

5.43 Tagish - Carcross Tagish First Nation Tagish Water Supply System

Carcross Tagish First Nation (CTFN) owns and operates a bulk delivery water system at Tagish, Yukon. The system is supplied by two groundwater wells (CTFN Wells No. 2 and No. 3), and the water treatment and storage system consists of a chlorination injection system, and a manganese removal unit, with three 1,500-lgal tanks for chlorine contact and storage (Tetra Tech 2012). The system serves more than 20 residences and is classified as a Large Public Drinking Water Supply System under the Yukon Drinking Water Regulations – Guidelines for Part I – Large Public Drinking Water Systems (YG 2007) and is also regulated under the Yukon Drinking Water Regulations - Guidelines for Part II - Bulk Delivery of Drinking Water (YG 2007).

5.43.1 Data Compilation Methodology

Tetra Tech approached stakeholders including the water system owner/operator and regulatory bodies 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 has had communication with the following parties regarding the CTFN Tagish Water Supply System:

- Carcross Tagish First Nation - CTFN confirmed that the most up to date information had been captured in the 2012 LPDWSA, and gave approval for use of Tetra Tech EBA data for the project.
- YG Environmental Health – YG EHS was contacted and assisted with the provision of data and contact information for water system operators.

5.43.2 Hydrogeology

CTFN Wells No. 2 and 3 are both completed within a deep confined aquifer at approximately 50 m bgs. The aquifer is overlain by a thick clay and/or silty to sandy till unit that is at least 18 m in thickness. From the Well No. 2 log, the apparent aquifer thickness is 9.2 m. However, due to the limited number of wells in the study area, it is not possible to delineate the extent of this deep confined aquifer (Tetra Tech 2012).

Bedrock underlying the overburden sediments is mapped as the Lower and Middle Jurassic Laberge Group which consists of poorly sorted, medium bedded to massive arkosic sandstone and minor shale with interbeds of thick resistant pebble and boulder conglomerate. Bedrock was not encountered at any of the CTFN public drinking wells; thus, depth to bedrock is unknown (Tetra Tech 2012).

According to available surficial mapping (Morison & Klassen 1991), the Laberge Group formation is overlain by any or all of the following:

- Alluvial valley bottom deposits of gravel, sand and silt with a thickness of 5 m to 20 m;
- Glaciolacustrine deposits of clay, silt, and sand with a thickness of 5 m to 10 m; and/or
- Silty to sandy till (lodgement to ablation till) deposits of 1 m to 30 m thick.

The groundwater flow direction within the aquifer is inferred to be northwesterly towards Marsh Lake, under a hydraulic gradient of 0.02 m/m; however, available groundwater elevation data suggested that the groundwater flow direction could change seasonally and even reverse temporarily. The actual magnitude of seasonal fluctuation and potential changes of the hydraulic gradient and groundwater flow direction cannot be determined due to limited available data (Tetra Tech 2012).

The main source of aquifer recharge is inferred to be from infiltration in topographically higher areas surrounding the valley. Local recharge to the aquifer from precipitation and snowmelt is probably very limited due to the confined

aquifer conditions and the relatively thick fine grained sediment cover present in the valley bottom. Given an inferred groundwater flow direction toward northwest, the main aquifer recharge area is likely to be from higher elevations approximately 4 km southeast of the well site.

The vulnerability of the aquifer encountered by Wells No. 2 and 3 was assessed using the semi quantitative ISI method suggested by the Ontario Ministry of Environment. The ISI method resulted in a calculated value of 269 to 285 for the two wells. The ISI method defines aquifers with ISI values greater than 80 as having a low intrinsic susceptibility to surface sources of contamination. The high values calculated for Well No. 2 and Well No. 3 indicate that the aquifer underlying the site has a low to very low vulnerability to potential surface-based contamination because of thick overlying poorly permeable lacustrine and till sediments above the aquifer and the depth of the aquifer zones (Tetra Tech 2012).

5.43.3 Summary of Wells

Logs for the two CTFN Tagish public wells serving the area of Tagish are included in the GIS map and database portion of this project. The following tables summarize the completion characteristics of the CTFN Tagish wells.

Table 5-109: CTFN Public Drinking Water System, Well No. 2 Summary		
Well Construction Parameters	Details	Source
Date of construction	Well was completed by Midnight Sun Drilling Co. Ltd. in September 2003	Well log
Total well depth	63 m bgs (tail pipe from 60.4 m to 63 m bgs)	
Casing	8.6" (220 mm) OD Steel Well Casing	
Casing depth	57.9 m bgs	
Well screen	2.5 m 10 slot (0.254 mm) stainless steel well screen from 57.9 m to 60.4 m bgs	
Static water level	1.4 m bgs (2003)	
Sanitary seal	Bentonite surface seal to 5.6 m bgs	
Wellhead completion	The wellhead is completed with a split gasket cap, and is located in a 1.9 m x 1.9 m building with a removable roof to allow future access for well rehabilitation or redevelopment.	Tetra Tech 2012
Wellhead stickup	0.93 m ags	
Well rated capacity	0.88 L/s (11.6 IGPM)	
Well GUDI status	Non-GUDI	
Well Construction Comments:	Well was constructed to meet Canadian Groundwater Association Well Construction Guidelines.	

Table 5-110: CTFN Public Drinking Water System, Well No. 3 Summary

Well Construction Parameters	Details	Source
Date of construction	Well was completed by Cathway Resources in September 2004	Well Log
Total well depth	51.2 m bgs	
Casing	8" (203 mm) ID Steel Well Casing	
Casing depth	49.7 m bgs	
Well screen	1.5 m 200 slot (5.1 mm) stainless steel well screen from 49.7 to 51.2 m bgs	
Static water level	3.99 m bgs (2004)	
Sanitary seal	Bentonite surface seal to 6 m bgs	
Wellhead completion	Pitless adapter. The wellhead is located in 0.65 m x 0.65 m lockable metal clad plywood framed enclosure	Tetra Tech 2012
Wellhead stickup	0.6 m ags	
Well rated capacity	1.28 L/s (16.9 IGPM)	
Well GUDI status	Non-GUDI	
Well Construction Comments:	Well was constructed to meet Canadian Groundwater Association Well Construction Guidelines.	

5.43.4 Source Water Quality

Tetra Tech reviewed water quality data for the CTFN Tagish public water supply system as part of the LPDWSA in 2012. In general, the raw water from the two CFTN Tagish public water supply wells meets the GCDWQ for all the parameters analyzed with the exceptions of total iron, total manganese and total arsenic (Tetra Tech 2012). The key observations and comments noted in 2012 are:

- The water is similar between the two wells and is considered soft with a measured hardness of 41.0 mg/L to 47.3 mg/L as CaCO₃, is classified as sodium-sulphate type, and has a pH of 8.1 to 8.4;
- Arsenic concentrations were consistently approaching or in exceedance of the GCDWQ MAC in raw water samples obtained from Wells No. 2 and No. 3 over the period of record with measured concentrations ranging from 0.096 mg/L to 0.0152 mg/L. Arsenic concentrations have been slightly higher at Well No. 2 than Well No. 3 over this period. There is no notable trend with respect to changes in arsenic concentrations in raw water over time;
- Arsenic concentration exceeded the MAC in the two treated water samples considered with measured concentrations of 0.0119 mg/L and 0.0105 mg/L;
- Total iron concentration exceeded the AO of 0.3 mg/L with measured values between 0.034 mg/L to 0.487 mg/L in raw water over the period of monitoring. Iron concentrations were variable and likely related to suspended solids within samples. Treated water samples had total iron concentrations below the AO;

- Total manganese concentration in the raw water exceeded the AO of 0.05 mg/L with measured values between 0.19 mg/L and 0.211 mg/L in the results reviewed. Treated water samples had total manganese concentrations below the AO; and,
- The water met all other GCDWQ health-based criteria and aesthetic objectives for the parameters in the results reviewed.

5.43.5 Water Treatment and Distribution

Table 5-111: CTFN Public Drinking Water System Treatment and Distribution Details

Item	Details	Source
Owner/Operator	Carcross Tagish First Nation	Tetra Tech 2012
Water source	Groundwater	
Wells serving the system	Well No. 2 and Well No.3	
Treatment type	Chlorination and manganese removal	Tetra Tech 2010
Population Served	Residents in the CTFN Tagish community and other communities in the Tagish and Squanga Lake areas obtain their drinking water from this water treatment system through bulk water delivery.	
Delivery method	Bulk truck delivery	Tetra Tech 2012
Age of system/last known major work	New water wells in 2003	

5.43.6 Source Water Protection Planning

Source Water Protection Planning in the form of Source Water Protection Plan (SWPP) was completed in 2010 for Wells No. 2 and No. 3, and can be found in the GIS map and database portion of this project. The key findings of the 2010 SWPP are (Tetra Tech 2010):

- Risks identified within the 1-year, 5-year and 10-year travel time zones for the CTFN public water supply wells can be eliminated or reduced if preventative action and contingency planning can be developed. Identified risks included:
 - Abandoned Well No. 1 (which was subsequently decommissioned in accordance to the Canadian Groundwater Association Guidelines for well decommissioning);
 - Miscellaneous household wastes including car, hulks and batteries; and
 - Above-ground and Underground Storage Tanks, septic systems, outhouses, the cemetery area, and potential spills that may occur.
- There had been no identified contamination in groundwater sampled from CTFN Wells No. 2 and No. 3 for water quality results available for review up to 2010; however, any release of contaminants within the travel time zones would represent a potential risk to the groundwater quality of the aquifer supplying these public water supply wells.

Tetra Tech understands CTFN has taken steps to address the recommendations made in the 2010 SWPP including decommissioning of Well No. 1.

5.43.7 Water Supply Information Data Gaps

To our knowledge we have captured the current status of the CTFN community water supply with the exception of the water system upgrades that were planned for 2016. The following data gaps were identified in the preparation of this report and where possible, this data should be obtained and included in future updates to this summary:

- The SWPP was completed in 2010, and, as Tetra Tech recommends updating SWPPs on a regular basis and as changes occur within the well capture zones, it is likely this SWPP is due to be updated.
- CTFN did not provide additional information system regarding upgrades that are thought to have been completed in 2016.