

Soils and Geology Report

Ryan Haskins
Haskins Subdivision
Horseshoe Bend, Idaho

PREPARED FOR:
Ryan Haskins
50 Teds Cabin Road
Horseshoe Bend, Idaho

PREPARED BY:
Innovate Geotechnical
Innovate Geotechnical Project No. 324004
February 20, 2024



February 20, 2024

Attention: Ryan Haskins

Subject: Soils and Geology Report
Haskins Subdivision
50 Teds Cabin Road
Horseshoe Bend, Idaho
Innovate Geotechnical Project No. 324004

Ryan,

Submitted herewith is the report of our soils and geology evaluation for the subject site. This report contains the results of our findings and an engineering interpretation of the results with respect to the available project characteristics. This report has been prepared to meet the Soils Report and Geology Report requirements set forth in Boise County Unified Land Use Ordinance adopted October 20, 2015, for a Hillside Subdivision.

On January 23rd, 2024, Innovate Geotechnical staff was on-site and completed eight (8) test pits up to 12 feet below the existing ground surface. Dynamic cone penetrometer (DCP) testing was also performed. Soil samples were obtained during the field operations and were then transported to our office for further testing. Previous explorations were also completed at earlier dates and were used in this evaluation.

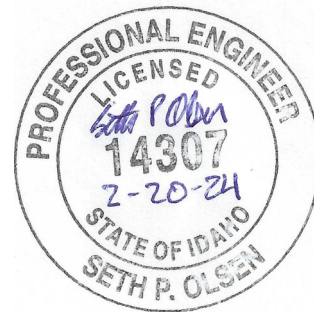
Based on the findings of the subsurface investigation and other information, geotechnical, geological, and slope stability recommendations are provided. A detailed discussion of observed conditions is presented in this report.

We appreciate the opportunity to work with you on this project. If we can be of further assistance or if you have any questions regarding this project, please do not hesitate to contact us at (208) 484-1090.

Sincerely,
Innovate Geotechnical



Macie Larranaga
Staff Geotechnical Engineer



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Senior Geotechnical Engineer

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1.0 INTRODUCTION

Innovate Geotechnical (IGEO) is pleased to present this report which presents the results of our geotechnical engineering evaluation for the Haskins Subdivision in Horseshoe Bend, Idaho. The project area is located approximately as shown in the Vicinity Map, Figure 1. Our understanding of the project is based on our communications with you, the previous Preliminary Soils Report completed by IGEO dated 3/29/2022, and the previous Revised Preliminary Soils Report completed by IGEO dated 3/6/2023.

2.0 PROJECT UNDERSTANDING

The proposed project consists of determining the feasibility of developing and subdividing the area into 23 residential lots. The property is located along Ted's Cabin Road in Boise County, Idaho. The roadways for the subdivision are already in place. We understand the slope present on the property are greater than 15% and therefore require a Soils Report and Geology Report as per the Boise County Unified Land Use Ordinance adopted October 20, 2015, for a Hillside Subdivision.

Our understanding of the project is based on our communications with you, our two previous reports for this project, and the preliminary site plan.

If the construction conditions are different than we have observed, please notify us so that any appropriate modifications to our conclusions and recommendations contained herein may be made. A site plan is presented in Figure 2.

3.0 SCOPE OF SERVICES

The purpose of our geotechnical engineering evaluation was to provide recommendations for site development based on our site evaluation, laboratory testing, and engineering analyses. Our specific scope of services included:

- Exploration of soil underlying the proposed development by completing 8 test pits, collecting samples for testing, and conducting DCP testing.
- Laboratory testing to assess pertinent physical and engineering properties of the soil observed.
- Engineering analysis and preparation of this report.

4.0 SITE CONDITIONS AND FIELD EVALUATION

Existing surface and subsurface conditions associated with the subject property are presented in this section.

4.1 Surface Conditions

The site is located in Horseshoe Bend, Idaho (see Figures 1 and 2). Topographically, the elevation varies across the site. The property is approximately 439 acres and will be divided into 15 lots. Primary access to the site is via Teds Cabin Road. In the past, the property has been used as pasture and/or unused with native grasses and sage brush. Currently the site has one house in the construction stage and a pad has been cut for another future residence, both of which are located in the north area of the property. Additionally, there is some heavy machinery equipment that has been used to crush aggregate, located in the north most edge of the property, near TP-8. Photos 1 through 4 present the surface conditions at the site during the time of our evaluation at TP-1’s location.



Photo 1: Looking North



Photo 2: Looking West



Photo 3: Looking South



Photo 4: Looking East

4.2 Field Evaluation

The subsurface soil conditions were determined by performing eight (8) test pits (TP-1 through TP-8) and Dynamic Cone Penetrometer testing at the locations shown on Figure 2. Test pits were advanced using a backhoe subcontracted to IGEO. Soil samples were obtained at significant changes of strata and in general accordance with ASTM D-420 and ASTM D-2488. The subsurface

conditions observed during the field evaluation are discussed in Section 4.3. Logs of the explorations, including a description of all soil strata encountered, are presented in Appendix A.

After completion of the field evaluation, soil samples were tested for their engineering properties. The results of the laboratory testing are presented in Appendix B and shown on the boring and test pit logs in Appendix A.

Dynamic Cone Penetrometer (DCP) testing was performed at all of the test pits to assess the in-situ bearing strength characteristics of the subgrade. Results of this testing are presented in Appendix C. Table 1 presents a summary of the explorations performed.

TABLE 1 – Exploration Summary

Exploration	Approx. Ground Surface Elevation (feet)	Depth (feet)	Approximate Locations	
			WGS 84 (degrees)	
			Latitude	Longitude
TP-1	4571	5.0	43.85466°	-116.25639°
TP-2	4646	7.0	43.85112°	-116.25574°
TP-3	4517	12.0	43.84767°	-116.25651°
TP-4	4367	8.0	43.84699°	-116.25119°
TP-5	4432	12.0	43.84864°	-116.25010°
TP-6	4527	6.0	43.85090°	-116.25205°
TP-7	4373	12.0	43.85633°	-116.25080°
TP-8	4236	6.0	43.85935°	-116.25022°

4.3 Subsurface Soil Profile

The results of our field evaluation and our laboratory testing indicate a varied subgrade across the site. In the test pits located in the north of the property, the subsurface profile is primarily made up of gravel with varying amounts of silt and clay up to the full depth explored (approximately 12 feet below the existing ground surface). The explorations in this area include TP-1, TP-7, and TP-8.

In center of the property, the subsurface profile is primarily made up of sand with varying amounts of gravel and clay up to the full depth explored (approximately 7 feet below the existing ground surface). The explorations in this area include TP-2 and TP-6.

In the south area of the property, the subsurface profile is primarily made up of varying amounts of sand, silt and clay up to the full depth explored (approximately 12 feet below the existing ground surface). The explorations in this area include TP-3, TP-4 and TP-5. It should be noted that in TP-5 fat clays were present and in TP-5 elastic silts were present.

The results of the DCP testing indicated loose to dense conditions 2 to 3 feet below the existing ground surface in the locations tested. For a detailed description of the soil profiles observed in this evaluation, see the test pit logs in Appendix A. See Figure 2 for the approximate exploration locations.

4.4 Geologic Setting

Idaho Geological Survey, map the area of this site as sedimentary rocks with associated with flood basalts (Miocene). The lithology for the area is described as consisting of sandstone, siltstone, arkose, conglomerate, claystone, tuffaceous sediment, minor basalt, and minor rhyolitic tuff. This description is consistent with what was observed on site as these are parent rocks of the clays, sand, and silts.

4.5 Groundwater

Groundwater was not observed in any of test pits during the field evaluation. Numerous factors such as heavy precipitation, irrigation practices, and other unforeseen factors may influence groundwater elevations at the site. The detailed evaluation of these and other factors, which may be responsible for groundwater fluctuations, is beyond the scope of this study.

4.6 Tectonic Setting and Active Faults

The project site is located within a belt of north-south striking faults coincident with the Western Idaho Suture Zone (WISZ). The WISZ is the boundary between Proterozoic continental crust to the east and Paleozoic and Mesozoic accreted terranes to the west (Fleck and Criss, 2004). The project site is between two north-south striking faults: the Squaw Creek fault, mapped approximately 10 miles to the west, and the Boise Ridge fault, mapped approximately 10 miles to the east (Breckenridge et al., 2003; U.S. Geological Survey and Idaho Geological Survey, 2022). The Squaw Creek fault is approximately 47 kilometers long. It is an east dipping normal fault and displaces Miocene Columbia River Basalts along most of its length. The slip rate of the Squaw Creek fault is estimated to be less than 0.2 mm/yr (U.S. Geological Survey and Idaho Geological Survey, 2022). Little is known about the age or activity of the Boise Ridge fault system. It is mapped as a discontinuous series of north-south striking, east dipping normal faults. Its location is not well constrained, and mapping is based mostly on linear valleys. (Breckenridge et al., 2003).

According to the findings of our subsurface evaluation and the guidelines of the International Building Code (IBC, 2018) the **Site Classification is D** (IBC, 2018, section 1613).

The following values should be used for site structural coefficients:

Short Period Spectral Response Acceleration	$S_s = 0.38g$
One Second Period Spectral Response Acceleration	$S_1 = 0.11g$
Short Period Spectral Response Design Acceleration	$S_{DS} = 0.37$
One Second Period Spectral Design Acceleration	$S_{D1} = 0.21g$

Liquefaction of a soil is defined as the condition when a saturated, loose, cohesion-less, (fine sand-type) soils have a sudden, large decrease, in their ability to support loads. This is because of excessive pore water pressure which develops during a seismic event. Cohesive (clay type) and dense sand and gravel soils typically do not liquefy during a seismic event. Because of the cohesive nature of the fine-grained soils at the site, it is our opinion that the potential for liquefaction at this site is low under seismic conditions.

4.7 Site Subsurface Variations

Based on the results of the subsurface exploration and our experience, variations in continuity and nature of subsurface conditions should be anticipated. Due to the heterogeneous characteristics of soils, care should be taken in interpolating or extrapolating subsurface conditions between or beyond the explorations. Seasonal fluctuations in groundwater conditions may also occur.

5.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the results of our site exploration, laboratory testing, and engineering analyses, it is our opinion that the proposed site may be improved as envisioned. Specific recommendations for the proposed improvements are presented in the following sections of this report.

5.1 Site Preparation and Earthwork

5.1.1 Initial Preparation

We recommend that proposed areas for improvements, including areas to receive fill, be prepared by clearing and grubbing of both the surface and subsurface of all debris, deleterious and organic matter, and roots greater than ½ inch diameter. We estimate that the depth of stripping required to remove organic topsoil will range from approximately 1 to 4 inches across the site.

5.1.2 Grading, Excavations, and Subgrade Preparation

Current site grades within the proposed improvements vary. In order to provide uniform bearing conditions for the proposed structures and pavements, we recommend the following site preparation activities:

- Within foundation limits for buildings, the native silty sand soils are to be proof-rolled and compacted to establish final foundation elevations. If fat clay soils or elastic silts are encountered at the proposed foundation elevation, the native soils are to be over-excavated a minimum of 12 inches below the final foundation elevation and structural fill is to be placed and compacted to establish final foundation elevations.
- Within floor-slab limits. The on-site soils should be proof-rolled before placing capillary break material. Floor-slab areas are to be supported by at least 4 inches of properly compacted capillary break material (see Section 5.2.1) to limit impact of near surface moisture levels.

In the event earthwork activities cause excessive subgrade disturbance, replacement with structural fill may be necessary. A greater depth of disturbance of the subgrade soil may be expected if site preparation work is conducted during periods of wet weather when the moisture content of the soil exceeds optimum. Any soft, loose, wet or otherwise unsuitable soil encountered is to be over-excavated to firm soil, or a depth of 2 feet, whichever is less, and replaced with structural fill, as described below.

5.2 Structural Fill

Soil used to support the foundations is classified as structural fill for the purposes of this report.

5.2.1 Structural Fill

Structural fill shall consist of granular soils free of organics, debris, or other deleterious materials and no particles larger than four inches in maximum dimension. Structural fill shall meet the specifications described below:

- Structural fill placed as embankment fill should consist of sand, silt, and mixed clay soils.
- Structural fill placed below structural foundations to replace fat clay soils, elastic silts or soft spots should consist of well-graded, sand and gravel material with no more than 12% passing the #200 sieve. Equivalent specifications may be used if approved by the project geotechnical engineer.
- Structural fill placed as capillary break material below floor slabs should consist of 1 ½ - inch-minus, free-draining, crushed gravel with less than 10 percent passing the U.S. No. 4 sieve and the fines content should not exceed 3 percent.

5.2.2 Use of on-site Soil

The on-site sandy and gravelly soils observed in our test pits may be reused as structural fill, provided it is reworked and meets the requirements set forth above. The on-site clayey sands soils may be mixed with on-site sand and silt soils to be used in embankment fill. Fat clays and elastic silts shall not be used as structural fill and should only be placed in non-structural open spaces or removed from the site.

5.3 Fill Placement and Compaction

The various types of compaction equipment have their limitations as to the maximum lift thickness that can be compacted. For example, hand operated equipment is limited to lifts of about four inches and most “trench compactors” have a maximum, consistent compaction depth of about six inches. Large rollers, depending on soil and moisture conditions can achieve compaction at eight to twelve inches. The full thickness of each lift should be compacted to at least the following percentages of the maximum dry density (MDD) as determined by ASTM D-1557:

- | | |
|--|-----|
| 1. Compacted fill/native soils, supporting foundations | 95% |
| 2. Compacted fill/native soils, below floor slabs | 95% |
| 3. Backfill of trenches | |
| a. Below foundations | 95% |
| b. Below pavement | 95% |
| c. Others | 90% |

Field density tests should be performed on each lift as necessary to ensure that compaction is being achieved.

Conditions of the structural fill, site grading fill, and compacted native soil should be evaluated by in-place density tests, visual evaluations, probing and proof-rolling as these materials are prepared to determine compliance with the contract documents and recommendations in this report. Over compaction should be avoided as increased compaction effort will result in lateral pressures higher than those provided in this report.

5.4 Slope Stability and Geologic Risk

While the slopes are steep, no evidence of current soil movement was observed across the property. Furthermore, the clay soils were observed primarily in the surface soils only, followed by stronger sand and gravel soils. Some minor surficial slumps may occur, especially during periods of high precipitation. However, we do not anticipate that slope failures will impact the homes below.

For permanent re-worked slopes on the property, we recommend slopes of no more than 3Horizontal : 1Vertical. Shallower slopes may be needed where loose, soft, or otherwise unstable slopes are encountered. Fill placed on existing slopes should be keyed into existing slopes steeper than 3H:1V with horizontal benches having a vertical face approximately 1 foot in height. Slope each bench to drain.

Where necessary, retaining walls may be used on site and we recommend utilizing the lateral earth pressures presented in Section 5.6 for the structural design of the walls.

The site is approximately 7 miles from any mapped faults. As a result, we estimate a minimal risk of fault rupture and we do not feel that geologic hazards pose a risk to developing the site as envisioned.

5.5 Foundation Support

We anticipate that the proposed footings will be established at a minimum elevation of two feet below the existing ground surface. To establish uniform bearing conditions the proposed footings should be established entirely on a specific zone of compacted structural fill or native soils, as described previously.

Foundations may be designed using a maximum allowable bearing pressure of 1,500 psf. In addition to the fill recommendations presented previously in this report, the following recommendations should be implemented:

- Continuous footing widths should be maintained at a minimum of 24 inches.
- Spot footings should be a minimum of 30 inches in width.
- Exterior footings should be placed a minimum of 24 inches below final grade for frost protection, and interior footings shall be placed a minimum of 16 inches below grade.
- Drainage around the site should be created so that water is not allowed to flow into the excavation during or after construction.

The allowable bearing pressure may be increased by 1/3 for temporary loads such as wind and seismic forces.

Based on the preliminary maximum foundation loads, as presented above, and given that the foundations are supported as described in this report, we estimate that total settlement will be less than about 1 inch. Differential settlement is estimated to be less than about ½ of the total settlement. Post-construction settlement should be minor. Loose soil or otherwise unsuitable soil not removed from footing excavations, or disturbance of soil at foundation grade during construction could result in larger settlements than estimated.

5.6 Lateral Pressures and Backfill

All granular backfill material used in the construction of any retaining wall on site should be free from organic and deleterious materials and should conform to structural fill requirements.

We recommend fill material to consist of free-draining granular material with a friction angle of 34 degrees or more and a moist unit weight of 125 pcf. The lateral earth pressure values for the proposed structural fill material are summarized in Table 2.

Table 2 – Lateral Earth Pressure Values

Earth Pressure State	Lateral Earth Coefficient		Equivalent Fluid Density (pcf)	
	Horizontal Backslope	3H:1V Backslope; Horizontal Foreslope	Horizontal Backslope	3H:1V Backslope; Horizontal Foreslope
Active	$K_a - 0.28$	$K_a - 0.41$	35	51
Passive	$K_p - 3.54$	$K_p - 10.0$	442	1250
At-rest	$K_o - 0.44$	$K_o - 0.63$	55	78

The passive pressure resistance should not be considered effective in the upper 24 inches of the subsurface soil profile. The estimated wall translation for active earth pressure conditions is 0.001H (where H is the height of the wall). The estimated wall translation for passive earth pressure conditions is 0.01H. If soil can be removed or eroded from the wall face, passive resistance should not be relied upon. The ultimate equivalent fluid densities provided in Table 1 are for properly drained backfill and do not include hydrostatic pressures that can develop if groundwater or surface water is trapped behind the retaining walls. In addition, no friction between the wall and the backfill material was used.

Additional earth pressures resulting from loads applied at the ground surface must also be included in the design of the retaining wall. These earth pressures may be generated by surface surcharge loads, point loads, line loads, hydrostatic forces, and strip loads. Seismic considerations may also need to be included in design.

The retaining wall backfill should be compacted to 95% compaction. Over compaction should be avoided as increased compaction effort will result in lateral pressures higher than those provided in this report. Heavy compaction equipment or other construction loads should not be allowed within 3 feet of the walls unless planned for in the structural design. Hand-held or lightweight compaction equipment, such as a vibrating plate, should be utilized within 3 feet of the structure walls and fill lift thickness reduced.

5.7 Floor Slabs

Floor slabs may be supported on structural fill overlying the on-site soils as recommended in the previous sections of this report. We recommend the slab be designed using a modulus of vertical subgrade reaction (k) of 90 pounds per cubic inch (pci).

To retard the upward wicking of moisture beneath the floor slab, we recommend that a capillary break be placed over the subgrade. Therefore, we recommend floor slabs be underlain by a minimum of 4 inches of free-draining crushed rock meeting gradation and compaction specifications described in Section 5.2.1 of this report. Alternate gradation specifications may be used provided they meet the requirements outlined above and are accepted by the geotechnical engineer of record. To help control normal shrinkage and stress cracking, the floor slabs should have the following features:

- Adequate reinforcement for the anticipated floor loads with the reinforcement continuous through interior floor joints
- Frequent crack control joints
- Non-rigid attachment of the slabs to foundation walls and bearing slabs

5.8 Drainage

All soils can experience some volume change when exposed to water, particularly the fat clay and elastic silt soils on the property. Therefore, adequate site drainage is always important. Site grading design and construction should be implemented to assure that all surface water is directed away from the foundation bearing soils. We recommend the following actions be taken:

1. All areas around the buildings should be sloped to provide drainage away from the structures. We recommend a minimum slope of 6 inches in the first 10 feet away from the structure.
 - a. For all structures built in fat clay or elastic silt areas on site - A **perimeter apron** should be constructed around the exterior of the residences extending a minimum of 10 feet from the exterior walls. This apron should be constructed using any durable paving material or "hardscape" such as concrete, brick, pavers, or other durable materials. We do not recommend the use of plastic for the barrier. The critical aspect of the apron is that it has to be watertight, particularly right at the base of the exterior wall, as to not allow moisture to penetrate into the underlying fill or bearing soils. All water collected on the perimeter apron should be captured and discharged well beyond the backfill limits. The perimeter apron should be sloped to provide drainage away from the residence. We recommend a minimum slope of 12 inches in the 10 feet away from the structure.
2. All roof drainage should be collected in rain gutters with downspouts designed to discharge well beyond the backfill limits or the stormwater drainage system, if applicable.
3. Adequate compaction of the foundation backfill should be provided. We suggest a minimum of 90% of the maximum laboratory density as determined by ASTM D-1557. Water consolidation methods should not be used under any circumstances.

4. Sprinklers should be aimed away from the foundation walls. The sprinkling systems should be designed with proper drainage and be well-maintained. Over watering should be avoided.
5. Other precautions may become evident during construction.
6. A **drainage trench** should be established around the perimeter of the footings with the following criteria.
 - a. Extend a minimum of 1 foot below the bottom of foundation elevation.
 - b. Be a minimum of 12 inches wide.
 - c. Separator fabric should be placed in the drainage trench with a minimum of 1 foot overlap and should extend to the surface on both sides of the trench.
 - d. Fill placed in the trench should be placed and should consist of 3 - inch-minus, free-draining gravel with less than 4 percent passing the U.S. No. 4 sieve and the fines content should not exceed 2 percent.
 - e. Trench should be sloped with a minimum of 1% slope until daylighting well away from the structure.

6.0 QUALITY CONTROL

Our recommendations in this report are based on the assumption that adequate quality control testing and observations will be conducted during construction to verify compliance.

7.0 LIMITATIONS

The recommendations provided herein were developed by evaluating the information obtained from the subsurface investigation and our experience in the area. The exploration data reflects the subsurface conditions only at the specific locations at the particular time designated on the logs. Soil and ground water conditions may differ from conditions encountered at the actual exploration locations. The nature and extent of any variation in the explorations may not become evident until during the course of construction. If variations do appear, it may become necessary to re-evaluate the recommendations of this report after we have observed the variation.

Our professional services have been performed, our findings obtained, and our recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices. This warranty is in lieu of all other warranties, either expressed or implied.

8.0 REFERENCES

AASHTO Guide for Design of Pavement Structures, American Association of State Highway and Transportation Officials, 1993.

ASTM, American Society for Testing and Materials

IBC, International Building Code, 2018 Edition

Idaho Geologic Survey. <http://www.idahogeology.org/webmap/> Accessed on February 9, 2024.

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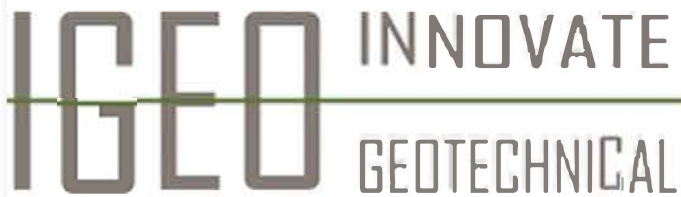
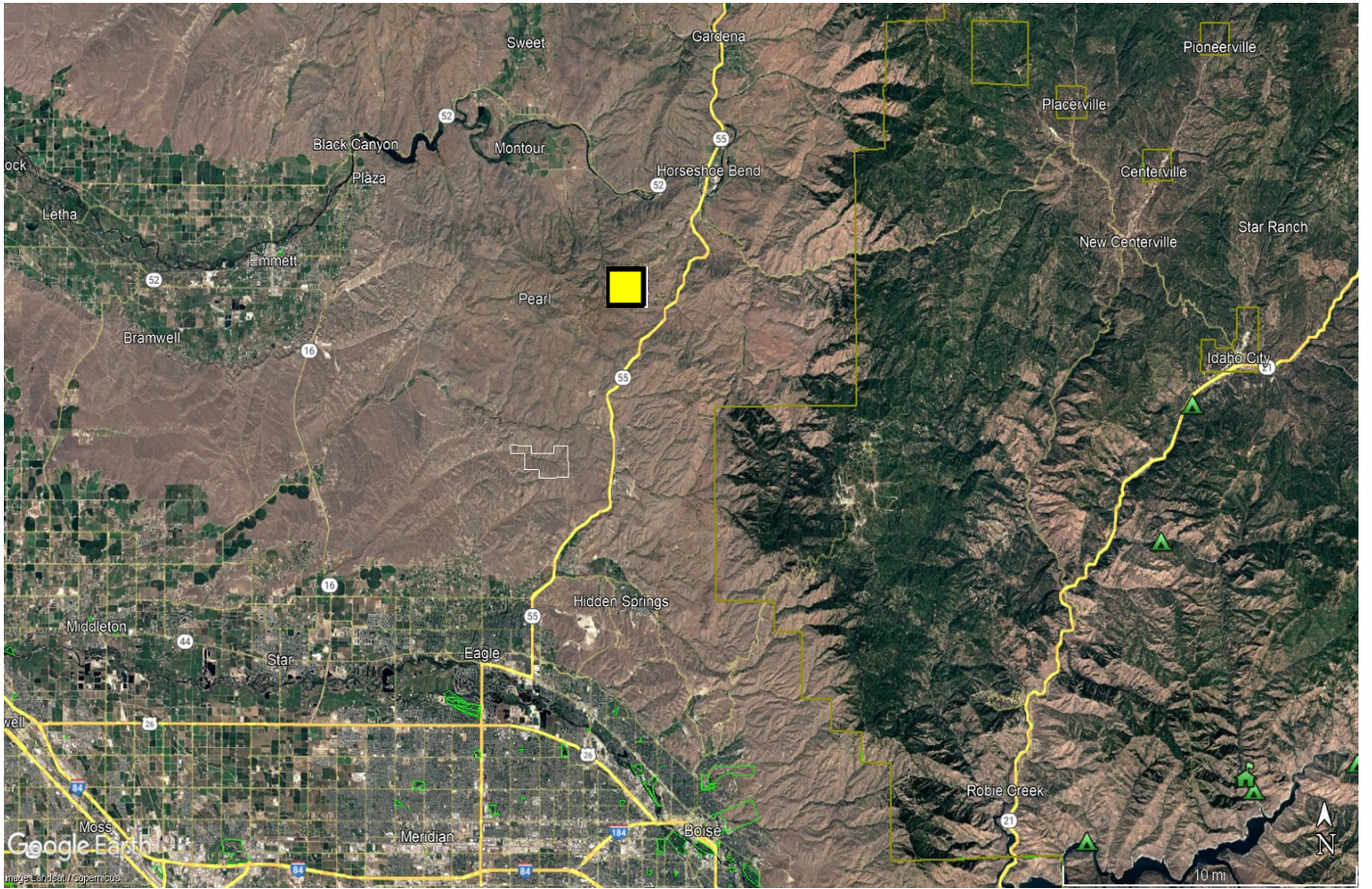
Essentials of Soil Mechanics and Foundations – David F. McCarthy (2007)

Principles of Foundation Engineering, Braja M. Das. (2004)

Foundation Engineering – Peck, Hanson, and Thornburn (1994)


ASCE 7 Hazard Tool

U.S. Seismic Design Maps (seismicmaps.org)



Vicinity Map

Locations are approximate

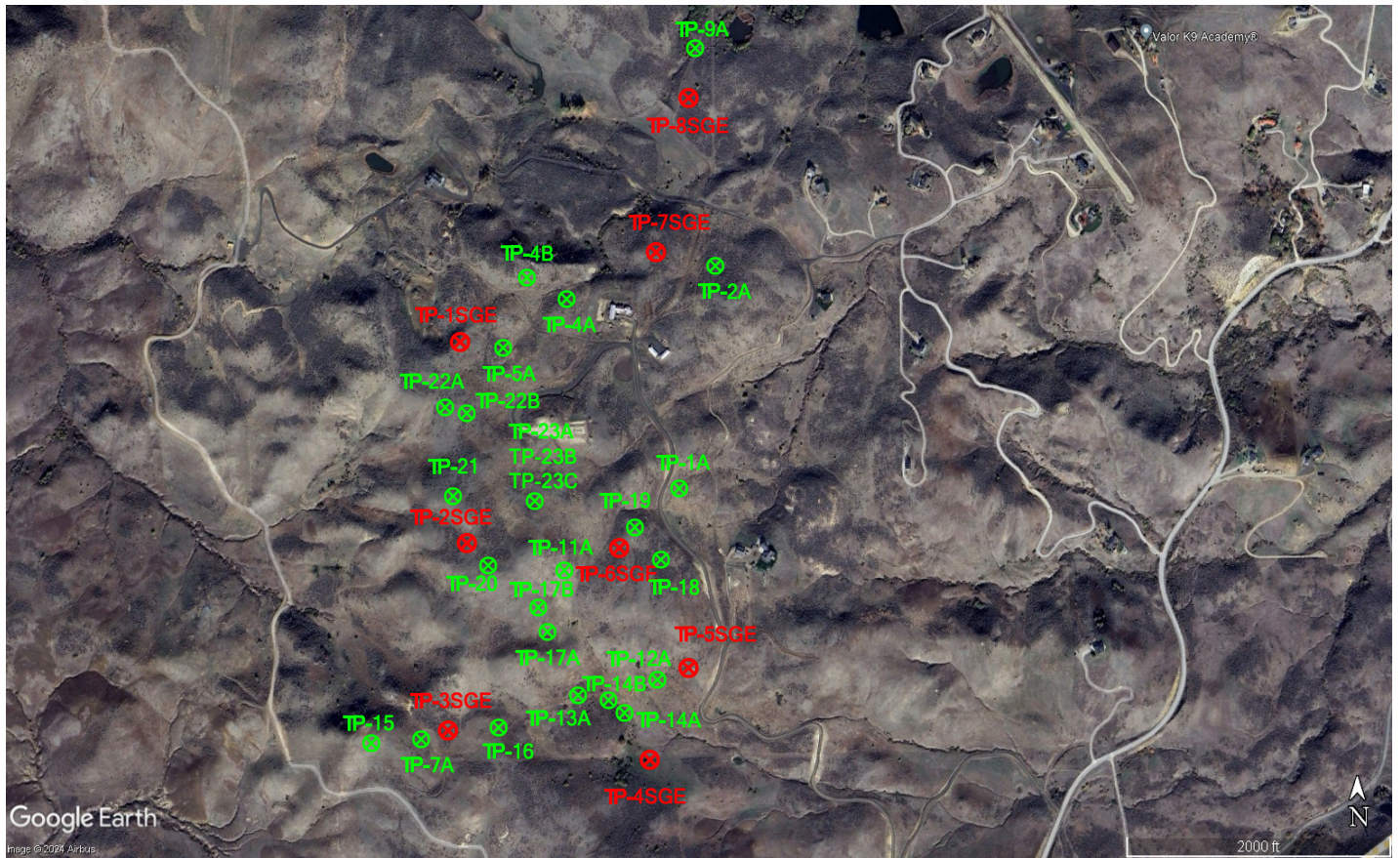
 Approximate Site Location

Haskins Subdivision

Date: 31-Jan-24
 Project No: 324004
 Drawn By: M. Larranaga
 Client: Ryan Haskins

Figure:

1



IGEO INNOVATE GEOTECHNICAL

Site Plan

Locations are approximate

- ⊗ Approximate Locations of Previously Performed Test Pits
 - ⊗ Approximate Test Pit Locations for Soils and Geology Evaluation
- Haskins Subdivision**

Date: 31-Jan-24
 Project No: 324004
 Drawn By: M. Larranaga
 Client: Ryan Haskins

Figure:

2

Appendix A

UNIFIED SOIL CLASSIFICATION SYSTEM								
FIELD IDENTIFICATION PROCEDURES					Graphic Symbol	Letter Symbol	Typical Descriptions	
Coarse Grained Soils More than half of material is larger than No. 200 sieve size (The No. 200 sieve size is about the smallest particle visible to the naked eye)	Gravels More than half of coarse fraction is larger than No. 4 sieve size (For visual classifications, the 1/4" size may be used as equivalent to the No. 4 sieve size)	Clean Gravels (little or no fines)	Wide range of grain size and substantial amounts of all intermediate particle sizes			GW	Well graded gravels, gravel-sand mixtures, little or no fines	
			Predominantly one size of a range of sizes with some intermediate sizes missing			GP	Poorly graded gravels, gravel-sand mixtures, little or no fines	
	Sands More than half of coarse fraction is smaller than No. 4 sieve size (For visual classifications, the 1/4" size may be used as equivalent to the No. 4 sieve size)	Clean Sands (little or no fines)	Wide range of grain size and substantial amounts of all intermediate particle sizes			SW	Well graded sands, gravelly sands, little or no fines	
			Predominantly one size of a range of sizes with some intermediate sizes missing			SP	Poorly graded sands, gravelly sands, little or no fines	
		Sands with Fines (appreciable amount of fines)	Non-plastic fines (for identification procedures see ML below)			SM	Silty sands, poorly graded sand-silt mixtures	
			Plastic fines (for identification procedures see CL below)			SC	Clayey sands, poorly graded sand-clay mixtures	
Fine Grained Soils Less than half of material is larger than No. 200 sieve size (The No. 200 sieve size is about the smallest particle visible to the naked eye)	IDENTIFICATION PROCEDURES ON FRACTION SMALLER THAN NO. 4 SIEVE SIZE							
	Silts and Clays Liquid limit less than 50		Dry Strength (Crushing Characteristics)	Dilatancy (Reaction to Shaking)	Toughness (Consistency Near Plastic Limit)		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sand with slight plasticity
			None to Slight	Quick to Slow	None		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
			Medium to High	None to Very Slow	Medium		OL	Organic silts and organic silt-class of low plasticity
	Silts and Clays Liquid limit greater than 50		Slight to Medium	Slow	Slight		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
			Slight to Medium	Slow to None	Slight to Medium		CH	Inorganic clays of high plasticity, fat clays
			High to Very High	None	High		OH	Organic clays of medium to high plasticity
			Medium to High	None to Very Slow	Slight to Medium		PT	Peat and other highly organic soils

- 1) Boundary Classifications: Soils possessing characteristics of two groups are designated by combinations of group symbols. For example GW-GC, well graded gravel-sand mixture with clay binder.
 2) All sieve sizes on this chart are U.S. standard.

Sampling Methods					
	AU	Auger Cuttings		GB	Grab Sample
	MC	Modified California Sampler		NR	No Recovery
	RC	Rock Core		SPT	Standard Penetration Test
	SS	Split Spoon		ST	Shelby Tube
	UD	Undisturbed Sample		VA	Vane Shear

General Notes
1) In general, Unified Soil Classification Designation presented on the logs were evaluated by visual methods only. Therefore, actual designations (based on laboratory testing) may differ.
2) Lines separating strata on the logs represent approximate boundaries only. Actual transitions may be gradual.
3) Logs represent general soil conditions observed at the point of exploration on the date indicated.
4) No warranty is provided as to the continuity of soil conditions between individual sample locations.

Modifiers					
Fine Grained Soils			Coarse Grained Soils		
Granular Portion			Granular Portion		Fine Grained Portion
Description	%		Description	%	Description
Trace	5 - 15		Trace	5 - 15	Trace
With	15 - 30		With	> 15	With
Use Modifier	> 30				Use Modifier
Coarse grained soils with 5 to 12% fines require dual symbols					

Moisture Content	
Description	Criteria
Dry	Absence of moisture, dusty, dry to the touch
Damp	Apparent moisture, but below optimum
Moist	Damp, no visible water; at or near optimum moisture
Very Moist	Above optimum moisture content
Wet	Well above optimum moisture content

Cementation	
Description	Criteria
Weakly	Crumbles or breaks with handling or slight finger pressure
Moderately	Crumbles or breaks with considerable finger pressure
Strongly	Will not crumble or break with finger pressure

Coarse Grained Soils			
Apparent Density	SPT (blows/ft)	Relative Density (%)	Field Test
Very Loose	< 4	0 - 15	Easily penetrated with 1/2" reinforcing rod pushed by hand
Loose	4 - 10	15 - 35	Difficult to penetrate with 1/2" reinforcing rod pushed by hand
Medium Dense	10 - 30	35 - 65	Easily penetrated a foot with 1/2" reinforcing rod driven by a 5 lb hammer
Dense	30 - 50	65 - 85	Difficult to penetrate a foot with 1/2" reinforcing rod driven by a 5 lb hammer
Very Dense	> 50	85 - 100	Penetrated only a few inches with 1/2" reinforcing rod driven by a 5 lb hammer

Water Level Symbols	
	Water Level (where first encountered)
	Water Level (after completion)

Fine Grained Soils				
Consistency	SPT (blows/ft)	Torvane	Pocket Penetrometer	Field Test
		Undrained Shear Strength (tsf)	Unconfined Compressive Strength (tsf)	
Very Soft	< 2	< 0.125	< 0.25	Easily penetrated several inches by thumb. Squeezes through fingers.
Soft	2 - 4	0.125 - 0.25	0.25 - 0.5	Easily penetrated 1" by thumb. Molded by light finger pressure.
Firm	4 - 8	0.25 - 0.5	0.5 - 1.0	Penetrated over 1/2" by thumb with slight effort. Molded by strong finger pressure.
Stiff	8 - 15	0.5 - 1.0	1.0 - 2.0	Indented about 1/2" by thumb but penetrated only with great effort.
Very Stiff	15 - 30	1.0 - 2.0	2.0 - 4.0	Readily indented by thumbnail.
Hard	> 30	> 2.0	> 4.0	Indented with difficulty by thumbnail.

Stratification	
Description	Thickness
Seam	1/16" - 1/2"
Layer	1/2" - 12"
Occasional	one or less per foot of thickness
Frequent	foot of thickness

Figure:
A-1



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 2006 E Franklin Rd, Ste 110
 Meridian, Idaho 83642
 Telephone: (208)484-1090

TEST PIT NUMBER TP-1

CLIENT <u>Ryan Haskins</u>	PROJECT NAME <u>Haskins Subdivision</u>
PROJECT NUMBER <u>324004</u>	PROJECT LOCATION <u>Horseshoe Bend, Idaho</u>
DATE STARTED <u>1/23/24</u> COMPLETED <u>1/23/24</u>	GROUND ELEVATION <u>4571 ft</u> TEST PIT SIZE <u>inches</u>
EXCAVATION CONTRACTOR _____	GROUND WATER LEVELS:
EXCAVATION METHOD <u>Excavator</u>	AT TIME OF EXCAVATION <u>---</u>
LOGGED BY <u>M. Larranaga</u> CHECKED BY <u>S. Olsen</u>	AT END OF EXCAVATION <u>---</u>
NOTES <u>Approximate Location: 43.85466, -116.25639</u>	AFTER EXCAVATION <u>---</u>

GEOTECH BH COLUMNS - GINT STD US LAB.GDT - 2/9/24 11:56 - C:\USERS\MACIELARRANAGA\ONEEDRIVE - INNOVATE GEOTECHNICAL\DOCUMENTS\324004 - HASKINS SUBDIVISION\HASKINS SUBDIVISION - TP LOGS.GPJ

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES CONTENT (%)
									LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0.0		SILTY GRAVEL, (GM) top of ridge, snowy/muddy conditions, grass and weeds										
2.5		77 % gravel, 7 % sand, 16 % fines, dark brown, moist, hard, cobbles up to 8"	GB 1					11				16
5.0			GB 2									

Refusal at 5.0 feet.
 Bottom of test pit at 5.0 feet.



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TEST PIT NUMBER TP-2

CLIENT Ryan Haskins
PROJECT NUMBER 324004
DATE STARTED 1/23/24 **COMPLETED** 1/23/24
EXCAVATION CONTRACTOR _____
EXCAVATION METHOD Excavator
LOGGED BY M. Larranaga **CHECKED BY** S. Olsen
NOTES Approximate Location: 43.85112, -116.25574

PROJECT NAME Haskins Subdivision
PROJECT LOCATION Horseshoe Bend, Idaho
GROUND ELEVATION 4646 ft **TEST PIT SIZE** inches
GROUND WATER LEVELS:
AT TIME OF EXCAVATION ---
AT END OF EXCAVATION ---
AFTER EXCAVATION ---

GEOTECH BH COLUMNS - GINT STD US LAB.GDT - 2/9/24 11:56 - C:\USERS\MACIELARRANAGA\ONE DRIVE - INNOVATE GEOTECHNICAL\DOCUMENTS\324004 - HASKINS SUBDIVISION\HASKINS SUBDIVISION - TP LOGS.GPJ

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES CONTENT (%)
									LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0.0		SANDY LEAN CLAY, (CL) top of ridge, snowy/muddy conditions, grass and weeds										
2.5		61 % fines, dark brown, moist, dense	GB 1					28	38	23	15	61
5.0		CLAYEY SAND WITH GRAVEL, (SC) 26 % gravel, 50 % sand, 25 % fines, light brown, dry, medium dense	GB 3					20				25

Refusal at 7.0 feet.
 Bottom of test pit at 7.0 feet.



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TEST PIT NUMBER TP-3

CLIENT Ryan Haskins
PROJECT NUMBER 324004
DATE STARTED 1/23/24 **COMPLETED** 1/23/24
EXCAVATION CONTRACTOR _____
EXCAVATION METHOD Excavator
LOGGED BY M. Larranaga **CHECKED BY** S. Olsen
NOTES Approximate Location: 43.84767, -116.25651

PROJECT NAME Haskins Subdivision
PROJECT LOCATION Horseshoe Bend, Idaho
GROUND ELEVATION 4517 ft **TEST PIT SIZE** inches
GROUND WATER LEVELS:
AT TIME OF EXCAVATION ---
AT END OF EXCAVATION ---
AFTER EXCAVATION ---

GEOTECH BH COLUMNS - GINT STD US LAB.GDT - 2/9/24 11:56 - C:\USERS\MACIELARRANAGA\ONE DRIVE - INNOVATE GEOTECHNICAL\DOCUMENTS\324004 - HASKINS SUBDIVISION\HASKINS SUBDIVISION - TP LOGS.GPJ

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES CONTENT (%)
									LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0.0		SANDY FAT CLAY, (CH) on slope, snowy/muddy conditions, grass and weeds										
2.5		68 % fines, brown, dry to moist, loose to medium dense	GB 1					36	52	25	27	68
5.0		CLAYEY SAND WITH GRAVEL, (SC) 20 % gravel, 67 % sand, 13 % fines, light brown, dry, medium dense	GB 2					13				13
7.5												
10.0												

Bottom of test pit at 12.0 feet.



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TEST PIT NUMBER TP-4

CLIENT Ryan Haskins
PROJECT NUMBER 324004
DATE STARTED 1/23/24 **COMPLETED** 1/23/24
EXCAVATION CONTRACTOR _____
EXCAVATION METHOD Excavator
LOGGED BY M. Larranaga **CHECKED BY** S. Olsen
NOTES Approximate Location: 43.84699, -116.25119

PROJECT NAME Haskins Subdivision
PROJECT LOCATION Horseshoe Bend, Idaho
GROUND ELEVATION 4367 ft **TEST PIT SIZE** _____ inches
GROUND WATER LEVELS:
AT TIME OF EXCAVATION ---
AT END OF EXCAVATION ---
AFTER EXCAVATION ---

GEOTECH BH COLUMNS - GINT STD US LAB.GDT - 2/9/24 11:56 - C:\USERS\MACIELARRANAGA\ONE DRIVE - INNOVATE GEOTECHNICAL\DOCUMENTS\324004 - HASKINS SUBDIVISION\HASKINS SUBDIVISION - TP LOGS.GPJ

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES CONTENT (%)
									LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0.0		SILTY SAND WITH GRAVEL, (SM) level ground between ridges, snowy/muddy conditions, grass and weeds										
2.5		29 % gravel, 54 % sand, 17 % fines, dark brown, moist, dense	GB 1					29				17
5.0												
7.5			GB 2									

Bottom of test pit at 8.0 feet.






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TEST PIT NUMBER TP-5

CLIENT Ryan Haskins
PROJECT NUMBER 324004
DATE STARTED 1/23/24 **COMPLETED** 1/23/24
EXCAVATION CONTRACTOR _____
EXCAVATION METHOD Excavator
LOGGED BY M. Larranaga **CHECKED BY** S. Olsen
NOTES Approximate Location: 43.84864, -116.25010

PROJECT NAME Haskins Subdivision
PROJECT LOCATION Horseshoe Bend, Idaho
GROUND ELEVATION 4432 ft **TEST PIT SIZE** inches
GROUND WATER LEVELS:
AT TIME OF EXCAVATION ---
AT END OF EXCAVATION ---
AFTER EXCAVATION ---

GEOTECH BH COLUMNS - GINT STD US LAB.GDT - 2/9/24 11:56 - C:\USERS\MACIELARRANAGA\ONE DRIVE - INNOVATE GEOTECHNICAL\DOCUMENTS\324004 - HASKINS SUBDIVISION\HASKINS SUBDIVISION - TP LOGS.GPJ

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES CONTENT (%)
									LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0.0		SANDY ELASTIC SILT, (MH) on slope, snowy/muddy conditions, grass and weeds										
2.5		26 % fines, whiteish brown, dry, loose to medium dense, moderate cementation	 GB 1					38	56	55	1	26
5.0			 GB 2									
7.5												
10.0		40 % fines, grayish brown	 GB 3					33				40

Bottom of test pit at 12.0 feet.



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TEST PIT NUMBER TP-6

CLIENT Ryan Haskins
PROJECT NUMBER 324004
DATE STARTED 1/23/24 **COMPLETED** 1/23/24
EXCAVATION CONTRACTOR _____
EXCAVATION METHOD Excavator
LOGGED BY M. Larranaga **CHECKED BY** S. Olsen
NOTES Approximate Location: 43.85090, -116.25205

PROJECT NAME Haskins Subdivision
PROJECT LOCATION Horseshoe Bend, Idaho
GROUND ELEVATION 4527 ft **TEST PIT SIZE** inches
GROUND WATER LEVELS:
AT TIME OF EXCAVATION ---
AT END OF EXCAVATION ---
AFTER EXCAVATION ---

GEOTECH BH COLUMNS - GINT STD US LAB.GDT - 2/9/24 11:56 - C:\USERS\MACIELARRANAGA\ONE DRIVE - INNOVATE GEOTECHNICAL\DOCUMENTS\324004 - HASKINS SUBDIVISION\HASKINS SUBDIVISION - TP LOGS.GPJ

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES CONTENT (%)
									LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0.0		SILTY GRAVEL WITH SAND, (GM) top of ridge, snowy/muddy conditions, grass and weeds										
2.5		47 % gravel, 25 % sand, 29 % fines, dark brown, dry to moist, hard, cobbles up to 7"	GB 1					28				29
5.0			GB 2									

Refusal at 6.0 feet.
 Bottom of test pit at 6.0 feet.



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TEST PIT NUMBER TP-7

CLIENT Ryan Haskins
PROJECT NUMBER 324004
DATE STARTED 1/23/24 **COMPLETED** 1/23/24
EXCAVATION CONTRACTOR _____
EXCAVATION METHOD Excavator
LOGGED BY M. Larranaga **CHECKED BY** S. Olsen
NOTES Approximate Location: 43.85633, -116.25080

PROJECT NAME Haskins Subdivision
PROJECT LOCATION Horseshoe Bend, Idaho
GROUND ELEVATION 4373 ft **TEST PIT SIZE** inches
GROUND WATER LEVELS:
AT TIME OF EXCAVATION ---
AT END OF EXCAVATION ---
AFTER EXCAVATION ---

GEOTECH BH COLUMNS - GINT STD US LAB.GDT - 2/9/24 17:09 - C:\USERS\MACIELARRANAGA\ONE DRIVE - INNOVATE GEOTECHNICAL\DOCUMENTS\324004 - HASKINS SUBDIVISION\HASKINS SUBDIVISION - TP LOGS.GPJ

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES CONTENT (%)
									LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0.0		SILTY SAND, (SM) on slope, snowy/muddy conditions, grass and weeds										
2.5		46 % fines, dark brown, moist, loose to medium dense	GB 1					28				46
5.0		50 % fines	GB 2					27				50
7.5		10 % gravel, 50 % sand, 41 % fines, cobbles up to 1.5'	GB 3					34				41
10.0												

Bottom of test pit at 12.0 feet.



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TEST PIT NUMBER TP-8

CLIENT Ryan Haskins
PROJECT NUMBER 324004
DATE STARTED 1/23/24 **COMPLETED** 1/23/24
EXCAVATION CONTRACTOR _____
EXCAVATION METHOD Excavator
LOGGED BY M. Larranaga **CHECKED BY** S. Olsen
NOTES Approximate Location: 43.85935, -116.25022

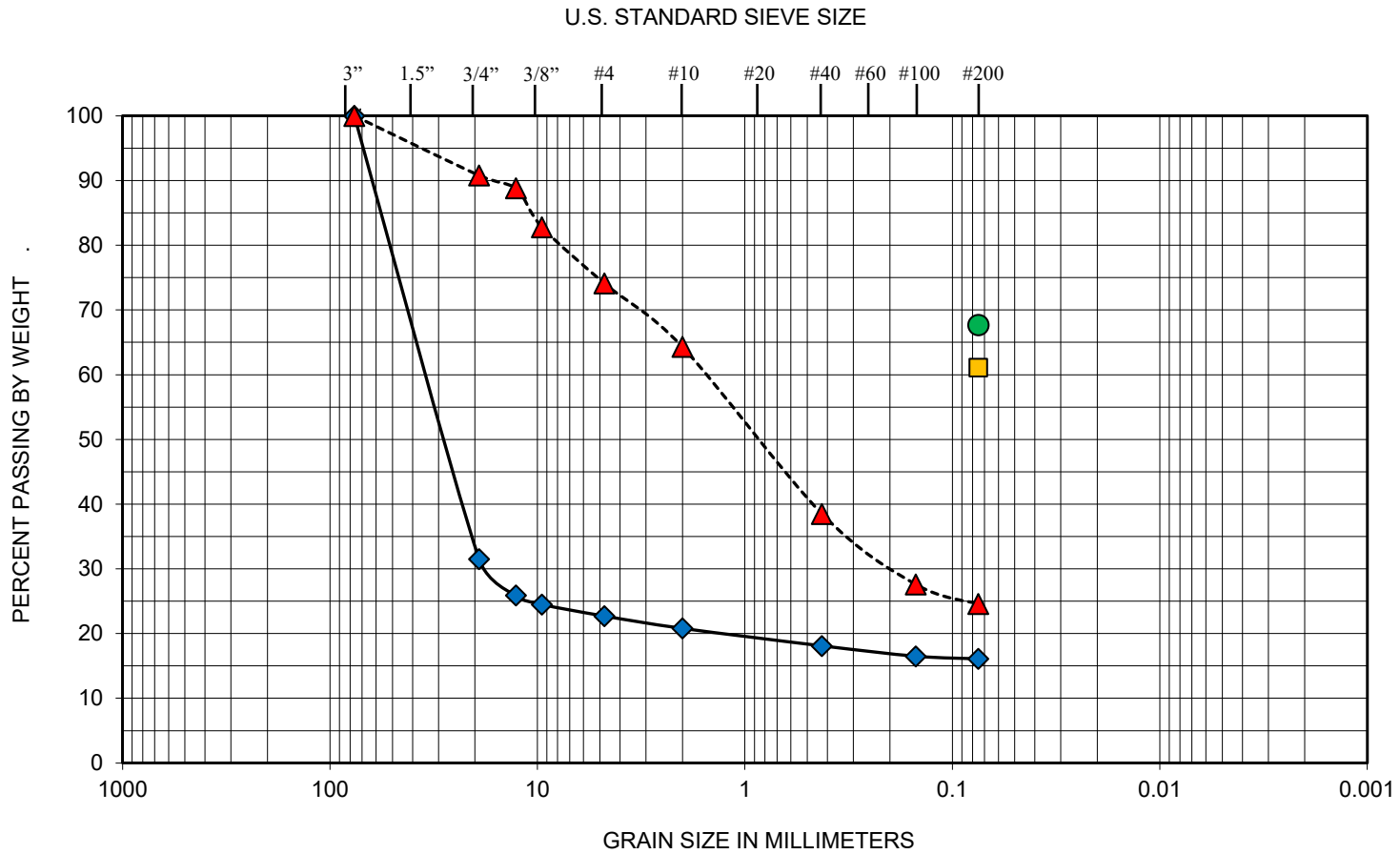
PROJECT NAME Haskins Subdivision
PROJECT LOCATION Horseshoe Bend, Idaho
GROUND ELEVATION 4236 ft **TEST PIT SIZE** _____ inches
GROUND WATER LEVELS:
AT TIME OF EXCAVATION ---
AT END OF EXCAVATION ---
AFTER EXCAVATION ---

GEOTECH BH COLUMNS - GINT STD US LAB.GDT - 2/9/24 11:56 - C:\USERS\MACIELARRANAGA\ONE DRIVE - INNOVATE GEOTECHNICAL\DOCUMENTS\324004 - HASKINS SUBDIVISION\HASKINS SUBDIVISION - TP LOGS.GPJ

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS			FINES CONTENT (%)
									LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
0.0		POORLY GRADED GRAVEL WITH CLAY, (GP-GC) level ground, snowy/muddy conditions, grass and weeds										
2.5		Dark brown, moist to wet, dense, cobbles up to 2'	GB 1									
5.0		79 % gravel, 14 % sand, 7 % fines, dry, hard, cobbles up to 2.5'	GB 2					11				7

Bottom of test pit at 6.0 feet.

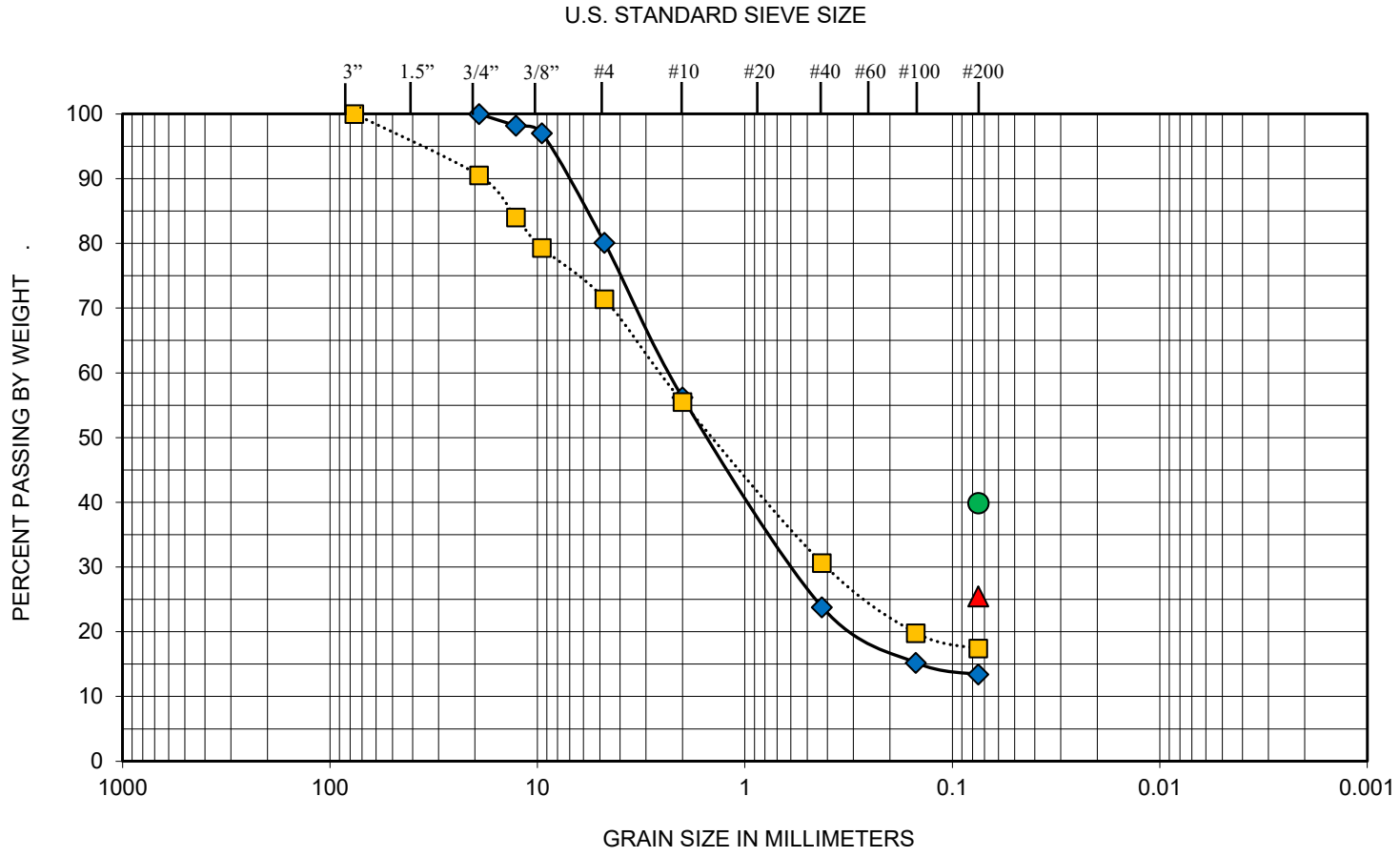
Appendix B



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Symbol	Boring/ Test Pit	Sample Depth (feet)	Moisture Content (%)	Gravel (%)	Sand (%)	Fines (%)	USCS Class	Soil Classification
◆	TP-1	2	11.3	77	7	16	GM	Silty gravel
■	TP-2	2.5	27.6	-	-	61	CL	Sandy lean clay
▲	TP-2	4.5	20.1	26	50	25	SC	Clayey sand with gravel
●	TP-3	3	36.4	-	-	68	CH	Sandy fat clay

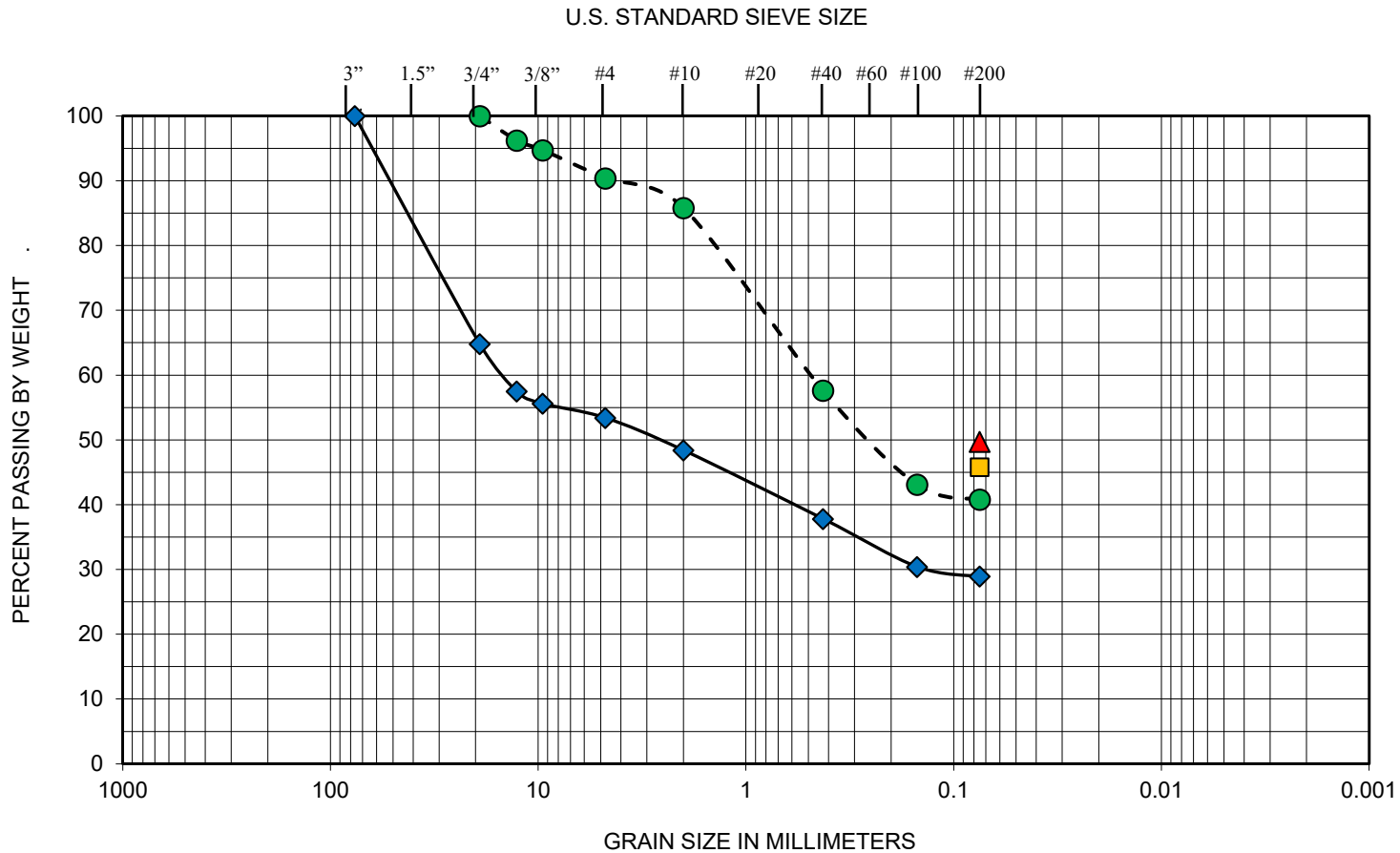
<p>Sieve Analysis Results</p> <p>Horseshoe Bend, Idaho</p>	Haskins Subdivision	
	Date: 2/9/2024	<p>Figure: B-1</p>
	Project: 324004	
	Client: Ryan Haskins	



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Symbol	Boring/ Test Pit	Sample Depth (feet)	Moisture Content (%)	Gravel (%)	Sand (%)	Fines (%)	USCS Class	Soil Classification
◆	TP-3	5	37.3	20	67	13	SC	Clayey sand with gravel
■	TP-4	3	28.8	29	54	17	SM	Silty sand with gravel
▲	TP-5	3	38.4	-	-	26	MH	Sandy elastic silt
●	TP-5	10	33.0	-	-	40	MH	Sandy elastic silt

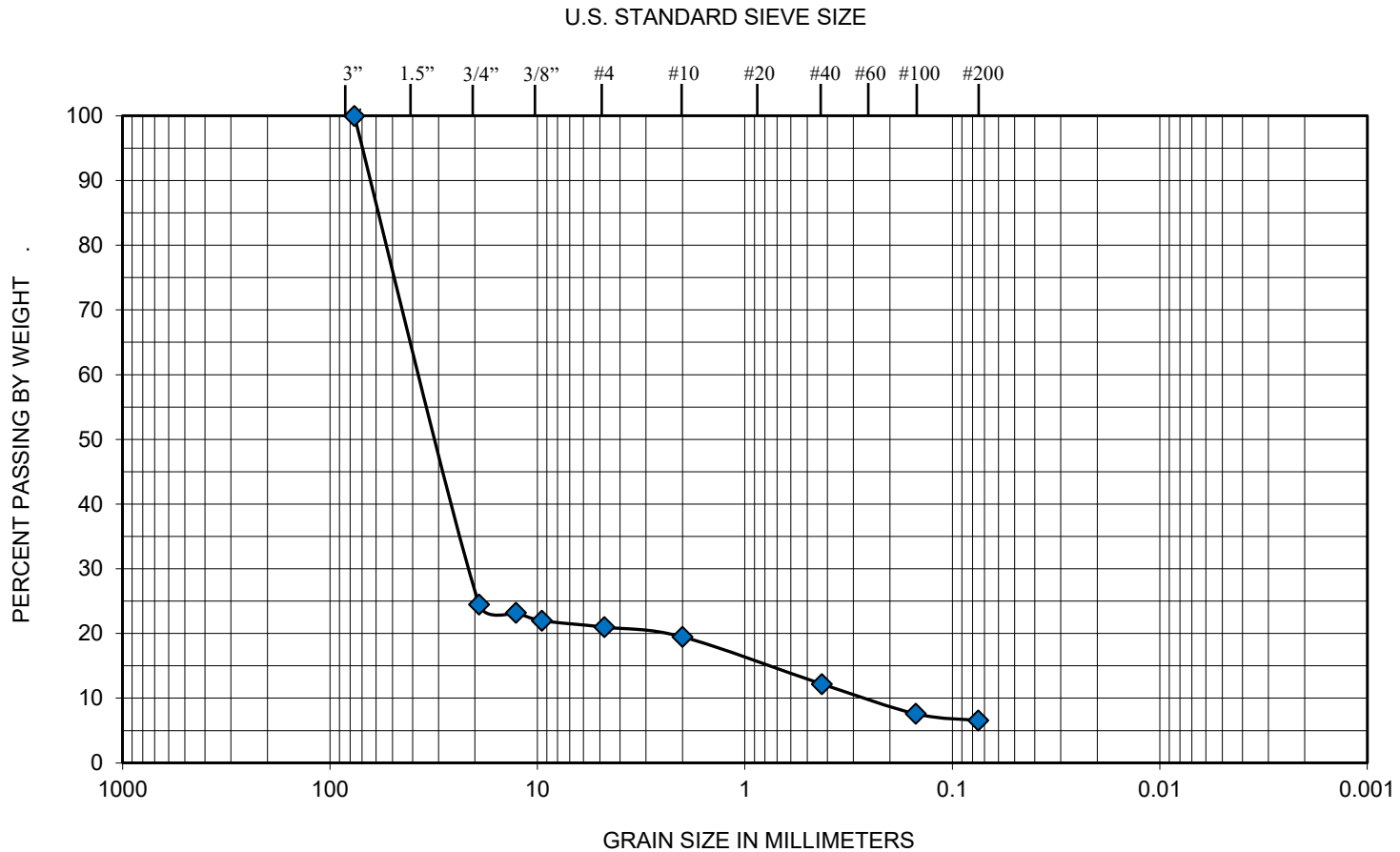
<p>Sieve Analysis Results</p> <p>Horseshoe Bend, Idaho</p>	Haskins Subdivision	
	Date: 2/9/2024	Figure: B-2
	Project: 324004	
	Client: Ryan Haskins	



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Symbol	Boring/ Test Pit	Sample Depth (feet)	Moisture Content (%)	Gravel (%)	Sand (%)	Fines (%)	USCS Class	Soil Classification
◆	TP-6	2	28.4	47	25	29	GM	Silty gravel with sand
■	TP-7	3	27.9	-	-	46	SM	Silty sand
▲	TP-7	6	27.2	-	-	50	SM	Silty sand
●	TP-7	8	34.0	10	50	41	SM	Silty sand

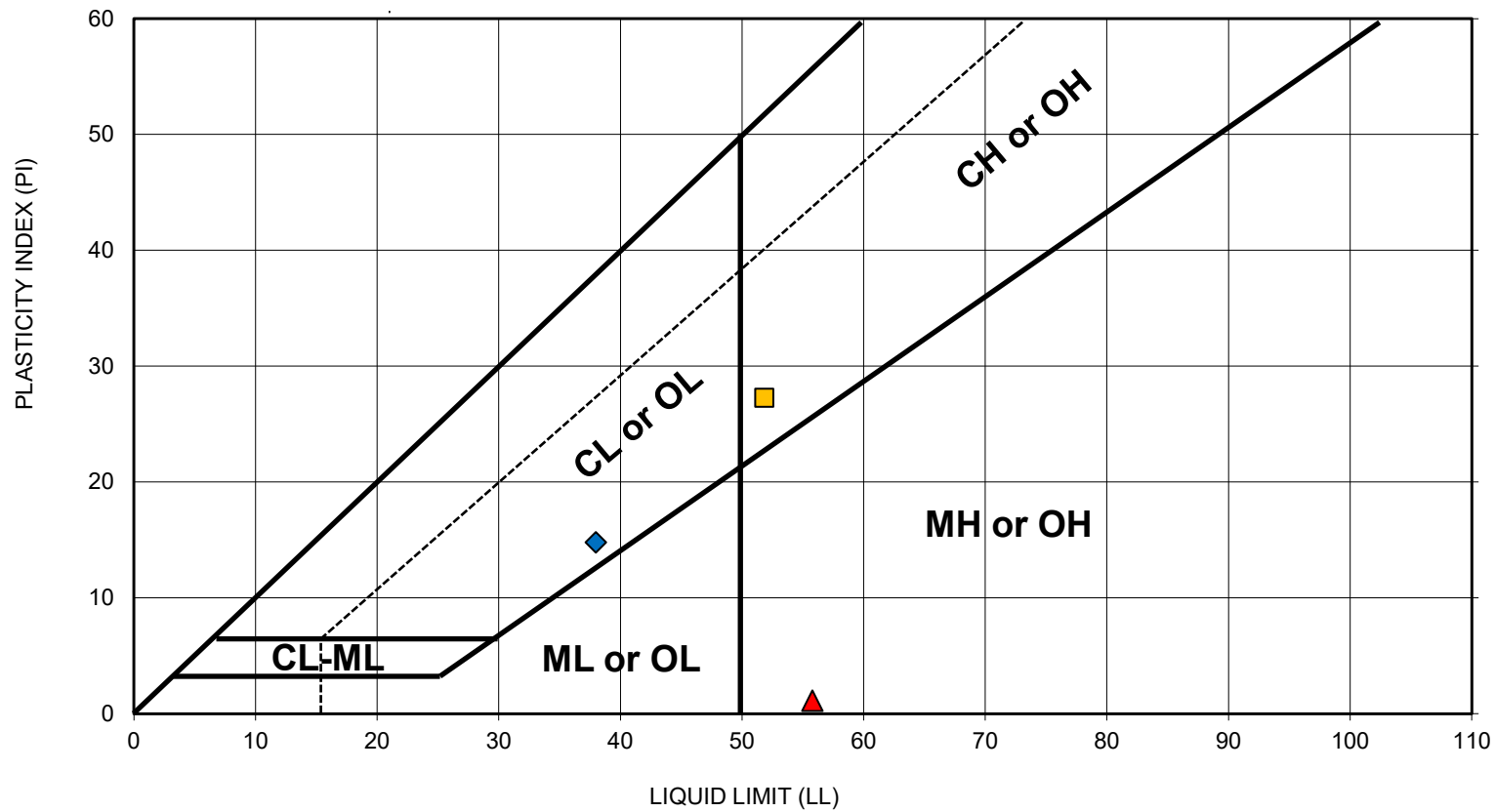
<p>Sieve Analysis Results</p> <p>Horseshoe Bend, Idaho</p>	Haskins Subdivision	
	Date: 2/9/2024	Figure: B-3
	Project: 324004	
	Client: Ryan Haskins	



COBBLES	GRAVEL		SAND			SILT OR CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

Symbol	Boring/ Test Pit	Sample Depth (feet)	Moisture Content (%)	Gravel (%)	Sand (%)	Fines (%)	USCS Class	Soil Classification
◆	TP-8	5.5	10.8	79	14	7	GP-GC	Poorly graded gravel with clay

<p>Sieve Analysis Results</p> <p>Horseshoe Bend, Idaho</p>	Haskins Subdivision	
	Date: 2/9/2024	Figure: B-4
	Project: 324004	
Client: Ryan Haskins		



Symbol	Location	Sample Depth (feet)	Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	USCS Class	Soil Classification*
◆	TP-2	2.5	38	23	15	CL	Sandy lean clay
■	TP-3	3	52	25	27	CH	Sandy fat clay
▲	TP-5	3	56	55	1	MH	Sandy elastic silt

IGEO INNOVATE GEOTECHNICAL Atterberg Limits Results Horseshoe Bend, Idaho	Haskins Subdivision	
	Date: 2/9/2024	Figure: B-5
	Project: 324004	
Client: Ryan Haskins		

Appendix C

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