

**Town of Norman Wells
Former Water Reservoir
Abandonment and Restoration
Plan**

August 22, 2018

Prepared for:

Town of Norman Wells

Prepared by:

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Project Number:
144930099

Revision History and Conformity Table

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Executive Summary

The Town of Norman Wells (Norman Wells) holds a Type B Municipal Water Licence (No. S07L3-002), from the Sahtu Land and Water Board (SLWB), to withdraw water and operate municipal sewage and solid waste disposal facilities. Water Licence S07L3-002 was issued in August 2008 by the SLWB and expired on August 1, 2018.

As part the Water Licence operating conditions (Part G, Item 1), the Town is required to submit Abandonment and Restoration (A&R) Plans to the SLWB six months prior to abandoning any Water Treatment, Storage and Distribution Facility, or Waste Disposal Facilities. The following A&R Plan has been prepared for the former water reservoir that was decommissioned in 2009, in effort to comply with the Water Licence conditions.

The community of Norman Wells (65° 17' N and 126° 50'W) is located in the Sahtu region of the Northwest Territories (NT) on the east bank of the Mackenzie River. It is approximately 685 km northwest of Yellowknife, NT. The current population of Norman Wells is estimated at 803 residents (in 2016) and is expected to decrease over the next two decades.

The water treatment and distribution system consists of a raw water intake, Water Treatment Facility (WTF) and reservoir, and water distribution system (e.g., community piping, trucked water delivery). Norman Wells uses the Mackenzie River as its primary raw water source. The former water reservoir was located on the west side of the current WTF within the town centre. The former water reservoir was built in 1977 and constructed of steel. It had a capacity of 900 m³ with a diameter of 12 m and height of 10 m. It was filled with potable water only during its 30-year use (1978 to 2008).

The former water reservoir and associated infrastructure were decommissioned in 2009. The former reservoir and associated piping were removed and disposed at the Norman Wells' Solid Waste Disposal Facility. Some reusable parts were kept and stored at the WTF as spare material.

This A&R Plan describes contaminated site remediation, including leachate prevention and hazardous waste management, cover materials, management of surface and groundwater and future areas use at the former water reservoir location.



Glossary and Acronyms

A&R	Abandonment and Restoration
cm	centimetre
GNWT	Government of the Northwest Territories
km	kilometre
Leachate	Contaminated water that has extracted harmful substances from stored waste while permeating through it
m	metre
mm	millimetre
NT	Northwest Territories
SLWB	Sahtu Land and Water Board
Utilidor	Above ground piping
WTF	Water Treatment Facility



**TOWN OF NORMAN WELLS
FORMER WATER RESERVOIR ABANDONMENT AND RESTORATION PLAN**

Introduction
August 22, 2018

1.0 INTRODUCTION

The Town of Norman Wells (Norman Wells) holds a Type B Municipal Water Licence (No. S07L3-002) from the Sahtu Land and Water Board (SLWB) to withdraw water and operate municipal sewage and solid waste disposal facilities. Water Licence S07L3-002 was issued in August 2008 by the SLWB and expired on August 1, 2018.

As part the Water Licence operating conditions (Part G, Item 1), the Town is required to submit Abandonment and Restoration (A&R) Plans to the SLWB six months prior to abandoning any Water Treatment, Storage and Distribution Facility, or Waste Disposal Facilities.

The following A&R Plan has been prepared for the former water reservoir, which was decommissioned in 2009, in effort to comply with the Water Licence operating conditions. Table 1-1 illustrates where each item (Part G, Item 1a through j) of the Water Licence is addressed in this A&R Plan.

Table 1-1 Cross-reference between the Water Licence (Part G, Item 1) and this A&R Plan for the Norman Wells Former Water Reservoir

Required Sections from the Water Licence (Part G, Item 1)	Corresponding Sections in this A&R Plan
Contaminated site remediation	3.1
Leachate prevention	3.1
Implementation schedule	1.0
Maps delineating all disturbed areas and site facilities	Figure 2-1 and Figure 2-2
Consideration of altered drainage patterns	3.3.1
Type and source of cover materials	3.2
Future area use	1.0
Hazardous wastes	3.1
Potential for groundwater contamination	3.3.2



**TOWN OF NORMAN WELLS
FORMER WATER RESERVOIR ABANDONMENT AND RESTORATION PLAN**

Site Description
August 22, 2018

2.0 SITE DESCRIPTION

The community of Norman Wells (65° 17' N and 126° 50' W) is located in the Sahtu region of the Northwest Territories (NT) on the east bank of the Mackenzie River (Figure 2-1), approximately 685 km northwest of Yellowknife, NT. Based on the 1981 to 2010 Canadian Climate Normals, the average annual precipitation in Norman Wells is 294.4 millimetres (mm), including 171.7 mm as rain and 161.5 centimetres (cm) as snow (Government of Canada 2018). As outlined in Table 2-1, the average daily temperature for January is -26.1°C (the coldest month) and July is 17.1°C (the warmest month; Government of Canada 2018).

Table 2-1 Climate for Norman Wells, NT (Government of Canada 2018)

Month	Average Daily Temperature (°C)	Precipitation (mm)
January	-26.1	15.6
February	-24.0	14.9
March	-18.4	10.7
April	-5.1	11.1
May	6.4	19.0
June	15.0	42.7
July	17.1	41.8
August	13.8	41.8
September	6.6	33.1
October	-4.7	26.7
November	-18.7	18.7
December	-23.4	18.2

In 2016, the population of Norman Wells was estimated at 803 residents representing less than two percent of the population of the Northwest Territories (GNWT 2018). The population change of Norman Wells was estimated at -0.3% per year between 2004 and 2016, and the decline is anticipated to continue through to 2035. The population projections for Norman Wells are presented Table 2-2 (GNWT 2018).

Table 2-2 Population Projection for Norman Wells, NT (GNWT 2018)

Year	Population
2016	803
2020	803
2025	795
2030	795
2035	796



**TOWN OF NORMAN WELLS
FORMER WATER RESERVOIR ABANDONMENT AND RESTORATION PLAN**

Site Description
August 22, 2018

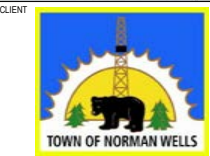
The community of Norman Wells is located within the Norman Range low subarctic ecoregion of the Taiga Plains ecozone. As described for the ecoregion by the Ecological Classification Group (2009), the geology of this ecoregion consists of dolomite and limestone bedrock overlain by fine to medium textured tills. Brunisolic and Luvisolic soils are most common in the Norman Wells area. Vegetation is dominated by trembling aspen, paper birch and spruce (white and black). Norman Wells is also located in a zone of extensive discontinuous permafrost with 50 to 90% ice content (Natural Resources Canada 1993). The active layer thickness ranges from 0.5 to 2 metres (m) below ground surface (UMA Engineering Ltd 2008).





- LEGEND:
- SNP STATION LOCATIONS
 - FACILITY LOCATION BOUNDARY

- GENERAL NOTES:
1. ALL DIMENSIONS ARE IN METERS (m) UNLESS OTHERWISE SHOWN.
 2. MAP WAS ACQUIRED FROM GOOGLE EARTH.
 3. THIS MAP IS A USER GENERATED STATIC OUTPUT FROM AN INTERNET MAPPING SITE AND IS FOR REFERENCE ONLY.
 4. DATA LAYERS THAT APPEAR ON THIS MAP MAY OR MAY NOT BE ACCURATE OR CURRENT.
 5. THIS MAP IS NOT TO BE USED FOR NAVIGATION.



Still in continuation Plan

NORMAN WELLS MUNICIPAL
FACILITIES

PROJECT No.	OFFICE	DES	ORD	REV	DRAWING
144930099	YK	GM	GM	0	FIGURE 2-1
DATE:	SHEET No.	DWN	APP	STATUS	
JULY 2018	2 of 2	JN	-	0	

**TOWN OF NORMAN WELLS
FORMER WATER RESERVOIR ABANDONMENT AND RESTORATION PLAN**

Site Description
August 22, 2018

2.1 FACILITY DESCRIPTION

Norman Wells' current water treatment and distribution system consists of a raw water intake, water treatment facility (WTF), and an above-ground steel storage tank (reservoir), as well as a water distribution system (e.g., community piping, trucked water delivery; see Figure 2-2). Raw water is withdrawn from the Mackenzie River, as needed, and transported to the WTF through an insulated supply line for subsequent treatment. Treated water leaving the WTF is stored in the current water reservoir, which was installed in 2008, and is distributed in the community via above-ground piping within a utilidor, below-ground piping, and water trucks. The piping system was constructed between 1976 and 1985, and mostly consist of 150 mm (diameter) schedule 80 steel pipes. Most (70%) of the water is distributed via the piped system and the remainder of the water is distributed via water trucks that fill from the WTF (Stantec 2018).

The former water reservoir was located on the west side of the WTF and was decommissioned in 2009 (Figure 2-2). It was built in 1977 and constructed of steel. It had a capacity of 900 m³ with a diameter of 12 m and height of 10 m. It was filled with potable water only during its 30-year use (1978–2008). The former reservoir structure rested on a granular pad foundation approximately 30 cm thick secured with cryo-anchors. The foundation was thermally stabilized by heat pipes (EBA 2005 and Earth Tech Inc. 2005).





- LEGEND:
- WATER LINE
 - WATER TREATMENT PLANT
 - FACILITY LOCATION BOUNDARY

- GENERAL NOTES:
1. ALL DIMENSIONS ARE IN METERS (m) UNLESS OTHERWISE SHOWN.
 2. MAP WAS ACQUIRED FROM GOOGLE EARTH.
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Former Water Reservoir Abandonment and Restoration Plan					
WATER TREATMENT AND DISTRIBUTION SYSTEM					
PROJECT No. 144930099	OFFICE YK	DES GM	OKD GM	REV 0	DRAWING FIGURE 2-2
DATE: JULY 2018	SHEET No. 2 of 2	DWN JN	APP -	STATUS 0	

**TOWN OF NORMAN WELLS
FORMER WATER RESERVOIR ABANDONMENT AND RESTORATION PLAN**

Abandonnement and Restoration
August 22, 2018

3.0 ABANDONNEMENT AND RESTORATION

The former water reservoir and associated infrastructure were decommissioned in 2009. The former reservoir and associated piping was removed and disposed of at Norman Wells' Solid Waste Disposal Facility. Some reusable parts were kept and stored at the WTF as spare material. The foundation of the former reservoir was left as a granular pad. Because the decommissioning was completed in 2009, there is no implementation schedule presented in this A&R Plan.

3.1 CONTAMINATED SITE REMEDIATION

The former water reservoir only contained potable water that is typically free of contaminants. The reservoir and its associated infrastructure were removed during decommissioning. As such, the presence of contaminants, leachate, or hazardous wastes are not suspected at the former water reservoir location. At this time, there are no recommendations to conduct contaminated site remediation for the former water reservoir location, including leachate prevention or hazardous waste removal.

3.2 COVER MATERIALS

Cover materials were not used or required in the decommissioning of the former water reservoir.

3.3 MANAGEMENT OF WATER

3.3.1 Surface Water

The reservoir and its associated infrastructure were removed during decommissioning. The presence of the reservoir and its 30-year usage is not suspected to have altered drainage patterns as it was located on a built-up site near the town centre. The surface of the former reservoir is now gravel and covers an area of approximately 200 m². The current use of the former reservoir location (see Section 4.0) is also not expected to alter drainage patterns. At this time, there are no recommendations for surface water monitoring at the former water reservoir location.

3.3.2 Groundwater

The reservoir and its associated infrastructure were removed during decommissioning. The presence of the reservoir and its 30-year usage is not suspected to have caused groundwater contamination or alteration of groundwater quantity. Earth Tech Inc. (2005) found that the permafrost was not altered by the reservoir and its associated infrastructure. At this time, there are no recommendations for groundwater monitoring at the former water reservoir location.



**TOWN OF NORMAN WELLS
FORMER WATER RESERVOIR ABANDONMENT AND RESTORATION PLAN**

Future Area Use
August 22, 2018

4.0 FUTURE AREA USE

The former water reservoir location remains part of Norman Wells' current WTF property. The empty space created by the removal of the reservoir and its associated infrastructure was transformed into a storage area for material associated with the WTF. See Photo 1



**Photo 1 Miscellaneous Storage in the Area of the Former Water Reservoir;
Northwest Aspect**



**TOWN OF NORMAN WELLS
FORMER WATER RESERVOIR ABANDONMENT AND RESTORATION PLAN**

References
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5.0 REFERENCES

- EBA Engineering Consultants Ltd. 2005. Preliminary Geotechnical Evaluation for Water Storage Tank Norman Wells, NT. Prepared for the Town of Norman Wells.
- Ecosystem Classification Group. 2007 (rev. 2009). Ecological Regions of the Northwest Territories—Taiga Plains. Department of Environment and Natural Resources, Government of the Northwest Territories, Yellowknife, NT, Canada. viii + 173 pp. + folded insert map
- Earth Tech Inc. 2005. Town of Norman Wells Water Storage Facilities Final Report. NT. Prepared for the Town of Norman Wells.
- GNWT (Government of the Northwest Territories). 2018. Northwest Territories Bureau of Statistics. Accessed April 2018. <https://www.statsnwt.ca/index.html>
- Government of Canada. 2018. Canadian Climate Normal 1981-2010 Station Data (2202800). Accessed May 2018. http://climate.weather.gc.ca/climate_normals/results_1981_2010_e.html?stnID=1680&autofwd=1
- Natural Resources Canada. 1993. Canada-Permafrost [map]. Accessed May 2018. <http://www.nrcan.gc.ca/earth-sciences/geography/atlas-canada/selected-thematic-maps/16876>
- Stantec Architecture Ltd (Stantec). 2018. Norman Wells Water and Sewer Assessment Final Report. Prepared for the Town of Norman Wells. 79.
- UMA Engineering Ltd. 2008. Norman Wells Landfill. Landfill Expansion Master Plan. Prepared for the Town of Norman Wells. 47 pp

