RYZUK GEOTECHNICAL
Engineering & Materials Testing

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November 29, 2019
File No: 4472-15

District of Sooke
2205 Otter Point Road
Sooke, BC
V9Z 1J2

Attn: Teunesha Evertse (By E-mail: tevertse@sooke.ca)

Re: Geotechnical Assessment
Lot A, 6671 Wadams Way – Sooke, BC

As requested, and in accordance with our proposal dated October 18, 2019, we have completed a preliminary geotechnical investigation at the above referenced site. This report summarizes the results of our investigation and associated recommendations as such relate to the proposed development. Our work in this regard has been carried out in accordance with, and is subject to, the enclosed Terms of Engagement.

PROPOSED DEVELOPMENT

The proposed site is rectangular in shape with an associated area of approximately 21,300 m^2 and is bounded by Wadams Way to the north, residential properties to the east and west, and a commercial/mall area at 6660 Sooke Road to the south. It is currently undeveloped and generally vegetated with shrubs, tall grasses, and mature trees.

Based on the provided Concept Site Plan included in the RFQ, we understand the proposed development consists of a public library within the northwest area of the site, a public plaza including public washrooms and market stands within the southwest area of the site, and two four- to six-storey mixed use buildings, with one level of underground parking, within the east area of the site, along with the associated access roads and parking areas within the central area.

INVESTIGATION PROCEDURE

Our work consisted of a review of surficial geology maps, aerial photographs, and previous projects we have been involved with in the vicinity of the site. Following our review, we executed a field investigation using conventional excavating equipment to collect subsurface information.

Our field investigation consisted of excavating seven test pits (TP19-01 and TP19-07) to depths ranging from 1.7 to 2.3 metres below ground surface (mBGS). The work was completed on November 7, 2019 using an excavator supplied and operated by Sooke Backhoe Services Ltd.

Test pits were located near the perimeter of the property as well as in locations where foundation footprints are anticipated. Final test pit locations are shown on the attached Location Plan (4472-15-1).

The soil types and conditions were assessed visually in the field and were classified according to the Modified Unified Soil Classification System, see enclosed Summary of Test Pit Information. Sample collection and in-situ testing was not completed as a part of our investigation. Also, long-term groundwater monitoring wells were not installed during our investigation. A summary of the subsurface conditions encountered in each test pit is enclosed.

SURFACE AND SUBSURFACE CONDITIONS

The southern portion of the site has been used for stockpiling building rubble and gravel. Although the site is undeveloped, signs of the site being used as a waste disposal area are evident. A small unpaved path along the eastern portion of the site has also been made, which accommodates pedestrians.

At the northwestern portion of the site, we observed localized mound of higher elevation with a relief of approximately up to 3 m. Atop the mound are boulders approximately 300 mm in size, alongside shrubs and small trees. Site topography is noted to be dipping towards the middle of the site where signs of a small drainage or watercourse are observed, running from southwest to northeast. It appears to be seasonal and a catchment of runoff as no running water was observed flowing through it. This is also evident by the amount of overgrown grasses and shrubs along the drainage course.

Based on the surficial geology map for the area of Sooke, the anticipated soil conditions consist of glacial till based sand, clay and silts. Previous investigations in the surrounding area have shown subsurface conditions of shallow topsoil and compact silty sand over top very stiff to hard silts.

Our recent investigation confirmed subsurface conditions consisting of 0 to 0.9 m of shallow topsoil/fill soils overlying 0.6 m to 2.3 m of very stiff to hard clayey silts or very dense silty sand and gravel (glacial till). Practical refusal was relatively shallow as very dense soils or large boulders are encountered at around 2 m in depth. No seepage was encountered in any of the test pits.

GEOTECHNICAL ASSESSMENT AND RECOMMENDATIONS

Based on the findings of our investigation, we consider the planned development to be feasible from a geotechnical perspective. We expect that the foundations will include conventional spread footings bearing on very stiff to hard native clays and silts or very dense sand and gravel for all building areas. We anticipate that excavations on site can be done using open cutslopes as detailed below. Due to uneven topography, the use of engineered fill will be expected in order to achieve design grade in some areas

Site Preparation

Prior to construction, all vegetation and refuse, such as garbage and concrete rubble stockpiles, must be removed. All topsoil and other deleterious and disturbed materials should not to be relied on for support of foundation or engineered fill and must be removed from the area unless it is judged suitable for future landscaping use. The subgrade should be inspected/approved by a geotechnical engineer prior to placement of any required engineered fill.

Excavation Considerations

As the provided Concept Site Plan indicated at least one level of underground parking, along the eastern portion of the site, we anticipate excavations during construction will reach up to 5 m in depth. Given the soil conditions encountered, we expect cutslopes will be stable at the following configurations:

- 1.0 Horizontal : 1.0 Vertical (1.0H : 1.0V) for surficial topsoil, fills, stiff clays;
- 0.5H:1.0V for very stiff to hard clayey silts or very dense sand and gravel (inferred glacial till);

Adjustments to the above may be required during construction if variations in the soil or seepage is observed. According to WorkSafeBC guidelines, excavations deeper than 1.2 m must be inspected and approved by a qualified geotechnical professional prior to worker entry, unless sloped or shored in accordance with the guidelines

Foundations

We expect that conventional pad and strip footings will be used for the proposed development. Provided the footings bear directly on undisturbed native mineral soils, or approved engineered fill placed upon such, foundation elements can be dimensioned using serviceable limit state (SLS) bearing resistances of 150 kPa and 175 kPa for strip and pad footings respectively. For ultimate limit state (ULS), bearing resistances of 225 kPa and 260 kPa can be used for strip and pad footings respectively, assuming a geotechnical resistance factor of 0.5 as per the current Canadian Foundation Engineering Manual. Actual bearing resistances of the foundation subgrade will need to be confirmed by Ryzuk Geotechnical once footing subgrade is exposed. Footings bearing directly on undisturbed glacial till could have higher bearing capacities of approximately 250 kPa (SLS).

We recommend minimum footing widths of 400 and 600 mm for strip and pad footings, respectively. For frost protection, the base of all footings should extend to a depth of at least 450 mm below adjacent finished grades.

Seismic Considerations

The Capital Regional District is situated in a region of very high seismicity. Considerable earthquake risk exists, stemming from our proximity to the Cascadia subduction zone and numerous more local faults in southwestern BC and northwestern Washington State. Based on soil conditions observed at the site and anticipated basement grades, building foundations are generally expected to bear on any one of: sand and gravel (glacial till), clayey silt (glacial till), and/or engineered fill placed atop such.

Based on our observed/expected soil conditions, it is reasonable to expect the shear wave velocity in the upper 30 m (Vs30) to be between 360 and 760 m/s. This corresponds to a Site Classification for Seismic Site Response of 'C', in accordance with the current BC Building Code. The site might be classified under Seismic Site Response of 'B'. However, drilling to at least 30 m will be needed in order to confirm this classification.

As determined from the 2015 National Building Code Seismic Hazard Calculation, for a 2% probability of exceedance in 50 years, the Peak Ground Acceleration (PGA) and Spectral Acceleration Values for Seismic hazard values for Site Class 'C' are summarized in Table 1. The raw values provided from the National Seismic Hazard Calculator are provided as an attachment to this report.

Table 1. Summary of PGA and Spectral Acceleration Values (NBC 2015)

Period (sec)	0.2	0.5	1.0	2.0	5.0	10.0	PGA (g)	PGV (m/s)
Response (g) Site Class 'C'	1.35	1.24	0.76	0.45	0.14	0.05	0.61	0.88

Engineered Fill or Material Reuse

If it is desired to raise grades back to design grade after removal of topsoil / fill material, approved engineered fill would be required. We understand that site sourced native soils and granular fills may be used as engineered fill on the site. Subject to inspection at the time of construction, excavated native sand and gravel as well as some of the excavated native clays and silts on site may be suitable for reuse for engineered fill under roads (except for the pavement structure), or general fill not directly adjacent to buildings, provided clasts larger than 150 mm are removed. Native clay and silt fill material is to be placed at slightly lower than the optimum moisture content, in maximum 150 mm lifts, and compacted with a sheeps-foot roller or approved equivalent. Note that the native clay and silt material has a high content of fines, can easily become oversaturated, and is generally difficult to place and compact, especially in the wetter winter months. Granular fill material is to be well graded, at or near optimum water content, and should be placed in maximum 300 mm lifts and compacted with a smooth-drum roller.

All fill materials are to be compacted to a minimum of 95% of Standard Proctor Maximum Dry Density (SPMDD), with in-situ density testing conducted to ensure compaction in the engineered fill. The engineered fill must have a footprint that extends horizontally beyond the footings a distance equal to the thickness of the engineered fill, to provide adequate splay for foundation loads. In perimeter areas, it is inadvisable to have the fill splay extend beyond property lines.

Settlement Considerations

Provided unsuitable soils (topsoils or fills) are removed from all building / foundation areas, and other areas of expected heavy loading and that any engineered fill below footings is suitably compacted, we expect that settlement at this site will be minor, if any, and of minimal significance to the structural or geotechnical design.

Slab on Grade

Slab on grade construction is considered feasible for the proposed development provided that all undesirable or deleterious material is removed below the slab area. A sub-slab leveling fill layer should be placed comprised of 19 mm minus crushed rock, or approved alternative, with conventional sub-slab poly vapour barrier recommended immediately beneath the slab to minimize the capillary rise of moisture into the underside of the slab. As with the engineered fill, the sub-slab material should be compacted to at least 95% SPMDD.

Foundation Wall Backfill

Foundation walls should be backfilled per the Engineered Fill section. Where the grade elevation differs significantly between the two sides of a perimeter wall, and the wall is free to rotate in order to develop the active earth pressure state (rotation of 0.1% of the wall height, non rigid wall), the wall should be designed to resist a lateral earth pressure (due to granular backfill) similar in magnitude and distribution to that of a fluid having a unit weight of 6.3 kN/m^3. Lateral earth pressures due to floor loadings and/or foundation loads from adjacent portions of the building can be calculated assuming a lateral coefficient of 0.35. Where the wall cannot rotate (rigid wall), it should be designed to resist an at rest lateral earth pressure loading, similar in magnitude and distribution to that of a fluid having a unit weight of 8.6 kN/m^3. In this case, lateral earth pressure due to floor loadings and/or foundation loads from adjacent buildings can be calculated assuming a lateral coefficient of 0.45. Equipment larger than a bobcat should not be allowed within 1.5 m of the foundation walls during backfilling.

Lateral earth pressures resulting from seismic activity can be calculated according to the following equations:

Non Rigid Wall : $PE = 0.375\ k_h\ \gamma\ H^2$
Rigid Wall : $PE = 0.5\ k_h\ \gamma\ H^2$

where:

- PE is the resultant force per unit length of wall;
- the coefficients of 0.375 and 0.5 are dimensionless;
- k_h is the design peak horizontal ground acceleration coefficient;
- γ is the moist unit weight of the backfill material, which is approximately 20.4 kN/m^3 for most granular backfill;
- H is the height of the wall

In the case of the non rigid wall, the backfill pressure distribution resulting from the earthquake loading can be assumed to be triangular, increasing from zero at the base of the wall to a maximum of $0.75\ k_h\ \gamma\ H$ at the top of the wall, with the resultant force acting at 0.67H above the base of the wall.

In the case of the rigid wall, the backfill pressure distribution resulting from the earthquake loading can be assumed to be parabolic, with the resultant force acting at 0.5H above the base of the wall.
For design purposes, the pressure distribution resulting from earthquake loading on the backfill should be added to either the active or at rest pressure distribution depending on whether the noted wall rotation can occur.

Foundation Drainage

Conventional perimeter foundation drainage consisting of perforated drainpipe surrounded by free draining granular material containing no fines or clean drain rock, tied into the recommended free draining backfill material is typically recommended. To prevent the migration of fine-grained soil particles into the drainage system, a layer of medium weight, non-woven geotextile fabric should be

placed between the clean drain rock around the perforated pipe and the granular backfill material. The geotextile fabric should encompass the entire drain rock/drain pipe system.

In general, pipe inverts should be kept at least 300 mm below interior grades. Any structures that extend below the invert of adjacent perimeter/interior drainage will be subject to moisture ingress unless they are waterproofed/tanked or are provided with localized drainage. Such structures provided without drainage must be designed to accommodate hydrostatic pressure. Where interior slab levels are at least 300 mm above exterior grades, it is possible that the perimeter drains can be deleted. This can be reviewed further once building details are known.

Pavement Considerations

In areas of light traffic within driveways and parking areas, 50 mm of asphalt over at least 100 mm of 20 mm minus crushed rock (granular base) atop a minimum of 150 mm of 75 mm minus crushed rock product (granular sub-base) is recommended. For heavier traffic areas, we recommend 75 mm of asphalt and the sub-base be thickened to 150 mm. The sub-base material should be placed directly atop approved native soil subgrade, or suitably recompacted existing fill materials provided that it is free of organic material. A concrete slab is often preferred in front of garbage enclosures. We recommend spot check in-situ density tests to ensure fill materials are compacted to a minimum 95% Modified Proctor Maximum Dry Density (MPMDD) for support of civil infrastructure.

CLOSURE

We trust the preceding is suitable for your purposes at present. Please do not hesitate to contact our office if we can be of further assistance.

Yours truly,
Ryzuk Geotechnical

Pauline Sarmiento, EIT
Junior Engineer

Bruce Dagg, P.Eng,
Principal/ Geotechnical Engineer

PROFESSIONAL
PROVINCE OF
B. R. DAGG
BRITISH COLUMBIA
ENGINEER

29/11/19

Enclosures - Terms of Engagement
Location Plan, Dwg. 4472-15-1
Summary of Test Pit Information, TP19-01 to TP19-07

RYZUK GEOTECHNICAL
ENGINEERING & MATERIALS TESTING

TERMS OF ENGAGEMENT

GENERAL

Ryzuk Geotechnical (the Consultant) shall render the Services, as specified in the agreed Scope of Services, to the Client for this Project in accordance with the following terms of engagement. The Services, and any other associated documents, records or data, shall be carried out and/or prepared in accordance with generally accepted engineering practices in the location where the Services were performed. No other warranty, expressed or implied is made. The Consultant may, at its discretion and at any stage, engage sub-consultants to perform all or any part of the Services.

Ryzuk Geotechnical is a wholly owned subsidiary of C. N. Ryzuk & Associates Ltd.

COMPENSATION

All charges will be payable in Canadian Dollars. Invoices will be due and payable by the Client on receipt of the invoice without hold back. Interest on overdue accounts is 24% per annum.

REPRESENTATIVES

Each party shall designate a representative who is authorized to act on behalf of that party and receive notices under this Agreement.

TERMINATION

Either party may terminate this engagement without cause upon thirty (30) days' notice in writing. On termination by either party under this paragraph, the Client shall forthwith pay to the Consultant its Charges for the Services performed, including all expenses and other charges incurred by the Consultant for this Project.

If either party breaches this engagement, the non-defaulting party may terminate this engagement after giving seven (7) days' notice to remedy the breach. On termination by the Consultant under this paragraph, the Client shall forthwith pay to the Consultant its Charges for the Services performed to the date of termination, including all fees and charges for this Project.

ENVIRONMENTAL

The Consultant's field investigation, laboratory testing and engineering recommendations will not address or evaluate pollution of soil or pollution of groundwater. The Consultant will cooperate with the Client's environmental consultant during the field work phase of the investigation.

PROFESSIONAL RESPONSIBILITY

In performing the Services, the Consultant will provide and exercise the standard of care, skill and diligence required by customarily accepted professional practices and procedures normally provided in the performance of the Services contemplated in this engagement at the time when and the location in which the Services were performed.

INSURANCE

Ryzuk Geotechnical is covered by Professional Indemnity Insurance as follows:

1. $ 3,000,000 each and every claim
2. $ 5,000,000 aggregate
3. $ 5,000,000 commercial/general liability coverage

LIMITATION OF LIABILITY

The Consultant shall not be responsible for:

1. the failure of a contractor, retained by the Client, to perform the work required for the Project in accordance with the applicable contract documents;
2. the design of or defects in equipment supplied or provided by the Client for incorporation into the Project;
3. any cross-contamination resulting from subsurface investigations;
4. any Project decisions made by the Client if the decisions were made without the advice of the Consultant or contrary to or inconsistent with the Consultant's advice;
5. any consequential loss, injury or damages suffered by the Client, including but not limited to loss of use, earnings and business interruption;
6. the unauthorized distribution of any confidential document or report prepared by or on behalf of the consultant for the exclusive use of the Client
7. Subsurface structures and utilities

The Consultant will make all reasonable efforts prior to and during subsurface site investigations to minimize the risk of damaging any subsurface utilities/mains. If, in the unlikely event that damage is incurred where utilities were unmarked and/or undetected, the Consultant will not be held responsible for damages to the site or surrounding areas, utilities/mains or drilling equipment or the cost of any repairs.

The total amount of all claims the Client may have against the Consultant or any present or former partner, executive officer, director, stockholder or employee thereof under this engagement, including but not limited to claims for negligence, negligent misrepresentation and breach of contract, shall be strictly limited to the amount of any professional liability insurance the Consultant may have available for such claims.

No claim may be brought against the Consultant in contract or tort more than two (2) years after the date of discovery of such defect.

DOCUMENTS AND REPORTING

All of the documents prepared by the Consultant or on behalf of the Consultant in connection with the Project are instruments of service for the execution of the Project. The Consultant retains the property and copyright in these documents, whether the Project is executed or not. These documents may not be used on any other project without the prior written agreement of the Consultant.

The documents have been prepared specifically for the Project, and are applicable only in the case where there has been no physical alteration to, or deviation from any of the information provided to the Consultant by the Client or agents of the Client. The Client may, in light of such alterations or deviations, request that the Consultant review and revise these documents.

The identification and classification as to the extent, properties or type of soils or other materials at the Project site has been based upon investigation and interpretation consistent with the accepted standard of care in the engineering consulting practice in the location where the Services were performed. Due to the nature of geotechnical engineering, there is an inherent risk that some conditions will not be detected at the Project site, and that actual subsurface conditions may vary considerably from investigation points. The Client must be aware of, and accept this risk, as must any other party making use of any documents prepared by the Consultant regarding the Project.

Any conclusions and recommendations provided within any document prepared by the Consultant for the Client has been based on the investigative information undertaken by the Consultant, and any additional information provided to the Consultant by the Client or agents of the Client. The Consultant accepts no responsibility for any associated deficiency or inaccuracy as the result of a miss-statement or receipt of fraudulent information.

JOBSITE SAFETY AND CONTROL

The Client acknowledges that control of the jobsite lies solely with the Client, his agents or contractors. The presence of the Consultant's personnel on the site does not relieve the Client, his agents or contractors from their responsibilities for site safety. Accordingly, the Client must endeavor to inform the Consultant of all hazardous or otherwise dangerous conditions at the Project site of which the Client is aware.

The client must acknowledge that during the course of a geotechnical investigation, it is possible that a previously unknown hazard may be discovered. In this event, the Client recognizes that such a hazard may result in the necessity to undertake procedures which ensure the safety and protection of personnel and/or the environment. The Client shall be responsible for payment of any additional expenses incurred as a result of such discoveries, and recognizes that under certain circumstances, discovery of hazardous conditions or elements requires that regulatory agencies must be informed. The Client shall not bring about any action or dispute against the Consultant as a result of such notification.

FIELD SERVICES

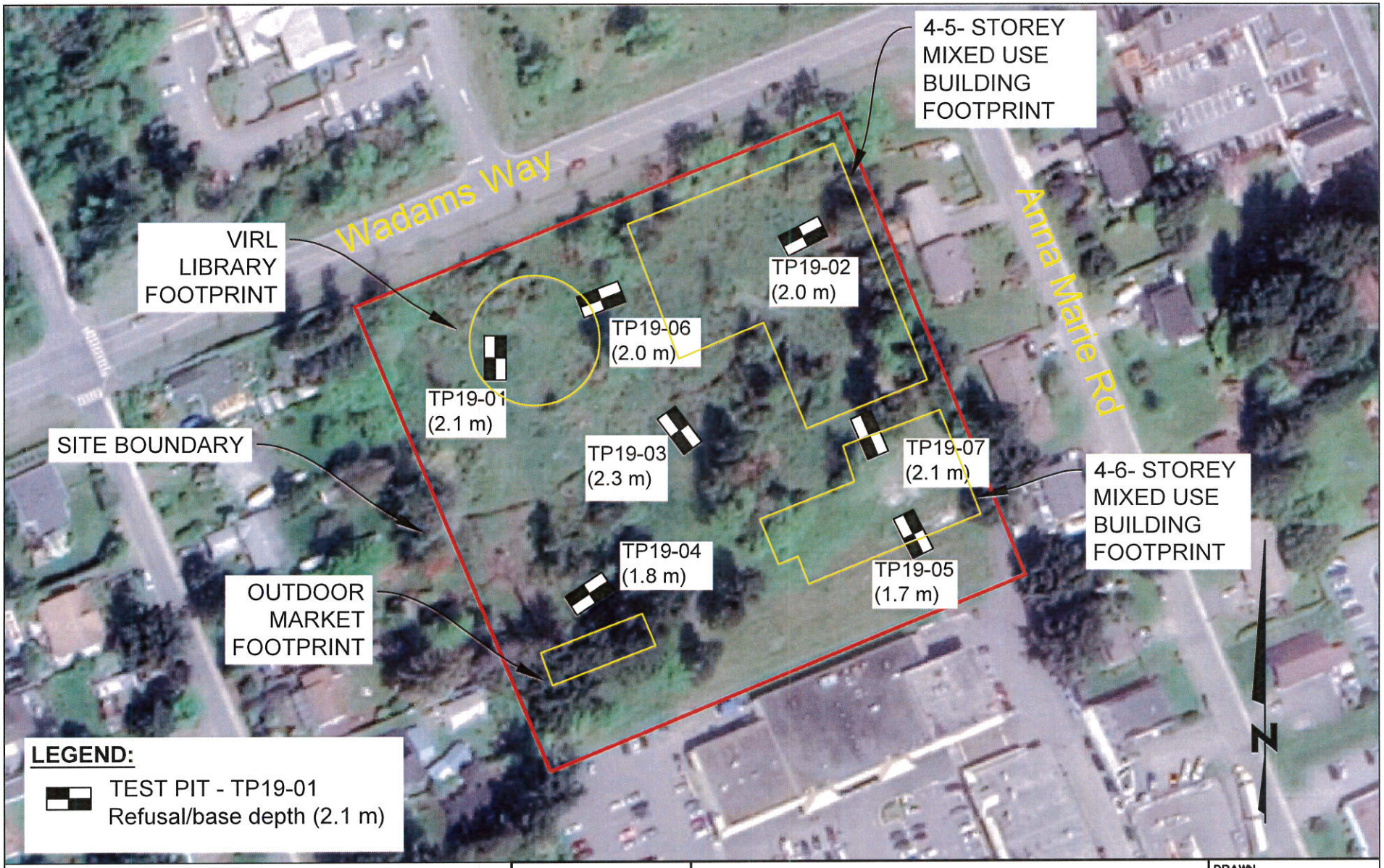
Where applicable, field services recommended for the Project are the minimum necessary, in the sole discretion of the Consultant, to observe whether the work or a contractor retained by the Client is being carried out in general conformity with the intent of the Services. Any reduction from the level of services recommended will result in the Consultant providing qualified certifications for the work.

DISPUTE RESOLUTION

If requested in writing by either the Client or the Consultant, the Client and the Consultant shall attempt to resolve any dispute between them arising out of or in connection with this Agreement by entering into structured non-binding negotiations with the assistance of a mediator on a without prejudice basis. The mediator shall be appointed by agreement of the parties. If a dispute cannot be settled within a period of thirty (30) calendar days with the mediator, the dispute shall be referred to and finally resolved by arbitration under the rules of the arbitrator appointed by agreement of the parties or by reference to a Judge of the British Columbia Court.

CONFIDENTIALITY

During the period of this Agreement, the Consultant shall not use or disclose any Confidential Information to any third parties. The Consultant will only use Confidential Information for the sole purpose of carrying out the service(s) agreed upon. Access to the Client's Confidential Information will be restricted to employees who need the information to perform work duties. The Consultant may share photos of the project without disclosing any information not already made public unless the Client refuses consent of photos shared on social media. Unless already made public, the Consultant will not share owner or site address information on social media or with outside parties.



Notes:

1. Base plan taken from Google Maps (Aerial Image 2019).
2. Test pit locations estimated to relative surface features. Estimated accuracy of +/- 2 m.
3. Soils logged in the field by Ryzuk Geotechnical.

District of Sooke	DRAWN PKES
LOCATION PLAN Geotechnical Assesment Lot A, 6671 Wadams Way — Sooke, B.C.	DATE November, 2019 APPROVED SCALE NTS
RYZUK GEOTECHNICAL — Engineering & Materials Testing	DRAWING No. 4472-15-1

RYZUK GEOTECHNICAL
ENGINEERING & MATERIALS TESTING

Practical. Innovative. Experienced.

Project: Geotechnical Assessment
Client: District of Sooke

Investigation Date: November 7, 2019
Location: See Location Plan drawing 4472-15-1

Inspector: PKES
Ryzuk Job Number: 4472-15

Summary of Test Pit Information

Test Pit 19-01 (TP19-01)

(Northwest portion of the site)
Stratigraphy:

0.0	to	0.9 m	Topsoil – organic silt and sand, some cobbles, some boulders, roots, moist, dark brown
0.9	to	1.5 m	CLAY– silty, trace to some sand, some gravel, some rootlets, stiff to very stiff, orange mottling, moist to wet, light brown
1.5	to	2.1 m	CLAY and SILT – trace to some sand, some gravel, hard, dry to damp, grey, brown in some areas, reddish brown coating on clumps (inferred till)
	at	2.1 m	End of test pit- Desired depth

Notes: No seepage encountered.

Test Pit 19-02 (TP19-02)

(Northeast portion of the site)
Stratigraphy:

0.0	to	0.5 m	Topsoil – organic silt and sand, some cobbles, some boulders, roots, moist, dark brown
0.5	to	1.1 m	CLAY – silty, some sand, trace gravel, very stiff, light brown, orange mottling, moist
1.1	to	2.0 m	CLAY and SILT– trace to some sand, trace gravel, hard, damp, greyish in the upper 0.3m then turns light brown, reddish brown coating on clumps (inferred till)
	at	2.0 m	End of test pit – Refusal on very dense soil/boulders

Notes: No seepage encountered.

Test Pit 19-03 (TP19-03)

(Central portion of the site)
Stratigraphy:

0.0	to	0.5 m	Topsoil – organic silt and sand, roots, some cobbles, moist, dark brown
0.5	to	0.6 m	CLAY - silty, some sand, trace gravel, stiff to very stiff, rootlets, light brown, orange mottling
0.6	to	2.3 m	CLAY and SILT – trace sand, trace gravel, hard, damp, grey in some areas, brown in some areas, reddish brown coating on clumps (inferred till)
	at	2.3 m	End of test pit – Refusal on very dense soil/boulders

Notes: No seepage encountered.

Test Pit 19-04 (TP19-04)

(Southwest portion of the site)
Stratigraphy:

0.0	to	0.6 m	Topsoil – organic silt and sand, roots, moist, dark brown
0.6	to	0.8 m	SAND – silty/clayey, dense, fine to medium grained, trace to some gravel, rootlets, moist, light brown, orange mottling
0.8	to	1.8 m	CLAY and SILT – trace sand, trace gravel, trace boulders around 1.7 m, hard, moist to damp, brown, grey in some areas, dark brown coating on clumps (inferred till)
	at	1.8 m	End of test pit – Refusal on very dense soil/boulders

Notes: No seepage encountered.

Test Pit 19-05 (TP19-05)

(Southeast portion of the site)
Stratigraphy:

0.0	to	0.9 m	Topsoil – organic silt and sand, cobbly, rootlets, moist, dark brown, reddish brown layering at 0.6 m
0.9	to	1.7 m	SAND and GRAVEL– silty, some cobbles, very dense to hard, damp to moist, brown (inferred till)
	at	1.7 m	End of test pit – Refusal on very dense soil/boulders

Notes: Upper 50 mm of the surface consists of 30 mm minus gravel (remnants of a stockpile)
No seepage encountered.

Test Pit 19-06 (TP19-06)

(North-central portion of the site)
Stratigraphy:

0.0	to	0.6 m	Topsoil – organic silt and sand, roots, moist, dark brown
0.6	to	2.0 m	SAND and GRAVEL– silty, trace to some cobbles, trace boulders, very dense, damp, light brown (till)
	at	2.0 m	End of test pit – Refusal on very dense soil/boulders

Notes: No seepage encountered.

Test Pit 19-07 (TP19-07)

(East-central portion of the site)
Stratigraphy:

0.0	to	0.9 m	Topsoil – organic silt and sand, rootlets, abandoned old pvc pipes, moist, dark brown
0.9	to	1.8 m	Fill – sand, gravel, concrete rubble, organics, dark brown, damp, dense
1.8	to	2.0 m	SAND and GRAVEL – silty, some cobbles, very dense, brown, damp (till)
2.0	to	2.1 m	CLAY and SILT – trace sand, trace gravel, trace boulders, brown, hard, reddish brown staining on clumps (till)
	at	2.1 m	End of test pit – Refusal on very dense soil/boulders

Notes: No seepage encountered.

GEOLOGIC LOG SYMBOLS AND ABBREVIATIONS
MODIFIED UNIFIED SOIL CLASSIFICATION SYSTEM

UPDATED SEPT.2019

RYZUK GEOTECHNICAL
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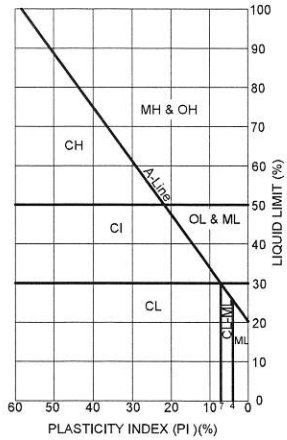
Victoria, BC, Canada
V8Z 1S3
www.ryzuk.com

MAJOR DIVISIONS			Symbol	USC	TYPICAL DISCRIPTION	LAB CLASSIFCATION CRITERIA	
COARSE GRAINED SOILS	GRAVELS (MORE THAN HALF COARSE GRAINS LARGER THAN 4.75 mm)	CLEAN GRAVELS (LITTLE TO NO FINES)		GW	WELL GRADED GRAVELS, LITTLE OR NO FINES	$C_u = \frac{D_{60}}{D_{10}} > 4$ $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}} = 1$ to 3	
				GP	POORLY GRADED GRAVELS AND GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	DOES NOT MEET ABOVE REQUIREMENTS	
		GRAVELS WITH FINES		GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES	CONTENT OF FINES EXCEEDS 12%	ATTERBERG LIMITS BELOW 'A' LINE PI LESS THAN 4
				GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES		ATTERBERG LIMITS ABOVE 'A' LINE PI MORE THAN 7
	SANDS (MORE THAN HALF COARSE GRAINS SMALLER THAN 4.75 mm)	CLEAN SANDS (LITTLE TO NO FINES)		SW	WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	$C_u = \frac{D_{60}}{D_{10}} > 6$ $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}} = 1$ to 3	
				SP	POORLY GRADED SANDS, LITTLE OR NO FINES	DOES NOT MEET ABOVE REQUIREMENTS	
		SANDS WITH FINES		SM	SILTY SANDS, SAND-SILT MIXTURES	CONTENT OF FINES EXCEEDS 12%	ATTERBERG LIMITS BELOW 'A' LINE PI LESS THAN 4
				SC	CLAYEY SANDS, SAND-CLAY MIXTURES		ATTERBERG LIMITS ABOVE 'A' LINE PI MORE THAN 7
FINE GRAINED SOILS	SILTS (BELOW 'A' LINE, NEGLIGIBLE ORGANIC CONTENT)	$W_L < 50$		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY SANDS OF SLIGHT PLASTICITY	CLASSIFICATION IS BASED ON PLASTICITY CHART	
		$W_L > 50$		MH	INORGANIC SILTS, MICACEOUS OR DIAMACEOUS FINE SANDY OR SILTY SOILS		
	CLAYS (ABOVE 'A' LINE, NEGLIGIBLE ORGANIC CONTENT)	$W_L < 30$		CL	INORGANIC CLAYS OF LOW PLASTICITY, GRAVELLY, SANDY, OR SILTY LEAN CLAYS		
		$30 < W_L < 50$		CI	INORGANIC CLAYS OF MEDIUM PLASTICITY, SILTY CLAYS		
		$W_L > 50$		CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS		
	ORGANIC SILTS AND CLAYS	$W_L < 50$		OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY		
		$W_L > 50$		OH	ORGANIC CLAYS OF HIGH PLASTICITY		
FILL				FL	SEE REPORT DESCRIPTION		
HIGHLY ORGANIC SOILS				Pt	PEAT AND OTHER HIGHLY ORGANIC SOILS	STRONG COLOUR OR ODOUR, AND OFTEN FIBROUS TEXTURE	
BEDROCK				BR	SEE REPORT DESCRIPTION		



SPT RESISTANCES (BLOWS/300 mm)		Undrained Shear Strength (S_u) (kPa)	
COHESIONLESS		COHESIVE	
0 - 4	VERY LOOSE	<12	VERY SOFT
4 - 10	LOOSE	12 - 25	SOFT
10 - 30	COMPACT	25 - 50	FIRM
30 - 50	DENSE	50 - 100	STIFF
50 +	VERY DENSE	100 - 200	VERY STIFF
		>200	HARD

DEFINING RANGES OF PERCENTAGE BY WEIGHT OF MINOR COMPONENTS	
PERCENT	IDENTIFIER
1 - 10	TRACE
10 - 20	SOME
20 - 35	_____Y
35 - 50	AND

SOIL COMPONENTS (mm)			
BOULDERS		> 200	
COBBLES		75 - 200	
FRACTION		PASSING	RETAINED
GRAVEL	COARSE	75	19
	FINE	19	4.75
SAND	COARSE	4.75	2.00
	MEDIUM	2.00	0.425
	FINE	0.425	0.075
FINE GRAINED SOILS (SILT AND CLAY)		0.075	