

5.27 Haines Junction - Water Supply System

The Village of Haines Junction (VHJ) was established as a community in the 1940s and today is home to approximately 613 people (Yukon Bureau of Statistics 2016). The VHJ system supplies domestic water to the residents and to commercial and government buildings in the community. VHJ is served by a water supply system with two deep groundwater wells (Wells No.3 and No. 5) completed in confined artesian aquifers. One additional well, known as Well No.4, is not currently in use, and, Tetra Tech understands it will be decommissioned in summer 2017. The VHJ 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).

5.27.1 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 the parties regarding the VHJ Water Supply System:

- Village of Haines Junction – Confirmed that the most up to date information had been captured in the 2012 LPDWSA and subsequent work such as the 2017 AWPP which Tetra Tech was involved in and therefore additional data was not needed and gave approval for use of Tetra Tech data for the project.
- YG Community Services (the client) – YG CS provided data and approval for Tetra Tech to use information from reports where YG CS provided project management and funding.

YG Environmental Health – YG EHS provided review and general comments for the summary.

5.27.2 Hydrogeology

Haines Junction is located in the Dezadeash Valley, east of the Auriol Range. Based on regional geology maps and soil stratigraphy reported on well logs from past drilling investigations, Haines Junction is underlain primarily by glaciolacustrine silt and clay deposits and occasional sand lenses. Groundwater recharge is thought to occur at higher elevations in the Auriol Range.

Both Wells No.3 and No.5 are completed in deep, confined sand and gravel aquifers at different depths and are artesian under static conditions. The VHJ aquifers are used for both community and domestic water supplies. In 2012, Tetra Tech completed an analysis of the vulnerability of the aquifers serving the two wells based on the semi-quantitative ISI (Ontario Ministry of Environment, 2001). The ISI score for the deep artesian aquifer at Well No.3 was calculated to be 381 and the score for the deep artesian aquifer at Well No.5 was found to be 1316 (EBA 2012b). The high ISI scores suggest that the aquifers underlying the two well sites have very low to extremely low vulnerability to surface-based contamination.

The nearest surface waterbody to the VHJ wells is the Dezadeash River which is approximately 40 m from Well No.3. In 2014, Tetra Tech completed GUDI screening for Well No.3, which found that the well is very unlikely to be GUDI (Tetra Tech 2014).

5.27.3 Summary of Wells

Logs for the two VHJ public wells currently serving the community are included in the GIS map produced for this study. The following tables summarize the completion characteristics of the VHJ Wells 3 and 5.

Table 5-68: Village of Haines Junction, Well No.3 Summary

Well Construction Parameters	Details	Source
Date of construction	Well was completed by Midnight Sun Drilling Co. Ltd. in May 1980.	
Total well depth	82.3 m bgs	Well Log
Casing	8" (203 mm) ID Steel Well Casing	
Casing depth	79.3 m bgs	
Well screen	3 m 50 slot (1.27 mm) stainless steel well screen from 79.3 m bgs to 82.3 m bgs.	Well Log, Tetra Tech 2012b
Static water level	Artesian (~3.6 m ags)	Tetra Tech 2014, Tetra Tech 2017
Sanitary seal	None	
Wellhead completion	Pitless unit	Tetra Tech 2013
Wellhead stickup	1.5 m ags	
Well rated capacity	8.4 L/s (111 IGPM)	Tetra Tech 2012b
Well GUDI status	Non-GUDI	Tetra Tech 2014
Well Construction Comments:	The well is constructed without a sanitary seal; however, Tetra Tech concluded that natural silts and clays have formed an adequate seal around the well casing (Tetra Tech 2014). The well has a pressure vent valve to allow for flow during artesian conditions positioned 330 mm ags.	

Table 5-69: Village of Haines Junction, Well No.5 Summary

Well Construction Parameters	Details	Source
Date of construction	Well was completed by Midnight Sun Drilling Co. Ltd. in September 2002 under the supervision of Gartner Lee Limited	
Total well depth	369.2 m bgs	GLL 2002, Tetra Tech 2012a
Casing	366 mm steel surface casing to 15 m bgs, 244 mm steel casing to 303 m bgs, and 7" (178 mm) steel liner from 144 m bgs to 361.9 m bgs. 99 mm (3.9") bridging casing from 139.08 m bgs to 145.30 m bgs.	
Casing depth	361.9 m bgs	

Table 5-69: Village of Haines Junction, Well No.5 Summary

Well Construction Parameters	Details	Source
Well screen	7.3 m 60 slot (1.52 mm) stainless steel well screen from 361.9 m bgs to 369.2 m bgs.	GLL 2002 Tetra Tech 2012a
Static water level	Artesian, 76.4 psi shut in pressure after 15 minutes (August 2011)	
Sanitary seal	Portland cement seal to 154 m bgs	
Wellhead completion	Welded casing cap and sealed piping.	Tetra Tech 2012b
Wellhead stickup	0.95 m ags	
Well rated capacity	25.8 L/s (340 IGPM)	
Well GUDI status	Non-GUDI	
Well Construction Comments:	Well was constructed to meet Canadian Groundwater Association Guidelines.	

5.27.4 Source Water Quality

As part of the AWHPP process in 2016, Tetra Tech reviewed water quality results for the VHJ wells from 2004 to 2016. The following summary is based on the water quality review from that report. Samples collected from the wells have been analyzed for general chemical and physical parameters as well as total metals as required for yearly reporting under the Yukon Public Health and Safety Act. In addition to the water chemistry results, Tetra Tech reviewed bacteriological sampling results as part of the Large Public Drinking Water Systems review in 2012, and the results of this review are included herein.

- The water supplied from Wells 3 and 5 comes from aquifers at different depths. Water from Well No.3 was classified as calcium-bicarbonate type and soft, with hardness measured between 41 mg/L and 47 mg/L (as CaCO₃). Water from Well No.5 was sodium-bicarbonate type and soft with hardness measurements from 9 mg/L to 33.4 mg/L (as CaCO₃). Health Canada's GCDWQ defines water with hardness from 0 mg/L to 60 mg/L to be soft;
- Over the period of April 4, 2005 to April 19, 2011 there were three positive Total Coliform results from raw water samples and no positive *E. coli* results reported. Raw water samples were taken from Well No.3 and Well No.5 as well as a mixed water line at Pump House 1, and positive total coliform results included one sample at Well No.5 and two samples from the mixed water line (0.7% of all tests). Positive Total Coliform results were observed in August and April 2005 and October 2008;
- Arsenic in raw water has been consistently elevated at both Well No.3 and Well No.5 above the Guidelines for Canadian Drinking Water Quality (GCDWQ) maximum acceptable concentration (MAC) of 0.01 mg/L;
- In 2009, the cadmium concentration in a raw water sample taken from Well No.5 was more than 20 times higher than the GCDWQ MAC of 0.005 mg/L. Results prior and subsequent to 2009 were below the GCDWQ MAC; and,
- In 2006, the copper concentration in a sample taken from Well No.5 exceeded the GCDWQ AO of 1 mg/L. Subsequent samples taken from this well had copper concentrations below the GCDWQ AO value.

5.27.5 Water Treatment and Distribution

Table 5-70: Village of Haines Junction Water Treatment and Distribution Details

Item	Details	Source
Owner/Operator	Village of Haines Junction	YES 2012
Water source	Groundwater	
Wells serving the system	Well No.3 and Well No.5	Tetra Tech 2012b, Tetra Tech 2017
Treatment type	Chlorine injection, pH adjustment (CO ₂ injection), oxide arsenic filtration	p.c. Dave Hatherley 2016
Number of connections	Approximately 613 people	Yukon Bureau of Statistics 2016
Delivery method	Piped	YES 2012
Age of system/last known update	Installation of new pump and drop pipe in Well No.3 in 2013. AWPP in 2016.	Tetra Tech 2013 Tetra Tech 2017

5.27.6 Source Water Protection Planning

VHJ has an AWHPP completed in February 2017. The VHJ AWHPP was developed following the guidelines provided in the BC Ministry of Environment Well Protection Toolkit with the addition of risk-based consideration of potential threats to the security of the water source.

To calculate the well capture zones, Tetra Tech conservatively assumed the gradient of the groundwater flow is similar to topography from surrounding mountain range to the wellhead location for both wells, resulting in an inferred groundwater gradient of 0.05 m/m, which is within the general range of typical groundwater gradients. Based on this assumption, and the aquifer characteristics, Tetra Tech calculated the distance to the edge of the horizontal well capture zone for 90 days, one year, five years and ten years using the analytical method as presented in the BC Well Toolkit. Both wells are protected by significant thicknesses of fine grained overburden materials, and, to evaluate the potential for surficial sources of contamination to migrate to the depth of the aquifers targeted by Well No.3 and Well No.5 through the overlying fine-grained sediments, Tetra Tech made a very conservative estimate of vertical travel time at each well. Based on the results of these calculations, Tetra Tech broke down the well capture zones for the two wells into reasonable well protection areas as shown in the GIS map.

Key conclusions and recommendations From the VHJ AWHPP are summarized below:

- Well No.3 and Well No.5 are completed in highly protected, artesian aquifers with likely recharge zones in the Aurial Range within Kluane National Park. The chance of anthropogenically sourced contaminants to enter either aquifer is considered extremely low.
- The risks presented to the source water quality in VHJ are related to potential contaminant sources in the vicinity of Well No.3. These risks have been identified as:
 - Ground squirrels living under the Well No.3 well house cement slab (Medium Risk);
 - Potential former waste oil dump site approximately 200 m north of Well No.3 (Medium Risk); and
 - Potential military waste burial in the area surrounding Well No.3 (Medium Risk).

- Risks from each of the identified APECs can be mitigated through eliminating rodent access under the Well No.3 slab and through assessment and assessment and remediation (if required) of the potential waste oil dump site and military waste.
- The nearest surface waterbody to the VHJ water supply wells is the Dezadeash River which is not thought to be hydraulically connected to either well (Tetra Tech 2012b, Tetra Tech 2014).
- The VHJ water supply system is supported by two wells resulting in some redundancy in the system and preventing total loss of water supply should one well fail or be temporarily shut off for maintenance or repair.
- Tetra Tech recommended decommissioning Well No.4 and completing upgrades to Well No.3, testing for hydrocarbons in the water and completing a Phase II Environmental Site Assessment in the vicinity of Well No.3. Government of Yukon is currently in the planning process to complete these works in summer 2017.
- Tetra Tech recommended long term risk management measures including forming a risk management team, conducting public education program, implementing an emergency response plan for the water supply system, implementing tracking and monitoring programs in the vicinity of the wellheads, review and update AWHPP on a regular basis and ensure AWHPP recommendations are considered in community planning.

5.27.7 Water Supply Information Data Gaps

Tetra Tech has not identified any data gaps with respect to the VHJ water supply system. Tetra Tech understands Village of Haines Junction and Government of Yukon are currently in the planning stages to complete the work recommended in the AWHPP with several of the recommendations to be addressed in summer 2017.