

5.14 Carmacks – LSCFN Truck Fill Water Supply System

The Village of Carmacks is located at km 354 on the North Klondike Highway. Carmacks is the home of the Little Salmon Carmacks First Nation (LSCFN). The LSCFN community is located in a meander of the Yukon River. The LSCFN trucked water supply facility is served by one water supply well, PW05-01, and serves approximately 25 people at a total of 16 delivery points (from the LPDWS water licence application). The LSCFN trucked water supply system 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).

5.14.1 Methodology and Data Sources

Tetra Tech approached stakeholders including the water system owner and operator, LSCFN, and the Government of Yukon 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 LSCFN Carmacks Water Supply:

- Little Salmon Carmacks First Nation – Did not respond to requests to provide review comments for this 2017 summary.
- Indigenous and Northern Affairs Canada – Directed Tetra Tech to contact YG EHS or LSCFN for data regarding the system.
- Yukon Government Environmental Health Services – YG EHS provided the AWPP for inclusion in the project summary.

We have made an effort to present the most up-to-date information available to us at the time of this project and included the source and year for all information presented in this report and the GIS database. Data gaps, including obtaining buy-in and review comments from LSCFN, should be addressed in the next iteration of the project.

5.14.2 Hydrogeology

The LSCFN Village is located on a glaciofluvial plain adjacent to the Yukon River. The surficial geology in the area is mapped as moderately-well to well drained veneer of fine sand and silt fluvial material overlying thick glaciofluvial and fluvial deposits of loose sandy gravel and/or gravelly sand (Jackson 2000). Wells drilled in the area range in depth from 11 m bgs to 55 m bgs and the average well depth is 16 m bgs (Tetra Tech 2001). Bedrock exposed on higher-relief and resistant bluffs to the southeast of Carmacks are mapped as conglomerate, sandstone and shale with coal seams (Klassen 1978).

There is some suggestion that both a shallow, unconfined aquifer and a deeper, confined aquifer exist in the LSCFN Village area; however, seasonal fluctuation of groundwater elevation in concert with changes in the Yukon River suggests both are hydraulically connected to the Yukon River.

The groundwater flow direction, interpreted from groundwater elevation measurement, was inferred to be northwest with a horizontal gradient of 0.001 m/m. However, the presence of the confluence of the Nordenskiöld and Yukon Rivers directly northwest and down-gradient of the area may complicate the groundwater flow regime and the groundwater flow direction and gradient may vary.

Lithology encountered during the drilling of PW05-01 included varying amounts of sand and gravel and the material becomes silty from 25.0 m bgs to 40.2 m bgs. The presence of 15 m of silty material will provide some protection from surface sources of contamination.

5.14.3 Well Summary

The log for the LSCFN truck fill supply well PW05-01 is included in the GIS mapping portion of this project. The following tables summarize the completion characteristics of the well.

Table 5-34: LSCFN Truck Fill Supply, Well PW05-01 Summary		
Well Construction Parameters	Details	Source
Date of construction	Well was completed by Double D Drilling Ltd. in June 2005	Tetra Tech 2006
Total well depth	43.1 m bgs	
Casing	8" (203 mm) ID Steel Well Casing	
Casing depth	40.1 m bgs	
Well screen	3.01 m 200 slot (5.08 mm) v-wire well screen from 40.1m bgs to 43.1 m bgs.	
Static water level	20.4 m bgs (June 30, 2005)	
Sanitary seal	Cement bentonite grout seal to 6.0 m bgs	
Wellhead completion	Pitless unit	
Wellhead stickup	1 m ags	
Well rated capacity	9.7 L/s (128 IGPM)	
Well GUDI status	Potentially GUDI	Tetra Tech 2010
Well Construction Comments:	Well was constructed to meet Canadian Groundwater Association Well Construction Guidelines.	

5.14.4 Source Water Quality

Upon completion of PW05-01 in 2005, Tetra Tech collected a water sample to characterize the water quality and potability. From the water quality results and summaries provided in the well completion report:

- The water provided from PW05-01 was calcium-bicarbonate type with a pH of approximately 7.8 and was considered hard with a measured hardness of 154 mg/L (as CaCO₃);
- The Langelier Saturation Index of groundwater from PW05-1 was -0.2, indicating the water would dissolve calcium carbonate;
- The Ryznar Stability Index for the water was 8.1, indicating the water is slightly corrosive;
- The total manganese concentration measured in the well was 0.126 mg/L, which exceeds the GCDWQ AO of 0.05 mg/L; and
- The water quality from the well met the GCDWQ MAC and AO for all other parameters tested.

Tetra Tech has not completed a review of more recent water quality data, but understands this data is collected on a regular basis and is on file with YG-EHS.

5.14.5 Water Treatment and Distribution

The Little Salmon Carmacks First Nation owns and operates the LSCFN trucked water distribution system. Water is distributed to residential and commercial properties in the community via truck. In 2012, a new WTP was built in the community.

Item	Details	Source
Owner/Operator	Little Salmon Carmacks First Nation	Tetra Tech 2010
Water source	Groundwater	
Wells serving the system	PW05-1	
Treatment type	Filtration (10 micron to 1 micron), and chlorine disinfection**	LPDWS water license application
Population served	25 people	LPDWS water license application
Delivery method	Trucked	LPDWS water license application
Age of system/last known update	New WTP was completed in 2012.	

**Note: Water treatment may have changed since 2012. This should be verified and updated.

5.14.6 Source Water Protection Planning

Carmacks is a hub for transport of goods and services from southern Yukon to communities in northern Yukon including City of Dawson, Ross River, Faro, Mayo and Keno. Industrial activities in the area are primarily related to transport and residential needs. Goods transported through the community include mineral ore, fuel, and chemicals for mining and road maintenance purposes.

An AWPP was completed for the LSCFN Community Water Supply by Vista Tek in March 2008. The LSCFN AWPP was based on British Columbia’s Environment (BC MoE) Well Protection Tool Kit (BC MoE 2000). The well capture zone was estimated using the analytical model presented in BC MoE’s Well Protection Toolkit. The well capture zone resulting from this analysis is long and narrow and truncated at one end by the Yukon River indicating water from the well is primarily recharged from the river. Vista Tek applied a conservative assumption to account for variation in groundwater flow direction by assuming the width and downgradient extent of the capture zone is 60 m (approximately 4 to 7 times greater than predicted by the analytical model).

Key conclusions and recommendations are summarized below and the AWPP is included, included in the GIS map and database.

- A 120 m wide protection zone extending from the new well southeast to the Yukon River and northwest 60 m from the well was established.
- Due to the sand and gravel soil and the lack of any fine grained materials between the ground surface and the aquifer that supplies the community well, the aquifer is considered to be vulnerable to surface sources of contamination;

- Vista Tek recommended existing potential contaminant sources in the vicinity of the well protection area including two underground fuel storage tanks be removed and/or upgraded to reduce the risk of contamination to the aquifer.
- Vista Tek recommended ongoing monitoring of groundwater levels in the community to determine the groundwater flow direction more exactly;
- Remove UST at Heritage Hall and at the old laundromat and complete level II environmental assessment;
- Ensure properly constructed septic systems or holding tanks are in place and implement septic monitoring program;
- Endorse and promote hazardous waste minimization and collection programs and educate LSCFN community members on the importance of maintaining a clean environment on the land surrounding their community well;
- Implement contingency planning including emergency response planning for the water supply system in the event of a spill in the well capture zone;
- Upgrade residential wells as needed to ensure they are properly constructed and do not provide a pathway for surface contaminants to enter the aquifer;
- Install security measures around the community well including fencing and a lockable gate and conduct routine inspection of the well to ensure the longevity of the well;
- Include residential well monitoring in regular water quality monitoring and monitor the water level in the community well to monitor the well performance and determine if rehabilitation is needed.

Tetra Tech understands LSCFN has undertaken some of the measures including the removal of the Heritage Hall UST and environmental assessment of the area.

5.14.7 Water Supply Information Data Gaps

Tetra Tech has reviewed available data from YG Community Services, but was not able to obtain data from LSCFN, YG Property Management Division or Environmental Health Services at the time of completion of this reporting. Significant data gaps include:

- Tetra Tech understands that a new well has been completed for backup supply to this water system, but was not provided with a copy of the well log and well completion report;
- The new water well completed for this system has not been included in the AWPP, this should be updated when the AWPP is updated; and,
- The wellhead completion details have not been confirmed. The wells should be properly completed with adequate stick up (at least 0.5 m above the highest flood level) and proper piping connections to the system.