Appendix 3

Water Treatment Plant Operation and Maintenance (O&M) Plan Template

MVLWB

Operation and Maintenance Plan Templates for Municipal Water Licences: Water Treatment Plant Colville Lake, NT

Plan prepared: October 17, 2023

Mackenzie Valley Land and Water Board

Template updated: March 2018

Operation & Maintenance Plan Templates for Municipal Water Licences: Water Treatment Plant
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Operation & Maintenance Plan Templates for Municipal Water Licences: Water Treatment Plant

If you have any questions about this document, please contact your regional Manager of Community Infrastructure Planning.

1. Site Description

Date this plan was prepared: October 17, 2023

Where is the Water Treatment Plant (WTP) located?

Community: Colville Lake, NT (Designated Authority)

Latitude: 67°02'46.233"N

Longitude: 126°05'51.869"W

Which coordinate system was used for these coordinates?

- ○ Decimal Degrees
- ◉ Degrees, Decimal Minutes
- ○ Universal Transverse Mercator (UTM)

☑ Location Map Attached

Map to include drawing scale, north arrow, and site access/roads.

Date of Commissioning of WTP: 2007 yyyy/mm/dd (if date is unknown, estimate year)

2. WTP Staff

Provide the name, contact information, and role for each staff member.

Name	Phone	Email
David Codzi	867-709-2200	codzi@behdziahda.com

Role/Responsibilities: Assistant Band Manager, Oversees Water Treatment Plant (WTP)

Name	Phone	Email
Corey Kochon	867-620-0557	

Role/Responsibilities: WTP Worker

Name	Phone	Email
Gilbert Turo	No Phone - use Band	Office phone 867-709-2200

Role/Responsibilities

WTP Worker

3. Security and Control

How is public access to the facility controlled? (Check any that apply.)

- ☑ No control
- ☐ Chain-link fence around reservoir
- ☐ Locked man-door
- ☐ Other:

Is the following signage posted at the WTP? (Check any that apply.)

- ☑ Name of facility
- ☐ Notification of restriction of public access
- ☐ Warning signage regarding chemicals used in the treatment process

4. Facility Design

Facility design shall be provided in the form of a piping and instrumentation diagram (P&ID) and general arrangement views of the equipment and facility prepared by a Professional Engineer or Geoscientist registered with NAPEG, who has expertise in the subject area. Attach one of the following drawing options with the documents you are submitting. As-built drawings are preferred, if available. All drawings are required to have scales and north arrows (for plan views).

Indicate what type of drawings are attached:

○ As-built drawings ○ Design drawings ◉ Other: See Page 12 of 12 for current process

5. Raw Water Sources

Name of **primary** raw water source (if applicable). Note that if you have a second water source, there will be a place to add information for the secondary source later in this section. For now, enter the information for the source that is used most often.

Colville Lake (Attachment 1, Water sampling results and Page 12 and Attachment 2 Water Calculations)

Type of raw water source (check any that apply):

☑ Lake ☐ River ☐ Groundwater ☐ Other:

Average annual quantity of water drawn from the source:

Present 33,990 Future 37,500 m^3/year

For **river** sources, what is the flow rate of the river? m^3/d

For **lake** sources, what is the size (area) of the lake? 439,000,000 m^2

When does the ice on the water source normally **freeze up**? October

When does the ice on the water source normally **break up**? June

What is the flow rate of raw water being withdrawn from the **primary** source? 4.2 L/s

Does raw water from the **primary** source fill a reservoir (i.e. seasonal or annual fill), or does it go directly to the treatment system, tanks, or trucks?

○ Reservoir fill ◉ Direct to treatment, tanks, or trucks

If the primary source is used to fill a reservoir, how many times per year is the reservoir filled?

fills/year

During which months is the reservoir filled? (Skip if not filling a reservoir.)

☐ All Months

☐ January ☐ February ☐ March ☐ April ☐ May ☐ June

☐ July ☐ August ☐ September ☐ October ☐ November ☐ December

How long does it take to fill the reservoir? (Skip if not filling a reservoir.) Days

If the primary source is used to supply the treatment system, tanks, or trucks directly, how many days per week is water drawn from the source? (Skip if a reservoir is used.)

7 days/week

How many times does the intake pump run on an average delivery day? (Skip if a reservoir is used.)

3-4 times/day

What type of intake is used for the **primary** water source?

- [x] Inclined shaft (submersible pump and discharge pipe inside a larger casing pipe)
- [ ] Gravity-fed wetwell (gravity fed well from which raw water is drawn – NOT a storage well filled by a pump from the source)
- [ ] Groundwater well
- [ ] Infiltration gallery
- [ ] Temporary/seasonal surface intake (pump and piping are removed from the source after use or at the end of the season)
- [ ] Other (specify):

Provide the opening size for the mesh on the fish screen at the end of the intake in the water (the smallest dimension of the openings in the mesh): Unknown mm

Is a Source Water Protection Plan (SWPP) in place for the **primary** raw water source?

○ Yes ◉ No

If **yes**, provide the following information for the plan:

Prepared by (name of company or person that wrote the plan):

Title of document:

Completion date: yyyy/mm/dd

Location of document (where is the plan kept, or where can a copy be obtained?):

If **no**, what is being done to protect the **primary** raw water source?

The WTP is 500 m NW of community. Sewage collection by truck transported to Sewage Lagoon. Spent petroleum related materials drummed and stored in secondary containment in Garage for off-site disposal.

Identify the type of raw water storage (check any that apply):

☐ None ☐ Reservoir ☑ Storage Tank ☑ Other: Tank used intermittently See pg 12

Raw water storage capacity: 3 m^3

Name of **secondary or alternate** raw water source (if applicable). This could include a source used seasonally, during maintenance, when there are problems with the primary source, or any other backup raw water source. If only one water source is used, skip to Section 6.

Not Applicable

Type of raw water source (check any that apply):

☐ Lake ☐ River ☐ Groundwater ☐ Other:

Average annual quantity of water drawn from the source:

m^3/year

For **river** sources, what is the flow rate of the river? m^3/d

For **lake** sources, what is the size (area) of the lake? m^2

When does the ice on the water source normally **freeze up**? January

When does the ice on the water source normally **break up**? January

What is the flow rate of raw water being withdrawn from the **secondary** source? L/s

Does raw water from the **primary** source fill a reservoir (i.e. seasonal or annual fill), or does it go directly to the treatment system, tanks, or trucks?

○ Reservoir fill ○ Direct to treatment, tanks, or trucks

If the secondary source is used to fill a reservoir, how many times per year is the reservoir

fills/year

During which months is the reservoir filled? (Skip if not filling a reservoir.)

☐ All Months

☐ January ☐ February ☐ March ☐ April ☐ May ☐ June

☐ July ☐ August ☐ September ☐ October ☐ November ☐ December

How long does it take to fill the reservoir? (Skip if not filling a reservoir.) Days

If the secondary source is used to supply the treatment system, tanks, or trucks directly, how many days per week is water drawn from the source? (Skip if a reservoir is used.)

days/week

How many times does the intake pump run on an average delivery day? (Skip if a reservoir is used.)

times/day

What type of intake is used for the **secondary** water source?

- ☐ Inclined shaft (submersible pump and discharge pipe inside a larger casing pipe)
- ☐ Gravity-fed wetwell (gravity fed well from which raw water is drawn – NOT a storage well filled by a pump from the source)
- ☐ Groundwater well
- ☐ Infiltration gallery
- ☐ Temporary/seasonal surface intake (pump and piping are removed from the source after use or at the end of the season)
- ☐ Other (specify): _____

Provide the opening size for the mesh on the fish screen at the end of the intake in the water (the smallest dimension of the openings in the mesh): _____ mm

Is a Source Water Protection Plan (SWPP) in place for the **secondary** raw water source? (Skip this question if no secondary source is used.)

○ Yes ○ No

If **yes**, provide the following information for the plan:

Prepared by (name of company or person that wrote the plan):

Title of document:

Completion date: _____ yyyy/mm/dd

Location of document (where is the plan kept, or where can a copy be obtained?):

If **no**, what is being done to protect the **secondary** raw water source?

Explain the reasons or situations where the secondary raw water source is used, including the time of year for seasonal sources (skip this question if no secondary source is used):

6. Water Treatment Process

Indicate any **pre-treatment** processes that are used at the WTP. (Check any that apply.)

☐ Screen ☐ pH adjustment ☐ Gravity settling ☑ Other: See Page 12 of 12

Indicate any treatment technologies that are used at the WTP. (Check any that apply.)

☐ Coagulation and Flocculation

(A chemical is added to the water to make particles of dirt stick together and sink.)

List chemical(s) added:

Clarification (methods to help particles settle out after they are stuck together)

☐ Gravity ☐ Inclined plate ☐ Settling tubes ☐ Dissolved air floatation (DAF)

☐ Other:

Filtration (filters use various methods to trap particles and remove them from the water)

☐ Slow sand ☐ Rapid rate gravity ☐ Rapid rate pressure ☐ Bag/cartridge

☐ Other:

Membrane Filtration (a material with tiny holes is used to strain particles from the water)

☐ Microfiltration ☐ Ultrafiltration ☐ Nanofiltration ☐ Reverse osmosis

☐ Membrane of unknown type

☐ Other:

Additional Treatment Processes

☐ Activated carbon ☐ Ion exchange (softening or targeted removal)

☐ Other:

Iron and/or Manganese Removal

☐ Greensand ☐ Oxidation/filtration

☐ Other:

Indicate what types of disinfection are done at the facility. (Check any that apply.)

☑ Chlorination

○ Solid ◉ Liquid ○ Gas

☐ Ozonation

☐ Ultraviolet Radiation (UV)

☑ Other: using 12% sodium hypochlorite

Water Demand, Production and Distribution:

Total annual water usage:

Present 33,990 Future 37,500 m^3/year

Identify the water distribution methods used (check any that apply):

☐ Piped (underground or utilidor) ☑ Trucked ☐ Other:

Identify the type of treated water storage (check any that apply):

☐ None ☐ Reservoir ☐ Storage Tank ☑ Other: In-home storage tank

Treated water storage capacity:

Based on family size: 2.5 or 1.5 m^3

7. WTP Waste Production

Skip this section if the WTP does not produce sludge.

Is sludge composition data available? (Lab report, engineering study, etc. showing what substances are in the sludge.)

○ Yes ○ No

If yes, please attach the data to this document when submitting.

☐ Sludge composition data attached

Estimate monthly quantity of sludge disposal: m^3/month

How is the sludge disposed of?

- ○ Discharged to sewage system or lagoon
- ○ Direct discharge to waterbody (lake, river, etc)
- ○ Discharged onto land
- ○ Mechanical dewatering
- ○ Evaporative sludge drying (sludge is spread out to air dry before disposal)
- ○ Other: _____

Skip this section if the WTP does not produce wastewater from backwashing, regeneration (e.g. for softeners), or a reject water stream from membrane filtration.

Estimate monthly quantity of filter backwash, regeneration and/or membrane reject wastewater disposal:

_____ m^3/month

How is the backwash/regeneration/membrane reject water disposed of?

- ○ Discharged to sewage system or lagoon
- ○ Direct discharge to waterbody (lake, river, etc)
- ○ Exfiltration
- ○ Discharged onto land
- ○ Other: _____
- ○ Combination (describe):

_____

Indicate if any of the following waste streams are produced at the plant. Provide the annual quantity and the disposal method for each. (Check any that apply.) **Skip** this section if no waste is generated at the WTP.

Check the items that apply:	Method of Disposal	Quantity per year	Units
☑ Spent cartridges or other disposable filters	Regular trash	4-6	count/number/ea
☐ Spent media and/or resin	(choose or type)		(choose or type)
☐ Expired reagents such as DPD	(choose or type)		(choose or type)
☐ Expired calibration standards	(choose or type)		(choose or type)
☐ Chemical waste (specify):			
	(choose or type)		(choose or type)
	(choose or type)		(choose or type)
	(choose or type)		(choose or type)
☑ Other*:			
Cleaned NaOCl 12%, 20L	Well Cleaned-Reuse or Recycle	5.26	count/number/ea

*Do not include regular municipal waste (garbage, such as paper towels and packaging) or wastewater from a sink or washroom that is discharged to the municipal system (trucked or piped).

8. WTP O&M and Record-Keeping

Does the WTP have an existing O&M Plan or Manual?

○ Yes ◉ No

If yes, please provide the following information for the plan:

Prepared by (name of company or person that wrote the plan):

Existing plant is damaged and not used to treat water. Will be replaced with new system.

Title of document:

Completion date: [ ] yyyy/mm/dd

Location of document (where is the plan kept, or where can a copy be obtained?):

[ ]

The following are record keeping requirements related to O&M of the WTP and should be filed as an annual report with the MVLWB no later than the date stipulated in the water license for the previous year. The annual report should include the following items:

- Monthly and annual quantities of fresh water obtained from all sources, reported in cubic metres.
  How and where is this recorded? Distribution sheet for water truck delivery, number of truckloads.
  Where are these records kept? Band Office
- A summary of modifications and/or major maintenance work carried out on the WTP, including all associated structures. Check your water licence for specific requirements regarding modifications.
  How and where is this recorded?
  Where are these records kept?
- A list of spills and unauthorized discharges.
  How and where is this recorded?
  Where are these records kept?
- A summary of any studies requested by the MVLWB that relate to water treatment waste disposal or water use and a brief description of any future studies planned.
  How and where is this recorded?
  Where are these records kept?

Are records of repairs kept?

○ Yes ◉ No

Are records of upgrades kept?

○ Yes ◉ No

9. Surveillance Network Program

Annex A of the Community's water licence, "the Surveillance Network Program", outlines the requirements for water quality/quantity monitoring for the Water Treatment Plant.

10. Additional Comments or Notes

If there is any additional information that was not covered or didn't fit in the sections above, please include it here.

Figures for this O&M Template are Figure 1 Overall Site Plan and Figure 2 Water Treatment Plant (Appendix 1) . Note: Regional topography does not reflect engineered contours.

The current Water Treatment Plant (WTP) is damaged; the system does not treat water. The existing pumphouse and piping is used to pump water from Colville Lake (raw water analytical results and particle size evaluation see Appendix 2-A and 2-B) directly into a 3,000 L storage tank (previously the old system treated water tank). The truckfill system transfers water from the storage tank to the dedicated water truck where it is chlorinated in-place using ClearTech 12% sodium hypochlorite (72 milliliters for a 18,676 litre (L) truck capacity, calculated per MACA). The ClearTech solution is mixed in the truck by its circulating pump. Chlorinated water is then delivered to community house-based indoor water tanks via quick-connect hose/pipes. During periods where the pumphouse or truckfill equipment is not accessible (due to maintenance) or when water demand is great for a given day, water is pumped from Colville Lake into the delivery truck using an ancillary pump with cartridge filter and is chlorinated prior to delivery.

The community plans to replace the current system with a new water treatment plant, details to be determined. The expected timeline to be determined once Council has approved the path forward. Preliminary schedule is design in 2024 with construction in spring and summer 2025 dependent on equipment transport via winter road March 2024-2025.

Question 5. Raw Water Sources, Average annual quantity of water drawn from the source
At present, the community is pumping from the lake directly to a water truck using the existing shaft pumphouse, treating in-place in the water truck, and distributing to homes via an exterior quick disconnect hose to a home storage tank and piping within the dwelling. As is typical for the region, there is no subsurface delivery piping system. There is currently no flow meter in the flexible hoses used to withdraw water from Colville Lake. The present community water used/delivered is calculated on Appendix 3-A, Question 6.

Present Community Withdrawal for population of 169 people = 33,990 cu m/yr [See Question 6. for Present Community Water Used calculation]

The community of Colville Lake wishes to be able to sell water to others such as oil and gas companies working in the area. Water supplied by Colville Lake Water Treatment Plant could span the fall and winter as companies prepare and execute fieldwork.

Maximum Future Withdrawal from Colville Lake = Future Community Usage + Future Oil & Gas Camp Usage with transfer loss

Future Community Water Use: 35,800 cu m/yr [See Question 6., Appendix 3-A]
Future Two O&G Camp Usage (including 5% loss): 1,678 cu m/yr [See Question 6., Appendix 3-A]

Maximum Future Water Withdrawal from Colville Lake Including Loss = 35,800 cu m/yr + 1,678 cu m/yr = 37,478 rounded to 37,500 cu m/yr.

Additional Comments and Notes are continued on Water Treatment Plant Appendix 3-A

Appendix 3-A

Question 10. Additional Comments or Notes (continued)

Appendix 3-A 10.Additional Comments or Notes, continued

Question 6. Total Annual Water Usage, Page 8 of 12.

Present Community Use: The Community consumption (169 people) is currently a maximum of 4-5 trucks/day delivered 7 days per week, 52 weeks/year = 1,820 trucks/yr
1 truck is 18,676 litres (L) *1,820 trucks/yr = 33,990,320 L/yr or **33,990 cubic metres per year(m^3/yr).**

Assumptions for Future Community Water Usage

- Increase in population from 169 to 178 people (population per the Statistics Canada (statcan) link provided in the Questionnaire template) with similar usage patterns, and
- Future use calculated using a ratio approach, based on usage by 169 persons at 33,990 m^3/yr.

Future Community Water Use: (169 people/33,990 cu m/yr) =(178 people/X) = **35,800 m^3/yr**

Future O&G Camps Water Use
Assumptions:

- Number of people - 20-person crew per camp; 2 camps simultaneously with similar number and usage pattern
- Present - September to April and January to March - highest possible consumption for entire period (242 days)
- Consumption -150 L/day/person personal consumption, food preparation, personal hygiene, and dish washing.
- General camp water usage at 10%

Calculating Personnel Consumption *for 1 Camp*
20 people*(150 L/person per day)*(242 days) = 726,000 L or 726 metres^3/year

Calculating General Camp Usage per Camp
726 cu m/yr *0.1 = 72.6 m^3/yr

Total for 1 camp Personnel and Camp Usage with transfer loss (5%) = (726 m^3 + 72.6 m^3)*1.05 = 839 m^3

For 2 oil companies simultaneously with similar crew size = 2*839 cu m = 1,678 m^3

Future Water Usage = Future Community + Future 2 Camps = 35,800 +1,678 = **37,500 m^3/yr (rounded)**

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