Aquifer Name: East Pine Bedrock Aquifer

Aquifer Number: 0589

Date of Mapping: February 10, 2023

Authors: Tibor Lengyel, M.Sc., P.Geo., Judit Deri-Takacs, Ph.D., and Andrew Hinnell, Ph.D., P.Geo.

A. AQUIFER DESCRIPTION FOR AQUIFER 0589

A.1 CONCEPTUAL UNDERSTANDING OF HYDROSTRATIGRAPHY

A.1.1 AQUIFER EXTENTS

The aquifer is located east of the Pine River. It was delineated based on watershed boundaries in the east and the south, the Pine River in the west, and Stewart Creek in the north (Lengyel et al. 2023, Figure 1). The aquifer boundary is uncertain where it follows Stewart Creek in the north. The aquifers to the east and south of the aquifer (0591 and 0595) are part of the same geological/hydrostratigraphical unit.

A.1.2 GEOLOGIC FORMATION (OVERLYING MATERIALS)

The aquifer is overlain by till, glaciolacustrine, and alluvial deposits. Four out of the five wells associated with the aquifer reported fine-grained material (clay, till) on the surface. The thickness of the overlying material ranges from less than 15 to more than 70 meters.

A.1.3 GEOLOGIC FORMATION (AQUIFER) – 5A FRACTURED SEDIMENTARY ROCK

The bedrock aquifer comprises sediments of the Upper Cretaceous Dunvegan and Kaskapau formations. The Dunvegan Formation is interpreted to be a regionally continuous hydrostratigraphic unit. The Dunvegan Formation consists of massive conglomerate, fine- to coarse-grained sandstone, and carbonaceous shale (Massey et al. 2005), while the Kaskapau Formation mostly consists of shale, siltstone, and sandstone. The deepest well associated with the aquifer is 98.1 m deep.

Permeability is associated with both the primary and the secondary porosity (through fractures) of the formations. The Dunvegan and Kaskapau formations are described in further detail by Lengyel et al. (2023).

The aquifer is interpreted to be a confined aquifer based on the overlying materials.

A.1.4 VULNERABILITY

Depth to groundwater varies from shallow to moderately shallow. While the permeability of the aquifer was not tested, it is expected to be low to medium based on the type of aquifer material (shale, sandstone) and high where fractures are present. Surficial mapping by Reimchen (1980) and borehole logs indicate that the bedrock aquifer is covered by fine-grained materials of variable thickness. 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 shallow (9.1 m) to moderately shallow (18.3 m). No active provincial monitoring wells and no wells with artesian conditions exist in the aquifer.

The groundwater surface is interpreted to be a subdued representation of the topography, based on regional interpolation of groundwater surface elevations. Groundwater is interpreted to flow primarily towards the Pine River and its tributaries.

A.2.2 RECHARGE

Recharge to the aquifer could occur via distributed infiltration of precipitation and snowmelt through the thin overburden (Baye et al. 2016). Much of the recharge is expected to occur in the spring associated with snowmelt. The aquifer may also be recharged by the overlying minor tributaries of the Pine River and/or regional groundwater flow in the bedrock units. However, the spatial and temporal understanding of these recharge pathways as well as vertical flow potential within the bedrock are uncertain and further investigation is required to be evaluated.

A.2.3 POTENTIAL FOR HYDRAULIC CONNECTION

Groundwater in the aquifer is in direct hydraulic connection with its neighbouring bedrock Aquifers 0591 and 0595. Aquifer boundaries are defined based on inferred groundwater flow paths within the Dunvegan and Kaskapau formations (continuous hydrostratigraphic units) rather than by structural boundaries. Groundwater may also be hydraulically connected with the overlying buried valley aquifer (0592).

Groundwater in the aquifer may also be in direct hydraulic connection with minor tributaries of the Pine River and wetlands in the east, where the thickness of the overburden separating them is thin.

A.3 WATER MANAGEMENT

A.3.1 ADDITIONAL INFORMATION ON WATER USE AND MANAGEMENT

Baye et al. (2016) reported exceedances for iron, manganese, and hardness in some of the bedrock wells within the area of aquifer 0589. Stated yields in the well records range from 0.63 to 1.26 L/s, with geometric mean of 0.98 L/s indicating moderate productivity. Groundwater is used primarily for domestic and commercial water supply purposes (3 out of 5 wells), based on the GWELLS database.

A.3.2 ADDITIONAL ASSESSMENTS OR MANAGEMENT ACTIONS

Baye et al. (2016) concluded that recharge occurs in upland areas by precipitation percolating through the till, however the exact recharge source of the regional bedrock aquifer is currently unclear and requires further investigation.

Aquifer 0589 is part of the Dunvegan Formation. Bedrock aquifers in the weathered and fractured Dunvegan and Kaskapau formations in the Study Area (0589, 0591, 0593, 0595, 0633, and 1275) are inferred to be part of the same hydrostratigraphic unit and are interpreted to be continuous on a regional scale (see Lengyel et al. 2023). The aquifer is differentiated from adjacent aquifers (0591 and 0595) based on regional groundwater flow paths. Water management decisions for the aquifer may require assessment of adjacent aquifers, especially where development is near the aquifer boundaries.

A.4 AQUIFER REFERENCES

Baye, A., Rathfelder, K., Wei, M., and Yin, J., 2016. Hydrostratigraphic, hydraulic and hydrogeochemical descriptions of Dawson Creek-Groundbirch areas, Northeast BC. Victoria, Prov of B.C. Water Science Series 2016-04.

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

Lengyel, T., Deri-Takacs, J., Hinnell, A. C, & Clague, J. J. 2023. Kiskatinaw-Peace Aquifer Mapping and Hydrostratigraphic Characterization. Victoria, B.C.

Massey, N.W.D., MacIntyre, D.G., Desjardins, P.J. & Cooney, R.T. 2005. Geology of British Columbia. Ministry of Energy and Mines, BC Geological Survey, Geoscience Map 2005-3.

Reimchen, T.H.F, 1980. Surficial Geology Dawson Creek; Geological Survey of Canada, Map 1467A, 1:250000 scale map.

A.5 REVISION HISTORY

Date	Version	Revision Class	Comments	Author
2011	1	Major	Initial mapping of aquifer	Lowen Hydrogeology Consulting Ltd. 2011
02/10/2023	2	Major	Remapping of aquifer	Tibor Lengyel, M.Sc., P.Geo., Judit Deri-Takacs, Ph.D., Andrew Hinnell, Ph.D., P.Geo.