



Water Audit Report

Eagle Plains Lodge

MN07-075-2

October 6, 2026



Preface

The Water Science and Stewardship Branch (WSS) within the Government of Yukon's Department of Environment includes a team of water scientists and technologists in water quality, groundwater and hydrology. We conduct periodic studies at various sites across the Yukon that have a potential to impact water. These studies, called audits, are undertaken to improve our knowledge and understanding of a project's effects on the receiving water environment.

As technical experts in water science, we provide advice for compliance and inspection purposes and conduct reviews of projects undergoing water licensing and environmental assessment processes. Through the audit process we aim to identify emerging issues and build enhanced understanding of water quality and quantity conditions to support input into these regulatory processes. The opinions and recommendations expressed in this report are based on relevant data, reports, field observations, interpretation/analyses of scientific information available to WSS and is subject to evolve as further information becomes available. While most of the findings are based on western science, we strive to recognize diverse ways of knowing and being and intend to create space to learn from both Indigenous and western perspectives side-by-side.

While WSS provides support to inspectors on enforcement and compliance matters related to water licences, it is not WSS's role to determine or enforce compliance. As such, the findings of this report should not be considered a determination of compliance with any existing permit or licence.

Executive summary

Government of Yukon's Water Science and Stewardship Branch (WSS) conducted a water audit of the Eagle Plains Lodge wastewater treatment system to better understand the performance of the facility, evaluate ongoing treatment difficulties and trace the flow path of wastewater discharged from site. Wastewater generated at the site is treated using a mechanical Fixed Activated Sludge Treatment (FAST) system and discharged to ground through a buried rock infiltration pit.

Historical monitoring data shows that, although effluent samples collected within the treatment plant frequently exceed Effluent Quality Standards (EQS) for fecal coliforms, biochemical oxygen demand (BOD₅) and total suspended solids (TSS), these parameters do not appear to result in significant detections in the downstream monitoring locations. This supports the assumption that significant dilution and attenuation is occurring through ground infiltration before the water reaches the receiving environment.

To evaluate subsurface flowpaths, WSS used artificial sweeteners as tracers of wastewater movement. Sweeteners were detected in the effluent and at downstream stations, confirming that treated wastewater is reaching downstream monitoring locations. However, sweeteners were unexpectedly detected at the presumed control station EP-3, suggesting possible hydrologic connectivity between the discharge area and the control watershed, or alternatively, analytical uncertainty. This finding raises concerns regarding the suitability of EP-3 as an unaffected background reference site.

The audit also identified persistent sampling and quality assurance issues related to fecal coliform analysis. Since monitoring of the facility began, every fecal coliform sample that WSS has reviewed has exceeded the required 24-hour analytical hold time, likely due to the remoteness of the site and logistical limitations associated with sample transport. Because exceedance of hold times can reduce data reliability, WSS recommends that alternative analytical methods or logistical approaches be explored to ensure defensible monitoring results.

Acronyms and abbreviations

Acronym/Abbreviation	Definition
CCME	Canadian Council of Ministers of the Environment
LTPAL	Long Term Protection of Aquatic Life
QA/QC	Quality Assurance/Quality Control
BOD ₅	Biochemical Oxygen Demand over 5 days
TSS	Total Suspended Solids
WSER	Wastewater Systems Effluent Regulations
EQS	Effluent Quality Standards
CFU	Colony Forming Units
ARD	Acid Rock Drainage
FAST	Fixed Activated Sludge Treatment
WSS	Water Science and Stewardship
YG	Government of Yukon
YG-CSR	Government of Yukon Contaminated Sites Regulation

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1 Introduction and objectives

Eagle Plains Lodge is located at kilometre 371 on the Dempster Highway. The lodge functions as a full-service stop that includes a hotel and garage and has a self-contained wastewater treatment system on site that receives wastewater and mechanically treats it before discharging to ground in a buried rock pit drain. The lodge is on the Traditional Territory of the Vuntut Gwitchin First Nation and borders a 435 km² parcel of Vuntut Gwitchin Category A Settlement Land on the west side on the highway, where effluent is discharged to ground and is expected to daylight into a down-gradient, unnamed creek approximately 500 to 700m from the facility. This unnamed creek flows north for approximately 15 km, collecting several smaller tributary creeks before joining the Eagle River.

The licensee and wastewater facility operator McNevin Management Ltd. holds a Type B municipal water use and deposit of waste licence for the Eagle Plains Complex (MN07-075-2). This is a 25-year licence issued in August 2008 that expires in August 2033. Water quality is monitored twice annually (June and August) at a potentially impacted creek monitoring location down-gradient called EP-1, a presumed unimpacted control station EP-3, and downstream of the confluence of these two stations at EP-2 (Map 1). All three stations have a long record of acidic water generally found to be between 2.5 and 5.5 pH and associated elevated metals concentrations - typically cadmium, iron and zinc. Studies on the east side of the Dempster Highway at the same location found ARD conditions that were enhanced by construction of the highway (Lacelle, 2007).

The objectives of this audit are as follows:

- 1) Develop an understanding of the design and function of the wastewater treatment system at Eagle Plains Lodge;
- 2) Review existing records to understand any treatment difficulties being exhibited by the system; and
- 3) Trace the presence of wastewater on the receiving environment using artificial sweeteners.

WSS has been made aware of consistent and ongoing difficulties meeting Effluent Quality Standards (EQS), specifically for fecal coliforms, thus WSS wanted to understand exactly how the system functioned as well as undertake a review of available long-term water quality data for the treatment plant. This would help confirm

if the system is experiencing a failure or posing a risk to the receiving environment. These objectives were achieved with a desktop review of documents pertaining to the site and water licence. Additionally, the consultant hired to conduct water licence monitoring, Enteck, was provided with additional sample bottles to be collected on behalf of WSS, which were analyzed for artificial sweeteners by Trent University. This desktop exercise and additional sweetener sampling were used to understand subsurface flow paths between the effluent discharge and the receiving environment.

The licence MN07-075-2 was amended in 2010 and 2014 to include some additional operating conditions, and outlines EQS for water discharged from the treatment system in operation for the Eagle Plains Complex, detailed in Table 1 below. Table 2 outlines the monitoring locations included in MN07-075-2, which are monitored twice annually during the months of June and August. While only the parameters listed in Table 1 have associated EQS, the licence also required additional parameters be sampled beyond those listed.

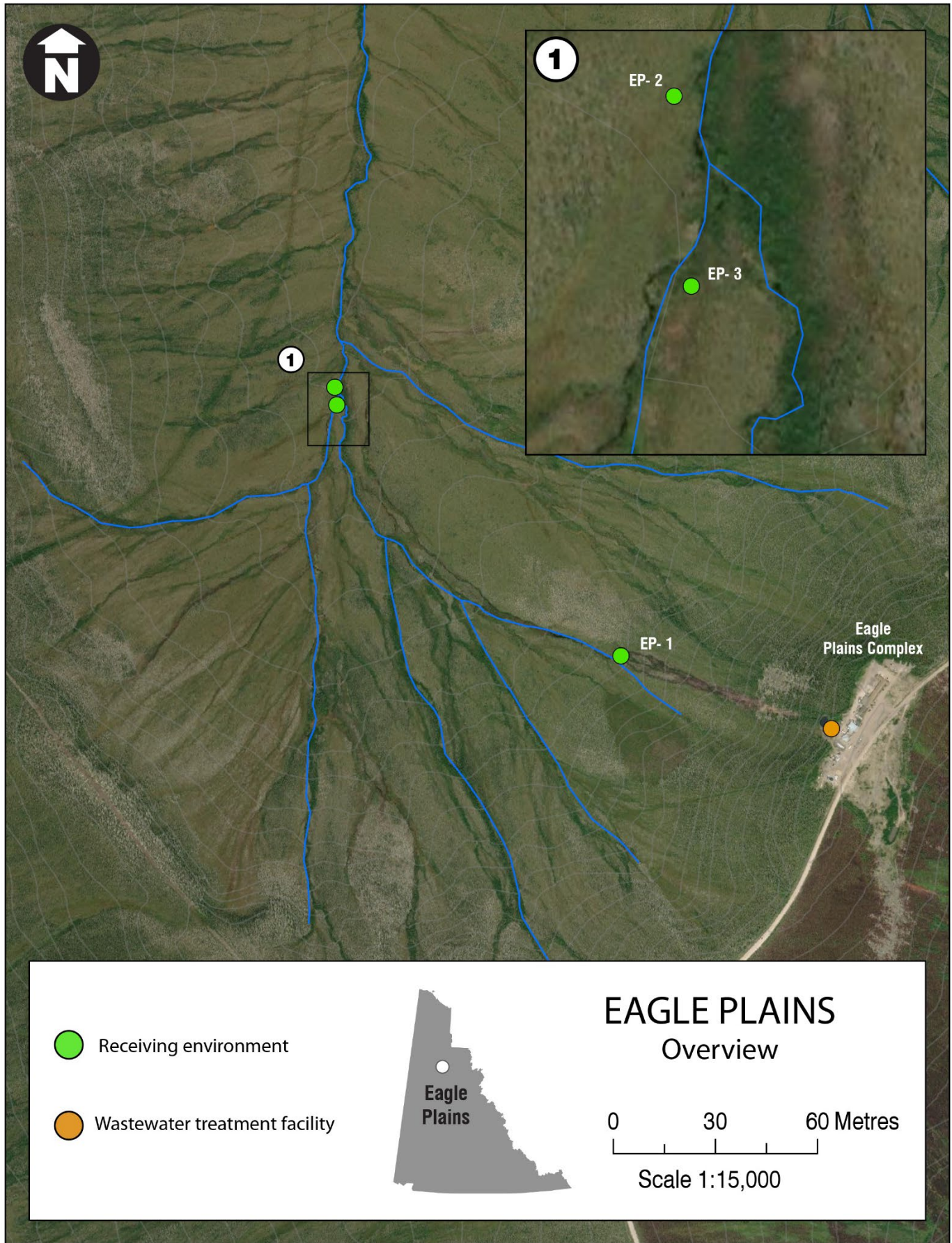
The complete water licence can be found on <https://apps.gov.yk.ca/waterline>.

Table 1. MN07-075-2 EQS, applicable at “Effluent” station only.

Parameter	Maximum concentration (mg/L)
pH	6 – 9 pH units
Total Suspended Solids (TSS)	60 mg/L
BOD ₅	45 mg/L
Fats, oils and grease	No visible sheen
Fecal coliforms	2000 CFU/100 ml

Table 2. Sampling stations included in MN07-075-2.

Sampling Station	Description
EP-1	Located approximately 1 km directly downgradient from the site of the sewage lagoon
EP-2	Located in a small watercourse downstream of EP-3 and approximately 1 km downstream of EP-1
EP-3	Control station located in adjacent watercourse not affected by the Eagle Plains Complex or Dempster Highway
Effluent	Sampled from within the wastewater treatment plant (Figure 4)



Map 1. Site overview.

2 Background and discussion

2.1 Wastewater treatment system review

WSS needed to develop an understanding of the function of the system to assess the efficacy of the treatment plant and examine any current or ongoing treatment difficulties. This was done by reviewing existing annual reports and other historical documents available on Waterline as well as conversations with the site operator, inspector and the past and present consultants. Each wastewater treatment facility in the Yukon presents challenges unique to that facility. Eagle Plains is an extremely isolated site and as such, exhibits many characteristics specific to its particular system.

The mechanical system installed at Eagle Plains Lodge was provided by Pinnacle Environmental Technologies, who also installed and ran verification processes for the treatment system (Access Consulting Group, 2009). Water enters the facility into a pre-aeration chamber where minimal treatment occurs by way of aeration and settling. Next, the effluent moves to the “Trash Collection/Settling Chamber” designed to properly settle and attenuate solids and other physical debris that can be removed by rudimentary screening processes. After travelling through a pump chamber, the effluent reaches a Fixed Activated Sludge Treatment (FAST) chamber that used microbial films and aeration to remove organic matter from effluent via biological oxidation. This chamber also produces some amount of solid/sludge material, which all ultimately gets removed from the system approximately once a year by truck. This process is intended to produce relatively high oxygen water with the only other byproduct being carbon dioxide. The final step of the mechanical treatment process is the UV & Discharge pump bay (Figure 4).

The treatment facility and the associated underground discharge workings were constructed beginning in 2008 (EBA, 2008). From the documents available to WSS and from conversations with inspectors, site staff and operators, it is understood that this facility was constructed to replace a previous lagoon system that had minimal use, though it is unclear why this decision was made. The pre-existing lagoon system became Cell #1 when it was retrofitted with an impermeable liner. This was completed in 2010 and the licence was amended to allow this cell to be used for emergency storage in the event of a treatment system failure. To WSS’s knowledge, the facility has never had to emergency discharge and there has only ever been snowmelt or precipitation collected in Cell #1 since its refurbishment.

The treatment facility is contained within a fenced-in structure, approximately the size of four Sea Cans. The as-built diagrams of the in-ground workings include photographs and show construction of the underground rock pit and the 150 mm perforated PVC pipe, through which effluent discharges to ground at a slow and variable rate. It is difficult to speculate the exact flow rate of the effluent discharge, as it likely corresponds to the water usage and treatment plant’s operational cycles. The facility operator informed WSS that a small amount of settled sludge is removed once a year,

pumped out by a septic truck and hauled to Fort McPherson for disposal. Other than this annual sludge removal, WSS is not aware of any other wastewater-related solids being removed from site.



Photo 1. Taken from Waterline as-built documents (EBA, 2008), and described as “placement of 40mm crushed gravel mounded on either side of the PVC pipe prior to placement of geotextile (August 18, 2008)”.

2.1.1 Site water use

All water used on site is trucked from either Glacier Creek (generally used throughout the summer) or a shallow infiltration well located on the bank of the Eagle River (generally used throughout the winter). Glacier Creek is used through the summer because of the generally high relative sediment load in the Eagle River through the open water season. However, the Eagle River is significantly closer to the lodge and exhibits greatly reduced sediment load during periods of ice cover, so operators can switch to trucking from the Eagle River during winter months. The site utilizes this water for standard municipal purposes including sanitation.

There is no effluent discharge volume monitoring requirement in the water licence. Instead, because it is a closed system, the monthly discharge has always simply been considered to be equal to the monthly trucked volumes. These trucked volumes are tracked by site operators using daily logs. From 2016 to 2019, trucked volumes exceeded the allowable licence limit of 42 m³ per day on 38 days. Since water is trucked daily it should be noted that in that four-year period, these 38 exceedances only represent approximately 2% of all water transport over that period. Additionally, since July 2019, trucked volumes have been consistently below the allowable limit of 42 m³ per day with only three instances since 2019 where intake volumes exceeded the 42 m³ limit.

2.2 Historical water quality

Using the measuring tools and imagery available on GeoYukon, it can be determined that EP-1 is approximately 720 m from the wastewater treatment discharge and 136 m lower in elevation. EP-2

and EP-3 are both more than 1900 m from the effluent discharge and both approximately 195 m down in elevation from the discharge. Given these distances and elevation changes, it is suspected significant attenuation of contaminants would occur over the course of these flowpaths. It should be noted that EQS that apply to the “Effluent” water quality sample do not apply to the down-gradient monitoring locations and have been used below for comparison purposes only. EQS can be used as frame of reference to determine that down-gradient station water quality likely benefits from the significant attenuation and dilution after discharge to the rock pit.

Waterline has annual reports or other design documents as far back as 2008 and regular water quality data being collected since 2014. Throughout the record, fecal coliforms, BOD₅ and TSS have all exhibited difficulty meeting EQS when sampled from the effluent sampling location within the plant. However, there has not been a detection of fecal coliforms (Figure 1) or BOD₅ (Figure 2) at EP-1 for the entirety of the record since the new facility was installed in 2010. The same is true for EP-2 and EP-3 with the exception one detection of BOD₅ at EP-2 in August 2023, and one detection of both BOD₅ and fecal coliforms at EP-3 in August 2023. TSS – while present in the EQS – is difficult to compare in the same way as these down-gradient sites may exhibit spikes in TSS due to precipitation events or other factors outside wastewater treatment. Additionally, elevated TSS is unlikely to persist in water that infiltrates to (and subsequently emerges from) ground.

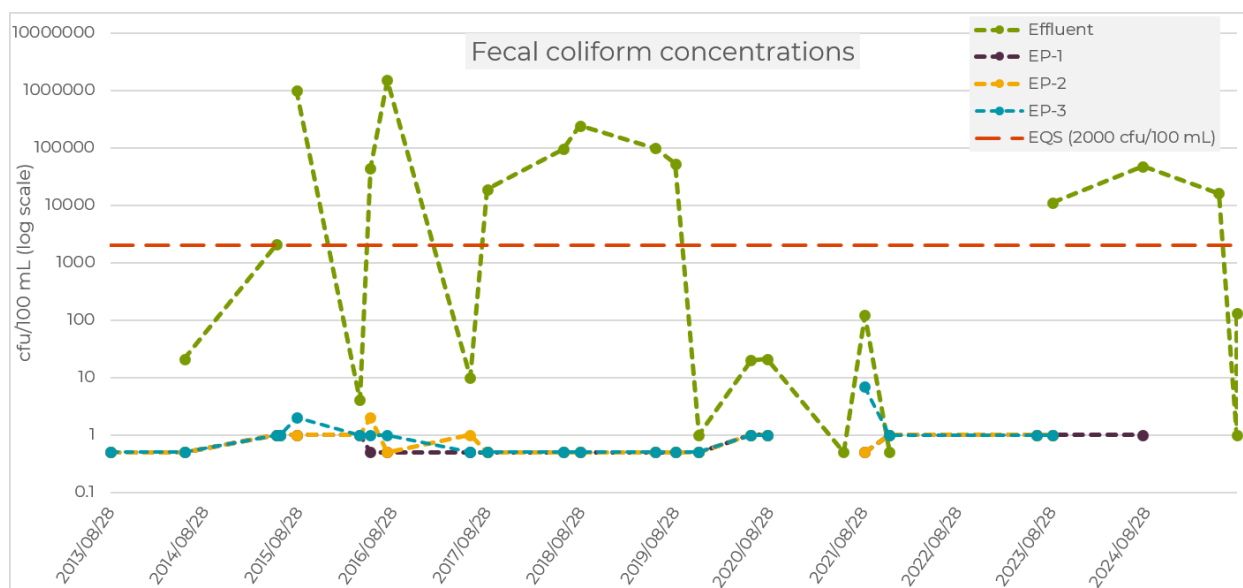


Figure 1. Fecal coliform concentrations in effluent and downstream monitoring locations. Where there are non-detect values, the data has been displayed as half of the detection limit. Note that EQS apply only to “Effluent”. Also note Log-10 scale.

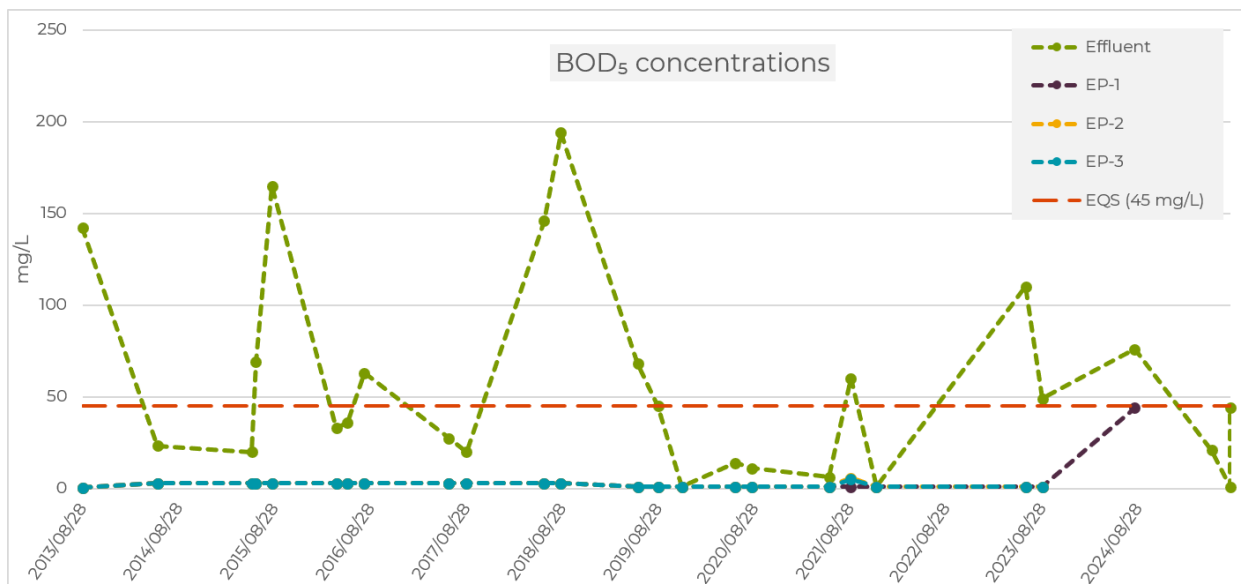


Figure 2. BOD₅ concentrations in effluent and downstream monitoring locations. EP-1, EP-2 and EP-3 are stacked on the plot and difficult to see all three. Where there are non-detect values, the data has been displayed as half of the detection limit. Note that EQS apply only to “Effluent”.

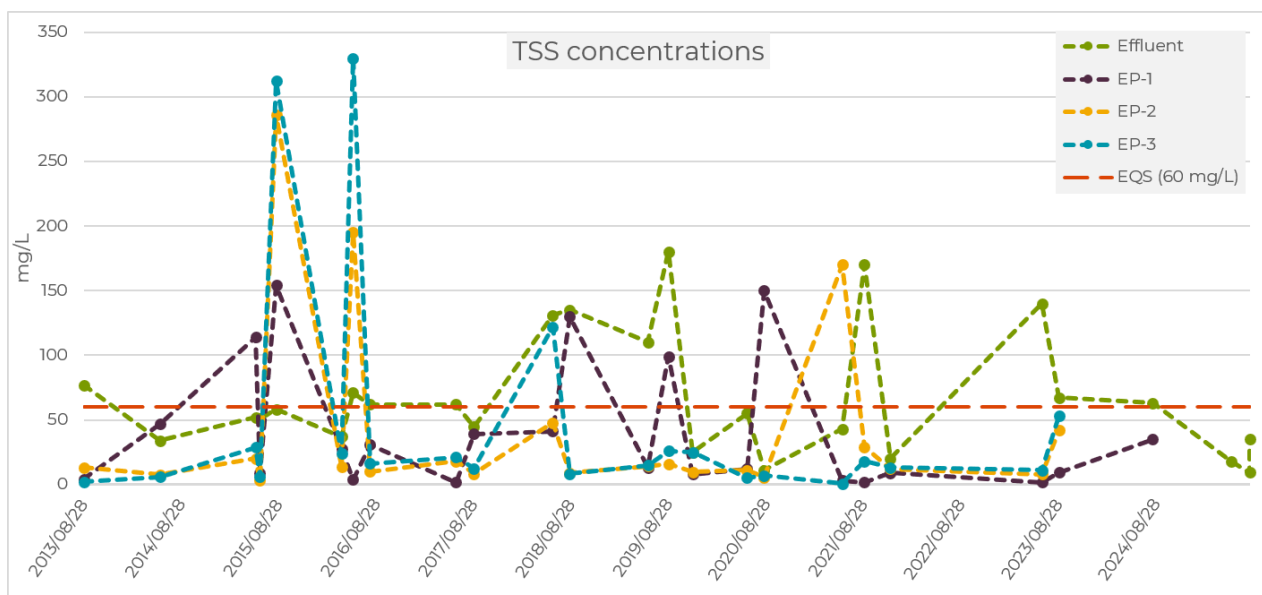


Figure 3. TSS concentrations in effluent and downstream monitoring locations. Where there are non-detect values, the data has been displayed as half of the detection limit. Note that EQS apply only to “Effluent”.

2.2.1 Effluent and compliance point

The current water licence MN07-075-2 states that “The points of compliance, for the effluent quality standards included in this licence, shall be the final point of control, prior to discharging effluent from the mechanical wastewater treatment system to the rock pit.”

It is likely that the effluent sampling location was set up for practical reasons (i.e. this is the last physically accessible location before discharging to the rock pit) and considerations should be made when interpreting water quality data. When a sample is collected from the current effluent sampling

location (Figure 4) it is recognized that once it has left the mechanical treatment facility, it is still being deliberately discharged to the buried rock drain.



Figure 4. Inside the treatment plant where effluent sample is collected. UV lights inside white pipes attached to yellow wires.

2.2.2 Sample data and QA/QC errors

Every fecal coliform sample since June 2018 that WSS has reviewed has exceeded the analytical process hold time of 24 hours. It is unclear how the samplers were able to successfully observe hold times in August 2017 and June 2018, but there has been consistent inability to meet hold times ever since likely due to the remoteness of the site. According to the Guidelines for Canadian Drinking Water Quality: Guideline Technical Document, studies on the effects of hold time on the detection of coliforms in water samples have been limited and contradictory. Some studies show a sharp decline in coliform counts between 12 and 48 hours storage, while other studies have shown no significant differences between samples tested after eight hours and those tested after 30 hours (Government of Canada, 2020). While there is some disagreement in the literature as to what the exact consequence of hold time exceedance is, there is consensus that data quality is significantly degraded. Without adequate sampling procedures and observed hold times, it is difficult to rely on water quality data and caution should be used when using these results. To avoid hold time expiry, options should be explored to deal with ongoing fecal coliform sampling difficulties.

In addition to maintaining hold times, emphasis should be placed on data QA/QC when sampling for compliance monitoring. Water quality analytical and field data should be reviewed for completion and errors before submitting the data to Waterline both by the proponent and consultant hired to conduct water quality monitoring.

Currently there is no stipulation in MN07-075-2 about data submission format; however, WSS preferred submission standards are outlined in the 'Laboratory Data Submission Standards for Water Quality' document (Yukon Water Board, 2023). This document outlines the optimal format that data should be reported to Waterline which helps to expedite WSS's uploading and in turn perform internal QA/QC on data.

2.3 Sweetener results

Artificial sweeteners are man-made compounds commonly used as food additives. These compounds have no natural source and are persistent in the natural environment, making them useful as tracers of municipal wastewater. Artificial sweeteners analyzed for this project include acesulfame, saccharin, cyclamate and sucralose, of which acesulfame is the most persistent. Trent University's Water Quality Centre analyzed these samples for artificial sweeteners using organic Mass Spectrometry. Complete sweetener data can be found in Appendix A.

Varying proportions of the analyzed artificial sweeteners were observed at all sampled sites except for cyclamate, which was only detected in the effluent sample. Artificial sweetener results are presented in Figure 5. The highest total concentration of sweeteners is observed in the effluent followed by a progressive decrease along the flow path as measured between EP-1 and EP-2. However, in both June and August 2025 sampling events, sweeteners were detected in the control station EP-3. No obvious relationship is apparent between the ratios of the different artificial sweeteners and the sampling locations, although acesulfame appears to be the dominant component of most samples, which is known as the most persistent of the artificial sweeteners. Chloride – another relatively conservative parameter – was compared with sweetener concentrations against the effluent concentrations and receiving environment stations. The ratio of chloride and acesulfame at EP-1 were both approximately 2% of the concentration found in the effluent, with EP-2 and EP-3 both being non-detect for chloride in the June and August samples. This would indicate that a relatively small portion of wastewater is appearing in the EP-1 sample, and that dilution is likely an important factor.

The sweetener results were unexpected, particularly the concentrations detected at EP-3 which is meant to be an unimpacted sampling location. This could either be due to erroneous analytical results, or the detections indicate that the EP-3 is being impacted by discharged effluent. The number of sweetener samples taken for this study is insufficient to provide a conclusive result, but if the EP-3 sampling location is being impacted by discharged effluent, the ability to use data from EP-3 to assess downstream impacts is limited.

It is important to note that there are no health-based guidelines for artificial sweeteners. Artificial sweeteners are approved for human consumption by Health Canada and occur in various food, beverage and personal care products (e.g. toothpaste, medicines). They are not broken down in the body and therefore end up in municipal wastewater. It is common to find artificial sweeteners in groundwater in areas where septic systems are used. The Eagle Plains wastewater treatment facility is designed to discharge partially treated water to ground for additional treatment and the detection of trace (nanogram per litre) levels of artificial sweeteners does not necessarily indicate that the water is contaminated, nor does it indicate improper septic system performance.

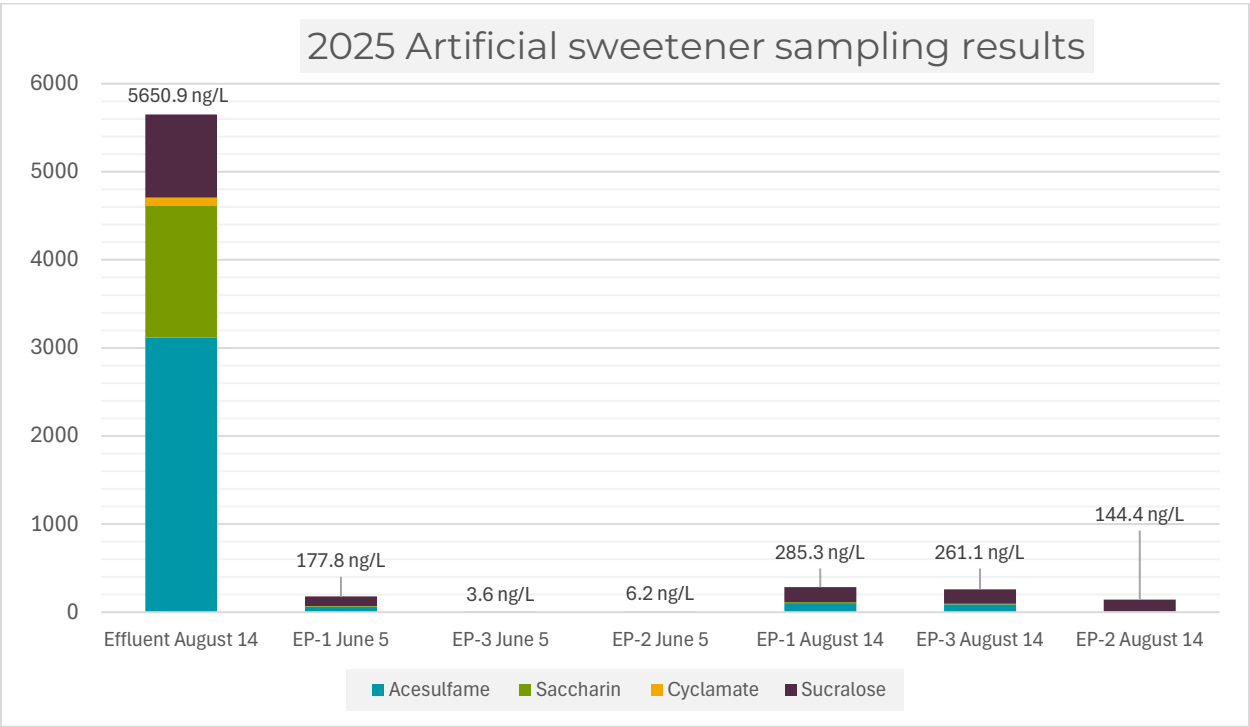
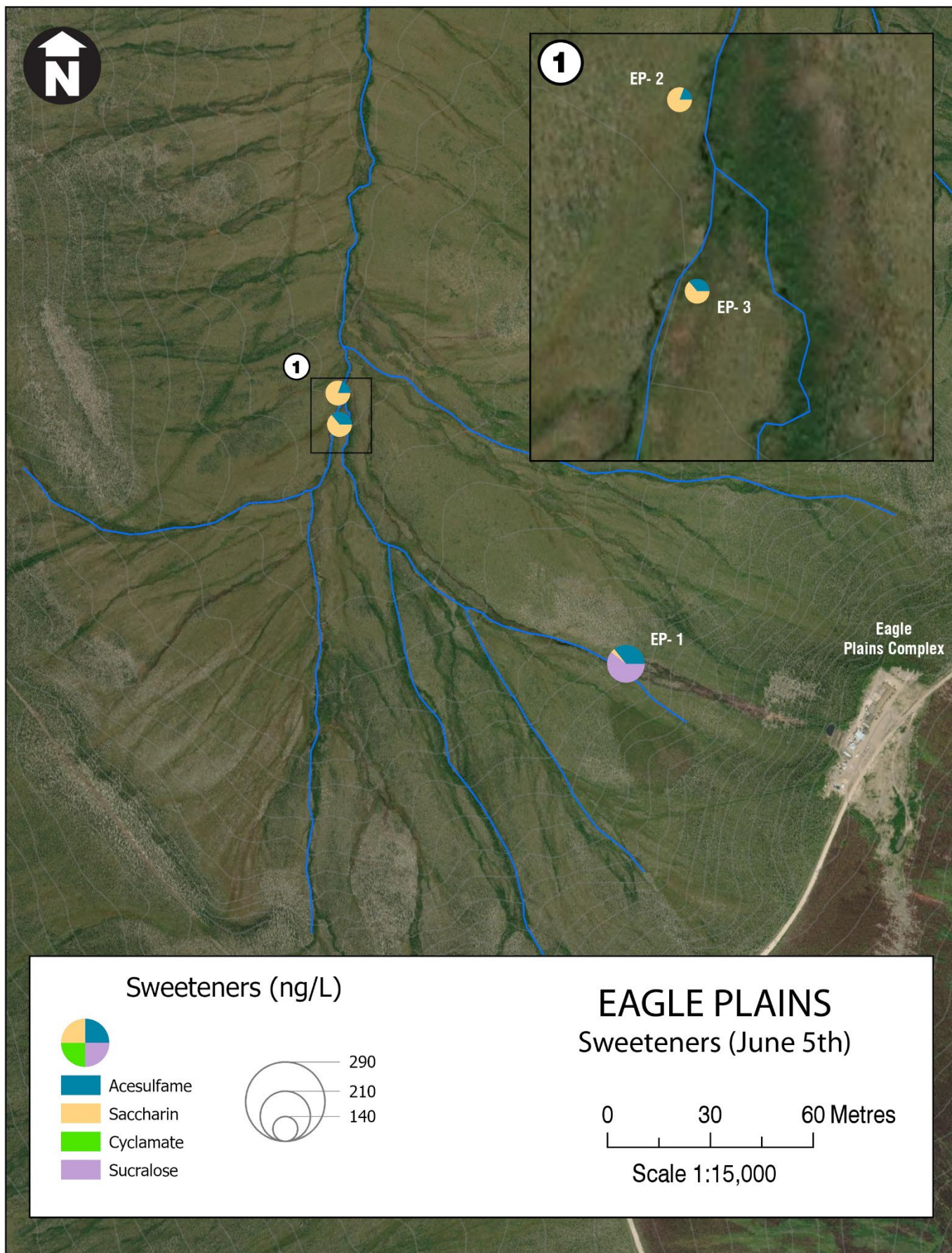
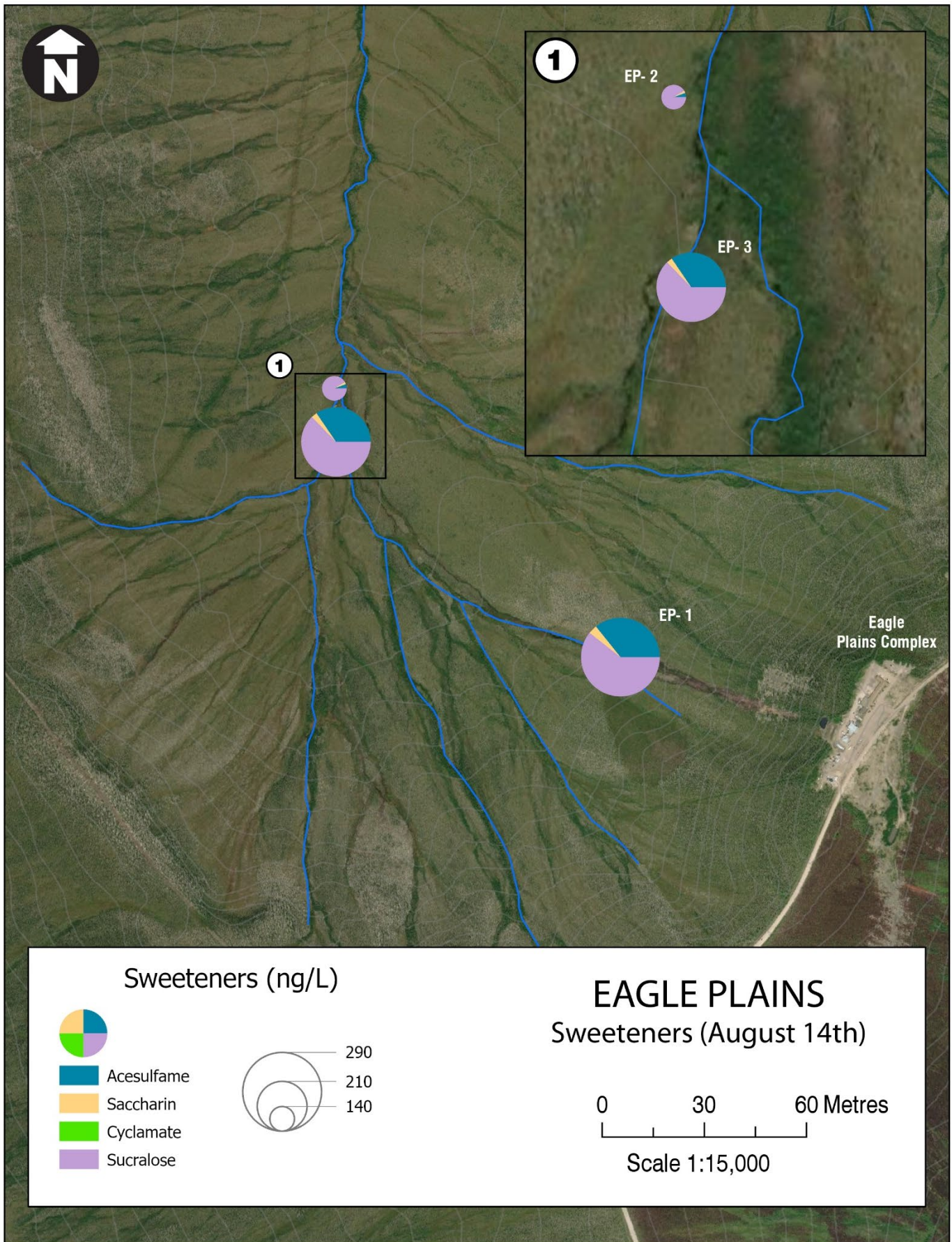


Figure 5. Sweetener concentrations from the 2025 licence monitoring sampling.



Environment Map ID: ENV.666.002

Map 2. Sweetener samples collected during the June 2025 sampling event.



Environment Map ID: ENV.666.001

Map 3. Sweetener samples collected during the August 2025 sampling event.

3 Conclusions and recommendations

3.1 Sweetener tracing

Sweetener data indicates that effluent is travelling to the downgradient surface water monitoring locations. This provides confidence that any potential downstream effects are being monitored. However, sweetener detections at the control station EP-3 were unexpected given sweeteners are not present in unimpacted waters. These results suggest possible subsurface flow path connectivity from the point of discharge to the creek upstream of the control station, or connectivity between the complex network of channels in this permafrost environment. Given these results only represent two sampling events, caution should be applied to this interpretation, and further study would be required to confirm this result. If EP-3 is confirmed to be influenced by wastewater, it suggests a need to relocate the control station further upstream or into a neighbouring catchment. This would allow for more accurate background characterisation.

Recommendation #1: In any future WSS study of the facility, there would be value in collecting additional sweetener samples to verify 2025 results and confirm whether EP-3 location should in fact be relocated.

3.2 Impact on receiving environment

A thorough assessment of the impacts of the wastewater on downstream water quality was not in scope for this study. Additionally, interpretation of downstream results may be complicated by the background acidic nature of the area and the sweetener results discussed above suggesting potentially complicated flow paths. Regardless, this is a relatively small-scale wastewater system that discharges to ground. Direct effects from the wastewater to surface water bodies are unlikely. This is supported by downstream water quality results from parameters that have had historical EQS exceedances (fecal coliforms, BOD₅), which have largely been non-detect downstream. Future assessments may benefit by considering whether there is potential for indirect effects such as those related to changes in vegetation, permafrost or groundwater chemistry.

3.3 Water monitoring

Controls should be put in place to ensure fecal coliform samples meet method specific hold times for membrane filtration. If existing analytical approaches are not adequately

observing hold times, the consultant should explore alternative options for fecal coliform analysis to ensure accurate data is collected.

Recommendation #2: The licensee should examine options (including potentially different analytical procedures available) to facilitate meeting hold times for fecal coliforms.

For more information about this report contact:

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Appendices

Appendix A: Sweetener Data

From: Naomi Stock



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To: Devon O'Connor

Yukon Government - Water Resources Branch

Date: Nov 19 2025

Samples Received: Oct 14 2025

Number of Samples: 7

Instrument: LC-MS/MS
Thermo Ultimate 3000 LC-QExactive Orbitrap MS

#	Sample ID	Note	Concentration (ng/L)				Sum
			Acesulfame	Saccharin	Cyclamate	Sucralose	
1	EP-1	Aug 14-25	102	10.3	< LOQ	173	285
2	EP-2	Aug 14-25	8.1	4.3	< LOQ	132	144
3	EP-3	Aug 14-25	90.1	7.0	< LOQ	164	261
4	Effluent	Aug 14-25	3119	1497	90.9	944	5651
5	EP-1	June 5-25	63.4	6.4	< LOQ	108	178
6	EP-2	June 5-25	1.2	5.0	< LOQ	< LOQ	6
7	EP-3	June 5-25	1.3	2.3	< LOQ	< LOQ	4
Limit of Quantitation (LOQ)			1.2	0.6	1.2	0.9	

We request that any publications, posters and oral presentations resulting from work performed by the Water Quality Centre at Trent University acknowledge the contribution by the Centre and/or research staff within the Centre. This allows the Centre to report information to our funding agencies.