5.16 Carmacks - Health Centre Water Supply System

The Village of Carmacks is located on the North Klondike Highway approximately 180 km north of Whitehorse, Yukon. The Carmacks Health Centre water system is served by a 17.7 m deep well located in a well house approximately 3 m from the Health Centre building. The water system supplies potable water to the Health Centre and the adjacent Nursing Residence and is governed under the Sections 12.1 (a) and (b) and 17 of the *Public Health and Safety Act* and Section 5 of the *Public Health Regulations* (C.O. 1958/079, O.I.C. 2009/194), which require safety measures and inspection for water and water sources for systems that provide for human consumption.

5.16.1 Data Compilation Methodology

Tetra Tech approached stakeholders including 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 has had communication with YG PMD regarding all water systems they operate and/or maintain. YG PMD has provided review comments review comments and data for the compilation.

5.16.2 Hydrogeology

The aquifer underlying the central Carmacks Village area is a permeable, unconfined sand and gravel aquifer comprised of glaciofluvial and recent alluvial deposits. The well log for this well shows coarse grained lithology from surface consisting of sands and gravels. The well is completed in an unconfined aquifer, and, from other wells in the area, the static water level is likely relatively shallow resulting in high vulnerability of the aquifer to surface sources of contamination. The regional groundwater flow direction in the vicinity of the Village core is inferred from topography to be northeast towards the Yukon River.

5.16.3 Well Summary

A partially complete well log for the Carmacks Health Centre well is included in the GIS map and database portion of this project. The following table summarizes available data for the water well.

Table 5-39: Carmacks Health Centre Well Summary

Well Construction Parameters	Details	Source
Date of construction	The well was completed in 1982	Well log
Total well depth	17.7 m bgs	
Casing	6” (152 mm) Steel Well Casing	Tetra Tech 2006 p.c. Nick Barnett 2017
Casing depth	Unknown	
Well screen	Unknown	
Static water level	Unknown	
Sanitary seal	Likely no surface seal	
Wellhead completion	Well cap, well is located in a generator room	
Wellhead stickup	0.06 m ags	

Table 5-39: Carmacks Health Centre Well Summary		
Well Construction Parameters	**Details**	**Source**
Well rated capacity	Unknown	
Well GUDI status	Potentially GUDI	Based on well construction
Well Construction Comments:	Based on the wellhead completion and the lack of a surface seal, the well was not constructed to meet the Canadian Groundwater Association Well Construction Guidelines.	

5.16.4 Source Water Quality

As part of the SPDWSA review conducted in 2005, Tetra Tech reviewed available groundwater chemistry data and collected an additional sample to test for identified parameters of concern. The observations made in 2005 are summarized below:

- The source water was likely calcium-magnesium-sulphate type as seen from nearby wells, but the treated water was potassium-sulphate type, due to the water softening;
- All GCDWQ health-based criteria and aesthetic objectives were met for the parameters analyzed;
- Additional testing included EPH and PAH and the reported concentrations of these parameters were below the laboratory detection limits, indicating that the well had not been impacted by hydrocarbons from the previously recorded spill at the time of sampling; and
- Review of chloride, nitrate and nitrite showed all three to be low and within the normal background ranges, suggesting that the aquifer was not under the influence of anthropogenic surface sources of nutrients or anions such as septic wastes at the time of sampling.

5.16.5 Water Treatment and Distribution

Table 5-40: Carmacks Health Centre Water Treatment and Distribution Details		
Item	**Details**	**Source**
Owner/Operator	Government of Yukon	Tetra Tech 2006 p.c. Nick Barnett 2017
Water source	Groundwater	
Wells serving the system	Carmacks Health Centre well	
Treatment type	Filtration and water softening on the Health Centre side of the system	
Water users	YG employees and patients	
Delivery method	Piped to Health Centre building and to nursing residences	
Age of system/last known update	Well completed in 1982	

5.16.6 Source Water Protection Planning

There is no SWPP in place for Carmacks Health Centre Well 6975, and Tetra Tech was not able to obtain any record of GUDI assessment completed for Well 6975. Given the unconfined, vulnerable nature of the aquifer, a SWPP would provide a valuable tool for identifying, monitoring and managing risks to the wells and aquifer. Source water protection planning here could be incorporated with planning for the Central Carmacks Village area to create a comprehensive SWPP.

Potential sources of contamination in the vicinity of the wellhead that were identified as part of the 2005 SPDWSA site review, included:

- An electric generator is located 2 m from the well;
- An AST is located 11 m from the wellhead; and
- A soil relocation permit was issued in 2003 for this site. It is understood that a heating oil fuel leak occurred between the AST and the Health Centre sometime between 2001 and 2002; however, the 2005 groundwater quality analysis shows no evidence of hydrocarbon contamination from this leak.

5.16.7 Water Supply Information Data Gaps

Tetra Tech has obtained review comments from YG PMD regarding the current status of this system and to our knowledge this summary is complete and accurate to March 2017. The following data gaps have been identified:

- There is no source water protection planning for this groundwater resource. Source water protection planning here could be incorporated with planning for other locations in the central Carmacks Village to create a comprehensive Carmacks SWPP;
- Additional filtration (to 1 micron) and disinfection was recommended for this system, and Tetra Tech understands this has not yet been completed.
- Upgrades to the fuel storage were recommended; however, Tetra Tech understands this work has not yet been completed; and
- Upgrades to the wellhead were recommended in 2006; however Tetra Tech understands this has not yet been completed.