Municipal water licence renewal

Wastewater management

September 2020

Under the *NWT Waters Act*, the City of Yellowknife requires a water licence from the Mackenzie Valley Land and Water Board (MVLWB) to draw water from local water bodies and to deposit waste into the environment. The City is applying to renew its water licence. This factsheet is part of a series designed to provide residents and stakeholders with information on the licence renewal application in support of public engagement.

Background

The City of Yellowknife is responsible for ensuring the collection and treatment of wastewater throughout the city and for the proper management and maintenance of the wastewater system.

The City's wastewater comes from three main sources:

- Piped sewage
- Trucked sewage
- Honey bags and animal waste

The Wastewater Management System is made up of the following components:

- ***14 lift stations:*** These stations pump wastewater through the system, "lifting" it from lower to higher elevations to maintain flow in the system.
- ***Sewer piping:*** A network of pipes are used to collect and move wastewater from its sources to the sewage lagoon. Yellowknife has 50.3 kms of gravity mains and 12.4 kms of pressurized forcemains.
- ***The Fiddler's Lake Treatment System (FLTS):*** The City currently treats municipal wastewater though a network of open water bodies and wetlands that filters and treats contaminants in the wastewater before it is discharged to an open channel that leads to Great Slave Lake. This system has two main parts:
    - Fiddler's Lagoon: This is where the wastewater enters the system. This "facultative lagoon" acts as a holding cell where wastewater is stabilized and starts being broken down by exposure to air, wind and sun as well as the organisms in the lagoon. The current lagoon was constructed in 1981 and the water surface raised to the current elevation in 1987. The lagoon currently provides approximately 9 months of holding time.

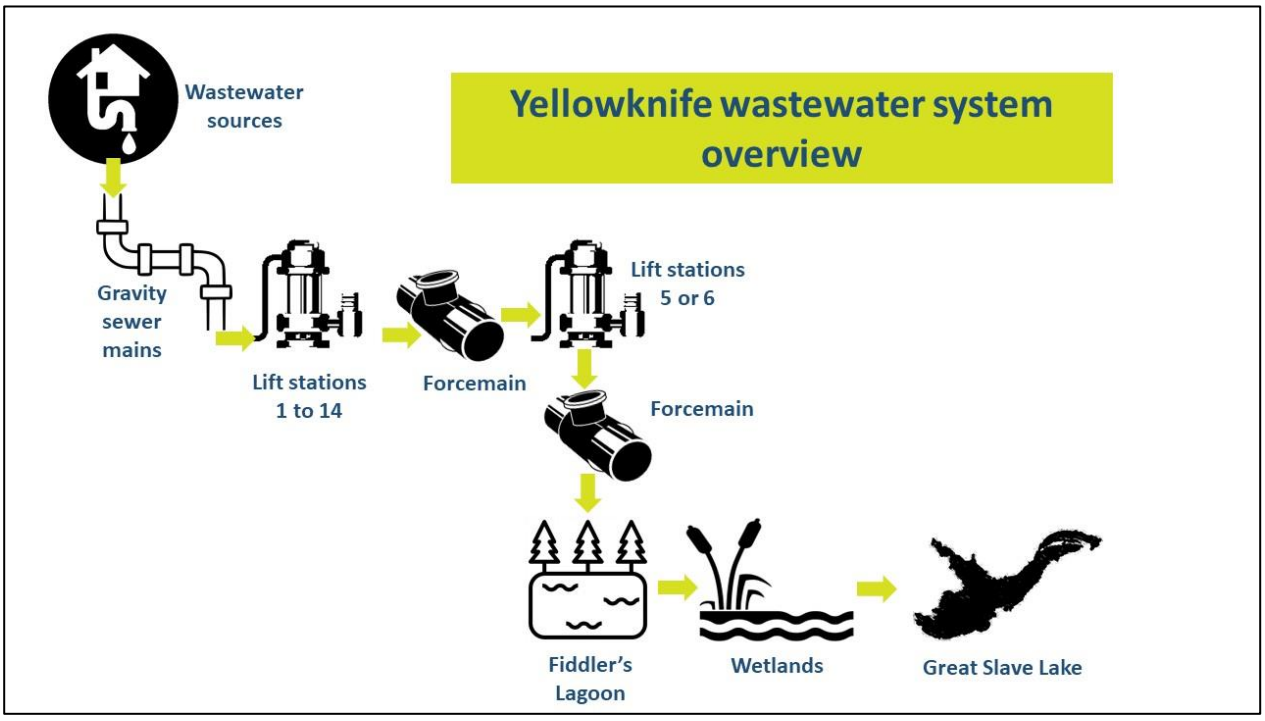
What is wastewater?

Wastewater is water that has been contaminated by human use. Municipal wastewater, historically referred to as "sewage", is made up of used water from all municipal sources, including homes, businesses and other buildings and institutions. Wastewater can contain physical, chemical and biological constituents and requires treatment.

The lagoon is "decanted" once a year over several weeks, which means effluent from the top of the lagoon is discharged into the wetlands portion of the system, without disturbing the settled solids on the bottom of the lagoon.

- Wetlands system: Effluent decanted from the lagoon flows through approximately 13 km of wetlands before reaching Great Slave Lake. These wetlands are a mixture of organic and sandy materials which helps to further treat the effluent before it reaches Great Slave Lake.

Water quality monitoring currently takes place at three locations in the system. The point where compliance with water quality regulations is checked is approximately 6 kilometers upstream of where the flow reaches Great Slave Lake at Station 003-F32.



What the water licence regulates

The content of the Sewage Disposal Facilities Operations and Maintenance Manual and the Fiddler's Lake Treatment System Management Plan;

- The quality of water discharged into the environment ("effluent");
- Monitoring requirements (Surveillance Network Program);
- Dam and dyke condition monitoring requirements (control structures);
- Reporting requirements and action items; and
- Development approval and construction record requirements.

Recent initiatives

The City of Yellowknife has conducted many studies and projects over the past several years to better understand the effectiveness of its wastewater treatment system and to assess potential impacts on the local environment. Some of these studies and projects were in response to questions and concerns raised by regulators and stakeholders.

These studies and projects have been focussed in a few key areas:

- pH levels in the treatment system and their potential linkages to algae growth;
- effluent characterization, including biochemical oxygen demand (BOD) and carbonaceous biochemical oxygen demand (cBOD);
- Ammonia and phosphorus levels and accumulation in the system and receiving water bodies;
- Fiddler's Lake control structures (i.e. dykes and dams);
- Sludge management; and
- Water and sewer infrastructure upgrades.

Key documents

Two key documents that will be submitted for this aspect of the water licence:

1) *Sewage Disposal Facilities Operations and Maintenance Manual*

The Manual provides information to assist City of Yellowknife personnel with the operation and maintenance of the Yellowknife wastewater facilities, which includes:

- the wastewater collection pipe system;
- wastewater pumping/lift stations;
- the Fiddler's Lake Treatment System (FLTS);
- trucked waste management;
- "honey bag" and animal waste management; and
- residual solids (sludge) management.

Specifically, it describes:

- City personnel duties, responsibilities and training;
- infrastructure component operations and maintenance requirements and procedures;
- sampling and monitoring program requirements;
- record keeping, safety, site access control, and emergency response guidance and procedures; and,
- plans for sludge management.

2) *Fiddler's Lake Treatment System (FLTS) Management Plan*

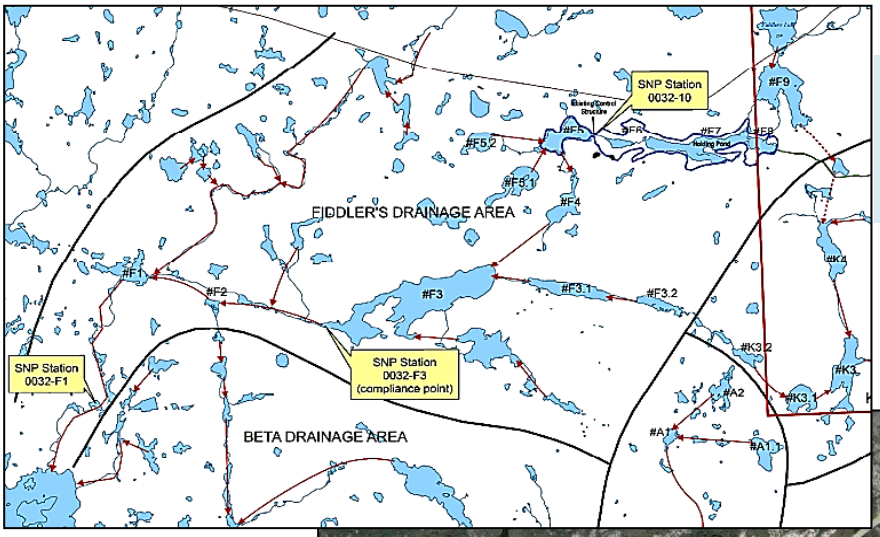
This document is an overarching Wastewater Management Plan that speaks to various wastewater topics. It explains what the City is, or will be doing with the Fiddler's Lake Treatment System, depending on conditions in the system

Specifically, it:

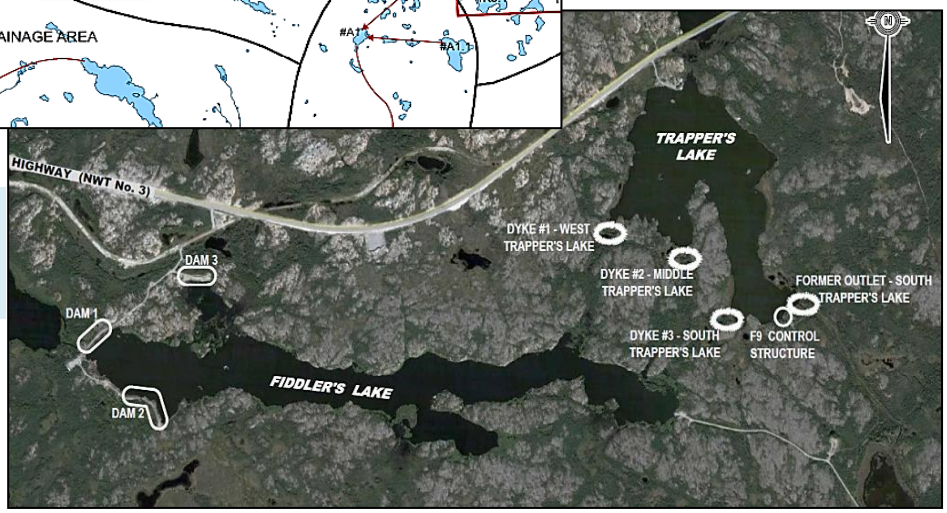
- describes FLTS components, current effluent requirements and objectives, and actual effluent quality relative to these items;
- discusses water quality trends and other observations in the effluent receiving environment;
- proposes effluent quality requirements and objectives, water quality triggers and thresholds, and Surveillance Network Program requirements;
- outlines contingency actions the City could take if required;
- presents considerations related to climate change vulnerability/ adaptation, non-traditional effluent constituents, and facility siting/land availability;
- describes the City's plan for managing residual solids ("sludge") accumulated in Fiddler's Lagoon; and
- describes contingency actions for the forcemain that conveys wastewater to the FLTS.

Fiddler's Lake Treatment System at a glance

The Fiddler's Lake Treatment System (FLTS) is located to the west of Yellowknife, with access from Deh Cho Boulevard and Highway #3. Fiddler's Lagoon itself covers an area of 900,000 m^2 (about 170 football fields), has a total volume of approximately 2,700,000 m^3 (the volume of about 1480 Olympic-sized swimming pools), and a working volume of about 2,300,000 m^3.



This map shows where effluent from the FLTS is current sampled and analyzed.



This map shows the control structure (dams and dykes) in the FLTS.

Wastewater management

Topics of interest

Phosphorous and ammonia

Monitoring has shown an upward trend in total phosphorus and ammonia in the system. In some cases, results have exceeded water quality guidelines. These are findings the City is working on to understand through further study and research, particularly the potential impacts on receiving water bodies.

In 2017, the City sampled at seven sites within Great Slave Lake to determine the potential effect of the FLTS on the lake. Additional research is required to determine whether the City will need to look at adding treatment for phosphorous or ammonia in the system.

The City is committed to working with regulators to address these important areas of concern. As treatment options could entail significant investment of tax dollars, it is important to ensure that any treatment option is both necessary, effective and cost-effective.

Sludge management

Sludge management has been an area of focus for the City in recent years. This is because the Fiddler's Lake Treatment System has accumulated residual solids over the years and, while the effect this is having on the overall performance of the system is not fully understood, this material occupies volume and normal facultative lagoon operating practice requires its removal on a periodic basis.

In 2018, a study of Fiddler's Lagoon found that there was 226,000 cubic meters of accumulated solids in the lagoon (the volume of about 80 Olympic-sized swimming pools), which represents 10% of the lagoon's working volume.

The City has committed to "de-sludging" the Fiddler's Lagoon. The project is getting underway this year. The actual process of de-sludging is expected to begin in 2022 and be completed in 2025.

Once this process is completed, the City will be able to see if the removal of the sludge has an impact on the treatment system and to determine whether other treatment options may be needed to address the presence of phosphorous, ammonia or other substances of concern in the system.

After de-sludging of Fiddler's is complete, sludge monitoring will continue on an annual basis.

Have questions or comments?

The City has posted information on each of the components of the water licence renewal at www.yellowknife.ca/WaterLicenceRenewal and will be soliciting feedback from interested residents and stakeholders via email, letter and our online engagement tool PlaceSpeak. Additional details on engagement opportunities will be provided in the weekly Capital Update and via Twitter and Facebook.

Questions related to the renewal process can be directed to Madison Warren, Municipal Engineer at waterlicence@yellowknife.ca.