Comox Valley REGIONAL DISTRICT

Staff Report

DATE: June 6, 2019

FILE: 3160-20/FR 2C 19

TO: Chair and Directors
Electoral Areas Services Committee

Supported by Russell Dyson
Chief Administrative Officer

R. Dyson

FROM: Russell Dyson
Chief Administrative Officer

RE: **Site Specific Floodplain Setback Reduction**
Unaddressed Lot along Comox Lake Mainline (Comox Valley Regional District)
Electoral Area C (Puntledge – Black Creek)
Lot A, Sections 32 and 33, Township 10, Comox District, Plan EPP90548, PID 030-774-535

Purpose
The purpose of this report is to consider a request from staff for a site specific exemption to the floodplain setback to allow construction of a building(s) associated with the Comox Lake raw water pump station as part of the Comox Valley Water Treatment Project.

Recommendation from the Chief Administrative Officer:
THAT the board grant a site specific exemption of the floodplain setback for the purposes of locating building(s) associated with the Comox Valley Water Treatment Project's raw water pump station in the vicinity of the lakeshore on Lot A, Sections 32 and 33, Township 10, Comox District, Plan EPP90548, PID 030-774-535 (unaddressed lot along Comox Lake Mainline);

AND FINALLY THAT, as a condition of the site specific exemption, the Comox Valley Regional District building services department not issue final occupancy for a building within 15 metres of the natural boundary of Comox Lake on the property described as Lot A, Sections 32 and 33, Township 10, Comox District, Plan EPP90548, PID 030-774-535 (unaddressed lot along Comox Lake Mainline) until a restrictive covenant is registered on the title under Section 219 of the Land Title Act, specifying conditions that would enable the land to be safely used for the use intended according to the terms of the professional engineer's report by Sarah Morse, P.Eng., PMP, of Golder Associates Ltd, dated May 28, 2019, which will form part of the restrictive covenant.

Executive Summary

- The Comox Valley Water Treatment Project's raw water pump station will involve construction of a building with floor space for the storage of goods that are susceptible to damage by floodwater, such as electrical equipment.
- While the building can be constructed above the flood construction level, a site specific exemption of the 15 metre floodplain setback from the natural boundary of Comox Lake is required.
- A professional engineer's report was commissioned to provide a Geotechnical Review and concluded that the site is safe for the use intended.
- Staff recommends a site specific exemption to the floodplain setback be provided for the purpose of locating the raw water pump station.

Prepared by:	Concurrence:	Concurrence:
J. MacLean	***T. Trieu***	***S. Smith***
Jodi MacLean, MCIP, RPP Rural Planner	Ton Trieu, MCIP, RPP Manager of Planning Services	Scott Smith, MCIP, RPP General Manager of Planning and Development Services Branch

Concurrence:

C. Gore

Charlie Gore
Manager of Capital Projects

Stakeholder Distribution (Upon Agenda Publication)

Golder Associates Ltd.	✔

Background/Current Situation

As part of the Comox Valley Water Treatment Project, the Comox Valley Regional District (CVRD) is constructing a raw water pump station to convey water from an intake structure in Comox Lake to a water treatment plant. To locate the pump station and related infrastructure the CVRD acquired a 4 hectare property along the northern shore in proximity to the Puntledge River (Figures 1 and 2). Because there will be floor space for the storage of goods that are susceptible to damage by floodwater, such as electrical equipment, the CVRD Floodplain Management Bylaw applies. However, staff is requesting a site specific exemption to the floodplain setback so the pump station can be located at the subject property.

Planning analysis

Floodplain management bylaw

The CVRD Floodplain Management Bylaw, Bylaw No. 2782, being the "Floodplain Management Bylaw, 2005", states that the floodplain setback is 15 metres from the natural boundary of Comox Lake. The floodplain setback is defined as the required minimum distance from the natural boundary of the waterbody (or watercourse) to any landfill or structural support required to elevate a floor system or pad above the flood construction level. While the flood construction level can be achieved with the use of structural supports, the floodplain setback cannot. For such cases, Section 403 of the bylaw allows for a site specific exemption of the floodplain specifications where a professional engineer's report is provided.

In support of this request, a Geotechnical Review was prepared by Sarah Morse, P.Eng., PMP, of Golder Associates Ltd (Appendix A). As noted in Section 5.3 of the report, the provincial *Flood Hazard Area Land Used Management Guidelines*, the purpose of floodplain setbacks is to (a) keep development away from areas of potential erosion, (b) avoid restricting the flow capacity of the floodway, (c) reduce the risk of damage to neighbouring properties, and (d) reduce disruptions to natural river processes. The report addresses each of these points and concludes that: "*Based on Golder's assessment and the information available at the time of preparation of this report, we consider the site safe for the use intended as defined in Section 2.0, provided the recommendations in this report are implemented.*"

Official Community Plan

Sections 15 and 16 of the Official Community Plan, Bylaw No. 337 being the "Rural Comox Valley Official Community Plan Bylaw No. 337, 2014", provides objectives and policies regarding development in the vicinity of natural hazards. Objective 15(2) states "*To direct new development away from hazard areas*" and Policy 16(1) states "*Do not permit new development in hazard areas, including mapped floodplains, steep slopes and areas of active erosion*." In the absence of a mapped floodplain for Comox Lake, a flood construction level of 137.5 metres geodetic (specific to Comox Lake) with a general 15 metre floodplain setback (applicable to all lakes) from the natural boundary is utilized. According to the professional engineer's Geotechnical Review, the average lake level is at the 133.77 metres geodetic elevation and the historical maximum level 136.15 metres. Given the nature of the utility use, the shape and location of the property, and the geography of the land, the request is being made to locate the pump station within the floodplain setback but with the storage areas above the flood construction level.

Zoning

The subject property is zoned Upland Resource. Section 301 of the Zoning Bylaw, Bylaw No. 2781, being the "Comox Valley Zoning Bylaw, 2005", allows for utility uses to locate in any zone. Despite this, buildings must still adhere to the minimum property line setbacks.

Policy Analysis

Section 524 of the *Local Government Act* (RSBC, 2015, c. 1) (LGA) authorizes a local government to establish a bylaw to designate a flood plain and specify a setback from a watercourse, body of water or dike, to any landfill or structural support required to elevate a floor system or pad above the flood level. Sections 524(7) and (8) allows a local government to grant an exemption to a floodplain bylaw upon receipt of a report by a Qualified Professional that the land may be used safely for the use intended and that the exemption may include terms and conditions the local government considers necessary or advisable.

Options

The board may choose to grant or refuse the site specific exemption of the floodplain specifications. Staff recommends the site specific exemption of the floodplain specifications be granted so that the raw water pump station can be constructed at this location.

Financial Factors

The cost for the Raw Water Pump Station is estimated at $10 million, as part of the $110 million Water Treatment Project, and is contained in the 2019 budget for the Comox Valley Water Supply System, function 300 service.

Legal Factors

This report and recommendation contained herein are in compliance with the LGA and CVRD bylaws.

Regional Growth Strategy Implications

The subject property is within the Resource Areas designation of the Regional Growth Strategy, Bylaw No. 120, being the "Comox Valley Regional District Regional Growth Strategy Bylaw No. 120, 2010". Lands in these areas should be protected and used for resource-focused and related value-added uses to support local economic development.

Intergovernmental Factors

There are no intergovernmental factors.

Interdepartmental Involvement
This proposal was referred to applicable internal departments.

Citizen/Public Relations
There are no citizen and/or public relations factors related to this report.

Attachments: Appendix A – "Professional Engineer's Report by Sarah Morse, P.Eng., PMP, of Golder Associates Ltd, dated May 28, 2019"

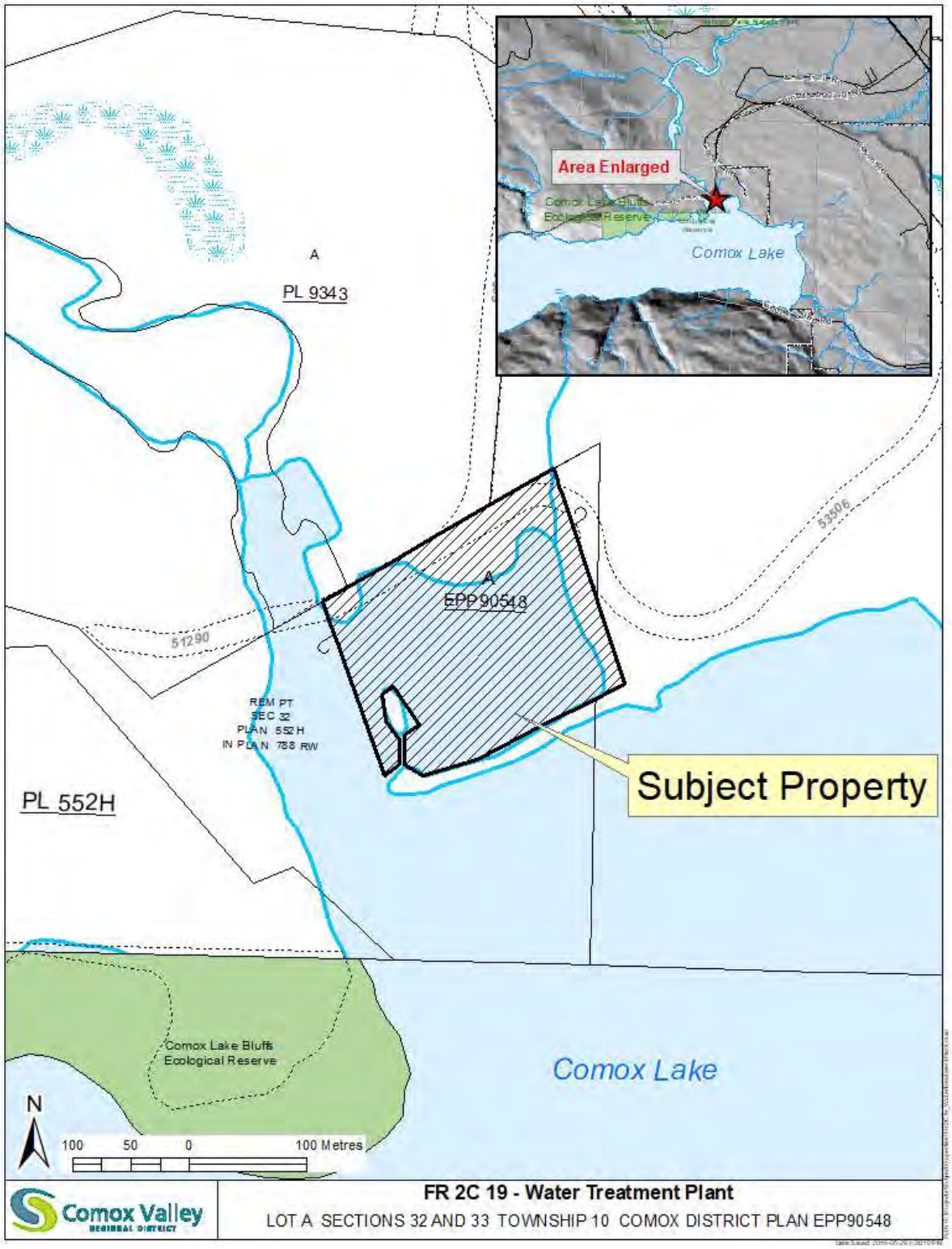

Figure 1: Subject Property

Figure 2: Air Photo

GOLDER

TECHNICAL MEMORANDUM

DATE 28 May 2019

Reference No. 1773081-004-TM-Rev0

TO Trevor Dykstra, PEng, PE
WSP Canada Group Ltd.

FROM Sarah Morse, PEng, PMP

EMAIL smorse@golder.com

COMOX VALLEY WATER TREATMENT PROJECT
RAW WATER PUMP STATION GEOTECHNICAL REVIEW
DESIGN FLOOD LEVEL CONSIDERATIONS
PARCEL IDENTIFIER: 030-774-535

WSP Canada Group Ltd. (WSP) has engaged Golder Associates Ltd. (Golder) to provide geotechnical input for the proposed Raw Water Pump Station (RWPS) and Intake Structure for the Comox Valley Water Treatment Project (CVWTP). We understand that, based on the proposed location for the RWPS, an exemption from the Comox Valley Regional District (CVRD) Floodplain Management Bylaw[1] is required. Golder has carried out a geotechnical review to assess the geotechnical risks and potential impact to the new structure associated with construction within the defined Floodplain. This report provides a summary of our assessment and recommendations related to geotechnical aspects of the proposed RWPS site. This report should be read in conjunction with the "*Important Information and Limitations of this Report*" included as Attachment 1.

1.0 BACKGROUND AND UNDERSTANDING

It is understood that the RWPS is being tendered as a Design-Build project, therefore, the detailed format, footprint and layout of the facility are not known at this stage. The RWPS may be a single building, or multiple structures, including pumping equipment, piping, instrumentation, electrical equipment, and (a) generator/s, with a total footprint of up to 650 sq. metres. All electrical equipment and the generator/s will be installed above 139.9 m elevation, which is 2.4 m above the Flood Construction Level (FCL) for the site. All equipment installed below the FCL will be installed in non-habitable areas and shall be fully submersible. Two areas of the site have been geotechnically assessed as alternative locations for the proposed RWPS (see Figure 1). Alternative 1 is proposed to be located along the north shore of the existing lagoon. Alternative 2 is located within the lagoon, immediately adjacent to the foot of the earth-filled jetty where it connects to the existing boat launch. It is further understood that local bylaws require a 30 m setback from Comox Lake. Both of the location alternatives assessed encroach on the existing designated floodplain setback. The CVRD is seeking to relax setback requirements to allow building either within the seasonal lagoon or on the shore of the lagoon. The lagoon has a surface hydraulic

[1] Comox Valley Regional District, 2005. Bylaw No. 2782, Floodplain Management Bylaw, 2005: Adopted 27 June 2005"

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connection to Comox Lake when water levels are high and a presumed subsurface hydraulic connection to the lake when lagoon water levels are low.

The proposed pump station may comprise a single building or multiple buildings, consisting of three major components:

- A large, deep underground concrete chamber, the pump wet well, which is hydraulically connected to Comox Lake.
- An above ground room, or below ground chamber which houses pumping equipment.
- An above ground room or rooms which contain electrical equipment.

2.0 ASSESSMENT OBJECTIVES

Our assessment, as summarized within this report, is intended to meet the following objectives:

1) Confirm that the land is considered geotechnically safe and suitable for the use intended. For the purposes of this report, the use intended is defined as construction and operation of an industrial pump station within a flood plain setback, for the purpose of providing drinking water to the Comox Valley.

2) Identify potential geotechnical considerations that could impact the design and construction of the development and provide recommendations for mitigation of geotechnical risk.

3) Provide geotechnically related recommendations with respect to flooding hazards.

3.0 ASSESSMENT METHODOLOGY

a) In June 2016, Golder carried out a limited subsurface geotechnical investigation at the Alternative 1 RWPS site by drilling a single borehole (BH16-01). Details on the 2016 geotechnical investigation are provided in a technical memorandum dated 25 August 2016 (Golder File Reference No. 1533831 002 TM Rev0). In 2017, Golder carried out a subsequent geotechnical investigation for the Alternative 1 RWPS site. In 2018, Golder carried out a supplemental geotechnical investigation for the Alternative 2 RWPS site. The findings of the 2017 geotechnical investigation and geophysical survey, as well as the 2018 supplemental geotechnical investigation are presented in Golder's report titled "Geotechnical and Geophysical Investigations for the Raw Water Pump Station and Intake, Comox Valley Water Treatment Project, Courtenay, BC", dated 21 June 2017 (Golder File Reference No. 1773081-001-R-Rev 1).

b) Golder carried out a desktop review comprising a review of the following documents:

   a. CVRD Flood Plain Management Bylaw No. 2782 (2005).

   b. Comox Valley Water Treatment Project, Schedule 2 Statement of Requirements.

4.0 SITE CONDITIONS

4.1 Location at Topography

a) The property is located at the point at which Comox Logging Road meets Comox Lake, prior to the bridge over the Puntledge River. This site is within the CVRD and is zoned as Upland Resource (UR). The property is in the process of being subdivided from the Courtenay District Fish and Game Protective Association's (CDFPGA) large parcels as per the CVRD's agreement with them for the Comox Valley Water Treatment Project. Once subdivided, the parcel will be bounded by the CDFGPGA parcel on the east, south and west side, and BC Hydro's parcel on the north.

b) The majority of the property is within a seasonal lagoon that was created by the old route of the Comox Logging Road before it was relocated. The property was subdivided and purchased specifically for the purpose of optimizing the location of the Raw Water Pump Station.

c) The upland areas of the site range from approximately 134 m to 140 m elevation geodetic, sloping toward the lagoon, and the estimated elevation of the lagoon area of the site ranges from approximately 132 m to 134 m elevation.

d) Golder did not observe existing infrastructure on the property beyond previous and existing logging roads.

4.2 Soil Conditions

Details on subsurface conditions at the two proposed construction locations are provided in the following sections. The data presented was obtained at locations where geotechnical boreholes were advanced at the site. Subsurface conditions between borehole locations can be expected to vary from those described below.

4.2.1 Alternative 1 Location

The following stratigraphy was observed in BH17-03 in order of increasing depth below ground surface:

- fill
- sand to gravelly sand with boulders
- clayey sand and gravel
- bedrock

The physical characteristics of each of these units are described in detail in the following sections.

Fill

Fill material was encountered at surface to a depth of approximately 2.1 m. The upper approximately 0.3 m consisted of clayey sand and gravel, and was described as brown, cohesive, with a water content below the plastic limit, and hard. Underlying the clayey sand and gravel, the fill material consisted of sand and gravel with trace non-plastic fines, and was described as grey, non cohesive, moist and dense.

Two Standard Penetration Testing (SPT) N values of 31 and 38 (average of 35) were obtained within this unit.

Sand to Gravelly Sand with Boulders

Sand to gravelly sand with boulders was encountered underlying the fill for a thickness of approximately 2.4 m. A single boulder was encountered for a thickness of approximately 0.6 m contacting the fill at the top of this unit, and was described as conglomerate, composed of rounded cobbles, fine gravel, sand and plastic fines. The material encountered directly beneath the boulder for a thickness of 0.3 m consisted of clayey sand and gravel, and was described as brown, cohesive, with a water content greater than the plastic limit, and hard. The composition of the material transitioned to sand with some gravel at approximately 3.0 m bgs, and to gravelly sand at approximately 3.8 m bgs. The sand to gravelly sand was generally described as grey, non cohesive, moist to wet, and compact to very dense. It is inferred that water introduced into the borehole during drilling caused plastic fines and gravel from the boulder to wash out into the underlying sand to gravelly sand, creating a clayey sand and gravel material in the upper 0.3 m.

SPT N values of 20 and 71 (average of 46) were obtained within this unit. The SPT N value of 71 was obtained at the contact between the clayey sand and gravel and sand materials. The SPT N value of 20 was obtained near the bottom of this unit, where the gravelly sand material is in contact with the underlying clayey sand and gravel unit.

Clayey Sand and Gravel

Clayey sand and gravel was encountered underlying the sand to gravelly sand with boulders for a thickness of approximately 12.2 m. The material composition was predominantly clayey sand and gravel, however, it ranged from sandy gravelly silty clay to sandy clayey gravel. The material contained rounded cobbles, and was generally described as grey with brown patches, cohesive, with a water content either below or above the plastic limit, and hard. Layers of gravelly sand and sand and gravel were encountered from approximately 9.2 to 9.6 m bgs, and from 14.9 to 16.2 m bgs, respectively. The gravelly sand mainly consisted of fine to medium sand and was grey, non-cohesive, wet and very dense. The sand and gravel contained trace non-plastic fines, and was described as grey, non-cohesive, wet, and dense to very dense.

Five SPT N values ranging from 49 to 91 were obtained within this unit. Three of the SPTs were terminated before 600 mm of penetration could be achieved, due to practical refusal of the split spoon sampler in hard soils.

The measured natural water content of the clayey sand and gravel was 14.4 to 15.0 percent, with an average of 14.7 percent, based on laboratory testing of two samples.

Bedrock

Bedrock was encountered underlying the clayey sand and gravel at a depth of approximately 16.8 m bgs (121.2 m elevation). Coring of the bedrock continued to a depth of approximately 19.5 m bgs (118.5 m elevation). The upper 1.5 m of the bedrock was observed to be moderately weathered and was drilled with similar effort to that of the overlying soils. The lower 1.2 m of the bedrock was observed to be fresh and required significantly more effort for coring and core recovery. The bedrock was observed to consist of basaltic conglomerate, inferred to be part of the Karmutsen Formation. It was described as dark grey, fine grained, with rounded clasts up to approximately 45 mm in diameter, non porous to faintly porous, and strong. Quartz veins up to 1 mm wide were observed throughout the lower 1.2 m of bedrock within the borehole.

The lower 1.2 m of the cored bedrock was observed to be massive. Four prominent fractures were observed; the upper two of these fractures were inferred to be natural joints, with a spacing of approximately 36 cm, sub horizontal in orientation, planar, and smooth. The lower two fractures were inferred to be mechanical breaks caused by the drilling process.

4.2.2 Alternative 2 Location

The following surficial materials were encountered in BH18-02 (inclined 45° to vertical) in order of increasing depth as measured along the borehole axis.

- fill
- sandy silt, some gravel
- sand, some gravel to gravelly
- silty sand interbedded with clayey silt and silt
- gravel and sand interbedded with sand containing varying amounts of gravel
- silty sand, some gravel, interbedded with gravelly sand
- bedrock

The physical characteristics of each of these units are described in detail in the following sections.

Fill

Fill material was encountered from surface to approximately 1.8 m. The fill consisted of sand and gravel with some silt, and was described as brown, with woody debris, non-cohesive, wet, and compact.

Sandy silt, some gravel

Sandy silty with some gravel was encountered underlying the fill material from 1.8 m to approximately 2.4 m. The sandy silty with some gravel was described as red, non-cohesive, dry, and compact.

Sand, some gravel to gravelly

Sand with some gravel to gravelly was encountered from approximately 2.4 m to 4.7 m. This unit contained trace to some silt and was described as brown, non-cohesive, wet, and compact.

Silty sand interbedded with clayey silt and silt

Silty sand interbedded with clayey silt and silt was encountered from approximately 4.7 m to 7.8 m. The silty sand layers contained varying amounts of gravel, and were generally described as brown, non-cohesive, wet, and compact to dense. The clayey silt layers contained trace to some sand, and were described as brown, cohesive, with a field moisture content generally greater than the Plastic Limit, and firm to stiff. A layer of silt with some sand, approximately 0.6 m in apparent thickness was encountered in this unit. It was described as brown, cohesive, with a field moisture content generally greater than the Plastic Limit, and firm.

Gravel and sand interbedded with sand containing varying amounts of gravel

Gravel and sand interbedded with sand containing varying amounts of gravel was encountered from approximately 7.8 m to 14.1 m. The gravel and sand layers contained trace to some non-plastic fines, and were generally described as brown, non-cohesive, wet, and dense. The sand layers containing varying amounts of gravel contained trace silt, and were described as brown, non-cohesive, wet and dense, with inferred cobbles and boulders.

Silty sand, some gravel, interbedded with gravelly sand

Silty sand with some gravel interbedded with gravelly sand was encountered from approximately 14.1 m to 18.7 m. The silty sand with some gravel layers were described as brown, non-cohesive, wet, and dense. The gravelly sand layers contained trace to some fines, and were described as brown, non-cohesive, wet and dense, with inferred cobbles and boulders.

Bedrock

Bedrock was encountered at a depth of approximately 18.7 m (124.8 m estimated elevation). The bedrock was described as slightly weathered, massive, dark grey, fine grained, non porous to faintly porous, strong to very strong basalt with thin quartz veins. Sulphide minerals were observed in hand samples using a 10x magnification hand lens.

4.3 Comox Lake Lagoon Physical Description

a) The lagoon is fed from the mouth of the Puntledge River, upstream of the BC Hydro impoundment dam.

b) In a typical year, it holds water between October and July, but often dries up in August and September.

c) A description of the lagoon's environmental significance is provided in the Project Description as part of the Project's Environmental Assessment Office Exemption Certificate.

Lake Level Design Elevations (Table 1) for this area have been developed by BC Hydro, which manages water levels in Comox Lake and the Puntledge River through their Comox Dam hydroelectric facility.

Table 1: Lake Level Design Elevations[2]

Parameter	Elevation (m Geodetic)
Probable Maximum Flood Elevation	139.90
Historical Maximum Lake Level	136.15
Average Lake Level	133.77
Historical Low Lake Level	130.20
Minimum Design Lake Level	128.20

[2] Comox Valley Water Treatment Project, Schedule 2, Statement of Requirements, Table 2.2.3.

4.4 Flood Hazard Guidelines

a) CVRD Floodplain Management Bylaw No. 2782 states that the Flood Construction Level (FCL) for this site is 137.5 m (Part 302.2.a). The bylaw also specifies a Floodplain Setback of 30 m from the natural boundary of Comox Lake, as the designated flood is far more than 80 cubic metres per second (Part 303.1.b).

b) The Client should be aware that CVRD Floodplain Management Bylaw No. 2782 (Part 403) states that as a condition of a site-specific exemption, the property owner will be required at his/her expense to prepare and register a restrictive covenant under Section 219 of the *Land Title Act* in favour of the Regional District:

   a. Specifying conditions that would enable the land to be safely used for the use intended according to the terms of the Qualified Professional's report which will form part of the restrictive covenant.

   b. Acknowledging that no Disaster Financial Assistance Funding is available for the building or its contents.

   c. Releasing and indemnifying the Regional District from liability in the event any damage is caused by flooding or erosion.

c) The provincial *Flood Hazard Area Land Use Management Guidelines* state that the purpose of floodplain setbacks are *"…to keep development away from areas of potential erosion and avoid restricting the flow capacity of the floodway. Keeping the floodway clear of development can reduce the risk of damage to neighboring properties and reduce disruptions to natural river processes…"* (Section 3.04).

5.0 CONCLUSIONS

5.1 General

a) Based on Golder's assessment and the information available at the time of preparation of this report, we consider the site safe for the use intended as defined in Section 2.0, provided the recommendations in this report are implemented.

b) The RWPS structures are to be located within the areas shown in Figure 1 as Alternative 1 and Alternative 2.

c) The RWPS structures are to be designed and constructed in compliance with Flood Construction Level of 137.5 m. There may be one building or multiple structures, however, all rooms which are habitable will be built above the FCL, and all rooms below the FCL will contain fully submersible equipment and will therefore not be habitable areas as per the bylaw.

d) The designer of the proposed pump station must ensure that all habitable areas are constructed with in compliance with the requirements of the FCL of 137.5 m above Canadian Geodetic Vertical datum, as per the bylaw.

e) There are no known CVRD exemption precedents in the surrounding area. Many of the properties on the shore of Comox Lake are within the municipal boundaries of Cumberland and, therefore, are outside the CVRD's authority.

5.2 Flood Construction Level

a) Golder has not carried out a Flood Assessment for this site or carried out an assessment of the Flood Construction Level in the CVRD Floodplain Management Bylaw No. 2782.

b) In the absence of a Flood Assessment, it is recommended that the Flood Construction Level of 137.5 m included in the Bylaw be applied to habitable areas of the proposed structures.

c) It is noted that spaces including the pump station pump room may be constructed below the FCL if they are designed to be non-habitable with submersible equipment.

5.2.1 Method of Achieving the FCL

a) The natural topography allows habitable areas to be built on natural ground above the FCL.

b) Where habitable areas are built on locations within the property where the natural ground elevation is below FCL, structural methods such as increasing the height of foundation walls above suitable bearing grade, or supporting the structure on piles are required to bring the floor level above the FCL.

c) Structural fill *may not be used* to raise the bearing grade of the foundation within a flood plain setback according to CVRD Bylaw 2782, Section 304.4.

d) The design builder will be responsible for ensuring that the foundation walls are protected against scour, erosion from flood flows, wave action, ice, and other debris.

5.2.2 Disclaimers Regarding FCL

a) Golder has not carried out a Flood Assessment for this site or carried out an assessment of the Flood Construction Level in the CVRD Floodplain Management Bylaw No. 2782.

b) The FCL applies to the underside of a wooden floor system or the top of a concrete floor system.

c) No area below the FCL shall be used for habitation, business, storage of goods damageable by floodwater, or the installation of fixed equipment such as mechanical and electrical utilities that may be adversely affected by flooding.

d) The underside of any floor system or the top of any pad supporting any space or room that is used for dwelling purposes, business, or the storage of goods which are susceptible to damage by floodwater shall be above the specified FCL.

e) Areas used solely for vehicular parking may be located below the FCL.

5.3 Floodplain Setback

a) Golder considers the relaxation of the Floodplain Setback to allow construction of the proposed raw water pump station and associated structures with the areas identified on Figure 1 acceptable, provided the Flood Construction Level and recommendations contained within this report are followed.

b) According to the *Flood Hazard Area Land Used Management Guidelines* (Section 3.04), the purpose of floodplain setbacks is to:

   a. Keep development away from areas of potential erosion.

   b. Avoid restricting the flow capacity of the floodway.

   c. Reduce the risk of damage to neighboring properties.

   d. Reduce disruptions to natural river processes.

c) As the proposed construction areas are located adjacent to and within a lagoon with limited existing flow, the potential for erosion is considered limited. However; ~~to~~ the design-builder shall maintain the existing vegetation where possible, and the design-builder must provide erosion protection for disturbed areas. The design-builder will be required to:

   a. Schedule and conduct all work in or near water bodies in a manner that will minimize the erosion of soils in the area of the work and will provide erosion control measures required to prevent silting, muddying, or polluting of wetlands, streams, rivers, impoundments, lakes, and stormwater ponds. All erosion control measures will be in place in an area prior to any construction activity in that area and shall be maintained throughout construction.

   b. Protect all disturbed areas and stock piles during construction to prevent erosion and transport of sediment from exposed ground surfaces.

   c. Provide low groundcover or riprap to minimize erosion on banks steeper than 3 horizontal to 1 vertical.

   d. Utilize landscaping in a manner that provides erosion control.

d) It is not anticipated that construction within the proposed areas will restrict the existing flow capacity of the lagoon area. The design-builder will be required to provide finished grade to direct drainage away from buildings, structures and other critical areas.

e) The surface area of the lagoon and potential encroachment areas of structures are small relative to the area of Comox Lake; infrastructure constructed within the lagoon will not impact water levels in Comox Lake.

f) It is not anticipated that relaxation of the floodplain setback on this property will result in an increase to the risk of damage to neighboring properties as the infrastructure will not impact the overall lake levels.

g) It is not anticipated that the proposed development will result in disruptions to natural river processes. The proposed construction areas are located within the lagoon and are not anticipated to impact the Puntledge River.

h) The proposed development areas do not encroach on the seasonal creek which flows into the lagoon through the north-east corner of the lagoon. Any other development such as roads will be required to accommodate this flow.

5.4 Engineered Fill

a) Engineered fill may not be used to raise the bearing grade of the foundation within a flood plain setback; structural methods, such as increasing the height of the foundation walls above suitable bearing grade, or pile support of the structure will be required.

b) Engineered Fill will be used in areas where fill is required to raise grades to tie into surrounding topography or for parking areas.

c) Engineered Fill will comprise 100 mm minus pit-run sand and gravel containing less than 8% fine material passing the 0.075 mm sieve. Fill will be placed in 300 mm lifts and compacted to 100% Standard Proctor Maximum Dry Density.

d) We recommend that placement and compaction of Engineered Fills be observed and approved by the Geotechnical Engineer. This would include approval of the proposed fill materials and performance of a suitable program of compaction testing during construction.

6.0 ACKNOWLEDGEMENTS

a) Golder acknowledges that this report may be requested by the approving officers of the Comox Valley Regional District for the acceptance of a setback relaxation.

b) Golder acknowledges that this report has been prepared for and at the expense of the Comox Valley Regional District.

c) We acknowledge that this report has been prepared as a pre-condition to the issuance of a Site Specific Exemption under Section 910 of the *Local Government Act*, and conditions within this report will be included in a Restrictive Covenant under Section 219 of the *Land Title Act* and filed against the subject property.

7.0 CLOSURE

We trust that this letter meets your current requirements. Please contact the undersigned if you require further information at this time.

Golder Associates Ltd.

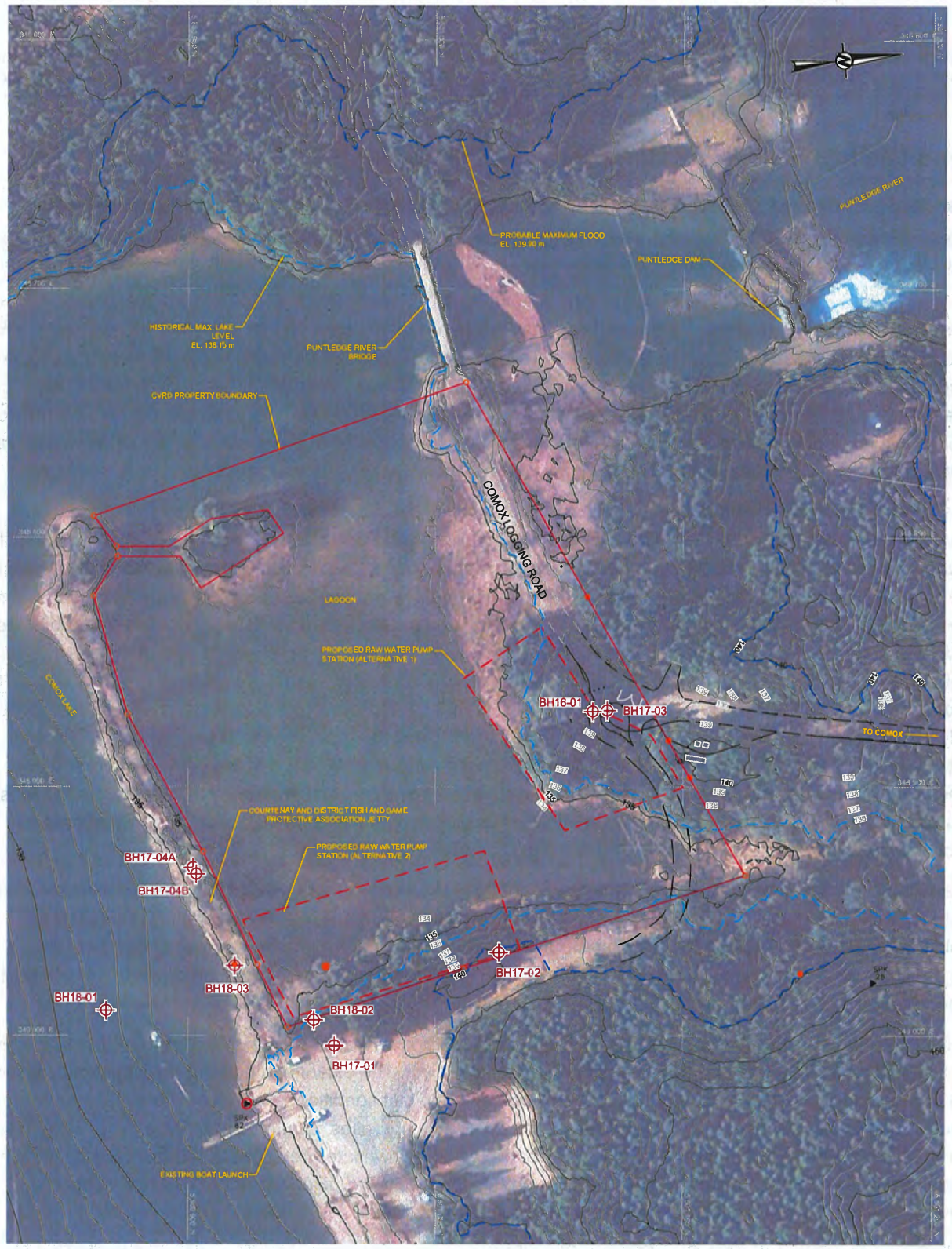
S. L. MORSE # 20550 28 May 2019

Sarah Morse, PEng, PMP
Senior Geotechnical Engineer

Jeff Fillipone, PGeo, PhD
Principal, Senior Geologist

SEM/JAF/asd/lmk

Attachments: Figure 1 – Site Plan
Attachment 1 – Important Information and Limitations of this Report



LEGEND

- APPROXIMATE BOREHOLE LOCATION
- MINOR TOPOGRAPHIC CONTOUR (INTERVAL = 1 m)
- MAJOR TOPOGRAPHIC CONTOUR (INTERVAL = 5 m)
- PROBABLE MAXIMUM FLOOD ELEVATION 139.90 m
- HISTORICAL MAX. LAKE LEVEL 136.15 m
- EXISTING ROADWAY
- PROPOSED ROADWAY
- STANDARD IRON POST
- NON-STANDARD IRON POST
- STANDARD IRON POST SET
- TRAVERSE HUB

0 25 50
1:1,500 METRES

NOTES

1. ALL DISTANCES AND ELEVATIONS ARE DISPLAYED IN METRES GRID IS DISPLAYED IN UTM NAD83 ZONE 10 COORDINATES.
2. PROBABLE MAXIMUM FLOOD ELEVATION DEVELOPED BY BC HYDRO.
3. SPK - SPIKE

REFERENCES

1. BASE MAPS OBTAINED FROM OPUS, CAD FILE: RWPS site for Golder.dwg, DATED 2018-06-21, ORIGINAL SCALE 1:500.
2. PROPOSED INTAKE LOCATION OBTAINED FROM OPUS, CAD FILE: 2018-06-07_OPUS_D-13124.00_COMOX.DWG
3. BACKGROUND IMAGE ©2016 DIGITALGLOBE, OBTAINED FROM GOOGLE EARTH PRO. USED UNDER LICENSE. IMAGE DATE 5-8-2015. GOOGLE EARTH IMAGE IS NOT TO SCALE.
4. LEGAL SURVEY PROVIDED MCELHANNEY ASSOCIATES ON 2019-05-09. FILE: 05-708-REF-1.

CLIENT
CANADA GROUP LTD

CONSULTANT
GOLDER

YYYY-MM-DD	2019-05-28
DESIGNED	S. MORSE
PREPARED	R. MARTIN
REVIEWED	S. MORSE
APPROVED	J. FILLIPONE

PROJECT
GEOTECHNICAL INVESTIGATION
COMOX VALLEY WATER TREATMENT PROJECT
COURTENAY, B.C.

TITLE
SITE PLAN

PROJECT NO.	PHASE/TASK	REV.	FIGURE
1773081	1000/1005	0	1

Important Information and Limitations of this Report

Standard of Care: Golder Associates Ltd. (Golder) has prepared this report in a manner consistent with that level of care and skill ordinarily exercised by members of the engineering and science professions currently practising under similar conditions in the jurisdiction in which the services are provided, subject to the time limits and physical constraints applicable to this report. No other warranty, expressed or implied is made.

Basis and Use of the Report: This report has been prepared for the specific site, design objective, development and purpose described to Golder by the Client. The factual data, interpretations and recommendations pertain to a specific project as described in this report and are not applicable to any other project or site location. Any change of site conditions, purpose, development plans or if the project is not initiated within eighteen months of the date of the report may alter the validity of the report. Golder can not be responsible for use of this report, or portions thereof, unless Golder is requested to review and, if necessary, revise the report.

The information, recommendations and opinions expressed in this report are for the sole benefit of the Client. No other party may use or rely on this report or any portion thereof without Golder's express written consent. If the report was prepared to be included for a specific permit application process, then upon the reasonable request of the client, Golder may authorize in writing the use of this report by the regulatory agency as an Approved User for the specific and identified purpose of the applicable permit review process. Any other use of this report by others is prohibited and is without responsibility to Golder. The report, all plans, data, drawings and other documents as well as all electronic media prepared by Golder are considered its professional work product and shall remain the copyright property of Golder, who authorizes only the Client and Approved Users to make copies of the report, but only in such quantities as are reasonably necessary for the use of the report by those parties. The Client and Approved Users may not give, lend, sell, or otherwise make available the report or any portion thereof to any other party without the express written permission of Golder. The Client acknowledges that electronic media is susceptible to unauthorized modification, deterioration and incompatibility and therefore the Client cannot rely upon the electronic media versions of Golder's report or other work products.

The report is of a summary nature and is not intended to stand alone without reference to the instructions given to Golder by the Client, communications between Golder and the Client, and to any other reports prepared by Golder for the Client relative to the specific site described in the report. In order to properly understand the suggestions, recommendations and opinions expressed in this report, reference must be made to the whole of the report. Golder can not be responsible for use of portions of the report without reference to the entire report.

Unless otherwise stated, the suggestions, recommendations and opinions given in this report are intended only for the guidance of the Client in the design of the specific project. The extent and detail of investigations, including the number of test holes, necessary to determine all of the relevant conditions which may affect construction costs would normally be greater than has been carried out for design purposes. Contractors bidding on, or undertaking the work, should rely on their own investigations, as well as their own interpretations of the factual data presented in the report, as to how subsurface conditions may affect their work, including but not limited to proposed construction techniques, schedule, safety and equipment capabilities.

Soil, Rock and Groundwater Conditions: Classification and identification of soils, rocks, and geologic units have been based on commonly accepted methods employed in the practice of geotechnical engineering and related disciplines. Classification and identification of the type and condition of these materials or units involves judgment, and boundaries between different soil, rock or geologic types or units may be transitional rather than abrupt. Accordingly, Golder does not warrant or guarantee the exactness of the descriptions.

Special risks occur whenever engineering or related disciplines are applied to identify subsurface conditions and even a comprehensive investigation, sampling and testing program may fail to detect all or certain subsurface conditions. The environmental, geologic, geotechnical, geochemical and hydrogeologic conditions that Golder interprets to exist between and beyond sampling points may differ from those that actually exist. In addition to soil variability, fill of variable physical and chemical composition can be present over portions of the site or on adjacent properties. **The professional services retained for this project include only the geotechnical aspects of the subsurface conditions at the site, unless otherwise specifically stated and identified in the report.** The presence or implication(s) of possible surface and/or subsurface contamination resulting from previous activities or uses of the site and/or resulting from the introduction onto the site of materials from off-site sources are outside the terms of reference for this project and have not been investigated or addressed.

Soil and groundwater conditions shown in the factual data and described in the report are the observed conditions at the time of their determination or measurement. Unless otherwise noted, those conditions form the basis of the recommendations in the report. Groundwater conditions may vary between and beyond reported locations and can be affected by annual, seasonal and meteorological conditions. The condition of the soil, rock and groundwater may be significantly altered by construction activities (traffic, excavation, groundwater level lowering, pile driving, blasting, etc.) on the site or on adjacent sites. Excavation may expose the soils to changes due to wetting, drying or frost. Unless otherwise indicated the soil must be protected from these changes during construction.

Sample Disposal: Golder will dispose of all uncontaminated soil and/or rock samples 90 days following issue of this report or, upon written request of the Client, will store uncontaminated samples and materials at the Client's expense. In the event that actual contaminated soils, fills or groundwater are encountered or are inferred to be present, all contaminated samples shall remain the property and responsibility of the Client for proper disposal.

Follow-Up and Construction Services: All details of the design were not known at the time of submission of Golder's report. Golder should be retained to review the final design, project plans and documents prior to construction, to confirm that they are consistent with the intent of Golder's report.

During construction, Golder should be retained to perform sufficient and timely observations of encountered conditions to confirm and document that the subsurface conditions do not materially differ from those interpreted conditions considered in the preparation of Golder's report and to confirm and document that construction activities do not adversely affect the suggestions, recommendations and opinions contained in Golder's report. Adequate field review, observation and testing during construction are necessary for Golder to be able to provide letters of assurance, in accordance with the requirements of many regulatory authorities. In cases where this recommendation is not followed, Golder's responsibility is limited to interpreting accurately the information encountered at the borehole locations, at the time of their initial determination or measurement during the preparation of the Report.

Changed Conditions and Drainage: Where conditions encountered at the site differ significantly from those anticipated in this report, either due to natural variability of subsurface conditions or construction activities, it is a condition of this report that Golder be notified of any changes and be provided with an opportunity to review or revise the recommendations within this report. Recognition of changed soil and rock conditions requires experience and it is recommended that Golder be employed to visit the site with sufficient frequency to detect if conditions have changed significantly.

Drainage of subsurface water is commonly required either for temporary or permanent installations for the project. Improper design or construction of drainage or dewatering can have serious consequences. Golder takes no responsibility for the effects of drainage unless specifically involved in the detailed design and construction monitoring of the system.