

SCHOTT'S LAKE RV AND GUEST

SCHOTT'S LAKE RESORT DEVELOPMENT SERVICES GEOTECHNICAL INVESTIGATION MOUNTAIN VIEW COUNTY, ALBERTA

OCTOBER 2021



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WSP PROJECT NO.

211-04399-00



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1 INTRODUCTION

WSP Canada Inc. (WSP) was retained by Schott's Lake RV and Guest Ranch Inc. to complete a geotechnical assessment for a proposed development in Mountain View County.

The purpose of this geotechnical assessment was to evaluate the subsurface and groundwater conditions and to provide geotechnical design parameters and construction recommendations for the project. The approved scope of work included:

- Coordination and oversight of a geotechnical field program comprising of a total of thirteen (13) geotechnical borehole using solid steam augers
- Laboratory testing, including index and specialized soils testing on selected soil samples (American Society for Testing Materials [ASTM] methods)
- Geotechnical reporting

This report summarizes our preliminary geotechnical assessment.

2 SITE AND PROJECT DESCRIPTION

The project site is located approximately 6 km southeast of Bearberry, Alberta. The plan for the development is a motel along with additional recreational vehicle (RV) stalls comprising:

- Expansion to the existing RV campsites
- Serviced family campsites
- Hotel
- Cabins
- Access gravel roads (about 1.1 km long)
- Event centre sites
- Stormwater management facilities
- Septic disposal system areas

A site map is located in Appendix A showing the borehole location.

3 BACKGROUND INFORMATION

The surficial geology at the proposed site is expected to consist of glaciolacustrine deposits consisting of primarily fine-grained, distal sediments deposited in or along the margins of glacial lakes (AB Interactive Maps).

Upon review of the Alberta Water Wells website (Alberta Water Wells website (Alberta Environment and Parks, 2021) two water well drilling reports with relevant lithologic information were encountered within the proposed development. A copy of the water well record is provided in Appendix B.

Table 1 Water Well Drilling reports

Number	GIC Well ID/Owner name	Latitude (°)	Longitude (°)	Total Depth (m)
1	432810	51.807714	-114.86644	35.05
2	407034	51.805932	-114.881497	50.29
3	2086262	51.802890	-114.871060	67.06

Generally, the driller's water well records indicate soils described mainly as fine-grained (clay and clay till) over bedrock (weathered bedrock). The static groundwater table recorded was at shallow at 26 mbgs.

A summary of the lithologic description, the interpreted bedrock depth, and the static water level information from the three water wells records referred to the arbitrary stationing are provided in Table 2 below.

Table 2 Summary of Lithologic Description Driller Wells

Number	GIC Well ID	Total Depth (mbgs)	Clay (mbgs)	Shale/Sandstone (below m)	Static Water (mbgs)
1	432810	35.05	[4.88-32.61]	[Below 32.61]	26.82
2	407034	50.29	[16.46-38.1]	[Below 38.1]	00
3	2086262	67.06	11.28-15.85	[Below 15.85]	27.98

4 GEOTECHNICAL FIELD INVESTIGATION

4.1 Field Investigation

Preliminary activities before definition of the proposed boreholes locations included the delineation of the wetland by WSP Ecology team to verify all the boreholes were located outside any mapped or potential wetland.

Before conducting the proposed subsurface investigation at the subject site, WSP completed an Alberta One-Call and contracted a third-party utility locator subcontractor (Ernco Environmental) to locate existing buried utilities and to clear the proposed borehole locations of underground and overhead utilities.

WSP oversaw the drilling of thirteen (13) boreholes on June 17 and June 18th, 2021 at depth ranging from 2 to 6.8 mbgs using a truck-mounted drill rig and solid stem augers supplied by All Service Drilling Inc. All the boreholes drilled at depth less than 5 mbgs were for the roads.

The approximate borehole (BH21-01 to BH21-13) locations are provided on Figure 1 in Appendix A and summarized in Table 3 below.

Table 3 WSP Borehole Details

Borehole Number	Approx. Depth (mbgs)	Latitude (°)	Longitude (°)
BH21-01	2.0	51.806683978	-114.8679573
BH21-02	5.1	51.806904380	-114.868770596
BH21-03	2.0	51.808272265	-114.873187942
BH21-04	6.6	51.807843321	-114.872814696
BH21-05	2.0	51.806699862	-114.872278506
BH21-06	6.6	51.806158978	-114.871639805
BH21-07	4.8	51.805595756	-114.87274815
BH21-08	2.0	51.805147324	-114.872296778
BH21-09	5.1	51.804431509	-114.872678407
BH21-10	5.1	51.803663895	-114.871515082
BH21-11	2.0	51.803118284	-114.869842306
BH21-12	6.60	51.803568969	-114.872220252
BH21-13	2.0	51.80290286	-114.873534702

Notes: mbgs – meters below ground surface

Coordinates were recorded with a hand-held GPS unit (NAD83) accurate to ±3 m.

Standard Penetration Tests (SPTs) per ASTM D1586 were performed at selected intervals. Pocket penetrometer readings were taken on intact cohesive soil samples to obtain an indication of the soil's unconfined compressive strengths. Soil samples were obtained from the auger, the split-spoon sampler, and 75 mm Shelby tubes. The soil stratigraphy, sampling sequences, and the field and laboratory test results are shown on the borehole logs in Appendix A.

Piezometers installation was not part of the scope of work.

4.2 Laboratory Testing

The following laboratory testing on selected soil samples was completed and are presented in Appendix C.

Table 4 Laboratory Testing

Laboratory Test	Ref. Standard	Number of Tests
Moisture Content	ASTM D2216	All
Atterberg Limits (on cohesive materials)	ASTM D4318	3
Particle Size Analysis (with Hydrometer)	ASTM D422	5
Water soluble sulphate	ASTM A23.1-14	1
California Bearing Ratio	ASTM D1883	1

The laboratory test results are also shown on the borehole logs.

5 SUBSURFACE GROUND CONDITIONS

The subsurface stratigraphy encountered at the boreholes locations generally consisted of topsoil or gravel fill overlying clay over clay till until termination of the boreholes. Groundwater table was recorded at completion of boreholes. It should be noted that subsurface stratigraphy may vary across the site in locations not investigated during this assessment's borehole locations.

Groundwater levels are presented in Section 5.5. The individual soil layers encountered in each borehole were similar and are described in the following sub-sections.

Table 5 provides a summary of the soil's stratigraphy encountered within the boreholes completed at the subject site.

Table 5 Summary of Stratigraphy

Borehole Number	Total Depth (mbgs)	Thickness (m) – [top and bottom] (mbgs)			
		Topsoil	Gravel Fill	Clay	Clay Till
BH21-01	2.0	0.1 [0.0-0.1]	-	1.4 [0.1-1.5]	0.6 - Below 1.5
BH21-02	5.10	-	0.3 [0.0-0.3]	4.8 – Below 0.3	-
BH21-03	2.0	0.15 [0.0-0.15]	-	1.85 – Below 0.15	-
BH21-04	6.60	0.15 [0.0-0.15]	-	3.35 [0.15-3.5]	3.1 – Below 3.5
BH21-05	2.0	-	0.5 [0.-0.5]	1.54 – Below 0.5	-
BH21-06	6.60	-	-	5.0 – Below 0.0	-
BH21-07	4.80	-	-	3.35 [0-3.35]	1.45 – Below 3.35
BH21-08	2.0	0.1 [0.0-0.10]	-	1.9 – Below 0.1	-
BH21-09	5.10	-	-	3.5 [0-3.5]	1.6 – Below 3.5
BH21-10	5.10	-	-	3.05 [0-3.05]	2.05 – Below 3.05
BH21-11	2.0	0.1 [0.0-0.1]	-	1.9 – Below 0.1	-
BH21-12	6.60	0.13 [0.0-0.13]	-	1.7 [0.13-1.8]	6.5 – Below 6.5
BH21-13	2.0	0.1 [0.0-0.1]	-	1.9 – Below 0.1	-

5.1 Topsoil

Topsoil was encountered in every borehole except in BH21-02, BH21-05, BH21-06, BH21-07, BH21-09 and BH21-10. The surficial topsoil was between 100 and 150 mm thick when encountered.

5.2 Gravel fill

Gravel fill was encountered in BH21-02 and BH21-05 from surface at depth of 300 mm and 460 mm, respectively.

5.3 Clay

Clay was encountered either below the topsoil or the gravel fill layer at the depth shown in Table 5. Clay was generally described as silty, trace to some sand, medium to high plastic and moist.

Standard penetration “N” values varied between 6 to 13 blows per 300 mm of penetration which resulted in firm to stiff clay.

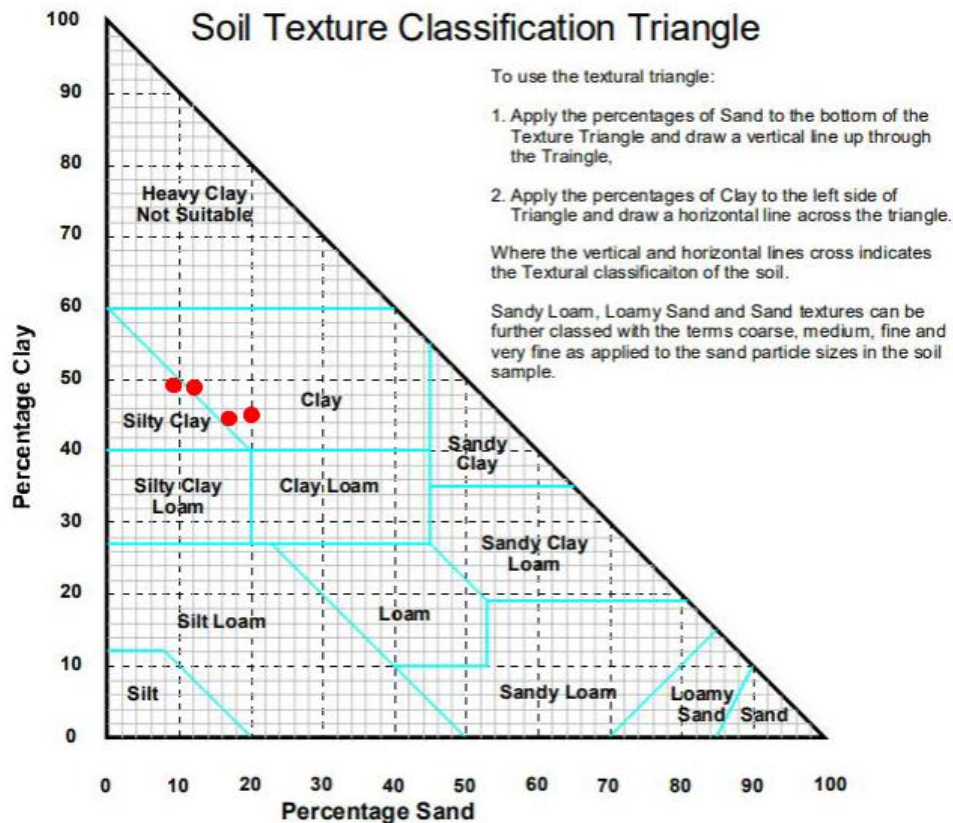
Moisture contents on sand samples ranged from about 27 to over 30%, indicating wet conditions.

The additional laboratory testing on the clay till is summarized in the following table below.

Table 6 Laboratory Test Results – Clay

Borehole Number (BH21-*)	Sample Depth (mbgs)	Atterberg Limits			Sieve & Hydrometer				Soluble Sulfate %
		Liquid Limit (%)	Plastic Limit (%)	Plasticity Symbol	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	
02	1.5	67	26	CH	2.9	17.1	35.9	44.1	0.05
05	1.5	67	25	CH	-	9.5	41.5	49.0	-
06	1.5	-	-	-	-	11.0	40.0	49.0	-
13	1.5	67	24	CH	-	20.0	34.6	45.4	-

Soil Texture Classification Triangle



Note: Plotting the percentage of sand and clay provides the remaining percentage of silt.

The results of a Grain or Particle Size analysis will provide the percentages of Sand, Silt and Clay in the Soil sample.

Based on the Soil Texture Classification Triangle provided in Alberta Private Sewage Standard of Practice, the tested soil is classified as Silty Clay (BH21-05) or Clay (BH21-02, BH21-06 and BH21-13).

5.4 Clay Till

Clay till was encountered in every borehole at variable depths as shown in Table 5. The clay till was described as silty, with some sand, trace to some gravel, medium to high plasticity, and firm to stiff with SPT "N" values ranged from 6 to over 30 per 300 mm of penetration. Pocket Penetrometer reading ranged from 1.0 kg/cm² to over 2.0 kg/cm², confirmed the consistency obtained with the SPT values.

It was encountered at each drilled location except in BH21-02, BH21-03, BH21-05, BH21-06, BH21-08, BH21-11 and BH21-13; either below the topsoil or clay or from surface until borehole termination depths

Moisture contents on samples of clay till ranged from about 15 to over 30%, indicating moist to wet condition.

One proctor resulted in BH21-13 in Standard Proctor Maximum Dry Density (SPMDD) of 1470 (kg/m³) at 24.5 % Optimum Moisture Content (OMC)

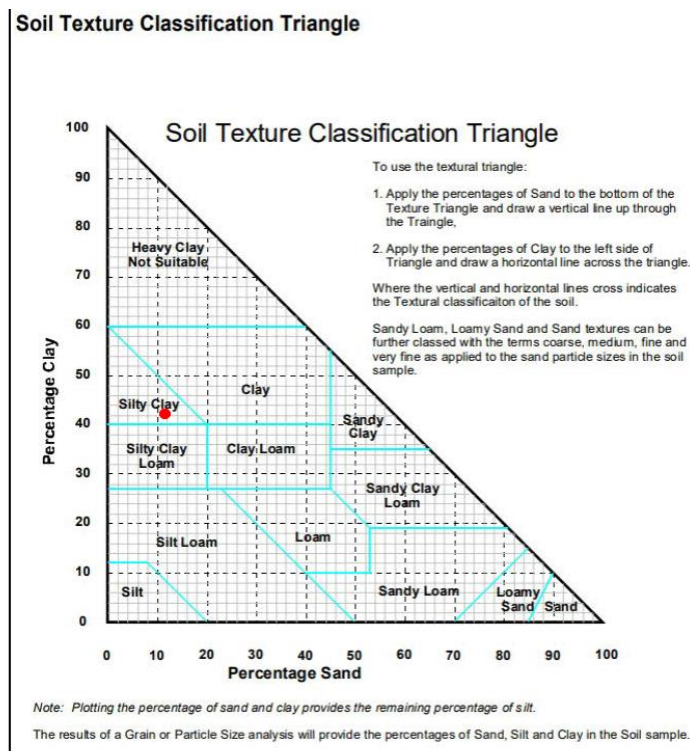
The additional laboratory testing on the clay till is summarized in the following table below.

Table 7 Laboratory Test Results – Clay Till

Borehole Number (BH21-*)	Sample Depth (mbgs)	Atterberg Limits			Sieve & Hydrometer*				Soluble Sulfate %
		Liquid Limit (%)	Plastic Limit (%)	Plasticity Symbol	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	
04	1.5	-	-	-	0.5	11.5	46.6	41.4	-

Note: CH – high plastic clay

*-Based on Alberta Private Sewage Standard of Practice



Based on the Soil Texture Classification Triangle provided in Alberta Private Sewage Systems Standard of Practice 2015, the tested soil is classified as Silty Clay.

5.5 Groundwater

No seepage and sloughing was observed within the boreholes except in BH21-12; where water was observed at 5.9 m upon completion. No groundwater monitoring wells were installed.

It should be noted that groundwater levels are prone to fluctuations and may be affected by seasonal fluctuations, recent rainfall, surface drainage, infiltration, etc.

6 GEOTECHNICAL COMMENTS AND RECOMMENDATIONS

The recommendations are based on WSP's interpretation of the soils encountered during field drilling, review of available and pertinent background data, WSP's understanding of the site conditions, and experience. Parties requiring information beyond the scope or purpose of this report must make their interpretation of the information provided.

6.1 Soil Design Parameters

Interpreted soil design parameters are developed using standard engineering techniques as indicated in the Canadian Foundation Engineering Manual (CFEM). The soil design parameters provided in Table 8 can be considered for earth pressure determination and bearing capacities.

If conditions are different at the construction time, WSP should be contacted immediately to re-evaluate the below design parameters.

Table 8: Static Soil Design Parameters

Parameters	Clay	Clay Till	Engineered Fill (Clay)
Total Unit Weight (KN/m ³)	17	18	18
Undrained Shear Strength Su (kPa)	50	60	50
Effective Friction Angle (*)	22	24	28
Coefficient of Active Earth Pressure, K _a , (Rankine)	0.45	0.42	0.36
Coefficient of Active Earth Pressure, K _o , (Rankine)	0.63	0.59	0.53
Coefficient of Active Earth Pressure, K _p , (Rankine)	2.20	2.37	2.77

The coefficient for earth pressure provided above assumes horizontal ground conditions at the top of the wall.

6.2 Frost Penetration Depth

The maximum seasonal frost penetration depth was calculated for the near-surface soils in accordance with the Canadian Foundation Engineering Manual (CFEM). A mean freezing index of 1,400 Degree Days Celsius (°C-days) was used for the location. The average seasonal frost penetration depth is estimated to be approximately 2.2 m. The estimated frost penetration depth assumes a uniform soil type without topsoil and snow cover.

For the heated building, the base of the shallow foundations (i.e., footing) must be placed at least 1.2 mbgs in order to avoid the effects of frost heave (i.e., no rigid insulation would be required in this case).

To reduce the potential for frost heaving of foundations, soil foundations should be provided with a minimum amount of cover, as detailed in Table 9 below.

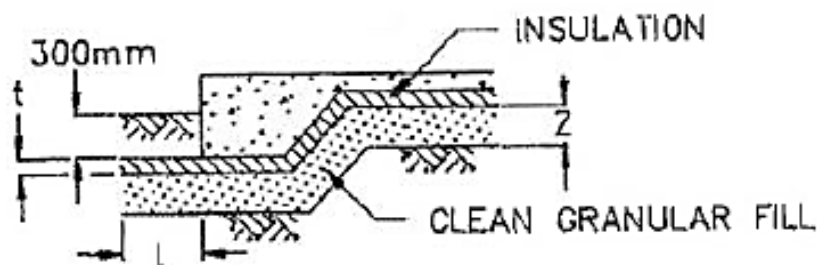
Table 9 Recommended Foundation Soil Cover for Frost Protection

Foundations	Minimum Foundation Soil Cover
Interior Foundation - Permanently Heated Structure (minimum 15°C)	0.6 m
Permanently heated structure (minimum 15°C)	1.2 m
Exterior foundations for an unheated structure or unheated portion of a structure	2.4 m

Thermal insulation for slab frost protection should be considered if the foundations are founded at shallower depths with less soil cover than recommended in Table 9 for permanent heated and unheated exterior structures.

The CFEM³ Section 13.5.2 indicated the following:

- The insulation sheets should be placed with a minimum cover of 300 and extend at least 1.2 m and 2.4 m out from the slab's edge (L) for heated and unheated buildings, respectively.
- The minimum thickness (t) of insulation (Mean Freezing Index Design of 1500 °C in clayey soils) for heated and unheated buildings is 25 mm and 100 mm, respectively, as per Figures 13.10 and 13.11 of CFEM³. The minimum thickness of thermal insulation for heated and unheated buildings is 50 mm and 100 mm, respectively, per standard care practices.



However, as a general guide, each 25 mm of insulation may be assumed to provide approximately 0.3 m of equivalent soil cover. WSP recommend the insulation used for frost protection should be placed at a minimum depth of 0.6 m below the finished ground surface.

6.3 Site Preparation

All topsoil, organic soil, loose, soft, or any other deleterious materials must be removed from beneath footings, access roads or any other proposed structure or where engineered fill is needed. Upon removal of unsuitable material, the exposed subgrade must be reviewed by geotechnical engineering personnel, and a proof-roll must be undertaken using a minimum 8,200 kg loaded single-axle truck. Any areas which demonstrate rutting, cracking or other deformations should be examined in detail and remedial action taken, as required. The upper 300 mm of exposed subgrade shall be scarified and re-compacted to minimum 98% Standard Proctor Maximum Dry Density (SPMDD; per ASTM D698).

Engineered fill, associated with the proposed construction, may consist of imported low to medium plastic cohesive or granular materials. The in-situ materials should not be re-used as engineered fill. Engineered fill is imported to grade the site, the material should be approved by a geotechnical engineer before placement. All engineered fill materials must be free of oversized rocks, organics, roots, debris, and other deleterious materials.

Fill material must not contain organic matter, frozen material, or rocks over 75 mm in diameter. Cohesive fill should be placed in lifts not exceeding 150 mm loose measure and be compacted to minimum 98% SPMDD. The moisture content at placement should be within 0% to +2% of OMC for compaction purposes.

Granular fill should be placed in lifts not exceeding 200 mm loose measure and be compacted to minimum 98% SPMDD. The moisture content at placement should be within -3 to +1% of OMC for compaction purposes.

Subgrade surfaces should be protected from freezing. In addition, the subgrade should be protected from wetting or drying, both before and after the placement of fill. Subgrade surfaces that are allowed to dry or become wet must be scarified, moisture conditioned, and re-compacted.

6.4 Permanent Dewatering and Site Drainage

The prepared subgrade surface for the site should be shaped to prevent ponding of water on the site. Excess water should not be allowed to pond and should be drained or pumped from the site as quickly as possible both during and after construction.

Subgrade below exterior slabs should have a minimum 2% grade downwards away from the slabs, in order to prevent moisture migration into base gravels below the slab. Any cracking observed in the exterior slabs-on-grade should be promptly repaired to avoid increased moisture infiltration to the subgrade.

The finished grades should provide surface drainage away from all structures. Within 2 m of building perimeters, the exterior should be graded to slope away from the building at a sufficient gradient. A gradient of 2% should be used wherever possible. Roofs and other drains should discharge well clear of any buildings or equipment.

Positive surface drainage of the site as well as access roads should be established to prevent ponding of water. Recommended minimum grades of 2% should be used in gravel surfaced areas, where possible. For roadways, a minimum cross slope of 2% is recommended. Surrounding landscaping should be designed such that runoff water is prevented from ponding.

6.5 Geosynthetics

A Polyvinyl Chloride (PVC), High Density Polyethylene (HDPE), or rubber liner are suitable synthetic impermeable liners. For each synthetic liner type, a layer of sand bedding may be required to minimize the potential for liner perforation from in situ soils. A Geosynthetic Clay Liner (GCL) may also be considered; however, if the pond extends below the groundwater table, seepage may cause difficulty during installation of the GCL.

A synthetic liner should be installed as per the manufacturer's specifications.

6.6 Foundations

6.6.1 Temporary Excavations

Temporary excavations at the site should be sloped or shored for worker and foundation protection. Construction must conform to good practice and comply with regulations. Based on the document, the soil should be classified as "likely to crack or crumble soil"; therefore, excavation walls must be sloped at an angle of not less than 45 degrees (i.e., 1H:1V) measured from the vertical from the bottom of the excavation. WSP should review the proposed excavation layout and provide further guidance if steeper cut slopes are desired.

It is anticipated that temporary excavations will occur in uncontrolled fills, high plasticity clay, and clay till with the following depths:

- 0.5 m for on-grade structures including gravel pads and parking lots, cabins and event centre sites.
- 2.5 mbgs for the proposed sewer and water lines and manholes.
- 3.4 mbgs for the proposed shallow foundation (including over excavation as per Section 6.6.2).

Excavations must be protected from rain, snow or any ingress of free water. Prolonged exposure of excavated areas should be avoided to prevent deterioration of exposed soil with resultant slope instability. Similarly, excavated materials should be stockpiled away from the excavations to avoid any slope instability and to prevent materials from falling back into the excavations. Temporary surcharge loads, such as stocks of material or heavy equipment, should be kept back from the excavation faces at a distance equal to the excavation depth. For crane pads, the distance should be increased equal to three times to the excavation depth.

6.6.2 Shallow Foundations

Based on the findings of the geotechnical investigation, the subsurface conditions generally consist of native highly plastic clay.

Shallow foundations placed in the high plastic clay are considered a suitable foundation system for the proposed development. However, the foundation supported on the native highly plastic clay will be subject to heaving and/or undergoing settlements with the moisture fluctuation in the clay stratum. Proper moisture barriers should be employed to limit the moisture fluctuation in the soil. We recommend that the clay be over-excavated at least 1.2 m below the proposed foundation bearing surface and replaced with engineered fill as discussed in Section 6.3.

The foundation design parameters provided in this report are presented in terms of Limit States Design, as per National Building Code of Canada (NBCC) and Canadian Foundation Engineering Manual (CFEM) design standards.

Spread or strip footings founded in native undisturbed clay or clay till with proper moisture barriers may be used to support the lightly loaded structures. As discussed in Section 6.1, footings supporting heated and unheated structures should be placed no less than 1.2m and 2.2m below final grade, respectively, for adequate frost protection. Alternatively, rigid insulation may be used to provide adequate frost protection. In order to mitigate heave/shrinkage potential, the native clay below foundation bearing surface be over-excavated and replaced with engineered fill.

The ultimate geotechnical bearing resistance at ULS for shallow foundations (spread and strip footings) founded within the native clay or engineered fill may be taken as 250kPa for footings widths ranging from 0.5 to 2.5 m. A resistance factor (ϕ) of 0.5 as per NBCC should be applied to determine the factored bearing resistance at ULS.

The geotechnical bearing resistance at Serviceability Limit States (SLS) for spread and strip footings varies with footing widths and embedment depths. The embedment depth is to be measured from ground surface or from the top of adjacent non-structural slabs-on-grade, whichever is less. When applying the factored geotechnical bearing resistance at ULS (i.e. 125 kPa) on spread and strip footings with sizes ranging from 0.5 to 2.5 m widths, total and differential settlements are expected not to exceed 25 mm and 20 mm, respectively. Detailed settlement analyses should be completed for larger footings; however, it is anticipated that the proposed buildings will not require larger footing sizes.

In calculation of the geotechnical bearing resistance and the settlement of the foundations, it was assumed that proper moisture barrier system will be employed to minimize moisture fluctuation in the clay stratum. The geotechnical bearing resistance and pressure presented above has been determined for vertical, concentric loading as described in the CFEM.

The ultimate lateral resistance of footings may be calculated by considering the sliding resistance acting along the footing base and the passive earth pressure resistance of permanent soil on the side of the buried structure opposite the applied lateral load. The ultimate sliding resistance at the foundation base may be calculated multiplying the total vertical load acting on the foundation by the coefficient of friction. A coefficient of friction of 0.25 is recommended between concrete foundation base and the soil bearing surface. A geotechnical resistance factor of 0.8 should be considered for factored lateral capacity of the foundation.

Bearing surfaces shall be protected from ingress of free water, typically resulting in softening of the soil. Footings must not be placed on fill, organic, disturbed, or frozen soil. Bearing material that becomes frozen, dried or softened must be removed and replaced with concrete, or the footings shall be extended to reach material in an unaffected condition. It is also essential the foundation soil not be allowed to freeze after the concrete for the footing has been placed. All foundation elements should be placed on undisturbed and clean surfaces. Trees or vegetation in the vicinity of the building structure should be avoided since those could potentially extract moisture from the soil by transpiration.

The prepared bearing surface shall be reviewed by WSP's geotechnical engineering staff to confirm that the bearing surface conditions are consistent with the design assumptions presented in this report.

6.6.3 Slab-on-Grade

Non-structural cast-in-place concrete slabs-on-grade placed on the existing highly plastic subgrade is likely to experience settlement with decrease of soil moisture within heated building structures. In order to reduce the severity of potential damages to non-structural slabs-on-grade by heaving or differential settlements, it is recommended to sub-excavate the existing clay 600 mm below the proposed slab-on-grade and install a gravel base-course comprising minimum 500 mm of clean, well-graded 25 mm minus crushed gravel. The gravel fill should be placed in lifts not exceeding 300 mm loose measure and compacted to minimum 98% of its SPMDD, within $\pm 3\%$ of its OMC. A non-woven geotextile (such as NILEX 4546 or similar) should be placed as a separator between cohesive subgrade soil and the gravel fill to prevent migration of coarse-grained base course material into the subgrade during compaction.

Slabs-on-grade should be floated independently of all load-bearing walls and columns to minimize the potential for damage from differential settlement between these elements. The gravel base-course would act as a capillary break between soil and concrete, and also provide more uniform settlement characteristics in case of non-uniform soil settlement. However, a non-structural slab-on-grade may exhibit larger vertical movements as the native soil may expand or shrink. If the risk of larger settlement is not acceptable, a suspended structural slab supported by footings/piles should be considered. The reinforced suspended slab would reduce the risk of potential vertical movements of the floor slab. The suspended slab should be placed of minimum 150 mm of void space or compressible void form to separate the slab from the soil.

It is important that the subgrade surface be protected from moisture changes and freezing temperatures both during and after construction in order to minimize the potential of frost heave/thaw, expansion/shrinkage and softening action on the subgrade soils.

It should be noted that even for properly compacted engineered fill, consolidation may occur over time which may result in settlement of surface supported structures such as slab-on-grade and/or pavements. Furthermore, long-term settlement and heaving of the existing clay soil, if not replaced using engineered granular fill is expected,

resulting in additional maintenance and repair requirements and reduced design life on any non-structural slab-on-grade placed on the existing soil. If the settlement and heaving cannot be tolerated, a structural concrete slab should be considered.

The recommended vertical subgrade modulus (K_v1) for the design of slab-on-grade for the stiff subgrade condition at the site is 10 MPa/m.

6.7 Utilities Installation

All underground pipes must be placed on competent ground. Any soft, loose, organic, or otherwise deleterious soil existing below the pipes must be over-excavated and replaced with suitable well-compacted material. The subgrade soil and bedding soil beneath the pipes should not be allowed to freeze. All fill and backfill material in the trench should be free of wet, organic, and/or frozen soil. All material for filling and backfilling purposes should be placed in lifts not exceeding 200 mm in thickness (loose measure) and compacted to 98% SPMDD.

6.8 Gravel Pavement Structure

The gravel pavement structure design in this section can be considered for any roads or laydown areas on site. The site preparation recommendations in Section 6.3 should be followed.

The gravel road structure was designed using the Giroud-Han method of design (Giroud and Han, 2004a; 2004b). Traffic loading information was not provided to WSP. The design inputs in Table 10 were used in the design.

Table 10 Gravel Road Structure Design Inputs

Design Input	Value
Axle Load (kN)	80
Number of Axle Passes	10,000
Tire Pressure (kPa)	689
Rut Depth (mm)	40
California Bearing Ratio (CBR) of Roadway Aggregate (%)	20
Subgrade CBR (%)	2.7

The gravel road structure design in Table 11 is provided, assuming that routine maintenance is completed on the gravel road structure.

Table 11 Gravel Road Structure

Material	Thickness Without Reinforcement (mm)	Thickness With Reinforcement (mm)
Gravel Base Course (GBC)	275	100
Sub-base Course	275	150
Reinforcement	None	Tensar TX5 (or equivalent) Placed Below Sub-base Course

The gravel structure should be compacted in lift thickness not exceeding 150 mm to a minimum of 100% SPMD within -3 to +1% of OMC.

Periodic maintenance of the gravel road will be required. For serviceability considerations, rutting of the gravel road should not be permitted to exceed a maximum depth of 40 mm. During and immediately following prolonged precipitation events and during spring thaw, it should be anticipated that the proposed structure may require increased maintenance.

Positive drainage away from the road structure is required. The subgrade materials encountered at the site are considered frost susceptible and liable to experience frost heaving. Appropriate drainage of subgrade surfaces should be provided prior to sub-base course placement.

A non-woven geotextile with the minimum grab strength of 600 N should be placed between the prepared fine-grained subgrade and granular fill to prevent the migration of coarse particles into the cohesive subgrade during compaction. The non-woven geotextile for separation should be installed as per the manufacturers' specifications.

6.9 Seismic Site Classification

Available information was reviewed to assess the seismic classification of the project site. The reviewed information included the borehole logs, the NBCC, and CFEM.

The site classification for seismic site response is provided in Sections 4.1.8.4 of NBCC and in Chapter 6 of CFEM, and is determined using the expected shear wave velocity, standard penetration resistance N-value and undrained shear strength within the top 30 m. Based on the available information, the average ground properties in the upper 30 m at the site are inferred to be stiff soil, corresponding to Class D as per Table 6.1A, CFEM.

Liquefaction potential due to an earthquake is very low due to soil type and relative density / consistency. Seismic hazards in the site area are very low and significant events are very rare.

6.10 Sulfate Exposure Class

One soluble sulfate test was completed within the clay as summarized in Table 6.

The test result indicated negligible degree of exposure to sulfate attack on concrete in contact with the soil as per degree CSA A23.1-14. Any imported soils should be tested for water-soluble sulfate concentration and associated sulfate exposure classification.

Concrete properties should be specified by the structural engineer to meet structural requirements and exposure to freeze and thawing and/or chlorides.

7 CLOSURE

This report has been prepared for the sole benefit of the Schott's Lake RV and Guest and is not intended for use by others. This report may not be reproduced without the prior written consent of WSP. Contractors undertaking the work must draw their own interpretations of the factual information provided in this report as they affect the construction costs, procedures, and scheduling.

As boreholes are a localized representation of the total study area, subsurface conditions may vary between and/or beyond the borehole locations. If conditions encountered at the site vary significantly from that reported

herein, WSP should be notified immediately so that our interpretation and recommendations can be reviewed and revised if necessary.

8 REFERENCES

Alberta Geological Survey (2019). *Alberta Interactive Map Database*. Information retrieved on June 25, 2021 from <https://ags-aer.maps.arcgis.com/>.

Alberta Geological Survey (2019). *Alberta Interactive Map Database*. Information retrieved on July 30, 2021 from <https://ags-aer.maps.arcgis.com/>.

Alberta Private Sewage Systems Standard of Practice 2015

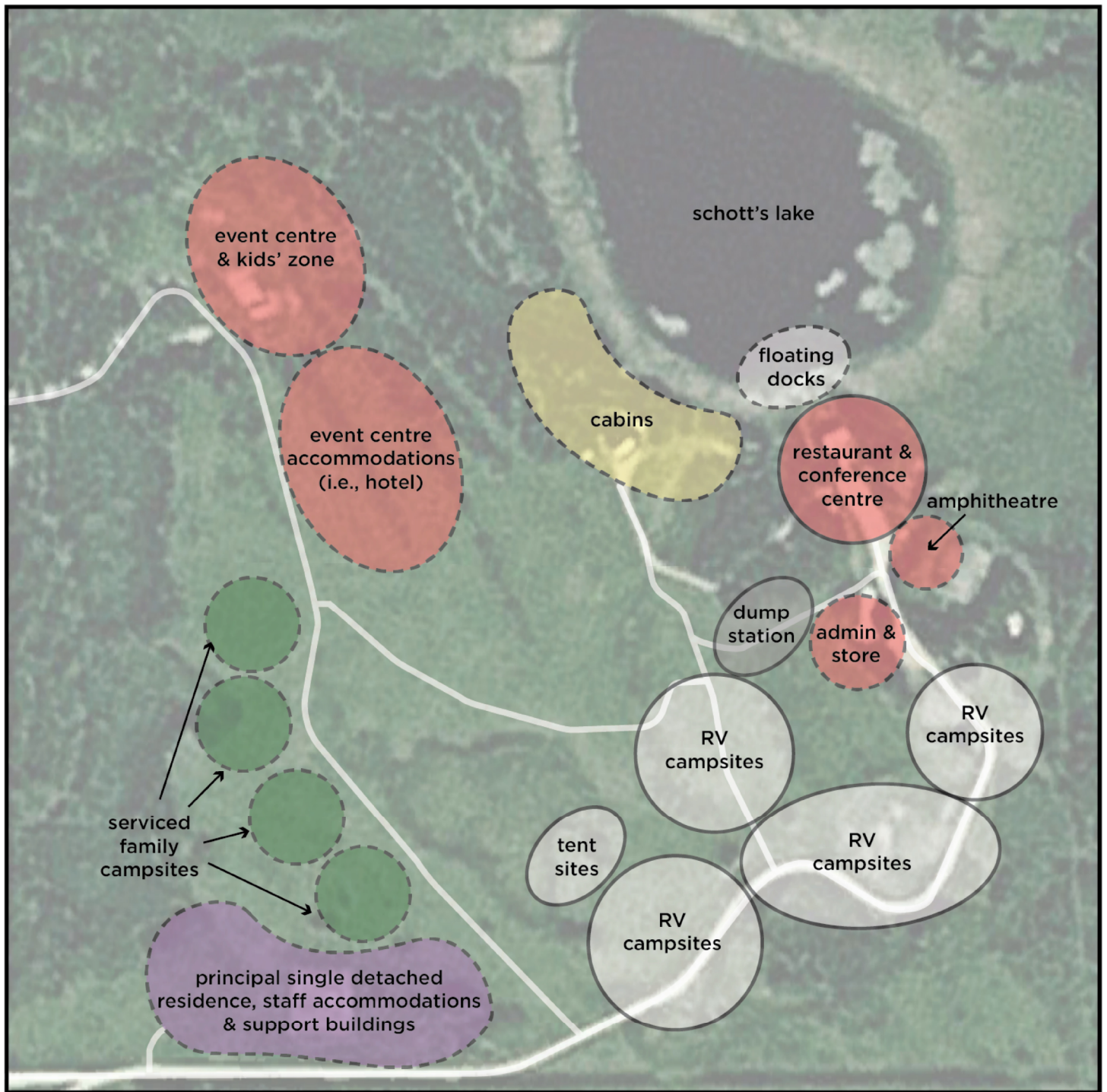
Canadian Standards Association; 2014; Concrete Materials and Methods of Concrete Construction, Canadian Standards Association International; CSA A23.1-14.

APPENDIX










APPENDIX

A BOREHOLE LOCATION PLAN AND BOREHOLE LOGS



legend

- | | | |
|--|--|--|
|  future development |  standard campsites |  commercial activities |
|  existing development |  family campsites |  maintenance activities |
| |  cabins | |



SOURCE				wsp				Site Plan Schott's Lake Mountain View, AB			
Google Earth				CLIENT NAME Moundtain View County				PROJECT NUMBER 211-04399-00			
DRAWN KB	CHECK JL	APPR -	EPSP -	DATE 2021-07-15	SCALE -	FIGURE NUMBER Figure 1				REV. 0	



MODIFIED UNIFIED SOIL CLASSIFICATION SYSTEM											
MAJOR DIVISIONS			GROUP SYMBOLS		TYPICAL NAMES	LABORATORY CLASSIFICATION CRITERIA					
COARSE GRAINED SOILS (More than half of material is retained in No.200 Sieve (0.075 mm))	GRAVELS (More than half of coarse fraction is larger than No. 4 sieve size (4.75 mm))	CLEAN GRAVELS ($< 5\%$ fines)	GW		Well-graded gravels, gravel-sand mixtures, little or no fines	Determine amount of sand and gravel from graded size curve Depending on percent of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows: $< 5\%$GW, GP, SW, SP $> 12\%$GM, GC, SM, SC $5 - 12\%$Borderline cases requiring dual symbols**	$C_u = D_{60}/D_{10} : C_u \geq 4$ $C_c = (D_{30})^2/(D_{10} \times D_{60}) : 1 < C_c < 3$				
		GRAVELS WITH FINES ($> 12\%$ fines)	GP		Poorly graded gravels, gravel-sand mixtures, little or no fines		Not meeting all gradations requirements for GW				
			GM		Silty gravels, gravel-sand-silt mixtures		Atterberg Limits below "A" Line or P.I. < 4	Above "A" Line with P.I. Between 4 and 7 are borderline cases requiring use of dual symbols			
		GC		Clayey gravels, gravel-sand-clay mixtures	Atterberg Limits above "A" Line with P.I. > 7						
	SANDS (More than half of coarse fraction is smaller than No. 4 sieve size (4.75 mm))	CLEAN SANDS ($< 5\%$ fines)	SW		Well-graded sands, gravelly sands, little or no fines		$C_u = D_{60}/D_{10} : C_u \geq 6$ $C_c = (D_{30})^2/(D_{10} \times D_{60}) : 1 < C_c < 3$				
		DIRTY SANDS ($> 12\%$ fines)	SP		Poorly graded sands, gravelly sands, little or no fines		Not meeting all gradations requirements for SW				
			SM		Silty Sands; sand-silt mixtures		Atterberg Limits below "A" Line or P.I. < 4	Limits plotting in hatched zone with P.I. Between 4 and 7 are borderline cases requiring use of dual symbols			
			SC		Clayey sands; sand-clay mixtures		Atterberg Limits above "A" Line with P.I. > 7				
			FINE GRAINED SOILS (More than half of material pass the No. 200 sieve size (0.075 mm))	CLAYS (Above "A" Line on PLASTICITY CHART: negligible organic content)	$W_L < 30\%$		CL		Inorganic clays of low plasticity, gravelly clays, sandy clays, silty clays, lean clays	 (NOTE: For soils passing No. 400 sieve & sieve size in μm)	
		$30 < W_L < 50\%$			CI			Inorganic clays of medium plasticity, gravelly clays, sandy clays, silty clays			
$W_L > 50\%$	CH				Inorganic clays of high plasticity, fat clays						
SILTS (Below "A" Line; negligible organic content)	$W_L < 50\%$	ML			Inorganic silts and very fine sands, silty or clayey fine sands, clayey silts with slight plasticity						
	$W_L > 50\%$	MH			Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts						
ORGANIC SILTS AND CLAYS (Below "A" Line)	$W_L < 50\%$	OL			Organic silts and organic silty clays of low plasticity						
	$W_L > 50\%$	OH			Organic clays of medium to high plasticity, organic silts						
	HIGHLY ORGANIC SOILS	Pt			Peat and other highly organic soils	Strong colour or odor and fibrous textures					
SOIL COMPONENTS					RELATIVE DENSITY AND CONSISTENCY						
Fraction		U.S. Standard Sieve Size		Percentage (by weight)	Description	Cohesionless Soils		Cohesive Soils			
		Passing	Retained			Relative Density	SPT (N) Value	Consistency	Undrained Shear Strength (kPa)		
Gravel	Coarse	76 mm	19 mm	35-50	AND	Very Loose	0-4	Very Soft	< 12		
	Fine	19 mm	4.75 mm			Loose	4-10	Soft	12-25		
Sand	Coarse	4.75 mm	2.00 mm	20-35	Y	Compact	10-30	Firm	25-50		
	Medium	2.00 mm	0.425 mm			Dense	30-50	Stiff	50-100		
	Fine	0.425 mm	0.075 mm	10-20	SOME	Very Dense	> 50	Very Stiff	100-200		
		0.075 mm or less						Hard	> 200		
Fines (Silt or Clay)		0.075 mm or less		1-10	TRACE						
Oversize Material	Cobbles	76 mm to 300 mm									
	Boulders	> 300 mm									
Prepared By JL & SR Revision 1 - April 2019											



BOREHOLE RECORD: BH21-01

Page 1 of 1

Prepared by: **Khalid Samriny**
Reviewed by: **Sonia R. Polo**

Date (Start): **6/17/2021**
Date (End): **6/17/2021**

Project Name: **Schott's Lake RV and Guest Ranch Ranch Inc.**
Site:
Sector:
Client: **Schott's Lake RV and Guest**

Project Number: **211-04399-00**
Coordinates: **X = 114.867957 °W**
Y = 51.806684 °N
Surface Elevation: **Not measured**

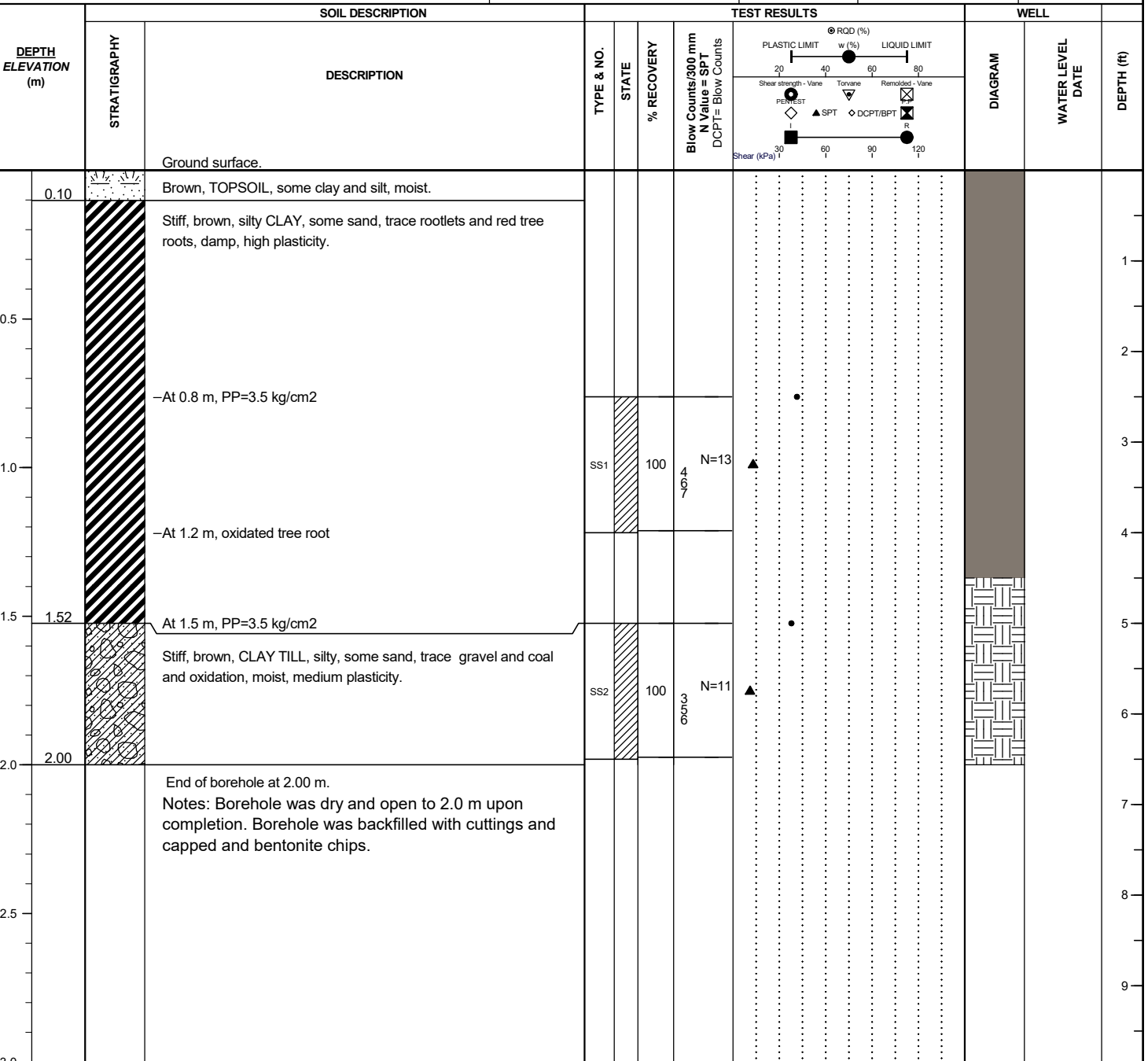
Drilling Company: **All Service Drilling**
Drilling Equipment: **Diedrich D-90**
Drilling Method: **Solid Stem Auger / DCPT**
Borehole Diameter: **152 mm**

WELL DETAILS
COPING Elevation :
SCREEN Bottom Depth :
Length :
Opening :
WATER Elevation:
WATER Date:
Water Level Free phase

SAMPLE TYPE
GS - Grab sample
SS - Split Spoon
ST - Shelby Tube

TESTS
AL - Atterberg Limits
DCPT - Dynamic Cone Penetration Test
GSA - Grain Size Analysis
PENTEST - Pocket Penetrometer
Sg - Specific Gravity
SPT - N Value (Blow Counts/300mm)
UCS - Uniax. Comp. Strength
w - Moisture Content
wL - Liquidity Limit
wP - Plasticity Limit

SAMPLE STATE
Undisturbed
Remoulded
Lost
Cored



Notes: Borehole was dry and open to 2.0 m upon completion. Borehole was backfilled with cuttings and capped and bentonite chips.



BOREHOLE RECORD: BH21-02

Page 1 of 1

Prepared by: **Khalid Samriny**
Reviewed by: **Sonia R. Polo**

Date (Start): **6/17/2021**
Date (End): **6/17/2021**

Project Name: **Schott's Lake RV and Guest Ranch Ranch Inc.**
Site:
Sector:
Client: **Schott's Lake RV and Guest**

Project Number: **211-04399-00**
Coordinates: **X = 114.868771 °W**
Y = 51.806904 °N
Surface Elevation: **Not measured**

Drilling Company: **All Service Drilling**
Drilling Equipment: **Diedrich D-90**
Drilling Method: **Solid Stem Auger / DCPT**
Borehole Diameter: **152 mm**

WELL DETAILS
COPING Elevation :
SCREEN Bottom Depth :
Length :
Opening :
WATER Elevation:
WATER Date:
Water Level Free phase

SAMPLE TYPE
GS - Grab sample
SS - Split Spoon
ST - Shelby Tube

TESTS
AL - Atterberg Limits
DCPT - Dynamic Cone Penetration Test
GSA - Grain Size Analysis
PENTEST - Pocket Penetrometer
Sg - Specific Gravity
SPT - N Value (Blow Counts/300mm)
UCS - Uniax. Comp. Strength
w - Moisture Content
wL - Liquidity Limit
wP - Plasticity Limit

SAMPLE STATE
Undisturbed
Remoulded
Lost
Cored

DEPTH ELEVATION (m)	STRATIGRAPHY	SOIL DESCRIPTION		TEST RESULTS				WELL		
		DESCRIPTION	TYPE & NO.	STATE	% RECOVERY	Blow Counts/300 mm N Value = SPT DCPT = Blow Counts	Plastic Limit w (%) Liquid Limit Shear strength - Vane Torvane Remoulded - Vane	DIAGRAM	WATER LEVEL DATE	DEPTH (ft)
0.30		Ground surface.								
0.5		Compact, brown, rounded and angular coarse sandy GRAVEL, moist (fill).								1
1.0		Firm, brown, CLAY, silty, some sand, trace gravel and rootlets, moist, high plasticity. -At 0.8 m, PP=1.5 kg/cm2	GS1							2
1.5		Atterberg Limits (1.5m): LL 67% - PL 26% - PI 41% Hydrometer (1.5m): 3% Gravel, 15% Sand, 38% Silt, 44% Clay	SS2		33	N=8				3
2.0		-At 2.3 m, PP=1.25 kg/cm2, trace coal	GS3							4
2.5		-At 3.1 m, trace gravel	SS4		100	N=10				5
3.0		-At 5.3 m, PP=1.75 kg/cm2	GS5							6
3.5			SS6		100	N=11				7
4.0										8
4.5										9
5.0		End of borehole at 5.10 m. Notes: Borehole was dry and open to 5.1 m upon completion. Borehole was backfilled with cuttings and capped with bentonite chips.								10
5.5										11
6.0										12

Notes: Borehole was dry and open to 5.1 m upon completion. Borehole was backfilled with cuttings and capped with bentonite chips.



BOREHOLE RECORD: BH21-03

Page 1 of 1

Prepared by: **Khalid Samriny**
Reviewed by: **Sonia R. Polo**

Date (Start): **6/17/2021**
Date (End): **6/17/2021**

Project Name: **Schott's Lake RV and Guest Ranch Ranch Inc.**
Site:
Sector:
Client: **Schott's Lake RV and Guest**

Project Number: **211-04399-00**
Coordinates: **X = 114.873188 °W**
Y = 51.808272 °N
Surface Elevation: **Not measured**

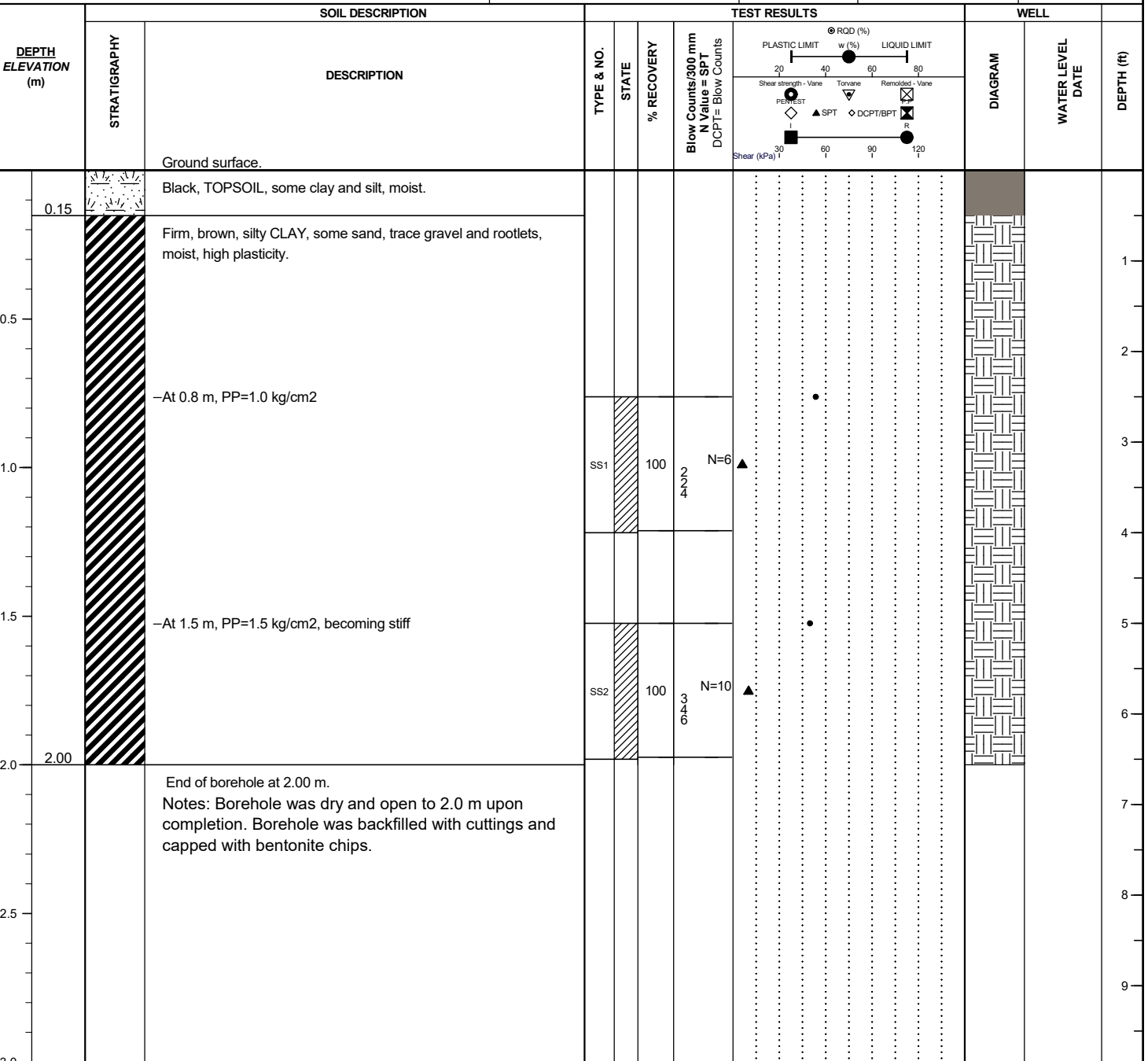
Drilling Company: **All Service Drilling**
Drilling Equipment: **Diedrich D-90**
Drilling Method: **Solid Stem Auger / DCPT**
Borehole Diameter: **152 mm**

WELL DETAILS
COPING Elevation :
SCREEN Bottom Depth :
Length :
Opening :
WATER Elevation:
WATER Date:
Water Level Free phase

SAMPLE TYPE
GS - Grab sample
SS - Split Spoon
ST - Shelby Tube

TESTS
AL - Atterberg Limits
DCPT - Dynamic Cone Penetration Test
GSA - Grain Size Analysis
PENTEST - Pocket Penetrometer
Sg - Specific Gravity
SPT - N Value (Blow Counts/300mm)
UCS - Uniax. Comp. Strength
w - Moisture Content
wL - Liquidity Limit
wP - Plasticity Limit

SAMPLE STATE
Undisturbed
Remoulded
Lost
Cored



Notes: Borehole was dry and open to 2.0 m upon completion. Borehole was backfilled with cuttings and capped with bentonite chips.



BOREHOLE RECORD: BH21-04

Page 1 of 1

Prepared by: **Khalid Sarminy**
Reviewed by: **Sonia R. Polo**

Date (Start): **6/17/2021**
Date (End): **6/17/2021**

Project Name: **Schott's Lake RV and Guest Ranch Ranch Inc.**
Site:
Sector:
Client: **Schott's Lake RV and Guest**

Project Number: **211-04399-00**
Coordinates: **X = 114.872815 °W**
Y = 51.807843 °N
Surface Elevation: **Not measured**

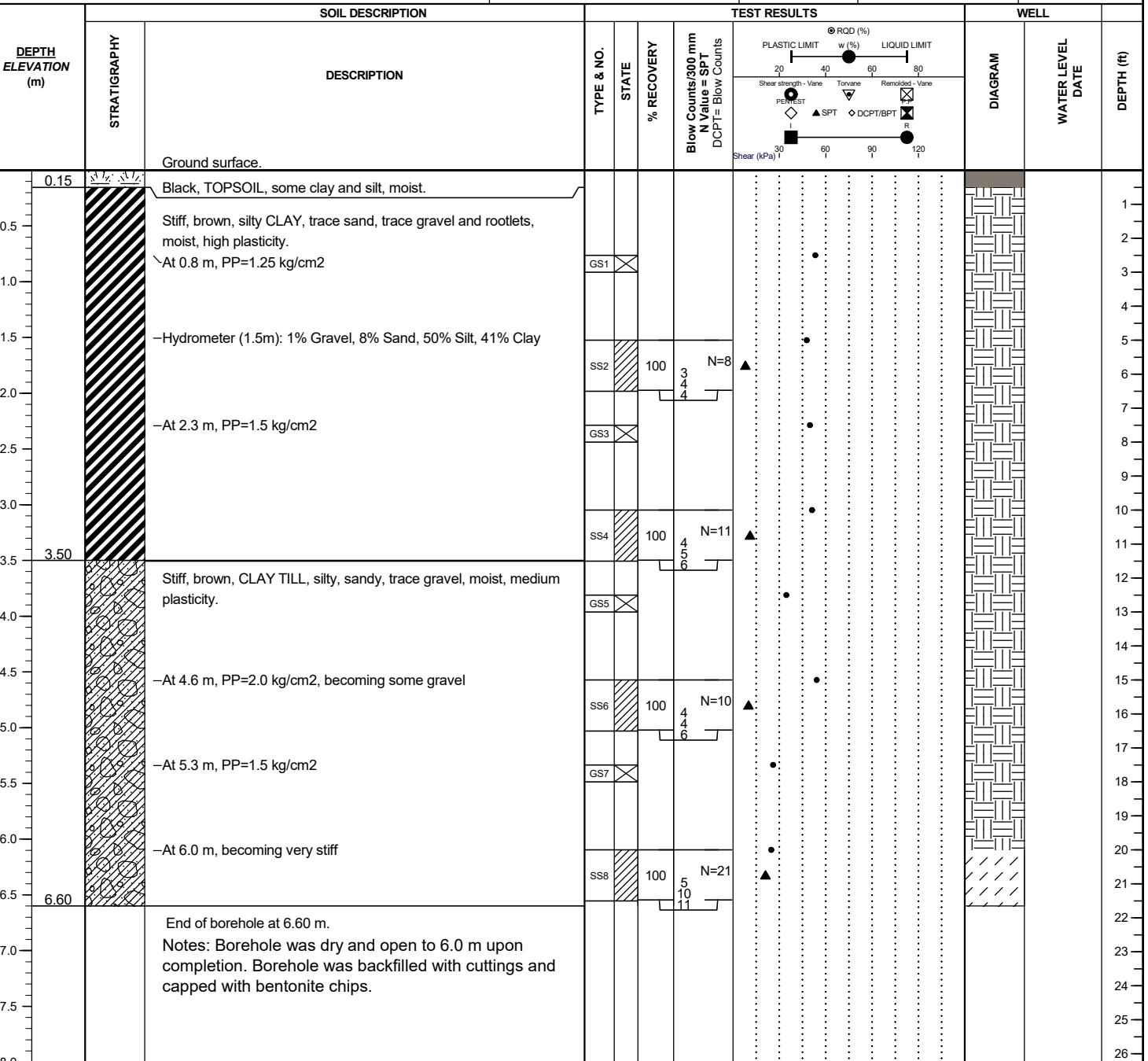
Drilling Company: **All Service Drilling**
Drilling Equipment: **Diedrich D-90**
Drilling Method: **Solid Stem Auger / DCPT**
Borehole Diameter: **152 mm**

WELL DETAILS
COPING Elevation :
SCREEN Bottom Depth :
Length :
Opening :
WATER Elevation:
WATER Date:
Water Level Free phase

SAMPLE TYPE
GS - Grab sample
SS - Split Spoon
ST - Shelby Tube

TESTS
AL - Atterberg Limits
DCPT - Dynamic Cone Penetration Test
GSA - Grain Size Analysis
PENTEST - Pocket Penetrometer
Sg - Specific Gravity
SPT - N Value (Blow Counts/300mm)
UCS - Uniax. Comp. Strength
w - Moisture Content
wL - Liquidity Limit
wP - Plasticity Limit

SAMPLE STATE
Undisturbed
Remoulded
Lost
Cored



Notes: Borehole was dry and open to 6.0 m upon completion. Borehole was backfilled with cuttings and capped with bentonite chips.



BOREHOLE RECORD: BH21-05

Page 1 of 1

Prepared by: **Khalid Samriny**
Reviewed by: **Sonia R. Polo**

Date (Start): **6/17/2021**
Date (End): **6/17/2021**

Project Name: **Schott's Lake RV and Guest Ranch Ranch Inc.**
Site:
Sector:
Client: **Schott's Lake RV and Guest**

Project Number: **211-04399-00**
Coordinates: **X = 114.872279 °W**
Y = 51.806700 °N
Surface Elevation: **Not measured**

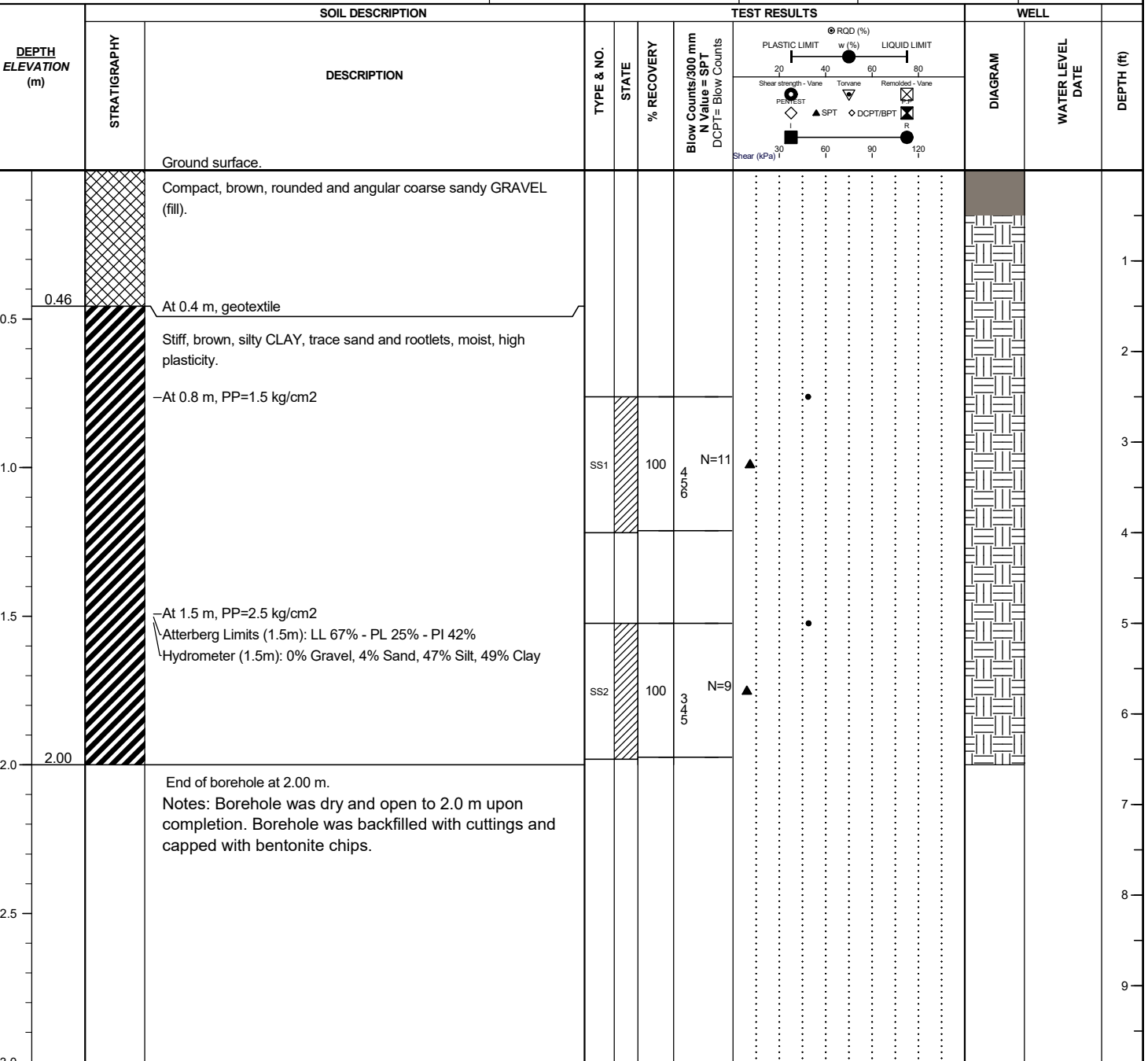
Drilling Company: **All Service Drilling**
Drilling Equipment: **Diedrich D-90**
Drilling Method: **Solid Stem Auger / DCPT**
Borehole Diameter: **152 mm**

WELL DETAILS
COPING Elevation :
SCREEN Bottom Depth :
Length :
Opening :
WATER Elevation:
WATER Date:
Water Level Free phase

SAMPLE TYPE
GS - Grab sample
SS - Split Spoon
ST - Shelby Tube

TESTS
AL - Atterberg Limits
DCPT - Dynamic Cone Penetration Test
GSA - Grain Size Analysis
PENTEST - Pocket Penetrometer
Sg - Specific Gravity
SPT - N Value (Blow Counts/300mm)
UCS - Uniax. Comp. Strength
w - Moisture Content
wL - Liquidity Limit
wP - Plasticity Limit

SAMPLE STATE
Undisturbed
Remoulded
Lost
Cored



Notes: Borehole was dry and open to 2.0 m upon completion. Borehole was backfilled with cuttings and capped with bentonite chips.



BOREHOLE RECORD: BH21-06

Page 1 of 1

Prepared by: **Khalid Sarminy**
Reviewed by: **Sonia R. Polo**

Date (Start): **6/17/2021**
Date (End): **6/17/2021**

Project Name: **Schott's Lake RV and Guest Ranch Ranch Inc.**
Site:
Sector:
Client: **Schott's Lake RV and Guest**

Project Number: **211-04399-00**
Coordinates: **X = 114.871640 °W**
Y = 51.806159 °N
Surface Elevation: **Not measured**

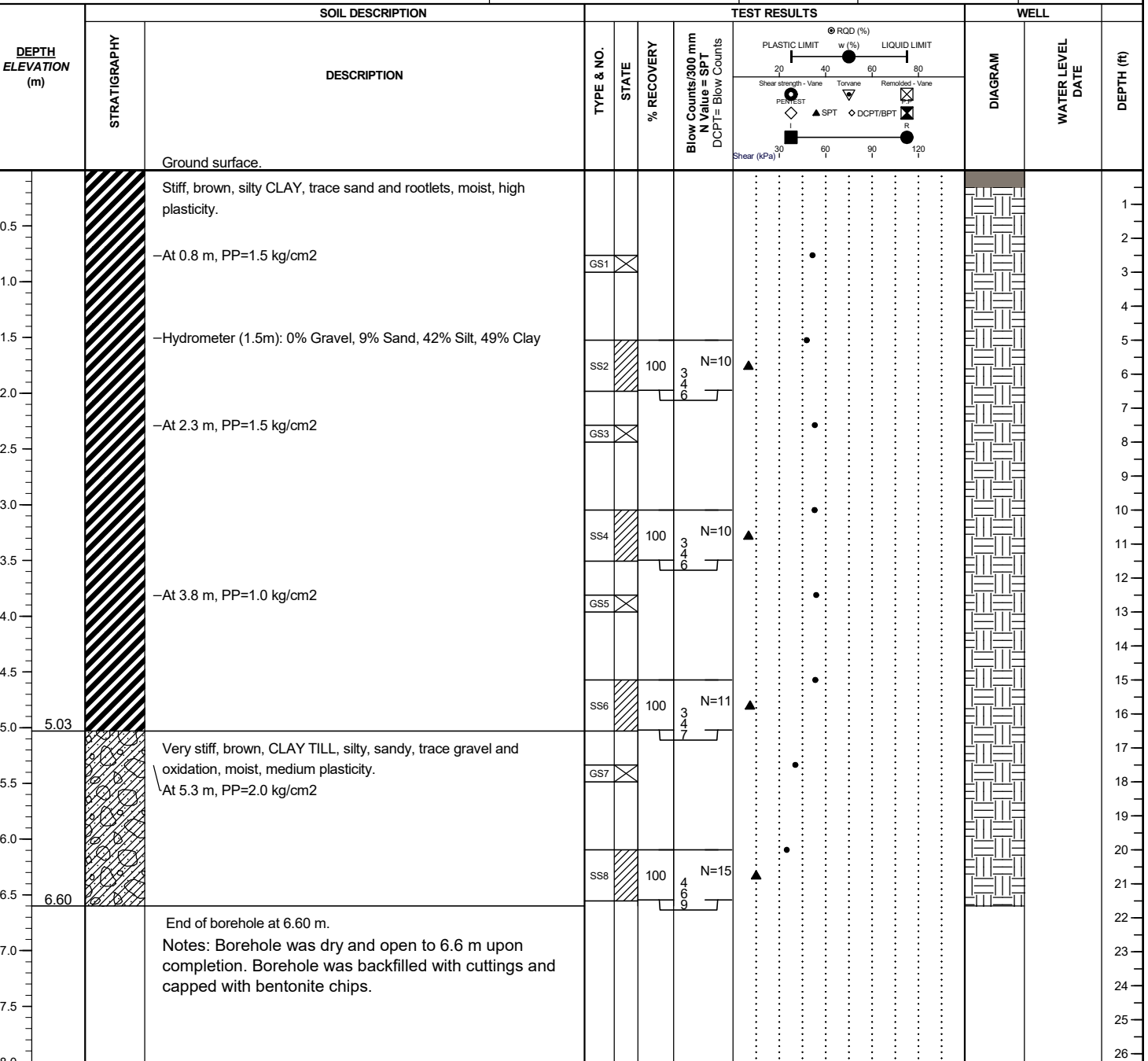
Drilling Company: **All Service Drilling**
Drilling Equipment: **Diedrich D-90**
Drilling Method: **Solid Stem Auger / DCPT**
Borehole Diameter: **152 mm**

WELL DETAILS
COPING Elevation :
SCREEN Bottom Depth :
Length :
Opening :
WATER Elevation:
WATER Date:
Water Level Free phase

SAMPLE TYPE
GS - Grab sample
SS - Split Spoon
ST - Shelby Tube

TESTS
AL - Atterberg Limits
DCPT - Dynamic Cone Penetration Test
GSA - Grain Size Analysis
PENTEST - Pocket Penetrometer
Sg - Specific Gravity
SPT - N Value (Blow Counts/300mm)
UCS - Uniax. Comp. Strength
w - Moisture Content
wL - Liquidity Limit
wP - Plasticity Limit

SAMPLE STATE
Undisturbed
Remoulded
Lost
Cored



Notes: Borehole was dry and open to 6.6 m upon completion. Borehole was backfilled with cuttings and capped with bentonite chips.



BOREHOLE RECORD: BH21-07

Page 1 of 1

Prepared by: **Khalid Samriny**
Reviewed by: **Sonia R. Polo**

Date (Start): **6/17/2021**
Date (End): **6/17/2021**

Project Name: **Schott's Lake RV and Guest Ranch Ranch Inc.**
Site:
Sector:
Client: **Schott's Lake RV and Guest**

Project Number: **211-04399-00**
Coordinates: **X = 114.872749 °W**
Y = 51.805596 °N
Surface Elevation: **Not measured**

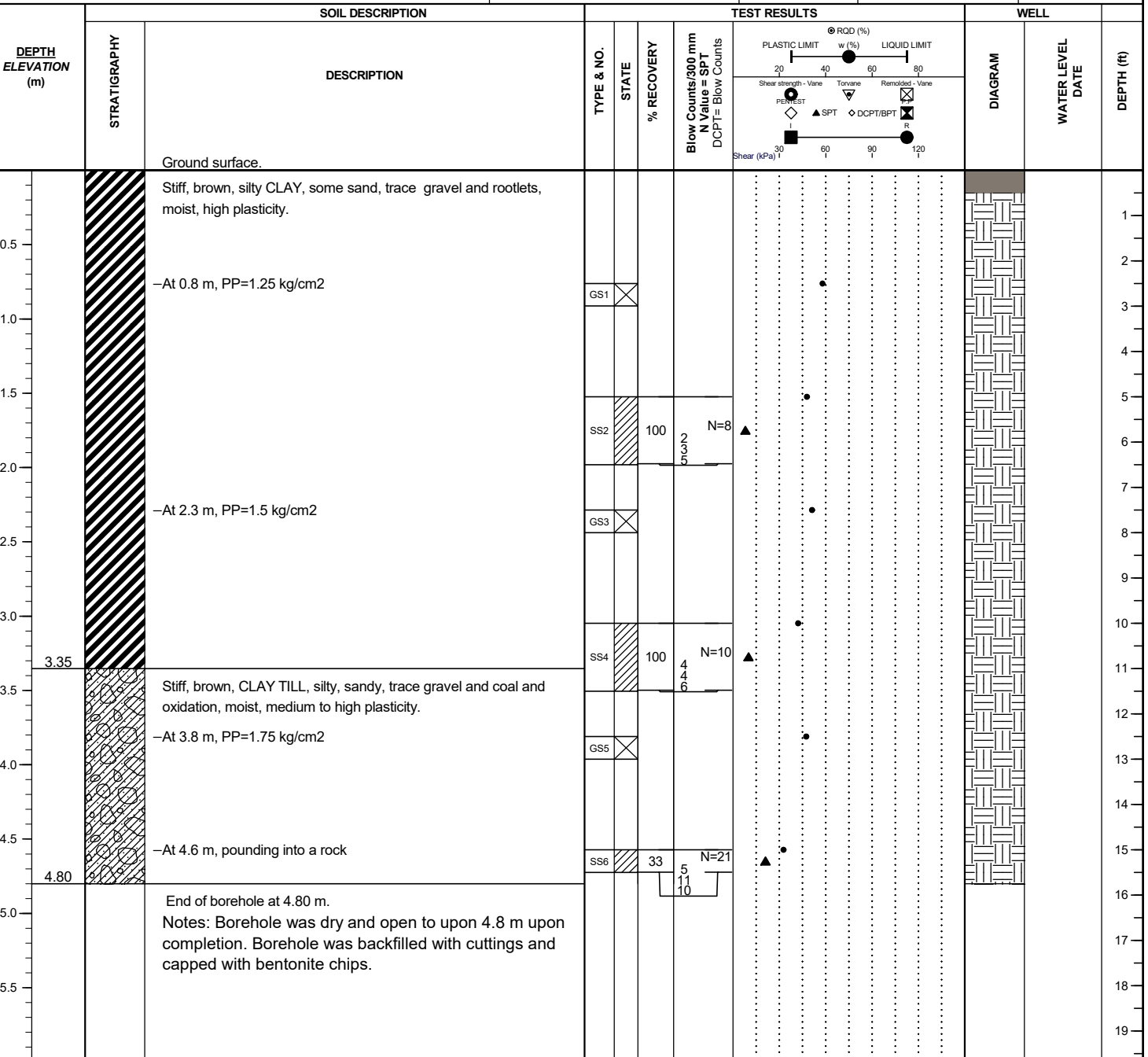
Drilling Company: **All Service Drilling**
Drilling Equipment: **Diedrich D-90**
Drilling Method: **Solid Stem Auger / DCPT**
Borehole Diameter: **152 mm**

WELL DETAILS
COPING Elevation :
SCREEN Bottom Depth :
Length :
Opening :
WATER Elevation:
WATER Date:
Water Level Free phase

SAMPLE TYPE
GS - Grab sample
SS - Split Spoon
ST - Shelby Tube

TESTS
AL - Atterberg Limits
DCPT - Dynamic Cone Penetration Test
GSA - Grain Size Analysis
PENTEST - Pocket Penetrometer
Sg - Specific Gravity
SPT - N Value (Blow Counts/300mm)
UCS - Uniax. Comp. Strength
w - Moisture Content
wL - Liquidity Limit
wP - Plasticity Limit

SAMPLE STATE
Undisturbed
Remoulded
Lost
Cored



Notes: Borehole was dry and open to upon 4.8 m upon completion. Borehole was backfilled with cuttings and capped with bentonite chips.



BOREHOLE RECORD: BH21-08

Page 1 of 1

Prepared by: **Khalid Samriny**
Reviewed by: **Sonia R. Polo**

Date (Start): **6/17/2021**
Date (End): **6/17/2021**

Project Name: **Schott's Lake RV and Guest Ranch Ranch Inc.**
Site:
Sector:
Client: **Schott's Lake RV and Guest**

Project Number: **211-04399-00**
Coordinates: **X = 114.872297 °W**
Y = 51.805147 °N
Surface Elevation: **Not measured**

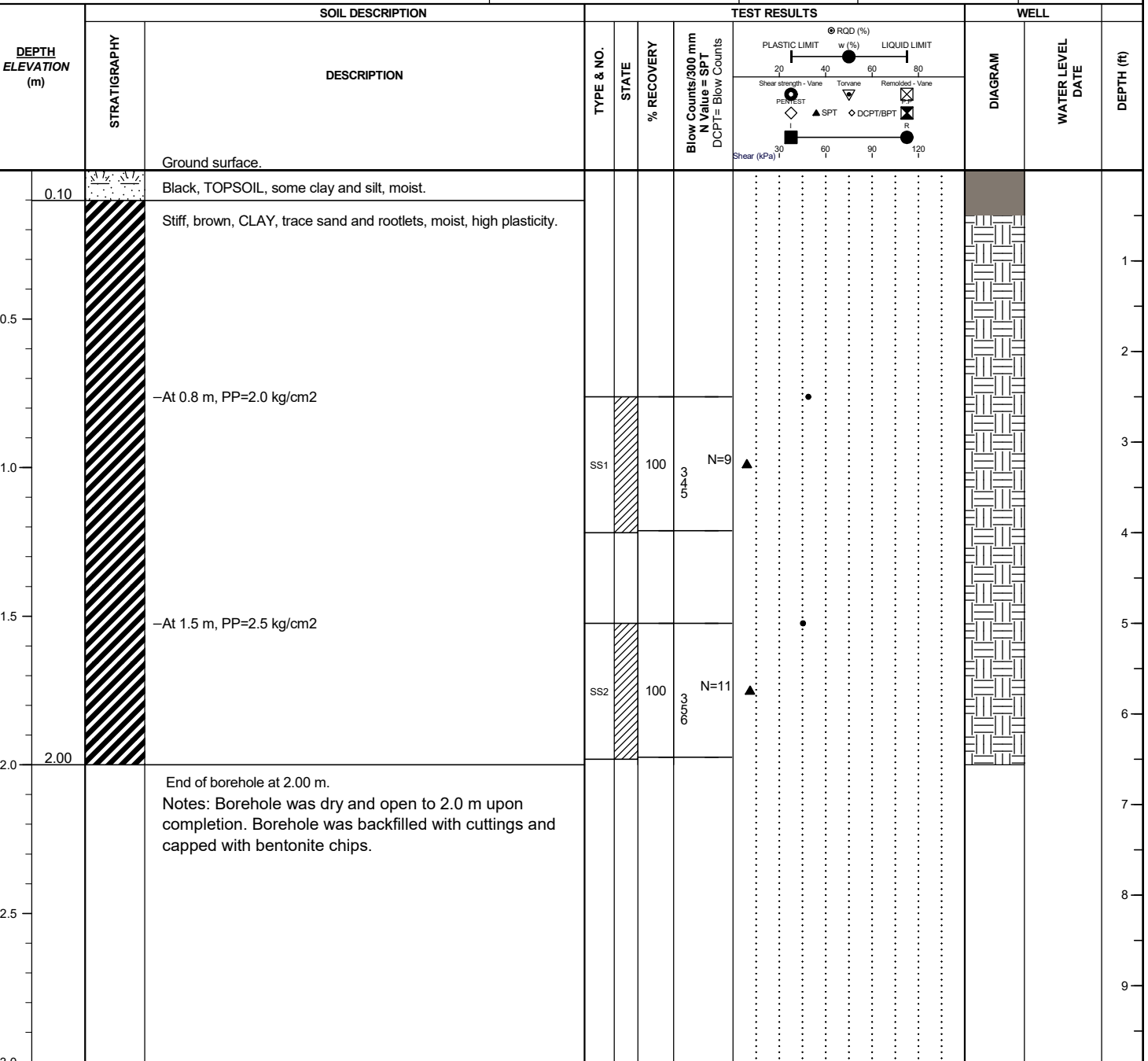
Drilling Company: **All Service Drilling**
Drilling Equipment: **Diedrich D-90**
Drilling Method: **Solid Stem Auger / DCPT**
Borehole Diameter: **152 mm**

WELL DETAILS
COPING Elevation :
SCREEN Bottom Depth :
Length :
Opening :
WATER Elevation:
WATER Date:
Water Level Free phase

SAMPLE TYPE
GS - Grab sample
SS - Split Spoon
ST - Shelby Tube

TESTS
AL - Atterberg Limits
DCPT - Dynamic Cone Penetration Test
GSA - Grain Size Analysis
PENTEST - Pocket Penetrometer
Sg - Specific Gravity
SPT - N Value (Blow Counts/300mm)
UCS - Uniax. Comp. Strength
w - Moisture Content
wL - Liquidity Limit
wP - Plasticity Limit

SAMPLE STATE
Undisturbed
Remoulded
Lost
Cored



Notes: Borehole was dry and open to 2.0 m upon completion. Borehole was backfilled with cuttings and capped with bentonite chips.



BOREHOLE RECORD: BH21-09

Page 1 of 1

Prepared by: **Khalid Samriny**
Reviewed by: **Sonia R. Polo**

Date (Start): **6/17/2021**
Date (End): **6/17/2021**

Project Name: **Schott's Lake RV and Guest Ranch Ranch Inc.**
Site:
Sector:
Client: **Schott's Lake RV and Guest**

Project Number: **211-04399-00**
Coordinates: **X = 114.872678 °W**
Y = 51.804432 °N
Surface Elevation: **Not measured**

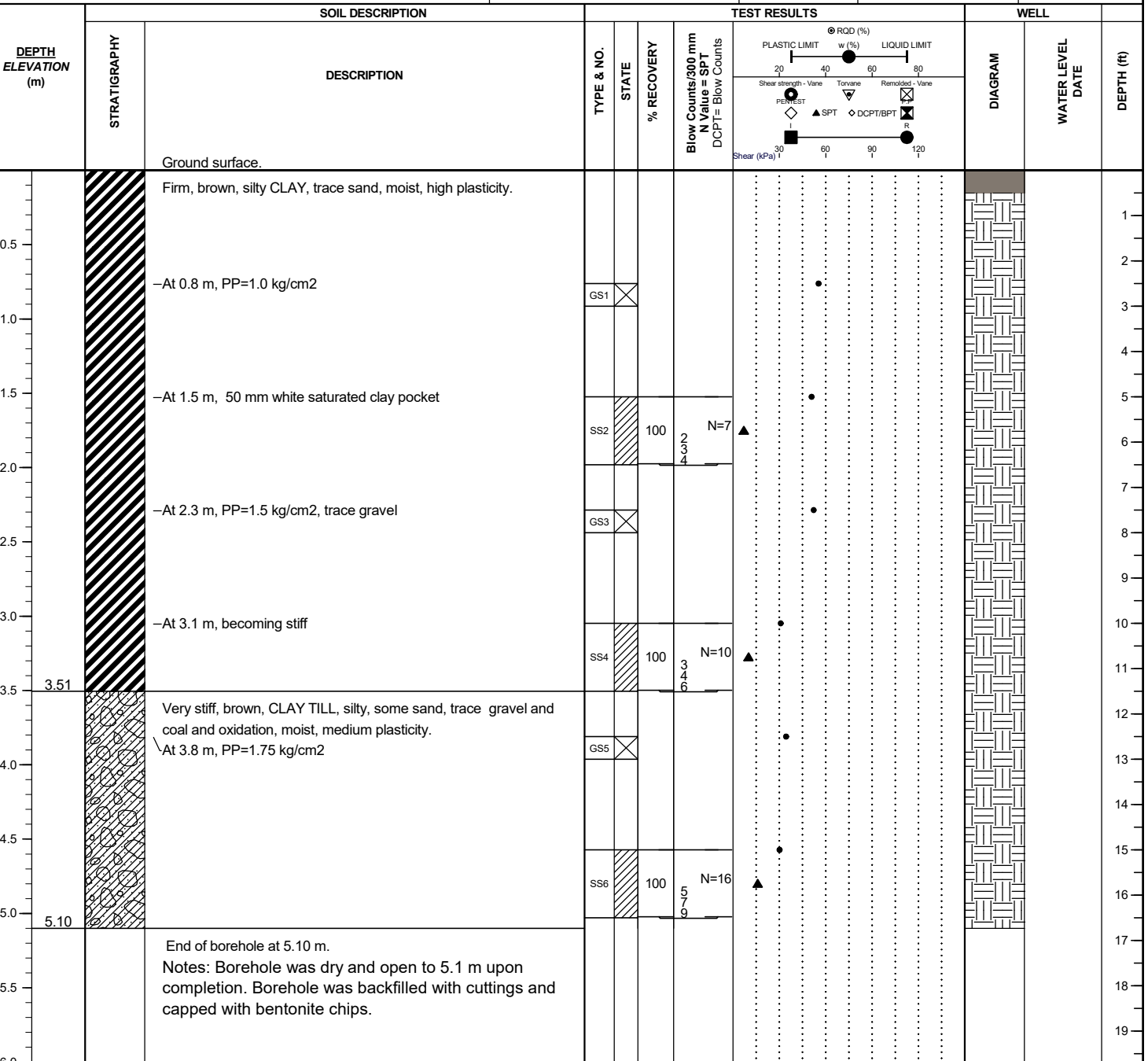
Drilling Company: **All Service Drilling**
Drilling Equipment: **Diedrich D-90**
Drilling Method: **Solid Stem Auger / DCPT**
Borehole Diameter: **152 mm**

WELL DETAILS
COPING Elevation :
SCREEN Bottom Depth :
Length :
Opening :
WATER Elevation:
WATER Date:
Water Level Free phase

SAMPLE TYPE
GS - Grab sample
SS - Split Spoon
ST - Shelby Tube

TESTS
AL - Atterberg Limits
DCPT - Dynamic Cone Penetration Test
GSA - Grain Size Analysis
PENTEST - Pocket Penetrometer
Sg - Specific Gravity
SPT - N Value (Blow Counts/300mm)
UCS - Uniax. Comp. Strength
w - Moisture Content
wL - Liquidity Limit
wP - Plasticity Limit

SAMPLE STATE
Undisturbed
Remoulded
Lost
Cored



Notes: Borehole was dry and open to 5.1 m upon completion. Borehole was backfilled with cuttings and capped with bentonite chips.



BOREHOLE RECORD: BH21-10

Page 1 of 1

Prepared by: **Khalid Samriny**
Reviewed by: **Sonia R. Polo**

Date (Start): **6/18/2021**
Date (End): **6/18/2021**

Project Name: **Schott's Lake RV and Guest Ranch Ranch Inc.**
Site:
Sector:
Client: **Schott's Lake RV and Guest**

Project Number: **211-04399-00**
Coordinates: **X = 114.871515 °W**
Y = 51.803664 °N
Surface Elevation: **Not measured**

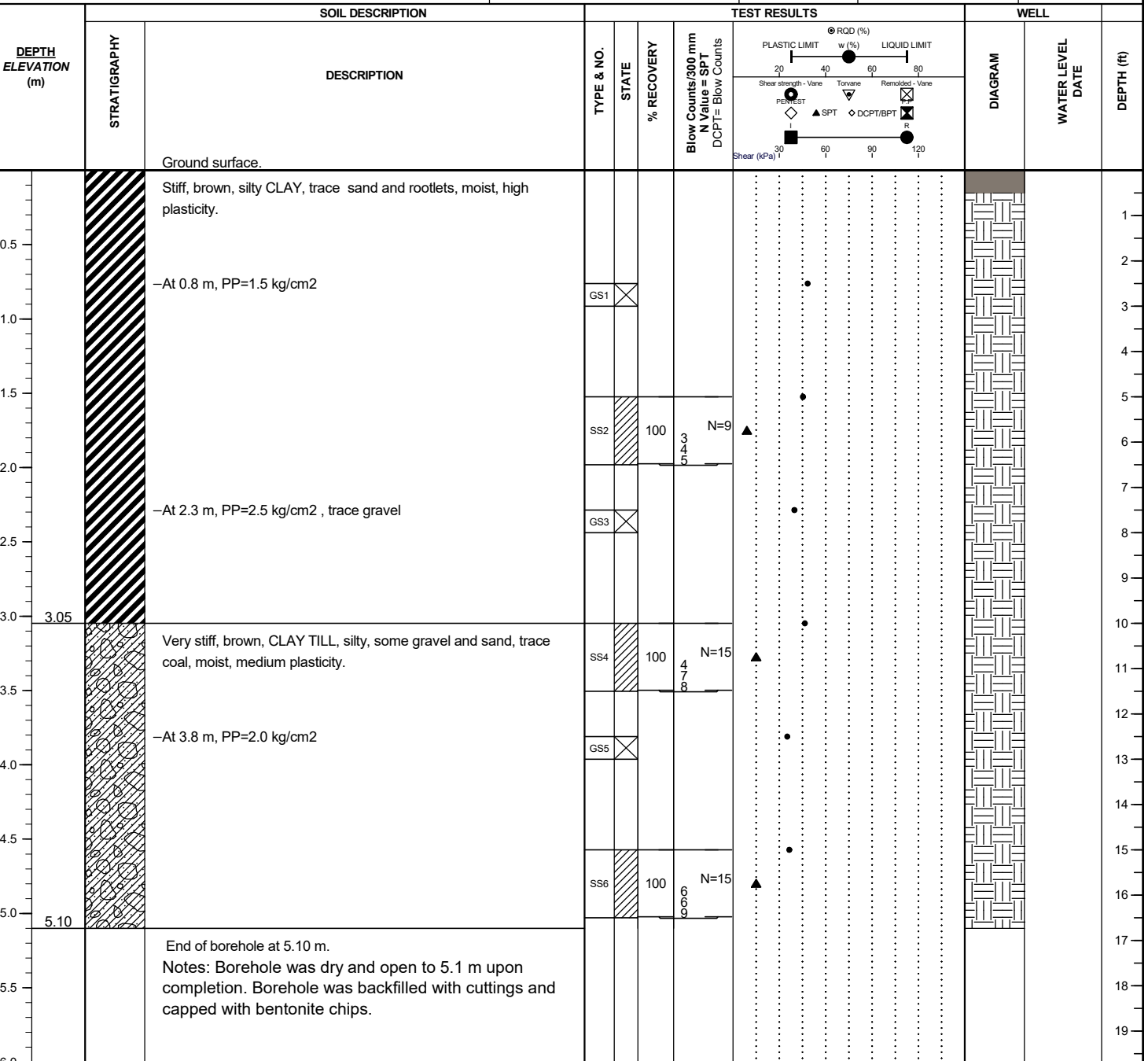
Drilling Company: **All Service Drilling**
Drilling Equipment: **Diedrich D-90**
Drilling Method: **Solid Stem Auger / DCPT**
Borehole Diameter: **152 mm**

WELL DETAILS
COPING Elevation :
SCREEN Bottom Depth :
Length :
Opening :
WATER Elevation:
WATER Date:
Water Level Free phase

SAMPLE TYPE
GS - Grab sample
SS - Split Spoon
ST - Shelby Tube

TESTS
AL - Atterberg Limits
DCPT - Dynamic Cone Penetration Test
GSA - Grain Size Analysis
PENTEST - Pocket Penetrometer
Sg - Specific Gravity
SPT - N Value (Blow Counts/300mm)
UCS - Uniax. Comp. Strength
w - Moisture Content
wL - Liquidity Limit
wP - Plasticity Limit

SAMPLE STATE
Undisturbed
Remoulded
Lost
Cored



Notes: Borehole was dry and open to 5.1 m upon completion. Borehole was backfilled with cuttings and capped with bentonite chips.



BOREHOLE RECORD: BH21-11

Page 1 of 1

Prepared by: **Khalid Samriny**
Reviewed by: **Sonia R. Polo**

Date (Start): **6/18/2021**
Date (End): **6/18/2021**

Project Name: **Schott's Lake RV and Guest Ranch Ranch Inc.**
Site:
Sector:
Client: **Schott's Lake RV and Guest**

Project Number: **211-04399-00**
Coordinates: **X = 114.869842 °W**
Y = 51.803118 °N
Surface Elevation: **Not measured**

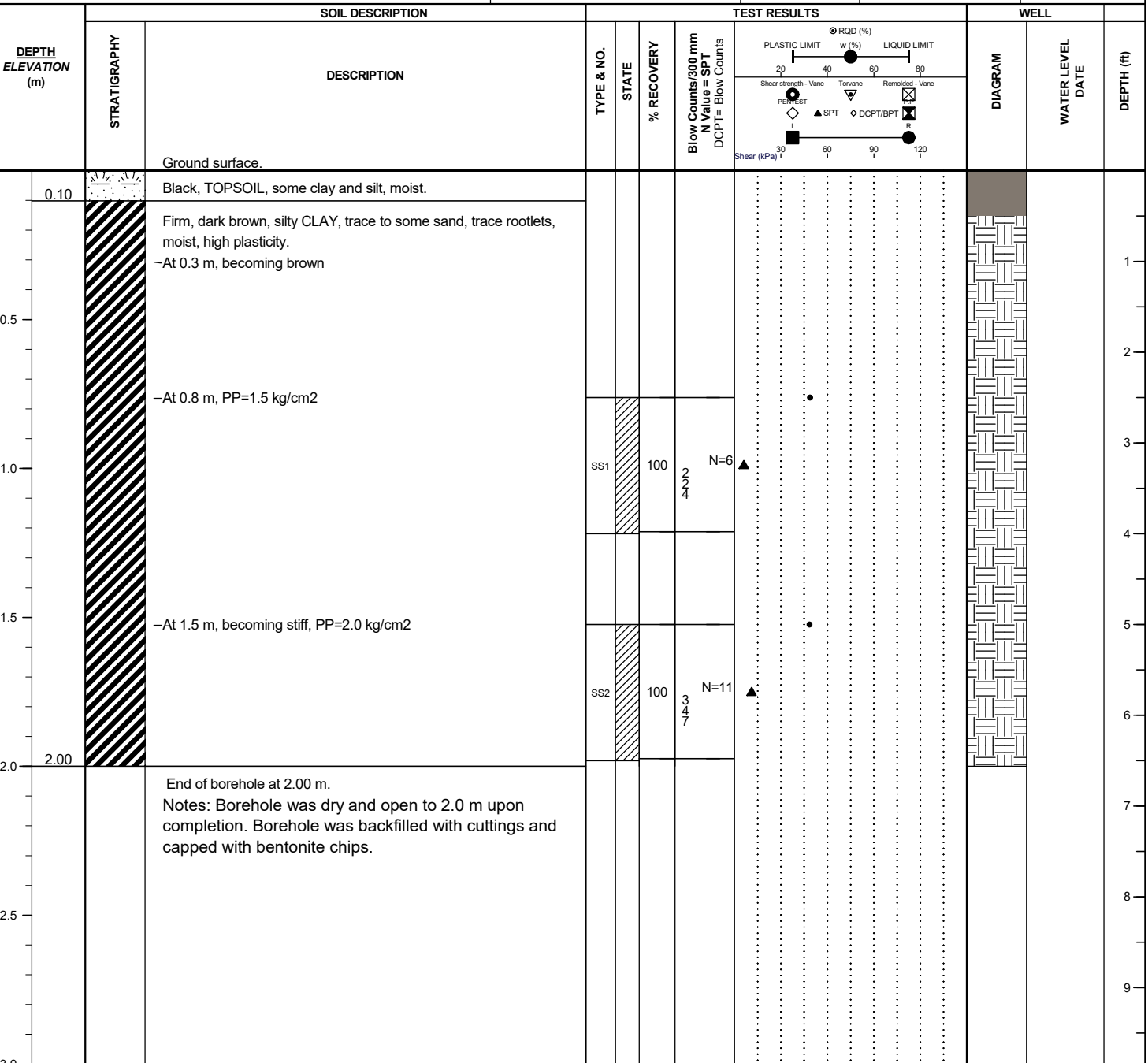
Drilling Company: **All Service Drilling**
Drilling Equipment: **Diedrich D-90**
Drilling Method: **Solid Stem Auger / DCPT**
Borehole Diameter: **152 mm**

WELL DETAILS
COPING Elevation :
SCREEN Bottom Depth :
Length :
Opening :
WATER Elevation:
WATER Date:
Water Level Free phase

SAMPLE TYPE
GS - Grab sample
SS - Split Spoon
ST - Shelby Tube

TESTS
AL - Atterberg Limits
DCPT - Dynamic Cone Penetration Test
GSA - Grain Size Analysis
PENTEST - Pocket Penetrometer
Sg - Specific Gravity
SPT - N Value (Blow Counts/300mm)
UCS - Uniax. Comp. Strength
w - Moisture Content
wL - Liquidity Limit
wP - Plasticity Limit

SAMPLE STATE
Undisturbed
Remoulded
Lost
Cored



Notes: Borehole was dry and open to 2.0 m upon completion. Borehole was backfilled with cuttings and capped with bentonite chips.



BOREHOLE RECORD: BH21-12

Page 1 of 1

Prepared by: **Khalid Samriny**
Reviewed by: **Sonia R. Polo**

Date (Start): **6/18/2021**
Date (End): **6/18/2021**

Project Name: **Schott's Lake RV and Guest Ranch Ranch Inc.**
Site:
Sector:
Client: **Schott's Lake RV and Guest**

Project Number: **211-04399-00**
Coordinates: **X = 114.872220 °W**
Y = 51.803569 °N
Surface Elevation: **Not measured**

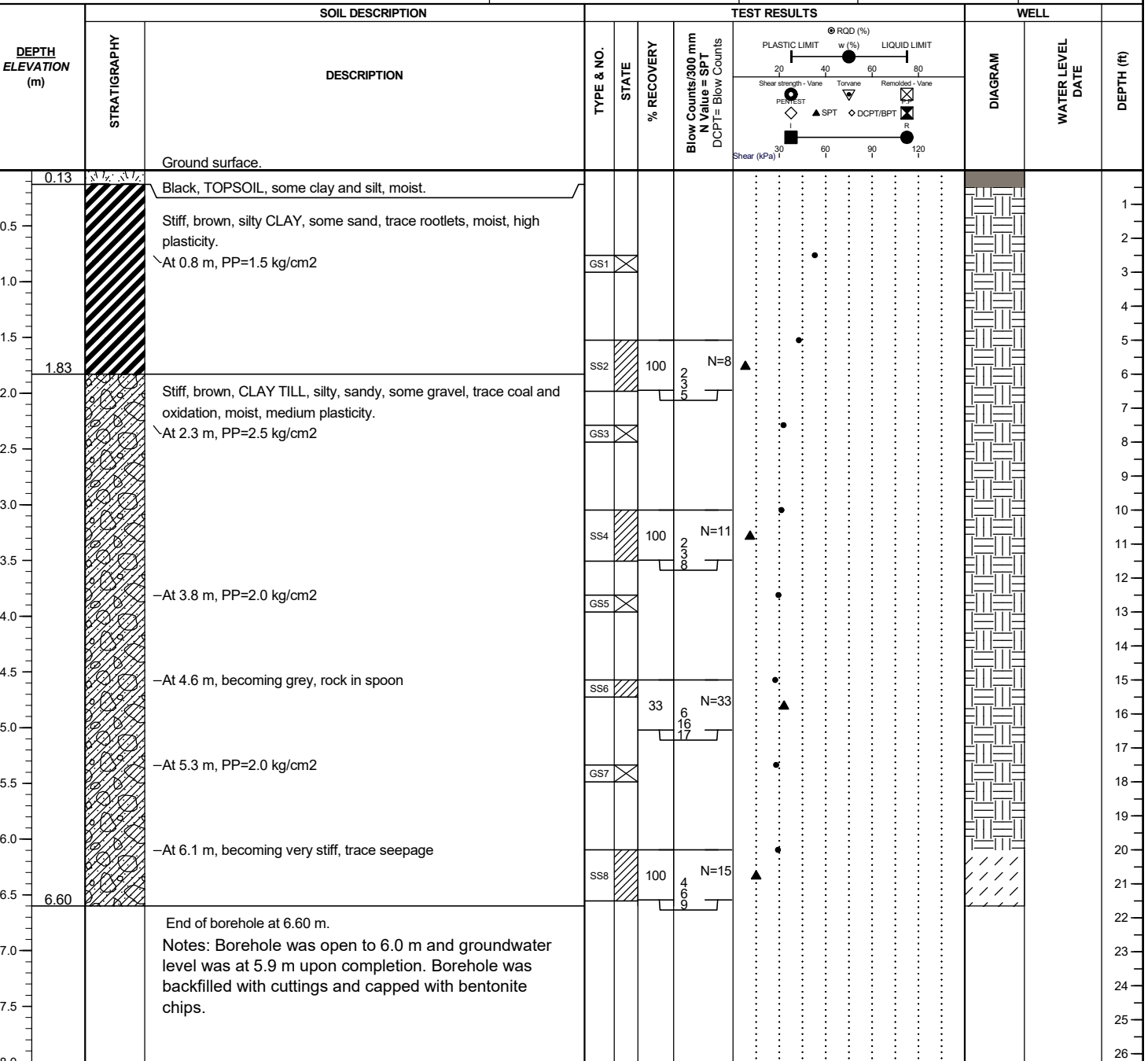
Drilling Company: **All Service Drilling**
Drilling Equipment: **Diedrich D-90**
Drilling Method: **Solid Stem Auger / DCPT**
Borehole Diameter: **152 mm**

WELL DETAILS
COPING Elevation :
SCREEN Bottom Depth :
Length :
Opening :
WATER Elevation:
WATER Date:
Water Level Free phase

SAMPLE TYPE
GS - Grab sample
SS - Split Spoon
ST - Shelby Tube

TESTS
AL - Atterberg Limits
DCPT - Dynamic Cone Penetration Test
GSA - Grain Size Analysis
PENTEST - Pocket Penetrometer
Sg - Specific Gravity
SPT - N Value (Blow Counts/300mm)
UCS - Uniax. Comp. Strength
w - Moisture Content
wL - Liquidity Limit
wP - Plasticity Limit

SAMPLE STATE
Undisturbed
Remoulded
Lost
Cored



Notes: Borehole was open to 6.0 m and groundwater level was at 5.9 m upon completion. Borehole was backfilled with cuttings and capped with bentonite chips.



BOREHOLE RECORD: BH21-13

Page 1 of 1

Prepared by: **Khalid Samriny**
Reviewed by: **Sonia R. Polo**

Date (Start): **6/18/2021**
Date (End): **6/18/2021**

Project Name: **Schott's Lake RV and Guest Ranch Ranch Inc.**
Site:
Sector:
Client: **Schott's Lake RV and Guest**

Project Number: **211-04399-00**
Coordinates: **X = 114.873535 °W**
Y = 51.802903 °N
Surface Elevation: **Not measured**

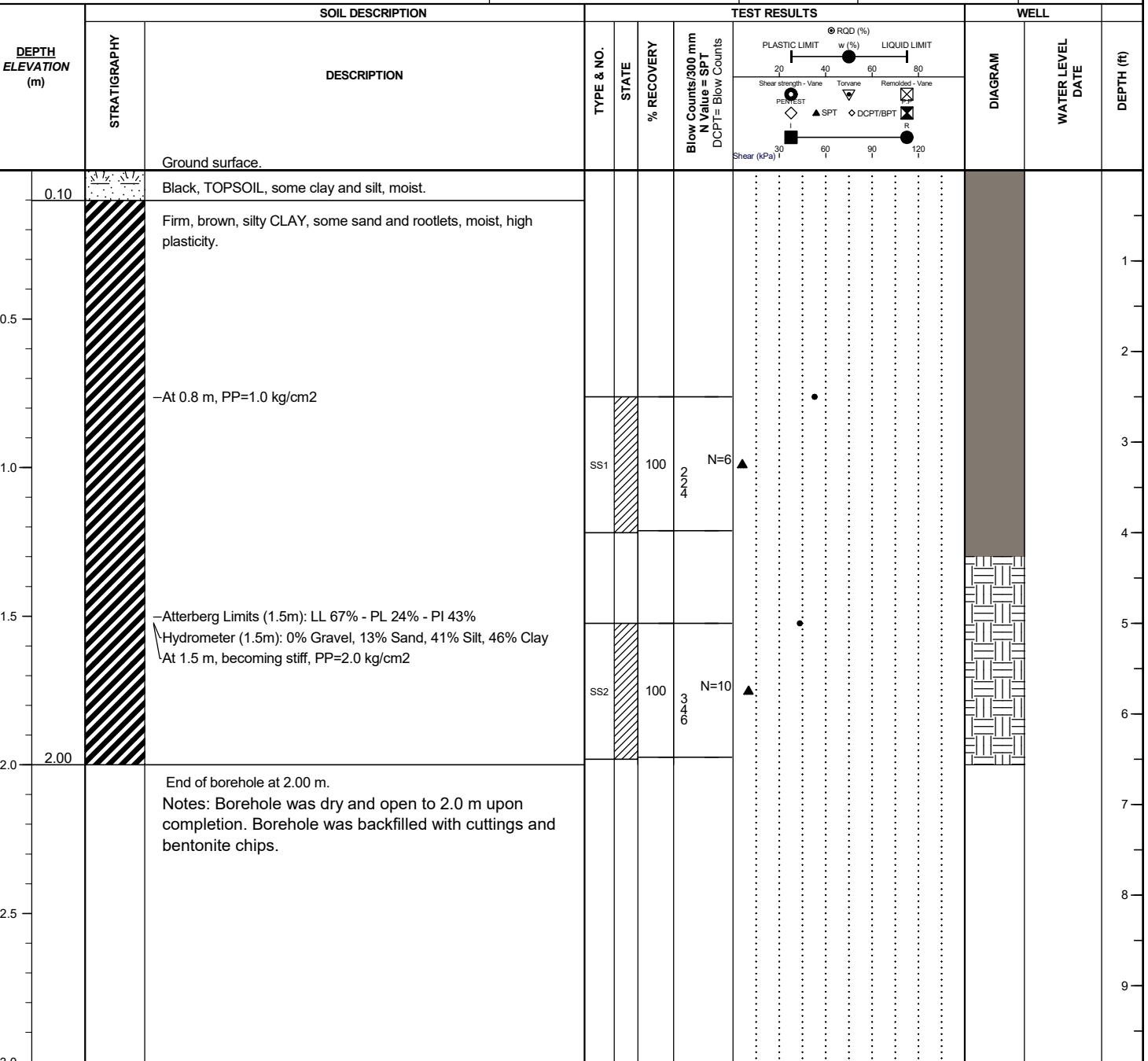
Drilling Company: **All Service Drilling**
Drilling Equipment: **Diedrich D-90**
Drilling Method: **Solid Stem Auger / DCPT**
Borehole Diameter: **152 mm**

WELL DETAILS
COPING Elevation :
SCREEN Bottom Depth :
Length :
Opening :
WATER Elevation:
WATER Date:
Water Level Free phase

SAMPLE TYPE
GS - Grab sample
SS - Split Spoon
ST - Shelby Tube

TESTS
AL - Atterberg Limits
DCPT - Dynamic Cone Penetration Test
GSA - Grain Size Analysis
PENTEST - Pocket Penetrometer
Sg - Specific Gravity
SPT - N Value (Blow Counts/300mm)
UCS - Uniax. Comp. Strength
w - Moisture Content
wL - Liquidity Limit
wP - Plasticity Limit

SAMPLE STATE
Undisturbed
Remoulded
Lost
Cored



B WATER WELL DRILLING REPORTS



Water Well Drilling Report

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GIC Well ID 432810
GoA Well Tag No.
Drilling Company Well ID
Date Report Received 1980/09/08

GOWN ID

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

Well Identification and Location										Measurement in Metric		
Owner Name		Address			Town		Province		Country		Postal Code	
213805 HLDG (CENTURY CLUB)		204-140-1ST AVE SW, CALGARY										
Location		1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description		
14		1	33	7	5							
Measured from Boundary of					GPS Coordinates in Decimal Degrees (NAD 83)					Elevation		
_____ m from					Latitude 51.807714 Longitude -114.866644					1219.20 m		
_____ m from					How Location Obtained					How Elevation Obtained		
					Map					Estimated		

Drilling Information	
Method of Drilling	Type of Work
Rotary	New Well
Proposed Well Use	
Domestic	

Formation Log			Measurement in Metric	
Depth from ground level (m)	Water Bearing	Lithology Description		
4.88		Brown Clay		
26.21		Blue Sticky Clay		
32.61		Brown Shale & Rocks		
35.05		Blue Shale & Rocks		

Yield Test Summary			Measurement in Metric	
Recommended Pump Rate			0.00 L/min	
Test Date	Water Removal Rate (L/min)	Static Water Level (m)		
1980/07/04	90.92	26.82		

Well Completion			Measurement in Metric	
Total Depth Drilled	Finished Well Depth	Start Date	End Date	
35.05 m		1980/07/03	1980/07/04	
Borehole				
Diameter (cm)	From (m)	To (m)		
0.00	0.00	35.05		
Surface Casing (if applicable)		Well Casing/Liner		
Steel		Plastic		
Size OD :	14.12 cm	Size OD :	12.70 cm	
Wall Thickness :	0.478 cm	Wall Thickness :	2.540 cm	
Bottom at :	25.60 m	Top at :	0.00 m	
		Bottom at :	35.05 m	
Perforations				
From (m)	To (m)	Diameter or Slot Width (cm)	Slot Length (cm)	Hole or Slot Interval (cm)
28.96	35.05	0.318		20.32
Perforated by Machine				
Annular Seal Driven				
Placed from 0.00 m to 25.30 m				
Amount				
Other Seals				
Type		At (m)		
Screen Type				
Size OD : 0.00 cm				
From (m)	To (m)	Slot Size (cm)		
Attachment				
Top Fittings		Bottom Fittings		
Pack				
Type		Grain Size		
Amount				

Contractor Certification	
Name of Journeyman responsible for drilling/construction of well	Certification No
UNKNOWN NA DRILLER	1
Company Name	Copy of Well report provided to owner
M.E. LAWSON WATER WELLS	Date approval holder signed



Water Well Drilling Report

[View in Imperial](#) [Export to Excel](#)

GIC Well ID 432810
GoA Well Tag No.
Drilling Company Well ID
Date Report Received 1980/09/08

GOWN ID

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

Well Identification and Location										Measurement in Metric	
Owner Name		Address			Town		Province		Country	Postal Code	
213805 HLDG (CENTURY CLUB)		204-140-1ST AVE SW, CALGARY									
Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description		
14		1	33	7	5						
Measured from Boundary of					GPS Coordinates in Decimal Degrees (NAD 83)						
_____ m from					Latitude 51.807714 Longitude -114.866644					Elevation 1219.20 m	
_____ m from					How Location Obtained					How Elevation Obtained	
					Map					Estimated	

Additional Information										Measurement in Metric
Distance From Top of Casing to Ground Level _____ cm										
Is Artesian Flow _____										
Rate _____ L/min										
Is Flow Control Installed _____										
Describe _____										
Recommended Pump Rate					0.00 L/min					
Recommended Pump Intake Depth (From TOC)					0.00 m					
Pump Installed					Depth					m
Type					Make					H.P.
					Model (Output Rating)					
Did you Encounter Saline Water (>4000 ppm TDS)					Depth					m
Gas					Depth					m
Well Disinfected Upon Completion										
Geophysical Log Taken										
Submitted to ESRD										
Sample Collected for Potability										
Submitted to ESRD										
Additional Comments on Well										

Yield Test			Taken From Ground Level	Measurement in Metric
			Depth to water level	
Test Date	Start Time	Static Water Level		
1980/07/04	12:00 AM	26.82 m		
			Pumping (m)	Elapsed Time
				Minutes:Sec
				Recovery (m)
Method of Water Removal				
Type Bailer & Pump				
Removal Rate 90.92 L/min				
Depth Withdrawn From 33.53 m				
If water removal period was < 2 hours, explain why				

Water Diverted for Drilling		
Water Source	Amount Taken	Diversion Date & Time
	L	

Contractor Certification	
Name of Journeyman responsible for drilling/construction of well	Certification No
UNKNOWN NA DRILLER	1
Company Name	Copy of Well report provided to owner
M.E. LAWSON WATER WELLS	Date approval holder signed



Water Well Drilling Report

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GIC Well ID 407034
GoA Well Tag No.
Drilling Company Well ID
Date Report Received 1970/06/19

GOWN ID

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

Well Identification and Location										Measurement in Metric	
Owner Name		Address		Town		Province		Country		Postal Code	
MCKILLOP, P.		SUNDRE									
Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description		
	NE	2	33	7	5						
Measured from Boundary of					GPS Coordinates in Decimal Degrees (NAD 83)						
_____ m from					Latitude 51.805932 Longitude -114.881497					Elevation _____ m	
_____ m from					How Location Obtained					How Elevation Obtained	
					Map					Not Obtained	

Drilling Information	
Method of Drilling Cable Tool	Type of Work New Well
Proposed Well Use Domestic	

Formation Log			Measurement in Metric		
Depth from ground level (m)	Water Bearing	Lithology Description			
16.46		Clay			
38.10		Sandstone			
50.29		Shale			

Yield Test Summary			Measurement in Metric		
Recommended Pump Rate 0.00 L/min					
Test Date	Water Removal Rate (L/min)	Static Water Level (m)			
1970/06/17	454.61	0.00			

Well Completion				Measurement in Metric			
Total Depth Drilled	Finished Well Depth	Start Date	End Date				
50.29 m			1970/06/17				
Borehole							
Diameter (cm)	From (m)	To (m)					
0.00	0.00	50.29					
Surface Casing (if applicable)				Well Casing/Liner			
Unknown				Unknown			
Size OD : 0.00 cm		Size OD : 0.00 cm					
Wall Thickness : 0.000 cm		Wall Thickness : 0.000 cm					
Bottom at : 17.07 m		Top at : 0.00 m					
		Bottom at : 39.62 m					
Perforations							
From (m)	To (m)	Diameter or Slot Width (cm)	Slot Length (cm)	Hole or Slot Interval(cm)			
Perforated by							
Annular Seal							
Placed from 0.00 m to 0.00 m							
Amount							
Other Seals							
Type		At (m)					
Screen Type							
Size OD : 0.00 cm							
From (m)	To (m)	Slot Size (cm)					
Attachment							
Top Fittings		Bottom Fittings					
Pack							
Type		Grain Size					
Amount							

Contractor Certification	
Name of Journeyman responsible for drilling/construction of well UNKNOWN NA DRILLER	Certification No 1
Company Name FORESTER, AUGUST R.	Copy of Well report provided to owner Date approval holder signed



Water Well Drilling Report

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GIC Well ID 407034
GoA Well Tag No.
Drilling Company Well ID
Date Report Received 1970/06/19

GOWN ID

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

Well Identification and Location										Measurement in Metric	
Owner Name		Address		Town		Province		Country		Postal Code	
MCKILLOP, P.		SUNDRE									
Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description		
	NE	2	33	7	5						
Measured from Boundary of					GPS Coordinates in Decimal Degrees (NAD 83)						
_____ m from					Latitude 51.805932 Longitude -114.881497					Elevation _____ m	
_____ m from					How Location Obtained					How Elevation Obtained	
					Map					Not Obtained	

Additional Information										Measurement in Metric
Distance From Top of Casing to Ground Level _____ cm										
Is Artesian Flow _____										
Rate _____ L/min										
Is Flow Control Installed _____										
Describe _____										
Recommended Pump Rate _____ 0.00 L/min										
Pump Installed _____										
Depth _____ m										
Recommended Pump Intake Depth (From TOC) _____ 0.00 m										
Type _____										
Make _____										
H.P. _____										
Model (Output Rating) _____										
Did you Encounter Saline Water (>4000 ppm TDS) _____										
Depth _____ m										
Well Disinfected Upon Completion _____										
Gas _____										
Depth _____ m										
Geophysical Log Taken _____										
Submitted to ESRD _____										
Sample Collected for Potability _____										
Submitted to ESRD _____										
Additional Comments on Well										
ORIGINAL LSD EH										

Yield Test			Taken From Ground Level	Measurement in Metric
			Depth to water level	
Test Date	Start Time	Static Water Level		
1970/06/17	12:00 AM	0.00 m		
			Pumping (m)	Elapsed Time
				Minutes:Sec
				Recovery (m)
Method of Water Removal				
Type Bailer				
Removal Rate 454.61 L/min				
Depth Withdrawn From 0.00 m				
If water removal period was < 2 hours, explain why				

Water Diverted for Drilling		
Water Source	Amount Taken	Diversion Date & Time
	L	

Contractor Certification	
Name of Journeyman responsible for drilling/construction of well	Certification No
UNKNOWN NA DRILLER	1
Company Name	Copy of Well report provided to owner
FORESTER, AUGUST R.	Date approval holder signed



Water Well Drilling Report

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GIC Well ID 2086262
GoA Well Tag No.
Drilling Company Well ID
Date Report Received 2020/02/03

GOWN ID

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

Well Identification and Location										Measurement in Metric	
Owner Name VERKERK, MIKE & KIM		Address SITE 8, COMP 3, RR 2			Town SUNDRE		Province ALBERTA		Country CANADA	Postal Code T0M 1X0	
Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description		
	12	1	33	7	5						
Measured from Boundary of					GPS Coordinates in Decimal Degrees (NAD 83)						
_____ m from _____					Latitude <u>51.802890</u> Longitude <u>-114.871060</u>					Elevation <u>1223.47</u> m	
_____ m from _____					How Location Obtained					How Elevation Obtained	
					Hand held autonomous GPS 20-30m					Hand held autonomous GPS 20-30m	

Drilling Information	
Method of Drilling Rotary - Air	Type of Work New Well
Proposed Well Use Domestic	

Formation Log			Measurement in Metric	
Depth from ground level (m)	Water Bearing	Lithology Description		
11.28		Brown Clay		
15.85		Brown Sandstone		
20.73		Gray Sandstone		
36.58		Gray Shale		
38.10		Gray Sandstone		
45.72		Gray Shale		
46.33		Gray Sandstone		
50.29		Gray Shale		
50.90		Gray Sandstone		
55.17		Gray Shale		
65.53	Yes	Gray Sandstone		
67.06		Gray Shale		

Yield Test Summary			Measurement in Metric	
Recommended Pump Rate		<u>45.46</u> L/min		
Test Date	Water Removal Rate (L/min)	Static Water Level (m)		
2019/11/05	136.38	27.98		

Well Completion				Measurement in Metric	
Total Depth Drilled	Finished Well Depth	Start Date	End Date		
67.06 m	67.06 m	2019/11/05	2019/11/05		
Borehole					
Diameter (cm)		From (m)		To (m)	
22.23		0.00		23.77	
12.70		23.77		67.06	
Surface Casing (if applicable)					
Steel			Well Casing/Liner		
			Plastic		
Size OD :		<u>14.13</u> cm		Size OD :	
				<u>11.43</u> cm	
Wall Thickness :		<u>0.655</u> cm		Wall Thickness :	
				<u>0.602</u> cm	
Bottom at :		<u>23.77</u> m		Top at :	
				<u>18.29</u> m	
				Bottom at :	
				<u>67.06</u> m	
Perforations					
From (m)	To (m)	Diameter or Slot Width (cm)	Slot Length (cm)	Hole or Slot Interval(cm)	
54.86	60.96	1.270	30.48		
Perforated by Drill					
Annular Seal Bentonite Chips					
Placed from		<u>0.00</u> m to <u>23.77</u> m			
Amount		<u>150.00</u> Pounds			
Other Seals					
Type			At (m)		
Drive Shoe			23.77		
Screen Type					
Size OD : _____ cm					
From (m)		To (m)		Slot Size (cm)	
Attachment _____					
Top Fittings		Bottom Fittings			
Pack					
Type		Grain Size			
Amount					

Contractor Certification	
Name of Journeyman responsible for drilling/construction of well RILEY PEARSON	Certification No 83061A
Company Name BLACK DOG DRILLING & ENV SERV. LTD.	Copy of Well report provided to owner Date approval holder signed Yes 2019/11/05

Water Well Drilling Report

The driller supplies the data contained in this report. The Province disclaims responsibility for its accuracy. The information on this report will be retained in a public database.

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GIC Well ID 2086262

GoA Well Tag No.

Drilling Company Well ID

Date Report Received 2020/02/03

GOWN ID

Well Identification and Location											Measurement in Metric	
Owner Name		Address			Town		Province		Country		Postal Code	
VERKERK, MIKE & KIM		SITE 8, COMP 3, RR 2			SUNDRE		ALBERTA		CANADA		T0M 1X0	
Location	1/4 or LSD	SEC	TWP	RGE	W of MER	Lot	Block	Plan	Additional Description			
12	1	33	7	5								
Measured from Boundary of					GPS Coordinates in Decimal Degrees (NAD 83)							
_____ m from					Latitude <u>51.802890</u> Longitude <u>-114.871060</u>					Elevation <u>1223.47 m</u>		
_____ m from					How Location Obtained					How Elevation Obtained		
					Hand held autonomous GPS 20-30m					Hand held autonomous GPS 20-30m		

Additional Information		Measurement in Metric	
Distance From Top of Casing to Ground Level	60.96 cm	Is Flow Control Installed	
Is Artesian Flow		Describe	
Rate	L/min		
Recommended Pump Rate	45.46 L/min	Pump Installed	Depth m
Recommended Pump Intake Depth (From TOC)	51.82 m	Type	Make H.P.
			Model (Output Rating)
Did you Encounter Saline Water (>4000 ppm TDS)	Depth m	Well Disinfected Upon Completion	Yes
Gas	Depth m	Geophysical Log Taken	
		Submitted to ESRD	
		Sample Collected for Potability	Submitted to ESRD
Additional Comments on Well			

Yield Test			Taken From Top of Casing		Measurement in Metric
Test Date	Start Time	Static Water Level	Depth to water level		
2019/11/05	4:00 PM	27.98 m	Pumping (m)	Elapsed Time Minutes:Sec	Recovery (m)
Method of Water Removal				0:00	67.06
Type	Air			1:00	49.74
Removal Rate	136.38 L/min			2:00	40.26
Depth Withdrawn From	67.06 m			3:00	32.43
				4:00	29.96
				5:00	28.83
				6:00	28.41
				7:00	28.16
				8:00	28.04
				9:00	28.01
				10:00	27.98
				12:00	27.98
				20:00	27.98
				60:00	27.98
				120:00	27.98
If water removal period was < 2 hours, explain why					

Water Diverted for Drilling		
Water Source	Amount Taken	Diversion Date & Time
SHOP	9092.18 L	2019/11/01 3:00 PM

Contractor Certification	
<i>Name of Journeyman responsible for drilling/construction of well</i> RILEY PEARSON	<i>Certification No</i> 83061A
<i>Company Name</i> BLACK DOG DRILLING & ENV SERV. LTD.	<i>Copy of Well report provided to owner</i> Yes
	<i>Date approval holder signed</i> 2019/11/05

C LABORATORY TEST RESULTS



WSP Canada Inc.
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 Calgary, AB T2E 6J5 Canada
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 D +1 (587) 480-0031

ATTERBERG LIMITS

(ASTM D4318)

TRN: 21-021

Client: Schott's Lake RV & Guest Ranch Inc.

Sampled By: KS

Project: Schott's Lake RV and Guest Ranch

Tested By: DH

Job No.: 211-04399-00

Sample Date: 18-Jun-21

Report Date: June 24, 2021

Test Date: 22-Jun-21

Bore Hole No.: BH21-02

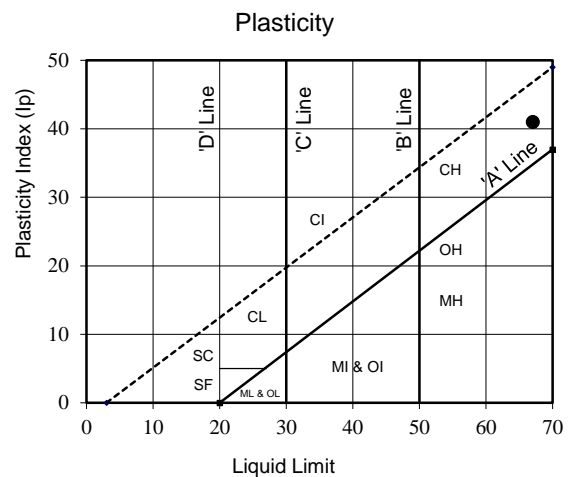
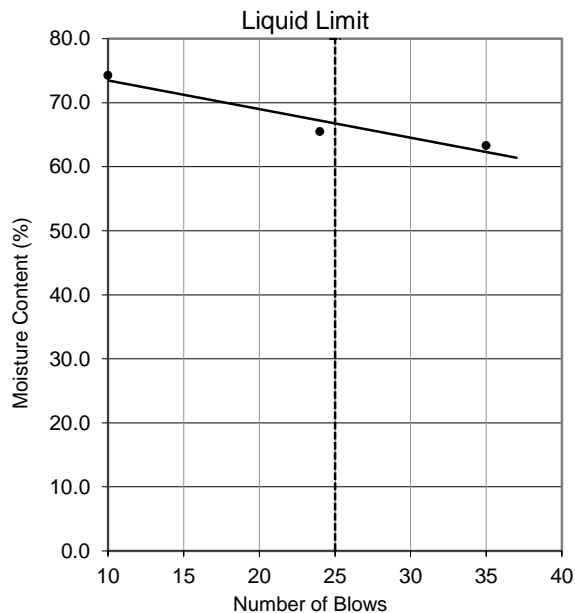
Depth: 5.0 feet

Liquid Limit Test

Trial	A	B	C
No. of Blows	35	24	10
Tare Number	# 108	# 110	# 103
Wt. of Tare, g	16.31	17.68	17.80
Wt. Wet Soil + Tare, g	32.54	36.31	36.20
Wt. Dry Soil + Tare, g	26.25	28.94	28.36
Wt. of Water, g	6.29	7.37	7.84
Wt. of Dry Soil, g	9.94	11.26	10.56
Moisture Content (%)	63.3	65.5	74.2

Plastic Limit Test

Trial	A	B
Tare Number	# 137	# 106
Wt. of Tare, g	17.92	17.40
Wt. Wet Soil + Tare, g	20.44	19.46
Wt. Dry Soil + Tare, g	19.92	19.03
Wt. of Water, g	0.52	0.43
Wt. of Dry Soil, g	2.00	1.63
Moisture Content (%)	26.0	26.4



USCS Symbol CH

Soil Description: High Plastic Clay

Liquid Limit (%) 67

Plastic Limit (%) 26

Plasticity Index (%) 41

Per: _____



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ATTERBERG LIMITS

(ASTM D4318)

TRN: 21-021

Client: Schott's Lake RV & Guest Ranch Inc.

Sampled By: KS

Project: Schott's Lake RV and Guest Ranch

Tested By: DH

Job No.: 211-04399-00

Sample Date: 18-Jun-21

Report Date: June 24, 2021

Test Date: 22-Jun-21

Bore Hole No.: BH21-05

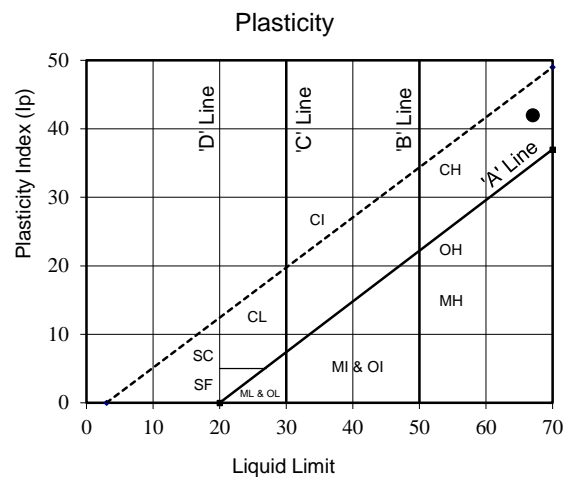
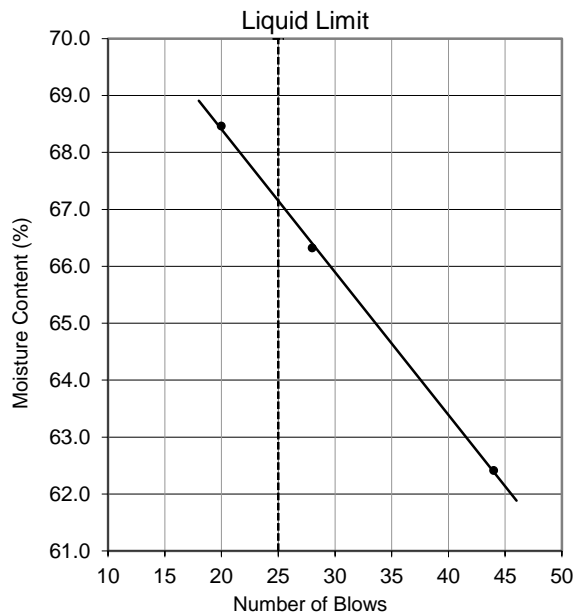
Depth: 5.0 feet

Liquid Limit Test

Trial	A	B	C
No. of Blows	44	28	20
Tare Number	# 142	# 112	# 146
Wt. of Tare, g	17.25	17.03	18.83
Wt. Wet Soil + Tare, g	35.70	34.61	38.86
Wt. Dry Soil + Tare, g	28.61	27.60	30.72
Wt. of Water, g	7.09	7.01	8.14
Wt. of Dry Soil, g	11.36	10.57	11.89
Moisture Content (%)	62.4	66.3	68.5

Plastic Limit Test

Trial	A	B
Tare Number	# 121	# 144
Wt. of Tare, g	16.07	17.86
Wt. Wet Soil + Tare, g	18.50	20.11
Wt. Dry Soil + Tare, g	18.01	19.65
Wt. of Water, g	0.49	0.46
Wt. of Dry Soil, g	1.94	1.79
Moisture Content (%)	25.3	25.7



USCS Symbol CH
 Liquid Limit (%) 67
 Plastic Limit (%) 25
 Plasticity Index (%) 42

Soil Description: High Plastic Clay

Per: _____



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ATTERBERG LIMITS

(ASTM D4318)

TRN: 21-021

Client: Schott's Lake RV & Guest Ranch Inc.

Sampled By: KS

Project: Schott's Lake RV and Guest Ranch

Tested By: DH

Job No.: 211-04399-00

Sample Date: 18-Jun-21

Report Date: June 24, 2021

Test Date: 22-Jun-21

Bore Hole No.: BH21-13

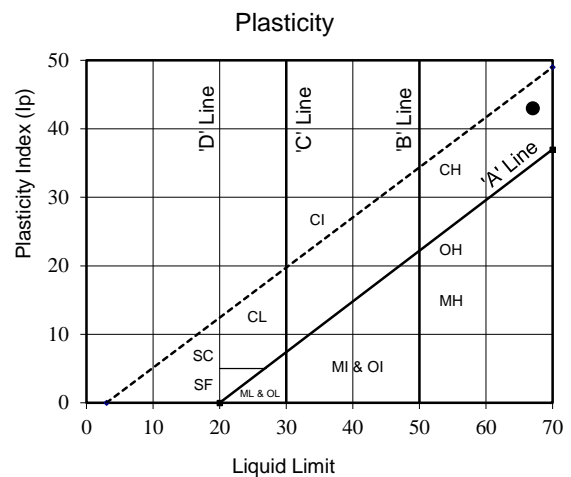
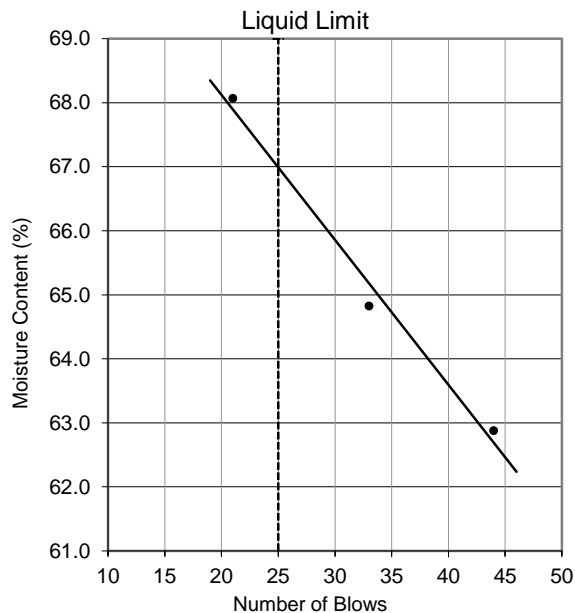
Depth: 5.0 feet

Liquid Limit Test

Trial	A	B	C
No. of Blows	44	33	21
Tare Number	# 122	# 102	# 120
Wt. of Tare, g	16.75	16.93	17.25
Wt. Wet Soil + Tare, g	34.08	33.89	36.46
Wt. Dry Soil + Tare, g	27.39	27.22	28.68
Wt. of Water, g	6.69	6.67	7.78
Wt. of Dry Soil, g	10.64	10.29	11.43
Moisture Content (%)	62.9	64.8	68.1

Plastic Limit Test

Trial	A	B
Tare Number	# 123	# 135
Wt. of Tare, g	16.95	16.78
Wt. Wet Soil + Tare, g	19.57	19.33
Wt. Dry Soil + Tare, g	19.07	18.84
Wt. of Water, g	0.50	0.49
Wt. of Dry Soil, g	2.12	2.06
Moisture Content (%)	23.6	23.8



USCS Symbol CH
Liquid Limit (%) 67
Plastic Limit (%) 24
Plasticity Index (%) 43

Soil Description: High Plastic Clay

Per: _____

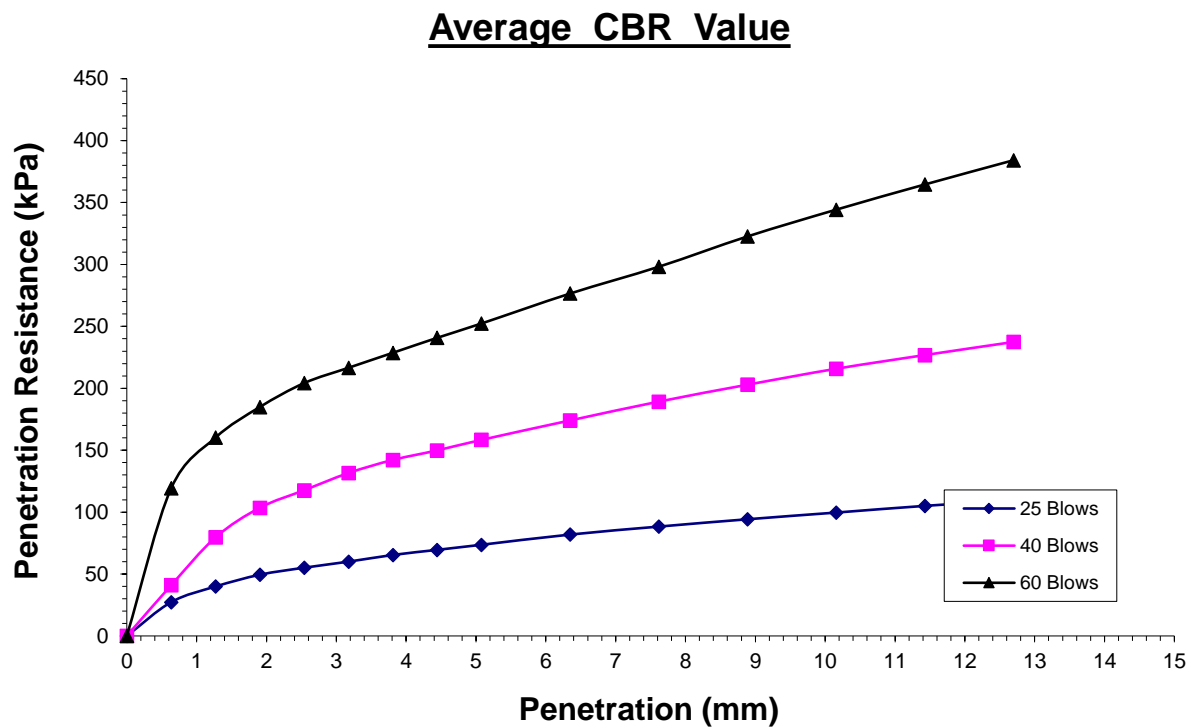


WSP Canada Inc.
California Bearing Ratio Test
ASTM D-1883

TRN: 247

Client: Schott's Lake RV & Guest Ranch Inc.
Project: Schott's Lake RV & Guest Ranch
Soil Type: Silty clay
Sample Location: Jobsite

Job No.: 211-04399-00
Tech.: DH
Date Tested: 2021-07-06



	25 Blows	40 Blows	60 Blows
Moisture Before Soaking :	24.4%	24.4%	24.3%
Moisture After Soaking :	41.3%	32.8%	30.4%
Wet Density, (kg/m3) :	1547	1717	1787
Dry Density, (kg/m3) :	1244	1380	1438
Percent Compaction :	84.5%	93.8%	97.7%
CBR Value :	0.76%	1.62%	2.70%



WSP Canada Inc.

405 - 18 Street SE
Calgary, AB, T2E 6J5.

Sieve Analysis

Report Date: June 24, 2021
Project Number: 211-04399-00
Report Number: 21-021

To: Schott's Lake RV and Guest Ranch Inc.

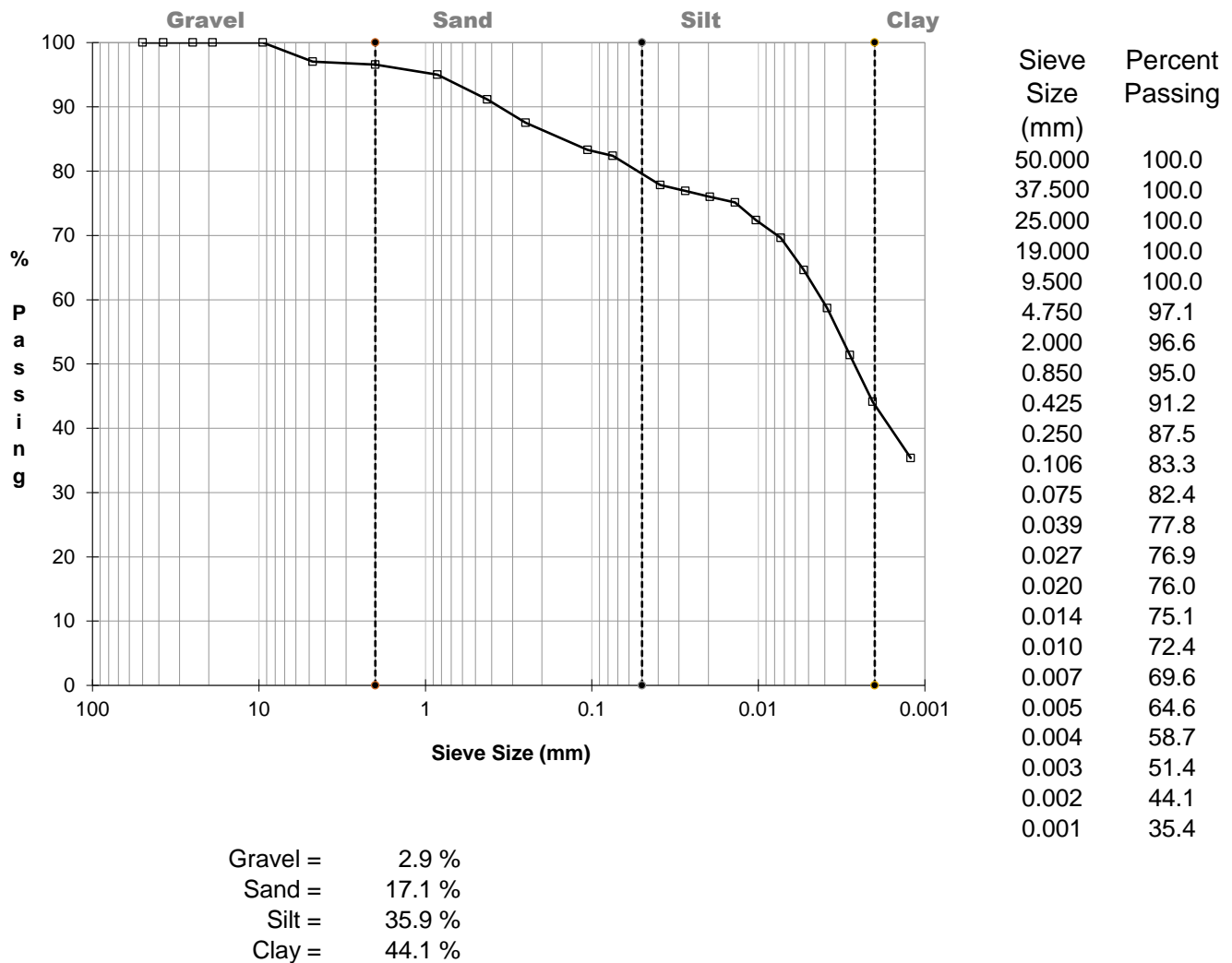
Project: Schott's Lake RV and Guest Ranch

Borehole No.: 2
Sample Depth: 5
Source: Job Site
Sampled By: KS
Tested By: DH

Sample Date: June 18, 2021

Date Tested: June 22, 2021

Date Received: June 18, 2021



Sample Description:

Remarks:

Per: _____



WSP Canada Inc.

405 - 18 Street SE
Calgary, AB, T2E 6J5.

Sieve Analysis

Report Date: June 24, 2021
Project Number: 211-04399-00
Report Number: 21-021

To: Schott's Lake RV and Guest Ranch Inc.

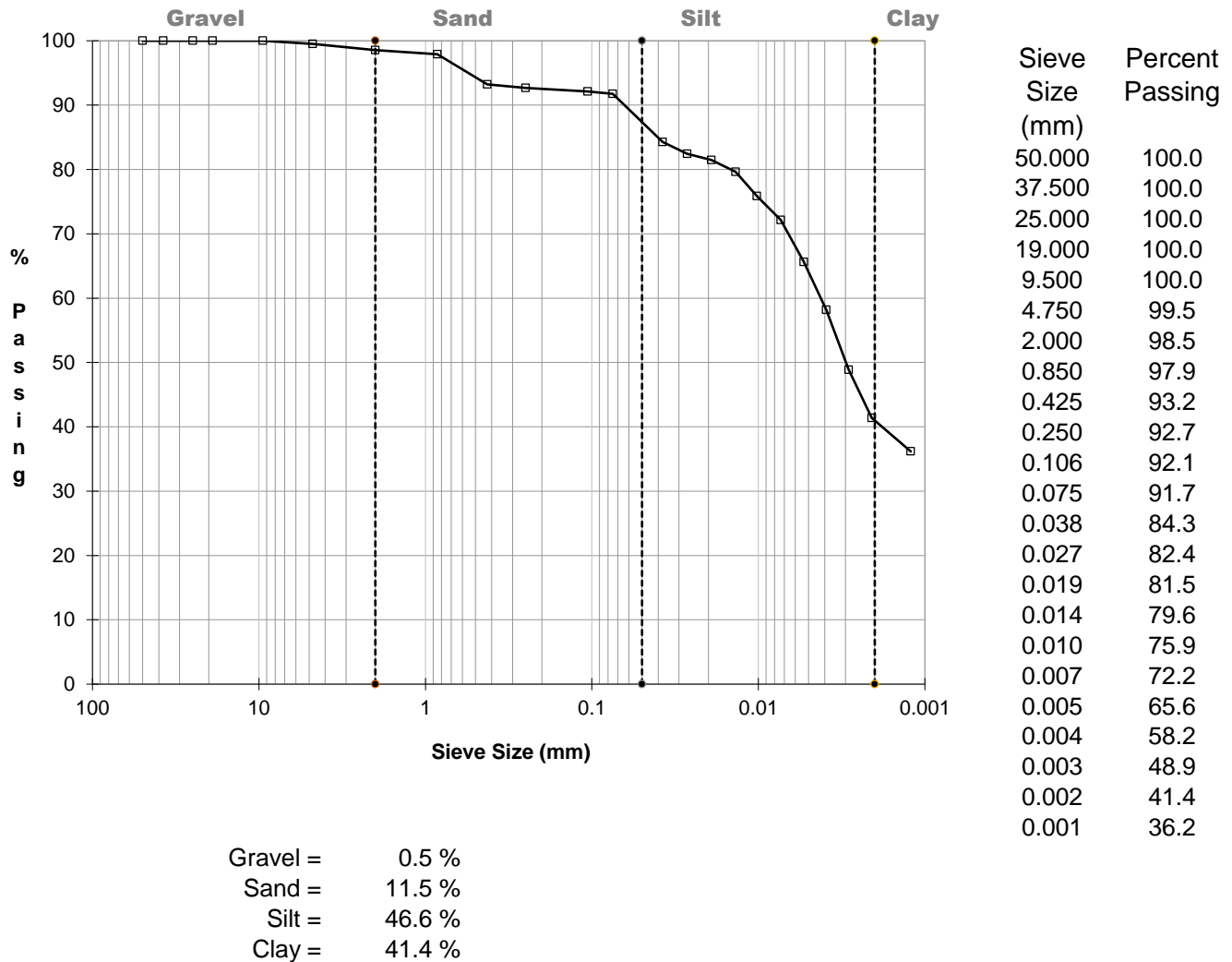
Project: Schott's Lake RV and Guest Ranch

Borehole No.: 4
Sample Depth: 5
Source: Job Site
Sampled By: KS
Tested By: DH

Sample Date: June 18, 2021

Date Tested: June 22, 2021

Date Received: June 18, 2021



Sample Description:

Remarks:

Per: _____



WSP Canada Inc.

405 - 18 Street SE
Calgary, AB, T2E 6J5.

Sieve Analysis

Report Date: June 24, 2021
Project Number: 211-04399-00
Report Number: 21-021

To: Schott's Lake RV and Guest Ranch Inc.

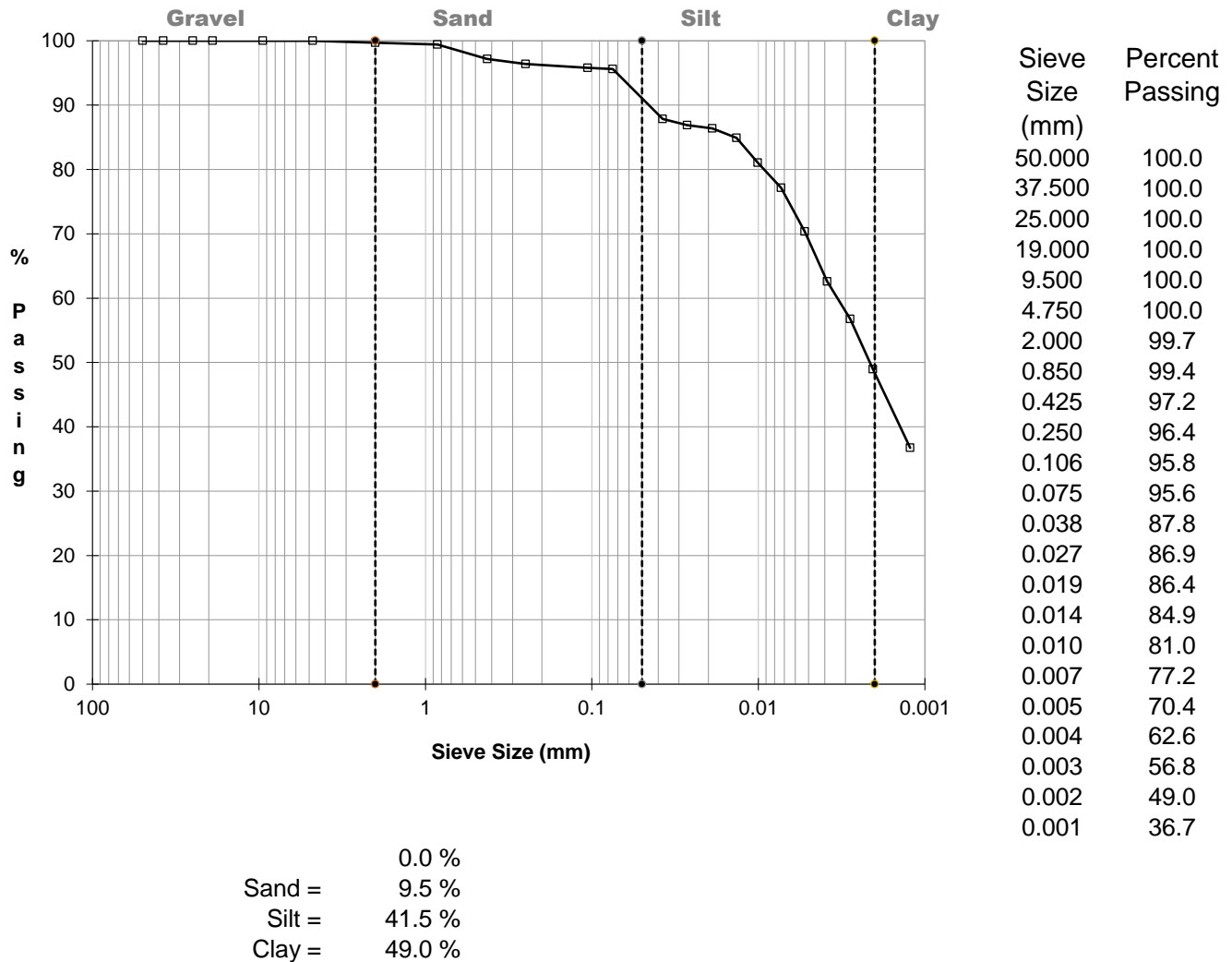
Project: Schott's Lake RV and Guest Ranch

Borehole No.: 5
Sample Depth: 5
Source: Job Site
Sampled By: KS
Tested By: DH

Sample Date: June 18, 2021

Date Tested: June 22, 2021

Date Received: June 18, 2021



Sample Description:

Remarks:

Per: _____



WSP Canada Inc.

405 - 18 Street SE
Calgary, AB, T2E 6J5.

Sieve Analysis

Report Date: June 24, 2021
Project Number: 211-04399-00
Report Number: 21-021

To: Schott's Lake RV and Guest Ranch Inc.

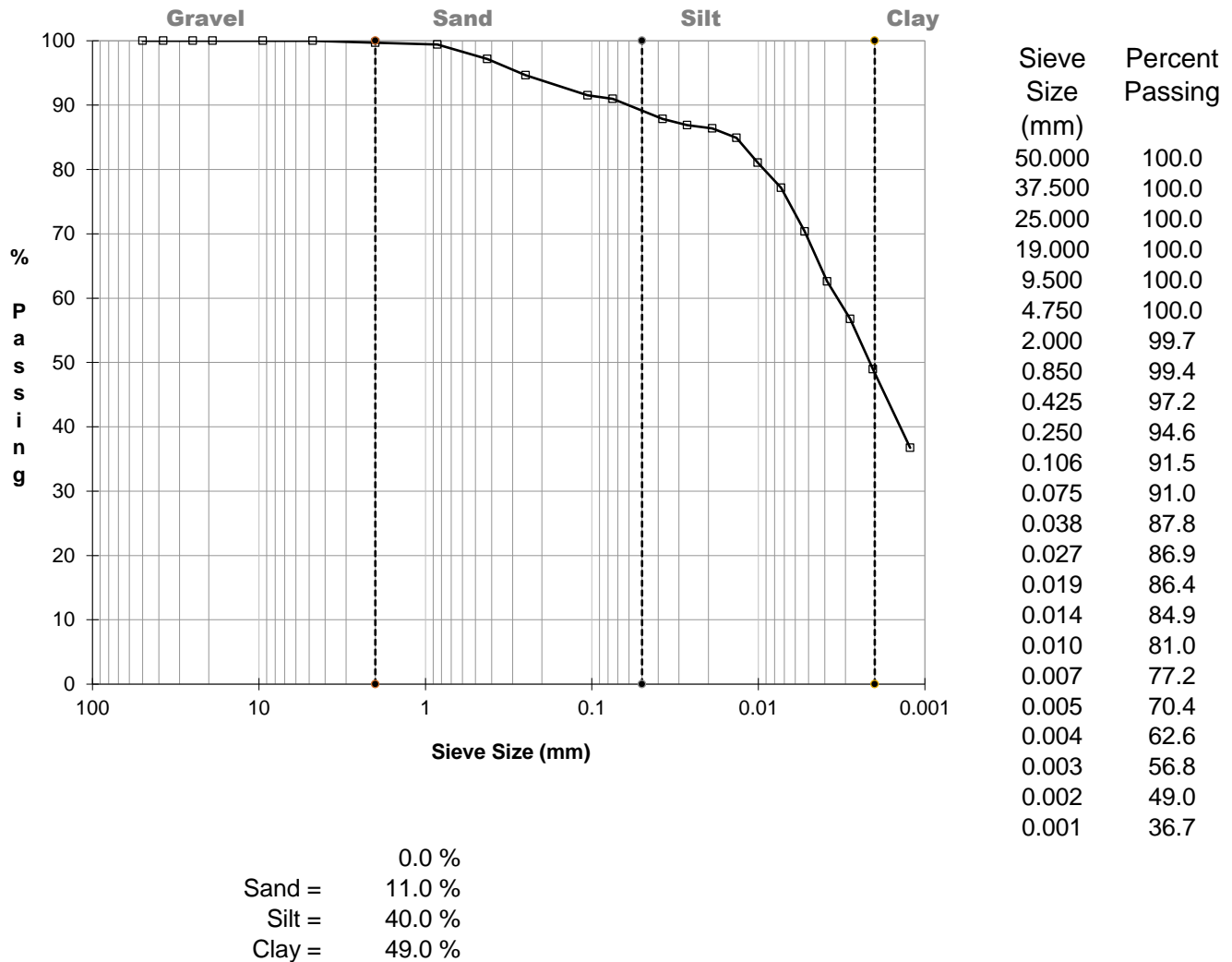
Project: Schott's Lake RV and Guest Ranch

Borehole No.: 5
Sample Depth: 5
Source: Job Site
Sampled By: KS
Tested By: DH

Sample Date: June 18, 2021

Date Tested: June 22, 2021

Date Received: June 18, 2021



Sample Description:

Remarks:

Per: _____



WSP Canada Inc.

405 - 18 Street SE
Calgary, AB, T2E 6J5.

Sieve Analysis

Report Date: June 24, 2021
Project Number: 211-04399-00
Report Number: 21-021

To: Schott's Lake RV and Guest Ranch Inc.

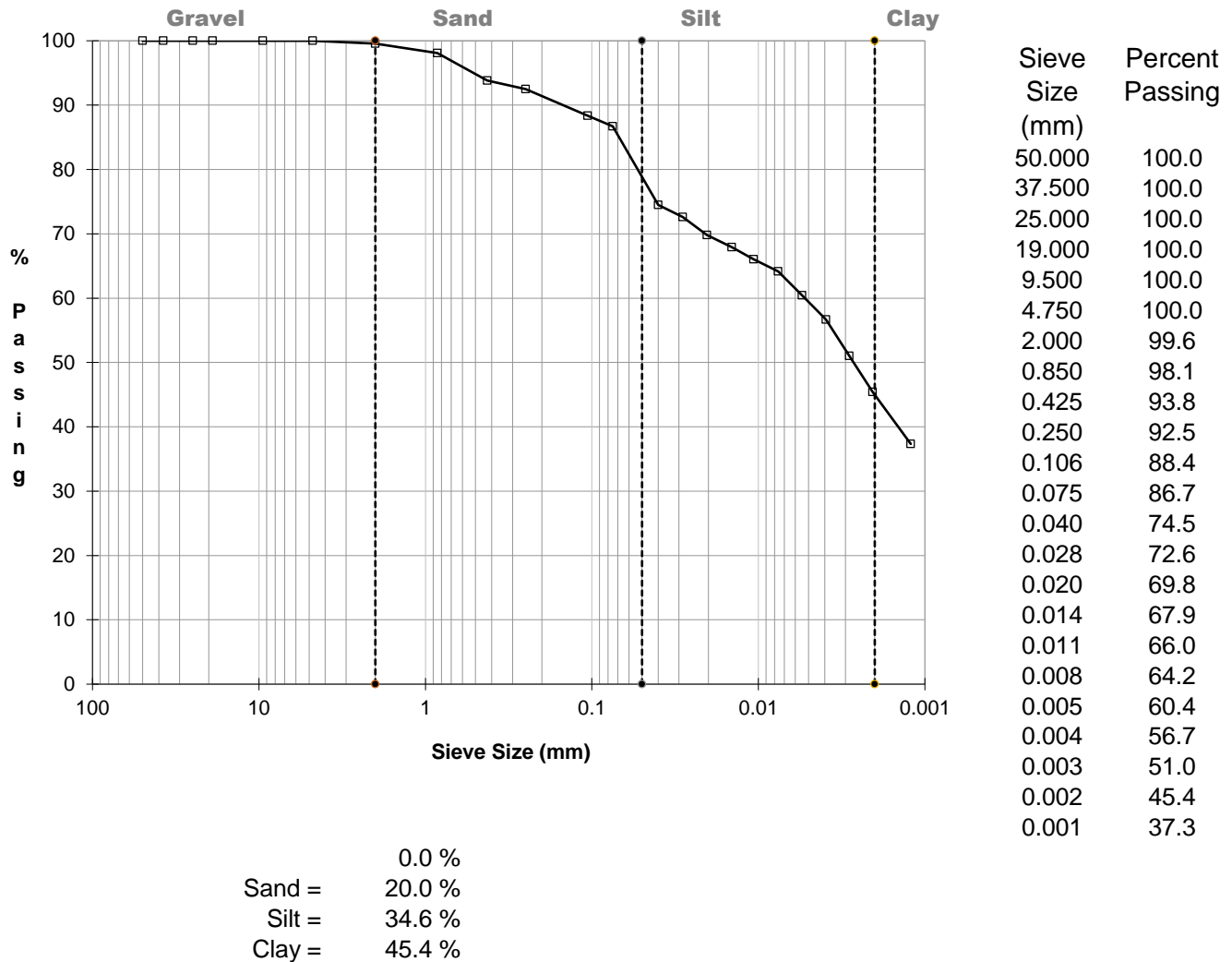
Project: Schott's Lake RV and Guest Ranch

Borehole No.: 13
Sample Depth: 5
Source: Job Site
Sampled By: KS
Tested By: DH

Sample Date: June 18, 2021

Date Tested: June 22, 2021

Date Received: June 18, 2021



Sample Description:

Remarks:

Per: _____



WSP Canada Inc.

405 - 18 Street SE

Calgary, AB T2E 6J5 Canada

T (403) 243-8380

SULFATE TEST

(ASTM C1580)

TRN: 21-021

Client: Schott's Lake RV & Guest Ranch Inc.

Project: Schott's Lake RV & Guest Ranch Inc.

Job No.: 211-04399-00

Report Date: July 13, 2021

Sampled By: KS

Tested By: DH

Sample Date: June 18, 2021

Test Date: July 12, 2021

BH No.	BH21-02						
Depth in feet	5.00						
Tare No.	# 3						
Actual Reading	25.0						
Correction Factor	1						
Corrected Reading	25						
SO4 Content (%)	0.050						
BH No.							
Depth in feet							
Tare No.							
Actual Reading							
Correction Factor							
Corrected Reading							
SO4 Content (%)							
BH No.							
Depth in feet							
Tare No.							
Actual Reading							
Correction Factor							
Corrected Reading							
SO4 Content (%)							
BH No.							
Depth in feet							
Tare No.							
Actual Reading							
Correction Factor							
Corrected Reading							
SO4 Content (%)							

Per: _____