Kollaard Associates
Engineers

210 Prescott Street, Unit 1
P.O. Box 189
Kemptville, Ontario K0G 1J0

Civil • Geotechnical •
Structural • Environmental •
Hydrogeology

(613) 860-0923

FAX: (613) 258-0475

REPORT ON

GEOTECHNICAL INVESTIGATION
PROPOSED COMMERCIAL DEVELOPMENT
3904 MARCH ROAD, CARP
CITY OF OTTAWA, ONTARIO

Project # 190622

Submitted to:

Dog World Bedrock Kennels
3904 March Road
Carp, Ontario
K0A 1L0

DISTRIBUTION

4 copies – City of Ottawa
1 copy - Dog World Bedrock Kennels
1 copy - Kollaard Associates Inc.

June 2020

TABLE OF CONTENTS

Kollaard Associates
Engineers
210 Prescott Street, Unit 1
P.O. Box 189
Kemptville, Ontario K0G 1J0

Civil • Geotechnical •
Structural • Environmental •
Hydrogeology

(613) 860-0923

FAX: (613) 258-0475

June 9, 2020 190622

Dog World Bedrock Kennels
3904 March Road
Carp, Ontario
K0A 1L0

RE: GEOTECHNICAL INVESTIGATION
PROPOSED COMMERCIAL DEVELOPMENT
3904 MARCH ROAD, CARP
CITY OF OTTAWA, ONTARIO

1.0 INTRODUCTION

This report presents the results of a geotechnical investigation carried out for the above noted proposed commercial development (Kennel and Gym) to be located at 3904 March Road, Carp, Ottawa, Ontario (see Key Plan, Figure 1).

The purpose of the investigation was to:

- Identify the subsurface conditions at the site by means of a limited number of boreholes;
- Based on the factual information obtained, provide recommendations and guidelines on the geotechnical engineering aspects of the project design; including bearing capacity and other construction considerations, which could influence design decisions.

2.0 BACKGROUND INFORMATION AND SITE GEOLOGY

2.1 Existing Conditions and Site Geology

The site is located within a rural setting consisting of vacant fields and scattered residential development along March Road. The existing site is comprised of a residential dwelling along with a dog kennel and is located about 360 metres east of the intersection of March Road and Upper Dwyer Hill Road in the City of Ottawa. The site is located on the south side of March Road. Based on a review of site plan provided by the client, it is proposed to construct two additional buildings for the dog kennel business at the site. It is proposed to construct the buildings south of the southernmost existing buildings at the site for the dog kennel business. Surface drainage for the proposed buildings will be directed away from the buildings by means of sheet flow and swales.

Based on a review of the surficial geology map for the site area (*Surficial Geology Map*: Geological Survey of Canada, Surficial Geology, Ottawa, Ontario, Map 1506A, published 1982, scale 1:50,000.), it is expected that the site is generally underlain by coarse textured glaciomarine deposits consisting of sand gravel, silt and clay (Glacial Till). A review of the bedrock geology map indicates that the bedrock underlying the site consists of sandstone and dolomite of the March Formation (*Bedrock Geology Map*: Geological Survey of Canada, Generalized Bedrock Geology, Ottawa-Hull, Ontario and Quebec, Map 1508A, published 1979, scale 1:125,000.).

The local topography across the property is relatively flat laying.

2.2 Proposed Development

Plans are being prepared to construct two additional commercial buildings for the dog kennel business at the site. The buildings are to consist of a proposed indoor dog gym/play area measuring about 443.5 square metres along with a proposed 4-plus run kennel with a footprint of approximately 110.9 square metres at the site. It is understood that the buildings are to be constructed in two phases.

Preliminary plans indicate that the proposed commercial buildings will be single storey, wood framed structures. The proposed buildings will be placed on a conventional concrete spread footing foundation with a concrete slab-on-grade construction. The proposed buildings will be accessed by an existing gravel driveway located at the site.

The proposed buildings will be serviced by a drilled cased well and a new onsite septic system.

3.0 PROCEDURE

The field work for this investigation was carried out on May 28, 2020, at which time three boreholes numbered BH1, BH2 and BH3 were put down at the site using a truck mounted drill rig equipped with a hollow stem auger owned and operated by CCC Environment and Geotechnical Drilling of Ottawa, Ontario. The boreholes were put down within the proposed building footprint.

Sampling of the overburden materials encountered at the borehole locations were carried out at regular 0.75 metre depth intervals using a 50 millimetre diameter drive open conventional split spoon sampler in conjunction with standard penetration testing (ASTM D-1586 – Penetration Test and Split Barrel Sampling of Soils). In situ vane shear testing (ASTM D-2573 Standard Test Method for Field Shear Test in Cohesive Soil) were attempted but not completed as the stiffness of the cohesive materials exceeded the capacity of the testing apparatus. All of the boreholes (BH1, BH2 and BH3) were advanced near the building footprints to depths ranging between 3.6 to 4.5 metres below the existing ground surface using 200 mm hollow stem augers.

The subsurface soil conditions encountered at the boreholes were classified based on visual and tactile examination of the samples recovered (ASTM D2488 - Standard Practice for Description and Identification of Soils (Visual-Manual Procedure), standard penetration tests (ASTM D-1586 – Penetration Test and Split Barrel Sampling of Soils as well as laboratory test results on select samples. The soils were classified using the Unified Soil Classification System. Groundwater conditions at the boreholes were noted at the time of drilling. The boreholes were loosely backfilled with the auger cuttings upon completion of drilling.

Two soil samples (BH1 - SS4 and BH2 - SS5) were submitted for particle size analysis and moisture content analysis (ASTM D422 and ASTM D2216) and Atterberg Limits (D4318) testing. The samples were selected based on depth and tactile examination to be representative of the various soil conditions encountered at the site.

One sample of soil obtained from BH1 (SS2 - 0.76 - 1.37m) was also delivered to a chemical laboratory for testing for any indication of potential soil sulphate attack and soil corrosion on buried concrete and steel. A total of 14 soil samples recovered from the boreholes were also tested for moisture content (ASTM D2216).

The field work was supervised throughout by a member of our engineering staff who located the boreholes in the field, logged the boreholes and cared for the samples obtained. A description of the subsurface conditions encountered at the boreholes are given in the attached Record of Borehole Sheets. The results of the laboratory testing of the soil samples are presented in the Laboratory Test Results section and Attachment A and B following the text in this report. The approximate location of the boreholes are shown on the attached Site Plan, Figure 2.

4.0 SUBSURFACE CONDITIONS

4.1 General

As previously indicated, a description of the subsurface conditions encountered at the boreholes is provided in the attached Record of Borehole Sheets following the text of this report. The borehole logs indicate the subsurface conditions at the specific drill locations only. Boundaries between zones on the logs are often not distinct, but rather are transitional and have been interpreted. Subsurface conditions at locations other than borehole locations may vary from the conditions encountered at the boreholes.

The soil descriptions in this report are based on commonly accepted methods of classification and identification employed in geotechnical practice. Classification and identification of soil involves judgement and Kollaard Associates Inc. does not guarantee descriptions as exact, but infers accuracy to the extent that is common in current geotechnical practice.

The groundwater conditions described in this report refer only to those observed at the location and on the date the observations were noted in the report and on the borehole logs. Groundwater conditions may vary seasonally, or may be affected by construction activities on or in the vicinity of the site.

The ground surface elevations at the borehole and test pit locations were determined, in the field, relative to a local benchmark provided by Kollaard Associates. The local benchmark is described as a nail in a utility pole located immediately east of an existing metal building and west of a turn in the driveway at the site. The elevation of the benchmark is 126.69 metres local datum.

The following is a brief overview of the subsurface conditions encountered at the boreholes.

4.2 Topsoil

From the surface at all of the boreholes, a layer of topsoil was encountered. The topsoil consists of dark brown to black sandy silt and has a thickness of about 100 to 230 millimetres. The material was classified as topsoil based on the colour and the presence of organic materials. The identification of the topsoil layer is for geotechnical purposes only and does not constitute a statement as to the suitability of this layer for cultivation and sustainable plant growth.

4.3 Sand

Beneath the layer of topsoil, a layer of red brown to grey brown to grey fine to medium sand with a trace of silt was encountered at all of the borehole locations. The deposits of sand ranged in thickness from about 1.2 to 1.5 metres below the existing ground surface. The results of standard penetration testing carried out in the sand material, which range from 4 to 9 blows per 0.3 metres with an average value of 6 blows per 0.3 metres, indicate a loose state of packing.

4.4 Silt

Beneath the layer of sand, a layer of grey silt with some clay was encountered at all of the borehole locations. The deposits of silt ranged in thickness from about 0.2 to 0.6 metres and was encountered at depth ranging from about 1.3 to 2.3 below the existing ground surface. The results of standard penetration testing carried out in the silt with some clay material, which range from 8 to 10 blows per 0.3 metres with an average value of 6 blows per 0.3 metres, indicate a loose to compact state of packing.

4.5 Silty Clay

A deposit of grey silty clay was encountered beneath the silt with some clay at all of the borehole locations. The results of standard penetration test N values at all of the boreholes were ranging from 6 to 13 blows per 0.3 metres with an average of 11 blows per 0.3 metres, indicating a stiff to very stiff consistency. In situ vane shear testing was attempted but not completed as the stiffness of the silty clay exceeded the capacity of the testing apparatus. The results of the attempted tests and the tactile examination carried out for the silty clay material indicate that the silty clay is very stiff in consistency for the full length of the silty clay silty layer within the boreholes.

The results of Atterberg Limits tests and moisture content (ASTM D422) conducted on one soil sample (BH2 – SS5 - 3.05 - 3.65 metres) of the silty clay are presented in the following table and in Attachment A at the end of the report. The tested silty clay sample classifies as medium plasticity in accordance with the Unified Soil Classification System. The results of the laboratory testing are located in Attachment A.

Table I – Atterberg Limit and Water Content Results

Sample	Depth(metres)	LL (%)	PL (%)	PI (%)
BH2-SS5	3.05 - 3.65m	44.1	22.1	22.0

LL: Liquid Limit PL: Plastic Limit Pl: Plasticity Index w: water content
CH: Inorganic Medium Plastic Soils

The results of one hydrometer test (ASTM D422 and D2216) on a sample of soil (BH1-SS4 - 2.28 - 2.89m) indicates the sample has a sand content of 6.6 percent, silt content of about 22.9 percent and a clay content of 70.5 percent. The moisture content is 30.5 percent The results are located in Attachment A.

The silty clay layer was fully penetrated at all of the borehole locations.

4.6 Sand and Gravel

A thin deposit of grey silty sand and gravel was encountered beneath the silty clay layer at all of the borehole locations. The thickness of the silty sand and gravel was determined to be 0.6 metres at BH1, 0.3 metres at BH2 and 0.1 metres at BH3.

Practical refusal advancement of the standard penetration split spoon and/or augers on bedrock or large boulder was encountered at depths of 4.47, 4.52 and 3.63 metres below the existing ground surface at boreholes BH1, BH2 and BH3, respectively.

4.7 Bedrock

All of the boreholes encountered practical refusal on the surface of bedrock or large boulders at depths ranging from about 3.63 to 4.52 metres below the existing ground surface.

4.8 Groundwater

Some groundwater seepage was encountered within each of the boreholes at the time of drilling. The seepage was observed within the sand deposit at depths of 0.8 to 0.9 metres below he existing ground surface at all of the boreholes. It should be noted that the groundwater levels may be higher during wet periods of the year such as the early spring.

4.8 Moisture Contents

A total of 14 soil samples recovered from the boreholes were also tested for moisture content (ASTM D2216). The measured moisture contents of the soil samples ranged from about 8 to 33 percent. The results of the moisture content are located on the Record of Borehole sheets following the text of this report and in Attachment A.

4.9 Corrosivity on Reinforcement and Sulphate Attack on Portland Cement

The results of the laboratory testing of a soil sample for submitted for chemistry testing related to corrosivity is summarized in the following table.

Item	Threshold of Concern	Test Result	Comment
Chlorides (Cl)	Cl > 0.04 %	<0.0005	Negligible
pH	5.0 < pH	6.98	Negligible concern
Resistivity	R < 20,000 ohm-cm	20400	Non-Corrosive
Sulphates (SO_4)	SO_4 > 0.1%	<0.002	Negligible concern

The results of the laboratory testing of a soil sample for sulphate gave a percent sulphate of less than 0.002. The National Research Council of Canada (NRC) recognizes four categories of potential sulphate attack of buried concrete based on percent sulphate in soil. From 0 to 0.10 percent the potential is negligible, from 0.10 to 0.20 percent the potential is mild but positive, from 0.20 to 0.50 percent the potential is considerable and 0.50 percent and greater the potential is severe. Based on the above, the soils are considered to have a negligible potential for sulphate attack on buried concrete materials and accordingly, conventional GU or MS Portland cement may be used in the construction of the proposed concrete elements.

The pH value for the soil sample was reported to be at 6.98, indicating a durable condition against corrosion. This value was evaluated using Table 2 of Building Research Establishment (BRE) Digest 362 (July 1991).The pH is greater than 5.5 indicating the concrete will not be exposed to attack from acids.

The chloride content of the sample was also compared with the threshold level and present negligible concrete corrosion potential.

Corrosivity Rating for soils ranges from extremely corrosive to non-corrosive as follows:

Soil Resistivity (ohm-cm)	Corrosivity Rating
> 20,000	non- corrosive
10,000 to 20,000	mildly corrosive
5,000 to 10,000	moderately corrosive
3,000 to 5,000	corrosive
1,000 to 3,000	highly corrosive
< 1,000	extremely corrosive

The soil resistivity was found to be 20400 ohm-cm for the sample analyzed making the soil non-corrosive for buried steel within below grade concrete walls. Consideration to increasing the specified strength and/or adding air entrainment into any reinforced concrete in contact with the soil is not necessary. There are also no requirement given to increasing the minimum concrete cover over reinforcing steel.

The laboratory results are presented at the end of this report.

5.0 GEOTECHNICAL GUIDELINES AND RECOMMENDATIONS

5.1 General

This section of the report provides engineering guidelines on the geotechnical design aspects of the project based on our interpretation of the information from the test holes and the project requirements. It is stressed that the information in the following sections is provided for the guidance of the designers and is intended for this project only. Contractors bidding on or undertaking the works should examine the factual results of the investigation, satisfy themselves as to the adequacy of the information for construction, and make their own interpretation of the factual data as it affects their construction techniques, schedule, safety and equipment capabilities.

The professional services for this project include only the geotechnical aspects of the subsurface conditions at this site. The presence or implications of possible surface and/or subsurface contamination resulting from previous uses or activities at this site or adjacent properties, and/or resulting from the introduction onto the site of materials from offsite sources are outside the terms of reference for this report.

5.2 Foundations for Proposed Commercial Buildings

The subsurface conditions at the site encountered at the boreholes advanced during the investigation consisted of topsoil followed by native sand then silt overlying very stiff silty clay. With the exception of the topsoil, the subsurface conditions encountered at the test holes advanced during the investigation are suitable for the support of the proposed buildings placed on a native subgrade or on engineered fill placed on the native subgrade.

The information provided indicates the proposed commercial development is to consist of a single storey indoor dog gym/play area along with a single storey 4-plus run kennel. It is recommended that the foundation for the proposed buildings consist of convention cast-in-place concrete foundations set on footings bearing below the depth of seasonal frost penetration.

It is considered that the excavation for the foundations could be completed by removing the topsoil throughout the footprints of the proposed buildings. The excavations for the perimeter strip footings should be continued to below the depth of seasonal frost penetration. The interior pad footings more than 3 metres from the perimeter foundations can be founded within the exposed sand immediately below the topsoil or on engineered fill placed on the native subgrade. .

5.3 Subsurface Conditions at the Underside of Footing Level

With the exception of the topsoil materials, the subsurface conditions encountered at the test holes advanced during the investigation are suitable for the support of the proposed commercial buildings on conventional spread footing foundations placed on a native subgrade or on engineered fill placed on the native subgrade. The excavations for the foundation should be taken through any granular fill, topsoil or otherwise deleterious material to expose the native, undisturbed sand.

It is expected that the subgrade immediately below the proposed footing levels will consist of a grey brown fine to medium sand. Once the excavation for the foundation are completed for both buildings, the exposed subgrades should be inspected by a qualified geotechnical person.

5.4 Conventional Spread Footing Foundations

The subsurface conditions at the site encountered at the boreholes advanced during the investigation consisted of topsoil followed by native sand overlying silt followed by very stiff silty clay with depth. With the exception of the topsoil, the subsurface conditions encountered at the test holes advanced during the investigation are suitable for the support of the proposed buildings on conventional spread footing foundations placed on a native subgrade or on engineered fill placed on the native subgrade.

For predictable performance of the proposed foundations, all existing topsoil and any deleterious materials should be removed from within the proposed foundation areas to expose the native sand.

Strip and pad footings, a minimum 0.5 metres in width bearing on the native sand at a founding depths of about 0.9 metres below the existing ground surface and above the groundwater level or on a suitably constructed engineering pad placed on the native sand may be designed using a maximum allowable bearing pressure of 70 kilopascals for serviceability limit states and 200 kilopascals for the factored ultimate bearing resistance.

The above allowable bearing pressure is subject to a maximum grade raise of 2.0 metres above the existing ground surface and to maximum strip and pad footing widths of 1.5 metres.

Provided that any loose and/or disturbed soil is removed from the bearing surfaces prior to pouring concrete, the total and differential settlement of the footings should be less than 25 millimetres and 20 millimetres, respectively.

The allowable bearing pressure for any footings depends on the depth of the footings below original ground surface, the width of the footings, and the height above the original ground surface of any landscape grade raise adjacent to the foundation.

5.5 Engineered Fill

Any fill required to raise the footings for the proposed buildings to founding level should consist of imported granular material (engineered fill). The engineered fill should consist of granular material meeting Ontario Provincial Standards Specifications (OPSS) requirements for Granular A or Granular B Type II and should be compacted in maximum 300 millimetre thick loose lifts to at least 98 percent of the standard Proctor maximum dry density. It is considered that the engineered fill should be compacted using dynamic compaction with a large diameter vibratory steel drum roller or diesel plate compactor. If a diesel plate compactor is used, the lift thickness may need to be restricted to less than 300 mm to achieve proper compaction. Compaction should be verified by a suitable field compaction test method.

To allow the spread of load beneath the foundations, the engineered fill should extend out from the outside edges of the footings for a horizontal distance of 0.5 metres and then down and out at a slope of 1 horizontal to 1 vertical, or flatter. The excavations for the structure should be sized to accommodate this fill placement.

The first lift of engineered fill material should have a thickness of 300 millimetres in order to protect the subgrade during compaction. It is considered that the placement of a geotextile fabric between the engineered fill and the subgrade is not necessary where granular materials meeting the grading requirements for OPSS Granular B Type I or Type II are placed on a sand or silty clay subgrade above the normal ground water level. Should the subgrade surface consist of silt, a 4 ounce per square yard non woven geotextile fabric should be placed between the engineered fill and the silt subgrade. It is recommended that trucks are not used to place the engineered fill on the subgrade. The fill should be dumped at the edge of the excavation and moved into place with a tracked bulldozer or excavator.

The native soils at this site will be sensitive to disturbance from construction operations and from rainwater or snowmelt, and frost. In order to minimize disturbance, construction traffic operating directly on the subgrade should be kept to an absolute minimum and the subgrade should be protected from below freezing temperatures.

5.5.1 Foundation Excavation

Any excavation for the proposed structures will likely be carried out through topsoil to bear within the native sand subgrade. The sides of the excavations should be sloped in accordance with the requirements of Ontario Regulation 213/91, s. 226 under the Occupational Health and Safety Act. According to the Act, the native soils at the site can be classified as Type 4 soil, however this classification should be confirmed by qualified individuals as the site is excavated and if necessary, adjusted.

It is expected that the side slopes of the excavation will be stable in the short term provided the walls are sloped at 1H:1V through the sand to 0.9 metres or less from the bottom of the excavation and provided no excavated materials are stockpiled within 3 metres of the top of the excavations.

5.5.2 Ground Water in Excavation and Construction Dewatering

Groundwater inflow from the native soils into the excavations during construction, if any should be handled by pumping from sumps within the excavation.

Groundwater was observed in all three boreholes at about 0.8 to 0.9 metres below the ground surface at time of drilling. Based on the groundwater levels observed, it is considered that the excavation for the new buildings at the site should not extend below the ground water level. As such a permit to take water is will not be required prior to excavation.

5.6 Frost Protection Requirements for Spread Footing Foundations

In general, all exterior foundation elements and those in any unheated parts of the proposed buildings should be provided with at least 1.5 metres of earth cover for frost protection purposes. Isolated, unheated foundation elements adjacent to surfaces, which are cleared of snow cover during winter months should be provided with a minimum 1.8 metres of earth cover for frost protection purposes. Alternatively, the required frost protection could be provided using a combination of earth cover and extruded polystyrene insulation. Detailed guidelines for footing insulation frost protection could be provided upon request.

5.7 Foundation Wall Backfill and Drainage

Provided everywhere the proposed finished floor surfaces are everywhere above the exterior finished grade, the granular materials beneath the proposed floor slabs are properly compacted and provided the exterior grade is adequately sloped away from the proposed buildings, no perimeter foundation drainage system is required.

Groundwater inflow from the native soils into the foundation excavations during construction, if any should be handled by pumping from sumps within the excavations.

The native soils encountered at this site are considered to be slightly frost susceptible. As such, to prevent possible foundation frost jacking, the backfill against any unheated or insulated walls or isolated walls or piers should consist of free draining, non-frost susceptible material. If imported material is required, it should consist of sand or sand and gravel meeting OPSS Granular B Type I grading requirements.

Alternatively, foundations could be backfilled on the exterior with native material in conjunction with the use of an approved proprietary drainage layer system (such as Platon System Membrane) against the foundation walls. There is potential for possible frost jacking of the upper portion of some types of these drainage layer systems if frost susceptible material is used as backfill. To mitigate this potential, the upper approximately 0.6 metres of the foundations should be backfilled with non-frost susceptible granular material.

Where the granular backfill will ultimately support a pavement structure or walkway, it is suggested that the wall backfill material be compacted in 250 millimetre thick lifts to 95 percent of the standard Proctor dry density value. In that case any native material proposed for foundation backfill should be inspected and approved by the geotechnical engineer.

5.8 Slab on Grade Support

As stated above, it is expected that the proposed buildings will be founded on native sand or on an engineered pad placed on the native subgrade. For predictable performance of the proposed concrete floor slab all existing fill material, topsoil and any otherwise deleterious material should be removed from below the proposed floor slab area. The exposed native subgrade surface should then be inspected and approved by geotechnical personnel. Any soft areas evident should be subexcavated and replaced with suitable engineered fill. Any fill materials consisting of granular material, removed from the proposed concrete floor slab area, could be stockpiled for possible reuse with approval from the geotechnical engineer.

The fill materials beneath the proposed concrete floor slab on grade should consist of a minimum of 150 millimetre thickness of crushed stone meeting OPSS Granular A immediately beneath the concrete floor slab followed by sand, or sand and gravel meeting the OPSS for Granular B Type I, or crushed stone meeting OPSS grading requirements for Granular B Type II, or other material approved by the Geotechnical Engineer. The fill materials should be compacted in maximum 300 millimetre thick lifts to at least 95 percent of the standard Proctor maximum dry density.

The slab should be structurally independent from walls and columns, which are supported by the foundations. This is to reduce any structural distress that may occur as a result of differential soil movement. If it is intended to place any internal non-load bearing partitions directly on the slab-on-grade, such walls should also be structurally independent from other elements of the building founded on the conventional foundation system so that some relative vertical movement between the floor slab and foundation can occur freely.

The concrete floor slab should be saw cut at regular intervals to minimize random cracking of the slab due to shrinkage of the concrete. The saw cut depth should be about one quarter of the thickness of the slab. The crack control cuts should be placed at a grid spacing not exceeding the lesser of 25 times the slab thickness or 4.5 metres. The slab should be cut as soon as it is possible to work on the slab without damaging the surface of the slab. Under slab drainage is not considered necessary provided that the floor slab level is above the finished exterior ground surface level. If any areas of the proposed buildings are to remain unheated during the winter period or under slab insulation is to be used, thermal protection of the foundation may be required. Further details on the insulation requirements could be provided, if necessary.

5.9 Seismic Design for the Proposed Light Industrial Building

5.9.1 Seismic Site Classification

Based on the limited information from the boreholes, for seismic design purposes, in accordance with the 2012 OBC Section 4.1.8.4, Table 4.1.8.4.A., the site classification for seismic site response is Site Class D. It is expected that the proposed underside of footing level is to be 0.9 metres below the existing ground surface and will be underlain by compact silt and sand followed by stiff to very stiff silty clay then dense to very dense sand and gravel and bedrock.

5.9.2 National Building Code Seismic Hazard Calculation

The design Peak Ground Acceleration (PGA) for the site was calculated as 0.231 with a 2% probability of exceedance in 50 years based on the interpolation of the 2015 National Building Code Seismic Hazard calculation. The seismic site classification for the site is indicated to be Seismic Site Class C. The results of the test are attached following the text of this report.

5.9.3 Potential for Soil Liquefaction

As indicated above, the proposed footings will be underlain by by compact silt and sand followed by stiff to very stiff silty clay then dense to very dense sand and gravel and bedrock. The thickness of the silt and sand deposits are limited and are compact to dense. As such there is little potential for soil liquefaction at the site and no risk or potential for damage of the proposed building structures due to liquefaction of the soil subgrade during seismic activity at the site.

6.0 ACCESS ROADWAY AND PARKING LOT PAVEMENTS

A review of the proposed site grading plan indicates the no additional materials are to be added to the existing gravel surfaced driveway and/or parking area. Notwithstanding the information provided on the proposed site grading plan, the following pavement structure is suggested to provide an appropriate road and parking structure to adequately service the proposed dog training facility development.

6.1 Subgrade Preparation

In preparation for pavement construction at this site any topsoil and any soft, wet or deleterious materials should be removed from the proposed access roadway and parking lot area. The exposed subgrade surface should then be proof inspected and approved by geotechnical personnel. Any soft or unacceptable areas evident should be subexcavated and replaced with suitable earth borrow material. The subgrade should be shaped and crowned to promote drainage of the roadway and parking area granulars. Following approval of the preparation of the subgrade, the pavement granulars may be placed.

For any areas of the site that require the subgrade to be raised to proposed roadway and parking area subgrade level, the material used should consist of OPSS select subgrade material or OPSS Granular B Type I or Type II. Materials used for raising the subgrade to proposed roadway and parking area subgrade level should be placed in maximum 300 millimetre thick loose lifts and be compacted to at least 95 percent of the standard Proctor maximum dry density using suitable compaction equipment.

6.2 Parking and Roadway Area Structure

Granular Surfaced Areas

It is suggested that provision be made for the following minimum pavement structure:

200 millimetres of OPSS Granular A base over
300 millimetres of OPSS Granular B, Type II subbase
(50 or 100 millimetre minus crushed stone)

Non-woven geotextile fabric (6 oz/sqy) such as Terrafix 360R or Thrace-Ling 150EX or approved alternative.

The above pavement structures will be adequate on an acceptable subgrade, that is, one where any roadway fill has been adequately compacted. If the roadway subgrade is disturbed or wetted due to construction operations or precipitation, the granular thicknesses given above may not be adequate and it may be necessary to increase the thickness of the Granular B Type II subbase between the roadway subgrade surface and the granular subbase material.

7.0 CONSTRUCTION CONSIDERATIONS

It is suggested that the final design drawings for the project, including the proposed site grading plan, be reviewed by the geotechnical engineer to ensure that the guidelines provided in this report have been interpreted as intended and to re-evaluate the guidelines provided in the report with respect to the actual project plans.

The engagement of the services of the geotechnical consultant during construction is recommended to confirm that the subsurface conditions throughout the proposed development do not materially differ from those given in the report and that the construction activities do not adversely affect the intent of the design.

All foundation areas and any engineered fill areas for the proposed buildings should be inspected by Kollaard Associates Inc. to ensure that a suitable subgrade has been reached and properly prepared. The placing and compaction of any granular materials beneath the foundations should be inspected to ensure that the materials used conform to the grading and compaction specifications.

Should a new access roadway or parking area be constructed, the subgrade for the access roadway and parking areas should be inspected and approved by geotechnical personnel. In situ density testing should be carried out on the roadway granular materials to ensure the materials meet the specifications from a compaction point of view.

The native subgrade soils at this site will be sensitive to disturbance from construction operations, from rainwater or snow melt, and frost. In order to minimize disturbance, construction traffic operating directly on the subgrade should be kept to an absolute minimum and the subgrade should be protected from below freezing temperatures.

We trust this report provides sufficient information for your present purposes. If you have any questions concerning this report or if we may be of further services to you, please do not hesitate to contact our office.

Regards,
Kollaard Associates Inc.

LICENSED PROFESSIONAL ENGINEER
09.06.2020
S.E. deWit
100079612
PROVINCE OF ONTARIO

Dean Tataryn, B.E.S., EP. Steve DeWit, P.Eng.

RECORD OF BOREHOLE BH1

PROJECT: Proposed Commercial Development
CLIENT: Dog World Bedrock Kennels
LOCATION: 3904 March Road, Carp, Ottawa, Ontario
PENETRATION TEST HAMMER: 63.5kg, Drop, 0.76mm

PROJECT NUMBER: 190622
DATE OF BORING: May 28, 2020
SHEET 1 of 1
DATUM: LOCAL

DESCRIPTION	ELEV. / DEPTH (M)	NUMBER	TYPE	BLOWS/0.3m	ADDITIONAL LAB TESTING (%M)
Ground Surface	125.75				
TOPSOIL	0.00				
Red brown fine to medium SAND, trace silt	125.52 / 0.23	1	SS	6	17
Grey brown to grey fine to medium SAND, trace silt	124.99 / 0.76	2	SS	9	
Grey SILT, some clay	124.08 / 1.67	3	SS	10	24
Very stiff grey SILTY CLAY	123.47 / 2.28	4	SS	10	
		5	SS	6	31
Grey silty SAND and GRAVEL	121.90 / 3.85	6	SS	50	8
End of Borehole, refusal on large boulder or bedrock	121.28 / 4.47				

Depth scale (meters): 0, 1, 2, 3, 4, 5, 6

UNDIST. SHEAR STRENGTH × Cu, kPa ×: 20 40 60 80
REM. SHEAR STRENGTH ○ Cu, kPa ○: 20 40 60 80
DYNAMIC CONE PENETRATION TEST blows/300 mm: 10 30 50 70 90

PIEZOMETER OR STANDPIPE INSTALLATION:
Water observed in borehole at approximately 0.8 metres below the existing ground surface on May 28, 2020.

DEPTH SCALE: 1 to 100
BORING METHOD: Power Auger
AUGER TYPE: 200 mm Hollow Stem
LOGGED: DT
CHECKED: SD

RECORD OF BOREHOLE BH2

PROJECT: Proposed Commercial Development
CLIENT: Dog World Bedrock Kennels
LOCATION: 3904 March Road, Carp, Ottawa, Ontario
PENETRATION TEST HAMMER: 63.5kg, Drop, 0.76mm

PROJECT NUMBER: 190622
DATE OF BORING: May 28, 2020
SHEET 1 of 1
DATUM: LOCAL

DEPTH SCALE (meters)	SOIL PROFILE – DESCRIPTION	ELEV. / DEPTH (M)	SAMPLES – NUMBER	TYPE	BLOWS/0.3m	ADDITIONAL LAB TESTING (%M)	PIEZOMETER OR STANDPIPE INSTALLATION
	Ground Surface	125.97					
0	TOPSOIL	0.00					
	Red brown fine to medium SAND, trace silt		1	SS	4	16	
	Grey brown to grey fine to medium SAND, trace silt	125.14 / 0.83	2	SS	5	20	Water observed in borehole at approximately 0.9 metres below the existing ground surface on May 28, 2020.
2	Grey SILT, some clay	124.30 / 1.67	3	SS	8		
	Very stiff grey SILTY CLAY	123.64 / 2.33	4	SS	12	23	
3			5	SS	13		
4			6	SS	8	33	
	Grey silty SAND and GRAVEL	121.76 / 4.21					
	End of Borehole, refusal on large boulder or bedrock	121.45 / 4.52					
5							
6							

UNDIST. SHEAR STRENGTH × Cu, kPa 20 40 60 80
REM. SHEAR STRENGTH ○ Cu, kPa 20 40 60 80
DYNAMIC CONE PENETRATION TEST blows/300 mm 10 30 50 70 90

DEPTH SCALE: 1 to 35
BORING METHOD: Power Auger
AUGER TYPE: 200 mm Hollow Stem
LOGGED: DT
CHECKED: SD

RECORD OF BOREHOLE BH3

PROJECT: Proposed Commercial Development
CLIENT: Dog World Bedrock Kennels
LOCATION: 3904 March Road, Carp, Ottawa, Ontario
PENETRATION TEST HAMMER: 63.5kg, Drop, 0.76mm

PROJECT NUMBER: 190622
DATE OF BORING: May 28, 2020
SHEET 1 of 1
DATUM: LOCAL

DEPTH SCALE (meters)	SOIL PROFILE: DESCRIPTION	ELEV. DEPTH (M)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	UNDIST. SHEAR STRENGTH × Cu, kPa (20 40 60 80) / REM. SHEAR STRENGTH ○ Cu, kPa (20 40 60 80)	DYNAMIC CONE PENETRATION TEST blows/300 mm (10 30 50 70 90)	ADDITIONAL LAB TESTING (%M)	PIEZOMETER OR STANDPIPE INSTALLATION
	Ground Surface	125.68							
0	TOPSOIL	0.00							
	Red brown fine to medium SAND, trace silt	125.58 0.10	1	SS	6			15	
	Grey brown to grey fine to medium SAND, trace silt	124.73 0.95	2	SS	6			25	Water level symbol at approx. 0.9 m
1	Grey SILT, some clay	124.36 1.32							Water observed in borehole at approximately 0.9 metres below the existing ground surface on May 28, 2020.
	Very stiff grey SILTY CLAY	124.16 1.52	3	SS	13			25	
2			4	SS	13			25	
3			5	SS	13			10	
	Grey silty SAND and GRAVEL	122.15 3.53							
	End of Borehole, refusal on large boulder or bedrock	122.05 3.63							
4									

DEPTH SCALE: 1 to 25
BORING METHOD: Power Auger
AUGER TYPE: 200 mm Hollow Stem
LOGGED: DT
CHECKED: SD

LIST OF ABBREVIATIONS AND TERMINOLOGY

SAMPLE TYPES

AS auger sample
CS chunk sample
DO drive open
MS manual sample
RC rock core
ST slotted tube .
TO thin-walled open Shelby tube
TP thin-walled piston Shelby tube
WS wash sample

PENETRATION RESISTANCE

Standard Penetration Resistance, N ,
The number of blows by a 63.5 kg hammer dropped 760 millimeter required to drive a 50 mm drive open sampler for a distance of 300 mm. For split spoon samples where less than 300 mm of penetration was achieved, the number of blows is reported over the sampler penetration in mm.

Dynamic Penetration Resistance
The number .of blows by a 63.5 kg hammer dropped 760 mm to drive a 50 mm diameter, 60° cone attached to 'A' size drill rods for a distance of 300 mm.

WH
_Sampler advanced by static weight of hammer and drill rods.

WR
Sampler advanced by static weight of drill rods.

PH
Sampler advanced by hydraulic pressure from drill rig.

PM
Sampler advanced by manual pressure.

SOIL TESTS

C consolidation test
H hydrometer analysis
M sieve analysis
MH sieve and hydrometer analysis
U unconfined compression test
Q undrained triaxial test
V field vane, undisturbed and remolded shear strength

SOIL DESCRIPTIONS

Relative Density	'N' Value
Very Loose	0 to 4
Loose	4 to10
Compact	10 to 30
Dense	30 to 50
Very Dense	over 50

Consistency	Undrained Shear Strength (kPa)
Very soft	0 to 12
Soft	12 to 25
Firm	25 to 50 ,
Stiff	50 to100
Very Stiff	over100

LIST OF COMMON SYMBOLS

C_u undrained shear strength
e void ratio
C_c compression index
C_v coefficient of consolidation
k coefficient of permeability
I_p plasticity index
n porosity
u pore pressure
w moisture content
w_L liquid limit
w_p plastic limit
$\$^1$ effective angle of friction
r unit weight of soil
y^1 unit weight of submerged soil
cr normal stress

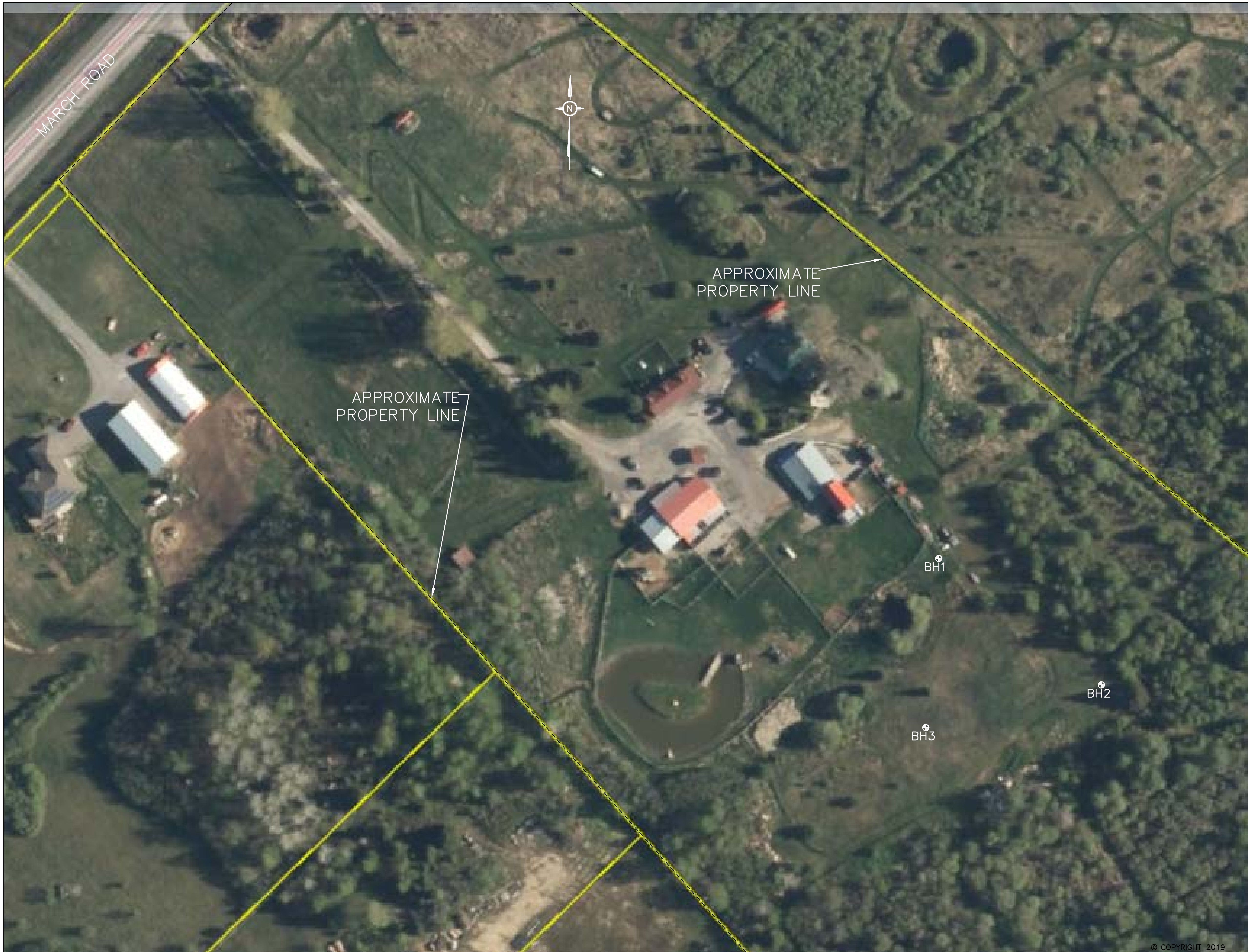
KEY PLAN	FIGURE 1

NOT TO SCALE

Kollaard Associates
Engineers

Project No. 190622

Date May 2020



DRAWING NUMBER:
SITE PLAN, FIGURE 2

LEGEND:

BH1 APPROXIMATE BOREHOLE LOCATION

REFERENCE: PLAN SUPPLIED BY CITY OF OTTAWA EMAPS.

SPECIAL NOTE: THIS DRAWING TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING REPORT.

REV.	NAME	DATE	DESCRIPTION

Kollaard Associates
Engineers
PO, BOX 189, 210 PRESCOTT ST
KEMPTVILLE ONTARIO
K0G 1J0 FAX (613) 258-0475
http://www.kollaard.ca
(613) 860-0923
info@kollaard.ca

CLIENT:
DOG WORLD BEDROK KENNELS

PROJECT:
GEOTECHNICAL INVESTIGATION FOR PROPOSED COMMERCIAL DEVELOPMENT

LOCATION:
3904 MARCH ROAD
CITY OF OTTAWA, ONTARIO

DESIGNED BY:	DATE:
--	JUNE 9, 2020
DRAWN BY: DT	SCALE: N.T.S

KOLLAARD FILE NUMBER:
190622

Laboratory Test Results for Chemical Properties

Kollaard Associates (Kemptville)
ATTN: Dean Tataryn
210 Prescott Street Unit 1
P.O. Box 189
Kemptville ON K0G 1J0

Date Received: 02-JUN-20
Report Date: 10-JUN-20 14:40 (MT)
Version: FINAL

Client Phone: 613-860-0923

Certificate of Analysis

Lab Work Order #: L2454934
Project P.O. #: NOT SUBMITTED
Job Reference:
C of C Numbers:
Legal Site Desc:

Emily Smith
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2454934-1 BH1 SS2 2'6-4'6 Sampled By: CLIENT on 28-MAR-20 Matrix: SOIL							
Physical Tests							
Conductivity	0.0489		0.0040	mS/cm		09-JUN-20	R5112777
% Moisture	17.4		0.25	%	05-JUN-20	06-JUN-20	R5110016
pH	6.98		0.10	pH units		10-JUN-20	R5115096
Redox Potential	303		-1000	mV		09-JUN-20	R5112795
Resistivity	20400		1.0	ohm*cm		09-JUN-20	
Leachable Anions & Nutrients							
Chloride	<0.00050		0.00050	%	08-JUN-20	08-JUN-20	R5112517
Anions and Nutrients							
Sulphate	<0.0020		0.0020	%	08-JUN-20	08-JUN-20	R5112517
Inorganic Parameters							
Acid Volatile Sulphides	<0.20	PEHR	0.20	mg/kg	08-JUN-20	08-JUN-20	R5110769

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

Sample Parameter Qualifier key listed:

Qualifier	Description
PEHR	Parameter Exceeded Recommended Holding Time On Receipt: Proceed With Analysis As Requested.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
CL-R511-WT	Soil	Chloride-O.Reg 153/04 (July 2011)	EPA 300.0

5 grams of dried soil is mixed with 10 grams of distilled water for a minimum of 30 minutes. The extract is filtered and analyzed by ion chromatography.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

EC-WT	Soil	Conductivity (EC)	MOEE E3138

A representative subsample is tumbled with de-ionized (DI) water. The ratio of water to soil is 2:1 v/w. After tumbling the sample is then analyzed by a conductivity meter.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

MOISTURE-WT	Soil	% Moisture	CCME PHC in Soil - Tier 1 (mod)
PH-WT	Soil	pH	MOEE E3137A

A minimum 10g portion of the sample is extracted with 20mL of 0.01M calcium chloride solution by shaking for at least 30 minutes. The aqueous layer is separated from the soil and then analyzed using a pH meter and electrode.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

REDOX-POTENTIAL-WT	Soil	Redox Potential	APHA 2580

This analysis is carried out in accordance with the procedure described in the "APHA" method 2580 "Oxidation-Reduction Potential" 2012. Samples are extracted at a fixed ratio with DI water. Results are reported as observed oxidation-reduction potential of the platinum metal-reference electrode employed, in mV.

RESISTIVITY-CALC-WT	Soil	Resistivity Calculation	APHA 2510 B

The reported Resistivity value is calculated as the inverse of the conductivity of a 2:1 water:soil leachate. This method does not use direct measurement of Soil Resistivity using a resistivity meter.

RESISTIVITY-CALC-WT	Soil	Resistivity Calculation	MOECC E3138

The reported Resistivity value is calculated as the inverse of the conductivity of a 2:1 water:soil leachate. This method does not use direct measurement of Soil Resistivity using a resistivity meter.

SO4-WT	Soil	Sulphate	EPA 300.0

5 grams of soil is mixed with 50 mL of distilled water for a minimum of 30 minutes. The extract is filtered and analyzed by ion chromatography.

SULPHIDE-WT	Soil	Sulphide, Acid Volatile	APHA 4500S2J

This analysis is carried out in accordance with the method described in APHA 4500 S2-J. Hydrochloric acid is added to sediment samples within a purge and trap system. The evolved hydrogen sulphide (H2S) is carried into a basic solution by inert gas. The acid volatile sulfide is then determined colourimetrically.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

Chain of Custody Numbers:

Reference Information

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid weight of sample
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Chain of Custody (COC) / Analytical Request Form

ALS Environmental
www.alsglobal.com

Canada Toll Free: 1 800 668 9878

L2454934-COFC

COC Number: 17 -

Page 1 of 1

Report To	Contact and company name below will appear on the final report
Company:	Kollaard Associates (27196)
Contact:	Dean Tataryn
Phone:	613.860.0923, ext.225
	Company address below will appear on the final report
Street:	210 Prescott Street, Unit 1 P.O. Box 189
City/Province:	Kemptville, Ontario
Postal Code:	K0G 1J0
Invoice To	Same as Report To ☐ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution

Select Report Format: ☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)

Quality Control (QC) Report with Report ☐ YES ☐ NO

☐ Compare Results to Criteria on Report - provide details below if box checked

Select Distribution: ☐ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax dean@kollaard.ca

Email 2

Email 3

Invoice Distribution

Select Invoice Distribution: ☐ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax mary@kollaard.ca

Email 2

Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)

Regular [R] ☐ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days): 4 day [P4-20%] ☐ 3 day [P3-25%] ☐ 2 day [P2-50%] ☐

EMERGENCY: 1 Business day [E1 - 100%] ☐ Same Day, Weekend or Statutory holiday [E2 -200% (Laboratory opening fees may apply)] ☐

Date and Time Required for all E&P TATs:

For tests that can not be performed according to the service level selected, you will be contacted.

Project Information

ALS Account # / Quote #: Q71021

Job #:

PO / AFE:

LSD:

ALS Lab Work Order # (lab use only): L2454934 CF

Oil and Gas Required Fields (client use)

AFE/Cost Center: | PO#

Major/Minor Code: | Routing Code:

Requisitioner:

Location:

ALS Contact: Melanie M. | Sampler:

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Corrosivity (KOLLAARD-CORR-WT)	Subdivision-Chem (KOLLAARD-SDCHEM-W)	Subdivision-Micro (KOLLAARD-SDMICRO-W)		BTEX / F1-F4	SAMPLES ON HOLD	Sample is hazardous (please provide further detail)	NUMBER OF CONTAINERS
	BH1 SS2 2'6-4'6	Mar 28/20		Soil	X							

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☐ NO

Are samples for human consumption/ use? ☐ YES ☐ NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice Packs ☐ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C: 24.1

FINAL COOLER TEMPERATURES °C: 15.3

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: K. Linton	Date: June 1 2020	Time:	Received by: Custas Farassoglou	Date: 6/2/20	Time: 12:00	Received by: [signature]	Date: 6/3/20	Time: 913

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

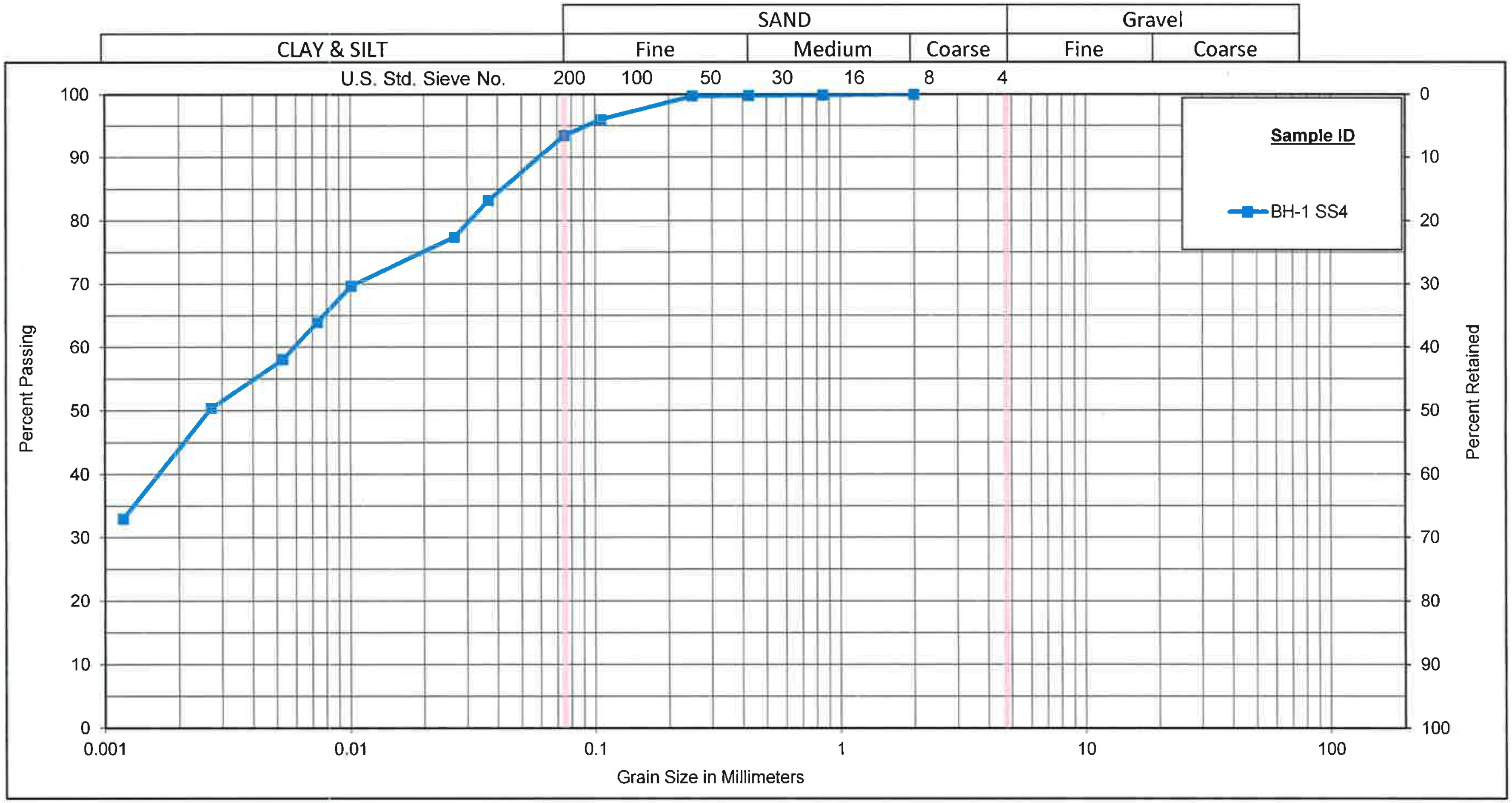
SEPT 2017 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

Laboratory Test Results for Physical Properties

Unified Soil Classification System



Sample ID	Depth	% Gravel	% Sand	% Silt	% Clay
BH-1 SS4	7'6"-9'6"	0.0	6.6	22.9	70.5

Stantec

GRAIN SIZE DISTRIBUTION

Kollaard Associates, File # 190622

Dog World Bedrock Kennells

Figure No.

Project No. 122410003

Stantec

Particle-Size Analysis of Soils
LS702
AASHTO T88

PROJECT DETAILS

Client:	Kollaard Associates, File # 190622	Project No.:	122410003
Project:	Dog World Bedrock Kennells	Test Method:	LS702
Material Type:	Soil	Sampled By:	Kollaard Associates Engineers
Source:	BH-1	Date Sampled:	May 28, 2020
Sample No.:	SS4	Tested By:	Denis Rodrigeuz
Sample Depth	7'6"-9'6"	Date Tested:	June 3, 2020

WASH TEST DATA

Oven Dry Mass in Hydrometer Analysis (g)	50.58
Sample Weight after Hydrometer and Wash (g)	3.37
Percent Passing No. 200 Sieve (%)	93.3
Percent Passing Corrected (%)	93.34

PERCENT LOSS IN SIEVE

Sample Weight Before Sieve (g)	133.10
Sample Weight After Sieve (g)	133.10
Percent Loss in Sieve (%)	0.00

SOIL INFORMATION

Liquid Limit (LL)		
Plasticity Index (PI)		
Soil Classification		
Specific Gravity (G_s)	2.750	
Sg. Correction Factor (α)	0.978	
Mass of Dispersing Agent/Litre	48	g

CALCULATION OF DRY SOIL MASS

Oven Dried Mass (W_o), (g)	47.72
Air Dried Mass (W_a), (g)	48.49
Hygroscopic Corr. Factor ($F=W_o/W_a$)	0.9841
Air Dried Mass in Analysis (M_a), (g)	51.40
Oven Dried Mass in Analysis (M_o), (g)	50.58
Percent Passing 2.0 mm Sieve (P_{10}), (%)	100.00
Sample Represented (W), (g)	50.58

SIEVE ANALYSIS

Sieve Size mm	Cum. Wt. Retained	Percent Passing
75.0		100.0
63.0		100.0
53.0		100.0
37.5		100.0
26.5		100.0
19.0		100.0
13.2		100.0
9.5		100.0
4.75		100.0
2.00	0.0	100.0
Total (C + F)[1]	133.10	
0.850	0.07	99.86
0.425	0.10	99.80
0.250	0.14	99.72
0.106	2.02	96.01
0.075	3.32	93.44
PAN	3.37	

Note 1: (C + F) = Coarse + Fine

HYDROMETER DETAILS

Volume of Bulb (V_B), (cm^3)	63.0
Length of Bulb (L_2), (cm)	14.47
Length from '0' Reading to Top of Bulb (L_1), (cm)	10.29
Scale Dimension (h_s), (cm/Div)	0.155
Cross-Sectional Area of Cylinder (A), (cm^2)	27.25
Meniscus Correction (H_m), (g/L)	1.0

START TIME 9:58 AM

HYDROMETER ANALYSIS

Date	Time	Elapsed Time T Mins	H_s Divisions g/L	H_c Divisions g/L	Temperature T_c °C	Corrected Reading $R = H_s - H_c$ g/L	Percent Passing P %	L cm	η Poise	K	Diameter D mm
03-Jun-20	9:59 AM	1	51.0	8.0	23.5	43.0	83.17	8.30904	9.28431	0.012744	0.03674
03-Jun-20	10:00 AM	2	48.0	8.0	23.5	40.0	77.37	8.77404	9.28431	0.012744	0.02669
03-Jun-20	10:03 AM	5	48.0	8.0	23.5	40.0	77.37	8.77404	9.28431	0.012744	0.01688
03-Jun-20	10:13 AM	15	44.0	8.0	23.5	36.0	69.63	9.39404	9.28431	0.012744	0.01009
03-Jun-20	10:28 AM	30	41.0	8.0	23.0	33.0	63.83	9.85904	9.39251	0.012818	0.00735
03-Jun-20	10:58 AM	60	38.0	8.0	23.0	30.0	58.02	10.32404	9.39251	0.012818	0.00532
03-Jun-20	2:08 PM	250	34.0	8.0	22.0	26.0	50.2882	10.94404	9.61570	0.012970	0.00271
04-Jun-20	9:58 AM	1440	25.0	8.0	23.0	17.0	32.8807	12.33904	9.39251	0.012818	0.00119

Remarks:

Reviewed By: Brian Prevost
Date: June 12/2020

V:\01216\active\laboratory_standing_offers\2020 Laboratory Standing Offers\122410003 Kollaard Associates Engineers\May 28, Hyd, Limit, MC, Kollaard #190622\Hydrometer Analysis MTO Projects May2014.xlsx

Stantec
Stantec Consulting Ltd
2781 Lancaster Rd, Suite 100 A&B
Ottawa, ON K1B 1A7
Tel: (613) 738-6075
Fax: (613) 722-2799

June 15, 2020
File: 122410003

Attention: **Dean Tataryn, Kollaard Associates Engineers**

Reference: **Kollaard File #190622 ASTM D4318 Atterberg Limit**

The following table summarizes Atterberg Limit results.

Source	Depth	Liquid Limit	Plastic Limit	Plasticity Index
BH-2 SS-5	10'-12'	44.1	22.1	22.0

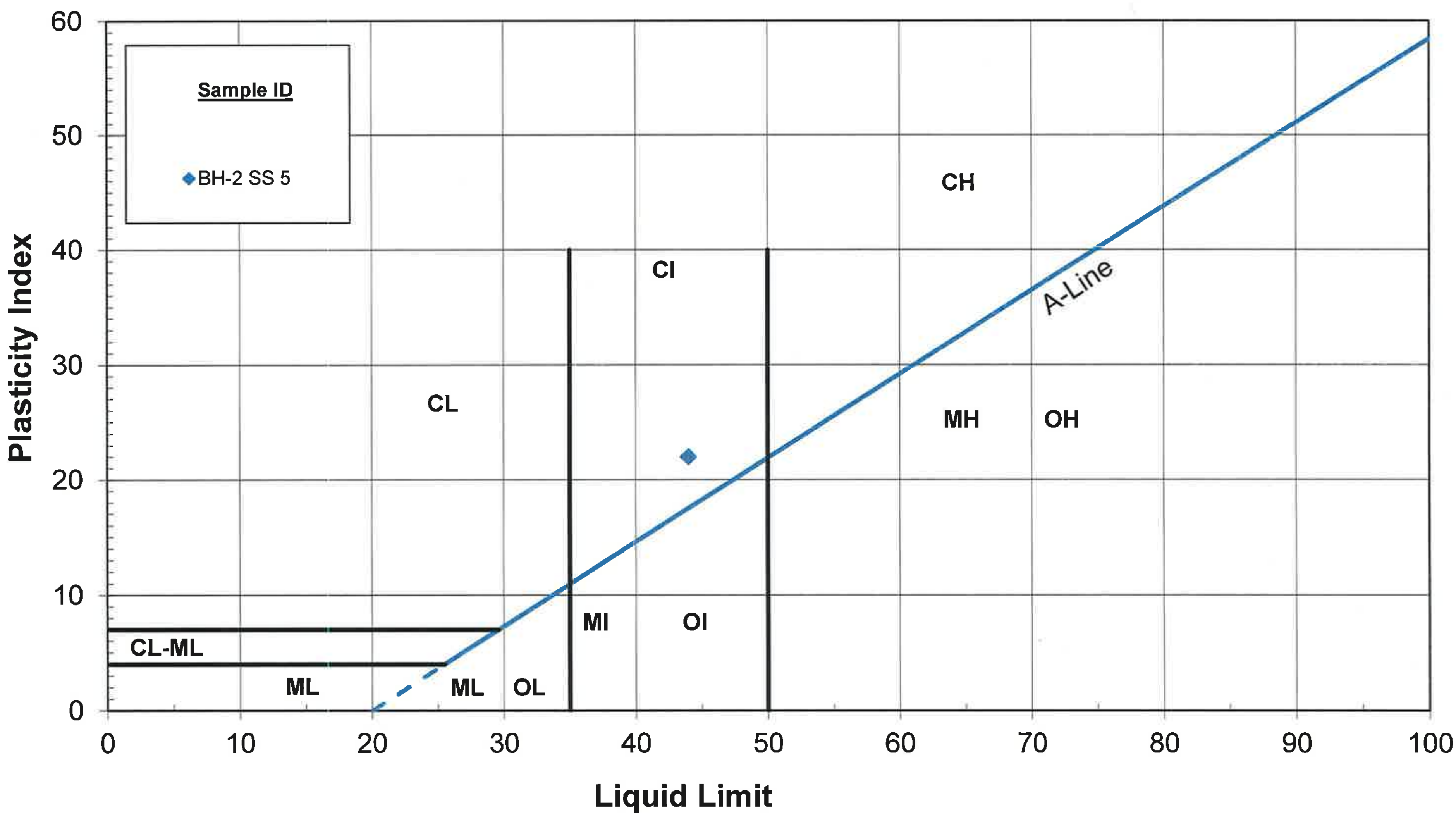
Sincerely,

Stantec Consulting Ltd

Brian Prevost

Brian Prevost
Laboratory Supervisor
Tel: 613-738-6075
Fax: 613-722-2799
brian.prevost@stantec.com

Attachments: Atterberg Limit Plasticity Chart



Stantec	Kollaard Associates, File #190622 Dog World Bedrock Kennells PLASTICITY CHART	Figure No. Project No. 122410003

National Building Code Seismic Hazard Calculation

2015 National Building Code Seismic Hazard Calculation

INFORMATION: **Eastern Canada English (613) 995-5548 français (613) 995-0600 Facsimile (613) 992-8836**
Western Canada English (250) 363-6500 Facsimile (250) 363-6565

Site: 45.269N 76.122W **User File Reference:** 3904 March Road, Ottawa, ON 2021-09-09 20:03 UT

Probability of exceedance per annum	0.000404	0.001	0.0021	0.01
Probability of exceedance in 50 years	2 %	5 %	10 %	40 %
Sa (0.05)	0.360	0.190	0.112	0.035
Sa (0.1)	0.428	0.237	0.146	0.049
Sa (0.2)	0.361	0.207	0.131	0.046
Sa (0.3)	0.276	0.161	0.104	0.037
Sa (0.5)	0.198	0.117	0.076	0.027
Sa (1.0)	0.102	0.061	0.040	0.014
Sa (2.0)	0.049	0.029	0.019	0.006
Sa (5.0)	0.013	0.007	0.004	0.001
Sa (10.0)	0.005	0.003	0.002	0.001
PGA (g)	0.231	0.130	0.080	0.027
PGV (m/s)	0.166	0.094	0.058	0.019

Notes: Spectral (Sa(T), where T is the period in seconds) and peak ground acceleration (PGA) values are given in units of g (9.81 m/s^2). Peak ground velocity is given in m/s. Values are for "firm ground" (NBCC2015 Site Class C, average shear wave velocity 450 m/s). NBCC2015 and CSAS6-14 values are highlighted in yellow. Three additional periods are provided - their use is discussed in the NBCC2015 Commentary. Only 2 significant figures are to be used. **These values have been interpolated from a 10-km-spaced grid of points. Depending on the gradient of the nearby points, values at this location calculated directly from the hazard program may vary. More than 95 percent of interpolated values are within 2 percent of the directly calculated values.**

References

National Building Code of Canada 2015 NRCC no. 56190; Appendix C: Table C-3, Seismic Design Data for Selected Locations in Canada

Structural Commentaries (User's Guide - NBC 2015: Part 4 of Division B)
Commentary J: Design for Seismic Effects

Geological Survey of Canada Open File 7893 Fifth Generation Seismic Hazard Model for Canada: Grid values of mean hazard to be used with the 2015 National Building Code of Canada

See the websites www.EarthquakesCanada.ca and www.nationalcodes.ca for more information

Natural Resources Canada Ressources naturelles Canada

Canada