

AQUIFER CLASSIFICATION WORK SHEET

DATE:

December 10, 2002. (Aquifer extents and statistics updated March 2012)

AQUIFER LOCATION:

Sunshine Coast Regional District.

REFERENCE NUMBER:

0559.

DESCRIPTIVE LOCATION:

Sakinaw Lake / Mixel Lake / Garden Bay Lake / Hotel Lake.

NTS MAP SHEET:

NTS Map: 092F / 9.
Trim Map: 092F.070.

WELL LOCATION MAPS:

New Westminster Map No. 56.

BCGS MAP SHEETS:

CLASSIFICATION: IIA *RANKING: 12*

Aquifer Size:

14.5 km².

Aquifer Sub-type:

6b

Aquifer Boundaries:

This bedrock aquifer has been delineated on the basis of well development, well lithology, and the drainage basin (topography). The boundaries have been shown as dashed (less certain) along the topographic divide in the east and solid (reasonable certainty along Sakinaw lakeshore and the coast). In 2002, this aquifer was mapped based on an assumed groundwater flow divide estimated from the local topography. The aquifer extents were extended in 2012 to the coast in the west and south due to a review of the bottom of well elevations. It is unlikely that there is a groundwater flow divide along the original western and southern boundaries between the deep bedrock aquifers. In the south, the topographic relief appears to slope downwards towards the coast. Therefore, this southern boundary is estimated an insufficient flow divide for both shallow and deep bedrock aquifer systems. Within the west, a cluster of 13 bedrock wells were reviewed to determine the likeliness of a hydraulic connection between these wells and the wells near the lakes. The bottom hole elevations within these wells were comparable, or deeper than the wells around the lake. The deep wells are less influenced by the assumed groundwater flow divide based on the topographic high. Therefore, the western boundary was extended to the coast.

In total, 57 wells were used to delineate this aquifer. An additional 22 unlocated wells were included to define the aquifer characteristics. It is unknown where the information from the 22 unlocated wells was sourced. They were included in the original mapping completed in 2002. For consistency, information from these unlocated wells were used to define aquifer properties such as the depth to bedrock, confining thickness and material type, depth to water, and aquifer productivity. All located and unlocated wells known to be within the boundaries of this aquifer are completed in fractured granite.

Geologic Formation (overlying):

Bedrock is overlain by a thin veneer of fluvial, glaciomarine and glaciofluvial sediments described on well records simply as overburden. Overlying material where reported, varies in thickness from 0 (bedrock at surface) to a maximum thickness of 12.19 m. Thirty-two of the 79 well records (located and unlocated) report bedrock within one meter of ground surface.

Geologic Formation (aquifer):

Bedrock – fractured granite. Well records indicate the granite is moderately fractured. The fractured granite is described on located and unlocated well records as light, white, dark blue, and some green.

Confined/Unconfined/Bedrock:

Bedrock. Unconfined. Thin overlying material is simply described as overburden.

Vulnerability:

High. Depth to water is moderately shallow. The permeability of the aquifer material is low (fractured bedrock). Well records indicate bedrock is located at or near ground surface. Thirty-two of the 79 well records (located and unlocated) report bedrock at surface. As well, this is a coastal aquifer and it is vulnerable to salt water intrusion although most located wells are situated away from the coast.

Productivity:

Moderate. Yields were reported for 73 of the 79 wells with values ranging between 0.02 and 6.31 L/s. The median well yield has been determined as 0.63 L/s while the geometric mean well yield has been determined as 0.48 L/s. Well yields reported are based on short-term air tests carried out by the well driller.

Depth to Water Table:

Depth to water was reported for 16 of the 79 wells within this aquifer with values ranging between 3.05 m and 85.34 m. The second highest depth to water was reported as 32.92 m below ground surface. The maximum depth to water of 85.34 m was observed in well 93082, the deepest well of a cluster of 15 wells that vary in depth from 12 m to 152.4 m and are spaced within a 15 m radius. Another well within this group is 123.75 m deep and has a depth to water of 19.50. As this is a complex, highly fractured bedrock aquifer, it is likely that the 85.45 m measurement is accurate, relating to a deep groundwater zone, and was therefore retained for this analysis. The depth of well is 152 m. The average and median depths to water are 20.13 m and 12.19 m.

Direction of Groundwater Flow:

No data available to determine direction of groundwater flow. It is anticipated that flow is generally towards Sakinaw Lake and the coast. Localized flow patterns within shallow fractures may be towards Mixel Lake, Garden Bay Lake, and Hotel Lake

Recharge:

Water wells are likely recharged from direct infiltration of precipitation at ground surface. Surface water infiltration may be considerably high due to the absence of surficial cover overlying the fractured bedrock. Some wells may also be hydraulically connected to the lakes.

Domestic Well Density:

Moderate with approximately 5.4 domestic wells per km². Domestic well density was calculated from 62 reported domestic wells (located and unlocated) as well as 16 unknown wells with a yield of less than 1 L/s. An unknown well with a yield of less than 1 L/s is assumed to represent a

domestic well as a commercial, water supply, or irrigation well is anticipated to require a higher yield.

Reliance on Source:

Water licenses exist at Garden Lake and Hotel Lake. From a site visit on October 19, 2002, it was noted that some residents use a mix of surface water from Mixel Lake and groundwater to meet their domestic water needs.

Conflicts Between Users:

None documented.

Quantity Concerns (type, source, level of concern):

None documented.

Quality Concerns (type, source, level of concern):

Isolated – The identification of high arsenic levels in wells in Powell River prompted the Coast Garibaldi Health Unit to initiate a large-scale well water survey. A total of 199 wells in Powell River and 259 wells in the Sunshine Coast area were sampled and analyzed for dissolved arsenic (Carmichael, 1995). The Mixel Lake area was included within the study area and it is apparent that two wells (DL 4282) reported arsenic levels between 0.025 and 0.050mg/L.

Comments:

For the purpose of standardization and to achieve all the objectives of the aquifer mapping program, the documents *An Aquifer Classification System for Groundwater Management in British Columbia* (Kreye, et al, 1994) and *Guide to Using the BC Aquifer Classification Maps* (Berardinucci et al, 2002) were referenced in the preparation of this worksheet.

The aquifer boundaries were field checked on October 19, 2002, but these boundaries were revised during March 2012 mapping (see text regarding aquifer boundary delineation above). The area around Camp Burly Road was checked and residents of small subdivision use a mixture of surface water (Mixel Lake) and groundwater and pump to a reservoir. Residents are concerned about Guardia (Beaver Fever). Bedrock at surface common (fractured and broken up at surface)

References:

Berardinucci J. and K. Ronneseth, 2002. *Guide to Using the BC Aquifer Classification Maps for the Protection and Management of Groundwater*. BC Ministry of Water, Land and Air Protection, Water Air and Climate Change Branch, Water Protection Section.

Carmichael Vicki, April 1995. *Well Water Survey for Arsenic in the Powell River and Sunshine Coast Communities of British Columbia*. Environmental Health Assessment and Safety Branch, Ministry of Health.

Kreye, R. and M. Wei, 1994. *A Proposed Aquifer Classification System for Groundwater Management in British Columbia. Groundwater Section*. Water Management Branch, Ministry of Environment, Lands and Parks, Victoria, B.C. File No. 00400-20. 68pp.

AQUIFER CLASSIFICATION AND RANKING

AQUIFER LOCATION: Sakinaw Lake / Mixel Lake / Garden Bay Lake / Hotel Lake.

AQUIFER REFERENCE NUMBER: 0559

CLASSIFICATION: IIA **RANKING VALUE: 12**

Classification Component:

Level of Development: Moderate level of demand and moderate yield.

Level of Vulnerability: Depth to water is moderately shallow, the permeability of the aquifer material is low, the aquifer is unconfined, and it is vulnerable to salt water intrusion.

<i>Ranking Component:</i>	<i>Ranking Value</i>
Productivity	2
Vulnerability	3
Size:	2
Demand:	*2
Type of Use:	2
Quality Concerns:	1 (note discussion under quality concerns)
Quantity Concerns:	<u>0</u>
<u>Total:</u>	12

*Demand is often based on reported well capacity (i.e. the amount of groundwater that a well is estimated to yield). Verification of actual demand levels is recommended before any major water-use decisions are made.

Number of water wells available for aquifer delineation = 79

Statistical Analysis of Well Data = Aquifer No. 0559

	Well Depth (m)	Depth to Water (m)	Depth to Bedrock (m)	Reported Est. Well Yield (L/s)	Estimated Thickness of Confining Materials (m)
Count	79	16	55	73	11
Maximum	185.93	85.34	12.19	6.31	5.49

Minimum	18.29	3.05	0.3	0.02	1.22
Median	68.58	12.19	2.13	0.63	1.83
Average	76.15	20.13	2.83	0.94	2.80
Geometric Mean	67.58	13.57	2.01	0.48	2.32