# 1. AQUIFER DESCRIPTION FOR AQUIFER TAG 0899 ELK MOUNTAIN BEDROCK AQUIFER

## 1.1 Conceptual Understanding of Hydrostratigraphy

### *1.1.1 Aquifer Extents*

The aquifer is located in the in the southeast part of the City of Chilliwack and adjacent areas of the Skagit Ranges. It underlies the slopes of Elk Mountain, Mount Archibald, Mount Thurston and Mount Mercer that drain directly into the Fraser Lowland and Chilliwack River. The western boundary of this aquifer follows the approximate trace of the east-dipping thrust fault that emplaces Pennsylvanian to Permian Chilliwack Group rocks on the Triassic to Jurassic Cultus Formation (Monger, 1970a, b, 1989; Monger et al., 1992; Journeay and Monger, 1994). The northern boundary follows the mountain front adjacent to the Fraser Lowland. The eastern boundary follows the drainage divide between the Chipmunk Creek and the Chilliwack River drainages on the south, and between the Chipmunk Creek and the Fraser Lowland drainages on the north, as far as Mount Archibald and Bridal Veil Falls. It may extend further northeast adjacent to the Fraser Lowland as far as Mount Cheam and Popkum, where the Chilliwack Group rocks are intruded by the Mount Barr Batholith

### *1.1.2 Geologic Formation (Overlying Materials)*

The aquifer is overlain by Late Wisconsin glacigenic sediments, mainly of Sumas age, comprising till, clay, and sand and gravel, and Holocene colluvium and alluvial fan deposits (Armstrong, 1980; Levson et al., 1996). In the 30 wells reported in this aquifer, depth to bedrock varies from 0 to 68 m; the mean is 22 m and the median is 20 m. These sediments are thickest in valleys of major creeks, alluvial fans at the mountain front, and the southern flank of Lookout Ridge (Armstrong, 1980; Levson et al., 1996). However, surficial geological maps show that over most of this aquifer, bedrock is overlain by a thin discontinuous cover of sediment and colluvium (Armstrong, 1980; Levson et al., 1996).

Aquifers occur locally within thicker sections of overlying sediments: at Marble Hill Creek (Aquifer 1213) and the south flank of Lookout Ridge (Aquifer 1211).

### *1.1.3 Geologic Formation (Aquifer)*

Fractured bedrock. The aquifer consists of a thrust faulted succession of volcanic and sedimentary rocks of the Pennsylvanian to Permian Chilliwack Group and mudstones and fine sandstones of the overlying Triassic to Jurassic Cultus Formation (Monger, 1970a, b, 1989; Monger et al., 1992; Journeay and Monger, 1994). However, Chilliwack Group rocks predominate at lower elevations, where ground water development has occurred, and Cultus Formation mudstones occur mainly at higher elevations. All wells to date have been drilled into the upper division of the Chilliwack Group, which consists of altered volcanic rocks (greenstones) and pyroclastics. Represented in other parts of the Chilliwack Group are conglomerate, limestone, sandstone and pelite. The principal water-bearing intervals are fractured intervals, both at or near the bedrock top and in deeper fractured zones.

Reported well yields range from 2 to 500 gpm, with a mean of 72 gpm and a median of 10 gpm. Well yields of 100 to 500 gpm are reported at the City of Chilliwack Marble Hill Road well field and in the Dunville and Nevin Creek alluvial fan (Baldry, 1976; Green and Bianchin, 2015, 2016). At the Marble Hill Road well field, the high rates are related to a greater degree of fracturing in proximity to the thrust fault that forms the western boundary of the aquifer. At the Dunville and Nevin Creek alluvial fan, increased fracture intensity in proximity to faults is also likely the cause of the high productivity (Monger, 1970a, b, 1989; Monger et al., 1992; Journeay and Monger, 1994). However, pump tests on

one well in this locale suggest the lateral extent of the highly fractured interval may be limited (Badry, 1976). Elsewhere in the aquifer, median well yield is 10 gpm.

### *1.1.4 Vulnerability*

Moderate. Wells are in a moderate to high productivity bedrock aquifer, depth to water is moderate, ranging from 1 to 93 m, with a mean of 29 m and a median of 26 m, and sediments overlying bedrock are thin or absent over most of the aquifer (Armstrong, 1980; Levson et al., 1996.)

## 1.2 Conceptual Understanding of Flow Dynamics

### *1.2.1 Groundwater Levels and Flow Direction*

Reported depths to water in wells range from 1 to 93 m, with a mean of 29 m and a median of 26 m. Flow is inferred to follow regional topography, northwest to the Fraser Lowland and south to the Chilliwack River Valley.

## 1.3 Recharge

Recharge is inferred to be primarily from precipitation through areas of bedrock exposure, particularly at higher elevation on Elk Mountain, Mount Thurston, Mount Mercer and Mount Archibald.

### *1.3.1 Potential for Hydraulic Connection*

The aquifer locally recharges the Chilliwack Rosedale Aquifer (0006).

In the Marble Hill Road area, the aquifer is hydraulically connected to the Harmeling Spring, which flows at average rate of 960 gpm, and to the Marble Hill Road Unconsolidated Aquifer (Aquifer 1213) , from which the spring discharges directly (Tixier and Tiplady, 2013; Green and Bianchin, 2015, 2016).

In the Lookout Ridge area, the aquifer is likely hydraulically connected with the Lookout Ridge Aquifer (Aquifer 1211).

The aquifer does not appear to be in hydraulic connection with the Mount Tom Bedrock Aquifer (0890) to the west. Static water levels and water chemistry demonstrate that the aquifers are separate in the area of the Marble Hill Road well field. The wells in the Mount Tom Bedrock Aquifer have static levels of 259 to 264 m asl (flowing artesian conditions) and a strong hydrogen sulphide odour. The wells in the Elk Mountain Bedrock Aquifer have static level of 232 m asl, and no odour (Green and Bianchin, 2015, 2016).

## 1.4 Additional Information on Water Use and Management

The City of Chilliwack Marble Hill Road well field is located in this aquifer (Green and Bianchin, 2015, 2016). Two production wells are established in highly fractured greenstones of the Upper Division of The Chilliwack Group.

Thirty wells have been reported in this aquifer. Well depths range from 25 to 195 m with a mean of 61 m and a median of 53 m. Wells are localized in four clusters: the Dunville and Nevin Creek alluvial fan (3 wells), the Nixon Road area (16 wells), the Marble Hill Road area (5 wells) and south of Lookout Ridge (6 wells).

In the Dunville and Nevin Creek alluvial fan, well depths range from 31 to 61 m, with a mean and median of 46 m. Depths to bedrock range from 5 to 24 m, with a mean of 15 m and a median of 17 m. Depth to water is 5 m in one well, and reported well yields are 200 gpm.

In the Nixon Road cluster, well depths range from 25 to 195 m, with a mean of 65 m and a median of 49 m. Depths to bedrock range from 0 to 28 m, with a mean of 11 m and a median of 9 m. Depths to water range from 1 to 97 m, with a mean of 39 m and a median of 33 m, and reported well yields are 0 to 30 gpm, with a mean of 9 gpm and a median of 7 gpm.

In the Marble Hill Road area, well depths range from 41 to 78 m, with a mean of 58 m and a median of 53 m. Depths to bedrock range from 26 to 68 m, with a mean of 44 m and a median of 37 m. Depths to water range from 3 to 27 m, with a mean of 13 m and a median of 7 m, and reported well yields are 100 to 500 gpm, with a mean of 325 gpm and a median of 350 gpm.

In the Lookout Ridge area, well depths range from 43 to 78 m, with a mean of 59 m and a median of 60 m. Depths to bedrock range from 29 to 54 m, with a mean of 39 m and a median of 38 m. Depths to water range from 1 to 49 m, with a mean of 27 m and a median of 30 m, and reported well yields are 3.5 to 60 gpm, with a mean of 17 gpm and a median of 10 gpm.

### 1.5 Additional Assessments or Management Actions:

The areal extent of the aquifer has been expanded from the area initially included in this aquifer by Kohut (2007a) to include the wells formerly included in the Upper Young Creek Aquifer (Aquifer 891; Kohut 2007b).

### 1.6 Aquifer References


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