

Aquifer Classification Worksheet for Sooke-Metchosin Aquifer (606)

Aquifer number: 606

Proposed name of aquifer: Sooke-Metchosin Aquifer (606)

Aquifer Classification: IIIA(12).

Descriptive location of aquifer:

This bedrock aquifer is found on southwest Vancouver Island, encompassing much of the land area in the municipalities of Metchosin, Colwood, Langford and Sooke, including the East Sooke Peninsula. Jordan River defines the western boundary of the aquifer, and the southern aquifer boundary is formed by the marine coastline from Jordan River to Esquimalt Lagoon. The northern and eastern aquifer boundary is defined by the Leech River Fault, in the Sooke Hills, which separates bedrock of the Metchosin Igneous Complex and the Leech River Complex (Massey, 1994; Yorath and Nasmith, 1995).

Date: July 2004.

NTS mapsheet: 092B/05, 092B/06, 092B/12, 092C/08

TRIM mapsheets: 092B.031, .032, .033, .041, .042, .043, .051, .052, 092C.050

What geological formation does the aquifer belong to?

The aquifer is made up of rocks from the Metchosin Igneous Complex, a gabbroic and basaltic igneous and volcanic bedrock of Paleocene to Eocene origin, 50-56 Ma in age (Massey, 1994). The Metchosin Igneous Complex is a layered gabbro and leucogabbro (light-coloured feldspar- and quartz-rich gabbro) including sheeted gabbroic and dioritic dykes that extend upward into fine-grained pillow and flow basalts. The unit also contains minor tuff, breccia, and rare limestone (Massey, 1994; Yorath and Nasmith, 1995).

Well records indicate alternating layers of light and dark green igneous bedrock intercepted by quartz and feldspar veins, and water bearing fractures at depth. Other well logs describe the lithology as blue, red, brown or black volcanic bedrock, or layered hard grey and soft green bedrock. A few records indicate the occurrence of limestone, while some describe the presence of “conglomerate,” which may correspond with brecciated rock in shear and fracture zones. Described occurrences of layered “sandstone and shale” are thought mainly to correspond with weathered, feldspar-rich igneous bedrock, or grus, and fine-grained black basalt. Some wells may be drilled through true sandstone and conglomerate of the Sooke Formation, which

comprises Muir Creek aquifer 449, a sedimentary bedrock formation that unconformably overlies the Metchosin Complex in parts of Sooke, including at Orveas Bay, Loss Creek and Jordan River.

Overlying portions of the bedrock aquifer are Vashon and Capilano sediments deposited during the Fraser glaciation (13-29 ka)(Blyth and Rutter, 1993; Monahan and Levson, 2000), including water bearing strata of aquifers 599, 604, and 605, and water bearing surficial deposits associated with shallow wells along the coastal margin of Orveas Bay, and on the East Sooke Peninsula that were not delineated separately due to the small number of wells and their lack of spatial connectivity. Aquifer 682, formed from glaciofluvial sediments of the Colwood delta, overlies the Sooke-Metchosin aquifer in a sandur (glaciofluvial flood deposit) that extends from Langford Lake area south-east toward Esquimalt Lagoon. Aquifer 683 similarly overlies much of the lowland (<60 m elevation), inland approximately 2.5 km from the coast at Parry Bay (Witty's Lagoon), and extending north along the historical Metchosin Creek floodplain, east of Metchosin Mountain.

What type of aquifer is it (unconsolidated/bedrock? Confined/unconfined)?

The aquifer is a partially confined bedrock aquifer. The aquifer is confined by sediments deposited at the end of the Fraser glaciation including Victoria clay and Vashon till. A blanket (> 1 km thick) of till is present over parts of the aquifer within the lowlands adjacent to the maritime coast; while colluvium forms the surficial layer at elevations >80-100 m, as indicated on the surficial geology and quaternary geology maps of the area (Blyth and Rutter, 1993; Monahan and Levson, 2000).

How was the aquifer boundary delineated?

The aquifer boundary was delineated to encompass bedrock of the Metchosin Igneous Complex in areas of present groundwater development. The aquifer covers the largest land area of all aquifers in the Capital Regional District. The spatial extent could be amended in future to include land west of Jordan River, as far west as Sombrio Point, an area for which there are presently no records of bedrock wells. The Leech River Fault is thought to be a natural barrier to groundwater movement, and forms the north and north-eastern aquifer boundary.

What is the size of the aquifer? 537.6 km²

What is the aquifer's productivity?

The productivity of the aquifer is considered low. The aquifer is made up of consolidated igneous and volcanic bedrock. Estimated well yields range from a minimum of 0.005 L/s up to a maximum of 6.3 L/s, with an arithmetic mean well yield of 0.25 L/s and a median

yield of 0.05 L/s. Higher water yields are likely attributable, for the most part, to the influence of surface water sources, as higher well yields are observed in wells found in close proximity to permanent or ephemeral streams. For example, the highest yields were observed wells found adjacent to Doer Creek or Veitch Creek. There is insufficient information to determine transmissivity and specific capacity of the aquifer at this time.

What is the groundwater pumped from the aquifer used for?

The groundwater is used predominantly for drinking water and irrigation, including bedrock wells in the Langford area that are used for irrigation of local parks (Dave Newman, Municipality of Langford, pers. comm. July 12, 2004).

What is the level of groundwater demand?

The level of groundwater demand is interpreted to be low. There are records of 632 wells completed into this aquifer, resulting in a calculated well density of 1 well/km². Most wells are found along the southern area of the aquifer, within ≤ 6 km of the coast, where suburban and rural development is greatest. Parkland and Department of National Defence property covers much of the East Sooke Peninsula, and a significant part of the northern area of the aquifer is undeveloped Crown land or forestry tenures.

Describe the reliance on the aquifer for supply.

There is an overall low reliance upon the aquifer for supply. However, the greatest reliance upon groundwater is in parts of Sooke and Metchosin where there are limited opportunities to connect to a municipal water supply. Municipal water sources are available over the majority of the Langford and Colwood area. Water for domestic drinking and irrigation purposes may also be obtained from surface water bodies including Ayum Creek, Barnes Creek, Bilston Creek, Charters Creek, Doerr Creek, Metchosin Creek, Pedder Creek, Pike Creek, Veitch Creek, Waugh Creek, Vera Brook, Jordan River, Leech River, Sooke River, Glenairly Spring, Glen Lake, Langford Lake, and Quarantine Lake. A total of 66 water licences exist for the above water bodies for the licenced purposes of domestic use, enterprise, waterworks, irrigation, storage, and land improvement.

Are there any known water use conflicts?

There are no water use conflicts reported for the aquifer.

Describe the groundwater flow direction(s).

The information available at present is insufficient to determine the direction of groundwater flow. Groundwater flow is assumed to be from upland areas to adjacent lowland areas. Topography of the area would suggest that the dominant regional groundwater flow direction is southeast toward the coast.

Describe the source(s) of recharge to the aquifer.

The source of aquifer recharge is expected to be infiltration of precipitation in the surface watershed area overlying the aquifer. Streams and rivers may also be a source of aquifer recharge or discharge.

How deep is the water table or the aquifer?

Water depth ranges from a minimum of 0.61 m (2.0 m) to a maximum of 213 m (700 ft). The arithmetic mean depth to water is 21 m (68 ft), the geometric mean water depth is 7.9 m (26 ft) and the median water depth is 6.9 m (23 ft). These values may not be representative of conditions over the entire aquifer as they were calculated using information available from 56 of 632 well records (9% of wells). The arithmetic mean and median well depth are 98 m (322 ft) and 91 m (299 ft) respectively. While the minimum well depth is 7.3 m (24 ft), and the maximum well depth is 262 m (860 ft). The depth to bedrock ranges from 0 to 47 m (154 ft), with an average depth of 5.4 m and a median depth of 3.0 m (18 ft and 10 ft). Within the aquifer water is thought to flow through discrete fractures rather than through primary porosity. The majority of water bearing fractures occur within the depth range of 30 to 100 m (100 to 300 ft) from the land surface.

Is the aquifer vulnerable to human activities at the land surface? If so, why?

The aquifer is considered highly vulnerable to contamination from human activities at the surface. The aquifer is partially confined with a Victoria clay or Vashon till present in 260 wells (41% of the wells); for an additional 22% of the wells there is insufficient information to confirm the presence or absence of a confining layer, and within 37% of the wells there is no confining layer noted. Where present clay or till range in thickness from 0.46 to 85 m (1.5 to 138 ft) with geometric mean and median thickness of 4.3 m (14 ft). The surficial and quaternary geology maps indicate that much of the aquifer area is covered by a thin (< 1 m) veneer of unconsolidated colluvium or weathered broken rock with little or no confining properties; a blanket (> 1 m thick) of silty till is found over the aquifer at elevations < 80 m to 100 m, where most of the groundwater development has occurred (Blyth and Rutter, 1993). The great depth of the wells and thickness of the bedrock layer above the water level are expected to provide a measure of protection of the water source from surface pollutants. In contrast, the vulnerability of the aquifer may be increased by the fact that water can travel rapidly through bedrock fractures, compared to the speed of water travel through the pore spaces of unconsolidated sediments. Much of the upslope (recharge) area of the aquifer is presently undeveloped forest. Vulnerability indices such as the Aquifer Vulnerability Index (Van Stempvoort, et al., 1993) or DRASTIC (Aller, et al., 1987) were not used to evaluate individual well or aquifer vulnerability at this time.

Are there any documented water quantity concerns?

Very low to trace yields have been identified for some wells. There are no additional concerns regarding water quantity documented in Water Protection Section files.

Are there any documented water quality concerns that are health-related?

There are no health-related water quality concerns documented in Water Protection Section files.

Observation Wells

There is one active WLAP Observation Well in the aquifer, in the Metchosin area.

References

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- Van Stempvoort, D., Ewert, L. and Wassenaar, L. 1993. "Aquifer Vulnerability Index: A GIS-compatible method for groundwater vulnerability mapping." *Canadian Water Resources Journal*, V.18,1,25-37.
- Yorath, C.J. and Nasmith, H.W. 1995. *The geology of Southern Vancouver Island*. Victoria, BC: Orca Book Publishers.

Aquifer Classification Summary for Sooke-Metchosin Aquifer (606)

Classification

Level of development (use): III – Low
Degree of vulnerability: A - High

Classification **IIIA**

Ranking Value

Productivity: 1 – Low
Vulnerability: 3 – High
Size: 3 – >25 km²
Demand: 1 – Low
Type of Groundwater Use: 3 – Multiple use
Documented Quantity Concerns: 1 – Isolated
Documented Quality Concerns Related to Human Health: 0 – None reported

Rank **12**