ground surface scarified as described above.
- Place 3 inches of compost and rototill into 5 inches of soil.
- Rake beds to smooth and remove surface rocks larger than 2 inches in diameter.
- Plant landscaping plants as required.
- Mulch planting bed with 2 inches of organic mulch except immediately around plants.

4. **Stockpiled soils replaced and amended for lawn/turf.**

- Stockpile and cover existing topsoil removed during grading with a weed barrier material that sheds moisture yet allows air transmission. This will prevent the destruction of soil organisms essential to functioning topsoil.
- If sufficient volume of stockpiled topsoil exists to provide for a settled depth of 8 inches (approximately 9.5 inches loose) after replacement and the existing topsoil can be verified to meet soil quality criteria (may require testing), then compost amendment is not required.
- If replaced topsoil plus compost will amount to less than 12 inches scarify or rototill subgrade to depth needed to achieve 12 inches of loosened soil after topsoil and amendment are placed. Do not scarify within the dripline of trees to be retained.

For example: if there is only enough stockpiled topsoil to place 3-inches and an additional 1.75-inches of compost is placed, then the subgrade should be scarified to a depth of 7.25 inches prior to replacement of topsoil and compost amendment.

- Replace stockpiled topsoil and spread uniformly over the ground surface scarified as described above. 
- Place 1.75 inches of compost and rototill into 6.25 inches of soil.
- Water or roll to compact soil to approximately 85% of maximum dry density.
- Rake to level and remove surface woody debris and rocks greater than 1 inch in diameter.
- Seed or sod per recommendations of seed/sod provider.

**Importing Topsoil**

As an alternative to compost amendment of soils an applicant may choose to import topsoil for installation in landscape and lawn/turf areas. Topsoil shall meet the requirements provided in the “materials” section of this design guide and installation shall be in accordance with the following procedures:

1. **Imported Topsoil For Planting Beds (landscape areas)**

Post-Construction Soils Quality & Depth Design Guide
- Scarify or till subgrade in two directions to a depth of 6-inches. The entire surface should be disturbed by scarification. Do not scarify within drip line of existing trees to be retained.
- Place 3 inches of imported topsoil mix on surface and till into 2 inches of soil.
- Place a second lift of 3 inches of topsoil mix on the surface.
- Rake beds to smooth and remove surface rocks over 2 inches in diameter.
- Plant landscaping plants as required.
- Mulch planting bed with 2 inches of organic mulch except immediately around plants.

2. Imported Topsoil for Lawn/Turf Areas

- Scarify or till subgrade in two directions to a depth of 6-inches. The entire surface should be disturbed by scarification. Do not scarify within drip line of existing trees to be retained.
- Place 3 inches of topsoil mix on surface and till into 2 inches of soil.
- Place a second lift of 3 inches of topsoil mix on surface.
- Water or roll to compact soil to approximately 85% of maximum dry density.
- Rake to level and remove surface rocks or debris greater than 1 inch in diameter.
- Seed or sod per recommendations of seed/sod provider.

Materials

Your landscaper should be able to locate a source of materials that meet the following requirements. The source of materials should be identified and testing data should be obtained certifying the material meets standards. Include test data in SMP.

1. Compost

- Compost shall meet the definition of “composted materials” in WAC 173-350-220.
- Compost must have an organic matter content of 35% to 65% as determined by “loss on ignition” test method and a carbon to nitrogen ratio below 25:1 (35:1 if used in landscape area).
- Carbon to nitrogen ratio may be as high as 35:1 for plantings composed entirely of plants native to the Puget Sound Lowlands region.
- Compost shall meet the contaminant standards of Grade A Compost.
- The following potential sources for compost meeting the above specifications include*:
  - Silver Springs Organics Composting, Tenino (360) 446-0197
  - Pierce County Recycling, Composting & Disposal in Puyallup (253) 847-7555
  - Purdy Compost Facility, Gig Harbor, (253) 857-2075
2. Mulch

- Mulch for planting beds shall be organic mulch or stockpiled forest duff. Mulch may be compost, fine ground freshwater bark, composted sawdust, wood chips, or equivalent.

3. Imported Topsoil

- Imported topsoil mix for planting beds shall contain a minimum of 10% organic matter (typically around 40% compost) with the soil portion consisting of sand or sandy loam as defined by the USDA with little or no clay.

- Imported topsoil mix for turf areas shall contain a minimum of 5% organic matter (typically around 25% compost) with the soil portion consisting of sand or sandy loam as defined by the USDA with little or no clay.

Maintenance

A maintenance checklist is provided in Appendix V of the DDECM for inclusion in the Maintenance Plan prepared for the project (if required). General maintenance considerations include:

- Soil quality and depth should be established toward the end of construction and once established, should be protected from compaction, such as from large machinery use, and from erosion.

- Soil should be planted and mulched as soon as possible after installation to avoid erosion.

- Plant debris or its equivalent should be left on the soil surface to replenish organic matter.

- Proper implementation of this BMP should reduce the use of irrigation, fertilizers, herbicides and pesticides.

Submittal Information

For projects submitting a full Drainage Design and Erosion Control Report a site specific Soil Management Plan (SMP) shall be prepared and submitted with other project documentation. The SMP includes:

- 11x17 or larger scale drawing identifying area where native soil and vegetation will be retained undisturbed and which soil treatments will be applied in landscape areas.

- A completed SMP form identifying treatments and products to be used to meet the soil depth and organic content requirements of each area.

- Computations of compost or topsoil volumes to be imported (and/or soil to be stockpiled) to meet “pre-approved” amendment rates; or calculations by a qualified
professional to meet organic content requirements if custom calculated rates are used.

- Copies of laboratory analyses for compost and topsoil products to be used documenting organic matter content and carbon to nitrogen ratios. These should be available from the compost/soil provider or from the qualified professional for custom rate calculations.

- If applicant proposes to use stockpiled topsoils from on-site without amendment submit testing to indicate that existing topsoil meets organic content requirements.

- If a Maintenance Plan is required for the project include maintenance checklist from Appendix V-C of the DDECM.

- The As-Built submittal for the project shall include any deviations from the approved Soil Management Plan and copies of original delivery tickets for all soil and mulch products.

**Abbreviated Drainage Plan Submittals**

For those projects allowed to submit an Abbreviated Drainage Plan or Engineered Abbreviated Drainage Plan and for which the default amendment rates or imported topsoil is proposed for all lawn or landscape areas, the following shall be submitted with the Abbreviated Drainage Plan to meet the requirements of this BMP:

- Identify on the Abbreviated Drainage Plan Plot Plan areas where native soil and vegetation will be retained and areas for which soil amendment will be applied.

- Determine which method of soil restoration will be provided for each area and note this on the face of the Plot Plan. (See Section: “Soil Amendment Rates” and “Importing Topsoil”).

- Attach the applicable soil default application rate or imported topsoil restoration method description to the Plot Plan and reference it for each area of soils restoration.

- Identify sources of compost, topsoil and mulch and provide documentation that the materials meet the material specifications. If you hire a landscaper, they should be able to provide this for you.

- The Soil Management Plan Form and Site Plan is not required to be completed if the above information is provided as part of the Abbreviated Drainage Plan submittal. Attachment B is a condensed reference guide that can be used in preparing the Abbreviated Drainage Plan.
# POST-CONSTRUCTION SOIL QUALITY AND DEPTH

## REVIEW CHECKLIST

### APPLICABILITY & SPECIAL REQUIREMENTS

<table>
<thead>
<tr>
<th>Applicant Use</th>
<th>Staff Use Only</th>
</tr>
</thead>
<tbody>
<tr>
<td>If project is a redevelopment that is required to retrofit to current stormwater standards verify that existing landscape and lawn areas are proposed for soil amendment.</td>
<td></td>
</tr>
<tr>
<td>If project is within a Well Head Protection area for a public water system with over 1,000 connections compost shall be comprised entirely of vegetative materials. No animal manure or biosolids components shall be contained in the compost.</td>
<td></td>
</tr>
<tr>
<td>If poorly draining areas are proposed for turf establishment, confirm that compost amendment is no more than 30% by volume. (Note: Standard amendment rate is 40% by volume).</td>
<td></td>
</tr>
<tr>
<td>Are soil restoration requirements for engineered slopes or structural fill areas provided and in conformance with geotechnical or civil engineer recommendations?</td>
<td></td>
</tr>
</tbody>
</table>

### DESIGN ELEMENTS

<table>
<thead>
<tr>
<th>Applicant Use</th>
<th>Staff Use Only</th>
</tr>
</thead>
<tbody>
<tr>
<td>Are all areas of the project where soils have been disturbed identified in the Soil Management Plan with recommendations for soil restoration (Options 1 through 4).</td>
<td></td>
</tr>
<tr>
<td>Are construction notes provided in construction drawings indicating the method and procedure for post construction soil quality and depth restoration.</td>
<td></td>
</tr>
<tr>
<td>Have sources for topsoil, compost and mulch been identified and supporting documentation of testing been submitted with the application.</td>
<td></td>
</tr>
<tr>
<td>For custom soil amendment has a soils professional performed testing and provide recommendations and has this information been submitted with the Soils Management Plan.</td>
<td></td>
</tr>
<tr>
<td>If existing topsoil is to be stockpiled has the stockpile area been shown on the plans and a suitable weed barrier cover provided that sheds moisture yet allows air transmission.</td>
<td></td>
</tr>
<tr>
<td>If use of topsoil from onsite is proposed without amendment, has soil testing been performed and results submitted documenting adequate organic content (10% for landscape areas &amp; 5% for lawn/turf areas). Is adequate volume available for 8” final depth.</td>
<td></td>
</tr>
</tbody>
</table>

### MATERIALS

<table>
<thead>
<tr>
<th>Applicant Use</th>
<th>Staff Use Only</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is source of compost identified and information provided certifying that compost material meets definition of “composted materials” in WAC 173-350-220, has organic matter content of 35% to 65% and a carbon to nitrogen ratio below 25:1.</td>
<td></td>
</tr>
<tr>
<td>Has the type and source of mulch been provided? Is mulch either stockpiled forest duff, compost, fine ground freshwater bark, composted sawdust, wood chips or an equivalent?</td>
<td></td>
</tr>
<tr>
<td>If imported topsoil is to be used has the applicant identified the source of topsoil and provided documentation that topsoil meets organic content requirements (5% for lawn areas, 10% for landscape areas) with soil components consisting of sand or sandy loam with little or no clay.</td>
<td></td>
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</tbody>
</table>

### SUBMITTAL REQUIREMENTS

<table>
<thead>
<tr>
<th>Applicant Use</th>
<th>Staff Use Only</th>
</tr>
</thead>
<tbody>
<tr>
<td>Has a Soil Management Plan been prepared and submitted?</td>
<td></td>
</tr>
<tr>
<td>Is a Soil Management Site Plan provided showing all areas for post-construction soil restoration and area designations? For an Abbreviated Drainage Plan this information can be shown on the Abbreviated Drainage Plan Plot Plan.</td>
<td></td>
</tr>
<tr>
<td>Has a Soil Management Plan Form been completed with areas identified and corresponding to areas shown on the Soil Management Plan Site Plan. For an Abbreviated Drainage Plan using only default amendment rates or imported topsoil the form is not required and the applicable amendment method description should be attached to the Abbreviated Drainage Plan Plot Plan with reference to the areas identified on the Plot plan to which each method applies.</td>
<td></td>
</tr>
<tr>
<td>If custom calculated amendment rates are proposed has testing data been provided with the Soil Management Plan.</td>
<td></td>
</tr>
<tr>
<td>Has the Soil Management Site plan been included in the Construction drawings for the project or has the information been incorporated into the construction drawings with notes and details consistent with the Soils Management Plan?</td>
<td></td>
</tr>
<tr>
<td>Do project specifications (either incorporated into the construction drawings or as a separate contract document) include soils restoration requirements.</td>
<td></td>
</tr>
<tr>
<td>If a Maintenance Plan is required has the appropriate checklist been included for Post-Construction Soils Quality and Depth BMP LID.02</td>
<td></td>
</tr>
<tr>
<td>Delivery tickets for topsoil, mulch, and compost shall be provided to the County as part of the final project inspection and as-built submittals.</td>
<td></td>
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</tbody>
</table>
ATTACHMENTS

A. SOIL MANAGEMENT PLAN FORM & INSTRUCTIONS
B. ABBREVIATED DRAINAGE PLAN ATTACHMENT
C. FIELD GUIDE TO VERIFYING SOIL QUALITY AND DEPTH
D. FIELD VERIFICATION FORM
# Soil Management Plan for BMP LID.02

**PROJECT INFORMATION**

Complete all information on page 1; only site address and permit number on additional pages.

<table>
<thead>
<tr>
<th>Site Address / Lot No.:</th>
<th>Permit Type:</th>
<th>Permit Number:</th>
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<tbody>
<tr>
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<table>
<thead>
<tr>
<th>Permit Holder:</th>
<th>Phone:</th>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Mailing Address:</th>
<th>Contact Person:</th>
<th>Phone:</th>
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<tbody>
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<td></td>
<td></td>
<td></td>
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</tbody>
</table>

**Plan Prepared By:**

**ATTACHMENTS REQUIRED** (Check off required items that are attached to this plan)

- [ ] Site Plan showing, to scale:
- [ ] Areas of undisturbed native vegetation (no amendment required)
- [ ] New planting beds and turf areas (amendment required)
- [ ] Type of soil improvement proposed for each area
- [ ] Soil test results (required if proposing custom amendment rates)
- [ ] Product test results for proposed amendments

**AREA #**

(should match Area # on Site Plan)

<table>
<thead>
<tr>
<th>PLANTING TYPE</th>
<th>SQUARE FOOTAGE OF THIS AREA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**SCARIFICATION**

- [ ] Subsoil will be scarified
- [ ] inches of scarification needed to achieve finished total 12” loosened depth.

**PRE-APPROVED AMENDMENT METHOD:**

- [ ] Topsoil import
- [ ] Amend with compost
- [ ] Stockpile and amend
  
  
  
  

<table>
<thead>
<tr>
<th>PRODUCT:</th>
<th>QUANTITY:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CU. YDS.</td>
</tr>
</tbody>
</table>

**CUSTOM AMENDMENT**

- [ ] Topsoil import
- [ ] Topsoil & compost lift
- [ ] Amend
- [ ] Stockpile and amend
  
  
  
  

<table>
<thead>
<tr>
<th>PRODUCT:</th>
<th>QUANTITY:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CU. YDS.</td>
</tr>
</tbody>
</table>

**MULCH**

- [ ] inches of mulch applied
- [ ] cu. yds. stockpiled
- [ ] inches of mulch applied

<table>
<thead>
<tr>
<th>PRODUCT:</th>
<th>QUANTITY:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CU. YDS.</td>
</tr>
</tbody>
</table>

**TOTAL AMENDMENT/TOPSOIL/MULCH FOR ALL AREAS**

- [ ] Product #1:
  
  
  
  

- [ ] Product #2:
  
  
  
  

- [ ] Product #3:
  
  
  
  

**Date: Inspector: Approved: Revisions Required:**
INSTRUCTIONS FOR COMPLETING SOIL MANAGEMENT PLAN FORM

The numbers correspond to the numbers shown on the Soil Management Plan Form from on the following page.

1. Page _ of _ pages: Indicate page number and total number of pages. More than one page may be required if there is more than one area requiring soil amendment. Attach a separate page for each additional area requiring soil amendment.

PROJECT INFORMATION

Complete all information for page 1 and only site address and permit number for additional pages.

2. Site Address/Lot No.: Provide site address and assessor’s parcel number(s). If no address indicate nearest street and cross-street.

3. Permit Type: Provide permit type, i.e. building permit, short plat, etc.

4. Permit Number: Provide Thurston County project number as assigned by the County.

5. Permit Holder: Provide name of applicant, if a company provide company name.

6. Phone: Provide project applicant’s business phone number.

7. Mailing Address: Provide mailing address of applicants business.

8. Contact Person: Provide individual’s name that represents applicant for this project.

9. Phone: Provide phone number for contact person.

10. Plan Prepared By: Provide name of person preparing plan. May be different from Applicant or Contact person. If different, also provide phone number.

ATTACHMENTS REQUIRED

Only Required to be completed for the first page. Leave blank for additional pages.

11. Site Plan: Provide site plan showing information requested.

12. Soil Test Results: Provide results of testing of existing soils, only required if proposing custom amendment rates.

13. Product Test Results: Provide test results for compost and topsoil showing that materials meet specification requirements.

AREA SOIL AMENDMENT DATA

14. Area #: Provide area number corresponding to areas on site plan. Attach additional sheets for each additional area.

15. Planting Type: Check what type of plantings will occur in area.

16. Square Footage of This Area: Calculate square footage of area and enter here.

17. Scarification: Check if scarification is required and indicate depth of scarification.

18. Pre-Approved Amendment Method: Check if this area will use pre-approved amendment rates.

19. Provide inches of compost or topsoil and calculate cubic yards required.

20. Product & Quantity: State what product is used, i.e. compost or topsoil and cubic yards calculated from block 19.

21. Custom Amendment: If custom amendment is used check type. Either the pre-approved or custom amendment block should be completed, not both.

22. Provide inches of compost or imported topsoil and calculate cubic yards required.

23. Product & Quantity: State what product is used, i.e. compost or topsoil and cubic yards calculated from block 22.

24. Mulch: No mulch required for turf/grass, if area is a landscape planting bed complete this block.

25. Enter square feet of area to be mulched and calculate cubic yards required.


TOTAL AMENDMENT/TOPSOIL/MULCH FOR ALL AREAS

Complete on page 1 only, totaling all areas/pages in the Plan. If more than 3 products are proposed Indicate total on 2nd page and indicate so on Page 1.

27. Indicate product (compost, topsoil, mulch), quantity for all areas, and test results. C:N ratio and “stable” is only applicable for compost, for topsoil or mulch indicate “n/a” for not applicable.

28. Repeat step 27 for each additional product.

29. Repair step 27 for each additional product.

30. For County Use – Leave Blank.
# Soil Management Plan for BMP LID.02

## Project Information

Complete all information on page 1; only site address and permit number on additional pages.

<table>
<thead>
<tr>
<th>Site Address / Lot No.:</th>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Attachments Required (Check off required items that are attached to this plan)

- Site Plan showing, to scale: ___ Areas of undisturbed native vegetation (no amendment required)
- ___ New planting beds and turf areas (amendment required)
- Type of soil improvement proposed for each area

### Soil test results (required if proposing custom amendment rates)

### Product test results for proposed amendments

## Area # (should match Area # on Site Plan)

<table>
<thead>
<tr>
<th>Area #</th>
<th>PLANTING TYPE</th>
<th>SQUARE FOOTAGE OF THIS AREA:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Turf</td>
<td>___ square feet</td>
</tr>
<tr>
<td></td>
<td>Undisturbed native vegetation</td>
<td>___ square feet</td>
</tr>
<tr>
<td></td>
<td>Planting Beds</td>
<td>___ square feet</td>
</tr>
<tr>
<td></td>
<td>Other: ___</td>
<td>___ square feet</td>
</tr>
</tbody>
</table>

## Scarification

- Subsoil will be scarified
- ___ inches (depth) of scarification needed to achieve finished total 12” loosened depth.

## Pre-Approved Amendment Method

- Topsoil import
- Amend with compost
- Stockpile and amend
  - (____ cu. yds. stockpiled)

- Topsoil import
- Amend
- Stockpile and amend
  - (____ cu. yds. stockpiled)

### Conversion Factor

- X 3.1. (conversion factor, inches to cubic yards) = cu. yards per 1,000 sq. ft.
- X ___000s sq.ft. in this area
- ___ = cubic yards of amendment
  - (needed to cover this area to designated depth)

### Conversion Factor

- X 3.1
- X ___000s sq.ft. in this area
- ___ = cubic yards of amendment
  - (needed to cover this area to designated depth)

## Custom Amendment

- Topsoil import
- Topsoil & compost lift
- Amend
- Stockpile and amend
  - (____ cu. yds. stockpiled)

### Conversion Factor

- X 6.2. (conversion to give 2 inch mulch depth)
- X ___000s sq.ft. in this area
- ___ = cubic yards of mulch
  - (needed to cover this area to designated depth)

## Total Amendment/Topsoil/Mulch for All Areas

<table>
<thead>
<tr>
<th>Product #1</th>
<th>Quantity: ___ cu. yds.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test Results: ___% organic matter ___C:N ratio &lt;25:1 (except mulch, or &lt;35:1 for native plants) ______ “stable” (yes/no)</td>
<td></td>
</tr>
<tr>
<td>Test Results: ___% organic matter ___C:N ratio &lt;25:1 (except mulch, or &lt;35:1 for native plants) ______ “stable” (yes/no)</td>
<td></td>
</tr>
<tr>
<td>Product #3</td>
<td>Quantity: ___ cu. yds.</td>
</tr>
<tr>
<td>Test Results: ___% organic matter ___C:N ratio &lt;25:1 (except mulch, or &lt;35:1 for native plants) ______ “stable” (yes/no)</td>
<td></td>
</tr>
</tbody>
</table>

## Revisions Required

Date: ___ Inspector: ___ Approved: ___ Revisions Required: ___
ATTACHMENT B
ABBREVIATED DRAINAGE PLAN ATTACHMENT
POST-CONSTRUCTION SOIL QUALITY AND DEPTH
COMPLIANCE GUIDE
FOR PROJECTS SUBMITTING ABBREVIATED DRAINAGE PLANS

References:
1. Thurston County 2009 Drainage Design and Erosion Control Manual, Volume I, Section 2.4.6
2. Thurston County 2009 Drainage Design and Erosion Control Manual, Volume V, Section 2.1.2
3. Guidelines and Resources for Implementing Soil Quality and Depth BMP T5.13 in WDOE

Projects required to comply with Minimum Requirement #5, On-Site Stormwater
Management, per the 2009 Thurston County Drainage Design and Erosion Control Manual and
eligible to submit an Abbreviated Drainage Plan or Engineered Abbreviated Drainage Plan can
use this Guide to comply with the requirement for restoring Post-Construction Soil Quality
and Depth (BMP LID.02).

1. Identify on the plot plan those areas that will be landscaped and those areas that will
   be lawn/turf. Use a letter or number designator for each area.
2. Calculate the area in square feet for each area.
3. Select a soil amendment method for each area based on the following alternatives:
   A. Compost amendment of in-place soils for landscape areas
   B. Compost amendment of in-place soils for lawn/turf areas.
   C. Compost amendment of replaced stockpiled topsoil for landscape areas.
   D. Compost amendment of replaced stockpiled topsoil for lawn/turf areas.
   E. Imported Topsoil for Landscape Areas
   F. Imported Topsoil for Lawn/Turf Areas
   G. Replacement of stockpiled topsoil without compost amendment. (testing of
      soil stockpile required to ensure it meets organic content requirements).
4. Indicate on the plot plan which area will receive which type of soil amendment (A–G).
   Add a note on your plot plan such as:
   Soil Amendment
   Area 1: Method A
   Area 2: Method C
   See attached soil amendment method descriptions
5. Calculate the quantity of each product required (mulch, imported topsoil, compost)
   and indicate the quantities on the plot plan. Use the following formula:
   Cubic Yards = “inches placed” x 0.0031 x “Area in SF”
   For example: if you place 2” of mulch on 1500 square feet of area, then:
   Cubic Yards Mulch = 2” x 0.0031 x 1500 sf = 9.3 cubic yards
6. Identify the supplier you will use for compost and imported topsoil and obtain a test
   report for each indicating that the product meets the following specifications:
   Compost: --C:N less than 25:1 (except less than 35:1 for Native Plants)
              --Organic Content: 35% to 65%
              --Meets definition of “composted materials” per WAC 173-350-220
              --Meets contaminant standards of Grade A Compost
   Topsoil:  --Minimum of 10% organic matter for landscape planting beds
             --Minimum of 5% organic matter for lawn/turf areas.
             --Soil portion consists of sand or sandy loam as defined by USDA with
                little or no clay.
7. Mulch shall be organic mulch such as compost, fine ground freshwater bark,
   composted sawdust, wood chips, stockpiled forest duff or equivalent.
8. Include the test reports with your Abbreviated Drainage Plan submittal.
9. Attach this document (which describes amendment methods) to your Plan.
PRE-APPROVED “DEFAULT” SOIL AMENDMENT METHODS

Compost Amendment of In-Place Soils

METHOD A: Compost Amendment of In-Place Soils for Landscape Areas
- Scarify or till subgrade to 8” depth except within the dripline of trees to be retained.
- Place 3” of compost and rototill into 5” of soil.
- Rake area smooth and remove large rocks (>2” in diameter).
- Plant landscaping plants as required.
- Mulch planting bed with 2” of organic mulch.

METHOD B: Compost Amendment of In-Place Soils for Lawn/Turf Areas.
- Scarify or till subgrade to 8” depth except within the dripline of trees to be retained.
- Place 1.75” of compost and rototill into 6.25” of soil.
- Water or roll to compact.
- Rake level and remove debris and rocks greater than 1” in diameter.
- Seed or sod per recommendations of seed/sod provider.

Compost Amendment of Replaced Stockpiled Topsoil

METHOD C: Compost Amendment of Replaced Stockpiled Topsoil for Landscape Areas
- Remove, stockpile and cover existing topsoil with a weed barrier material that sheds moisture yet allows air transmission.
- If replaced topsoil plus compost will amount to less than 12” scarify or rototill subgrade to depth needed to achieve 12” of loosened soil after topsoil and amendment are placed, 4” minimum. Do not scarify within the dripline of trees to be retained.

For example: if there is only enough stockpiled topsoil to place 3” and an additional 3” of compost is placed, then the subgrade should be scarified to a depth of 6” (12” total depth) prior to replacement of topsoil and compost.

- Replace topsoil and spread uniformly over surface scarified as described above.
- Place 3 inches of compost and rototill into 5” of soil.
- Rake beds to smooth and remove surface rocks larger than 2” in diameter.
- Plant landscaping plants as required.
- Mulch planting bed with 2” of organic mulch.

METHOD D: Compost Amendment of Replaced Stockpiled Topsoil for Lawn/Turf Areas.
- Remove, stockpile and cover existing topsoil with a weed barrier material that sheds moisture yet allows air transmission.
- If replaced topsoil plus compost will amount to less than 12” scarify or rototill subgrade to depth needed to achieve 12” of loosened soil after topsoil and amendment are placed, 4” minimum. Do not scarify within the dripline of trees.

For example: if there is only enough stockpiled topsoil to place 3” and an additional 1.75” of compost is placed, then the subgrade should be scarified to a depth of 7.25” (12” total depth) prior to replacement of topsoil and compost amendment.

- Replace topsoil and spread uniformly over surface scarified as described above.
- Place 1.75” of compost and rototill into 6.25” of soil.
- Water or roll to compact soil.
- Rake level and remove woody debris and rocks greater than 1” in diameter.
- Seed or sod per recommendations of seed/sod provider.
**Imported Topsoil – No Amendment**

As an alternative to compost amendment of soils an applicant may choose to import topsoil for installation in landscape and lawn/turf areas. Installation shall be in accordance with the following procedures:

**METHOD E: Imported Topsoil For Landscape Areas**
- Scarify or till subgrade in two directions to a depth of 6”. The entire surface should be disturbed by scarification. Do not scarify within drip line of existing trees.
- Place 3” of imported topsoil mix on surface and till into 2” of soil.
- Place a second lift of 3” of topsoil mix on the surface.
- Rake beds to smooth and remove surface rocks over 2” in diameter.
- Plant landscaping plants as required.
- Mulch planting bed with 2” of organic mulch.

**METHOD F: Imported Topsoil for Lawn/Turf Areas**
- Scarlet or till subgrade in two directions to a depth of 6”. The entire surface should be disturbed by scarification. Do not scarify within drip line of existing trees.
- Place 3” of topsoil mix on surface and till into 2” of soil.
- Place a second lift of 3” of topsoil mix on surface.
- Water or roll to compact soil.
- Rake to level and remove surface rocks or debris greater than 1 inch in diameter.
- Seed or sod per recommendations of seed/sod provider.

**Stockpiled Topsoil Replacement – Without Amendment**

**METHOD G: Replacement of Stockpiled Topsoil Without Compost Amendment**
If sufficient volume of stockpiled topsoil exists to provide for a settled depth of 8 inches (approximately 9.5 inches loose) after replacement and the existing topsoil can be verified to meet soil quality criteria (see below), then compost amendment is not required and the following procedure should be followed:

- Remove, stockpile and cover existing topsoil with a weed barrier material that sheds moisture yet allows air transmission.
- Test stockpiled topsoil to ensure minimum organic content (10% for landscape beds, 5% for lawn/turf areas). Otherwise, compost amendment is required.
- Scarify or till subgrade 4” minimum except within the dripline of trees to be retained.
- Place 3” of topsoil on scarified surface and till into 2” of soil.
- Place remainder of topsoil on surface.
- Rake bed smooth and remove surface rocks over 2” diameter for landscape beds and rocks and woody debris over 1” for lawn/turf areas.
- For lawn/turf areas water or roll to compact.
- Plant lawn/turf or landscape plants.
- For landscape areas mulch planting bed with 2” of organic mulch.
This guide is provided to help professional inspectors verify implementation of soil improvements to fulfill BMP T5.13 “Post Construction Soil Quality and Depth” in the Washington Department of Ecology’s Stormwater Management Manual Western Washington.

The main conditions to be confirmed are:
1. Provision of eight inches of topsoil containing 10% organic matter in planting beds, or 5% in turf areas.
2. Scarification of compacted subsoil four inches below the topsoil layer (for a total uncompacted depth of 12 inches).
3. Placement of two inches of mulch on all planting beds.

Site Inspection Supplies
- A copy of the approved Soil Management Plan (SMP) for the site, with site drawing.
- A sturdy shovel
- Tape measure or 12” ruler
- 3/8 inch diameter 3-4 foot stainless steel “rod penetrometer” with a 1/8” bevel cut into the tip at 30 degrees from the side, and a 90 degree bend at top to form a handle (see illustration, next page).
- Field Verification Form to record results

The following steps may be completed at multiple visits as a project progresses or in one final project approval inspection, depending on local practices:

STEP 1: Compare site conditions with approved Soil Management Plan (SMP).
The SMP approved with the site permit describes soil treatments approved for each area. Make sure site conditions match these details in the SMP:
- Site location and permit holder.
- Turf and planting areas match approved drawings.
- Areas to remain as undisturbed native soil and vegetation have been fenced off during construction to prevent soil compaction or damage to plants.

STEP 2: Inspect delivery tickets for compost, topsoil and mulches.
Permittee must provide original delivery tickets for all soil and mulch products. Compare delivery tickets with the SMP to match the following information:
- Delivery location.
- Total quantities for each soil product and mulch.
- Product descriptions and sources.
  If materials other than those listed in the SMP were delivered, laboratory test results must be provided to confirm that they are equivalent to approved products.

STEP 3: Verify depth of amended soil and scarification.
Use a shovel to dig at least one test hole per acre for turf and one per acre for planting beds to verify eight inch topsoil depth (below mulch layer), incorporation of amendments, and four inches of uncompacted subsoil.

Eight Inch Depth of Amended Soil. The top eight inches of soil should be easy to dig using a garden spade driven solely by your weight. The soil should be darker than the unamended soil below, and particles of added organic
matter are likely to be visible. Clay soil that been saturated and then dried may require jumping on the shovel step to penetrate, but the soil should yield easily when moist. Soil that requires vigorous chipping with the shovel to penetrate probably does not meet the specification.

**Four Inch Depth of Scarified Subsoil.** The next four-inch depth of soil should be loose enough to penetrate with the shovel. It may be rocky, and the loosened depth may vary due to the pattern of scarifying equipment – but some sections of subsoil in a one foot square hole should be loose four inches deep into the subsoil (that is, to a total 12 inch depth from the soil surface).

**STEP 4: Check soil depth in several spots.**

Use a simple “rod penetrometer” (illustration below) to confirm that the soil is uncompacted twelve inches deep at ten locations per acre – with a minimum of ten on smaller sites. To locate test spots, imagine a line dividing the site (or each acre) in half lengthwise, then divide each half into five nearly equal sections. Conduct tests near the middle of each section. Additional test locations are encouraged.

The rod penetrometer should enter the soil twelve inches deep, driven solely by the inspector’s weight. Irregular scarification or rocks in the lower layer may require probing a few spots at each location to reach the full depth.

**STEP 5: Check mulch depth.**

Use a shovel to scrape away and reveal surface mulch thickness. A two inch layer of organic material (mulch) such as composted sawdust, wood chips, or ground bark should be distinguished from the underlying soil on all planting beds.

**FINAL STEP: Record results on “Field Verification Form” or similar document (see sample form on next page).**

**What should be attached to the Soil Management Plan?**

- Scale drawings showing layout of turf and planting beds, and identifying where soil treatments described in the SMP will be applied.
- Copies of compost and topsoil test results demonstrating that products contain adequate organic matter, and meet carbon to nitrogen ratio and stability standards.
- Where custom calculated amendment rates are used, include laboratory analyses of the soil and organic matter sources plus calculations by a qualified professional showing that the organic matter requirement will be achieved.

**What If A Site Does Not Meet the Soil Management Plan Requirements?**

If inspection indicates that an installation does not fulfill the approved SMP, the permit holder or their agent should be notified of what steps are needed to comply. When results are unclear or disputed, an independent consultant should conduct sampling for analytical testing of organic matter as described in the project specifications. Qualified consultants include: Certified Soil Scientists, Crop Advisors or Agronomists; or Licensed Landscape Architects, Civil Engineers or Geologists.
### Model FIELD VERIFICATION FORM for BMP T5.13

(available as MS Word file at www.SoilsforSalmon.org)

#### PROJECT INFORMATION

Complete all information on page 1, only site address and permit number on additional pages.

- **Site Address:**
- **Permit Type:**
- **Permit Number:**
- **Permit Holder:**
- **Phone:**
- **Mailing Address:**
- **Customer Representative At Inspection:**
- **Phone:**
- **Plan Prepared By:**

#### VISIT RECORD

<table>
<thead>
<tr>
<th>Date:</th>
<th>Inspector:</th>
<th>Items Approved:</th>
<th>Fencing off undisturbed areas</th>
<th>Soil preparation</th>
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<td></td>
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<td>Other:</td>
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<tr>
<td></td>
<td></td>
<td>Mulch</td>
<td>Other:</td>
<td></td>
</tr>
</tbody>
</table>

#### DELIVERY TICKETS FOR AMENDMENT, TOPSOIL & MULCH.

( Check if tickets match Soil Management Plan (SMP). Total volumes for all areas should be on page 1 of the SMP.)

- **Product #1:**
  - Test Results: % organic matter C:N ratio <25:1 “stable” (Y/N)
  - Quantity: cu. yds. (except mulch, or <35:1 for native plants)
  
- **Product #2:**
  - Test Results: % organic matter C:N ratio <25:1 “stable” (Y/N)
  - Quantity: cu. yds. (except mulch, or <35:1 for native plants)

- **Product #3:**
  - Test Results: % organic matter C:N ratio <25:1 “stable” (Y/N)
  - Quantity: cu. yds. (except mulch, or <35:1 for native plants)

#### AREA #

(Refer to Areas mapped on Site Plan and described on Soil Management Plan)

**PLANTING TYPE**
- Undisturbed vegetation
- Turf
- Planting Beds
- Other: __________

**Square footage:** __________

- **Subsoil Loose/Scarified 12 Inches Deep?** Y / N

- **Rod Test**
  - **Number Rod Tests Required:** (minimum 10 tests/acre)
  - **Comment:**

- **Test Holes**
  - **Number Test Holes Required:** (minimum 1 hole/acre)
  - **Soil Amended 8 Inches Deep?** Y / N
  - **Amendment Matches Soil Mgmt. Plan?** Y / N
  - **Rod penetrates 12 inches deep in all areas?** Y / N

- **Mulch Product:**
- **Mulch two inches deep?** Y / N

#### AREA #

<table>
<thead>
<tr>
<th>PLANTING TYPE</th>
<th>Test Holes</th>
<th>Rod Test</th>
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</thead>
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<td>Turf</td>
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<td>Rod penetrates 12 inches deep in all areas? Y / N</td>
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<tr>
<td>Planting Beds</td>
<td>Amendment Matches Soil Mgmt. Plan? Y / N</td>
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<td>Other:</td>
<td>Topsoil Product?</td>
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<td></td>
<td>Amendment Visible?</td>
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<tr>
<td>Square footage:</td>
<td>Subsoil Loose/Scarified 12 Inches Deep? Y / N</td>
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</table>

- **Mulch Product:**
- **Mulch two inches deep?** Y / N

Add additional sheets for additional Areas
APPENDIX D – United States Natural Resource Conservation Service Maps
The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: Web Mercator (EPSG:3857)
Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.
Soil Survey Area: Thurston County Area, Washington
Survey Area Data: Version 12, Sep 10, 2018

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Apr 1, 2016—Sep 27, 2016

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.
## Map Unit Legend

<table>
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<tr>
<th>Map Unit Symbol</th>
<th>Map Unit Name</th>
<th>Acres in AOI</th>
<th>Percent of AOI</th>
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</thead>
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<tr>
<td>1</td>
<td>Alderwood gravelly sandy loam, 0 to 8 percent slopes</td>
<td>11.6</td>
<td>35.8%</td>
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<tr>
<td>2</td>
<td>Alderwood gravelly sandy loam, 8 to 15 percent slopes</td>
<td>3.2</td>
<td>9.8%</td>
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<tr>
<td>3</td>
<td>Alderwood gravelly sandy loam, 15 to 30 percent slopes</td>
<td>1.7</td>
<td>5.4%</td>
</tr>
<tr>
<td>30</td>
<td>Dystric Xerochrepts, 60 to 90 percent slopes</td>
<td>5.9</td>
<td>18.1%</td>
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<tr>
<td><strong>Totals for Area of Interest</strong></td>
<td></td>
<td><strong>32.3</strong></td>
<td><strong>100.0%</strong></td>
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</table>
Thurston County Area, Washington

1—Alderwood gravelly sandy loam, 0 to 8 percent slopes

Map Unit Setting

National map unit symbol: 2t625
Elevation: 50 to 800 feet
Mean annual precipitation: 25 to 60 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 160 to 240 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Alderwood and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the map unit.

Description of Alderwood

Setting

Landform: Hills, ridges
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Crest, talf
Down-slope shape: Convex, linear
Across-slope shape: Convex
Parent material: Glacial drift and/or glacial outwash over dense glaciomarine deposits

Typical profile

A - 0 to 7 inches: gravelly sandy loam
Bw1 - 7 to 21 inches: very gravelly sandy loam
Bw2 - 21 to 30 inches: very gravelly sandy loam
Bg - 30 to 35 inches: very gravelly sandy loam
2Cd1 - 35 to 43 inches: very gravelly sandy loam
2Cd2 - 43 to 59 inches: very gravelly sandy loam

Properties and qualities

Slope: 0 to 8 percent
Depth to restrictive feature: 20 to 39 inches to densic material
Natural drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 18 to 37 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 2.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: B
Forage suitability group: Limited Depth Soils (G002XN302WA), Limited Depth Soils (G002XF303WA), Limited Depth Soils (G002XS301WA)

Hydric soil rating: No

Minor Components

Everett

Percent of map unit: 5 percent
Landform: Kames, eskers, moraines
Landform position (two-dimensional): Summit, shoulder
Landform position (three-dimensional): Interfluve, crest
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Mckenna

Percent of map unit: 5 percent
Landform: Depressions, drainageways
Landform position (three-dimensional): Dip
Down-slope shape: Concave, linear
Across-slope shape: Concave
Hydric soil rating: No

Shalcar

Percent of map unit: 3 percent
Landform: Depressions
Landform position (three-dimensional): Dip
Down-slope shape: Concave
Across-slope shape: Concave
Hydric soil rating: Yes

Norma

Percent of map unit: 2 percent
Landform: Drainageways, depressions
Landform position (three-dimensional): Dip
Down-slope shape: Linear, concave
Across-slope shape: Concave
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: Thurston County Area, Washington
Survey Area Data: Version 12, Sep 10, 2018
Thurston County Area, Washington

30—Dystric Xerochrepts, 60 to 90 percent slopes

Map Unit Setting

- National map unit symbol: 2nd8r
- Elevation: 0 to 3,280 feet
- Mean annual precipitation: 50 inches
- Mean annual air temperature: 50 degrees F
- Frost-free period: 180 days
- Farmland classification: Not prime farmland

Map Unit Composition

- Dystric xerochrepts and similar soils: 85 percent
- Minor components: 5 percent
- Estimates are based on observations, descriptions, and transects of the map unit.

Description of Dystric Xerochrepts

Setting

- Landform: Escarpments
- Parent material: Colluvium and glacial till

Typical profile

- H1 - 0 to 4 inches: very gravelly sandy loam
- H2 - 4 to 30 inches: very gravelly sandy loam
- H3 - 30 to 34 inches: very gravelly sandy loam

Properties and qualities

- Slope: 60 to 90 percent
- Depth to restrictive feature: 20 to 72 inches to densic material
- Natural drainage class: Well drained
- Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
- Depth to water table: More than 80 inches
- Frequency of flooding: None
- Frequency of ponding: None
- Available water storage in profile: Very low (about 2.1 inches)

Interpretive groups

- Land capability classification (irrigated): None specified
- Land capability classification (nonirrigated): 7e
- Hydrologic Soil Group: C
- Hydric soil rating: No

Minor Components

- Skipopa
  - Percent of map unit: 5 percent
Hydric soil rating: No

Data Source Information

Soil Survey Area: Thurston County Area, Washington
Survey Area Data: Version 12, Sep 10, 2018
Appendix E   Geotechnical Report
November 15, 2019

Tom Schrader  
RE/MAX Parkside Affiliates  
300 Deschutes Way SW # 200  
Olympia, WA 98501  

Subject: MTC Memorandum #1  
Schrader Residential Project – 25th Ave Improvements (MTC Project No.: 18S318)  
25th Ave NW, Olympia, WA

Dear Mr. Schrader,

MTC understands that Thurston County is requesting we review the updated plans for roadway improvement to confirm they meet the requirements of our previous critical area evaluation, involving the roadway and parcels 83002100100 and 83002000400 (dated 02/26/2019). A copy of the most recent civil drawings (dated 07/17/2019) was provided to MTC for review. MTC understands that several areas of pavement expansion are proposed as well as drainage improvements.

Specifically, upon review we see that all new roadway expansions along the critical slope face expand the road inward & uphill, rather than outward or downslope, preventing further encroachment on the existing slope crests. Plans also depict maintaining existing grade upslope from the roadways to limit any disturbance. Drainage improvements appear to catch water from the roadway, as well as water migrating to the road from upslope, providing additional drainage to help dewater the local slope face, further improving overall local conditions. These drainage features appear to be planned to outfall safely beyond the base of the slope utilizing appropriate energy reducing features to prevent scouring. The proposed roadway improvements appear to meet or exceed our geotechnical requirements, and are anticipated to generally improve the local stability overall within the roadway vicinity.

Mr. Schrader, we trust this correspondence will satisfy your needs. If you have further questions, please feel free to contact us.

Respectfully Submitted;

Materials Testing & Consulting, Inc.

Luke Preston McCann, G.I.T.  
Senior Geologist

Medhanie Tecle, P.E.  
Engineering Manager
NOTE: SEWER GRINDER PUMPS WOULD BE OUTSIDE OF THE BUILDING AREA, AND OFF THE SIDE, AND AT THE LOWEST ELEVATION (LOWER THAN LOWER FLOOR SURFACE)

SECTION 3, TOWNSHIP 18 N., RANGE 2 W., W.M.

SCALE: 1" = 80 FEET

EXISTING TURNOUT

ASPHALT TURNOUT

ROW (TYP)

TO BEGINNING OF TURNOUT

EXISTING 25TH AVENUE

ROW (TYP)

EXISTING WATER APPROX LOCATION

EXISTING SEWER APPROX LOCATION

PROPOSED GAS SERVICE LINE

FORCE MAIN SEWER SERVICES

EXT. HOPE WATER SERVICE LINES

PROPOSED 15.00' EASEMENT

PROPOSED 30.00' ROW

EXISTING GAS APPROX LOCATION

VERTICAL DATUM: NGVD 29

2 FOOT CONTOURS SHOWN HEREON

SURVEY DESCRIPTION

LOTS 4 AND 5 IN BLOCK 20 PLAT OF WEST OLYMPIA AS RECORDED IN VOLUME 1 OF PLATS, AT PAGE 12 RECORDS OF THURSTON COUNTY, WASHINGTON, SITUATED IN THURSTON COUNTY, WASHINGTON

LOT 1 AND THE NORTH HALF OF VACATED CALIFORNIA STREET IN BLOCK 21 PLAT OF WEST OLYMPIA AS RECORDED IN VOLUME 1 OF PLATS, AT PAGE 12 RECORDS OF THURSTON COUNTY, WASHINGTON, SITUATED IN THURSTON COUNTY, WASHINGTON

SET CAPPED IRON BAR LS 33138

FOUND CAPPED IRON BAR LS 22655

BRACY & THOMAS

LAND SURVEYORS

1120 BROAD ST, SUITE 5
TUMWATER, WASHINGTON 98512
(360) 357-5893

MAY, 2012

BASIS OF MERIDIAN:

RECORD OF SURVEY FILED UNDER AUDITOR'S FILE NO. 905019099

THE LAND DEVELOPERS ENGINEERED SOLUTION

5737 UNDERSON WAY SW
PO BOX 4420, TUMWATER, WA 98501
(360) 869-4846
E-MAIL: info@landdeveloper.com

PROJECT: 25TH AVENUE & UTILITY PLAN

CLIENT: TURNBERRY, LANE SE

DATE: 11/3/1992

SHEET 1 OF 8

TOPOGRAPHIC NOTE:

THE EXISTING TOPOGRAPHIC DATA SHOWN ON THESE DRAWINGS HAS BEEN PREPARED IN PART, BASED UPON INFORMATION FURNISHED BY OTHERS. WHILE THIS INFORMATION IS BELIEVED TO BE RELIABLE, THE LAND DEVELOPERS, INC. CANNOT ENSURE ITS ACCURACY AND THUS IS NOT RESPONSIBLE FOR THE ACCURACY OF THAT INFORMATION OR FOR ANY ERRORS OR OMISSIONS WHICH MAY HAVE BEEN INCORPORATED INTO THESE DRAWINGS AS A RESULT.
SECTION 3, TOWNSHIP 18 N., RANGE 2 W., W.M.

WIDEN EXISTING ROAD TO 12' WIDE

DISPERSE INTO THE EXISTING FOREST UNDER-STORY SOILS ALONG DRIVE

EXISTING EDGE OF ASPHALT

WIDEN EXISTING ROAD TO 20' FOR 1ST 40'

NEW PAVING TO DRAIN TO EXISTING FOREST UNDER-STORY SOILS ALONG DRIVE MEETING AMENDED SOIL CRITERIA

ROW (TYP)
Subject: Report of Geotechnical Consultation
Schrader Residential Lots - North Parcel - 83002100100
1730 25th Ave NW, Olympia, WA
MTC Project No.: 18S318

Dear Mr. Schrader:

At your request, Materials Testing & Consulting, Inc. (MTC) has completed a limited-scope geotechnical and critical area consultation of the above referenced property, including site and slope visual reconnaissance, and review of past geotechnical exploration and design data for the site. The project site consists of an undeveloped residential parcel comprising a coastal bluff face. It is our understanding that the client intends to construct a new single-family residence supported by auger-cast piles.

MTC understands multiple geotechnical letters exist for the project. Due to the extent of time that has passed, and newly proposed developments, the design team requests a follow-up consultation to confirm current conditions have not deteriorated and provide any additionally necessary recommendation regarding critical area considerations and other planned developments. The following report presents the findings and conclusions of our literature review, addresses feasibility of proposed site development, and provides additional geotechnical recommendations for planning and design intended to reduce the inherent risks associated with site development within a potentially geologically hazardous area.

Document and Existing Literature Review:

Per the existing third-party geotechnical review letter (by Associated Earth Sciences, dated September 9, 2014; referencing findings by Bradley-Noble Geotechnical Services), new residential developments on site shall bear on auger cast piles with a minimum diameter of 16 inches and a minimum embedment of 40 feet below existing access road elevation to bear at elevations where very dense (N=100+) native soils were encountered in drilling explorations. Characterization of site conditions include the documented presence of shallow mass wasting events from typical coastal bluff erosion. No pervasive groundwater
table was encountered during historic past explorations. The reports provide more specific design requirements and soil parameters for pile foundations, loaded walls and access improvements. MTC confirms the original observations and recommendations appear suitable for the intended developments at this time, and recommends the original reports be referenced by the design team when considering design scenarios. Additionally, MTC provides some supplementary recommendations herein to assure design and construction do not decrease slope safety factors.

**Site Investigation Methodology:**

On December 5, 2018, an MTC staff geologist visited the site to perform visual reconnaissance of surface and topographic features of the subject property and its proximal slope for general geologic hazard assessment and site characterization. Salient slope features and existing vegetation were documented as observed in order to assess general site and slope condition as well as to look for signs of local instability of an erosional or subsurface nature currently or in the past. The local slope was observed and photographed from within the site. Direct observations of soils where exposed by localized surface erosion were used to classify soils and interpret site geology. Inferences from observations are described herein.

A project location and its vicinity map are shown in Figure 1, Appendix A. A site plan depicting the proposed home location and improvements is shown in Figure 2, Appendix B. A reconstructed slope profile is provided in Figure 3, Appendix C.

**Surface Observation:**

MTC performed general site reconnaissance to observe and document any indications of localized surface degradation or large-scale slope instability. The bluff-face, exposed root structures, and irregular crest edge geometry indicates active slope-crest-retreat is occurring to some degree, although no long-term study of the effect has been conducted. Some downslope accumulation in the form of shallow slumps were noted, confirming past observations. Small tension cracks in the existing asphalt in proximity to the crest were observed, appearing to also correlate with the shallow erosion observed across the entire slope. Daylighting perched stormwater was noted to traverse the slope face and the drainage ditch in the road. Some areas of scouring were noted near the base of the bluff, indicating the site has a moderate potential for erosion.

No indications of historic deep-seated movement were observed within or near to the residence. Topography was generally consistent, lacking significantly oversteepened areas (other than the pronounced bluff), channelized runout zones, or hummocky zones. No obvious evidence of rotational or translational failures or major toppling hazards was observed on the slopes in the proximity of the home.
No significant failure features were observed on adjacent slope areas visible from the subject property during the visit.

MTC’s extent of exploration did not include the use of advanced surveying equipment, employment of licensed surveyors, or subsurface exploration activities. MTC is not aware of the existence of any private survey data for the subject parcels at this time.

MTC’s scope of work did not include determination of seasonal groundwater elevation variations, documentation of wet season site conditions, or conclusive measurement of groundwater elevations at depths past the extent feasible for hand-operated explorations.

Discussion and Critical Area Recommendations:

The findings of MTC’s reconnaissance at the subject site appear broadly consistent with available geologic literature and do not indicate that any excessively prohibitive conditions exist for the anticipated level of development. Based on the information herein, MTC provides the following development and site-specific recommendations to be followed to minimize the inherent risks of developing a sloped property.

Since soils may be difficult to work with during periods of wet weather due to elevated soil moisture content, and frozen soil is not suitable for use as structural fill, we generally recommend that earthwork activities generally take place in late spring, summer or early fall. If wet season construction is conducted, stormwater controls and dewatering efforts may be required locally depending on total excavation depth and location as well as weather conditions during earthwork.

Limited Slope Stability & Pile Embedment

The proposed building location is located over the eastern slope face. Explorations of this study coupled with interpretation geologic literature have identified generally medium dense, unsaturated interbedded sands with varying sand and gravel content comprise the internal slope conditions.

Considering the conditions of the potential critical slope and shallow soil conditions, specific foundation requirements must be followed for successful construction at this location. Where coarse-grained cohesionless soils are present and groundwater conditions are outside the realm of internal slope influence, slope factor of safety may be determined by the following simplified relationship (Landslides: Investigation and Mitigation, Turner and Schuster, 1996):

\[
\text{Factor of Safety (FS)} = \frac{\tan(\phi)}{\tan(\alpha)}
\]

Where

- \(\phi\) = Internal friction angle of soil
- \(\alpha\) = Angle of slope or projection plane.
An average $\phi = 41$ degrees friction angle was recommended by the original geotechnical letters by Bradley-Noble Geotechnical Services, corresponding to the observed soil types and relative $N$ values, which can be used for assessing slope factor of safety and determining a suitable building setback. Target factor of safety for residential structures is typically $FS = 1.5$ for static analysis. Factor of safety is an indication of stability; an $FS = 1.0$ or below corresponds to the point of failure. The setback projection angle for a suitable factor of safety is found by using:

$$\text{Factor of Safety (FS)} = \frac{\tan (\phi)}{\tan (\alpha)} = \frac{\tan (41)}{\tan (\alpha)} = 1.5 + \alpha$$

MTC’s profile estimates were used to create a projection from the slope base for an $\alpha = 27$ degrees projection angle, as shown on Figure 3, emanating from the approximate toe of the slope. This geometry meets typical factor of safety requirements for residential development. Therefore, MTC recommends any new pile foundations for the proposed home or retaining walls penetrate beneath this projection plane (but not less than the depth that is required by the design detailed in the original geotechnical report i.e. 40 feet). No foundation elements shall bear above this plane, including deck and stair foundations. This will allow for slopeward pile foundation placement as necessary to accommodate the desired extent of construction.

**Horizontal setback & Foundation Recommendations**

Horizontal setbacks were determined based on International Building Code (IBC) requirements as accepted by the State of Washington, and Thurston County. The IBC details required setback delineations for slopes less than or equal to 45 degrees. Structures in the vicinity shall maintain a minimum horizontal slope face setback, the lesser of $H/3$ or 40 feet from these eastern descending slope faces. MTC’s reviewed existing topographic data and general site observations made during our visit to infer general horizontal setbacks. MTC recommends the building maintain a minimum slope face setback of 16 feet between the base of any pile footing and the face of any newly graded or natural descending slope. It should be noted that the permitting authority may still require increased setbacks depending on other easement and shoreline restrictions. These can typically be achieved by embedding piles at deeper elevations.

The stability of ascending slopes is not anticipated to be impacted due to: proposed roadway surface improvements, installation of new drainage features to intercept daylighting stormwater, use of pile foundations for the house, and general stabilization imparted by engineered and embedded stem walls or basement retaining walls of the home. Therefore, MTC recommends the minimum horizontal setback of
15 feet between the closest face of the house and the toe of the upland slope to the west, which will already be adequately established by the roadway and new parking.

MTC does not recommend reducing the required embedments or setbacks unless further site-specific foundation design efforts are undertaken to ensure building and slope stability is maintained. Based on the structure setbacks determined above, we recommend that the completed project should maintain a portion of the space between the slopes and structures as a non-disturbance vegetated buffer with no permanent clearing of vegetation. The non-disturbance area should begin as close to the structure envelope as is feasible.

Heavy compaction equipment and excessive vibratory activities should not be used near adjacent steep slopes or their crest. Stockpiling of excavated tailings is to be prohibited above, near, or on slopes. Tailings should be removed to an inland area of the site, sufficiently away from the crest if temporary storage of exported/imported materials is required. Marginal areas disturbed during construction should be revegetated at the end of the construction phase, preferably using a pre-determined planting schedule.

If plans change to incorporate deep trenching, or additional excavations, or the type of installation changes, MTC should be contacted to reevaluate site conditions and provide further analysis. If additional developments, such as drainage features or other structures are considered, MTC should also be contacted for further site analysis, applicable to the type and extent of development or construction.

Retaining Wall Recommendations:

MTC understands the project proposes to improve the access roadway by means of the installation of an upland retaining wall with drainage improvements, as well as the installation of daylight basement retaining walls for the home. The following recommendations pertain to the design (by others) of laterally loaded retaining wall structures founded on piles. These recommendations are not applicable to: exceedingly sloping backfills, backfills composed of non-granular soil materials, braced or tied-back walls, or for walls greater than 10 feet in height. MTC expressly recommends that we review final plans and specifications for retaining walls to ensure consistency with the recommendations presented herein, and to provide additional geotechnical consultation and recommendations as needed for final design and construction.

- **Foundations**

  MTC recommends retaining wall foundations bear on piles as designed by others, founded in suitably dense native sandy soils, detailed by the original geotechnical reports to exist at or below depths of 40 feet below existing roadway elevations.
• **Active and At-Rest Pressures:**

Yielding (cantilever) retaining walls should be designed to withstand an appropriate active lateral earth pressure, whereas non-yielding (restrained) walls should be designed to withstand an appropriate at-rest lateral earth pressure. The at-rest case is applicable where retaining wall movement is confined to less than 0.005 \( H \), where \( H \) is the wall height. If greater movement is possible, the active case applies. A wall movement of about 0.02 \( H \) will be required to develop the full passive pressure. These pressures act over the entire back of the wall and vary with the backslope inclination. For lateral pressures relative to seismic loading conditions, we recommend applying a uniform blanket seismic surcharge of 10 \( H \) psf for a generalized design situation based on our limited subsurface testing at the project site.

For retaining walls up to 10 feet in height with a level backslope and retaining intact native soils, we recommend using parameters for active and at-rest pressure (given as equivalent fluid unit weights) provided in the following table:

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• **Surcharges:**

The proposed basement retaining walls shall account for the potential surcharge of adjacent roadway improvements, and new upland stabilization features potentially bearing within the uphill zone of influence of the wall. Additionally, the proposed soldier pile wall stabilizing the upland slopes shall consider the potential surcharges of ascending sloped soils, and nearby existing residences.

**Retaining Wall Construction Recommendations:**

• **Excavations:**

The duration of time that excavations behind walls remain open should be limited to only as necessary to prepare the base pad and placement of the wall features, backfilling with drain rock and approved fill immediately. Temporary worker protections such as trench boxes or temporary shoring may be required for entering excavations deeper than 4 feet, and all OSHA safety regulations should be observed. Extended open cut periods or work proceeding in wet weather may require surface coverings, lesser cut angles, and/or temporary bracing be applied. We
suggest a minimum 5-foot horizontal buffer be maintained from the temporary cut to the upslope property lines (to allow for some near-surface disturbance during excavation).

- **Wall Drainage:**

  Due to the detailed elevated water table in the original geotechnical report, and tidal influences, MTC recommends the design team account for the potential effects of hydrostatic pressure, and head pressure/uplift on any new bulkhead features. To preclude build-up of hydrostatic pressure, we recommend a minimum width of 1 foot of clean, granular, free-draining material extend from the footing drain at the base of the wall to the ground surface immediately behind the wall. Native soils are not considered suitable as drainage material. Imported wall drain aggregate should conform to WSDOT Standard Specification 9-03.12(4) Gravel Backfill for Drains or 9-03.12(5) Gravel Backfill for Drywells. A filter fabric suitable for use in soil separation and water transmission is recommended to be placed against retained soil cuts behind the wall (if present) to limit migration of fines into the drain corridor. Final parameters shall be determined by the wall designer.

- **Wall Backfill:**

  Native material is not considered suitable for wall backfill due to its elevated fines content. For additional wall backfills as needed, soils should be relatively granular with less than 5 percent fines (material passing the U.S. No. 200 sieve). MTC recommends wall backfill import material to conform to WSDOT Standard Specification 9-03.12(2) Gravel Backfill for Walls.

- **Wall Backfill Compaction:**

  It is recommended that wall backfill be compacted to a firm and unyielding condition and at least to 95 percent of the modified Proctor maximum dry density per ASTM D1557. Wall backfill supporting landscaping elements and other non-structural components should be compacted to a relatively firm and unyielding condition.

**Road Improvement Planning**

Our understanding is that the improved road will service the new and existing residential home lots. As such, MTC does not anticipate high or regular traffic loads or frequent heavy loads on the proposed road. Furthermore, we assume that the road improvements will be constructed as narrowly as feasible and allowed by local jurisdiction. However, as the entire site is sloped, total avoidance is generally infeasible for the project. The currently proposed patching and installation of new drainage features is generally anticipated to improve the overall stabilization of the lower roadway. We understand the majority of the undisturbed pavement, remaining in fair condition, will remain in place.
General Road Site Preparations

Where roadway improvements or patching is proposed, MTC recommends removing existing surfacing and uncontrolled fills if present, buried topsoil deposits and landscape materials, as well as any organic or unsuitably loose or soft subgrade soils from beneath pavement areas. Road level should be graded down into native silty sand to sand soils. Exposed subgrade should be in a firm and unyielding condition prior to commencing further road preparations. Locally loose conditions may be recompacted in place as possible and evaluated for suitability. If unsuitably organic or loose conditions persist, we recommend over-excavating to suitably dense soils and replacing to proposed subgrade level with structural fill per the guidelines recommended below.

After excavation to subgrade level, but before placing the pavement section, soils should be evaluated for suitability by the geotechnical engineer of record. Due to the nature as a prior altered site, as well as from geotechnical site explorations conducted for the current assessment, some locations within the road footprint have been disturbed to a greater depth and may require additional preparation to establish firm subgrade. As these locations are identified during construction by methods noted above, the site preparation contractor is responsible for completing the necessary local remediation in accordance with the recommendations herein.

Structural Fill Materials and Compaction

All material placed below pavement areas and foundations is considered structural fill, and shall be free of deleterious material, have a maximum particle size of 6 inches, and be compactable to the required compaction level.

Existing fills and native soils of silty sand to sand are not anticipated to be suitable for re-use as a substitute for structural fill. Imported material can be used as structural fill. MTC recommends imported structural fill material should conform to Section 9-03.14(1), Gravel Borrow, of the most recent edition (at the time of construction) of the State of Washington Department of Transportation Standard Specifications for Road, Bridge, and Municipal Construction (WSDOT Standard Specifications).

Prior to placement and compaction, structural fill should be moisture conditioned to within 3 percent of its optimum moisture content. Loose lifts of structural fill shall not exceed 12 inches in thickness; thinner lifts will be required for walk-behind or hand operated equipment.

We recommend all structural fill be compacted to a firm and unyielding condition and to a minimum percent compaction based on its modified Proctor maximum dry density as determined per ASTM
D1557. Structural fill placed beneath each of the following shall be compacted to the indicated percent compaction, or as required by the design engineer:

- **Pavement Subgrades (upper 2 feet):** 95 Percent
- **Pavement Subgrades (below 2 feet):** 90 Percent
- **Utility Trenches (upper 4 feet):** 95 Percent
- **Utility Trenches (below 4 feet):** 90 Percent

**Drainage Controls**

MTC recommends proper drainage controls for mitigating the increased potential for stormwater runoff should be implemented along with site development to protect conditions of the site and slope. MTC anticipates on-site infiltration potential is infeasible due to the presence of shallow silty soils within the subject site. MTC does not recommend dispersion or infiltration of collected stormwater between the proposed development and slope, or on the slope itself, as increased runoff or localized stormwater inundation can negatively impact long-term erosional and global slope stability.

MTC recommends roof and footing water sources be tightlined away from the building to an existing upland catch basin and stormwater system, or down the slope to be released beyond the base using appropriate energy-dissipating features at the outfall to minimize point erosion. Roof and footing drains should be tightlined separately, or should be gathered in an appropriately sized catch basin structure and redistributed collectively. If storm drains are incorporated for impervious flatworks (driveways, patios, etc.), collected waters should also be discharged according to the above recommendations. All drainage tightlines should be composed of appropriately sturdy material (such as rigid PVC), sized adequately according to anticipated flow, and anchored sufficiently. MTC recommends slope tightlines be inspected by the owner periodically to look for signs of damage or displacement requiring repair.

**Erosion Controls and Vegetation Improvements**

Implementing sturdy erosion control measures and practices during and after site preparations is necessary to limit the effects of construction on the adjacent slope area, and protect the adjacent slope environment. Standard recommendations for construction-phase erosion control are presented below. Ultimately it is the responsibility of the project designer and contractor to ensure suitable protective measures are in place at the start of construction and maintained or revised as needed throughout the project.

Disturbance of the ground surface and existing vegetation outside of the planned building footprint should be avoided in the vicinity of the slope crest. Marginal landscape areas disturbed during construction should be revegetated at the end of the construction phase.
MTC recommends the design team consider robust stabilization of surfaces where water is known to regularly daylight or sheet flow over soils along the bluff face. This may include one or a combination of proprietary erosion reduction materials, landscape fabric, rockery, plastic sheeting, or approved mechanically equivalent features.

Following construction and for long-term site use, maintaining existing downslope vegetation and installing additional beneficial ground plantings within the ancillary vicinity of the improvements and the slope itself is encouraged assuming installation is done in a manner that minimizes slope face disturbance and erosional hazard in the long term. Adding vegetation will increase the erosional and hydrologic resistance of the slope, and assist in retaining cover soils. Further information and recommendations for erosion control including typical beneficial native plantings for sloping areas are provided herein. In general, MTC recommends avoiding altering the area near the slope or on the slope face by terracing or similar landscaping unless adequately designed as part of a comprehensive improvement which also takes into account surface stability. In the event that surface alterations are proposed outside of the planned building footprint, MTC should be contacted to review and consult on the geotechnical feasibility and implementation of landscape improvement plans involving earthwork.

Stability of the slope face should be improved by planting and maintaining vegetation coverage. Installing beneficial ground plantings is encouraged. Adding vegetation will encourage rooting stabilization and in turn increase the erosional and hydrologic resistance of the slope. The section below provides general information on preferable plantings and stabilization guidelines. The severity of the slope inclination will call for careful plant selection, planning and execution to best achieve establishment and long-term surface stability. Additional erosion control measures may be required if plantings are unsuccessful in establishing on bare areas. In this event, MTC recommends the use of more robust temporary erosion control measures beyond traditional straw mats. A sufficient geotextile fabric suitable for up to 1:1 (H:V) slopes can be used to reduce erosion and encourage vegetation establishment, if necessary. It may be preferable to incorporate rolled erosion control products (RECPs) on an as needed basis during replanting activities to increase the likelihood of successful vegetation. MTC may be contacted for recommendations on erosion control products.

*Standard Erosion Protection Guidelines*

Erosion is one of the most common driving forces leading to slope instability. In addition to the above commentary, the following general recommendations should be implemented in general to reduce long-term erosion potential of the slope below the project site and maintain the present slope stability:

1. The ground surface adjacent to the building should be sloped to drain away from the building pad and slope at a 5% minimum to prevent ponding of water adjacent to the house. Footing drains
and yard drains should be incorporated as needed for the building and site design to help maintain a dry building area.

2. Minimize the volume and velocity of water that travels toward and down the slope face (via proper choice of site development features including stormwater controls discussed above).

3. Avoid accelerating slope erosion and mass wasting due to human activity such as:
   a) Adding side-cast debris to the slopes
   b) Using heavy construction equipment on or near steep slopes
   c) Excavating near adjacent steep slopes toe or on slope face
   d) Placing excavated soil near the steep slope crest

4. Prior to construction, a silt fence and/or a continuous line of straw bales should be placed on the slopeward edge of the construction area. Heavy construction equipment, construction materials, or native and imported soils should not be placed behind the erosion control devices. Suitable temporary erosion and sediment control measures should be implemented at the construction site during and immediately after ground disturbance occurs. Temporary areas bare of vegetation should be protected from erosion via a blanket of straw or rolled erosion control product (RECP) during prolonged breaks in site work and prior to reseeding or revegetation.

5. At the end of the project, all disturbed vegetation should be repaired and maintained until it is established. Concentrated surface water should not be allowed to traverse the slope during or after the construction phase of the project. Roof downspouts and footing drains should be routed into closed separate pipes which outfall into appropriate drainages. Outlets for these pipes should be protected from erosion through the use of rip-rap or some other energy dissipating device. Similarly, concentrated drainages should be captured in closed pipe systems and routed down slope to appropriate outfalls.

6. Clearing of existing vegetation outside the proposed building area on and adjacent to the existing slopes should be avoided except as approved by a qualified professional. This provides additional stability to the loose top soil and minimizes the effects of down-slope water movement. This is excepting removal of dead or dying trees if posing a direct hazard to site installations or adjacent roadways.

7. Grading or excavation of soils during construction should be accompanied by grass reseeding and re-vegetation as the project is completed. According to “Vegetation Management: A Guide for Puget Sound Bluff Property Owners” (Manashe, 1993) the following types of vegetation provide good to excellent erosion control:
### Closing Remarks:

The information included in this letter should be considered supplemental to the information contained in the above reference geotechnical reports and, as such, should be read in conjunction with any preexisting geotechnical literature for the subject site. The selected recommendations presented in this letter are not intended to supersede any specific corresponding recommendations contained in the referenced reports.

The project location is designated as a potential critical area. Upon acceptance and use of this report, and its interpretations and recommendations, the owner shall agree to indemnify and hold harmless MTC, including its owners and employees, from any adverse effects resulting from development and residence in a critical area. Ultimately it is the owner’s choice to develop and live in a geologically hazardous area, and therefore the future consequences, both anticipated and unknown, are solely the responsibility of the owner. By using this report for development of the subject property, the owner must accept and understand that it is not possible to fully anticipate all inherent risks of development within a potentially geologically hazardous critical area. The recommendations provided above are intended to reduce, but not eliminate, such risks as is practically feasible from the point of view of geotechnical engineering.

The findings of this study are limited by the level of scope applied. Our professional services were performed using that degree of care and skill ordinarily exercised, under similar circumstances, by reputable geotechnical engineers practicing in this or similar localities. No other warranties, express or implied, are intended or made.
Respectfully Submitted,


Luke Preston McCann, G.I.T.
Senior Geologist

Medhanie G. Tecle, P.E.
Engineering Manager

Attached:  
Limitations and Use of this Report
Appendix A.  Location and Vicinity Maps
Appendix B.  Site Plan Overview
Appendix C.  Slope Profile
Limitations and Use of This Letter

Recommendations contained in this report are based on our understanding of the proposed development and construction activities, our field observations and exploration and our laboratory test results. It is possible that soil and groundwater conditions could vary and differ between or beyond the points explored. If soil or groundwater conditions are encountered during construction that vary or differ from those described herein, MTC shall be notified immediately in order that a review may be made and supplemental recommendations provided. If the scope of the proposed construction, including the proposed loads or structural locations, changes from that described in this report, our recommendations shall also be reviewed.

We have prepared this letter in substantial accordance with the generally accepted geotechnical engineering practice as it exists in the site area at the time of our study. No warranty, expressed or implied, is made. The recommendations provided in this report are based on the assumption that an adequate program of tests and observations will be conducted by MTC during the construction phase in order to evaluate compliance with our recommendations. Other standards or documents referenced in any given standard cited in this report, or otherwise relied upon by the author of this report, are only mentioned in the given standard; they are not incorporated into it or “included by reference”, as that latter term is used relative to contracts or other matters of law.

This letter may be used only by Mr. Schrader, the current property owners, and their design consultants and only for the purposes stated within a reasonable time from its issuance, but in no event later than 18 months from the date of the report. Note that if another firm assumes Geotechnical Engineer of Record responsibilities, they need to review this report and either concur with the findings, conclusions, and recommendations or provide alternate findings, conclusions and recommendation under the guidance of a professional engineer registered in the State of Washington. The recommendations of this report are based on the assumption that the Geotechnical Engineer of Record has reviewed and agrees with the findings, conclusion and recommendations of this report.

Land or facility use, on- and off-site conditions, regulations, or other factors may change over time, and additional work may be required with the passage of time. Based on the intended use of the report, MTC may recommend that additional work be performed and that an updated report be issued. Non-compliance with any of these requirements by Mr. Schrader, the property owner or anyone else will release MTC from any liability resulting from the use of this report by any unauthorized party and Mr. Schrader agrees to defend, indemnify, and hold MTC harmless from any claim or liability associated with such unauthorized use or non-compliance. We recommend that MTC be given the opportunity to review the final project plans and specifications to evaluate if our recommendations have been properly interpreted. We assume no responsibility for misinterpretation of our recommendations.

The scope of work for this subsurface exploration and geotechnical report did not include environmental assessments or evaluations regarding the presence or absence of wetlands or hazardous substances in the soil, surface water, or groundwater at this site.
Appendix A. Location and Vicinity Maps

Maps Source: Google Imagery 2018

Material Testing & Consulting, Inc.
2118 Black Lake Blvd SW
Olympia, WA 98512

Site Location and Vicinity Maps
1730 25th Ave NW
Olympia, WA
Appendix B. Site Plan Overview

Maps Source:
Bracy & Thomas 2012 Survey

* Not for Construction *

Materials Testing & Consulting, Inc.
2118 Black Lake Blvd SW
Olympia, WA 98512

Site Plan with Proposed Improvements
1730 25th Ave NW Olympia, WA

FIGURE 2
Appendix C. Slope Profile

**Scale IS APPROXIMATE**
(Based on site measurements and mapped topography)

*Not for Construction*

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Materials Testing & Consulting, Inc.
2118 Black Lake Blvd SW
Olympia, WA 98512

Slope Profile – A to A’
1730 25th Ave NW
Olympia, WA

FIGURE 2
January 11, 2019
Revised February 26, 2019

Tom Schrader
RE/MAX PARKSIDE AFFILIATES
300 Deschutes Way SW # 200
Olympia, WA 98501
toms@remax.net

Subject: Report of Geotechnical Consultation
Schrader Residential Lots - South Parcel - 83002000400
1638 25th Ave NW, Olympia, WA
MTC Project No.: 18S318

Dear Mr. Schrader:

At your request, Materials Testing & Consulting, Inc. (MTC) has completed a limited-scope geotechnical and critical area consultation of the above referenced property, including site and slope visual reconnaissance, and review of past geotechnical exploration and design data for the site. The project site consists of an undeveloped residential parcel comprising a coastal bluff face. It is our understanding that the client intends to construct a new single-family residence supported by auger-cast piles.

MTC understands multiple geotechnical letters exist for the project. Due to the extent of time that has passed, and newly proposed developments, the design team requests a follow-up consultation to confirm current conditions have not deteriorated and provide any additionally necessary recommendation regarding critical area considerations and other planned developments. The following report presents the findings and conclusions of our literature review, addresses feasibility of proposed site development, and provides additional geotechnical recommendations for planning and design intended to reduce the inherent risks associated with site development within a potentially geologically hazardous area.

Document and Existing Literature Review:

Per the existing third-party geotechnical review letter (by Associated Earth Sciences, dated September 9, 2014; referencing findings by Bradley-Noble Geotechnical Services), new residential developments on site shall bear on auger cast piles with a minimum diameter of 16 inches and a minimum embedment of 40 feet below existing access road elevation to bear at elevations where very dense (N=100+) native soils were encountered in drilling explorations. Characterization of site conditions include the documented presence of shallow mass wasting events from typical coastal bluff erosion. No pervasive groundwater
table was encountered during historic past explorations. The reports provide more specific design requirements and soil parameters for piles foundations, loaded walls and access improvements. MTC confirms the original observations and recommendations appear suitable for the intended developments at this time, and recommends the original reports be referenced by the design team when considering design scenarios. Additionally, MTC provides some supplementary recommendations herein to assure design and construction do not decrease slope safety factors.

**Site Investigation Methodology:**

On December 5, 2018, an MTC staff geologist visited the site to perform visual reconnaissance of surface and topographic features of the subject property and its proximal slope for general geologic hazard assessment and site characterization. Salient slope features and existing vegetation were documented as observed in order to assess general site and slope condition as well as to look for signs of local instability of an erosional or subsurface nature currently or in the past. The local slope was observed and photographed from within the site. Direct observations of soils where exposed by localized surface erosion were used to classify soils and interpret site geology. Inferences from observations are described herein.

A project location and its vicinity map are shown in Figure 1, Appendix A. A site plan depicting the proposed home location and improvements is shown in Figure 2, Appendix B. A reconstructed slope profile is provided in Figure 3, Appendix C.

**Surface Observation:**

MTC performed general site reconnaissance to observe and document any indications of localized surface degradation or large-scale slope instability. The bluff-face, exposed root structures, and irregular crest edge geometry indicates active slope-crest-retreat is occurring to some degree, although no long-term study of the effect has been conducted. Some downslope accumulation in the form of shallow slumps were noted, confirming past observations. Small tension cracks in the existing asphalt in proximity to the crest were observed, appearing to also correlate with the shallow erosion observed across the entire slope. Daylighting perched stormwater was noted to traverse the slope face and the drainage ditch in the road. Some areas of scouring were noted near the base of the bluff, indicating the site has a moderate potential for erosion.

No indications of historic deep-seated movement were observed within or near to the residence. Topography was generally consistent, lacking significantly oversteepened areas (other than the pronounced bluff), channelized runout zones, or hummocky zones. No obvious evidence of rotational or translational failures or major toppling hazards was observed on the slopes in the proximity of the home.
No significant failure features were observed on adjacent slope areas visible from the subject property during the visit.

MTC’s extent of exploration did not include the use of advanced surveying equipment, employment of licensed surveyors, or subsurface exploration activities. MTC is not aware of the existence of any private survey data for the subject parcels at this time.

MTC’s scope of work did not include determination of seasonal groundwater elevation variations, documentation of wet season site conditions, or conclusive measurement of groundwater elevations at depths past the extent feasible for hand-operated explorations.

Discussion and Critical Area Recommendations:

The findings of MTC’s reconnaissance at the subject site appear broadly consistent with available geologic literature and do not indicate that any excessively prohibitive conditions exist for the anticipated level of development. Based on the information herein, MTC provides the following development and site-specific recommendations to be followed to minimize the inherent risks of developing a sloped property.

Since soils may be difficult to work with during periods of wet weather due to elevated soil moisture content, and frozen soil is not suitable for use as structural fill, we generally recommend that earthwork activities generally take place in late spring, summer or early fall. If wet season construction is conducted, stormwater controls and dewatering efforts may be required locally depending on total excavation depth and location as well as weather conditions during earthwork.

Limited Slope Stability & Pile Embedment

The proposed building location is located over the eastern slope face. Explorations of this study coupled with interpretation geologic literature have identified generally medium dense, unsaturated interbedded sands with varying sand and gravel content comprise the internal slope conditions.

Considering the conditions of the potential critical slope and shallow soil conditions, specific foundation requirements must be followed for successful construction at this location. Where coarse-grained cohesionless soils are present and groundwater conditions are outside the realm of internal slope influence, slope factor of safety may be determined by the following simplified relationship (Landslides: Investigation and Mitigation, Turner and Schuster, 1996):

\[
\text{Factor of Safety (FS)} = \frac{\tan(\phi)}{\tan(\alpha)}
\]

Where

- \(\phi\) = Internal friction angle of soil
- \(\alpha\) = Angle of slope or projection plane.
An average $\phi = 41$ degrees friction angle was recommended by the original geotechnical letters by Bradley-Noble Geotechnical Services, corresponding to the observed soil types and relative N values, which can be used for assessing slope factor of safety and determining a suitable building setback. Target factor of safety for residential structures is typically $FS = 1.5$ for static analysis. Factor of safety is an indication of stability; an $FS = 1.0$ or below corresponds to the point of failure. The setback projection angle for a suitable factor of safety is found by using:

$$\frac{\tan(\phi)}{\tan(\alpha)} = \frac{\tan(41)}{\tan(\alpha)} = 1.5 + \alpha$$

$$\alpha = 27 \text{ degrees}$$

MTC’s profile estimates were used to create a projection from the slope base for an $\alpha = 27$ degrees projection angle, as shown on Figure 3, emanating from the approximate toe of the slope. This geometry meets typical factor of safety requirements for residential development. Therefore, MTC recommends any new pile foundations for the proposed home or retaining walls penetrate beneath this projection plane (but not less than the depth that is required by the design detailed in the original geotechnical report i.e. 40 feet). No foundation elements shall bear above this plane, including deck and stair foundations. This will allow for slopeward pile foundation placement as necessary to accommodate the desired extent of construction.

**Horizontal Setback & Foundation Recommendations**

Horizontal setbacks were determined based on International Building Code (IBC) requirements as accepted by the State of Washington, and Thurston County. The IBC details required setback delineations for slopes less than or equal to 45 degrees. Structures in the vicinity shall maintain a minimum horizontal slope face setback, the lesser of H/3 or 40 feet from these eastern descending slope faces. MTC’s reviewed existing topographic data and general site observations made during our visit to infer general horizontal setbacks. MTC recommends the building maintain a minimum slope face setback of 16 feet between the base of any pile footing and the face of any newly graded or natural descending slope. It should be noted that the permitting authority may still require increased setbacks depending on other easement and shoreline restrictions. These can typically be achieved by embedding piles at deeper elevations.

The stability of ascending slopes is not anticipated to be impacted due to: proposed roadway surface improvements, installation of new drainage features to intercept daylighting stormwater, use of pile foundations for the house, and general stabilization imparted by engineered and embedded stem walls or basement retaining walls of the home. Therefore, MTC recommends the minimum horizontal setback of
15 feet between the closest face of the house and the toe of the upland slope to the west, which will already be adequately established by the roadway and new parking.

MTC does not recommend reducing the required embedments or setbacks unless further site-specific foundation design efforts are undertaken to ensure building and slope stability is maintained. Based on the structure setbacks determined above, we recommend that the completed project should maintain a portion of the space between the slopes and structures as a non-disturbance vegetated buffer with no permanent clearing of vegetation. The non-disturbance area should begin as close to the structure envelope as is feasible.

Heavy compaction equipment and excessive vibratory activities should not be used near adjacent steep slopes or their crest. Stockpiling of excavated tailings is to be prohibited above, near, or on slopes. Tailings should be removed to an inland area of the site, sufficiently away from the crest if temporary storage of exported/imported materials is required. Marginal areas disturbed during construction should be revegetated at the end of the construction phase, preferably using a pre-determined planting schedule.

If plans change to incorporate deep trenching, or additional excavations, or the type of installation changes, MTC should be contacted to reevaluate site conditions and provide further analysis. If additional developments, such as drainage features or other structures are considered, MTC should also be contacted for further site analysis, applicable to the type and extent of development or construction.

**Retaining Wall Recommendations:**

MTC understands the project proposes to improve the access roadway by means of the installation of an upland retaining wall with drainage improvements, as well as the installation of daylight basement retaining walls for the home. The following recommendations pertain to the design (by others) of laterally loaded retaining wall structures founded on piles. These recommendations are not applicable to: exceedingly sloping backfills, backfills composed of non-granular soil materials, braced or tied-back walls, or for walls greater than 10 feet in height. MTC expressly recommends that we review final plans and specifications for retaining walls to ensure consistency with the recommendations presented herein, and to provide additional geotechnical consultation and recommendations as needed for final design and construction.

- **Foundations**

  MTC recommends retaining wall foundations bear on piles as designed by others, founded in suitably dense native sandy soils, detailed by the original geotechnical reports to exist at or below depths of 40 feet below existing roadway elevations.
• **Active and At-Rest Pressures:**

Yielding (cantilever) retaining walls should be designed to withstand an appropriate active lateral earth pressure, whereas non-yielding (restrained) walls should be designed to withstand an appropriate at-rest lateral earth pressure. The at-rest case is applicable where retaining wall movement is confined to less than 0.005 H, where H is the wall height. If greater movement is possible, the active case applies. A wall movement of about 0.02 H will be required to develop the full passive pressure. These pressures act over the entire back of the wall and vary with the backslope inclination. For lateral pressures relative to seismic loading conditions, we recommend applying a uniform blanket seismic surcharge of 10 H psf for a generalized design situation based on our limited subsurface testing at the project site.

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• **Surcharges:**

The proposed basement retaining walls shall account for the potential surcharge of adjacent roadway improvements, and new upland stabilization features potentially bearing within the uphill zone of influence of the wall.

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The duration of time that excavations behind walls remain open should be limited to only as necessary to prepare the base pad and placement of the wall features, backfilling with drain rock and approved fill immediately. Temporary worker protections such as trench boxes or temporary shoring may be required for entering excavations deeper than 4 feet, and all OSHA safety regulations should be observed. Extended open cut periods or work proceeding in wet weather may require surface coverings, lesser cut angles, and/or temporary bracing be applied. We suggest a minimum 5-foot horizontal buffer be maintained from the temporary cut to the upslope property lines (to allow for some near-surface disturbance during excavation).
• **Wall Drainage:**

Due to the detailed elevated water table in the original geotechnical report, and tidal influences, MTC recommends the design team account for the potential effects of hydrostatic pressure, and head pressure/uplift on any new bulkhead features. To preclude build-up of hydrostatic pressure, we recommend a minimum width of 1 foot of clean, granular, free-draining material extend from the footing drain at the base of the wall to the ground surface immediately behind the wall. Native soils are not considered suitable as drainage material. Imported wall drain aggregate should conform to WSDOT Standard Specification 9-03.12(4) Gravel Backfill for Drains or 9-03.12(5) Gravel Backfill for Drywells. A filter fabric suitable for use in soil separation and water transmission is recommended to be placed against retained soil cuts behind the wall (if present) to limit migration of fines into the drain corridor. Final parameters shall be determined by the wall designer.

• **Wall Backfill:**

Native material is not considered suitable for wall backfill due to its elevated fines content. For additional wall backfills as needed, soils should be relatively granular with less than 5 percent fines (material passing the U.S. No. 200 sieve). MTC recommends wall backfill import material to conform to WSDOT Standard Specification 9-03.12(2) Gravel Backfill for Walls.

• **Wall Backfill Compaction:**

It is recommended that wall backfill be compacted to a firm and unyielding condition and at least to 95 percent of the modified Proctor maximum dry density per ASTM D1557. Wall backfill supporting landscaping elements and other non-structural components should be compacted to a relatively firm and unyielding condition.

---

**Road Improvement Planning**

Our understanding is that the improved road will service the new and existing residential home lots. As such, MTC does not anticipate high or regular traffic loads or frequent heavy loads on the proposed road. Furthermore, we assume that the road improvements will be constructed as narrowly as feasible and allowed by local jurisdiction. However, as the entire site is sloped, total avoidance is generally infeasible for the project. The currently proposed patching and installation of new drainage features is generally anticipated to improve the overall stabilization of the lower roadway. We understand the majority of the undisturbed pavement, remaining in fair condition, will remain in place.
**General Road Site Preparations**

Where roadway improvements or patching is proposed, MTC recommends removing existing surfacing and uncontrolled fills if present, buried topsoil deposits and landscape materials, as well as any organic or unsuitably loose or soft subgrade soils from beneath pavement areas. Road level should be graded down into native silty sand to sand soils. Exposed subgrade should be in a firm and unyielding condition prior to commencing further road preparations. Locally loose conditions may be recompacted in place as possible and evaluated for suitability. If unsuitably organic or loose conditions persist, we recommend over-excavating to suitably dense soils and replacing to proposed subgrade level with structural fill per the guidelines recommended below.

After excavation to subgrade level, but before placing the pavement section, soils should be evaluated for suitability by the geotechnical engineer of record. Due to the nature as a prior altered site, as well as from geotechnical site explorations conducted for the current assessment, some locations within the road footprint have been disturbed to a greater depth and may require additional preparation to establish firm subgrade. As these locations are identified during construction by methods noted above, the site preparation contractor is responsible for completing the necessary local remediation in accordance with the recommendations herein.

**Structural Fill Materials and Compaction**

All material placed below pavement areas and foundations is considered structural fill, and shall be free of deleterious material, have a maximum particle size of 6 inches, and be compactable to the required compaction level.

Existing fills and native soils of silty sand to sand are not anticipated to be suitable for re-use as a substitute for structural fill. Imported material can be used as structural fill. MTC recommends imported structural fill material should conform to Section 9-03.14(1), Gravel Borrow, of the most recent edition (at the time of construction) of the State of Washington Department of Transportation *Standard Specifications for Road, Bridge, and Municipal Construction (WSDOT Standard Specifications)*.

Prior to placement and compaction, structural fill should be moisture conditioned to within 3 percent of its optimum moisture content. Loose lifts of structural fill shall not exceed 12 inches in thickness; thinner lifts will be required for walk-behind or hand operated equipment.

We recommend all structural fill be compacted to a firm and unyielding condition and to a minimum percent compaction based on its modified Proctor maximum dry density as determined per ASTM D1557. Structural fill placed beneath each of the following shall be compacted to the indicated percent compaction, or as required by the design engineer:
Drainage Controls

MTC recommends proper drainage controls for mitigating the increased potential for stormwater runoff should be implemented along with site development to protect conditions of the site and slope. MTC anticipates on-site infiltration potential is infeasible due to the presence of shallow silty soils within the subject site. MTC does not recommend dispersion or infiltration of collected stormwater between the proposed development and slope, or on the slope itself, as increased runoff or localized stormwater inundation can negatively impact long-term erosional and global slope stability.

MTC recommends roof and footing water sources be tightlined away from the building to an existing upland catch basin and stormwater system, or down the slope to be released beyond the base using appropriate energy-dissipating features at the outfall to minimize point erosion. Roof and footing drains should be tightlined separately, or should be gathered in an appropriately sized catch basin structure and redistributed collectively. If storm drains are incorporated for impervious flatworks (driveways, patios, etc.), collected waters should also be discharged according to the above recommendations. All drainage tightlines should be composed of appropriately sturdy material (such as rigid PVC), sized adequately according to anticipated flow, and anchored sufficiently. MTC recommends slope tightlines be inspected by the owner periodically to look for signs of damage or displacement requiring repair.

Erosion Controls and Vegetation Improvements

Implementing sturdy erosion control measures and practices during and after site preparations is necessary to limit the effects of construction on the adjacent slope area, and protect the adjacent slope environment. Standard recommendations for construction-phase erosion control are presented below. Ultimately it is the responsibility of the project designer and contractor to ensure suitable protective measures are in place at the start of construction and maintained or revised as needed throughout the project.

Disturbance of the ground surface and existing vegetation outside of the planned building footprint should be avoided in the vicinity of the slope crest. Marginal landscape areas disturbed during construction should be revegetated at the end of the construction phase.

MTC recommends the design team consider robust stabilization of surfaces where water is known to regularly daylight or sheet flow over soils along the bluff face. This may include one or a combination of
proprietary erosion reduction materials, landscape fabric, rockery, plastic sheeting, or approved mechanically equivalent features.

Following construction and for long-term site use, maintaining existing downslope vegetation and installing additional beneficial ground plantings within the ancillary vicinity of the improvements and the slope itself is encouraged assuming installation is done in a manner that minimizes slope face disturbance and erosional hazard in the long term. Adding vegetation will increase the erosional and hydrologic resistance of the slope, and assist in retaining cover soils. Further information and recommendations for erosion control including typical beneficial native plantings for sloping areas are provided herein. In general, MTC recommends avoiding altering the area near the slope or on the slope face by terracing or similar landscaping unless adequately designed as part of a comprehensive improvement which also takes into account surface stability. In the event that surface alterations are proposed outside of the planned building footprint, MTC should be contacted to review and consult on the geotechnical feasibility and implementation of landscape improvement plans involving earthwork.

Stability of the slope face should be improved by planting and maintaining vegetation coverage. Installing beneficial ground plantings is encouraged. Adding vegetation will encourage rooting stabilization and in turn increase the erosional and hydrologic resistance of the slope. The section below provides general information on preferable plantings and stabilization guidelines. The severity of the slope inclination will call for careful plant selection, planning and execution to best achieve establishment and long-term surface stability. Additional erosion control measures may be required if plantings are unsuccessful in establishing on bare areas. In this event, MTC recommends the use of more robust temporary erosion control measures beyond traditional straw mats. A sufficient geotextile fabric suitable for up to 1:1 (H:V) slopes can be used to reduce erosion and encourage vegetation establishment, if necessary. It may be preferable to incorporate rolled erosion control products (RECPs) on an as needed basis during replanting activities to increase the likelihood of successful vegetation. MTC may be contacted for recommendations on erosion control products.

*Standard Erosion Protection Guidelines*

Erosion is one of the most common driving forces leading to slope instability. In addition to the above commentary, the following general recommendations should be implemented in general to reduce long-term erosion potential of the slope below the project site and maintain the present slope stability:

1. The ground surface adjacent to the building should be sloped to drain away from the building pad and slope at a 5% minimum to prevent ponding of water adjacent to the house. Footing drains and yard drains should be incorporated as needed for the building and site design to help maintain a dry building area.
2. Minimize the volume and velocity of water that travels toward and down the slope face (via proper choice of site development features including stormwater controls discussed above).

3. Avoid accelerating slope erosion and mass wasting due to human activity such as:
   a) Adding side-cast debris to the slopes
   b) Using heavy construction equipment on or near steep slopes
   c) Excavating near adjacent steep slopes toe or on slope face
   d) Placing excavated soil near the steep slope crest

4. Prior to construction, a silt fence and/or a continuous line of straw bales should be placed on the slopeward edge of the construction area. Heavy construction equipment, construction materials, or native and imported soils should not be placed behind the erosion control devices. Suitable temporary erosion and sediment control measures should be implemented at the construction site during and immediately after ground disturbance occurs. Temporary areas bare of vegetation should be protected from erosion via a blanket of straw or rolled erosion control product (RECP) during prolonged breaks in site work and prior to reseeding or revegetation.

5. At the end of the project, all disturbed vegetation should be repaired and maintained until it is established. Concentrated surface water should not be allowed to traverse the slope during or after the construction phase of the project. Roof downspouts and footing drains should be routed into closed separate pipes which outfall into appropriate drainages. Outlets for these pipes should be protected from erosion through the use of rip-rap or some other energy dissipating device. Similarly, concentrated drainages should be captured in closed pipe systems and routed down slope to appropriate outfalls.

6. Clearing of existing vegetation outside the proposed building area on and adjacent to the existing slopes should be avoided except as approved by a qualified professional. This provides additional stability to the loose top soil and minimizes the effects of down-slope water movement. This is excepting removal of dead or dying trees if posing a direct hazard to site installations or adjacent roadways.

7. Grading or excavation of soils during construction should be accompanied by grass reseeding and re-vegetation as the project is completed. According to “Vegetation Management: A Guide for Puget Sound Bluff Property Owners” (Manashe, 1993) the following types of vegetation provide good to excellent erosion control:
### Closing Remarks:

The information included in this letter should be considered supplemental to the information contained in the above reference geotechnical reports and, as such, should be read in conjunction with any preexisting geotechnical literature for the subject site. The selected recommendations presented in this letter are not intended to supersede any specific corresponding recommendations contained in the referenced reports.

The project location is designated as a potential critical area. Upon acceptance and use of this report, and its interpretations and recommendations, the owner shall agree to indemnify and hold harmless MTC, including its owners and employees, from any adverse effects resulting from development and residence in a critical area. Ultimately it is the owner’s choice to develop and live in a geologically hazardous area, and therefore the future consequences, both anticipated and unknown, are solely the responsibility of the owner. By using this report for development of the subject property, the owner must accept and understand that it is not possible to fully anticipate all inherent risks of development within a potentially geologically hazardous critical area. The recommendations provided above are intended to reduce, but not eliminate, such risks as is practically feasible from the point of view of geotechnical engineering.

The findings of this study are limited by the level of scope applied. Our professional services were performed using that degree of care and skill ordinarily exercised, under similar circumstances, by reputable geotechnical engineers practicing in this or similar localities. No other warranties, express or implied, are intended or made.
Respectfully Submitted,


Senior Geologist           Engineering Manager

Attached:  Limitations and Use of this Report
Appendix A.  Location and Vicinity Map
Appendix B.  Site Plan Overview
Appendix C.  Slope Profile
Limitations and Use of This Letter

Recommendations contained in this report are based on our understanding of the proposed development and construction activities, our field observations and exploration and our laboratory test results. It is possible that soil and groundwater conditions could vary and differ between or beyond the points explored. If soil or groundwater conditions are encountered during construction that vary or differ from those described herein, MTC shall be notified immediately in order that a review may be made and supplemental recommendations provided. If the scope of the proposed construction, including the proposed loads or structural locations, changes from that described in this report, our recommendations shall also be reviewed.

We have prepared this letter in substantial accordance with the generally accepted geotechnical engineering practice as it exists in the site area at the time of our study. No warranty, expressed or implied, is made. The recommendations provided in this report are based on the assumption that an adequate program of tests and observations will be conducted by MTC during the construction phase in order to evaluate compliance with our recommendations. Other standards or documents referenced in any given standard cited in this report, or otherwise relied upon by the author of this report, are only mentioned in the given standard; they are not incorporated into it or “included by reference”, as that latter term is used relative to contracts or other matters of law.

This letter may be used only by Mr. Schrader, the current property owners, and their design consultants and only for the purposes stated within a reasonable time from its issuance, but in no event later than 18 months from the date of the report. Note that if another firm assumes Geotechnical Engineer of Record responsibilities, they need to review this report and either concur with the findings, conclusions, and recommendations or provide alternate findings, conclusions and recommendation under the guidance of a professional engineer registered in the State of Washington. The recommendations of this report are based on the assumption that the Geotechnical Engineer of Record has reviewed and agrees with the findings, conclusion and recommendations of this report.

Land or facility use, on- and off-site conditions, regulations, or other factors may change over time, and additional work may be required with the passage of time. Based on the intended use of the report, MTC may recommend that additional work be performed and that an updated report be issued. Non-compliance with any of these requirements by Mr. Schrader, the property owner or anyone else will release MTC from any liability resulting from the use of this report by any unauthorized party and Mr. Schrader agrees to defend, indemnify, and hold MTC harmless from any claim or liability associated with such unauthorized use or non-compliance. We recommend that MTC be given the opportunity to review the final project plans and specifications to evaluate if our recommendations have been properly interpreted. We assume no responsibility for misinterpretation of our recommendations.

The scope of work for this subsurface exploration and geotechnical report did not include environmental assessments or evaluations regarding the presence or absence of wetlands or hazardous substances in the soil, surface water, or groundwater at this site.
Appendix A. Location and Vicinity Maps

Maps Source: Google Imagery 2018
Appendix B. Site Plan Overview

Maps Source:
Bracy & Thomas 2012 Survey

* Not for Construction *
Appendix C. Slope Profile

Material Testing & Consulting, Inc.
2118 Black Lake Blvd SW
Olympia, WA 98512

Slope Profile – A to A’
1638 25th Ave NW
Olympia, WA

FIGURE 2
Short Form Construction Stormwater Pollution Prevention Plan (SWPPP) Template

This Short Form Construction Stormwater Pollution Prevention Plan (SWPPP) may be used for projects less than 1-acre that require submittal of only an Abbreviated or Engineered Abbreviated Drainage Plan.

Section 1 – Project and Contact Information

Project Name/Description __________________________________________________
Contact/Owner Tom Schrader Phone number 360.507.1000
Erosion Control Supervisor Tom Schrader Phone number 360.507.1000
Emergency (after hour) contact Tom Schrader Phone number 360.507.1000

Section 2 – Site Information

Site address 1730 & 1638 25th Avenue NW, OLYMPIA, WA
Parcel # __________________________________________
Soil type A/D (Soil type A, B, C, or D & Soil series per SCS Soil survey)

To find parcel number: http://www.geodata.org/parcelsrch.asp
For soil information, see http://websoilsurvey.nrcs.usda.gov/app/

For County Use Only:
County Permit No. ____________________________ Review Date ________________________
Reviewer _______________________

Section 3 – Eligibility for Abbreviated Drainage Plan/ Short Form SWPPP

Have you reviewed Volume I, Chapter 3 to confirm that your project is eligible to use the Abbreviated Drainage Plan? YES NO

Section 4 - Project Narrative

This narrative must be completed as part of the Construction SWPPP. Any information described as part of the narrative shall be shown on the site plan. See Attached

Note: From October 1 thru April 30, clearing, grading, and other soil disturbing activities are not permitted unless it can be demonstrated that no silt laden water will discharge from the site and except with authorization from Thurston County Development Services.
### Project Description (check all that apply)

**Project Type**

<table>
<thead>
<tr>
<th>Subdivision, Type</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Family Residential Project (building permit)</td>
<td>X</td>
</tr>
<tr>
<td>Large Lot (&gt;2.5 acres)</td>
<td></td>
</tr>
<tr>
<td>Grading Permit</td>
<td></td>
</tr>
<tr>
<td>Commercial Development</td>
<td></td>
</tr>
<tr>
<td>Land Clearing</td>
<td></td>
</tr>
<tr>
<td>Conversion of native vegetation to landscaping or pasture</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
</tr>
</tbody>
</table>

**Project Areas**

<table>
<thead>
<tr>
<th>Total site area</th>
<th>SF</th>
</tr>
</thead>
<tbody>
<tr>
<td>What is the area of land disturbance?</td>
<td>7,000 SF</td>
</tr>
<tr>
<td>Area of existing impervious surfaces</td>
<td>0 SF</td>
</tr>
<tr>
<td>Area of new impervious surfaces</td>
<td>4,650 SF</td>
</tr>
<tr>
<td>Total area of new, replaced, and existing impervious surface after project improvements</td>
<td>4,650 SF</td>
</tr>
<tr>
<td>Area of existing native vegetation to be converted to landscaping or pasture</td>
<td>2,350 SF</td>
</tr>
<tr>
<td>Will there be stormwater runoff or sediment discharges to adjoining properties or waters of the U.S. from the site?</td>
<td>YES NO</td>
</tr>
<tr>
<td>If a grading permit is required, what is the total volume of grading?</td>
<td>N/A CY</td>
</tr>
</tbody>
</table>

### Additional Project Information (attach additional sheets if necessary)

________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________
________________________________________________________________________

Page 2 of 7

SWPPP Template
Existing Site Conditions

1. What existing vegetation is present on the site? (check all that apply)

<table>
<thead>
<tr>
<th>Description</th>
<th>EXIST? (Y/N)</th>
<th>% of Total Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forest</td>
<td>Y</td>
<td>100</td>
</tr>
<tr>
<td>Pasture/prairie grass</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>Pavement</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>Lawn/landscaping</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>Brush</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>Deciduous Trees</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. How does surface water drainage flows across/from the site? (check all that apply)

<table>
<thead>
<tr>
<th>Drainage Type</th>
<th>EXIST? (Y/N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sheet flow/dispersion (with runoff from site)</td>
<td>X</td>
</tr>
<tr>
<td>Sheet flow/dispersion (no runoff from site)</td>
<td></td>
</tr>
<tr>
<td>Infiltration – no surface drainage leaving site</td>
<td>X</td>
</tr>
<tr>
<td>Ditch/swale</td>
<td></td>
</tr>
<tr>
<td>Stream</td>
<td></td>
</tr>
<tr>
<td>Storm Sewer/catch basin or inlet</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
</tr>
</tbody>
</table>

3. Which of the following site condition(s) or other features of note are present on the site (indicate their location on site map)?

<table>
<thead>
<tr>
<th>Feature</th>
<th>EXIST? (Y/N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steep slopes (&gt;20%)</td>
<td>X</td>
</tr>
<tr>
<td>Large depression</td>
<td></td>
</tr>
<tr>
<td>Underground tanks</td>
<td></td>
</tr>
<tr>
<td>Springs/Seeps</td>
<td></td>
</tr>
<tr>
<td>Easements</td>
<td></td>
</tr>
<tr>
<td>Existing structures</td>
<td></td>
</tr>
<tr>
<td>Existing utilities</td>
<td></td>
</tr>
<tr>
<td>Existing roadways</td>
<td></td>
</tr>
<tr>
<td>Waters of the State (pond, stream, creek, river, etc.)</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
</tr>
</tbody>
</table>
Adjacent Areas

1. Which of the following adjacent areas could be impacted by site disturbance?

<table>
<thead>
<tr>
<th>Area</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Streams*</td>
<td></td>
</tr>
<tr>
<td>Lakes*</td>
<td></td>
</tr>
<tr>
<td>Wetlands*</td>
<td></td>
</tr>
<tr>
<td>Steep slopes*</td>
<td>X</td>
</tr>
<tr>
<td>Residential Areas</td>
<td>X</td>
</tr>
<tr>
<td>Roads</td>
<td>X</td>
</tr>
<tr>
<td>Ditches, pipes, culverts</td>
<td>X</td>
</tr>
<tr>
<td>Marine Bluff*</td>
<td>X</td>
</tr>
<tr>
<td>Other</td>
<td></td>
</tr>
</tbody>
</table>

*Note: If site is on or adjacent to a critical area, Thurston County may require additional information, engineering, and other permits to be submitted with this short-form.

2. Describe the downstream drainage path leading from the site to the receiving body of water. (Minimum distance of ¼-mile (1,320 feet))

{e.g., water flows from site, into curb-line to catch basin at intersection of X and Y streets. A 10-inch pipe system conveys water another 1,000 feet to a ravine/wetland.} (attach additional sheets if necessary)

The site topography generally slopes from the west to east. Offsite stormwater generally sheet flows onto the property along the western property line flows through the site and discharges along the eastern property line along the existing private access drive. Stormwater along 25th Avenue NW flows along south and west side of the roadway in an existing ditch. Stormwater flows down to the east to a number of culverts located on 25th Avenue where it flows under the street into a culvert that discharges at the beach at the Budd Inlet. There do not appear to be any flow restriction along the path to the beach.
**Section 5 – Abbreviated Erosion Control Plan**

Enter estimated start/end dates for the following construction activities/milestones.

<table>
<thead>
<tr>
<th>Construction Schedule</th>
<th>Estimated Start/End Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Permit obtained (start date)</td>
<td>7/15/19</td>
</tr>
<tr>
<td>2. Mark clearing limits</td>
<td>7/15/19</td>
</tr>
<tr>
<td>3. Establish construction access</td>
<td>7/15/19</td>
</tr>
<tr>
<td>4. Install sediment controls</td>
<td>7/15/19</td>
</tr>
<tr>
<td>5. Demolition</td>
<td>7/15/19</td>
</tr>
<tr>
<td>6. Grading</td>
<td>12/1/19</td>
</tr>
<tr>
<td>7. Utility construction</td>
<td>12/15/19</td>
</tr>
<tr>
<td>8. Building or structure construction</td>
<td>12/15/19</td>
</tr>
<tr>
<td>9. Landscaping/final site stabilization</td>
<td>12/15/19</td>
</tr>
</tbody>
</table>
# Complete Checklist for all Projects

<table>
<thead>
<tr>
<th>Element/ Description</th>
<th>Requirement</th>
<th>Applicable BMP(s)(^1)</th>
<th>Confirmation</th>
</tr>
</thead>
</table>
| **Mark Clearing Limits**      | Prior to beginning land-disturbing activities, mark clearing limits and delineate sensitive areas and their buffers with high visibility fence | BMP C101: Preserving Natural Vegetation  
BMP C102: Buffer Zones  
BMP C103: High Visibility Plastic Fence | Will comply □  
N/A (explain): |
| **Establish Construction Access** | Provide stabilized construction entrance (e.g., quarry spalls or crushed rock); clean public roads if any sediment is transported off site. If an existing driveway will be used for construction access, describe condition and show on Site Plan. | BMP C105: Stabilized Construction Entrance | Will comply □  
N/A (explain): |
| **Install Sediment Controls** | Provide suitable sediment control BMP to prevent sediment from leaving site. | BMP C233: Silt Fence  
BMP C234: Vegetated Strip  
BMP C235: Straw Wattles | Will comply □  
N/A (explain): |
| **Stabilize Soils**           | All unworked and exposed soils shall be stabilized to prevent erosion.  
From October 1 through April 30, no soils shall remain exposed and unworked for more than 2 days.  
From May 1 to September 30, no soils shall remain exposed and unworked for more than 7 days. | BMP C120: Temporary and Permanent Seeding  
BMP C121: Mulching  
BMP C122: Nets and Blankets  
BMP C123: Plastic Covering | Will comply □  
N/A (explain): |
| **Protect Slopes**            | Design and construct cut and fill slopes to minimize erosion. | BMP C120: Temporary and Permanent Seeding  
BMP C130: Surface Roughening | Will comply □  
N/A (explain): |
| **Protect Drain Inlets**      | Protect conveyance system from sediment by providing filtration of stormwater prior to entering inlets. | BMP C220: Storm Drain Inlet Protection | Will comply □  
N/A (explain): |
| **Control Pollutants**        | Handle and dispose of construction debris in dumpster or by hauling to waste transfer station so that it does not contaminate stormwater. | | Will comply □  
N/A (explain): |
| **Control Dewatering**        | Manage dewatering water from construction activities to prevent sediment discharge from site. Manage highly turbid dewatering water separate from stormwater. | | Will comply □  
N/A (explain): |
| **Maintain BMPs**             | Maintain BMPs to insure continued function. | | Will comply □  
N/A (explain): |
| **Manage the Project**        | Phase the project to avoid soil disturbance from Oct. 1 through April 30 if possible. Modify BMPs if not effective or to meet changed conditions. | | Will comply □  
N/A (explain): |

\(^1\) Descriptions of BMPs designated can be found in Volume II of this manual.
Section 6 – Site Plan (see attached example)

A site plan, to scale, shall be included with this checklist that shows the following items:

<table>
<thead>
<tr>
<th>Item</th>
<th>Complete</th>
</tr>
</thead>
<tbody>
<tr>
<td>Address, Parcel Number, and Street names*</td>
<td></td>
</tr>
<tr>
<td>North Arrow</td>
<td></td>
</tr>
<tr>
<td>Indicate boundaries of existing vegetation (e.g., tree lines, grassy areas, pasture areas, fields, etc.)*</td>
<td></td>
</tr>
<tr>
<td>Identify any onsite or adjacent critical areas and associated buffers (e.g., wetlands, steep slopes, streams, etc.).</td>
<td></td>
</tr>
<tr>
<td>Identify any FEMA base flood boundaries and Shoreline Management boundaries. *</td>
<td></td>
</tr>
<tr>
<td>Show existing and proposed contours. *</td>
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<tr>
<td>Delineate areas that are to be cleared and graded.</td>
<td></td>
</tr>
<tr>
<td>Show all cut and fill slopes, indicating top and bottom of slope catch lines</td>
<td></td>
</tr>
<tr>
<td>Indicate existing surface water flow direction(s).</td>
<td></td>
</tr>
<tr>
<td>Label final grade contours and indicate proposed surface water flow direction and surface water conveyance systems (e.g., pipes, catch basins, ditches, etc.).</td>
<td></td>
</tr>
<tr>
<td>Show grades, dimensions, and direction of flow in all (existing and proposed) ditches, swales, culverts, and pipes.</td>
<td></td>
</tr>
<tr>
<td>Indicate locations and outlets of any dewatering systems (usually to sediment trap).</td>
<td></td>
</tr>
<tr>
<td>Identify and locate all erosion control techniques to be used during and after construction.</td>
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</tbody>
</table>

* For GIS information on these items, see Thurston County Geodata at www.geodata.org
May 24, 2019

**Project Narrative**

There is an existing shared access drive that is paved with approximately 8-12 feet of paving throughout the length of the drive. As part of the construction of two new single family homes it is required to improve the access to meet a minimum of 12’ paved width. The attached plans shows the extent of the roadway widening along 25th Avenue. The proposal includes the widening the upper portion of roadway utilizing approximately 1,361 sf of addition asphalt. This stormwater will utilize the existing forested understory for dispersion where it will flow overland until it is infiltrated. The lower portion of road widening includes an area of approximately 3,289 sf of addition paving. This stormwater will flow into a roadside bioretention area with an underdrain that will direct stormwater to existing discharges to the Puget Sound. Most of the project is located within right of way, the rest is located in existing or proposed easements. This project discharges to the Puget Sound and is therefore exempt for LID requirements however LID elements will be utilized for this project.

**Lawn and landscaped areas:**

Post-Construction Soil Quality and Depth in accordance with BMP LID.02 in Chapter 2 of Volume V. This option is proposed to be utilized for this project.

**Other Hard Surfaces:**

The upper portion will utilize roadside sheet flow dispersion per BMP LID.06. The lower portion of road widening includes an area of approximately 3,289 sf of addition paving. This stormwater will flow into a roadside bioretention area with an underdrain that will direct stormwater to existing discharges to the Puget Sound.

Only the portion shown on the site plan is planned to be disturbed as part of this development. The project is expected to start on 7/1/19 and be completed by 12/30/19.
Appendix G  Stormwater Maintenance Agreement