GeoPacific Engineering, Inc.

Real-World Geotechnical Solutions
Investigation • Design • Construction Support

May 10, 2016
Project No. 16-4142

West Hills Properties
Mr. Howard Aster
PO Box 731
McMinnville, Oregon 97128
Phone: (503) 472-0473

c/o AKS Engineering and Forestry
Alex Hurley
12965 SW Herman Rd #100
Tualatin, Oregon 97062
Phone: (503) 563-6151

Via email with hard copies mailed upon request: Alex Hurley (alex@aks-eng.com)

SUBJECT: PRELIMINARY GEOTECHNICAL ENGINEERING REPORT
VALLEY'S EDGE PHASE 4 SUBDIVISION
WEST 2ND STREET & NW CANYON CREEK DRIVE
MCMINNVILLE, OREGON

This report presents the results of a geotechnical explorations conducted by GeoPacific Engineering, Inc. (GeoPacific) for the above-referenced project. The purpose of our work was to evaluate subsurface conditions at the site and provide preliminary recommendations for site development. The report can be finalized after grading plans are reviewed by GeoPacific. This geotechnical study was performed in accordance with GeoPacific Proposals No. P-5547 and No. P-5621 dated January 8, 2016 and April 28, 2016, respectively, and your subsequent authorization of our proposals and *General Conditions for Geotechnical Services*.

SITE DESCRIPTION AND PROPOSED DEVELOPMENT

The subject site is located on the north side of West 2nd Street in the City of McMinnville, Yamhill County, Oregon as shown on the attached Vicinity Map (Figure 1). The site is roughly rectangular in shape, as shown on the attached Site Plan (Figure 2). Topography generally slopes down to the west, southwest, south, and southeast from the central and northern portions of the site at an average grade of approximately 15 to 20 percent. Steeper slopes exist in the western portion of the site, with topography sloping down to the west at grades of up to 50 percent. Vegetation on the site consists primarily of grasses and sparse brush.

We understand that a landslide occurred on the subject site during grading and retaining wall construction on adjacent lots to the southwest of the site. The slide is approximately 100 feet wide and temporary measures, such as shallow swales to divert surface runoff and a sump drain, have been installed on the subject site. Also, between March 17, 2016 and May 3, 2016

a trench appears to have been excavated along the southern property boundary for the width of the landslide. A drain may have been installed at this location. The sump was installed in the approximate middle of the landslide mass and appears to have been installed to a depth of 10 feet.

It is our understanding that the proposed development consists of a 45 lot subdivision with grading to support new single family residences, approximately 1,900 feet of new public streets, and associated underground utilities. Grading plans have not yet been provided for our review.

SITE GEOLOGY

Regionally, the subject site lies within the Willamette Valley/Puget Sound lowland, a broad structural depression situated between the Coast Range on the west and the Cascade Range on the east. A series of discontinuous faults subdivide the Willamette Valley into a mosaic of fault-bounded, structural blocks (Yeats et al., 1996). Uplifted structural blocks form bedrock highlands, while down-warped structural blocks form sedimentary basins. Valley-fill sediment in the adjacent basin achieves a maximum thickness of 1,500 feet and overlies Miocene Columbia River Basalt at depth (Madin, 1990; Yeats et al., 1996).

Available geologic mapping indicates that the site is underlain by the Eocene age (33.9-55.8 million years ago) Nestucca Formation (Baldwin et al, 1955). The Nestucca Formation contains marina strata, consisting of siltstone and sandstone, as well as volcanic flows and tuffs.

REGIONAL SEISMIC SETTING

At least three major fault zones capable of generating damaging earthquakes are thought to exist in the vicinity of the subject site. These include the Portland Hills Fault Zone, the Gales Creek-Newberg-Mt. Angel Structural Zone, and the Cascadia Subduction Zone.

Portland Hills Fault Zone

The Portland Hills Fault Zone is a series of NW-trending faults that include the central Portland Hills Fault, the western Oatfield Fault, and the eastern East Bank Fault. These faults occur in a northwest-trending zone that varies in width between 3.5 and 5.0 miles. The combined three faults vertically displace the Columbia River Basalt by 1,130 feet and appear to control thickness changes in late Pleistocene (approx. 780,000 years) sediment (Madin, 1990). The Portland Hills Fault occurs along the Willamette River at the base of the Portland Hills, and is about 30 miles northeast of the site. The Oatfield Fault occurs along the western side of the Portland Hills, and is about 32.4 miles northeast of the site. The Oatfield Fault is considered to be potentially seismogenic (Wong, et al., 2000). Mabey et al., (1996) indicate the Portland Hills Fault Zone has experienced Late Quaternary (last 780,000 years) fault movement; however, movement has not been detected in the last 20,000 years. The accuracy of the fault mapping is stated to be within 500 meters (Wong, et al., 2000). No historical seismicity is correlated with the mapped portion of the Portland Hills Fault Zone, but in 1991 a M3.5 earthquake occurred on a NW-trending shear plane located 1.3 miles east of the fault (Yelin, 1992). Although there is no definitive evidence of recent activity, the Portland Hills Fault Zone is assumed to be potentially active (Geomatrix Consultants, 1995).

Gales Creek-Newberg-Mt. Angel Structural Zone

The Gales Creek-Newberg-Mt. Angel Structural Zone is a 50-mile-long zone of discontinuous, NW-trending faults that lies about 12.2 miles northeast of the subject site. These faults are recognized in the subsurface by vertical separation of the Columbia River Basalt and offset seismic reflectors in the overlying basin sediment (Yeats et al., 1996; Werner et al., 1992). A geologic reconnaissance and photogeologic analysis study conducted for the Scoggins Dam site in the Tualatin Basin revealed no evidence of deformed geomorphic surfaces along the structural zone (Unruh et al., 1994). No seismicity has been recorded on the Gales Creek Fault or Newberg Fault (the fault closest to the subject site); however, these faults are considered to be potentially active because they may connect with the seismically active Mount Angel Fault and the rupture plane of the 1993 M5.6 Scotts Mills earthquake (Werner et al. 1992; Geomatrix Consultants, 1995).

Cascadia Subduction Zone

The Cascadia Subduction Zone is a 680-mile-long zone of active tectonic convergence where oceanic crust of the Juan de Fuca Plate is subducting beneath the North American continent at a rate of 4 cm per year (Goldfinger et al., 1996). A growing body of geologic evidence suggests that prehistoric subduction zone earthquakes have occurred (Atwater, 1992; Carver, 1992; Peterson et al., 1993; Geomatrix Consultants, 1995). This evidence includes: (1) buried tidal marshes recording episodic, sudden subsidence along the coast of northern California, Oregon, and Washington, (2) burial of subsided tidal marshes by tsunami wave deposits, (3) paleoliquefaction features, and (4) geodetic uplift patterns on the Oregon coast. Radiocarbon dates on buried tidal marshes indicate a recurrence interval for major subduction zone earthquakes of 250 to 650 years with the last event occurring 300 years ago (Atwater, 1992; Carver, 1992; Peterson et al., 1993; Geomatrix Consultants, 1995). The inferred seismogenic portion of the plate interface lies roughly along the Oregon coast at depths of between 20 and 40 miles.

SUBSURFACE CONDITIONS

Our initial site-specific exploration was conducted on March 17, 2016. As part of our initial exploration, 15 exploratory test pits were excavated with a trackhoe to depths ranging from 2.5 to 12.5 feet. We returned to the site on May 3, 2016 to perform further exploration of the site. As part of our further study of the site, 9 additional exploratory test pits were excavated to depths ranging from 6.5 to 12 feet and one soil boring was drilled to a depth of 21.5 feet.

Approximate locations of our explorations are shown on Figure 2. It should be noted that exploration locations were located in the field by pacing distances from apparent property corners and other site features shown on the plans provided. As such, the locations of the explorations should be considered approximate.

The borehole was drilled using a portable drill rig and solid stem auger methods. At the boring location, SPT (Standard Penetration Test) sampling was performed in general accordance with ASTM D1586 using a 2-inch outside diameter split-spoon sampler and a 140-pound hammer equipped with a rope and cathead mechanism. During the test, a sample is obtained by driving the sampler 18 inches into the soil with the hammer free-falling 30 inches. The number of blows for each 6 inches of penetration is recorded. The Standard Penetration Resistance ("N-value") of the soil is calculated as the number of blows required for the final 12 inches of penetration. If 50 or more blows are recorded within a single 6-inch interval, the test is terminated, and the

blow count is recorded as 50 blows for the number of inches driven. This resistance, or N-value, provides a measure of the relative density of granular soils and the relative consistency of cohesive soils. At the completion of the boring, the hole was backfilled with bentonite.

A GeoPacific geotechnical engineer continuously monitored the field exploration program and logged the test pits and the boring. Soils observed in the explorations were classified in general accordance with the Unified Soil Classification System. Rock hardness was classified in accordance with Table 1, modified from the ODOT Rock Hardness Classification Chart. During exploration, our engineer also noted geotechnical conditions such as soil consistency, moisture and groundwater conditions. Logs of our explorations are attached to this report. The following report sections are based on the exploration program and summarize subsurface conditions encountered at the site.

Table 1 - Rock Hardness Classification Chart

ODOT Rock Hardness Rating	Field Criteria	Unconfined Compressive Strength	Typical Equipment Needed For Excavation
Extremely Soft (R0)	Indented by thumbnail	<100 psi	Small excavator
Very Soft (R1)	Scratched by thumbnail, crumbled by rock hammer	100-1,000 psi	Small excavator
Soft (R2)	Not scratched by thumbnail, indented by rock hammer	1,000-4,000 psi	Medium excavator (slow digging with small excavator)
Medium Hard (R3)	Scratched or fractured by rock hammer	4,000-8,000 psi	Medium to large excavator (slow to very slow digging), typically requires chipping with hydraulic hammer or mass excavation)
Hard (R4)	Scratched or fractured w/ difficulty	8,000-16,000 psi	Slow chipping with hydraulic hammer and/or blasting
Very Hard (R5)	Not scratched or fractured after many blows, hammer rebounds	>16,000 psi	Blasting

Topsoil Horizon: Directly underlying the ground surface in all test pits except for TP-9 and TP-11 through TP-14, we observed highly organic SILT (ML-OL) to silty CLAY (CL-OL) with fine roots. The thickness of the topsoil layer ranged from 8 to 14 inches, as summarize on Table 2 below. The topsoil horizon was generally very soft to soft.

Till Zone: Underlying the topsoil horizon in test pits TP-1, TP-3 through 8, TP-15, TP-21, , TP-22, TP-23, and TP-24 we observed a layer of disturbed native soil. This layer was generally soft and likely resulted from previous agricultural operations on the site. Therefore, it is referred to as the till zone for the purposes of this report. The till zone generally consisted of low to moderately organic silty CLAY (CL) with some fine roots.

Laboratory testing on representative samples within this layer indicate that it contains 7.5 percent organic material. The total depth of the till zone, measured from the ground surface

ranges from 18 to 36 inches, where encountered. The total depths of the till zone layer are summarized on Table 2.

Table 2 - Thicknesses of Topsoil Horizon and Till Zone in Test Pit Explorations

Test Pit Designation	Topsoil Thickness (in)	Total Depth of Topsoil and Till Zone (in)
TP-1	8	18
TP-2	12	N/A (erosional deposit)
TP-3	12	36
TP-4	10	18
TP-5	10	18
TP-6	8	22
TP-7	12	24
TP-8	10	24
TP-10	14	N/A
TP-15	10	24
TP-16	12	N/A
TP-17	10	N/A
TP-18	8	N/A
TP-19	10	N/A
TP-20	10	N/A
TP-21	10	24
TP-22	10	20
TP-23	8	16
TP-24	10	24

Erosional Deposits: Underlying the topsoil layer in test pit TP-2 we observed very soft, highly organic silty CLAY (CL-OL). It is likely that this material was deposited in the low-lying area in the northeast portion of the site by erosion. We attempted to dig a test pit in this material, but had to terminate the test pit at a depth of 5 feet due to extensive caving. Erosional deposits extended beyond the maximum depth of exploration in test pit TP-2 (5 feet).

Undocumented Fill: Directly underlying the ground surface in test pits TP-9 and TP-11 through TP-13, and underlying the topsoil layer in test pit TP-10, we observed undocumented fill material. In test pit TP-9 the undocumented fill material generally consisted of loose GRAVEL, COBBLES, and BOULDERS in a silt matrix. The consistency of the undocumented fill material in test pits TP-10 through TP-13 was highly variable, ranging from SILT (ML) to silty GRAVEL (GM) with differing amounts of organic debris and construction debris. The depths of undocumented fill material encountered in test pits TP-9 and TP-11 through TP-14 are summarized on Table 3.

Buried Topsoil: Underlying the undocumented fill material in test pits TP-10, TP-11, and TP-12, we observed a layer of buried topsoil. The buried topsoil consisted of soft to medium stiff, low to moderately organic clayey SILT (ML-OL) to silty CLAY (CL-OL) with varying amounts of organic material. In test pits TP-11 and TP-12 the layer of buried topsoil contained partially decomposed roots up to 3 inches in diameter. The total depths of buried topsoil are summarized on Table 3.

Table 3 - Depth of Undocumented Fill and Buried Topsoil in Test Pit Explorations

Test Pit Designation	Depth of Undocumented Fill (ft)	Total Depth of Undocumented Fill and Buried Topsoil (ft)
TP-9	10	N/A
TP-10	5.5	7.5
TP-11	4	5.5
TP-12	3	4
TP-13	1.7	N/A

Landslide Mass: Test pit TP-6 and boring B-1 were located in the apparent central portion of the landslide. Directly underlying the till zone in test pit TP-6, we observed silty CLAY (CL) with some fragments of siltstone which is labeled as landslide mass for the purposes of this report. The upper portion of this material was generally stiff to very stiff, but graded to medium stiff below 9.5 feet. We observed that the landslide mass soils from 11 to 11.5 feet had a disturbed texture. We also observed rapid groundwater seepage at depths of 11 to 11.5 feet, which appeared to occur at the same plane in all sides of the test pit. Below 11.5 feet, soils became very stiff which may indicate that the landslide mass is 11.5 feet thick at the location of test pit TP-6.

In boring B-1, we encountered similar soil conditions to test pit TP-6, with the landslide mass generally consisting of silty CLAY (CL) with some fragments of siltstone and a slight disturbed texture. The upper 10 feet of the landslide mass was generally medium stiff to stiff with SPT N-values of N=6 to N=8. However, when driving the sampler at a depth of 10 feet, we observed that it only took 1 blow to drive the first six inches and 2 blows to drive the next six inches. The low blow counts observed from 10 to 11 feet bgs indicate the presence of the slide plane and that the slide mass is approximately 11 feet thick at the location of boring B-1.

Alluvium: Underlying the buried topsoil horizon in test pits TP-11 and TP-12, we observed alluvial soil deposits. Alluvium soils generally consisted of soft, gravelly CLAY (CL) to gravelly SILT (ML). The gravel was generally subrounded. Alluvium soils extended to a depth of 9.5 feet in test pits TP-11 and TP-12.

Colluvium: Underlying the till zone in test pits TP-1, TP-2 through TP-5, TP-7, TP-8, TP-15, TP-21, and TP-22, underlying the undocumented fill material in test pits TP-9 and TP-13, and underlying the alluvium in test pits TP-11 and TP-12, we observed soils derived from ancient colluvial debris flows of the native Nestucca Formation. The colluvial soils generally consisted of silty CLAY (CL) to highly plastic CLAY (CH) with varying amounts of angular, sand to gravel-size fragments of siltstone. The consistency of the colluvium soils ranged from medium stiff to hard. Colluvium soils extended to depths of 8 feet in test pit TP-4, 2 feet in test pit TP-5, 7 feet in test pit TP-7, 6 feet in test pit TP-8, 11 feet in test pit TP-12, 3 feet in test pit TP-13, 4 feet in test pit TP-21, 9.5 feet in test pit TP-22

Colluvium soils extended beyond the maximum depth of exploration in test pit TP-1, TP-3, TP-9, TP-11, and TP-15. On March 3, 2016 when soils were wetter, caving frequently occurred in the sidewalls of our test pits. On May 3, 2016 when soils were dryer we did not observe significant caving.

Portions of the colluvial soils were observed to display highly plasticity. Highly plastic CLAY (CH) was encountered below a depth of 1.5 feet in test pit TP-1, below a depth of 3 feet in test pit TP-3, from 6 to 8 feet in test pit TP-4, and below a depth of 2.5 to 6 feet in test pit TP-8, from 2 to 4 feet in test pit TP-21, and from 1.5 to 9.5 feet in test pit TP-22.

Laboratory tests indicated that this material has a plasticity index of 70.1 and liquid limit of 104, which indicates a very high plasticity. We subcontracted Northwest Testing, Inc. to perform expansion index testing on this soil. A representative sample taken at a depth of 3 feet in test pit TP-1 exhibited an expansion index of 156, indicating a very high potential for shrinkage and swelling with changes in moisture content. The depths and thicknesses of soil with very high expansion potential are summarized on the following table.

Table 4 – Summary of Depths of Soil with Very High Expansion Potential

Test Pit Designation	Depth of Soil with Very High Expansion Potential (ft)
TP-1	>1.5
TP-3	3
TP-4	6 - 8
TP-8	2.5 - 6
TP-21	2 - 4
TP-22	1.5 – 9.5

Nestucca Formation: Underlying the colluvium soils in test pits TP-4, TP-5, TP-7, TP-8, TP-12, TP-13, TP-21, and TP-22, the ground surface in test pit TP-14, the buried topsoil horizon in test pits TP-10 and TP-16, TP-17, the till zone in test pits TP-23 and TP-24, and the landslide mass in boring B-1 we observed materials belonging the Nestucca Formation. The Nestucca Formation soils generally consisted of siltstone. In test pit TP-4 we observed that the bedding of the siltstone appeared to be relatively level. In boring B-1 we observed a layer of residual soil consisting of highly plastic CLAY (CH), derived from in-place weathering of the Nestucca Formation.

Basalt belonging to or intruding into the Nestucca Formation was encountered in test pits TP-14, TP-16, TP-17, TP-18, TP-20. Practical refusal was obtained on basalt in test pits TP-14, TP-16, TP-17, and TP-18 at depths of 2.5, 6.5, 7, and 7.5 feet, respectively. In test pit TP-20, we were to excavate through the layer of basalt from 1 to 7.5 feet, and into the underlying siltstone. In test pit TP-20 the basalt layer contained a 2-foot diameter chunk of soft (R2) siltstone, centered at a depth of approximately 2.5 feet.

Residual soil derived from in-place weathering of basalt was encountered in test pits TP-18 and TP-19. The residual soil of basalt generally consisted of silty CLAY (CL) with some gravel and cobble-size basalt clasts and extended to a depth of 2.5 feet in test pit TP-18 and to a depth of 8 feet in test pit TP-19.

Practical refusal was obtained on siltstone in test pits TP-5, TP-8, TP-13, TP-19, TP-20, TP-21, TP-23, and TP-24 at depths of 5 to 6.5, 8, 9, 12, 11, 6.5 to 8.5, 7.5, and 8 feet, respectively. The depths of practical refusal are summarized on the following table.

Table 5 - Depths of Practical Refusal in Test Pit Explorations

Test Pit Designation	Depth of Refusal (ft)	Material
TP-5	5-6.5	Siltstone
TP-8	8	Siltstone
TP-13	9	Siltstone
TP-14	2.5	Basalt
TP-16	6.5	Basalt
TP-17	7	Basalt
TP-18	7.5	Basalt
TP-19	12	Siltstone
TP-20	11	Siltstone
TP-21	6.5-8.5	Siltstone
TP-23	7.5	Siltstone
TP-24	8	Siltstone

Soil Moisture and Groundwater

On March 17, 2016, we encountered seepage in all test pits except test pits TP-1, TP-8, TP-9, TP-13, and TP-14. In some locations the rate of groundwater seepage was rapid, visually estimated at 10 gallons per minute or more. Groundwater was encountered at a depth of 7 feet in test pit TP-12. On March 17, 2016 we observed that the water level in the sump installed in the central portion of the landslide was approximately 9 feet beneath the ground surface and that a pump installed in the sump was running frequently. We also observed running water on the ground surface along the west and east property boundaries.

On May 3, 2016, we encountered groundwater seepage at a depth of 9.5 feet in test pit TP-22 and at a depth of 8 feet in test pit TP-24. Groundwater seepage encountered in test pits TP-22 and TP-24 was very slow, visually estimated at less than 1 gallon per minute. We did not observe groundwater seepage in boring B-1, but the side of the sampler was wet at a depth of 20 to 21.5 feet and the soil from 10 to 11.5 feet was very moist to wet. Also, on May 3, 2016 we measured groundwater at a depth of 7 feet in the sump installed in the central portion of the landslide and that the pump had been removed from the sump. On May 3, 2016 we did not observe running water on the ground surface along the west and east property boundaries.

Experience has shown that temporary storm related perched groundwater within the near surface soils often occur over fine-grained native deposits such as those beneath the site during the wet season, particularly in clay soils such as were identified in the test pits. It is anticipated that groundwater conditions will vary depending on the season, local subsurface conditions, changes in site utilization, and other factors.

PORTABLE DYNAMIC CONE PENETROMETER TESTING - INTERIOR STREETS

As part of this study, GeoPacific evaluated the subgrade conditions for the proposed interior public streets. On March 17, 2016 GeoPacific performed field testing of subgrade strength using a portable dynamic cone penetrometer (PDCP) to determine the strength parameters of the soil for support of crushed aggregate surfacing. The PDCP tests were performed at the approximate locations of test pits TP-1, TP-7, and TP-15. Representative California Bearing

Ratio (CBR) values at each test location are summarized on Table 6, for the depth intervals indicated.

Table 6 - PDCP Field Test Results and Representative CBR Values

Field Test Designation	Material Tested	Depth Interval of Test (feet)	Representative CBR Value
TP-1	Native Clay	1.6-2.4	4
TP-7	Native Clay	1.5-2.4	3.5
TP-15	Native Clay	1.4-2.5	3.5

The test results indicate moderate subgrade soil conditions for support of traffic loading. A low-end CBR value of 3.5 was used for subgrade soils in our analyses for the proposed interior public streets, discussed in a subsequent report section.

PRELIMINARY CONCLUSIONS AND RECOMMENDATIONS

Based on the results of our geotechnical investigation, there are several significant geotechnical issues for project completion. Although we consider the proposed development to be geotechnically feasible, we anticipate that the overall feasibility of the proposed development will depend on the cost of construction. The most significant geotechnical issues currently known to us are listed below.

1) *Existing slopes in the central and northeastern portions of the site are marginally stable*- As evidenced by the recent landslide which occurred on the site by grading on the adjacent site, the existing slopes are marginally stable and may be negatively affected by grading activities on the site. No additional fill material should be placed on existing slopes without remedial measures. In order to improve the stability of existing slopes in the central and northeastern portions of the site, we recommend that the colluvial soils along the downslope portions of the site be removed down to competent native soil and replaced with an engineered fill slope buttress. The fill slope buttress should incorporate a keyway, drainage measures, and cement-treated engineered fill material.

2) *Presence of a recently active landslide* - We recommend that the existing landslide mass be completely removed down to competent native soils. This work should only be attempted in a dry weather season. The slide plane was encountered at a depth of 11.5 feet in test pit TP-6 and at a depth of 10 to 11 feet in boring B-1. An engineered fill slope buttress may be constructed at the location of the existing landslide, with a keyway, drainage measures, and cement-treated engineered fill material.

3) *Significant depths of undocumented fill material, buried topsoil, erosional deposits, and soft alluvium* – Undocumented fill material, buried topsoil, erosional deposits, and soft alluvium should be completely removed and the excavations backfilled with engineered fill.

4) *Presence of expansive soils* - Where highly expansive soils are present within 5 feet of foundation subgrade elevation, the highly expansive soils should be over-excavated to a depth of 5 feet below foundation subgrade or below the highly expansive soils, whichever is shallower. After highly expansive soils have been over-excavated, the lots

should be backfilled to finished grade with compacted structural fill consisting of soils with low expansion potential.

5) *Deep till zone* - Due to the organic content of the till zone (7.5 percent), it is must be blended with other materials in order to be used as engineered fill.

6) *Groundwater seepage and perched groundwater at relatively shallow depths* – On March 17, 2016 groundwater seepage was encountered at relatively shallow depths in test pits TP-2 through TP-7, TP-10 through TP-12, and TP-15. Groundwater was encountered at a depth of 7 feet in test pit TP-12. On May 3, 2016 groundwater seepage was encountered in test pits TP-22 and TP-24.

7) *Caving issues for trench excavations* – On March 17, 2016 in colluvium soils the sides of the test pits frequently caved in, indicating that special attention will need to be paid to the stability of trench sidewalls during installation of utilities.

8) *Hard rock at relatively shallow depths in portions of the site* – Practical refusal was obtained in several test pits at the depths summarized on Table 5.

The following report sections provide recommendations for site development and construction in accordance with the current applicable codes and local standards of practice. These recommendations are considered preliminary because grading plans have not yet been finalized. The report can be finalized after grading plans are reviewed by GeoPacific. GeoPacific should be consulted to review the proposed grading plans and to provide specific recommendations for the proposed plans prior to construction.

General Slope Stability – Fill Buttress on Downslope Side of the Site

Based on the results of our geotechnical investigation, the downslope sections of existing slopes in the central and eastern portions of the site are underlain by colluvium. This material is considered marginally stable. No fill material should be placed on existing slopes in the central and northeastern portions of the site without remedial measures.

In order to improve the stability of existing slopes in the central and northeastern portions of the site, we recommend that the colluvial soils along the downslope portions of the site be removed down to competent native soil and replaced with an engineered fill slope buttress. The fill slope buttress should incorporate a keyway, drainage measures, and cement-treated engineered fill material. A typical detail for the engineered fill slope buttress is shown on Figure 3. For preliminary planning purposes, we anticipate that the fill slope buttress will need to be constructed across lots 26 through 34, as shown on the attached Site Plan (Figure 2). The extent of the fill buttress will depend on proposed site grading and may need to extend across Lots 21 through 24 as well.

We recommend that surface runoff be collected and water discharged to a suitable location in a controlled manner. In no case should uncontrolled stormwater runoff be allowed to flow over slopes.

Remediation of Recently Active Landslide

We understand that a landslide occurred on the subject site during grading and retaining wall construction on adjacent lots to the south of the site. The slide is approximately 100 feet wide

and temporary measures, such as shallow swales to divert surface runoff and a sump, have been installed on the subject site. Between March 17, 2016 and May 3, 2016 it appears that a trench was excavated by others along the southern property boundary for the width of the landslide. A drain may have been installed in this trench. The sump was installed in the approximate middle of the landslide mass and appears to have been installed to a depth of 10 feet. However, on May 3, 2016 the pump had been removed from the sump and water was measured at a depth of 7 feet beneath the ground surface.

Based on the results of our geotechnical investigation, the slide plane of the existing landslide appears to have been encountered at a depth of 11.5 feet in test pit TP-6 and at a depth of 10 to 11 feet in boring B-1.

We recommend that the landslide mass be completely removed down to competent native soils. This work should only be attempted in a the dry weather season. An engineered fill slope buttress, as described in the previous report section, may be constructed at the location of the existing landslide, with a keyway, drainage measures, and cement treated fill material. A preliminary cross section of the engineered fill slope buttress is shown on Figure 3.

Site Preparation

Areas of proposed buildings, streets, and areas to receive fill should be cleared of vegetation and any organic and inorganic debris. Inorganic debris should be removed from the site. Organic materials from clearing should either be removed from the site or placed as landscape fill in areas not planned for structures.

Organic-rich topsoil should then be stripped from construction areas of the site or where engineered fill is to be placed. The estimated average necessary depth of removal in undisturbed areas for moderately to highly organic soils is 11 inches. The topsoil layer ranges in thickness from 8 to 14 inches, as summarized in Table 2. Deeper stripping to remove large tree roots or other organics may be necessary in localized areas. The final depth of soil removal will be determined on the basis of a site inspection after the stripping/excavation has been performed. Stripped topsoil should be stockpiled only in designated areas and stripping operations should be observed and documented by the geotechnical engineer or his representative.

The till zone soils contain too much organic material to be suitable for foundation subgrade or to be reused as engineered fill. As summarized on Table 2, the till zone soils extended to depths of 18 to 36 inches, with an average depth of approximately 23 inches. This material must be blended with other soils to reach an organic content of 5 percent or less in order to be reused as engineered fill. Therefore, till zone soils should either be completely removed from the site, placed as landscape fill in areas not planned for structures, or blended to an appropriate organic content and reused as engineered fill.

Any remaining undocumented fill material, buried topsoil, soft alluvium, erosional deposits, and subsurface structures (tile drains, basements, driveway and landscaping fill, old utility lines, septic leach fields, etc.) should be removed and the excavations backfilled with engineered fill. Depths of undocumented fill material and buried topsoil are summarized on Table 3. Soft alluvium soils were encountered in test pits TP-11 and TP-12. To a depth of 9.5 feet. Erosional deposits extended beyond a depth of 5 feet in test pit TP-2.

Highly plastic, highly expansive clay was encountered in test pits TP-1, TP-3, TP-4, TP-8, TP-12, and TP-22. Expansive soils may also be present in other areas of the site, outside of our explorations. Expansion index testing of clay material from test pit TP-1 indicates the highly plastic clay on the site has a very high potential for expansion and shrinkage. The depths of highly expansive clay are summarized on Table 4.

Where highly expansive soils are present within 5 feet of foundation subgrade elevation, the highly expansive soils should be over-excavated to a depth of 5 feet below foundation subgrade or below the highly expansive soils, whichever is shallower. The highly plastic clay material should also be removed 5 feet horizontally beyond the building envelopes. Other areas of potentially expansive clay may exist on the site outside of our explorations. The proposed on site public streets are comprised of flexible pavements that are not significantly impacted by expansive soils, therefore no soil removal is recommended within the streets.

Other alternatives may be considered for addressing the presence of expansive soils on the site, depending on the final grading plan. Alternatives may include placing at least 5 feet of engineered fill over the layer of expansive soil or treating the potentially expansive soil with cement or chemicals such as CondorSF and recompacting it. Additional measures may include installation of footing perimeter drains, elimination of deep-rooted plants and irrigation systems adjacent to structures, and placement of additional reinforcing steel in footings and floor slabs.

Once stripping/excavation of a particular area is approved, the area must be ripped or tilled to a depth of 12 inches, moisture conditioned, root-picked, and compacted in-place prior to the placement of engineered fill or crushed aggregate base for pavement. Exposed subgrade soils should be evaluated by the geotechnical engineer. For large areas, this evaluation is normally performed by proof-rolling the exposed subgrade with a fully loaded scraper or dump truck. For smaller areas where access is restricted, the subgrade should be evaluated by probing the soil with a steel probe. Soft/loose soils identified during subgrade preparation should be compacted to a firm and unyielding condition, over-excavated and replaced with engineered fill (as described below), or stabilized with rock prior to placement of engineered fill. The depth of overexcavation, if required, should be evaluated by the geotechnical engineer at the time of construction.

Engineered Fill

All grading for the proposed development should be performed as engineered grading in accordance with the applicable building code at time of construction with the exceptions and additions noted herein. Proper test frequency and earthwork documentation usually requires daily observation and testing during stripping, rough grading, and placement of engineered fill. Imported fill material must be approved by the geotechnical engineer prior to being imported to the site. Oversize material greater than 6 inches in size should not be used within 3 feet of foundation footings, and material greater than 12 inches in diameter should not be used in engineered fill.

Engineered fill should be compacted in horizontal lifts not exceeding 8 inches using standard compaction equipment. We recommend that engineered fill be compacted to at least 95% of the maximum dry density determined by Standard Proctor AASHTO T-99 or equivalent. Field density testing should conform to ASTM D2922 and D3017, or D1556. All engineered fill should be observed and tested by the project geotechnical engineer or his representative. Typically, one density test is performed for at least every 2 vertical feet of fill placed or every 500 yd^3, whichever requires more testing. Because testing is performed on an on-call basis, we

recommend that the earthwork contractor be held contractually responsible for test scheduling and frequency.

Site earthwork will be impacted by soil moisture and shallow groundwater conditions. Earthwork in wet weather would likely require extensive use of cement, lime, or chemical treatment, or other special measures, at considerable additional cost compared to earthwork performed under dry-weather conditions.

Excavating Conditions and Utility Trenches

Subsurface test pit exploration indicates that medium hard basalt and siltstone belonging to the Nestucca Formation exists at relatively shallow depths in portions of the site. Practical refusal was obtained with the small trackhoe used in our geotechnical investigation in many of the test pits. The depths of practical refusal are summarized on Table 5.

We anticipate that native silts and clays can be excavated using conventional heavy equipment such as dozers and trackhoes. Excavating into rock may require blasting or specialized equipment such as rock chippers or trackhoes fitted with rock teeth.

Maintenance of safe working conditions, including temporary excavation stability, is the responsibility of the contractor. Actual slope inclinations at the time of construction should be determined based on safety requirements and actual soil and groundwater conditions. All temporary cuts in excess of 4 feet in height should be sloped in accordance with U.S. Occupational Safety and Heath Administration (OSHA) regulations (29 CFR Part 1926), or be shored. The existing soils classify as Type B Soil and temporary excavation side slope inclinations as steep as 1H:1V may be assumed for planning purposes. This cut slope inclination is applicable to excavations above the water table only. Maintenance of safe working conditions, including temporary excavation stability, is the responsibility of the contractor. Actual slope inclinations at the time of construction should be determined based on safety requirements and actual soil and groundwater conditions.

Saturated soils and groundwater may be encountered in utility trenches, particularly during the wet season. We anticipate that dewatering systems consisting of ditches, sumps and pumps would be adequate for control of perched groundwater. Regardless of the dewatering system used, it should be installed and operated such that in-place soils are prevented from being removed along with the groundwater.

Vibrations created by traffic and construction equipment may cause some caving and raveling of excavation walls. In such an event, lateral support for the excavation walls should be provided by the contractor to prevent loss of ground support and possible distress to existing or previously constructed structural improvements.

PVC pipe should be installed in accordance with the procedures specified in ASTM D2321. We recommend that trench backfill be compacted to at least 95% of the maximum dry density obtained by Standard Proctor ASTM D698 or equivalent. Initial backfill lift thickness for a ¾"-0 crushed aggregate base may need to be as great as 4 feet to reduce the risk of flattening underlying flexible pipe. Subsequent lift thickness should not exceed 1 foot. If imported granular fill material is used, then the lifts for large vibrating plate-compaction equipment (e.g. hoe compactor attachments) may be up to 2 feet, provided that proper compaction is being achieved and each lift is tested. Use of large vibrating compaction equipment should be

carefully monitored near existing structures and improvements due to the potential for vibration-induced damage.

Adequate density testing should be performed during construction to verify that the recommended relative compaction is achieved. Typically, one density test is taken for every 4 vertical feet of backfill on each 200-lineal-foot section of trench.

Erosion Control Considerations

During our field exploration program, we did not observe soil types that would be considered highly susceptible to erosion. In our opinion, the primary concern regarding erosion potential will occur during construction, in areas that have been stripped of vegetation. Erosion at the site during construction can be minimized by implementing the project erosion control plan, which should include judicious use of straw bales and silt fences. If used, these erosion control devices should be in place and remain in place throughout site preparation and construction.

Erosion and sedimentation of exposed soils can also be minimized by quickly re-vegetating exposed areas of soil, and by staging construction such that large areas of the project site are not denuded and exposed at the same time. Areas of exposed soil requiring immediate and/or temporary protection against exposure should be covered with either mulch or erosion control netting/blankets. Areas of exposed soil requiring permanent stabilization should be seeded with an approved grass seed mixture, or hydroseeded with an approved seed-mulch-fertilizer mixture.

Wet Weather Earthwork

Soils underlying the site are likely to be moisture sensitive and may be difficult to handle or traverse with construction equipment during periods of wet weather. Earthwork is typically most economical when performed under dry weather conditions. Earthwork performed during the wet-weather season will probably require expensive measures such as cement treatment or imported granular material to compact fill to the recommended engineering specifications. If earthwork is to be performed or fill is to be placed in wet weather or under wet conditions when soil moisture content is difficult to control, the following recommendations should be incorporated into the contract specifications.

- Earthwork should be performed in small areas to minimize exposure to wet weather. Excavation or the removal of unsuitable soils should be followed promptly by the placement and compaction of clean engineered fill. The size and type of construction equipment used may have to be limited to prevent soil disturbance. Under some circumstances, it may be necessary to excavate soils with a backhoe to minimize subgrade disturbance caused by equipment traffic;
- The ground surface within the construction area should be graded to promote run-off of surface water and to prevent the ponding of water;
- Material used as engineered fill should consist of clean, granular soil containing less than 5 percent fines. The fines should be non-plastic. Alternatively, cement treatment of on-site soils may be performed to facilitate wet weather placement;
- The ground surface within the construction area should be sealed by a smooth drum vibratory roller, or equivalent, and under no circumstances should be left uncompacted and

exposed to moisture. Soils which become too wet for compaction should be removed and replaced with clean granular materials;

- Excavation and placement of fill should be observed by the geotechnical engineer to verify that all unsuitable materials are removed and suitable compaction and site drainage is achieved; and
- Straw waddles and/or geotextile silt fences should be strategically located to control erosion.

If cement or lime treatment is used to facilitate wet weather construction, GeoPacific should be contacted to provide additional recommendations and field monitoring.

New Pavement Sections for Proposed Interior Light-Duty Public Roads

We understand that approximately 1,900 feet of new light-duty public roads are to be constructed on the site. The proposed new streets within the subdivision will be surfaced with asphalt pavement. We assume the proposed new streets will be subjected to an initial two-way ADT (average daily traffic count) of 250 vehicles per day. Further, we assumed 2 percent of the vehicles will be heavy trucks (FHWA Class 5 or greater). For design purposes, we used an estimated resilient modulus of 5,250 pci for existing subgrade soils. This correlates to a CBR value of about 3.5, which is consistent with our PDCP test results.

Table 7 presents the recommended section thicknesses for the proposed public streets that are to be completed as part of the project, under dry weather construction conditions. In our opinion, this pavement section is suitable to support the anticipated levels of traffic. See attached pavement section calculations for details.

Table 7 - Recommended Minimum Dry-Weather Pavement Section

Material Layer	Section Thickness (in)	Compaction Standard
Asphaltic Concrete (AC)	3	91%/ 92% of Rice Density AASHTO T-209
Crushed Aggregate Base ¾"-0 (leveling course)	2	95% of Modified Proctor AASHTO T-180
Crushed Aggregate Base 1½"-0	8	95% of Modified Proctor AASHTO T-180
Subgrade	12	95% of Standard Proctor AASHTO T-99

The subgrade should be ripped or tilled to a depth of 12 inches (as permitted by existing utilities), moisture conditioned, root-picked, and compacted in-place prior to the placement of crushed aggregate base for pavement. Any pockets of organic debris or loose fill encountered during ripping or tilling should be removed and replaced with engineered fill (see *Site Preparation* Section). In order to verify subgrade strength, we recommend proof-rolling directly on subgrade with a loaded dump truck during dry weather and on top of base course in wet weather. Soft areas that pump, rut, or weave should be stabilized prior to paving.

If pavement areas are to be constructed during wet weather, the subgrade and construction plan should be reviewed by the project geotechnical engineer at the time of construction so that condition specific recommendations can be provided. The moisture sensitive subgrade soils

make the site a difficult wet weather construction project. General recommendations for wet weather pavement sections are provided below.

During placement of pavement section materials, density testing should be performed to verify compliance with project specifications. Generally, one subgrade, one base course, and one asphalt compaction test is performed for every 100 to 200 linear feet of paving.

Wet Weather Construction Pavement Section

This section presents our recommendations for wet weather pavement section and construction, which are for on-site and off-site light duty public streets, and for off-site improvements to SW Taylors Ferry Road to be constructed as part of the project. These wet weather pavement section recommendations are intended for use in situations where it is not feasible to compact the subgrade soils to project requirements, due to wet subgrade soil conditions, and/or construction during wet weather.

Based on our site review, we recommend a wet weather section with a minimum subgrade deepening of 6 inches to accommodate a working subbase of additional 1½"-0 crushed rock. Geotextile fabric, Mirafi 500x or equivalent, should be placed on subgrade soils prior to placement of base rock.

In some instances it may be preferable to use Special Treated Base (STB) in combination with overexcavation and increasing the thickness of the rock section. GeoPacific should be consulted for additional recommendations regarding use of STB in wet weather pavement sections if it is desired to pursue this alternative. Cement treatment of the subgrade may also be considered instead of overexcavation. For planning purposes, we anticipate that treatment of the on site soils would involve mixing cement powder to approximately 6 percent cement content and a mixing depth on the order of 12 inches.

With implementation of the above recommendations, it is our opinion that the resulting pavement section will provide equivalent or greater structural strength than the dry weather pavement section currently planned. However, it should be noted that construction in wet weather is risky and the performance of pavement subgrades depend on a number of factors including the weather conditions, the contractor's methods, and the amount of traffic the road is subjected to. There is a potential that soft spots may develop even with implementation of the wet weather provisions recommended in this letter. If soft spots in the subgrade are identified during roadway excavation, or develop prior to paving, the soft spots should be overexcavated and backfilled with additional crushed rock.

During subgrade excavation, care should be taken to avoid disturbing the subgrade soils. Removals should be performed using an excavator with a smooth-bladed bucket. Truck traffic should be limited until an adequate working surface has been established. We suggest that the crushed rock be spread using bulldozer equipment rather than dump trucks, to reduce the amount of traffic and potential disturbance of subgrade soils.

Care should be taken to avoid overcompaction of the base course materials, which could create pumping, unstable subgrade soil conditions. Heavy and/or vibratory compaction efforts should be applied with caution. Following placement and compaction of the crushed rock to project specifications (95% of Modified Proctor), a finish proof-roll should be performed before paving.

The above recommendations are subject to field verification. GeoPacific should be on-site during construction to verify subgrade strength and to take density tests on the engineered fill, base rock and asphaltic pavement materials.

Spread Foundations

The proposed residential structures may be supported on shallow foundations bearing on competent undisturbed, native soils and/or engineered fill, appropriately designed and constructed as recommended in this report. As previously discussed, expansive soils should be over-excavated to a depth of 5 feet below foundation subgrade or below the highly expansive soils, whichever is shallower. After highly expansive soils have been over-excavated, the lots should be backfilled to finished grade with compacted structural fill.

Foundation design, construction, and setback requirements should conform to the applicable building code at the time of construction. For maximization of bearing strength and protection against frost heave, spread footings should be embedded at a minimum depth of 12 inches below exterior grade.

The anticipated allowable soil bearing pressure is 1,500 lbs/ft^2 for footings bearing on competent, native soil and/or engineered fill. A maximum chimney and column load of 30 kips is preliminarily recommended for the site. The recommended maximum allowable bearing pressure may be increased by 1/3 for short-term transient conditions such as wind and seismic loading. For heavier loads, the geotechnical engineer should be consulted. The coefficient of friction between on-site soil and poured-in-place concrete may be taken as 0.42, which includes no factor of safety. The maximum anticipated total and differential footing movements (generally from soil expansion and/or settlement) are 1 inch and ¾ inch over a span of 20 feet, respectively. We anticipate that the majority of the estimated settlement will occur during construction, as loads are applied. Excavations near structural footings should not extend within a 1H:1V plane projected downward from the bottom edge of footings.

Footing excavations should penetrate through topsoil and any loose soil to competent subgrade that is suitable for bearing support. All footing excavations should be trimmed neat, and all loose or softened soil should be removed from the excavation bottom prior to placing reinforcing steel bars. Due to the moisture sensitivity of on-site native soils, foundations constructed during the wet weather season may require overexcavation of footings and backfill with compacted, crushed aggregate.

Below-Grade Structural Walls

Lateral earth pressures against below-grade retaining walls will depend upon the inclination of any adjacent slopes, type of backfill, degree of wall restraint, method of backfill placement, degree of backfill compaction, drainage provisions, and magnitude and location of any adjacent surcharge loads. At-rest soil pressure is exerted on a retaining wall when it is restrained against rotation. In contrast, active soil pressure will be exerted on a wall if its top is allowed to rotate or yield a distance of roughly 0.001 times its height or greater.

If the subject retaining walls will be free to rotate at the top, they should be designed for an active earth pressure equivalent to that generated by a fluid weighing 35 pcf for level backfill against the wall. For restrained walls, an at-reset equivalent fluid pressure of 54 pcf should be used in design, again assuming level backfill against the wall. These values assume that the

recommended drainage provisions are incorporated, hydrostatic pressures are not allowed to develop against the wall, and free draining granular backfill is utilized.

During a seismic event, lateral earth pressures acting on below-grade structural walls will increase by an incremental amount that corresponds to the earthquake loading. Based on the Mononobe-Okabe equation and peak horizontal accelerations appropriate for the site location, seismic loading should be modeled using the active or at-rest earth pressures recommended above, plus an incremental rectangular-shaped seismic load of magnitude 6.5H, where H is the total height of the wall.
We assume relatively level ground surface below the base of the walls. As such, we recommend passive earth pressure of 320 pcf for use in design, assuming wall footings are cast against competent native soils or engineered fill. If the ground surface slopes down and away from the base of any of the walls, a lower passive earth pressure should be used and GeoPacific should be contacted for additional recommendations.

A coefficient of friction of 0.42 may be assumed along the interface between the base of the wall footing and subgrade soils. The recommended coefficient of friction and passive earth pressure values do not include a safety factor, and an appropriate safety factor should be included in design. The upper 12 inches of soil should be neglected in passive pressure computations unless it is protected by pavement or slabs on grade.

The above recommendations for lateral earth pressures assume that the backfill behind the subsurface walls will consist of properly compacted structural fill, and no adjacent surcharge loading. If the walls will be subjected to the influence of surcharge loading within a horizontal distance equal to or less than the height of the wall, the walls should be designed for the additional horizontal pressure. For uniform surcharge pressures, a uniformly distributed lateral pressure of 0.3 times the surcharge pressure should be added. Traffic surcharges may be estimated using an additional vertical load of 250 psf (2 feet of additional fill), in accordance with local practice.

The recommended equivalent fluid densities assume a free-draining condition behind the walls so that hydrostatic pressures do not build-up. This can be accomplished by placing a minimum 12- to 18-inch wide zone of crushed drain rock containing less than 5 percent fines against the walls. A 3-inch minimum diameter perforated, plastic drain pipe should be installed at the base of the walls and connected to a sump to remove water from the crushed drain rock zone. The drain pipe should be wrapped in filter fabric (Mirafi 140N or other as approved by the geotechnical engineer) to minimize clogging. The above drainage measures are intended to remove water from behind the wall to prevent hydrostatic pressures from building up. Additional drainage measures may be specified by the project architect or structural engineer, for damp-proofing or other reasons.

GeoPacific should be contacted during construction to verify subgrade strength in wall keyway excavations, to verify that backslope soils are in accordance with our assumptions, and to take density tests on the wall backfill materials.

Footing and Roof Drains

If the proposed structures will have raised floors, and no concrete slab-on-grade floors are used, perimeter footing drains would not be required based on soil conditions encountered at the site and experience with standard local construction practices. Where it is desired to reduce the

potential for moist crawl spaces, footing drains may be installed. If concrete slab-on-grade floors are used, perimeter footing drains should be installed as recommended below.

Where used, perimeter footing drains should consist of 3 or 4-inch diameter, perforated plastic pipe embedded in a minimum of 1 ft^3 per lineal foot of clean, free-draining drain rock. The drain pipe and surrounding drain rock should be wrapped in non-woven geotextile (Mirafi 140N, or approved equivalent) to minimize the potential for clogging and/or ground loss due to piping. Water collected from the footing drains should be directed to the local storm drain system or other suitable outlet. A minimum 0.5 percent fall should be maintained throughout the drain and non-perforated pipe outlet. The footing drains should include clean-outs to allow periodic maintenance and inspection. In our opinion, footing drains may outlet at the curb, or on the back sides of lots where sufficient fall is not available to allow drainage to the street.

Construction should include typical measures for controlling subsurface water beneath the homes, including positive crawlspace drainage to an adequate low-point drain exiting the foundation, visqueen covering the exposed ground in the crawlspace, and crawlspace ventilation (foundation vents). The homebuyers should be informed and educated that some slow flowing water in the crawlspaces is considered normal and not necessarily detrimental to the home given these other design elements incorporated into its construction. Appropriate design professionals should be consulted regarding crawlspace ventilation, building material selection and mold prevention issues, which are outside GeoPacific's area of expertise.

Down spouts and roof drains should collect roof water in a system separate from the footing drains in order to reduce the potential for clogging. Roof drain water should be directed to an appropriate discharge point well away from structural foundations. Grades should be sloped downward and away from buildings to reduce the potential for ponded water near structures.

Seismic Design

Structures should be designed to resist earthquake loading in accordance with the methodology described in the 2012 International Residential Code (IRC) for One- and Two-Family Dwellings, with applicable Oregon Structural Specialty Code (OSSC) revisions (*current 2014*). We recommend Site Class D be used for design per the OSSC, Table 1613.5.2 and as defined in ASCE 7, Chapter 20, Table 20.3-1. Design values determined for the site using the USGS (United States Geological Survey) *2016 Seismic Design Maps Summary Report* are summarized in Table 7.

Table 7 - Recommended Earthquake Ground Motion Parameters (2016 USGS)

Parameter	Value
Location (Lat, Long), decimal	45.2086, -123.2443
Probabilistic Ground Motion Values, 2% Probability of Exceedance in 50 yrs	
Short Period, S_s	1.022 g
1.0 Sec Period, S_1	0.486 g
Soil Factors for Site Class D:	
F_a	1.091
F_v	1.514
Residential Site Value = 2/3 x F_a x S_s	0.744 g
Residential Seismic Design Category	D

Soil liquefaction is a phenomenon wherein saturated soil deposits temporarily lose strength and behave as a liquid in response to earthquake shaking. Soil liquefaction is generally limited to loose, granular soils located below the water table. The on-site soils consist predominantly of medium stiff to hard fine-grained soils and hard rock, and are not considered susceptible to liquefaction.

UNCERTAINTIES AND LIMITATIONS

We have prepared this report for the owner and their consultants for use in design of this project only. This report should be provided in its entirety to prospective contractors for bidding and estimating purposes; however, the conclusions and interpretations presented in this report should not be construed as a warranty of the subsurface conditions. Experience has shown that soil and groundwater conditions can vary significantly over small distances. Inconsistent conditions can occur between explorations that may not be detected by a geotechnical study. If, during future site operations, subsurface conditions are encountered which vary appreciably from those described herein, GeoPacific should be notified for review of the recommendations of this report, and revision of such if necessary.

Sufficient geotechnical monitoring, testing and consultation should be provided during construction to confirm that the conditions encountered are consistent with those indicated by explorations. The checklist attached to this report outlines recommended geotechnical observations and testing for the project. Recommendations for design changes will be provided should conditions revealed during construction differ from those anticipated, and to verify that the geotechnical aspects of construction comply with the contract plans and specifications.

Within the limitations of scope, schedule and budget, GeoPacific attempted to execute these services in accordance with generally accepted professional principles and practices in the fields of geotechnical engineering and engineering geology at the time the report was prepared. No warranty, expressed or implied, is made. The scope of our work did not include environmental assessments or evaluations regarding the presence or absence of wetlands or hazardous or toxic substances in the soil, surface water, or groundwater at this site.

We appreciate this opportunity to be of service.

Sincerely,

GEOPACIFIC ENGINEERING, INC.

Benjamin G. Anderson, P.E.
Geotechnical Engineer

EXPIRES: 06/30/2017

James D. Imbrie, G.E., C.E.G.
Principal Geotechnical Engineer

Attachments: References
Figure 1 - Vicinity Map
Figure 2 - Site Plan and Exploration Locations
Figure 3 - Engineered Fill Slope Buttress (Preliminary)
Photographic Log (8 Pages)
Laboratory Test Results (4 Pages)
Test Pit Logs (TP-1 through TP-24)
Boring Log (B-1)
Pavement Design Calculations (3 Pages)

REFERENCES

Atwater, B.F., 1992, Geologic evidence for earthquakes during the past 2,000 years along the Copalis River, southern coastal Washington: Journal of Geophysical Research, v. 97, p. 1901-1919.

Baldwin, E.M., Brown, R.D., Jr., Gair, J.E., and Pease, M.H., Jr., 1955, Geology of the Sheridan and McMinnville quadrangles: U.S. Geological Survey, Oil an dGas Investigations Map OM-155, scale 1:62500.

Carver, G.A., 1992, Late Cenozoic tectonics of coastal northern California: American Association of Petroleum Geologists-SEPM Field Trip Guidebook, May, 1992.

Geomatrix Consultants, 1995, Seismic Design Mapping, State of Oregon: unpublished report prepared for Oregon Department of Transportation, Personal Services Contract 11688, January 1995.

Goldfinger, C., Kulm, L.D., Yeats, R.S., Appelgate, B, MacKay, M.E., and Cochrane, G.R., 1996, Active strike-slip faulting and folding of the Cascadia Subduction-Zone plate boundary and forearc in central and northern Oregon: in Assessing earthquake hazards and reducing risk in the Pacific Northwest, v. 1: U.S. Geological Survey Professional Paper 1560, P. 223-256.

Madin, I.P., 1990, Earthquake hazard geology maps of the Portland metropolitan area, Oregon: Oregon Department of Geology and Mineral Industries Open-File Report 0-90-2, scale 1:24,000, 22 p.

Peterson, C.D., Darioenzo, M.E., Burns, S.F., and Burris, W.K., 1993, Field trip guide to Cascadia paleoseismic evidence along the northern California coast: evidence of subduction zone seismicity in the central Cascadia margin: Oregon Geology, v. 55, p. 99-144.

Unruh, J.R., Wong, I.G., Bott, J.D., Silva, W.J., and Lettis, W.R., 1994, Seismotectonic evaluation: Scoggins Dam, Tualatin Project, Northwest Oregon: unpublished report by William Lettis and Associates and Woodward Clyde Federal Services, Oakland, CA, for U. S. Bureau of Reclamation, Denver CO (in Geomatrix Consultants, 1995).

Werner, K.S., Nabelek, J., Yeats, R.S., Malone, S., 1992, The Mount Angel fault: implications of seismic-reflection data and the Woodburn, Oregon, earthquake sequence of August, 1990: Oregon Geology, v. 54, p. 112-117.

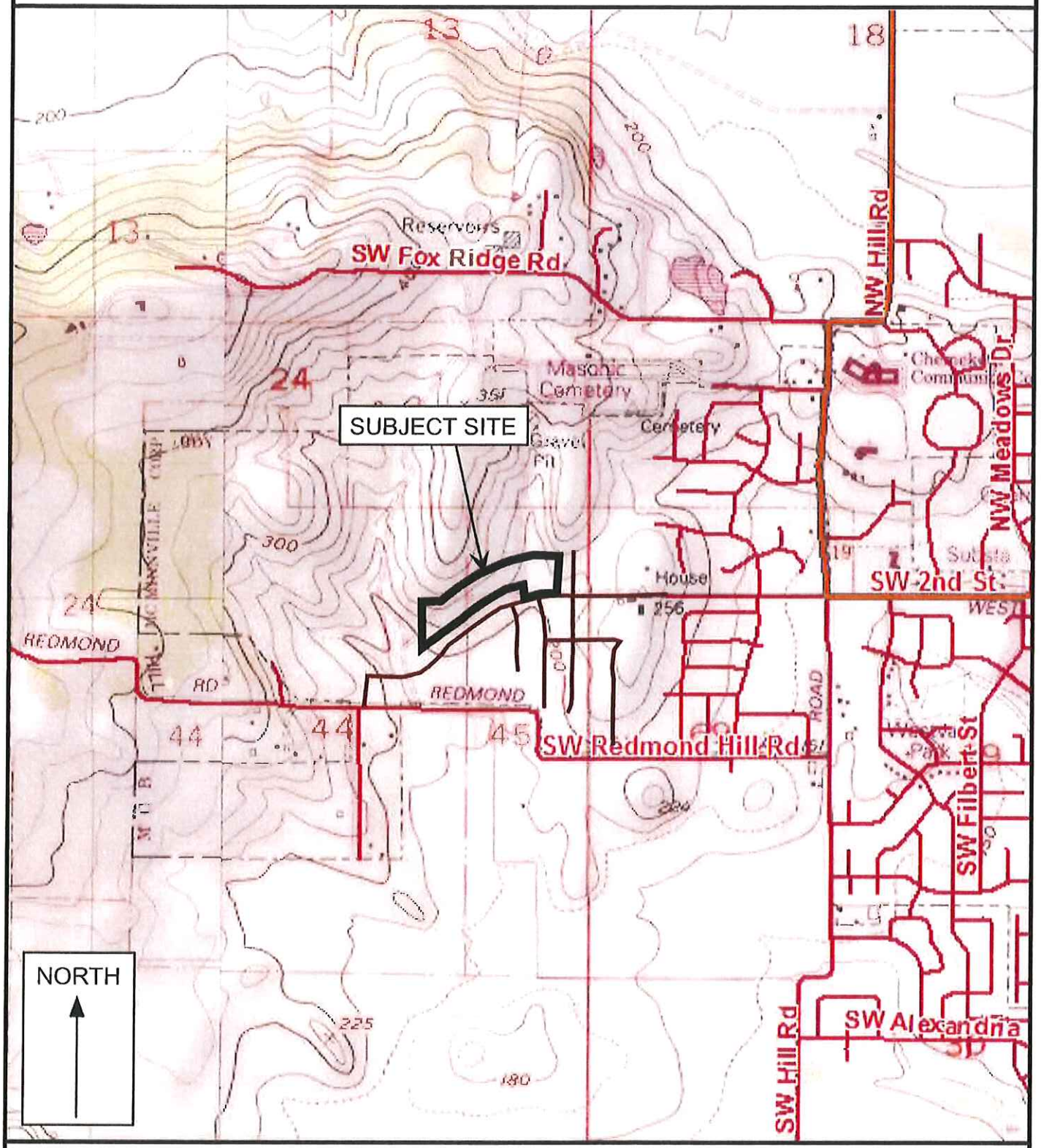
Wong, I. Silva, W., Bott, J., Wright, D., Thomas, P., Gregor, N., Li., S., Mabey, M., Sojourner, A., and Wang, Y., 2000, Earthquake Scenario and Probabilistic Ground Shaking Maps for the Portland, Oregon, Metropolitan Area; State of Oregon Department of Geology and Mineral Industries; Interpretative Map Series IMS-16.

Yeats, R.S., Graven, E.P., Werner, K.S., Goldfinger, C., and Popowski, T., 1996, Tectonics of the Willamette Valley, Oregon: in Assessing earthquake hazards and reducing risk in the Pacific Northwest, v. 1: U.S. Geological Survey Professional Paper 1560, P. 183-222, 5 plates, scale 1:100,000.

Yelin, T.S., 1992, An earthquake swarm in the north Portland Hills (Oregon): More speculations on the seismotectonics of the Portland Basin: Geological Society of America, Programs with Abstracts, v. 24, no. 5, p. 92.

GeoPacific Engineering, Inc.
14835 SW 72nd Avenue
Portland, Oregon 97224
Tel: (503) 598-8445 Fax: (503) 941-9281

VICINITY MAP



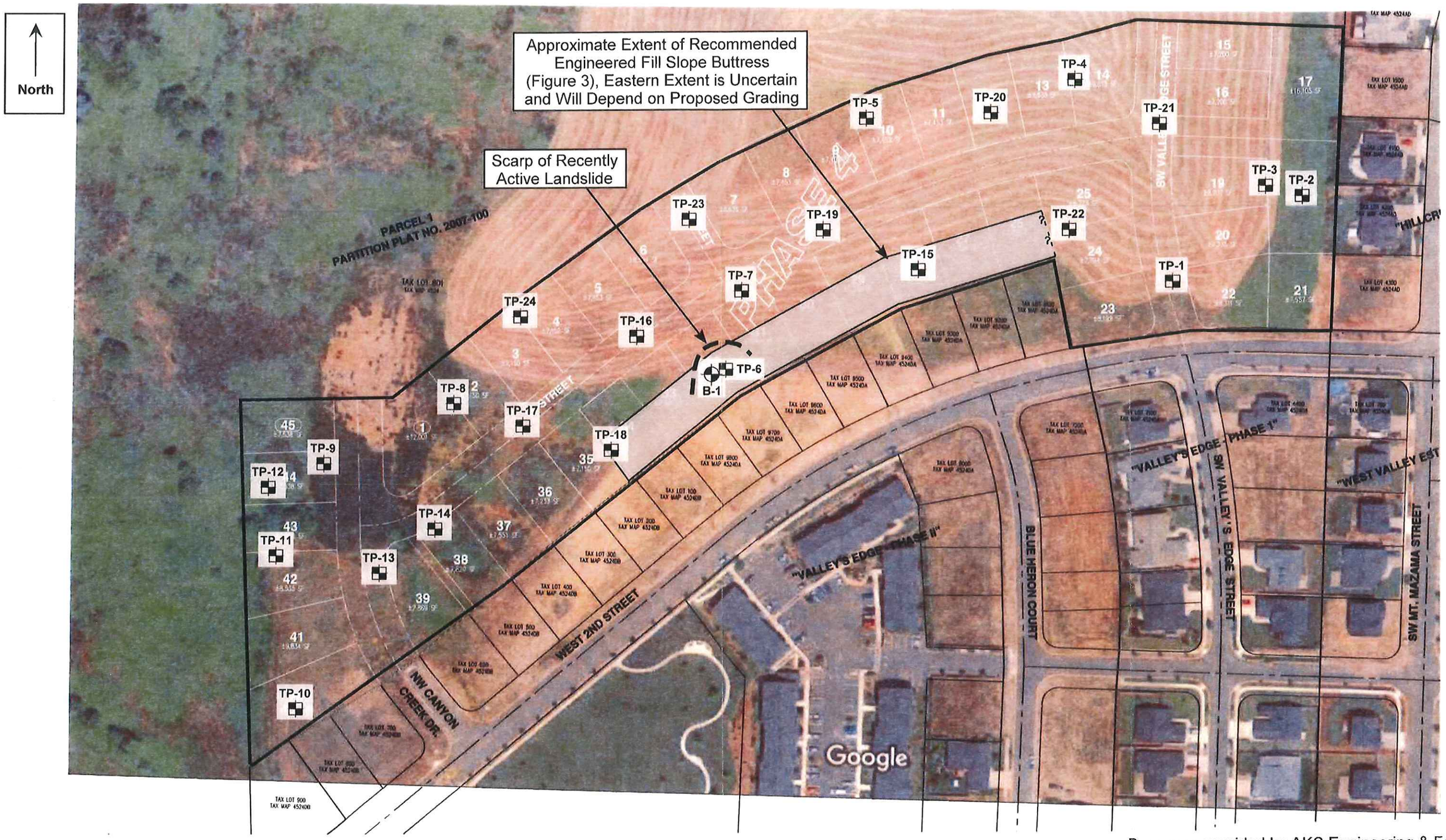
Legend

Approximate Scale 1 in = 1,400 ft

Date: 04/13/16
Drawn by: BGA

Base maps: National Geographic TOPO!, Tele Atlas, Oregon, 1990.

Project: Valley's Edge Subdivision Phase 4 McMinnville, Oregon	Project No. 16-4142	FIGURE 1



Base map provided by AKS Engineering & Forestry

Legend

TP-1 Test Pit Designation and Approximate Location

B-1 Boring Designation and Approximate Location

Note: Location of all geotechnical information is approximate.

SCALE

0 120 240 FEET

1 IN = 120 FT

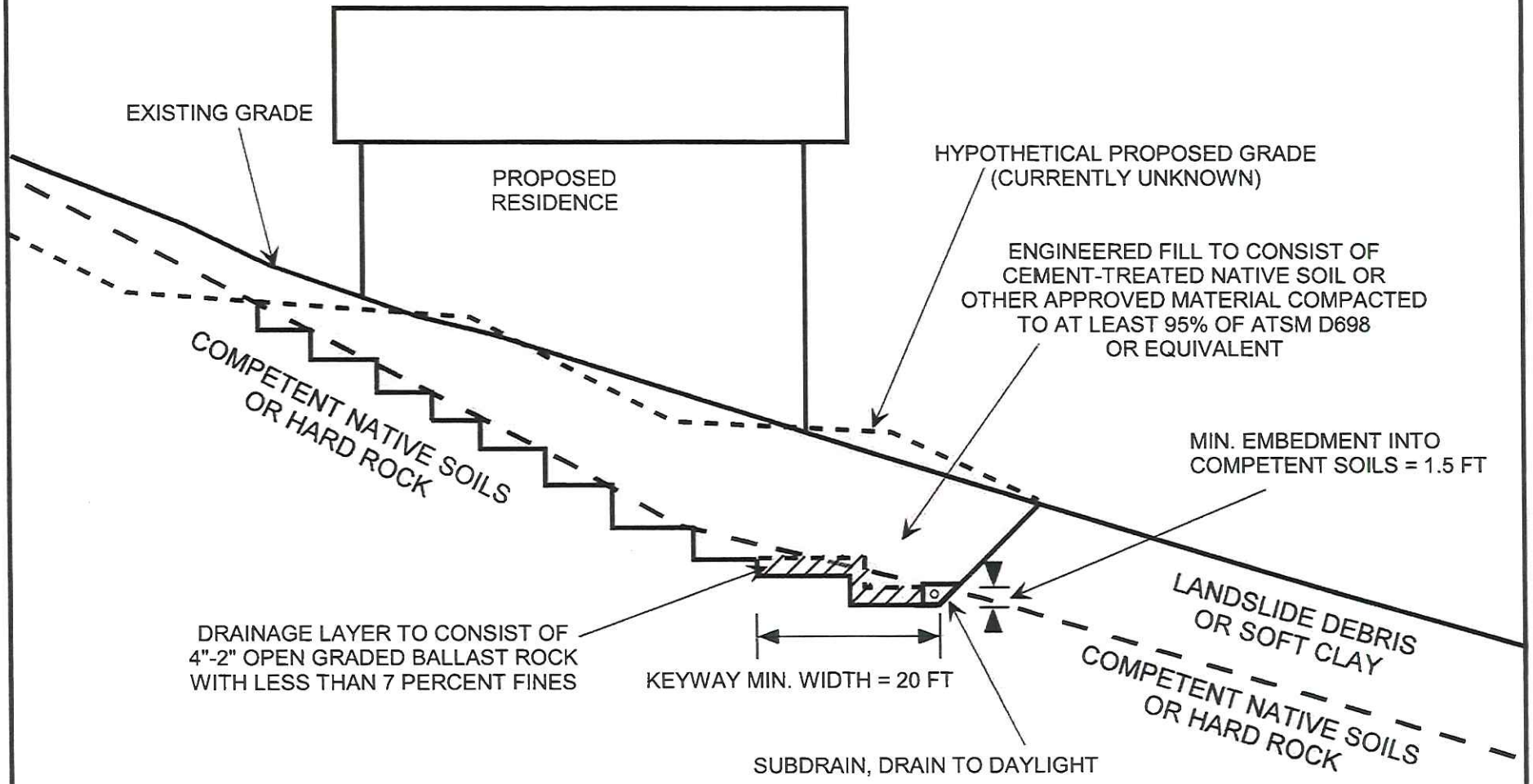
GeoPacific Engineering, Inc.
14835 SW 72nd Avenue
Portland, Oregon 97224
Tel: (503) 598-8445 Fax: (503) 941-9281

SITE PLAN AND EXPLORATION LOCATIONS

Project	Project No.	Drawn By	
Valley's Edge Phase 4 Subdivision Wilsonville, Oregon	16-4142	BGA	FIGURE 2

GeoPacific Engineering, Inc.
14835 SW 72nd Avenue
Portland, Oregon 97224
Tel: (503) 598-8445 Fax: (503) 941-9281

ENGINEERED FILL SLOPE BUTTRESS DETAIL (PRELIMINARY)



Date: 04/13/16
Drawn by: BGA

Project: Valley's Edge Phase 4 McMinnville, Oregon	Project No. 16-4142	FIGURE 3

GeoPacific Engineering, Inc.
Real-World Geotechnical Solutions
Investigation • Design • Construction Support

PHOTOGRAPHIC LOG

14835 SW 72nd Avenue
Portland, Oregon 97224

Tel (503) 598-8445
Fax (503) 941-9281

GeoPacific Engineering, Inc.

Real-World Geotechnical Solutions
Investigation • Design • Construction Support

VALLEY'S EDGE PHASE 4 SUBDIVISION
GEOTECHNICAL SITE INVESTIGATION
PHOTOGRAPHIC LOG

Northeast Portion of the Site – View to the North
March 17, 2016

VALLEY'S EDGE PHASE 4 SUBDIVISION
GEOTECHNICAL SITE INVESTIGATION
PHOTOGRAPHIC LOG

Central Portion of the Site – View to the West
March 17, 2016

GeoPacific Engineering, Inc.

Real-World Geotechnical Solutions
Investigation • Design • Construction Support

VALLEY'S EDGE PHASE 4 SUBDIVISION
GEOTECHNICAL SITE INVESTIGATION
PHOTOGRAPHIC LOG

Western Portion of the site – View to the South
March 17, 2016

VALLEY'S EDGE PHASE 4 SUBDIVISION
GEOTECHNICAL SITE INVESTIGATION
PHOTOGRAPHIC LOG

Western Portion of the Site – View to the North
March 17, 2016

VALLEY'S EDGE PHASE 4 SUBDIVISION
GEOTECHNICAL SITE INVESTIGATION
PHOTOGRAPHIC LOG

Existing, Recently Active Landslide – View to the East
March 17, 2016

VALLEY'S EDGE PHASE 4 SUBDIVISION
GEOTECHNICAL SITE INVESTIGATION
PHOTOGRAPHIC LOG

Existing, Recently Active Landslide – View to the West
March 17, 2016

VALLEY'S EDGE PHASE 4 SUBDIVISION
GEOTECHNICAL SITE INVESTIGATION
PHOTOGRAPHIC LOG

Existing, Recently Active Landslide – View to the North
March 17, 2016

VALLEY'S EDGE PHASE 4 SUBDIVISION
GEOTECHNICAL SITE INVESTIGATION
PHOTOGRAPHIC LOG

Location of Boring B-1, View to the Southwest
May 3, 2016

GeoPacific Engineering, Inc.
Real-World Geotechnical Solutions
Investigation • Design • Construction Support

LABORATORY TEST RESULTS

14835 SW 72nd Avenue
Portland, Oregon 97224

Tel (503) 598-8445
Fax (503) 941-9281

GeoPacific Engineering, Inc.

Project: Valley's Edge Subdivision Ph. 4 Project No.: 16-4142 Samp By: BGA Tested By: SJC
Sample ID: S16-078 Depth: 1' TP-8 Samp Date: 3/17/2016 Test Date: 3/25/2016
Material Type: Silt with Organics
Material Source:

Moisture

Tare Number:	46
Tare Wt.:	512.3
Tare + Wet Soil:	791
Tare + Dry Soil:	730.5
Percent Moisture:	28%

Organic Content

ASTM D 2974 at 440°F

Tare Number:	1	3
Tare Wt.:	19.29	22.01
Tare + Pre-Oven Soil:	45.09	46.5
Tare + Post-Oven Soil:	43.2	44.55
Percent Organic:	7.3	8.0
	avg	7.65

No. 200 Wash Data

Tare Number	
Tare Wt:	
Tare+Pre-Wash Samp:	
Tare+Post-Wash Samp:	
-#200 From Wash:	0
Pre-Wash Mass:	0
Percent Pass No. 200	#DIV/0!

Grain Size Data

Sieve Size (max wt individually retained)	Individual Weight Retained	Cumulative Weight Retained	Weight Passing	Percent Retained	Percent Passing
3"					
1.5"					
1"					
3/4 / 900					
1/2 / 570					
3/8 / 550					
1/4					
#4 / 325					
#8					
#10 / 180					
#16					
#30					
#40 / 75					
#50					
#100 / 40					
#200 / 20					
Pan					

Grain Size Data

Tare #	
Tare Wt.	
Tare+Samp	
Pre-Sieve Mass:	

Atterberg Analysis LI

Main Sample Tare #

	Point 1	Point 2	Point 3	Point 4	Point 5	Point 6
Tare #						
Tare Wt.						
Wet Wt						
Dry Wt						
# of Blows						
MC	0	0	0	0	0	0
Moist. %	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

Atterberg Analysis PI

	Point 1	Point 2	Point 3	Point 4
Tare #				
Tare Wt.				
Wet Wt				
Dry Wt				
# of Blows				
MC	0	0	0	0
Moist. %	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

GeoPacific Engineering, Inc.

Project: Valley's Edge Subdivision Ph. 4 Project No.: 16-4142 Samp By: BGA Tested By: SJC
Sample ID: S16-079 Depth: 2' TP-8 Samp Date: 3/17/2016 Test Date: 3/25/2016
Material Type: Silt with Organics
Material Source:

Moisture

Tare Number:	7
Tare Wt.:	258.5
Tare + Wet Soil:	479.9
Tare + Dry Soil:	418.9
Percent Moisture:	38%

Organic Content

ASTM D 2974 at 440°F

Tare Number:	1	3
Tare Wt.:	19.28	22
Tare + Pre-Oven Soil:	46.05	47.14
Tare + Post-Oven Soil:	44.04	45.28
Percent Organic:	7.5	7.4
	avg	7.45

No. 200 Wash Data

Tare Number	
Tare Wt:	
Tare+Pre-Wash Samp:	
Tare+Post-Wash Samp:	
-#200 From Wash:	0
Pre-Wash Mass:	0
Percent Pass No. 200	#DIV/0!

Grain Size Data

Sieve Size (max wt individually retained)	Individual Weight Retained	Cumulative Weight Retained	Weight Passing	Percent Retained	Percent Passing
3"					
1.5"					
1"					
3/4 / 900					
1/2 / 570					
3/8 / 550					
1/4					
#4 / 325					
#8					
#10 / 180					
#16					
#30					
#40 / 75					
#50					
#100 / 40					
#200 / 20					
Pan					

Grain Size Data

Tare #	
Tare Wt.	
Tare+Samp	
Pre-Sieve Mass:	

Atterberg Analysis LI

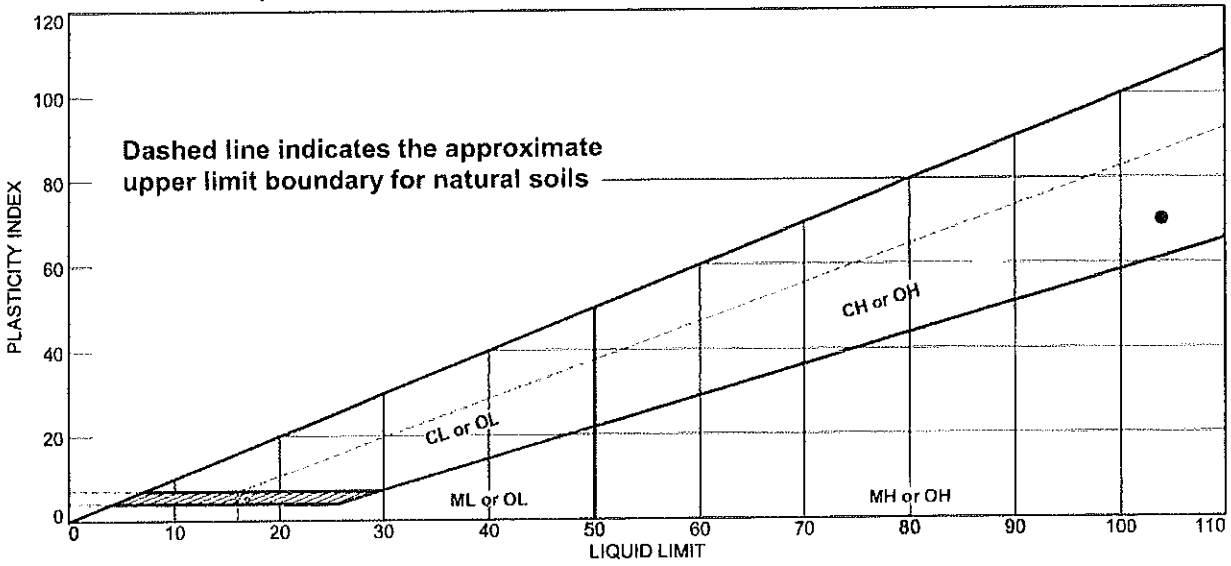
Main Sample Tare #

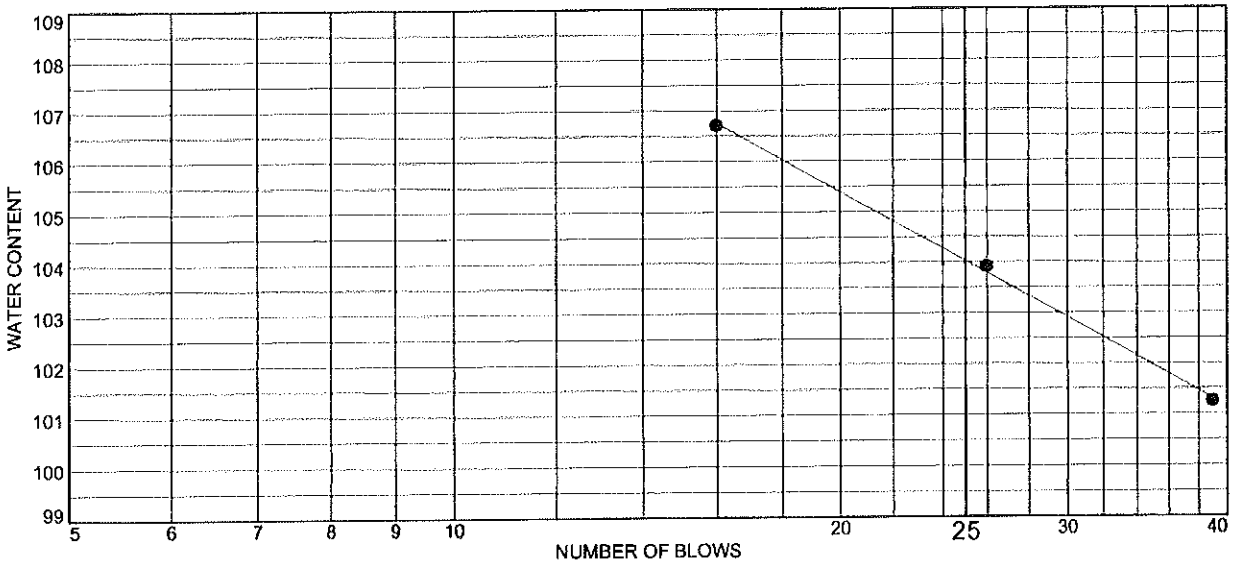
	Point 1	Point 2	Point 3	Point 4	Point 5	Point 6
Tare #						
Tare Wt.						
Wet Wt						
Dry Wt						
# of Blows						
MC	0	0	0	0	0	0
Moist. %	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

Atterberg Analysis PI

	Point 1	Point 2	Point 3	Point 4
Tare #				
Tare Wt.				
Wet Wt				
Dry Wt				
# of Blows				
MC	0	0	0	0
Moist. %	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Fat Clay	104.0	33.9	70.1			

Project No. 16-4142 **Client:** West Hills Properties

Project: Valley's Edge Ph. 4

Location: TP-8
Sample Number: S16-080 **Depth:** 3'

Remarks:

GEOPACIFIC ENGINEERING, INC.

Figure

Tested By: SJC

Northwest Testing, Inc.
A Division of Northwest Geotech, Inc.
9120 SW Pioneer Court, Suite B • Wilsonville, Oregon 97070 503/682-1880 FAX: 503/682-2753

TECHNICAL REPORT

Report To:	Ms. Beth Rapp, R.G., C.E.G. GeoPacific Engineering, Inc. 14835 SW 72nd Avenue Portland, Oregon 97224	**Date:** **Lab No.:**	3/28/16 16-054
Project:	Laboratory Testing – No. 16-4142 Valley's Edge Phase IV	**Project No.:**	2684.1.1

Report of: Expansion index of soil

Sample Identification

As requested, NTI completed expansion index testing on a sample delivered to our laboratory on March 21, 2016 by a GeoPacific Engineering, Inc. representative. All testing was performed in general accordance with the methods indicated. Our laboratory's test results are summarized on the following table.

Laboratory Test Results

Expansion Index of Soils (ASTM D 4829)	
Test	**Test Results**
Initial Moisture Content, (%)	16.7
Initial Dry Unit Weight, (pcf)	86.5
Initial Height of Specimen, (inches)	1.00
Initial Degree of Saturation, (%)	48
Final Moisture Content, (%)	43.8
Expansion Index, *EI*	156

Copies: Addressee

BKA

GeoPacific Engineering, Inc.
14835 SW 72nd Avenue
Portland, Oregon 97224
Tel: (503) 598-8445 Fax: (503) 941-9281

TEST PIT LOG

Project: Valley's Edge Phase 4 Subdivision
McMinnville, Oregon

Project No. 14-4142

Test Pit No. **TP- 1**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
1						8" soft, highly organic silty CLAY (OL-CL), dark brown, with fine roots throughout, very moist to wet (Topsoil)
						Soft, moderately organic, silty CLAY (CL), with some fine roots and organic odor, very moist (Till Zone)
2	1.5					Stiff, highly plastic CLAY (CH), brown, with small angular fragments of siltstone, disturbed texture, very moist (Colluvium)
3	1.5	100 to 1,000 g				[Expansion index = 152, indicating very high expansion potential]
4	1.5					
5						Grades to very stiff
6						
7						Grades to medium stiff to stiff
8						
9						
10						Grades to very stiff to hard and with increased amounts of siltstone fragments, still with disturbed texture
11						Test pit terminated at 11 feet
12						
13						Note: No seepage or groundwater encountered
14						No caving observed
15						
16						
17						

LEGEND

100 to 1,000 g — Bag Sample
5 Gal Bucket — Bucket Sample
Shelby Tube Sample
Seepage
Water Bearing Zone
Water Level at Abandonment

Date Excavated: 03/17/16
Logged By: BGA
Surface Elevation:

GeoPacific Engineering, Inc.
14835 SW 72nd Avenue
Portland, Oregon 97224
Tel: (503) 598-8445 Fax: (503) 941-9281

TEST PIT LOG

Project: Valley's Edge Phase 4 Subdivision McMinnville, Oregon	Project No. 14-4142	Test Pit No. **TP-2**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
1						Very soft, highly organic silty CLAY (OL-CL), dark brown, with fine roots throughout, wet (Erosional Deposit)
2						Grades to without roots
3						[Global caving 0-5 feet]
4						
5						Grades to medium stiff
6						Test pit terminated at 5 feet due to global caving from 0-5 feet
7						
8						Notes: Seepage encountered at the ground surface Visually estimated at greater than 10 gallons per minute
9						
10						Global caving from 0 to 5 feet
11						
12						
13						
14						
15						
16						
17						

LEGEND

Bag Sample

Bucket Sample


Shelby Tube Sample


Seepage


Water Bearing Zone


Water Level at Abandonment

Date Excavated: 03/17/16
Logged By: BGA
Surface Elevation:

GeoPacific Engineering, Inc.
14835 SW 72nd Avenue
Portland, Oregon 97224
Tel: (503) 598-8445 Fax: (503) 941-9281

TEST PIT LOG

Project: Valley's Edge Phase 4 Subdivision McMinnville, Oregon	Project No. 14-4142	Test Pit No. **TP-3**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
1						12" soft, highly organic silty CLAY (OL-CL), dark brown, with fine roots throughout, very moist to wet (Topsoil)
2		100 to 1,000 g				Soft, moderately organic, silty CLAY (CL), with some fine roots and organic odor, very moist (Till Zone)
3						
4	1.5 2.0					Stiff, highly plastic CLAY (CH), brown, with small angular fragments of siltstone, disturbed texture, very moist (Colluvium)
5						
6						
7						
8						
9						Test pit terminated at 9 feet
10						
11						Notes: Seepage encountered from 0 to 3 feet bgs Visually estimated at 5 gallons per minute
12						
13						Significant caving 0 to 3 feet
14						
15						
16						
17						

LEGEND

Bag Sample

Bucket Sample


Shelby Tube Sample


Seepage


Water Bearing Zone


Water Level at Abandonment

Date Excavated: 03/17/16
Logged By: BGA
Surface Elevation:

GeoPacific Engineering, Inc.
14835 SW 72nd Avenue
Portland, Oregon 97224
Tel: (503) 598-8445 Fax: (503) 941-9281

TEST PIT LOG

Project: Valley's Edge Phase 4 Subdivision
McMinnville, Oregon

Project No. 14-4142

Test Pit No. **TP-4**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
1		100 to 1,000 g				10" soft, highly organic silty CLAY (OL-CL), dark brown, with fine roots throughout, very moist to wet (Topsoil)
2	2.0					Soft, moderately organic, silty CLAY (CL), with some fine roots and organic odor, very moist (Till Zone)
3	2.0					Stiff, silty CLAY (CL), brown, moderate plasticity, with small angular fragments of siltstone, disturbed texture, very moist (Colluvium)
4	2.0					
5						Caving from 0 to 5.5 feet
6						Stiff, highly plastic CLAY (CH), brown, very moist to wet (Colluvium)
7						
8						SILTSTONE, very soft to soft (R1-R2), brown, gray, and black, very moist to wet (Nestucca Formation)
9						Test pit terminated at 8.5 feet
10						
11						Notes: Seepage at 0 to 1.5 feet, visually estimated at 1 to 3 gpm Seepage at 5 feet, visually estimated at 5 gpm Seepage at 7.5 feet, visually estimated at 5 gpm
12						Caving from 0 to 5.5 feet
13						
14						
15						
16						
17						

LEGEND

100 to 1,000 g — Bag Sample
5 Gal. Bucket — Bucket Sample
Shelby Tube Sample
Seepage
Water Bearing Zone
Water Level at Abandonment

Date Excavated: 03/17/16
Logged By: BGA
Surface Elevation:

GeoPacific Engineering, Inc.
14835 SW 72nd Avenue
Portland, Oregon 97224
Tel: (503) 598-8445 Fax: (503) 941-9281

TEST PIT LOG

Project: Valley's Edge Phase 4 Subdivision
McMinnville, Oregon

Project No. 14-4142

Test Pit No. **TP-5**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
1						10" soft, highly organic silty CLAY (OL-CL), dark brown, with fine roots throughout, very moist to wet (Topsoil)
2	2.0					Soft, moderately organic, silty CLAY (CL), with some fine roots and organic odor, very moist (Till Zone)
3	2.0					6 to 10 inches of stiff, brown silty CLAY, very moist (Colluvium)
4	2.0					SILTSTONE, extremely soft to very soft (RO-R1), gray, brown, and black, highly fractured, relatively level bedding, very moist (Nestucca Formation)
5						Grades to soft to medium hard (R2-R3)
6						Test pit terminated due to practical refusal at 5 feet on north side of test pit and 6.5 feet on south side of test pit
7						
8						Notes: Slow groundwater seepage encountered at 4.5 feet Visually estimated at 1 gpm
9						No caving observed
10						
11						
12						
13						
14						
15						
16						
17						

LEGEND

Bag Sample

Bucket Sample


Shelby Tube Sample


Seepage


Water Bearing Zone


Water Level at Abandonment

Date Excavated: 03/17/16
Logged By: BGA
Surface Elevation:

GeoPacific Engineering, Inc.
14835 SW 72nd Avenue
Portland, Oregon 97224
Tel: (503) 598-8445 Fax: (503) 941-9281

TEST PIT LOG

Project: Valley's Edge Phase 4 Subdivision McMinnville, Oregon	Project No. 14-4142	Test Pit No. **TP-6**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
1						8" soft, highly organic silty CLAY (OL-CL), dark brown, with fine roots throughout, very moist to wet (Topsoil)
2	1.5					Soft, low to moderately organic, silty CLAY (CL), with some fine roots and organic odor, very moist (Till Zone)
3	3.0					Stiff to very stiff, silty CLAY (CL), brown, low to moderate plasticity, with siltstone fragments, very moist (Landslide Mass)
4	3.0					
5						Increased plasticity below 6 feet
6						
7						
8						
9						
10						Grades to medium stiff
11						
12						Disturbed texture 11 to 11.5 feet Grades to gray, very stiff, and with increased amounts of siltstone fragments
13						Test pit terminated at 12.5 feet
14						
15						Note: Seepage encountered at 11.5 to 12 feet bgs Visually estimated at 10 gpm
16						Caving 0 to 12 feet on east side of test pit Caving 10 to 12 feet on west side of test pit
17						

LEGEND

Bag Sample

Bucket Sample


Shelby Tube Sample


Seepage


Water Bearing Zone


Water Level at Abandonment

Date Excavated: 03/17/16
Logged By: BGA
Surface Elevation:

GeoPacific Engineering, Inc.
14835 SW 72nd Avenue
Portland, Oregon 97224
Tel: (503) 598-8445 Fax: (503) 941-9281

TEST PIT LOG

Project: Valley's Edge Phase 4 Subdivision
McMinnville, Oregon

Project No. 14-4142

Test Pit No. **TP-7**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
1	1.0					12" soft, highly organic silty CLAY (OL-CL), dark brown, with fine roots throughout, very moist to wet (Topsoil)
2	1.0					Soft, low to moderately organic, silty CLAY (CL), with some fine roots and organic odor, very moist (Till Zone)
3	1.5					Stiff to very stiff, silty CLAY (CL), brown, low to moderate plasticity, with siltstone fragments, very moist (Colluvium)
4	3.0					
5	3.0					
6						
7						SILTSTONE, extremeley soft (R0), gray, brown, and black, very moist (Nestucca Formation)
8						
9						
10						
11						
12						Test pit terminated at 11.5 feet
13						
14						Note: Seepage encountered at 6 to 7 feet bgs Visually estimated at 3 gpm
15						No caving observed
16						
17						

LEGEND

Bag Sample

Bucket Sample


Shelby Tube Sample


Seepage


Water Bearing Zone


Water Level at Abandonment

Date Excavated: 03/17/16
Logged By: BGA
Surface Elevation:

GeoPacific Engineering, Inc.
14835 SW 72nd Avenue
Portland, Oregon 97224
Tel: (503) 598-8445 Fax: (503) 941-9281

TEST PIT LOG

Project: Valley's Edge Phase 4 Subdivision
McMinnville, Oregon

Project No. 14-4142

Test Pit No. **TP-8**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
1	0.5	100 to 1,000 g				10" soft, highly organic silty CLAY (OL-CL), dark brown, with fine roots throughout, very moist to wet (Topsoil)
2	1.0					Soft, low to moderately organic, silty CLAY (CL), with some fine roots and organic odor, very moist (Till Zone)
3	1.5	100 to 1,000 g				Stiff to very stiff, highly plastic CLAY (CH), brown, moist (Colluvium)
4	3.0					
5	3.0					
6						SILTSTONE, extremely soft (R0), gray, brown, and black, very moist (Nestucca Formation)
7						Grades to very soft (R1)
8						Test pit terminated at 8 feet due to practical refusal on soft to medium hard (R2-R3) SILTSTONE
9						
10						Notes: No seepage or groundwater encountered
11						No caving observed
12						
13						
14						
15						
16						
17						

LEGEND

100 to 1,000 g — Bag Sample
5 Gal. Bucket — Bucket Sample
Shelby Tube Sample
Seepage
Water Bearing Zone
Water Level at Abandonment

Date Excavated: 03/17/16
Logged By: BGA
Surface Elevation:

GeoPacific Engineering, Inc.
14835 SW 72nd Avenue
Portland, Oregon 97224
Tel: (503) 598-8445 Fax: (503) 941-9281

TEST PIT LOG

Project: Valley's Edge Phase 4 Subdivision McMinnville, Oregon	Project No. 14-4142	Test Pit No. **TP-9**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
1–10						Loose, GRAVEL, COBBLES, and BOULDERS in a silt matrix, brown, subrounded to subangular, basaltic, damp (Undocumented Fill)
10–11						Medium stiff, clayey SILT (ML) to silty CLAY (CL), orange-brown, low plasticity, moist (Colluvium)
11–17						Test pit terminated at 12 feet Notes: No seepage or groundwater encountered Small amount of caving from 2 to 7 feet bgs

LEGEND

Bag Sample | Bucket Sample | Shelby Tube Sample | Seepage | Water Bearing Zone | Water Level at Abandonment

Date Excavated: 03/17/16
Logged By: BGA
Surface Elevation:

GeoPacific Engineering, Inc.
14835 SW 72nd Avenue
Portland, Oregon 97224
Tel: (503) 598-8445 Fax: (503) 941-9281

TEST PIT LOG

Project: Valley's Edge Phase 4 Subdivision
McMinnville, Oregon

Project No. 14-4142

Test Pit No. **TP-10**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
0						14" soft, moderately organic SILT (ML-OL), dark brown, moist (Topsoil)
1						
2						Stiff, SILT (ML) and CLAY (CL), brown, with occasional rounded and angular gravel, trace amount of wood debris, disturbed texture (Undocumented Fill)
3						
4						
5						
6		100 to 1,000 g				Medium stiff, clayey SILT (ML) to silty CLAY (CL), low organic content, moist (Buried Topsoil Horizon)
7						
8						SILTSTONE, extremely soft (R0), gray, brown, and black, very moist (Nestucca Formation)
9						
10						
11						
12						Test pit terminated at 12 feet
13						
14						Notes: Slow seepage encountered at 10.5 feet Visually estimated at 1 gpm
15						
16						No caving observed
17						

LEGEND

100 to 1,000 g — Bag Sample
5 Gal Bucket — Bucket Sample
Shelby Tube Sample
Seepage
Water Bearing Zone
Water Level at Abandonment

Date Excavated: 03/17/16
Logged By: BGA
Surface Elevation:

GeoPacific Engineering, Inc.
14835 SW 72nd Avenue
Portland, Oregon 97224
Tel: (503) 598-8445 Fax: (503) 941-9281

TEST PIT LOG

Project: Valley's Edge Phase 4 Subdivision
McMinnville, Oregon

Project No. 14-4142

Test Pit No. **TP-11**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
1–3						Soft, gravelly, moderately organic SILT (ML), dark brown, moist (Undocumented Fill) Grades to brown and with some debris and angular gravel
4–5						Medium stiff, moderately organic, clayey SILT (ML-OL), with some organic debris including roots up to 3 inches in diameter, moist (Buried Topsoil Horizon)
6–7					≈	Medium stiff, silty CLAY (CL), gray, moist (Alluvium) Grades to soft, wet, reddish brown and gravelly, gravel is rounded
8		100 to 1,000 g				
9–10		100 to 1,000 g			≈	Stiff, silty CLAY (CL), brown with gray staining, very moist to wet (Colluvium)
11–12						Test pit terminated at 12 feet Notes: Seepage encountered at 7.5 feet, visually estimated at 5 gpm Seepage encountered at 10 feet, visually estimated at 10 gpm No caving observed
13–17						

LEGEND

100 to 1,000 g — Bag Sample
5 Gal Bucket — Bucket Sample
Shelby Tube Sample
Seepage
Water Bearing Zone
Water Level at Abandonment

Date Excavated: 03/17/16
Logged By: BGA
Surface Elevation:

GeoPacific Engineering, Inc.
14835 SW 72nd Avenue
Portland, Oregon 97224
Tel: (503) 598-8445 Fax: (503) 941-9281

TEST PIT LOG

Project: Valley's Edge Phase 4 Subdivision
McMinnville, Oregon

Project No. 14-4142

Test Pit No. **TP-12**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
1						Loose, silty GRAVEL (GM), brown and gray, moist (Undocumented Fill)
3						Layer of geotextile fabric encountered at 3 feet bgs
4						Soft, moderately organic, clayey SILT (ML-OL), with some organic debris including roots up to 3 inches in diameter, moist (Buried Topsoil Horizon)
5						Soft, SILT (ML), reddish brown, wet (Alluvium)
6						Grades to gravelly, subrounded gravel
7						Grades to wet
8		100 to 1,000 g				
10		100 to 1,000 g				Stiff, silty CLAY (CL) to clayey SILT (ML), brown with angular siltsone fragments, wet (Colluvium)
11						BASALT, extremely soft to very soft (R0-R1), dark gray, vesicular, wet
12						Test pit terminated at 12 feet
						Notes: Groundwater encountered at 7 feet bgs
						No caving observed

LEGEND

100 to 1,000 g — Bag Sample
5 Gal. Bucket — Bucket Sample
Shelby Tube Sample
Seepage
Water Bearing Zone
Water Level at Abandonment

Date Excavated: 03/17/16
Logged By: BGA
Surface Elevation:

GeoPacific Engineering, Inc.
14835 SW 72nd Avenue
Portland, Oregon 97224
Tel: (503) 598-8445 Fax: (503) 941-9281

TEST PIT LOG

Project: Valley's Edge Phase 4 Subdivision
McMinnville, Oregon

Project No. 14-4142

Test Pit No. **TP-13**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
1						20" soft, gravelly SILT (ML), dark brown, moist (Undocumented Fill)
2						Stiff to very stiff, silty CLAY (CL), brown, with angular siltstone fragments, moist (Colluvium)
3						SILTSTONE, extremely soft (R0), dark gray and brown, very moist (Nestucca Formation)
4						
5						
6						Grades to very soft (R1)
7						
8						
9						Test pit terminated at 9 feet due to practical refusal on soft to medium hard (R2-R3) SILTSTONE
10						
11						Notes: No seepage or groundwater encountered
12						No caving observed
13						
14						
15						
16						
17						

LEGEND

Bag Sample

Bucket Sample


Shelby Tube Sample


Seepage


Water Bearing Zone


Water Level at Abandonment

Date Excavated: 03/17/16
Logged By: BGA
Surface Elevation:

GeoPacific Engineering, Inc.
14835 SW 72nd Avenue
Portland, Oregon 97224
Tel: (503) 598-8445 Fax: (503) 941-9281

TEST PIT LOG

Project: Valley's Edge Phase 4 Subdivision McMinnville, Oregon	Project No. 14-4142	Test Pit No. **TP-14**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
1						BASALT, extremely soft (R0), dark gray, damp, excavating as gravel, cobbles, and boulders in a silt matrix
2						Grades to very soft (R1)
3						Test pit terminated at 2.5 feet due to practical refusal on soft to medium hard (R2-R3) BASALT
4						
5						Notes: No seepage or groundwater encountered
6						No caving observed
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						

LEGEND

Bag Sample

Bucket Sample


Shelby Tube Sample


Seepage


Water Bearing Zone


Water Level at Abandonment

Date Excavated: 03/17/16
Logged By: BGA
Surface Elevation:

GeoPacific Engineering, Inc.
14835 SW 72nd Avenue
Portland, Oregon 97224
Tel: (503) 598-8445 Fax: (503) 941-9281

TEST PIT LOG

Project: Valley's Edge Phase 4 Subdivision
McMinnville, Oregon

Project No. 14-4142

Test Pit No. **TP-15**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
0						10" soft, highly organic silty CLAY (OL-CL), dark brown, with fine roots throughout, very moist to wet (Topsoil)
1	1.0					Soft, moderately organic, silty CLAY (CL), with some fine roots and organic odor, very moist (Till Zone)
2	2.0					Medium stiff to stiff, silty CLAY (CL), brown, very moist to wet (Colluvium)
3						
4						
5						
6						
7						Grades to with increased plasticity
8						
9						
10						
11		100 to 1,000 g				Grades to hard and blue gray
12						Test pit terminated at 12 feet
13						
14						Notes: Seepage encountered below 2 feet bgs, visually estimated at 5 gpm Seepage encountered below 7 feet, visually estimated at 10 gpm
15						
16						Significant caving 0 to 10 feet
17						

LEGEND

100 to 1,000 g — Bag Sample
5 Gal Bucket — Bucket Sample
Shelby Tube Sample
Seepage
Water Bearing Zone
Water Level at Abandonment

Date Excavated: 03/17/16
Logged By: BGA
Surface Elevation:

GeoPacific Engineering, Inc.
14835 SW 72nd Avenue
Portland, Oregon 97224
Tel: (503) 598-8445 Fax: (503) 941-9281

TEST PIT LOG

Project: Valley's Edge Phase 4 Subdivision
McMinnville, Oregon

Project No. 14-4142

Test Pit No. **TP-16**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
1						12" soft, highly organic silty CLAY (OL-CL), brown, with fine roots throughout, moist (Topsoil)
2						BASALT, extremely soft (R0), dark gray to black, damp, vesicular
3						
4						Grades to very soft (R1)
5						Grades to soft (R2) with very hard digging below 5 feet
6						
7						Test pit terminated at 6.5 feet due to practical refusal on soft to medium hard (R2-R3) BASALT
8						
9						Notes: No seepage or groundwater encountered
10						No caving observed
11						
12						
13						
14						
15						
16						
17						

LEGEND

Bag Sample

Bucket Sample


Shelby Tube Sample


Seepage


Water Bearing Zone


Water Level at Abandonment

Date Excavated: 05/03/16
Logged By: BGA
Surface Elevation:

GeoPacific Engineering, Inc.
14835 SW 72nd Avenue
Portland, Oregon 97224
Tel: (503) 598-8445 Fax: (503) 941-9281

TEST PIT LOG

Project: Valley's Edge Phase 4 Subdivision McMinnville, Oregon	Project No. 14-4142	Test Pit No. **TP-17**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
1						10" soft, highly organic clayey SILT (ML-OL), dark brown, with fine roots throughout, moist (Topsoil)
2						BASALT, extremely soft to very soft (R0-R1), dark gray to black, damp, vesicular
3						
4						
5						Grades to soft (R2) with very hard digging below 5 feet
6						
7						
8						Test pit terminated at 7 feet due to practical refusal on soft to medium hard (R2-R3) BASALT
9						
10						Notes: No seepage or groundwater encountered
11						No caving observed
12						
13						
14						
15						
16						
17						

LEGEND

Bag Sample

Bucket Sample


Shelby Tube Sample


Seepage


Water Bearing Zone


Water Level at Abandonment

Date Excavated: 05/03/16
Logged By: BGA
Surface Elevation:

GeoPacific Engineering, Inc.
14835 SW 72nd Avenue
Portland, Oregon 97224
Tel: (503) 598-8445 Fax: (503) 941-9281

TEST PIT LOG

Project: Valley's Edge Phase 4 Subdivision
McMinnville, Oregon

Project No. 14-4142

Test Pit No. **TP-18**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
0						8" soft, highly organic clayey SILT (ML-OL), dark brown, with fine roots throughout, moist (Topsoil)
1	3.5					Very stiff to hard, silty CLAY (CL), reddish brown, with occasional gravel to cobble size basalt clasts, moist (Residual Soil of BASALT)
2	3.0					
	>4.5					
3						BASALT, extremely soft to very soft (R0-R1), dark gray to black, damp, vesicular
4						
5						Grades to very soft to soft (R1-R2) with very hard digging below 5 feet
6						Grades to soft (R2) with very hard digging below 6 feet
7						
8						Test pit terminated at 7.5 feet due to practical refusal on soft to medium hard (R2-R3) BASALT
9						
10						Notes: No seepage or groundwater encountered
11						No caving observed
12						
13						
14						
15						
16						
17						

LEGEND

Bag Sample

Bucket Sample


Shelby Tube Sample


Seepage


Water Bearing Zone


Water Level at Abandonment

Date Excavated: 05/03/16
Logged By: BGA
Surface Elevation:

GeoPacific Engineering, Inc.
14835 SW 72nd Avenue
Portland, Oregon 97224
Tel: (503) 598-8445 Fax: (503) 941-9281

TEST PIT LOG

Project: Valley's Edge Phase 4 Subdivision
McMinnville, Oregon

Project No. 14-4142

Test Pit No. **TP-19**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
1	3.5					10" soft, moderately organic clayey SILT (ML-OL), dark brown, with fine roots throughout, moist (Topsoil)
2	4.0					Very stiff, silty CLAY (CL), reddish brown, moist (Residual Soil of BASALT)
3	3.5					
4						
5						Grades to lighter color and with occasional gravel and cobble size vesicular basalt fragments
6						
7						
8						SILTSTONE, extremely soft (R0), dark gray and brown, with black and orange mineral staining, very moist (Nestucca Formation)
9						
10						
11						Grades to very soft to soft (R1-R2)
12						Test pit terminated at 12 feet due to practical refusal on soft to medium hard (R2-R3) SILTSTONE
13						
14						Notes: No seepage or groundwater encountered
15						No caving observed
16						
17						

LEGEND

Bag Sample

Bucket Sample


Shelby Tube Sample


Seepage


Water Bearing Zone


Water Level at Abandonment

Date Excavated: 05/03/16
Logged By: BGA
Surface Elevation:

GeoPacific Engineering, Inc.
14835 SW 72nd Avenue
Portland, Oregon 97224
Tel: (503) 598-8445 Fax: (503) 941-9281

TEST PIT LOG

Project: Valley's Edge Phase 4 Subdivision
McMinnville, Oregon

Project No. 14-4142

Test Pit No. **TP-20**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
1	>4.5					10" soft, moderately organic clayey SILT (ML-OL), dark brown, with fine roots throughout, moist (Topsoil)
2	>4.5					BASALT, extremely soft (R0), brown to black, moist, vesicular, in a matrix of clayey silt
3	>4.5					2-foot diameter chunk of R2 Siltstone encountered at 2.5 feet
4						
5						Grades to very soft (R1)
6						
7						
8						SILTSTONE, extremely soft to very soft (R0-R1), dark gray and brown, with black and orange mineral staining, very moist (Nestucca Formation)
9						
10						
11						Test pit terminated at 11 feet due to practical refusal on dark gray, soft to medium hard (R2-R3) SILTSTONE
12						
13						Notes: No seepage or groundwater encountered
14						No caving observed
15						
16						
17						

LEGEND

Bag Sample

Bucket Sample


Shelby Tube Sample


Seepage


Water Bearing Zone


Water Level at Abandonment

Date Excavated: 05/03/16
Logged By: BGA
Surface Elevation:

GeoPacific Engineering, Inc.
14835 SW 72nd Avenue
Portland, Oregon 97224
Tel: (503) 598-8445 Fax: (503) 941-9281

TEST PIT LOG

Project: Valley's Edge Phase 4 Subdivision
McMinnville, Oregon

Project No. 14-4142

Test Pit No. **TP-21**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
1						10" soft, highly organic silty CLAY (OL-CL), dark brown, with fine roots throughout, very moist to wet (Topsoil)
2						Soft, moderately organic, silty CLAY (CL), with some fine roots and organic odor, moist (Till Zone)
3						Stiff, highly plastic CLAY (CH), gray, with occasional gravel-size angular siltstone fragments, moist (Colluvium)
4						
5						SILTSTONE, extremely soft to very soft (R0-R1), reddish brown, gray, and black, with some sandstone, moist (Nestucca Formation)
6						Grades to very soft to soft (R1-R2) with very hard digging below 5 feet
7						Test pit terminated due to practical refusal on soft to medium hard (R2-R3) SILTSONE at 6.5 feet on NW side of test pit and at 8.5 feet on SE side of test pit
8						
9						Notes: No seepage or groundwater encountered
10						No caving observed
11						
12						
13						
14						
15						
16						
17						

LEGEND

Bag Sample

Bucket Sample


Shelby Tube Sample


Seepage


Water Bearing Zone


Water Level at Abandonment

Date Excavated: 05/03/16
Logged By: BGA
Surface Elevation:

GeoPacific Engineering, Inc.
14835 SW 72nd Avenue
Portland, Oregon 97224
Tel: (503) 598-8445 Fax: (503) 941-9281

TEST PIT LOG

Project: Valley's Edge Phase 4 Subdivision
McMinnville, Oregon

Project No. 14-4142

Test Pit No. **TP-22**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
1						10" soft, highly organic silty CLAY (OL-CL), dark brown, with fine roots throughout, very moist to wet (Topsoil)
2	2.0					10" soft, moderately organic, silty CLAY (CL), with some fine roots and organic odor, moist (Till Zone)
3	2.5 3.0					Stiff to very stiff, moderately to highly plastic CLAY (CH), gray, with gray and orange mottling, moist (Colluvium)
4	3.5					
5						Increased plasticity below 4.5 feet, very high plasticity
6						Grades to with some gavel-size angular fragments of siltstone and very moist to wet
7						
8						
9						
10						SILTSTONE, extremely soft to very soft (R0-R1), reddish brown, gray, and black, moist (Nestucca Formation)
11						
12						Test pit terminated at 12 feet
13						
14						Notes: Groundwater seepage encountered at 9.5 feet Visually estimated at less than 1 gpm
15						No caving observed
16						
17						

LEGEND

Bag Sample (100 to 1,000 g) | Bucket Sample (5 Gal. Bucket) | Shelby Tube Sample | Seepage | Water Bearing Zone | Water Level at Abandonment

Date Excavated: 05/03/16
Logged By: BGA
Surface Elevation:

GeoPacific Engineering, Inc.
14835 SW 72nd Avenue
Portland, Oregon 97224
Tel: (503) 598-8445 Fax: (503) 941-9281

TEST PIT LOG

Project: Valley's Edge Phase 4 Subdivision
McMinnville, Oregon

Project No. 14-4142

Test Pit No. **TP-23**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
1						8" soft, highly organic silty CLAY (OL-CL), dark brown, with fine roots throughout, very moist to wet (Topsoil)
						8" soft, moderately organic, silty CLAY (CL), with some fine roots and organic odor, moist (Till Zone)
2						SILTSTONE, extremely soft to very soft (R0-R1), light gray and brown, moist (Nestucca Formation)
3						Grades to very soft to soft (R1-R2)
4						
5						
6						
7						
8						Test pit terminated at 7.5 feet due to practical refusal on soft to medium hard (R2-R3) SILTSTONE
9						
10						Notes: No seepage or groundwater encountered
11						No caving observed
12						
13						
14						
15						
16						
17						

LEGEND

Bag Sample

Bucket Sample


Shelby Tube Sample


Seepage


Water Bearing Zone


Water Level at Abandonment

Date Excavated: 05/03/16
Logged By: BGA
Surface Elevation:

GeoPacific Engineering, Inc.
14835 SW 72nd Avenue
Portland, Oregon 97224
Tel: (503) 598-8445 Fax: (503) 941-9281

TEST PIT LOG

Project: Valley's Edge Phase 4 Subdivision
McMinnville, Oregon

Project No. 14-4142

Test Pit No. **TP-24**

Depth (ft)	Pocket Penetrometer (tons/ft²)	Sample Type	In-Situ Dry Density (lb/ft³)	Moisture Content (%)	Water Bearing Zone	Material Description
1						10" soft, highly organic silty CLAY (OL-CL), dark brown, with fine roots throughout, very moist to wet (Topsoil)
						14" soft, moderately organic, silty CLAY (CL), with some fine roots and organic odor, moist (Till Zone)
2						SILTSTONE, extremely soft to very soft (R0-R1), light gray and brown, moist (Nestucca Formation)
3						
4						Grades to very soft to soft (R1-R2)
5						
6						
7						
8						Test pit terminated at 8 feet due to practical refusal on soft to medium hard (R2-R3) SILTSTONE
9						
10						Notes: Groundwater seepage encountered at 8 feet Visually estimated at less than 1 gpm
11						
12						No caving observed
13						
14						
15						
16						
17						

LEGEND

Bag Sample (100 to 1,000 g) | Bucket Sample (5 Gal. Bucket) | Shelby Tube Sample | Seepage | Water Bearing Zone | Water Level at Abandonment

Date Excavated: 05/03/16
Logged By: BGA
Surface Elevation:

GeoPacific Engineering, Inc.
14835 SW 72nd Avenue
Portland, Oregon 97224
Tel: (503) 598-8445 Fax: (503) 941-9281

BORING LOG

Project: Valley's Edge Phase 4 McMinnville, Oregon	Project No. 16-4142	Boring No. **B-1**

Depth (ft)	Sample Type	N-Value	Well Construction	Moisture Content (%)	Water Bearing Zone	Material Description
5		6				Medium stiff, silty CLAY (CL), brown, with some coarse sand to gravel-size subrounded to subangular fragments of silstone, with slight disturbed texture, moist (Landslide Mass)
		8				Grades to medium stiff to stiff
		8				
10		1 2 4 6				
		11				Medium stiff, highly plastic CLAY (CH), brown, appears undisturbed, very moist to wet (Residual Soil of the Nestucca Formation) Grades to with weathered rock fabric from in-place weathering
15		37				SILTSONE, very soft to soft (RO-R1), gray, brown, and black, highly fractured, relatively level bedding, very moist (Nestucca Formation)
20		55				Grades to soft to medium hard (R1-R2) and dark gray [side of the sampler is wet]
25						Boring terminated at 21.5 feet Notes: No significant groundwater encountered in boring in period of three hours Water elevation at 7 feet bgs in 18-inch diameter sump located approximately 15 feet south of boring B-1
30						
35						

LEGEND

Date Drilled: 05/03/16
Logged By: BGA
Surface Elevation:

DARWin(tm) - Pavement Design

A Proprietary AASHTOWARE(tm)
Computer Software Product

Flexible Structural Design Module

Project Description
Valley's Edge Phase 4 Subdivision - Light-Duty Public Streets

Flexible Structural Design Module Data

18-kip ESALs Over Initial Performance Period:	53,979
Initial Serviceability:	4.2
Terminal Serviceability:	2.5
Reliability Level (%):	85
Overall Standard Deviation:	.44
Roadbed Soil Resilient Modulus (PSI):	5,250
Stage Construction:	1

Calculated Structural Number: 2.35

Specified Layer Design

Layer:	1
Material Description:	New Asphalt Pavement
Structural Coefficient (Ai):	.44
Drainage Coefficient (Mi):	1
Layer Thickness (Di) (in):	3.00
Calculated Layer SN:	1.32

Layer:	2
Material Description:	3/4"-0 crushed agg
Structural Coefficient (Ai):	.12
Drainage Coefficient (Mi):	1
Layer Thickness (Di) (in):	2.00
Calculated Layer SN:	.24

Layer:	3
Material Description:	1 1/2"-0 crushed agg
Structural Coefficient (Ai):	.11
Drainage Coefficient (Mi):	1
Layer Thickness (Di) (in):	8.00
Calculated Layer SN:	.88

Total Thickness (in):	13.00
Total Calculated SN:	2.44

Simple ESAL Calculation

Initial Performance Period (years):	20
Initial Two-Way Daily Traffic (ADT):	250
% Heavy Trucks (of ADT) FHWA Class 5 or Greater:	2
Number of Lanes In Design Direction:	1
Percent of All Trucks In Design Lane (%):	100
Percent Trucks In Design Direction (%):	50
Average Initial Truck Factor (ESALs/truck):	2.2
Annual Truck Factor Growth Rate (%):	0
Annual Truck Volume Growth Rate (%):	3
Growth:	Compound

Total Calculated Cumulative Esals: 53,979