February 4th, 2022

Mr. Fleming Larsen
407 – 16380 64th Avenue
Surrey, BC V3S 6X6

DISTRICT LOT 85, GALIANO ISLAND, BC

PRELIMINARY ON-SITE GROUNDWATER SUPPLY / SEWAGE DISCHARGE SUITABILITY ASSESSMENTS

INTRODUCTION

McElhanney Ltd. (McElhanney) was retained by you to provide preliminary on-site groundwater supply and sewage discharge suitability assessments of selected portions of District Lot 85, Galiano Island, BC (the site) in support of Land Use / Rezoning and/or Official Community Plan (OCP) Bylaw Amendment applications to the Islands Trust Local Trust Committee (ITLTC) to facilitate the site's eventual subdivision and development.

The site is legally described as "District Lot 85, Galiano Island, Cowichan District (PID 009-625-259)", centred at latitude 48°59'23.5"N longitude 123°33'17.5"E (UTM 10 5426478N 459408E), and located immediately north of the Galiano Island Ecological Reserve 128. The site covers 59.6 hectares (ha), is densely forested, and currently hosts several unserviced temporary residences. The regional location of the site is shown on *Figure 1*.

The development of the site will require rezoning for its proposed fee-simple subdivision. The development plan calls for subdivision of the site into five "Rural Residential" lots collectively covering 10.0 ha (16.8%), one "Forestry" lot covering 20.0 ha (33.6%), one "Amenity" lot covering 0.9 ha (1.5%), one "Resource" parcel covering 2.8 ha (.7%), three "Park" areas collectively covering 22.3 ha (37.4%), and road dedications covering 3.6 ha (6.0%). The development plan calls for each proposed lot except for the three "Park" lots and one "Resource" lot to be serviced by individual on-site groundwater supply wells and sewerage systems. The configuration of the site and concept plan[1] for its rezoning and eventual subdivision is shown on *Figure 2*.

The site is within the municipal jurisdiction of the Capital Regional District (CRD) and currently zoned F-1 (Forest Zone 1) under the Galiano Island Local Trust CRD Land Use Bylaw No. 127[2]. The zoning designations of the site and surrounding properties are shown on *Figure 3*. In accordance with Section 13 (Subdivision and Development Regulations), Subsection 13.23 (Standards for Potable Water Supply) of the bylaw, each proposed lot must have a source of potable water whose quality meets or exceeds Health Canada's Guidelines for Canadian Drinking Water Quality (GCDWQ)[3] and is capable of supplying at least 2,275 L/day (0.026 L/s or 0.42 USgpm) for each residential structure while not adversely affecting the quantity or quality of water obtainable from any existing well or surface water when used as a source of potable water. In addition, Section 13, Subsection 13.29 (Standards for Sewage Disposal) of the bylaw requires that each lot must contain an area or areas of sufficient size and

[1] *"District Lot 85, Galiano Island" Lot Layout – Rezoning. McElhanney Drawing "18-015 (Layout 11)"* (March 30th, 2021). Prepared by McElhanney Ltd. for Mr. Fleming Larson

[2] "*Galiano Island Local Trust CRD Land Use Bylaw No. 127*" (1999, including amendments up to Bylaw No. 268/2018). Islands Trust https://islandstrust.bc.ca/wp-content/uploads/2020/12/gl-ltc-lub-bl-127_consolidated_july2020.pdf

[3] "*Guidelines for Canadian Drinking Water Quality*" Health Canada https://www.canada.ca/en/health-canada/services/environmental-workplace-health/reports-publications/water-quality/guidelines-canadian-drinking-water-quality-summary-table.html

appropriate characteristics to satisfy the requirements of the Island Health (IH) Subdivision Standards[4] in respect to the buildings, structures, and uses that are permitted on the lot by the bylaw; Table B of these standards indicates that each lot must contain a minimum discharge area of 715 m^2 (including 180 m of field length in a primary sewage discharge area and an undeveloped reserve sewage discharge area of equal size), assuming an average soil percolation rate of between 6 and 15 minutes/inch and average ground slope of less than 30% within the primary and standby discharge areas.

Since the objectives of this assessment are to provide opinions on the site's potential suitabilities to host lot-specific, on-site groundwater supply sources and sewage discharge areas fields in support Land Use / Rezoning and/or OCP Bylaw Amendment applications to the ITLTC only, and it is appreciated that high upfront costs associated with drilling and flow-testing groundwater supply wells and intrusively testing soil conditions for sewage discharge suitabilities and system designs on each proposed lot may represent significant financial risks due to the uncertain nature of rezoning application process, these assessments have relied mainly on the review and evaluation of existing information and the results of a brief site examination to form opinions on the site's potential suitabilities. It is anticipated that supplemental technical assessments and intrusive site testing will be required by regulatory agencies to confirm the sustainable productivities and hydraulic capacities of each proposed on-site groundwater supply well and sewerage system, respectively, if the project proceeds to the subdivision, development permit, and/or building permit application stages of its development process.

SCOPE OF WORK

In accordance with your instructions, McElhanney undertook the following work tasks to develop opinions on the suitability of proposed lots to host an appropriate on-site groundwater supply well and sewage discharge areas:

- desktop research on the site and surrounding area's environmental setting using available online information sources, including their climate, terrain, hydrology, geology, and hydrogeology;
- desktop research on the site and surrounding area's historical water resource development using available online information sources and previous technical reports on the site provided by you;
- brief, reconnaissance-level visual examinations of the site's proposed lots on October 13th, 2021 to confirm their existing environmental conditions and drilled water well locations and locate potentially suitable areas for sewage discharge to ground; and
- prepare a brief letter expressing preliminary opinions on the potential suitabilities of the five proposed "Rural Residential" lots, one "Forestry" lot, and one "Amenity" lot to host individual on-site potable groundwater supply wells and sewage discharge areas. At your request, the potential suitabilities of the three proposed "Park" lots and one "Resource" lot were not evaluated.

ENVIRONMENTAL SETTING

Climate

The climate of Galiano Island is classified as "Transitional Cool Mediterranean"[5] and characterized by warm, dry summers and cool, wet winters. The area lies within the rain shadows of the Vancouver Island Insular Ranges to the west and the Olympic Mountains to the south, which modify east-moving, moisture laden air masses and

[4] "*Subdivision Standards*" (February 2020). Island Health https://www.islandhealth.ca/sites/default/files/environment/documents/subdivision-standards.pdf

[5] "*Climate, Vancouver Island - Land of Contrasts*". (Tuller S.E. 1979). Western Geographical Series, Volume 17. Edited by C.N. Forward, UVIC, Victoria, BC pp71-91.

result in the area being dominated by low-pressure systems in the winter and high-pressure systems in the summer. Most of the area's precipitation falls during the winter, with annual water deficits (droughts) being experienced from mid-June to early October. Prevailing winds are predominantly from the southeast in winter, while northwest winds dominate in summer.

The nearest Environment Canada climate station to the site, "Saltspring St. Mary's Lake, EC 1016995"[6] 11.3 km to the south, indicates that the area receives 987 mm of annual precipitation, of which 32.0 cm falls as snow. The areas' highest average monthly rainfall is in November (163.5 mm) and lowest in July (23.2 m), with almost 90% of the area's rainfall occurring between October and April. The area's average yearly temperature is 10.7°C, with the highest average monthly temperatures occurring in August (18.4°C) and lowest in December (4.1°C).

The location of EC 1016995 relative to the site is shown on *Figure 4*.

Terrain

Terrain in the vicinity of the site is generally rounded, subdued, and dominated by long, parallel ridges overlooking narrow, interior linear valleys that reflect the underlying bedrock stratigraphy (i.e., the direction of bedding plane dips) and structure. Ridges tend to be formed by erosionally-resistant sandstone and conglomerate, while depressional areas are generally underlain by erosionally-recessive shales and mudstone.

The site's ground surface is generally benched to gently undulating and rolling, with ground slopes varying from more than 30° within its steep, east-facing bench scarp slopes to less than 5% along its east side adjacent to the marine shoreline on the Strait of Georgia (Salish Sea). The extreme east side of the site consists of a 3 to 8 m high rock bluff overlooking a rocky wave-cut shoreline platform.

Topographic elevations[7] on the site range from 110 m above mean sea level (amsl) in its southwest corner to sea level along its east side. The local topography of the site was overlain on a 2021 orthophoto base layer with the UTM coordinate grid and is shown on *Figure 5*. A derivative LIDAR map of the site prepared internally by McElhanney showing four ground slope ranges (<10%, 10-20%, 20-30%, and >30%) is presented as *Figure 6*.

Hydrology

The site fronts onto the marine shoreline of the Strait of Georgia along its east side.

Surface drainage on those parts of the site with inclined ground slopes is generally good to rapid, although it can be locally imperfect to poor within level to gently sloping areas underlain by bedrock depressions. Surface runoff on the site generally flows towards the northeast marine shoreline. There are no gazetted[8,9] fresh watercourses or water bodies on the site. The nearest freshwater bodies to the site are a 25.5 ha wetland/pond complex within the Galiano Island Ecological Reserve 128 m to the immediate southwest, a 1.97 ha northeast-trending linear pond 85 m to the west, a 4.70 ha wetland 610 m to the west, and a 1.61 ha northeast-trending linear pond 750 m to the northwest. The nearest gazetted watercourses to the site are Jack Creek 580 m to the southwest and

[6] "*Saltspring St. Mary's Lake, EC 1016995*". Canadian Climate Normals 1981-2010. Environment Canada. https://climate.weather.gc.ca/climate_normals/results_1981_2010_e.html?searchType=stnProx&txtRadius=25&selCity=&selPark=&optProxType=custom&txtCentralLatDeg=48&txtCentralLatMin=59&txtCentralLatSec=23.5&txtCentralLongDeg=123&txtCentralLongMin=33&txtCentralLongSec=17.5&txtLatDecDeg=&txtLongDecDeg=&stnID=93&dispBack=0

[7] LIDAR topographic information and orthophoto imagery for this project was dated 2021 and flown by McElhanney

[8] "*HabitatWizard website*". BC Ministry of Environment and Climate Change Strategy https://maps.gov.bc.ca/ess/hm/habwiz/

[9] "*CRD Regional Map / Natural Areas Atlas website*". Capital Regional District https://maps.crd.bc.ca/Html5Viewer/?viewer=public

Shaw Creek 740 m to the south; both watercourses, which originate in the wetland/pond complex immediately southwest of the site and flow southwest before discharging into Trincomali Channel.

The local hydrological setting of the site relative to these gazetted water features is shown on *Figure 7*.

Geology

The site is underlain by well-bedded, relatively brittle, calcareous to ferruginous sandstone of the upper Cretaceous-aged Gabriola Formation, Nanaimo Group[10], which are part of the Overlap Terrane and exposed along the site's eastern bluff and wave-cut platform.

Nanaimo Group rocks on Galiano Island underwent folding, faulting, and thrusting towards the northeast during the later Tertiary era mountain-building period that resulted in the formation of the nearby Cascade and Olympic Mountains in Washington State. The structural setting of the site is defined by its position on the eroded eastern limb of the Trincomali Anticline, which extends from Dodd's Narrows to the north to Saturna Island in the south with a gently curving axial trace that underlies Trincomali Channel west of Galiano Island. Bedrock on the site dips gently towards the northeast and forms a series of relatively planar benches separated by steeper scarp slopes. At least three north-northeast to northeast trending, high-angle normal and/or transcurrent faults reportedly[11] cross the site and appear to intersect near its northeast corner.

A map showing the bedrock geology in the vicinity of the site is presented as *Figure 8*.

Bedrock on the site has been extensively modified by glaciation, which resulted in the deposition of areally extensive, variably thick, semi-consolidated veneers and blankets of Vashon Drift Formation ground moraine (till) over the bedrock surface. These deposits are locally overlain by surface veneers and blankets of unconsolidated glaciofluvial deposits of the younger Capilano Formation. Post-glacial, unconsolidated fluvial and lacustrine veneers of the Salish Formation may also overlie Vashon Drift and Capilano Formation sediments within the area's valleys and topographic depressions.

Natural soils[12] on the site consist of the following series:

- Saturna-Qualicum Soil Association (map unit ST-QU, northeast 2/3 of the site): 45-60% of this area consists of veneers to thin blankets (<100 cm deep) of well drained orthic dystric brunisols that developed over shallow deposits of channery sandy loam to channery loamy sand textured, colluviated ground moraine (till) over sandstone bedrock, while 40-55% of the area consists of blankets (>150 cm deep) of well-drained coarse-textured soil that developed over glaciofluvial or glaciomarine deposits occupying depressional areas within the underlying sandstone bedrock. Coarse fragment contents vary from 20 to 50% and primarily consist of subangular to angular sandstone clasts up to 6" along their longest axes. During and shortly after intense or prolonged rain events, water may flow laterally through saturated subsoil on top of the sloping bedrock surface;

---

[10] "*MapPlace 1 Website*". BC Geological Survey http://webmap.em.gov.bc.ca/mapplace/minpot/bcgs.asp
11 "*The Stratigraphy, Structure, and Sedimentology of the Cretaceous Nanaimo Group, Galiano Island, British Columbia".* (Carter, 1976). Oregon State University, Unpublished M.Sc. Thesis
[12] "*Soils of the Gulf Islands of British Columbia, Volume 3: Soils of Galiano, Valdes, Thetis, Kuper, and Lesser Islands"* (Green et al, 1989). Report No. 43, British Columbia Soils Survey, Land Resource Research Centre, Contribution No. 86-37. Research Branch, Agriculture Canada https://www.env.gov.bc.ca/esd/distdata/ecosystems/Soils_Reports/bc43-3_report.pdf

- Saturna Soil Association (map unit ST, southwest 1/3 of the site): generally consists of veneers to thin blankets (<100 cm deep) of well drained orthic dystric brunisols that developed over shallow deposits of channery sandy loam to channery loamy sand textured colluviated ground moraine (till) over sandstone bedrock; and
- Qualicum Soil Association (map unit QU, small area in the southwest corner of the site): generally consists of blankets (>150 cm deep) of well to rapidly drained orthic dystric brunisols that developed over thick deposits of gravelly sandy loam to gravelly-sand textured glaciofluvial, fluvial, and/or glaciomarine deposits. Coarse fragment contents vary from 20 to 50%.

A map showing the distribution of these soil associations on the site is presented as *Figure 9*.

Hydrogeology

Groundwater occurrence, distribution, and movement within the site is generally typical[13] of glaciated mountainous regions dominated by heavily eroded bedrock exposures and dissected valley systems. Groundwater generally occurs along open sedimentary bedding plane partings, stratigraphic contacts between rock types with differing competencies, and structural fracture zones with elevated secondary porosities - particularly along the traces of large-scale, anastomosing fault systems or in areas where faults of differing orientations intersect. Groundwater distribution is closely linked to the orientation, intensity, and continuity of local fracture sets and the structural competence of their host rocks, with groundwater being present within individual planar fracture openings and intervening blocks of finely shattered rock between and around the larger voids. Some fractures may be more hydraulically significant than others due to differences in their void connectivity, with open continuous fractures functioning as groundwater conduits and occluded fractures functioning as relative barriers to groundwater flow. Bedrock fracture aquifers are likely to be unconfined to semi-confined, with subvertical blocks of comparatively low porosity, competent bedrock separating the individual porous fracture zones. The storage capacities of bedrock fracture aquifers will be linked to the amount of secondary porosity available within from open fracture systems, with the productivity of wells completed within the fracture zones being dependent on the degree of open void connectivity.

Gabriola Formation sandstones like those underlying the site reportedly have typical aquifer transmissivity values (the ability of rock to transmit groundwater) of approximately 3 x 10-5 m^2/s[14]. This value is considered low for sandstone aquifers, which suggests that unfractured sandstone may have moderate to low productivity in terms of groundwater yield due to their low primary porosities. Most groundwater flow in bedrock fracture zones is typically within 120 m of surface. Significant groundwater flow may also occur in large fault systems at depths of hundreds of metres across adjacent surface watersheds, with deep flow systems eventually discharging into major river systems, lakes, and/or the marine environment. Spatial variations in secondary bedrock porosity and topographic relief will also influence local groundwater flow regimes. Based on the site's topography, unconfined groundwater flow should largely mirror ground slopes and flow towards the northeast approximately perpendicular to the long axis of Galiano Island. A schematic representation of groundwater flow in fractured rocks typical of Galiano Island is presented as *Figure 10*.

[13] "*Groundwater Resources of British Columbia, Chapter 9.1.2 "Groundwater Resources of the Basins, Lowlands, and Plains: Nanaimo and Georgia Lowlands*" (1991) Ronneseth et al. BC Ministry of Environment
http://www.env.gov.bc.ca/wsd/plan_protect_sustain/groundwater/gwbc/C0912_Nanaimo_Georgia.html
[14] "*Regional Evaluation of Hydraulic Properties in Variably Fractured Rock Using a Hydrostructural Domain Approach"* (Surrete et al, 2008). Hydrogeology Journal 16(1) 11-30

Local net recharge within bedrock aquifers may range from less than 1% of precipitation to as much as 45%, depending on the presence of overlying, low-permeability surficial materials and bedrock fracture morphology, orientation, intensity, and transmissivity. Recharge will tend to occur at high where bedding planes, stratigraphic contacts, and bedrock fractures are exposed at the surface, with discharge occurring at low elevations as springs and base flow into watercourses. Recharging waters entering bedrock fracture aquifers may originate from more than one adjoining surface water catchments, depending on whether the fracture systems traverse such boundaries. Wetlands and ponds found on Galiano Island that occupy linear bedrock depressions may represent transitional discharge-recharge zones depending on their relative elevations and surrounding land features.

The site is underlain by Aquifer 320[15], which is an extensive, low-productivity, semi-confined to confined bedrock aquifer hosted by a mixed assemblage of fractured, upper Cretaceous-aged Nanaimo Group sedimentary rocks that covers 58 km^2 and underlies Galiano Island. This aquifer is rated by ENV as moderately vulnerable from surface contamination sources and subject to moderate extraction demand.

Based on 1,088 registered wells completed within Aquifer 320, ENV considers the aquifer to have a moderate well density with local areas being highly to potentially over-developed. Reported airlift well yields range from less than 0.06 to 15.15 L/s (less than 1.0 to 240 USgpm), with 24% yielding less than 0.06 L/s (1 USgpm) and 94% yielding less than 1.9 L/s (25 USgpm). Reported groundwater depths range from flowing artesian to 81.7 m bgs. The median yield of wells constructed within this aquifer is 0.22 L/s (3.48 USgpm), with a median groundwater depth of 8.2 m below ground surface (bgs) and median well depth of 51.97 m. Reported well usages within Aquifer 320 are primarily domestic.

Based on Galiano Island's historically elevated average rainfall, low snowpack, and generally thin soil coverage, Aquifer 320 may receive significant amounts of recharge from the infiltration of precipitation from October to April. However, due to the area's history of extended moisture deficits from May to September, little or no recharge may occur for extended periods over the remainder of the year.

Groundwater samples collected and analyzed by ENV suggest that the water within Aquifer 320 is typically of the Ca-Mg-HCO_3 and Ca-Mg-HCO_3-Cl types, with Ca and Mg being the dominant cations indicative of a less evolved (i.e., shorter) flow path groundwater type. HCO_3 is the dominant anion followed by Cl, which suggests that recharge may be primarily from recent precipitation. Cl enrichment could be attributed to local incidences of saline intrusion (including lateral seawater intrusion and saline groundwater upconing) and/or anthropogenic activities such as application of chemical fertilizers and/or sewage effluents. Local occurrences of elevated fluorine, iron, and/or hydrogen sulphide in registered wells have also been reported by ENV within the aquifer.

While relatively rare on Galiano Island, groundwater in the extreme southwest corner of the site is also hosted by an unconsolidated granular overburden deposit (i.e., sand and gravel) that has been historically mined for aggregate and may also underlie the adjacent wetland-pond complex within the Galiano Island Ecological Reserve 128. Groundwater in this setting generally occurs within open pore spaces between the granular particles and may occupy up to 25% of the deposit's volume.

[15] "*BC Water Resources Atlas website*". BC Ministry of Environment and Climate Change Strategy http://webmaps.gov.bc.ca/imf5/imf.jsp?site=wrbc

Potential and actual groundwater resources on Galiano Island have been characterized by previous workers[16,17,18,19] within 21 "critical groundwater areas (CGWAs)", whose boundaries are primarily a function of surface water catchments, subsurface geological and structural conditions, relative land areas, topographic features including ground elevations and slopes, groundwater uses, and aquifer characteristics including hydrostratigraphy, degrees of hydraulic confinement, groundwater levels, and groundwater flow directions. Subsurface interconnectivity of groundwater regimes between adjacent CGWAs may exist in some areas. Most of the site lies within the "3: North Georgia Strait" CGWA that covers 136 ha, except for the extreme southwest corner of the site that lies within the adjacent "4: North Trincomali Channel" CGWA.

The configuration of Galiano Island's CGWAs relative to the site are shown on *Figure 11*.

HISTORICAL WATER RESOURCE DEVELOPMENT

Surface Water Development

There are 10 licensed, active surface water points of diversion (PODs) registered with the BC Ministry of Environment and Climate Change Strategy (ENV) within 2 km of the site, all of which are situated on the west side of Galiano Island and draw varying amounts of water from Crabtree Swamp, Stemo Spring, Spotlight Creek, Jack Creek, and Pirart Brook.

There are no licensed PODs on the site. The nearest licensed POD to the site is License C058557 (POD PD34076), which is reportedly 730 m to the west-southwest within a different surface water catchment to the site and permitted to draw up to 2.27 m^3/day from Spotlight Creek.

The locations of these licensed PODs are shown on *Figure 12*. Detailed information on these licenses is included in *Appendix A*.

Groundwater Development - General

There are 23 ENV-registered wells[20] within the "North Georgia Strait" CGWA hosting the site, which equates to a well density of 6.2 wells/ha. All wells were completed in bedrock Aquifer 320 except for one well at the southwest corner of the site that was completed in an unregistered overburden aquifer. Previous workers have rated the demand storage ratio of "3: North Georgia Strait" CGWA - which is defined as the ratio of water supply demand in a region versus the estimated amount of groundwater stored in a defined aquifer - as 1%, which is one of the lowest ratios on Galiano Island. However, the level of uncertainty in this estimate may be high due to the wide range of potential variabilities in groundwater demand-storage and recharge estimates inherent with fractured bedrock environments.

---

[16] "*A Review of Groundwater Conditions on Galiano Island, Report 6453*" (Mordaunt et al, August 1983). BC Ministry of Environment, Water Management Branch, Groundwater Section
https://a100.gov.bc.ca/pub/acat/documents/r6453/766_1143681920149_8b7182b483ed458aad9da29ff7cef555.pdf
[17] "*Assessment of Groundwater Availability and Quality, Galiano Island, British Columbia*" (Kohut et al, May 15th, 1998) BC Ministry of Environment, Water Management Branch, Environmental and Resource Management Department
https://a100.gov.bc.ca/pub/acat/documents/r6457/776_1143682105055_8b7182b483ed458aad9da29ff7cef555.pdf
[18] "*Galiano Groundwater Study: A Review of Well Development and Groundwater Conditions on Galiano Island*" (Harrison, 1994). Prepared for the Galiano Conservancy Association
[19] ""*Galiano Groundwater Study WL11-1755*" (March 31st, 2011). Prepared by Waterline Resources Inc. for Islands Trust
https://islandstrust.bc.ca/wp-content/uploads/2020/05/galiano-gw-study-rpt-final-march-31.pdf
[20] "*BC Wells Database*". BC Ministry of Environment and Climate Change Strategy. https://apps.nrs.gov.bc.ca/gwells/

Reported airlift well yields from the 23 registered wells within the "North Georgia Strait" CGWA range from less than 0.02 to 15.15 L/s (less than 0.25 to 240 USgpm), with 83% yielding less than 1.26 L/s (20 USgpm) and 61% yielding less than 0.32 L/s (5 USgpm). Reported groundwater depths range from flowing artesian to 40.5 m bgs. Reported well usages are all private domestic. The nearest registered off-site well to the site is WTN 60240, which is reportedly 90 m to the north, completed to a total depth of 61.9 m bgs, displays a static water well of 12.8 m bgs, and yields 0.06 L/s (1 USgpm) from a bedrock fracture 48.77 m bgs. Historical groundwater development within the "3: North Georgia Strait" CGWA is shown on *Figure 13*.

Detailed information on these wells' locations, installation specifications, reported yields, and uses are tabulated in *Appendix B*.

Groundwater Development – On-Site

Information provided by you indicated that seven wells have been historically completed on the site, of which only four are registered with ENV. The locations of these wells relative to the site's proposed lots are shown on *Figure 14*, while a list of their installation specifications and copies of their ENV and drillers logs are included in *Appendix C*.

WTN 62866 / Well 95-1

WTN 62686 (also referred to as Well 95-1) was completed March 20th, 1995, to a total depth of 89.9 m bgs on proposed Rural Residential Lot A near the northeast corner of the site. The surface elevation of the well was surveyed at 11.12 m amsl. The static water level of the well was above the top of the casing at 0.46 m above ground surface (i.e., flowing artesian). The driller reported the well's airlift yield on completion at 1.26 L/s (20 USgpm) from a bedrock fracture zone at 89.31 – 89.92 m bgs.

A pumping test[21] conducted on the well on April 6th, 1995, at a constant rate of 0.22 L/s (3.5 USgpm) indicated a water level drawdown of 0.644 m after 480 minutes (8 hours), although the drawdown appeared to recover to 0.55 m after 820 minutes (13.67 hours) before the pumping phase of the test was terminated. Following pump shutoff, the water level in the well recovered to 100% of its pre-pumping static level (flowing artesian) after 97 minutes (1.6 hours). The water levels in the well during the pumping and recovery phases of the test appeared to indicate a tidal effect, with an estimate ratio of approximately 10:1 for well water level vs tidal effects (i.e., a tidal rise and fall of 2 m appeared to result in a corresponding fluctuation of 0.2 m in the well's water level).

During the pumping phase of the test, the water levels in one adjacent off-site and two adjacent on-site wells were monitored for hydraulic interference and produced the following results:

- WTN 60562 (off-site), 250 m to the north-northwest: 0.45 m total water level drawdown observed, which was attributed to local tidal effects;
- Well 95-2 (on-site, not ENV-registered), 210 m to the southeast: 0.28 m total water level drawdown observed, which was attributed to local tidal effects; and
- WTN 62687 (on-site, Well 95-3), 385 m to the southeast: 0.28 m total water level drawdown observed, which was attributed to local tidal effects.

[21] *"District Lot 85 – Galiano Island: Residential Development Groundwater Supply Evaluation"* (May 3rd, 1995). Prepared by Thurber Engineering Ltd. for Mr. Fleming Larsen

The test concluded that the well was likely capable of sustainably yielding at least 0.22 L/s (3.5 USgpm). Based on a calculated specific capacity value for this well of 0.34 L/s/m (5.43 USgpm/m) of drawdown, the well may be potentially capable of yielding 3.81 L/s (60.43 USgpm) using 11.12 m or 100% of available drawdown to sea level, although the water level drawdown in the well did not appear to have stabilized at the end of the pumping phase of the test. Graphs showing the drawdown responses obtained during the test from the pumping well and observation well WTN 60562 are included in *Appendix D*.

One water sample was collected from the well after 660 minutes (11 hours) of elapsed pumping time. The results indicated that all parameters analyzed met the CDWQG except for the concentration of total coliform (reported concentration = 10 CFU/100 mL; CDWQG maximum allowable concentration (MAC) = 0 CFU/mL). The water was soft and weakly to moderately mineralized. Evidence for significant saline intrusion into the well during the test was not considered present based on total sodium and total chloride concentrations of 91.0 and 15.0 mg/L, respectively. A copy of the analytical laboratory's certificate of analysis is included in *Appendix D*.

Well 95-2

Well 95-2 (not registered with ENV) was completed March 19th, 1995, to a total depth of 37.49 m bgs on proposed Rural Residential Lot B in the northeast part of the site, 210 m southeast of WTN 62686 (Well 95-1). The surface elevation of the well was surveyed at 9.62 m amsl. The static water level of the well was 12.2 m bgs. The driller reported the well's airlift yield on completion at 0.76 L/s (12 USgpm) from a bedrock fracture zone at 30.48 – 35.97 m bgs.

The well has not been pump tested as of the date of this report.

Well 95-3

WTN 62687 (also referred to as Well 95-3) was completed in March 1995, to a total depth of 43.59 m bgs on proposed Rural Residential Lot C in the east-centre part of the site, 175 m southeast of Well 95-2. The surface elevation of the well was surveyed at 12.10 m amsl. The static water level of the well was 13.72 m bgs. The driller reported the well's airlift yield on completion at 3.15 L/s (50 USgpm) from a bedrock fracture zone at 37.8 m bgs.

A pumping test[22] conducted on the well on April 10th, 1995, at a constant rate of 0.22 L/s (3.5 USgpm) indicated a water level drawdown of 1.020 m after 420 minutes (7 hours), although the drawdown appeared to recover to 0.78 m after 719 minutes (12.0 hours) before the pumping phase of the test was terminated. Following pump shutoff, the water level in the well recovered to 55% of its pre-pumping static level (7.52 m bgs) after 300 minutes (5.0 hours). The water levels in the well during the pumping and recovery phases of the test appeared to indicate a tidal effect, with an estimate ratio of approximately 10:1 for well water level vs tidal effects.

During the pumping phase of the test, the water levels in two adjacent on-site wells were monitored for hydraulic interference and produced the following results:

- Well 95-2 (on-site, not ENV-registered), 170 m to the north-northwest: 0.25 m total water level drawdown observed, which was attributed to local tidal effects; and

[22] *"District Lot 85 – Galiano Island: Residential Development Groundwater Supply Evaluation"* (May 3rd, 1995). Prepared by Thurber Engineering Ltd. for Mr. Fleming Larsen

- Well 95-5 (on-site, not ENV-registered), 305 m to the southeast: 0.23 m total water level drawdown observed, which was attributed to local tidal effects.

The test concluded that the well was likely capable of sustainably yielding at least 0.22 L/s (3.5 USgpm). Based on a calculated specific capacity value for this well of 0.34 L/s/m (3.43 USgpm/m) of drawdown, the well may be potentially capable of yielding 2.41 L/s (15.71 USgpm) using 4.58 m or 100% of available drawdown to sea level, although the water level drawdown in the well did not appear to have stabilized at the end of the pumping phase of the test. Graphs showing the drawdown responses obtained during the test from the pumping well are included in *Appendix E*.

One water sample collected from the well after 660 minutes (11 hours) of elapsed pumping time. The results indicated that all parameters analyzed met the CDWQG except for the concentration of total manganese (reported concentration = 0.22 mg/L; CDWQG AO = 0.2 mg/L). The water was soft and weakly to moderately mineralized. Evidence for significant saline intrusion into the well during the test was not considered present based on total sodium and total chloride concentrations of 40.0 and 23.0 mg/L, respectively. A copy of the analytical laboratory's certificate of analysis is included in *Appendix E*.

Well 95-5

Well 95-5 (not registered with ENV) was completed March 26th, 1995, to a total depth of 31.09 m bgs on proposed Forestry Lot in the southeast part of the site, 300 m southeast of WTN 62687 (Well 95-3). The surface elevation of the well was surveyed at 17.16 m amsl. The static water level of the well was 14.02 m bgs. The driller reported the well's airlift yield on completion at 0.63 L/s (10 USgpm) from a bedrock fracture zone at 24.38 m bgs.

The well has not been pump tested as of the date of this report.

Well 95-6

Well 95-6 (not registered with ENV) was completed March 28th, 1995, to a total depth of 55.78 m bgs on the proposed Forestry Lot F in the southeast part of the site, 92 m southeast of Well 95-5. The surface elevation of the well was surveyed at 27.66 m amsl. The static water level of the well was 16.15 m bgs. The driller reported the well's airlift yield on completion at 0.32 L/s (5 USgpm) from a bedrock fracture zone at 44.19 – 49.38 m bgs.

The well has not been pump tested as of the date of this report.

WTN 62683 (TH89-1)

WTN 62683 (also referred to TH89-1) was completed October 25th, 1989, to a total depth of 30.79 m bgs on the proposed Resource Lot H near the southwest corner of the site, 550 m west-southwest of Well 95-6. The surface elevation of the well was estimated at 91.0 m amsl. The static water level of the well was 8.22 m bgs. The driller reported the well's airlift yield on completion at 7.57 L/s (120 USgpm) from an unconsolidated sand-gravel deposit at 10.97 – 21.50 m bgs.

The well has not been pump tested as of the date of this report.

WTN 62684 (TH89-2)

WTN 62684 (also referred to as TH89-2) was completed October 26th, 1995, to a total depth of 121.92 m bgs on proposed Resource Lot H near the northwest corner of the site, 20 m north of Well TH89-1. The surface elevation of the well was estimated at 91.0 m amsl. The static water level of the well was 8.53 m bgs The driller reported the well's airlift yield on completion at 1.26 L/s (240 USgpm) from thirteen bedrock fracture zones at 22.86 – 121.92 m bgs.

A pumping test[23] conducted on the well on November 1st, 1989, at a constant rate of 2.33 L/s (37.0 USgpm) indicated a water level drawdown of 1.560 m after 4,320 minutes (72 hours). Following pump shutoff, the water level in the well recovered to 43% of its pre-pumping static level (8.98 m bgs) after 1,450 minutes (24.16 hours). The water levels in the well during the pumping and recovery phases of the test did not appear to indicate a tidal effect.

During the pumping phase of the test, the water levels in one adjacent on-site well were monitored for hydraulic interference and produced the following results:

- WTN 62683 (onsite, also referred to TH89-1), 20 m to the south: 1.40 m total water level drawdown observed.

The test concluded that the well was likely capable of sustainably yielding at least 2.33 L/s (37.0 USgpm). Based on a calculated specific capacity value for this well of 1.50 L/s/m (23.71 USgpm/m) of drawdown, the well may be potentially capable of yielding 20.77 L/s (329.21 USgpm) using 13.88 m or 100% of available drawdown to highest bedrock fracture, with the water level drawdown in the well appearing to have stabilized at the end of the pumping phase of the test. Graphs showing the drawdown responses obtained during the test from the pumping well are included in *Appendix F*.

Two water samples collected from the well after 1,440 and 4,320 minutes (24 and 72 hours) of elapsed pumping time. The results indicated the following:

- T + 24-hour sample: at all parameters analyzed met the CDWQG. The water was soft and weakly to moderately mineralized. Evidence for significant saline intrusion into the well during the test was not considered present based on total sodium and total chloride concentrations of 11.0 and 7.0 mg/L, respectively;
- T + 72-hour sample: at all parameters analyzed met the CDWQG. The water was soft and weakly to moderately mineralized. Evidence for significant saline intrusion into the well during the test was not considered present based on total sodium and total chloride concentrations of 8.5 and 8.0 mg/L, respectively.

A copy of the analytical laboratory's certificate of analysis is included in *Appendix F*.

[23] *"Proof of Potable Water from Groundwater Sources: Proposed Subdivision of District Lot 85, Galiano Island, Cowichan District".* (December 4th, 1994). Prepared by Turner Groundwater Consultants Ltd. for Mr. Fleming Larsen

VISUAL SITE EXAMINATIONS

Proposed Rural Residential Lot A

Proposed Rural Residential Lot A is in the northeast corner of the site, covers 2.2 ha, and is centred at UTM 10 5426750N 459445E. The north half of the lot is crossed by a gravel road that provides vehicular access to a seasonal residence near its northeast corner. The lot is uniformly densely forested except for a 0.05 ha cleared area around the temporary residence. There is one drilled well on the lot near its north end (WTN 62866 / Well 95-1). The configuration and ground slope characteristics of the lot are shown on *Figure 15*.

Topography on the lot is dominated by two east-northeast facing, planar to undulating benches with average ground slopes of less than 15%, which are separated and flanked to the southwest by steeper, undulating to hummocky slopes with average ground slopes more than 30%. The lot is bordered to the northeast by a steep, 6 to 8 m high scarp slope above a rocky, wave-cut platform and the marine shoreline on the Strait of Georgia. Topographic elevations on the lot range from 40 m amsl in its southwest corner to sea level along its east side.

Surface drainage conditions on the lot are generally moderate to good with no ephemeral, intermittent, or perennial watercourses or water bodies being observed. No bedrock outcrops were observed except for along the face of the steep slope flanking the lot's northeast side and along its wave-cut platform. Local soil exposures generally consist of veneers to blankets of moderately to well drained, loose, granular, medium to dark brown coloured, sand to sand-silt loam of morainal origin, typical of the Qualicum and Saturna Soil Associations. Near-surface soils contain abundant plant roots and up to 40%, platey, subangular, colluviated rock fragments. Visually estimated soil percolation times may be in the range 5 to 15 minutes/inch, equivalent to a field-saturated hydraulic conductivity (Kfs) range of between approximately 550 and 1,900 mm/day. Potentially hydraulically restrictive soil layers were not observed.

One zone in the lot's south half was identified as being potentially suitable for sewage discharge to ground in accordance with IH's subdivision standards based on its horizontal extent of approximately 4,270 m^2, average ground slope of less than 15%, visually moderate to well-drained surface drainage and soil moisture conditions, and horizontal separations from key natural and mad-made features – including distances from lot boundaries (> 3 m), existing buildings (> 3 m), existing or proposed domestic water supply wells drawing water from a confined to semi-confined bedrock aquifer (> 30 m), the tidal high-water mark (> 30 m), potential breakout points (> 15 m), and potential up-slope interceptor ditches or drains (> 3 m).

The locations of natural and man-made features on the lot that may constrain the siting of sewage discharge areas, as well as the identified potentially suitable sewage discharge zone, are shown on *Figure 16*.

Proposed Rural Residential Lot B

Proposed Rural Residential Lot B is immediately south of proposed Rural Residential Lot A in the northeast corner of the site, covers 2.2 ha, and is centred at UTM 10 5426675N 459525E. The northeast half of the lot is crossed by a gravel road that provides vehicular access to a seasonal residence near in its northeast corner. The lot is uniformly densely forested except for two cleared areas around and west of the temporary residence that collectively cover 0.14 ha. There is one drilled well on the lot near its centre (Well 95-2). The configuration and ground slope characteristics of the lot are shown on *Figure 17*.

Topography on the lot is dominated by two east-northeast facing, planar to undulating benches with average ground slopes of less than 15%, which are separated by a steeper, undulating to hummocky slope with an average ground slopes more than 30%. The lot is bordered to the northeast by a steep, 4 to 6 m high scarp slope above a rocky, wave-cut platform and the marine shoreline on the Strait of Georgia. Topographic elevations on the lot range from 34 m amsl in its southwest corner to sea level along its east side.

Surface drainage conditions on the lot are generally moderate to good with no ephemeral, intermittent, or perennial watercourses or water bodies being observed, except for two small areas with imperfect to poor drainage near its centre and southwest corners where hydrophytic vegetation suggestive of near-surface water depths in short, shallow ravines were observed. No bedrock outcrops were observed except for along its eastern wave-cut platform. Local soil exposures generally consist of veneers to blankets of imperfectly to well drained, loose, granular, medium to dark brown coloured, sand to sand-silt loam of morainal origin, typical of the Qualicum and Saturna Soil Associations. Near-surface soils contain abundant plant roots and between 20 and 60%, platey, subangular, colluviated, pebble to cobble-sized rock fragments. Visually estimated soil percolation times may be in the range 5 to 15 minutes/inch, equivalent to a field-saturated hydraulic conductivity (Kfs) range of between approximately 550 and 1,900 mm/day. Potentially hydraulically restrictive soil layers were not observed.

Four zones in the lot's central and southwest parts were identified as being potentially suitable for sewage discharge to ground in accordance with IH's subdivision standards based on their combined horizontal extent of approximately 6,190 m^2, average ground slopes of less than 15%, visually moderate to well-drained surface drainage and soil moisture conditions, and horizontal separations from key natural and mad-made features – including distances from lot boundaries (> 3 m), existing buildings (> 3 m), existing or proposed domestic water supply wells drawing water from a confined to semi-confined bedrock aquifer (> 30 m), the tidal high-water mark (> 30 m), potential breakout points (> 15 m), and potential up-slope interceptor ditches or drains (> 3 m).

The locations of natural and man-made features on the lot that may constrain the siting of sewage discharge areas, as well as the identified potentially suitable sewage discharge zones, are shown on *Figure 18*.

Proposed Rural Residential Lot C

Proposed Rural Residential Lot C is immediately south of proposed Rural Residential Lot B in the east-central part of the site, covers 2.2 ha, and is centred at UTM 10 5426560N 459580E. The east side of the lot is crossed by a gravel road with two side-spurs that provide vehicular access to two seasonal residences along its east margin. The lot is uniformly densely forested except for two cleared areas around the temporary residences that collectively cover 0.05 ha. There is one drilled well on the lot near its south border (WTN 62687 / Well 95-3). The configuration and ground slope characteristics of the lot are shown on *Figure 19*.

Topography on the lot is dominated by two east-northeast facing, planar to undulating benches with average ground slopes of less than 15%, which are separated by a steeper, undulating to hummocky slope with an average ground slope more than 30%. The lot is bordered to the northeast by a steep, 4 to 6 m high scarp slope above a rocky, wave-cut platform and the marine shoreline on the Strait of Georgia. Topographic elevations on the lot range from 35 m amsl in its southwest corner to sea level along its east side.

Surface drainage conditions on the lot are generally moderate to good with no ephemeral, intermittent, or perennial watercourses or water bodies being observed, except for three small areas near its centre and southwest portion where hydrophytic vegetation suggestive of near-surface water depths in short, shallow ravines and swales were observed. No bedrock outcrops were observed except for along its eastern wave-cut platform. Local soil exposures generally consist of veneers to blankets of imperfectly to well drained, loose, granular,

medium to dark brown coloured, sand to sand-silt loam of morainal origin, typical of the Qualicum and Saturna Soil Associations. Near-surface soils contain abundant plant roots and between 20 and 50%, platey, subangular, colluviated, pebble to cobble-sized rock fragments. Visually estimated soil percolation times may be in the range 5 to 15 minutes/inch, equivalent to a field-saturated hydraulic conductivity (Kfs) range of between approximately 550 and 1,900 mm/day. Potentially hydraulically restrictive soil layers were not observed.

Four zones in the lot's central and southwest parts were identified as being potentially suitable for sewage discharge to ground in accordance with IH's subdivision standards based on their combined horizontal extent of approximately 7,940 m^2, average ground slope of less than 15%, visually moderate to well-drained surface drainage and soil moisture conditions, and horizontal separations from key natural and mad-made features – including distances from lot boundaries (> 3 m), existing buildings (> 3 m), existing or proposed domestic water supply wells drawing water from a confined to semi-confined bedrock aquifer (> 30 m), the tidal high-water mark (> 30 m), potential breakout points (> 15 m), and potential up-slope interceptor ditches or drains (> 3 m).

The locations of natural and man-made features on the lot that may constrain the siting of sewage discharge areas, as well as the identified potentially suitable sewage discharge zones, are shown on *Figure 20*.

Proposed Rural Residential Lot D

Proposed Rural Residential Lot D is immediately south of proposed Rural Residential Lot C in the east-central part of the site, covers 2.2 ha, and is centred at UTM 10 5426445N 459625E. The centre of the lot is crossed by a gravel road with one side-spur that provides vehicular access to a seasonal residence along its east margin. The lot is uniformly densely forested except for one cleared area around the residence that covers 0.11 ha. There are no drilled wells on the lot, although WTN 62687 / Well 95-3 on Lot C is located approximately 10 m north of its northern border. The configuration and ground slope characteristics of the lot are shown on *Figure 21*.

Topography on the lot is dominated by two east-northeast facing, planar to undulating benches with average ground slopes of less than 15%, which are separated by a steeper, undulating to hummocky slope with an average ground slope more than 30%. The lot is bordered to the northeast by a steep, 3 to 5 m high scarp slope above a rocky, wave-cut platform and the marine shoreline on the Strait of Georgia. Topographic elevations on the lot range from 35 m amsl in its southwest corner to sea level along its east side.

Surface drainage conditions on the lot are generally moderate with no ephemeral, intermittent, or perennial watercourses or water bodies being observed, except for one large area occupying most of the centre of the lot and two small areas on its west side where hydrophytic vegetation suggestive of near-surface water depths in short, shallow swales were observed. No bedrock outcrops were observed except for along its eastern wave-cut platform. Local soil exposures generally consist of veneers to blankets of poorly to moderately drained, loose, granular, medium to dark brown coloured, sand to sand-silt loam of morainal origin, typical of the Qualicum and Saturna Soil Associations. Near-surface soils contain abundant plant roots and between 20 and 50%, platey, subangular, colluviated, pebble to cobble-sized rock fragments. Visually estimated soil percolation times may be in the range 5 to 15 minutes/inch, equivalent to a field-saturated hydraulic conductivity (Kfs) range of between approximately 550 and 1,900 mm/day. Potentially hydraulically restrictive soil layers were not observed.

Two zones in the lot's west and east parts were identified as being potentially suitable for sewage discharge to ground in accordance with IH's subdivision standards based on their combined horizontal extent of approximately 6,270 m^2, average ground slopes of less than 15%, visually moderate surface drainage and soil moisture conditions, and horizontal separations from key natural and mad-made features – including distances from lot boundaries (> 3 m), existing buildings (> 3 m), existing or proposed domestic water supply wells drawing water

from a confined to semi-confined bedrock aquifer (> 30 m), the tidal high-water mark (> 30 m), potential breakout points (> 15 m), and potential up-slope interceptor ditches or drains (> 3 m).

The locations of natural and man-made features on the lot that may constrain the siting of sewage discharge areas, as well as the identified potentially suitable sewage discharge zones, are shown on *Figure 22*.

Proposed Rural Residential Lot E

Proposed Rural Residential Lot E is immediately south of proposed Rural Residential Lot D in the east-central part of the site, covers 1.2 ha, and is centred at UTM 10 5426385N 459655E. The east-centre of the lot is crossed by a gravel road. The lot is uniformly densely forested. There are no drilled wells on the lot. The configuration and ground slope characteristics of the lot are shown on *Figure 23*.

Topography on the lot is dominated by three east-northeast facing, planar to undulating benches with average ground slopes of less than 15%, which are separated by steeper, undulating to hummocky slopes with an average ground slope more than 30%. The lot is bordered to the northeast by a steep, 4 to 6 m high scarp slope above a rocky, wave-cut platform and the marine shoreline on the Strait of Georgia. Topographic elevations on the lot range from 36 m amsl in its southwest corner to sea level along its east side.

Surface drainage conditions on the lot are generally moderate with no ephemeral, intermittent, or perennial watercourses or water bodies being observed, except for two large wet areas in its west-central and east-central portions where hydrophytic vegetation suggestive of near-surface water depths in broad swales were observed. No bedrock outcrops were observed except for along its eastern wave-cut platform. Local soil exposures generally consist of veneers to blankets of poorly to moderately drained, loose, granular, medium to dark brown coloured, sand to sand-silt loam of morainal origin, typical of the Qualicum and Saturna Soil Associations. Near-surface soils contain abundant plant roots and between 20 and 50%, platey, subangular, colluviated, pebble to cobble-sized rock fragments. Visually estimated soil percolation times may be in the range 5 to 15 minutes/inch, equivalent to a field-saturated hydraulic conductivity (Kfs) range of between approximately 550 and 1,900 mm/day. Potentially hydraulically restrictive soil layers were not observed.

Three zones in the lot's west, central, and east parts were identified as being potentially suitable for sewage discharge to ground in accordance with IH's subdivision standards based on their combined horizontal extent of approximately 4,220 m^2, average ground slopes of less than 15%, visually moderate surface drainage and soil moisture conditions, and horizontal separations from key natural and mad-made features – including distances from lot boundaries (> 3 m), existing buildings (> 3 m), existing or proposed domestic water supply wells drawing water from a confined to semi-confined bedrock aquifer (> 30 m), the tidal high-water mark (> 30 m), potential breakout points (> 15 m), and potential up-slope interceptor ditches or drains (> 3 m).

The locations of natural and man-made features on the lot that may constrain the siting of sewage discharge areas, as well as the identified potentially suitable sewage discharge zones, are shown on *Figure 24*.

Proposed Amenity Lot

Proposed Amenity Lot is in the northwest part of the site approximately 25 m west of the south end of Rural Residential Lot D, covers 0.9 ha, and is centred at UTM 10 5426640N 459280E. The lot is uniformly densely forested. There are no drilled wells or roads on the lot. The configuration and ground slope characteristics of the lot are shown on *Figure 25*.

Topography on the lot is dominated by a northeast-facing, hummocky to benched slope with an average ground slope of 20 to 30% that occupies almost 80% of the lot. The remainder of the lot consist of narrow, planar to undulating benches with average ground slopes of less than 15%. Topographic elevations on the lot range from 70 m amsl along the northwest part of its west border to 45 m amsl at its east corner.

Surface drainage conditions on the lot are generally good to rapid no ephemeral, intermittent, or perennial watercourses or water bodies being observed. No bedrock outcrops were observed. Local soil exposures generally consist of veneers to blankets of well to rapidly drained, loose, granular, medium to dark brown coloured, sand to sand-silt loam of morainal origin, typical of the Qualicum and Saturna Soil Associations. Near-surface soils contain abundant plant roots and between 20 and 50%, platey, subangular, colluviated, pebble to cobble-sized rock fragments. Visually estimated soil percolation times may be in the range 5 to 15 minutes/inch, equivalent to a field-saturated hydraulic conductivity (Kfs) range of between approximately 550 and 1,900 mm/day. Potentially hydraulically restrictive soil layers were not observed.

Three zones were identified on the lot as being potentially suitable for sewage discharge to ground in accordance with IH's subdivision standards based on their combined horizontal extent of approximately 3,160 m^2, average ground slopes of less than 20%, visually moderate surface drainage and soil moisture conditions, and horizontal separations from key natural and mad-made features – including distances from lot boundaries (> 3 m), existing buildings (> 3 m), existing or proposed domestic water supply wells drawing water from a confined to semi-confined bedrock aquifer (> 30 m), the tidal high-water mark (> 30 m), potential breakout points (> 15 m), and potential up-slope interceptor ditches or drains (> 3 m).

The locations of natural and man-made features on the lot that may constrain the siting of sewage discharge areas, as well as the identified potentially suitable sewage discharge zones, are shown on *Figure 26*.

Proposed Forestry Lot

Proposed Forestry Lot is in the centre of the site, flanked by the proposed Amenity Lot to the north and Rural Residential Lot E to the northeast, covers 20.0 ha, and is centred at UTM 10 5426345N 454470E. The southeast part of the lot is crossed by a gravel road with two side-spurs that provides vehicular access to a seasonal residence near its northeast corner. The lot is uniformly densely forested except for a 0.28 ha cleared area around the temporary residence. There are two drilled wells on the lot in its southeast part (Wells 95-5 and 95-6). The configuration and ground slope characteristics of the lot are shown on *Figure 27*.

Topography on the lot is dominated by an areally-extensive, planar to undulating slope with average ground slopes of less than 15%, which is flanked to the east by two steep, undulating to hummocky slopes with average ground slopes more than 30%. The lot is bordered along its east side a steep, 4 to 6 m high scarp slope above a rocky, wave-cut platform and the marine shoreline on the Strait of Georgia. Topographic elevations on the lot range from 75 m amsl near the centre of its west border to sea level along its east side.

Surface drainage conditions on the lot are generally moderate to good with no ephemeral, intermittent, or perennial watercourses or water bodies being observed. No bedrock outcrops were observed except for along the face of the steep slope flanking the lot's east side and along its wave-cut platform. Local soil exposures generally consist of veneers to blankets of moderately to well drained, loose, granular, medium to dark brown coloured, sand to sand-silt loam of morainal origin, typical of the Qualicum and Saturna Soil Associations. Near-surface soils contain abundant plant roots and up to 40%, platey, subangular, colluviated rock fragments. Visually estimated soil percolation times may be in the range 5 to 15 minutes/inch, equivalent to a field-saturated hydraulic

conductivity (Kfs) range of between approximately 550 and 1,900 mm/day. Potentially hydraulically restrictive soil layers were not observed.

Most of the lot appears to be potentially suitable for sewage discharge to ground in accordance with IH's subdivision standards based on the combined horizontal extent of three identified areas of approximately 6.65 ha, average ground slope of less than 15%, visually moderate to well-drained surface drainage and soil moisture conditions, and horizontal separations from key natural and mad-made features – including distances from lot boundaries (> 3 m), existing buildings (> 3 m), existing or proposed domestic water supply wells drawing water from a confined to semi-confined bedrock aquifer (> 30 m), the tidal high-water mark (> 30 m), potential breakout points (> 15 m), and potential up-slope interceptor ditches or drains (> 3 m).

The locations of natural and man-made features on the lot that may constrain the siting of sewage discharge areas, as well as the identified potentially suitable sewage discharge zone, are shown on *Figure 28*.

CONCLUSIONS

On-Site Groundwater Supply Availability

Based on the scope work undertaken by this assessment, McElhanney reached the following conclusions regarding the potential or actual availability of potable groundwater supply sources within the seven evaluated proposed lots capable of meeting CRD Bylaw No. 127, Section 13, Subsection 13.23 (Standards for Potable Water Supply) requirements:

- the portion of bedrock Aquifer 320 underlying the site is subject to much lower extraction demand and appears to be significantly more productive compared to other areas of Galiano Island, possibly due in part to the area's comparatively lower population density and potential widespread presence of rock fracturing within the site associated with at least three north-northeast to northeast-trending, high-angle normal and/or transcurrent fault systems that cross the site. In combination with the site's relatively brittle Gabriola Formation sandstones, these bedrock fracture zones may collectively have sufficient open-void storage to mitigate the area's extended summer droughts that may in part be responsible for seasonally decreased groundwater availability elsewhere on Galiano Island, and facilitate the installation and sustainable operation of individual groundwater supply wells within the site's proposed lots or community wells serving two or more of the proposed lots;
- a highly productive, unregistered, unconsolidated overburden aquifer is present in the southwest corner of the site that may potentially represent an alternative community groundwater source capable of servicing the proposed lots, depending on its storage volume and degree of hydraulic connectivity with the adjacent wetland-pond complex within the Galiano Island Ecological Reserve 128 to the immediate southwest;
- water samples collected from two of the site's wells in 1995 from two of the site's wells following extended constant-rate pumping tests suggest that groundwater on the site may be generally potable except for local areas with elevated natural microbial activity and/or manganese concentrations. The risk to groundwater quality on the site from lateral seawater intrusion or saline groundwater upconing due to sustained well pumping appears to be low, provided its wells are pumped at low discharge rates (i.e., less than 0.22 L/s (3.5 USgpm)) and water levels in the wells are not drawn down below sea level. Similarly, risks to groundwater quality on the site due to elevated natural concentrations of fluorine, iron, and/or hydrogen sulphide reported elsewhere on Galiano Island, or from anthropogenic activities such as application of chemical fertilizers and/or sewage effluents, also appears to be very low;

- the likelihood that existing wells on proposed Rural Residential Lots A, B, and C are capable of supplying at least 2,275 L/day (0.026 L/s or 0.42 USgpm) of potable water for each proposed residential structure while not adversely affecting the quantity or quality of water obtainable from any existing off-site well, stream, or surface water body currently in use as a source of potable water is considered **high**, provided raw groundwater obtained from wells with elevated microbial levels are adequately disinfected;
- the likelihood that additional groundwater supply wells can be completed within proposed Rural Residential Lots D and E, the proposed Amenity Lot, and the proposed Forestry Lot that are capable of supplying at least 2,275 L/day (0.026 L/s or 0.42 USgpm) of potable water for each proposed residential structure while not adversely affecting the quantity or quality of water obtainable from the site's adjacent existing wells is considered **high**, provided raw groundwater obtained from wells with elevated microbial levels are adequately disinfected.

On-Site Sewage Discharge Suitability

Based on the scope work undertaken by this assessment, McElhanney reached the following conclusions regarding the potential suitability of the proposed lots to host on-site sewage discharge areas capable of meeting CRD Bylaw No. 127, Section 13, Subsection 13.29 (Standards for Sewage Disposal) requirements and system design guidelines prescribed by the BC Sewerage System Regulation(SSR)[24] for flows of less than 22.7 m^3/day:

- based on the known climatic setting of the site, its observed topographic, hydrological, geological, hydrogeological, and anthropogenic attributes, McElhanney's visual estimates of lot-specific soil permeabilities and moisture conditions, and evaluations of each lot's natural and man-made features that may constrain the siting of sewerage dispersal fields, the likelihood that the proposed Rural Residential, Amenity, and Forestry Lots are suitable to host sewage discharge areas covering at least 715 m^2 to service one 3-bedroom residential dwelling each with a daily sewage flow rate of up to 1,363 L/day of residential strength sewage[25] is considered **high**, provided the raw sewage from each residence is appropriately pre-treated prior to discharge to levels commensurate with lot-specific hydraulic loading capacities and unsaturated soil depth availabilities.

CLOSURE

McElhanney conducted the investigations described by this report pursuant to a request by you to provide such services. McElhanney has prepared this report for exclusive use by you, CRD, and Islands Trust in support of Land Use / Rezoning and/or Official Community Plan (OCP) Bylaw Amendment applications to the Islands Trust Local Trust Committee (ITLTC) to facilitate the site's eventual subdivision and development. Any other third-party use of this report, or reliance placed on it, or decisions taken based on it, are the responsibility of such parties. McElhanney accepts no responsibility for any damages suffered by any third party, or any claims made by any third party because of decisions made or actions taken, based on this report.

McElhanney's desktop investigations and fieldwork were conducted in accordance with generally accepted engineering practices for such investigations, and in accordance with regulatory guidelines and prescriptions. The findings of this report are partially based on information provided to McElhanney by you, as well as other individuals or organizations. While McElhanney believes that this information is true and accurate and provided in

[24] "*Sewerage System Regulation*". BC Reg. 326/2004, O.C. 701/2004 (including amendments up to BC Reg. 191/2018, October 1st, 2018). Public Health Act https://www.bclaws.ca/civix/document/id/complete/statreg/22_326_2004

[25] "*Residential-strength sewage*" is defined as having a 5-day Carbonaceous Biochemical Oxygen Demand (cBOD5) range from 290 – 560 mg/L; a Total Suspended Solids (TSS) range from 175 – 400 mg/L; and oil and grease content range from 35 to 60 mg/L

good faith, and has attempted to corroborate such information where possible, McElhanney does not accept responsibility for any inaccuracies, deficiencies or omissions contained in this report from the use of such information.

McElhanney has in good faith, and in accordance with generally accepted engineering practices and current regulatory guidelines, provided preliminary opinions on the suitability of the proposed lots to host on-site potable groundwater supply wells and sewage discharge areas capable of servicing one 3-bedroom single family dwelling. However, due to the complex nature of the area's geology and hydrogeology, McElhanney is unable to offer you or third parties any warranties, either express or implied, regarding the conclusions reached by this report.

The findings of this report are based in part on visual observations of proposed lots on October 13th, 2021 and are limited to the date of this assessment.

Thank you for the opportunity to assist you on this interesting project. If you have questions or require further information, please contact the undersigned.

Sincerely,

McELHANNEY LTD.

Prepared by:

02/04/22

Mike Harris, P.Geo., ROWP
Senior Environmental Geoscientist

Reviewed by:

Andy Gaylor, P.Eng.
Project Manager

Figures

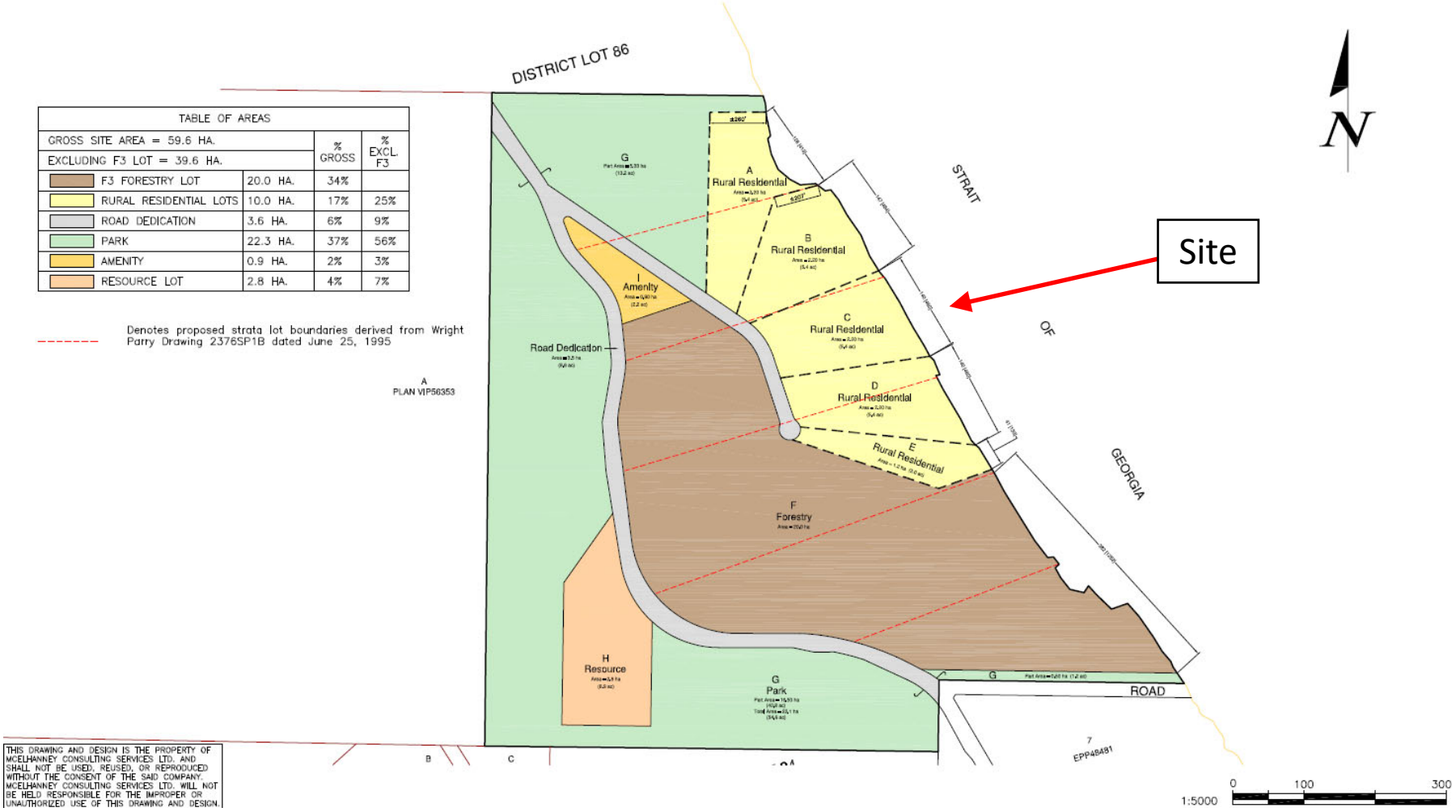
(Source: BC Water Resource Atlas website)

Mr. Flemming Larsen

District Lot 85, Galiano Island, BC
Preliminary On-Site Groundwater Supply /
Sewage Discharge Area Suitability Assessments

FIGURE 1: REGIONAL LOCATION

McElhanney Project #2243-18015-00



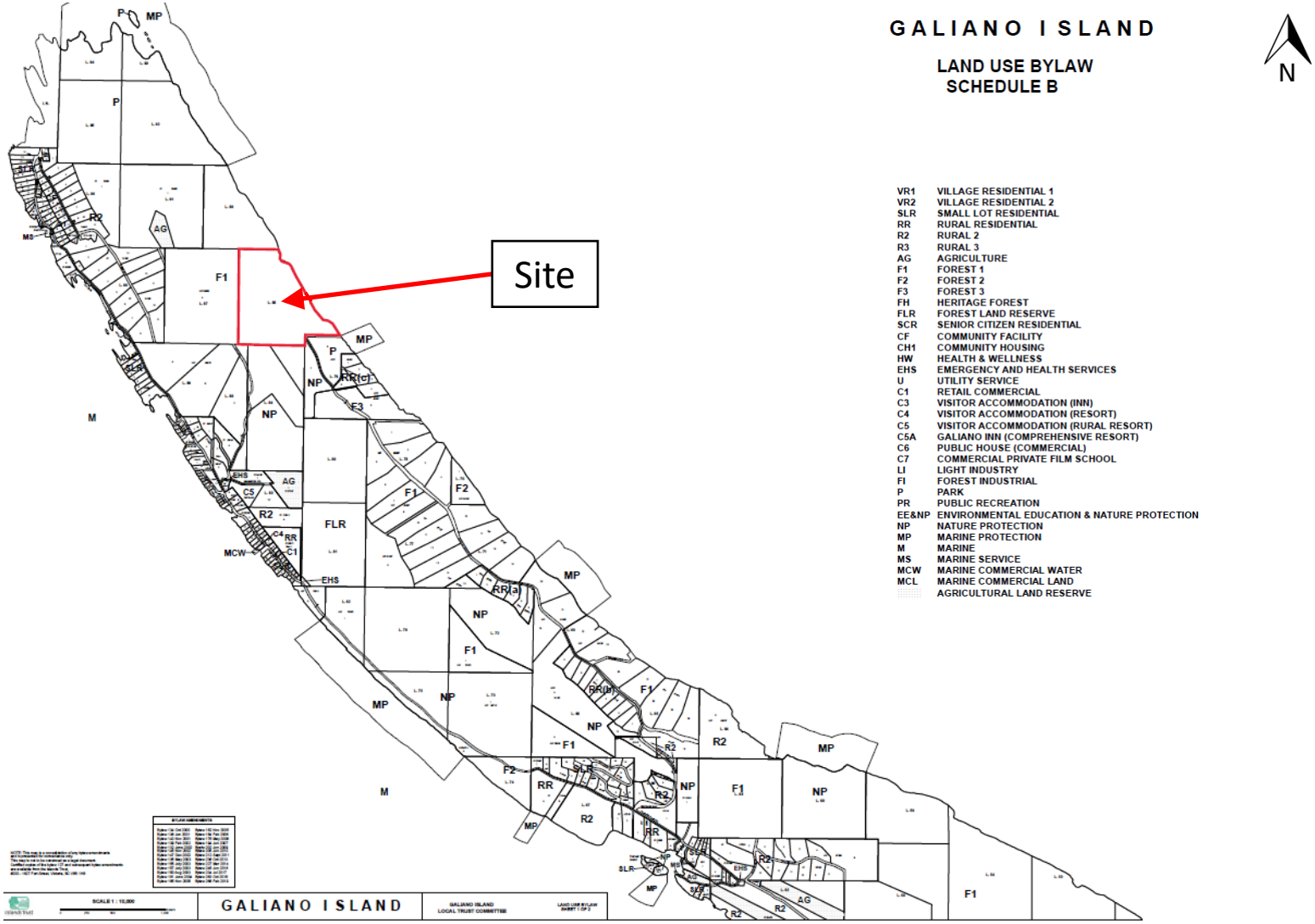
Mr. Flemming Larsen

District Lot 85, Galiano Island, BC
Preliminary On-Site Groundwater Supply /
Sewage Discharge Area Suitability Assessments

FIGURE 2: SITE CONFIGURATION / CONCEPTUAL DEVELOPMENT PLAN

McElhanney Project #2243-18015-00

(Source: McElhanney Drawing "#18-015 (Layout 11)" (March 30th, 2021))



Mr. Flemming Larsen

District Lot 85, Galiano Island, BC
Preliminary On-Site Groundwater Supply /
Sewage Discharge Area Suitability Assessments

FIGURE 3: REGIONAL ZONING DESIGNATIONS

McElhanney Project #2243-18015-00

(Source: Galiano Island Local Trust CRD Land Use Bylaw #127")

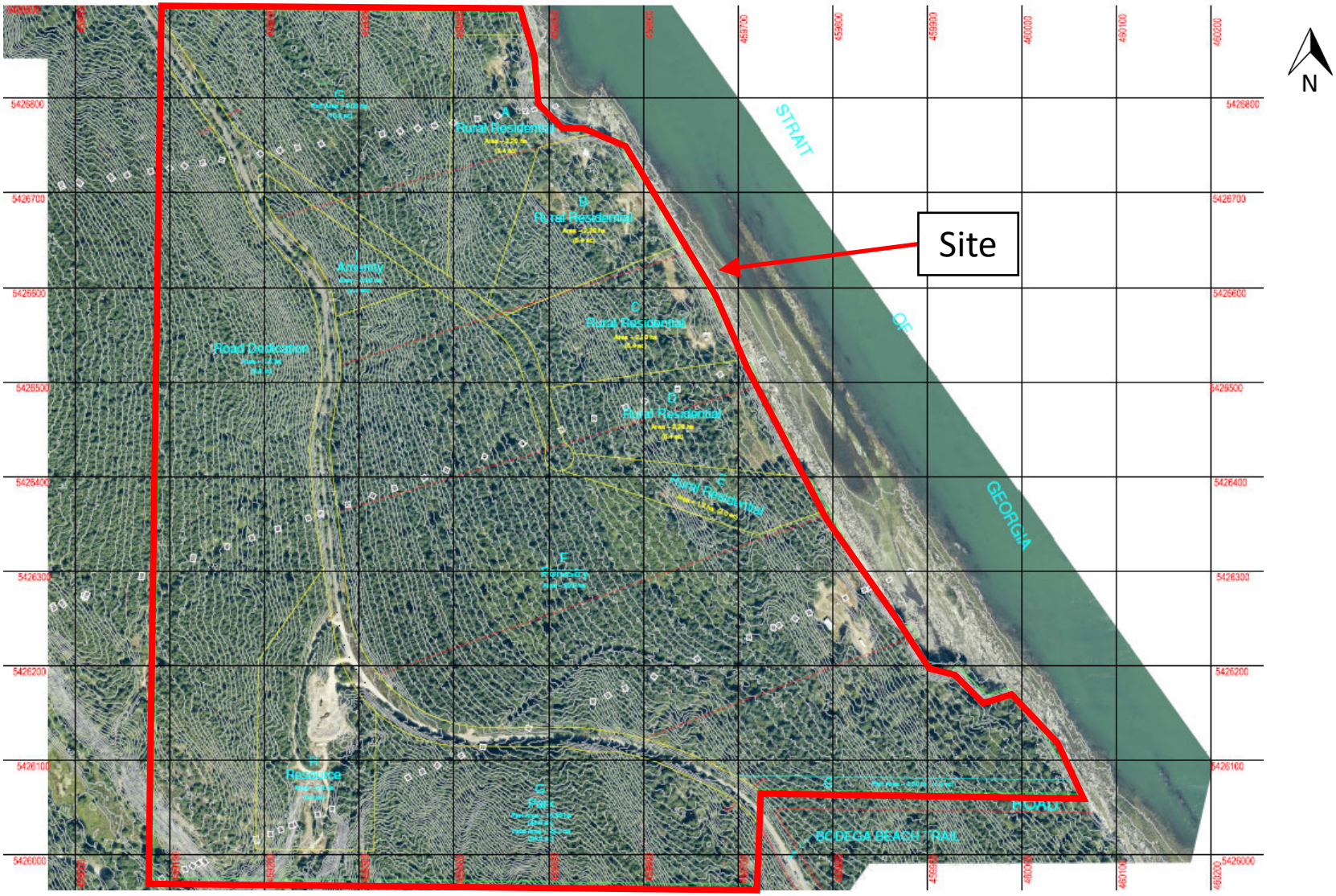
(Source: Google Earth / EC Canadian Climate Normals)

Mr. Flemming Larsen

District Lot 85, Galiano Island, BC
Preliminary On-Site Groundwater Supply /
Sewage Discharge Area Suitability Assessments

FIGURE 4: EC 1016995 CLIMATE STATION LOCATION

McElhanney Project #2243-18015-00



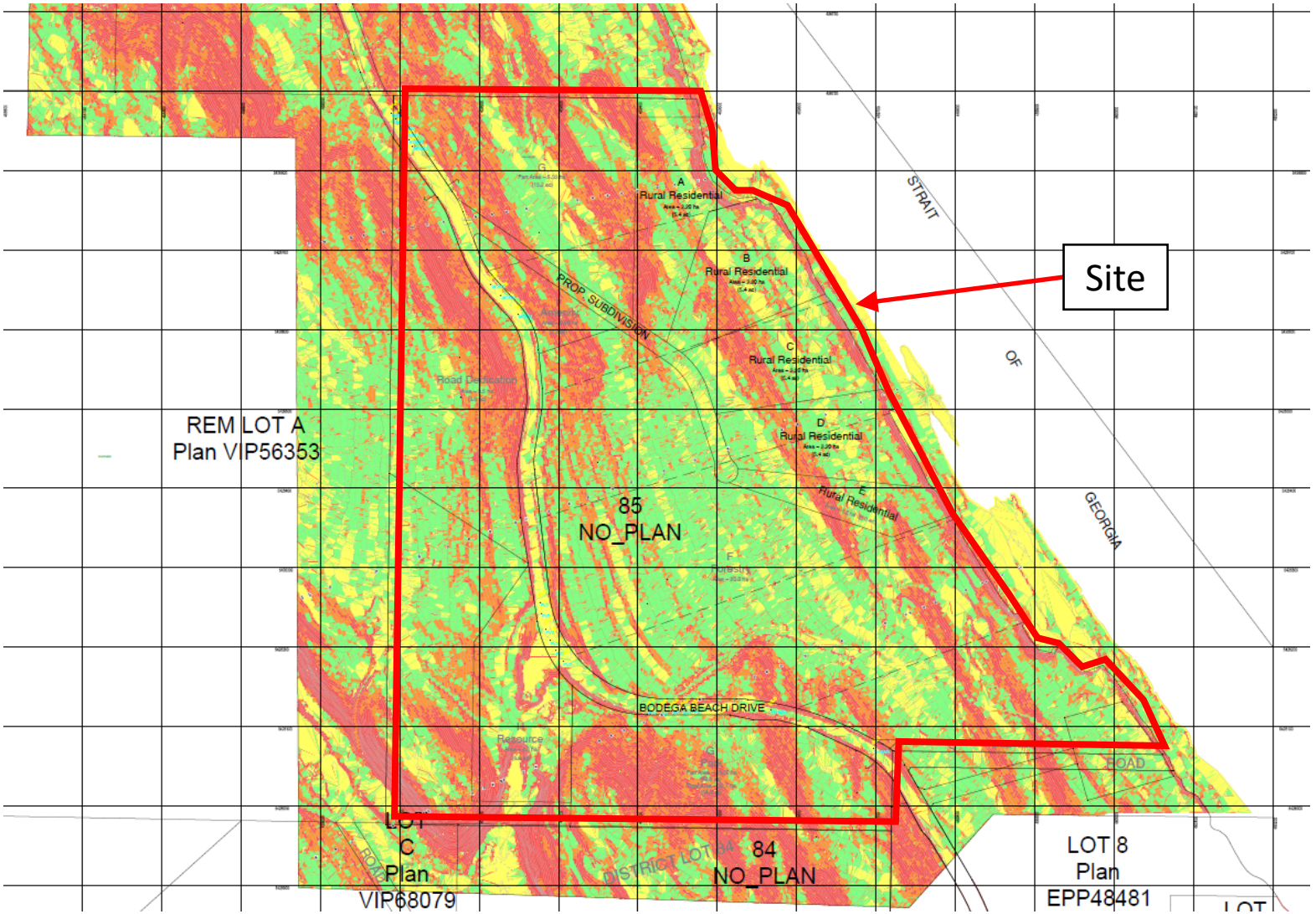
Mr. Flemming Larsen

District Lot 85, Galiano Island, BC
Preliminary On-Site Groundwater Supply /
Sewage Discharge Area Suitability Assessments

FIGURE 5: LOCAL 2021 ORTHOPHOTO / LIDAR TOPOGRAPHY

McElhanney Project #2243-18015-00

(Source: McElhanney LIDAR)



Slopes Table			
Number	Minimum Slope	Maximum Slope	Color
1	0%	10%	
2	10%	20%	
3	20%	30%	
4	30%	>30%	

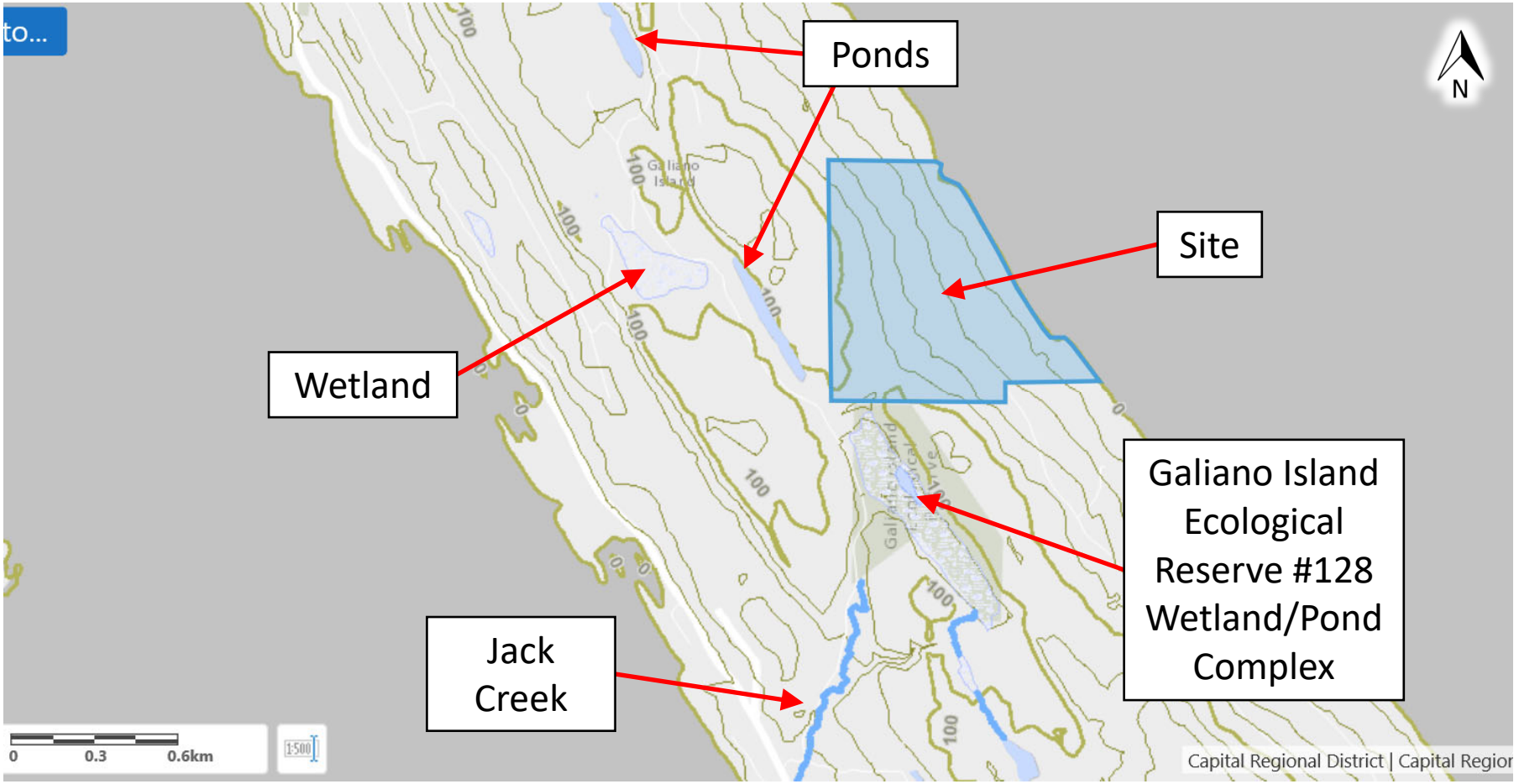
(Source: McElhanney LIDAR)

Mr. Flemming Larsen

District Lot 85, Galiano Island, BC
Preliminary On-Site Groundwater Supply /
Sewage Discharge Area Suitability Assessments

FIGURE 6: LOCAL GROUND SLOPE RANGES (LIDAR DERIVATIVE)

McElhanney Project #2243-18015-00



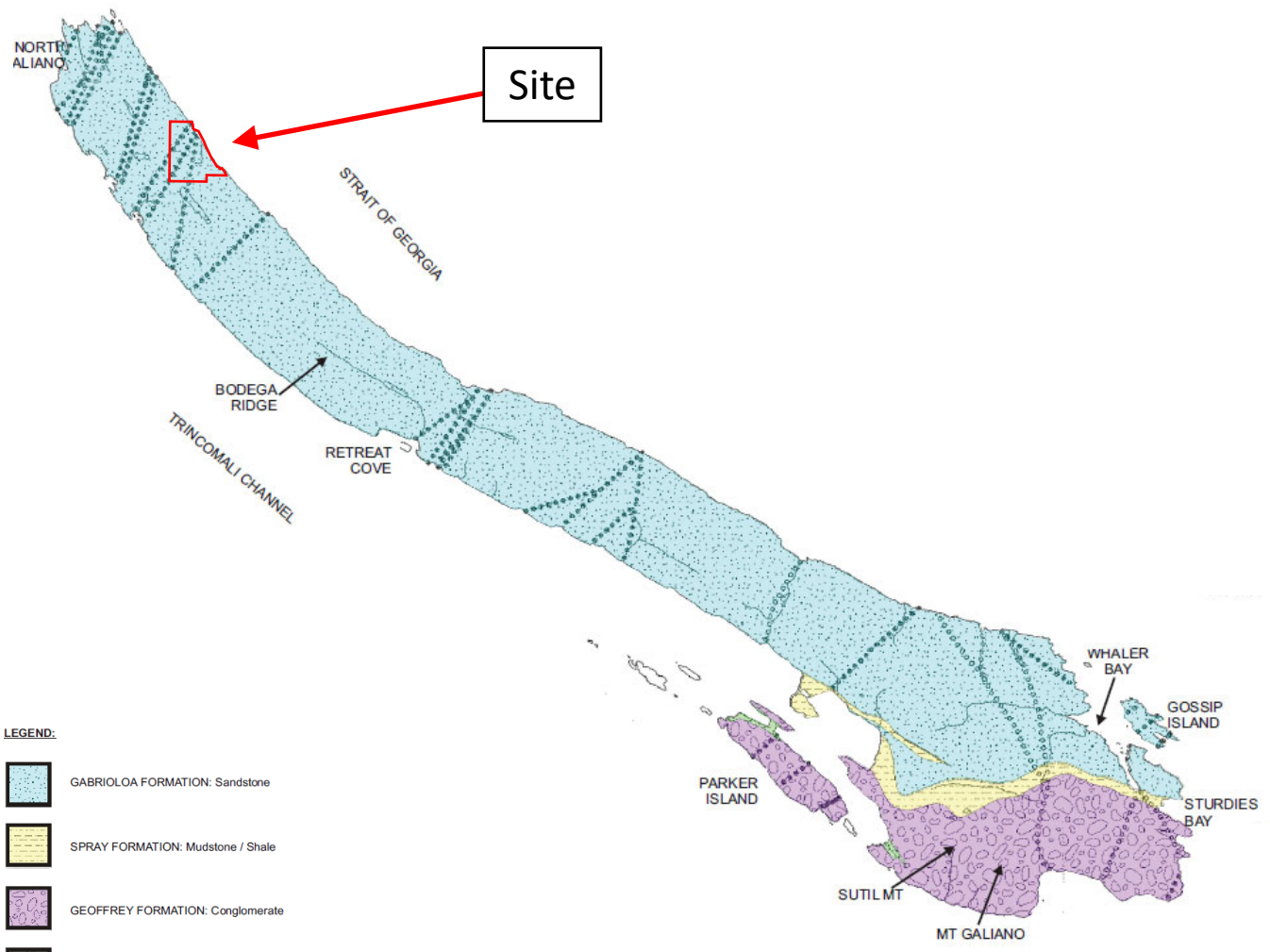
(Source: CRD Regional Map / Natural Areas Atlas website)

Mr. Flemming Larsen

District Lot 85, Galiano Island, BC
Preliminary On-Site Groundwater Supply /
Sewage Discharge Area Suitability Assessments

FIGURE 7: REGIONAL HYDROLOGY

McElhanney Project #2243-18015-00



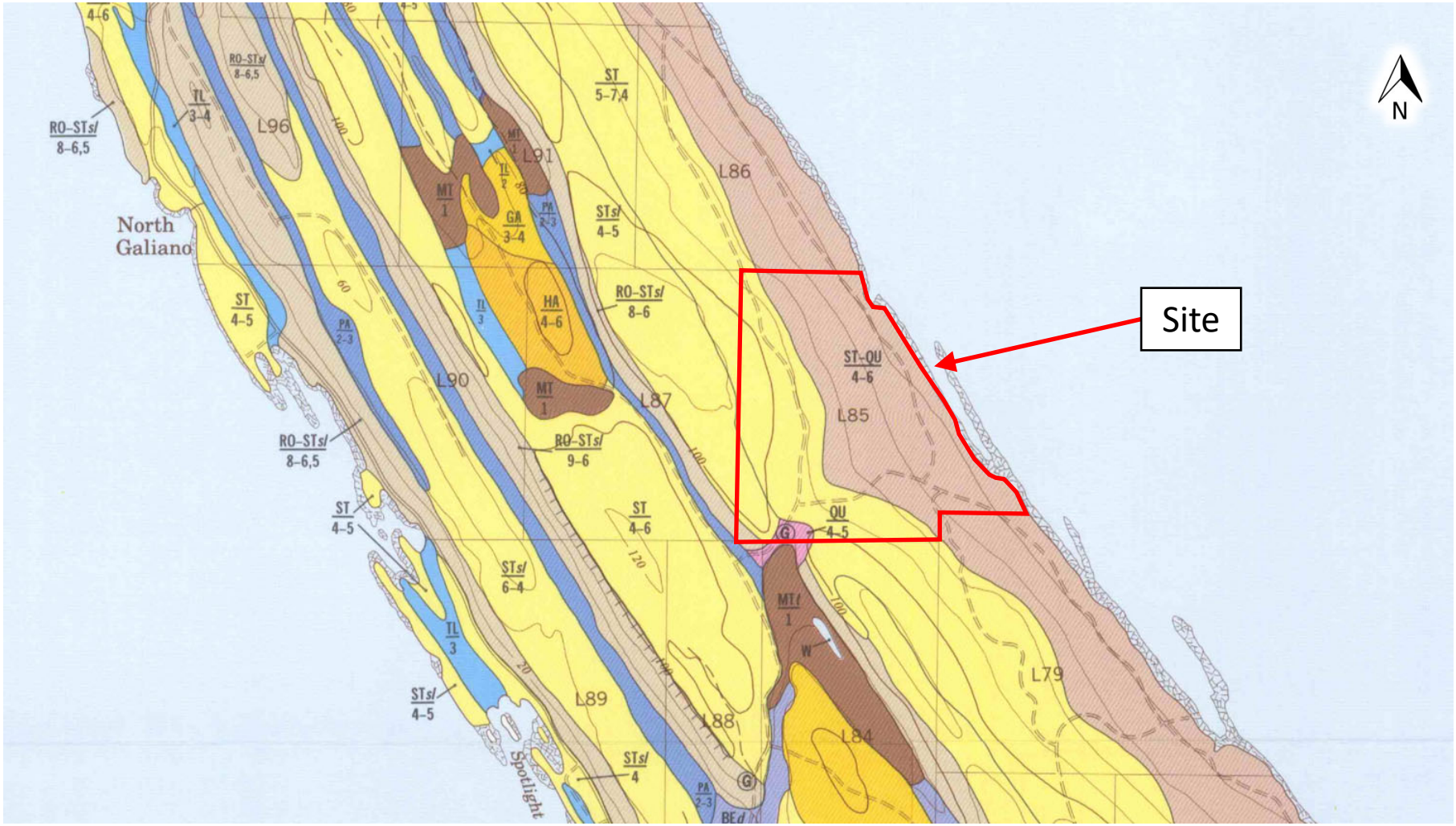
(Source: Galiano Groundwater Study WL11-1755" (March 31st, 2011). Prepared by Waterline Resources Inc. for Islands Trust)

Mr. Flemming Larsen

District Lot 85, Galiano Island, BC
Preliminary On-Site Groundwater Supply / Sewage Discharge Area Suitability Assessments

FIGURE 8: REGIONAL BEDROCK GEOLOGY

McElhanney Project #2243-18015-00



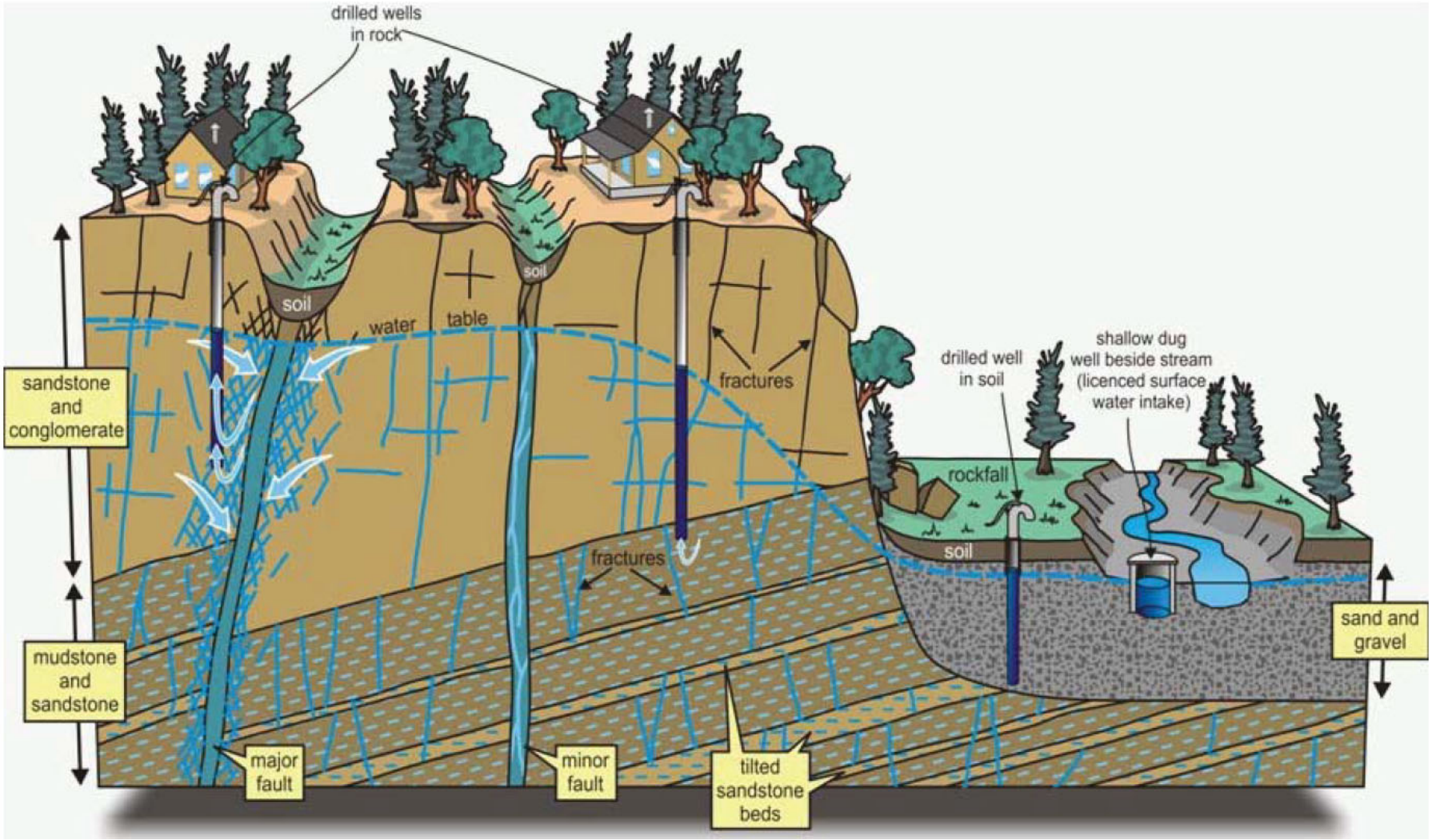
ST-QU	Saturna-Qualicum	Channery sandy loam colluvial and glacial drift materials less than 100 cm deep over sandstone bedrock (Saturna soil, 50-75%)
ST	Saturna	Channery sandy loam to channery loamy sand colluvial and glacial drift materials less than 100 cm deep over sandstone bedrock (Saturna soil, 75-100%)
QU	Qualicum	Gravelly sandy loam to gravelly sand glacioflu-vial, fluvial, or marine deposits more than 150 cm deep (Qualicum soil, 75-100%)

(Source: Soils of the Gulf Islands of British Columbia, Volume 3: Soils of Galiano, Valdes, Thetis, Kuper, and Lesser Islands" (Green et al, 1989). Report No. 43, British Columbia Soils Survey

Mr. Flemming Larsen

District Lot 85, Galiano Island, BC
Preliminary On-Site Groundwater Supply /
Sewage Discharge Area Suitability Assessments
FIGURE 9: REGIONAL SOILS

McElhanney Project #2243-18015-00



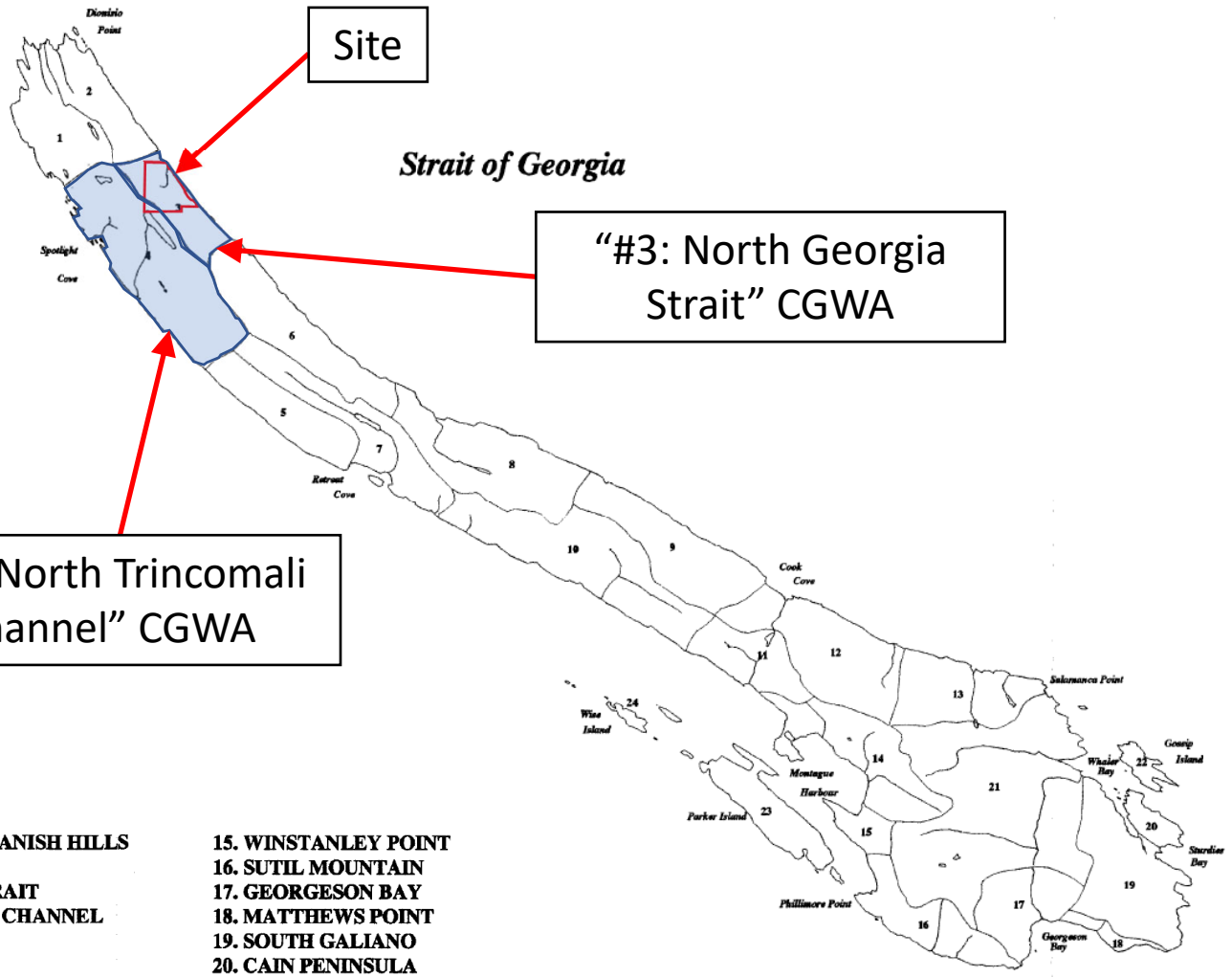
Mr. Flemming Larsen

District Lot 85, Galiano Island, BC
Preliminary On-Site Groundwater Supply /
Sewage Discharge Area Suitability Assessments

FIGURE 10: BEDROCK-HOSTED GROUNDWATER OCCURRENCE SCHEMATIC

McElhanney Project #2243-18015-00

(Source: Soils of the Gulf Islands of British Columbia, Volume 3: Soils of Galiano, Valdes, Thetis, Kuper, and Lesser Islands" (Green et al, 1989). Report No. 43, British Columbia Soils Survey



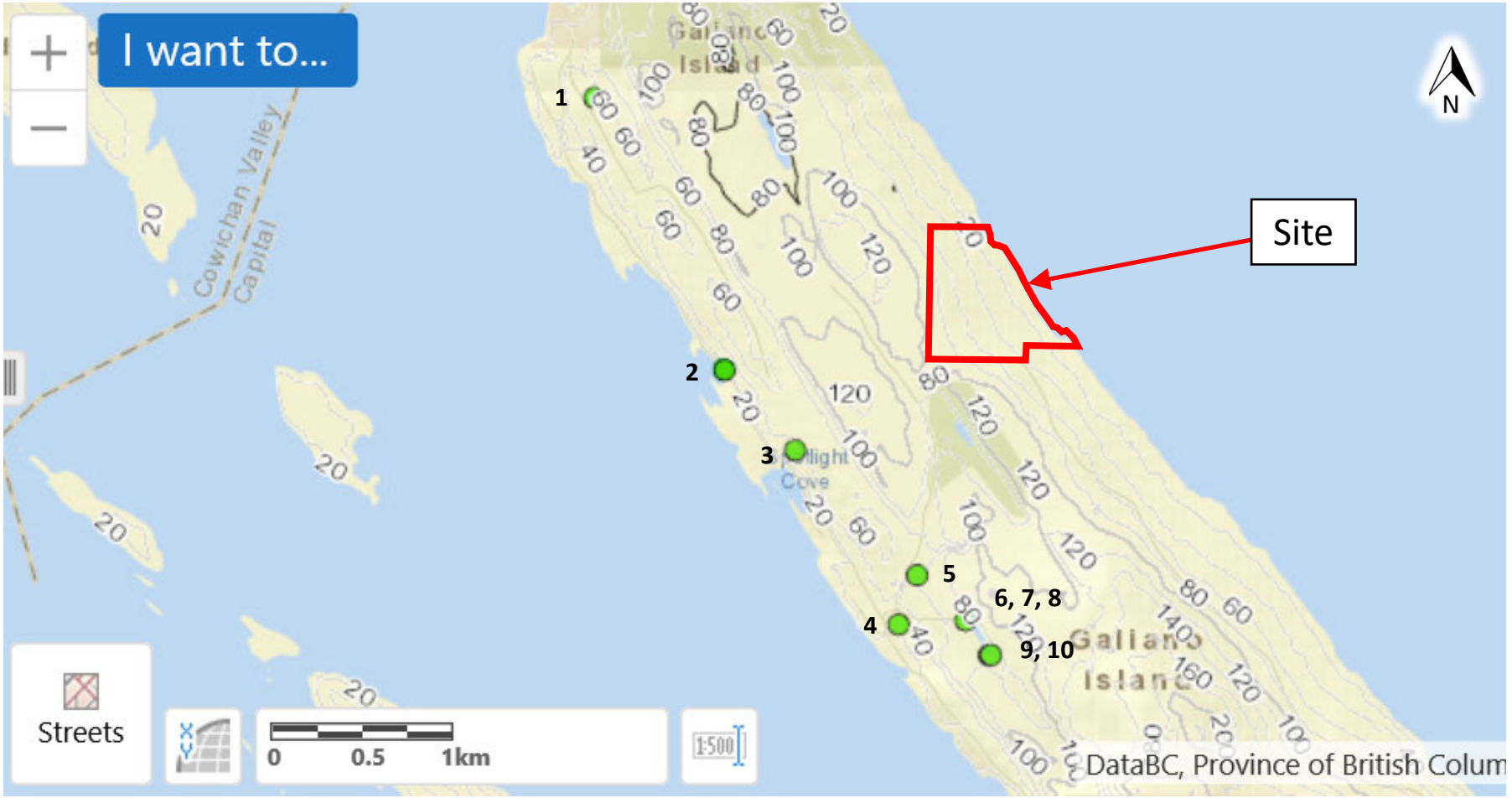
1. NORTH GALIANO - SPANISH HILLS
2. DIONISIO POINT
3. NORTH GEORGIA STRAIT
4. NORTH TRINCOMALI CHANNEL
5. WEST GALIANO
6. EAST GALIANO
7. GREIG CREEK
8. CENTRAL GEORGIA STRAIT
9. QUADRA HILL - EAST
10. QUADRA HILL - WEST
11. SOUTH TRINCOMALI CHANNEL
12. COOK COVE
13 FINLAY LAKE
14. MONTAGUE HARBOUR
15. WINSTANLEY POINT
16. SUTIL MOUNTAIN
17. GEORGESON BAY
18. MATTHEWS POINT
19. SOUTH GALIANO
20. CAIN PENINSULA
21. MURCHISON - WHALER BAY

NEIGHBOURING ISLANDS

22. GOSSIP ISLAND
23. PARKER ISLAND
24. WISE ISLAND

(Source: Assessment of Groundwater Availability and Quality, Galiano Island, British Columbia" (Kohut et al, May 15th, 1998))

Mr. Flemming Larsen
District Lot 85, Galiano Island, BC
Preliminary On-Site Groundwater Supply / Sewage Discharge Area Suitability Assessments
FIGURE 11: GALIANO ISLAND CRITICAL GROUNDWATER AREAS
McElhanney Project #2243-18015-00



Licensed Surface Water Point of Diversion

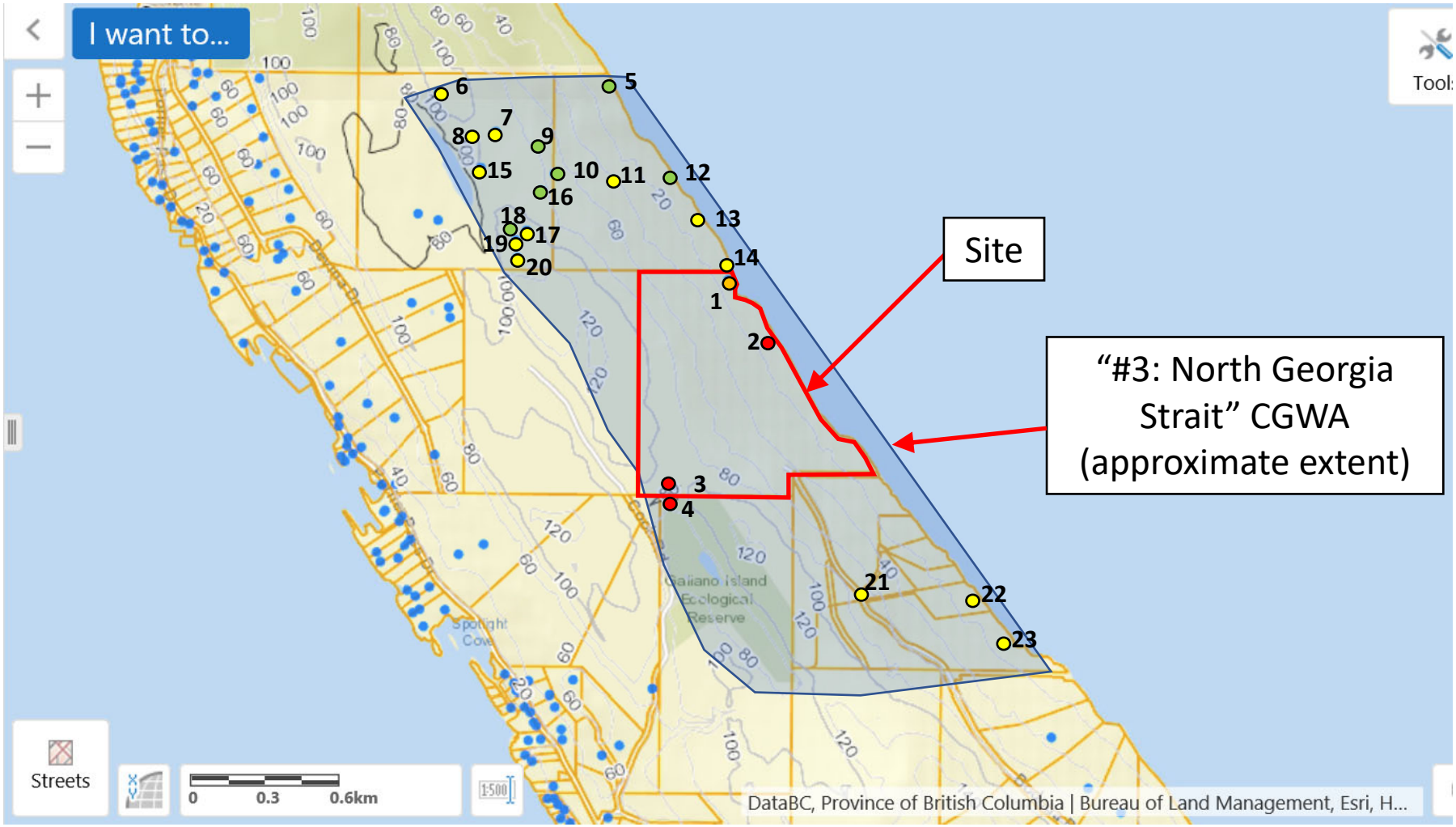
(Source: CRD Regional Map / Natural Areas Atlas website)

Mr. Flemming Larsen

District Lot 85, Galiano Island, BC
Preliminary On-Site Groundwater Supply /
Sewage Discharge Area Suitability Assessments

FIGURE 12: LICENSED SURFACE WATER POINTS OF DIVERSION

McElhanney Project #2243-18015-00

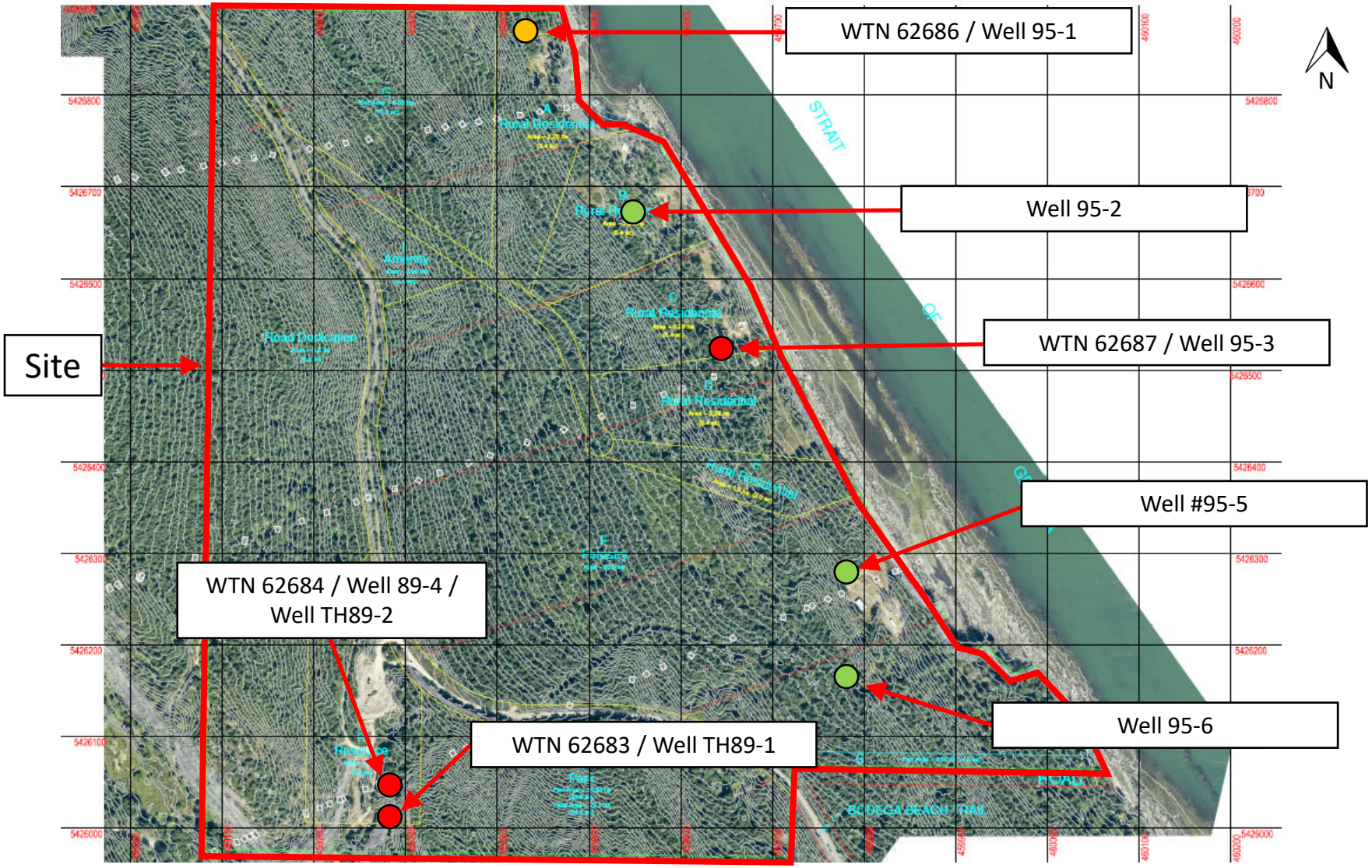


Estimated Yields

- < 0.31 L/s (< 5 USgpm)
- 0.31 – 0.95 L/s (5 - 15 USgpm)
- 0.95 –1.89 L/s (15 - 30 USgpm)
- > 1.89 L/s (> 30 USgpm)

(Source: BC Water Resources Atlas website)

Mr. Flemming Larsen
District Lot 85, Galiano Island, BC
Preliminary On-Site Groundwater Supply / Sewage Discharge Area Suitability Assessments
FIGURE 13: #3 NORTH GEORGIA STRAIT CGWA HISTORICAL GROUNDWATER DEVELOPMENT
McElhanney Project #2243-18015-00

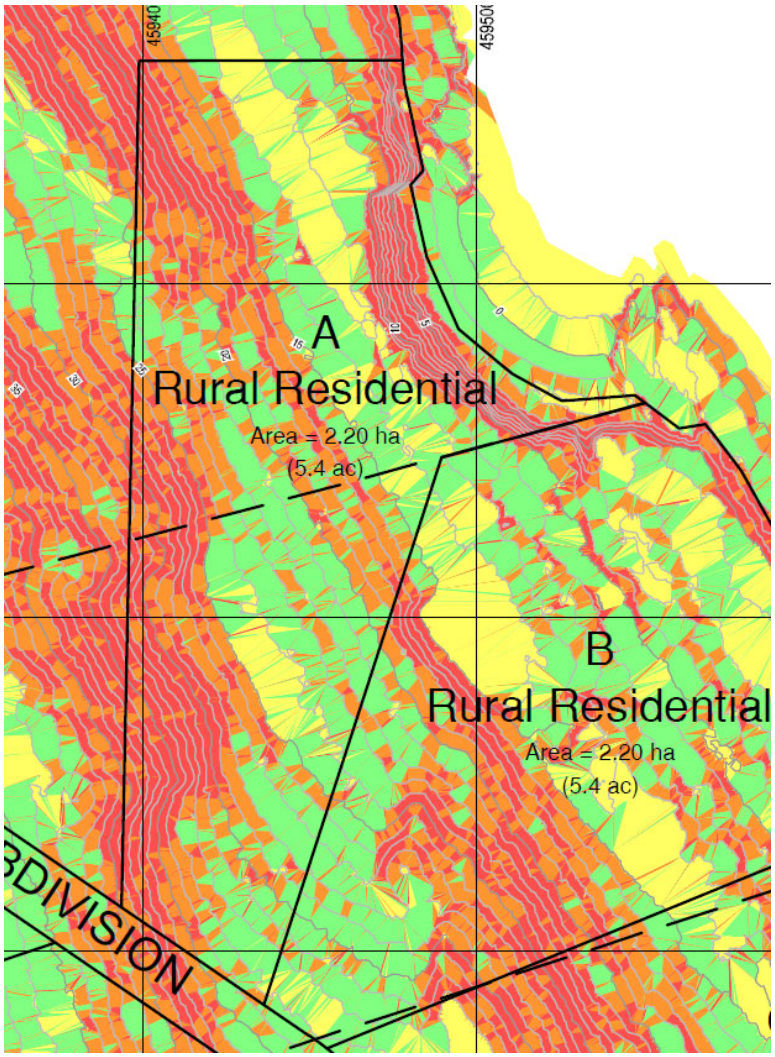


Estimated Yields

- < 0.31 L/s (< 5 USgpm)
- 0.31 – 0.95 L/s (5 - 15 USgpm)
- 0.95 –1.89 L/s (15 - 30 USgpm)
- > 1.89 L/s (> 30 USgpm)

(Source: Wright Parry Taylor Fuller Well Sketch Map (1995)

Mr. Flemming Larsen
District Lot 85, Galiano Island, BC
Preliminary On-Site Groundwater Supply / Sewage Discharge Area Suitability Assessments
FIGURE 14: ON-SITE WATER WELL LOCATIONS
McElhanney Project #2243-18015-00



N

Slopes Table			
Number	Minimum Slope	Maximum Slope	Color
1	0%	10%	
2	10%	20%	
3	20%	30%	
4	30%	>30%	

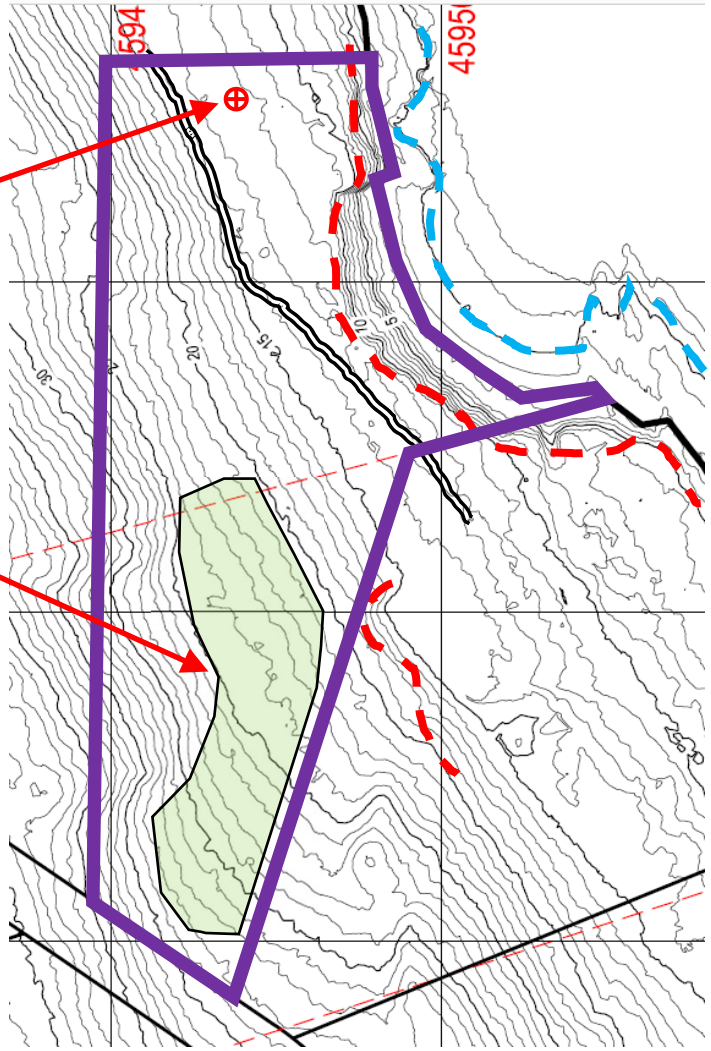
Mr. Flemming Larsen

District Lot 85, Galiano Island, BC

Preliminary On-Site Groundwater Supply / Sewage Discharge Area Suitability Assessments

FIGURE 15: SITE EXAMINATION:PROPOSED RURAL RESIDENTIAL LOT A SLOPE ANALYSIS MAP

McElhanney Project #2243-18015-00

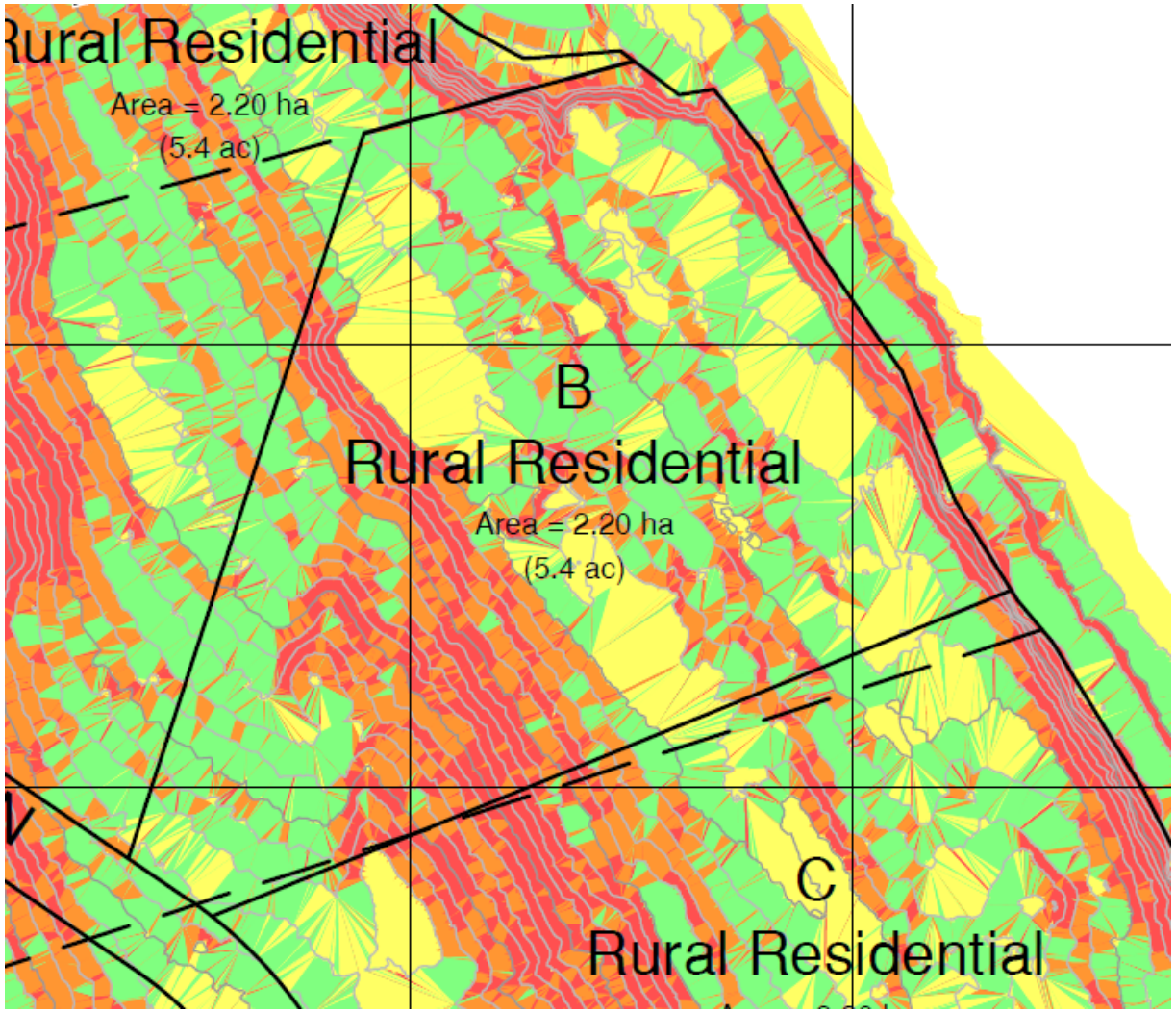


Mr. Flemming Larsen

District Lot 85, Galiano Island, BC
Preliminary On-Site Groundwater Supply / Sewage Discharge Area Suitability Assessments

FIGURE 16: SITE EXAMINATION:PROPOSED RURAL RESIDENTIAL LOT A POTENTIAL SEWAGE DISCHARGE AREAS

McElhanney Project #2243-18015-00



Slopes Table			
Number	Minimum Slope	Maximum Slope	Color
1	0%	10%	
2	10%	20%	
3	20%	30%	
4	30%	>30%	

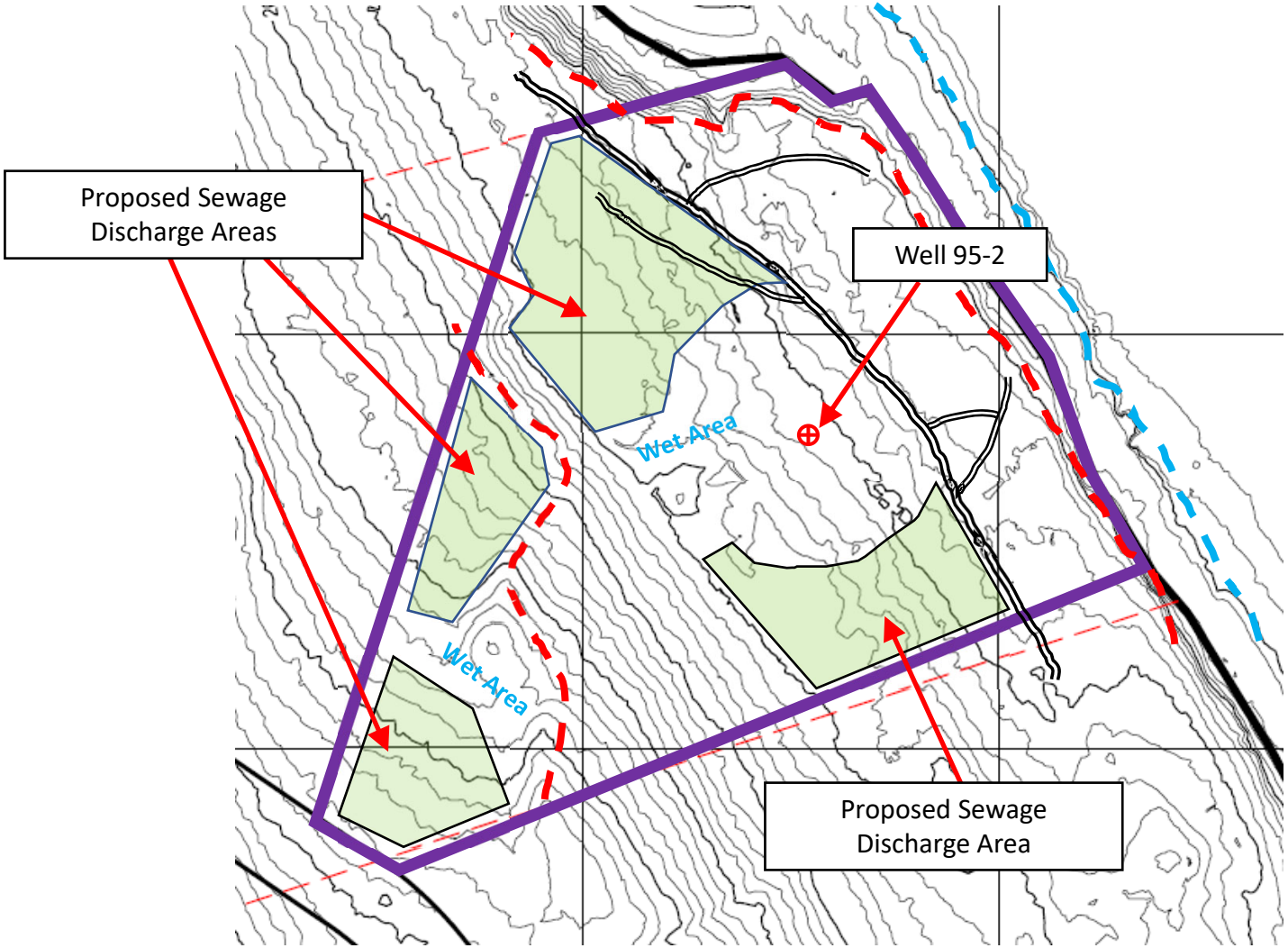
Mr. Flemming Larsen

District Lot 85, Galiano Island, BC

Preliminary On-Site Groundwater Supply / Sewage Discharge Area Suitability Assessments

FIGURE 17: SITE EXAMINATION:PROPOSED RURAL RESIDENTIAL LOT B SLOPE ANALYSIS MAP

McElhanney Project #2243-18015-00



Discharge Area Setback Distances

Min 3 m from a parcel boundary
Min 3 m from a building
Min 3 m from a domestic water line
Min 30 m from a well
Min 3 m from an upslope interceptor ditch
Min 30 m from a high watermark
Min 15 m from a breakout point

Septic Tank Setback Distances

Min 30 m from a well Min 3 m from a water line
Min 3 m from a building
Min 3 m from a parcel boundary
Min 15 m from a surface water body

Proposed Lot Boundary

Gravel Road (partial plot)

Drilled Well

Potential Effluent Breakout Area

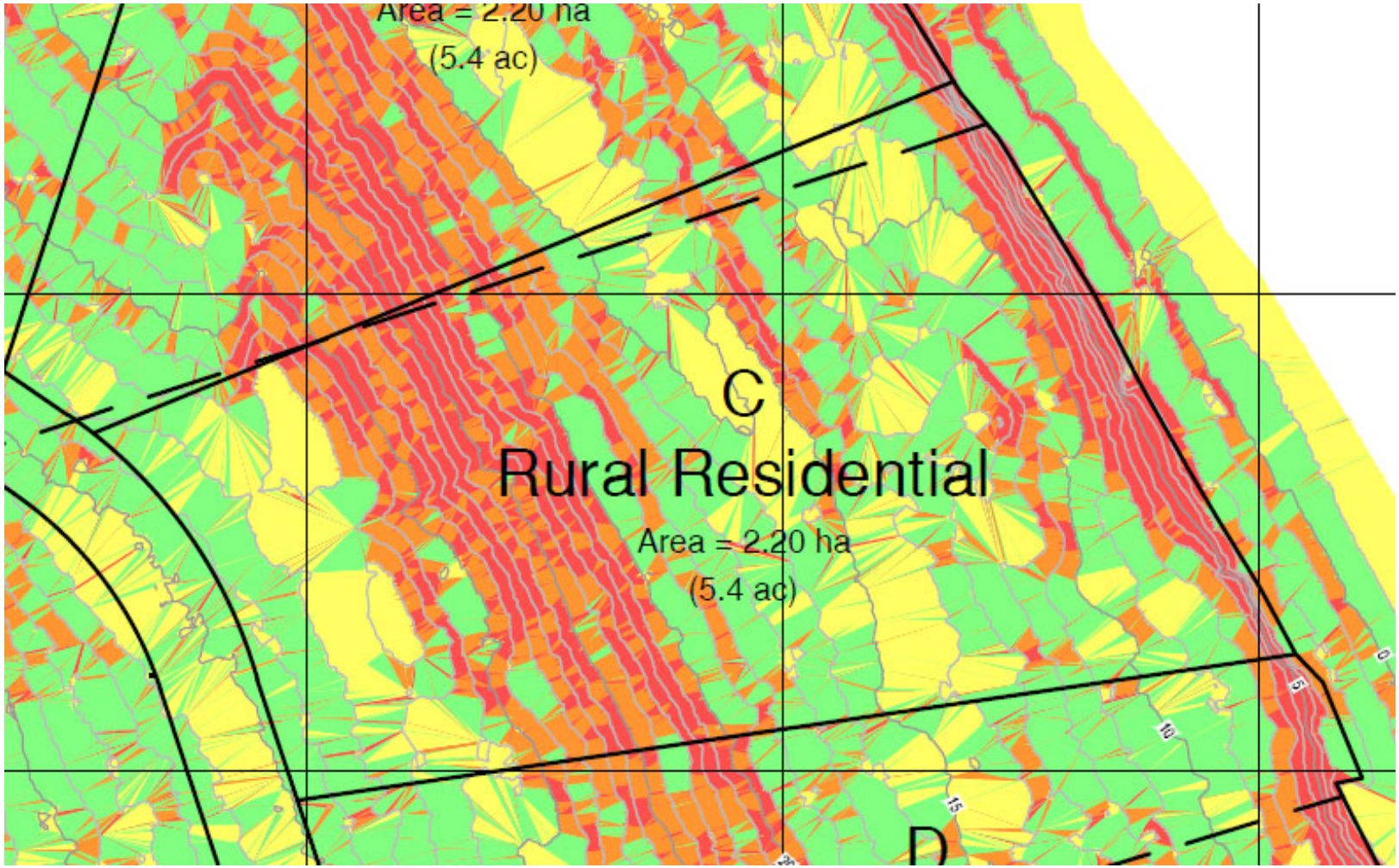
Tidal / Non-Tidal High-Water Mark

Mr. Flemming Larsen

District Lot 85, Galiano Island, BC
Preliminary On-Site Groundwater Supply / Sewage Discharge Area Suitability Assessments

FIGURE 18: SITE EXAMINATION:PROPOSED RURAL RESIDENTIAL LOT B POTENTIAL SEWAGE DISCHARGE AREAS

McElhanney Project #2243-18015-00



Slopes Table			
Number	Minimum Slope	Maximum Slope	Color
1	0%	10%	
2	10%	20%	
3	20%	30%	
4	30%	>30%	

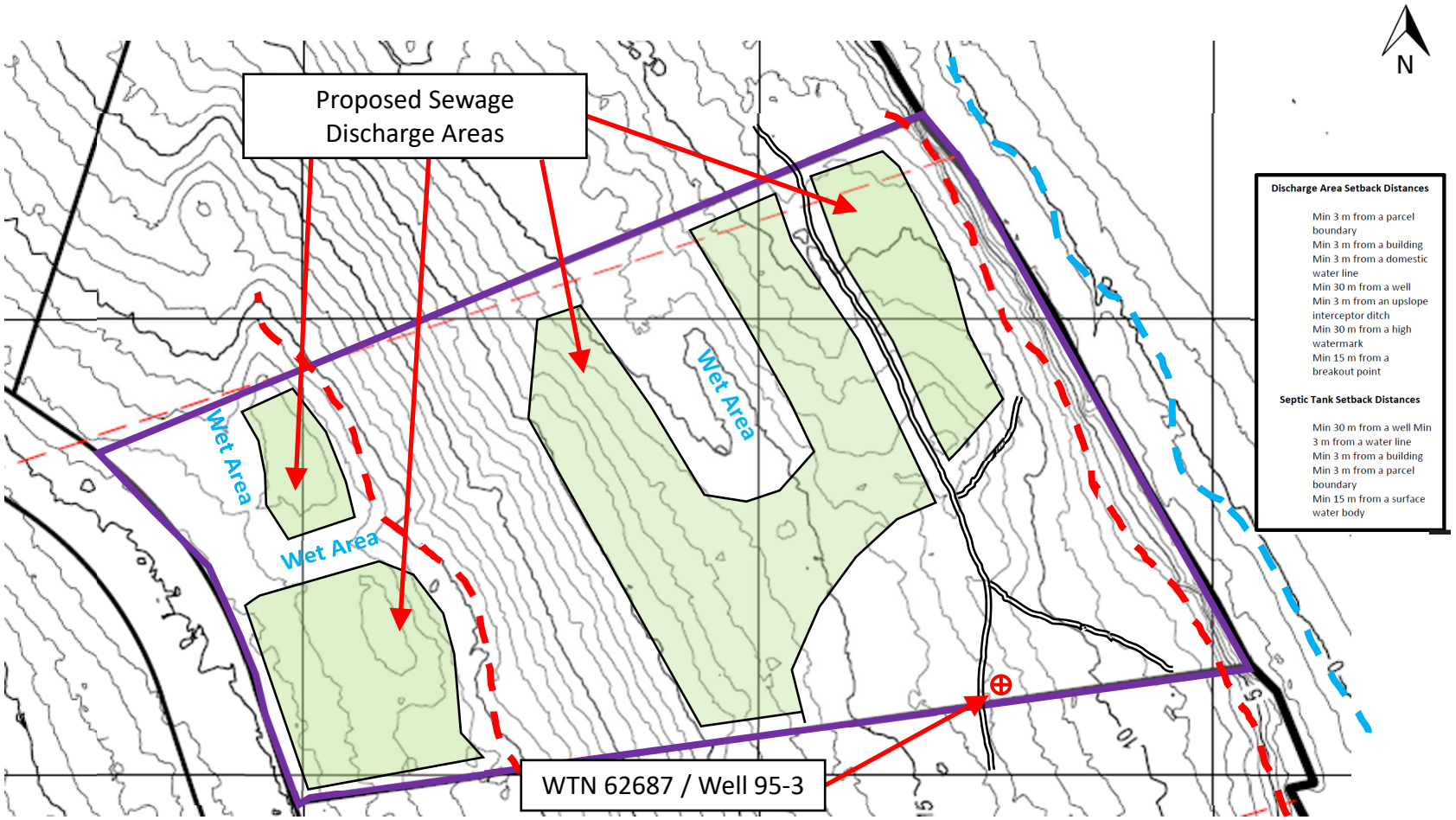
Mr. Flemming Larsen

District Lot 85, Galiano Island, BC

Preliminary On-Site Groundwater Supply / Sewage Discharge Area Suitability Assessments

FIGURE 19: SITE EXAMINATION:PROPOSED RURAL RESIDENTIAL LOT C SLOPE ANALYSIS MAP

McElhanney Project #2243-18015-00



Proposed Lot Boundary

Gravel Road (partial plot)

Drilled Well

Potential Effluent Breakout Area

Tidal / Non-Tidal High-Water Mark

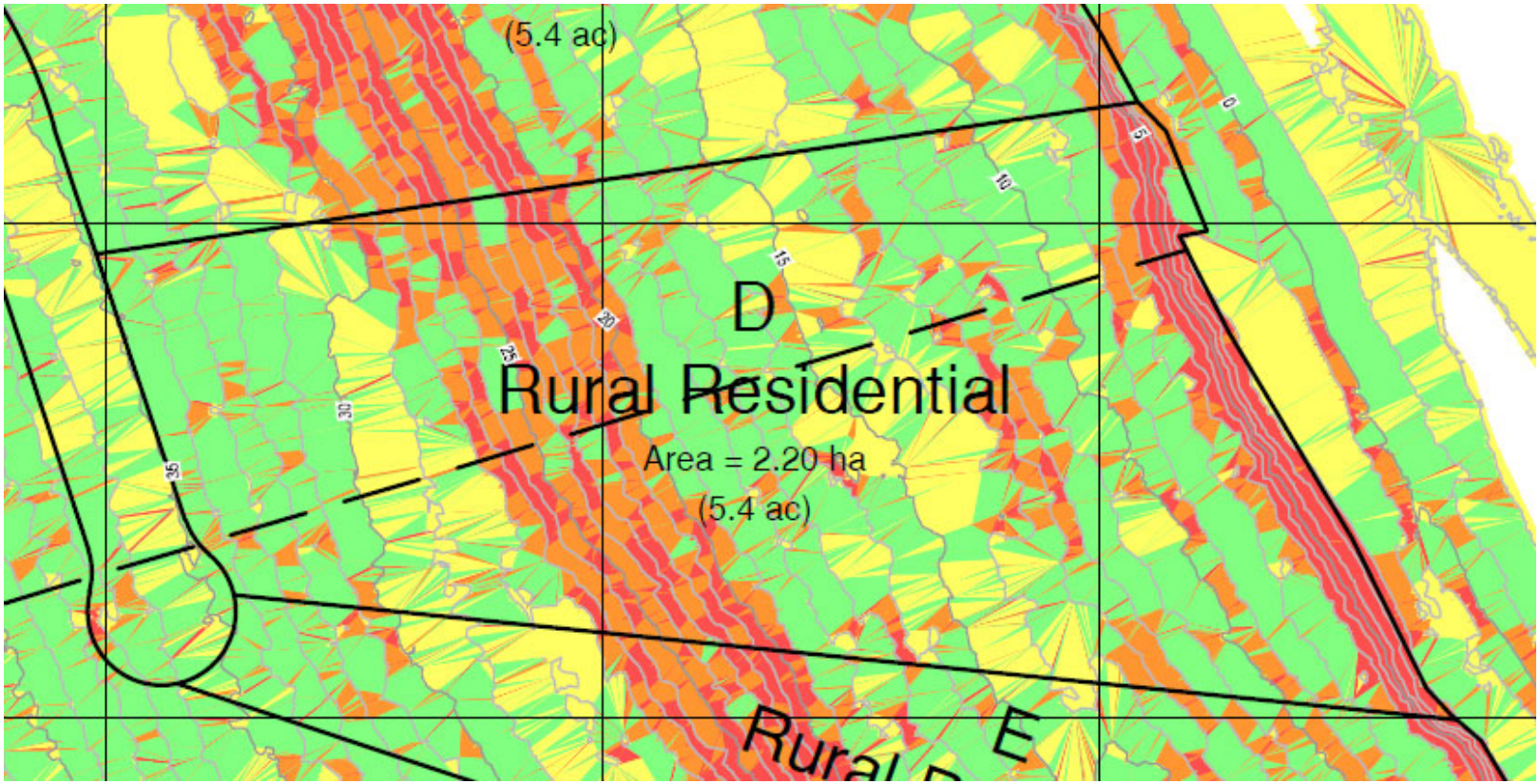
Mr. Flemming Larsen

District Lot 85, Galiano Island, BC

Preliminary On-Site Groundwater Supply / Sewage Discharge Area Suitability Assessments

FIGURE 20: SITE EXAMINATION:PROPOSED RURAL RESIDENTIAL LOT C POTENTIAL SEWAGE DISCHARGE AREAS

McElhanney Project #2243-18015-00



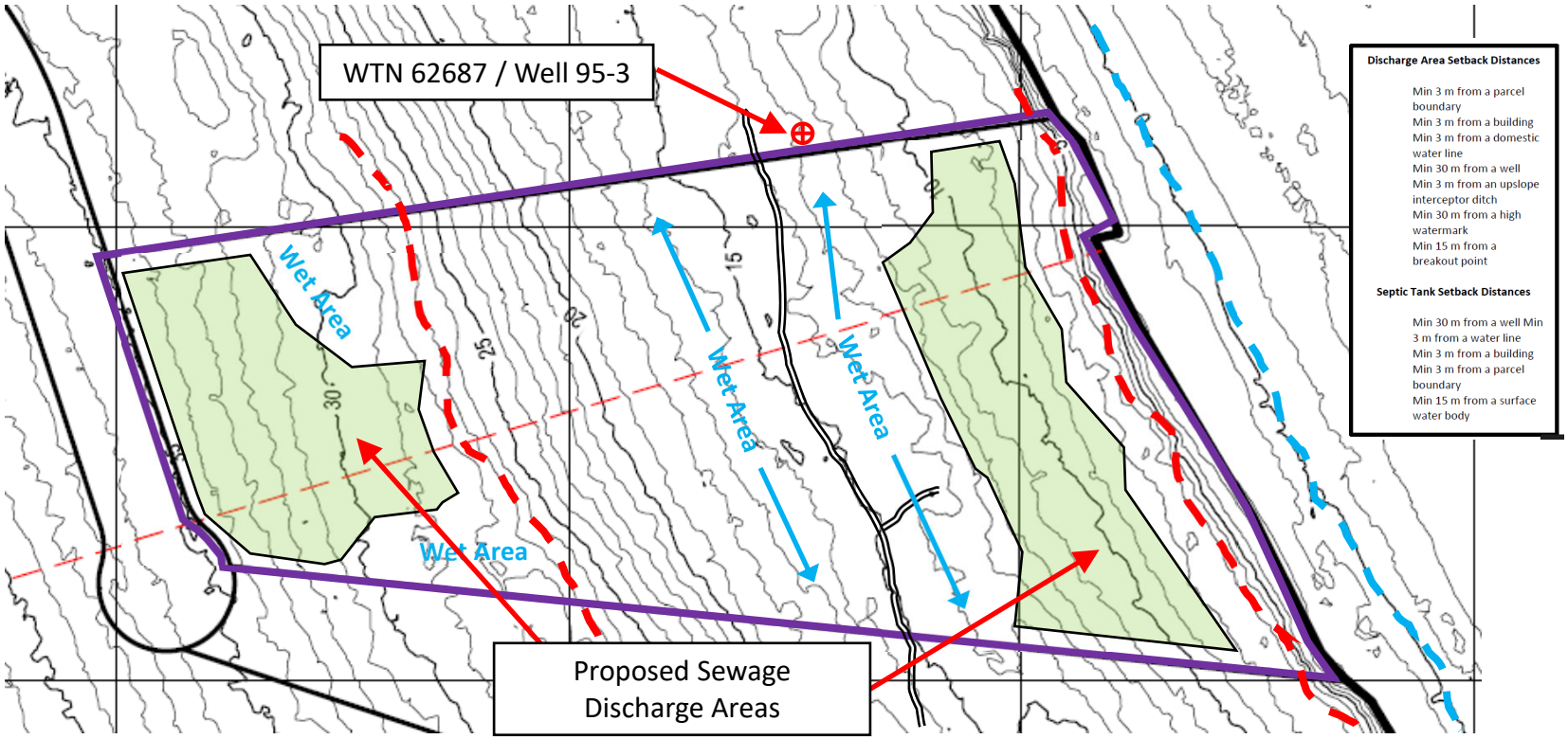
Slopes Table			
Number	Minimum Slope	Maximum Slope	Color
1	0%	10%	
2	10%	20%	
3	20%	30%	
4	30%	>30%	

Mr. Flemming Larsen

District Lot 85, Galiano Island, BC
Preliminary On-Site Groundwater Supply /
Sewage Discharge Area Suitability Assessments

FIGURE 21: SITE EXAMINATION:PROPOSED RURAL RESIDENTIAL LOT D SLOPE ANALYSIS MAP

McElhanney Project #2243-18015-00



Proposed Lot Boundary

Gravel Road (partial plot)

Drilled Well

Potential Effluent Breakout Area

Tidal / Non-Tidal High-Water Mark

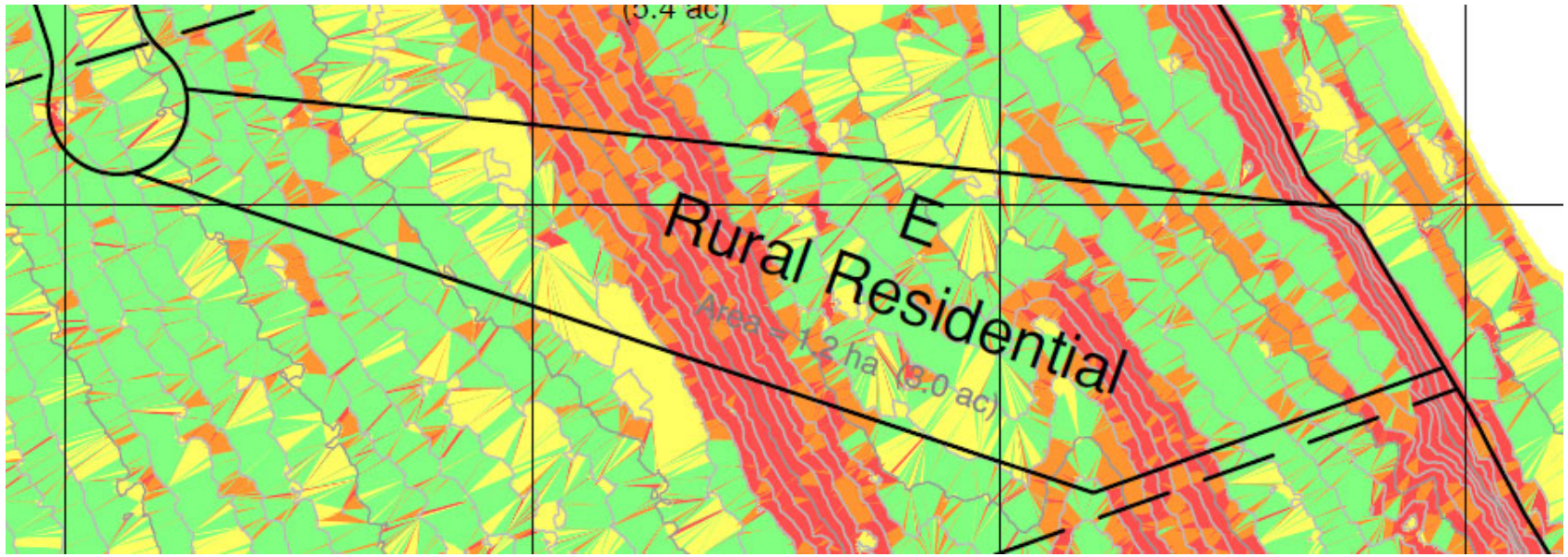
Mr. Flemming Larsen

District Lot 85, Galiano Island, BC

Preliminary On-Site Groundwater Supply / Sewage Discharge Area Suitability Assessments

FIGURE 22: SITE EXAMINATION:PROPOSED RURAL RESIDENTIAL LOT D POTENTIAL SEWAGE DISCHARGE AREAS

McElhanney Project #2243-18015-00



Slopes Table			
Number	Minimum Slope	Maximum Slope	Color
1	0%	10%	
2	10%	20%	
3	20%	30%	
4	30%	>30%	

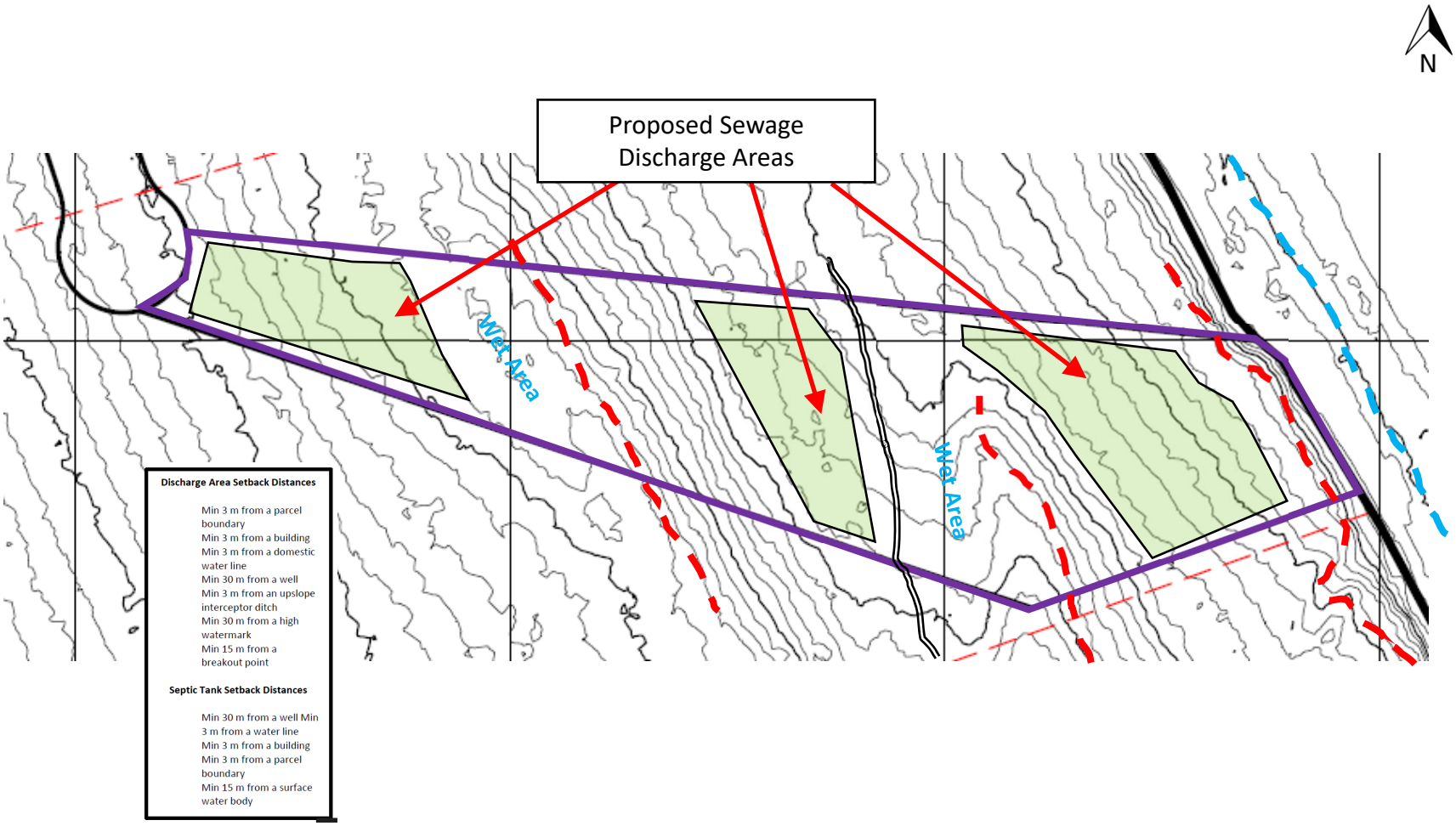
Mr. Flemming Larsen

District Lot 85, Galiano Island, BC

Preliminary On-Site Groundwater Supply / Sewage Discharge Area Suitability Assessments

FIGURE 23: SITE EXAMINATION:PROPOSED RURAL RESIDENTIAL LOT E SLOPE ANALYSIS MAP

McElhanney Project #2243-18015-00



Proposed Lot Boundary

Gravel Road (partial plot)

Drilled Well

Potential Effluent Breakout Area

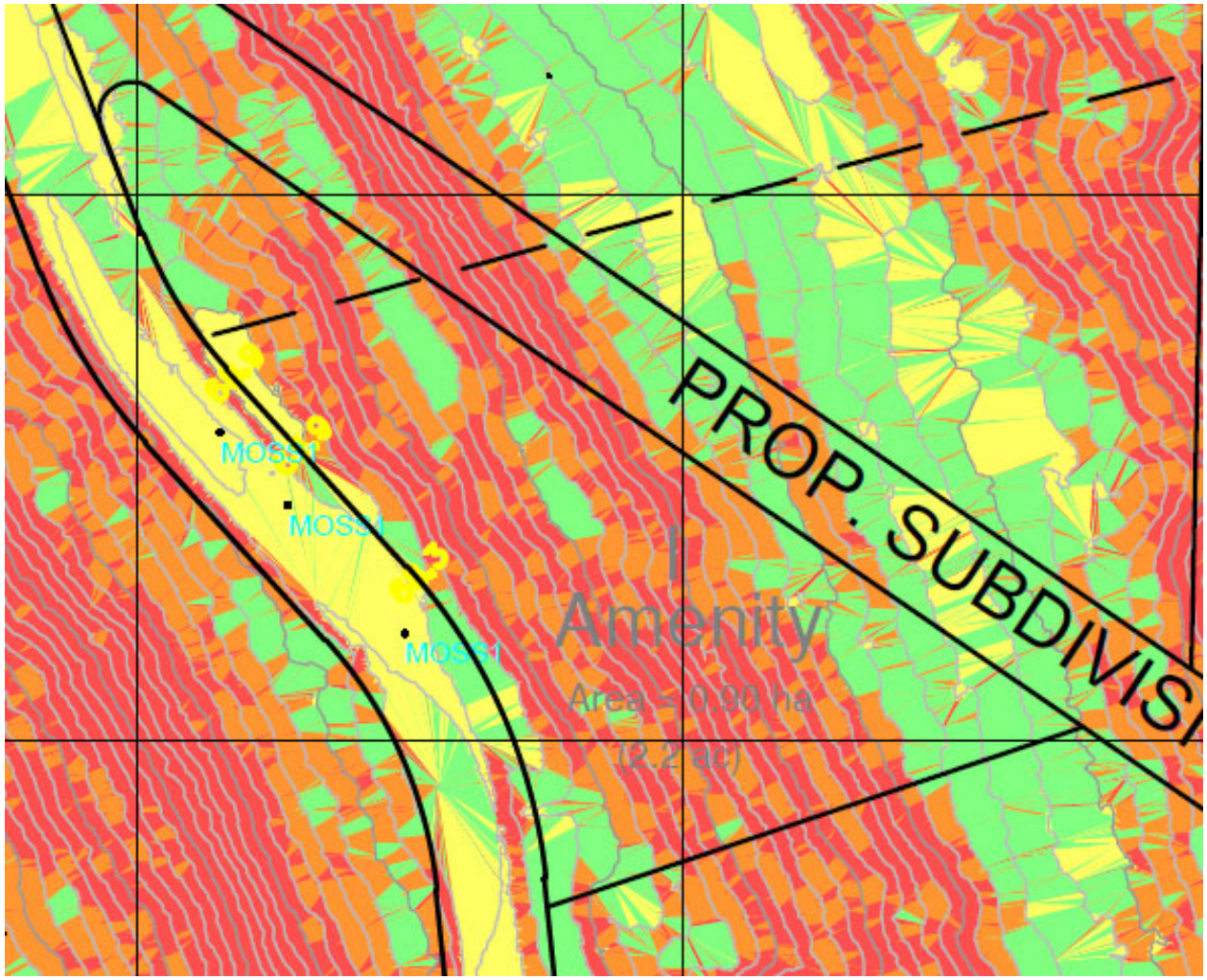
Tidal / Non-Tidal High-Water Mark

Mr. Flemming Larsen

District Lot 85, Galiano Island, BC
Preliminary On-Site Groundwater Supply /
Sewage Discharge Area Suitability Assessments

FIGURE 24: SITE EXAMINATION:PROPOSED RURAL RESIDENTIAL LOT E POTENTIAL SEWAGE DISCHARGE AREAS

McElhanney Project #2243-18015-00



Slopes Table			
Number	Minimum Slope	Maximum Slope	Color
1	0%	10%	
2	10%	20%	
3	20%	30%	
4	30%	>30%	

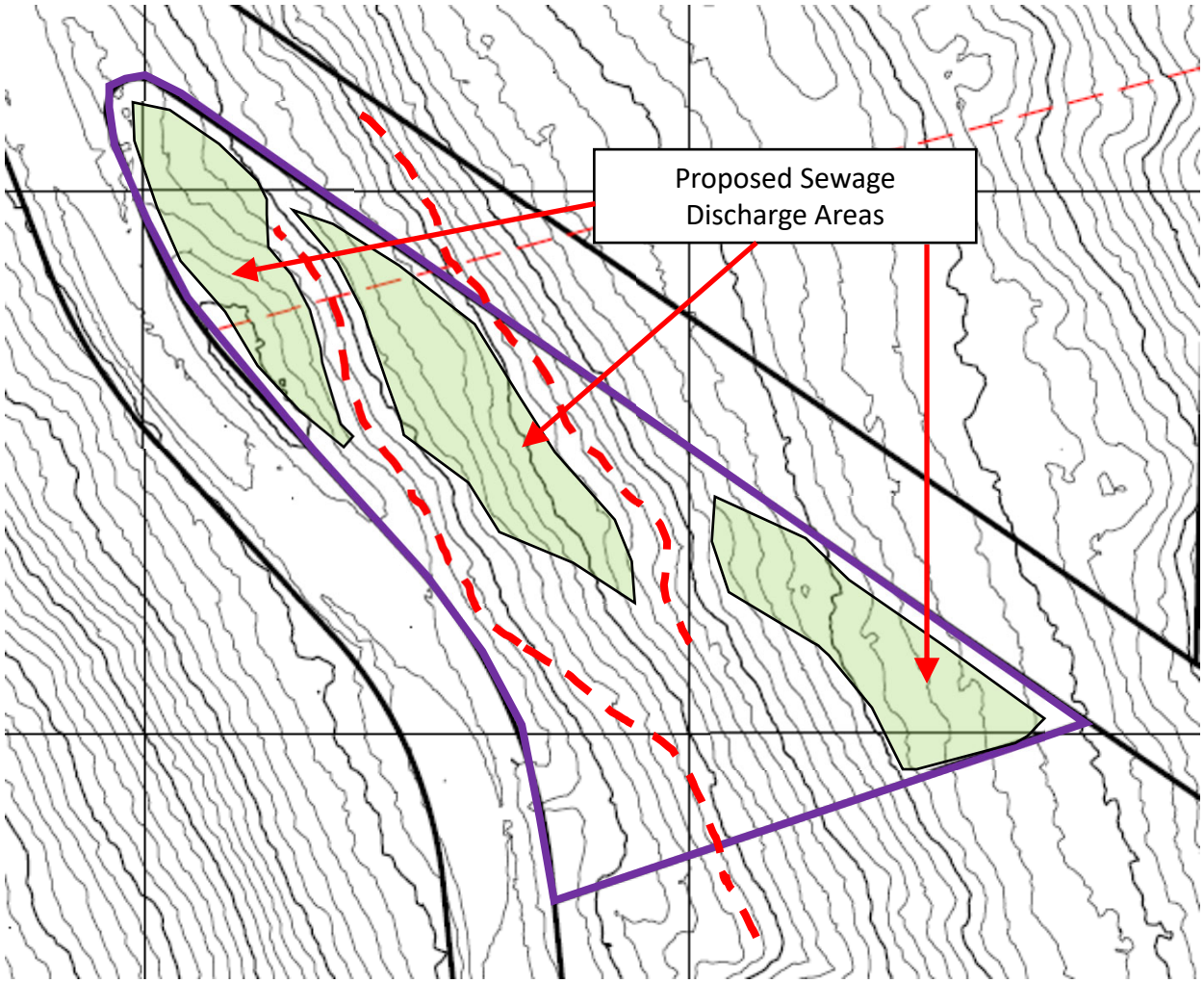
Mr. Flemming Larsen

District Lot 85, Galiano Island, BC

Preliminary On-Site Groundwater Supply / Sewage Discharge Area Suitability Assessments

FIGURE 25: SITE EXAMINATION:PROPOSED AMENITY LOT SLOPE ANALYSIS MAP

McElhanney Project #2243-18015-00



Discharge Area Setback Distances

Min 3 m from a parcel boundary
Min 3 m from a building
Min 3 m from a domestic water line
Min 30 m from a well
Min 3 m from an upslope interceptor ditch
Min 30 m from a high watermark
Min 15 m from a breakout point

Septic Tank Setback Distances

Min 30 m from a well Min 3 m from a water line
Min 3 m from a building
Min 3 m from a parcel boundary
Min 15 m from a surface water body

Proposed Lot Boundary

Gravel Road (partial plot)

Drilled Well

Potential Effluent Breakout Area

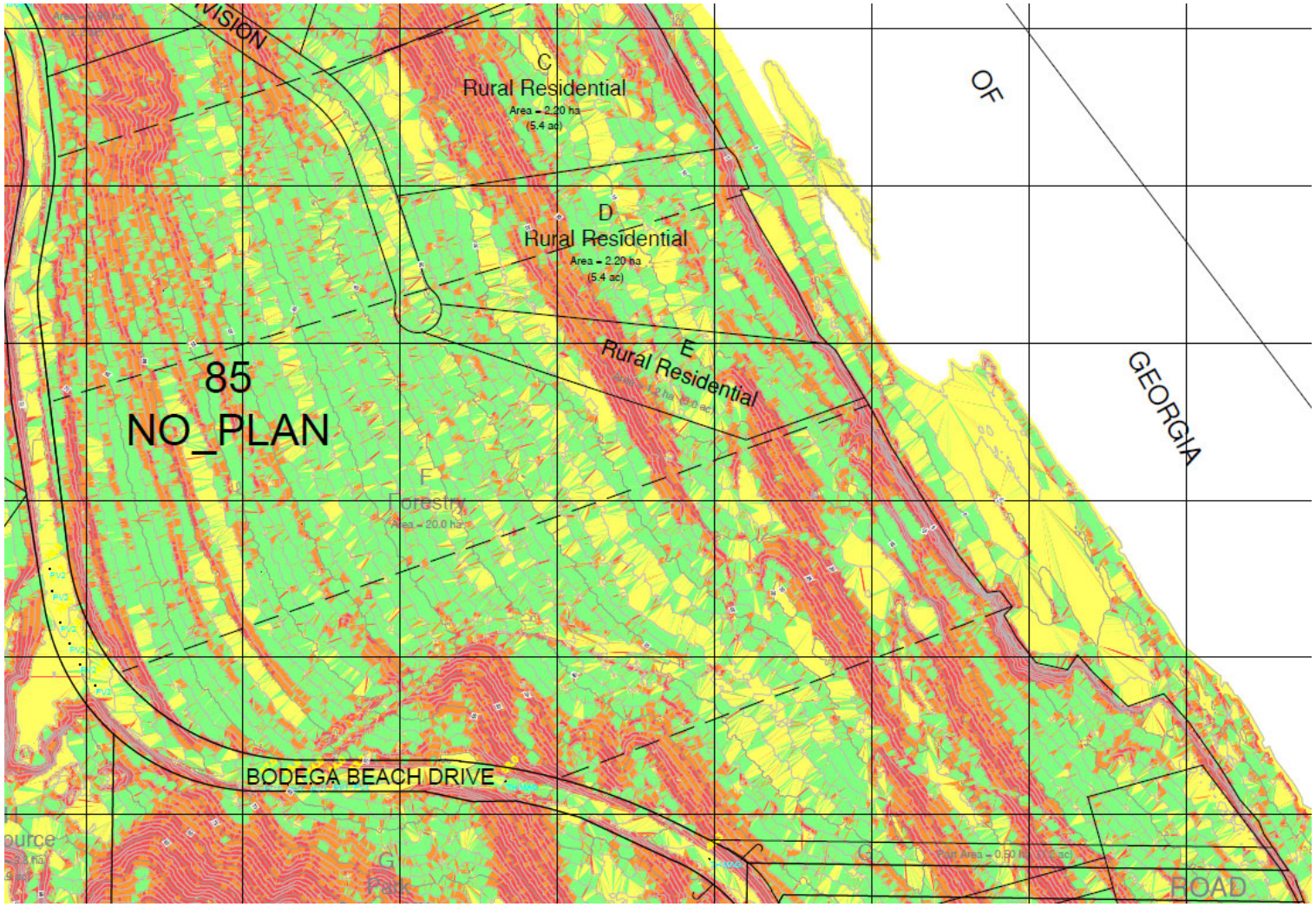
Tidal / Non-Tidal High-Water Mark

Mr. Flemming Larsen

District Lot 85, Galiano Island, BC
Preliminary On-Site Groundwater Supply /
Sewage Discharge Area Suitability Assessments

FIGURE 26: SITE EXAMINATION:PROPOSED AMENITY LOT
POTENTIAL SEWAGE DISCHARGE AREAS

McElhanney Project #2243-18015-00



Slopes Table			
Number	Minimum Slope	Maximum Slope	Color
1	0%	10%	
2	10%	20%	
3	20%	30%	
4	30%	>30%	

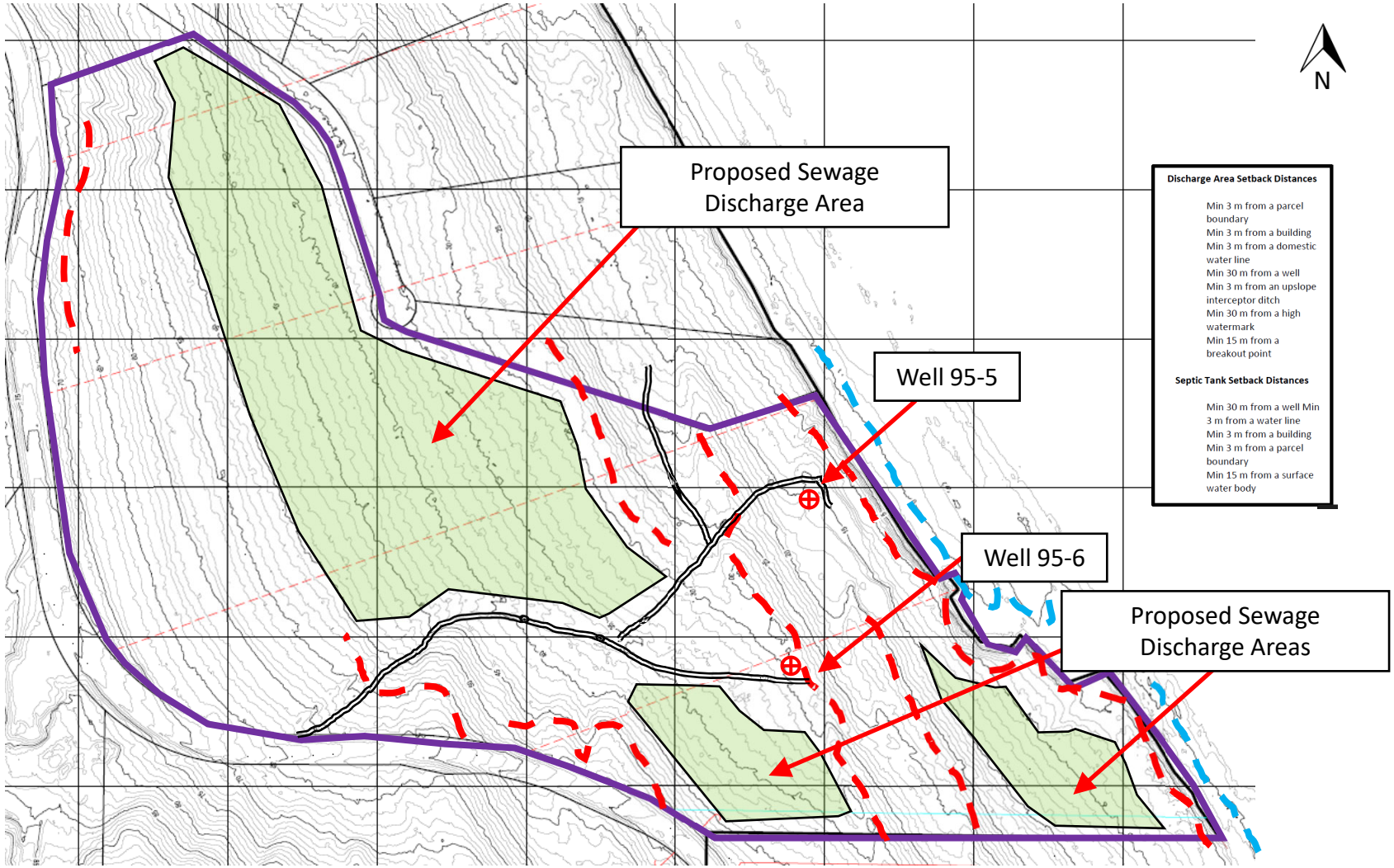
Mr. Flemming Larsen

District Lot 85, Galiano Island, BC

Preliminary On-Site Groundwater Supply / Sewage Discharge Area Suitability Assessments

FIGURE 27: SITE EXAMINATION:PROPOSED FORESTRY LOT SLOPE ANALYSIS MAP

McElhanney Project #2243-18015-00



Proposed Lot Boundary

Gravel Road (partial plot)

Drilled Well

Potential Effluent Breakout Area

Tidal / Non-Tidal High-Water Mark

Mr. Flemming Larsen

District Lot 85, Galiano Island, BC
Preliminary On-Site Groundwater Supply / Sewage Discharge Area Suitability Assessments

FIGURE 28: SITE EXAMINATION:PROPOSED FORESTRY LOT POTENTIAL SEWAGE DISCHARGE AREAS

McElhanney Project #2243-18015-00

Appendix A

APPENDIX A

District Lot 85
Surface Water Licenses within 2 km of Site

POD Map ID	ENV License #	ENV POD #	UTM Northing	UTM Easting	Distance from Site (m)	Direction from Site	Status	Source	Diversion Volume	Use
1	C101581	PD63139	5427575	457313	1900	WNW	Active	Crabtree Swamp	493 m2/year	Land Improvement (General)
2	C106042	PD34075	5426046	458033	1012	WNW	Active	Stemo Spring	0.68 m3/day	Domestic
3	C058557	PD34076	5425593	459160	730	WSW	Active	Spotlight Creek	2.27 m3/day	Domestic
4	C124747	PD34071	5424616	459003	1349	S	Active	Jack Creek	246 m3/year	Land Improvement (General)
5	C064058	PD34074	5424893	459108	1078	S	Active	Jack Creek	814 m3/year	Irrigation (Private)
6	C124754A	PD34072	5424435	459507	1333	S	Active	Pirart Brook	6414 m3/year	Irrigation (Private)
7	C124754B	PD34072	5424435	459507	1333	S	Active	Pirart Brook	6784 m3/year	Stream Storage (Non-Power)
8	C124754C	PD34072	5424435	459507	1333	S	Active	Pirart Brook	0.9 m3/day	Livestock & Animal Watering / Stockwater
9	C113512A	PD73982	5424434	459521	1508	S	Active	Pirart Brook	2466 m3/year	Stream Storage (Non-Power)
10	C113512B	PD73982	5424434	459521	1508	S	Active	Pirart Brook	2466 m3/year	Irrigation (Private)

Appendix B

APPENDIX B

District Lot 85
ENV-Registered Wells within CGWA #3 "North Georgia Strait"

Well ID	Well Identification Number	Well Plate Number	UTM Northing	UTM Easting	Distance from Site (m)	Direction from Site	Date Installed	Diameter (mm)	Type	Total Depth	Depth to Bedrock (m bgs)	Static Water Level (m bgs)	Water Source (m bgs)	Airlift Yield (L/s)	Airlift Yield (USgpm)	Use
On-Site																
1	62686	-	5426846	459438	On-Site	On-Site	3/20/1995	152	Rock	89.92	1.52	NM	89.31 - 89.92	1.26	20.0	Private Domestic
2	62687	-	5426519	459635	On-Site	On-Site	1995	152	Rock	43.59	1.83	13.72	37.80	3.15	50.0	Private Domestic
3	62683	-	5426006	459257	On-Site	On-Site	10/26/1989	152	Overburden	30.79	29.40	9.50	10.97 - 21.5	7.57	120.0	Private Domestic
4	62684	-	5426019	459264	On-Site	On-Site	10/25/1989	152	Rock	121.92	21.34	8.53	22.86 - 121.92	15.14	240.0	-
Off-Site														0.83		
5	60556	-	5427646	458985	735	N	6/1/1994	152	Rock	38.10	2.74	38.10	31.09	0.63	10.0	Private Domestic
6	91060	20101	5427635	458278	1105	NW	3/2/2007	152	Rock	91.44	5.64	NM	82.3 - 94.5	0.25	4.0	Private Domestic
7	52390	-	5427467	458510	825	NW	6/30/1983	152	Rock	91.44	0.61	3.66	6.71	0.06	1.0	Private Domestic
8	56572	-	5427450	458415	880	NW	9/27/1986	152	Rock	91.44	6.71	15.24	27.43	0.02	0.3	Private Domestic
9	115909	43777	5427411	458682	660	NW	6/19/2018	152	Rock	60.96	3.96	15.24	NM	0.32	5.0	Private Domestic
10	104974	34956	5427296	458750	533	NW	4/16/2011	152	Rock	96.01	3.66	25.15	NM	0.64	10.0	Private Domestic
11	63075	-	5427267	458992	385	NNW	6/9/1993	152	Rock	61.87	1.22	15.24	48.77	0.06	1.0	Private Domestic
12	60555	-	5427274	459224	365	N	1/6/1994	152	Rock	38.10	2.74	3.05	31.09	0.64	10.0	Private Domestic
13	60562	-	5427104	459344	200	N	6/7/1994	152	Rock	56.39	0.00	3.66	48.77 - 56.39	0.25	4.0	Private Domestic
14	60420	-	5426921	459448	90	N	9/6/1993	152	Rock	61.87	1.22	12.80	48.77	0.06	1.0	Private Domestic
15	98041	26041	5427321	458447	780	NW	5/10/2008	152	Rock	97.54	0.61	40.54	89.92	0.05	0.8	Private Domestic
16	87944	17371	5427226	458695	505	NW	12/19/2006	152	Rock	30.48	2.74	NM	18.29	0.95	15.0	Private Domestic
17	113143	43658	5427063	458633	470	WNW	5/3/2017	152	Rock	98.45	1.83	38.10	94.49	0.09	1.5	Private Domestic
18	59080	-	5427073	458572	535	WNW	9/22/1989	152	Rock	60.96	0.61	27.43	55.47	0.95	15.0	Private Domestic
19	101656	16499	5427023	458589	510	WNW	2/1/2006	152	Rock	30.48	3.05	NM	9.14	0.25	4.0	Private Domestic
20	59244	-	5426953	458594	485	W	4/1/1990	152	Rock	152.40	0.00	NM	NM	0.02	0.3	Private Domestic
21	110095	41493	5425565	459998	485	SSE	2/18/2015	152	Rock	79.25	3.35	NM	NM	0.03	0.5	Private Domestic
22	62681	-	5425540	460455	840	SE	3/13/1995	152	Rock	31.39	3.66	2.74	30.18	0.08	1.2	Private Domestic
23	62682	-	5425358	460588	1035	SE	3/15/1995	152	Rock	61.87	3.96	8.53	35.97 - 42.06	0.08	1.2	Private Domestic

Appendix C

APPENDIX C

District Lot 85
Registered and Non-Registered On-Site Wells

Well ID	Well Identification Number	Well Plate Number	UTM Northing	UTM Easting	Distance from Site (m)	Direction from Site	Date Installed	Diameter (mm)	Type	Total Depth	Depth to Bedrock (m bgs)	Static Water Level (m bgs)	Water Source (m bgs)	Airlift Yield (L/s)	Airlift Yield (USgpm)	Use
On-Site																
95-1	62686	-	5426846	459438	On-Site	On-Site	3/20/1995	152	Rock	89.92	1.52	> 0.46 ags (Flowing Artesian)	89.31 - 89.92	1.26	20.0	Private Domestic
95-2	Not Registered	Not Registered	5426673	459554	On-Site	On-Site	3/19/1995	152	Rock	37.49	2.44	12.19	30.48 – 35.97	0.76	12.0	Not in Use
95-3	62687	-	5426519	459635	On-Site	On-Site	1995	152	Rock	43.59	1.83	13.72	37.80	3.15	50.0	Not in Use
95-5	Not Registered	Not Registered	5426257	459780	On-Site	On-Site	3/26/1995	152	Rock	31.09	0.91	14.02	24.38	0.63	10.0	Not in Use
95-6	Not Registered	Not Registered	5426168	459784	On-Site	On-Site	3/28/1995	152	Rock	55.77	2.74	16.15	44.19 - 49.38	0.32	5.0	Not in Use
TH89-1	62683	-	5426006	459257	On-Site	On-Site	10/25/1989	152	Overburden	30.79	29.40	8.22	10.97 - 21.5	7.57	120.0	Not in Use
TH89-2	62684	-	5426019	459264	On-Site	On-Site	10/26/1989	152	Rock	121.92	21.34	8.53	22.86 - 121.92	15.14	240.0	Not in Use

Groundwater Wells and Aquifers

Well Summary

Well Tag Number: 62686
Well Identification Plate Number:
Owner Name: FLEMING LARSEN
Intended Water Use: Private Domestic
Artesian Condition: Yes

Well Status: New
Well Class: Water Supply
Well Subclass:
Aquifer Number: 320

Observation Well Number:
Observation Well Status:
Environmental Monitoring System (EMS) ID:
Alternative specs submitted: No

Licensing Information

Licensed Status: Unlicensed

Licence Number:

Location Information

Street Address:
Town/City:

Legal Description:

Lot	1
Plan	
District Lot	85
Block	
Section	
Township	
Range	
Land District	16
Property Identification Description (PID)	

Description of Well Location:

Geographic Coordinates - North American Datum of 1983 (NAD 83)
Latitude: 48.993265 **Longitude:** -123.5542
UTM Easting: 459459 **UTM Northing:** 5426855
Zone: 10 **Coordinate Acquisition Code:** (20 m accuracy) Digitized from 1:5,000 mapping

Well Activity

Activity	Work Start Date	Work End Date	Drilling Company	Date Entered
Legacy record	1995-03-20		Red William's Drilling	August 13th 2003 at 4:37 AM

Well Work Dates

Start Date of Construction	End Date of Construction	Start Date of Alteration	End Date of Alteration	Start Date of Decommission	End Date of Decommission
1995-03-20					

Well Completion Data

Total Depth Drilled:
Finished Well Depth: 295 ft bgl
Final Casing Stick Up:
Depth to Bedrock: 5 feet bgl
Ground elevation: 36 feet
Estimated Well Yield: 11 USgpm
Well Cap:
Well Disinfected Status: Not Disinfected
Drilling Method: Other
Method of determining elevation: Unknown
Static Water Level (BTOC): 0 feet btoc
Artesian Flow:
Artesian Pressure (head):
Artesian Pressure (PSI):
Orientation of Well: VERTICAL

Lithology

From (ft bgl)	To (ft bgl)	Raw Data	Description	Moisture	Colour	Hardness	Observations	Water Bearing Flow Estimate (USGPM)
0	5	brown wet gravelly soil						
5	25	grey sandstone						
25	40	shaley sandstone						
40	99	grey sandstone						
99	123	shaley sandstone						
123	127	grey sandstone						
127	139	shaley sandstone						
139	295	grey sandstone						
0	5	brown wet gravelly soil						
5	25	grey sandstone						
25	40	shaley sandstone						
40	99	grey sandstone						
99	123	shaley sandstone						
123	127	grey sandstone						
127	139	shaley sandstone						
139	295	grey sandstone						
0	0	water source 293 - 295 ft						

Casing Details

From (ft bgl)	To (ft bgl)	Casing Type	Casing Material	Diameter (in)	Wall Thickness (in)	Drive Shoe
There are no records to show						

Surface Seal and Backfill Details

Surface Seal Material:
Surface Seal Installation Method:
Surface Seal Thickness:
Surface Seal Depth:
Backfill Material Above Surface Seal:
Backfill Depth:

Liner Details

Liner Material:
Liner Diameter:
Liner from:
Liner Thickness:
Liner to:

Liner perforations

From (ft bgl)	To (ft bgl)
There are no records to show	

Screen Details

Intake Method:
Type:
Material:
Opening:
Bottom:

Installed Screens

From (ft bgl)	To (ft bgl)	Diameter (in)	Assembly Type	Slot Size
There are no records to show				

Well Development

Developed by: **Development Total Duration:**

Well Yield

Estimation Method: **Estimation Rate:** **Estimation Duration:**
Static Water Level Before Test: **Drawdown:**
Hydrofracturing Performed: No **Increase in Yield Due to Hydrofracturing:**

Well Decommission Information

Reason for Decommission: **Method of Decommission:**
Sealant Material: **Backfill Material:**
Decommission Details:

Comments

ARTESIAN. METHOD OF DRILLING = DRILLED

Alternative Specs Submitted: Yes

Documents

- WTN 62686_Well Record.pdf

Disclaimer

The Groundwater Wells and Aquifers application will not work correctly on (Internet Explorer 11).

We recommend Chrome, Firefox or Safari.

Update browser

The Groundwater Wells and Aquifers application will not work correctly on (Internet Explorer 11).

We recommend Chrome, Firefox or Safari.

Update browser

Province of British Columbia — BC Environment — Water Management Division

I-298

WATER WELL RECORD

Date: 95 03 20 (YR MO DY)

NTS MAP ______ WELL No. ______ ELEV ______ Location Accuracy ______

UTM Z ______ E ______ N ______ UTM Date 19 ___ Well Type ______

Owners Name & Address: Flemming Larsen, 15054-91 Ave, Surrey, BC, V3R 1B7

Legal Description & Address: District Lot 85

Descriptive Location: Lot 1

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 ☐ Other ______

3. WATER WELL USE: 1 ☒ Domestic 2 ☐ Municipal 3 ☐ Irrigation 4 ☐ Comm. & Ind. ☐ Other ______

4. DRILLING ADDITIVES ______

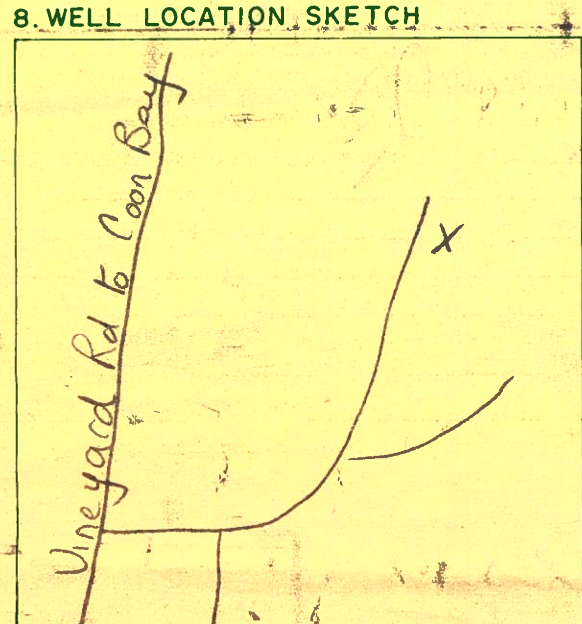
5. MEASUREMENTS from 1 ☒ ground level 2 ☐ top of casing; casing height above ground level 1'6" ft.

6. WELL LOG DESCRIPTION

FROM ft	TO ft	6. WELL LOG DESCRIPTION	SWL ft
0	5	Brown wet gravelly soil	
5	25	Grey sandstone	
25	40	Shaley sandstone	
40	99	Grey sandstone	
99	123	Shaley sandstone	
123	127	Grey sandstone	
127	139	Shaley sandstone	
139	295	Grey sandstone	
		Water source	
		293-295 ft	

7. CONSULTANT ______ Address ______

8. WELL LOCATION SKETCH



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

Hole Diameter						units
Diameter	6		I-297			ins
from	+1'6"					ft
to	18'6"					ft
Thickness	.188					ins
Weight						lb/ft

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

1 ☐ Welded 2 ☐ Cemented 3 ☐ Threaded | 1 ☐ New 2 ☐ Used

Perforations: ______

Shoe(s): No

Open hole, from 18'6" to 295 ft Diameter 6 ins

Grout: ______

10. SCREEN: 1 ☐ Nominal (Telescope) 2 ☐ Pipe Size

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

Material 1 ☐ Stainless Steel 2 ☐ Plastic ☐ Other ______

Set from ______ to ______ ft below ground level

RISER, 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 ☐ Other ______

12. TEST 1 ☐ Pump 2 ☐ Bail 3 ☐ Air Date ______ (YR MO DY)

Rate ______ USgpm Temp ______ °C SWL before test ______ ft

Water Level ______ ft after test of ______ hrs

☐ DRAWDOWN in ft				☐ RECOVERY in ft			
mins	WL	mins	WL	mins	WL	mins	WL

13. | RECOMMENDED PUMP TYPE | RECOMMENDED PUMP SETTING | RECOMMENDED PUMPING RATE |
|---|---|---|
| | ft | USgpm |

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

colour ______ smell ______; gas 1 ☐ yes 2 ☒ no

15. WATER ANALYSIS: 1 Hardness ______ mg/L 2 Iron ______ mg/L 3 Chloride ______ mg/L 4 pH ______

Field Date ______ Lab Date ______ (YR MO DY)

SITE ID No ______

16. FINAL WELL COMPLETION DATA

Well Depth 295 ft Well Yield 20+ US gpm

Static Water Level ______ ft Artesian Flow 5 US gpm Pressure Head ______ ft

Back filled: Rock chip slurry

Well Head Completion ______

17. DRILLER (PLEASE PRINT) SURNAME: NEGGERS FIRST NAME: ANDY

Signature ______

18. CONTRACTOR: RED WILLIAMS WELL DRILLING LTD

Address: 980 PRATT ROAD, QUALICUM BEACH, BC, V9K 1W5

539-5339

Member, BCWWDA ☒ yes ☐ no ; ______

Province of British Columbia — BC Environment — Water Management Division

WATER WELL RECORD

Date 95 03 19 (YR MO DY)

NTS MAP ____ WELL No. ____ ELEV ____ Location Accuracy ____

UTM Z ____ E ____ N ____ UTM Date 19__ Well Type ____

Owners Name & Address: Flemming Larsen, 15054 - 91 Ave, Surrey, BC, V3R 1B7

Legal Description & Address: District Lot 85

Descriptive Location: Lot 2

1. TYPE OF WORK 1 [X] New Well 2 [ ] Reconditioned 3 [ ] Deepened 4 [ ] Abandoned

2. WORK METHOD 1 [ ] Cable tool 2 [ ] Bored 3 [ ] Jetted 4 [X] Rotary a [ ] mud b [X] air c [ ] reverse [ ] Other ____

3. WATER WELL USE 1 [X] Domestic 2 [ ] Municipal 3 [ ] Irrigation 4 [ ] Comm. & Ind. [ ] Other ____

4. DRILLING ADDITIVES

5. MEASUREMENTS from 1 [X] ground level 2 [ ] top of casing

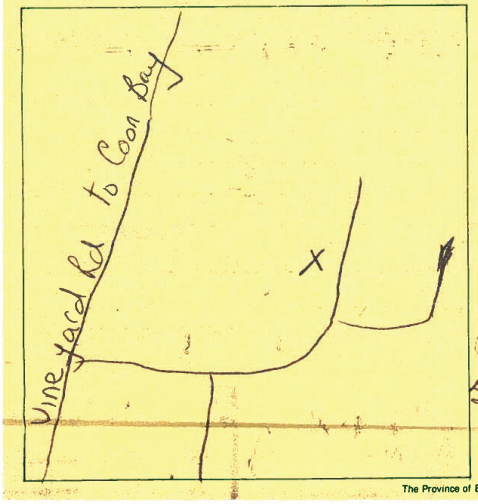
casing height above ground level 1' 6" ft.

FROM ft	TO ft	6. WELL LOG DESCRIPTION	SWL ft
0	8	Brown gravelly soil	
8	62	Grey sandstone.	
62	96	Shaley sandstone.	
96	123	Grey sandstone.	
		Water source.	
		2 gpm @ 100 ft	
		10 gpm @ 118 ft.	
		Total yield 12 gpm.	
		Static 40 ft 1 hour later.	

7. CONSULTANT

Address

8. WELL LOCATION SKETCH



9. CASING: Materials 1 [X] Steel 2 [ ] Galvanized 3 [ ] Wood 4 [ ] Plastic 5 [ ] Concrete [ ] Other ____

							units
Hole Diameter							ins
Diameter	6						ins
from	+1' 6"						ft
to	18' 6"						ft
Thickness	188						ins
Weight							lb/ft

Pitless unit ____ ft 1 [ ] above 2 [ ] below ground level

1 [ ] Welded 2 [ ] Cemented 3 [ ] Threaded | 1 [ ] New 2 [ ] Used

Perforations: ____

Shoe(s): No

Open hole, from 18' 6" to 123 ft Diameter 6 ins

Grout: ____

10. SCREEN: 1 [ ] Nominal (Telescope) 2 [ ] Pipe Size

Type 1 [ ] Continuous Slot 2 [ ] Perforated 3 [ ] Louvre [ ] Other ____

Material 1 [ ] Stainless Steel 2 [ ] Plastic [ ] Other ____

Set from ____ to ____ ft below ground level

RISER, 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 [ ] Other ____

12. TEST 1 [ ] Pump 2 [ ] Bail 3 [ ] Air Date (YR MO DY)

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

Water Level ____ ft after test of ____ hrs

[ ] DRAWDOWN in ft				[ ] RECOVERY in ft			
mins	WL	mins	WL	mins	WL	mins	WL

13.

RECOMMENDED PUMP TYPE	RECOMMENDED PUMP SETTING ft	RECOMMENDED PUMPING RATE USgpm

14. WATER TYPE: 1 [X] fresh 2 [ ] salty 3 [X] clear 4 [ ] cloudy

colour ____ smell ____ ; gas 1 [ ] yes 2 [X] no

15. WATER ANALYSIS: 1 Hardness ____ mg/L 2 Iron ____ mg/L 3 Chloride ____ mg/L 4 pH ____ Field Date ____ Lab Date (YR MO DY)

SITE I D No ____

16. FINAL WELL COMPLETION DATA

Well Depth 123 ft Well Yield 12 US gpm

Static Water Level 40 ft Artesian Flow ____ US gpm Pressure Head ____ ft

Back filled Rock chip slurry

Well Head Completion ____

17. DRILLER PLEASE PRINT SURNAME NEGGERS FIRST NAME ANDY

Signature ____

18. CONTRACTOR,

Address RED WILLIAMS WELL DRILLING LTD
539-5339 980 PRATT ROAD
QUALICUM BEACH, BC, V9K 1W5

Member, BCWWDA [X] yes [ ] no ; ____

BRITISH COLUMBIA Groundwater Wells and Aquifers

Well Summary

Well Tag Number: 62687
Well Identification Plate Number:
Owner Name: FLEMING LARSEN
Intended Water Use: Private Domestic
Artesian Condition: No

Well Status: New
Well Class: Water Supply
Well Subclass:
Aquifer Number: 320

Observation Well Number:
Observation Well Status:
Environmental Monitoring System (EMS) ID:
Alternative specs submitted: No

Licensing Information

Licensed Status: Unlicensed
Licence Number:

Location Information

Street Address:
Town/City:

Legal Description:

Lot	3
Plan	
District Lot	85
Block	
Section	
Township	
Range	
Land District	16
Property Identification Description (PID)	

Description of Well Location:

Geographic Coordinates - North American Datum of 1983 (NAD 83)
Latitude: 48.990964 **Longitude:** -123.551865
UTM Easting: 459628 **UTM Northing:** 5426598
Zone: 10 **Coordinate Acquisition Code:** (20 m accuracy) Digitized from 1:5,000 mapping

Well Activity

Activity	Work Start Date	Work End Date	Drilling Company	Date Entered
Legacy record	1995-01-01		Red William's Drilling	August 13th 2003 at 4:37 AM

Well Work Dates

Start Date of Construction	End Date of Construction	Start Date of Alteration	End Date of Alteration	Start Date of Decommission	End Date of Decommission
1995-01-01					

Well Completion Data

Total Depth Drilled:
Finished Well Depth: 143 ft bgl
Final Casing Stick Up:
Depth to Bedrock: 6 feet bgl
Ground elevation: 39 feet

Estimated Well Yield: 3.2 USgpm
Well Cap:
Well Disinfected Status: Not Disinfected
Drilling Method: Other
Method of determining elevation: Unknown

Static Water Level (BTOC): 25 feet btoc
Artesian Flow:
Artesian Pressure (head):
Artesian Pressure (PSI):
Orientation of Well: VERTICAL

Lithology

From (ft bgl)	To (ft bgl)	Raw Data	Description	Moisture	Colour	Hardness	Observations	Water Bearing Flow Estimate (USGPM)
0	6	brown gravelly soil						
6	18	grey sandstone						
18	38	grey black sandstone						
38	42	black shaley sandstone						
42	120	grey sandstone						
120	126	black sandstone						
126	143	grey sandstone						
0	0	30 gpm at 124 ft						

Casing Details

From (ft bgl)	To (ft bgl)	Casing Type	Casing Material	Diameter (in)	Wall Thickness (in)	Drive Shoe
There are no records to show						

Surface Seal and Backfill Details

Surface Seal Material: Other
Surface Seal Installation Method:
Surface Seal Thickness:
Surface Seal Depth:

Backfill Material Above Surface Seal:
Backfill Depth:

Liner Details

Liner Material:
Liner Diameter:
Liner from:

Liner Thickness:
Liner to:

Liner perforations

From (ft bgl)	To (ft bgl)
There are no records to show	

Screen Details

Intake Method:
Type:
Material: Other
Opening:
Bottom:

Installed Screens

From (ft bgl)	To (ft bgl)	Diameter (in)	Assembly Type	Slot Size
There are no records to show				

Well Development

Developed by:

Development Total Duration:

Well Yield

Estimation Method:
Static Water Level Before Test:
Hydrofracturing Performed: No

Estimation Rate:
Drawdown:
Increase in Yield Due to Hydrofracturing:

Estimation Duration:

Well Decommission Information

Reason for Decommission:
Sealant Material:
Decommission Details:
Method of Decommission:
Backfill Material:

Comments

METHOD OF DRILLING = DRILLED

Alternative Specs Submitted: Yes

Documents

- WTN 62687_Well Record.pdf

Disclaimer

The information provided should not be used as a basis for making financial or any other commitments. The Government of British Columbia accepts no liability for the accuracy, availability, suitability, reliability, usability, completeness or timeliness of the data or graphical depictions rendered from the data.

The Groundwater Wells and Aquifers application will not work correctly on (Internet Explorer 11).

We recommend Chrome, Firefox or Safari.

Update browser

The Groundwater Wells and Aquifers application will not work correctly on (Internet Explorer 11).

We recommend Chrome, Firefox or Safari.

Update browser

Province of British Columbia

BC Environment

Water Management Division

WATER WELL RECORD

Date 95 / MO / DY

NTS MAP ____ WELL No. ____ ELEV ____ Location Accuracy ____

UTM Z ____ E ____ N ____ UTM Date 19__ Well Type ____

Owners Name & Address Flemming Larsen, 15054 - 91 Ave Surrey BC, V3R 1B7

Legal Description & Address District Lot 85

Descriptive Location Lot 3. WELL #3

1. TYPE OF WORK: 1 [X] New Well 2 [ ] Reconditioned 3 [ ] Deepened 4 [ ] Abandoned

2. WORK METHOD: 1 [ ] Cable tool 2 [ ] Bored 3 [ ] Jetted 4 [X] Rotary a [ ] mud b [X] air c [ ] reverse [ ] Other

3. WATER WELL USE: 1 [X] Domestic 2 [ ] Municipal 3 [ ] Irrigation 4 [ ] Comm. & Ind. [ ] Other

4. DRILLING ADDITIVES

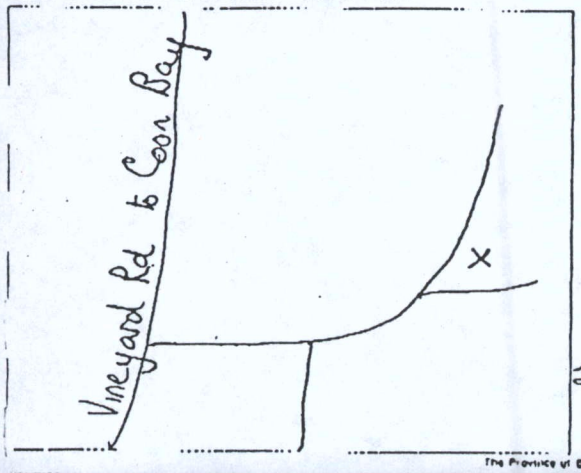
5. MEASUREMENTS from 1 [X] ground level 2 [ ] top of casing; casing height above ground level ____ ft.

FROM ft	TO ft	6. WELL LOG DESCRIPTION	SWL ft
0	6	Brown gravelly soil	
6	18	Grey sandstone	
18	38	Grey black sandstone	
38	42	Black shaley sandstone	
42	120	Grey sandstone	
120	126	Black sandstone	
126	143	Grey sandstone	
		Water Source	
		50 gpm @ 124 ft	

7. CONSULTANT ____

Address ____

8. WELL LOCATION SKETCH



9. CASING: Materials 1 [X] Steel 2 [ ] Galvanized 3 [ ] Wood 4 [ ] Plastic 5 [ ] Concrete [ ] Other

							units
Hole Diameter							ins
Diameter	8						ins
from	+						ft
to	7						ft
Thickness	.188						ins
Weight							lb/ft

Pitless unit ____ ft 1 [ ] above 2 [ ] below ground level

1 [ ] Welded 2 [ ] Cemented 3 [ ] Threaded | 1 [ ] New 2 [ ] Used

Perforations: ____

Shoe(s): No

Open hole, from 7 to 143 ft Diameter ____ ins

Grout: ____

10. SCREEN: 1 [ ] Nominal (Telescope) 2 [ ] Pipe Size

Type 1 [ ] Continuous Slot 2 [ ] Perforated 3 [ ] Louvre [ ] Other

Material 1 [ ] Stainless Steel 2 [ ] Plastic [ ] Other

Set from ____ to ____ ft below ground level

RISER, 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 [ ] Other ____

12. TEST 1 [ ] Pump 2 [ ] Bail 3 [ ] Air Date YR / MO / DY

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

Water Level ____ ft after test of ____ hrs

[ ] DRAWDOWN in ft				[ ] RECOVERY in ft			
mins	WL	mins	WL	mins	WL	mins	WL

13. RECOMMENDED PUMP TYPE ____ RECOMMENDED PUMP SETTING ____ ft RECOMMENDED PUMPING RATE ____ USgpm

14. WATER TYPE: 1 [X] fresh 2 [ ] salty 3 [X] clear 4 [ ] cloudy

colour ____ small. ____; gas 1 [ ] yes 2 [X] no

15. WATER ANALYSIS: 1 Hardness ____ mg/L 2 Iron ____ mg/L 3 Chloride ____ mg/L 4 pH ____ Field Date ____ Lab Date YR / MO / DY

SITE I D No ____

16. FINAL WELL COMPLETION DATA

Well Depth 143 ft Well Yield 5 US gpm

Static Water Level 15 ft Artesian Flow ____ US gpm Pressure Head ____ ft

Back filled Rock chip slurry

Well Head Completion ____

17. DRILLER (PLEASE PRINT) SURNAME NEGGERS FIRST NAME ANDY

Signature ____

18. CONTRACTOR, Address RED WILLIAMS WELL DRILLING LTD 539-5339 980 PRATT RD QUALICUM BEACH, BC, V9K 1W5

Member, BCWWDA [X] yes [ ] no ; ____

JB LABS
827 FORT STREET,
VICTORIA, B.C. V8W 1H6
Tel: (604) 385-6112
Fax: (604) 382-6364

DATE: April 11, 1995

JOB NO: JB 1737
LR NO: 19642

SAMPLING DATE: See Below
SAMPLING AGENT: Client

The sample(s) submitted by the agent have been tested as requested and we report as follows:

CLIENT: Red Williams Well
Drilling Ltd.
980 Pratt Rd.
Qualicum Beach, B.C.
V9K 1W5

SAMPLE: Sample # 1: Well #3, Fleming Larson Apr 6/95
Sample # 2: Well #1 Apr 10/95

WELL #3

		Sample 1	Sample 2
Tot Dissolved Solids	mg/L	228	282
Conductivity	umhos/cm	364	412
pH		7.8	7.9
Alkalinity, Total	mg/L $CaCO_3$	147	199
Total Hardness	mg/L $CaCO_3$	39	28
Calcium	mg/L	6.8	10.0
Magnesium	mg/L	5.3	0.7
Iron	mg/L	0.1	< 0.1
Manganese	mg/L	0.22*	< 0.02
Sodium	mg/L	40.0	91.0
Chloride	mg/L	23	15
Sulphate	mg/L	9	13
Fluoride	mg/L	0.37	0.55
Nitrite	mg/L N	< 0.002	< 0.002
Nitrate	mg/L N	< 0.04	0.05
Total Coliform	CFU/100ml	< 1	10*
Faecal Coliform	CFU/100ml	< 1	< 1
Noncoliform bacteria	CFU/100ml	< 1	8

Thurber Consultants
Attn Bruce Ingimundsen

* Indicates Outside of Guidelines for Canadian Drinking Water Quality and / or the BC Safe Drinking Water Regulation.
< = less than

JB Laboratories Ltd.
water/wastewaters

John E. Evanoff, M.Sc.
Barbara M. Klassen, B.Sc.

Analysis performed according to "A Laboratory Manual for the Chemical Analysis of water, Wastewaters and Biological Tissues", Chemistry Laboratory, Water Resource Service and/or "Standard Methods/Water and Wastewater", American Public Health Association.

TECHNICAL DATA SHEET
WELL #3

1. District Lot: 85
2. Client: FLEMING LARSEN
3. File No: 19-2128-0
4. Well No. 3 (Located by Client)
5. Lot No. 3

6. Water Quality:
   - TDS 228
   - Sp.C. 364
   - Cl 23
   - T.Coli. <1
   - F.Coli. <1
7. Laboratory: J.B. Labs Ltd.

8. Test Pumping:
   - Date tested: Apr. 10,1995
   - Contractor: Red Williams Drilling
   - Pump Rate: 3.5 USgpm
9. Total lots to be served by well: 2
10. Total requirement (@500 lgpd/L): 1000 lgpd 0.84 USgpm
11. Total Well Depth: 44m
12. Non-pumping water level: 7.5 m
13. Depth to primary fracture: 38 m
14. Well elevation: 12 m, above mean sea level
15. Depth to sea level: 12 m
16. 100% available drawdown: 4 m to sea level
17. 70% available drawdown: 3 m to sea level
18. Total recovery expected: yes
19. Estimated well yield: 3800 lgpd 3.2 USgpm
20. Well Location:
    Groundwater Region: Georgia Strait (Mordant, Hodge, 1983)
    - % demand-storage ratio: 0
    - No. of wells within 500m: 4 on D.L. 85 (closest 180m)

21. COMMENTS:
    Observation readings taken on Well #2 (DL 85), 180 m away, with water level decline of 0.25m. Observation readings were taken on Well #5 (DL 85), 300m south, with a recorded drop in water level of 0.23m. In both cases the change in water levels on the observation wells is likely due to tide.

bii/D2

THURBER

JB LABS
827 FORT STREET,
VICTORIA, B.C. V8W 1H6
Tel: (604) 385-6112
Fax: (604) 382-6364

DATE: April 11, 1995

JOB NO: JB 1737
LR NO: 19642

SAMPLING DATE: See Below
SAMPLING AGENT: Client

CLIENT: Red Williams Well
Drilling Ltd.
980 Pratt Rd.
Qualicum Beach, B.C.
V9K 1W5

The sample(s) submitted by the agent have been tested as requested and we report as follows:

SAMPLE: Sample # 1: Well #3, Fleming Larson Apr 6/95
Sample # 2: Well #1 Apr 10/95

		Sample 1	Well #1 Sample 2
Tot Dissolved Solids	mg/L	228	282
Conductivity	umhos/cm	364	412
pH		7.8	7.9
Alkalinity, Total	mg/L $CaCO_3$	147	199
Total Hardness	mg/L $CaCO_3$	39	28
Calcium	mg/L	6.8	10.0
Magnesium	mg/L	5.3	0.7
Iron	mg/L	0.1	< 0.1
Manganese	mg/L	0.22*	< 0.02
Sodium	mg/L	40.0	91.0
Chloride	mg/L	23	15
Sulphate	mg/L	9	13
Fluoride	mg/L	0.37	0.55
Nitrite	mg/L N	< 0.002	< 0.002
Nitrate	mg/L N	< 0.04	0.05
Total Coliform	CFU/100ml	< 1	10*
Faecal Coliform	CFU/100ml	< 1	< 1
Noncoliform bacteria	CFU/100ml	< 1	8

Thurber Consultants
Mr Bruce Ingimundsen

* Indicates Outside of Guidelines for Canadian Drinking Water Quality and / or the BC Safe Drinking Water Regulation.
< = less than

JB Laboratories Ltd.
water/wastewaters

John E. Evanoff, M.Sc.
Barbara M. Klassen, B.Sc.

Analysis performed according to "A Laboratory Manual for the Chemical Analysis of water, Wastewaters and Biological Tissues", Chemistry Laboratory, Water Resource Service and/or "Standard Methods/Water and Wastewater", American Public Health Association.

PUMPING WELL #3

DRAWDOWN DATA

THURBER ENGINEERING LTD.

FILE No.: 19-2128-0

FLEMING LARSEN - D.L. 85; GALIANO ISLAND

START DATE: APRIL 6, 1995

START TIME: 12:00

SWL = 7.520 metres

ELAPSED TIME (min.)	WATER DEPTH (metres)	RATE (USGpm)	DRAWDOWN (metres)	NOTES
0.0	7.520		0.000	
0.5	7.620		-0.100	
1.0	7.640		-0.120	
1.5	7.650		-0.130	
2.0	7.660		-0.140	
2.5	7.670		-0.150	
3.0	7.675		-0.155	
3.5	7.675		-0.155	
4.0	7.670		-0.150	
4.5	7.670		-0.150	
5.0	7.680	3.8	-0.160	
8.0	7.700		-0.180	
9.0	7.740		-0.220	
10	7.720		-0.200	
12	7.730		-0.210	
14	7.740		-0.220	
16	7.760		-0.240	
18	7.764		-0.244	
20	7.778		-0.258	
25	7.800	3.6	-0.280	
30	7.830		-0.310	
35	7.860		-0.340	
40	7.800		-0.280	
45	7.691	3.6	-0.171	
50	7.930		-0.410	
60	7.960	3.6	-0.440	
70	8.010		-0.490	
80	8.050	3.6	-0.530	
90	8.080		-0.560	
100	8.110	3.5	-0.590	
120	8.210		-0.690	
150	8.275		-0.755	
180	8.340		-0.820	
240	8.460		-0.940	
300	8.530	3.5	-1.010	
360	8.540		-1.020	
420	8.540	3.4	-1.020	
480	8.494		-0.974	
540	8.370		-0.850	
600	8.330		-0.810	
660	8.310		-0.790	<-- water sample taken
719	8.300	3.4	-0.780	

THURBER

PUMPING WELL #3
DRAWDOWN CURVE

FLEMING LARSEN
D.L. 85; Galiano Island

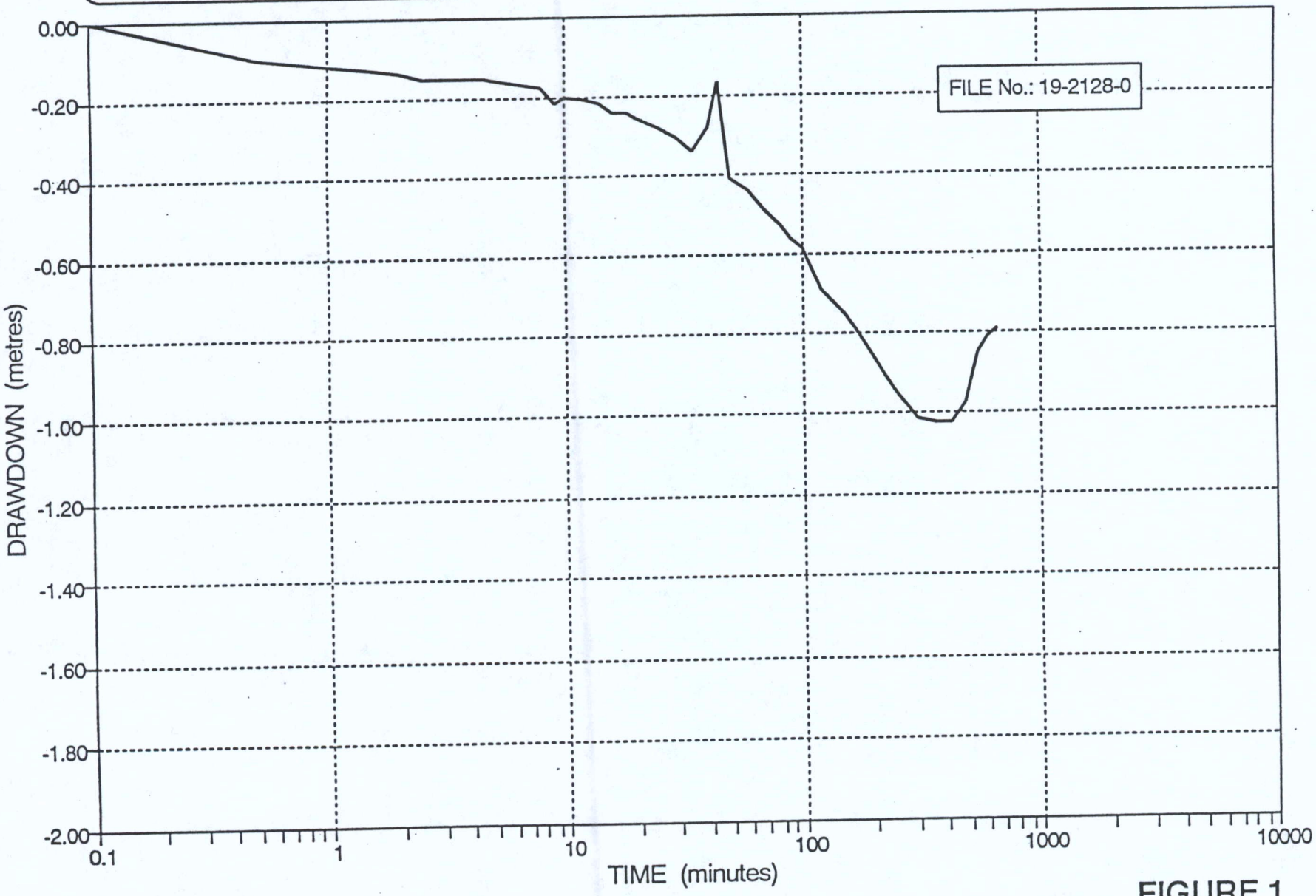


FIGURE 1

THURBER

PUMPING WELL #3
DRAWDOWN CURVE

FLEMING LARSEN
D.L. 85; Galiano Island

FIGURE 2

THURBER

PUMPING WELL #3

RESIDUAL DRAWDOWN

FILE No.: 19-2128-0

THURBER ENGINEERING LTD.

FLEMING LARSEN - D.L. 85; GALIANO ISLAND

START DATE: APRIL 7, 1995
START TIME: 0:00

SWL = 7.520 metres

ELAPSED TIME (Minutes) t @ t' = 720			WATER DEPTH	RATE	RESIDUAL DRAWDOWN	NOTES
t	t'	t/t'	s (metres)	(USGpm)	s' (metres)	
720	0		8.300		-0.780	Last reading pumping
721	0.5	1441	8.270		-0.750	
721	1	721	8.250		-0.730	
722	1.5	481	8.230		-0.710	
722	2	361	8.240		-0.720	
723	2.5	289	8.230		-0.710	
723	3	241	8.224		-0.704	
724	3.5	207	8.220		-0.700	
724	4	181	8.220		-0.700	
725	4.5	161	8.216		-0.696	
725	5	145	8.215		-0.695	
726	6	121	8.200		-0.680	
727	7	104	8.194		-0.674	
728	8	91	8.184		-0.664	
729	9	81	8.190		-0.670	
730	10	73	8.190		-0.670	
732	12	61	8.170		-0.650	
734	14	52	8.164		-0.644	
736	16	46	8.154		-0.634	
738	18	41	8.144		-0.624	
740	20	37	8.140		-0.620	
745	25	30	8.120		-0.600	
750	30	25	8.110		-0.590	
755	35	22	8.100		-0.580	
760	40	19	8.090		-0.570	
765	45	17	8.080		-0.560	
770	50	15	8.070		-0.550	
775	55	14	8.054		-0.534	
780	60	13	8.050		-0.530	
790	70	11	8.040		-0.520	
800	80	10	8.030		-0.510	
810	90	9	8.020		-0.500	
820	100	8	8.020		-0.500	
840	120	7	8.020		-0.500	
870	150	6	8.010		-0.490	
900	180	5	8.010		-0.490	
1020	300	3	7.980		-0.460	

THURBER

PUMPING WELL #3

RESIDUAL DRAWDOWN CURVE

FLEMING LARSEN

D.L. 85; Galiano Island

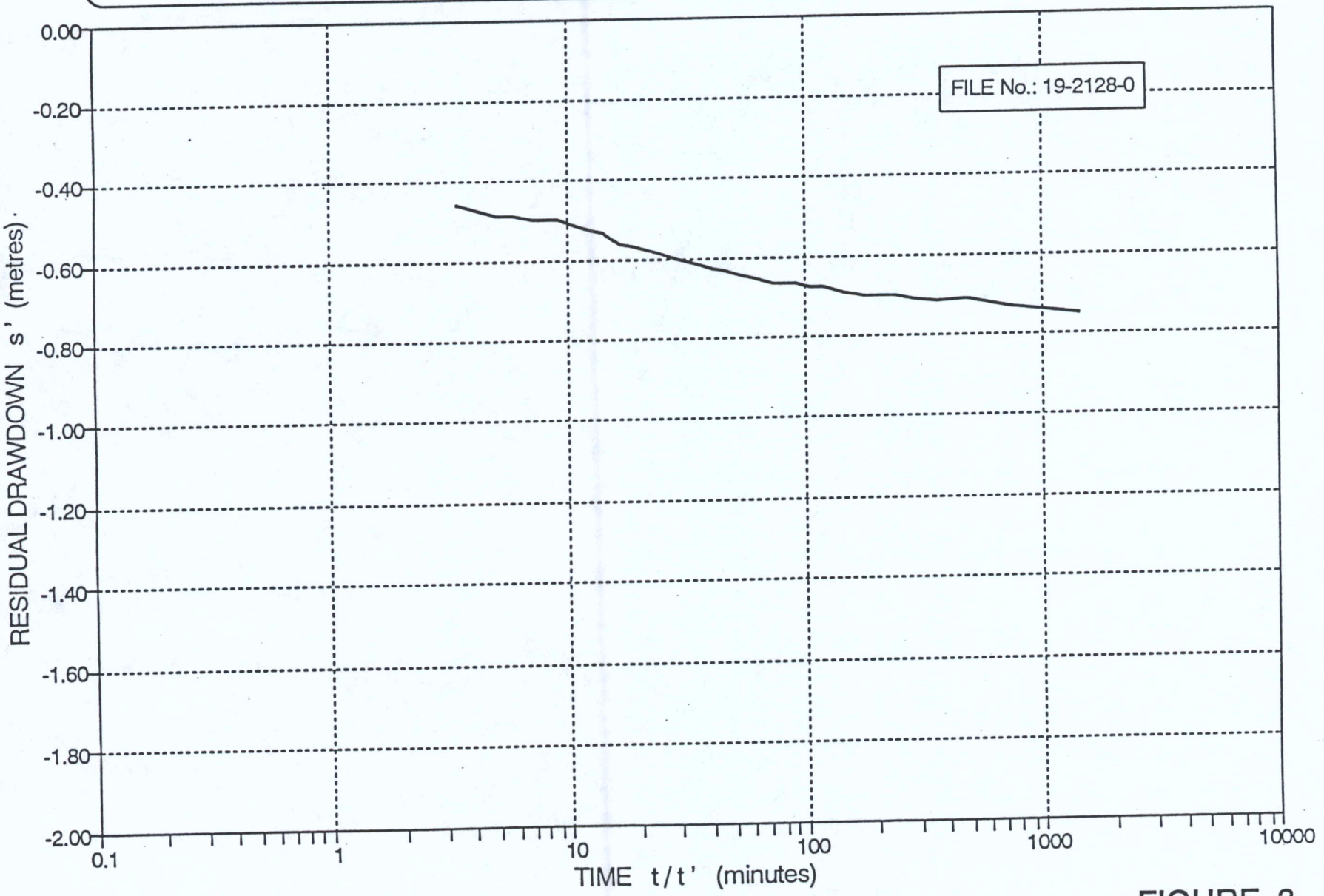
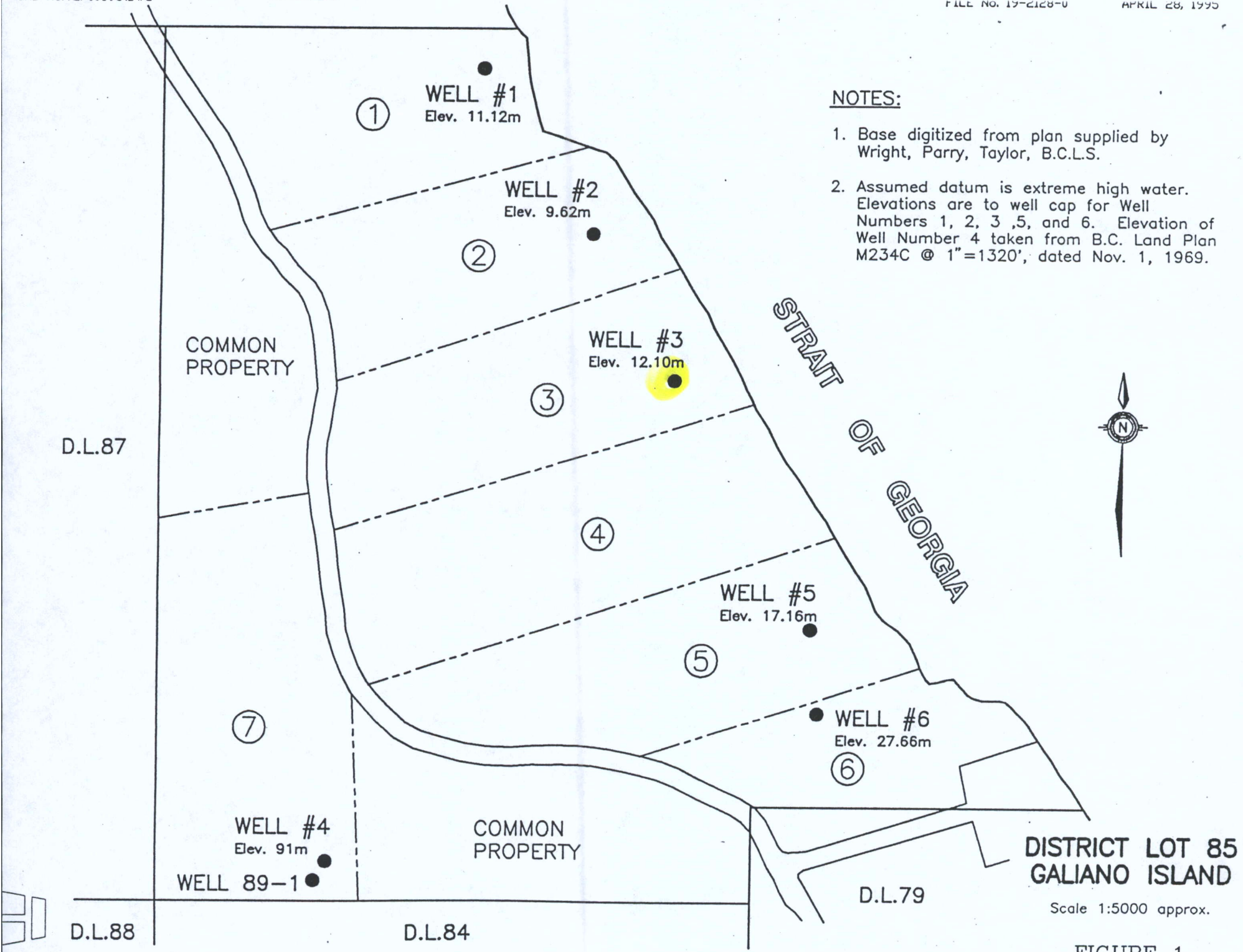


FIGURE 3



NOTES:

1. Base digitized from plan supplied by Wright, Parry, Taylor, B.C.L.S.
2. Assumed datum is extreme high water. Elevations are to well cap for Well Numbers 1, 2, 3 ,5, and 6. Elevation of Well Number 4 taken from B.C. Land Plan M234C @ 1"=1320', dated Nov. 1, 1969.

DISTRICT LOT 85
GALIANO ISLAND

Scale 1:5000 approx.

FIGURE 1

BCGS MAP 092B.053.3.3.4

WTN: 62697

WELL NO. 017

WATER WELL RECORD

MINISTRY OF ENVIRONMENT WATER MANAGEMENT DIVISION VICTORIA, BRITISH COLUMBIA

LEGAL DESCRIPTION: LOT 3 SEC. ____ TP. ____ R. ____ D.L. 85 LAND DISTRICT COWICHAN PLAN ____

DESCRIPTIVE LOCATION Well #3 Galiano Island LICENCE NO. ____ DATE ____

Z ____ WELL NO. ____

____ E

____ N

Z X Y NO.

NAT. TOPO. SHEET NO. ____

OWNER'S NAME FLEMING LARSEN ADDRESS ____

DRILLER'S NAME Red Williams Drilling ADDRESS ____ DATE COMPLETED ____

DEPTH 143' ELEVATION OF 39' ☐ ESTIMATED ☐ SURVEYED CASING DIAM. 6 LENGTH 7'

METHOD OF CONSTRUCTION Air Rotary CASING DIAM ____ LENGTH ____

SCREEN LOCATION ____ SCREEN ☐ SIZE ____ LENGTH ____ TYPE ____

SANITARY SEAL YES ☐ NO ☐ SCREEN ☐ SIZE ____ LENGTH ____ TYPE ____

PERFORATED CASING ☐ LENGTH ____ PERFORATIONS FROM ____ TO ____

GRAVEL PACK ☐ LENGTH ____ DIAM. ____ SIZE GRAVEL, ETC. ____

DISTANCE TO WATER 25' ☐ ESTIMATED WATER LEVEL

FROM ____ ☐ MEASURED ELEVATION ____ ARTESIAN PRESSURE ____

DATE OF WATER LEVEL MEASUREMENT ____ WATER USE ____

PRODUCTION TEST SUMMARY

DATE ____

TEST BY ____

BAIL TEST ☐ PUMP TEST ☐ DURATION OF TEST ____

RATE ____ DRAWDOWN ____

WATER LEVEL AT COMPLETION OF TEST ____

AVAILABLE DRAWDOWN ____ SPECIFIC CAPACITY ____

PERMEABILITY ____ STORAGE COEFF. ____

TRANSMISSIVITY ____

ESTIMATED WELL YIELD 3.2 US GPM

RECOMMENDED PUMPING RATE ____

RECOMMENDED PUMP SETTING ____

CHEMISTRY

TEST BY JB Laboratories DATE April 95

TOTAL DISSOLVED SOLIDS ____ mg/l TEMPERATURE ____ °C pH ____ SILICA (SiO_2) ____ mg/l

CONDUCTANCE ____ μmhos/cm AT 25°C TOTAL IRON (Fe) ____ mg/l TOTAL HARDNESS ($CaCO_3$) ____ mg/l

TOTAL ALKALINITY ($CaCO_3$) ____ mg/l PHEN. ALKALINITY ($CaCO_3$) ____ mg/l MANGANESE (Mn) ____ mg/l

COLOUR ____ ODOUR ____ TURBIDITY ____

ANIONS	mg/l	epm	CATIONS	mg/l	epm
CARBONATE (CO_3)			CALCIUM (Ca)		
BICARBONATE (HCO_3)			MAGNESIUM (Mg)		
SULPHATE (SO_4)			SODIUM (Na)		
CHLORIDE (Cl)			POTASSIUM (K)		
$NO_2 + NO_3$ (NITROGEN)			IRON (DISSOLVED)		
* TKN. (NITROGEN)					
PHOSPHORUS (P)					

* TKN = TOTAL KJELDAHL NITROGEN CHEMISTRY SITE NO. ____

NO_2 = NITRITE NO_3 = NITRATE

CHEMISTRY FIELD TESTS

TEST BY ____ DATE ____ EQUIPMENT USED ____

LITHOLOGY

FROM	TO	DESCRIPTION

CONTENTS OF FOLDER

☐ DRILL LOG ☐ PUMP TEST DATA ☐ CHEMICAL ANALYSIS

☐ SIEVE ANALYSIS ☐ GEOPHYSICAL LOGS ☐ REPORT

OTHER ____

SOURCES OF INFORMATION Thurber Report; DL 85 Galiano Island

Well Tag # 62697

NORTH

WEST

EAST

SOUTH

CARD BY _____ DATE _____

ADDITIONAL DATA ADDED BY _____

REMARKS

ENV 1995

16290

Province of British Columbia — BC Environment — Water Management Division

I 294

WATER WELL RECORD

Date 95 03 26 (YR MO DY)

NTS MAP ____ WELL No. ____ ELEV ____ Location Accuracy ____

UTM Z ____ E ____ N ____ UTM Date 19__ Well Type ____

Owners Name & Address: Flemmingharsen, 15054 - 91 Ave Surrey, BC, V3R 1B7

Legal Description & Address: District Lot 85

Descriptive Location: Lot 4

1. TYPE OF WORK 1 [X] New Well 2 [ ] Reconditioned 3 [ ] Deepened 4 [ ] Abandoned

2. WORK METHOD 1 [ ] Cable tool 2 [ ] Bored 3 [ ] Jetted 4 [X] Rotary a [ ] mud b [X] air c [ ] reverse [ ] Other ____

3. WATER WELL USE 1 [X] Domestic 2 [ ] Municipal 3 [ ] Irrigation 4 [ ] Comm. & Ind. [ ] Other ____

4. DRILLING ADDITIVES ____

5. MEASUREMENTS from 1 [X] ground level 2 [ ] top of casing

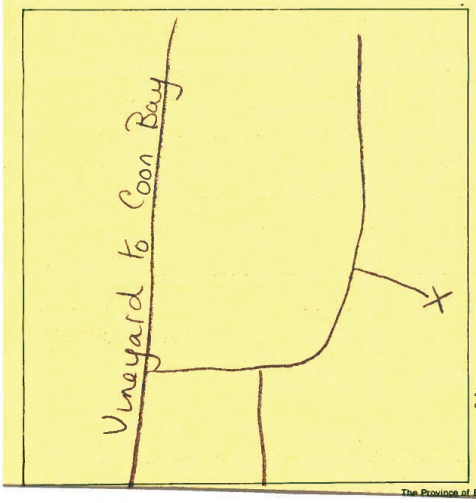
casing height above ground level ____ 1 ____ ft.

FROM ft	TO ft	6. WELL LOG DESCRIPTION	SWL ft
0	3	Brown gravelly Soil	
3	37	Grey Sandstone	
37	58	Shaley sandstone	
58	80	Grey Sandstone	
80	102	Shaley sandstone	
		Water source.	
		10 gpm @ 80 ft	
		~~NOTE: NEEDS LINER~~	
		1 100 ft" PVC Liner installed	
		Static level 46" - ½ hr.	

7. CONSULTANT ____

Address ____

8. WELL LOCATION SKETCH



9. CASING: Materials 1 [X] Steel 2 [ ] Galvanized 3 [ ] Wood 4 [ ] Plastic 5 [ ] Concrete [ ] Other ____

							units
Hole Diameter							ins
Diameter	6						ins
from	+1						ft
to	9'6"						ft
Thickness	.188						ins
Weight							lb/ft

Pitless unit ____ ft 1 [ ] above 2 [ ] below ground level

1 [ ] Welded 2 [ ] Cemented 3 [ ] Threaded | 1 [ ] New 2 [ ] Used

Perforations: ____

Shoe(s): No

Open hole, from 9'6" to 102 ft Diameter 6 ins

Grout: ____

10. SCREEN: 1 [ ] Nominal (Telescope) 2 [ ] Pipe Size

Type 1 [ ] Continuous Slot 2 [ ] Perforated 3 [ ] Louvre [ ] Other ____

Material 1 [ ] Stainless Steel 2 [ ] Plastic [ ] Other ____

Set from ____ to ____ ft below ground level

RISER, 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 [ ] Other ____

12. TEST 1 [ ] Pump 2 [ ] Bail 3 [ ] Air Date (YR MO DY)

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

Water Level ____ ft after test of ____ hrs

[ ] DRAWDOWN in ft				[ ] RECOVERY in ft			
mins	WL	mins	WL	mins	WL	mins	WL

13.

RECOMMENDED PUMP TYPE	RECOMMENDED PUMP SETTING ft	RECOMMENDED PUMPING RATE USgpm

14. WATER TYPE: 1 [X] fresh 2 [ ] salty 3 [X] clear 4 [ ] cloudy

colour ____ smell ____ ; gas 1 [ ] yes 2 [X] no

15. WATER ANALYSIS: 1 Hardness ____ mg/L 2 Iron ____ mg/L 3 Chloride ____ mg/L 4 pH ____ Field Date ____ Lab Date (YR MO DY) ____

SITE I D No ____

16. FINAL WELL COMPLETION DATA

Well Depth 102 ft Well Yield 10 US gpm

Static Water Level 46 ft Artesian Flow ____ US gpm Pressure Head ____ ft

Back filled Rock chip slurry

Well Head Completion ____

17. DRILLER PLEASE PRINT SURNAME NEGGERS FIRST NAME ANDY

Signature ____

18. CONTRACTOR

Address RED WILLIAMS WELL DRILLING LTD

539-5339 980 PRATT ROAD

QUALICUM BEACH, BC, V9K 1W5

Member, BCWWDA [X] yes [ ] no ; ____

The Province of British Columbia accepts no responsibility for the contents or accuracy of this record.

Province of British Columbia — BC Environment — Water Management Division

WATER WELL RECORD

1245

Date 95 10 31 28 (YR MO DY)

NTS MAP ____ WELL No. ____ ELEV ____ Location Accuracy ____

UTM Z ____ E ____ N ____ UTM Date 19__ Well Type ____

Owners Name & Address: Flemming Larsen, 15054 - 91 AVE SURREY BC, V3R 1B7

Legal Description & Address: District Lot 85

Descriptive Location: Lot 6

1. TYPE OF WORK 1 [X] New Well 2 [ ] Reconditioned 3 [ ] Deepened 4 [ ] Abandoned

2. WORK METHOD 1 [ ] Cable tool 2 [ ] Bored 3 [ ] Jetted 4 [X] Rotary a [ ] mud b [X] air c [ ] reverse [ ] Other ____

3. WATER WELL USE 1 [X] Domestic 2 [ ] Municipal 3 [ ] Irrigation 4 [ ] Comm. & Ind. [ ] Other ____

4. DRILLING ADDITIVES ____

5. MEASUREMENTS from 1 [X] ground level 2 [ ] top of casing

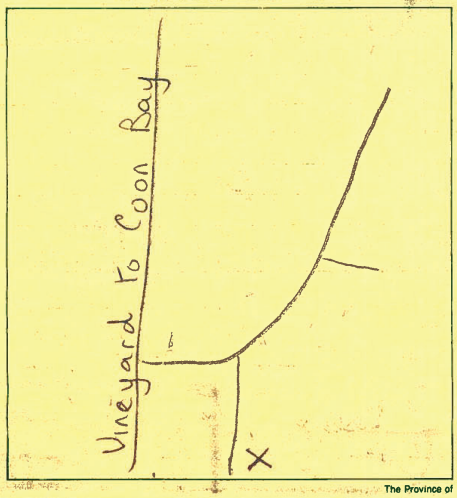
casing height above ground level ____ 1 ____ ft.

FROM ft	TO ft	6. WELL LOG DESCRIPTION	SWL ft
0	7	Brown saturated silty gravel	
7	9	Grey till, faulty sandstone	
9	20	Sandstone	
20	54	Shaley sandstone	
54	138	Grey sandstone	
138	150	Black shale	
150	174	Grey sandstone	
174	183	Grey shale.	
		Water source.	
		3 gpm @ 145 ft.	
		2 gpm @ 162 ft	
		Total yeild 5 gpm.	
		Static 53 ft 1 hr.	

7. CONSULTANT ____

Address ____

8. WELL LOCATION SKETCH



9. CASING: Materials 1 [X] Steel 2 [ ] Galvanized 3 [ ] Wood 4 [ ] Plastic 5 [ ] Concrete [ ] Other ____

								units
Hole Diameter								ins
Diameter	6							ins
from	+1							ft
to	11							ft
Thickness								ins
Weight								lb/ft

Pitless unit ____ ft 1 [ ] above 2 [ ] below ground level

1 [ ] Welded 2 [ ] Cemented 3 [ ] Threaded | 1 [ ] New 2 [ ] Used

Perforations: ____

Shoe(s): No

Open hole, from 11 to 183 ft Diameter 6 ins

Grout: ____

10. SCREEN: 1 [ ] Nominal (Telescope) 2 [ ] Pipe Size

Type 1 [ ] Continuous Slot 2 [ ] Perforated 3 [ ] Louvre [ ] Other ____

Material 1 [ ] Stainless Steel 2 [ ] Plastic [ ] Other ____

Set from ____ to ____ ft below ground level

RISER, 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 [ ] Other ____

12. TEST 1 [ ] Pump 2 [ ] Bail 3 [ ] Air Date (YR MO DY) ____

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

Water Level ____ ft after test of ____ hrs

[ ] DRAWDOWN in ft				[ ] RECOVERY in ft			
mins	WL	mins	WL	mins	WL	mins	WL

13.

RECOMMENDED PUMP TYPE	RECOMMENDED PUMP SETTING ft	RECOMMENDED PUMPING RATE USgpm

14. WATER TYPE: 1 [X] fresh 2 [ ] salty 3 [X] clear 4 [ ] cloudy

colour ____ smell ____ ; gas 1 [ ] yes 2 [X] no

15. WATER ANALYSIS: 1 Hardness ____ mg/L 2 Iron ____ mg/L 3 Chloride ____ mg/L 4 pH ____ Field Date ____ Lab Date (YR MO DY) ____

SITE I D No. ____

16. FINAL WELL COMPLETION DATA

Well Depth 183 ft Well Yield 5 US gpm

Static Water Level 53 ft Artesian Flow ____ US gpm Pressure Head ____ ft

Back filled ROCK CHIP SLURRY

Well Head Completion ____

17. DRILLER PLEASE PRINT SURNAME NEGGERS FIRST NAME ANDY

Signature ____

18. CONTRACTOR,

Address RED WILLIAMS WELL DRILLING LTD
980 PRATT ROAD
QUALICUM BEACH, BC, V9K 1W5

539-5339

Member, BCWWDA [X] yes [ ] no ; ____

BRITISH COLUMBIA Groundwater Wells and Aquifers

Well Summary

Well Tag Number: 62683
Well Identification Plate Number:
Owner Name: MACMILLAN BLOEDEL LT
Intended Water Use: Private Domestic
Artesian Condition: No

Well Status: New
Well Class: Water Supply
Well Subclass:
Aquifer Number: 320

Observation Well Number:
Observation Well Status:
Environmental Monitoring System (EMS) ID:
Alternative specs submitted: No

Licensing Information

Licensed Status: Unlicensed
Licence Number:

Location Information

Street Address:
Town/City:

Legal Description:

Lot	
Plan	
District Lot	85
Block	
Section	
Township	
Range	
Land District	16
Property Identification Description (PID)	

Description of Well Location:

Geographic Coordinates - North American Datum of 1983 (NAD 83)
Latitude: 48.98502 **Longitude:** -123.55739
UTM Easting: 459219 **UTM Northing:** 5425940
Zone: 10 **Coordinate Acquisition Code:** (20 m accuracy) Digitized from 1:5,000 mapping

Well Activity

Activity	Work Start Date	Work End Date	Drilling Company	Date Entered
Legacy record	1989-10-25	1989-10-25	Drillwell Enterprises	August 13th 2003 at 4:37 AM

Well Work Dates

Start Date of Construction	End Date of Construction	Start Date of Alteration	End Date of Alteration	Start Date of Decommission	End Date of Decommission
1989-10-25	1989-10-25				

Well Completion Data

Total Depth Drilled:
Finished Well Depth: 101 ft bgl
Final Casing Stick Up:
Depth to Bedrock: 96 feet bgl
Ground elevation:
Estimated Well Yield: 120 USgpm
Well Cap:
Well Disinfected Status: Not Disinfected
Drilling Method: Other
Method of determining elevation: Unknown
Static Water Level (BTOC): 27 feet btoc
Artesian Flow:
Artesian Pressure (head):
Artesian Pressure (PSI):
Orientation of Well: VERTICAL

Lithology

From (ft bgl)	To (ft bgl)	Raw Data	Description	Moisture	Colour	Hardness	Observations	Water Bearing Flow Estimate (USGPM)
0	6	brown sandy gravel						
6	18	brown gravel, some sand						
18	48	brown to blue sandy gravel						
48	76	blue sand and sandy gravel						
76	82	blue silty, sandy gravel (shells)						
82	85	blue, sandy, silty clay						
85	96	blue to grey sandy clayey gravel (till?)						
96	100	loose, infilled, weathered sandstone						
100	101	grey sandstone						

Casing Details

From (ft bgl)	To (ft bgl)	Casing Type	Casing Material	Diameter (in)	Wall Thickness (in)	Drive Shoe
There are no records to show						

Surface Seal and Backfill Details

Surface Seal Material:
Surface Seal Installation Method:
Surface Seal Thickness:
Surface Seal Depth:
Backfill Material Above Surface Seal:
Backfill Depth:

Liner Details

Liner Material:
Liner Diameter:
Liner from:
Liner Thickness:
Liner to:

Liner perforations

From (ft bgl)	To (ft bgl)
There are no records to show	

Screen Details

Intake Method:
Type:
Material:
Opening:
Bottom:

Installed Screens

From (ft bgl)	To (ft bgl)	Diameter (in)	Assembly Type	Slot Size
There are no records to show				

Well Development

Developed by:
Development Total Duration:

Well Yield

Estimation Method:
Static Water Level Before Test:
Hydrofracturing Performed: No
Estimation Rate:
Drawdown:
Increase in Yield Due to Hydrofracturing:
Estimation Duration:

Well Decommission Information

Reason for Decommission:
Sealant Material:
Decommission Details:
Method of Decommission:
Backfill Material:

Comments

METHOD OF DRILLING = DRILLED

Alternative Specs Submitted: Yes

Documents

- WTN 62683_Well Record.pdf

Disclaimer

The information provided should not be used as a basis for making financial or any other commitments. The Government of British Columbia accepts no liability for the accuracy, availability, suitability, reliability, usability, completeness or timeliness of the data or graphical depictions rendered from the data.

The Groundwater Wells and Aquifers application will not work correctly on (Internet Explorer 11).

We recommend Chrome, Firefox or Safari.

Update browser

The Groundwater Wells and Aquifers application will not work correctly on (Internet Explorer 11).

We recommend Chrome, Firefox or Safari.

Update browser

JB Laboratories Ltd.
water/wastewaters

827 FORT STREET,
VICTORIA, B.C. V8W 1H6
TEL: (604) 385-6112
FAX: (604) 383-8099

B11

DATE: November 2, 1989

JOB NO.: JB 1433
LR NO.: 10703

SAMPLING DATE: Oct 31/89

SAMPLING AGENT: Client

The sample[s] submitted by the agent have been tested as requested and we report as follows:

Client: Thurber Consultants Ltd.
210 - 4475 Viewmont Avenue
Victoria, B. C.
V8Z 6L8

Sample: Galiano Island
Test Well TH89-1
19-438-13

Total Dissolved Solids	mg/L	85
Conductivity	umhos/cm	101
pH		6.9
Alkalinity	mg/L $CaCO_3$	33.3
Hardness, Total	mg/L $CaCO_3$	39.3
Calcium	mg/L	8.5
Magnesium	mg/L	4.4
Iron	mg/L	0.2
Manganese	mg/L	0.06*
Sodium	mg/L	4.4
Chloride	mg/L	8
Sulphate	mg/L	10
Fluoride	mg/L	0.14
Nitrite	mg/L N	0.003
Nitrate	mg/L N	0.06
Total Coliform	CFU/100mL	L 1

L = less than

* B.C. Recommended Drinking Water Guidelines: Manganese 0.05 mg/L

John E. Evanoff, M.Sc. **Barbara M. Klassen**, B.Sc., C.Tech.

Analysis performed according to "A Laboratory Manual for the Chemical Analysis of Water, Wastewaters and Biological Tissues", Chemistry Laboratory, Water Resource Service and/or "Standard Methods / Water and Wastewater", American Public Health Association.

JB LABORATORIES

CANTEST

CanTest Ltd

Professional
Analytical
Services

Suite 200
1523 West 3rd Ave
Vancouver, BC
V6J 1J8

Fax: 604 731 2386

Tel: 604 734 7276

REPORT ON: Analysis of Water Samples

REPORTED TO: Thurber Consultants Ltd.
#210 - 4475 Viewmont Ave.
Victoria, B.C.
V8Z 6L8

ATTENTION: Dave Myles

FILE NO: 9301H

DATE: November 16, 1989

We have tested the sample submitted by you and report as follows:

SAMPLE IDENTIFICATION:

The sample was identified as:

PROJECT NAME:	19-438-13 TH-89-1
DATE SAMPLED:	October 31, 1989
DATE SUBMITTED:	November 2, 1989
TYPE OF CONTAINER:	Plastic

for further identification, see "Results of Testing".

SUMMARY:

For the chemical parameters tested, the sample did not meet the limits set by the "British Columbia Drinking Water Quality Standards, 1982", Province of B.C., Ministry of Health and "Guidelines for Canadian Drinking Water Quality, 1978", published by authority of Health and Welfare Canada, as indicated in the "Results of Testing".

Parameters are limited for health or aesthetic reasons. The parameter that did not meet the limit was manganese, which is limited primarily for aesthetic considerations.

The water represented by the sample submitted may be characterized as high in dissolved mineralization and hard with respect to hardness.

For the bacteriological parameters tested, the sample met the limits.

RESULTS OF TESTING

(on the following page)

CAN TEST LTD.

Don M. Enns, B.Sc., M.B.A.
Assistant Manager

DME/tt
C:WATER

CANTEST

Thurber Consultants Ltd.
File No: 9301H

SAMPLE IDENTIFICATION AND RESULTS OF TESTING:

SAMPLE #		9301	MAXIMUM
CLIENT SAMPLE I.D.		Galiano Island Pump Test WELL #89-1 12HR Sample	ACCEPTABLE CONC.***
PHYSICAL TESTS			
pH (pH units)		7.56	6.5-8.5
Conductivity (us/cm)		115	-
True Color (CU)		<5	15.
Turbidity (NTU)		1.2	5.
Hardness as CaCO3		48.0	-
Total Dissolved Solids (mg/L)		109	500.*
DISSOLVED ANIONS (mg/L)			
Alkalinity:			
Bicarbonate	HC03	43.5	-
Carbonate	C03	NIL	-
Hydroxide	OH	NIL	-
Chloride	Cl	7.05	250.
Sulfates	SO4	13.5	500.
Nitrates/Nitrites	N	<0.05	10.**
Fluorides	F	<0.05	1.5
DISSOLVED METALS (mg/L)			
Calcium	Ca	10.2	-
Magnesium	Mg	5.31	-
Sodium	Na	5.21	-
Potassium	K	0.20	-
Iron	Fe	0.057	0.30
Manganese	Mn	0.067 X	0.05
Silica	Si02	24.0	-
TOTAL METALS (mg/L)			
Magnesium	Mg	5.12	-
Iron	Fe	0.13	0.30
Manganese	Mn	0.063 X	0.05
COLIFORM BACTERIA (Colonies/100 mL*R)			
Total (Confirmed)		<1	-
Fecal		<1	Not detected

* = filtered a 0.45 micron membrane
** = total nitrate and nitrite nitrogen
*** = maximum acceptable concentration as set by "B.C. Drinking Water Quality Standards, 1982" and "Guidelines for Canadian Drinking Water Quality, 1978"
< = less than; mg/L = milligrams per litre
*R = remarks
X = Exceeded the "Guidelines"

REMARKS:

When evaluating coliform results, the following excerpts from the "Guidelines for Canadian Drinking Water Quality, 1978", published by the authority of Health and Welfare, Canada should be noted:
Page 24-25 "It should be emphasized that no bacteriological analysis of water can take the place of a complete knowledge of the conditions at the sources of supply and throughout the distribution system. Contamination is often intermittent and may not be revealed by the examination of a single sample. The most a bacteriological report can prove is that, at the time of examination, bacteria indicating fecal pollution did or did not grow under laboratory conditions from a sample of water."
Page 26 "Since the presence of any type of coliform organism in treated water suggest either inadequate treatment or contamination, the objective level for total coliforms should be no organisms detectable per 100mL; however, in practice this level is not always attainable."
Page 27 "If any coliform organisms are detected, the site should be resampled, and if the presence of coliforms is confirmed, action taken to determine the cause. If the maximum acceptable level is exceeded, the local control agency or Medical Officer of Health should be contacted for the appropriate corrective action. The most common immediate actions include increasing the chlorine dosage, flushing the water mains, using an alternative source of water and advising consumers to boil drinking water."

The "B.C. Drinking Water Quality Standards, 1982" published by Province of British Columbia, Ministry of Health further state that:
Page 3 "If any raw water sample contains fecal coliforms or if more than five percent of the samples in any consecutive 30 day period have a total coliform density greater than 10 per 100mL, disinfection is required.

METHOD OF TESTING:
The analyses were carried out in accordance with procedures described in "Laboratory Manual for the Chemical Analysis of Water, Wastewater, Sediments and Biological Materials (2nd Edition)" published by the Government of B.C., Ministry of Environment, Water Resources Services, 1976 and "Standard Methods for the Examination of Water and Wastewater" 15th Edition, 1980, published by the American Public Health Association.

The metals were determined using Inductively Coupled Plasma Spectrographic analysis, direct or graphite furnace atomic absorption spectrophotometry.

FILE: 19 - 48:

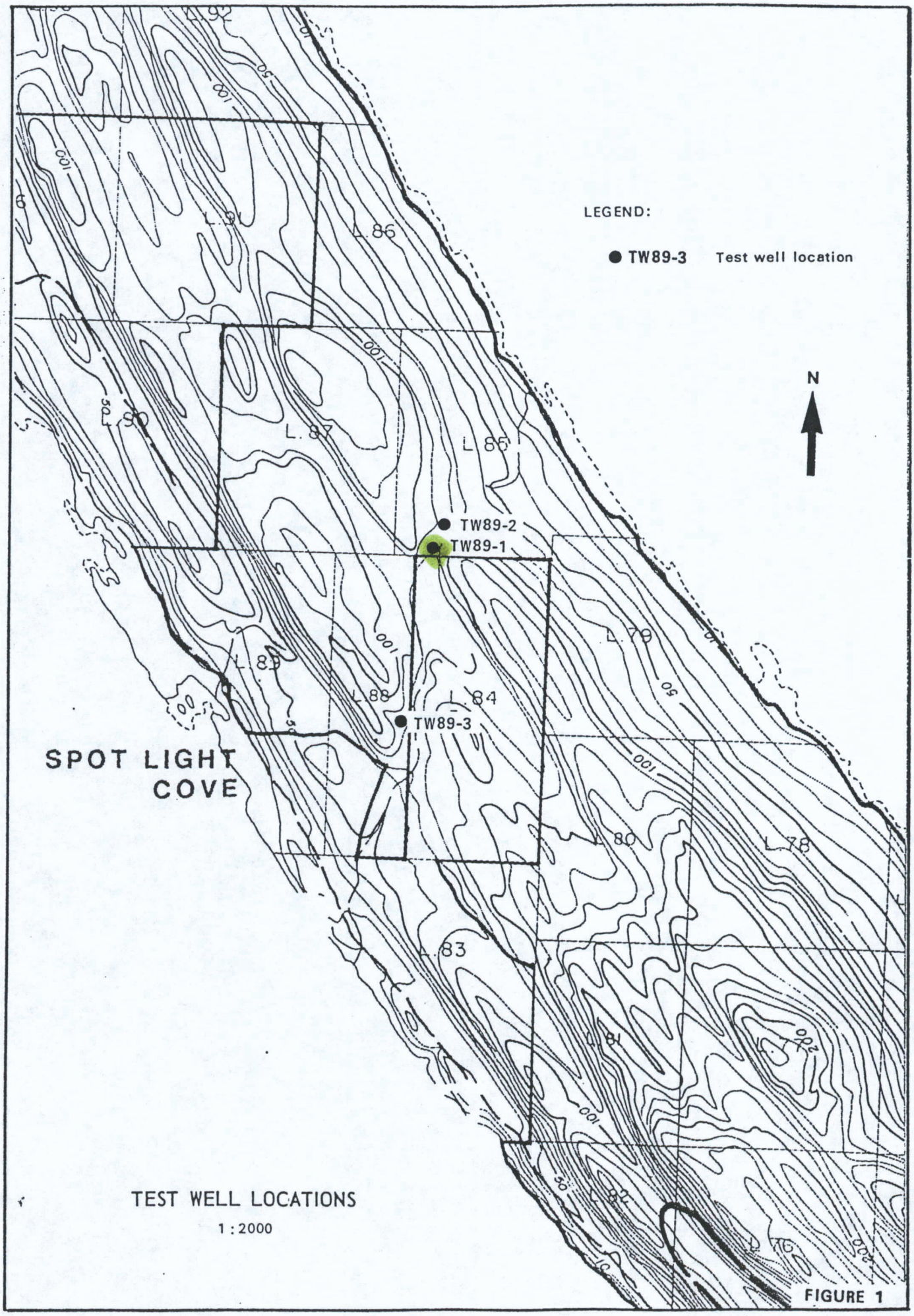


FIGURE 1

THURBER CONSULTANTS LTD.
Geotechnical Engineers

Sheet 1 of 2

TEST HOLE Nº TW89-1

LOG OF TEST WELL

LOCATION Lot 85, Galiano Island, BC

CLIENT Intrawest Properties Ltd.
PROJECT McMillan Bloedel Ltd. Galiano Is. Groundwater Study
DATE October 18-26, 1989
METHOD Air Rotary
DRILLING Co Drillwell Enterprises Ltd.
INSPECTOR D. Myles

ELEVATION (METRES)

REMARKS
CAP LOCKED

STICK-UP
0.9 m agl

LOG

DEPTH (METRES)

150 mm
STEEL CASING

Static
Water level
Oct. 26/90

water
bearing below
10.97 m bgl

Brown sandy GRAVEL — 2

Brown GRAVEL,
some sand — 4

6

8

Brown to blue sandy
GRAVEL — 10

12

14

16

Blue SAND and
sandy GRAVEL

18

20

SCALE: 1:100

FILE Nº 19-483-13

THURBER CONSULTANTS LTD.
Geotechnical Engineers

Sheet 2 of 2

TEST HOLE Nº TW89-1

LOG OF TEST WELL

LOCATION Lot 85, Galiano Island, BC

CLIENT Intrawest Properties Ltd.

PROJECT McMillan Bloedel Ltd. Galiano Is. Groundwater Study

DATE October 18-26, 1989

METHOD Air Rotary

DRILLING Co Drillwell Enterprises Ltd.

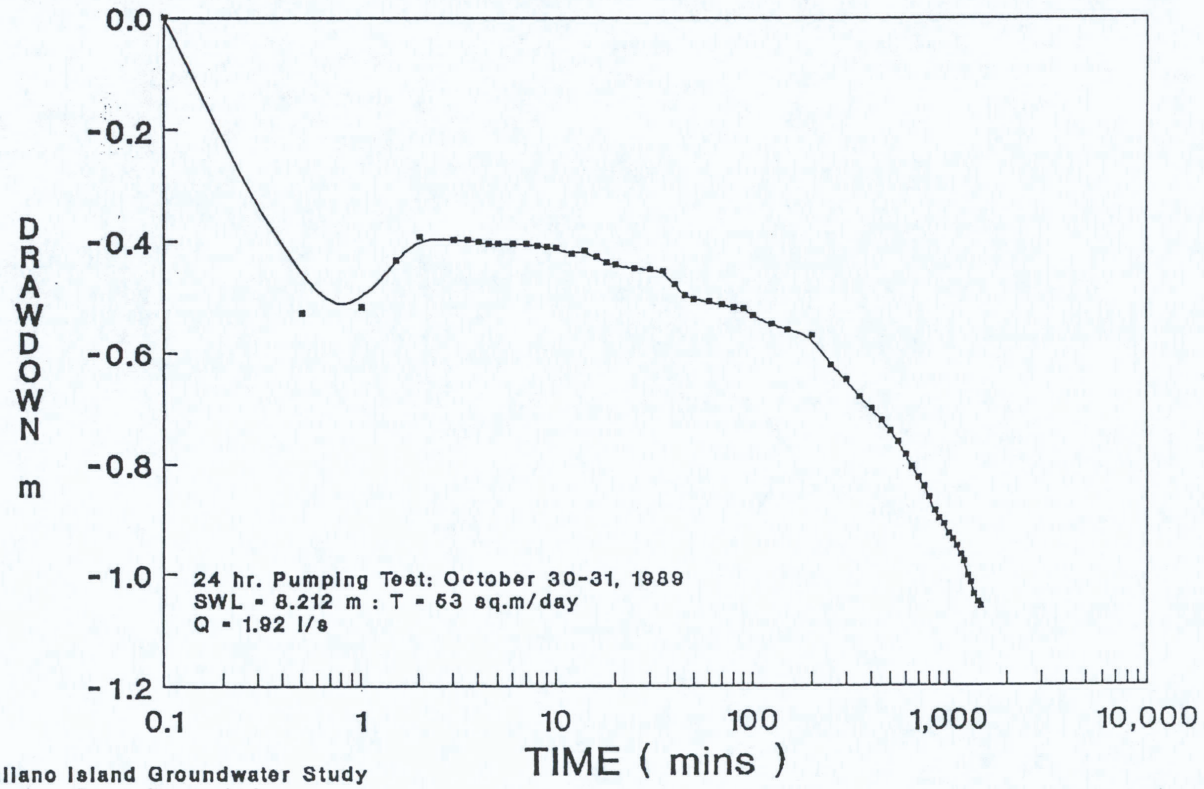
INSPECTOR D. Myles

ELEVATION (METRES)	REMARKS	LOG	DEPTH (METRES)
	Fig. K Packer 150 mm S.S. well screen #150 slot		
	Bottom of well @ 21.50 m		
		Blue SAND and sandy GRAVEL	22
		Blue SILT, SANDY GRAVEL (shells)	24
		Blue, sandy, silty CLAY	26
		Blue to grey sandy clayey GRAVEL (TILL?)	28
		Loose, infilled, weathered SANDSTONE, bedrock	30
		Grey SANDSTONE	
	End of DRILL HOLE @ 30.79 m bgl		

SCALE: 1:100

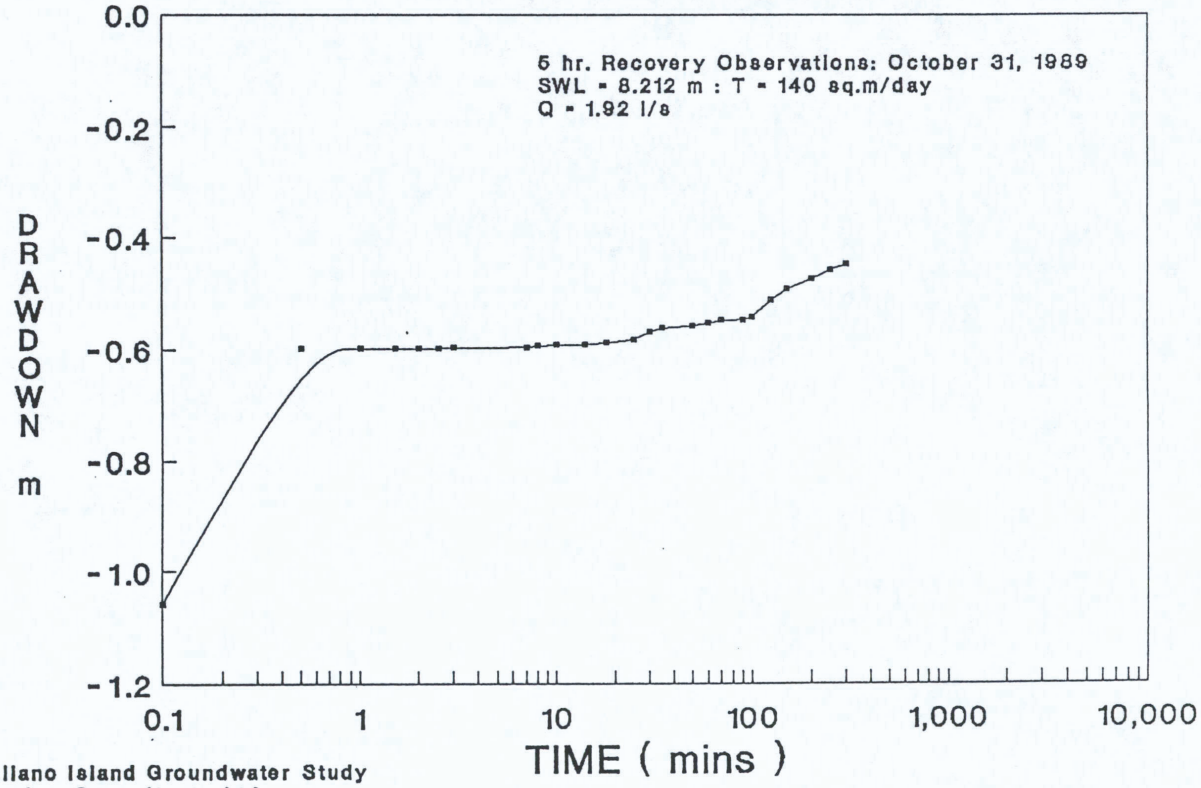
FILE Nº 19-483-13

DRAWDOWN IN PUMPING WELL TW-89-1



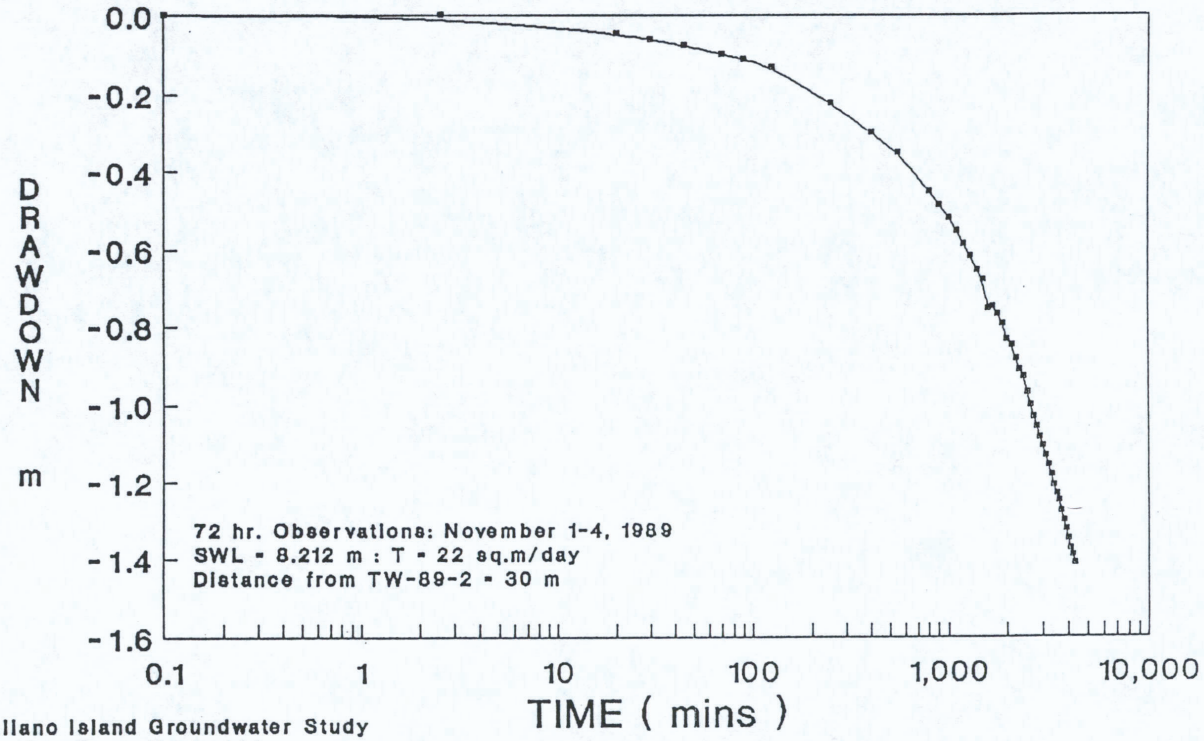
Galiano Island Groundwater Study
Thurber Consultants Ltd.
File: 19-483-13

RECOVERY IN PUMPING WELL TW-89-1



Galiano Island Groundwater Study
Thurber Consultants Ltd.
File: 19-483-13

DRAWDOWN IN OBSERVATION WELL TW-89-1
DURING PUMPING OF TW-89-2



Galiano Island Groundwater Study
Thurber Consultants Ltd.
File: 19-483-13

THURBER CONSULTANTS LTD. Geotechnical Engineers

CLIENT INTRAWEST PROPERTIES LTD. FILE NO. 19-483-13

PROJECT GALIANO ISLAND STUDY DATE OCT-NOV 1989

AQUIFER TEST DATA

WELL NO. TW-89-1 STATUS. PUMPING 24HR. MEASURED BY B.C. AQUIFER

LOCATION GALIANO ISLAND R= 6 SHEET 1 of 2

DATE	TIME (hrs & min)	ELAPSED TIME (min)	TIME SINCE PUMPING STOPPED (t')	t/t'	DEPTH TO WATER (M)	DRAWDOWN (M)	PUMPING RATE (L/s)	REMARKS (i.e. water temp., static level weather condition, well completion, etc.)
30 OCT 89	15:10	0			8.212	0		PUMP. 19.576M TO INTAKE; DATUM 0.95M AGL
		0.5			8.740	0.528		DISCHARGE 120M OF 2" LAYFLAT MEASURE INTO
		1			8.730	0.518		6.6 USGAL PAIL.
		1.5			8.647	0.435		
		2			8.605	0.393		POND STAFF GAUGE 1'5"
		2.5			8.610	0.398		
		3			8.610	0.398		
		3.5			8.610	0.398	1.87	13.3 SECS FOR 6.6 USGAL.
		4						
		4.5			8.617	0.405	1.92	
		5			8.618	0.406		
		6			8.618	0.406		H_2O BROWN
		7			8.617	0.405		
		8			8.620	0.408		
		9			8.623	0.411		
		10			8.625	0.413		
		12			8.634	0.422		H_2O CLEAN SOME FINE MATERIAL
		14			8.634	0.418		
		16			8.641	0.429		
		18			8.650	0.438		
		20			8.655	0.443		
		25			8.661	0.449		
		30			8.663	0.451		
		35			8.667	0.455		
		40			8.690	0.478		
		45			8.709	0.497		
		50			8.715	0.503		
		60			8.719	0.507		
		70			8.725	0.513		
		80			8.729	0.517		POND STAFF GAUGE 1'5"
		90			8.731	0.519		T=9.5°C
		100			8.744	0.532		
		125			8.759	0.547		
		150			8.770	0.558		POND STAFF GAUGE 1'5 1/16"
		200			8.780	0.568		
		250			8.835	0.623		
		300			8.862	0.650		
		350			8.893	0.681		
		400			8.915	0.708		POND STAFF GAUGE = 1'5 1/16"
		450			8.935	0.723		
		500			8.955	0.743		POND STAFF GAUGE = 1'5 1/16"
31 OCT 89		550			8.974	0.762		
		600			8.997	0.785		POND STAFF GAUGE = 1'5 1/16"
		650			9.018	0.806		
		700			9.037	0.825		TOOK H_2O Samples
		750			9.053	0.841		
		800			9.073	0.861		POND STAFF GAUGE = 1'5 1/8"
		850			9.098	0.886		
		900			9.111	0.899		
		950			9.122	0.910		

THURBER CONSULTANTS LTD. Geotechnical Engineers

CLIENT INTRANEST PROPERTIES LTD FILE NO. 19-483-13

PROJECT GALIANO ISLAND STUDY DATE OCT-NOV 1989

AQUIFER TEST DATA

WELL NO. TW-89-1 STATUS. PUMPING 24 HR MEASURED BY B.C. AQUIFER

LOCATION GALIANO ISLAND. R= 0 SHEET 2 of 2

DATE	TIME (hrs & min)	ELAPSED TIME (min)	TIME SINCE PUMPING STOPPED (t')	t/t'	DEPTH TO WATER (M)	DRAWDOWN (M)	PUMPING RATE (l/s)	REMARKS (i.e. water temp., static level weather condition, well completion, etc.)
31OCT89		1000			9.139	0.927		T=9.5°C; S=0; C=78
		1050			9.150	0.938		
		1100			9.163	0.951		T=9.0°C; S=0; C=80
		1150			9.179	0.967		
		1200			9.190	0.978		T=9.0°C; S=0; C=80
		1250			9.216	1.004		
		1300			9.229	1.017		C=80; S=0
		1350			9.250	1.038		STAFF GAUGE = 1'5 1/4"
		1400			9.265	1.053		STAFF GAUGE 1'5 3/8"; C=80
		1450			9.272	1.060		TOOK H_2O SAMPLES, STARTED RECOVERY
		1500						
		1550						
		1600						
		1650						
		1700						
		1750						
		1800						
		1850						
		1900						
		1950						
		2000						
		2050						
		2100						
		2150						
		2200						
		2250						
		2300						
		2350						
		2400						
		2450						
		2500						
		2550						
		2600						
		2650						
		2700						
		2750						
		2800						
		2850						
		2900						
		2950						
		3000						
		3050						
		3100						
		3150						
		3200						
		3250						
		3300						
		3350						
		3400						
		3450						

THURBER CONSULTANTS LTD., Geotechnical Engineers

CLIENT INTRAWEST PROPERTIES LTD. FILE No. 19-483-13

PROJECT GALLANO ISLAND STUDY DATE OCT-NOV 1989

AQUIFER TEST DATA

WELL NO. TH-89-1 STATUS RECOVERY IN PUMPING WELL MEASURED BY B.C. AQUIFER

LOCATION GALLANO ISL. R= SHEET ___ of ___

STATIC WATER LEVEL = 8.212

DATE	TIME (hrs & min)	ELAPSED TIME (min)	TIME SINCE PUMPING STOPPED (t')	t/t'	DEPTH TO WATER (M)	DRAWDOWN (M)	PUMPING RATE ( )	REMARKS (i.e. water temp., static level, weather condition, well completion, etc.)
31 OCT 89	1520	1 (1459) 0.1		0	9.272	1.06		STARTED MONITORING RECOVERY
		2 0.5		2901	8.810	0.598		
		3 1		1451	8.810			PUMPING RATE WAS 1.92 L/s
		4 1.5		967.7	8.810			OVER 24 HR. PERIOD.
		5 2		726	8.810			
		6 2.5		581	8.810	0.598		
		7 3		484.3	8.809	0.597		
		3.5						
		4						
		4.5						
		5						
		6						
		8 7		208.1	8.808	0.596		
		9 8		182.3	8.805	0.593		
		9						
		10 10		146.0	8.804	0.592		
		12						
		11 14		104.6	8.803	0.591		
		16						
		12 18		81.6	8.800	0.588		
		20						
		13 25		59.0	8.795	0.583		
		14 30		49.3	8.780	0.568		
		15 35		42.4	8.773	0.561		
		40						
		45						
		16 50		30.0	8.770	0.558		
		17 60		25.2	8.765	0.553		
		18 70		21.7	8.760	0.548		
		80						
		19 90		17.1	8.759	0.547		
		20 100		15.5	8.755	0.543		
		21 125		12.6	8.725	0.513		
		22 150		10.7	8.705	0.493		
		23 200		8.3	8.688	0.476		
		24 250		6.8	8.671	0.459		
		25 300		5.8	8.662	0.450		DISCONTINUED MONITORING RECOVERY.
		350						WELL 57.6% RECOVERED.
		400						
		450						
		500						
		550						
		600						
		650						
		700						
		750						
		800						
		850						
		900						
		950						

CLIENT INTRAWEST PROPERTIES LTD. FILE No. 19-483-13

PROJECT. GALIANO ISLAND STUDY DATE OCT-NOV 1989

AQUIFER TEST DATA

WELL NO. TW-89-1 STATUS. OBSERVATION (WELL IN AVAILABLE) MEASURED BY B.C. AQUIFER

LOCATION GALIANO ISL. R=30m (SEE MW 89-1) SHEET 1 of 3

PUMPING 89-2

DATE	TIME (hrs & min)	ELAPSED TIME (min)	TIME SINCE PUMPING STOPPED (t')	t/t'	DEPTH TO WATER (M)	DRAWDOWN (M)	PUMPING RATE (N/A)	REMARKS (i.e. water temp., static level weather condition, well completion, etc.)
01 NOV 89	12:00	0.1				0.0		DRAWDOWN
		0.5						
		1						
		1.5						
		2						
		2.5			8.518	0.0		ASSUMING SWL = 8.518
		3						
		3.5						
		4						
		4.5						
		5						
		6						
		7						
		8						
		9						
		10						
		12						
		14						
		16						
		18						
		20			8.565	0.047		
		25						
		30			8.580	0.062		
		35						
		40						
		45			8.595	0.077		
		50						
		60						
		70			8.617	0.099		
		80						
		90			8.630	0.112		
		100						
		125			8.650	0.132		
		150						
		200						
		250			8.740	0.222		
		300						
		350						
		400			8.816	0.298		
		450						
		500						
		550			8.870	0.352		
		600						
		650						
		700						
02 NOV 89	00:30	750						
		800			8.970	0.452		
		850						
		900			9.005	0.487		
		950						

CLIENT INTRANEST PROPERTIES LTD FILE NO. 19-483-13

PROJECT GALIANO ISLAND STUDY DATE OCT-NOV 1989

AQUIFER TEST DATA

WELL NO. TW-89-1 STATUS. OBSERVATION MEASURED BY B.C. AQUIFER

LOCATION GALIANO ISLAND R=. 30M SHEET 2 of 3

DATE	TIME (hrs & min)	ELAPSED TIME (min)	TIME SINCE PUMPING STOPPED (t')	t/t'	DEPTH TO WATER (M)	DRAWDOWN (M)	PUMPING RATE (N/A)	REMARKS (i.e. water temp., static level weather condition, well completion, etc.)
02 NOV 89		1000			9.037	0.519		
		1050						
		1100			9.070	0.552		
		1150						
		1200			9.104	0.586		
		1250						
		1300			9.135	0.617		
		1350						
		1400			9.168	0.650		
		1450						
		1500			9.195	0.677		
		1550						
		1600			9.270	0.752		
		1650						
		1700			9.265	0.747		
		1750						
		1800			9.285	0.767		
		1850						
		1900			9.310	0.792		
		1950						
		2000			9.350	0.832		
		2050						
		2100			9.365	0.847		
		2150						
		2200			9.400	0.882		
		2250						
		2300			9.428	0.910		
		2350						
03 NOV	00:40	2400			9.445	0.927		
		2450						
		2500			9.485	0.967		
		2650						
		2600			9.518	1.00		
		2650						
		2700			9.548	1.03		
		2750						
		2800			9.574	1.056		
		2850						
		2900			9.603	1.085		
		2950						
		3000			9.625	1.107		
		3050						
		3100			9.650	1.132		
		3150						
		3200			9.674	1.156		
		3250						
		3300			9.699	1.181		
		3350						
		3400			9.727	1.209		
		3450						

CLIENT INTRAWEST PROPERTIES LTD FILE NO. 19-483-13

PROJECT. GALIANO ISLAND STUDY DATE OCT-NOV 1989

AQUIFER TEST DATA

WELL NO. IW-89-1 STATUS. OBSERVATION MEASURED BY BC AQUIFER

LOCATION GALIANO ISLAND R=. 30M SHEET 3 of 3

DATE	TIME (hrs & min)	ELAPSED TIME (min)	TIME SINCE PUMPING STOPPED (t')	t/t'	DEPTH TO WATER (M)	DRAWDOWN (M)	PUMPING RATE (N/A)	REMARKS (i.e. water temp., static level weather condition, well completion, etc.)
		3500			9.750	1.232		
		3550						
		3600			9.767	1.249		
04NOV	00:50	3650						
		3700			9.796	1.278		
		3750						
		3800			9.822	1.304		
		3850						
		3900			9.844	1.326		
		3950						
		4000			9.870	1.352		
		4050						
		4100			9.893	1.375		
		4150						
		4200			9.911	1.393		
		4250						
		4300			9.931	1.413		
	12:00	4320						END OF PUMPING TEST START RECOVERY

CLIENT INTRAWEST PROPERTIES LTD. FILE NO. 19-483-13

PROJECT GALLANO ISLAND STUDY DATE OCT-NOV 1989

AQUIFER TEST DATA

ELL NO. IW-89-1 STATUS. OBSERVATION-RECOVERY MEASURED BY B.C. AQUIFER

LOCATION GALIANO ISL. R= 30M SHEET 1 of 2

DATE	TIME (hrs & min)	ELAPSED TIME (min)	TIME SINCE PUMPING STOPPED (t')	t/t'	DEPTH TO WATER (M)	RESIDUAL DRAWDOWN (M)	PUMPING RATE (N/A)	REMARKS (i.e. water temp., static level weather condition, well completion, etc.)
7NOV89	12:00	430		0	9.931	0		START OF RECOVERY
		0.5						
		1						
		1.5						
		2						
		2.5						
		3						
		3.5						
		4						
		4.5						
		5						
		6						
		7						
		8						
		9						
		10						
		12						
		14						
		16						
		18						
		20						
		25						
		30						
		35		124.4	9.885	1.367		
		40						
		45						
		50		87.4	9.877	1.359		
		60						
		70		62.7	9.863	1.345		
		80		55.0	9.857	1.339		
		90		49.0	9.845	1.327		
		100						
		125		29.8	9.828	1.310		
		150		22.6	9.816	1.298		
		200		18.3	9.794	1.276		
		250		15.4	9.770	1.252		
		300		13.3	9.754	1.236		
		350		11.8	9.735	1.217		
		400		10.6	9.714	1.196		
		450		9.6	9.692	1.174		
		500			9.680	1.162		
		550		8.2	9.669	1.151		
		600			9.650	1.132		
		650		7.2	9.632	1.114		
		700			9.623	1.105		
		750		6.4	9.593	1.075		
		800			9.586	1.068		
		850		5.8	9.572	1.054		
		900			9.557	1.039		
		950			9.545	1.027		

CLIENT INTRANEST PROPERTIES LTD FILE NO. 19-483-13

PROJECT GALIANO ISLAND STUDY DATE OCT-NOV 1989

AQUIFER TEST DATA

WELL NO. IW-89-1 STATUS. OBSERVATION / RECOVERY MEASURED BY B.C. AQUIFER

LOCATION GALIANO ISL. R= 30M SHEET 2 of 2

DATE	TIME (hrs & min)	ELAPSED TIME (min)	TIME SINCE PUMPING STOPPED (t')	t/t'	DEPTH TO WATER (M)	DRAWDOWN (M)	PUMPING RATE (N/A)	REMARKS (i.e. water temp., static level weather condition, well completion, etc.)
		1000		5.32	9.532	1.014		
		1050			9.520	1.002		
		1100			9.505	0.987		
		1150			9.494	0.976		
		1200			9.482	0.964		
		1250		4.5	9.469	0.951		
		1300			9.457	0.939		
		1350			9.444	0.926		
		1400			9.433	0.915		
		1450		4.0	9.425	0.907		END OF RECOVERY MONITORING 53.2% RECOVERED.
		1500						
		1550						
		1600						
		1650						
		1700						
		1750						
		1800						
		1850						
		1900						
		1950						
		2000						
		2050						
		2100						
		2150						
		2200						
		2250						
		2300						
		2350						
		2400						
		2450						
		2500						
		2650						
		2600						
		2650						
		2700						
		2750						
		2800						
		2850						
		2900						
		2950						
		3000						
		3050						
		3100						
		3150						
		3200						
		3250						
		3300						
		3350						
		3400						
		3450						

BCGS MAP 092B • 053 • 3 • 3 • 2

WTN: 62683

WELL NO. 04

WATER WELL RECORD

MINISTRY OF ENVIRONMENT WATER MANAGEMENT DIVISION — VICTORIA, BRITISH COLUMBIA

LEGAL DESCRIPTION: LOT ____ SEC. ____ TP. ____ R. ____ D.L. 85 LAND DISTRICT Cowichan PLAN ____

DESCRIPTIVE LOCATION TW 85-1 Galiano Island LICENCE NO. ____ DATE ____

Z ____ WELL NO. ____

____ E

____ N

Z X Y NO.

NAT. TOPO. SHEET NO. ____

OWNER'S NAME MacMillan Bloedel LTD. ADDRESS ____

DRILLER'S NAME Drillwell Enterprises ADDRESS ____ DATE COMPLETED Oct 26/95

DEPTH 101' ELEVATION ____ OF ____ ☐ ESTIMATED ☐ SURVEYED CASING DIAM. ____ LENGTH ____

METHOD OF CONSTRUCTION Air Rotary CASING DIAM ____ LENGTH ____

SCREEN LOCATION ____ SCREEN ☐ SIZE ____ LENGTH ____ TYPE ____

SANITARY SEAL YES ☐ NO ☐ SCREEN ☐ SIZE ____ LENGTH ____ TYPE ____

PERFORATED CASING ☐ LENGTH ____ PERFORATIONS FROM ____ TO ____

GRAVEL PACK ☐ LENGTH ____ DIAM. ____ SIZE GRAVEL, ETC. ____

DISTANCE TO WATER 22' ☐ ESTIMATED WATER LEVEL

FROM ____ ☐ MEASURED ELEVATION ____ ARTESIAN PRESSURE ____

DATE OF WATER LEVEL MEASUREMENT ____ WATER USE ____

PRODUCTION TEST SUMMARY

DATE ____

TEST BY ____

BAIL TEST ☐ PUMP TEST ☐ DURATION OF TEST ____

RATE ____ DRAWDOWN ____

WATER LEVEL AT COMPLETION OF TEST ____

AVAILABLE DRAWDOWN ____ SPECIFIC CAPACITY ____

PERMEABILITY ____ STORAGE COEFF. ____

TRANSMISSIVITY ____

ESTIMATED WELL YIELD 100 igpm

RECOMMENDED PUMPING RATE ____

RECOMMENDED PUMP SETTING ____

CHEMISTRY

TEST BY ____ DATE ____

TOTAL DISSOLVED SOLIDS ____ mg/l TEMPERATURE ____ °C pH ____ SILICA (SiO_2) ____ mg/l

CONDUCTANCE ____ μmhos/cm AT 25°C TOTAL IRON (Fe) ____ mg/l TOTAL HARDNESS ($CaCO_3$) ____ mg/l

TOTAL ALKALINITY ($CaCO_3$) ____ mg/l PHEN. ALKALINITY ($Ca\ CO_3$) ____ mg/l MANGANESE (Mn) ____ mg/l

COLOUR ____ ODOUR ____ TURBIDITY ____

ANIONS	mg/l	epm	CATIONS	mg/l	epm
CARBONATE (CO_3)			CALCIUM (Ca)		
BICARBONATE (HCO_3)			MAGNESIUM (Mg)		
SULPHATE (SO_4)			SODIUM (Na)		
CHLORIDE (Cl)			POTASSIUM (K)		
$NO_2 + NO_3$ (NITROGEN)			IRON (DISSOLVED)		
• TKN. (NITROGEN)					
PHOSPHORUS (P)					

• TKN = TOTAL KJELDAHL NITROGEN CHEMISTRY SITE NO. ____

NO_2 = NITRITE NO_3 = NITRATE

CHEMISTRY FIELD TESTS

TEST BY ____ DATE ____ EQUIPMENT USED ____

LITHOLOGY

FROM	TO	DESCRIPTION

CONTENTS OF FOLDER

☐ DRILL LOG ☐ PUMP TEST DATA ☐ CHEMICAL ANALYSIS

☐ SIEVE ANALYSIS ☐ GEOPHYSICAL LOGS ☐ REPORT

OTHER ____

SOURCES OF INFORMATION Thurber Report - GW Supply Study - Galiano Island

well Fig 62673

NORTH

WEST

EAST

SOUTH

CARD BY_____ DATE_____

ADDITIONAL DATA ADDED BY_____

REMARKS

97941

ENV 1995

BRITISH COLUMBIA Groundwater Wells and Aquifers

Well Summary

Well Tag Number: 62684
Well Identification Plate Number:
Owner Name: MACMILLAN BLOEDEL LT
Intended Water Use: Not Applicable
Artesian Condition: No

Well Status: New
Well Class: Unknown
Well Subclass:
Aquifer Number: 320

Observation Well Number:
Observation Well Status:
Environmental Monitoring System (EMS) ID:
Alternative specs submitted: No

Licensing Information

Licensed Status: Unlicensed
Licence Number:

Location Information

Street Address:
Town/City:

Legal Description:

Lot	
Plan	
District Lot	85
Block	
Section	
Township	
Range	
Land District	16
Property Identification Description (PID)	

Description of Well Location:

Geographic Coordinates - North American Datum of 1983 (NAD 83)
Latitude: 48.98552 **Longitude:** -123.55723
UTM Easting: 459231 **UTM Northing:** 5425996
Zone: 10 **Coordinate Acquisition Code:** (20 m accuracy) Digitized from 1:5,000 mapping

Well Activity

Activity	Work Start Date	Work End Date	Drilling Company	Date Entered
Legacy record	1989-10-25	1989-10-25	Drillwell Enterprises	August 13th 2003 at 4:37 AM

Well Work Dates

Start Date of Construction	End Date of Construction	Start Date of Alteration	End Date of Alteration	Start Date of Decommission	End Date of Decommission
1989-10-25	1989-10-25				

Well Completion Data

Total Depth Drilled:
Finished Well Depth: 400 ft bgl
Final Casing Stick Up:
Depth to Bedrock: 69 feet bgl
Ground elevation: 299 feet

Estimated Well Yield: 240 USgpm
Well Cap:
Well Disinfected Status: Not Disinfected
Drilling Method: Other
Method of determining elevation: Unknown

Static Water Level (BTOC): 28 feet btoc
Artesian Flow:
Artesian Pressure (head):
Artesian Pressure (PSI):
Orientation of Well: VERTICAL

Lithology

From (ft bgl)	To (ft bgl)	Raw Data	Description	Moisture	Colour	Hardness	Observations	Water Bearing Flow Estimate (USGPM)
0	8	brown sandy gravel						
8	18	brown gravel some sand						
18	49	brown to blue sandy gravel						
49	70	blue sandy gravel						
70	87	grey sandstone						
87	89	black shale						
89	398	light grey sandstone						
398	400	black shale						

Casing Details

From (ft bgl)	To (ft bgl)	Casing Type	Casing Material	Diameter (in)	Wall Thickness (in)	Drive Shoe
There are no records to show						

Surface Seal and Backfill Details

Surface Seal Material:
Surface Seal Installation Method:
Surface Seal Thickness:
Surface Seal Depth:

Backfill Material Above Surface Seal:
Backfill Depth:

Liner Details

Liner Material:
Liner Diameter:
Liner from:

Liner Thickness:
Liner to:

Liner perforations

From (ft bgl)	To (ft bgl)
There are no records to show	

Screen Details

Intake Method:
Type:
Material:
Opening:
Bottom:

Installed Screens

From (ft bgl)	To (ft bgl)	Diameter (in)	Assembly Type	Slot Size
There are no records to show				

Well Development

Developed by:

Development Total Duration:

Well Yield

Estimation Method:
Static Water Level Before Test:
Hydrofracturing Performed: No

Estimation Rate:
Drawdown:
Increase in Yield Due to Hydrofracturing:

Estimation Duration:

Well Decommission Information

Reason for Decommission:
Method of Decommission:
Sealant Material:
Backfill Material:
Decommission Details:

Comments

METHOD OF DRILLING = DRILLED

Alternative Specs Submitted: Yes

Documents

- WTN 62684_Well Record.pdf

Disclaimer

The information provided should not be used as a basis for making financial or any other commitments. The Government of British Columbia accepts no liability for the accuracy, availability, suitability, reliability, usability, completeness or timeliness of the data or graphical depictions rendered from the data.

The Groundwater Wells and Aquifers application will not work correctly on (Internet Explorer 11).

We recommend Chrome, Firefox or Safari.

Update browser

The Groundwater Wells and Aquifers application will not work correctly on (Internet Explorer 11).

We recommend Chrome, Firefox or Safari.

Update browser

TECHNICAL DATA SHEET
WELL #4 or TW 89-2

1. District Lot: 85
2. Client: FLEMING LARSEN
3. File No: 19-2128-0
4. Well No. 3 (Located by TEL)
5. Lot No. 7

6. Water Quality:
   - TDS 97/120
   - Sp.C. 109/126
   - Cl 8/7
   - T.Coli. <1
   - F.Coli. not determined in 1989
7. Laboratory: J.B. Labs Ltd. and CANTEST

8. Test Pumping:
   - Date tested: Nov. 1 - 4, 1989
   - Contractor: BC Aquifer
   - Pump Rate: 37 USgpm
9. Total lots to be served by well: 3
10. Total requirement (@500 lgpd/L): 1500 lgpd 1.26 USgpm
11. Total Well Depth: 122 m
12. Non-pumping water level: 9 m
13. Depth to primary fracture: 63 m
14. Well elevation: 91 m, above mean sea level
15. Depth to sea level: 91 m
16. 100% available drawdown: 54 m to primary fracture
17. 70% available drawdown: 38 m to primary fracture
18. Total recovery expected: yes
19. Estimated well yield: >120,000 lgpd >37 USgpm
20. Well Location:
    Groundwater Region: Georgia Strait (Mordant, Hodge, 1983)
    - % demand-storage ratio: 0
    - No. of wells within 500m: 1 on D.L. 85 (closest 30m, TW 89-1)

21. COMMENTS:
    Observation readings taken on Well TW89-1 (DL 85), overburden well 30m away, with max. drawdown of 1.4m. Observation readings were also taken on TW89-3 (DL88), 750m away. The recorded maximium drawdown was 0.3m.

bii/D3

THURBER

THURBER CONSULTANTS LTD.
Geotechnical Engineers

Sheet 1 of 2

TEST HOLE Nº ~~TW89-2~~

LOG OF TEST WELL

WELL # 4

LOCATION Lot 85
Galiano Island, BC

CLIENT ~~Intrawest Properties Ltd.~~

PROJECT McMillan Bloedel Ltd.
Galiano Is. Groundwater Study

DATE October 22-25, 1989

METHOD Air Rotary

DRILLING Cº Drillwell Enterprises Ltd.

INSPECTOR D. Myles

FLEMING LARSEN

ELEVATION (METRES)	REMARKS	LOG	DEPTH (METRES)
	Stick-up 0.9 m agl	Brown sandy GRAVEL	2
	150 mm Steel Casing	Brown GRAVEL some sand	4
			6
			8
		Brown to blue sandy GRAVEL	10
	Static water level on October 25, 1989		12
			14
			16
		Blue SANDY sandy GRAVEL	18
			20

THURBER CONSULTANTS LTD.
Geotechnical Engineers

Sheet 2 of 2

TEST HOLE Nº ~~TW88-2~~

LOG OF TEST WELL

LOCATION Lot 85, Galiano Island, BC

CLIENT Intrawest Properties Ltd.
PROJECT McMillan Bloedel Ltd. Galiano Is. Groundwater Study
DATE October 22-25, 1989
METHOD Air Rotary
DRILLING Co Drillwell Enterprises Ltd.
INSPECTOR D. Myles

FLEMING LARSEN

ELEVATION (METRES)	REMARKS	LOG	DEPTH (METRES)
	End of casing @ 21.34 m	Blue SANDY GRAVEL	
	150 mm open drill hole in bedrock below 21.34 m	Grey SANDSTONE *	22, 24, 26
	Major Fracture Zones (metres below ground level) 22.86 - 25.91 27.28 - 27.58 37.19 - 41.15 45.72 - 46.33 51.21 - 51.82 59.44 - 59.74 62.48 - 76.20 82.30 - 86.25 90.83 - 92.96 99.67 - 99.97 104.55 - 104.85 111.56 - 114.30 121.31 - 121.92	Black SHALE *	
		Light Grey SANDSTONE *	28, 30, 32
		Light Grey SANDSTONE *	116, 118, 120
	* Nanaimo Group Gabriola Formation	Black SHALE *	
	End of drill hole @ 121.92 m bgl		

PUMPING WELL #4

RESIDUAL DRAWDOWN CURVE

FLEMING LARSEN
D.L. 85; Galiano Island

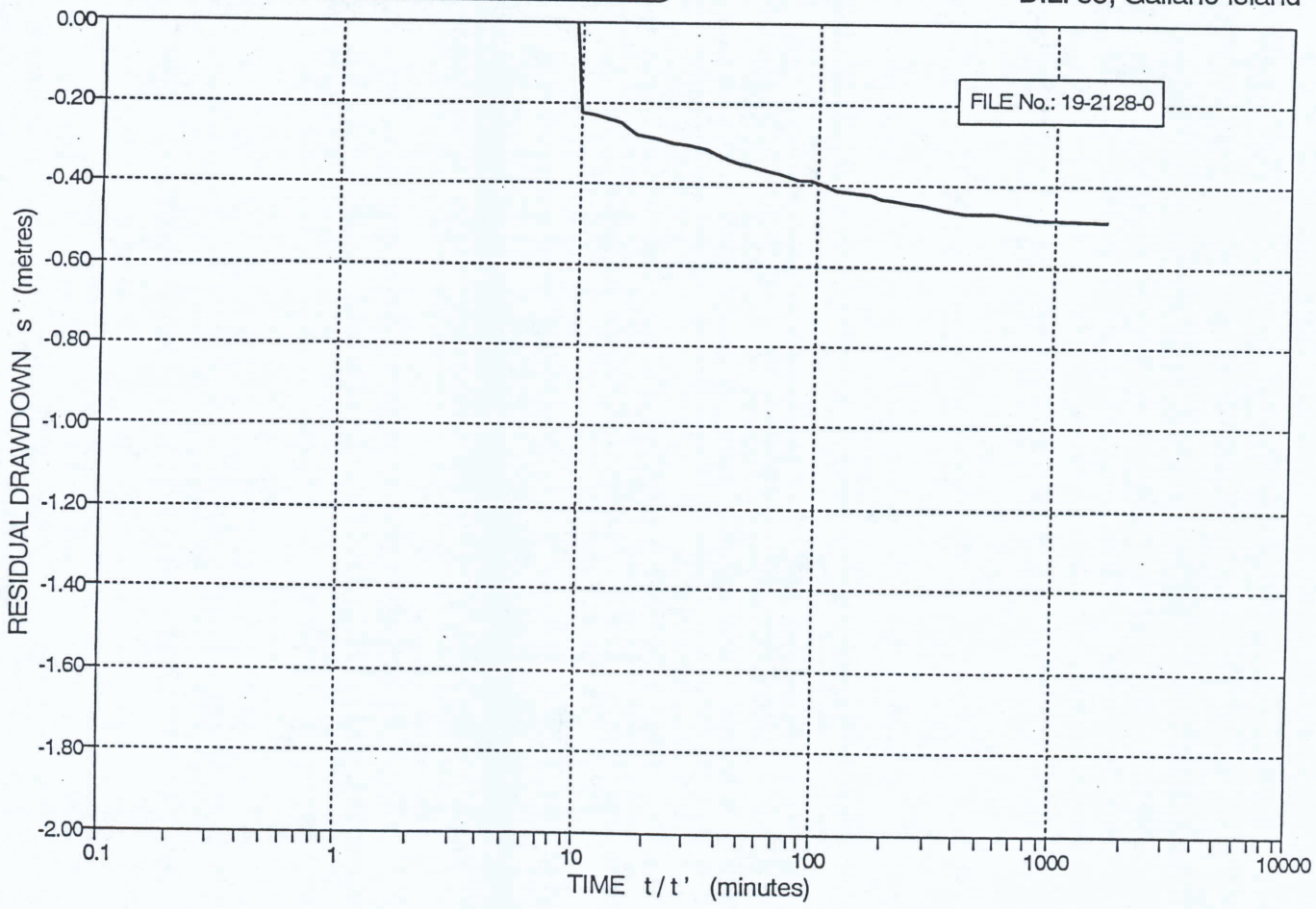
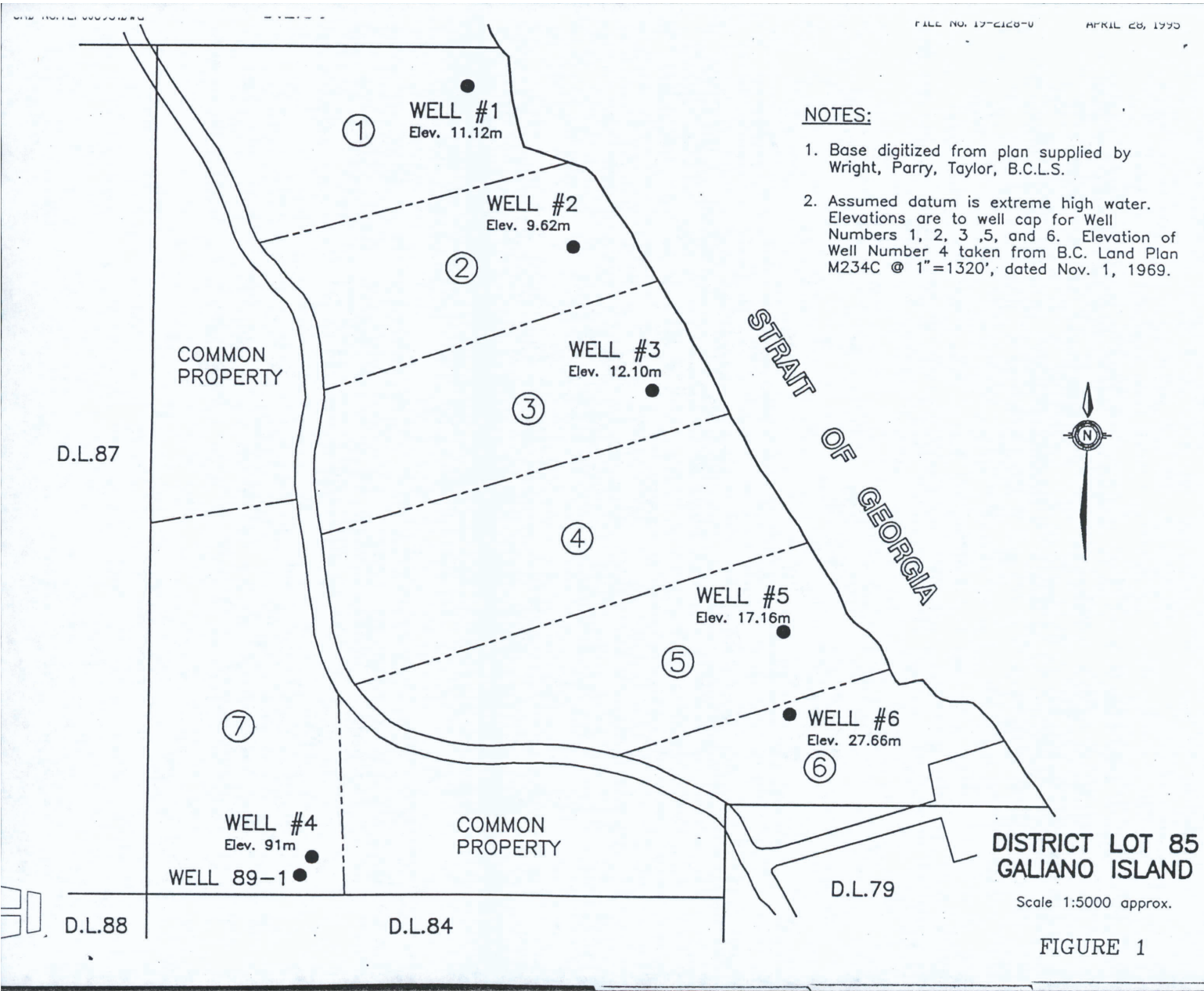


FIGURE 3



NOTES:

1. Base digitized from plan supplied by Wright, Parry, Taylor, B.C.L.S.
2. Assumed datum is extreme high water. Elevations are to well cap for Well Numbers 1, 2, 3 ,5, and 6. Elevation of Well Number 4 taken from B.C. Land Plan M234C @ 1"=1320', dated Nov. 1, 1969.

DISTRICT LOT 85
GALIANO ISLAND

Scale 1:5000 approx.

FIGURE 1

PUMPING WELL #4

DRAWDOWN DATA

THURBER ENGINEERING LTD.

FILE No.: 19-2128-0

FLEMING LARSEN - D.L. 85; GALIANO ISLAND

START DATE: NOVEMBER 1, 1989

START TIME: 12:00

SWL = 8.980 metres

ELAPSED TIME (min.)	WATER DEPTH (metres)	RATE (USGpm)	DRAWDOWN (metres)	NOTES
0.0	8.980		0.000	
0.5	9.275		-0.295	
1.0	9.200		-0.220	
1.5	9.195		-0.215	
2.0	9.195		-0.215	
2.5	9.200		-0.220	
4.0	9.185		-0.205	<-- Water grey in color
5.0	9.192	44.0	-0.212	
10	9.155		-0.175	
12	9.170		-0.190	
14	9.168		-0.188	
16	9.169	39.0	-0.189	
18	9.175		-0.195	
20	9.178		-0.198	
25	9.182		-0.202	<-- Water clear
30	9.185	37.0	-0.205	
35	9.195		-0.215	
40	9.200		-0.220	
45	9.205		-0.225	
50	9.210		-0.230	
60	9.213		-0.233	
70	9.240		-0.260	
80	9.249		-0.269	
90	9.260		-0.280	
100	9.269		-0.289	<-- C=90; S=0; T=10.5 degrees C.
125	9.287		-0.307	
150	9.290		-0.310	
200	9.320		-0.340	
250	9.355		-0.375	
300	9.394		-0.414	
350	9.400		-0.420	
400	9.425		-0.445	
450	9.445		-0.465	
500	9.475		-0.495	
550	9.492		-0.512	
600	9.520		-0.540	
650	9.550		-0.570	
700	9.570		-0.590	
750	9.567		-0.587	
800	9.571		-0.591	
850	9.590		-0.610	
900	9.600		-0.620	
950	9.618		-0.638	
1000	9.635		-0.655	
1050	9.653	37.0	-0.673	
1100	9.667		-0.687	
1150	9.679		-0.699	
1200	9.694		-0.714	
1250	9.714		-0.734	
1300	9.730		-0.750	
1350	9.754		-0.774	
1400	9.768		-0.788	
1450	9.785		-0.805	
1500	9.805		-0.825	
1550	9.830		-0.850	
1600	9.860		-0.880	<-- raining lightly
1650	9.870		-0.890	
1700	9.890		-0.910	
1750	9.870		-0.890	
1800	9.892		-0.912	
1850	9.900		-0.920	
1900	9.900		-0.920	<-- C=82; S=0; T=9.75 degrees C.
1950	9.917		-0.937	
2000	9.934		-0.954	
2050	9.975		-0.995	
2100	9.987	36.0	-1.007	
2150	10.003		-1.023	

PUMPING WELL #4

DRAWDOWN DATA

THURBER ENGINEERING LTD.

FILE No.: 19-2128-0

2200	10.013		-1.033	
2250	10.036	37.0	-1.056	
2300	10.036		-1.056	
2350	10.049		-1.069	
2400	10.053		-1.073	
2450	10.073		-1.093	
2500	10.085		-1.105	
2550	10.103		-1.123	
2600	10.117		-1.137	
2650	10.134		-1.154	
2700	10.151		-1.171	
2750	10.174		-1.194	
2800	10.185		-1.205	
2850	10.192		-1.212	
2900	10.200		-1.220	
2950	10.222		-1.242	
3000	10.230		-1.250	
3050	10.242		-1.262	<-- rain stopped
3100	10.250		-1.270	
3150	10.272		-1.292	
3200	10.284		-1.304	
3250	10.290		-1.310	
3300	10.305		-1.325	
3350	10.320		-1.340	
3400	10.328		-1.348	
3450	10.341		-1.361	
3500	10.360		-1.380	
3550	10.379	37.0	-1.399	
3600	10.395		-1.415	
3650	10.380		-1.400	
3700	10.407		-1.427	
3750	10.413		-1.433	
3800	10.425		-1.445	
3850	10.428		-1.448	
3900	10.433		-1.453	
3950	10.450		-1.470	
4000	10.458		-1.478	
4050	10.467		-1.487	
4100	10.483		-1.503	
4150	10.494		-1.514	
4200	10.505		-1.525	
4250	10.514		-1.534	
4300	10.521		-1.541	
4320	10.540	37.0	-1.560	<-- Stop pumping; took water sample; start recovery

PUMPING WELL #4
DRAWDOWN CURVE

FLEMING LARSEN
D.L. 85; Galiano Island

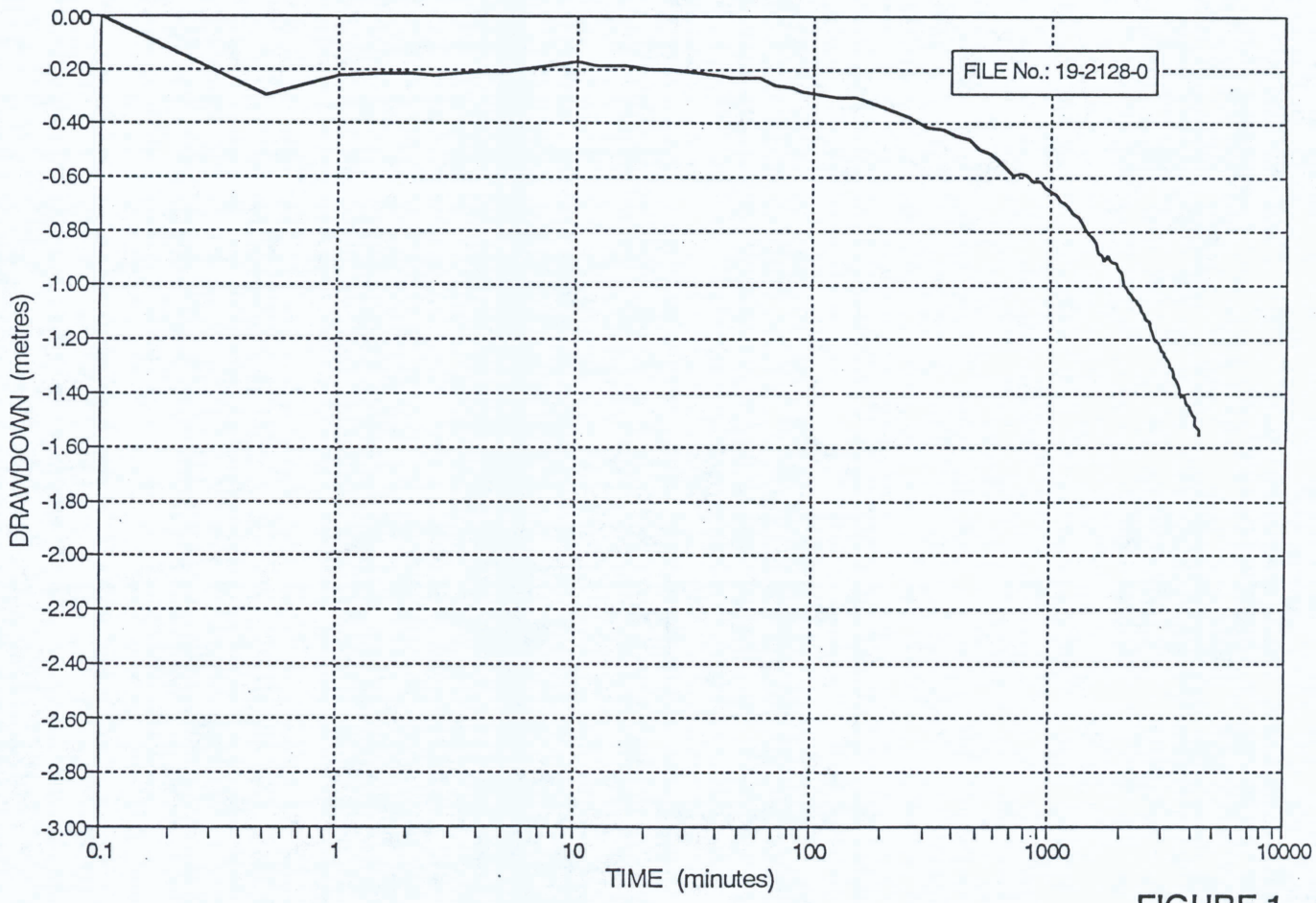


FIGURE 1

PUMPING WELL #4
DRAWDOWN CURVE

FLEMING LARSEN
D.L. 85; Galiano Island

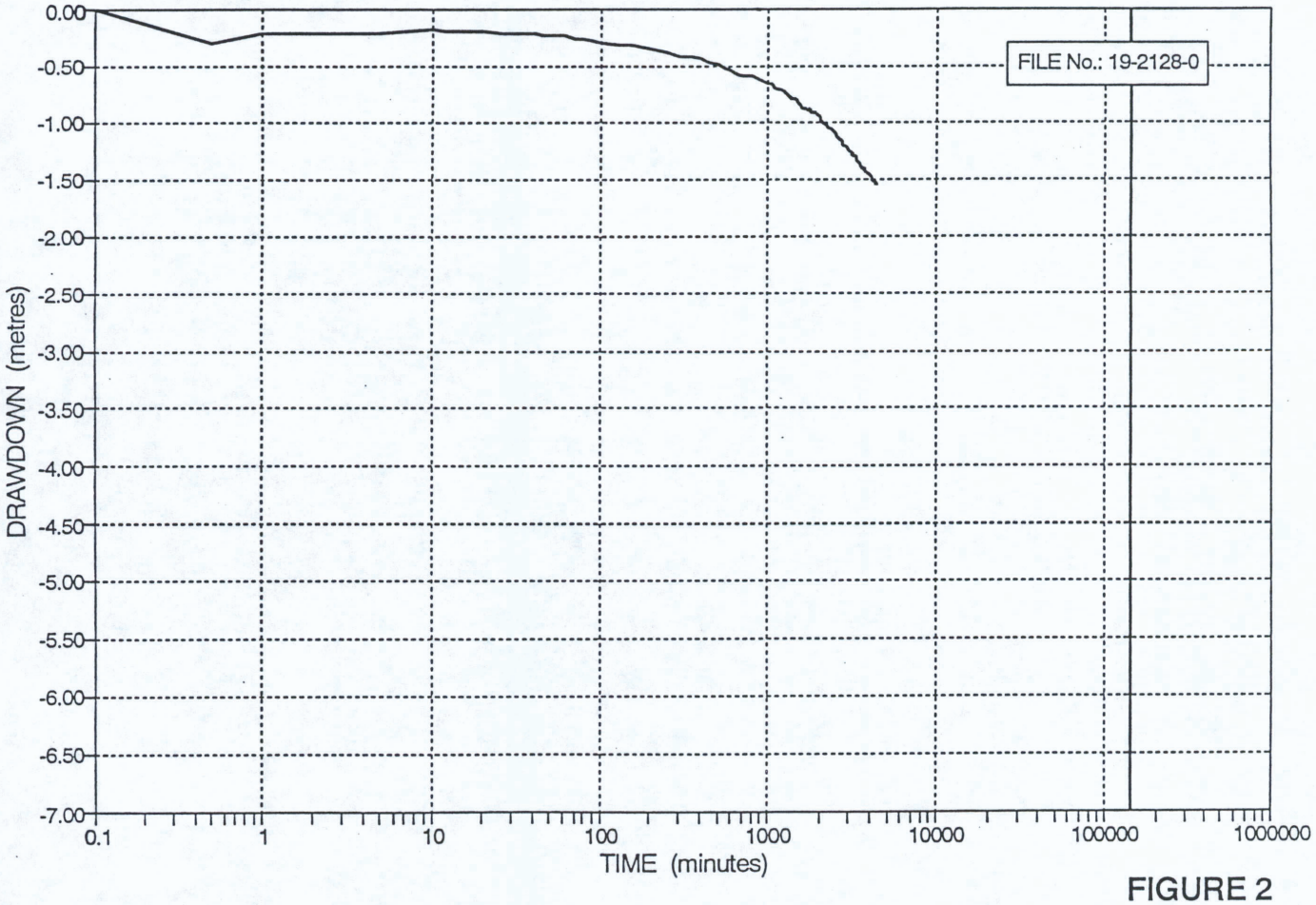


FIGURE 2

PUMPING WELL #4

RESIDUAL DRAWDOWN

THURBER ENGINEERING LTD.

FILE No.: 19-2128-0

FLEMING LARSEN - D.L. 85; GALIANO ISLAND

START DATE: NOVEMBER 4, 1989

START TIME: 12:00

SWL = 8.980 metres

ELAPSED TIME (Minutes) t @ t' = 4320			WATER DEPTH	RATE	RESIDUAL DRAWDOWN	NOTES
t	t'	t/t'	s (metres)	(USGpm)	s' (metres)	
4320	0		10.540		-1.560	Last reading pumping
4321	0.5	8641	10.412		-1.432	
4321	1	4321	10.377		-1.397	
4322	1.5	2881	10.377		-1.397	
4322	2	2161	10.377		-1.397	
4323	2.5	1729	10.377		-1.397	
4323	3	1441	10.377		-1.397	
4324	3.5	1235	10.377		-1.397	
4324	4	1081	10.377		-1.397	
4325	4.5	961	10.377		-1.397	
4325	5	865	10.377		-1.397	
4326	6	721	10.375		-1.395	
4327	7	618	10.370		-1.390	
4328	8	541	10.355		-1.375	
4329	9	481	10.354		-1.374	
4330	10	433	10.353		-1.373	
4332	12	361	10.350		-1.370	
4334	14	310	10.347		-1.367	
4336	16	271	10.345		-1.365	
4338	18	241	10.342		-1.362	
4340	20	217	10.340		-1.360	
4345	25	174	10.335		-1.355	
4350	30	145	10.330		-1.350	
4355	35	124	10.320		-1.340	
4360	40	109	10.319		-1.339	
4365	45	97	10.319		-1.339	
4370	50	87	10.315		-1.335	
4380	60	73	10.308		-1.328	
4390	70	63	10.301		-1.321	
4400	80	55	10.296		-1.316	
4410	90	49	10.287		-1.307	
4420	100	44	10.282		-1.302	
4445	125	36	10.266		-1.286	
4470	150	30	10.255		-1.275	
4520	200	23	10.230		-1.250	
4570	250	18	10.209		-1.229	
4620	300	15	10.190		-1.210	
4670	350	13	10.172		-1.192	
4720	400	12	10.151		-1.171	
4770	450	11	10.134		-1.154	
4820	500	10	10.115		-1.135	
4870	550	9	10.107		-1.127	
4920	600	8.2	10.080		-1.100	
4970	650	7.6	10.073		-1.093	
5020	700	7.2	10.053		-1.073	
5070	750	6.8	10.038		-1.058	
5120	800	6.4	10.027		-1.047	
5170	850	6.1	10.012		-1.032	
5220	900	5.8	9.998		-1.018	
5270	950	5.5	9.984		-1.004	
5320	1000	5.3	9.970		-0.990	
5370	1050	5.1	9.957		-0.977	
5420	1100	4.9	9.945		-0.965	
5470	1150	4.8	9.932		-0.952	
5520	1200	4.6	9.921		-0.941	
5570	1250	4.5	9.910		-0.930	
5620	1300	4.3	9.898		-0.918	
5670	1350	4.2	9.886		-0.906	
5720	1400	4.1	9.872		-0.892	
5770	1450	4.0	9.863		-0.883	<-- End recovery

THURBER

PUMPING WELL #4

RESIDUAL DRAWDOWN CURVE

FLEMING LARSEN
D.L. 85; Galiano Island

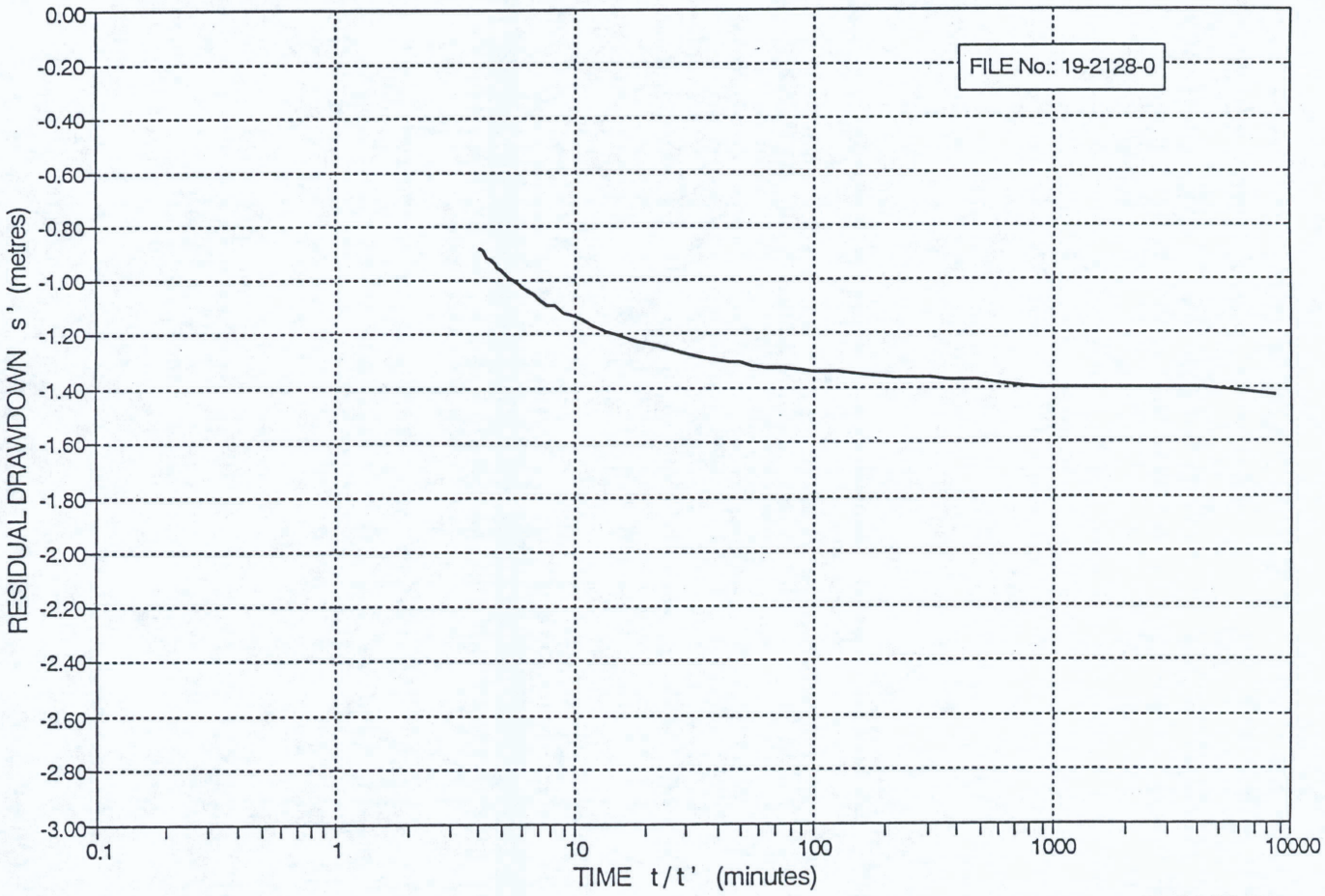


FIGURE 3

JB Laboratories Ltd.
water/wastewaters

827 FORT STREET,
VICTORIA, B.C. V8W 1H6
TEL: (604) 385-6112
FAX: (604) 383-8099

B11

DATE: November 10, 1989

JOB NO.: JB 1433
LR NO.: 10719

SAMPLING DATE: Nov 4/89

SAMPLING AGENT: Client

The sample(s) submitted by the agent have been tested as requested and we report as follows:

Client: Thurber Consultants Ltd
Attn: Mr. Bruce Ingimundson
210 - 4475 Viewmont Avenue
Victoria, B. C.
V8Z 6L8

Sample: WELL # 4
19-438-B TH89-2
72 Hours (Before Sweet)

Total Dissolved Solids	mg/L	97
Conductivity	umhos/cm	109
pH		6.9
Alkalinity	mg/L $CaCO_3$	39.3
Hardness, Total	mg/L $CaCO_3$	27.8
Calcium	mg/L	5.2
Magnesium	mg/L	3.6
Iron	mg/L	0.1
Manganese	mg/L	0.03
Sodium	mg/L	8.5
Chloride	mg/L	8
Sulphate	mg/L	8
Fluoride	mg/L	0.24
Nitrite	mg/L N	0.002
Nitrate	mg/L N	0.21
Total Coliform	CFU/100mL	L 1*

L : Less than; * other bacteria present

John E. Evanoff, M.Sc. Barbara M. Klassen, B.Sc., C.Tech.

Analysis performed according to "A Laboratory Manual for the Chemical Analysis of Water, Wastewaters and Biological Tissues"

CANTEST

Thurber Consultants Ltd.
File No: 9401H
Page No: 2

89-2 (Bedrock well)

SAMPLE IDENTIFICATION AND RESULTS OF TESTING:

		SAMPLE # 9401 CLIENT SAMPLE I.D. #89-2 Nov.2, 1989 24 HR Sample	MAXIMUM ACCEPTABLE CONC.***
PHYSICAL TESTS			
pH (pH units)		7.29	6.5-8.5
Conductivity (us/cm)		166	-
True Color (CU)		<5	15.
Turbidity (NTU)		1.0	5.
Hardness as CaCO3		40.0	-
Total Dissolved Solids (mg/L)		120	500.*
DISSOLVED ANIONS (mg/L)			
Alkalinity:			
Bicarbonate	HC03	53.0	-
Carbonate	C03	NIL	-
Hydroxide	OH	NIL	-
Chloride	Cl	7.00	250.
Sulfates	SO4	10.0	500.
Nitrates/Nitrites	N	0.14	10.**
Fluorides	F	<0.05	1.5
DISSOLVED METALS (mg/L)			
Calcium	Ca	9.17	-
Magnesium	Mg	4.00	-
Sodium	Na	11.0	-
Potassium	K	0.15	-
Iron	Fe	<0.030	0.30
Manganese	Mn	0.020	0.05
Silica	Si02	25.0	-
TOTAL METALS (mg/L)			
Magnesium	Mg	4.05	-
Iron	Fe	0.075	0.30
Manganese	Mn	0.027	0.05
COLIFORM BACTERIA (Colonies/100 mL*R)			
Total (Confirmed)		-	-
Fecal		-	Not detected

* = filtered a 0.45 micron membrane
** = total nitrate and nitrite nitrogen
*** = maximum acceptable concentration as set by "B.C. Drinking Water Quality Standards, 1982" and "Guidelines for Canadian Drinking Water Quality, 1978"
< = less than; mg/L = milligrams per litre
*R = remarks
X = Exceeded the "Guidelines"

JB Laboratories Ltd.
water/wastewaters

827 FORT STREET,
VICTORIA, B.C. V8W 1H6
TEL: (604) 385-6112
FAX: (604) 383-8099

B11

DATE: November 10, 1989

JOB NO.: JB 1433
LR NO.: 10719

SAMPLING DATE: Nov 4/89

SAMPLING AGENT: Client

The sample(s) submitted by the agent have been tested as requested and we report as follows:

Client: Thurber Consultants Ltd
Attn: Mr. Bruce Ingimundson
210 - 4475 Viewmont Avenue
Victoria, B. C.
V8Z 6L8

Sample: 19-438-B TH89-2
72 Hours

Total Dissolved Solids	mg/L	97
Conductivity	umhos/cm	109
pH		6.9
Alkalinity	mg/L $CaCO_3$	39.3
Hardness, Total	mg/L $CaCO_3$	27.8
Calcium	mg/L	5.2
Magnesium	mg/L	3.6
Iron	mg/L	0.1
Manganese	mg/L	0.03
Sodium	mg/L	8.5
Chloride	mg/L	8
Sulphate	mg/L	8
Fluoride	mg/L	0.24
Nitrite	mg/L N	0.002
Nitrate	mg/L N	0.21
Total Coliform	CFU/100mL	L 1*

L : Less than; * other bacteria present

John E. Evanoff, M.Sc. Barbara M. Klassen, B.Sc., C.Tech.

Analysis performed according to "A Laboratory Manual for the Chemical Analysis of Water, Wastewaters and Biological Tissues", Chemistry Laboratory, Water Resource Service and/or "Standard Methods/ Water and Wastewater", American Public Health Association.

JB LABORATORIES

NOV 2 2 1989

CANTEST

CanTest Ltd
Professional
Analytical
Services

Suite 200
1523 West 3rd Ave
Vancouver, BC
V6J 1J8

Fax: 604 731 2386

Tel: 604 734 7276

REPORT ON: Analysis of Water Samples

REPORTED TO: Thurber Consultants Ltd.
#210 - 4475 Viewmont Ave.
Victoria, B.C.
V8Z 6L8

ATTENTION: Dave Myles

FILE NO: 9401H

DATE: November 16, 1989

We have tested the sample submitted by you and report as follows:

SAMPLE IDENTIFICATION:

The sample was identified as:

PROJECT NAME:	19-438-13 TH-89-2
DATE SAMPLED:	November 2, 1989
DATE SUBMITTED:	November 8, 1989
TYPE OF CONTAINER:	Plastic

for further identification, see "Results of Testing".

SUMMARY:

For the chemical parameters tested, the sample met the limits set by the "British Columbia Drinking Water Quality Standards, 1982", Province of B.C., Ministry of Health and "Guidelines for Canadian Drinking Water Quality, 1978", published by authority of Health and Welfare Canada, as indicated in the "Results of Testing".

The water represented by the sample submitted may be characterized as moderate in dissolved mineralization and hard with respect to hardness.

RESULTS OF TESTING

(on the following page)

CAN TEST LTD.

per Elaine McLellan
Don M. Enns, B.Sc., M.B.A.
Assistant Manager

DME/tt
C:WATER

CANTEST

Thurber Consultants Ltd.
File No: 9401H
Page No: 2

SAMPLE IDENTIFICATION AND RESULTS OF TESTING:

		SAMPLE # 9401 CLIENT SAMPLE I.D. #89-2 Nov.2, 1989 24 HR Sample	MAXIMUM ACCEPTABLE CONC.***
PHYSICAL TESTS			
pH (pH units)		7.29	6.5-8.5
Conductivity (us/cm)		166	-
True Color (CU)		<5	15.
Turbidity (NTU)		1.0	5.
Hardness as CaCO3		40.0	-
Total Dissolved Solids (mg/L)		120	500.*
DISSOLVED ANIONS (mg/L)			
Alkalinity:			
Bicarbonate	HC03	53.0	-
Carbonate	C03	NIL	-
Hydroxide	OH	NIL	-
Chloride	Cl	7.00	250.
Sulfates	SO4	10.0	500.
Nitrates/Nitrites	N	0.14	10.**
Fluorides	F	<0.05	1.5
DISSOLVED METALS (mg/L)			
Calcium	Ca	9.17	-
Magnesium	Mg	4.00	-
Sodium	Na	11.0	-
Potassium	K	0.15	-
Iron	Fe	<0.030	0.30
Manganese	Mn	0.020	0.05
Silica	Si02	25.0	-
TOTAL METALS (mg/L)			
Magnesium	Mg	4.05	-
Iron	Fe	0.075	0.30
Manganese	Mn	0.027	0.05
COLIFORM BACTERIA (Colonies/100 mL*R)			
Total (Confirmed)		-	-
Fecal		-	Not detected

* = filtered a 0.45 micron membrane
** = total nitrate and nitrite nitrogen
*** = maximum acceptable concentration as set by "B.C. Drinking Water Quality Standards, 1982" and "Guidelines for Canadian Drinking Water Quality, 1978"
< = less than; mg/L = milligrams per litre
*R = remarks
X = Exceeded the "Guidelines"

CANTEST

Thurber Consultants Ltd.
File No: 9401H
Page No: 2

SAMPLE IDENTIFICATION AND RESULTS OF TESTING:

SAMPLE #		9401	MAXIMUM
CLIENT SAMPLE I.D.		#89-2 Nov.2, 1989 24 HR Sample	ACCEPTABLE CONC.***
PHYSICAL TESTS			
pH (pH units)		7.29	6.5-8.5
Conductivity (us/cm)		166	-
True Color (CU)		<5	15.
Turbidity (NTU)		1.0	5.
Hardness as CaCO3		40.0	-
Total Dissolved Solids (mg/L)		120	500.*
DISSOLVED ANIONS (mg/L)			
Alkalinity:			
Bicarbonate	HC03	53.0	-
Carbonate	C03	NIL	-
Hydroxide	OH	NIL	-
Chloride	Cl	7.00	250.
Sulfates	SO4	10.0	500.
Nitrates/Nitrites	N	0.14	10.**
Fluorides	F	<0.05	1.5
DISSOLVED METALS (mg/L)			
Calcium	Ca	9.17	-
Magnesium	Mg	4.00	-
Sodium	Na	11.0	-
Potassium	K	0.15	-
Iron	Fe	<0.030	0.30
Manganese	Mn	0.020	0.05
Silica	Si02	25.0	-
TOTAL METALS (mg/L)			
Magnesium	Mg	4.05	-
Iron	Fe	0.075	0.30
Manganese	Mn	0.027	0.05
COLIFORM BACTERIA (Colonies/100 mL*R)			
Total (Confirmed)		-	-
Fecal		-	Not detected

* = filtered a 0.45 micron membrane
** = total nitrate and nitrite nitrogen
*** = maximum acceptable concentration as set by "B.C. Drinking Water Quality Standards, 1982" and "Guidelines for Canadian Drinking Water Quality, 1978"
< = less than; mg/L = milligrams per litre
*R = remarks
X = Exceeded the "Guidelines"

REMARKS:

When evaluating coliform results, the following excerpts from the "Guidelines for Canadian Drinking Water Quality, 1978", published by the authority of Health and Welfare, Canada should be noted:
Page 24-25 "It should be emphasized that no bacteriological analysis of water can take the place of a complete knowledge of the conditions at the sources of supply and throughout the distribution system. Contamination is often intermittent and may not be revealed by the examination of a single sample. The most a bacteriological report can prove is that, at the time of examination, bacteria indicating fecal pollution did or did not grow under laboratory conditions from a sample of water."
Page 26 "Since the presence of any type of coliform organism in treated water suggest either inadequate treatment or contamination, the objective level for total coliforms should be no organisms detectable per 100mL; however, in practice this level is not always attainable."
Page 27 "If any coliform organisms are detected, the site should be resampled, and if the presence of coliforms is confirmed, action taken to determine the cause. If the maximum acceptable level is exceeded, the local control agency or Medical Officer of Health should be contacted for the appropriate corrective action. The most common immediate actions include increasing the chlorine dosage, flushing the water mains, using an alternative source of water and advising consumers to boil drinking water."

The "B.C. Drinking Water Quality Standards, 1982" published by Province of British Columbia, Ministry of Health further state that:
Page 3 "If any raw water sample contains fecal coliforms or if more than five percent of the samples in any consecutive 30 day period have a total coliform density greater than 10 per 100mL, disinfection is required.

METHOD OF TESTING:
The analyses were carried out in accordance with procedures described in "Laboratory Manual for the Chemical Analysis of Water, Wastewater, Sediments and Biological Materials (2nd Edition)" published by the Government of B.C., Ministry of Environment, Water Resources Services, 1976 and "Standard Methods for the Examination of Water and Wastewater" 15th Edition, 1980, published by the American Public Health Association.

The metals were determined using Inductively Coupled Plasma Spectrographic analysis, direct or graphite furnace atomic absorption spectrophotometry.

THURBER CONSULTANTS LTD.
Geotechnical Engineers

Sheet 1 of 2

TEST HOLE Nº TW89-2

LOG OF TEST WELL

LOCATION Lot 85, Galiano Island, BC

CLIENT Intrawest Properties Ltd.

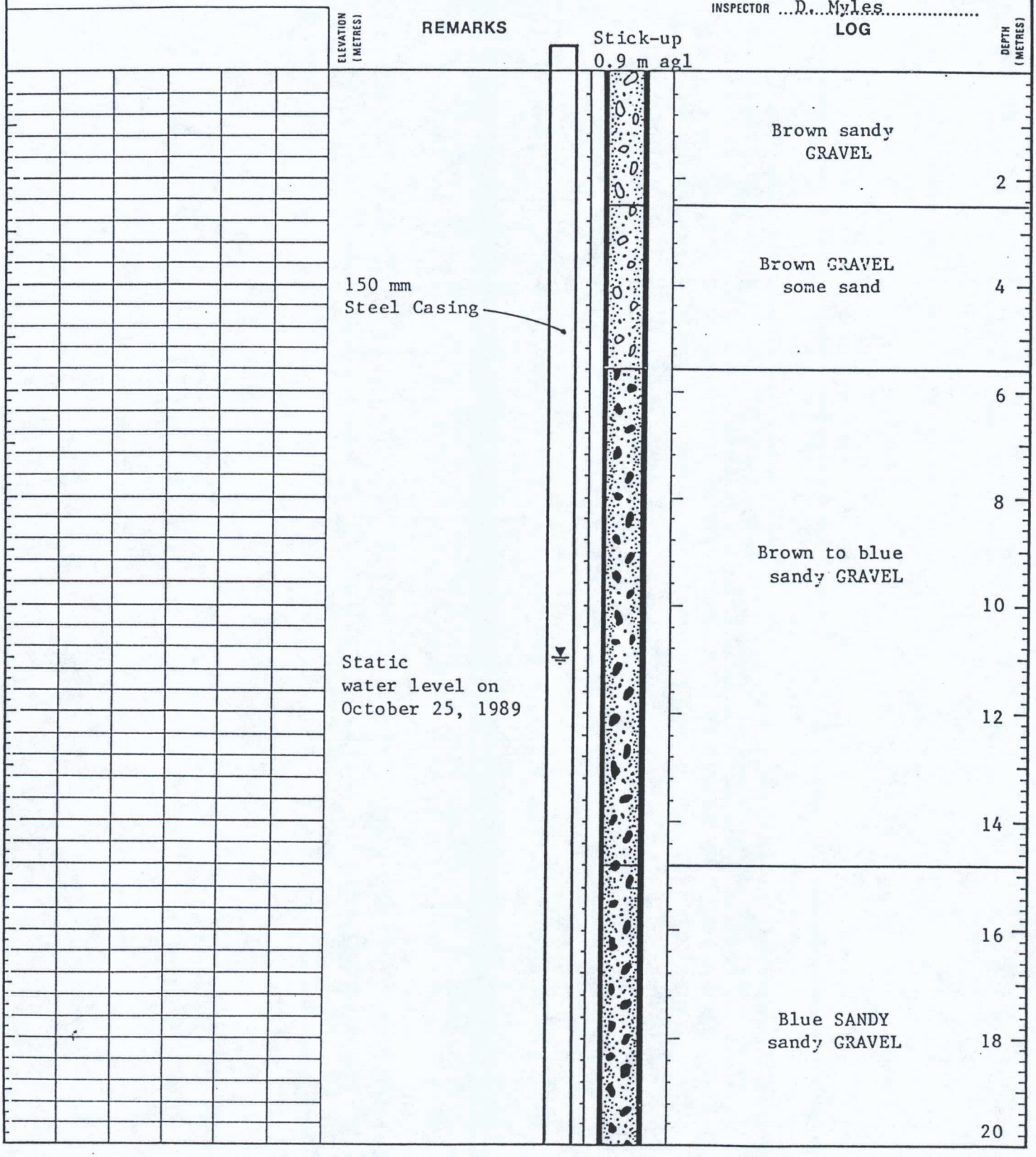
PROJECT McMillan Bloedel Ltd. Galiano Is. Groundwater Study

DATE October 22-25, 1989

METHOD Air Rotary

DRILLING Co Drillwell Enterprises Ltd.

INSPECTOR D. Myles



SCALE: 1:100

FILE Nº 10-482-12

THURBER CONSULTANTS LTD.
Geotechnical Engineers

Sheet 2 of 2

TEST HOLE Nº TW89-2

LOG OF TEST WELL

LOCATION Lot 85, Galiano Island, BC

CLIENT Intrawest Properties Ltd.
PROJECT McMillan Bloedel Ltd. Galiano Is. Groundwater Study
DATE October 22-25, 1989
METHOD Air Rotary
DRILLING Cº Drillwell Enterprises Ltd.
INSPECTOR D. Myles

ELEVATION (METRES)

REMARKS

End of casing @ 21.34 m

150 mm open drill hole in bedrock below 21.34 m

Major Fracture Zones (metres below ground level)

22.86 - 25.91
27.28 - 27.58
37.19 - 41.15
45.72 - 46.33
51.21 - 51.82
59.44 - 59.74
62.48 - 76.20
82.30 - 86.25
90.83 - 92.96
99.67 - 99.97
104.55 - 104.85
111.56 - 114.30
121.31 - 121.92

* Nanaimo Group Gabriola Formation

End of drill hole @ 121.92 m bgl

LOG

DEPTH (METRES)

Blue SANDY GRAVEL

22

Grey SANDSTONE *

24

26

Black SHALE *

28

Light Grey SANDSTONE *

30

32

116

Light Grey SANDSTONE *

118

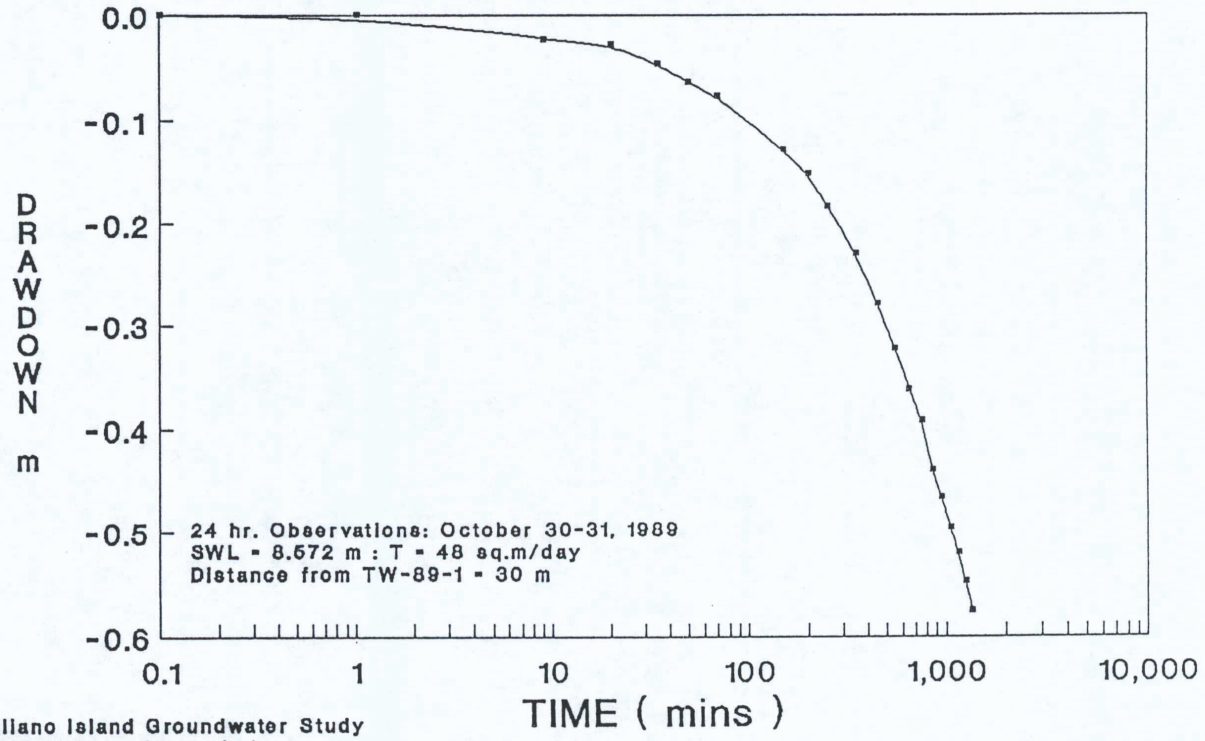
120

Black SHALE *

SCALE: 1:100

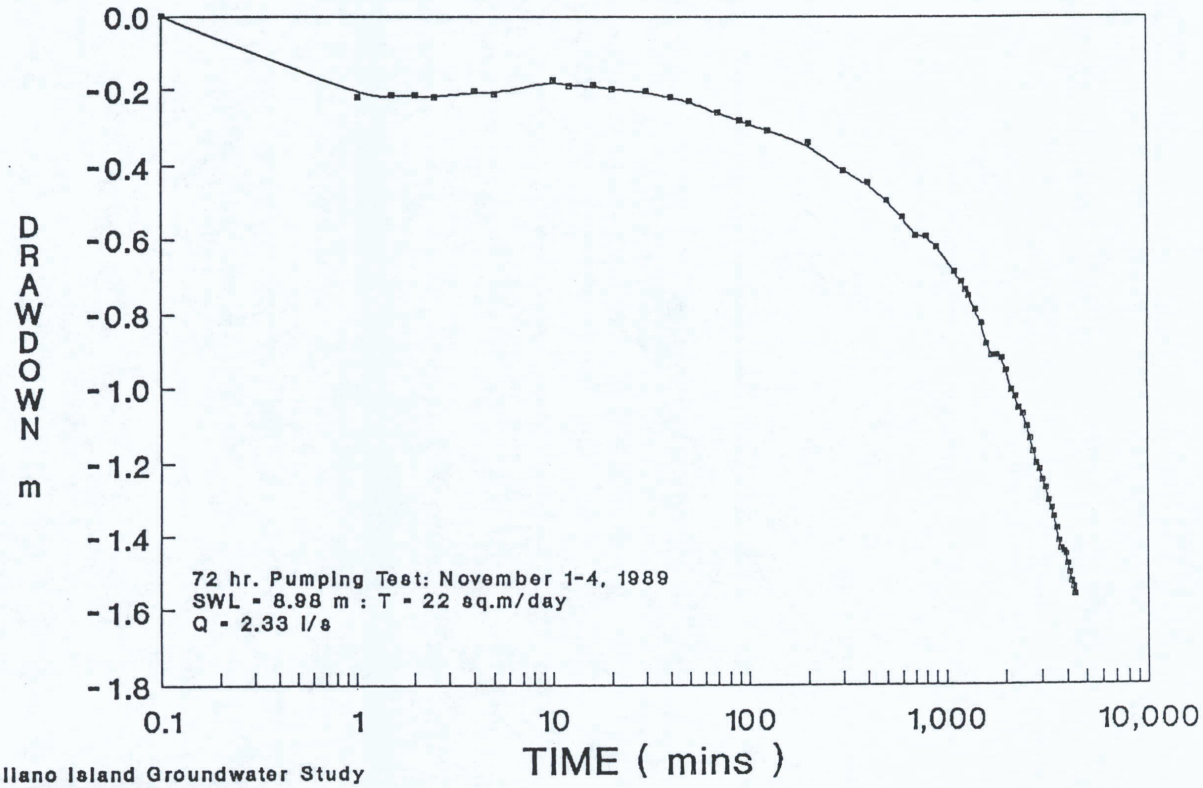
FILE Nº 19-483-13

DRAWDOWN IN OBSERVATION WELL TW-89-2
DURING PUMPING OF TW-89-1



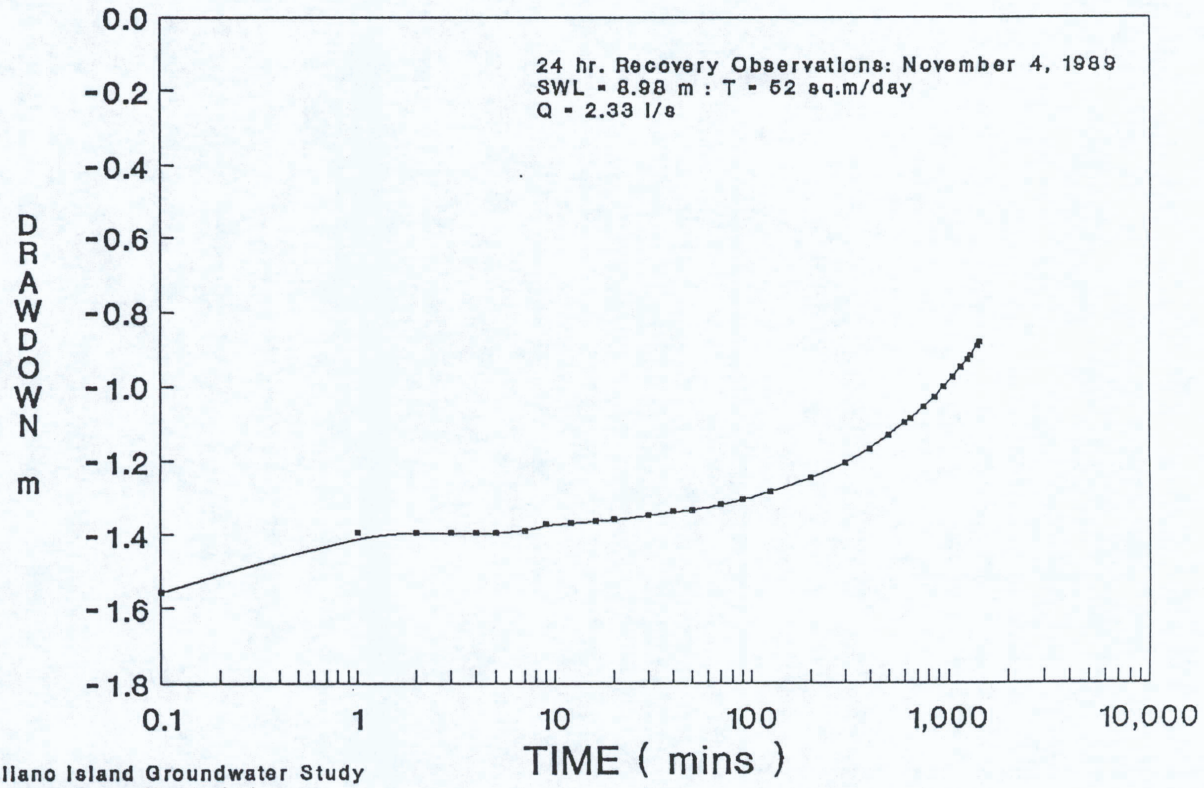
Galiano Island Groundwater Study
Thurber Consultants Ltd.
File: 19-483-13

DRAWDOWN IN PUMPING WELL TW-89-2



Galiano Island Groundwater Study
Thurber Consultants Ltd.
File: 19-483-13

RECOVERY IN PUMPING WELL TW-89-2



Gallano Island Groundwater Study
Thurber Consultants Ltd.
File: 19-483-13

THURBER CONSULTANTS LTD., Geotechnical Engineers

CLIENT INTRAWEST PROPERTIES LTD. FILE No. 19-483-13

PROJECT. GALIANO ISLAND STUDY DATE OCT-NOV 1989

AQUIFER TEST DATA

WELL NO. TW-89-2 STATUS. OBSERVATION (PUMPING) MEASURED BY B.C. AQUIFER

LOCATION GALIANO ISL. R= 30M SHEET ___ of ___

DATE	TIME (hrs & min)	ELAPSED TIME (min)	TIME SINCE PUMPING STOPPED (t')	t/t'	DEPTH TO WATER (M)	DRAWDOWN (M.)	PUMPING RATE ( )	REMARKS (i.e. water temp., static level weather condition, well completion, etc.)
30 OCT 89	1510	0			8.572	0		STATIC OF 89-2 = 8.572
		0.5						
		1			8.572	0		
		1.5						
		2						
		2.5						
		3						
		3.5						
		4						
		4.5						
		5						
		6						
		7						
		8						
		9			8.595	0.023		
		10						
		12						
		14						
		16						
		18						
		20			8.600	0.028		
		25						
		30						
		35			8.618	0.046		
		40						
		45						
		50			8.635	0.063		
		60						
		70			8.648	0.076		
		80						
		90						
		100						
		125			8.670	0.098		
		150			8.700	0.128		
		200			8.724	0.152		
		250			8.756	0.184		
		300						
		350			8.801	0.229		
		400						
		450			8.850	0.278		
		500						
31 OCT 89		550			8.894	0.322		
		600						
		650			8.934	0.362		
		700						
		750			8.973	0.391		
		800						
		850			9.012	0.440		
		900						
		950			9.038	0.466		

THURBER CONSULTANTS LTD., Geotechnical Engineers

CLIENT INTRANEST PROPERTIES LTD FILE No. 19-483-13

PROJECT. GALIANO ISLAND STUDY DATE OCT-NOV 1989

AQUIFER TEST DATA

WELL NO. TW-89-2 STATUS. OBSERVATION-PUMPING MEASURED BY B.C. AQUIFER

LOCATION GALIANO ISLAND R= 30 M SHEET 2 of 2

DATE	TIME (hrs & min)	ELAPSED TIME (min)	TIME SINCE PUMPING STOPPED (t')	t/t'	DEPTH TO WATER (M)	DRAWDOWN (M)	PUMPING RATE ( )	REMARKS (i.e. water temp., static level weather condition, well completion, etc.)
300189		1000						
		1050			9.068	0.496		
		1100						
		1150			9.093	0.521		
		1200						
		1250			9.120	0.548		
		1300						
		1350			9.147	0.575		
		1400						
		1450						STOP PUMPING – START RECOVERY
		1500						
		1550						
		1600						
		1650						
		1700						
		1750						
		1800						
		1850						
		1900						
		1950						
		2000						
		2050						
		2100						
		2150						
		2200						
		2250						
		2300						
		2350						
		2400						
		2450						
		2500						
		2650						
		2600						
		2650						
		2700						
		2750						
		2800						
		2850						
		2900						
		2950						
		3000						
		3050						
		3100						
		3150						
		3200						
		3250						
		3300						
		3350						
		3400						
		3450						

THURBER CONSULTANTS LTD. Geotechnical Engineers

CLIENT INTRAWEST PROPERTIES LTD. FILE No. 19-483-13

PROJECT GALLANO ISLAND STUDY DATE OCT-NOV 1989

AQUIFER TEST DATA

WELL NO. TW-89-2 STATUS OBSERVATION / RECOVERY MEASURED BY B.C. AQUIFER

LOCATION GALIANO ISL. R= SHEET ___ of ___

DATE	TIME (hrs & min)	ELAPSED TIME (min)	TIME SINCE PUMPING STOPPED (t')	t/t'	DEPTH TO WATER (M)	RESIDUAL DRAWDOWN (M)	PUMPING RATE ( )	REMARKS (i.e. water temp., static level weather condition, well completion, etc.)
31 OCT 89	1520	0						STARTED MONITORING RECOVERY.
		0.5						
		1						
		1.5						
		2						
		2.5						
		3						
		3.5						
		4						
		4.5						
		5						
		6						
		7						
		8						
		9						
		10		153	9.155	.583		
		12						
		14						
		16						
		18						
		20						
		25		61.8	9.145	.573		
		30						
		35						
		40		26	9.134	.562		
		45						
		50						
		60						
		70						
		80						
		90		17.9	9.110	.538		
		100						
		125		13.2	9.100	.528		
		150						
		200		8.6	9.072	.500		
		250		7.1	9.060	.488		
	2000	~~288~~						END OF MONITORING RECOVERY.
		350						
		400						
		450						
		500						
		550						
		600						
		650						
		700						
		750						
		800						
		850						
		900						
		950						

THURBER CONSULTANTS LTD., Geotechnical Engineers

CLIENT INTRAWEST PROPERTIES LTD. FILE No. 19-483-13

PROJECT GALIANO ISLAND STUDY DATE OCT-NOV 1989

AQUIFER TEST DATA

WELL NO. IW-89-2 STATUS. PUMPING MEASURED BY B.C. AQUIFER

LOCATION GALIANO ISL. R= 0 SHEET 1 of 3

DATE	TIME (hrs & min)	ELAPSED TIME (min)	TIME SINCE PUMPING STOPPED (t')	t/t'	DEPTH TO WATER (M)	DRAWDOWN (M)	PUMPING RATE (l/s)	REMARKS (i.e. water temp., static level weather condition, well completion, etc.)
01 NOV 89	1200	0			8.980	0.00		PUMP INTAKE @ 113.3m.; DATUM = 1.0m AGL
		0.5			9.275	0.385		2" LAYFLAT DISCHARGE (113m IN LENGTH)
		1			9.200	0.310		MEASURE INTO 6½ USGAL BUCKET & 57.05 GAL DRUM
		1.5			9.195	0.305		STAFF GAUGE = 1'5 7/8"
		2			9.195	0.305		
		2.5			9.200	0.310		
		3						
		3.5						
		4			9.185	0.295		H_2O GREY IN COLOR
		4.5						
		5			9.192	0.302		
		6					2.78	
		7						
		8						
		9						
		10			9.155	0.265		
		12			9.170	0.280		H_2O CLEANER BUT STILL GREY
		14			9.168	0.278		
		16			9.169	0.279	2.46	
		18			9.175	0.285		
		20			9.178	0.288		
		25			9.182	0.292		WATER CLEAR
		30			9.185	0.295	2.33	
		35			9.195	0.305		
		40			9.200	0.310		
		45			9.205	0.315		
		50			9.210	0.320		INSTALLED NEW STAFF GAUGE = 12"
		60			9.213	0.323		
		70			9.240	0.330		
		80			9.249	0.339		
		90			9.260	0.350		
		100			9.269	0.359		T=10.5°C; S=0; C=90
		125			9.287	0.397		
		150			9.290	0.400		
		200			9.320	0.430		T=10.5°C; S=0, C=90
		250			9.355	0.465		STAFF GAUGE = 12"
		300			9.394	0.504		T=10.5°C, S=0; C=90
		350			9.400	0.510		
		400			9.425	0.535		C=90; S=0
		450			9.445	0.555		
		500			9.475	0.585		C=85; S=0; T=9.5°C
		550			9.492	0.512		
		600			9.520	0.540		C=82; S=0; T=9.5°C
		650			9.550	0.570		
		700			9.570	0.590		
02 NOV 89	00:30	750			9.567	0.587		
		800			9.571	0.591		C=81; S=0; T=9.5°C
		850			9.590	0.610		
		900			9.600	0.620		C=80; S=0; T=9.5°C
		950			9.618	0.638		

THURBER CONSULTANTS LTD., Geotechnical Engineers

CLIENT INTRANEST PROPERTIES LTD — FILE No. 19-483-13

PROJECT. GALIANO ISLAND STUDY — DATE OCT-NOV 1989

AQUIFER TEST DATA

WELL NO. TW-89-2 — STATUS. PUMPING — MEASURED BY B.C. AQUIFER

LOCATION GALIANO ISLAND. — R=. 0 — SHEET 2 of 3

DATE	TIME (hrs & min)	ELAPSED TIME (min)	TIME SINCE PUMPING STOPPED (t')	t/t'	DEPTH TO WATER (M)	DRAWDOWN (M)	PUMPING RATE ( )	REMARKS (i.e. water temp., static level weather condition, well completion, etc.)
02 NOV 89	0440	1000			9.635	0.655	2.33	C=79; S=0; T=9.5°C
		1050			9.653	0.673		
		1100			9.667	0.687		
		1150			9.679	0.699		
		1200			9.694	0.714		C=81; S=0; T=9.5°C
		1250			9.714	0.734		VERY LIGHT RAIN.
		1300			9.730	0.750		C=80; S=0; T=9.75°C
		1350			9.754	0.774		
		1400			9.768	0.788		C=95; S=0; T=9.75°C
		1450			9.785	0.805		
		1500			9.805	0.825		STAFF GAUGE = 11 3/4"
		1550			9.830	0.850		
		1600			9.860	0.880		C=90; S=0; T=9.75°C RAINING - LIGHTLY.
		1650			9.870	0.890		
		1700			9.890	0.910		C=84; S=0; T=9.75
		1750			9.870	0.890		
		1800			9.892	0.912		
		1850			9.900	0.920		
		1900			9.900	0.920		C=82; S=0; T=9.75°C
		1950			9.917	0.937		
		2000			9.934	0.954		
		2050			9.975	0.995	↓	
		2100			9.987	1.007	2.27	
		2150			10.003	1.023	↓	
		2200			10.013	1.033	2.33	S=0, C=79; T=9.75°C
		2250			10.036	1.056		
		2300			10.036	1.056		STAFF GAUGE = 11 23/32" C=112; S=0; T=9.5°C
		2350			10.049	1.069		
		2400			10.053	1.073		STAFF GAUGE = 11 27/32" C=101; S=0; T=9.5°C
		2450			10.073	1.093		
		2500			10.085	1.105		C=91; S=0; T=9.5°C
		2650			10.103	1.123		
		2600			10.117	1.137		STAFF GAUGE = 11 3/4"; C=89; S=0; T=9.5°C
		2650			10.134	1.154		
		2700			10.151	1.171		STAFF GAUGE = 11 7/8"; C=90; S=0; T=9.5°C
		2750			10.174	1.194		
		2800			10.185	1.205		STAFF GAUGE = 12 3/8"; C=168; S=0; T=9.5°C
		2850			10.192	1.212		
		2900			10.200	1.220		STAFF GAUGE = 12 5/8"; C=230; S=0; T=9.5°C
		2950			10.222	1.242		
		3000			10.230	1.250		STAFF GAUGE = 12 3/4", C=300; S=0; T=9.5°C
		3050			10:242	1.262		RAIN STOPPED
		3100			10.250	1.270		C=275; S=0; T=9.5°C
		3150			10.272	1.292		
		3200			10.284	1.304		C=260; S=0; T=9.5°C
		3250			10.290	1.310		STAFF GAUGE = 13 1/8".
		3300			10.305	1.325		HARD RAIN; C=240; S=0; T=9.5°C
		3350			10.320	1.340		STAFF GAUGE = 13 3/8"
		3400			10.328	1.348	↓	C=200; S=0; T=9.5°C
		3450			10.341	1.361		STAFF = 13 5/8"

THURBER CONSULTANTS LTD., Geotechnical Engineers

CLIENT INTRAWEST PROPERTIES LTD FILE No. 19-483-13

PROJECT. GALIANO ISLAND STUDY DATE OCT-NOV 1989

AQUIFER TEST DATA

WELL NO. TW 89-2 STATUS. PUMPING MEASURED BY B.C. AQUIFER

LOCATION CALIANO IS R=0 SHEET 3 of 3

DATE	TIME (hrs & min)	ELAPSED TIME (min)	TIME SINCE PUMPING STOPPED (t')	t/t'	DEPTH TO WATER (M)	DRAWDOWN (M)	PUMPING RATE ( )	REMARKS (i.e. water temp., static level weather condition, well completion, etc.)
		3500			10.360	1.380	2.33	C=185; S:0; T:9.5°C
		3550			10.379	1.399		LIGHT RAIN
03NOV89	0000	3600			10.395	1.415		C=180; S:0; T=9.5°C
		3650			10.380	1.400		
		3700			10.407	1.427		STAFF GAUGE = 14" C=251; S:0; T:9.75°
		3750			10.413	1.433		
		3800			10.425	1.445		STAFF GAUGE 13 5/16", C=158; S:0; T= 9.75°C
		3850			10.428	1.448		
		3900			10.433	1.453		C=198; S:0; T:9.5°C
		3950			10.450	1.470		
		4000			10.458	1.478		STAFF GAUGE = 13 7/8"; C=218, S:0, T=9.5°C
		4050			10.467	1.487		
		4100			10.483	1.503		STAFF GAUGE = 13 7/8, C=200; S:0; T=9.5°C
		4150			10.494	1.514		
		4200			10.505	1.525		STAFF 13 1/2; C=208; S:0; T=9.75°C
		4250			10.514	1.534		
		4300			10.521	1.541		STAFF GAUGE = 13 3/4"; C=78; S:0; T=10°C
		4320			10.540	1.560	▼	TOOK H_2O SAMPLES
								SHUT DOWN TEST STARTED RECOVERY.
								3CM OF RAIN DURING 100 HRS OF TESTING.

THURBER CONSULTANTS LTD., Geotechnical Engineers

CLIENT INTRAWEST PROPERTIES LTD. FILE NO. 19-483-13

PROJECT GALLANO ISLAND STUDY DATE OCT-NOV 1989

AQUIFER TEST DATA

WELL NO. TW-89-2 STATUS RECOVERY IN PUMPING WELL MEASURED BY B.C. AQUIFER

LOCATION GALLANO ISL. R= Q SHEET 1 of 2

DATE	TIME (hrs & min)	ELAPSED TIME (min)	TIME SINCE PUMPING STOPPED (t')	t/t'	DEPTH TO WATER (M)	DRAWDOWN (M)	PUMPING RATE (N/A)	REMARKS (i.e. water temp., static level weather condition, well completion, etc.)
04/Nov89	12:00	4378			10.540	10		START MONITORING RECOVERY
		0.5	0.5	8641	10.412	1.432		
		1	1	4321	10.377	1.397		
		1.5	1.5	2881	10.377	1.397		
		2	2	2161	10.377			
		2.5	2.5	1729	10.377			
		3	3	1441	10.377			
		3.5	3.5	1235.8	10.377			
		4	4	1081	10.377			
		4.5	4.5	961	10.377			
		5	5	865	10.377	1.397		
		6	6	721	10.375	1.395		
		7	7	618	10.370	1.390		
		8	8	541	10.355	1.375		
		9	9	481	10.354	1.374		
		10	10	433	10.353	1.373		
		12	12	361	10.350	1.370		
		14	14	309.6	10.347	1.367		
		16	16	271	10.345	1.365		
		18	18	241	10.342	1.362		
		20	20	217	10.340	1.36		
		25	25	173.8	10.335	1.335		
		30	30	145.0	10.330	1.350		
		35	35	124.4	10.320	1.340		
		40	40	109	10.319	1.339		
		45	45	97	10.319	1.339		
		50	50	87.4	10.315	1.335		
		60	60	73.0	10.308	1.328		
		70	70	62.7	10.301	1.321		
		80	80	55.0	10.296	1.316		
		90	90	49.0	10.287	1.307		
		100	100	44.2	10.280	1.300		
		125			10.266	1.286		
		150	150	29.8	10.255	1.275		
		200	200	22.6	10.230	1.250		
		250	250	18.3	10.209	1.229		
		300	300	15.4	10.190	1.210		
		350	350	13.3	10.172	1.192		
		400	400	11.8	10.151	1.171		
		450	450	10.6	10.134	1.154		
		500	500	9.6	10.115	1.135		
		550			10.107	1.127		
		600	600	8.2	10.080	1.100		
		650			10.073	1.093		
		700	700	7.2	10.053	1.073		
05/NOV89	00:30	750			10.038	1.058		
		800	800	6.4	10.027	1.047		
		850			10.012	1.032		
		900	900	5.8	9.998	1.018		
		950			9.984	1.004		

CLIENT INTRANEST PROPERTIES LTD FILE NO. 19-483-13

PROJECT GALIANO ISLAND STUDY DATE OCT-NOV 1989

AQUIFER TEST DATA

WELL NO. IW-89-2 STATUS. RECOVERY MEASURED BY B.C. AQUIFER

LOCATION GALIANO ISL. R= 0 SHEET 2 of 2

DATE	TIME (hrs & min)	ELAPSED TIME (min)	TIME SINCE PUMPING STOPPED (t')	t/t'	DEPTH TO WATER (M)	DRAWDOWN (M)	PUMPING RATE ( )	REMARKS (i.e. water temp., static level weather condition, well completion, etc.)
05NOV	04:40	1000	1000	5.32	9.970	0.990		
		1050			9.957	0.997		
		1100			9.945	0.965		
		1150			9.932	0.952		
		1200			9.921	0.941		
		1250	1250	4.5	9.910	0.930		
		1300			9.898	0.918		
		1350			9.886	0.906		
		1400			9.872	0.892		
	12:00	1450	1450	4.0	9.863	0.883		
		1500						END OF RECOVERY
		1550						43.4% RECOVERED
		1600						
		1650						
		1700						
		1750						
		1800						
		1850						
		1900						
		1950						
		2000						
		2050						
		2100						
		2150						
		2200						
		2250						
		2300						
		2350						
		2400						
		2450						
		2500						
		2650						
		2600						
		2650						
		2700						
		2750						
		2800						
		2850						
		2900						
		2950						
		3000						
		3050						
		3100						
		3150						
		3200						
		3250						
		3300						
		3350						
		3400						
		3450						

FILE: 19-48:

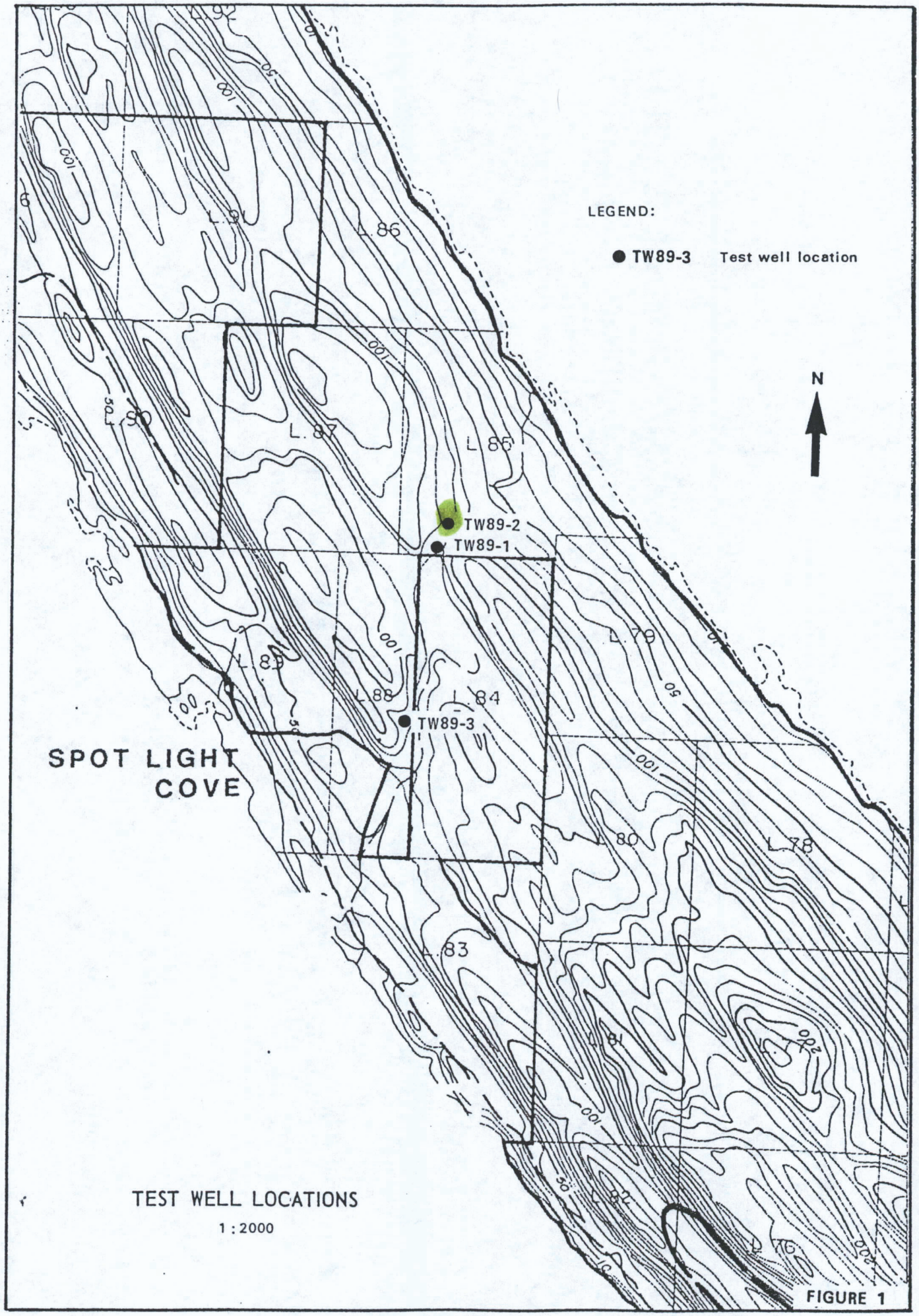


FIGURE 1

BCGS MAP 0 5 2 B • 0 9 3 • 3 • 3 • 2

WTN: 62684

WELL NO. 0 4 1

WATER WELL RECORD

MINISTRY OF ENVIRONMENT WATER MANAGEMENT DIVISION — VICTORIA, BRITISH COLUMBIA

LEGAL DESCRIPTION: LOT ____ SEC. ____ TP. ____ R. ____ D.L. 75 LAND DISTRICT Cowichan PLAN ____

DESCRIPTIVE LOCATION TW 75-2 Galiano Island LICENCE NO. ____ DATE ____

Z ☐ WELL NO. ____ E ____ N ____

Z X Y NO.

OWNER'S NAME MacMillan Bloedel Ltd ADDRESS ____

DRILLER'S NAME Drillwell Enterprises Ltd ADDRESS ____ DATE COMPLETED Oct 25/75

NAT. TOPO. SHEET NO. ____

DEPTH 400' ELEVATION OF 299' ☐ ESTIMATED ☐ SURVEYED CASING DIAM. ____ LENGTH ____

METHOD OF CONSTRUCTION Air Rotary CASING DIAM ____ LENGTH ____

SCREEN LOCATION ____ SCREEN ☐ SIZE ____ LENGTH ____ TYPE ____

SANITARY SEAL YES ☐ NO ☐ SCREEN ☐ SIZE ____ LENGTH ____ TYPE ____

PERFORATED CASING ☐ LENGTH ____ PERFORATIONS FROM ____ TO ____

GRAVEL PACK ☐ LENGTH ____ DIAM. ____ SIZE GRAVEL, ETC. ____

DISTANCE TO WATER 28' ☐ ESTIMATED WATER LEVEL

FROM ____ ☐ MEASURED ELEVATION ____ ARTESIAN PRESSURE ____

DATE OF WATER LEVEL MEASUREMENT ____ WATER USE ____

PRODUCTION TEST SUMMARY

DATE ____
TEST BY ____
BAIL TEST ☐ PUMP TEST ☐ DURATION OF TEST ____
RATE ____ DRAWDOWN ____
WATER LEVEL AT COMPLETION OF TEST ____
AVAILABLE DRAWDOWN ____ SPECIFIC CAPACITY ____
PERMEABILITY ____ STORAGE COEFF. ____
TRANSMISSIVITY ____
ESTIMATED WELL YIELD 200 igph
RECOMMENDED PUMPING RATE ____
RECOMMENDED PUMP SETTING ____

CHEMISTRY

TEST BY JB Laboratories DATE Nov 75

TOTAL DISSOLVED SOLIDS ____ mg/l TEMPERATURE ____ °C pH ____ SILICA (SiO_2) ____ mg/l

CONDUCTANCE ____ µmhos/cm AT 25°C TOTAL IRON (Fe) ____ mg/l TOTAL HARDNESS ($CaCO_3$) ____ mg/l

TOTAL ALKALINITY ($CaCO_3$) ____ mg/l PHEN. ALKALINITY ($CaCO_3$) ____ mg/l MANGANESE (Mn) ____ mg/l

COLOUR ____ ODOUR ____ TURBIDITY ____

ANIONS	mg/l	epm
CARBONATE (CO_3)		
BICARBONATE (HCO_3)		
SULPHATE (SO_4)		
CHLORIDE (Cl)		
$NO_2 + NO_3$ (NITROGEN)		
* TKN. (NITROGEN)		
PHOSPHORUS (P)		

CATIONS	mg/l	epm
CALCIUM (Ca)		
MAGNESIUM (Mg)		
SODIUM (Na)		
POTASSIUM (K)		
IRON (DISSOLVED)		

* TKN = TOTAL KJELDAHL NITROGEN CHEMISTRY SITE NO. ____

NO_2 = NITRITE NO_3 = NITRATE

CHEMISTRY FIELD TESTS

TEST BY ____ DATE ____ EQUIPMENT USED ____

LITHOLOGY

FROM	TO	DESCRIPTION

CONTENTS OF FOLDER

☐ DRILL LOG ☐ PUMP TEST DATA ☐ CHEMICAL ANALYSIS
☐ SIEVE ANALYSIS ☐ GEOPHYSICAL LOGS ☐ REPORT

OTHER ____

SOURCES OF INFORMATION Thurber Report – GW Supply Study Galiano Island and " " " – DL 75 Galiano Island (it is well #4)

TAG # 62684

NORTH

WEST

EAST

SOUTH

CARD BY_____ DATE_____

ADDITIONAL DATA ADDED BY_____

REMARKS

97941

ENV 1995

Appendix D

TECHNICAL DATA SHEET
WELL #1

1. District Lot: **85**
2. Client: **FLEMING LARSEN**
3. File No: **19-2128-0**
4. Well No. **1 (Located by Client)**
5. Lot No. **1**

6. Water Quality:
   - TDS **282**
   - Sp.C. **412**
   - Cl **15**
   - T.Coli. **10**
   - F.Coli. **<1**
7. Laboratory: **J.B. Labs Ltd.**

8. Test Pumping:
   - Date tested: **Apr. 6,1995**
   - Contractor: **Red Williams Drilling**
   - Pump Rate: **3.5USgpm**
9. Total lots to be served by well: **2**
10. Total requirement (@500 lgpd/L): **1000 lgpd 0.84 USgpm**
11. Total Well Depth: **90m**
12. Non-pumping water level: **0 m (Flowing)**
13. Depth to primary fracture: **89 m**
14. Well elevation: **11 m, above mean sea level**
15. Depth to sea level: **11 m**
16. 100% available drawdown: **11 m to sea level**
17. 70% available drawdown: **8 m to sea level**
18. Total recovery expected: **yes**

19. Estimated well yield: **13,150 lgpd 11 USgpm**
    Verification test rate **3.5 USgpm**
20. Well Location:
    Groundwater Region: **Georgia Strait** (Mordant, Hodge, 1983)
    - % demand-storage ratio: **0**
    - No. of wells within 500m: **4** on D.L. 85 (closest 200m)
      on D.L. 86 (Closest 250m)
21. COMMENTS:
    Observation readings taken on Well #4 (DL 86), 250 m away, with no suspected interferance effect (tidal effect only). Observation readings were taken on Well #2 (DL 85), 200m south, with a recorded drop in water level of 0.28m. Similarily a drop of 0.28m was noted on Well #3, 350m south. In all cases the change in water levels on the observation wells is likely due to tide.

bii/D1

THURBER

PUMPING WELL #1

DRAWDOWN DATA

THURBER ENGINEERING LTD.

FILE No.: 19-2128-0

FLEMING LARSEN - D.L. 85; GALIANO ISLAND

START DATE: APRIL 9, 1995

START TIME: 13:00

SWL = 0.000 metres (flowing)

ELAPSED TIME (min.)	WATER DEPTH (metres)	RATE (USGpm)	DRAWDOWN (metres)	NOTES
0.0	0.000		0.000	<< Flowing conditions
0.5	0.240		-0.240	
1.0	0.260		-0.260	
1.5	0.264		-0.264	
2.0	0.274		-0.274	
2.5	0.270		-0.270	
3.0	0.280		-0.280	
3.5	0.290		-0.290	
4.0	0.290		-0.290	
4.5	0.295		-0.295	
5.0	0.304		-0.304	
6.0	0.304		-0.304	
7.0	0.304		-0.304	
8.0	0.310		-0.310	
9.0	0.320		-0.320	
10	0.324		-0.324	
12	0.326		-0.326	
14	0.330		-0.330	
16	0.346		-0.346	
18	0.335		-0.335	
20	0.340		-0.340	
25	0.354		-0.354	
30	0.366	3.6	-0.366	<< SC = 410
35	0.374		-0.374	
40	0.380		-0.380	
45	0.380	3.6	-0.380	
50	0.390		-0.390	
55	0.392		-0.392	
60	0.405	3.5	-0.405	
70	0.410		-0.410	
80	0.415		-0.415	
100	0.432		-0.432	
120	0.450		-0.450	
150	0.510	3.5	-0.510	
180	0.510		-0.510	
240	0.550		-0.550	
300	0.610		-0.610	
360	0.632		-0.632	
420	0.630		-0.630	
480	0.644		-0.644	
540	0.610	3.5	-0.610	
600	0.600		-0.600	<< SC = 390
660	0.570		-0.570	<< water sample taken
820	0.550	3.5	-0.550	

THURBER

PUMPING WELL #1
DRAWDOWN CURVE

FLEMING LARSEN
D.L. 85; Galiano Island

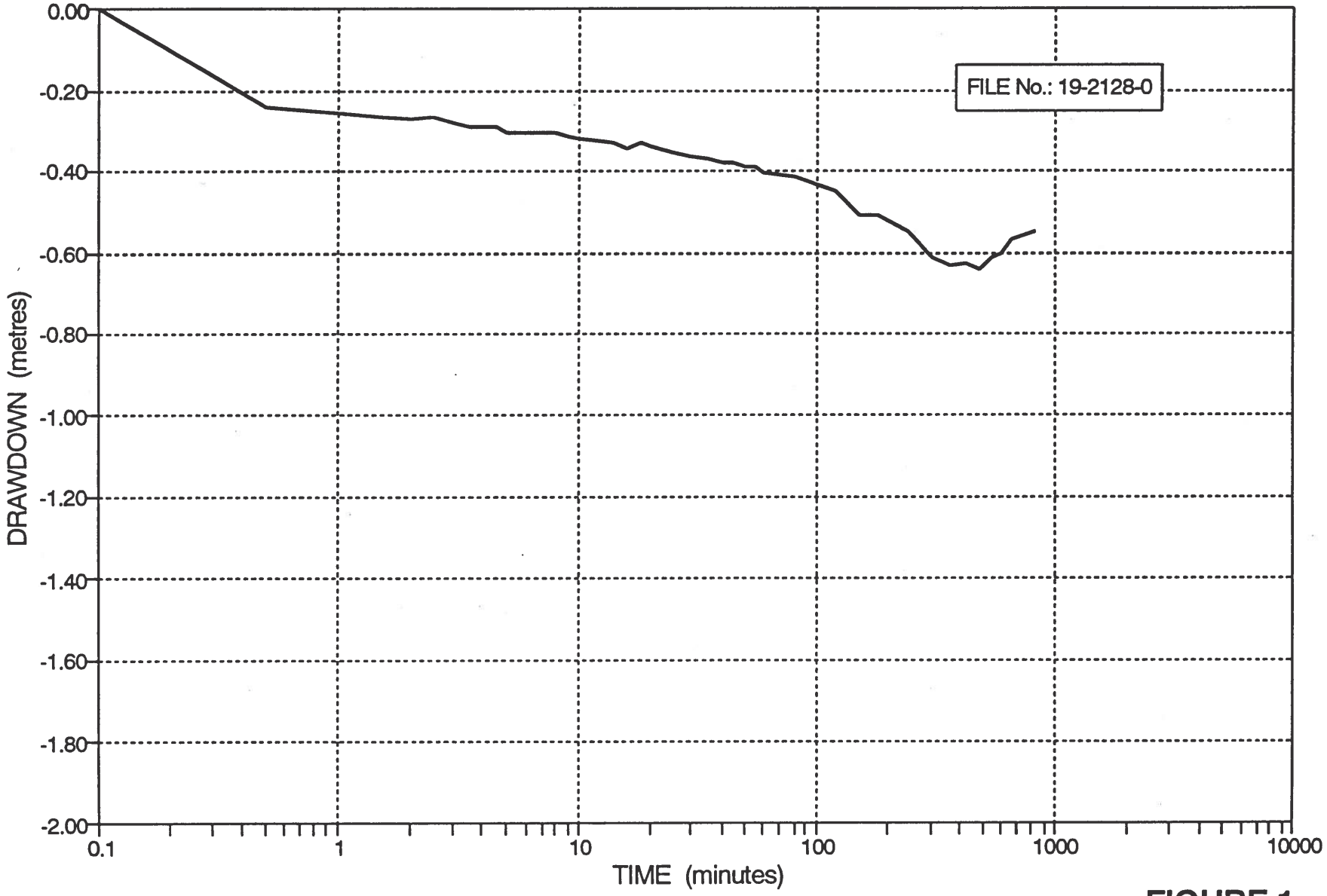


FIGURE 1

THURBER

PUMPING WELL #1
DRAWDOWN CURVE

FLEMING LARSEN
D.L. 85; Galiano Island

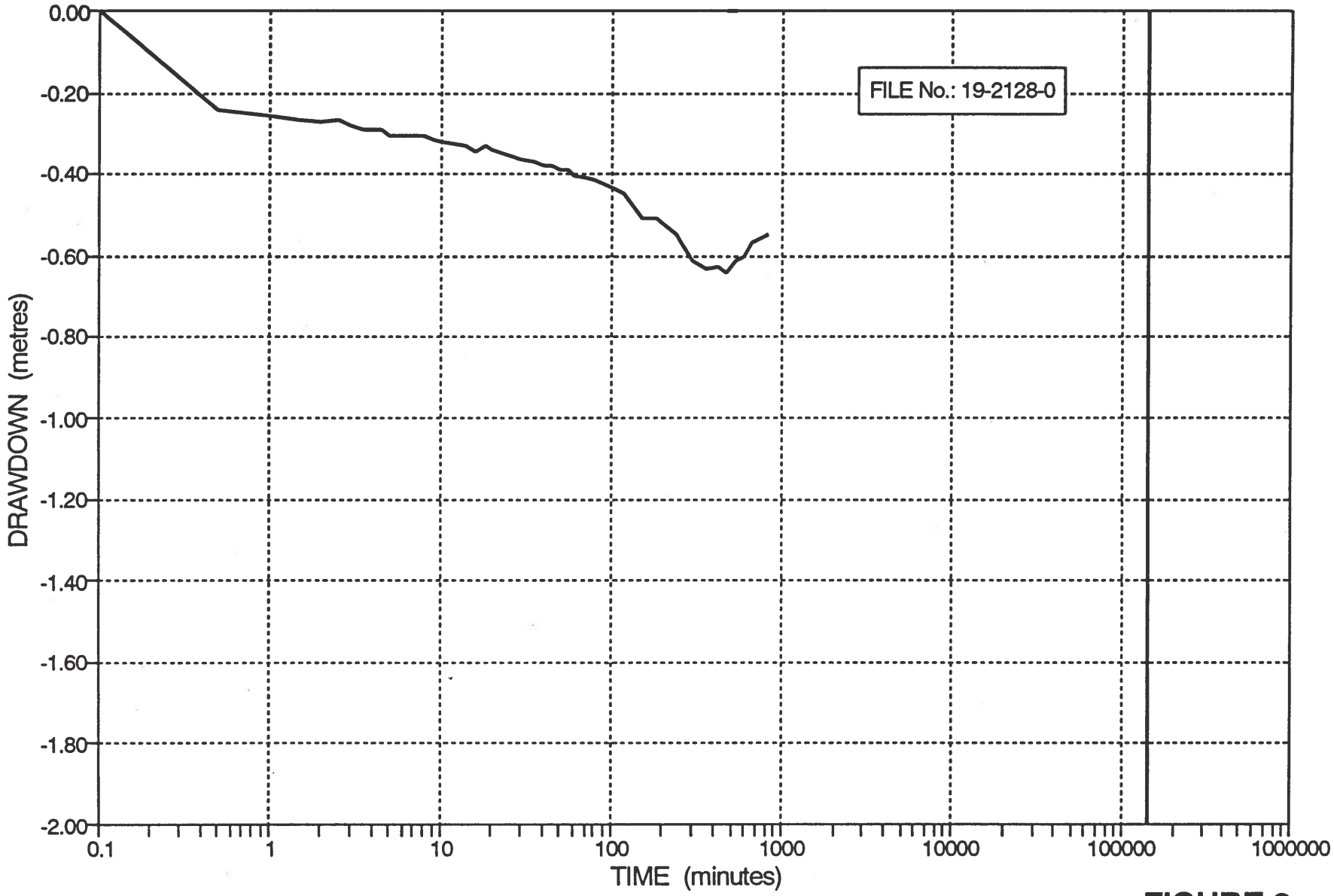


FIGURE 2

THURBER

PUMPING WELL #1

RESIDUAL DRAWDOWN

THURBER ENGINEERING LTD.

FILE No.: 19-2128-0

FLEMING LARSEN - D.L. 85; GALIANO ISLAND

START DATE: APRIL 10, 1995

START TIME: 01:00

SWL = 0.000 metres

ELAPSED TIME (Minutes) t @ t' = 820			WATER DEPTH	RATE	RESIDUAL DRAWDOWN	NOTES
t	t'	t/t'	s (metres)	(USGpm)	s' (metres)	
820	0		0.550		-0.550	Last reading pumping
821	0.5	1641	0.490		-0.490	
821	1	821	0.485		-0.485	
822	1.5	548	0.470		-0.470	
822	2	411	0.470		-0.470	
823	2.5	329	0.460		-0.460	
823	3	274	0.450		-0.450	
824	3.5	235	0.445		-0.445	
824	4	206	0.440		-0.440	
825	4.5	183	0.435		-0.435	
825	5	165	0.425		-0.425	
826	6	138	0.420		-0.420	
827	7	118	0.415		-0.415	
828	8	104	0.400		-0.400	
829	9	92	0.390		-0.390	
830	10	83	0.390		-0.390	
832	12	69	0.375		-0.375	
834	14	60	0.365		-0.365	
836	16	52	0.358		-0.358	
838	18	47	0.350		-0.350	
840	20	42	0.340		-0.340	
845	25	34	0.320		-0.320	
850	30	28	0.305		-0.305	
855	35	24	0.300		-0.300	
860	40	22	0.290		-0.290	
870	50	17	0.280		-0.280	
875	55	16	0.270		-0.270	
880	60	15	0.255		-0.255	
890	70	13	0.245		-0.245	
900	80	11	0.235		-0.235	
910	90	10	0.225		-0.225	
917	97	9	0.000		0.000	Flowing

THURBER

PUMPING WELL #4

RESIDUAL DRAWDOWN CURVE

FLEMING LARSEN
D.L. 85; Galiano Island

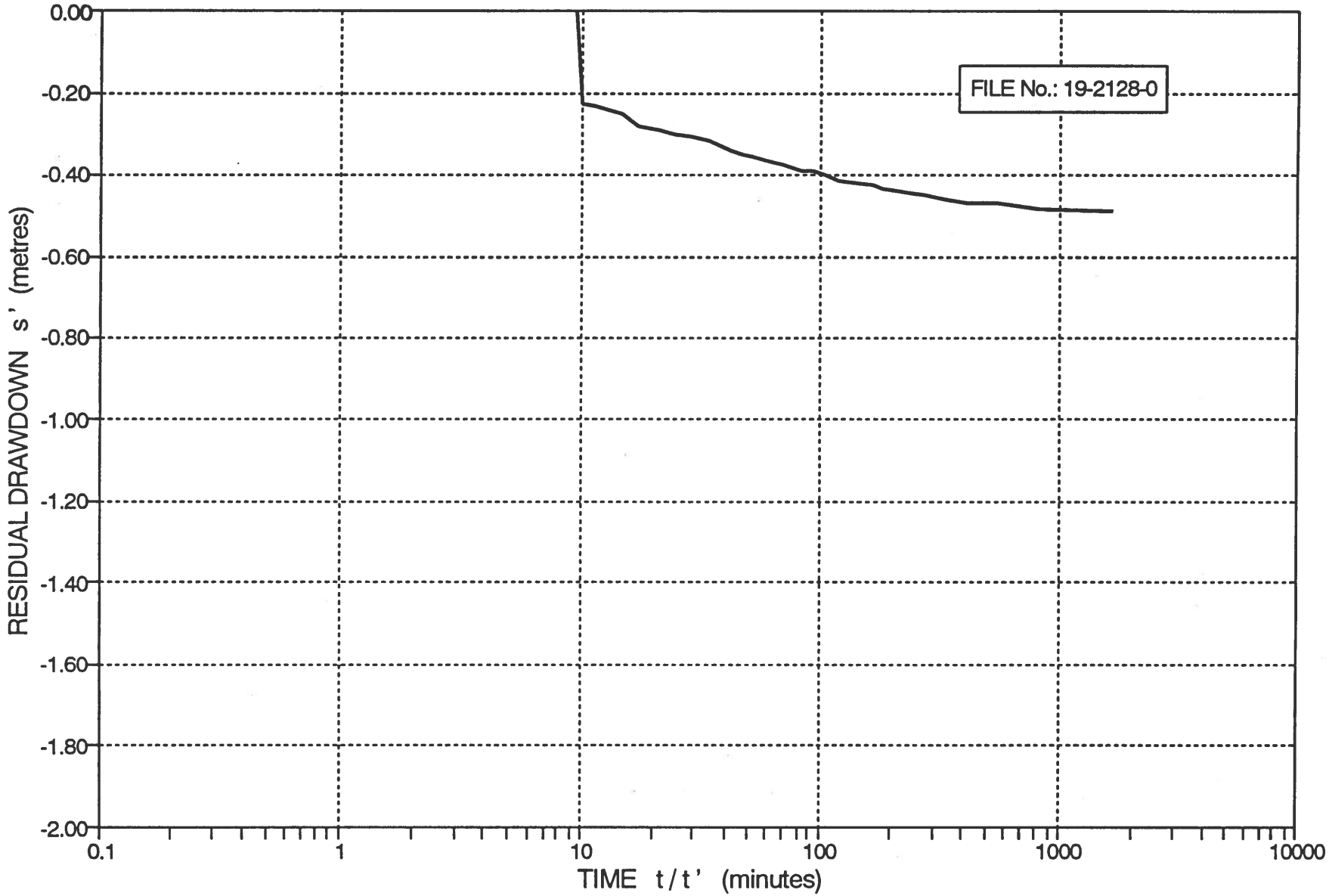


FIGURE 3

THURBER

JB LABS
827 FORT STREET,
VICTORIA, B.C. V8W 1H6
Tel: (604) 385-6112
Fax: (604) 382-6364

DATE: April 11, 1995

JOB NO: JB 1737
LR NO: 19642

SAMPLING DATE: See Below

CLIENT: Red Williams Well
Drilling Ltd.
980 Pratt Rd.
Qualicum Beach, B.C.
V9K 1W5

SAMPLING AGENT: Client

The sample(s) submitted by the agent have been tested as requested and we report as follows:

SAMPLE: Sample # 1: Well #3, Fleming Larson Apr 6/95
Sample # 2: Well #1 Apr 10/95

		Sample 1	Well #1 Sample 2
Tot Dissolved Solids	mg/L	228	282
Conductivity	umhos/cm	364	412
pH		7.8	7.9
Alkalinity, Total	mg/L $CaCO_3$	147	199
Total Hardness	mg/L $CaCO_3$	39	28
Calcium	mg/L	6.8	10.0
Magnesium	mg/L	5.3	0.7
Iron	mg/L	0.1	< 0.1
Manganese	mg/L	0.22*	< 0.02
Sodium	mg/L	40.0	91.0
Chloride	mg/L	23	15
Sulphate	mg/L	9	13
Fluoride	mg/L	0.37	0.55
Nitrite	mg/L N	< 0.002	< 0.002
Nitrate	mg/L N	< 0.04	0.05
Total Coliform	CFU/100ml	< 1	10*
Faecal Coliform	CFU/100ml	< 1	< 1
Noncoliform bacteria	CFU/100ml	< 1	8

Thurber Consultants
Attn Bruce Ingimundsen

* Indicates Outside of Guidelines for Canadian Drinking Water Quality and / or the BC Safe Drinking Water Regulation.
< = less than

JB Laboratories Ltd.
water/wastewaters

John E. Evanoff, M.Sc.
Barbara M. Klassen, B.Sc.

Analysis performed according to "A Laboratory Manual for the Chemical Analysis of water, Wastewaters and Biological Tissues", Chemistry Laboratory, Water Resource Service and/or "Standard Methods/Water and Wastewater", American Public Health Association.

Appendix E

TECHNICAL DATA SHEET
WELL #3

1. District Lot: **85**
2. Client: **FLEMING LARSEN**
3. File No: **19-2128-0**
4. Well No. **3 (Located by Client)**
5. Lot No. **3**

6. Water Quality:
   - TDS **228**
   - Sp.C. **364**
   - Cl **23**
   - T.Coli. **<1**
   - F.Coli. **<1**
7. Laboratory: **J.B. Labs Ltd.**

8. Test Pumping:
   - Date tested: **Apr. 10,1995**
   - Contractor: **Red Williams Drilling**
   - Pump Rate: **3.5 USgpm**
9. Total lots to be served by well: **2**
10. Total requirement (@500 lgpd/L): **1000 lgpd 0.84 USgpm**
11. Total Well Depth: **44m**
12. Non-pumping water level: **7.5 m**
13. Depth to primary fracture: **38 m**
14. Well elevation: **12 m, above mean sea level**
15. Depth to sea level: **12 m**
16. 100% available drawdown: **4 m to sea level**
17. 70% available drawdown: **3 m to sea level**
18. Total recovery expected: **yes**
19. Estimated well yield: **3800 lgpd 3.2 USgpm**
20. Well Location:
    Groundwater Region: **Georgia Strait** (Mordant, Hodge, 1983)
    - % demand-storage ratio: **0**
    - No. of wells within 500m: **4** on D.L. 85 (closest 180m)

21. COMMENTS:
    Observation readings taken on Well #2 (DL 85), 180 m away, with water level decline of 0.25m. Observation readings were taken on Well #5 (DL 85), 300m south, with a recorded drop in water level of 0.23m. In both cases the change in water levels on the observation wells is likely due to tide.

bii/D2

THURBER

PUMPING WELL #3

DRAWDOWN DATA

THURBER ENGINEERING LTD.

FILE No.: 19-2128-0

FLEMING LARSEN - D.L. 85; GALIANO ISLAND

START DATE: APRIL 6, 1995

START TIME: 12:00

SWL = 7.520 metres

ELAPSED TIME (min.)	WATER DEPTH (metres)	RATE (USGpm)	DRAWDOWN (metres)	NOTES
0.0	7.520		0.000	
0.5	7.620		-0.100	
1.0	7.640		-0.120	
1.5	7.650		-0.130	
2.0	7.660		-0.140	
2.5	7.670		-0.150	
3.0	7.675		-0.155	
3.5	7.675		-0.155	
4.0	7.670		-0.150	
4.5	7.670		-0.150	
5.0	7.680	3.8	-0.160	
8.0	7.700		-0.180	
9.0	7.740		-0.220	
10	7.720		-0.200	
12	7.730		-0.210	
14	7.740		-0.220	
16	7.760		-0.240	
18	7.764		-0.244	
20	7.778		-0.258	
25	7.800	3.6	-0.280	
30	7.830		-0.310	
35	7.860		-0.340	
40	7.800		-0.280	
45	7.691	3.6	-0.171	
50	7.930		-0.410	
60	7.960	3.6	-0.440	
70	8.010		-0.490	
80	8.050	3.6	-0.530	
90	8.080		-0.560	
100	8.110	3.5	-0.590	
120	8.210		-0.690	
150	8.275		-0.755	
180	8.340		-0.820	
240	8.460		-0.940	
300	8.530	3.5	-1.010	
360	8.540		-1.020	
420	8.540	3.4	-1.020	
480	8.494		-0.974	
540	8.370		-0.850	
600	8.330		-0.810	
660	8.310		-0.790	<-- water sample taken
719	8.300	3.4	-0.780	

THURBER

PUMPING WELL #3
DRAWDOWN CURVE

FLEMING LARSEN
D.L. 85; Galiano Island

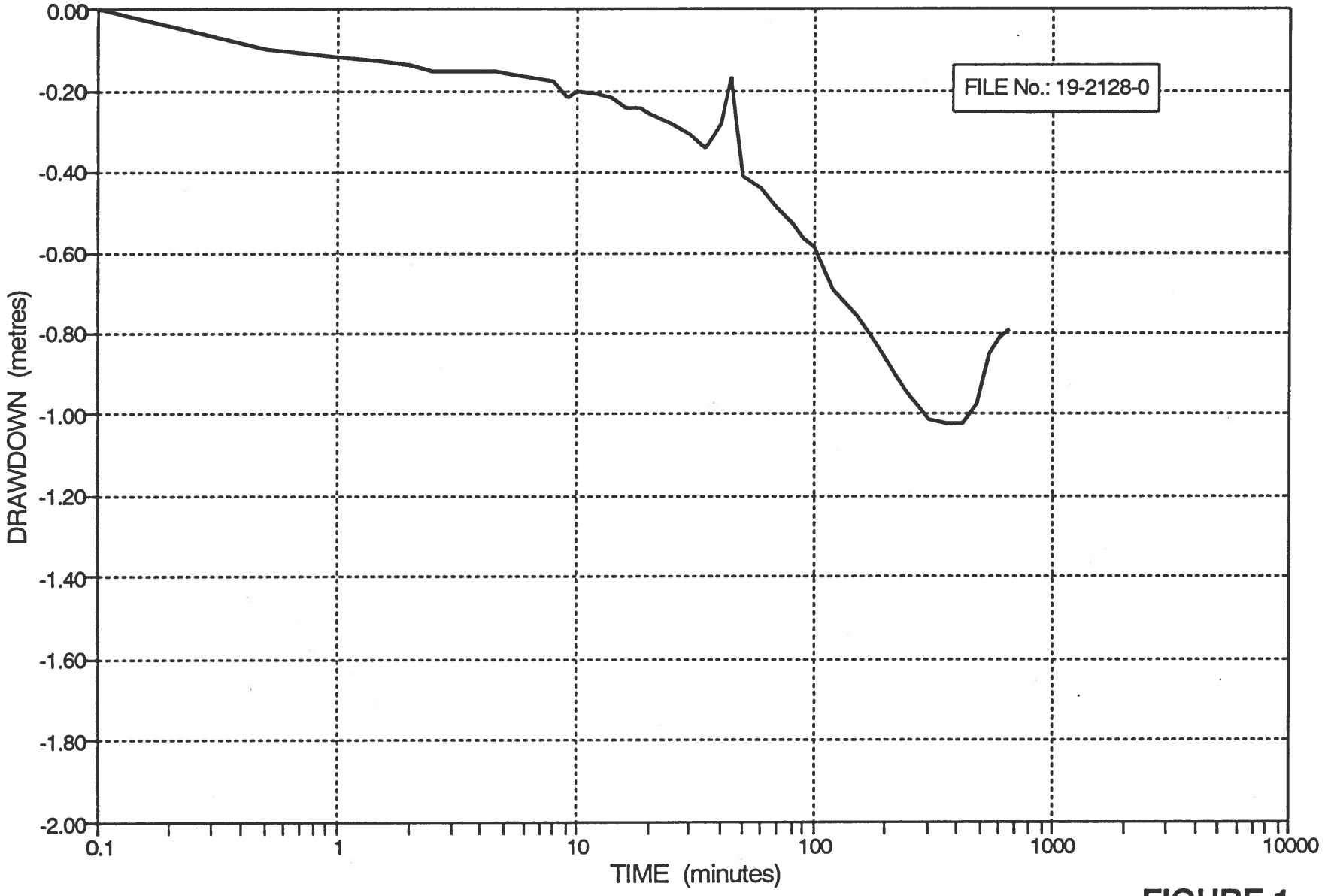


FIGURE 1

THURBER

PUMPING WELL #3
DRAWDOWN CURVE

FLEMING LARSEN
D.L. 85; Galiano Island

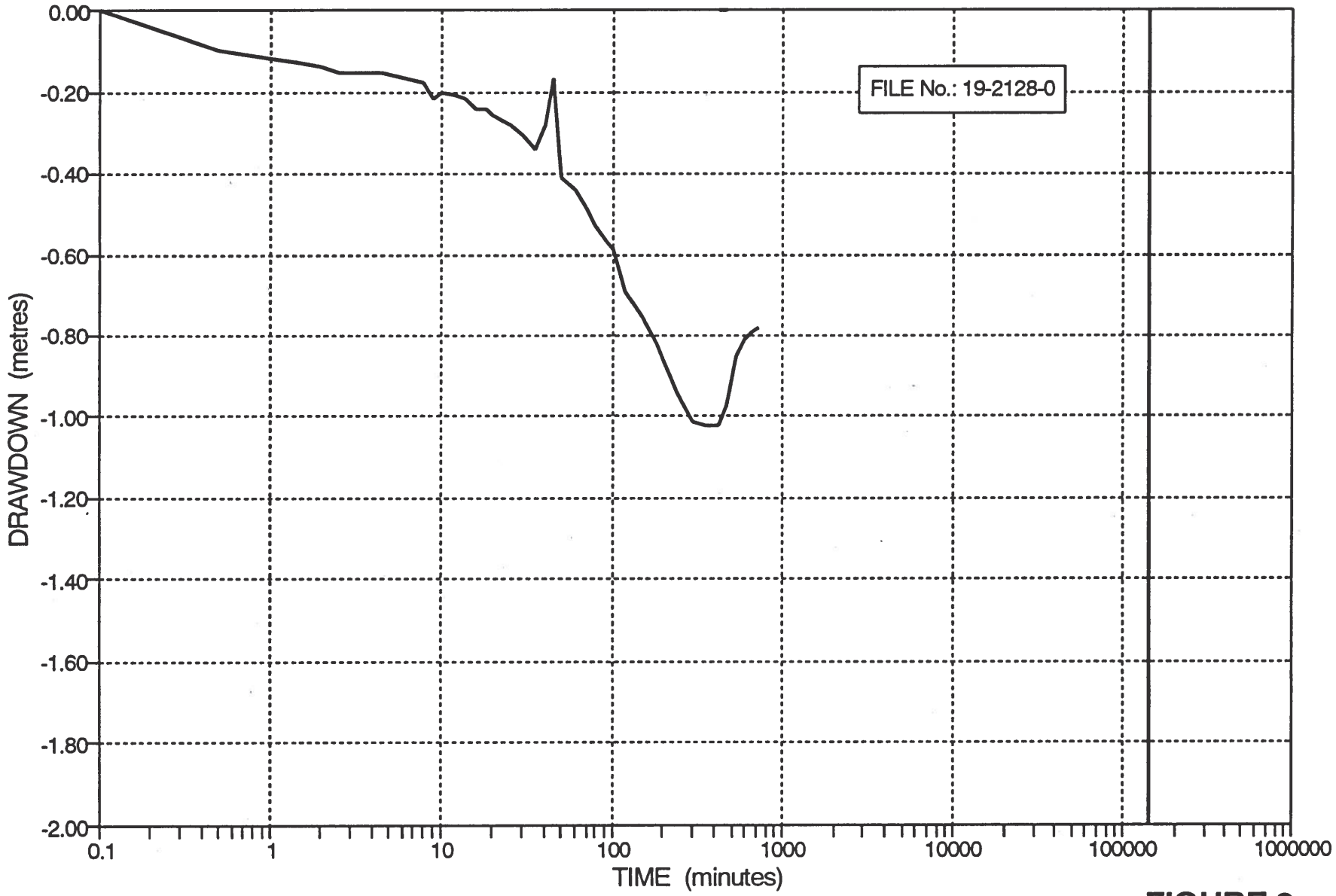


FIGURE 2

THURBER

PUMPING WELL #3 RESIDUAL DRAWDOWN

THURBER ENGINEERING LTD. FILE No.: 19-2128-0

FLEMING LARSEN - D.L. 85; GALIANO ISLAND

START DATE: APRIL 7, 1995

START TIME: 0:00 SWL = 7.520 metres

ELAPSED TIME (Minutes) t @ t' = 720			WATER DEPTH	RATE	RESIDUAL DRAWDOWN	NOTES
t	t'	t / t'	s (metres)	(USGpm)	s' (metres)	
720	0		8.300		-0.780	Last reading pumping
721	0.5	1441	8.270		-0.750	
721	1	721	8.250		-0.730	
722	1.5	481	8.230		-0.710	
722	2	361	8.240		-0.720	
723	2.5	289	8.230		-0.710	
723	3	241	8.224		-0.704	
724	3.5	207	8.220		-0.700	
724	4	181	8.220		-0.700	
725	4.5	161	8.216		-0.696	
725	5	145	8.215		-0.695	
726	6	121	8.200		-0.680	
727	7	104	8.194		-0.674	
728	8	91	8.184		-0.664	
729	9	81	8.190		-0.670	
730	10	73	8.190		-0.670	
732	12	61	8.170		-0.650	
734	14	52	8.164		-0.644	
736	16	46	8.154		-0.634	
738	18	41	8.144		-0.624	
740	20	37	8.140		-0.620	
745	25	30	8.120		-0.600	
750	30	25	8.110		-0.590	
755	35	22	8.100		-0.580	
760	40	19	8.090		-0.570	
765	45	17	8.080		-0.560	
770	50	15	8.070		-0.550	
775	55	14	8.054		-0.534	
780	60	13	8.050		-0.530	
790	70	11	8.040		-0.520	
800	80	10	8.030		-0.510	
810	90	9	8.020		-0.500	
820	100	8	8.020		-0.500	
840	120	7	8.020		-0.500	
870	150	6	8.010		-0.490	
900	180	5	8.010		-0.490	
1020	300	3	7.980		-0.460	

THURBER

PUMPING WELL #3

RESIDUAL DRAWDOWN CURVE

FLEMING LARSEN
D.L. 85; Galiano Island

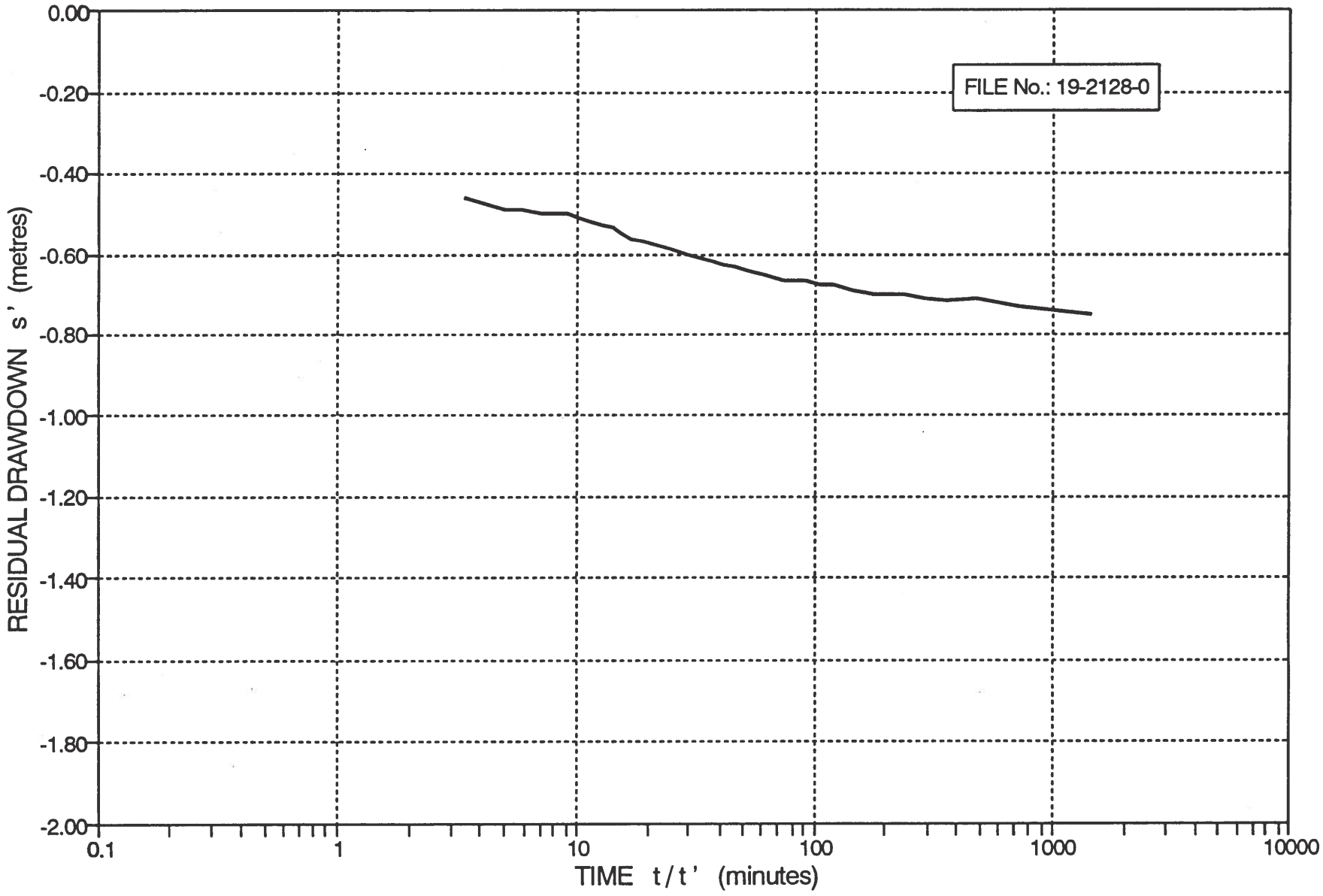


FIGURE 3

THURBER

JB LABS
827 FORT STREET,
VICTORIA, B.C. V8W 1H6
Tel: (604) 385-6112
Fax: (604) 382-6364

DATE: April 11, 1995

JOB NO: JB 1737
LR NO: 19642

SAMPLING DATE: See Below

CLIENT: Red Williams Well
Drilling Ltd.
980 Pratt Rd.
Qualicum Beach, B.C.
V9K 1W5

SAMPLING AGENT: Client

The sample(s) submitted by the agent have been tested as requested and we report as follows:

SAMPLE: Sample # 1: Well #3, Fleming Larson Apr 6/95
Sample # 2: Well #1 Apr 10/95

		Sample 1	Well #1 Sample 2
Tot Dissolved Solids	mg/L	228	282
Conductivity	umhos/cm	364	412
pH		7.8	7.9
Alkalinity, Total	mg/L $CaCO_3$	147	199
Total Hardness	mg/L $CaCO_3$	39	28
Calcium	mg/L	6.8	10.0
Magnesium	mg/L	5.3	0.7
Iron	mg/L	0.1	< 0.1
Manganese	mg/L	0.22*	< 0.02
Sodium	mg/L	40.0	91.0
Chloride	mg/L	23	15
Sulphate	mg/L	9	13
Fluoride	mg/L	0.37	0.55
Nitrite	mg/L N	< 0.002	< 0.002
Nitrate	mg/L N	< 0.04	0.05
Total Coliform	CFU/100ml	< 1	10*
Faecal Coliform	CFU/100ml	< 1	< 1
Noncoliform bacteria	CFU/100ml	< 1	8

Thurber Consultants
Attn Bruce Ingimundsen

* Indicates Outside of Guidelines for Canadian Drinking Water Quality and / or the BC Safe Drinking Water Regulation.
< = less than

JB Laboratories Ltd.
water/wastewaters

John E. Evanoff, M.Sc.
Barbara M. Klassen, B.Sc.

Analysis performed according to "A Laboratory Manual for the Chemical Analysis of water, Wastewaters and Biological Tissues", Chemistry Laboratory, Water Resource Service and/or "Standard Methods/Water and Wastewater", American Public Health Association.

Appendix F

TECHNICAL DATA SHEET
WELL #4

1. District Lot: **85**
2. Client: **FLEMING LARSEN**
3. File No: **19-2128-0**
4. Well No. **3 (Located by TEL)**
5. Lot No. **7**

6. Water Quality:
   - TDS **97/120**
   - Sp.C. **109/126**
   - Cl **8/7**
   - T.Coli. **<1**
   - F.Coli. **not determined in 1989**
7. Laboratory: **J.B. Labs Ltd. and CANTEST**

8. Test Pumping:
   - Date tested: **Nov. 1 - 4, 1989**
   - Contractor: **BC Aquifer**
   - Pump Rate: **37 USgpm**
9. Total lots to be served by well: **3**
10. Total requirement (@500 lgpd/L): **1500 lgpd** **1.26 USgpm**
11. Total Well Depth: **122 m**
12. Non-pumping water level: **9 m**
13. Depth to primary fracture: **63 m**
14. Well elevation: **91 m, above mean sea level**
15. Depth to sea level: **91 m**
16. 100% available drawdown: **54 m to primary fracture**
17. 70% available drawdown: **38 m to primary fracture**
18. Total recovery expected: **yes**
19. Estimated well yield: **>120,000 lgpd** **>37 USgpm**
20. Well Location:
    Groundwater Region: **Georgia Strait** (Mordant, Hodge, 1983)
    - % demand-storage ratio: **0**
    - No. of wells within 500m: **1** on D.L. 85 (closest 30m, TW 89-1)

21. COMMENTS:
    Observation readings taken on Well TW89-1 (DL 85), overburden well 30m away, with max. drawdown of 1.4m. Observation readings were also taken on TW89-3 (DL88), 750m away. The recorded maximium drawdown was 0.3m.

bii/D3

THURBER

PUMPING WELL #4

DRAWDOWN DATA

THURBER ENGINEERING LTD.

FILE No.: 19-2128-0

FLEMING LARSEN - D.L. 85; GALIANO ISLAND

START DATE: NOVEMBER 1, 1989

START TIME: 12:00

SWL = 8.980 metres

ELAPSED TIME (min.)	WATER DEPTH (metres)	RATE (USGpm)	DRAWDOWN (metres)	NOTES
0.0	8.980		0.000	
0.5	9.275		-0.295	
1.0	9.200		-0.220	
1.5	9.195		-0.215	
2.0	9.195		-0.215	
2.5	9.200		-0.220	
4.0	9.185		-0.205	<-- Water grey in color
5.0	9.192	44.0	-0.212	
10	9.155		-0.175	
12	9.170		-0.190	
14	9.168		-0.188	
16	9.169	39.0	-0.189	
18	9.175		-0.195	
20	9.178		-0.198	
25	9.182		-0.202	<-- Water clear
30	9.185	37.0	-0.205	
35	9.195		-0.215	
40	9.200		-0.220	
45	9.205		-0.225	
50	9.210		-0.230	
60	9.213		-0.233	
70	9.240		-0.260	
80	9.249		-0.269	
90	9.260		-0.280	
100	9.269		-0.289	<-- C=90; S=0; T=10.5 degrees C.
125	9.287		-0.307	
150	9.290		-0.310	
200	9.320		-0.340	
250	9.355		-0.375	
300	9.394		-0.414	
350	9.400		-0.420	
400	9.425		-0.445	
450	9.445		-0.465	
500	9.475		-0.495	
550	9.492		-0.512	
600	9.520		-0.540	
650	9.550		-0.570	
700	9.570		-0.590	
750	9.567		-0.587	
800	9.571		-0.591	
850	9.590		-0.610	
900	9.600		-0.620	
950	9.618		-0.638	
1000	9.635		-0.655	
1050	9.653	37.0	-0.673	
1100	9.667		-0.687	
1150	9.679		-0.699	
1200	9.694		-0.714	
1250	9.714		-0.734	
1300	9.730		-0.750	
1350	9.754		-0.774	
1400	9.768		-0.788	
1450	9.785		-0.805	
1500	9.805		-0.825	
1550	9.830		-0.850	
1600	9.860		-0.880	<-- raining lightly
1650	9.870		-0.890	
1700	9.890		-0.910	
1750	9.870		-0.890	
1800	9.892		-0.912	
1850	9.900		-0.920	
1900	9.900		-0.920	<-- C=82; S=0; T=9.75 degrees C.
1950	9.917		-0.937	
2000	9.934		-0.954	
2050	9.975		-0.995	
2100	9.987	36.0	-1.007	
2150	10.003		-1.023	

THURBER

PUMPING WELL #4

DRAWDOWN DATA

THURBER ENGINEERING LTD.

FILE No.: 19-2128-0

2200	10.013		-1.033	
2250	10.036	37.0	-1.056	
2300	10.036		-1.056	
2350	10.049		-1.069	
2400	10.053		-1.073	
2450	10.073		-1.093	
2500	10.085		-1.105	
2550	10.103		-1.123	
2600	10.117		-1.137	
2650	10.134		-1.154	
2700	10.151		-1.171	
2750	10.174		-1.194	
2800	10.185		-1.205	
2850	10.192		-1.212	
2900	10.200		-1.220	
2950	10.222		-1.242	
3000	10.230		-1.250	
3050	10.242		-1.262	<-- rain stopped
3100	10.250		-1.270	
3150	10.272		-1.292	
3200	10.284		-1.304	
3250	10.290		-1.310	
3300	10.305		-1.325	
3350	10.320		-1.340	
3400	10.328		-1.348	
3450	10.341		-1.361	
3500	10.360		-1.380	
3550	10.379	37.0	-1.399	
3600	10.395		-1.415	
3650	10.380		-1.400	
3700	10.407		-1.427	
3750	10.413		-1.433	
3800	10.425		-1.445	
3850	10.428		-1.448	
3900	10.433		-1.453	
3950	10.450		-1.470	
4000	10.458		-1.478	
4050	10.467		-1.487	
4100	10.483		-1.503	
4150	10.494		-1.514	
4200	10.505		-1.525	
4250	10.514		-1.534	
4300	10.521		-1.541	
4320	10.540	37.0	-1.560	<-- Stop pumping; took water sample; start recovery

THURBER

PUMPING WELL #4
DRAWDOWN CURVE

FLEMING LARSEN
D.L. 85; Galiano Island

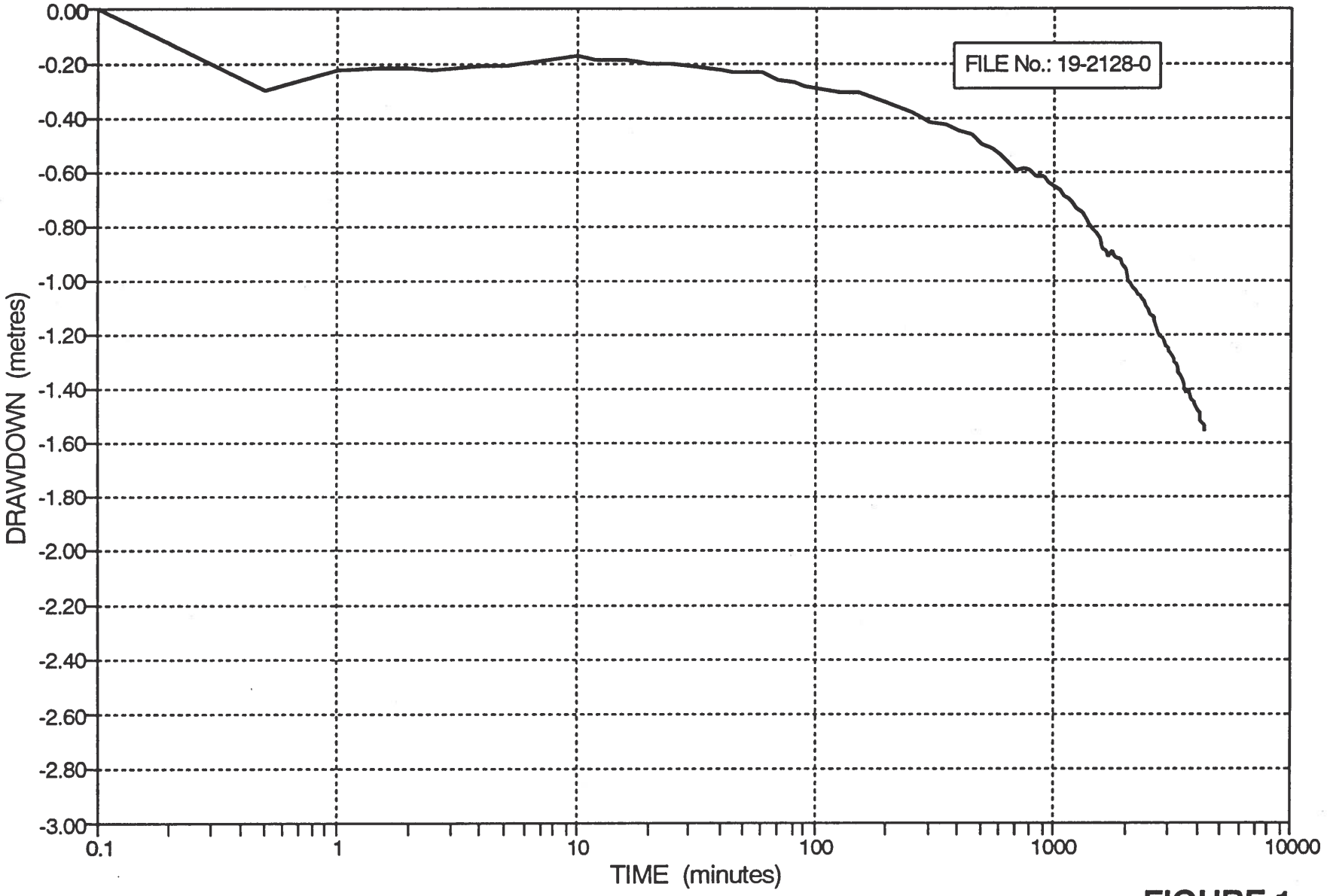


FIGURE 1

THURBER

PUMPING WELL #4
DRAWDOWN CURVE

FLEMING LARSEN
D.L. 85; Galiano Island

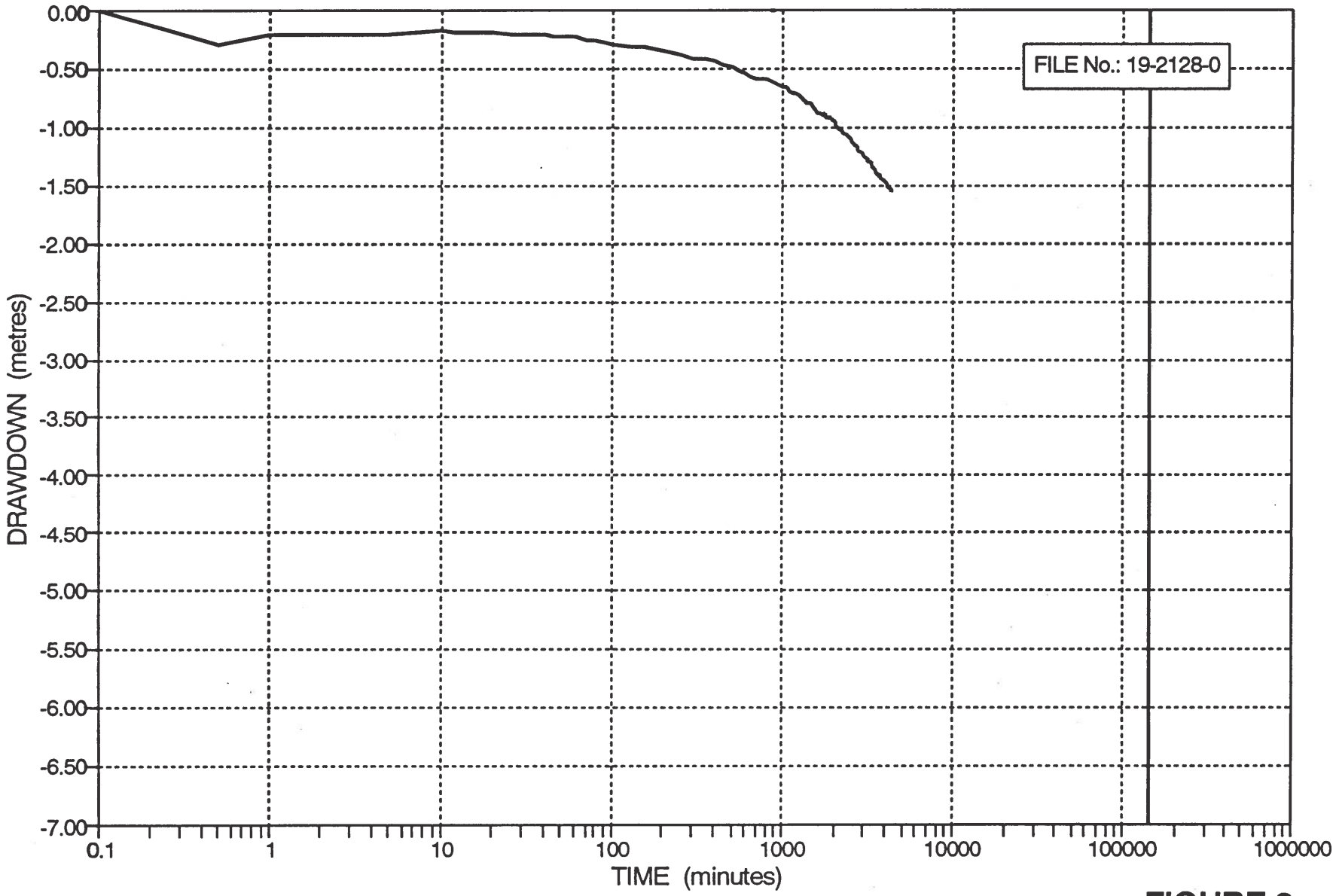


FIGURE 2

THURBER

PUMPING WELL #4 — RESIDUAL DRAWDOWN

THURBER ENGINEERING LTD.

FILE No.: 19-2128-0

FLEMING LARSEN - D.L. 85; GALIANO ISLAND

START DATE: NOVEMBER 4, 1989

START TIME: 12:00

SWL = 8.980 metres

ELAPSED TIME (Minutes) t @ t' = 4320			WATER DEPTH	RATE	RESIDUAL DRAWDOWN	NOTES
t	t'	t / t'	s (metres)	(USGpm)	s' (metres)	
4320	0		10.540		-1.560	Last reading pumping
4321	0.5	8641	10.412		-1.432	
4321	1	4321	10.377		-1.397	
4322	1.5	2881	10.377		-1.397	
4322	2	2161	10.377		-1.397	
4323	2.5	1729	10.377		-1.397	
4323	3	1441	10.377		-1.397	
4324	3.5	1235	10.377		-1.397	
4324	4	1081	10.377		-1.397	
4325	4.5	961	10.377		-1.397	
4325	5	865	10.377		-1.397	
4326	6	721	10.375		-1.395	
4327	7	618	10.370		-1.390	
4328	8	541	10.355		-1.375	
4329	9	481	10.354		-1.374	
4330	10	433	10.353		-1.373	
4332	12	361	10.350		-1.370	
4334	14	310	10.347		-1.367	
4336	16	271	10.345		-1.365	
4338	18	241	10.342		-1.362	
4340	20	217	10.340		-1.360	
4345	25	174	10.335		-1.355	
4350	30	145	10.330		-1.350	
4355	35	124	10.320		-1.340	
4360	40	109	10.319		-1.339	
4365	45	97	10.319		-1.339	
4370	50	87	10.315		-1.335	
4380	60	73	10.308		-1.328	
4390	70	63	10.301		-1.321	
4400	80	55	10.296		-1.316	
4410	90	49	10.287		-1.307	
4420	100	44	10.282		-1.302	
4445	125	36	10.266		-1.286	
4470	150	30	10.255		-1.275	
4520	200	23	10.230		-1.250	
4570	250	18	10.209		-1.229	
4620	300	15	10.190		-1.210	
4670	350	13	10.172		-1.192	
4720	400	12	10.151		-1.171	
4770	450	11	10.134		-1.154	
4820	500	10	10.115		-1.135	
4870	550	9	10.107		-1.127	
4920	600	8.2	10.080		-1.100	
4970	650	7.6	10.073		-1.093	
5020	700	7.2	10.053		-1.073	
5070	750	6.8	10.038		-1.058	
5120	800	6.4	10.027		-1.047	
5170	850	6.1	10.012		-1.032	
5220	900	5.8	9.998		-1.018	
5270	950	5.5	9.984		-1.004	
5320	1000	5.3	9.970		-0.990	
5370	1050	5.1	9.957		-0.977	
5420	1100	4.9	9.945		-0.965	
5470	1150	4.8	9.932		-0.952	
5520	1200	4.6	9.921		-0.941	
5570	1250	4.5	9.910		-0.930	
5620	1300	4.3	9.898		-0.918	
5670	1350	4.2	9.886		-0.906	
5720	1400	4.1	9.872		-0.892	
5770	1450	4.0	9.863		-0.883	<-- End recovery

THURBER

PUMPING WELL #4

RESIDUAL DRAWDOWN CURVE

FLEMING LARSEN
D.L. 85; Galiano Island

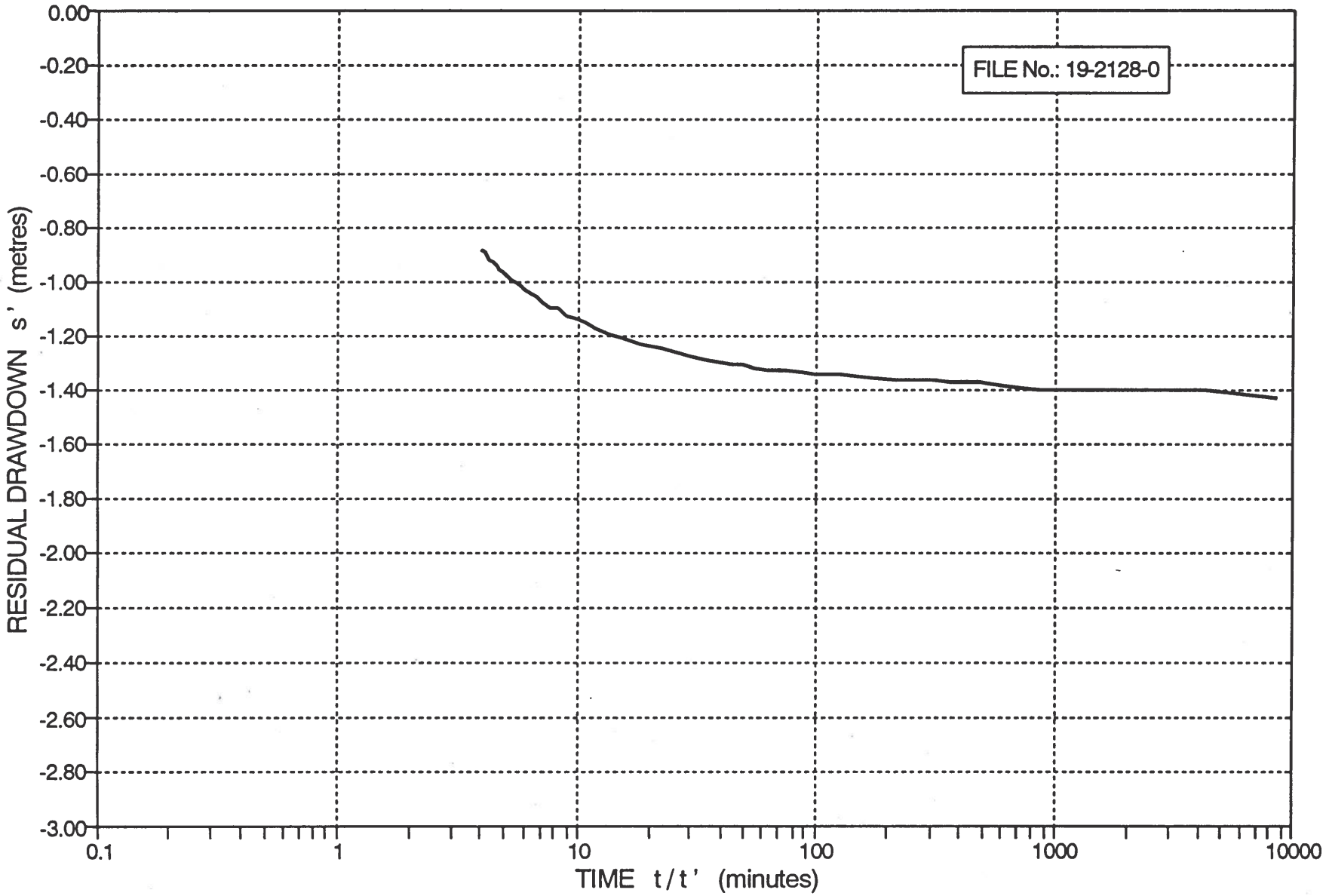


FIGURE 3

THURBER

JB Laboratories Ltd.
water/wastewaters

827 FORT STREET,
VICTORIA, B.C. V8W 1H6
TEL: (604) 385-6112
FAX: (604) 383-8099

B11

DATE: November 10, 1989

JOB NO.: JB 1433
LR NO.: 10719

SAMPLING DATE: Nov 4/89

SAMPLING AGENT: Client

The sample[s] submitted by the agent have been tested as requested and we report as follows:

Client: Thurber Consultants Ltd
Attn: Mr. Bruce Ingimundson
210 - 4475 Viewmont Avenue
Victoria, B. C.
V8Z 6L8

Sample: WELL #4
19-438-B TH89-2
72 Hours (Bedrock well)

Total Dissolved Solids	mg/L	97
Conductivity	umhos/cm	109
pH		6.9
Alkalinity	mg/L $CaCO_3$	39.3
Hardness, Total	mg/L $CaCO_3$	27.8
Calcium	mg/L	5.2
Magnesium	mg/L	3.6
Iron	mg/L	0.1
Manganese	mg/L	0.03
Sodium	mg/L	8.5
Chloride	mg/L	8
Sulphate	mg/L	8
Fluoride	mg/L	0.24
Nitrite	mg/L N	0.002
Nitrate	mg/L N	0.21
Total Coliform	CFU/100mL	L 1*

L : Less than; * other bacteria present

John E. Evanoff, M.Sc. Barbara M. Klassen, B.Sc., C.Tech.

Analysis performed according to "A Laboratory Manual for the Chemical Analysis of Water, Wastewaters and Biological Tissues", Chemistry Laboratory, Water Resource Service and/or "Standard Methods/ Water and Wastewater", American Public Health Association.

JB LABORATORIES

CANTEST

Thurber Consultants Ltd.
File No: 9401H
Page No: 2

89-2 (Bedrock well)

SAMPLE IDENTIFICATION AND RESULTS OF TESTING:

		9401	MAXIMUM ACCEPTABLE CONC.***
SAMPLE #			
CLIENT SAMPLE I.D.		#89-2 Nov.2, 1989 24 HR Sample	
PHYSICAL TESTS			
pH (pH units)		7.29	6.5-8.5
Conductivity (us/cm)		166	-
True Color (CU)		<5	15.
Turbidity (NTU)		1.0	5.
Hardness as CaCO3		40.0	-
Total Dissolved Solids (mg/L)		120	500.*
DISSOLVED ANIONS (mg/L)			
Alkalinity:			
Bicarbonate	HC03	53.0	-
Carbonate	C03	NIL	-
Hydroxide	OH	NIL	-
Chloride	Cl	7.00	250.
Sulfates	SO4	10.0	500.
Nitrates/Nitrites	N	0.14	10.**
Fluorides	F	<0.05	1.5
DISSOLVED METALS (mg/L)			
Calcium	Ca	9.17	-
Magnesium	Mg	4.00	-
Sodium	Na	11.0	-
Potassium	K	0.15	-
Iron	Fe	<0.030	0.30
Manganese	Mn	0.020	0.05
Silica	Si02	25.0	-
TOTAL METALS (mg/L)			
Magnesium	Mg	4.05	-
Iron	Fe	0.075	0.30
Manganese	Mn	0.027	0.05
COLIFORM BACTERIA (Colonies/100 mL*R)			
Total (Confirmed)		-	-
Fecal		-	Not detected

* = filtered a 0.45 micron membrane
** = total nitrate and nitrite nitrogen
*** = maximum acceptable concentration as set by "B.C. Drinking Water Quality Standards, 1982" and "Guidelines for Canadian Drinking Water Quality, 1978"
< = less than; mg/L = milligrams per litre
*R = remarks
X = Exceeded the "Guidelines"

JB Laboratories Ltd.
water/wastewaters

827 FORT STREET,
VICTORIA, B.C. V8W 1H6
TEL: (604) 385-6112
FAX: (604) 383-8099

B11

DATE: November 10, 1989

JOB NO.: JB 1433
LR NO.: 10719

SAMPLING DATE: Nov 4/89

SAMPLING AGENT: Client

The sample[s] submitted by the agent have been tested as requested and we report as follows:

Client: Thurber Consultants Ltd
Attn: Mr. Bruce Ingimundson
210 - 4475 Viewmont Avenue
Victoria, B. C.
V8Z 6L8

Sample: WELL #4
19-438-B TH89-2
72 Hours (Bedrock well)

Total Dissolved Solids	mg/L	97
Conductivity	umhos/cm	109
pH		6.9
Alkalinity	mg/L $CaCO_3$	39.3
Hardness, Total	mg/L $CaCO_3$	27.8
Calcium	mg/L	5.2
Magnesium	mg/L	3.6
Iron	mg/L	0.1
Manganese	mg/L	0.03
Sodium	mg/L	8.5
Chloride	mg/L	8
Sulphate	mg/L	8
Fluoride	mg/L	0.24
Nitrite	mg/L N	0.002
Nitrate	mg/L N	0.21
Total Coliform	CFU/100mL	L 1*

L : Less than; * other bacteria present

John E. Evanoff, M.Sc. Barbara M. Klassen, B.Sc., C.Tech.

Analysis performed according to "A Laboratory Manual for the Chemical Analysis of Water, Wastewaters and Biological Tissues", Chemistry Laboratory, Water Resource Service and/or "Standard Methods/ Water and Wastewater", American Public Health Association.

JB LABORATORIES

CANTEST

Thurber Consultants Ltd.
File No: 9401H
Page No: 2

89-2 (Bedrock well)

SAMPLE IDENTIFICATION AND RESULTS OF TESTING:

		9401	MAXIMUM ACCEPTABLE CONC.***
SAMPLE #			
CLIENT SAMPLE I.D.		#89-2 Nov.2, 1989 24 HR Sample	
PHYSICAL TESTS			
pH (pH units)		7.29	6.5-8.5
Conductivity (us/cm)		166	-
True Color (CU)		<5	15.
Turbidity (NTU)		1.0	5.
Hardness as CaCO3		40.0	-
Total Dissolved Solids (mg/L)		120	500.*
DISSOLVED ANIONS (mg/L)			
Alkalinity:			
Bicarbonate	HC03	53.0	-
Carbonate	C03	NIL	-
Hydroxide	OH	NIL	-
Chloride	Cl	7.00	250.
Sulfates	SO4	10.0	500.
Nitrates/Nitrites	N	0.14	10.**
Fluorides	F	<0.05	1.5
DISSOLVED METALS (mg/L)			
Calcium	Ca	9.17	-
Magnesium	Mg	4.00	-
Sodium	Na	11.0	-
Potassium	K	0.15	-
Iron	Fe	<0.030	0.30
Manganese	Mn	0.020	0.05
Silica	Si02	25.0	-
TOTAL METALS (mg/L)			
Magnesium	Mg	4.05	-
Iron	Fe	0.075	0.30
Manganese	Mn	0.027	0.05
COLIFORM BACTERIA (Colonies/100 mL*R)			
Total (Confirmed)		-	-
Fecal		-	Not detected

* = filtered a 0.45 micron membrane
** = total nitrate and nitrite nitrogen
*** = maximum acceptable concentration as set by "B.C. Drinking Water Quality Standards, 1982" and "Guidelines for Canadian Drinking Water Quality, 1978"
< = less than; mg/L = milligrams per litre
*R = remarks
X = Exceeded the "Guidelines"