April 30, 2021

Honda of Grays Harbor
John Csernotta, *President*
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Phone: (360) 532-5833
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c/o: Joe O'Brien
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RE: Report of Geotechnical Investigation and Engineering
Honda of Grays Harbor
1850 NW Louisiana Ave, Chehalis, Washington

MTC Project No.: **21S067-01**

Dear Mr. Csernotta:

This letter transmits our Geotechnical Investigation and Engineering Report for the above-referenced project. Materials Testing & Consulting, Inc. (MTC) performed this geotechnical engineering study in accordance with our Proposal for Geotechnical Services, dated March 17, 2021.

We would be pleased to continue our role as your geotechnical engineering consultants during the project planning and construction. We also have a keen interest in providing materials testing and special inspection during construction of this project. We will be pleased to meet with you at your convenience to discuss these services.

We appreciate the opportunity to provide geotechnical engineering services to you for this project. If you have any questions regarding this report, or if we can provide assistance with other aspects of the project, please contact me at (360) 755-1990.

Respectfully Submitted,
MATERIALS TESTING & CONSULTING, INC.

Marcus Van Valen, E.I.T
Geotechnical Division Manager

Medhanie G. Tecle, P.E.
Engineering Manager

Attachment: Geotechnical Investigation and Engineering Report

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GEOTECHNICAL
INVESTIGATION AND ENGINEERING REPORT

Honda of Grays Harbor - Chehalis
Lewis County
1850 Louisiana Ave, Chehalis, Washington

Prepared for:

Honda of Grays Harbor
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April 30, 2021
MTC Project Number: **21S067-01**

MTC
MATERIALS TESTING & CONSULTING, INC.

Table of Contents

1.0 Introduction

1.1 GENERAL

This report presents the findings and recommendations of Materials Testing & Consulting, Inc.'s (MTC) geotechnical engineering study, including liquefaction analysis, and infiltration assessment conducted for the design and construction of the proposed development. The project site for the development is currently vacant lot in a commercial development area 1.2 miles northwest of downtown Chehalis between Interstate 5 and NW Louisiana Ave. The location and vicinity maps of the site are presented in Figure 2 of Appendix A. A preliminary site plan of the project site including exploration locations are shown in Figure 3 of Appendix B.

In summary, MTC's subsurface investigation found generally unfavorable conditions for infiltration and favorable conditions for conventional foundations bearing on shallow soils. These silt-rich units were observed to be consistently 10 feet thick over a silty clay unit with no significant gravel content at depth. This silty clay unit contained fine grained soils and generally exhibited moderate to high levels of cohesion.

1.2 PROJECT DESCRIPTION

We understand that the project will consist of the construction of a new car dealership and car lot with landscaping and site improvements. Preliminary site plans were provided to MTC at the time of this report, and it is assumed that typical perimeter foundations and slab-on-grade construction will be used in design.

The current project site is a vacant 174,240 sq-ft lot with an approximate 8-foot difference in elevation from the existing roadways. At the periphery of the lot are landscaped features, a sidewalk, and utilities. Immediately to the North is a roadway across which is a separate unrelated car dealership. Access to the site is currently provided by multiple driveways into the lot from Louisiana Ave on the west side of the lot. Site plans provided to MTC call for the lot to be scarified and fully developed with structural fill and the previously described car dealership. MTC performed and logged four (4) test pit excavations (TP-1 through TP-4) and two (2) Wildcat Dynamic Cone Penetrometers (DCP-1 and DCP-2) within the areas of the planned developments.

Topography at the site and vicinity is very flat with little to no slope. The native soil conditions indicate that traditional shallow preparation and construction methods are likely feasible for the proposed development. No specific plans, other than the preliminary site plan described above, have been provided. However, MTC assumes that the proposed structures will employ continuous perimeter footings as well as isolated interior spread footings with a slab-on-grade floor.

See Sections 5.0 and 6.0 for design and construction recommendations and requirements, that include discussion of excavating to reach appropriately dense soils and backfilling with appropriately compacted structural fill to slab base grade.

MTC should be allowed to review the final plans and specifications for the project to ensure that the recommendations presented herein are appropriate. Recommendations and conclusions presented by this report will need to be re-evaluated in the event that changes to the proposed construction are made.

1.3 PURPOSE AND SCOPE OF SERVICES

The purpose of our study was to explore surface and subsurface conditions at the site and provide geotechnical engineering and infiltration recommendations for design and construction of the proposed improvements. Geotechnical aspects of construction are addressed in general accordance with applicable building codes and industry standard practices. A summary of MTC's findings, interpretations, and recommendations are provided herein for the client's planning and design of on-site infiltration facilities and site development. Our scope of services was consistent with that presented in our Proposal for Geotechnical Engineering Services, dated March 17, 2021.

Site location and vicinity maps are provided in Figure 2 of Appendix A. Exploration locations are shown on a site plan in Figure 3 of Appendix B along with approximate project footprint and existing conditions. Appendix C shows photos of site exploration. Additional information on the site exploration program is provided with our exploration logs in Appendix D of this report, accompanied by a USCS classification chart as Figure 4. Results of laboratory tests are presented in Appendix E. Plots of calculated liquefaction analysis are provided in Appendix F.

MTC's scope of services included field reconnaissance, laboratory analysis, computer modeling, and literature review. MTC will remain available for further consultation as the proposed project progresses.

2.0 SITE EXPLORATION AND LABORATORY TESTING

2.1 SITE EXPLORATION

Our site subsurface exploration was performed on April 8, 2021. Reconnaissance involved measurement, stratigraphic logging, sampling, and observation of four (4) Test Pit excavations (TP-1 through TP-4) and two (2) Wildcat Dynamic Cone Penetrometers (DCP-1 and DCP-2) performed within the proposed development area and in the vicinity of potential stormwater facility locations. Subsurface exploration locations were selected by MTC following discussion with, and using information supplied by the client to provide representative coverage of the area proposed for development. These locations were spread across the property to get a representative view of the underlying soils.

Test pits for soils testing and infiltration testing were excavated by backhoe services provided by MTC. TP-1 was dug near the northwest corner of the lot approximately 100 feet from the roundabout. TP-2 was located in the southwestern portion of the lot, approximately 100 feet South of TP-1. TP-3 was dug in the northeast corner of the lot approximately 150 feet West of Interstate 5. TP-4 was excavated 100 feet South of TP-3. Test pits were excavated to depths of 8.0 to 10.0 feet Below Present Grade (BPG) upon reaching approximate bearing and infiltration depths. Test pit excavations were monitored by MTC personnel, who examined and empirically classified the materials encountered in accordance with the Unified Soil Classification System (USCS) and ASTM D-2487, obtained representative soil samples, and recorded pertinent information including soil stratigraphy, consistency, in-situ moisture conditions, and indications of groundwater occurrences. Upon completion, test pits were backfilled with native soil tailings.

All DCP tests were terminated in dense or hard conditions. Refusal depths ranged from about 11.5 to 18.5 feet BPG. During penetrometer advancement, blow counts were recorded in 10-centimeter increments as a thirty-five-pound weight was dropped a distance of 15 inches. Blow counts were then converted to resistance (kg/cm2), standard penetration blow counts (N-values), and corresponding soil consistency, with complete results shown on the attached logs.

2.2 LABORATORY TESTING

Laboratory tests were conducted on several representative soil samples to better identify the soil classification of the units encountered and to evaluate the material's general physical properties and engineering characteristics. A brief description of the tests performed for this study is provided below. However, it is important to note that the test results may not accurately represent in situ soil conditions, our recommendations are based on our interpretation of the test results and their use in guiding our engineering judgment. MTC cannot be responsible for the interpretation of the data by others. Soil samples for this project will be retained for a minimum of 90 days following collection unless we are otherwise directed in writing.

2.2.1 SOIL CLASSIFICATION

Soil samples were visually examined in the field by our representative at the time they were obtained. They were subsequently packaged and returned to our laboratory where they were reexamined, and the original description checked and verified or modified. With the help of information obtained from the other classification tests, described below, the samples were described in general accordance with ASTM Standard D2487. The resulting descriptions are provided at the appropriate locations on the individual exploration logs, located in Appendix C, and are qualitative only.

2.2.2 GRAIN-SIZE DISTRIBUTION AND ATTERBERG LIMITS

Grain-size distribution analyses were conducted in general accordance with ASTM Standard D422 on representative soil samples to determine the grain-size distribution of the on-site soil. In addition, fine fraction of gradation samples were tested by hydrometer analysis ASTM Standard D7928 or soil liquid and plastic limits and plasticity index were determined with ASTM Standard D4318. The information gained from these analyses allows us to provide a description and classification of the in-place materials. In turn, this information helps us to understand engineering properties of the soil and thus how the in-place materials will react to conditions such as heavy seepage, traffic action, loading, potential liquefaction, and so forth. Grain size distribution results are used to estimate the hydraulic conductivities of the soils analyzed for stormwater infiltration potential.

3.0 EXISTING SITE CONDITIONS

3.1 SURFACE DESCRIPTION

The property is located in the City of Chehalis, Washington within close proximity to the mouth of the I-5 interstate. The property is roughly rectangular in shape with the eastern perimeter running parallel to the I-5. There is a car dealership on the parcel to the North of the project site, the lot across the street to the West is dominated by farmland, and the parcel immediately to the South is vacant and undeveloped. The project area is in a commercial zone dominated by industry and retail space and associated support facilities.

The parcel is currently vacant, cleared and approximately 8 feet below the grade of NW Louisiana Ave. A small concrete slab with no visible structures or connections was observed at the western perimeter of the lot with NW Louisiana Ave. Topography is generally flat throughout the site with minor decreases in grade on the order of a few inches towards a small irrigation ditch. The extent of historical site alterations beyond the existing conditions is unknown. A regional map and vicinity aerial image are included in Appendix A. The project site map is included in Appendix B and shows the locations of our field explorations.

3.2 GEOLOGIC SETTING

The *Geologic Map of the Centralia 7.5-minute Quadrangle, Lewis County, Washington* published by the Washington Department of Natural Resources (Polenz et al., 2018) indicates that site surface geology is mapped as non-glacial Quaternary Alluvium (Qa). Qa is commonly described as loose cobbles, sand, silt, and clay. Soils of this nature in this area commonly have high ground water, and are potentially liquefiable due to their loose, compressible, and saturated nature.

The United States Department of Agriculture - National Resource Conservation Service (NRCS) Web Soil Survey has the shallow subsurface conditions of the project site mapped as *Reed silty clay loam*. The NRCS describes this unit as silty clay loams and clay formed on flood plains and terraces. The NRCS considers this unit to be poorly drained with typical depth to a restrictive feature of more than 80 inches on a strongly contrasting textural stratification. The NRCS assigned Hydrologic Soil Group D; with a moderately low to moderately high capacity to transmit water with an estimated Saturated Hydraulic Conductivity (K_{sat}) of 0.06 to 0.20 inches/hour and typical water table 18 to 36 inches BPG.

Soil conditions encountered at the site typically consisted of silty sands and sandy silts with increased clay and fines content at depth. Observed conditions are generally consistent with regional geologic and soil map resources with a slight variation in observed depth to restrictive feature(s).

3.3 SOILS CONDITIONS

A general characterization of on-site soil units encountered during our exploration is presented below. The exploration logs in Appendix D present details of soils encountered at each exploration location.

The on-site soils are generally characterized as follows in stratigraphic order by depth:

- **Topsoil – Silty Sand (SM):**
  Topsoil was present in all boring locations from the surface to 1.5 feet BPG. This unit appeared native and consisted primarily of silty sand with trace amounts of gravel which was found to be loose and moist. Some organics including surficial grass and roots, were observed throughout.
- **Alluvial Outwash – Silty Sand (SM):**
  Soil interpreted as native recessional outwash underlie the topsoil and was consistently observed to 6.0 feet BPG. The unit was generally silty sand with some segments becoming sandy silts or sandy fat clays, moist and generally medium dense to dense.
- **Subsoil – Sandy Silt (MH):**
  Soils interpreted as subsoils were observed underlying the silts and sands to the termination depth of approximately 10.0 feet BPG. These units were moist to wet and had a very stiff to hard consistency.

3.4 SURFACE WATER AND GROUNDWATER CONDITIONS

Natural surface water features were not present within the project area at the time of this study. The Chehalis River is located approximately 0.5 to 0.8 miles northwest of the anticipated building footprint and the Airport Lake is located approximately 0.20 miles to the northwest.

Perched groundwater was encountered at approximately 3.0 feet BPG in TP-3.

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

4.0 KEY GEOTECHNICAL CONSIDERATIONS

This section discusses significant geotechnical issues that must be addressed in project planning and design and forms the basis for the geotechnical engineering design recommendations presented in Section 5.0 and construction recommendations presented in Section 6.0.

4.1 GENERAL SITE SOIL CONDSIDERATIONS

The results of MTC's investigation indicate the shallow subsurface is composed loose to medium dense, poorly sorted, fine grained soils. The generally loose consistency, perched shallow groundwater, and mechanics of these soil types yield high settlement concerns related to liquefaction. Liquefaction is the process by which tectonic energy released during an earthquake causes pore pressure in saturated soils to overcome internal friction causing the material to temporarily act fluidly. This can lead to extensive differential settlement of load bearing strata. MTC's Liquefaction analysis for this site is described in Section 4.5, liquefaction mitigation recommendations are included in Section 5.2, and computer modeling results are presented in Appendix E.

Generalized infiltration potential of the site soils was addressed as part of this investigation. Estimated parameters of Hydraulic Conductivity are very low, this and will limit infiltration potential for stormwater management. Details and discussion of our preliminary infiltration analysis are included in Section 5.5.

4.2 SCOPE OF SITE GRADING

A grading plan was not set at the time of this report. Based on discussions with the project team, nearby existing structures, and the relatively flat and low topography of the site, we understand that approximately 8.0 feet of imported fill will be used to raise the lot to meet the elevation of NW Louisiana Ave. MTC also understands from these discussions that the project team plans to scarify the existing site prior to placement of imported fill for foundations. *MTC has determined that these improvements are acceptable and further recommends we be allowed to assess the condition of the scarified lot prior to placement of imported fills.* Imported fills are anticipated to be utilized for foundations and slab-on-grade areas depending on final building design, recommendations relative to fill sections are included in Section 5.0 and Section 6.0.

4.3 TEMPORARY EXCAVATION CUT SLOPES, SHORING, AND DEWATERING

Plans for excavation including temporary cuts and proposed shoring, if required, were not available to MTC at the time of our field exploration and preparation of this report. Based on our project understanding, excavations into native soils are anticipated to be relatively shallow, if necessary. If deep excavations are left open and require worker entry, repealed cut slopes and/or shoring will likely be needed due to the soft nature of site soils. Section 6.3 of this report provides general recommendations for treatment of temporary excavations.

General recommendations for site preparation and wet weather construction are addressed in Section 6.1.3 of this report, however, this study did not include a hydrogeologic evaluation necessary for accurate appraisal of groundwater flow conditions.

MTC can provide further consultation, design, and evaluation services for cut slopes, shoring, and dewatering as the project develops.

4.4 SEISMIC DESIGN PARAMETERS

The *Site Class Map of Lewis County, Washington* (Palmer et al., 2004) classifies the project regional vicinity as "Seismic Site Class D to E". The *OSHPD Seismic Design Map Tool* was used to determine site-specific seismic design coefficients and spectral response accelerations for the project site, representing a sensitive subsurface profile including approximately 10 feet or more of soft soils in the upper 100 feet. The anticipated design criteria for site class D is included in Table 1 below. Parameters in Table 1 were calculated using 2008 USGS hazard data and 2012/2015 International Building Code standards with the American Society of Civil Engineers (ASCE) Standard 7-16 referenced for the site Peak Ground Acceleration (PGA_M).

Table 1. Seismic Design Parameters

Mapped Acceleration Parameters (MCE horizontal)	S_S	1.194 g
	S_1	0.489 g
Site Coefficient Values	F_a	1.200
	F_v	1.500
Calculated Peak SRA	S_{MS}	1.432 g
	S_{M1}	0.803 g
Design Peak SRA (*2/3 of peak*)	S_{DS}	0.955 g
	S_{D1}	0.535 g
Seismic Design Category – Short Period (0.2 Second) Acceleration		D
Seismic Design Category – 1-Second Period Acceleration		D

4.5 LIQUEFACTION HAZARD ANALYSIS

According to the *Liquefaction Susceptibility Map of Lewis County, Washington* (Palmer et al., 2004) the site vicinity is identified as having a moderate to high liquefaction susceptibility. MTC performed a site-specific analysis of liquefaction susceptibility and resulting ground subsidence. Analysis was completed using LiquefyPro Version 5.8h computer modeling software, published by CivilTech Software©. Parameters used in the modeling analysis were correlated to DCP sections based on MTC's findings and literature review. Analysis was performed for each DCP test location with the corresponding N-values.

LiquefyPro performs liquefaction settlement analysis in accordance with the latest National Center for Earthquake Engineering Research (NCEER) recommended procedures and provides several options for the treatment of data inputs. At each DCP location, modeling was performed using both the methods dictated by Tokimatsu and Seed (1987) and the methods dictated by Ishihara and Yoshimine (1990). In all simulations, a 7.0 magnitude earthquake event was applied. Calculations were completed using maximum peak ground acceleration of 0.632 g as provided by USGS resources, in accordance with ASCE 7-16 guidelines. To reflect liquefaction risk of existing conditions most accurately, no factor of safety, external surface load, or other ground disturbance was applied. For purposes of assessing a conservative scenario of liquefaction potential, the predominantly fine-grained members of the stratigraphy were not prohibited from liquefication and a seasonally high-water table depth of 2.0 feet was used. LiquifyPro output results are presented in Appendix F.

Liquefaction analysis predicts a maximum potential seismic-induced ground settlement of 1.69 inches. This analysis is based on liquefaction-induced settlement in the upper 19 feet of the subsurface profile, with greatest susceptibility in the upper 10 feet. In our opinion, this magnitude of potential seismic-induced settlement represents a relatively moderate site response to liquefaction and exceeds settlement tolerances commonly applied to proposed construction, which are typically on the order of 1.0 inch maximum.

Estimated maximum settlement is intended to represent an upper-bound limit of the potential settlement extent. Maximum liquefaction-induced settlement is unlikely to be realized site-wide at the ground surface, it is much more likely for spatially differential settlement to occur, particularly under varying loads. Therefore, the priority for incorporating mitigation techniques should be to limit as much as possible the adverse effects of differential settlement to the structure. Liquefaction mitigation considerations for the proposed construction are discussed further in Section 5.2 below.

5.0 DESIGN RECOMMENDATIONS

5.1 FOUNDATION FEASIBILITY

Two requirements must be fulfilled in foundation design: First, the ultimate bearing capacity of the underlying strata must exceed the applied load; Second, differential settlement must not exceed an amount that will produce adverse behavior of the structure. Allowable settlement is usually exceeded before bearing capacity failure, therefore design parameters that mitigate potential settlement concerns tend to fulfill or exceed design parameters for mitigating bearing capacity concerns.

Long-term deep, static settlement potential appears low in terms of consolidation, given the generally light building loads and calculated settlement values. Deep settlement concern for the site is directly related to the effects of liquefaction, which is only expected to manifest as a result of a seismic event. The high liquefaction potential at the project site will be the most limiting factor in foundation feasibility at the site, and mitigations for this hazard will likely serve to provide sufficient bearing capacities for foundation design at the project site.

The soft shallow soil conditions of project site and liquefaction concerns will require subsurface improvements for shallow foundation feasibility including removal of topsoil and soft shallow alluvial soil for the building footprint and its margins, and placement of structural fill sections. *It is MTC's opinion that a shallow foundation will be suitable for use provided the recommendations contained herein are followed to improve subsurface conditions to protect the structure from excessive damage and failure during a seismic event as a result of differential settlement. Recommendations for the design and construction of structural-fill sections are included in Section 5.1.1, Section 6.1, and Section 6.2.*

MTC believes that deep foundation options can be implemented in lieu of shallow subsurface improvements if desired. It is our estimation that deep foundation design and construction is not a cost-effective approach to liquefaction mitigation at the project site due to a lack of shallow end bearing strata. MTC is available to provide more detailed analysis if deep foundation considerations are desired.

5.2 LIQUEFACTION MITIGATION

In order to reduce structural damage due to liquefaction-induced differential settlement, MTC recommends the following options for shallow ground improvements and structural mitigation measures.

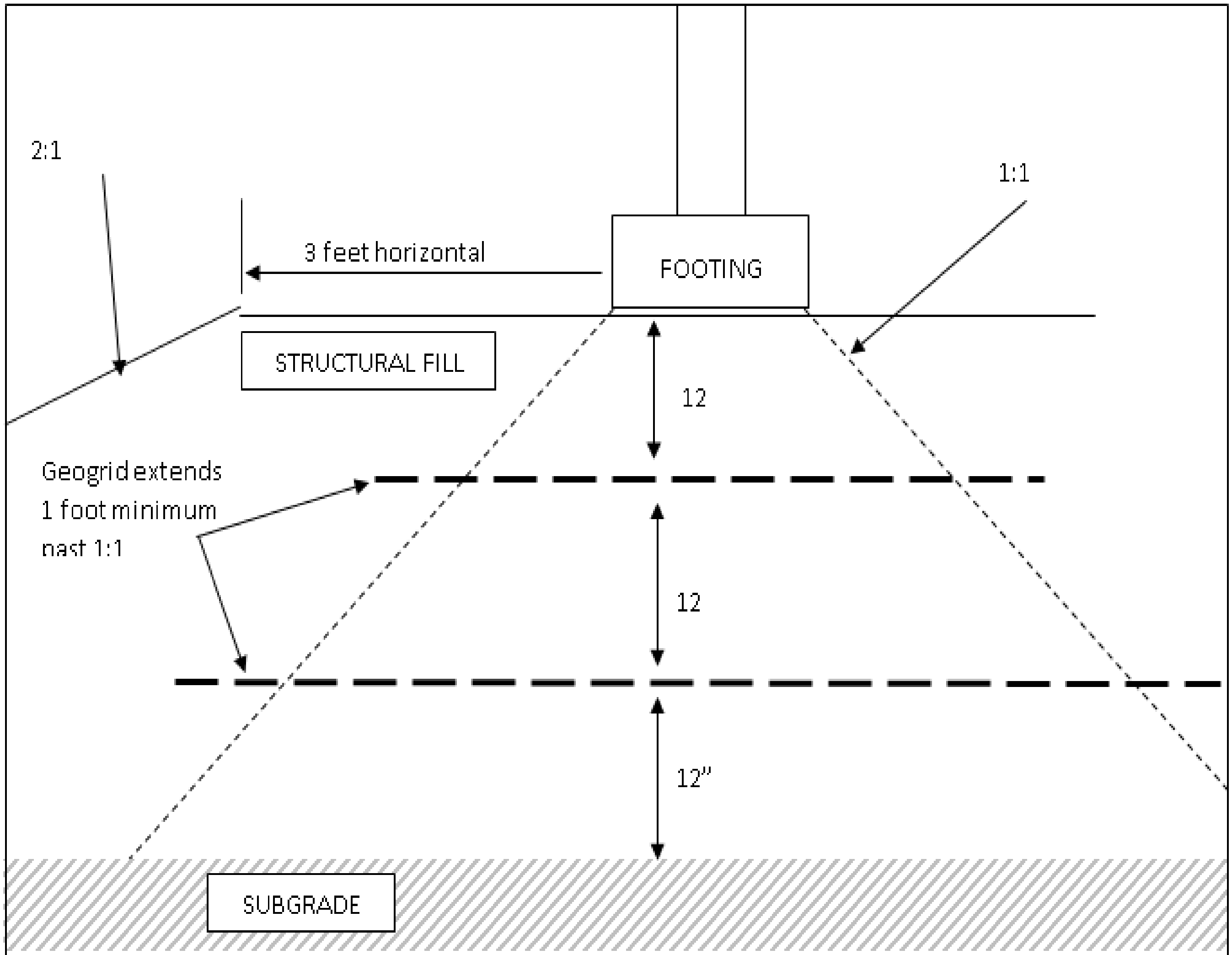
- **Subsurface Improvements:**

  For shallow foundation preparations, MTC recommends a geotextile-reinforced structural-fill pad placed directly beneath footings as described here and shown in Figure 1 below. Prior to placement of structural fill subgrade should be cleared of organic topsoil and any deleterious materials and prepared in accordance with Section 6.1 of this report. Classification and compaction of structural fill should meet or exceed the recommendations contained in Section 6.2. The fill section must be a minimum of 36 inches (3.0 feet) in thickness, after compaction, below all footing grades. For lateral stability, the structural fill pad should extend horizontally a minimum of 3.0 feet in all directions from the outer edge of footing locations before grading side slopes at a maximum inclination of 2:1 (H:V). Geotextile reinforcement should be incorporated in the fill section spaced vertically at 1 foot or less, extending horizontally a minimum of 1 foot past a 1:1 (H:V) projection downward from the edge of footing, and installed per manufacturer recommended guidelines. MTC recommends using a higher strength triaxial geotextile such as Tensar TriAx TX160 or equivalent. MTC should be contacted to review proposed product substitutions.

- **Structural Considerations:**

  Interfaces of building components that impose different loads on the bearing strata present high-risk areas prone to damage from differential settlement. If isolated spread footing design is desired for the proposed building, MTC recommends the inclusion of grade beams or similar reinforcements in the design, placed over geotextile-reinforced structural fill prepared as prescribed herein. MTC also recommends that non-foundational structural components that commonly rely on ground bearing, such as typical slab on grade design, be tied into the foundation system and/or otherwise designed to prevent damage due to differential movement.

MTC believes that design and construction practices that meet or exceed the recommendations contained herein will serve to mitigate structural damage due to liquefaction-induced differential settlement at the project site. In the event that the proposed structure contains much higher loads than anticipated at this time, more robust mitigations such as installation of stone columns (geo-piers) may be necessary. MTC is available to consult on the application of additional mitigation techniques if requested.



Geogrid Installation Specifications:

- Place a minimum of two (2) horizontal layers at depth increments shown as measured from base of footing.
- Center below footing and extend parallel along entire footing alignment.
- At grid interfaces, overlap a minimum of 6 inches. Avoid parallel interfaces as possible.
- Minimum widths per layer based on actual footing width. Extend 1 foot past 1:1 projection (*For example, a 2-foot wide footing will require minimum grid widths of about 6 and 10 feet*).

Typical Shallow Foundation Structural-Fill Section
NOT TO SCALE

FIGURE
1

5.3 ADDITIONAL FOUNDATION CONSIDERATIONS

The following recommendations shall be considered for foundation design and construction in addition to the recommendations contained in Section 5.2 above.

- **Allowable Soil Bearing Capacity:**
  A maximum allowable bearing capacity of 2,500 pounds per square foot (psf) for spread and strip perimeter foundations is recommended. This applies to footings placed on a geotextile-reinforced structural-fill pad in accordance with Section 5.2 of this report. Soils must be verified as suitably firm for the prescribed construction and organic-free at subgrade level prior to commencing pad installation. The allowable bearing capacity may be increased by 1/3 for transient loading due to wind and seismic events

- **Minimum Footing Depth:**
  For a shallow perimeter footing system, all exterior footings shall be embedded a minimum of 18 inches and all interior footings shall be embedded a minimum of 12 inches below the lowest adjacent finished grade, but not less than the depth required by design. All footings must be founded on the prescribed bearing stratum prescribed in Section 5.2, and no footing should be founded in or above organic-rich or unsuitably loose/soft soils or non-verified fills.

- **Minimum Footing Width:**
  Footings should be proportioned to meet the stated bearing capacity and/or the IBC 2015 (or current) minimum requirements. For a shallow perimeter and spread footing system, continuous strip footings should be a minimum of 16 inches wide and interior or isolated column footings should be a minimum of 24 inches wide.

- **Estimated Settlements:**

  As indicated in Section 4.5, maximum settlement potential is estimated to be around 7.85 inches. Seismic-induced settlement mitigation as addressed in Section 5.2 will serve to mitigate static settlement concerns as well.

- **Lateral Bearing Capacity:**

  We recommend an allowable lateral pressure equal to that generated by a fluid with an equivalent unit weight of 150 PCF corresponding to structural elements backfilled laterally with structural-fill and for footings placed directly against imported structural-fill. The upper 18 inches of soil should be ignored due to soil softening associated with freeze/thaw, unless the area is paved or covered with concrete. Additional resistance to lateral loads may be calculated by multiplying the vertical load on the base of the footing by a factor of 0.35 using a factor of safety of 1.5. This assumes fill sections conform to the recommendations contained herein and that footings are formed directly on the prescribed angular rock or structural-fill base pad.

5.4 SLAB-ON-GRADE CONSIDERATIONS

As noted in Section 5.2 above, slab on grade for this project site should be designed and constructed to prevent differential movement of the slab relative to other structural components due to settlement concerns. MTC recommends the following additional considerations for slab-on-grade design and construction.

- **Subgrade Modulus and Base Preparations:**
  We recommend stripping organic-rich or excessively loose soils from slab-on-grade footprints prior to slab base preparation. Anticipated stripping depth based on explorations is approximately 6 to 12 inches. We recommend a 12-inch minimum section of structural fill base be installed beneath the slab in accordance with Section 6.2 of this report. Subgrade at the base of fill shall be prepared in accordance with Section 6.1, and geotextile should be installed between subgrade and fill. A Subgrade Modulus (k) of 125 pounds per cubic inch is allowed for use in design of the slab-on-grade floor constructed. Capillary break may be included as part of the minimum section of structural fill if suitable structural material is used. Structural fill base recommendations may be subject to revision based on the final design and level of reinforcement in the concrete slab-on-grade.

- **Capillary Break:**
  A capillary break is recommended to maintain a dry slab floor and reduce the potential for floor damage resulting from shallow ground water inundation. To provide a capillary moisture break, a 6-inch thick, properly compacted granular mat consisting of open-graded, free-draining angular aggregate is recommended for use. To provide additional slab structural support, and to substitute for a structural fill base as specified, the capillary break should consist of angular to sub-angular rock with 100 percent passing the 1-inch sieve and no more than 3 percent (by weight) passing the U.S. No. #4 sieve, and compacted in accordance with Section 6.2.2.

- **Structural Slab Considerations:**
  Slab thickness related to structural or kinetic loading from heavy equipment or vehicle traffic should be a minimum of 6 inches, design specifications should be assessed by the project designer. MTC recommends that we be contacted to review specifications for heavily loaded or traffic areas if present, and to provide additional recommendations appropriate to the type and magnitude of loading including additional site preparation and increased base fill section requirements if needed.

5.5 STORMWATER INFILTRATION CONSIDERATIONS

5.5.1 INFILTRATION DESIGN AND RATES DISCUSSION

MTC proposed to perform (2) small-scale Pilot Infiltration Tests (P.I.T.s) during the course of our subsurface investigation to assess the infiltration characteristic of the site. During the initial site visits to perform excavations for test pits, MTC observed large amounts of highly plastic silts and clays with fine grained soil. Furthermore, MTC observed perched groundwater at approximately 3.0 feet BPG in TP-3.

In general, the results of MTC's investigation indicate that site soil conditions as a whole present significant limitations for conventional on-site infiltration design. The fine and clayey nature of the soils observed strongly will significantly limit conventional infiltration measures. The possibly shallow groundwater table (encountered as shallow as 3.0 feet BPG) in the area presents additional limitations. Due to these numerous inconsistencies, and settlement susceptible soils on site, it is recommended that any alternatives to infiltration into native soils be explored, if possible at all.

6.0 CONSTRUCTION RECOMMENDATIONS

6.1 EARTHWORK

6.1.1 EXCAVATION

Excavations can generally be performed with conventional earthmoving equipment such as bulldozers, scrapers, and excavators. Where possible, excavations made within about one foot of finished subgrade level should be performed with smooth-edged buckets to minimize subgrade disturbance and the potential for soil softening to the greatest extent practical.

6.1.2 SUBGRADE EVALUATION AND PREPERATION

After excavations have been completed to the planned subgrade elevations, but before placing fill or structural elements, the exposed subgrade soils should be compacted to firm and unyielding condition to be evaluated under the full-time observation and guidance of an MTC representative. Where appropriate, the evaluation should include proof-rolling with a fully loaded dump truck, water truck, or other sufficiently heavy vehicle. In circumstances where this seems unfeasible, an MTC representative may use alternative methods for subgrade evaluation.

Any loose soil should be compacted to a firm and unyielding condition and at least to 95 percent of the maximum dry density as determined by ASTM D1557. Any areas that are identified as being soft or yielding during subgrade evaluation should be over-excavated to prepare a firm and unyielding condition or otherwise to the depth determined by the geotechnical engineer. Where over-excavation is performed below foundation elements, the over-excavation area should extend horizontally beyond the outside of the footing a distance equal to the greater of 3 feet or the depth of the over-excavation below the footing. The over-excavated areas should be backfilled with properly compacted structural fill per recommendations in Section 6.2.

6.1.3 SITE PREPARATION, EROSION CONTROL, and WET WEATHER CONSTRUCTION

The existing native silty subgrade is moisture sensitive and is likely to become loose or soft and difficult to compact or traverse with construction equipment when wet. During wet weather, the contractor should take measures to protect the exposed building pad and subgrades and limit construction traffic during earthwork activities.

Once the geotechnical engineer has approved a subgrade, further measures should be implemented to prevent degradation or disturbance of the subgrade. These measures could include, but are not limited to, placing a layer of crushed rock or lean concrete on the exposed subgrade, or covering the exposed subgrade with a plastic tarp and keeping construction traffic off the subgrade. Once subgrade has been approved, any disturbance because the subgrade was not protected should be repaired by the contractor at no cost to the owner.

During wet weather, earthen berms or other methods should be used to prevent runoff from draining into excavations. All runoff should be collected and disposed of properly. Measures may also be required to reduce the moisture content of on-site soils in the event of wet weather. These measures can include, but are not limited to, air drying, soil amendment, etc.

It would be difficult, and not recommended, to work with the on-site native soils during periods of wet weather due to elevated soil moisture content and possible plasticity. We recommend that earthwork activities generally take place in late spring, summer or early fall to reduce potential interaction between water and these shallow subgrade soils. In addition, summer may be the most preferable time for major earthwork construction, corresponding to the period of generally lowest perched ground water occurrences.

Dewatering efforts may be required locally depending on total excavation depth, season of construction, and weather conditions during earthwork. MTC recommends major earthwork activities take place during the dry season, if possible, to minimize the potential for encountering groundwater or seepage near proposed excavation depth.

6.2 STRUCTURAL FILL MATERIALS AND COMPACTION

6.2.1 MATERIALS

All material placed below structures or pavement areas shall be free of deleterious material, have a maximum particle size of 6 inches, not contain organic soil or topsoil, and can be compacted per recommendations in Section 6.2. Deleterious material includes wood, organic waste, coal, charcoal, or any other extraneous or objectionable material.

Structural fill used beneath **footings, slabs, and pavement** shall meet WSDOT 9-03.14(1) definition of **Gravel Borrow** or structural equivalent approved by the project engineer. Aggregate for gravel borrow shall consist of granular material, either naturally occurring or processed, and shall meet the gradation requirements of Table 2.

Table 2. WSDOT Specifications for Gravel Borrow

Sieve Size	% Passing by weight
4"	99-100
2"	75-100
No. 4	50-80
No. 40	30 max.
No. 200	7.0 max.
Sand Equivalent	50 min.

WSDOT 9-03.14(1)

Excavated native soils consisting of sandy silt to silty sand are not suitable for re-use as structural fill due to low or absent gravel content and high fines content. These soils may have potential for reuse as site-grading fills in landscape areas. Reuse for landscaping purposes is subject to evaluation by others, such as the civil designer and/or a qualified landscape design professional.

Controlled-density fill (CDF) or lean mix concrete can be used as an alternative to structural fill materials, except in areas where free-draining materials are required or specified.

Angular ballast rock of one to two-inch diameter sizing and composed of competent rock may be used below structural fill areas at footing locations to provide support under columns and where mitigations with groundwater are required.

Frozen soil is not suitable for use as structural fill. Fill material may not be placed on frozen soil.

The contractor should submit samples of each of the required earthwork materials to the geotechnical engineer for evaluation and approval prior to delivery to the site. The samples should be submitted at least 5 days prior to delivery and sufficiently in advance of the work to allow the contractor to identify alternative sources if the material proves unsatisfactory.

Geotextile fabric in fill sections should meet or exceed the performance criteria of Tensar TriAx TX160 or equivalent, MTC should be contacted to review proposed product substitutions.

6.2.2 PLACEMENT AND COMPACTION

Prior to placement and compaction, structural fill should be moisture conditioned to within 2 percentage points of its optimum moisture content for coarse-grained soils and 3 percentage points of its optimum moisture content for fine-grained and mixed soils. Individual lifts of structural-fill shall not exceed 6 inches, in loose state, for compactive efforts using walk-behind or hand operated compaction equipment, 8 inches using light to medium-duty rollers, and 12 inches using heavy-duty compaction equipment.

All structural fill shall be compacted to a firm and unyielding condition and to a minimum relative compaction as follows, based on maximum dry density as determined per ASTM D1557.

Table 3. Structural Fill Compaction Recommendations

Prepared For	Compacted Relative Density (%)
Foundation and Floor Slab Subgrades:	95
Pavement Subgrades (upper 2 feet):	95
Pavement Subgrades (below 2 feet):	90
Utility Trenches (upper 4 feet):	95
Utility Trenches (upper 4 feet):	90

Maximum density determined by ASTM D1557

We recommend that fill placed on slopes steeper than 3:1 (H:V) be benched in accordance with hillside terraces entry of section 2-03.3(14) of the WSDOT Standard Specifications.

We recommend structural-fill placement and compaction be observed on a full-time basis by an MTC representative. A sufficient number of tests shall be performed to verify compaction of each lift. The number of tests required will vary depending on the fill material, its moisture condition and the equipment being used. Initially, more frequent tests will be anticipated while the contractor establishes the means and methods required to achieve proper compaction.

6.3 TEMPORARY EXCAVATIONS AND SLOPES

All excavations and slopes must comply with applicable local, state, and federal safety regulations. Construction site safety is the sole responsibility of the Contractor, who shall also be solely responsible for the means, methods, and sequencing of construction operations. We are providing soil type information solely as a service to our client for planning purposes. Under no circumstances should the information be interpreted to mean that MTC is assuming responsibility for construction site safety or the Contractor’s activities; such responsibility is not being implied and should not be inferred.

Based on our soil characterization, most of the near-surface silty sand to sandy silt at the site classify as OSHA Type A soils. Some areas containing more dominant silty sand classify as Type B soils. Temporary excavations in the cover soils and shallow alluvial soils should be inclined no steeper than 1.5:1 (H:V), unless approved by the geotechnical engineer. Applying lesser grades may be necessary depending on actual conditions encountered and the potential presence of water seepage. Steeper grades are likely to be feasible in favorable conditions but must be evaluated once exposed during construction for suitability per OSHA requirements. Heavy construction equipment, building materials, excavated soil, and vehicular traffic should not be allowed near the top of any excavation. Where the stability of adjoining walls or other structures is endangered by excavation operations, support systems such as shoring, bracing, or underpinning may be required to provide structural stability and to protect personnel working within the excavation. Earth retention, bracing, or underpinning required for the project (if any) should be designed by a professional engineer registered in the State of Washington.

Temporary excavations and slopes should be protected from the elements by covering with plastic sheeting or some other similar impermeable material. Sheeting sections should overlap by at least 12 inches and be tightly secured with sandbags, tires, staking, or other means to prevent wind from exposing the soils under the sheeting.

6.4 PERMANENT SLOPES

MTC recommends that new areas of permanent slopes including fill embankments be inclined no greater than 3H:1V. Permanent slopes should be planted with a deep-rooted, rapid-growth vegetative cover as soon as possible after completion of slope construction. Alternatively, the slope should be covered with plastic, straw, etc. until it can be landscaped. MTC is able to provide more detailed slope-stability analysis as the project progresses.

6.5 UTILITY TRENCHES AND EXCAVATIONS

The contractor shall be responsible for the safety of personnel working in utility trenches. Given that steep excavations in native soils on site may be prone to caving, we recommend all utility trenches, but particularly those greater than 4 feet in depth, be supported in accordance with state and federal safety regulations, including trench-shield or shoring as appropriate (See slope recommendations in Section 6.3).

Pipe bedding material should conform to the manufacturer’s recommendations and be worked around the pipe to provide uniform support. Cobbles exposed in the bottom of utility excavations should be covered with pipe bedding or removed to avoid inducing concentrated stresses on the pipe.

Trench backfill should be approved structural-fill material placed and compacted as recommended in Section 6.2. Particular care should be taken to ensure bedding or fill material is properly compacted to provide adequate support to the pipe. Jetting or flooding is not a substitute for mechanical compaction and should not be allowed.

7.0 ADDITIONAL RECOMMENDED SERVICES

The recommendations made in this report are based on the assumption that an adequate program of tests and observations will be made during construction to verify compliance with these recommendations. Testing and observations performed during construction should include, but not necessarily be limited to, the following:

- Geotechnical plan review and engineering consultation as needed prior to construction phase.
- Observations and testing during site preparation, earthwork, structural fill, and pavement section placement.
- Consultation on temporary excavation cut slopes and shoring if needed.
- Testing and inspection of any concrete or masonry included in the final construction plans.
- Consultation as may be required during construction.

We strongly recommend that MTC be retained for the construction of this project to provide these and other inspection services. Our knowledge of the project site and the design recommendations contained herein will be of benefit in the event that difficulties arise and either modifications or additional geotechnical engineering recommendations are required or desired. MTC, in a timely fashion, can observe the actual soil conditions encountered during construction, evaluate the applicability of the recommendations presented in this report to the soil conditions encountered, and recommend appropriate changes in design or construction procedures if conditions differ from those described herein.

We further recommend that project plans and specifications be reviewed by us to verify compatibility with our conclusions and recommendations.

Also, MTC retains fully accredited, WABO-certified laboratory and inspection personnel, and is available for this project’s testing, observation and inspection needs. Information concerning the scope and cost for these services can be obtained from our office.

8.0 LIMITATIONS

Recommendations contained in this report are based on our understanding of the proposed development and construction activities, our field observations and explorations, and our laboratory test results. It is possible that soil and groundwater conditions could vary from that which is described herein. If variable soil or groundwater conditions are encountered during construction, we should be notified immediately in order to review and provide supplemental recommendations. If the scope of the proposed construction, including the proposed loads or structural locations, changes from that described in this report, we should be notified to review and provide supplemental recommendations.

We have prepared this report in substantial accordance with the generally accepted geotechnical engineering standard of service as it exists in the site area at the time of our study. No warranty, expressed or implied, is made. The recommendations provided in this report are based on the assumption that an adequate program of tests and observations will be conducted by MTC during the construction phase in order to evaluate compliance with our recommendations.

This report may be used only by the Client and their design consultants and only for the purposes stated within a reasonable time from its issuance, but in no event later than 18 months from the date of the report. It is the Client's responsibility to ensure that the Designer, Contractor, Subcontractors, etc. are made aware of this report in its entirety. Note that if another firm assumes Geotechnical Engineer of Record responsibilities, they need to review this report and either concur with the findings, conclusions, and recommendations or provide alternate findings, conclusions and recommendation under the guidance of a professional engineer registered in the State of Washington.

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

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

9.0 REFERENCES CITED

Logan, R.L., Walsh, T.J., Schasse, H.W., and Polenz Michael, 2003, Geologic Map of the Chehalis River and Westport quadrangles, Washington: U.S. Geologic Survey, scale 1:100,000. https://www.dnr.wa.gov/Publications/ger_ofr87-8_geol_map_chehalisriver_westport_100k.zip

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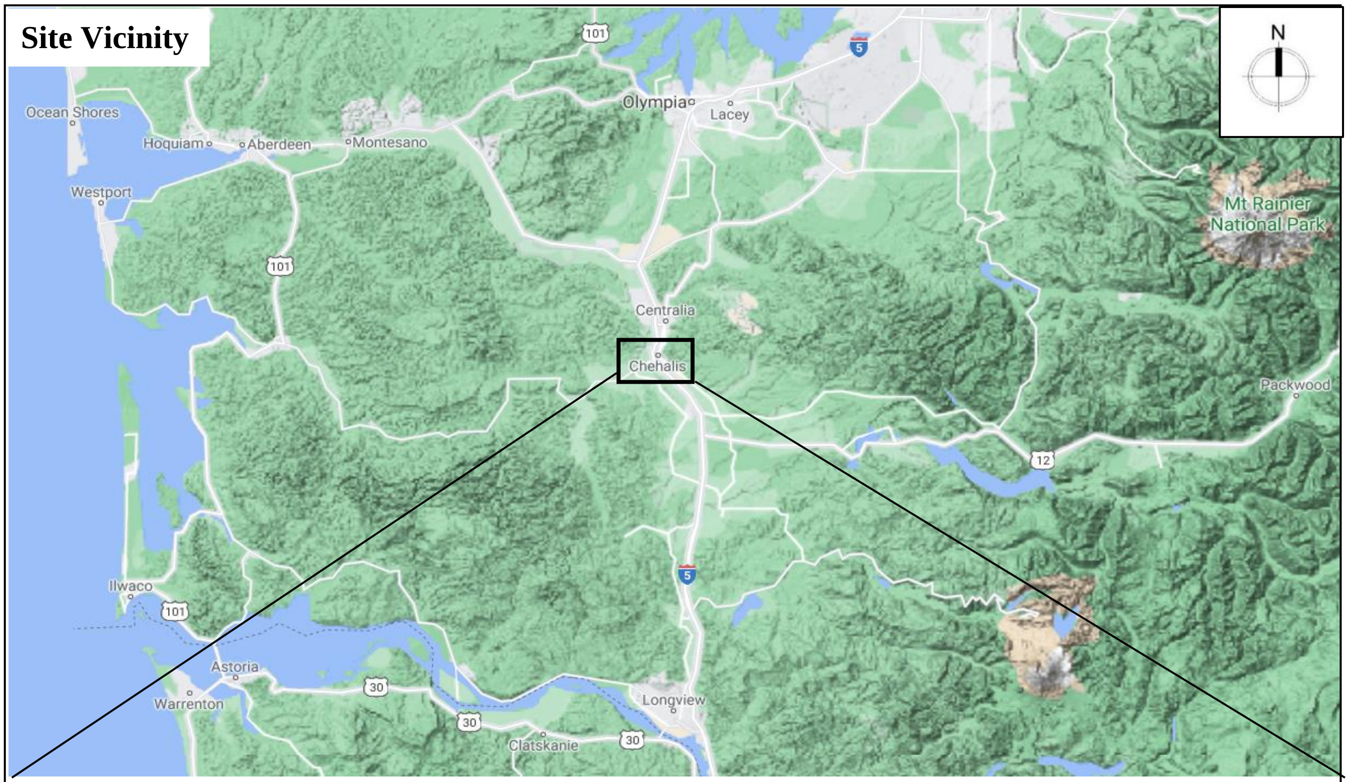
Property Account Summary, Lewis County Assessor
Parcels (lewiscountywa.gov)

Appendix A. Location and Vicinity Maps



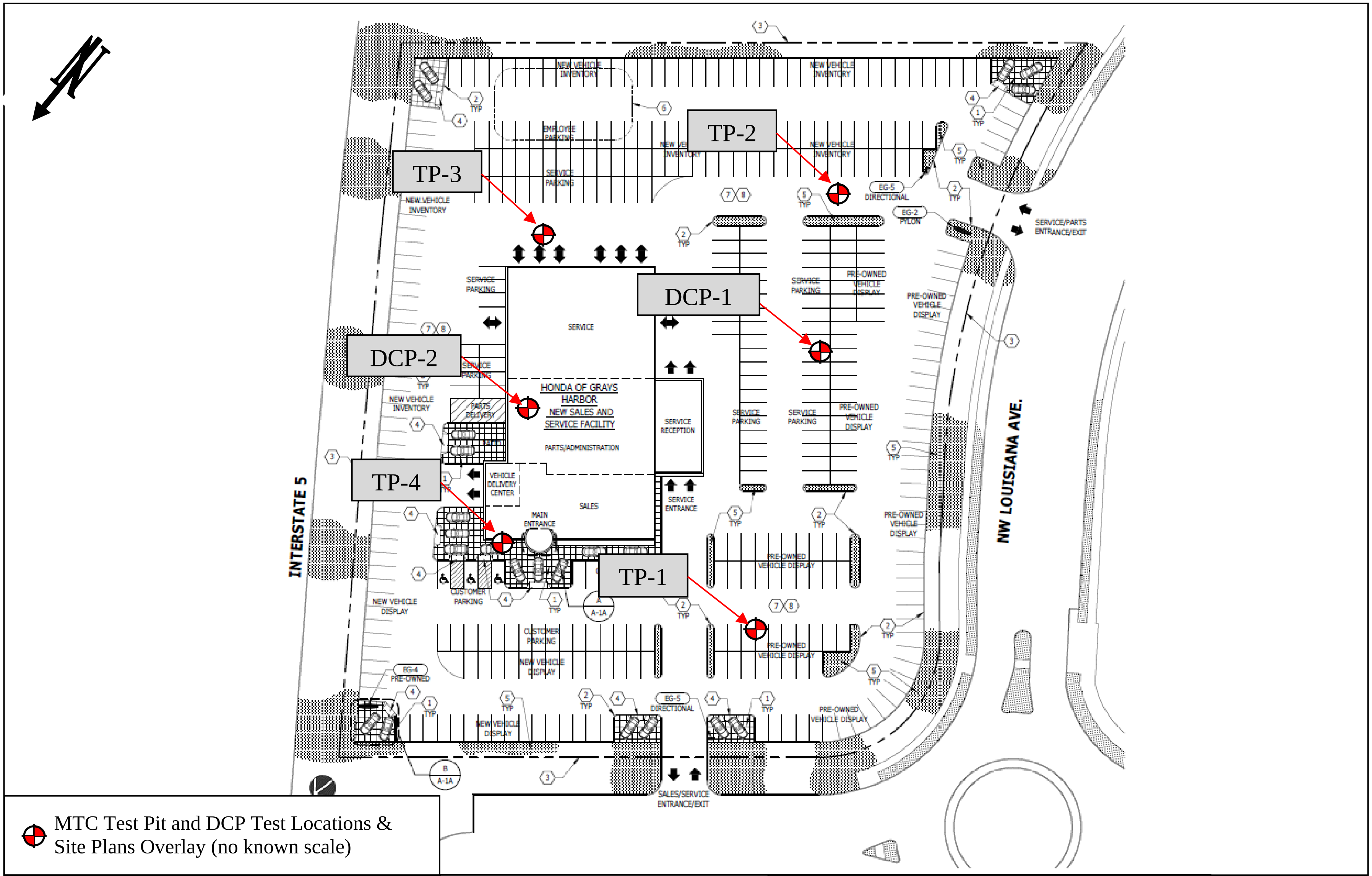
Site Vicinity

Site Location

Maps Source:
Google Imagery 2021

Materials Testing & Consulting, Inc. 2118 Black Lake Blvd Olympia, WA 98512	**Site Location & Vicinity Maps** **Honda of Grays Harbor – Chehalis** 1850 NW Louisiana Ave, Chehalis, WA	**FIGURE** **2**

Appendix B. Site Plan with Exploration Locations



⊕ MTC Test Pit and DCP Test Locations & Site Plans Overlay (no known scale)

Materials Testing & Consulting, Inc. 2118 Black Lake Blvd, Olympia, WA, 98512	**NOT TO SCALE** ***Shown locations are Approximate***	**Site Plan with Exploration Locations** **Honda of Grays Harbor - Chehalis** 1850 NW Louisiana Ave Chehalis, WA	**FIGURE** **3**

Appendix C. Photos of Site Exploration

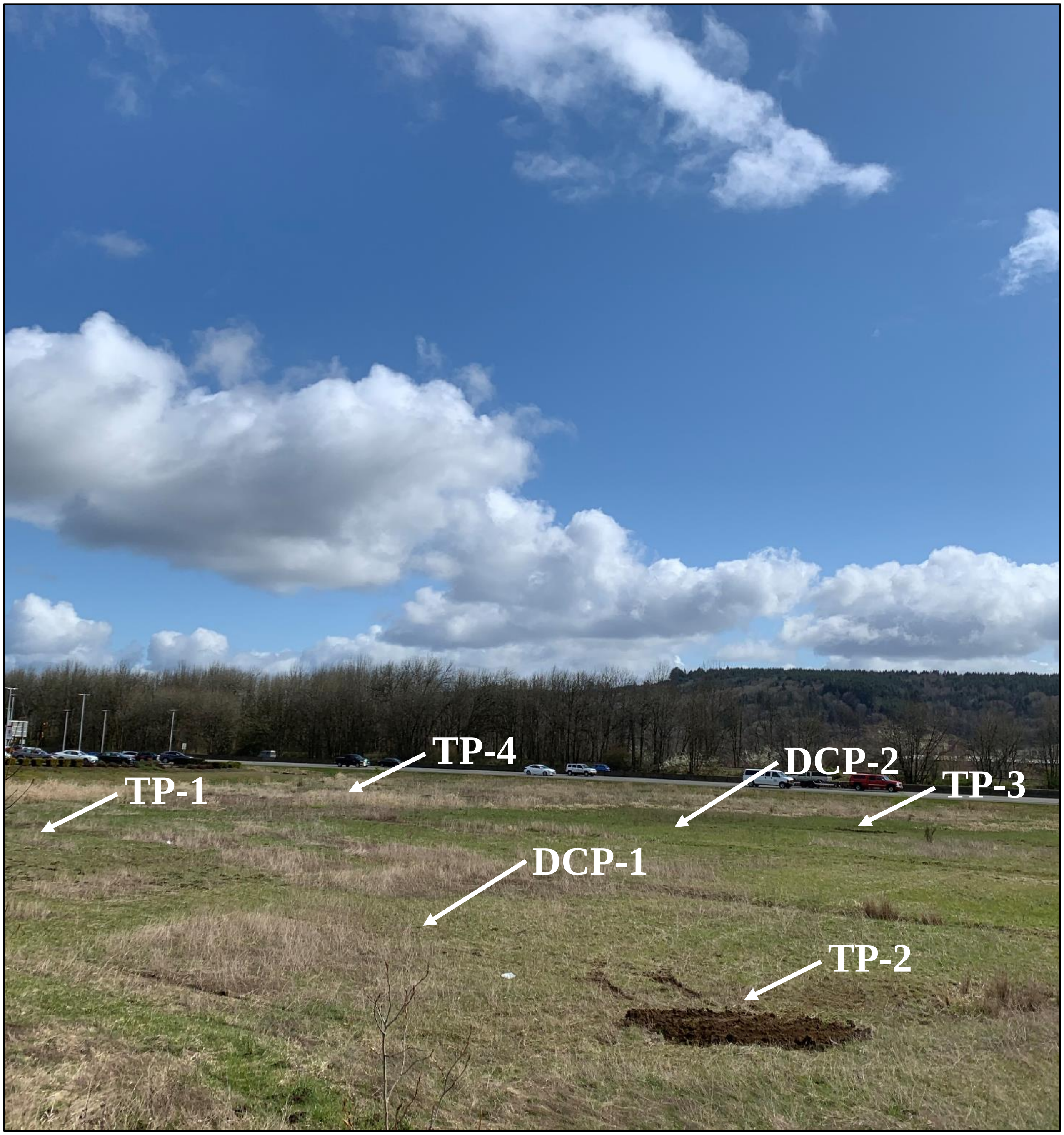
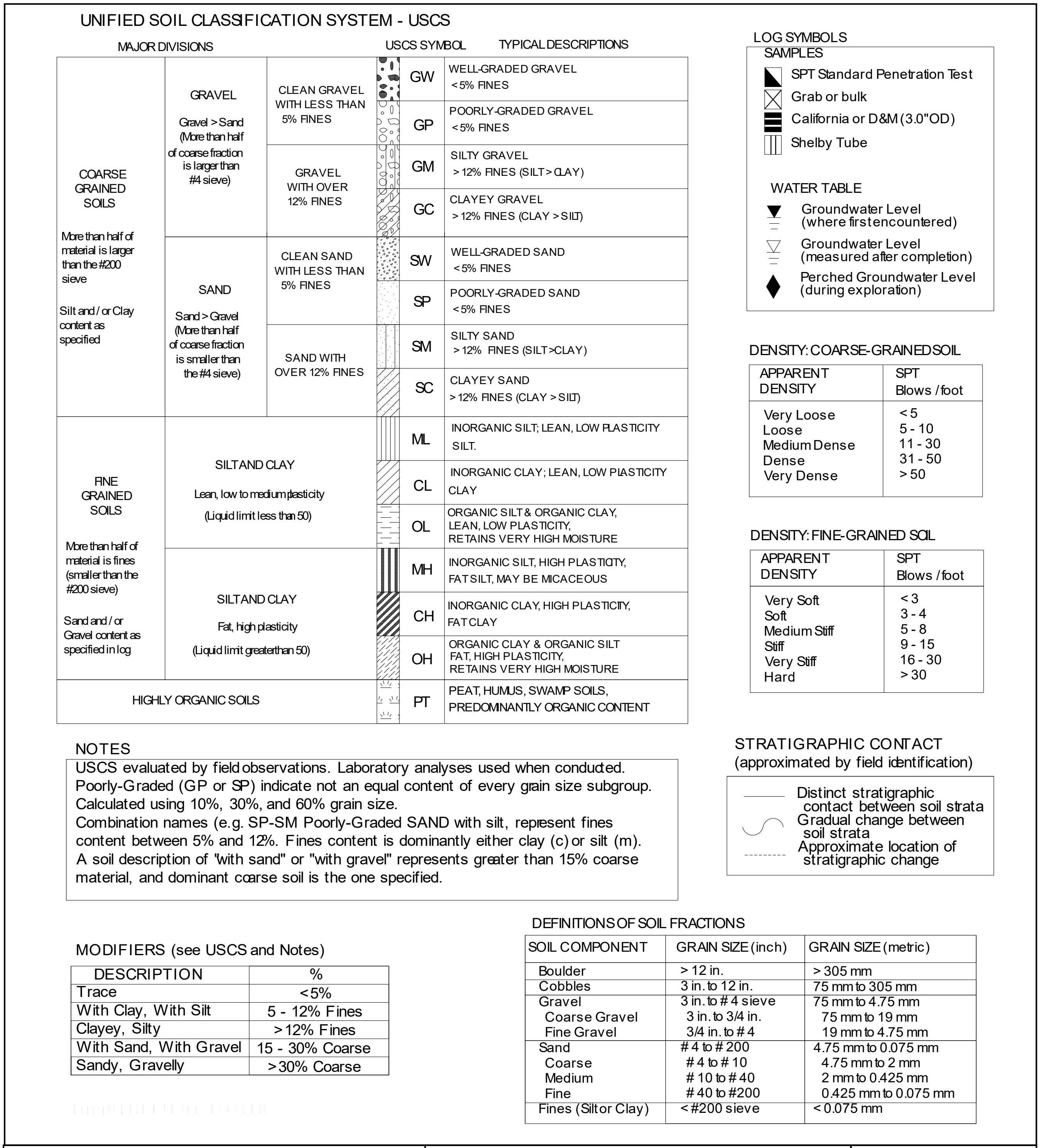


Photo A: Overview of project site, looking northeast from the access near NW Louisiana Ave at the approximate southern extent of the parcel.

Photos B, C and D (*clockwise*): Photos of excavations of Test Pits 1 through 3. Note the exposed cohesive soils excavated at Test Pit 3.

Appendix D. Exploration Logs



UNIFIED SOIL CLASSIFICATION SYSTEM - USCS

MAJOR DIVISIONS			USCS SYMBOL	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS More than half of material is larger than the #200 sieve Silt and / or Clay content as specified	GRAVEL Gravel > Sand (More than half of coarse fraction is larger than #4 sieve)	CLEAN GRAVEL WITH LESS THAN 5% FINES	GW	WELL-GRADED GRAVEL < 5% FINES
			GP	POORLY-GRADED GRAVEL < 5% FINES
		GRAVEL WITH OVER 12% FINES	GM	SILTY GRAVEL > 12% FINES (SILT > CLAY)
			GC	CLAYEY GRAVEL > 12% FINES (CLAY > SILT)
	SAND Sand > Gravel (More than half of coarse fraction is smaller than the #4 sieve)	CLEAN SAND WITH LESS THAN 5% FINES	SW	WELL-GRADED SAND < 5% FINES
			SP	POORLY-GRADED SAND < 5% FINES
		SAND WITH OVER 12% FINES	SM	SILTY SAND > 12% FINES (SILT>CLAY)
			SC	CLAYEY SAND > 12% FINES (CLAY > SILT)
FINE GRAINED SOILS More than half of material is fines (smaller than the #200 sieve) Sand and / or Gravel content as specified in log	SILT AND CLAY Lean, low to medium plasticity (Liquid limit less than 50)		ML	INORGANIC SILT; LEAN, LOW PLASTICITY SILT.
			CL	INORGANIC CLAY; LEAN, LOW PLASTICITY CLAY
			OL	ORGANIC SILT & ORGANIC CLAY, LEAN, LOW PLASTICITY, RETAINS VERY HIGH MOISTURE
	SILT AND CLAY Fat, high plasticity (Liquid limit greater than 50)		MH	INORGANIC SILT, HIGH PLASTICITY, FAT SILT, MAY BE MICACEOUS
			CH	INORGANIC CLAY, HIGH PLASTICITY, FAT CLAY
			OH	ORGANIC CLAY & ORGANIC SILT FAT, HIGH PLASTICITY, RETAINS VERY HIGH MOISTURE
HIGHLY ORGANIC SOILS			PT	PEAT, HUMUS, SWAMP SOILS, PREDOMINANTLY ORGANIC CONTENT

LOG SYMBOLS

SAMPLES

- ◣ SPT Standard Penetration Test
- ☒ Grab or bulk
- ▤ California or D&M (3.0"OD)
- ▥ Shelby Tube

WATER TABLE

- ▼ Groundwater Level (where first encountered)
- ▽ Groundwater Level (measured after completion)
- ◆ Perched Groundwater Level (during exploration)

DENSITY: COARSE-GRAINED SOIL

APPARENT DENSITY	SPT Blows / foot
Very Loose	< 5
Loose	5 - 10
Medium Dense	11 - 30
Dense	31 - 50
Very Dense	> 50

DENSITY: FINE-GRAINED SOIL

APPARENT DENSITY	SPT Blows / foot
Very Soft	< 3
Soft	3 - 4
Medium Stiff	5 - 8
Stiff	9 - 15
Very Stiff	16 - 30
Hard	> 30

NOTES

USCS evaluated by field observations. Laboratory analyses used when conducted. Poorly-Graded (GP or SP) indicate not an equal content of every grain size subgroup. Calculated using 10%, 30%, and 60% grain size.
Combination names (e.g. SP-SM Poorly-Graded SAND with silt, represent fines content between 5% and 12%. Fines content is dominantly either clay (c) or silt (m).
A soil description of "with sand" or "with gravel" represents greater than 15% coarse material, and dominant coarse soil is the one specified.

STRATIGRAPHIC CONTACT
(approximated by field identification)

———	Distinct stratigraphic contact between soil strata
∽	Gradual change between soil strata
- - - -	Approximate location of stratigraphic change

MODIFIERS (see USCS and Notes)

DESCRIPTION	%
Trace	< 5%
With Clay, With Silt	5 - 12% Fines
Clayey, Silty	> 12% Fines
With Sand, With Gravel	15 - 30% Coarse
Sandy, Gravelly	> 30% Coarse

DEFINITIONS OF SOIL FRACTIONS

SOIL COMPONENT	GRAIN SIZE (inch)	GRAIN SIZE (metric)
Boulder	> 12 in.	> 305 mm
Cobbles	3 in. to 12 in.	75 mm to 305 mm
Gravel	3 in. to # 4 sieve	75 mm to 4.75 mm
Coarse Gravel	3 in. to 3/4 in.	75 mm to 19 mm
Fine Gravel	3/4 in. to # 4	19 mm to 4.75 mm
Sand	# 4 to # 200	4.75 mm to 0.075 mm
Coarse	# 4 to # 10	4.75 mm to 2 mm
Medium	# 10 to # 40	2 mm to 0.425 mm
Fine	# 40 to #200	0.425 mm to 0.075 mm
Fines (Silt or Clay)	< #200 sieve	< 0.075 mm

Materials Testing & Consulting, Inc. 2118 Black Lake Blvd Olympia, WA 98512	**Exploration Log Key** **Honda of Grays Harbor - Chehalis** 1850 NW Louisiana Ave, Chehalis, WA	**FIGURE** **4**

Materials Testing & Consulting
Olympia, WA
Geotechnical & Enviornmental Engineering

Log of Test Pit 1

Honda of Grays Harbor - Geo
1850 NW Lousiana Ave
Chehalis,WA
MTC Project # 21S067-01

Date Started : April 08, 2021
Date Completed : April 08, 2021
Sampling Method : Hand Sample
Location : Tract #9
Logged By : MM

Depth in Feet	USCS	GRAPHIC	DESCRIPTION	Samples	Blow Count	Water Level
0	SM	░	SILTY SAND, moist, dark brown, fine grained, with organics			
1		░	SILTY SAND, moist, brown to dark brown, fine grained, few Clay seams.			
2	SM	░	*Approximately 1.3% Gravel, 62.7% Sand, 36.1% Fines.*	☒		
3		░				
4		▨	FAT CLAY, moist, brown and gray, fine grained, some Silt.			
5		▨	*Approximately 0.0% Gravel, 2.7% Sand, 97.3% Fines.*			
6	CH	▨		☒		
7		▨				
8			TD: Termination depth approximately 8.0 Feet Backfilled with native soil that was excavated. Groundwater was not encountered during excavation.			
9						
10						
11						
12						
13						
14						
15						

Materials Testing & Consulting
Olympia, WA
Geotechnical & Enviornmental Engineering

Log of Test Pit 2

Honda of Grays Harbor - Geo
1850 NW Lousiana Ave
Chehalis,WA
MTC Project # 21S067-01

Date Started : April 08, 2021
Date Completed : April 08, 2021
Sampling Method : Hand Sample
Location : Tract #9
Logged By : MM

Depth in Feet	USCS	GRAPHIC	DESCRIPTION	Samples	Blow Count	Water Level
0	SM	▨	SILTY SAND, moist, dark brown, fine grained, with organics (roots, grass, etc). **Topsoil**			
1	MH	▥	SANDY SILT, moist, brown and gray, fine grained, few FAT CLAY seams, heavily plastic.			
2				☒		
3						
4						
5			*Approximately 0.0% Gravel, 57.7% Sand, 42.3% Fines*	☒		
6						
7						
8			TD: Termination depth approximately 8.0 Feet Backfilled with native soil that was excavated. Groundwater was not encountered during excavation.			
9						
10						
11						
12						
13						
14						
15						

Materials Testing & Consulting
Olympia, WA

Geotechnical & Enviornmental Engineering

Log of Test Pit 3

Honda of Grays Harbor - Chehalis
1850 NW Lousiana Ave
Chehalis, WA
MTC Project #21S067-01

Date Started : April 08, 2021
Date Completed : April 08, 2021
Sampling Method : Hand Sample
Location : Tract #9
Logged By : MM

Depth in Feet	USCS	GRAPHIC	DESCRIPTION	Samples	Blow Count	Water Level
0–1.5	SM	▨	SILTY SAND, very loose, moist, dark brown, fine grained, with organics. **Topsoil**			
1.5–3	SM	▨	SILTY SAND, very loose to loose, moist, brown, fine grained. *Approximately 0.0% Gravel, 69.6% Sand, 30.4% Fines.* .	☒		
3–8	MH	▥	SANDY SILT, loose to medium dense, moist to wet, grayish brown, fine grained, few Fat Clay seams.	☒		

TD: Termination depth approximately 8.0 Feet
Backfilled with native soil that was excavated.
Groundwater was not encountered during excavation.

Depth scale: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15

Materials Testing & Consulting
Olympia, WA
Geotechnical & Enviornmental Engineering

Log of Test Pit 4

Honda of Grays Harbor - Chehalis
1850 NW Lousiana Ave
Chehalis,WA
MTC Project # 21S067-01

Date Started : April 08, 2021
Date Completed : April 08, 2021
Sampling Method : Hand Sample
Location : Tract #9
Logged By : MM

Depth in Feet	USCS	GRAPHIC	DESCRIPTION	Samples	Blow Count	Water Level
0 1	SM		SILTY SAND, very loose to loose, moist, dark brown, with organics **Topsoil**			
2 3 4	SM		SILTY SAND, loose to medium dense, moist to wet, brown, fine grained. *Approximately 0.0% Gravel, 61.9% Sand, 68.1% Fines* .	☒		
5 6 7 8	MH		SANDY SILT, loose to medium dense, moist to wet, grayish brown, some Fat Clay seams.	☒		
9 10 11 12 13 14 15			TD: Termination depth approximately 8.5 Feet Backfilled with native soil that was excavated. Groundwater was not encountered during excavation.			

WILDCAT DYNAMIC CONE LOG

Page 1 of 2

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

PROJECT NUMBER: 21S067-01
DATE STARTED: 04-08-2021
DATE COMPLETED: 04-08-2021

HOLE #: DCP-1
CREW: Maalik M
PROJECT: Honda of Grays Harbor Geo
ADDRESS: Tract #9
LOCATION: Chehailis, WA

SURFACE ELEVATION: Existing Grade
WATER ON COMPLETION: N/A
HAMMER WEIGHT: 35 lbs.
CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm^2	GRAPH OF CONE RESISTANCE	N'	TESTED CONSISTENCY	
			0 50 100 150		NON-COHESIVE	COHESIVE
-	4	17.8	•••••	5	LOOSE	MEDIUM STIFF
-	5	22.2	••••••	6	LOOSE	MEDIUM STIFF
- 1 ft	6	26.6	•••••••	7	LOOSE	MEDIUM STIFF
-	6	26.6	•••••••	7	LOOSE	MEDIUM STIFF
-	5	22.2	••••••	6	LOOSE	MEDIUM STIFF
- 2 ft	4	17.8	•••••	5	LOOSE	MEDIUM STIFF
-	4	17.8	•••••	5	LOOSE	MEDIUM STIFF
-	4	17.8	•••••	5	LOOSE	MEDIUM STIFF
- 3 ft	5	22.2	••••••	6	LOOSE	MEDIUM STIFF
- 1 m	14	62.2	••••••••••••••••••	17	MEDIUM DENSE	VERY STIFF
-	10	38.6	•••••••••••	11	MEDIUM DENSE	STIFF
- 4 ft	10	38.6	•••••••••••	11	MEDIUM DENSE	STIFF
-	11	42.5	••••••••••••	12	MEDIUM DENSE	STIFF
-	12	46.3	•••••••••••••	13	MEDIUM DENSE	STIFF
- 5 ft	10	38.6	•••••••••••	11	MEDIUM DENSE	STIFF
-	11	42.5	••••••••••••	12	MEDIUM DENSE	STIFF
-	11	42.5	••••••••••••	12	MEDIUM DENSE	STIFF
- 6 ft	13	50.2	••••••••••••••	14	MEDIUM DENSE	STIFF
-	11	42.5	••••••••••••	12	MEDIUM DENSE	STIFF
- 2 m	13	50.2	••••••••••••••	14	MEDIUM DENSE	STIFF
- 7 ft	11	37.6	••••••••••	10	LOOSE	STIFF
-	8	27.4	•••••••	7	LOOSE	MEDIUM STIFF
-	8	27.4	•••••••	7	LOOSE	MEDIUM STIFF
- 8 ft	13	44.5	••••••••••••	12	MEDIUM DENSE	STIFF
-	15	51.3	••••••••••••••	14	MEDIUM DENSE	STIFF
-	18	61.6	•••••••••••••••••	17	MEDIUM DENSE	VERY STIFF
- 9 ft	25	85.5	••••••••••••••••••••••••	24	MEDIUM DENSE	VERY STIFF
-	40	136.8	•••••••••••••••••••••••••••••••••••••••	25+	DENSE	HARD
-	36	123.1	•••••••••••••••••••••••••••••••••••	25+	DENSE	HARD
- 3 m 10 ft	36	123.1	•••••••••••••••••••••••••••••••••••	25+	DENSE	HARD
-	30	91.8	••••••••••••••••••••••••••	25+	MEDIUM DENSE	VERY STIFF
-	26	79.6	•••••••••••••••••••••••	22	MEDIUM DENSE	VERY STIFF
-	35	107.1	•••••••••••••••••••••••••••••••	25+	MEDIUM DENSE	VERY STIFF
- 11 ft	30	91.8	••••••••••••••••••••••••••	25+	MEDIUM DENSE	VERY STIFF
-	27	82.6	•••••••••••••••••••••••	23	MEDIUM DENSE	VERY STIFF
-	21	64.3	••••••••••••••••••	18	MEDIUM DENSE	VERY STIFF
- 12 ft	27	82.6	•••••••••••••••••••••••	23	MEDIUM DENSE	VERY STIFF
-	25	76.5	••••••••••••••••••••••	21	MEDIUM DENSE	VERY STIFF
-	25	76.5	••••••••••••••••••••••	21	MEDIUM DENSE	VERY STIFF
- 4 m 13 ft	23	70.4	••••••••••••••••••••	20	MEDIUM DENSE	VERY STIFF

HOLE #: DCP-1

WILDCAT DYNAMIC CONE LOG

Page 2 of 2

PROJECT: Honda of Grays Harbor Geo

PROJECT NUMBER: 21S067-01

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY NON-COHESIVE	COHESIVE
-	31	85.9	••••••••••••••••••••••••	24	MEDIUM DENSE	VERY STIFF
-	25	69.3	••••••••••••••••••••	19	MEDIUM DENSE	VERY STIFF
- 14 ft	22	60.9	•••••••••••••••••	17	MEDIUM DENSE	VERY STIFF
-	22	60.9	•••••••••••••••••	17	MEDIUM DENSE	VERY STIFF
-	29	80.3	•••••••••••••••••••••••	22	MEDIUM DENSE	VERY STIFF
- 15 ft	25	69.3	••••••••••••••••••••	19	MEDIUM DENSE	VERY STIFF
-	22	60.9	•••••••••••••••••	17	MEDIUM DENSE	VERY STIFF
-	22	60.9	•••••••••••••••••	17	MEDIUM DENSE	VERY STIFF
- 16 ft	24	66.5	•••••••••••••••••••	18	MEDIUM DENSE	VERY STIFF
- 5 m	30	83.1	••••••••••••••••••••••••	23	MEDIUM DENSE	VERY STIFF
-	23	58.4	••••••••••••••••	16	MEDIUM DENSE	VERY STIFF
- 17 ft	24	61.0	•••••••••••••••••	17	MEDIUM DENSE	VERY STIFF
-	20	50.8	••••••••••••••	14	MEDIUM DENSE	STIFF
-	20	50.8	••••••••••••••	14	MEDIUM DENSE	STIFF
- 18 ft	23	58.4	••••••••••••••••	16	MEDIUM DENSE	VERY STIFF
-	29	73.7	•••••••••••••••••••••	21	MEDIUM DENSE	VERY STIFF
-	50	127.0	••••••••••••••••••••••••••••••••••••	25+	DENSE	HARD
- 19 ft						
-						
- 6 m						
- 20 ft						
-						
-						
- 21 ft						
-						
-						
- 22 ft						
-						
-						
- 7 m 23 ft						
-						
-						
- 24 ft						
-						
-						
- 25 ft						
-						
-						
- 26 ft						
- 8 m						
-						
- 27 ft						
-						
-						
- 28 ft						
-						
-						
- 29 ft						
-						
- 9 m						

WILDCAT DYNAMIC CONE LOG

Page 1 of 1

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

PROJECT NUMBER: 21S067-01
DATE STARTED: 04-08-2021
DATE COMPLETED: 04-08-2021

HOLE #: DCP-2
CREW: Maalik M
PROJECT: Honda of Grays Harbor Geo
ADDRESS: Tract #9
LOCATION: Chehailis, WA

SURFACE ELEVATION: Existing Grade
WATER ON COMPLETION: N/A
HAMMER WEIGHT: 35 lbs.
CONE AREA: 10 sq. cm

	BLOWS	RESISTANCE	GRAPH OF CONE RESISTANCE		TESTED CONSISTENCY	
DEPTH	PER 10 cm	Kg/cm^2	0 50 100 150	N'	NON-COHESIVE	COHESIVE
-	1	4.4	•	1	VERY LOOSE	VERY SOFT
-	2	8.9	••	2	VERY LOOSE	SOFT
- 1 ft	2	8.9	••	2	VERY LOOSE	SOFT
-	4	17.8	•••••	5	LOOSE	MEDIUM STIFF
-	3	13.3	•••	3	VERY LOOSE	SOFT
- 2 ft	4	17.8	•••••	5	LOOSE	MEDIUM STIFF
-	3	13.3	•••	3	VERY LOOSE	SOFT
-	3	13.3	•••	3	VERY LOOSE	SOFT
- 3 ft	4	17.8	•••••	5	LOOSE	MEDIUM STIFF
- 1 m	5	22.2	••••••	6	LOOSE	MEDIUM STIFF
-	8	30.9	••••••••	8	LOOSE	MEDIUM STIFF
- 4 ft	8	30.9	••••••••	8	LOOSE	MEDIUM STIFF
-	9	34.7	••••••••••	9	LOOSE	STIFF
-	10	38.6	•••••••••••	11	MEDIUM DENSE	STIFF
- 5 ft	12	46.3	•••••••••••••	13	MEDIUM DENSE	STIFF
-	13	50.2	••••••••••••••	14	MEDIUM DENSE	STIFF
-	13	50.2	••••••••••••••	14	MEDIUM DENSE	STIFF
- 6 ft	8	30.9	••••••••	8	LOOSE	MEDIUM STIFF
-	14	54.0	•••••••••••••••	15	MEDIUM DENSE	STIFF
- 2 m	8	30.9	••••••••	8	LOOSE	MEDIUM STIFF
- 7 ft	8	27.4	•••••••	7	LOOSE	MEDIUM STIFF
-	11	37.6	••••••••••	10	LOOSE	STIFF
-	10	34.2	•••••••••	9	LOOSE	STIFF
- 8 ft	10	34.2	•••••••••	9	LOOSE	STIFF
-	10	34.2	•••••••••	9	LOOSE	STIFF
-	10	34.2	•••••••••	9	LOOSE	STIFF
- 9 ft	25	85.5	••••••••••••••••••••••••	24	MEDIUM DENSE	VERY STIFF
-	25	85.5	••••••••••••••••••••••••	24	MEDIUM DENSE	VERY STIFF
-	20	68.4	•••••••••••••••••••	19	MEDIUM DENSE	VERY STIFF
- 3 m 10 ft	20	68.4	•••••••••••••••••••	19	MEDIUM DENSE	VERY STIFF
-	30	91.8	••••••••••••••••••••••••••	25+	MEDIUM DENSE	VERY STIFF
-	37	113.2	••••••••••••••••••••••••••••••••	25+	DENSE	HARD
-	23	70.4	••••••••••••••••••••	20	MEDIUM DENSE	VERY STIFF
- 11 ft	26	79.6	•••••••••••••••••••••••	22	MEDIUM DENSE	VERY STIFF
-	50	153.0	••	25+	DENSE	HARD
-						
- 12 ft						
-						
-						
- 4 m 13 ft						

Appendix E. Laboratory Test Results

Materials Testing & Consulting, Inc.

Geotechnical Engineering • Special Inspection • Materials Testing • Environmental Consulting

MATERIALS TESTING & CONSULTING, INC.

Sieve Report

Project: Honda of Grays Harbor Geotech
Project #: 21S067-01
Client: Honda of Grays Harbor
Source: TP-1 @ 2 ft
Sample#: B21-0463

Date Received: 12-Apr-21
Sampled By: M. McClain
Date Tested: 14-Apr-21
Tested By: C. Kriss

ASTM D-2487 Unified Soils Classification System
SM, Silty Sand
Sample Color:
brown

ACCREDITED
Certificate #: 1366.01, 1366.02 & 1366.04

ASTM D-2216, ASTM D-2419, ASTM D-4318, ASTM D-5821

Specifications
No Specs
Sample Meets Specs ? N/A

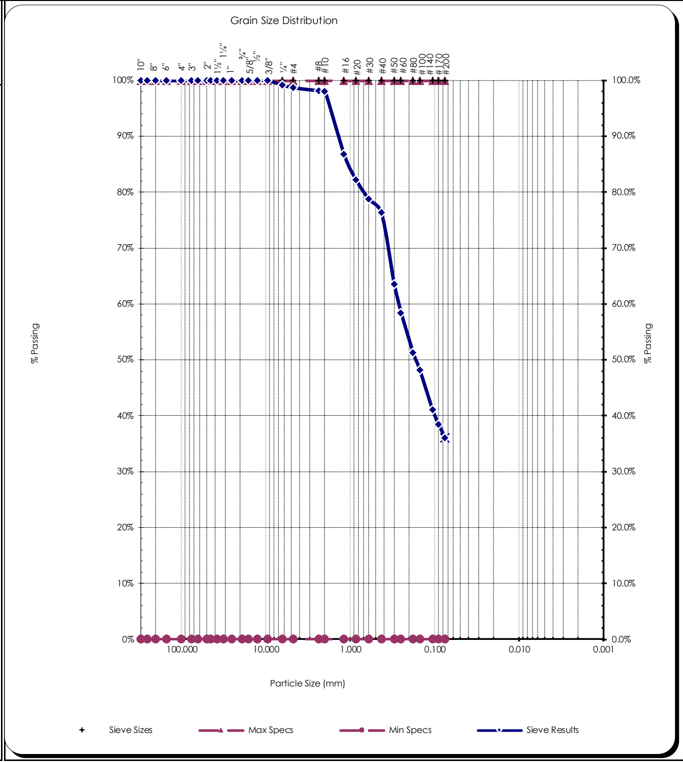
$D_{(5)}$ = 0.010 mm
$D_{(10)}$ = 0.021 mm
$D_{(15)}$ = 0.031 mm
$D_{(30)}$ = 0.062 mm
$D_{(50)}$ = 0.168 mm
$D_{(60)}$ = 0.266 mm
$D_{(90)}$ = 1.416 mm
Dust Ratio = 43/91

% Gravel = 1.3%
% Sand = 62.7%
% Silt & Clay = 36.1%
Liquid Limit = n/a
Plasticity Index = n/a
Sand Equivalent = n/a
Fracture %, 1 Face = n/a
Fracture %, 2+ Faces = n/a

Coeff. of Curvature, C_C = 0.70
Coeff. of Uniformity, C_U = 12.77
Fineness Modulus = 1.26
Plastic Limit = n/a
Moisture %, as sampled = 37.6%
Req'd Sand Equivalent =
Req'd Fracture %, 1 Face =
Req'd Fracture %, 2+ Faces =

ASTM C-136, ASTM D-6913

Sieve Size		Actual Cumulative Percent Passing	Interpolated Cumulative Percent Passing	Specs Max	Specs Min
US	Metric				
12.00"	300.00		100%	100.0%	0.0%
10.00"	250.00		100%	100.0%	0.0%
8.00"	200.00		100%	100.0%	0.0%
6.00"	150.00		100%	100.0%	0.0%
4.00"	100.00		100%	100.0%	0.0%
3.00"	75.00		100%	100.0%	0.0%
2.50"	63.00		100%	100.0%	0.0%
2.00"	50.00	100%	100%	100.0%	0.0%
1.75"	45.00		100%	100.0%	0.0%
1.50"	37.50		100%	100.0%	0.0%
1.25"	31.50		100%	100.0%	0.0%
1.00"	25.00	100%	100%	100.0%	0.0%
3/4"	19.00	100%	100%	100.0%	0.0%
5/8"	16.00		100%	100.0%	0.0%
1/2"	12.50	100%	100%	100.0%	0.0%
3/8"	9.50	100%	100%	100.0%	0.0%
1/4"	6.30		99%	100.0%	0.0%
#4	4.75	99%	99%	100.0%	0.0%
#8	2.36		98%	100.0%	0.0%
#10	2.00	98%	98%	100.0%	0.0%
#16	1.18		87%	100.0%	0.0%
#20	0.850		82%	100.0%	0.0%
#30	0.600		79%	100.0%	0.0%
#40	0.425	76%	76%	100.0%	0.0%
#50	0.300		64%	100.0%	0.0%
#60	0.250		58%	100.0%	0.0%
#80	0.180		51%	100.0%	0.0%
#100	0.150	48%	48%	100.0%	0.0%
#140	0.106		41%	100.0%	0.0%
#170	0.090		38%	100.0%	0.0%
#200	0.075	36.1%	36.1%	100.0%	0.0%



Comments: ______________________________

Reviewed by: Meghan Blodgett Carrillo

Meghan Blodgett-Carrillo

Materials Testing & Consulting, Inc.

Geotechnical Engineering • Special Inspection • Materials Testing • Environmental Consulting

MATERIALS TESTING & CONSULTING, INC.

Sieve Report

Project: Honda of Grays Harbor Geotech
Project #: 21S067-01
Client: Honda of Grays Harbor
Source: TP-1 @ 6 ft
Sample#: B21-0459

Date Received: 12-Apr-21
Sampled By: M. McClain
Date Tested: 14-Apr-21
Tested By: C. Kriss

Visual Identification
Silty Clay
Sample Color:
brown

ACCREDITED
Certificate #: 1366.01, 1366.02 & 1366.04

ASTM D-2216, ASTM D-2419, ASTM D-4318, ASTM D-5821

Specifications
No Specs
Sample Meets Specs ? N/A

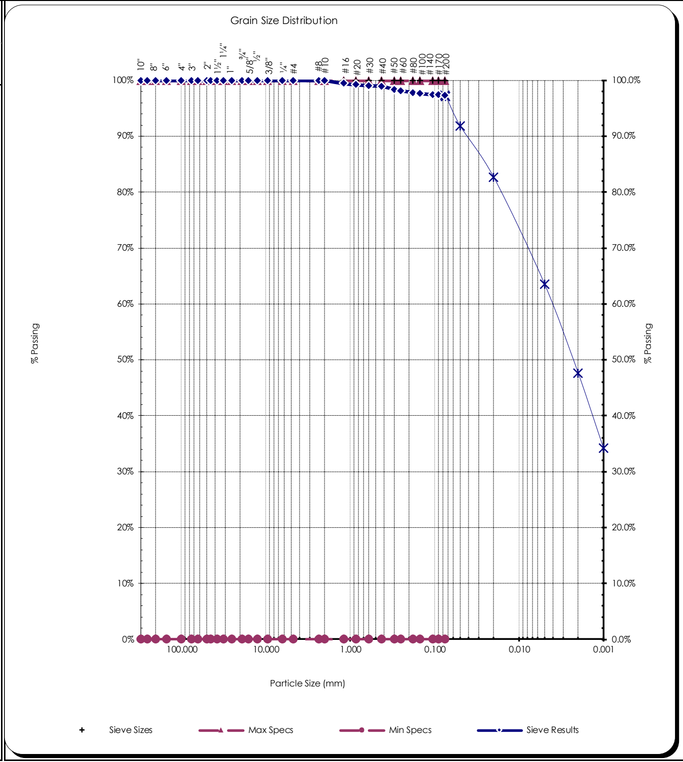
$D_{(5)}$ = 0.004 mm
$D_{(10)}$ = 0.008 mm
$D_{(15)}$ = 0.012 mm
$D_{(30)}$ = 0.023 mm
$D_{(50)}$ = 0.039 mm
$D_{(60)}$ = 0.046 mm
$D_{(90)}$ = 0.069 mm
Dust Ratio = 61/62

% Gravel = 0.0%
% Sand = 2.7%
% Silt & Clay = 97.3%
Liquid Limit = n/a
Plasticity Index = n/a
Sand Equivalent = n/a
Fracture %, 1 Face = n/a
Fracture %, 2+ Faces = n/a

Coeff. of Curvature, C_C = 1.50
Coeff. of Uniformity, C_U = 6.00
Fineness Modulus = 0.05
Plastic Limit = n/a
Moisture %, as sampled = 36.6%
Req'd Sand Equivalent =
Req'd Fracture %, 1 Face =
Req'd Fracture %, 2+ Faces =

ASTM C-136, ASTM D-6913

Sieve Size US	Sieve Size Metric	Actual Cumulative Percent Passing	Interpolated Cumulative Percent Passing	Specs Max	Specs Min
12.00"	300.00		100%	100.0%	0.0%
10.00"	250.00		100%	100.0%	0.0%
8.00"	200.00		100%	100.0%	0.0%
6.00"	150.00		100%	100.0%	0.0%
4.00"	100.00		100%	100.0%	0.0%
3.00"	75.00		100%	100.0%	0.0%
2.50"	63.00		100%	100.0%	0.0%
2.00"	50.00	100%	100%	100.0%	0.0%
1.75"	45.00		100%	100.0%	0.0%
1.50"	37.50		100%	100.0%	0.0%
1.25"	31.50		100%	100.0%	0.0%
1.00"	25.00	100%	100%	100.0%	0.0%
3/4"	19.00	100%	100%	100.0%	0.0%
5/8"	16.00		100%	100.0%	0.0%
1/2"	12.50	100%	100%	100.0%	0.0%
3/8"	9.50	100%	100%	100.0%	0.0%
1/4"	6.30		100%	100.0%	0.0%
#4	4.75	100%	100%	100.0%	0.0%
#8	2.36		100%	100.0%	0.0%
#10	2.00	100%	100%	100.0%	0.0%
#16	1.18		99%	100.0%	0.0%
#20	0.850		99%	100.0%	0.0%
#30	0.600		99%	100.0%	0.0%
#40	0.425	99%	99%	100.0%	0.0%
#50	0.300		98%	100.0%	0.0%
#60	0.250		98%	100.0%	0.0%
#80	0.180		98%	100.0%	0.0%
#100	0.150		98%	100.0%	0.0%
#140	0.106		97%	100.0%	0.0%
#170	0.090		97%	100.0%	0.0%
#200	0.075	97.3%	97.3%	100.0%	0.0%



Comments: ______________________________

Reviewed by: Meghan Blodgett-Carrillo

Meghan Blodgett-Carrillo

Hydrometer Report

Project: Honda of Grays Harbor Geotech
Project #: 21S067-01
Client : Honda of Grays Harbor
Source: TP-1 @ 6 ft
Sample#: B21-0459

Date Received: 12-Apr-21
Sampled By: M. McClain
Date Tested: 14-Apr-21
Tested By: C. Kriss

Visual Identification
Silty Clay
Sample Color
brown

ASTM D-422, HYDROMETER ANALYSIS

Assumed Sp Gr :	2.65	
Sample Weight:	75.22	grams
Hydroscopic Moist.:	8.19%	
Adj. Sample Wgt :	69.53	grams

ACCREDITED
Certificate #: 1366.01, 1366.02 & 1366.04

Hydrometer Reading Minutes	Corrected Reading	Percent Passing	Soils Particle Diameter
2	60	86.3%	0.0246 mm
5	55.5	79.8%	0.0165 mm
15	52	74.8%	0.0098 mm
30	49	70.5%	0.0072 mm
60	45	64.7%	0.0053 mm
250	37	53.2%	0.0028 mm
1440	29	41.7%	0.0012 mm

% Gravel:	0.0%	**Liquid Limit:**	n/a
% Sand:	2.7%	**Plastic Limit:**	n/a
% Silt:	33.8%	**Plasticity Index:**	n/a
% Clay:	63.5%		

ASTM C-136

Sieve Analysis
Grain Size Distribution

Sieve Size	Percent Passing	Soils Particle Diameter
3.0"	100%	75.000 mm
2.0"	100%	50.000 mm
1.5"	100%	37.500 mm
1.25"	100%	31.500 mm
1.0"	100%	25.000 mm
3/4"	100%	19.000 mm
5/8"	100%	16.000 mm
1/2"	100%	12.500 mm
3/8"	100%	9.500 mm
1/4"	100%	6.300 mm
#4	100%	4.750 mm
#10	100%	2.000 mm
#20	99%	0.850 mm
#40	99%	0.425 mm
#100	98%	0.150 mm
#200	97.3%	0.075 mm
Silts	97.1%	0.074 mm
	91.9%	0.050 mm
	82.6%	0.020 mm
Clays	63.5%	0.005 mm
	47.6%	0.002 mm
Colloids	34.2%	0.001 mm

USDA Soil Textural Classification

	Particle Size
% Sand:	2.0 - 0.05 mm
% Silt:	0.05 - 0.002 mm
% Clay:	< 0.002 mm

USDA Soil Textural Classification
Silty Clay

Comments: ____________________

Reviewed by: Megh Blodgett Carrillo
Meghan Blodgett-Carrillo

Materials Testing & Consulting, Inc.

Geotechnical Engineering • Special Inspection • Materials Testing • Environmental Consulting

Sieve Report

Project: Honda of Grays Harbor Geotech
Project #: 21S067-01
Client: Honda of Grays Harbor
Source: TP-2 @ 5 ft
Sample#: B21-0460

Date Received: 12-Apr-21
Sampled By: M. McClain
Date Tested: 14-Apr-21
Tested By: C. Kriss

ASTM D-2487 Unified Soils Classification System
SM, Silty Sand
Sample Color:
brown

ACCREDITED
Certificate #: 1366.01, 1366.02 & 1366.04

ASTM D-2216, ASTM D-2419, ASTM D-4318, ASTM D-5821

Specifications
No Specs
Sample Meets Specs ? N/A

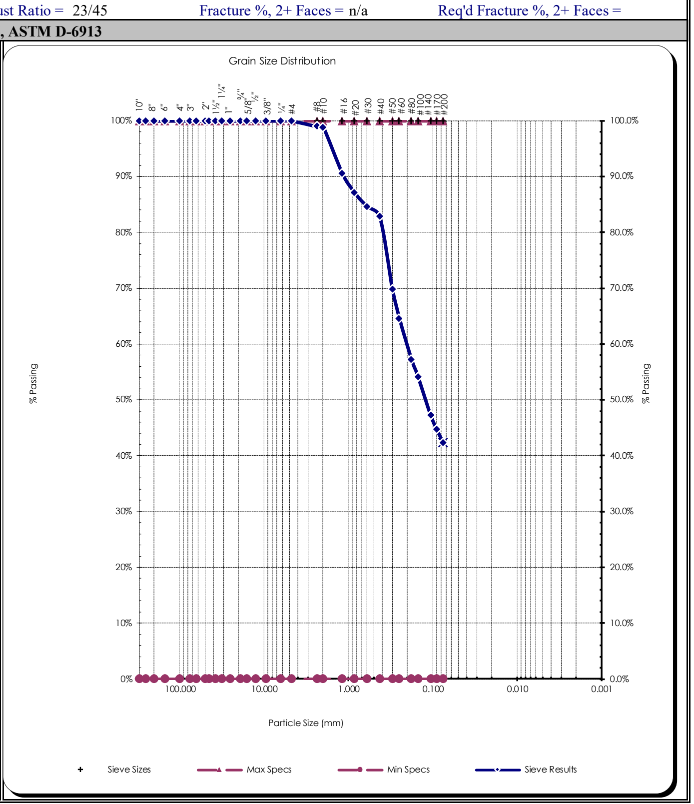
$D_{(5)}$ = 0.009 mm
$D_{(10)}$ = 0.018 mm
$D_{(15)}$ = 0.027 mm
$D_{(30)}$ = 0.053 mm
$D_{(50)}$ = 0.124 mm
$D_{(60)}$ = 0.206 mm
$D_{(90)}$ = 1.128 mm
Dust Ratio = 23/45

% Gravel = 0.0%
% Sand = 57.7%
% Silt & Clay = 42.3%
Liquid Limit = n/a
Plasticity Index = n/a
Sand Equivalent = n/a
Fracture %, 1 Face = n/a
Fracture %, 2+ Faces = n/a

Coeff. of Curvature, C_C = 0.77
Coeff. of Uniformity, C_U = 11.64
Fineness Modulus = 1.02
Plastic Limit = n/a
Moisture %, as sampled = 42.9%
Req'd Sand Equivalent =
Req'd Fracture %, 1 Face =
Req'd Fracture %, 2+ Faces =

ASTM C-136, ASTM D-6913

Sieve Size		Actual Cumulative Percent Passing	Interpolated Cumulative Percent Passing	Specs Max	Specs Min
US	Metric				
12.00"	300.00		100%	100.0%	0.0%
10.00"	250.00		100%	100.0%	0.0%
8.00"	200.00		100%	100.0%	0.0%
6.00"	150.00		100%	100.0%	0.0%
4.00"	100.00		100%	100.0%	0.0%
3.00"	75.00		100%	100.0%	0.0%
2.50"	63.00		100%	100.0%	0.0%
2.00"	50.00		100%	100.0%	0.0%
1.75"	45.00		100%	100.0%	0.0%
1.50"	37.50		100%	100.0%	0.0%
1.25"	31.50		100%	100.0%	0.0%
1.00"	25.00	100%	100%	100.0%	0.0%
3/4"	19.00	100%	100%	100.0%	0.0%
5/8"	16.00		100%	100.0%	0.0%
1/2"	12.50	100%	100%	100.0%	0.0%
3/8"	9.50	100%	100%	100.0%	0.0%
1/4"	6.30		100%	100.0%	0.0%
#4	4.75	100%	100%	100.0%	0.0%
#8	2.36		99%	100.0%	0.0%
#10	2.00	99%	99%	100.0%	0.0%
#16	1.18		91%	100.0%	0.0%
#20	0.850		87%	100.0%	0.0%
#30	0.600		85%	100.0%	0.0%
#40	0.425	83%	83%	100.0%	0.0%
#50	0.300		70%	100.0%	0.0%
#60	0.250		65%	100.0%	0.0%
#80	0.180		57%	100.0%	0.0%
#100	0.150	54%	54%	100.0%	0.0%
#140	0.106		47%	100.0%	0.0%
#170	0.090		45%	100.0%	0.0%
#200	0.075	42.3%	42.3%	100.0%	0.0%



Comments:

Reviewed by:

Meghan Blodgett-Carrillo

Materials Testing & Consulting, Inc.

Geotechnical Engineering • Special Inspection • Materials Testing • Environmental Consulting

MATERIALS TESTING & CONSULTING, INC.

Sieve Report

Project: Honda of Grays Harbor Geotech
Project #: 21S067-01
Client: Honda of Grays Harbor
Source: TP-3 @ 2 ft
Sample#: B21-0461

Date Received: 12-Apr-21
Sampled By: M. McClain
Date Tested: 14-Apr-21
Tested By: C. Kriss

ASTM D-2487 Unified Soils Classification System
SM, Silty Sand
Sample Color:
brown

ACCREDITED
Certificate #: 1366.01, 1366.02 & 1366.04

ASTM D-2216, ASTM D-2419, ASTM D-4318, ASTM D-5821

Specifications
No Specs
Sample Meets Specs ? N/A

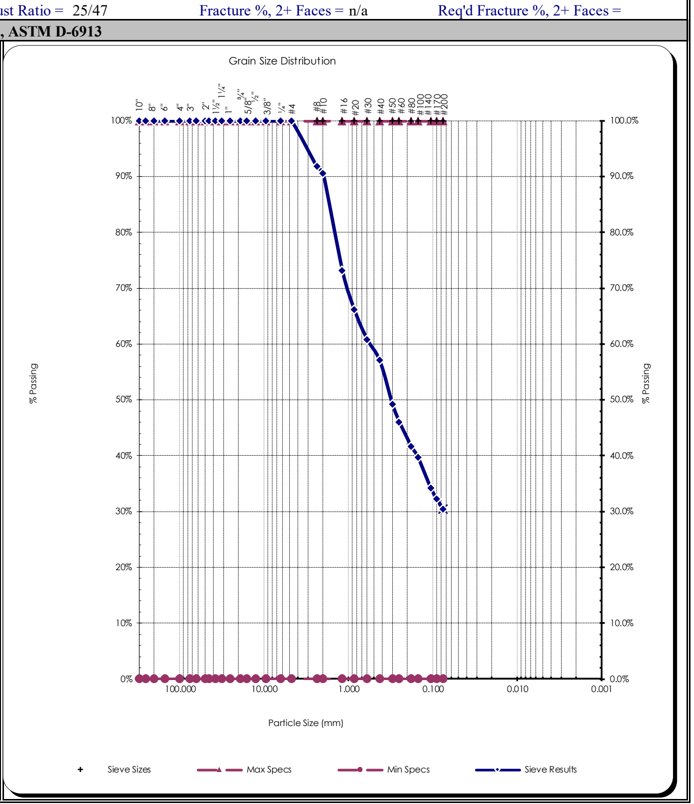
$D_{(5)}$ = 0.012 mm
$D_{(10)}$ = 0.025 mm
$D_{(15)}$ = 0.037 mm
$D_{(30)}$ = 0.074 mm
$D_{(50)}$ = 0.313 mm
$D_{(60)}$ = 0.562 mm
$D_{(90)}$ = 1.974 mm
Dust Ratio = 25/47

% Gravel = 0.0%
% Sand = 69.6%
% Silt & Clay = 30.4%
Liquid Limit = 86.1%
Plasticity Index = 37.8%
Sand Equivalent = n/a
Fracture %, 1 Face = n/a
Fracture %, 2+ Faces = n/a

Coeff. of Curvature, C_C = 0.40
Coeff. of Uniformity, C_U = 22.75
Fineness Modulus = 1.85
Plastic Limit = 48.4%
Moisture %, as sampled = 60.2%
Req'd Sand Equivalent =
Req'd Fracture %, 1 Face =
Req'd Fracture %, 2+ Faces =

ASTM C-136, ASTM D-6913

Sieve Size		Actual Cumulative Percent Passing	Interpolated Cumulative Percent Passing	Specs Max	Specs Min
US	Metric				
12.00"	300.00		100%	100.0%	0.0%
10.00"	250.00		100%	100.0%	0.0%
8.00"	200.00		100%	100.0%	0.0%
6.00"	150.00		100%	100.0%	0.0%
4.00"	100.00		100%	100.0%	0.0%
3.00"	75.00		100%	100.0%	0.0%
2.50"	63.00		100%	100.0%	0.0%
2.00"	50.00	100%	100%	100.0%	0.0%
1.75"	45.00		100%	100.0%	0.0%
1.50"	37.50		100%	100.0%	0.0%
1.25"	31.50		100%	100.0%	0.0%
1.00"	25.00	100%	100%	100.0%	0.0%
3/4"	19.00	100%	100%	100.0%	0.0%
5/8"	16.00		100%	100.0%	0.0%
1/2"	12.50	100%	100%	100.0%	0.0%
3/8"	9.50	100%	100%	100.0%	0.0%
1/4"	6.30		100%	100.0%	0.0%
#4	4.75	100%	100%	100.0%	0.0%
#8	2.36		92%	100.0%	0.0%
#10	2.00	91%	91%	100.0%	0.0%
#16	1.18		73%	100.0%	0.0%
#20	0.850		66%	100.0%	0.0%
#30	0.600		61%	100.0%	0.0%
#40	0.425	57%	57%	100.0%	0.0%
#50	0.300		49%	100.0%	0.0%
#60	0.250		46%	100.0%	0.0%
#80	0.180		42%	100.0%	0.0%
#100	0.150	40%	40%	100.0%	0.0%
#140	0.106		34%	100.0%	0.0%
#170	0.090		32%	100.0%	0.0%
#200	0.075	30.4%	30.4%	100.0%	0.0%



Comments:

Reviewed by:

Meghan Blodgett-Carrillo

ASTM D4318 - Liquid Limit, Plastic Limit and Plasticity Index of Soils

Project: Honda of Grays Harbor Geotech
Project #: 21S067-01
Client: Honda of Grays Harbor
Source: TP-3 @ 2 ft
Sample #: B21-0461

Date Received: 12-Apr-21
Sampled By: M. McClain
Date Tested: 14-Apr-21
Tested By: C. Kriss

Unified Soils Classification System, ASTM D-2487
SM, Silty Sand
Sample Color
brown

Liquid Limit Determination

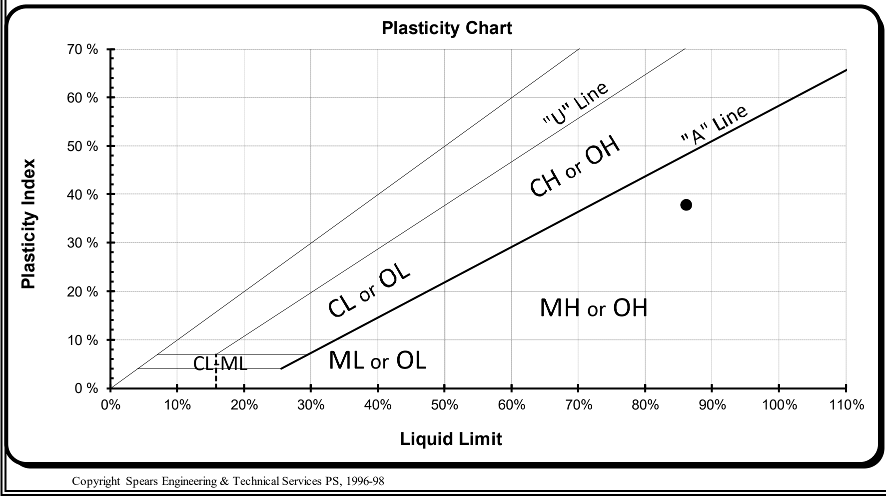
	#1	#2	#3	#4	#5	#6
Weight of Wet Soils + Pan:	29.90	28.43	33.21			
Weight of Dry Soils + Pan:	23.10	22.10	26.82			
Weight of Pan:	14.95	14.72	19.55			
Weight of Dry Soils:	8.15	7.38	7.27			
Weight of Moisture:	6.80	6.33	6.39			
% Moisture:	83.4 %	85.8 %	87.9 %			
Number of Blows:	31	26	21			

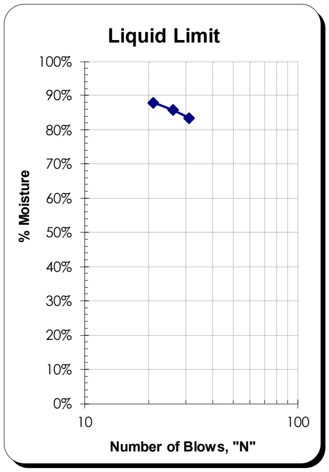
Liquid Limit @ 25 Blows:	86 %
Plastic Limit:	48 %
Plasticity Index, I_P:	38 %

Plastic Limit Determination

	#1	#2	#3	#4	#5	#6
Weight of Wet Soils + Pan:	34.86	35.25				
Weight of Dry Soils + Pan:	32.72	33.04				
Weight of Pan:	28.23	28.54				
Weight of Dry Soils:	4.49	4.50				
Weight of Moisture:	2.14	2.21				
% Moisture:	47.7 %	49.1 %				

ACCREDITED
Certificate #: 1366.01, 1366.02 & 1366.04





Comments: ______________________

Reviewed by: Megh Blodgett Carrillo

Meghan Blodgett-Carrillo

Materials Testing & Consulting, Inc.

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MATERIALS TESTING & CONSULTING, INC.

Sieve Report

Project: Honda of Grays Harbor Geotech
Project #: 21S067-01
Client: Honda of Grays Harbor
Source: TP-4 @ 4 ft
Sample#: B21-0462

Date Received: 12-Apr-21
Sampled By: M. McClain
Date Tested: 14-Apr-21
Tested By: C. Kriss

ASTM D-2487 Unified Soils Classification System
SM, Silty Sand
Sample Color:
brown

ACCREDITED
Certificate #: 1366.01, 1366.02 & 1366.04

ASTM D-2216, ASTM D-2419, ASTM D-4318, ASTM D-5821

Specifications
No Specs
Sample Meets Specs ? N/A

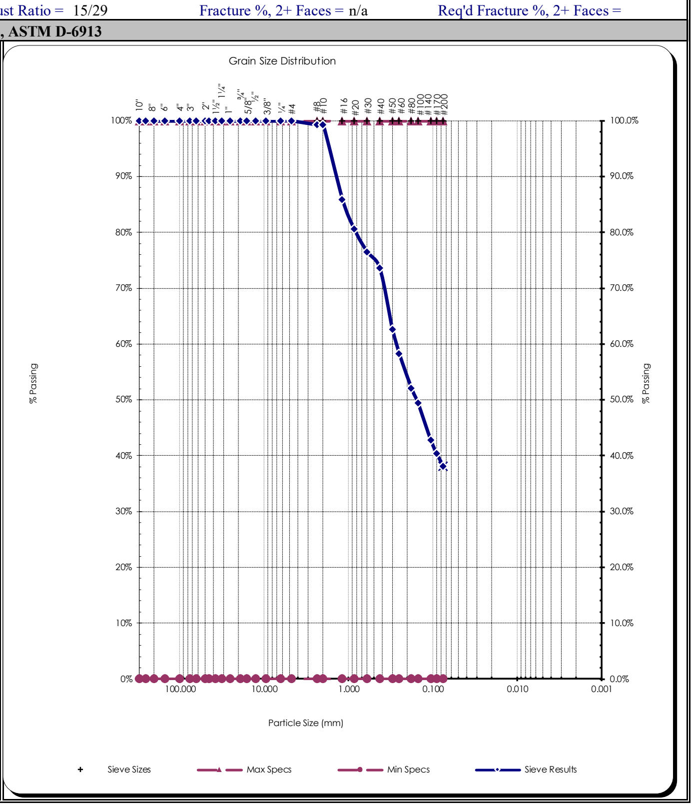
$D_{(5)}$ = 0.010 mm
$D_{(10)}$ = 0.020 mm
$D_{(15)}$ = 0.030 mm
$D_{(30)}$ = 0.059 mm
$D_{(50)}$ = 0.156 mm
$D_{(60)}$ = 0.270 mm
$D_{(90)}$ = 1.432 mm
Dust Ratio = 15/29

% Gravel = 0.0%
% Sand = 61.9%
% Silt & Clay = 38.1%
Liquid Limit = 97.0%
Plasticity Index = 51.2%
Sand Equivalent = n/a
Fracture %, 1 Face = n/a
Fracture %, 2+ Faces = n/a

Coeff. of Curvature, C_C = 0.66
Coeff. of Uniformity, C_U = 13.71
Fineness Modulus = 1.26
Plastic Limit = 45.8%
Moisture %, as sampled = 51.3%
Req'd Sand Equivalent =
Req'd Fracture %, 1 Face =
Req'd Fracture %, 2+ Faces =

ASTM C-136, ASTM D-6913

Sieve Size		Actual Cumulative Percent Passing	Interpolated Cumulative Percent Passing	Specs Max	Specs Min
US	Metric				
12.00"	300.00		100%	100.0%	0.0%
10.00"	250.00		100%	100.0%	0.0%
8.00"	200.00		100%	100.0%	0.0%
6.00"	150.00		100%	100.0%	0.0%
4.00"	100.00		100%	100.0%	0.0%
3.00"	75.00		100%	100.0%	0.0%
2.50"	63.00		100%	100.0%	0.0%
2.00"	50.00	100%	100%	100.0%	0.0%
1.75"	45.00		100%	100.0%	0.0%
1.50"	37.50		100%	100.0%	0.0%
1.25"	31.50		100%	100.0%	0.0%
1.00"	25.00	100%	100%	100.0%	0.0%
3/4"	19.00	100%	100%	100.0%	0.0%
5/8"	16.00		100%	100.0%	0.0%
1/2"	12.50	100%	100%	100.0%	0.0%
3/8"	9.50	100%	100%	100.0%	0.0%
1/4"	6.30		100%	100.0%	0.0%
#4	4.75	100%	100%	100.0%	0.0%
#8	2.36		99%	100.0%	0.0%
#10	2.00	99%	99%	100.0%	0.0%
#16	1.18		86%	100.0%	0.0%
#20	0.850		81%	100.0%	0.0%
#30	0.600		76%	100.0%	0.0%
#40	0.425	74%	74%	100.0%	0.0%
#50	0.300		63%	100.0%	0.0%
#60	0.250		58%	100.0%	0.0%
#80	0.180		52%	100.0%	0.0%
#100	0.150	49%	49%	100.0%	0.0%
#140	0.106		43%	100.0%	0.0%
#170	0.090		40%	100.0%	0.0%
#200	0.075	38.1%	38.1%	100.0%	0.0%



Comments:

Reviewed by: Megh Blodgett Carrillo

Meghan Blodgett-Carrillo

Materials Testing & Consulting, Inc.

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MATERIALS TESTING & CONSULTING, INC.

ASTM D4318 - Liquid Limit, Plastic Limit and Plasticity Index of Soils

Project: Honda of Grays Harbor Geotech
Project #: 21S067-01
Client: Honda of Grays Harbor
Source: TP-4 @ 4 ft
Sample #: B21-0462

Date Received: 12-Apr-21
Sampled By: M. McClain
Date Tested: 14-Apr-21
Tested By: C. Kriss

Unified Soils Classification System, ASTM D-2487
SM, Silty Sand
Sample Color
brown

Liquid Limit Determination

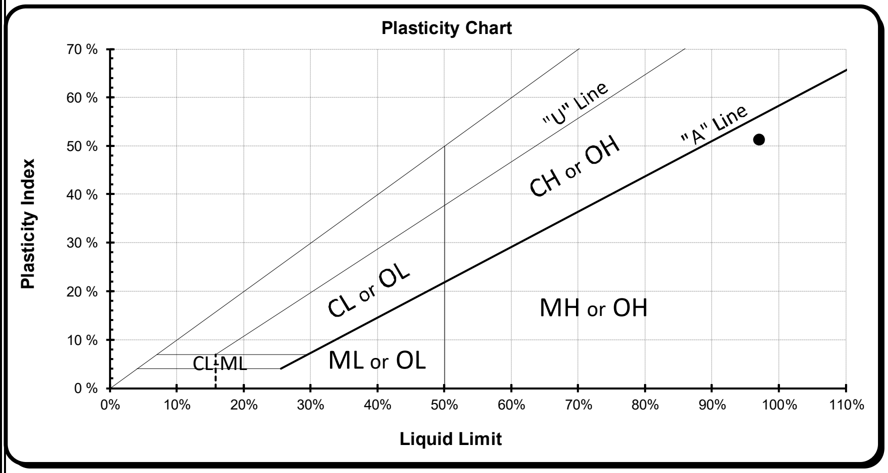
	#1	#2	#3	#4	#5	#6
Weight of Wet Soils + Pan:	32.07	31.39	26.46			
Weight of Dry Soils + Pan:	26.17	25.64	20.83			
Weight of Pan:	19.70	19.56	15.03			
Weight of Dry Soils:	6.47	6.08	5.80			
Weight of Moisture:	5.90	5.75	5.63			
% Moisture:	91.2 %	94.6 %	97.1 %			
Number of Blows:	35	29	25			

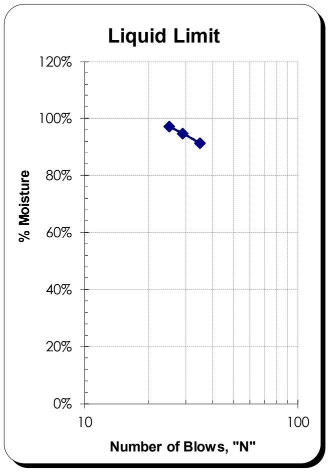
Liquid Limit @ 25 Blows: 97 %
Plastic Limit: 46 %
Plasticity Index, I_P: 51 %

Plastic Limit Determination

	#1	#2	#3	#4	#5	#6
Weight of Wet Soils + Pan:	34.16	35.32				
Weight of Dry Soils + Pan:	32.26	33.23				
Weight of Pan:	28.13	28.64				
Weight of Dry Soils:	4.13	4.59				
Weight of Moisture:	1.90	2.09				
% Moisture:	46.0 %	45.5 %				

ACCREDITED
Certificate #: 1366.01, 1366.02 & 1366.04





Comments:

Reviewed by: Megh Blodgett Carrillo

Meghan Blodgett-Carrillo

PAP-Accredited
NAPT
2021

soiltest
farm consultants, inc.
2925 Driggs Dr., Moses Lake, Wa 98837 - www.soiltestlab.com
Office: (509)765-1622 - Fax:(509)765-0314 - (800)764-1622

Soil & Plant Program
2021
NAPT
Participating Laboratory

MATERIALS TESTING
777 CHRYSLER DR

Burlington , WA 98233
Laboratory #: S21-06467

Date Received: 4/14/2021
Grower: 21S067-01-HONDA OF GRAY
Field: B21-0463 TP-1 AT 2FT
Sampled By:
Customer Account #:
Customer Sample ID:

Soil Test Results

Cation Exchange	CEC	meq/100g	43.1

pH 1:1
E.C. 1:1 m.mhos/cm
Est Sat Paste E.C. m.mhos/cm
Effervescence

Lbs/Acre

Ammonium - N mg/kg
Organic Matter W.B. %
ENR:

Other Tests:

Organic Matter (LOI 360) 7.1 %:

We make every effort to provide an accurate analysis of your sample. For reasonable cause we will repeat tests, but because of factors beyond our control in sampling procedures and the inherent variability of soil, our liability is limited to the price of the tests. Recommendations are to be used as general guides and should be modified for specific field conditions and situations. Note: "u" indicates that the element was analyzed for but not detected

This is your Invoice #: S21-06467 Account #: 234500 Reviewed by: K. Bair, PhD, C

MATERIALS TESTING
777 CHRYSLER DR

Burlington , WA 98233
Laboratory #: S21-06466

Date Received: 4/14/2021
Grower: 21S067-01-HONDA OF GRAY
Field: B21-0462 TP-4 AT 4FT
Sampled By:
Customer Account #:
Customer Sample ID:

Soil Test Results

Cation Exchange	CEC	meq/100g	39.4

pH 1:1
E.C. 1:1 m.mhos/cm
Est Sat Paste E.C. m.mhos/cm
Effervescence

Lbs/Acre

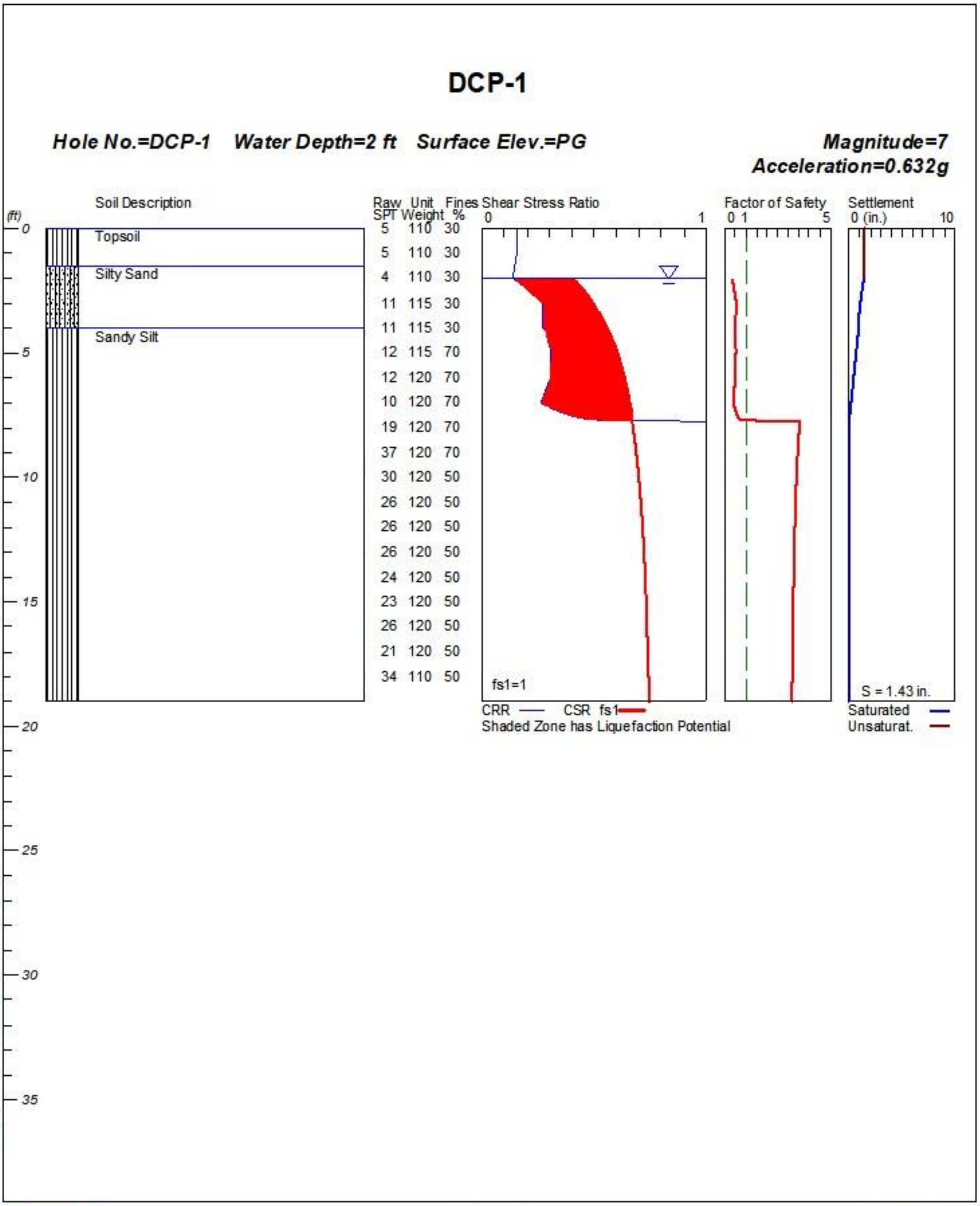
Ammonium - N mg/kg
Organic Matter W.B. %
ENR:

Other Tests:

Organic Matter (LOI 360) 5.2 %:

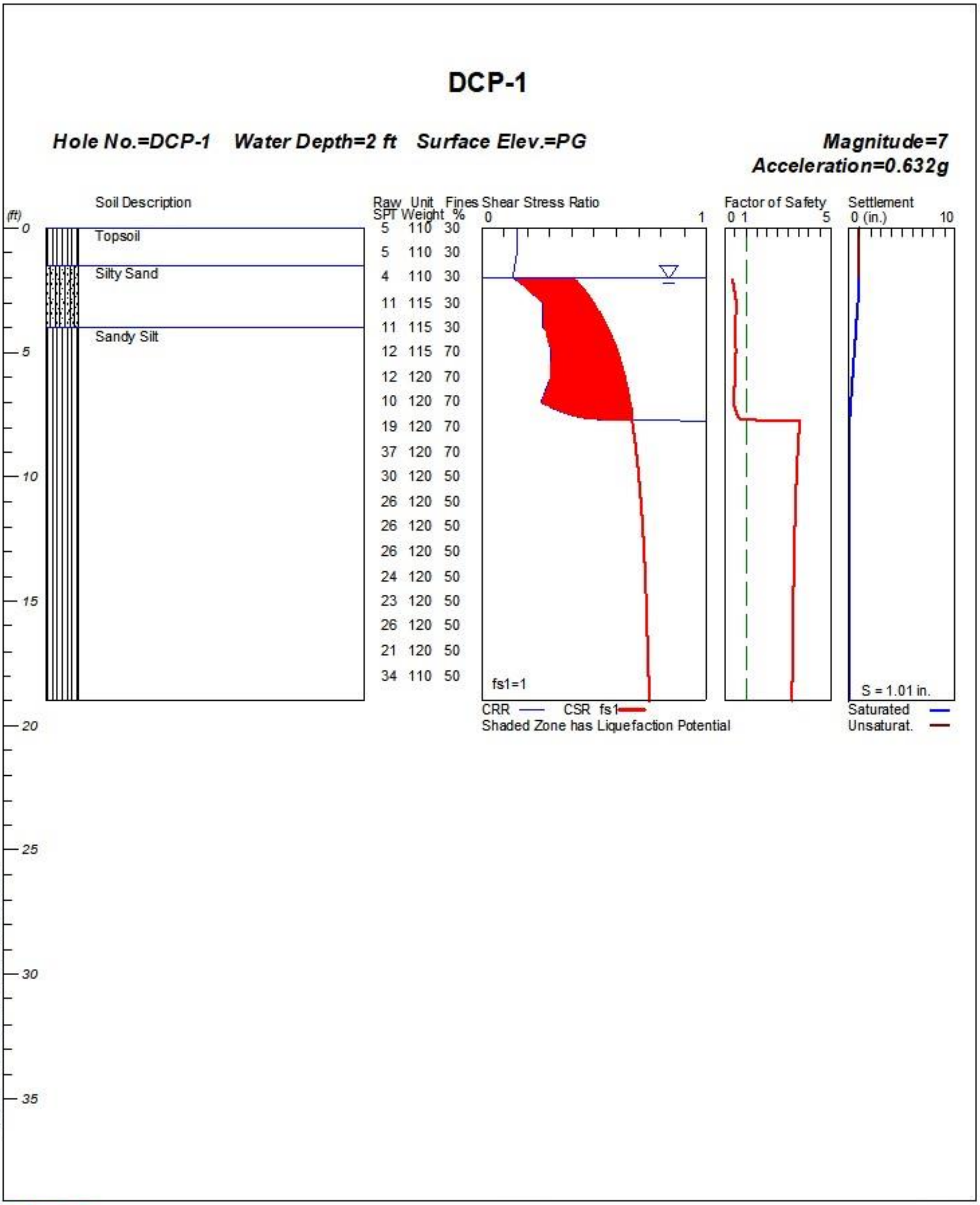
This is your Invoice #: S21-06466 Account #: 234500 Reviewed by: K. Bair, PhD, C

Appendix F. Liquefaction Analyses Results



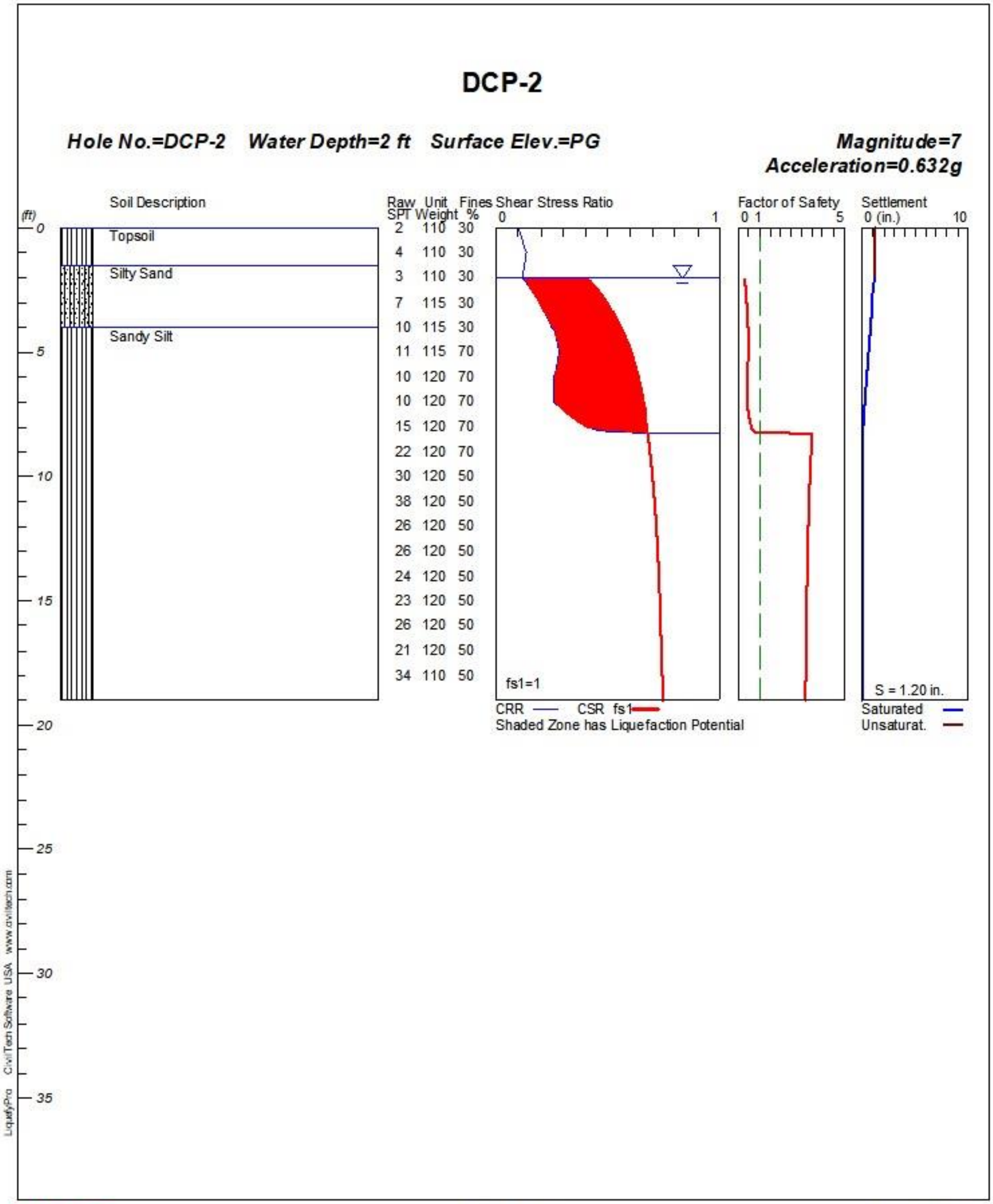
Ish/Yoshi

Plate A-1



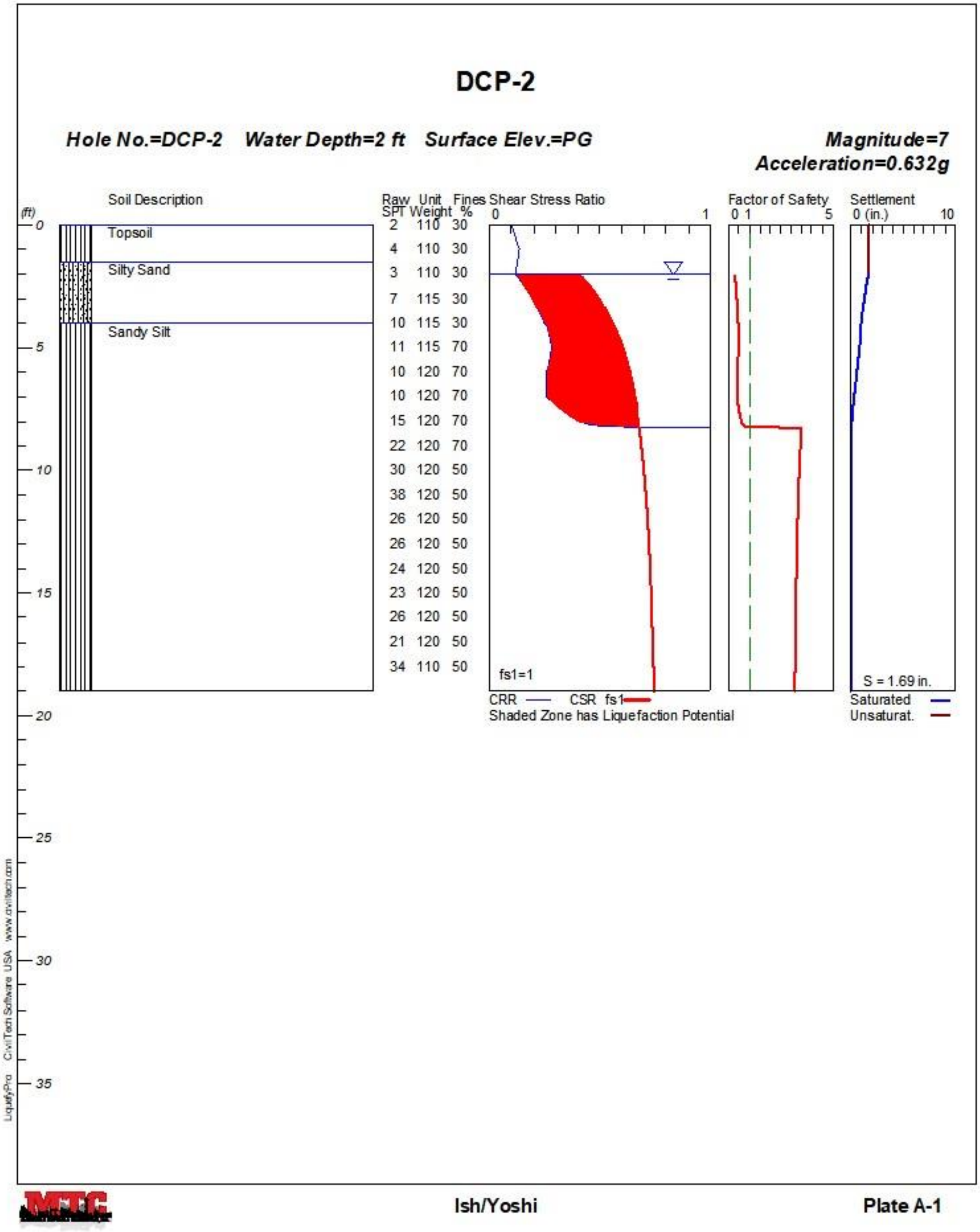
Tok/Seed

Plate A-1



Raw SPT	Unit Weight	Fines %
2	110	30
4	110	30
3	110	30
7	115	30
10	115	30
11	115	70
10	120	70
10	120	70
15	120	70
22	120	70
30	120	50
38	120	50
26	120	50
26	120	50
24	120	50
23	120	50
26	120	50
21	120	50
34	110	50

Tok/Seed **Plate A-1**


DCP-2
Hole No.=DCP-2 Water Depth=2 ft Surface Elev.=PG
Magnitude=7
Acceleration=0.632g
Soil Description
Topsoil
Silty Sand
Sandy Silt
(ft)
0
5
10
15
20
25
30
35
Raw SPT
Unit Weight
Fines %
2 110 30
4 110 30
3 110 30
7 115 30
10 115 30
11 115 70
10 120 70
10 120 70
15 120 70
22 120 70
30 120 50
38 120 50
26 120 50
26 120 50
24 120 50
23 120 50
26 120 50
21 120 50
34 110 50
Shear Stress Ratio
0
1
fs1=1
CRR
CSR fs1
Shaded Zone has Liquefaction Potential
Factor of Safety
0 1
5
Settlement
0 (in.)
10
S = 1.69 in.
Saturated
Unsaturat.
LiquefyPro CivilTech Software USA www.civiltech.com
MTC
Ish/Yoshi
Plate A-1