Aquifer Name: South Castlegar Bedrock Aquifer

Aquifer Number: 0500

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A. AQUIFER DESCRIPTION FOR AQUIFER 0500

A.1 CONCEPTUAL UNDERSTANDING OF HYDROSTRATIGRAPHY

A.1.1 AQUIFER EXTENTS

The aquifer is at the confluence of the Kootenay and Columbia rivers (see Figure 1; Lengyel et al. 2024). The extent of the aquifer is defined based on topography, major surface water features, and water licensing watershed boundaries within a regionally extensive geological/hydrostratigraphic unit. The Columbia River (major geographical feature) forms the northern and eastern boundary of the aquifer. The southern and western boundaries are inferred groundwater divides (ridges) drawn using the surface licensing watershed boundaries and are a representation of topography (extent of the drainage basin) in the area. The southernmost portion of the aquifer boundary outside of the Study Area is delineated based on the presence of surface water features (i.e., springs).

A.1.2 GEOLOGIC FORMATION (OVERLYING MATERIALS)

Fulton et al. (1984) described the area of the aquifer to be overlain by sandy till, sandy loam, and loamy till, and by glaciofluvial sand and gravel along the Columbia River floodplain. Sections of the till are described to be thin and discontinuous with thickness up to 2 m in some regions. Aquifer 0500 may be locally overlain by the sediments of overburden aquifers 0483 and 0501. Depth to bedrock ranges from 0.3 to 59.4 m. The average depth to bedrock is 13.9 m. Bedrock outcrops at higher elevations.

A.1.3 GEOLOGIC FORMATION (AQUIFER) – SUBTYPE: 6B – FRACTURED CRYSTALLINE ROCK

Aquifer 0500 is primarily comprised of fractured igneous intrusive rock (granite and granodioritic) of the Mesozoic and Cenozoic eras. There is some metamorphic rock (gneiss) along the Columbia River floodplain of the Cenozoic Era and some sedimentary rock toward the south of the aquifer of the Paleozoic Era (mudstone, siltstone, shale, fine clastic; Cui et al. 2017).

As the bedrock has been faulted and fractured throughout the area of the aquifer and surrounding region and well yields change over short distances and do not appear to be correlated with bedrock type, secondary permeability is expected to be dominant in all types of bedrock; and as such, all these rocks may act as aquifers. Accordingly, bedrock aquifers are expected to extend across lithological boundaries.

A.1.4 VULNERABILITY - MODERATE

The bedrock aquifer is composed of fractured rock. Depth to groundwater varies from shallow to deep. The average depth to water is 24.5 m.

The bedrock aquifer is confined, however, some areas throughout the aquifer show higher vulnerability (i.e., where permeable deposits are overlying the aquifer, overlying material is thin, and at higher elevations where the aquifer outcrops). Average depth to bedrock is shallow (13.9 m). There are artesian wells within the aquifer. Vulnerability across the aquifer ranges from moderate (where the aquifer is confined by overlying sediments [and where most of the development is expected to occur] and where the risk of contamination from land use is expected to be higher) to high (in areas of topographical high where bedrock outcrops and overlying material is thin). The overall vulnerability of the aquifer to surface contamination has been qualitatively assessed to be moderate.

A.2 CONCEPTUAL UNDERSTANDING OF FLOW DYNAMICS

A.2.1 GROUNDWATER LEVELS AND FLOW DIRECTION

Static groundwater levels recorded in the provincial groundwater wells database (GWELLS) range from artesian to deep (99.1 m). There are six wells with artesian groundwater conditions within the aquifer, located along the Columbia River. There are no provincial observation wells within the aquifer.

The groundwater surface is interpreted to be a subdued representation of the topography based on regional interpolation of groundwater surface elevations. Groundwater flow is interpreted to flow from higher elevation in the west toward the Columbia River floodplain in the north/east.

No information has been identified on the primary porosity and permeability of the bedrock unit. Based on the type of material (igneous intrusive and metamorphic rock), and the large variation of reported well yields over short distances, flow is expected to occur primarily through fractures.

No information is available on how faults impact groundwater flow in the area.

A.2.2 RECHARGE

Recharge to the aquifer varies depending on the thickness and material texture of the overlying sediments. In areas where the overburden is thick, surficial recharge to the aquifer is likely limited. The infiltration of precipitation and snowmelt is expected to focus on areas where fine-grained overburden is thinner and in areas of higher topographic elevations where overburden is absent, and the bedrock outcrops at surface (Fulton et al. 1984). Much of the recharge is expected to occur in the spring associated with snowmelt. Recharge may occur through the overlying overburden aquifers 0483 and 0501. Mountain block recharge from the neighboring mountain ranges may be also a source of recharge to this aquifer. The aquifer may also be recharged by overlying minor tributaries of the Columbia River where the intervening overburden is thin; however, spatial and temporal understanding of this recharge mechanism is uncertain and further investigation is required to confirm these hydraulic connections.

A.2.3 POTENTIAL FOR HYDRAULIC CONNECTION

Hydraulic connection to various surface water bodies (primarily the Columbia River, which forms the northern and eastern boundary of aquifer 0500, and its minor tributaries) is expected. As the bedrock has been faulted and fractured throughout the Study Area, hydraulic connection to other aquifers (including the overlying overburden aquifers 0483 and 0501) is inferred; however, the extent of the fracture network and its continuity requires further study.

A.3 WATER MANAGEMENT

A.3.1 ADDITIONAL INFORMATION ON WATER USE AND MANAGEMENT

Reported well yields for 62 out of 69 wells (excluding seven wells that were dry or had no reported well yield) within the aquifer range between 0.03 L/s and 63.1 L/s, with a geometric mean of 0.4 L/s, indicating an aquifer with generally moderate productivity with localized zones of low and high productivity. No water quality of quantity concerns were noted in the water quality comments of the GWELLS database.

The wells within aquifer 0500 are domestic use wells based on well purpose recorded in GWELLS.

A.3.2 ADDITIONAL ASSESSMENTS OR MANAGEMENT ACTIONS

No water availability or water budget studies have been completed in the area.

A.4 AQUIFER 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.

Cui, Y., Miller, D., Schiarizza, P., and Diakow, L.J. 2017. British Columbia Digital Geology. BC Ministry of Energy Mines and Petroleum Resources, BC Geological Survey Open File 2017-8, 9p. Data Version 2019-12-19.

Fulton, R.J., Shetsen, I., and Rutter, N.W., 1984. Surficial geology, Kootenay Lake, British Columbia-Alberta. Geological Survey of Canada, Open File 1084, 1:1,000,000 scale.

Geographic datasets from the BC Data Catalogue, accessed December 2022 https://data.gov.bc.ca/.

Lengyel, T., Verma, S., Deri-Takacs, J., and Hinnell., A. 2024. Aquifer Mapping in the Kootenay/Boundary Region of British Columbia: Creston, Rossland, Castlegar, and Salmo. Water Science Series, WSS2024-05. Prov. B.C., Victoria B.C.

A.5 REVISION HISTORY

Date	Version	Revision Class	Comments	Author
20020308	1	Major	Initial mapping of aquifer	N/A
20230202	2	Minor	Remapping of Aquifer	Tibor Lengyel, M.Sc., P.Geo., Simrat Verma, M.Sc., and Andrew Hinnell, PhD, P.Geo.

Note: Author of first mapping not available