5.13 Carcross - Community Water Supply System

Government of Yukon, Department of Community Services owns and operates the community water supply system in the Village of Carcross, Yukon. The Carcross water system obtains surface water from a surface water intake in Bennett Lake. The surface water intake consists of a 150 mm pipe extending about 380 m from the shoreline (EDI 2010) and about 417 m from the wet well to a screened intake installed in Bennett Lake. The water is pumped about 140 m from the wet well to a treatment plant facility located at the corner of 4th Street and Tagish Avenue. After treatment (filtration, UV and chlorination), the water is pumped into an overhead water storage tank inside the facility and is then distributed to the residents of Carcross through bulk water delivery with a piped connection to the Carcross School. The Carcross Community Water Supply System is classified as a Large Public Drinking Water Supply System (LPDWS) under the Yukon Drinking Water Regulations – Guidelines for Part I – Large Public Drinking Water Systems (YG 2007).

5.13.1 Data Compilation Methodology

Tetra Tech approached stakeholders including YG departments, water system operators and owners to let them know the project was in progress and to request their assistance in compiling the most complete data set possible. Through the process of compiling the data, Tetra Tech obtained data regarding the Carcross Community Water Supply system from the following proponents:

- YG Community Services (the client) – YG CS provided data for the Carcross Community Water Supply as this system is owned and operated by YG CS. The YG CS operator provided review comments and edits for the final summary to ensure completeness and accuracy.

5.13.2 Hydrology and Hydrogeology

5.13.2.1 Hydrology

The Bennett Lake catchment area covers 3,525 km^2 extending from Yukon into the northwest corner of British Columbia and a small area in Southeast Alaska. This catchment area receives water from the Yukon Stikine Highlands which encompasses the Boundary Range Mountains. Drainage from this area into Bennett Lake displays typical glacial system flows with large snowmelt discharges in May and peak discharge in July and August due to glacial melting (EDI 2010).

The vulnerability of the surface water supply to contamination was assessed by EDI in 2010 (EDI 2010). EDI detailed the level of risk posed by sources of contamination to Bennett Lake as follows:

- Recreational use of Bennett Lake and Watershed: Low
- Land use in Community of Carcross: Low
- Industrial Site Contamination: Low
- Historic Mine Sites: Low
- Mining Exploration and Production: Low (as it is controlled by regulation)
- Railroad: Low (as regulated by safety standards and maintenance)
- Sedimentation: Moderate
- Climate Change and Extreme Weather Events: Moderate

- Vandalism: High
- Severe Earthquake: High

5.13.2.2 Hydrogeology

The groundwater flow direction is inferred to range from southwesterly to southeasterly in the vicinity of the Carcross Firehall, towards Bennett Lake and/or the Nares River (Tetra Tech 2006). From the log for the abandoned well "Carcross Firehall," the well is 105.8 m (347 feet) deep completed in a confined aquifer underlying sand clay, and till (Tetra Tech 2006). The well was abandoned due to high arsenic concentrations.

5.13.3 Bennett Lake Intake Details

The following table summarizes the surface water intake details on the Carcross LPDWS.

Table 5-32: Carcross Large Public Drinking Water System Surface Water Intake Summary

Well Construction Parameters	Details	Source
Date of construction	The intake, the wet well and the transfer line were constructed in 1990	Tetra Tech 2012
Intake	150 mm dia. Polyethylene (PE) Series 160. End of intake is 560 mm dia., screened, on concrete base in deep water close to south shore of lake.	
Pumps	Submersible pumps in wet well were installed in May 2010. Pumps are 5 hp, 230 V, 3 phase Grundfos 75550-8.	

5.13.4 Source Water Quality

The Carcross LPDWS is supplied by water from a surface water source (Bennett Lake). Records provided to Tetra Tech for review during the 2012 LPDWSA indicates that the wet well was previously sampled in June 2005, July 2009, and April 2010 (Tetra Tech 2012). The key observations and comments noted by Tetra Tech during the 2012 chemical water quality review are summarized as follows (Tetra Tech 2006):

- Over the testing period, there were no exceedances of GCDWQ for the parameters analyzed; and,
- When tested in the field during the 2012 LPDWSA, turbidity of the raw water sample (1.06 NTU) was considered typical of a surface water source. The water treatment plant was designed to provide cartridge filtration to 1 NTU or less using stepped filtration with a 10-micron screen, 5-micron cartridge filters and 1-micron absolute filter;
- Tetra Tech did not review recent water quality data but understands water chemistry analysis is completed at this system annually and bacteriological monitoring is completed on a regular basis with results sent to YG EHS for review.

5.13.5 Water Treatment and Distribution

Table 5-33: Carcross Large Public Drinking Water System Water Treatment and Distribution Details

Item	Details	Source
Owner/Operator	Government of Yukon – Community Services	Tetra Tech 2012
Water source	Surface Water	
Treatment type	Cartridge filtration, UV disinfection, chlorination	ODK 2013
Population served	Approximately 336 people	Yukon Bureau of Statistics 2016
Delivery method	Gravity feed to bulk water delivery truck Gravity fed piping to school Piped delivery to ambulance bay Self-serve fill point	ODK 2013 p.c. Steve Perrin 2017
Age of system/last known update	New water treatment plant completed in 2013.Tetra Tech understands maintenance on the intake structure was completed in 2016.	ODK 2013 p.c. Chris Evans, YG-CS

5.13.6 Source Water Protection Planning

EDI completed a SWPP for the Carcross LPDWS in 2010. EDI identified historical, existing and future potential sources of contamination to the Carcross water supply; possible sources identified by EDI are summarized below (Tetra Tech 2012):

- Historical, current and future contamination due to mining activity, industrial land use, and residential land use;
- Existing and future recreational use of Bennett Lake and watershed; and
- Future potential events including vandalism, sedimentation, earthquake, flooding and other natural events, climate change and changes in railroad activity.

Recommendations from this plan are summarized below:

- Increase security at the water intake by installing a cage around the structure in the water;
- Institute regular maintenance for the water intake (bi-annual at minimum);
- Continue regular monitoring of the raw water quality; and
- Institute water quality and hydrology monitoring for Bennett Lake watershed including monitoring mining inputs, fecal coliform and hydrocarbon monitoring in the vicinity of the intake, monitoring of precipitation and hydrology.

During the 2012 LPDWSA, several potential contaminant sources were identified in the vicinity of the system, including sewage holding tanks, fuel tanks, abandoned wells and other groundwater wells. Potential contaminant sources nearest the intake would have a higher potential for impacting the source water quality for this system;

however, as Bennett Lake is continuously mixed through wind and wave action, and generally is slowly flowing to the southeast towards the Nares River, potential sources of contamination could be derived from anywhere in the Bennett Lake watershed.

Tetra Tech understands that YG has begun implementing recommendations from the SWPP including cleaning of the water intake structure, ongoing monitoring of water quality and implementing increased filtration to address high turbidity during freshet.

5.13.7 Water Supply Information Data Gaps

A new water treatment plant was built in Carcross in 2013 and Tetra Tech understands that maintenance was completed on the intake structure in 2016 include verifying the location and cleaning of the intake structure (ODK 2013; p.c. Chris Evans, YG-CS March 2016, p.c. Steve Perrin, YG-CS 2017).

- The status of the abandoned well at the Firehall is unknown, the well should be properly secured or decommissioned based on future planning for the site.