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Enterprise Geoscience Services Ltd.

Texada Airport (YGB)
Assessment for Hangar Expansion Project

Project No. 16008

September, 2016

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Texada Airport (YGB)
Assessment for Hangar Expansion Project

Prepared For
Powell River Regional District
Powell River, BC

Prepared by
Enterprise Geoscience Services Ltd.
Vancouver, B.C.

Distribution:	Powell River Regional District	2 copies
	Enterprise Geoscience Services Ltd.	1 copy

Project No. 16008

September, 2016

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1.0 Introduction

The Powell River Regional District (PRRD) owns and operates an airport on Texada Island (YGB). Facilities at the airport include the runway, a terminal building with parking, water supply and septic field, and several hangars leased to aircraft owners. Recently there have been requests to the PRRD for a number of additional hangar spaces.

Most of the YGB property lies within the watershed of Cranby Lake, which is the water source for the Gilles Bay Improvement District (GBID). The Cranby Lake watershed is a designated "Community Watershed" and the Texada Island Official Community Plan (Bylaw No 395) designates the watershed as a Development Permit Area (DP1). Under this designation, an applicant proposing a development within the watershed:

"is required to provide to the Regional District (at the applicant's expense) a report by a Qualified Environmental Professional (as defined in Appendix A) which provides an opinion as to whether the natural features, functions or conditions that support fish life processes will be harmfully altered, disrupted or destroyed by the proposed development and whether the community water supplies for Gillies Bay and Van Anda will be adversely affected. In cases where such harmful or adverse effects are anticipated, the report must include recommendations as to how the impact of the works or activity proposed within the riparian assessment areas may be mitigated.

The Board will specify development permit conditions under Section 920(7) of the Local Government Act based on the report of the Qualified Environmental Professional."

The purpose of this report is to provide:

- a description of a proposed hangar expansion project at YGB;
- an opinion on the potential impacts to aquatic habitat and drinking water resources; and,
- recommendations to mitigate impacts.

Additional requirements for developments are described in the Texada Island Watershed Protection Bylaw No 237. The purpose of the bylaw is to protect water quantity and quality within the community watersheds through limitations on the types of developments. Section 4 of the bylaw applies to all zones and describes setback requirements for building structures and septic fields from water courses, minimum parcel sizes for accessory buildings and structures, and provides restrictions on use to avoid storage of materials or use of the land that could result in the release of deleterious substances to water. The airport area is zoned AP-1 which designates the following permissible uses:

(a) Airport;
(b) Accessory One-Family Residential;
(c) Accessory Airport Recreation;
(d) Public Utility.

The bylaw also restricts the storage and sale of fuel for protection of water quality.

2.0 Existing Site Conditions

Our understanding of site conditions is based upon review of existing sources of information and a site reconnaissance of the airport and surrounding area on August 26, 2016. The airport is located between Gilles Bay and the Lafarge limestone quarry on the west side of Texada Island (Figure 1). Access to the site is by way of Airport Road which runs between Cranby Lake and the airport.

2.1 Cranby Lake Watershed

The Cranby Lake Community Watershed boundary encompasses most of the airport property and is shown in Figure 2. The entire watershed boundary as defined in the bylaw is approximately 890 ha in area with YGB contributing drainage from a relatively small area west of the lake. The topographic divide runs essentially down the centerline of the runway. Drainage to the west of runway centerline flows towards Strait of Georgia and drainage to the east flows towards Cranby Lake. The airport and surrounding area are illustrated below in Photograph 1.

Photograph 1: YGB with Cranby Lake to the east (right side of photo) and the Lafarge Quarry in the background (looking north).

2.2 Existing Airport Infrastructure

Existing infrastructure at the airport includes the runway and apron, a small terminal building with parking area, a water supply well and septic field servicing the terminal building, a gravel taxiway and eight exiting hangar buildings located south of the terminal (Figure 3). Recently, a second water well was drilled by one of the hangar tenants west of the existing hangars. Copies of the original water well log and sewage disposal permit are provided in Appendix A.

2.3 Water Quality

Laboratory water quality test reports were provided by Vancouver Coastal Health for the airport drinking water well and for raw water samples from the Gilles Bay Improvement District. The raw water sample is collected from upstream of the treatment works and is therefore considered representative of Cranby Lake water quality. Copies of these testing reports are provided in Appendix B.

Potential concerns for water quality in Cranby Lake associated with the hangar expansion project primarily relate to turbidity and suspended solids associated with runoff and erosion from areas of filling required to create hangar lots and taxiways. There may also be increased concentrations of metals associated with the suspended solids. If the hangar project was to include developing new sanitary facilities, potential concerns for lake water quality would also include nutrients such as nitrate associated with any septic field expansion.

Water quality results (2014 and 2015) from Cranby Lake for seven parameters are presented below in Table 1. Overall, the water quality is very good as a surface water source for drinking water. Water pH is near neutral and turbidity is low (< 1 NTU) indicating little input of suspended particles such as silt and clay from surface runoff and erosion. Electrical conductivity is relatively low, consistent with low mineral content in the water as expected for a lake source. Nitrate levels are low and well below the maximum acceptable concentration (MAC) from the Guidelines for Canadian Drinking Water Quality (GCDWQ), indicating no significant inputs of nutrients from septic systems or agricultural runoff. Detectable concentrations of colour and iron are present, which is likely due to leaching of organic matter from the surrounding forests, which is typically for surface water sources in the coastal region of British Columbia. Arsenic concentrations are near or below the detection limit, and well below the MAC.

Table 1: Water Quality in Cranby Lake for Selected Parameters

Parameter	Arsenic (mg/L)	Iron (mg/L)	Nitrate (mg/L) as N	pH (units)	Turbidity (NTU)	Electrical Conductivity (µS/cm)	Colour (colour units)
Apr, 2014	0.0002	0.035	<0.01	7.50	0.68	117	20
Nov, 2015	<0.0002	0.084	0.04	7.13	0.80	118	20
MAC[1]	0.01	-	10	-	-	-	-
AO[2]	-	0.3	-	6.5-8.5	-	-	-

Notes

1. MAC – maximum acceptable concentration
2. AO – Aesthetic objective

Water quality results from the airport well are summarized for selected parameters in Table 2. Water pH is slightly alkaline at 8.2 and total dissolved solids are 150 mg/L, indicating a low to moderate level of overall mineral content in the well water. Dissolved iron is below the detection limit and the nitrate level is well below the MAC. Dissolved arsenic is somewhat elevated relative to background levels at 0.0092 mg/L, but below the MAC of 0.01 mg/L. Elevated arsenic concentrations are found in well water at many locations on the Sunshine Coast and are associated with naturally occurring mineralization in the rock (MOE, 2007).

Total coliform and E. Coli are bacteriological parameters and the CDWQG specify that they should not be present in detectable concentrations in drinking water sources “at the tap”. E.Coli was not detectable in the well water sample, but a detectable concentration of total coliform (2 “most probable number per 100 ml of water”) was measured. Total coliform is typically removed from drinking water by disinfection with chlorine or UV.

Table 2: Water Quality in Airport Well for Selected Parameters

Parameter	Arsenic (mg/L)	Iron (mg/L)	Nitrate (mg/L) as N	pH (units)	Turbidity (NTU)	Total Dissolved Solids (mg/L)	Total Coliform (MPN/100 mL)	E. Coli (MPN/100mL)
Oct, 2010	0.0092	<0.005	0.34	8.22	0.2	150	2	<1
MAC[1]	0.01	-	10	-	-	-	0	0
AO[2]	-	0.3	-	6.5-8.5	-	-	-	-

Notes

1. MAC – maximum acceptable concentration
2. AO – Aesthetic objective

2.4 Soils and Drainage

Soils in the vicinity of the airport are primarily clayey in texture (D. Glover, per comm.). The well log in Appendix A indicates brown clay and silt extending to a depth of about 20 m underlain by clay and broken rock. These soils are interpreted to be poorly drained (i.e. would have a low capacity to absorb and transmit seepage).

Other than the runway which is crowned to shed drainage to the east or west, there is little in the way of formal drainage improvements (i.e. ditches, culverts) at the site. A drainage ditch running approximately north-south has been developed in a topographically low-lying area east of the runway and west of the existing hangars (Figure 4). According to Mr. Rick Jones, who leases one of the existing hangar lots and arranges for grass trimming at the airport, the ditch is dry through most of the year and there is no significant ponding in the low lying area during winter months. Detailed topographic mapping provided by the PRRD indicates the ditch slopes from an elevation of about 95.5 masl at the north end to about 91.5 masl at the south end near

the edge of the forest. This slope of about 4 m over a distance of 160 m produces an overall grade of about 2.5 %.

The existing hangar lease lots have differing grades in some cases that direct drainage from one lot onto the next (Photograph 2). Roof drainage typically exhausts directly onto the ground surface creating ponding conditions and minor erosion during wet periods (Photograph 3). Based on these observations, it is concluded that a lack of drainage measures for the existing hangar lots produces nuisance runoff and minor erosion which could be controlled with simple improvements.

Photograph 2: Mismatching surface grades between adjacent hangar lots

Photograph 3: Roof drainage causing minor erosion and wet season ponding

3.0 Development Constraints and Opportunities

In determining areas that could be potentially suitable for development of additional hangars at YGB, two types of constraints were considered:

- airspace constraints required for aircraft maneuvering; and,
- environmental constraints related to setbacks and other requirements of the bylaws.

Airspace constraints are described in terms of an obstacle limitation surface (OLS) which diagrams the airspace required off the ends and sides of the runways for aircraft navigation. These concepts are shown in Figure 5.

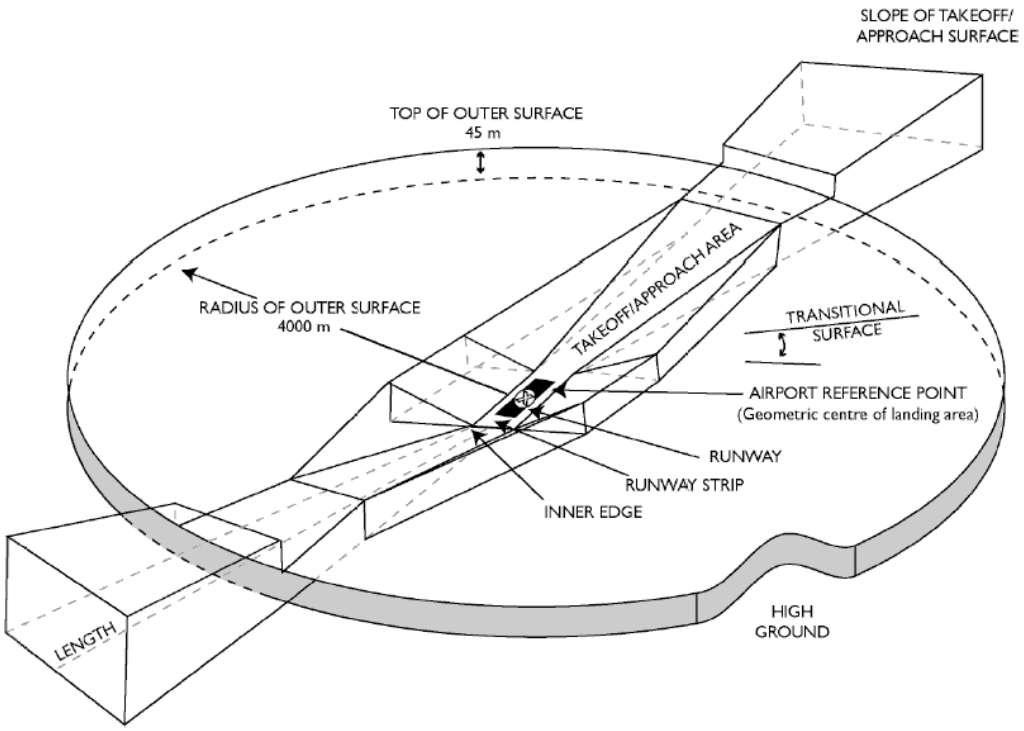


Figure 5: Example of Obstacle Limitation Surface about a runway (Source: Transport Canada).

Mr. Russell Storry, Airport Manager, assisted in providing the setback requirements for the local OLS at YGB. Parallel to the runway, the current OLS rises vertically 50 m east and west of the runway centerline. Future vertical OLS requirements may extend to 60 metres from runway centre-line. Essentially, this prohibits development of any above ground structure with 60 m either side of the centerline. Off the north end of the runway, the OLS rises at 8% beginning at a distance of 30 m beyond the end of pavement. At the south end of the runway, owing to lower surrounding terrain, the OLS rises at 5 % beginning 30 m beyond the end of pavement. The OLS thus provides a limitation for above ground structures such as hangars within 60 m of the runway centerline and within certain areas off the ends of the runway.

Allowing for the OLS, construction of hangars would not be permitted adjacent to the runway or within restricted areas off the ends of the runway. Hangar development at the south end of the runway is considered impractical given the distance from the site access off Airport Road and is not considered further. Similarly, there would be some restrictions off the north end of the runway for the OLS, leaving two relatively large areas, one to the north of the terminal building and the second to the south of the terminal building in the vicinity of the existing hangars, for potential future hangar development.

It is understood that consideration is being given to developing a medivac helipad in the area north of the Terminal Building (Figure 4). The helipad would create a new OLS causing some restriction in areas suitable for hangar development. Because of the airspace restrictions, and also due to a lack of natural or constructed points for surface drainage in the northern area, the

southern area in the vicinity of the existing hangars is considered to be the preferred location for future hangar development.

4.0 Hangar Development Assessment

4.1 General Requirements

Functionally, the proposed hangar expansion area must have:

- Structural fill placed to create a bearing surface for hangar structures and taxiways;
- The site must be graded to promote runoff and water must be directed to ditches or swales graded to carry away the runoff; and,
- Site grades must be sufficiently gentle to allow aircraft movement on taxiways and into hangars in accordance with Transport Canada requirements.

The Transport Canada requirements for allowable longitudinal grades for taxiways are technical and depend on the category of aircraft and other factors. Overall, they should be as flat as possible with grade limitations of between 1.5 and 3 %. Recognizing that the overall grade for the ditch in the south area is about 2.5 %, it should be feasible to achieve the required taxiway grades.

The South Area is approximately 0.81 ha in area. Allowing approximately 25 % of the area for taxiways, drainage facilities and other requirements, the area remaining for hangar development would be about 0.6 ha. It is understood that the existing hangar lease lots are about 250 m^2 in area. Therefore, the south area could potentially accommodate in the order of 20 or more new hangar lots.

In addition to these requirements, the PRRD may also consider constructing a new sanitary facility (e.g. shower and washrooms) and possibly a water supply source for washing and maintaining aircraft.

Environmentally, the proposed hangar expansion project must:

- Be constructed and maintained in a manner that does not detrimentally impact water quantity or quality in Cranby Lake; and,
- Meets all relevant bylaw requirements.

The overarching intent of the bylaws is to protect and maintain the water quality in Community Watersheds. This is largely achieved through restrictions on the type of land use and appropriate setbacks from watercourses. The bylaws define watercourses as:

- "Watercourse" means a natural watercourse or source of water supply, whether usually containing water or not, and includes a lake, river, creek, spring, ravine, swamp and gulch and does not include ditches or artificially created watercourses.

The existing ditch in the South Area is an artificially created watercourse that is not included in the bylaw definition and therefore, setback requirements are not applicable. The bylaws

specifically prohibit bulk storage of fuel at the airport and therefore, fuel storage is not considered as a potential concern. The primary environmental concerns associated with the hangar expansion project are judged to be erosion and sedimentation generated from fill, both during and after construction. A secondary and lesser concern would be loading of nutrients to the ground from a septic field if the project included new sanitary facilities.

4.2 Filling and Grading

A filling and grading plan needs to be developed that will promote drainage to the ditch and respect the required grade limitations for aircraft movement. This plan should be prepared by a Professional Engineer or other qualified person. This plan will require a detailed topographic survey. Soil conditions should be investigated by test pits or other means to confirm that there is adequate foundation bearing for the fill, and no soft organic soils or loose fill that could result in total or differential surface settlement.

The filling and grading plan should include measures, where required, such as intermediate ditches and culverts to direct drainage to the ditch identified in Figure 6. This plan should also include remedial drainage measures for the existing hangar lease lots east of the existing taxiway and east of the South Area. These remedial drainage measures are expected to be quite minimal.

Filling and grading will represent a significant cost for the proposed hangar expansion project. Fill quantities should be minimized to minimize costs as well as decreasing potential sediment load to the ditch. As an example, costs solely for fill purchase and delivery from the nearby Lafarge Quarry were estimated with the assistance of a local contractor. There are two types of construction aggregates commonly available from the quarry:

- Pit run which consists of blasted rock, normally containing particles about 100 mm with some particles up to 300 mm; and,
- Aggregate which consists of 19 mm minus material, compacts well and is suitable for finishing the surfaces of taxiways and hangar development lots.

Accurate quantities of fill would be developed from the grading and filling plan. Based on an area of 0.8 ha for the South Area, and assumptions about the probable range of fill thicknesses required, a rough approximation of fill purchase costs is shown in Table 3. These costs are exclusive of spreading and compacting fill, survey and engineering services, and other ancillary costs. If overall costs are prohibitive, the PRRD could consider carrying out the project in phases to defer costs.

Table 3: Examples of Fill Purchase Costs for Various Fill Thicknesses

Total Fill Thickness (m)	Pit Run Thickness (m)	Approx. Pit Run Cost ($/m^3)	Aggregate Thickness (m)	Approx. Aggregate Cost ($/m^3)	Approx. Total Cost of Fill[1,2]
0.3	0.15	$8.50	0.15	$16.50	$30,000
0.5	0.35	$8.50	0.15	$16.50	$44,000
1.0	0.85	$8.50	0.15	$16.50	$78,000

Notes

1. Costing is for illustrative purposes and does not include costs for spreading, compaction, engineering and surveying services, culverts, erosion control measures or other requirements.
2. Total fill cost assumes the indicated thickness of pit run and aggregate are placed over an area of 0.8 ha.

4.3 Lafarge Quarry Aggregate Products

The Lafarge Quarry is north of and in close proximity to YGB. The quarry produces limestone used in cement production, "chemical grade limestone" used in consumer products and aggregates. The aggregate products include "pit run" (300 mm minus) and "aggregate" (19 mm minus) used as structural fill in construction projects including road surfacing.

The limestone is produced from the Marble Bay Limestone Formation which is extensive throughout the north end of Texada Island. Locally, the limestone has been intruded by younger igneous rocks resulting in occurrences of sulphide mineralization (iron, copper, gold) that have been developed in past-producing mines.

When mineralized rock is broken up into smaller particles and exposed to oxygen and water, as in a quarry or mine, dissolved metals may be released into the drainage under certain geochemical conditions. These processes fall into two general categories: i) acid rock drainage or ARD; and, ii) metals leaching or ML. ARD occurs when acidity is generated during oxidation of sulphide minerals. ARD is a process that occurs under low pH conditions and it is considered very improbable that this could occur with aggregate products from the Lafarge Quarry because any acid generated is quickly neutralized by the limestone. ML is a process that occurs whereby certain metals can be leached from the rock under neutral pH conditions.

Lafarge staff were contacted and agreed to conduct testing of aggregate material currently stockpiled at the quarry to assess the metals leaching potential of their products. One sample of "pit run" consisting of a 50 % / 50 % mixture of limestone and granite (Sample 1) and one sample of 19 mm minus "high fines surfacing aggregate" consisting of granite with 5 % to 10 % limestone (Sample 2) were analyzed. The testing method involved the Synthetic Precipitation Leaching Procedure (SPLP). The testing method was developed by the US Environmental Protection Agency and is designed to assess leaching characteristics for waste rock material from mine sites. Briefly, the aggregate samples are contacted with a dilute acid intended to mimic precipitation for a period of 18 hours and then the resulting solution is analyzed for metals.

Results from the SPLP tests are summarized and compared with Canadian Drinking Water Quality Guidelines (CDWQG) on Table 4. As shown, the results from the pit run sample (Sample 1) had concentrations of all metals parameters less than the CDWQG levels. The metals results for the 19 mm minus high fines aggregate sample (Sample 2) also met the CDWQG for all parameters except arsenic. The SPLP result for arsenic was 0.011 mg/L

compared to the drinking water quality guideline of 0.01 mg/L, indicating it marginally exceeds the guideline value.

Based on these results the aggregate products are considered suitable as structural fill for the hangar expansion project and would not detrimentally impact water quality in Cranby Lake, provided there are adequate sediment and erosion controls in place as described below. The PRRD may consider further testing of the aggregate products as a quality control measure at the time of construction.

TABLE 4 - SPLP Test Results for Lafarge Quarry Aggregate Products

Test Date	Sample 1[1] 9/7/2016	Sample 2[1] 9/13/2016	Detection Limit	CDWQ MAC [2]	CDWQ AO[2]
Total Metals					
Antimony (Sb)	0.001	0.001	0.0005	0.006	
Arsenic (As)	< 0.001	0.011	0.001	0.010	
Barium (Ba)	< 0.10	< 0.10	0.1	1	
Berilium (Be)	< 0.005	< 0.005	0.005		
Boron (B)	< 0.050	< 0.050	0.05	5	
Cadmium (Cd)	0.0001	< 0.0001	0.0001	0.005	
Chromium (Cr)	< 0.005	< 0.005	0.005	0.05	
Cobalt (Co)	< 0.002	< 0.002	0.002		
Copper (Cu)	< 0.010	< 0.010	0.01		*1*
Iron (Fe)	< 0.10	< 0.10	0.1		*0.3*
Lead (Pb)	0.002	< 0.001	0.001	0.01	
Mercury (Hg)	< 0.0001	< 0.0001	0.0001	0.001	
Nickel (Ni)	< 0.010	< 0.010	0.01		
Selenium (Se)	< 0.002	< 0.002	0.002	0.05	
Silver (Ag)	0.0003	0.0001	0.0001		
Thalium (Th)	< 0.001	< 0.001	0.001		
Uranium (U)	< 0.002	< 0.002	0.002	0.02	
Vanadium (V)	< 0.005	< 0.005	0.005		
Zinc (Zn)	0.21	< 0.050	0.05		*5*
Zirconium (Zr)	< 0.005	< 0.005	0.005		

Footnotes:

Concentrations are in milligrams per litre unless otherwise stated.

1. Summary of Guidelines for Canadian Drinking Water Quality, Health Canada.

2. MAC = Maximum Acceptable Concentration, AO = Aesthetic Objective.

Italic values identifies result exceeding CDWQ AO.

Shaded values indentifies result exceeding CDWQ MAC.

4.4 Sediment and Erosion Control

Control of sediment and erosion on the YGB property, during and after construction is key to protection of water quality in Cranby Lake. Very effective methods for sediment control are commonly employed for similar projects. Mitigation measures for sediment and erosion control should be specified in the filling and grading plan.

The filling and grading plan should direct all site drainage from the proposed hangar expansion project to the existing ditch in the South Area. This provides a single point to control sediment before it leaves the YGB property. Methods for sediment control could involve, for example, a sedimentation pond, check dam and bioswale.

A check dam is a small dam constructed across a ditch to counteract erosion by reducing water flow velocity. A check dam constructed at the downstream outlet of a small sedimentation pond would be effective at removing larger sediment particles by gravity settlement in the pond. A bioswale is a swale with gently sloped sides and planted with vegetation. The purpose of a bioswale is to remove silt and finer particles in the drainage that do not settle as easily by gravity. An example of a rock check dam and bioswale is shown in Photograph 4.

Photograph 4: Example of bioswale and rock check dam for sediment and erosion control

In addition to these design elements, scheduling the construction work for the summer dry season will minimize the potential for generation of sediment while the control features are under construction.

4.5 Water Supply and Sanitary Facilities

Based on discussions with PRRD staff, consideration is being given to constructing improved sanitary facilities at the YGB. This could involve washroom/shower facilities and possibly a standpipe with water supply for washing aircraft or other purposes.

4.5.1 Water Supply

A water supply is required for washroom and shower facilities, and also to provide water to a standpipe or standpipes for aircraft washing and other purposes. If the water is used for drinking water, it must be of potable quality. As it understood that the nearest water system is the GBID, it is assumed that the improvements would be supplied by well water.

The driller's report for the existing airport well reports the yield as either 1.8 or 18 US gallons per minute (Appendix A). This represents a fairly large range as 1.8 USgpm would typically supply a household, but would not likely supply a washroom and shower facility as well as a water supply standpipe.

Based on discussion with a hangar tenant who drilled a second well in the vicinity of the existing hangar development, no well log is available and the yield is unknown. Therefore, the yield of the primary well is uncertain and is unknown for the secondary well. In addition, it is unknown if the water quality in the second well is of potable quality. Short duration pumping tests and water quality analysis on the second well should therefore be carried out as a basis to decide what the sustainable yield is and therefore whether improved sanitary facilities would be feasible from an onsite well water source.

4.5.2 Septic Field

The existing septic field for the terminal building is located south of the parking area and terminal building, east of the taxiway from the runway apron and west of Airport Road. The field was designed for the single bedroom caretaker's suite and would not be suitable for new expanded sanitary facilities associated with the proposed expansion.

Subject to proving up a water supply, it would be feasible to construct a septic field for the sanitary facilities. Individual septic fields should not be constructed by hangar tenants because this would require individual water supply connections to each hangar lease lot, the area of individual lease lots is not large enough to accommodate a hangar and septic field, and building individual septic fields would take up valuable space that can be used for other purposes (such as hangar lease lots).

If the PRRD intends to provide water supply and sanitary facilities, it is recommended that a common washroom / shower facility be designed and constructed with a single water supply source and single septic field. Regulation of septic systems with daily design flows less than 22,700 L/day falls under the Public Health Act Sewerage System Regulation (SSR). The actual daily design flow would depend on the available water supply and size of the sanitary facilities, but be less than the maximum under the SSR and would not fall under the scope of larger systems which fall under the Municipal Wastewater Regulation.

Design of the septic system must be undertaken by a professional qualified in design and construction of septic systems, or a registered onsite wastewater practitioner (ROWP).

The septic system must have a setback of at least 30 m from a drinking water well, unless a professional experienced in hydrogeology provides in writing that a lesser setback would be acceptable for protection of public health. Selection of the disposal area should be completed considering available area, proximity to the proposed sanitary facilities, design daily flow and soil conditions.

5.0 Recommendations

Based on review of the relevant bylaws, site analysis and review of available information, the following conclusions and recommendations are provided.

1) It is recommended that the "Southern Area" located between the runway and existing hangars be selected for future hangar development.

2) The PRRD should retain the services of a qualified engineer to prepare a grading and drainage plan for the expansion area that directs drainage to the existing ditch. The grading and drainage plan should include a sediment and erosion control plan to prevent off-site movement of silt and fines, both during and after construction. This plan should also include remedial measures to provide drainage for the newer existing hangar lots east of the taxiway which are expected to be quite minimal.

3) The grading and filling plan should minimize the quantities of new fill as it could render the project financially unfeasible and would also have the benefit of decreasing the extent of sediment control measures during construction.

4) Assuming the fill is to be sourced from local quarries, the material should be "non-leaching" for metals. It is recommended that SPLP testing on aggregate materials that produces an extract with concentrations no more than 2 x the Canadian Drinking Water Quality Guidelines would be suitable for on-site use and be protective of drinking water in Cranby Lake.

5) In accordance with the watershed protection bylaw, bulk storage or sales of fuel should be prohibited in that portion of the airport within the watershed.

6) If the PRRD wishes to provide water services to a washroom/shower facility, and possibly water supply for a standpipe, the "primary well" and "secondary well" should be tested for flow and water quality. If well yield and water quality are adequate to support a small water system, the PRRD should obtain a water system permit from Vancouver Coastal Health.

7) If the PRRD wishes to construct a washroom/shower facility, a new septic field would be required. It is recommended that any new sanitary facilities be "common" (i.e. not

individual systems associated with each hangar lot). The septic system should be designed and constructed under the direction of a professional or ROWP and should be sited more than 30 m from water supply wells.

6.0 Professional Statement

This report has been prepared by the undersigned. He is a Professional Engineer in good standing with the Association of Professional Engineers and Geoscientists of BC and has been practicing for over 30 years. He has previous experience with well water supplies, septic systems, soils and drainage, and assessment of water quality at mine sites.

7.0 Closure

Thank you for the opportunity to prepare this report for the proposed hangar expansion project at YGB. If you have any questions or concerns, please do not hesitate to contact the undersigned.

Respectfully submitted,

Enterprise Geoscience Services Ltd.

John Balfour, P.Eng.

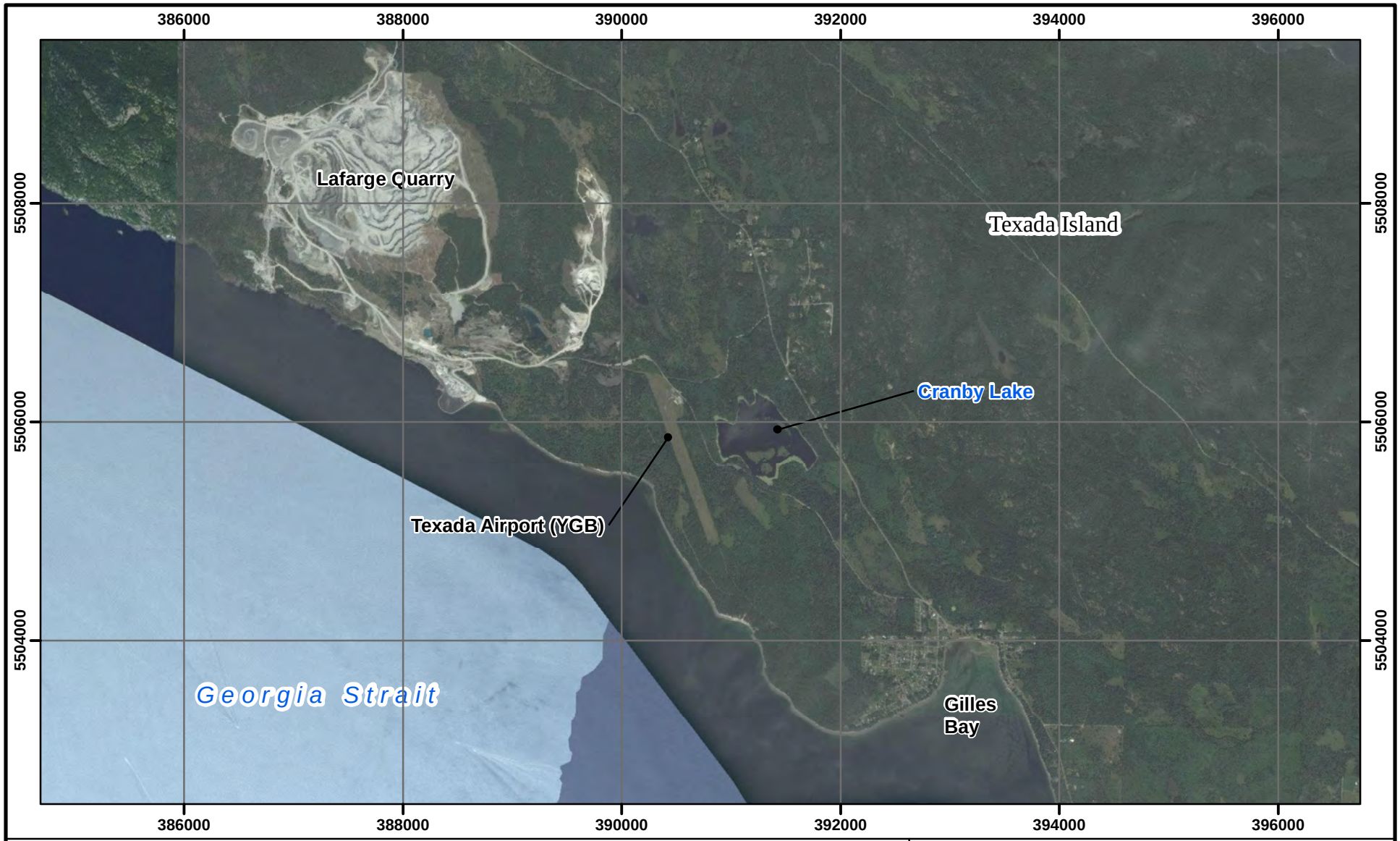
References

BC Ministry of Environment, February, 2007. Fact Sheet on Arsenic in Groundwater.

Public Health Act Sewerage System Regulation, June 28, 2010.

POWELL RIVER REGIONAL DISTRICT TEXADA ISLAND WATERSHED PROTECTION BYLAW NO. 237, 1993.

TEXADA ISLAND OFFICIAL COMMUNITY PLAN BYLAW NO. 395, 2005



Note:
Background imagery from ESRI Basemaps, 2015.
Map Projection is NAD 83 UTM Zone 10.

1:50,000

0 500 1,000 2,000 3,000 4,000 Meters

Enterprise Geoscience Services Ltd.
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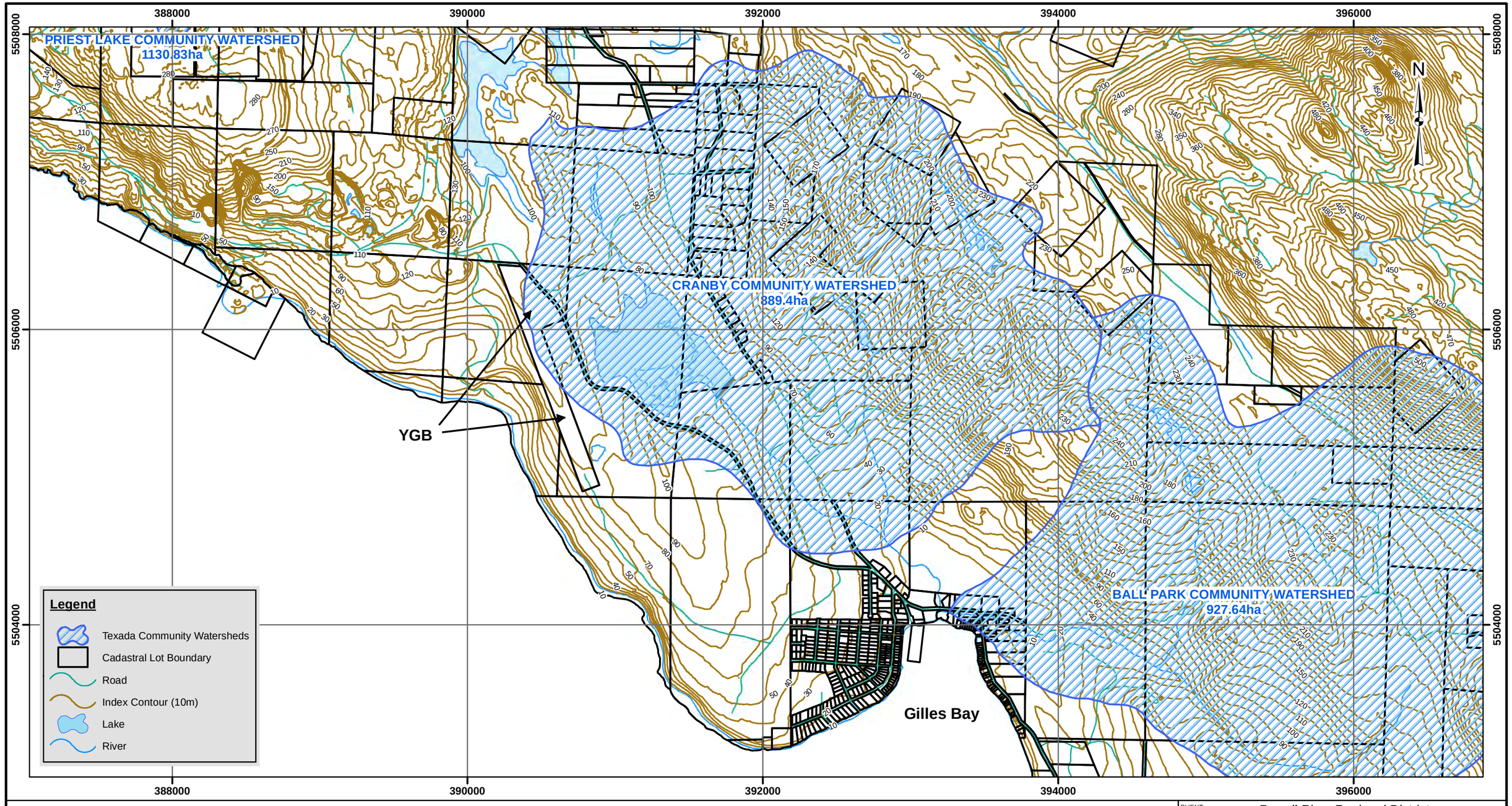
Vancouver, BC, V6K2G8

CLIENT:	Powell River Regional District		
PROJECT:	YGB Hanger Expansion Project		
TITLE:	Location Plan		
DRAWN BY:	YL	CHK BY:	JB
DATE:	2016/09/05	REVISED	
PROJ #:	121608		Figure 1



Note:
Imagery and Base Data from Powell River Regional District, 2016.
Map Projection is NAD 83 UTM Zone 10.

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Enterprise Geoscience Services Ltd.
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Vancouver, BC, V6K2G8

CLIENT:	Powell River Regional District
PROJECT:	YGB Hanger Expansion Project
TITLE:	Community Watersheds
DRAWN BY: YL	CHK BY: JB
DATE: 2016/09/05	REVISED
PROJ #: 121608	Figure 2

390000 390500 391000 391500

5506500 5506000 5505500 5505000 5504500

N

8%

5%

Cranby Lake

Airport Road

120 110 100 90 80 100 90 80

Legend

Obstacle Limitation Surface
Potential Future Medivac Helipad

Airport Points
Well

Airport Polyines
Edge of Pavement or Gravel
Fence
Painted Line

Airport Polygons
Asphalt Parking Area
Asphalt Runway/Taxiway
Concrete Pad
Gravel Parking Area
Gravel Taxiway/ Driveway
Hanger
Shed
Terminal Building

Cadastral Lot Boundary
Index Contour (10m)
Intermediate Contour (2m)
Road
Lake
River

Note:
Imagery and Base Data from Powell River Regional District, 2016.
Map Projection is NAD 83 UTM Zone 10.

1:8,000

0 50 100 200 300 400 Meters

Enterprise Geoscience Services Ltd.
203-2902 West Broadway
Vancouver, BC, V6K2G8

CLIENT:	Powell River Regional District
PROJECT:	YGB Hanger Expansion Project
TITLE:	YGB Existing Infrastructure and Obstacle Limitation Surface
DRAWN BY:	YL
CHK BY:	JB
DATE:	2016/09/05
REVISED	
PROJ #:	121608
	Figure 3

390200 390350 390500 390650

5506400 5506250 5506100 5505950

N

North Area

OLS Rises 8%

South Area
8090 m^2

Legend

Approx. Boundary of South Area
Obstacle Limitation Surface
Potential Future Medivac Helipad

Airport Points
Well

Airport Polyines
Edge of Pavement or Gravel
Fence
Painted Line

Airport Polygons
Asphalt Parking Area
Asphalt Runvway/Taxiway
Concrete Pad
Gravel Parking Area
Gravel Taxiway/ Driveway
Hanger
Shed
Terminal Building

Cadastral Lot Boundary
Index Contour (10m)
Intermediate Contour (2m)
Detailed Contour (0.5m)
Road
Lake
River

Note:
Imagery and Base Data from Powell River Regional District, 2016.
Map Projection is NAD 83 UTM Zone 10.

1:2,000

0 20 40 80 120 160 Meters

Enterprise Geoscience Services Ltd.
203-2902 West Broadway
Vancouver, BC, V6K2G8

CLIENT:	Powell River Regional District
PROJECT:	YGB Hanger Expansion Project
TITLE:	YGB Existing Infrastructure and Potential Future Hanger Development Areas
DRAWN BY: YL	CHK BY: JB
DATE: 2016/09/05	REVISED
PROJ #: 121608	Figure 4

390200 390350 390500 390650

5506400 5506250 5506100 5505950

N

North Area

OLS Rises 8%

South Area
8090 m^2

Legend

Approx. Boundary of South Area
Obstacle Limitation Surface
Potential Future Medivac Helipad

Airport Points
Well

Airport Polyines
Edge of Pavement or Gravel
Fence
Painted Line

Airport Polygons
Asphalt Parking Area
Asphalt Runvway/Taxiway
Concrete Pad
Gravel Parking Area
Gravel Taxiway/ Driveway
Hanger
Shed
Terminal Building

Cadastral Lot Boundary
Index Contour (10m)
Intermediate Contour (2m)
Detailed Contour (0.5m)
Road
Lake
River

Note:
Imagery and Base Data from Powell River Regional District, 2016.
Map Projection is NAD 83 UTM Zone 10.

1:2,000

0 20 40 80 120 160 Meters

Enterprise Geoscience Services Ltd.
203-2902 West Broadway
Vancouver, BC, V6K2G8

CLIENT:	Powell River Regional District
PROJECT:	YGB Hanger Expansion Project
TITLE:	YGB Existing Infrastructure and Potential Future Hanger Development Areas
DRAWN BY: YL	CHK BY: JB
DATE: 2016/09/05	REVISED
PROJ #: 121608	Figure 5

390425 390500 390575 390650

5506250 5506175 5506100 5506025 5505950 5505875

N

Ditch

South Area
8090 m^2

Legend

Approx. Boundary of South Area
Obstacle Limitation Surface

Airport Points
Well

Airport Polyines
Edge of Pavement or Gravel
Fence
Painted Line

Airport Polygons
Asphalt Parking Area
Asphalt Runway/Taxiway
Concrete Pad
Gravel Parking Area
Gravel Taxiway/ Driveway
Hanger
Shed
Terminal Building

Cadastral Lot Boundary
Index Contour (10m)
Intermediate Contour (2m)
Detailed Contour (0.5m)
Road
Lake
River

Note:
Imagery and Base Data from Powell River Regional District, 2016.
Map Projection is NAD 83 UTM Zone 10.

1:1,250

0 10 20 40 60 80 Meters

Enterprise Geoscience Services Ltd.
203-2902 West Broadway
Vancouver, BC, V6K2G8

CLIENT:	Powell River Regional District
PROJECT:	YGB Hanger Expansion Project
TITLE:	Detail Plan of South Area
DRAWN BY: YL	CHK BY: JB
DATE: 2016/09/05	REVISED
PROJ #: 121608	Figure 6

Appendix A

Well Log and Sewage Disposal Permit for YGB

Province of British Columbia — Ministry of Environment — Water Investigations Branch

WATER WELL RECORD

Date 82/11/23 (YR/MO/DY)

Legal Description & Address

Descriptive Location: Texada Island B.C. Airstrip.

Owners Name & Address: Powell River Regional District

NTS MAP | ELEV | WELL No.

UTM Z | E | N | UTM Date 19__

1. TYPE OF WORK 1 ☑ New Well 2 ☐ Reconditioned 3 ☐ Deepened 4 ☐ Abandoned

2. WORK METHOD 1 ☐ Cable tool 2 ☑ Bored 3 ☑ Jetted 4 ☑ Rotary a ☑ mud b ☑ air c ☐ reverse 5 ☐ Other

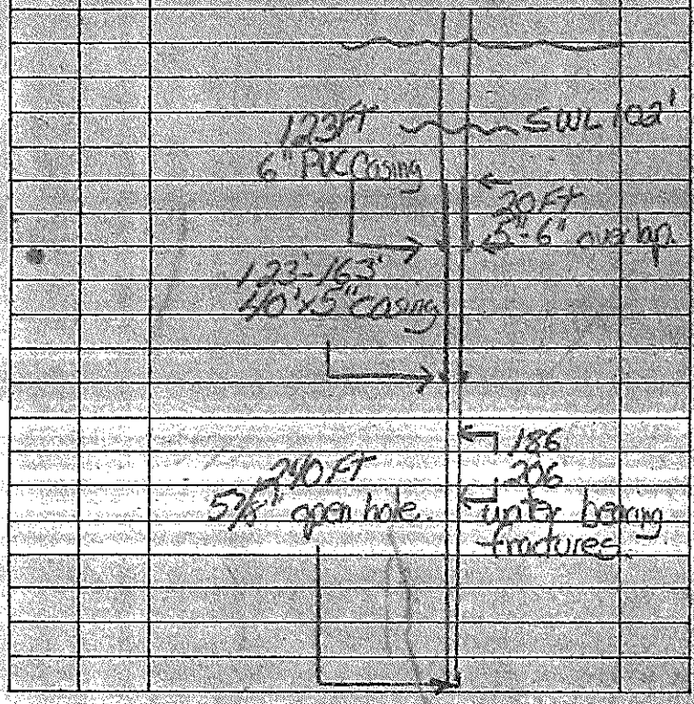
3. WATER WELL USE 1 ☐ Domestic 2 ☑ Municipal 3 ☐ Irrigation 4 ☐ Commercial & Industrial 5 ☐ Other

4. DRILLING ADDITIVES Gel, Revert

5. MEASUREMENTS from 1 ☑ ground level 2 ☐ top of casing

FROM ft	TO ft	6. WELL LOG DESCRIPTION	SWL ft
0	4	Surface till	
4	68	Brown clay, silt	
68	113	Grey clay, some Ang. rock	
113	126	Bedrock	
126	131	Lime stone	
131	403	Bedrock, some Limestone	

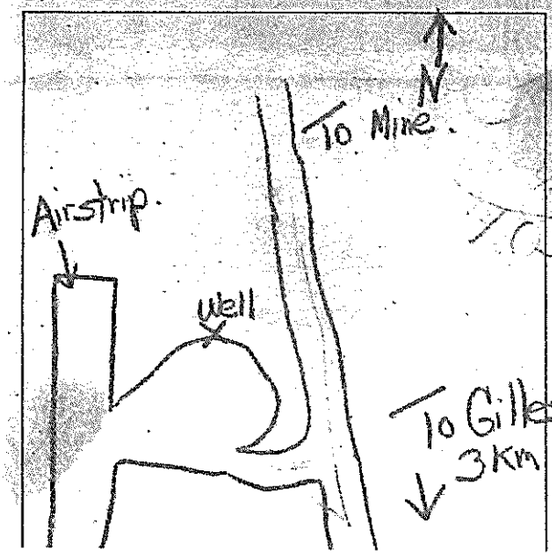
Casing Program



7. CONSULTANT

Address

8. WELL LOCATION SKETCH



9. CASING: Materials 1 ☐ Steel 2 ☐ Galvanized 3 ☐ Wood 4 ☑ Plastic 5 ☐ Concrete 6 ☐ Other

								units
Hole Diameter	8¾	5⅞						ins
Diameter	6	5						ins
from	0	123						ft
to	123	163						ft
Thickness	255	.188						ins
Weight								lb/ft

Pitless unit ____ ft 1 ☐ above 2 ☐ below ground level

1 ☐ Welded 2 ☐ Cemented 3 ☐ Threaded 4 ☐ New 5 ☐ Used

Perforations:

Shoe(s):

Open hole, from 163 to 403 ft Diameter 5⅞ ins

Grout:

10. SCREEN: 1 ☐ Nominal 2 ☐ Pipe Size

Type 1 ☐ Continuous Slot 2 ☐ Perforated 3 ☐ Louvre 4 ☐ Other

Material 1 ☐ Stainless Steel 2 ☐ Plastic 3 ☐ Other

Set from ____ to ____ ft below ground level

SCREEN & BLANKS								units
Length								ft
Diam. I D								ins
Slot Size								ins
from								ft
to								ft

Fittings, top ____ bottom ____

Gravel Pack

11. DEVELOPED BY: 1 ☐ Surging 2 ☐ Jetting 3 ☑ Air 4 ☐ Bailing 5 ☐ Pumping 6 ☐ Other

12. TEST 1 ☐ Pump 2 ☐ Bail Date 82/11/18 (YR/MO/DY)

Rate 1.8 USgpm Temp ____ °C SWL before test ____ ft

____ ft after test of ____ hrs ____ mins

TIME in mins & DRAWDOWN in ft				TIME in mins & RECOVERY in ft			
mins	WL	mins	WL	mins	WL	mins	WL
				10 mins	157		
					154		

13.

RECOMMENDED PUMP TYPE	RECOMMENDED PUMP SETTING	RECOMMENDED PUMPING RATE
SUB	350 ft	1.5 USgpm

14. WATER TYPE: 1 ☑ fresh 2 ☐ salty 3 ☐ clear 4 ☑ cloudy

colour Murky (Silty Sand) smell ____; gas 1 ☐ yes 2 ☑ no

15. WATER ANALYSIS: 1 ☐ Hardness ____ mg/l

2 ☐ Iron ____ mg/l 3 ☐ Chloride ____ mg/l

4 ☐ pH 7.0 Field Date ____

SITE I D No. Lab Date ____ (YR/MO/DY)

16. FINAL WELL COMPLETION DATA

Well Depth 403 ft Water Flowing ____ USgpm

Static Water Level 102 ft Pressure Head 301 ft

Back filled

Well Head Completion 6" PVC Sanitary Well Seal

17. DRILLER PLEASE PRINT SURNAME ROLER FIRST NAME MARK

Signature

18. CONTRACTOR, Address

J. B. CASWELL DRILLING LTD.
493-A PUNTLEDGE RD.
COURTENAY, B.C.
338-1358 V9N 3P9

Member, BCWWDA ☑ yes ☐ no ;

Province of British Columbia

Ministry of Health
PUBLIC HEALTH INSPECTION

APPLICATION FOR A PERMIT TO CONSTRUCT A SEWAGE DISPOSAL SYSTEM

THE APPLICANT LISTED BELOW HEREBY MAKES APPLICATION FOR A PERMIT TO CONSTRUCT A SEWAGE DISPOSAL SYSTEM PURSUANT TO THE REQUIREMENTS OF THE SEWAGE DISPOSAL REGULATIONS AND AS DESCRIBED IN THE PLAN AND SPECIFICATIONS CONTAINED HEREIN AND/OR ATTACHED HERETO.

PLEASE PRINT OR TYPE

APPLICANT'S FULL NAME		OWNER'S NAME	
Glen Calvert		Powell River Regional District	
LEGAL DESCRIPTION AND STREET ADDRESS		OWNER'S ADDRESS	
Texada Airport Lot A of the northwest ¼ southwest ¼ and east ½ of Section 5 T.I.D. Plan		5776 Marine Ave	
POSTAL CODE	APPLICANT'S PHONE	POSTAL CODE	OWNER'S PHONE
Airport Terminal, Texada	same	V8A 2M4	4833231

TYPE OF PREMISES SERVED

☐ SINGLE FAMILY DWELLING ☐ DUPLEX ☑ OTHER, SPECIFY: Texada Island Airport Terminal

ESTIMATED TOTAL DAILY SEWAGE FLOW (REFER TO APPENDIX 1 OF REGULATIONS FOR MINIMUM FLOWS)	DIMENSIONS OF LOT	LOT AREA
1 BED ROOM CARETAKER SUITE PLUS TERMINAL USE (375 GALS)		

DEPTH OF SOIL TO HARDPAN OR BEDROCK HIGHEST WATER TABLE	SEPTIC TANK (NAME, IF PREFABRICATED)	MATERIAL	LIQUID CAPACITY
36"	750 gallon concrete tank	Concrete	750 gallon

TYPE OF ULTIMATE DISPOSAL NODAK, LAGOON, SEEPAGE BED, CONVENTIONAL, ETC	TOTAL LENGTH OF DISPOSAL PIPE	TYPE OF PIPE	INSIDE DIAMETER OF PIPE
Seepage bed/drainfield		Plastic ABS	4"

DISTANCES FROM SOURCES OF DOMESTIC WATER

300' FROM OWN ; ? none FROM NEIGHBOUR'S ; ½ mile + FROM STREAM OR LAKE

IF A PACKAGE TREATMENT PLANT IS PROPOSED — MAKE AND MODEL _____ TREATMENT CAPACITY _____

NOTE: A SITE PLAN MUST BE SUBMITTED WITH THIS APPLICATION (see below) AND PERCOLATION TEST RESULTS MUST ALSO BE PROVIDED. RESULTS SHOULD BE RECORDED ON PLOT PLAN.

THE SEWAGE DISPOSAL SYSTEM DESCRIBED ABOVE MUST BE CONSTRUCTED IN ACCORDANCE WITH THE REQUIREMENTS OF THE SEWAGE DISPOSAL REGULATIONS. THE MEDICAL HEALTH OFFICER OR HIS DELEGATE MUST BE NOTIFIED WHEN THE INSTALLATION IS READY FOR INSPECTION.

Jan 4 1983 — DATE OF APPLICATION

Glen Calvert, Secretary Treasurer — SIGNATURE OF OWNER OR AGENT

PERMIT TO CONSTRUCT

PURSUANT TO THIS APPLICATION AND THE SEWAGE DISPOSAL REGULATIONS, PERMISSION IS HEREBY GRANTED FOR THE CONSTRUCTION OF A SEWAGE DISPOSAL SYSTEM.

CONDITIONS OF PERMIT ① Add 16" of soil over disposal field area ② Keep depth of disposal lines to 19" from finished grade ③ disposal area to be as per drawing at site

(Note: disposal field & septic tank to be raised to correct depths)

Jan 5/83 — DATE OF ISSUANCE

B. Atherton — MEDICAL HEALTH OFFICER OR DELEGATE

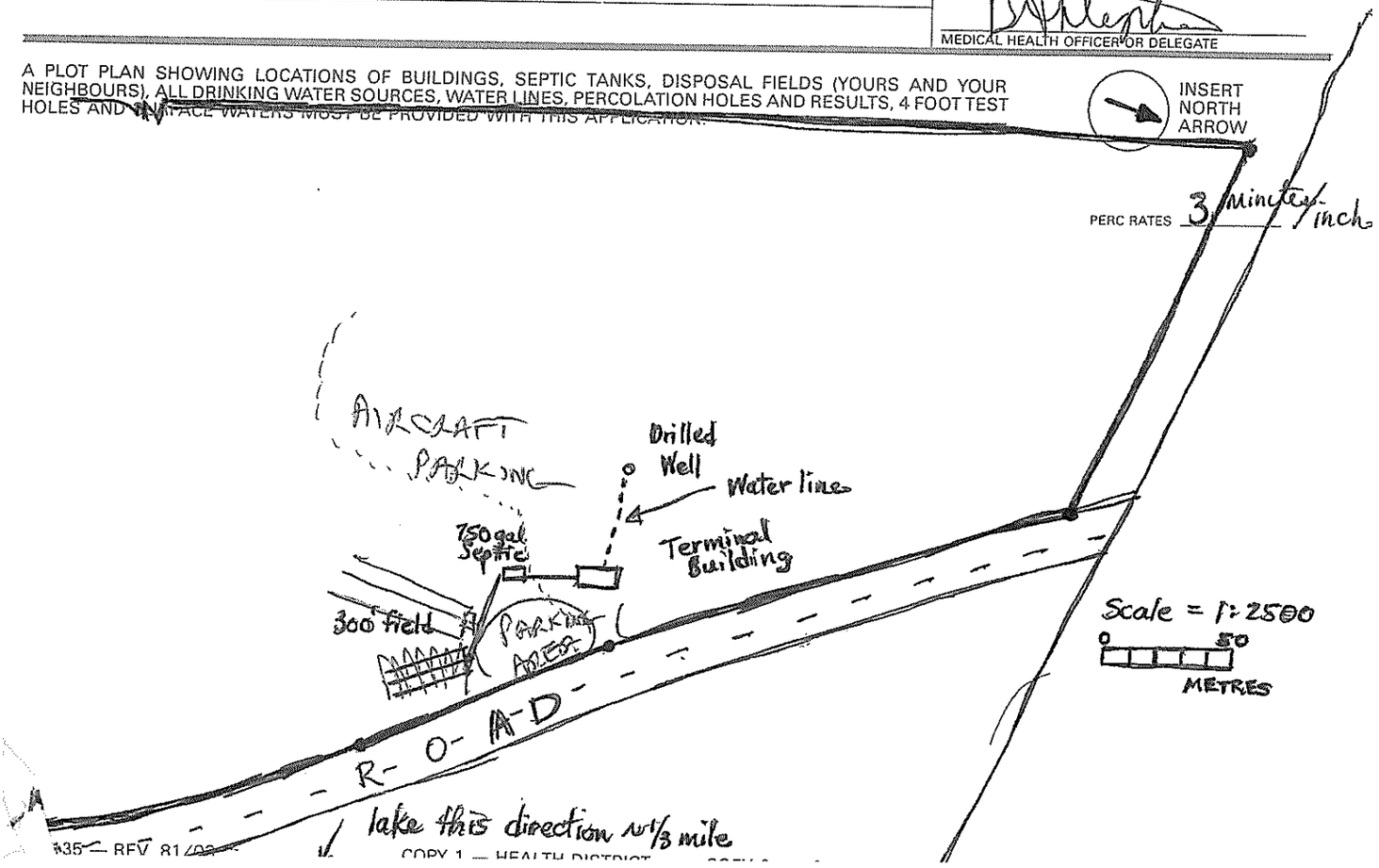
NOTE: CONSTRUCTION MUST NOT COMMENCE UNTIL THIS PERMIT HAS BEEN SIGNED BY THE MEDICAL HEALTH OFFICER OR HIS DELEGATE. THIS SEWAGE DISPOSAL SYSTEM MUST BE INSPECTED BY THE AUTHORITY HAVING JURISDICTION BEFORE BACKFILLING. CHECK WITH YOUR LOCAL AUTHORITIES REGARDING BUILDING AND ZONING BY-LAWS. THIS PERMIT IS NOT TRANSFERABLE AND EXPIRES SIX MONTHS FROM DATE OF ISSUE.

COMMENTS

BACKFILLING AND USE AUTHORIZED ☑ YES ☐ NO — DATE OF FINAL INSPECTION Jan 18/83

B. Atherton — MEDICAL HEALTH OFFICER OR DELEGATE

A PLOT PLAN SHOWING LOCATIONS OF BUILDINGS, SEPTIC TANKS, DISPOSAL FIELDS (YOURS AND YOUR NEIGHBOURS), ALL DRINKING WATER SOURCES, WATER LINES, PERCOLATION HOLES AND RESULTS, 4 FOOT TEST HOLES AND INTAKE WATERS MUST BE PROVIDED WITH THIS APPLICATION.



Appendix B

Water Quality Reports for Cranby Lake and YGB Well

Exova
#104, 19575-55 A Ave.
Surrey, British Columbia
V3S 8P8, Canada

T: +1 (604) 514-3322
F: +1 (604) 514-3323
E: Surrey@exova.com
W: www.exova.com

Report Transmission Cover Page

Bill To:	Gillies Bay Improvement District	Project:	
Report To:	Gillies Bay Improvement District	ID:	Yearly Base Line
	PO Box 237	Name:	
	Gillies Bay, BC, Canada	Location:	CL2 / Raw Tap
	V0N 1W0	LSD:	# 1 Chlorinator Road
Attn:	Ken Taylor	P.O.:	
Sampled By:		Acct code:	
Company:			

Lot ID:	**999436**
Control Number:	B031537
Date Received:	Apr 30, 2014
Date Reported:	May 16, 2014
Report Number:	1916327

Contact & Affiliation	Address	Delivery Commitments
Ken Taylor Gillies Bay Improvement District	, PO Box 237 Gillies Bay, British Columbia V0N 1W0 Phone: (604) 414-3703 Fax: null Email: deluxebros@hushmail.com	On [Lot Verification] send (COA) by Email - Single Report On [Report Approval] send (COC, Test Report) by Email - Merge Reports On [Report Approval] send (COC, Test Report) by Email - Merge Reports
Bridget Andrews Gillies Bay Improvement District	, PO Box 212 Gillies Bay, British Columbia V0N 1W0 Phone: (604) 414-3703 Fax: null Email: admin@gillies-bay.ca	On [Report Approval] send (Test Report) by Email - Single Report On [Lot Approval and Final Test Report Approval] send (Invoice) by Email - Single Report On [Lot Approval and Final Test Report Approval] send (Invoice) by Email - Single Report

Notes To Clients:

- Report was issued to include addition of metal and mercury analysis on sample 999436-1 requested by Bridget of Gillies Bay Improvement District on May 14, 2014. Previous report 1912600.
- Sample 999436-1; 4726764 pH analysis was performed past the recommended holding time of 15 minutes from sample collection.

Exova
#104, 19575-55 A Ave.
Surrey, British Columbia
V3S 8P8, Canada

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W: www.exova.com

Exova

Analytical Report

Bill To:	Gillies Bay Improvement District	Project:	
Report To:	Gillies Bay Improvement District	ID:	Yearly Base Line
	PO Box 237	Name:	
	Gillies Bay, BC, Canada	Location:	CL2 / Raw Tap
	V0N 1W0	LSD:	# 1 Chlorinator Road
Attn:	Ken Taylor	P.O.:	
Sampled By:		Acct code:	
Company:			

Lot ID:	**999436**
Control Number:	B031537
Date Received:	Apr 30, 2014
Date Reported:	May 16, 2014
Report Number:	1916327

Reference Number	999436-1
Sample Date	April 29, 2014
Sample Time	08:57
Sample Location	
Sample Description	Yearly Base Line- Raw
Sample Matrix	Drinking Water

Analyte		Units	Result	Nominal Detection Limit	Guideline Limit	Guideline Comments
Metals Extractable						
Aluminum	Extractable	mg/L	<0.005	0.005	0.1	Below OG
Antimony	Extractable	mg/L	<0.0002	0.0002	0.006	Below MAC
Arsenic	Extractable	mg/L	0.0002	0.0002	0.010	Below MAC
Barium	Extractable	mg/L	0.003	0.001	1	Below MAC
Boron	Extractable	mg/L	0.008	0.005	5	Below MAC
Cadmium	Extractable	mg/L	<0.00007	0.00007	0.005	Below MAC
Chromium	Extractable	mg/L	<0.0005	0.0005	0.05	Below MAC
Copper	Extractable	mg/L	0.001	0.001	1.0	Below AO
Lead	Extractable	mg/L	0.0002	0.0001	0.01	Below MAC
Selenium	Extractable	mg/L	<0.0006	0.0006	0.01	Below MAC
Uranium	Extractable	mg/L	<0.0005	0.0005	0.02	Below MAC
Vanadium	Extractable	mg/L	0.0004	0.0001		
Zinc	Extractable	mg/L	0.004	0.001	5.0	Below AO
Metals Total						
Mercury	Total	mg/L	<0.00001	0.00001	0.001	Below MAC
Physical and Aggregate Properties						
Colour	Apparent	Colour units	28	5		
Colour	True	Colour units	20	5		
Turbidity		NTU	0.68	0.02		
Routine Water						
pH	at 25 °C		7.50		6.5-8.5	Within AO
Electrical Conductivity		µS/cm at 25 C	117	1		
Calcium	Extractable	mg/L	16.4	0.1		
Iron	Extractable	mg/L	0.035	0.005	0.3	Below AO
Magnesium	Extractable	mg/L	2.02	0.1		
Manganese	Extractable	mg/L	0.004	0.001	0.05	Below AO
Potassium	Extractable	mg/L	0.4	0.1		
Silicon	Extractable	mg/L	0.32	0.05		
Sodium	Extractable	mg/L	4.4	0.1	200	Below AO
Bicarbonate		mg/L	58	5		
Carbonate		mg/L	<6	6		
Hydroxide		mg/L	<5	5		
P-Alkalinity	as CaCO3	mg/L	<5	5		
T-Alkalinity	as CaCO3	mg/L	47	5		
Chloride	Dissolved	mg/L	6.16	0.05	250	Below AO
Fluoride	Dissolved	mg/L	0.04	0.01	1.5	Below MAC

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Exova

Analytical Report

Bill To:	Gillies Bay Improvement District	Project:		Lot ID:	**999436**
Report To:	Gillies Bay Improvement District	ID:	Yearly Base Line	Control Number:	B031537
	PO Box 237	Name:		Date Received:	Apr 30, 2014
	Gillies Bay, BC, Canada	Location:	CL2 / Raw Tap	Date Reported:	May 16, 2014
	V0N 1W0	LSD:	# 1 Chlorinator Road	Report Number:	1916327
Attn:	Ken Taylor	P.O.:			
Sampled By:		Acct code:			
Company:					

Reference Number	999436-1
Sample Date	April 29, 2014
Sample Time	08:57
Sample Location	
Sample Description	Yearly Base Line- Raw
Sample Matrix	Drinking Water

Analyte		Units	Result	Nominal Detection Limit	Guideline Limit	Guideline Comments
Routine Water - Continued						
Nitrate - N	Dissolved	mg/L	<0.01	0.01	10	Below MAC
Nitrite - N	Dissolved	mg/L	<0.01	0.01	1	Below MAC
Sulfate (SO4)	Dissolved	mg/L	3.4	0.5	500	Below AO
Hardness	as CaCO3	mg/L	49	1		
Total Dissolved Solids	Extractable	mg/L	61	1		

Approved by:

Mathieu Simoneau
Operations Manager

Data have been validated by Analytical Quality Control and Exova's Integrated Data Validation System (IDVS).
Generation and distribution of the report, and approval by the digitized signature above, are performed through a secure and controlled automatic process.

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Methodology and Notes

Bill To:	Gillies Bay Improvement District	Project:	
Report To:	Gillies Bay Improvement District	ID:	Yearly Base Line
	PO Box 237	Name:	
	Gillies Bay, BC, Canada	Location:	CL2 / Raw Tap
	V0N 1W0	LSD:	# 1 Chlorinator Road
Attn:	Ken Taylor	P.O.:	
Sampled By:		Acct code:	
Company:			

Lot ID:	**999436**
Control Number:	B031537
Date Received:	Apr 30, 2014
Date Reported:	May 16, 2014
Report Number:	1916327

Method of Analysis

Method Name	Reference	Method	Date Analysis Started	Location
Alk, pH, EC, Turb in water (Surrey)	APHA	* Alkalinity - Titration Method, 2320 B	01-May-14	Exova Surrey
Alk, pH, EC, Turb in water (Surrey)	APHA	* Conductivity, 2510 B	01-May-14	Exova Surrey
Alk, pH, EC, Turb in water (Surrey)	APHA	* pH - Electrometric Method, 4500-H+ B	01-May-14	Exova Surrey
Anions by IEC in water (Surrey)	APHA	* Ion Chromatography with Chemical Suppression of Eluent Cond., 4110 B	01-May-14	Exova Surrey
Apparent Color (Surrey)	APHA	* Spectrophotometric - Single Wavelength Method, 2120 C	02-May-14	Exova Surrey
Mercury Low Level (Total) in water (Surrey)	EPA	* Mercury in Water by Cold Vapor Atomic Fluorescence Spectrometry, 245.7	15-May-14	Exova Surrey
Metals SemiTrace (Extractable) in water (Surrey)	US EPA	* Metals & Trace Elements by ICP-AES, 6010C	01-May-14	Exova Surrey
Trace Metals (extractable) in Water (Surrey)	US EPA	* Determination of Trace Elements in Waters and Wastes by ICP-MS, 200.8	14-May-14	Exova Surrey
True Color in water	APHA	* Spectrophotometric - Single Wavelength Method, 2120 C	02-May-14	Exova Surrey
Turbidity - Water (Surrey)	APHA	* Turbidity - Nephelometric Method, 2130 B	02-May-14	Exova Surrey

** Reference Method Modified*

References

APHA	Standard Methods for the Examination of Water and Wastewater
US EPA	US Environmental Protection Agency Test Methods

Guidelines

Guideline Description	Health Canada GCDWQ
Guideline Source	Guidelines for Canadian Drinking Water Quality, Health Canada, August 2012
Guideline Comments	MAC = Maximum Acceptable Concentration AO = Aesthetic Objective OG = Operational Guideline for Water Treatment Plants Refer to Health Canada GCDWQ for complete guidelines and additional drinking water information at www.hc-sc.gc.ca

Comments:

- Report was issued to include addition of metal and mercury analysis on sample 999436-1 requested by Bridget of Gillies Bay Improvement District on May 14, 2014. Previous report 1912600.
- Sample 999436-1; 4726764 pH analysis was performed past the recommended holding time of 15 minutes from sample collection.

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V3S 8P8, Canada

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Methodology and Notes

Bill To:	Gillies Bay Improvement District	Project:	
Report To:	Gillies Bay Improvement District	ID:	Yearly Base Line
	PO Box 237	Name:	
	Gillies Bay, BC, Canada	Location:	CL2 / Raw Tap
	V0N 1W0	LSD:	# 1 Chlorinator Road
Attn:	Ken Taylor	P.O.:	
Sampled By:		Acct code:	
Company:			

Lot ID:	**999436**
Control Number:	B031537
Date Received:	Apr 30, 2014
Date Reported:	May 16, 2014
Report Number:	1916327

The comparison of test results to guideline limits is provided for information purposes only. This is not to be taken as a statement of conformance / nonconformance to any guideline, regulation or limit. The data user is responsible for all conclusions drawn with respect to the data and is advised to consult official regulatory references when evaluating compliance.

Please direct any inquiries regarding this report to our Client Services group.
Results relate only to samples as submitted.

Exova
Testing Advising Assuring
www.exova.com

Billing Information

Company: GBID
Address:
Attention:
Phone:
Cell:
Fax:
E-mail:
Agreement ID:
Copy of report:

Copy of Report To:

Company:
Address:
Attention: BRIDGET ANDREWS
Phone:
Cell:
Fax:
E-mail:
Copy of invoice:

RUSH Priority

Upon filling out this section, client accepts that surcharges will be applied to the analysis

Date Required
As Indicated | All Analysis

When "ASAP" is requested, turn around will default to a 100% RUSH priority, with pricing and turn around time to match. Please contact the lab prior to submitting RUSH samples.

Signature

Project Information

Project ID: YEARLY BASELINE
Project Name:
Project Location: CL2/RAW TAP
Legal Location: #1 CHLORINATOR ROAD
PO/AFE#:
Proj. Acct. Code:

Sample Custody (please print)

Sampled by:
Company:
I authorize Exova to proceed with the work indicated on this form:
Date: Initial:

This section for Lab use only

Date/Time stamp: RECEIVED APR 30 2014

Report Results

[X] E-mail [ ] Online [ ] PDF [ ] QA/QC Report
[ ] Mail [ ] Fax [ ] Excel

Special Instructions/Comments (please include contact information including ph. # if different from above).

Include Regulatory Requirements Below:

Number of Containers: W 12 / POTABLE

	Sample Identification	Location	Depth IN CM M	Date/Time sampled	Matrix	Sampling Method	↓	Enter tests above (√ relevant samples below)
1	YEARLY BASELINE	RAW		29/04/2014/ 8:57AM			1.	X
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								

Indicate below any deficiencies in the condition of samples:

- Were Exova supplies used?
- Was there any damage to the shipping container?
- Were the containers packaged well?
- Were any extra samples received (document below)?
- Are samples within recommended holding times/temp?

ED 120-00

Environmental Sample Information Sheet

Note: Proper completion of this form is required in order to proceed with analysis

Please indicate any potentially hazardous samples

Page of Control # B031537

LOT: 999436 COC

Shipping:
COD Y/N
Cooler temp: 17C

and size of coolers received:
Delivery Method:
Waybill:
Received by:

Exova
#104, 19575-55 A Ave.
Surrey, British Columbia
V3S 8P8, Canada

T: +1 (604) 514-3322
F: +1 (604) 514-3323
E: Surrey@exova.com
W: www.exova.com

Report Transmission Cover Page

Bill To:	Gillies Bay Improvement District	Project:	
Report To:	Gillies Bay Improvement District	ID:	Annual Base Line Sample
	PO Box 237	Name:	Raw
	Gillies Bay, BC, Canada	Location:	
	V0N 1W0	LSD:	
Attn:	Ken Taylor	P.O.:	
Sampled By:		Acct code:	
Company:			

Lot ID:	**1107277**
Control Number:	B18253
Date Received:	Nov 18, 2015
Date Reported:	Nov 24, 2015
Report Number:	2062599

Contact & Affiliation	Address	Delivery Commitments
Ken Taylor Gillies Bay Improvement District	, PO Box 237 Gillies Bay, British Columbia V0N 1W0 Phone: (604) 414-3703 Fax: null Email: deluxebros@hushmail.com	On [Lot Verification] send (COA) by Email - Single Report On [Report Approval] send (COC, Test Report) by Email - Merge Reports
Bridget Andrews Gillies Bay Improvement District	, PO Box 212 Gillies Bay, British Columbia V0N 1W0 Phone: (604) 414-3703 Fax: null Email: admin@gillies-bay.ca	On [Lot Approval and Final Test Report Approval] send (Invoice) by Email - Single Report
Douglas Anderson Gillies Bay Improvement District	, PO Box 237 Gillies Bay, British Columbia V0N 1W0 Phone: (604) 414-3703 Fax: null Email: danderson@andersoncivil.com	On [Report Approval] send (Test Report) by Email - Single Report

Notes To Clients:

- Sample was decanted and preserved upon receipt.
- An appropriately preserved sample was not received for Total Mercury analysis of sample 1107277-1. Analysis was performed on unpreserved sample.
- pH analysis was performed past the recommended holding time of 15 minutes from sample collection.

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Exova

Analytical Report

Bill To:	Gillies Bay Improvement District	Project:	
Report To:	Gillies Bay Improvement District	ID:	Annual Base Line Sample
	PO Box 237	Name:	Raw
	Gillies Bay, BC, Canada	Location:	
	V0N 1W0	LSD:	
Attn:	Ken Taylor	P.O.:	
Sampled By:		Acct code:	
Company:			

Lot ID:	**1107277**
Control Number:	B18253
Date Received:	Nov 18, 2015
Date Reported:	Nov 24, 2015
Report Number:	2062599

Reference Number	1107277-1
Sample Date	November 17, 2015
Sample Time	09:21
Sample Location	
Sample Description	Annual Base Line Sample - Raw
Sample Matrix	Water

Analyte		Units	Result	Nominal Detection Limit	Guideline Limit	Guideline Comments
Metals Extractable						
Aluminum	Extractable	mg/L	<0.005	0.005	0.1	Below OG
Antimony	Extractable	mg/L	<0.0002	0.0002	0.006	Below MAC
Arsenic	Extractable	mg/L	<0.0002	0.0002	0.010	Below MAC
Barium	Extractable	mg/L	0.004	0.001	1	Below MAC
Boron	Extractable	mg/L	0.005	0.005	5	Below MAC
Cadmium	Extractable	mg/L	<0.00007	0.00007	0.005	Below MAC
Chromium	Extractable	mg/L	<0.0005	0.0005	0.05	Below MAC
Copper	Extractable	mg/L	0.002	0.001	1.0	Below AO
Lead	Extractable	mg/L	0.0002	0.0001	0.01	Below MAC
Selenium	Extractable	mg/L	<0.0006	0.0006	0.05	Below MAC
Uranium	Extractable	mg/L	<0.0005	0.0005	0.02	Below MAC
Vanadium	Extractable	mg/L	<0.00010	0.0001		
Zinc	Extractable	mg/L	0.004	0.001	5.0	Below AO
Metals Total						
Mercury	Total	mg/L	<0.00001	0.00001	0.001	Below MAC
Physical and Aggregate Properties						
Colour	True	Colour units	20	5		
Turbidity		NTU	0.80	0.02		
Routine Water						
pH	at 25 °C		7.13		6.5-8.5	Within AO
Electrical Conductivity		µS/cm at 25 C	118	1		
Calcium	Extractable	mg/L	17.2	0.1		
Iron	Extractable	mg/L	0.084	0.005	0.3	Below AO
Magnesium	Extractable	mg/L	2.07	0.1		
Manganese	Extractable	mg/L	0.008	0.001	0.05	Below AO
Potassium	Extractable	mg/L	0.4	0.1		
Silicon	Extractable	mg/L	2.33	0.05		
Sodium	Extractable	mg/L	4.2	0.1	200	Below AO
T-Alkalinity	as CaCO3	mg/L	51	5		
Chloride	Dissolved	mg/L	5.64	0.05	250	Below AO
Fluoride	Dissolved	mg/L	0.03	0.01	1.5	Below MAC
Nitrate - N	Dissolved	mg/L	0.04	0.01	10	Below MAC
Nitrite - N	Dissolved	mg/L	0.40	0.01	1	Below MAC
Sulfate (SO4)	Dissolved	mg/L	3.68	0.5	500	Below AO
Hardness	as CaCO3	mg/L	51	1		
Total Dissolved Solids	Extractable	mg/L	71	1		

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Analytical Report

Bill To:	Gillies Bay Improvement District	Project:	
Report To:	Gillies Bay Improvement District	ID:	Annual Base Line Sample
	PO Box 237	Name:	Raw
	Gillies Bay, BC, Canada	Location:	
	V0N 1W0	LSD:	
Attn:	Ken Taylor	P.O.:	
Sampled By:		Acct code:	
Company:			

Lot ID:	**1107277**
Control Number:	B18253
Date Received:	Nov 18, 2015
Date Reported:	Nov 24, 2015
Report Number:	2062599

Approved by:

Mathieu Simoneau
Operations Manager

Data have been validated by Analytical Quality Control and Exova's Integrated Data Validation System (IDVS).
Generation and distribution of the report, and approval by the digitized signature above, are performed through a secure and controlled automatic process.

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Methodology and Notes

Bill To:	Gillies Bay Improvement District	Project:		Lot ID:	**1107277**
Report To:	Gillies Bay Improvement District	ID:	Annual Base Line Sample	Control Number:	B18253
	PO Box 237	Name:	Raw	Date Received:	Nov 18, 2015
	Gillies Bay, BC, Canada	Location:		Date Reported:	Nov 24, 2015
	V0N 1W0	LSD:		Report Number:	2062599
Attn:	Ken Taylor	P.O.:			
Sampled By:		Acct code:			
Company:					

Method of Analysis

Method Name	Reference		Method	Date Analysis Started	Location
Alk, pH, EC, Turb in water (Surrey)	APHA	*	Alkalinity - Titration Method, 2320 B	19-Nov-15	Exova Surrey
Alk, pH, EC, Turb in water (Surrey)	APHA	*	Conductivity, 2510 B	19-Nov-15	Exova Surrey
Alk, pH, EC, Turb in water (Surrey)	APHA	*	pH - Electrometric Method, 4500-H+ B	19-Nov-15	Exova Surrey
Anions by IEC in water (Surrey)	APHA	*	Ion Chromatography with Chemical Suppression of Eluent Cond., 4110 B	19-Nov-15	Exova Surrey
Mercury Low Level (Total) in water (Surrey)	EPA	*	Mercury in Water by Cold Vapor Atomic Fluorescence Spectrometry, 245.7	23-Nov-15	Exova Surrey
Metals SemiTrace (Extractable) in water (Surrey)	US EPA	*	Metals & Trace Elements by ICP-AES, 6010C	19-Nov-15	Exova Surrey
Trace Metals (extractable) in Water (Surrey)	US EPA	*	Determination of Trace Elements in Waters and Wastes by ICP-MS, 200.8	19-Nov-15	Exova Surrey
True Color in water (Surrey)	APHA	*	Spectrophotometric - Single Wavelength Method, 2120 C	20-Nov-15	Exova Surrey
Turbidity - Water (Surrey)	APHA	*	Turbidity - Nephelometric Method, 2130 B	23-Nov-15	Exova Surrey

** Reference Method Modified*

References

APHA	Standard Methods for the Examination of Water and Wastewater
US EPA	US Environmental Protection Agency Test Methods

Guidelines

Guideline Description	Health Canada GCDWQ
Guideline Source	Guidelines for Canadian Drinking Water Quality, Health Canada, October 2014
Guideline Comments	MAC = Maximum Acceptable Concentration AO = Aesthetic Objective OG = Operational Guideline for Water Treatment Plants Refer to Health Canada GCDWQ for complete guidelines and additional drinking water information at www.hc-sc.gc.ca

Comments:

- Sample was decanted and preserved upon receipt.
- An appropriately preserved sample was not received for Total Mercury analysis of sample 1107277-1. Analysis was performed on unpreserved sample.
- pH analysis was performed past the recommended holding time of 15 minutes from sample collection.

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W: www.exova.com

Methodology and Notes

Bill To:	Gillies Bay Improvement District	Project:	
Report To:	Gillies Bay Improvement District	ID:	Annual Base Line Sample
	PO Box 237	Name:	Raw
	Gillies Bay, BC, Canada	Location:	
	V0N 1W0	LSD:	
Attn:	Ken Taylor	P.O.:	
Sampled By:		Acct code:	
Company:			

Lot ID:	**1107277**
Control Number:	B18253
Date Received:	Nov 18, 2015
Date Reported:	Nov 24, 2015
Report Number:	2062599

The comparison of test results to guideline limits is provided for information purposes only. This is not to be taken as a statement of conformance / nonconformance to any guideline, regulation or limit. The data user is responsible for all conclusions drawn with respect to the data and is advised to consult official regulatory references when evaluating compliance.

Please direct any inquiries regarding this report to our Client Services group.
Results relate only to samples as submitted.

Exova — Testing Advising Assuring

www.exova.com

Project Information

Project ID:
Project Name:
Project Location:
Legal Location:
PO/AFE#:
Proj. Acct. Code:

Billing Information

Company: Gillies Bay Improvement District
Address:
Gillies Bay, BC V0N 1W0
Attention: Ken Taylor
Phone: (604) 414-3703
Cell:
Fax:
E-mail: deluxebros@hushmail.com
Agreement ID: 79135
Copy of report: x

Copy of Report To:

Company: Gillies Bay Improvement District
Address:
Gillies Bay, BC V0N 1W0
Attention: Ken Taylor
Phone: (604) 414-3703
Cell:
Fax:
E-mail: deluxebros@hushmail.com
Copy of invoice:

RUSH Priority

Upon filling out this section, client accepts that surcharges will be applied to the analysis

Date Required
As Indicated | All Analysis

When "ASAP" is requested, turn around will default to a 100% RUSH priority, with pricing and turn around time to match. Please contact the lab prior to submitting RUSH samples.

Signature

Sample Custody (please print)

Sampled by:
Company:
I authorize Exova to proceed with the work indicated on this form:
Date: Initial:

This section for Lab use only

Date/Time stamp: 11-18-15A11:00 RCVD

Report Results: E-mail / Mail / Online / Fax / PDF / Excel / QA/QC Report

Special Instructions/Comments (please include contact information including ph. # if different from above).

Include Regulatory Requirements Below:

Number of Containers: W 99

	Sample Identification	Location	Depth IN CM M	Date/Time sampled	Matrix	Sampling Method	↓	Enter tests above (√ relevant samples below)
1	ANUAL BASE LINE SAMPLE	RAW		17/11/2015 9:21 AM			1	√
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								

Indicate below any deficiencies in the condition of samples:

- Were Exova supplies used?
- Was there any damage to the shipping container?
- Were the containers packaged well?
- Were any extra samples received (document below)?
- Are samples within recommended holding times/temp?

Lot: 1107277 COC

Environmental Sample Information Sheet

Note: Proper completion of this form is required in order to proceed with analysis

Please indicate any potentially hazardous samples

Shipping:
COD Y/N
Cooler temp: 14.2°C

and size of coolers received:
Delivery Method: Courier.
Waybill:
Received by: LC

Page of Control # B18253

ED 120-00

Exova
#104, 19575-55 A Ave.
Surrey, British Columbia
V3S 8P8, Canada

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W: www.exova.com

Exova

Analytical Report

Bill To:	Aaron Service	Project:		Lot ID:	**770776**
Report To:	Aaron Service	ID:	229656 Reg dis.	Control Number:	A159226
	4703 Marine Avenue	Name:	Aaron/ PR. Reg. District	Date Received:	Oct 27, 2010
	Powell River, BC, Canada	Location:	Texada Airport	Date Reported:	Nov 2, 2010
	V8A 2L2	LSD:		Report Number:	1375274
Attn:	Coranne Anderson	P.O.:	229656		
Sampled By:	S.Bennett/ W. Blanchet	Acct code:			
Company:	Aaron				

Airport Caretaker

Reference Number	770776-1
Sample Date	October 26, 2010
Sample Time	09:30
Sample Location	
Sample Description	229656 PR. Regional - Outside Tap
Sample Matrix	Drinking Water

Analyte		Units	Result	Nominal Detection Limit	Guideline Limit	Guideline Comments
Metals Extractable						
Aluminum	Extractable	mg/L	<0.005	0.005	0.1	Below OG
Antimony	Extractable	mg/L	<0.0002	0.0002	0.006	Below MAC
Arsenic	Extractable	mg/L	0.0092	0.0002	0.010	Below MAC
Barium	Extractable	mg/L	0.008	0.001	1	Below MAC
Boron	Extractable	mg/L	0.061	0.005	5	Below MAC
Cadmium	Extractable	mg/L	<0.00007	0.00007	0.005	Below MAC
Chromium	Extractable	mg/L	0.0013	0.0005	0.05	Below MAC
Copper	Extractable	mg/L	0.008	0.001	1.0	Below AO
Lead	Extractable	mg/L	0.0002	0.0001	0.01	Below MAC
Selenium	Extractable	mg/L	<0.0006	0.0006	0.01	Below MAC
Uranium	Extractable	mg/L	<0.0005	0.0005	0.02	Below MAC
Vanadium	Extractable	mg/L	0.0009	0.0001		
Zinc	Extractable	mg/L	0.002	0.001	5.0	Below AO
Microbiological Analysis						
Total Coliforms	Enzyme Substrate Test	MPN/100 mL	2.0	1.0	0 per 100 mL	Above MAC
Escherichia coli	Enzyme Substrate Test	MPN/100 mL	<1.0	1.0	0 per 100 mL	Below MAC
Heterotrophic Count - Aerobic	SimPlate	MPN/mL	4	2		
Physical and Aggregate Properties						
Turbidity		NTU	0.2	0.1		
Colour	Apparent	Colour units	<5	5		
Routine Water						
pH	@ 25 °C		8.22		6.5-8.5	Within AO
Calcium	Extractable	mg/L	30.9	0.1		
Iron	Extractable	mg/L	<0.005	0.005	0.3	Below AO
Magnesium	Extractable	mg/L	6.8	0.1		
Manganese	Extractable	mg/L	0.004	0.001	0.05	Below AO
Phosphorus	Extractable	mg/L	0.13	0.01		
Potassium	Extractable	mg/L	2.1	0.1		
Silicon	Extractable	mg/L	5.28	0.05		
Sodium	Extractable	mg/L	14.5	0.1	200	Below AO
T-Alkalinity	as CaCO3	mg/L	136	5		
Chloride	Dissolved	mg/L	3.34	0.02	250	Below AO
Fluoride	Dissolved	mg/L	0.08	0.01	1.5	Below MAC
Nitrate - N	Dissolved	mg/L	0.34	0.01	10	Below MAC

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Exova

Analytical Report

Bill To:	Aaron Service	Project:		Lot ID:	**770776**
Report To:	Aaron Service	ID:	229656 Reg dis.	Control Number:	A159226
	4703 Marine Avenue	Name:	Aaron/ PR. Reg. District	Date Received:	Oct 27, 2010
	Powell River, BC, Canada	Location:	Texada Airport	Date Reported:	Nov 2, 2010
	V8A 2L2	LSD:		Report Number:	1375274
Attn:	Coranne Anderson	P.O.:	229656		
Sampled By:	S.Bennett/ W. Blanchet	Acct code:			
Company:	Aaron				

Reference Number	770776-1
Sample Date	October 26, 2010
Sample Time	09:30
Sample Location	
Sample Description	229656 PR. Regional - Outside Tap
Sample Matrix	Drinking Water

Analyte		Units	Result	Nominal Detection Limit	Guideline Limit	Guideline Comments
Routine Water - Continued						
Nitrite - N	Dissolved	mg/L	<0.01	0.01	1	Below MAC
Sulfate (SO4)	Dissolved	mg/L	4.64	0.05	500	Below AO
Hardness	as CaCO3	mg/L	100	1		
Total Dissolved Solids	Extractable	mg/L	160	1		

Approved by: Andrew Garrard

Andrew Garrard, BSc
General Manager

Appendix C

SPLP Test Results for Lafarge Quarry Aggregate Products

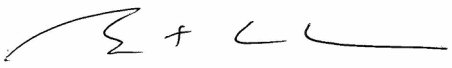
CERTIFICATE OF ANALYSIS

REPORTED TO	Lafarge Texada Quarry PO Box 160 Van Anda, BC V0N 3K0	**TEL** **FAX**	(604) 486-2009 -
ATTENTION	Neil Polding	**WORK ORDER**	6091167
PO NUMBER		**RECEIVED / TEMP**	2016-09-15 12:30 / 23°C
PROJECT	Texada Quarry Analysis	**REPORTED**	2016-09-20
PROJECT INFO			

General Comments:

CARO Analytical Services employs methods which are conducted according to procedures accepted by appropriate regulatory agencies, and/or are conducted in accordance with recognized professional standards using accepted testing methodologies and quality control efforts, except where otherwise agreed to by the client.

The results in this report apply to the samples analyzed in accordance with the Chain of Custody or Sample Requisition document. This analytical report must be reproduced in its entirety. CARO is not responsible for any loss or damage resulting directly or indirectly from error or omission in the conduct of testing. Liability is limited to the cost of analysis. Samples will be disposed of 30 days after the test report has been issued unless otherwise agreed to in writing.



Authorized By: **Brent Coates, B.Sc.**
Division Manager, Richmond

If you have any questions or concerns, please contact your Account Manager:
Jeffery Lopes (jlopes@caro.ca)

Locations:

#110 4011 Viking Way
Richmond, BC V6V 2K9
Tel: 604-279-1499 Fax: 604-279-1599

#102 3677 Highway 97N
Kelowna, BC V1X 5C3
Tel: 250-765-9646 Fax: 250-765-3893

17225 109 Avenue
Edmonton, AB T5S 1H7
Tel: 780-489-9100 Fax: 780-489-9700

www.caro.ca

ANALYSIS INFORMATION

REPORTED TO	Lafarge Texada Quarry	**WORK ORDER**	6091167
PROJECT	Texada Quarry Analysis	**REPORTED**	2016-09-20

Analysis Description	Method Reference	Technique	Location
SPLP Extraction (Non-Volatiles) in Solid	EPA 1312	20:1 Leach for 18 h	Richmond
SPLP Leachable Metals by ICPMS in Solid	APHA 3030E* / EPA 6020A	HNO3+HCl Hot Block Digestion / Inductively Coupled Plasma-Mass Spectroscopy (ICP-MS)	Richmond

Note: An asterisk in the Method Reference indicates that the CARO method has been modified from the reference method

Method Reference Descriptions:

EPA	United States Environmental Protection Agency Test Methods

Glossary of Terms:

MRL	Method Reporting Limit
<	Less than the Reported Detection Limit (RDL) - the RDL may be higher than the MRL due to various factors such as dilutions, limited sample volume, high moisture, or interferences
mg/L	Milligrams per litre
pH units	pH < 7 = acidic, ph > 7 = basic

REPORTED TO Lafarge Texada Quarry
PROJECT Texada Quarry Analysis

WORK ORDER 6091167
REPORTED 2016-09-20

Analyte	Result / *Recovery*	Standard / Guideline	MRL / *Limits*	Units	Prepared	Analyzed	Notes
Sample ID: NTP GRAB SAMPLE 510 Level (6091167-01) [Solid] Sampled: 2016-09-07 00:00							
SPLP Non-Volatile Extraction Details							
Extraction Fluid pH	**5.03**	N/A		pH units	N/A	2016-09-19	
Final Extract pH	**9.78**	N/A		pH units	N/A	2016-09-19	
SPLP Metals							
Antimony	**0.001**	N/A	0.0005	mg/L	2016-09-19	2016-09-19	
Arsenic	< 0.001	N/A	0.001	mg/L	2016-09-19	2016-09-19	
Barium	< 0.10	N/A	0.10	mg/L	2016-09-19	2016-09-19	
Beryllium	< 0.005	N/A	0.005	mg/L	2016-09-19	2016-09-19	
Boron	< 0.050	N/A	0.050	mg/L	2016-09-19	2016-09-19	
Cadmium	**0.0001**	N/A	0.0001	mg/L	2016-09-19	2016-09-19	
Chromium	< 0.005	N/A	0.005	mg/L	2016-09-19	2016-09-19	
Cobalt	< 0.002	N/A	0.002	mg/L	2016-09-19	2016-09-19	
Copper	< 0.010	N/A	0.010	mg/L	2016-09-19	2016-09-19	
Iron	< 0.10	N/A	0.10	mg/L	2016-09-19	2016-09-19	
Lead	**0.002**	N/A	0.001	mg/L	2016-09-19	2016-09-19	
Mercury	< 0.0001	N/A	0.0001	mg/L	2016-09-19	2016-09-19	
Nickel	< 0.010	N/A	0.010	mg/L	2016-09-19	2016-09-19	
Selenium	< 0.002	N/A	0.002	mg/L	2016-09-19	2016-09-19	
Silver	**0.0003**	N/A	0.0001	mg/L	2016-09-19	2016-09-19	
Thallium	< 0.001	N/A	0.001	mg/L	2016-09-19	2016-09-19	
Uranium	< 0.002	N/A	0.002	mg/L	2016-09-19	2016-09-19	
Vanadium	< 0.005	N/A	0.005	mg/L	2016-09-19	2016-09-19	
Zinc	**0.21**	N/A	0.050	mg/L	2016-09-19	2016-09-19	
Zirconium	< 0.005	N/A	0.005	mg/L	2016-09-19	2016-09-19	
Sample ID: HFSA SAMPLE (6091167-02) [Solid] Sampled: 2016-09-13 00:00							
SPLP Non-Volatile Extraction Details							
Extraction Fluid pH	**5.03**	N/A		pH units	N/A	2016-09-19	
Final Extract pH	**10.0**	N/A		pH units	N/A	2016-09-19	
SPLP Metals							
Antimony	**0.001**	N/A	0.0005	mg/L	2016-09-19	2016-09-19	
Arsenic	**0.011**	N/A	0.001	mg/L	2016-09-19	2016-09-19	
Barium	< 0.10	N/A	0.10	mg/L	2016-09-19	2016-09-19	
Beryllium	< 0.005	N/A	0.005	mg/L	2016-09-19	2016-09-19	
Boron	< 0.050	N/A	0.050	mg/L	2016-09-19	2016-09-19	
Cadmium	< 0.0001	N/A	0.0001	mg/L	2016-09-19	2016-09-19	
Chromium	< 0.005	N/A	0.005	mg/L	2016-09-19	2016-09-19	
Cobalt	< 0.002	N/A	0.002	mg/L	2016-09-19	2016-09-19	
Copper	< 0.010	N/A	0.010	mg/L	2016-09-19	2016-09-19	
Iron	< 0.10	N/A	0.10	mg/L	2016-09-19	2016-09-19	
Lead	< 0.001	N/A	0.001	mg/L	2016-09-19	2016-09-19	
Mercury	< 0.0001	N/A	0.0001	mg/L	2016-09-19	2016-09-19	
Nickel	< 0.010	N/A	0.010	mg/L	2016-09-19	2016-09-19	
Selenium	< 0.002	N/A	0.002	mg/L	2016-09-19	2016-09-19	

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Analyte	Result / *Recovery*	Standard / Guideline	MRL / *Limits*	Units	Prepared	Analyzed	Notes
Sample ID: HFSA SAMPLE (6091167-02) [Solid] Sampled: 2016-09-13 00:00, Continued							
SPLP Metals, Continued							
Silver	**0.0001**	N/A	0.0001	mg/L	2016-09-19	2016-09-19	
Thallium	< 0.001	N/A	0.001	mg/L	2016-09-19	2016-09-19	
Uranium	< 0.002	N/A	0.002	mg/L	2016-09-19	2016-09-19	
Vanadium	< 0.005	N/A	0.005	mg/L	2016-09-19	2016-09-19	
Zinc	< 0.050	N/A	0.050	mg/L	2016-09-19	2016-09-19	
Zirconium	< 0.005	N/A	0.005	mg/L	2016-09-19	2016-09-19	

APPENDIX 1: QUALITY CONTROL DATA

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The following section displays the quality control (QC) data that is associated with your sample data. Groups of samples are prepared in "batches" and analyzed in conjunction with QC samples that ensure your data is of the highest quality. Common QC types include:

- **Method Blank (Blk)**: Laboratory reagent water is carried through sample preparation and analysis steps. Method Blanks indicate that results are free from contamination, i.e. not biased high from sources such as the sample container or the laboratory environment
- **Duplicate (Dup)**: Preparation and analysis of a replicate aliquot of a sample. Duplicates provide a measure of the analytical method's precision, i.e. how reproducible a result is. Duplicates are only reported if they are associated with your sample data.
- **Blank Spike (BS)**: A known amount of standard is carried through sample preparation and analysis steps. Blank Spikes, also known as laboratory control samples (LCS), are prepared from a different source of standard than used for the calibration. They ensure that the calibration is acceptable (i.e. not biased high or low) and also provide a measure of the analytical method's accuracy (i.e. closeness of the result to a target value).
- **Standard Reference Material (SRM)**: A material of similar matrix to the samples, externally certified for the parameter(s) listed. Standard Reference Materials ensure that the preparation steps in the method are adequate to achieve acceptable recoveries of the parameter(s) tested.

Each QC type is analyzed at a 5-10% frequency, i.e. one blank/duplicate/spike for every 10 samples. For all types of QC, the specified recovery (% Rec) and relative percent difference (RPD) limits are derived from long-term method performance averages and/or prescribed by the reference method.

Analyte	Result	MRL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Notes
SPLP Metals, Batch B6I1039										
Blank (B6I1039-BLK1)				Prepared: 2016-09-19, Analyzed: 2016-09-19						
Antimony	< 0.0005	0.0005	mg/L							
Arsenic	< 0.001	0.001	mg/L							
Barium	< 0.10	0.10	mg/L							
Beryllium	< 0.005	0.005	mg/L							
Boron	< 0.050	0.050	mg/L							
Cadmium	< 0.0001	0.0001	mg/L							
Chromium	< 0.005	0.005	mg/L							
Cobalt	< 0.002	0.002	mg/L							
Copper	< 0.010	0.010	mg/L							
Iron	< 0.10	0.10	mg/L							
Lead	< 0.001	0.001	mg/L							
Mercury	< 0.0001	0.0001	mg/L							
Nickel	< 0.010	0.010	mg/L							
Selenium	< 0.002	0.002	mg/L							
Silver	< 0.0001	0.0001	mg/L							
Thallium	< 0.001	0.001	mg/L							
Uranium	< 0.002	0.002	mg/L							
Vanadium	< 0.005	0.005	mg/L							
Zinc	< 0.050	0.050	mg/L							
Zirconium	< 0.005	0.005	mg/L							
Duplicate (B6I1039-DUP1)				**Source: 6091167-01**	Prepared: 2016-09-19, Analyzed: 2016-09-19					
Antimony	0.0007	0.0005	mg/L		0.001				73	
Arsenic	< 0.001	0.001	mg/L		< 0.001				31	
Barium	< 0.10	0.10	mg/L		< 0.10				36	
Beryllium	< 0.005	0.005	mg/L		< 0.005				30	
Boron	< 0.050	0.050	mg/L		< 0.050				30	
Cadmium	< 0.0001	0.0001	mg/L		0.0001				61	
Chromium	< 0.005	0.005	mg/L		< 0.005				30	
Cobalt	< 0.002	0.002	mg/L		< 0.002				30	
Copper	< 0.010	0.010	mg/L		< 0.010				57	
Iron	< 0.10	0.10	mg/L		< 0.10				70	

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Analyte	Result	MRL	Units	Spike Level	Source Result	% REC	REC Limit	% RPD	RPD Limit	Notes
SPLP Metals, Batch B6I1039, Continued										
Duplicate (B6I1039-DUP1), Continued		**Source: 6091167-01**		Prepared: 2016-09-19, Analyzed: 2016-09-19						
Lead	< 0.001	0.001	mg/L		0.002				74	
Mercury	< 0.0001	0.0001	mg/L		< 0.0001				49	
Nickel	< 0.010	0.010	mg/L		< 0.010				38	
Selenium	< 0.002	0.002	mg/L		< 0.002				30	
Silver	< 0.0001	0.0001	mg/L		0.0003				59	
Thallium	< 0.001	0.001	mg/L		< 0.001				60	
Uranium	< 0.002	0.002	mg/L		< 0.002				30	
Vanadium	< 0.005	0.005	mg/L		< 0.005				30	
Zinc	0.054	0.050	mg/L		0.21				37	
Zirconium	< 0.005	0.005	mg/L		< 0.005				30	
Matrix Spike (B6I1039-MS1)		**Source: 6091167-02**		Prepared: 2016-09-19, Analyzed: 2016-09-19						
Antimony	0.386	0.0005	mg/L	0.400	0.001	96	70-130			
Arsenic	0.230	0.001	mg/L	0.200	0.011	109	70-130			
Barium	1.00	0.10	mg/L	1.00	< 0.100	99	70-130			
Beryllium	0.089	0.005	mg/L	0.100	< 0.005	89	70-130			
Cadmium	0.103	0.0001	mg/L	0.100	< 0.0001	103	70-130			
Chromium	0.446	0.005	mg/L	0.400	< 0.005	112	70-130			
Cobalt	0.442	0.002	mg/L	0.400	< 0.002	110	70-130			
Copper	0.442	0.010	mg/L	0.400	< 0.010	111	70-130			
Iron	2.23	0.10	mg/L	2.00	< 0.100	111	70-130			
Lead	0.196	0.001	mg/L	0.200	< 0.001	98	70-130			
Nickel	0.441	0.010	mg/L	0.400	< 0.010	110	70-130			
Selenium	0.112	0.002	mg/L	0.100	< 0.002	112	70-130			
Silver	0.106	0.0001	mg/L	0.100	0.0001	106	70-130			
Thallium	0.097	0.001	mg/L	0.100	< 0.001	97	70-130			
Vanadium	0.430	0.005	mg/L	0.400	< 0.005	107	70-130			
Zinc	1.09	0.050	mg/L	1.00	< 0.050	109	70-130			
SPLP Non-Volatile Extraction Details, Batch B6I1021										
Blank (B6I1021-BLK1)				Prepared: 2016-09-19, Analyzed: 2016-09-19						
Extraction Fluid pH	5.03		pH units							
Final Extract pH	9.67		pH units							
Duplicate (B6I1021-DUP1)		**Source: 6091167-01**		Prepared: 2016-09-19, Analyzed: 2016-09-19						
Extraction Fluid pH	5.03		pH units		5.03				< 1	
Final Extract pH	10.1		pH units		9.78				3	