GREEN

Geotechnical Engineering Report

Proposed Chick-fil-A #03686
8811 35th Avenue
Marysville, Washington
July 16th, 2015
Terracon Project No. 81155034

Prepared for:
Chick-fil-A, Inc.
Atlanta, Georgia

Prepared by:
Terracon Consultants, Inc.
Mountlake Terrace, Washington

July 16th, 2015

Terracon

Chick-fil-A, Inc.
5200 Buffington Road
Atlanta, Georgia 30349

Attn: Mr. Don Ikeler
P: [404] 305 4407
E: don.ikeler@chick-fil-a.com

Re: Geotechnical Engineering Report
Proposed Chick-fil-A #03686
8811 35th Avenue
Marysville, Washington
Terracon Project No. 81155034

Dear Mr. Ikeler:

Terracon Consultants, Inc. (Terracon) has completed the geotechnical engineering services for the above referenced project. These services were performed in accordance with the Master Services Agreement (MSA) between Chick-fil-A, Inc. and Terracon, dated March 31, 2005. This geotechnical engineering report presents the results of the subsurface exploration and provides geotechnical recommendations concerning earthwork and the design and construction of foundations, floor slabs, and pavements for the proposed project.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report, or if we may be of further service, please contact us at (425) 771-3304.

Sincerely,
Terracon Consultants, Inc.

Tristan T Anderson, EIT
Staff Geotechnical Engineer

Ryan M Scheffler, PE
Project Engineer

DAVID A. BASKA
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7/16/15

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EXECUTIVE SUMMARY

A geotechnical exploration has been performed for the Proposed Chick-fil-A #03686 located at 8811 35th Avenue in Marysville, Washington. Terracon's geotechnical scope of work included the advancement of 8 soil test borings to approximate depths of 11.5 to 51.5 feet below existing site grades.

The site appears suitable for the proposed construction based upon geotechnical conditions encountered in the borings and our current understanding of the proposed development. The following geotechnical considerations were identified:

- Explorations in the proposed building location disclosed loose to medium dense, poorly graded sand at and below estimated footing elevations. The recommended allowable bearing capacity is 3,000 pounds per square foot (psf) for conventional shallow spread footings bearing on medium dense native soils or engineered fill above medium dense native soils.

- Groundwater was encountered in one of our explorations at a depth of approximately 29 feet below the existing ground surface. Based on previous experience in the area, the time of year the site was drilled, and rust discolorations in the soil, the water table may rise up to approximately 15 feet below the existing ground surface.

- Native sand with variable silt soils typically appear suitable for use as general structural fill from a compositional perspective; however, further testing should be performed during construction to assess specific conditions at that time.

- The 2012 International Building Code seismic site classification for this site is F, however Site Class D may be used for selection of site coefficients, F_a and F_v.

- The site is moderately liquefiable. During the design earthquake, we anticipate approximately 2 to 4 inches of settlement depending on the time of year and depth to water. We believe that 1 to 2 inches of differential settlement may occur across the building pad during the design earthquake.

Close monitoring of the construction operations discussed herein will be critical in achieving the design subgrade support. We therefore recommend that Terracon be retained to monitor this portion of the work.

This summary should be used in conjunction with the entire report for design purposes. It should be recognized that details were not included or fully developed in this section, and the report must be read in its entirety for a comprehensive understanding of the items contained herein. The section titled **GENERAL COMMENTS** should be read for an understanding of the report limitations.

GEOTECHNICAL ENGINEERING REPORT
PROPOSED CHICK-FIL-A #03686
8811 35TH AVENUE
MARYSVILLE, WASHINGTON

Terracon Project No. 81155034
July 16th, 2015

1.0 INTRODUCTION

This report presents the results of our geotechnical engineering services performed for the Proposed Chick-fil-A #03686 to be located at 8811 35th Avenue in Marysville, Washington. Our geotechnical engineering scope of work for this project included the advancement of 8 soil test borings to depths ranging from approximately 11.5 to 51.5 feet below existing site grades. The purpose of these services is to provide information and geotechnical engineering recommendations relative to:

- subsurface soil conditions
- earthwork
- floor slab design and construction
- lateral earth pressure
- pavement design and construction
- groundwater conditions
- foundation design and construction
- seismic considerations
- liquefaction analysis

2.0 PROJECT INFORMATION

2.1 Project Description

ITEM	DESCRIPTION
Site layout	Refer to the Site Location Map and Site and Exploration Plan (Exhibits A-1 and A-2 in Appendix A).
Structures	Approximately 4,544 square-foot restaurant.
Building construction	Details not provided, but understood to be concrete masonry units (CMU) with steel and/or wood framing with concrete foundations.
Finished floor elevation	Finished floor elevation is assumed to be near existing grade.
Maximum loads	Building: Details not provided, but expected to be: Column Load – 120 kips Load-Bearing Wall Loads – 3,500 plf Maximum Uniform Floor Slab Load – 100 psf

ITEM	DESCRIPTION
Grading in building and parking area	A grading plan was not available when this report was prepared. We have assumed less than 2 feet of excavation or fill placement for grading.
Traffic loading, assumed	Design equivalent single axle loads (ESAL's): On-site Pavement Light Duty: 50,000 On-site Pavement Heavy Duty: 100,000

2.2 Site Location and Description

ITEM	DESCRIPTION
Location	8811 35th Ave., Marysville, Washington
Existing Improvements	Unimproved grass lot with several trees mostly in the south half of the site
Existing topography	Relatively level across the site, sloping gently down from west to east.

3.0 SUBSURFACE CONDITIONS

3.1 Site Geology

The *Geologic Map of the Marysville Quadrangle, Snohomish County, Washington* (Minard, 1985) indicates that near-surface deposits at the site are Marysville Sand Member (Qvrm). The unit is described as mostly consisting of well-drained, stratified to massive sand, with some fine gravel and beds of silt and clay. The sediments were deposited by meltwater flowing south from the stagnating and receding Vashon glacier, and are generally similar to recessional outwash deposits. This deposit is generally underlain by glacial till at increasing depth toward the center of the valley. The results of subsurface exploration generally match this soil unit description.

3.2 Typical Subsurface Profile

Based on the results of the borings, subsurface conditions on the project site can be generalized as follows:

Description	Approximate Depth to Bottom of Stratum	Material Encountered	Consistency/Density
Grass and Topsoil	0 to 6 inches	topsoil	N/A

Description	Approximate Depth to Bottom of Stratum	Material Encountered	Consistency/Density
Marysville Sand Member	50 feet in B-4, exceeds termination depth in other borings	Sand with variable silt and gravel content. Occasional sandy silt layers	Typically Loose to Medium Dense.
Glacially Consolidated Silt	Exceeds termination depth in B-4	Sandy Silt	Stiff to very stiff

Laboratory tests were conducted on selected soil samples and the test results are presented in Appendix B. Moisture content, grain size analysis, and #200 sieve wash tests were performed as part of this study. The results of testing indicated that the soils generally range from clean sands (<5% fines by weight) to silty sands (up to 15% fines by weight) with very little gravel.

Specific conditions encountered at each boring location are indicated on the individual boring logs. Stratification boundaries on the boring logs represent the approximate location of changes in soil types; in-situ, the transition between materials may be gradual. Details for each of the borings can be found on the boring logs included in Appendix A of this report.

3.3 Groundwater

The borings were observed while drilling and after completion for the presence and level of groundwater. Groundwater was observed in the one of the borings while drilling, B-4, at approximately 29 feet below the ground surface. Based on previous knowledge of the area, the date of drilling and rust mottling observed in the samples, the high groundwater mark may be 15 feet below ground surface during seasonal fluctuations.

Groundwater level fluctuations occur due to seasonal variations in the amount of rainfall, runoff and other factors not evident at the time the borings were performed. The explorations for this study were performed during drought conditions and likely represent a seasonal low-water mark in groundwater levels. In addition, perched water can develop over low permeability soil. Therefore, groundwater levels during construction or at other times in the life of the structure may be higher or lower than the levels indicated on the boring logs. The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for the project.

4.0 RECOMMENDATIONS FOR DESIGN AND CONSTRUCTION

4.1 Geotechnical Considerations

The site appears suitable for the proposed construction using shallow foundations and slab-on-grade floors based upon geotechnical conditions encountered in the borings and our current understanding of the proposed development. No evidence of fill deposits were observed in our explorations.

Soil deposits were typically loose to medium dense clean to silty sand. This type of soil can be sensitive to liquefaction during a design event. Our estimates show that the site is moderately sensitive to liquefaction, with settlement of the soil on the order of 2 to 4 inches depending on the depth to groundwater.

Geotechnical engineering recommendations for foundation systems and other earth connected phases of the project are outlined below. The recommendations contained in this report are based upon the results of data presented herein, engineering analyses, and our current understanding of the proposed project. References to ASTM and WSDOT specifications refer to the current version of the American Society of Testing and Materials and the 2014 Washington State Department of Transportation *Standards and Specifications for Road, Bridge, and Municipal Construction*, publication number M 41-10, respectively.

4.2 Earthwork

The following presents recommendations for site preparation, excavation, subgrade preparation and placement of structural fills on the project. The recommendations presented for design and construction of earth supported elements including foundations, slabs and pavements are contingent upon following the recommendations outlined in this section.

Earthwork on the project should be observed and evaluated by Terracon. The evaluation of earthwork should include observation and testing of engineered fill, subgrade preparation, foundation bearing soils, and other geotechnical conditions exposed during the construction of the project.

4.2.1 Site Preparation

We anticipate construction will be initiated by stripping vegetation, and loose, soft or otherwise unsuitable material. Stripped materials consisting of vegetation and organic materials should be wasted off site, or used to vegetate landscaped areas or exposed slopes after completion of grading operations. Stripping depths between our boring locations and across the site could vary considerably as such we recommend actual stripping depths be evaluated by a representative of Terracon during construction to aid in preventing removal of excess material.

The silty sand soils encountered in the borings will be sensitive to disturbance from construction activity and water seepage. If precipitation occurs prior to or during construction, the near-surface silty soils could increase in moisture content and become more susceptible to disturbance. Construction activity should be monitored, and should be curtailed if the construction activity is causing subgrade disturbance. A Terracon representative can help with monitoring and developing recommendations to aid in limiting subgrade disturbance.

After stripping, proofrolling should be performed with heavy rubber tire construction equipment such as a loaded scraper or fully loaded tandem-axle dump truck. A geotechnical engineer or his representative should observe proofrolling to aid in locating unstable subgrade materials. Proofrolling should be performed after a suitable period of dry weather to avoid degrading an otherwise acceptable subgrade and to reduce the amount of undercutting / remedial work required. Unstable materials located should be stabilized as recommended by the engineer based on conditions observed during construction. Undercut and replacement and densification in place are typical remediation methods.

4.2.2 Material Types

The suitability of soils used for structural fill depends primarily on their grain-size distribution and moisture content when they are placed. As the fines content (that soil fraction passing the U.S. No. 200 Sieve) increases, soils become more sensitive to small changes in moisture content. Soils containing more than about 5 percent fines (by weight) cannot be consistently compacted to a firm, unyielding condition when the moisture content is more than 2 percentage points above or below optimum. Optimum moisture content is the moisture at which the maximum dry density for the material is achieved in the laboratory following ASTM procedures.

Existing clean to silty sands encountered on site generally appeared to be below the optimum moisture content and are likely suitable for reuse after moisture conditioning (i.e., wetting). Clean, uniformly graded sands may be difficult to properly moisture condition given their high permeability; they may also be difficult to compact when unconfined. Silty sands are suitable for as structural fill provided that they are protected from moisture and disturbance after placement.

The project specifications should include provisions for using imported, clean, granular fill. As a general structural fill material, we recommend using a well-graded sand and gravel such as “Ballast” or “Gravel Borrow” per WSDOT 9-03.9(1) and 9-03.14, respectively. For combined structural fill and drainage purposes, a relatively clean and uniform angular material such as “Crushed Surfacing Base Course” per WSDOT 9-03.9(3) is preferable. Structural fill should consist of approved materials, free of organic material, debris, and particles larger than about 4 inches. The maximum particle size criteria may be relaxed by the geotechnical engineer of record depending on construction techniques, material gradation, allowable lift thickness and observations during fill placement.

4.2.3 Compaction Requirements

Structural fill materials should be placed in horizontal lifts not exceeding about 8 inches in loose thickness. We recommend that each lift then be thoroughly compacted with a mechanical compactor to a uniform density of at least 95 percent, based on the modified Proctor test (ASTM D 1557). Where light compaction equipment is used, as is typical within a few feet of retaining walls and in utility trenches, the lift thickness may need to be reduced to achieve the desired degree of compaction. Soils removed which will be used as structural fill should be protected by plastic sheeting to aid in preventing an increase in moisture content due to rain and other factors. Moisture contents at the time of compaction should be within ±2 percent of the optimum moisture content.

4.2.4 Grading and Drainage

Adequate positive drainage should be provided during construction and maintained throughout the life of the development to prevent an increase in moisture content of the foundation, pavement and backfill materials. Surface water drainage should be controlled to prevent undermining of structures during and after construction.

Gutters and downspouts that drain water a minimum of 10 feet beyond the footprint of the proposed structures are recommended. This can be accomplished through the use of splash-blocks, downspout extensions, and flexible pipes that are designed to attach to the end of the downspout. Flexible pipe should only be used if it is daylighted in such a manner that it gravity-drains collected water. Splash-blocks should also be considered below hose bibs and water spigots.

4.2.5 Construction Considerations

It is anticipated that excavations for the proposed construction can be accomplished with conventional earthmoving equipment.

Upon completion of filling and grading, care should be taken to maintain the subgrade moisture content prior to construction of floor slabs and pavements. Construction traffic over the completed subgrade should be avoided to the extent practical. The site should also be graded to prevent ponding of surface water on the prepared subgrades or in excavations. If the subgrade should become frozen, desiccated, saturated, or disturbed, the affected material should be removed or these materials should be scarified, moisture conditioned, and recompacted prior to floor slab and pavement construction and observed by Terracon.

Surface water should not be allowed to pond on the site and soak into the soil during construction. Construction staging should provide drainage of surface water and precipitation away from the building and pavement areas. Any water that collects over or adjacent to construction areas should be promptly removed, along with any softened or disturbed soils. Surface water control in the form of sloping surfaces, drainage ditches and trenches, and possibly sump pits and pumps will be important to avoid ponding and associated delays due to precipitation and seepage.

Groundwater was encountered in B-4 at an approximate depth of 29 feet, but, depending on the time of year, may rise to depths of 15 feet. Based on our understanding of the proposed development, we do not expect groundwater to significantly affect construction. If groundwater is encountered during construction, some form of temporary dewatering may be required. Conventional dewatering methods, such as pumping from sumps, should likely be adequate for temporary removal of any groundwater encountered during excavation at the site.

All excavations should be sloped or braced as required by OSHA regulations to provide stability and safe working conditions. Temporary excavations will probably be required during grading operations. The grading contractor, by his contract, is usually responsible for designing and constructing stable, temporary excavations and should shore, slope or bench the sides of the excavations as required to maintain stability of both the excavation sides and bottom. All excavations should comply with applicable local, state and federal safety regulations, including the current Occupational Health and Safety Administration (OSHA) Excavation and Trench Safety Standards.

Construction site safety is the sole responsibility of the contractor who controls the means, methods and sequencing of construction operations. Under no circumstances shall the information provided herein be interpreted to mean that Terracon is assuming any responsibility for construction site safety or the contractor's activities; such responsibility shall neither be implied nor inferred.

4.3 Foundations

In our opinion, the proposed building can be supported by a shallow, spread footing foundation system bearing on medium dense native soils or structural fill above medium dense native soils. Design recommendations for shallow foundations for the proposed structure bearing on medium dense native soils or structural fill above medium dense native soils are presented in the following paragraphs.

4.3.1 Design Recommendations

DESCRIPTION	Column	Wall
Net allowable bearing pressure [1]	3,000 psf	2,000 psf
Minimum dimensions	24 inches	18 inches
Minimum embedment below finished grade for frost protection [2]	18 inches	18 inches
Approximate total static settlement [3]	<1 inch	<1 inch
Estimated differential settlement [3]	<½ inch between columns	<½ inch over 40 feet
Ultimate coefficient of sliding friction	0.40	

1. The recommended net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation. Assumes any unsuitable fill or soft/organic soils, if encountered, will be undercut and replaced with engineered fill.
2. And to reduce the effects of seasonal moisture variations in the subgrade soils. For perimeter footing and footings beneath unheated areas.
3. The foundation settlement will depend upon the variations within the subsurface soil profile, the structural loading conditions, the embedment depth of the footings, the thickness of compacted fill, and the quality of the earthwork operations. Once loading conditions and footing dimensions are known, Terracon should be provided the opportunity to confirm the estimated settlement values.

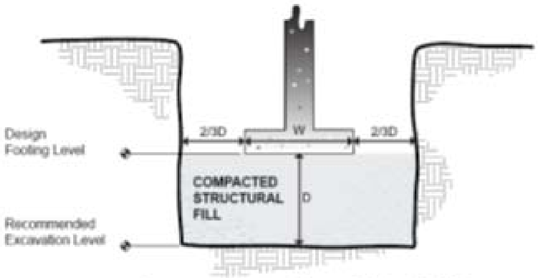
The allowable foundation bearing pressures apply to dead loads plus design live load conditions. The design bearing pressure may be increased by one-third when considering total loads that include wind or seismic conditions. The weight of the foundation concrete below grade may be neglected in dead load computations. Interior footings should bear a minimum of 12 inches below finished grade. Finished grade is the lowest adjacent grade for perimeter footings and floor level for interior footings.

Footings, foundations, and masonry walls should be reinforced as necessary to reduce the potential for distress caused by differential foundation movement. The use of joints at openings or other discontinuities in masonry walls is recommended.

Foundation excavations should be observed by the geotechnical engineer. If the soil conditions encountered differ from those presented in this report, supplemental recommendations may be required.

4.3.2 Construction Considerations

If unsuitable (e.g., loose sand) bearing soils are encountered in footing excavations, the excavations should be extended deeper to suitable soils and the footings could bear directly on these soils at the lower level or on properly compacted backfill extending down to the suitable soils. Overexcavation for compacted backfill placement below footings should extend laterally beyond all edges of the footings at least 8 inches per foot of overexcavation depth below footing base elevation. The overexcavation should then be backfilled up to the footing base elevation with granular material placed in lifts of 8 inches or less in loose thickness and compacted to at least 95 percent of the material's maximum modified Proctor dry density (ASTM D-1557). The overexcavation and backfill procedure is described in the figure below.



Overexcavation / Backfill

NOTE: Excavation shown vertical for convenience; excavations should be sloped as necessary for safety.

4.3.3 Footing Drains

A perimeter footing drain should also be provided and consist of a minimum 4 inch diameter heavy-walled, perforated PVC pipe or equivalent. We recommend that the footing drains have a minimum slope of 0.5 percent, and that the pipe invert is at least 12 inches below the finish floor slab. The pipe should be bedded in at least 4 inches and surrounded by at least 6 inches to either side, of drainage material consisting of ¾ inch washed drain rock. We recommend use of nonwoven filter fabric (Mirafi 140N or equivalent) to wrap the entire pipe and rock assembly. Cleanouts are recommended for the footing drain system.

4.4 Floor Slab

In our opinion, the site is suitable for conventional, concrete slabs-on-grade. Design recommendations for floor slabs for the proposed structure bearing on medium dense native soils or structural fill above medium dense native soils are presented in the following paragraphs.

4.4.1 Design Recommendations

DESCRIPTION	VALUE
Interior floor system	Slab-on-grade concrete.
Subbase/Capillary Break	4-inch compacted layer of free draining, granular subbase material

DESCRIPTION	VALUE
1. Floor slabs should be structurally independent of any building footings or walls to reduce the possibility of floor slab cracking caused by differential movements between the slab and foundation. Narrower, turned-down slab-on-grade foundations may be utilized at the approval of the structural engineer. The slabs should be appropriately reinforced to support the proposed loads. 2. We recommend subgrades be maintained at the proper moisture condition until floor slabs are constructed. If the subgrade should become desiccated or excessively wet prior to construction of floor slabs, the affected material should be removed or the materials scarified, moisture conditioned, and recompacted. Upon completion of grading operations in the building areas, care should be taken to maintain the recommended subgrade moisture content and density prior to construction of the building floor slabs. 3. The floor slab design should include a capillary break, comprised of free-draining, compacted, granular material, at least 4 inches thick.	

A subgrade prepared and tested as recommended in this report should provide adequate support for lightly loaded floor slabs.

Where appropriate, saw-cut control joints should be placed in the slab to help control the location and extent of cracking. For additional recommendations refer to the ACI Design Manual.

The use of a vapor retarder or barrier should be considered beneath concrete slabs on grade that will be covered with wood, tile, carpet or other moisture sensitive or impervious coverings, or when the slab will support equipment sensitive to moisture. When conditions warrant the use of a vapor retarder, the slab designer and slab contractor should refer to ACI 302 and ACI 360 for procedures and cautions regarding the use and placement of a vapor retarder/barrier.

4.4.2 Construction Considerations

On most project sites, the site grading is generally accomplished early in the construction phase. However as construction proceeds, the subgrade may be disturbed due to utility excavations, construction traffic, desiccation, rainfall, etc. As a result, the floor slab subgrade may not be suitable for placement of base rock and concrete and corrective action may be required.

We recommend the area underlying the floor slab be rough graded and then thoroughly proofrolled with a loaded tandem axle dump truck prior to final grading and placement of base rock. Particular attention should be paid to high traffic areas that were rutted and disturbed earlier and to areas where backfilled trenches are located. Areas where unsuitable (e.g., loose sand) conditions are located should be repaired by removing and replacing the affected material with properly compacted fill. All floor slab subgrade areas should be moisture conditioned and properly compacted to the recommendations in this report immediately prior to placement of the base rock and concrete.

4.5 Seismic Considerations

DESCRIPTION	VALUE
2012 International Building Code Site Classification (IBC)[1]	F[2]
Site Latitude	48.076° N
Site Longitude	122.183° W
S_s Spectral Acceleration for a Short Period for Site Class B	1.142g
S_1 Spectral Acceleration for a 1-Second Period for Site Class B	0.443g
F_a Site Coefficient for a Short Period	1.043
F_v Site Coefficient for a 1-Second Period	1.557

[1] Note: The 2012 International Building Code (IBC) indicates that the seismic site classification is based on the average soil and bedrock properties in the top 100 feet. The current scope does not include a 100-foot soil profile determination. This seismic site class definition considers that soils encountered at depth in our borings continue below the termination depth. Additional exploration to deeper depths would be required to confirm the conditions below the current depth of exploration.

[2] Note: The Site Class is F because of the potential for earthquake-induced soil liquefaction. Assuming the fundamental period of the structure is less than 0.5 seconds, Site Class D may be used for determination of the site coefficients. Site Class D applies to an average soil profile within the top 100 feet consisting predominantly of medium dense soils. These soils are characterized by average Standard Penetration Test blowcounts between 15 and 50, an average shear wave velocity of between 600 and 1,200 feet per second, and an undrained shear strength ranging from 1,000 to 2,000 pounds per square foot. Average blowcounts and shear wave velocities are determined using a harmonic mean.

As part of our services, we evaluated the risk of liquefaction at this site. Though we observed groundwater in one of our explorations at 29 feet below the ground surface, in our experience with the area, the date of drilling and the presence of rust discolorations in the soil, it is our opinion that the water table could reach up to 15 feet below ground surface. In our opinion, the risk of liquefaction at this site is moderate with predicted liquefaction settlements on the order of 2 to 4 inches depending on the location of the water table, with differential settlements across the building pad on the order of 1 to 2 inches. Liquefaction estimates were performed using the information from Boring B-4; it is our opinion that we found the bottom of the liquefiable layer at 50 feet below ground surface, but no further samples were taken to prove this conclusively. If more liquefiable deposits are present below 50 feet, liquefaction settlements may be higher than our estimates.

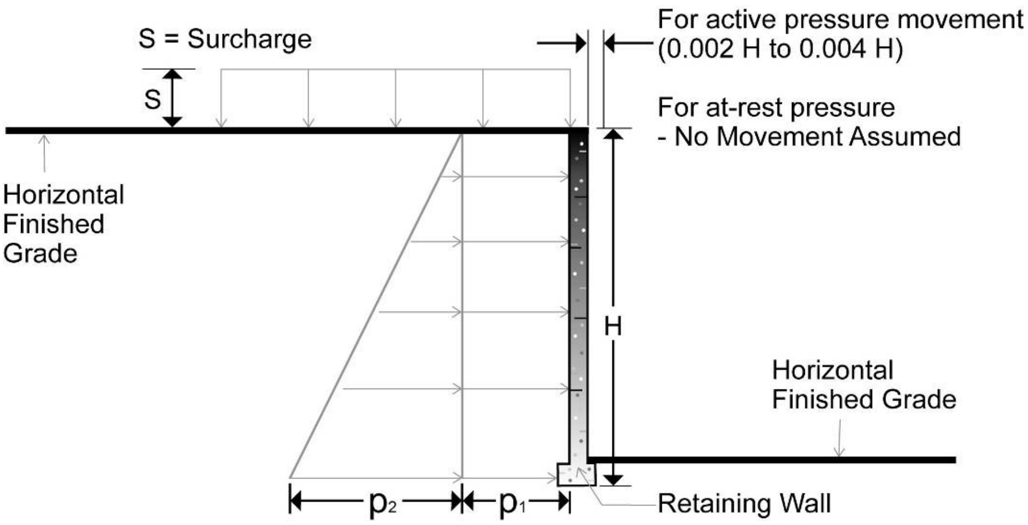
We reviewed the USGS Earthquake Hazards Program Quaternary Faults and Folds Database available online (http://earthquake.usgs.gov/hazards/qfaults/map/hazfault2014.html). The nearest fault to the project site is the north most fault of the Southern Whidbey Island fault zone approximately ten miles southwest of the project site. According to this source, the fault has been mapped with northwest striking features, and has a slip rate of 0.22 to 0.23mm/year. Based on information described above, we estimate that the risk associated with surface rupture is low.

4.6 Lateral Earth Pressures

4.6.1 Design Recommendations

The lateral earth pressure recommendations herein are applicable to the design of rigid retaining walls subject to slight rotation, such as cantilever, or gravity type concrete walls. These recommendations are not applicable to the design of modular block - geogrid reinforced backfill walls. Recommendations covering these types of wall systems are beyond the scope of services for this assignment and we understand these walls are not a part of the currently proposed site layout.

Reinforced concrete walls with unbalanced backfill levels on opposite sides should be designed for earth pressures at least equal to those indicated in the following table. Earth pressures will be influenced by structural design of the walls, conditions of wall restraint, methods of construction and/or compaction and the strength of the materials being restrained. Two wall restraint conditions are shown. Active earth pressure is commonly used for design of free standing cantilever retaining walls and assumes wall movement. The "at rest" condition assumes no wall movement. The recommended design lateral earth pressures do not include a factor of safety and do not provide for possible hydrostatic pressure on the walls.



EARTH PRESSURE COEFFICIENTS

EARTH PRESSURE CONDITIONS	COEFFICIENT FOR BACKFILL TYPE	EQUIVALENT FLUID DENSITY (pcf)	SURCHARGE PRESSURE, p_1 (psf)	EARTH PRESSURE, p_2 (psf)
Active (Ka)	0.27	35	(0.27)S	(35)H
At-Rest (Ko)	0.43	55	(0.43)S	(55)H

EARTH PRESSURE CONDITIONS	COEFFICIENT FOR BACKFILL TYPE	EQUIVALENT FLUID DENSITY (pcf)	SURCHARGE PRESSURE, p_1 (psf)	EARTH PRESSURE, p_2 (psf)
Passive (Kp)	3.69	460	---	---

Applicable conditions to the above include:

- For active earth pressure, wall must rotate about base, with top lateral movements of about 0.002 **H** to 0.004 **H**, where **H** is wall height
- For passive earth pressure to develop, wall must move horizontally to mobilize resistance
- Uniform surcharge, where S is surcharge pressure
- In-situ soil backfill weight a maximum of 125 pcf
- Horizontal backfill, compacted between 90 and 92 percent of modified Proctor maximum dry density
- Loading from heavy compaction equipment not included
- No hydrostatic pressures acting on wall
- No dynamic loading
- No safety factor included in soil parameters
- Ignore passive pressure in frost zone

Backfill placed against structures should consist of granular soils. To calculate the resistance to sliding, a value of 0.40 should be used as the ultimate coefficient of friction between the footing and the underlying soil.

To aid in reducing the potential for hydrostatic pressure behind walls, we recommend a perimeter drain be installed at the foundation wall with a collection pipe leading to a reliable discharge. If adequate drainage is not possible, then combined hydrostatic and lateral earth pressures should be calculated for granular backfill using an equivalent fluid weighing 80 and 90 pcf for active and at-rest conditions, respectively. These pressures do not include the influence of surcharge, equipment or floor loading, which should be added. Heavy equipment should not operate within a distance closer than the exposed height of retaining walls to prevent lateral pressures more than those provided.

4.7 Pavements

4.7.1 Subgrade Preparation

On most project sites, the site grading is accomplished relatively early in the construction phase. Fills are placed and compacted in a uniform manner. However, as construction proceeds, excavations are made into these areas, rainfall and surface water saturates some areas, heavy traffic from concrete trucks and other delivery vehicles disturbs the subgrade and many surface irregularities are filled in with loose soils to temporarily improve trafficability. As a result, the pavement subgrades, initially prepared early in the project, should be carefully evaluated as the time for pavement construction approaches.

Prior to placement of aggregate base and pavements, we recommend at least the upper 12 inches of the existing pavement subgrades be moisture conditioned, if required, and compacted to at least 95 percent of their maximum dry density (MDD). Pavement subgrades should be within plus or minus 2 percent of their optimum moisture content (OMC) and should be evaluated and proofrolled within two days prior to commencement of actual paving operations. Areas not in compliance with the required ranges of moisture or density should be moisture conditioned and recompacted. Particular attention should be paid to high traffic areas that were rutted and disturbed earlier and to areas where backfilled trenches are located. Areas where unsuitable conditions are located should be repaired by removing and replacing the materials with properly compacted fills. If a significant precipitation event occurs after the evaluation or if the surface becomes disturbed, the subgrade should be reviewed by qualified personnel immediately prior to paving. The subgrade should be in its finished form at the time of the final review.

4.7.2 Design Considerations

Traffic patterns and anticipated loading conditions were not available at the time that this report was prepared. However, we anticipate that traffic loads will be produced primarily by automobile traffic and occasional delivery and trash removal trucks. The thickness of pavements subjected to heavy truck traffic should be determined using expected traffic volumes, vehicle types, and vehicle loads and should be in accordance with local, city or county ordinances.

Pavement thickness can be determined using AASHTO, Asphalt Institute and/or other methods if specific wheel loads, axle configurations, frequencies, and desired pavement life are provided. Terracon can provide thickness recommendations for pavements subjected to loads other than personal vehicle and occasional delivery and trash removal truck traffic if this information is provided.

Pavement performance is affected by its surroundings. In addition to providing preventive maintenance, the civil engineer should consider the following recommendations in the design and layout of pavements:

- Final grade adjacent to parking lots and drives should slope down from pavement edges at a minimum 2%;
- The subgrade and the pavement surface should have a minimum ¼ inch per foot slope to promote proper surface drainage;
- Install pavement drainage surrounding areas anticipated for frequent wetting (e.g., landscaping areas, etc.);
- Install joint sealant and seal cracks immediately;
- Seal all landscaped areas in, or adjacent to pavements to reduce moisture migration to subgrade soils, and;

- Place compacted, low permeability backfill against the exterior side of curb and gutter

4.7.3 Estimates of Minimum Pavement Thickness

As a minimum, we recommend the following typical pavement section be considered for car only areas.

Material	Thickness (inches)	WSDOT Std. Spec.
Subgrade	Minimum 12 inches of compacted subgrade	95% of Modified Proctor MDD, -2 to +2% OMC
Aggregate Base	4	9-03.9(3) Base Course
Asphalt Surface Course	3	9-03.8(2) ½-inch HMA 9-03.8(6) ½-inch Aggregate
Total Pavement Section	7	

As a minimum, we suggest the following typical pavement section be considered for combined car and delivery truck traffic.

Material	Thickness (inches)	WSDOT Std. Spec.
Subgrade	Minimum 12 inches of compacted subgrade	95% of Modified Proctor MDD, -2 to +2% OMC
Aggregate Base	6	9-03.9(3) Base Course
Asphalt Surface Course	3½	9-03.8(2) ½-inch HMA 9-03.8(6) ½-inch Aggregate
Total Pavement Section	9½	

The graded aggregate base should be compacted to a minimum of 95 percent of the material's modified Proctor (ASTM D-1557, Method C) maximum dry density. Where base course thickness exceeds 8 inches, the material should be placed and compacted in two or more lifts of equal thickness. Asphalt concrete aggregates and base course materials should conform to the 2014 Washington State Department of Transportation (WSDOT) M 41-10 "Standard Specifications for Road, Bridge, and Municipal Construction".

The listed pavement component thicknesses should be used as a guide for pavement systems at the site for the traffic classifications stated herein. These recommendations assume a 20-year pavement design life. If pavement frequencies or loads will be different than that specified Terracon should be contacted and allowed to review these pavement sections.

We recommend a Portland cement concrete (PCC) pavement be utilized in entrance and exit sections, dumpster pads, loading dock areas, or other areas where extensive wheel maneuvering or repeated loading are expected. The dumpster pad should be large enough to support the wheels of the truck which will bear the load of the dumpster. We recommend a minimum of 6 inches of PCC underlain by 4 inches of crushed aggregate base. Although not required for structural support, the base course layer is recommended to help reduce potentials for slab curl, shrinkage cracking, and subgrade "pumping" through joints. Proper joint spacing will also be required to prevent excessive slab curling and shrinkage cracking. All joints should be sealed to prevent entry of foreign material and dowelled where necessary for load transfer.

Portland cement concrete should be designed with proper air-entrainment and have a minimum compressive strength of 4,000 psi after 28 days of laboratory curing. Adequate reinforcement and number of longitudinal and transverse control joints should be placed in the rigid pavement in accordance with ACI requirements. The joints should be sealed as soon as possible (in accordance with sealant manufacturer's instructions) to minimize infiltration of water into the soil.

4.7.4 Pavement Drainage

Pavements should be sloped to provide rapid drainage of surface water. Water allowed to pond on or adjacent to the pavements could saturate the subgrade and contribute to premature pavement deterioration. In addition, the pavement subgrade should be graded to provide positive drainage within the granular base section.

4.7.5 Pavement Maintenance

The pavement sections provided in this report represent minimum recommended thicknesses and, as such, periodic maintenance should be anticipated. Therefore preventive maintenance should be planned and provided for through an on-going pavement management program. Preventive maintenance activities are intended to slow the rate of pavement deterioration, and to preserve the pavement investment. Preventive maintenance consists of both localized maintenance (e.g., crack and joint sealing and patching) and global maintenance (e.g., surface sealing). Preventive maintenance is usually the first priority when implementing a planned pavement maintenance program and provides the highest return on investment for pavements. Prior to implementing any maintenance, additional engineering observation is recommended to determine the type and extent of preventive maintenance. Even with periodic maintenance, some movements and related cracking may still occur and repairs may be required.

5.0 GENERAL COMMENTS

Terracon should be retained to review the final design plans and specifications so comments can be made regarding interpretation and implementation of our geotechnical recommendations in the design and specifications. Terracon also should be retained to provide observation and testing services during grading, excavation, foundation construction and other earth-related construction phases of the project.

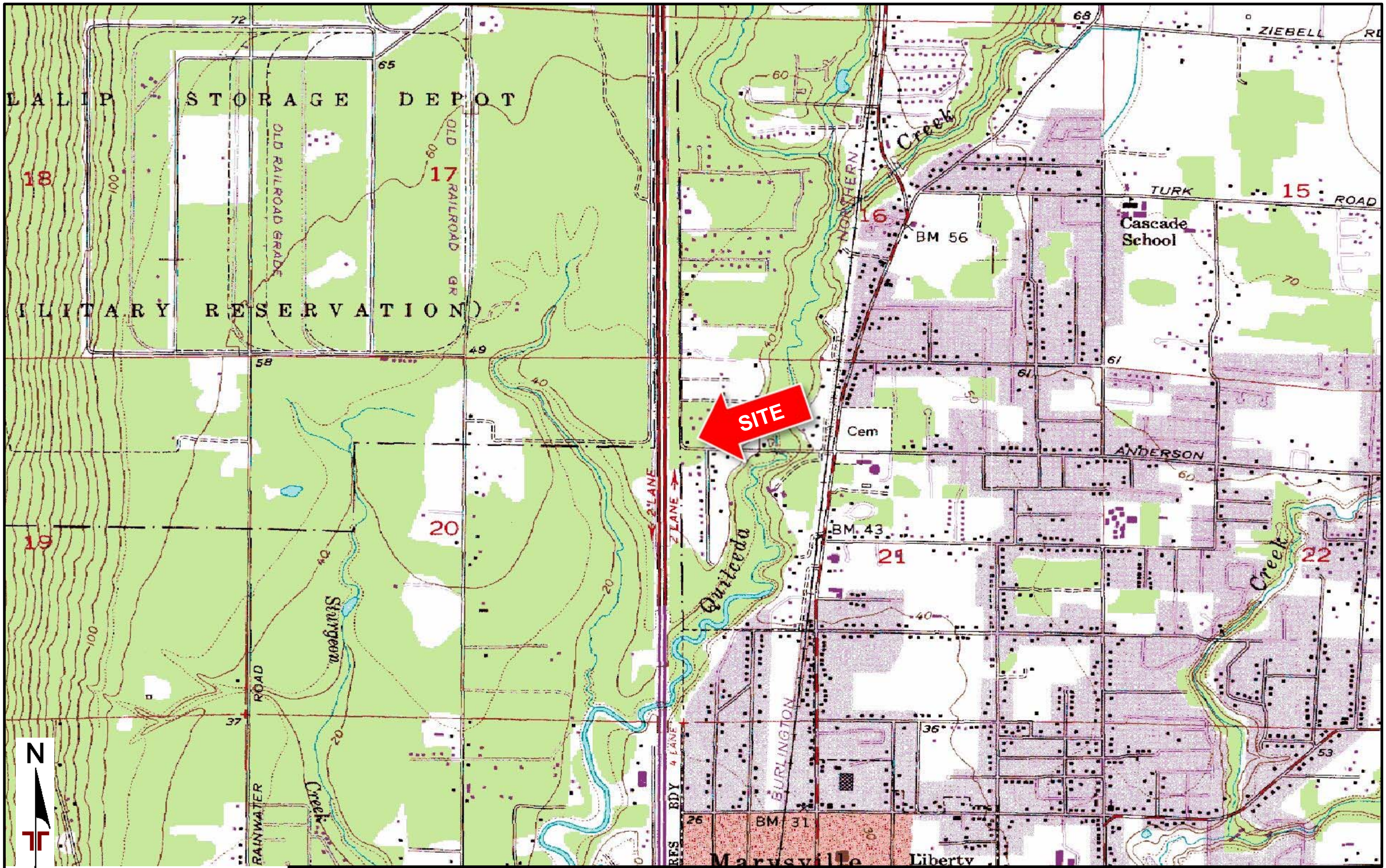
The analysis and recommendations presented in this report are based upon the data obtained from the borings performed at the indicated locations and from other information discussed in this report. This report does not reflect variations that may occur between borings, across the site, or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. If variations appear, we should be immediately notified so that further evaluation and supplemental recommendations can be provided.

The scope of services for this project does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

Site safety, excavation support, and dewatering requirements are the responsibility of others. In the event that changes in the nature, design, or location of the project as outlined in this report are planned, the conclusions and recommendations contained in this report shall not be considered valid unless Terracon reviews the changes and either verifies or modifies the conclusions of this report in writing.

APPENDIX A

FIELD EXPLORATION



TOPOGRAPHIC MAP IMAGE COURTESY OF THE U.S. GEOLOGICAL SURVEY QUADRANGLES INCLUDE: MARYSVILLE, WA (1/1/1973).

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

Project Manager: RMS
Drawn by: TTA
Checked by: RMS
Approved by: RMS

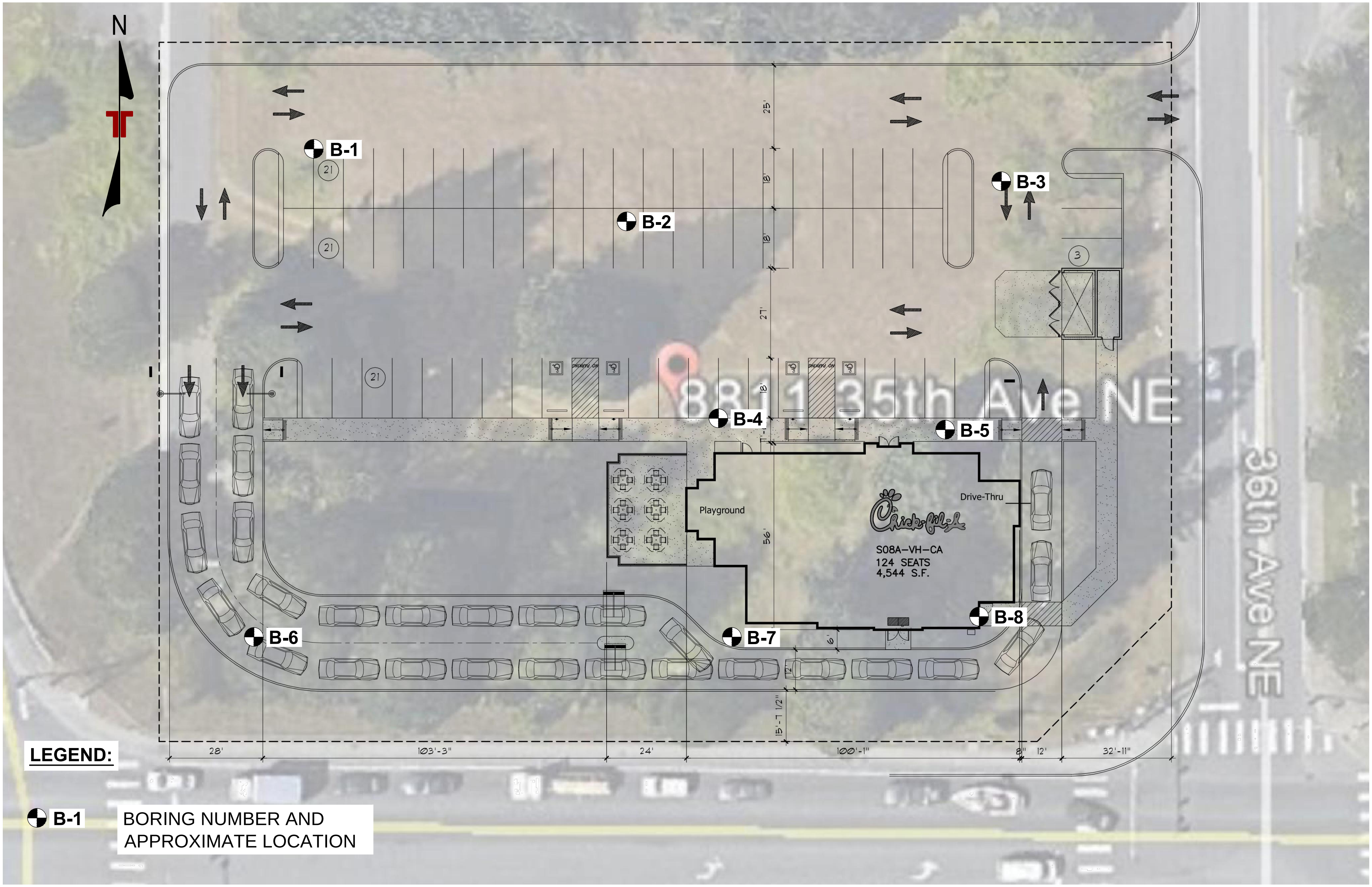
Project No. 81155034
Scale: 1"=24,000 SF
File Name: Exhibit A-2.docx
Date: July 2015

Terracon
21905 64th Ave W Suite 100
Mountlake Terrace, WA 98043

SITE LOCATION

Marysville CFA
8811 35th Ave.
Marysville, WA

Exhibit
A-1



LEGEND:

● B-1	BORING NUMBER AND APPROXIMATE LOCATION

Basemap PDF file provided by Client and modified by Terracon.

Project Mngr: RMS	Project No. 81155034		
Drawn By: TTA	Scale: 1" = 20'		
Checked By: RMS	File No. Exhibit A-2.dwg		
Approved By: RMS	Date: July 2015		

Terracon
Consulting Engineers and Scientists
21905 64th Avenue W., Ste 100 Mountlake Terrace, WA 98043
PH. (425) 771-3304 FAX. (425) 771-3549

SITE AND EXPLORATION PLAN

Marysville CFA
8811 35th Avenue
Marysville, Washington

EXHIBIT

A-2

Field Exploration Description

The subsurface exploration consisted of drilling and sampling 8 borings at the site to depths ranging from about 11.5 to 51.5 feet below existing grade. The boring locations were laid out by Terracon personnel and measured from existing site features. Distances from these locations to the reference features indicated on the attached diagram are approximate and were estimated. The locations of the borings should be considered accurate only to the degree implied by the means and methods used to define them.

The borings were drilled with a trailer-mounted drill rig using hollow stem augers to advance the boreholes. Representative soil samples were obtained by the split-barrel sampling procedure. In the split-barrel sampling procedure, the number of blows required to advance a standard 2-inch O.D. split-barrel sampler the last 12 inches of the typical total 18-inch penetration by means of a 140-pound hammer with a free fall of 30 inches, is the standard penetration resistance value (N). These values are indicted on the boring logs at the depths of occurrence. This value is used to estimate the in-situ relative density of cohesionless soils and the consistency of cohesive soils. The sampling depths and penetration distance, plus the standard penetration resistance values, are shown on the boring logs. The samples were sealed and taken to the laboratory for testing and classification.

Field logs of each boring were prepared by the geotechnical engineer on site. These logs included visual classifications of the materials encountered during drilling as well as the engineer's interpretation of the subsurface conditions between samples. Final boring logs included with this report represent an interpretation of the field logs and include modifications based on laboratory observation and tests of the samples.

The samples were classified in the laboratory based on visual observation, texture and plasticity. The descriptions of the soils indicated on the boring logs are in general accordance with the enclosed General Notes and the Unified Soil Classification System. Estimated group symbols according to the Unified Soil Classification System are given on the boring logs. A brief description of this classification system is attached to this report.

Exhibit A-3

BORING LOG NO. B-1

Page 1 of 1

PROJECT: Marysville CFA

CLIENT: Chick-fil-A, Inc.
Atlanta, Georgia

SITE: 8811 35th Avenue
Marysville, Washington

LOCATION See Exhibit A-2

Latitude: 48.04633° Longitude: -122.18363°

GRAPHIC LOG	DEPTH		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	PERCENT FINES
	0.5	**TOPSOIL**, grass surface and topsoil						
	2.5	**SILTY SAND WITH GRAVEL (SM)**, yellowish-brown, dry to moist						
	11.5	**POORLY GRADED SAND (SP)**, trace gravel, light yellowish-brown, loose, dry to moist			☒	2-4-3 N=7	1	
			5		☒	3-4-5 N=9		
		medium dense, 1 inch silt lens at 7.5 feet			☒	4-6-7 N=13		
			10		☒	6-8-6 N=14		
		Boring Terminated at 11.5 Feet	15					
			20					
			25					

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Rope & Cathead

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Borings backfilled with bentonite chips upon completion

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Terracon
21905 64th Ave. W, Suite 100
Mountlake Terrace, Washington

Boring Started: 6/26/2015	Boring Completed: 6/26/2015
Drill Rig: DR XL Trailer	Driller: Geologic Drill
Project No.: 81155034	Exhibit: A-4

BORING LOG NO. B-2

PROJECT: Marysville CFA

CLIENT: Chick-fil-A, Inc.
Atlanta, Georgia

SITE: 8811 35th Avenue
Marysville, Washington

LOCATION See Exhibit A-2

Latitude: 48.07628° Longitude: -122.18318°

GRAPHIC LOG	DEPTH		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	PERCENT FINES
SM		**SILTY SAND (SM)**, yellowish-brown, loose, moist						
	3.0	**POORLY GRADED SAND (SP)**, trace gravel, light yellowish-brown, loose to medium dense, dry to moist			☒	3-4-5 N=9	4	1
			5		☒	5-6-6 N=12		
					☒	5-4-5 N=9		
	11.5		10		☒	5-10-11 N=21		
		Boring Terminated at 11.5 Feet						
			15					
			20					
			25					

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Rope & Cathead

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Borings backfilled with bentonite chips upon completion

See Exhibit A-3 for description of field procedures.
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Terracon
21905 64th Ave. W, Suite 100
Mountlake Terrace, Washington

Boring Started: 6/26/2015	Boring Completed: 6/26/2015
Drill Rig: DR XL Trailer	Driller: Geologic Drill
Project No.: 81155034	Exhibit: A-5

BORING LOG NO. B-3

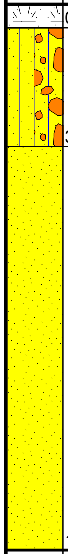
PROJECT: **Marysville CFA**

CLIENT: **Chick-fil-A, Inc.**
Atlanta, Georgia

SITE: **8811 35th Avenue**
Marysville, Washington

LOCATION See Exhibit A-2

Latitude: 48.07631° Longitude: -122.18278°



DEPTH	
0.5	**TOPSOIL**, grass surface and topsoil
3.0	**SILTY SAND WITH GRAVEL (SM)**, dark yellowish-brown, dry to moist
11.5	**POORLY GRADED SAND (SP)**, fine to medium, light yellowish-brown, medium dense, dry to moist 15" SANDY SILT stratum with rust mottling 4 inch SILTY SAND stratum, fine grained, dark brown, wet
	Boring Terminated at 11.5 Feet

DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	PERCENT FINES
		☒	4-5-8 N=13	3	
5		☒	5-5-8 N=13		
		☒	6-8-10 N=18		
10		☒	6-10-9 N=19		
15					
20					
25					

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Rope & Cathead

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Borings backfilled with bentonite chips upon completion

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Terracon
21905 64th Ave. W, Suite 100
Mountlake Terrace, Washington

Boring Started: 6/26/2015	Boring Completed: 6/26/2015
Drill Rig: DR XL Trailer	Driller: Geologic Drill
Project No.: 81155034	Exhibit: A-6

BORING LOG NO. B-4

PROJECT: Marysville CFA

CLIENT: Chick-fil-A, Inc.
Atlanta, Georgia

SITE:
8811 35th Avenue
Marysville, Washington

LOCATION See Exhibit A-2

Latitude: 48.0761° Longitude: -122.18314°

DEPTH	Description	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	PERCENT FINES
0.5	**TOPSOIL**, grass surface and topsoil						
2.5	**SILTY SAND WITH GRAVEL (SM)**, dark yellowish-brown, dry to moist						
	POORLY GRADED SAND (SP), trace gravel and silt, fine grained, light yellowish brown, very loose to medium dense, dry to moist, rust mottled			☒	3-2-1 N=3	3	
		5		☒	2-3-5 N=8		
10.0				☒	3-4-5 N=9		
	POORLY GRADED SAND (SP), trace gravel and silt, fine grained, light yellowish brown, medium dense	10		☒	6-7-10 N=17		
	no silt, rust mottling ends	15		☒	8-10-11 N=21		
	trace silt, moist	20		☒	8-10-13 N=23	7	3
25.0		25					

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Rope & Cathead

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Borings backfilled with bentonite chips upon completion

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *While drilling*

Terracon
21905 64th Ave. W, Suite 100
Mountlake Terrace, Washington

Boring Started: 6/26/2015	Boring Completed: 6/26/2015
Drill Rig: DR XL Trailer	Driller: Geologic Drill
Project No.: 81155034	Exhibit: A-7

BORING LOG NO. B-4

PROJECT: **Marysville CFA**

CLIENT: **Chick-fil-A, Inc.**
Atlanta, Georgia

SITE: **8811 35th Avenue**
Marysville, Washington

LOCATION See Exhibit A-2

Latitude: 48.0761° Longitude: -122.18314°

GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	PERCENT FINES
	SILTY SAND (SM), yellowish-brown, medium dense, wet			☒	7-10-16 N=26	23	15
			▽				
	30.0						
	POORLY GRADED SAND (SP), trace gravel and silt, fine grained, light yellowish brown, medium dense, wet	30		☒	7-11-15 N=26	22	1
	35.0						
	SILTY SAND (SM), gray, dense, wet	35		☒	11-18-19 N=37	21	13
	dark gray, medium dense	40		☒	7-10-12 N=22		
	45.0						
	POORLY GRADED SAND (SP), trace silt, dark gray, medium dense, laminated, wet, roughly 1mm wide rust lamina at 45.95 ft, 46 ft, 46.5 ft	45		☒	7-10-10 N=20		
	driller notes harder drilling, possible silt layer						
	50.0	50					

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Rope & Cathead

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Borings backfilled with bentonite chips upon completion

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *While drilling*

Terracon
21905 64th Ave. W, Suite 100
Mountlake Terrace, Washington

Boring Started: 6/26/2015	Boring Completed: 6/26/2015
Drill Rig: DR XL Trailer	Driller: Geologic Drill
Project No.: 81155034	Exhibit: A-7

BORING LOG NO. B-4

PROJECT: **Marysville CFA**

CLIENT: **Chick-fil-A, Inc.**
Atlanta, Georgia

SITE: **8811 35th Avenue**
Marysville, Washington

LOCATION See Exhibit A-2

Latitude: 48.0761° Longitude: -122.18314°

GRAPHIC LOG	DEPTH	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	PERCENT FINES
▨	50.8 **SILTY SAND (SM)**, dark brown, medium dense, wet			☒	10-12-11 N=23		
▥	51.5 **SANDY SILT (ML)**, dark brown, stiff to very stiff, moist						
	Boring Terminated at 51.5 Feet						
		55					
		60					
		65					
		70					
		75					

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Rope & Cathead

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Borings backfilled with bentonite chips upon completion

See Exhibit A-3 for description of field procedures.
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

▽ *While drilling*

Terracon
21905 64th Ave. W, Suite 100
Mountlake Terrace, Washington

Boring Started: 6/26/2015
Boring Completed: 6/26/2015
Drill Rig: DR XL Trailer
Driller: Geologic Drill
Project No.: 81155034
Exhibit: A-7

BORING LOG NO. B-5

Page 1 of 1

PROJECT: Marysville CFA

CLIENT: Chick-fil-A, Inc.
Atlanta, Georgia

SITE: 8811 35th Avenue
Marysville, Washington

LOCATION See Exhibit A-2

Latitude: 48.07609° Longitude: -122.18284°

DEPTH		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	PERCENT FINES
0.5	**TOPSOIL**, grass surface and topsoil						
2.9	**SILTY SAND WITH GRAVEL (SM)**, brownish gray to dark yellowish-brown, dry to moist						
	POORLY GRADED SAND (SP), light yellowish brown, loose to medium dense, dry to moist, 2" wood at 2.9 ft			☒	4-4-5 N=9		
7.5		5		☒	5-8-8 N=16	3	
10.0	**POORLY GRADED SAND WITH SILT (SP-SM)**, fine to medium, loose, moist, rust mottling			☒	4-3-5 N=8	9	8
	POORLY GRADED SAND (SP), fine grained, light yellowish brown, medium dense	10		☒	6-7-5 N=12		
	fine to medium	15		☒	7-11-10 N=21		
21.5		20		☒	7-12-14 N=26		
	Boring Terminated at 21.5 Feet	25					

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Rope & Cathead

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Borings backfilled with bentonite chips upon completion

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Terracon
21905 64th Ave. W, Suite 100
Mountlake Terrace, Washington

Boring Started: 6/26/2015	Boring Completed: 6/26/2015
Drill Rig: DR XL Trailer	Driller: Geologic Drill
Project No.: 81155034	Exhibit: A-8

BORING LOG NO. B-6

Page 1 of 1

PROJECT: **Marysville CFA**

CLIENT: **Chick-fil-A, Inc.**
Atlanta, Georgia

SITE: **8811 35th Avenue**
Marysville, Washington

GRAPHIC LOG	DEPTH	LOCATION See Exhibit A-2 Latitude: 48.076° Longitude: -122.18369°	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	PERCENT FINES
	0.5	**TOPSOIL**, grass surface and topsoil						
	2.5	**SILTY SAND WITH GRAVEL (SM)**, dark yellowish-brown, dry to moist						
		POORLY GRADED SAND (SP), trace silt, light yellowish-brown, medium dense, dry to moist			☒	4-5-6 N=11	4	
		clean sand	5		☒	5-5-9 N=14		
	8.8	fine to medium			☒	6-7-8 N=15		
	10.1	**SILTY SAND (SM)**, fine grained, light yellowish-brown, medium dense, moist, rust mottling at 10 feet	10					
	11.5	**POORLY GRADED SAND (SP)**, light yellowish-brown, medium dense, moist			☒	7-8-8 N=16		
		Boring Terminated at 11.5 Feet	15 20 25					

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Rope & Cathead

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Borings backfilled with bentonite chips upon completion

See Exhibit A-3 for description of field procedures.
See Appendix B for description of laboratory procedures and additional data (if any).
See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Terracon
21905 64th Ave. W, Suite 100
Mountlake Terrace, Washington

Boring Started: 6/26/2015	Boring Completed: 6/26/2015
Drill Rig: DR XL Trailer	Driller: Geologic Drill
Project No.: 81155034	Exhibit: A-9

BORING LOG NO. B-7

Page 1 of 1

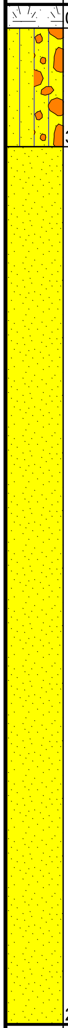
PROJECT: Marysville CFA

CLIENT: Chick-fil-A, Inc.
Atlanta, Georgia

SITE: **8811 35th Avenue**
Marysville, Washington

LOCATION See Exhibit A-2

Latitude: 48.0793° Longitude: -122.18313°



GRAPHIC LOG DEPTH		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	PERCENT FINES
0.5	**TOPSOIL**, grass surface and topsoil						
3.0	**SILTY SAND WITH GRAVEL (SM)**, dark yellowish-brown, dry to moist			☒	10-8-7 N=15		
	POORLY GRADED SAND (SP), trace silt, light yellowish-brown, medium dense, dry to moist						
	fine to medium, clean sand	5		☒	5-5-7 N=12	4	
	fine to medium, stratified, 4" fine, rust colored, sand strata throughout sample, moist			☒	6-9-10 N=19	6	1
	no rust mottling observed	10		☒	4-4-7 N=11		
		15		☒	7-8-8 N=16		
21.5	rust mottling observed	20		☒	10-12-11 N=23		
	Boring Terminated at 21.5 Feet	25					

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Rope & Cathead

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Borings backfilled with bentonite chips upon completion

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Terracon
21905 64th Ave. W, Suite 100
Mountlake Terrace, Washington

Boring Started: 6/26/2015	Boring Completed: 6/26/2015
Drill Rig: DR XL Trailer	Driller: Geologic Drill
Project No.: 81155034	Exhibit: A-10

BORING LOG NO. B-8

PROJECT: Marysville CFA

CLIENT: Chick-fil-A, Inc.
Atlanta, Georgia

SITE:
8811 35th Avenue
Marysville, Washington

LOCATION See Exhibit A-2

Latitude: 48.07593° Longitude: -122.18279°

GRAPHIC LOG	DEPTH		DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	WATER CONTENT (%)	PERCENT FINES
	0.5	**TOPSOIL**, grass surface and topsoil						
	2.8	**SILTY SAND WITH GRAVEL (SM)**, dark yellowish-brown, dry to moist						
		POORLY GRADED SAND (SP), fine to medium, light yellowish-brown, medium dense, dry to moist			☒	4-6-6 N=12	4	
			5		☒	4-5-7 N=12		
					☒	4-7-8 N=15		
			10		☒	4-6-7 N=13		
		fine grained sand	15		☒	6-9-9 N=18		
	20.5		20					
	21.5	**POORLY GRADED SAND WITH SILT (SP-SM)**, fine grained sand, light yellowish-brown, medium dense, moist			☒	6-7-10 N=17		
		Boring Terminated at 21.5 Feet	25					

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Rope & Cathead

Advancement Method:
Hollow Stem Auger

Abandonment Method:
Borings backfilled with bentonite chips upon completion

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

Terracon
21905 64th Ave. W, Suite 100
Mountlake Terrace, Washington

Boring Started: 6/26/2015	Boring Completed: 6/26/2015
Drill Rig: DR XL Trailer	Driller: Geologic Drill
Project No.: 81155034	Exhibit: A-11

APPENDIX B

LABORATORY TESTING

Laboratory Testing

As part of the testing program, all samples were examined in the laboratory by experienced personnel and classified in accordance with the attached General Notes and the Unified Soil Classification System based on the texture and plasticity of the soils. The group symbol for the Unified Soil Classification System is shown in the appropriate column on the boring logs and a brief description of the classification system is included with this report in the Appendix.

At that time, the field descriptions were confirmed or modified as necessary and an applicable laboratory testing program was formulated to determine index properties of the subsurface materials.

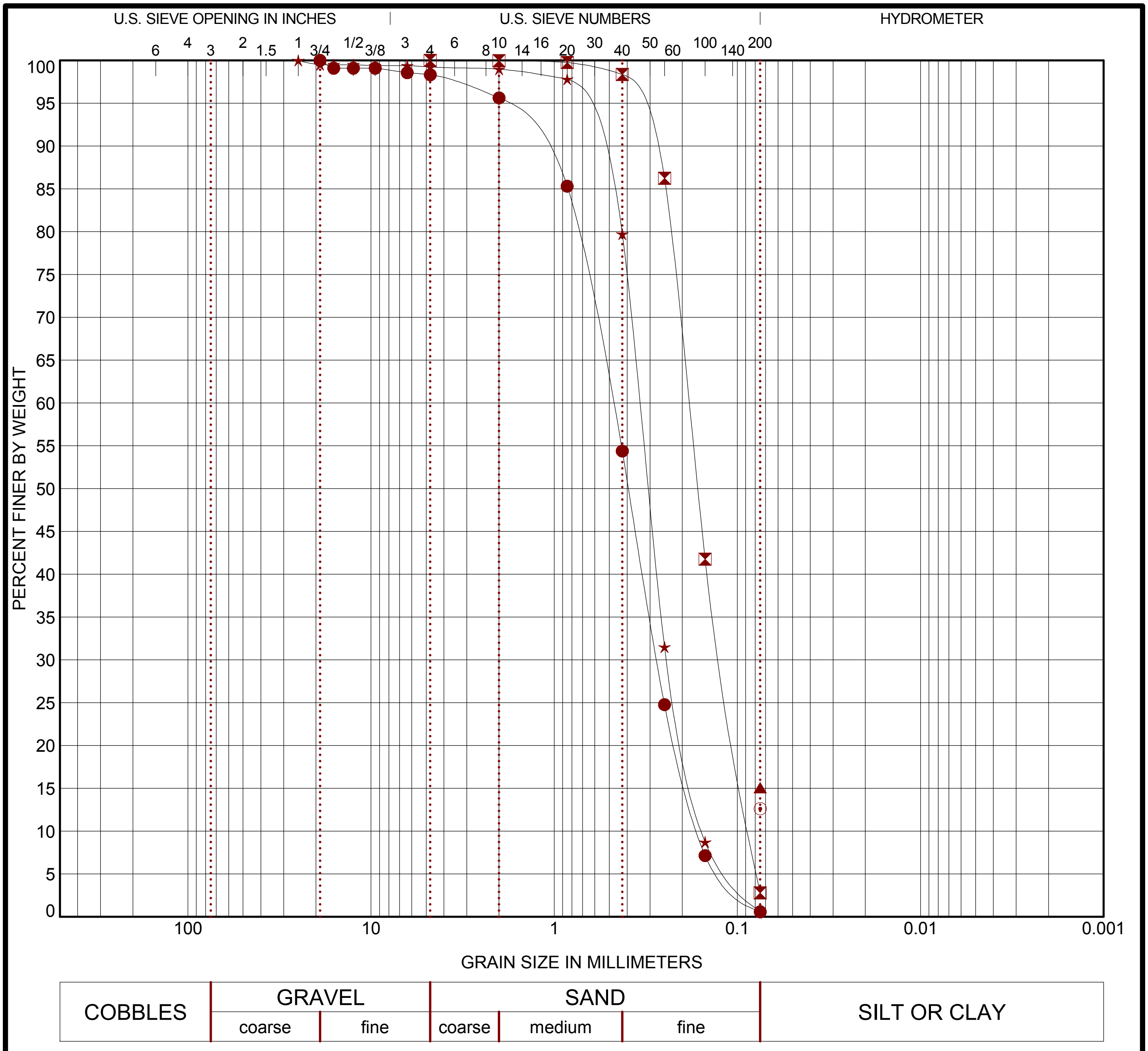
Laboratory tests were conducted on selected soil samples and the test results are presented in this appendix and / or on the boring logs. The laboratory test results were used for the geotechnical engineering analyses, and the development of foundation and earthwork recommendations. Laboratory tests were performed in general accordance with the applicable ASTM, local or other accepted standards.

Selected soil samples obtained from the site were tested for the following engineering properties:

- Grain-Size Analysis
- In-situ Water Content

GRAIN SIZE DISTRIBUTION

ASTM D422



Boring ID	Depth (Ft)	USCS Classification	LL	PL	PI	Cc	Cu
● B-2	2.5	POORLY GRADED SAND(SP)				0.96	2.96
⧗ B-4	20.0	POORLY GRADED SAND(SP)				0.94	2.17
▲ B-4	25.0	SILTY SAND (SM)					
★ B-4	30.0	POORLY GRADED SAND(SP)				1.11	2.22
⊙ B-4	35.0	SILTY SAND (SM)					

Boring ID	Depth (Ft)	D_{100}	D_{60}	D_{30}	D_{10}	%Gravel	%Sand	%Silt	%Clay
● B-2	2.5	19	0.482	0.275	0.163	1.7	97.7	0.6	
⧗ B-4	20.0	4.75	0.185	0.122	0.085	0.0	97.2	2.8	
▲ B-4	25.0	0.075				0.0	0.0	15.1	
★ B-4	30.0	25	0.342	0.242	0.154	0.8	98.6	0.6	
⊙ B-4	35.0	0.075				0.0	0.0	12.6	

PROJECT: Marysville CFA

SITE: 8811 35th Avenue
Marysville, Washington

Terracon
21905 64th Ave. W, Suite 100
Mountlake Terrace, Washington

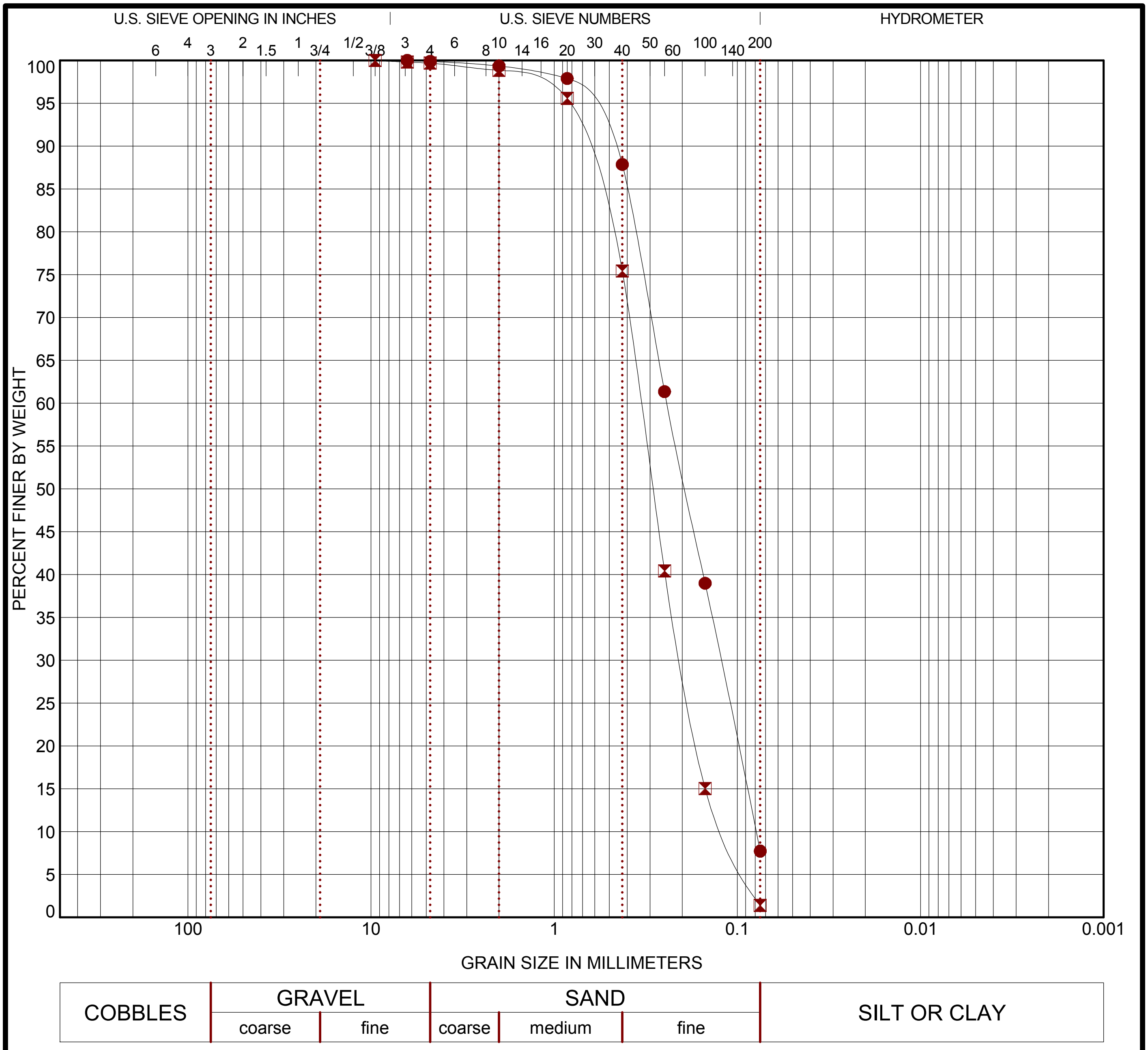
PROJECT NUMBER: 81155034

CLIENT: Chick-fil-A, Inc.
Atlanta, Georgia

EXHIBIT: B-2

GRAIN SIZE DISTRIBUTION

ASTM D422



	Boring ID	Depth (Ft)	USCS Classification	LL	PL	PI	Cc	Cu
●	B-5	7.5	POORLY GRADED SAND WITH SILT (SP-SM)				0.79	3.07
⧗	B-7	7.5	POORLY GRADED SAND(SP)				1.05	2.90

	Boring ID	Depth (Ft)	D_{100}	D_{60}	D_{30}	D_{10}	%Gravel	%Sand	%Silt	%Clay
●	B-5	7.5	6.35	0.242	0.123	0.079	0.1	92.2	7.7	
⧗	B-7	7.5	9.5	0.336	0.203	0.116	0.3	98.3	1.4	

PROJECT: Marysville CFA

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Mountlake Terrace, Washington

PROJECT NUMBER: 81155034

CLIENT: Chick-fil-A, Inc.
Atlanta, Georgia

EXHIBIT: B-3

APPENDIX C

SUPPORTING DOCUMENTS

GENERAL NOTES

DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

SAMPLING

☒ Standard Penetration Test

WATER LEVEL

▽	**Water Initially Encountered**
▽	**Water Level After a Specified Period of Time**
▼	**Water Level After a Specified Period of Time**

Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.

FIELD TESTS

N	**Standard Penetration Test Resistance (Blows/Ft.)**
(HP)	**Hand Penetrometer**
(T)	**Torvane**
(DCP)	**Dynamic Cone Penetrometer**
(PID)	**Photo-Ionization Detector**
(OVA)	**Organic Vapor Analyzer**

DESCRIPTIVE SOIL CLASSIFICATION

Soil classification is based on the Unified Soil Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

LOCATION AND ELEVATION NOTES

Unless otherwise noted, Latitude and Longitude are approximately determined using a hand-held GPS device. The accuracy of such devices is variable. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

STRENGTH TERMS

RELATIVE DENSITY OF COARSE-GRAINED SOILS (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance		**CONSISTENCY OF FINE-GRAINED SOILS** (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance		
Descriptive Term (Density)	**Standard Penetration or N-Value Blows/Ft.**	**Descriptive Term (Consistency)**	**Unconfined Compressive Strength Qu, (tsf)**	**Standard Penetration or N-Value Blows/Ft.**
Very Loose	0 - 3	Very Soft	less than 0.25	0 - 1
Loose	4 - 9	Soft	0.25 to 0.50	2 - 4
Medium Dense	10 - 29	Medium Stiff	0.50 to 1.00	4 - 8
Dense	30 - 50	Stiff	1.00 to 2.00	8 - 15
Very Dense	> 50	Very Stiff	2.00 to 4.00	15 - 30
		Hard	> 4.00	> 30

RELATIVE PROPORTIONS OF SAND AND GRAVEL

Descriptive Term(s) of other constituents	**Percent of Dry Weight**
Trace	< 15
With	15 - 29
Modifier	> 30

GRAIN SIZE TERMINOLOGY

Major Component of Sample	**Particle Size**
Boulders	Over 12 in. (300 mm)
Cobbles	12 in. to 3 in. (300mm to 75mm)
Gravel	3 in. to #4 sieve (75mm to 4.75 mm)
Sand	#4 to #200 sieve (4.75mm to 0.075mm
Silt or Clay	Passing #200 sieve (0.075mm)

RELATIVE PROPORTIONS OF FINES

Descriptive Term(s) of other constituents	**Percent of Dry Weight**
Trace	< 5
With	5 - 12
Modifier	> 12

PLASTICITY DESCRIPTION

Term	**Plasticity Index**
Non-plastic	0
Low	1 - 10
Medium	11 - 30
High	> 30

Terracon

Exhibit: C-1

UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A]					Soil Classification	
					Group Symbol	Group Name [B]
Coarse Grained Soils: More than 50% retained on No. 200 sieve	**Gravels:** More than 50% of coarse fraction retained on No. 4 sieve	**Clean Gravels:** Less than 5% fines [C]	$Cu \geq 4$ and $1 \leq Cc \leq 3$ [E]		GW	Well-graded gravel [F]
			$Cu < 4$ and/or $1 > Cc > 3$ [E]		GP	Poorly graded gravel [F]
		Gravels with Fines: More than 12% fines [C]	Fines classify as ML or MH		GM	Silty gravel [F,G,H]
			Fines classify as CL or CH		GC	Clayey gravel [F,G,H]
	Sands: 50% or more of coarse fraction passes No. 4 sieve	**Clean Sands:** Less than 5% fines [D]	$Cu \geq 6$ and $1 \leq Cc \leq 3$ [E]		SW	Well-graded sand [I]
			$Cu < 6$ and/or $1 > Cc > 3$ [E]		SP	Poorly graded sand [I]
		Sands with Fines: More than 12% fines [D]	Fines classify as ML or MH		SM	Silty sand [G,H,I]
			Fines classify as CL or CH		SC	Clayey sand [G,H,I]
Fine-Grained Soils: 50% or more passes the No. 200 sieve	**Silts and Clays:** Liquid limit less than 50	**Inorganic:**	$PI > 7$ and plots on or above “A” line [J]		CL	Lean clay [K,L,M]
			$PI < 4$ or plots below “A” line [J]		ML	Silt [K,L,M]
		Organic:	Liquid limit - oven dried	< 0.75	OL	Organic clay [K,L,M,N]
			Liquid limit - not dried			Organic silt [K,L,M,O]
	Silts and Clays: Liquid limit 50 or more	**Inorganic:**	PI plots on or above “A” line		CH	Fat clay [K,L,M]
			PI plots below “A” line		MH	Elastic Silt [K,L,M]
		Organic:	Liquid limit - oven dried	< 0.75	OH	Organic clay [K,L,M,P]
			Liquid limit - not dried			Organic silt [K,L,M,Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor				PT	Peat

[A] Based on the material passing the 3-inch (75-mm) sieve

[B] If field sample contained cobbles or boulders, or both, add “with cobbles or boulders, or both” to group name.

[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay

[E] $Cu = D_{60}/D_{10} \qquad Cc = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains ≥ 15% sand, add “with sand” to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add “with organic fines” to group name.

[I] If soil contains ≥ 15% gravel, add “with gravel” to group name.

[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29% plus No. 200, add “with sand” or “with gravel,” whichever is predominant.

[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add “sandy” to group name.

[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add “gravelly” to group name.

[N] $PI \geq 4$ and plots on or above “A” line.

[O] $PI < 4$ or plots below “A” line.

[P] PI plots on or above “A” line.

[Q] PI plots below “A” line.

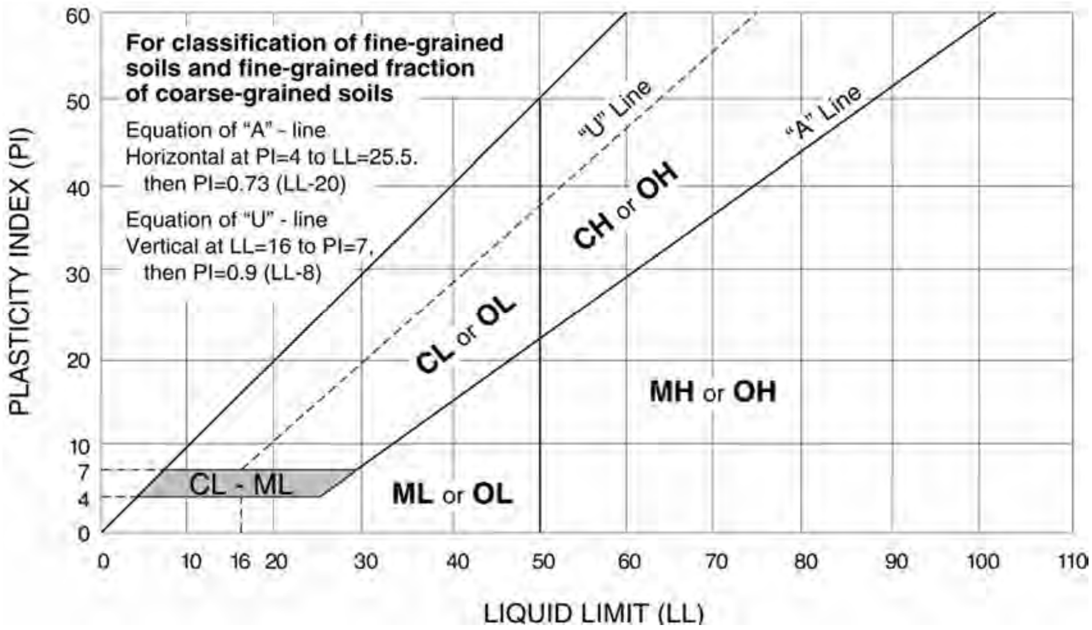
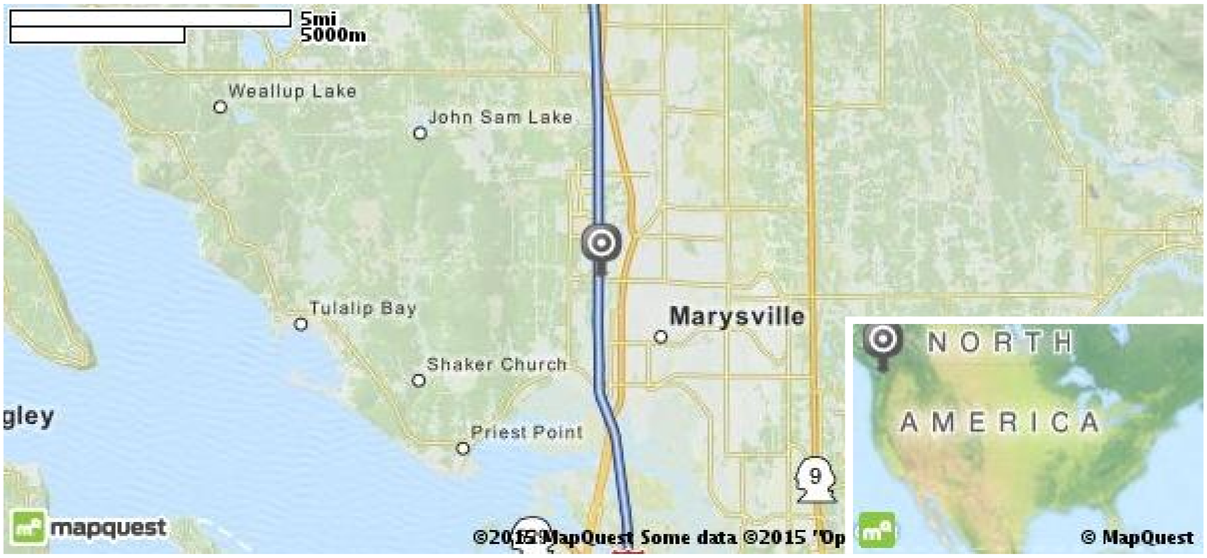


Exhibit C-2

Design Maps Summary Report

User–Specified Input

Report Title	Marysville CFA Wed July 15, 2015 21:46:40 UTC
Building Code Reference Document	ASCE 7-10 Standard (which utilizes USGS hazard data available in 2008)
Site Coordinates	48.076°N, 122.183°W
Site Soil Classification	Site Class D – “Stiff Soil”
Risk Category	I/II/III

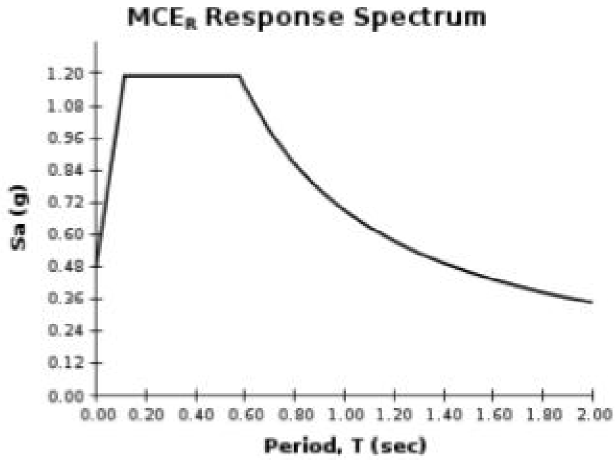


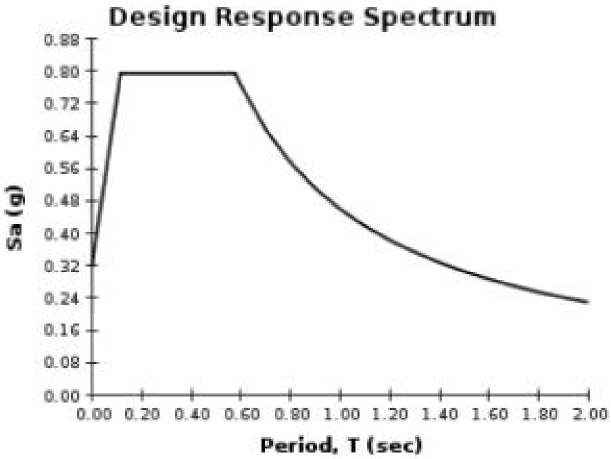
USGS–Provided Output

S_S = 1.142 g S_{MS} = 1.191 g S_{DS} = 0.794 g

S_1 = 0.443 g S_{M1} = 0.689 g S_{D1} = 0.460 g

For information on how the SS and S1 values above have been calculated from probabilistic (risk-targeted) and deterministic ground motions in the direction of maximum horizontal response, please return to the application and select the “2009 NEHRP” building code reference document.


MCE_R Response Spectrum


Design Response Spectrum

For PGA_M, T_L, C_{RS}, and C_{R1} values, please view the detailed report.

Exhibit C-3

Exhibit C-3