CITY OF NORTH BATTLEFORD
2024 ANNUAL WASTEWATER TREATMENT PLANT REPORT

North Battleford
Treaty Six Territory | Heartland of the Métis | Saskatchewan | Canada

March 2025

Executive Summary

This report provides an overview of the 2024 Wastewater Treatment Plant (WWTP) operations for the City of North Battleford (CNB).

The WWTP experienced permit exceedances from conditions experienced with the force main commissioned in 2023. E.coli exceedances were reported in the months of March, April, September, and December. All other permit samples were within WSA limits. A number of groundwater monitoring wells exceeded Saskatchewan Environmental Quality Guidelines for chloride, nitrate, sodium, and sulphate. These exceedances are believed to be associated with the former (pre 1968, two 1968, and 1988) Saskatchewan Hospital wastewater lagoons.

In 2023 a newly completed sewage force main and lift station were commissioned. The lift station is located in the area of the historic Sewage Treatment Plant just west of Riverview and the force main transports approximately 60% of the City sewage from Riverview to the WWTP. The introduction of the force main resulted in aerobic sewage turning into anaerobic sewage believed to be the cause of the WWTP E.coli exceedances. The operation of the force main also resulted in high concentrations of H_2S gas within the WWTP and along the force main. As a result of the H_2S gas the force mains operating status was changed from regular to intermittent operation with regular flushing.

A summary of the results are as follows:

- The Wastewater Treatment Plant treated over 1.8 million m^3 of domestic wastewater in 2024.
- All required *off-site* permit samples results were below the Permit to Operate a Sewage Works (PTO) except for four permit exceedances for bi-weekly grab effluent (treated sewage) samples.
    - There were four permit exceedances for E.coli single sample of over 400 organisms/100 ml in the months of March, April, September, and December.
        - WSA was notified each time a permit exceedance occurred.
- Since the start of LysteGro fertilizer at the WWTP, 47,640 m^3 of bio-fertilizer has been produced and transferred to the storage lagoon. In 2024, 4,297 m^3 bio-fertilizer was land applied.
- Effluent (treated sewage) passed all acute lethality testing on rainbow trout allowing for continued reduction from quarterly to annually in the frequency of acute lethality testing.

In general, the results reported by the accredited lab(s) were comparable with the results reported by the WWTP.

Northland Power Energy Center has continued to take effluent to be used in their power process.

Looking towards the future, the major capital projects that have been identified in the 2025 budget include:

- A new septage receiving station was installed on the main sewer trunk just north of the plant in 2021 and was commissioned in late 2024 with a hauler implementation date of January 1, 2025.
- Evaluation of H_2S gas generation of the new forcemain and the development of engineering solutions to reduce the H_2S concentrations.
    - Stop the aerobic sewage in the force main from turning into anaerobic sewage that results in high H_2S concentrations.
- UPAR construction of new sewer mains throughout the distribution system will continue.

In conclusion, operations at the CNB WWTP proceeded smoothly. The WWTP was able to meet most of the guidelines set forth by the WSA.

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Introduction

The City of North Battleford (CNB) owns and operates a Wastewater Treatment Plant (WWTP). The goal of the North Battleford Wastewater Treatment Plant is to treat the City's sewage and produce effluent (treated sewage) that meets or exceeds the Permit to Operate a Sewage Works (PTO) as set by the Water Security Agency (WSA). Data represented within this annual report is taken from operations, sampling, and data collection from the CNB WWTP. The PTO can be found in Appendix A.

Background

The WWTP began operating in 2006 and is a Level 4 plant. The plant is located in the south-east of the City. Effluent is discharged to the North Saskatchewan River, downstream of the F.E. Holliday Water Treatment Plant. The plant is designed to treat an average flow of 7,320 m^3/day, a maximum flow of 7,617 m^3/day and a peak flow of 11,950 m^3/day. The WWTP complex includes two evaporation lagoons for vacuum trucks hauling heavy grit, primarily carwash grit cleanout, that were constructed in 1968 for the former Saskatchewan Hospital and was later purchased by the City and a septic receiving station for septic waste that was installed in 2021 and commissioned in 2024.

Quality Assurance/Quality Control (QA/QC)

QA/QC involves a duplicate/standard program. WWTP staff conduct daily/weekly *in-house* tests on sewage effluent (treated sewage). The parameters tested include total ammonia, total suspended solids (TSS), biochemical oxygen demand (BOD), carbonaceous biochemical oxygen demand (cBOD), and phosphorous. These *in-house* tests results are compared to the PTO accredited 3rd Party laboratory test results.

Although sewage influent (raw sewage) sampling is not part of the PTO requirements, WWTP staff conduct *in-house* testing of sewage influent. The results of the parameters tested assist with effectively treating the sewage influent to meet the sewage effluent limits set by the WSA.

Tested Parameters

Monthly/Quarterly Data

The following parameters are tested daily or weekly but reported as a monthly or quarterly average since the limits set out by WSA are based on a calendar monthly or quarterly arithmetic average. The exception to this is coliforms which is based on a monthly geometric average. The data is collected and reported from January 1 to December 31 of 2024.

Each of the following parameters are tested for on the basis that each affects the final quality of river water and may be detrimental to aquatic life if higher than the permitted limit.

Ammonia - Total

Ammonia as N (NH_3-N) is an inorganic, dissolved form of nitrogen that can be found in water and is the preferred form of nitrogen for algae and plant growth. Discharge of effluent high in ammonia to receiving waters (i.e. rivers) may result in oxygen-depleted conditions. Total ammonia refers to two chemical species which are in equilibrium in water. They are NH_4^+ (ionized) and NH_3 (un-ionized). Tests for ammonia measure total ammonia. A composite effluent *in-house* sample is tested daily, and accredited 3rd Party samples are tested bi-weekly. A composite influent (raw sewage) *in-house* sample is tested every Wednesday and Thursday and for operational efficiency while not regulated to do so is accredited 3rd Party tested bi-weekly. An *in-house* grab sample of the influent is tested daily. The composite effluent is regulated for ammonia. WSA limits for ammonia as N are 7 mg/L (October – May) and 3 mg/L (June – September).

Un-ionized Ammonia

The toxicity of ammonia is primarily attributed to the un-ionized form (NH_3) as opposed to the ionized form. In general, the un-ionized ammonia is highly toxic to fish and other aquatic life. Toxicity increases as pH and temperature increase. Accredited 3rd Party bi-weekly testing for un-ionized ammonia in the effluent composite sample is a requirement for the PTO. The limit is 1.24 mg/L at 15°C.

Total Phosphate

Like nitrogen, phosphorus is essential for the growth of plants and animals. Influent (composite) and effluent(grab) sampling for total phosphate are conducted twice a week *in-house*. Effluent composite samples are required to be tested by an accredited 3rd Party bi-weekly.

Coliforms

Total Coliform

Coliforms can be found in water, soil, and on vegetation. They are divided into fecal and nonfecal coliforms. Samples are analyzed for the presence of the coliform group of bacteria which serve as indicator organisms for other pathogens. Coliforms are generally not pathogenic but are usually present when pathogens are present. There is no limit for total coliforms. An effluent grab sample is required to be tested by an accredited 3rd Party bi-weekly. For operational efficiency, CNB samples total coliforms weekly.

E. coli/Fecal Coliforms

Escherichia Coli (also known as E.coli) is a fecal coliform. Their presence indicates the potential presence of microorganisms capable of causing gastrointestinal illnesses. Influent is treated to minimize the number of fecal coliforms released into the environment. E. coli/Fecal coliforms are not to exceed a monthly geometric mean density of 200 organisms per 100 mL and not to exceed a single sample maximum of 400 organisms per 100 mL. An effluent grab sample is required to be tested by an accredited 3rd Party bi-weekly. For operational efficiency, CNB samples E.coli weekly.

pH

pH tests are performed to determine if the wastewater effluent is acidic or basic. The pH scale ranges from 0 to 14 with substances less than 7.0 being acidic while pH greater than 7.0 is considered basic or alkaline. A pH of 7.0 is considered neutral. A pH range of 6.5 to 9.0 has been set as the guideline for the Protection of Aquatic Life. Effluent grab samples are tested *in-house* daily. Effluent composite samples are tested bi-weekly by an accredited 3rd Party at 15°C +/- 1°C.

Temperature

Daily temperature samples are collected from the effluent stream. Temperature ranges from 6.7º C in the winter to 18.3º C in the summer.

Turbidity

Turbidity is used to assess the clarity of water. It is a measure of suspended inorganic and organic particles in the water. Effluent turbidity is tested *in-house* once per day using a grab sample. Effluent turbidity stays consistent. WSA has set no limit for effluent turbidity. An online turbidimeter installed inside the UV channel continuously monitors turbidity.

BOD

Biochemical oxygen demand (BOD) is a chemical process used for determining how fast organisms use up oxygen in a body of water. WSA does not regulate BOD testing in the influent and effluent. CNB performs weekly *in-house* influent and effluent BOD tests. Bi-weekly influent tests by an accredited 3rd Party are taken for BOD.

cBOD

Carbonaceous biochemical oxygen demand (cBOD) measures the amount of oxygen consumed by organisms in decomposing the organic portion of waste. Weekly effluent composite *in-house* and bi-weekly accredited 3rd Party samples are taken for this test. WSA requires that cBOD values for effluent do not exceed a quarterly arithmetic mean of 25 mg/L.

Suspended Solids

TSS

Total suspended solids (TSS) are a measure of suspended particles in a fluid. The TSS test measures both the active bacterial mass and the inert material in the sample. Influent and effluent TSS are tested *in-house* twice weekly. Effluent and influent are tested *by an* accredited 3rd Party bi-weekly. Influent TSS values are tested for internal use but are not required by WSA. WSA requires that effluent TSS does not exceed a quarterly arithmetic mean of 25 mg/L. Influent TSS values are not required by WSA.

VSS

Volatile suspended solids (VSS) test measures the mass of the organic solids compared to the mass of the combined organic and inorganic solids. Most of the VSS component will be active microorganisms in the effluent. Sampling for VSS is not a permit requirement, however VSS for influent and effluent is sampled twice weekly *in-house* to monitor the efficiency of the WWTP.

River Analysis

River samples are taken monthly from locations upstream and downstream of the WWTP outfall and tested by an accredited 3rd Party. The upstream samples provide background or normal conditions that the downstream or post treatment samples are compared to. Differences in analytical results may indicate chemical or biological changes from the release of effluent into the river. The upstream sample is taken from the intake at the F.E. Holliday Water Treatment Plant, while the downstream sample is taken at an irrigation site 1.7km southeast of the outfall.

Major Ions Scan plus TDS and Conductivity

Increased concentrations of ions, TDS, and conductivity can cause harm to aquatic organisms. A composite effluent sample is taken semi-annually and tested by an accredited 3rd Party.

Trace Metal Sampling

Trace metals in large quantities can be detrimental to aquatic life. Trace metals such as lead, mercury, and cadmium are considered toxic and exposure over time to these metals can cause serious illness. One composite sewage effluent sample is taken annually and tested by an accredited 3rd Party.

Acute Lethality

Acute lethality refers to the ability of a substance to cause harm to an organism during a relatively short period of time. A grab effluent sample is collected quarterly and sent for testing by an accredited 3rd Party using rainbow trout to determine if it is lethal. The sampling frequency is reduced from quarterly to annually when four consecutive quarterly tests are passed.

Groundwater Well Monitoring

The groundwater underlying the WWTP is sampled annually between September and October at 12 piezometer locations and is tested by an accredited 3rd Party. The condition of each monitoring well is noted and groundwater samples are collected. The groundwater samples are sampled for total coliforms, E.coli., specific conductivity, and chloride. Field monitoring of the piezometer provides the depth to water, pH, and temperature.

Biosolids Monitoring

All sample results, the product label, and the Product Management Yearly Report for biosolids can be found in Appendix E

Biosolids, also known as sewage sludge, is a semi-solid or liquid residue generated during treatment of domestic sewage in treatment works. It consists mainly of water (90 to 99%) and settleable solids. The solids, that are mostly organics, are removed during primary, secondary, or advanced wastewater treatment processes. The biosolids generated by the WWTP are converted to a registered bio-fertilizer product.

Biosolids Volume Produced

In 2024, all biosolids were converted into bio-fertilizer product. Since the start of LysteGro fertilizer at the WWTP, 47,640 m^3 of bio-fertilizer has been produced and transferred to the storage lagoon. In 2024, 4,297 m^3 bio-fertilizer was land applied.

Biosolids Analysis

WSA does not regulate biosolids in the PTO. One biosolid sample is submitted for sampling monthly for metals, mercury, Total-P, Total-N, moisture, fecal coliforms + Salmonella, and total organic carbon (TOC) by an accredited 3rd Party. The biosolid is tested to ensure all the regulatory requirements set out by the Canadian Food Inspection Agency (CFIA) for a registered fertilizer product are met.

PTO Regulated Sample Results

The required test parameters and limits can be found in Appendix A.

Treated Wastewater Effluent Discharge to Environment

All sample results for effluent discharge to environment can be found in Appendix B.

Flows

As part of a requirement in the PTO, the volume of effluent discharged to the environment is monitored and recorded. The WWTP continuously monitors and records all influent entering and all effluent leaving the plant. In 2024, the WWTP treated approximately 1.9 million m^3 of domestic wastewater. The monthly flows ranged from 125,388.2 m^3 (February) to 180,078.1 m^3 (June). The lowest average daily flow was 4,184.9 m^3 (January), and the highest was 6,209.6 m^3 (June). Flow data for 2024 can be found in Table 1B.

In 2024, 3,657.6 m^3 of leachate was pumped from the WMF landfill pit to the WWTP to be treated.

Bi-Weekly Effluent Composite and Grab Samples

As shown in Table 2B, 26 composite Group 4 Panel effluent samples were taken in 2024. Results for all tested parameters were below permit limits.

As shown in Table 3B, 51 grab total coliform and E.coli effluent samples were taken in 2024. Four permit exceedances for E.coli single sample of over 400 organisms/100 ml occurred for the months of March, April, September, and December. These permit exceedances were related to a force main coming into operation in 2023. WSA was notified each time a permit exceedance occurred.

Quarterly Effluent Grab Samples

The results show that the effluent had no impact on the test organism’s mortality rate at all effluent concentrations, including 100% effluent. The results can be found in Table 4B.

Semi-Annual Effluent Composite Samples

The test parameters do not have regulated limits. Results can be found in Table 5B.

Annual Effluent Composite Sample

The test parameters do not have regulated limits. Results can be found in Table 6B.

Receiving Environment Upstream and Downstream locations

All sample results for receiving environment upstream and downstream can be found in Appendix C.

Monthly River Samples

The downstream sample location is not accessible during winter months. No samples were taken in the months of January, February, March, and April. The required test parameters can be found in Appendix A. Downstream nitrogen compounds are the only parameters that are consistently elevated in comparison to upstream results. Downstream nitrogen concentrations are not significantly elevated and may be elevated from runoff/stormwater from North Battleford and Battleford, agricultural runoff, and wastewater effluent. Results can be found in Table 1C.

Groundwater Monitoring Wells (GWMW)

All sample results for GWMW can be found in Appendix D.

Annual GWMW Samples

There are 12 groundwater wells within proximity of the WWTP and evaporation lagoons (Figure 1). Out of the twelve piezometers at the WWTP, eleven were field tested and sampled. GWMW MW14_06 was dry. The results from the groundwater well monitoring describe the state of each well and the condition of the groundwater. The results were consistent with historical data and did not demonstrate any anomalous results. The 2024 results were compared to the Saskatchewan Environmental Quality Guidelines (SEQG) for agricultural land-use and the following exceedances were noted:

Chloride concentrations ranged from 5 (MW14-07) to 2,980 mg/L (MW14-11). Monitoring wells MW14-05, and MW14-09 through MW14-12 exceeded the SEQG tier 1 guideline for chloride of 100 mg/L.

Nitrate concentrations ranged from below the method detection limit of <0.4 (MW14-08) to 1200 mg/L (MW14-11). Monitoring wells MW14-02 through MW-05, MW14-07, and MW14-09 through MW14-12 exceeded the SEQG tier 1 guideline of 3 mg/L.

TDS concentrations ranged from 362 (MW14-07) to 7,350 mg/L (MW14-11). With the exception of Monitoring well MW14-07, all groundwater wells exceeded the SEQG tier 1 guideline of 500 mg/L.

Sodium concentrations ranged from 16 (MW14-07) to 1990 mg/L (MW14-11). Monitoring wells MW14-01, MW14-03, MW14-05, and MW14-09 through MW14-12 exceeded the SEQG tier 1 guideline for sodium of 200 mg/L.

Sulphate concentrations ranged from 20 (MW14-07) to 3000 mg/L (MW14-03). Monitoring wells MW14-01, MW14-03, MW14-05, MW14-08, and MW14-10 exceeded the SEQG tier 1 guideline for sulphate of 500 mg/L.

The SEQG tier 1 exceedances are likely related to a large former lagoon that was utilized at some point between the Saskatchewan Hospital's opening date of 1914 and the construction of the1968 wastewater lagoons (still in place used today as City evaporation lagoons), and the decommissioned 1988 lagoon that was later converted into the current WWTP surge pond. The former historical (pre 1968) lagoon is referenced in the 1968 lagoon drawings and is present in a 1962 aerial photo. Nitrate and sulphate exceedances in monitoring wells MW14-03, MW14-07, and MW14-08 may be impacted through agricultural fertilizer application. Results can be found in Table 1D.

Conclusion

The WWTP experienced permit exceedances from conditions experienced with the force main commissioned in 2023. E.coli exceedances were reported in the months of March, April, September, and December. All other permit samples were within WSA limits. A number of groundwater monitoring wells exceeded Saskatchewan Environmental Quality Guidelines for chloride, nitrate, sodium, and sulphate. These exceedances are believed to be associated with the former (pre 1968, two 1968, and 1988) Saskatchewan Hospital wastewater lagoons.

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A summary of the results are as follows:

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Looking towards the future, the major capital projects that have been identified in the 2025 budget include:

- A new septage receiving station was installed on the main sewer trunk just north of the plant in 2021 and was commissioned in late 2024 with a hauler implementation date of January 1, 2025.
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    - Stop the aerobic sewage in the force main from turning into anaerobic sewage that results in high H_2S concentrations.
- UPAR construction of new sewer mains throughout the distribution system will continue.

ACKNOWLEDGEMENTS

The Department of Utility Services of the City of North Battleford prepared this report. The dedication and commitment of civic staff in providing regulated wastewater during 2024 is acknowledged.

Also acknowledged is the ongoing assistance of the WSA.

For more information, please contact:

City of North Battleford

Department of Utility Services
Box 460
North Battleford, SK
S9A 2Y6
Phone: (306) 445-1700

City of North Battleford
Wastewater Treatment Plant
2024 Report
Appendix A: Permit to Operate a Sewage Works – North Battleford

Water Security Agency

April 24, 2024

City of North Battleford
1291-101st St
Box 460
North Battleford, SK S9A 2Y6

Dear Sewage Works Owner/Operator:

Permit to Operate a Sewage Works

Please be advised that the Water Security Agency has hereby issued the City of North Battleford's Permit to Operate a Sewage Works, pursuant to the authority of Section 28(1)(h) of *The Environmental Management and Protection Act, 2010*. This permit (No. 00050936-08-00) is attached for your information.

This permit expires on May 1, 2027. Please ensure that a copy of this permit is provided to the operators and posted in a conspicuous place at the sewage works or administration office.

If you have any questions regarding the Permit to Operate a Sewage Works or any other related matters, please contact the undersigned at 306-230-3184 or bruce.dahl@wsask.ca.

Sincerely,

Bruce Dahl, B. Sc.
Environment Officer
Water Security Agency

Water Security Agency

Science and Licensing Division

Permit to Operate a Sewage Works

Altered pursuant to section 28(1)(h) of *The Environmental Management and Protection Act, 2010*

Permit No.: 00050936-08-00
File: 21050-50/WWW/OP/North Battleford

ISSUED TO **The City of North Battleford (the permittee)** the person/entity responsible for the sewage works consisting of a **Class 4** wastewater treatment facility and a **Class 2** wastewater collection facility, located in City of North Battleford and at the sewage treatment works located at Northeast ¼ of Section 22, in Township 43, in Range 16, West of the 3rd Meridian; the Northwest ¼ of Section 22, in Township 43, in Range 16 West of the 3rd Meridian, which provides sewage collection and treatment to the City of North Battleford in the Province of Saskatchewan.

PURSUANT to section 28(1)(h) of *The Environmental Management and Protection Act, 2010*, the Permit to Operate a Sewage Works No. 00050936-07-01 issued to the permittee on 23rd day of January, 2023, whose sewage works is located at Northeast ¼ of Section 22, in Township 43, in Range 16, West of the 3rd Meridian; the Northwest ¼ of Section 22, in Township 43, in Range 16 West of the 3rd Meridian, in the Province of Saskatchewan, and which operation involves the discharge of effluent into the North Saskatchewan River at LSD 2 Section 22 in Township 43, in Range 16, West of the 3rd Meridian in the Province of Saskatchewan, is hereby altered and amended, subject to the terms and conditions attached to this permit.

This permit takes effect on the **1st day of May, 2024**.

This permit expires on the **1st day of May, 2027**, unless cancelled or suspended before that date.

Issued

Bruce Dahl, B. Sc.*
Environment Officer
Water Security Agency

*☑ This digital signature affixed to the permit is legally binding and is considered a sufficient electronic signature as required under *The Electronic Information and Documents Act*, 2000. The original copy is retained by the Water Security Agency and shall be considered the official record.

Terms and Conditions

Section One: Definitions

1.1 All words and phrases have the same definitions as set out in *The Environmental Management and Protection Act, 2010*, or *The Waterworks and Sewage Works Regulations*, as the case may be.

1.2 In this permit:

(a) "*Act*" means *The Environmental Management and Protection Act, 2010;*

(b) "Accredited laboratory" means a laboratory that is accredited under the International Organization for Standardization standard ISO/IEC 17025:2005 entitled *General requirements for the competence of testing and calibration laboratories*, as amended from time to time, by an accrediting body that is a signatory to the *International Laboratory Accreditation Cooperation (ILAC) Mutual Recognition Arrangement* or a laboratory that is accredited under the *Environment Quality Act,* R.S.Q., c. Q-2, as amended from time to time, by an accredited body that is recognized in accordance with the *Environment Quality Act*;

(c) "Adverse effect" has the same meaning as defined in the *Act*;

(d) "*Regulations*" means *The Waterworks and Sewage Works Regulations;*

(e) "Science and Licensing Division" means the Science and Licensing Division of the Water Security Agency;

(f) "Environment" has the same meaning as defined in the *Act*; and

(g) "Environment officer" has the same meaning as defined in the *Act*.

Section Two: Operation

2.1 The permittee shall comply with the *Act* and the *Regulations*, and the terms and conditions of this permit.

2.2 In the event of an inconsistency between the *Act* and this permit, or the *Regulations* and this permit, the more stringent requirement shall apply.

2.3 The permittee shall not extend or alter the sewage works without approval from the Science and Licensing Division.

2.4 The permittee shall ensure that the operation, repair and maintenance of the sewage works is under the direction of an operator who holds at least the corresponding certificate for the classification of the sewage works as set out in the Saskatchewan Water and Wastewater Works Operator Certification Standards, December 2016.

2.5 The permittee shall continuously disinfect the treated effluent prior to discharge to the receiving environment.

2.6 The permittee shall dispose of all biosolids generated by the sewage works at a Saskatchewan Ministry of Environment approved waste disposal grounds or other location that is permitted to accept biosolids.

2.7 In the event of an upset or bypass condition, the permittee shall ensure all downstream water users that may be adversely impacted by the sewage works discharge are notified.

2.8 Pursuant to section 8 of the *Act*, no person shall discharge or allow the discharge of a substance into the environment in an amount, concentration or level or at a rate of release that may cause or is causing an adverse effect unless otherwise expressly authorized pursuant to this permit.

2.9 The permittee shall maintain an emergency response plan that is satisfactory to the minister and shall update the plan from time to time to incorporate changes to the sewage works equipment, operational procedures, chemical use, upset/bypass conditions, or any other matter or thing that could affect the quality of the effluent produced by the sewage treatment works and may adversely affect the environment. The permittee shall:

(a) provide a copy of the plan to any employee, agent or contractor performing work or service in relation to the sewage works; and,

(b) inform the certified operator(s), mentioned in 2.4, of the contents of the emergency response plan.

Section Three: Sampling, Monitoring and Effluent Quality

3.1 The permittee shall cause samples to be taken from the sewage works and receiving environment and tested for the parameters listed in Appendix A, at the locations, times and frequency set out in Appendix A.

3.2 The permittee shall ensure that the effluent quality results for those samples required by 3.1 do not exceed the limits set out in Appendix B for the chemical parameters listed in Appendix B.

3.3 The permittee shall take samples in accordance with the instructions provided by the institution or laboratory that provides the sampling bottles or containers

3.4 Subject to 3.5, the permittee shall have all effluent and receiving environment samples analyzed by an accredited laboratory.

3.5 The permittee may perform on-site effluent and receiving environment sample analyses for parameters indicated in the monitoring schedule as "field test" or "on-site test".

Section Four: Recordkeeping

4.1 The permittee shall cause operational records or logs to be maintained, including information respecting:
- (a) tests conducted and the information to be collected as required by this permit;
- (b) site inspections, maintenance work and any failure of treatment components;
- (c) types, dosages and total amount of chemicals or other substances added to sewage;
- (d) dates and volumes of sewage effluent discharges;
- (e) locations from which samples for any tests are taken;
- (f) the results of any tests conducted on the samples taken pursuant to 3.1;
- (g) records of public complaints including complaints over impacts from suspected seepage from the facility and/or complaints over impacts resulting from discharge practices.

4.2 The permittee shall cause the operational records or logs mentioned in 4.1 to be recorded and maintained in the following manner:
- (a) operational records or logs must be made in chronological order, with the dates, times and testing locations clearly indicated;
- (b) entries in an operational record or log must only be made by the permittee, which includes, by definition, any principal or agent of a permittee;
- (c) any person making an entry in an operational record or log must do so in a manner that allows the person to be unambiguously identified as the maker of the entry;
- (d) operational records or logs must be maintained on a daily basis and retained for at least five years;
- (e) any anomalies or instances of missing entries in an operational record or log must be accompanied by explanatory notes;
- (f) operational records or logs must only contain data or information that is actually observed or produced;
- (g) operational records or logs must not contain default values generated manually or by automated means; and
- (h) operational records or logs maintained pursuant to clause (d) must be made available promptly on request of the Water Security Agency.

4.3 The permittee shall review the records and logs mentioned in 4.1 on a monthly basis to ensure that the operating parameters are being achieved and that the limits set out in Appendix B are not exceeded.

4.4 The permittee shall report the findings to the minister as soon as is reasonably practicable after each review required by 4.3, should the review of the records and logs indicate that the operating parameters have not been achieved and effluent quality limits have been exceeded.

Section Five: Reporting

5.1 The permittee shall submit the results of water sampling analyses performed in accordance with this permit to the Science and Licensing Division, within 7 days following completion of the sampling analyses.

5.2 The permittee shall direct the laboratory performing its water sampling analyses to submit the results within the timeframes mentioned in 5.1. The results must be provided directly to the Science and Licensing Division, in a format compatible with the EPB 383 Water Security Agency and Ministry of Environment - Environmental Management System (SEEMS) Lab-Operator (LAB-OPR) Data File Format, in addition to submitting the written results to the permittee.

5.3 The permittee shall report to the minister any known or anticipated upset condition, bypass condition or events at or affecting the sewage works that could adversely affect the quality of effluent produced by the sewage works.

5.4 The permittee shall immediately report to the minister any instance where:
- (a) effluent disinfection equipment fails;
- (b) the level of effluent disinfection identified in Appendix B is not achieved or is not anticipated to be achieved;
- (c) any other parameter level identified in Appendix B is not achieved or is not anticipated to be achieved; and
- (d) there is a retirement, suspension, resignation, scheduled absence or termination of employment of any certified sewage works collection or sewage works treatment operator, or any anticipated retirement, suspension, resignation or termination that results in the sewage works not being under the direction of a certified operator.

5.5 The permittee shall instruct its employees, agents and contractors performing work or service in relation to the sewage works of their obligation, under section 13(2) of the *Regulations,* to report to the minister any instance described in 5.4 and any known or anticipated upset condition, bypass condition or events at or affecting a sewage works that could adversely affect the quality of effluent discharged into the environment.

5.6 The permittee shall, as soon as reasonably practical, report any of the events mentioned in 5.3 or 5.4 to the minister.

5.7 The permittee shall submit an annual operating report to the Water Security Agency by March 31st of the following year of operation, which shall include all monitoring data as required by condition 3.1 and all record keeping information as required by condition 4.1 of this permit.

Section Six: Inspection

6.1 An environment officer may enter the sewage works at any time to conduct an inspection to ensure that the permittee is complying with this permit, the *Act* or the *Regulations*.

6.2 Upon the request of an environment officer, the permittee shall immediately provide any books, records, logs, graphs, papers, documents, or data, including any computer, digital or electronic records, logs, graphs, files or data maintained with respect to the sewage works.

Section Seven: General

7.1 A copy of this permit shall be posted in a conspicuous place at the sewage works or administration office.

7.2 The permittee shall provide each operator of the sewage works with a copy of this permit and the *Regulations*.

7.3 The minister may cancel, alter or suspend this permit for the reasons and in the manner set out in the *Act*.

7.4 The permittee shall apply for renewal/alteration of this permit at least 60 days prior to its expiry.

7.5 In the event of any inconsistency between a previously issued Permit to Operate a Sewage Works, and the terms and conditions of this Permit to Operate a Sewage Works, the terms and conditions of this permit prevail.

7.6 This permit does not replace or supersede any approvals, licenses or authorizations that may be required due to municipal, provincial or federal legislation. The permittee shall maintain in force any and all such approvals, licenses or authorizations that may be required.

7.7 Where any notice or reporting is required to be given by the permittee, it shall be provided to:

Water Security Agency
Bruce Dahl B. Sc.
10-3904 Millar Ave
Telephone: 306-230-3184
Fax: 306-933-6820
Email: bruce.dahl@wsask.ca

After hours, weekends and holidays, the Water Security Agency can be contacted by calling the Upset Report Line at 1.844.536.9494.

Appendix A

Permit to Operate a Sewage Works
Monitoring Schedule
Permit No.: 00050936-07-01

Location	Station Number	Frequency	Type of Sample	Parameter(s)
1. Treated Wastewater Effluent Discharge to Environment	SK05EG0281	Daily	Volume of influent or effluent discharged at final discharge point[1]	
		Bi-weekly (at least seven days after any other sample)	24-hour Composite	**Group 4 Panel** 5-day Carbonaceous Biochemical Oxygen Demand Chloride pH at 15ºC ± 1ºC Total Suspended Solids Total Phosphorous Total Nitrogen Total Ammonia Nitrogen Total Kjeldahl Nitrogen Calculated Un-ionized Ammonia[2]
			Grab	Total Coliform Bacteria *Escherichia coli* Temperature *(field test)* pH *(field test)*
		Quarterly[3,4] (at least 60 days after any other sample)	Grab	Acute Lethality[5]

		Semi-annually (at least four months after any other sample)	24-hour Composite	**Major Ions Scan plus TDS and Conductivity** Alkalinity, Total Bicarbonate Calcium Carbonate Conductivity at 25ºC Magnesium Nitrate – N Potassium Sodium Sulphate Total Dissolved Solids Total Hardness
		Annually (at least six months after any other sample)	24-hour composite	**Trace Metals** Aluminum Arsenic Antimony Barium Beryllium Boron Cadmium Chromium Cobalt Copper Iron Lead Manganese Mercury Molybdenum Nickel Selenium Silver Strontium Thallium Tin Titanium Uranium Vanadium Zinc

2. Receiving Environment Upstream and Downstream locations	SK05EG0089 and SK05GD0093	Monthly (at least 21 days after any other sample)	Grab	**<u>Group 4 Panel plus TDS and Conductivity</u>** 5-day Carbonaceous Biochemical Oxygen Demand Chloride Conductivity at 25ºC pH at 15ºC ± 1ºC Total Suspended Solids Total Phosphorous Total Nitrogen Total Ammonia Nitrogen Total Dissolved Solids Total Kjeldahl Nitrogen Calculated Un-ionized Ammonia[6] Total Coliform Bacteria *Escherichia coli* Temperature *(field test)* pH *(field test)*
			Grab	**<u>Major Ions Scan</u>** Alkalinity, Total Bicarbonate Calcium Carbonate Magnesium Nitrate – N Potassium Sodium Sulphate Total Hardness

3. Monitoring Wells	SK050EG0176 MW 14-01 SK050EG0278 MW 14-02 SK050EG0347 MW 14-03 SK050EG0351 MW 14-04 SK050EG0352 MW 14-05 SK050EG0353 MW 14-06 SK050EG0354 MW 14-07 SK050EG0355 MW 14-08 SK050EG0356 MW 14-09 SK050EG0357 MW 14-10 SK050EG0358 MW 14-11 SK050EG0359 MW 14-12	Once per year (October)	Grab (Following the purging of at least two volumes of water from the well if possible or the stabilization of pH and conductivity)	**Group 1 Panel** Conductivity at 25ºC Chloride Nitrate – N Total Coliform Bacteria *Escherichia Coli*

[1] The permittee shall calibrate or conduct calibration verification of the flow monitoring equipment at least once in every calendar year and at least five months after a previous calibration. The monitoring equipment must be able to determine the volume or rate of flow with a margin of error of ±15%.

[2] The un-ionized portion of total ammonia (NH_3) in the treated effluent shall be calculated using the formula:

Total Ammonia Nitrogen x 1 ÷ (1+ $10^{9.56-pH}$)

- where pH is the pH of the effluent adjusted to 15ºC ± 1ºC

[3] If a treated wastewater effluent sample is determined to be acutely lethal, the permittee must collect a grab sample of treated wastewater effluent twice per month but at least seven days after any previous sample and conduct the acute lethality test on each of the samples. The permittee shall continue to sample twice per month until such time as three consecutive samples are found not to be acutely lethal. Once three consecutive samples are found not to be acutely lethal, the permittee shall revert back to quarterly acute lethality testing.

[4] Following the collection of 4 consecutive quarterly samples, that have been collected and analyzed and found not to be acutely lethal, the acute lethality sampling and testing requirement may be reduced to yearly (one per calendar year but at least 6 months after any other sample). Should an acute lethality test fail, the permittee shall revert to sampling as per the frequency in footnote 3.

[5] The accredited laboratory must adhere to the following biological test methods:

Biological Test Method: Reference Method for Determining Acute Lethality of Effluents to Rainbow Trout (Reference Method EPS 1/RM/13 Second Edition)

Procedure for pH Stabilization During the Testing of Acute Lethality of Wastewater Effluent to Rainbow Trout (Reference Method EPS 1/RM/50)

[6] The un-ionized portion of total ammonia (NH_3) in the receiving waters shall be calculated using the formula:

Total Ammonia Nitrogen x 1 ÷ (1+ 10^{pKa-pH})

- where pKa is 0.09018 + 2729.92/T
- where T is the ambient receiving water temperature in degrees Kelvin
- where pH is the pH of the receiving water

Appendix B

Permit to Operate a Sewage Works
Permit Limits
Permit No.: 00050936-07-01

Location	Parameter	Limit
Final Treated Wastewater Effluent	5-day Carbonaceous Biochemical Oxygen Demand	Shall not exceed a quarterly arithmetic mean of 25 milligrams per litre.
	Total Suspended Solids	Shall not exceed a quarterly arithmetic mean of 25 milligrams per litre.
	Un-ionized Ammonia - N	Shall not exceed 1.24 milligrams per litre at 15°C ± 1°C.
	Total Chlorine Residual	Shall not exceed 0.02 milligrams per litre.
	Acute Lethality (pH-stabilized)	Shall be non-lethal to 50% or more of test organisms at 100% effluent concentration.
	Escherichia coli	Shall not exceed a monthly geometric mean of 200 organisms per 100 millilitres and shall not exceed a single sample maximum of 400 organisms per 100 millilitres.
	Total Ammonia Nitrogen *(October 1st to May 31st)*	Shall not exceed a monthly arithmetic mean of 7 milligrams per litre
	Total Ammonia Nitrogen *(June 1st to September30th)*	Shall not exceed a monthly arithmetic mean of 3 milligrams per litre

City of North Battleford
Wastewater Treatment Plant
2024 Report
Appendix B: Regulated Results Tables – Effluent Discharge to Environment

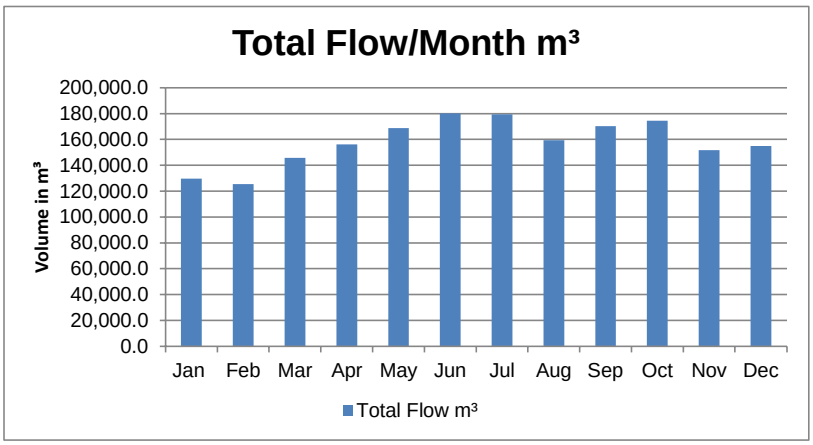
Total Flows

Month	Total Flow m³
Jan	129,732.4
Feb	125,388.2
Mar	145,631.0
Apr	156,168.0
May	168,859.4
Jun	180,078.1
Jul	179,290.2
Aug	159,381.5
Sep	170,299.2
Oct	174,414.7
Nov	151,691.9
Dec	154,861.3
Total	**1,895,795.9**

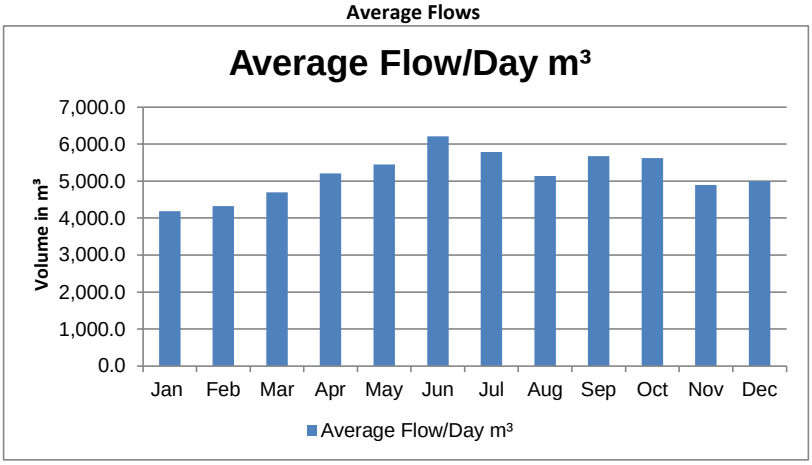
Average Flows

Month	Average Flow/Day m³
Jan	4,184.9
Feb	4,323.7
Mar	4,697.8
Apr	5,205.6
May	5,447.1
Jun	6,209.6
Jul	5,783.6
Aug	5,141.3
Sep	5,676.6
Oct	5,626.3
Nov	4,893.3
Dec	4,995.5
Average	**5,180.7**

Total Flows



Average Flows



Date	cBOD	Chloride	ph	TSS	Total Phosphorous	Total Nitrogen	Total Ammonia Nitrogen	Total Kjeldahl Nitrogen	Calculated Un-ionized Ammonia
	mg/L	mg/L	pH Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
9-Jan	<3	233	7.82	4	0.16	25	0.08	1.8	<0.01
24-Jan	3.00	208	7.89	6	0.23	29	0.07	2.1	<0.01
7-Feb	3.00	273	7.72	8	0.33	26	0.09	2.5	<0.01
21-Feb	<3	207	7.67	5	0.18	24	0.09	2.0	<0.01
5-Mar	3.00	225	7.61	7	1.50	25	0.26	2.3	<0.01
20-Mar	<3	217	7.75	10	0.49	20	1.40	3.7	<0.01
2-Apr	4.00	208	7.40	16	0.47	23	2.00	4.3	0.01
17-Apr	5.00	202	7.50	13	0.52	24	0.12	2.5	<0.01
1-May	4.00	209	7.71	9	0.49	22	0.08	2.4	<0.01
15-May	<3	197	7.89	13	0.44	26	0.08	2.5	<0.01
28-May	<3	176	7.76	4	0.28	19	0.08	2.1	<0.01
12-Jun	<3	192	7.74	6	0.42	30	0.72	3.0	0.01
26-Jun	<3	181	7.96	3	0.14	19	0.01	1.7	<0.01
10-Jul	<3	185	7.95	4	0.26	18	0.06	1.7	<0.01
24-Jul	<3	184	7.90	8	0.38	22	0.05	2.0	<0.01
7-Aug	<3	185	7.99	10	0.90	22	0.11	2.3	<0.01
21-Aug	<3	181	7.87	2	2.10	21	0.20	2.4	<0.01
4-Sep	3.00	195	8.00	11	1.50	20	0.18	2.4	<0.01
18-Sep	3.00	204	7.93	11	0.84	24	0.15	2.1	<0.01
2-Oct	<3	161	7.98	8	0.89	19	0.04	1.9	<0.01
15-Oct	<3	187	7.81	2	0.77	22	0.06	1.8	<0.01
30-Oct	3.00	609	8.07	4	0.44	20	0.06	2.5	<0.01
13-Nov	<3	183	7.94	4	0.18	22	0.03	1.8	<0.01
27-Nov	12.00	203	7.91	4	0.15	24	<0.01	1.9	<0.01
12-Dec	4.00	238	7.58	6	0.43	27	0.96	2.9	<0.01
17-Dec	<3	198	7.75	4	0.17	20	0.02	2.0	<0.01

Date	Total Coliform	E.Coli	E. Coli Limit - Monthly Geometric <200/100mL Single Sample <400/100mL	
			E.Coli Monthly Geometric Mean	E.Coli Single Sample
January				
3-Jan	40	3		<400
9-Jan	100	12		<400
17-Jan	210	11		<400
24-Jan	820	25		<400
31-Jan	91	<1		<400
Geo-Mean	**144.35**	**9.97**	<200	
February				
7-Feb	650	8		<400
14-Feb	31	5		<400
14-Feb	200	2		<400
28-Feb	190	12		<400
Geo-Mean	**166.35**	**5.57**	<200	
March				
5-Mar	1000	490		>400
13-Mar	250	6		<400
20-Mar	1100	25		<400
27-Mar	>1000	35		<400
Geo-Mean	**650.30**	**40.05**	<200	
April				
2-Apr	5500	520		>400
10-Apr	980	56		<400
17-Apr	310	42		<400
24-Apr	550	53		<400
Geo-Mean	**979.10**	**89.73**	<200	
May				
1-May	1600	210		<400
8-May	120	16		<400
15-May	160	8		<400
22-May	120	8		<400
28-May	120	34		<400
Geo-Mean	**213.38**	**23.59**	<200	
June				
6-Jun	1000	57		<400
12-Jun	1000	150		<400
19-Jun	180	15		<400
26-Jun	110	10		<400
Geo-Mean	**375.12**	**33.65**	<200	

Date	Total Coliform	E.Coli	E. Coli Limit - Monthly Geometric <200/100mL Single Sample <400/100mL	
			E.Coli Monthly Geometric Mean	E.Coli Single Sample
July				
3-Jul	240	20		<400
10-Jul	250	20		<400
17-Jul	980	54		<400
24-Jul	820	49		<400
31-Jul	120	62		<400
Geo-Mean	**356.84**	**36.59**	<200	
August				
8-Aug	69	3		<400
14-Aug	120	62		<400
21-Aug	150	20		<400
28-Aug	1000	160		<400
Geo-Mean	**187.73**	**27.78**	<200	
September				
4-Sep	1000	650		>400
11-Sep	610	47		<400
18-Sep	460	32		<400
24-Sep	400	14		<400
Geo-Mean	**578.81**	**60.82**	<200	
October				
2-Oct	870	150		<400
9-Oct	41	10		<400
15-Oct	100	16		<400
23-Oct	35	6		<400
30-Oct	140	8		<400
Geo-Mean	**105.70**	**19.48**	<200	
November				
6-Nov	8	1		<400
13-Nov	120	9		<400
20-Nov	26	4		<400
27-Nov	390	28		<400
Geo-Mean	**55.86**	**5.63**	<200	
December				
4-Dec	91	6		<400
12-Dec	1000	610		>400
17-Dec	69	11		<400
Geo-Mean	**184.49**	**34.27**	<200	

Acute Lethality							
Parameter	Species	Unit	Results				Limit
			12-Mar	N/A	N/A	N/A	
Acute Lethality (96 hr LC_{50} - survival)	Trout	%	>100	N/A	N/A	N/A	>50

Note:
Only one sample needed for Acute Lethality for 2024. The Permit to Operate a Sewage Works states: "Following the collection fo 4 consecutive quarterly samples that have been collected and analyzed and foulnd not to be acutely lethal, the acute lethality sampling and testing requirements may be reduced to yearly."

CITY OF NORTH BATTLEFORD **TABLE 5B** **WASTEWATER TREATMENT PLANT**

Semi-Annual Lab Results - Major Ions Scan Plus TDS and Conductivity **2024 REPORT**

Sewage Effluent Discharge to Environment (Composite)

Parameter	Units	Date	
		17-Apr	23-Oct
Total Alkalinity	mg/L	169	220
Bicarbonate	ug/L	206	268
Calcium	mg/L	89	126
Carbonate	mg/L	<1	<1
Conductivity (at 25°C)	uS/cm	1600	1930
Magnesium	mg/L	39	66
Nitrate	mg/L	22	19
Potassium	mg/L	15	15
Sodium	mg/L	165	190
Sulphate	mg/L	240	440
Total Dissolved Solids	mg/L	988	1280
Total Hardness	mg/L	382	586

CITY OF NORTH BATTLEFORD | TABLE 6B | WASTEWATER TREATMENT PLANT

Annual Lab Results - Trace Metals | **2024 REPORT**

Sewage Effluent Discharge to Environment (Composite)

Parameter	Units	Date
		23-Oct
Aluminum	mg/L	0.0078
Antimony	ug/L	0.0005
Arsenic	mg/L	0.4
Barium	mg/L	0.059
Beryllium	mg/L	<0.0001
Boron	mg/L	0.19
Cadmium	mg/L	0.00001
Chromium	mg/L	<0.0005
Cobalt	mg/L	0.0003
Copper	mg/L	0.0092
Iron	mg/L	0.044
Lead	mg/L	0.0003
Manganese	mg/L	0.022
Mercury	ng/L	<1
Molybdenum	ng/L	0.0021
Nickel	mg/L	0.002
Selenium	mg/L	0.0009
Silver	mg/L	0.00006
Strontium	ug/L	0.86
Thallium	mg/L	<0.0002
Tin	mg/L	0.0001
Titanium	mg/L	0.0003
Uranium	ug/L	6.8
Vanadium	mg/L	0.0001
Zinc	mg/L	0.032

City of North Battleford
Wastewater Treatment Plant
2024 Report
Appendix C: Regulated Results Tables – Receiving Environment Upstream and Downstream locations

TABLE 1C
Monthly Lab Results - Group 4 Panel + TDS Conductivity/Major Ions Scan
Receiving Environment Upstream and Downstream locations

Month		23-Jan-24		16-Feb-24		13-Mar-24		11-Apr-24	
Parameter	**Units**	**Upstream**	**Downstream**	**Upstream**	**Downstream**	**Upstream**	**Downstream**	**Upstream**	**Downstream**
cBOD	mg/L	>3	Not Accessible	<3	Not Accessible	<3	Not Accessible	<3	Not Accessible
Chloride	mg/L	5.00	Not Accessible	7	Not Accessible	4	Not Accessible	9	Not Accessible
Specific Conductivity	uS/cm	418.00	Not Accessible	406	Not Accessible	403	Not Accessible	355	Not Accessible
pH at 15°C	pH Units	8.04	Not Accessible	8.08	Not Accessible	7.97	Not Accessible	8.06	Not Accessible
TSS	mg/L	9.00	Not Accessible	10	Not Accessible	2	Not Accessible	8	Not Accessible
Total-P	mg/L	<0.02	Not Accessible	<0.01	Not Accessible	<0.02	Not Accessible	0.02	Not Accessible
Total-N	mg/L	0.82	Not Accessible	0.27	Not Accessible	0.4	Not Accessible	0.45	Not Accessible
Ammonia as N	mg/L	0.12	Not Accessible	0.24	Not Accessible	0.1	Not Accessible	0.1	Not Accessible
TDS	mg/L	248.00	Not Accessible	247	Not Accessible	251	Not Accessible	209	Not Accessible
TKN	mg/L	0.22	Not Accessible	0.27	Not Accessible	0.2	Not Accessible	0.34	Not Accessible
Un-ionized Ammonia	mg/L	<0.01	Not Accessible	<0.01	Not Accessible	<0.01	Not Accessible	<0.01	Not Accessible
Total Coliforms	ct/100mL	25.00	Not Accessible	120	Not Accessible	29	Not Accessible	>1000	Not Accessible
E.coli	ct/100mL	1.00	Not Accessible	45	Not Accessible	2	Not Accessible	8	Not Accessible
Temp (field test)	C°	4.20	Not Accessible	4.1	Not Accessible	2.6	Not Accessible	3.1	Not Accessible
ph (field test)	pH Units	8.02	Not Accessible	7.32	Not Accessible	7.38	Not Accessible	7.64	Not Accessible
Total Alkalinity	mg/L	149.00	Not Accessible	134	Not Accessible	142	Not Accessible	115	Not Accessible
Bicarbonate	mg/L	182.00	Not Accessible	163	Not Accessible	173	Not Accessible	140	Not Accessible
Calcium	mg/L	53.00	Not Accessible	50	Not Accessible	50	Not Accessible	38	Not Accessible
Carbonate	mg/L	<1	Not Accessible	<1	Not Accessible	<1	Not Accessible	<1	Not Accessible
Magnesium	mg/L	16.00	Not Accessible	15	Not Accessible	15	Not Accessible	13	Not Accessible
Nitrate-N	mg/L	0.60	Not Accessible	<0.01	Not Accessible	0.2	Not Accessible	0.11	Not Accessible
Potassium	mg/L	1.30	Not Accessible	1.3	Not Accessible	1.4	Not Accessible	2.8	Not Accessible
Sodium	mg/L	8.90	Not Accessible	10	Not Accessible	8.3	Not Accessible	13	Not Accessible
Sulphate	mg/L	63.00	Not Accessible	61	Not Accessible	61	Not Accessible	54	Not Accessible
Total Hardness	mg/L	198.00	Not Accessible	186	Not Accessible	186	Not Accessible	148	Not Accessible

Notes:

E.coli is not reported (NR) when Total Coliform is not detected.

Downstream river samples site is not accessible during winter months.

TABLE 1C
Monthly Lab Results - Group 4 Panel + TDS Conductivity/Major Ions Scan
Receiving Environment Upstream and Downstream locations

Month		16-May-24		20-Jun-24		11-Jul-24		22-Aug	
Parameter	**Units**	**Upstream**	**Downstream**	**Upstream**	**Downstream**	**Upstream**	**Downstream**	**Upstream**	**Downstream**
cBOD	mg/L	<3	<3	<3	<3	<3	<3	<3	<3
Chloride	mg/L	12	13	5	7	5	6	4	5
Specific Conductivity	uS/cm	422	429	399	418	381	395	377	387
pH at 15°C	pH Units	8.33	8.36	8.75	8.74	8.69	8.77	8.52	8.54
TSS	mg/L	66	55	18	10	39	24	8	9
Total-P	mg/L	0.05	0.05	<0.02	<0.02	<0.02	<0.02	0.01	0.02
Total-N	mg/L	0.66	0.79	0.24	0.42	0.47	0.9	0.42	0.63
Ammonia as N	mg/L	0.04	0.02	0.04	0.03	0.05	0.06	0.04	0.06
TDS	mg/L	270	267	266	278	260	266	218	233
TKN	mg/L	0.54	0.59	0.24	0.25	0.11	0.44	0.31	0.39
Un-ionized Ammonia	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Total Coliforms	ct/100mL	160	120	24	42	>1000	>1000	3300	3800
E.coli	ct/100mL	6	7	2	2	12	24	8	9
Temp (field test)	C°	14.6	13.2	16.6	24	25.4	20.8	21.6	18.5
ph (field test)	pH Units	7.93	8.34	8.73	8.12	8.55	8.88	8.44	8.4
Total Alkalinity	mg/L	146	144	146	146	139	141	135	136
Bicarbonate	mg/L	176	173	171	171	162	165	165	166
Calcium	mg/L	46	46	47	48	47	48	47	47
Carbonate	mg/L	1	1	4	4	4	4	<1	<1
Magnesium	mg/L	14	14	15	15	14	15	15	16
Nitrate-N	mg/L	0.12	0.2	<0.01	0.17	0.36	0.46	0.11	0.24
Potassium	mg/L	2	2.1	1.4	1.6	1.4	1.6	1.3	1.4
Sodium	mg/L	15	16	11	13	9	10	8.6	9.7
Sulphate	mg/L	55	56	58	62	52	56	55	57
Total Hardness	mg/L	172	172	179	181	175	181	179	183

Notes:

E.coli is not reported (NR) when Total Coliform is not detected.

Downstream river samples site is not accessible during winter months.

TABLE 1C
Monthly Lab Results - Group 4 Panel + TDS Conductivity/Major Ions Scan
Receiving Environment Upstream and Downstream locations

Month		17-Sep		9-Oct		19-Nov		12-Dec	
Parameter	**Units**	**Upstream**	**Downstream**	**Upstream**	**Downstream**	**Upstream**	**Downstream**	**Upstream**	**Downstream**
cBOD	mg/L	<3	<3	<3	<3	<3	<3	<3	Not Accessible
Chloride	mg/L	1	2	6	8	4	8	8	Not Accessible
Specific Conductivity	uS/cm	366	376	414	423	395	421	491	Not Accessible
pH at 15°C	pH Units	8.5	8.57	8.42	8.4	8.24	8.26	7.99	Not Accessible
TSS	mg/L	22	12	4	5	8	11	6	Not Accessible
Total-P	mg/L	0.01	<0.01	0.01	0.01	<0.01	0.01	<0.01	Not Accessible
Total-N	mg/L	0.28	0.42	0.45	0.72	0.56	0.63	1.1	Not Accessible
Ammonia as N	mg/L	0.02	0.02	0.02	0.03	0.04	0.04	0.1	Not Accessible
TDS	mg/L	242	238	247	251	239	252	308	Not Accessible
TKN	mg/L	0.24	0.23	0.25	0.28	0.14	0.2	0.33	Not Accessible
Un-ionized Ammonia	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	Not Accessible
Total Coliforms	ct/100mL	580	330	77	99	66	120	91	Not Accessible
E.coli	ct/100mL	25	20	8	3	6	3	4	Not Accessible
Temp (field test)	C°	16.7	16.8	11.3	7.9	1.8	2.1	1.4	Not Accessible
ph (field test)	pH Units	8.36	8.74	7.68	8.24	8.28	8.3	7.94	Not Accessible
Total Alkalinity	mg/L	127	128	137	138	131	134	165	Not Accessible
Bicarbonate	mg/L	152	151	167	168	160	163	201	Not Accessible
Calcium	mg/L	47	47	46	48	49	50	59	Not Accessible
Carbonate	mg/L	1	2	<1	<1	<1	<1	<1	Not Accessible
Magnesium	mg/L	15	15	16	17	15	16	18	Not Accessible
Nitrate-N	mg/L	0.04	0.19	0.2	0.44	0.42	0.43	0.78	Not Accessible
Potassium	mg/L	1.1	1.2	2	2	1.2	1.4	1.7	Not Accessible
Sodium	mg/L	7	8.3	13	14	8.5	11	12	Not Accessible
Sulphate	mg/L	57	59	62	66	56	60	76	Not Accessible
Total Hardness	mg/L	179	179	180	190	184	184	221	Not Accessible

Notes:

E.coli is not reported (NR) when Total Coliform is not detected.

Downstream river samples site is not accessible during winter months.

City of North Battleford
Wastewater Treatment Plant
2024 Report
Appendix D: Regulated Results Tables – Ground Water Monitoring Wells

TABLE 5C - Annual Groundwater Well Monitoring at WWTP - October 8-10, 2024

Lab Parameter	Units	Piezometer					
		MW14_01	MW14_02	MW14_03	MW14_04	MW14_05	MW14_06
Total Coliforms	MPN/100mL	22	<1	<1	<1	1	n/a
E.coli	MPN/100mL	<1	Not Reported	Not Reported	Not Reported	<1	n/a
Specific Conductivity	uS/cm	4850	961	4930	1620	7130	n/a
Chloride	mg/L	66	6	96	19	1050	n/a
Nitrate - N	mg/L	2.4	24.0	5.1	22.0	60.0	n/a
Field Parameter	**Units**	**Piezometer**					
		MW14_01	MW14_02	MW14_03	MW14_04	MW14_05	MW14_06
Specific Conductivity	uS/cm	4773	950	4888	1613	6651	n/a
pH	pH units	7.34	7.66	7.52	7.48	7.24	n/a
Temperature	°C	11.4	9.8	9.9	9.7	8.7	n/a
Depth to Water	m	5.14	5.25	6.00	6.24	6.12	n/a
Depth to Well Bottom	m	7.25	6.95	7.00	8.26	6.83	n/a
Volume of Water in Well	L	4.14	3.34	1.96	3.97	1.39	n/a
Volume Purged	L	9.0 Dry	7.25 Dry	4.5 Dry	7.5 Dry	4.18 Dry	n/a
Condition of Well	n/a	Good	Good	Good	Good	Good	Good
Notes	n/a	n/a	n/a	n/a	n/a	n/a	n/a

Lab Parameter	Units	Piezometer					
		MW14_07	MW14_08	MW14_09	MW14_10	MW14_11	MW14_12
Total Coliforms	MPN/100mL	<1	110	<1	<1	<1	<1
E.coli	MPN/100mL	Not Reported	<1	Not Reported	Not Reported	Not Reported	Not Reported
Specific Conductivity	uS/cm	586	2700	9710	9900	12500	8200
Chloride	mg/L	5	22	2640	2470	2980	2240
Nitrate - N	mg/L	10	<0.4	100	170	1200	37
Field Parameter	**Units**	**Piezometer**					
		MW14_07	MW14_08	MW14_09	MW14_10	MW14_11	MW14_12
Specific Conductivity	uS/cm	585	2706	8737	9567	12088	8078
pH	pH units	8.15	7.25	6.86	7.01	7.5	7.1
Temperature	°C	11.3	11.8	9.3	9.5	9.2	9.8
Depth to Water	m	5.02	4.68	7.46	5.81	5.09	6.35
Depth to Well Bottom	m	6.60	8.12	8.62	8.30	6.97	7
Volume of Water in Well	L	2.71	6.75	2.28	4.90	3.69	1.28
Volume Purged	L	8.1	13 Dry	3.75 Dry	14.7	3 Dry	2.75 Dry
Condition of Well	n/a	Good	Good	Good	Good	Good	Good
Notes	n/a	n/a	n/a	n/a	n/a	n/a	n/a

n/a - Not Applicable

Notes:

E. coli is not reported when Total Coliform is not detected.

October 8, 2024 - Water was purged from from all wells.

October 9 & 10, 2024 - Water samples were collected from all wells.

City of North Battleford
Wastewater Treatment Plant
2024 Report
Appendix E: Biosolids Results Table/Yearly Report

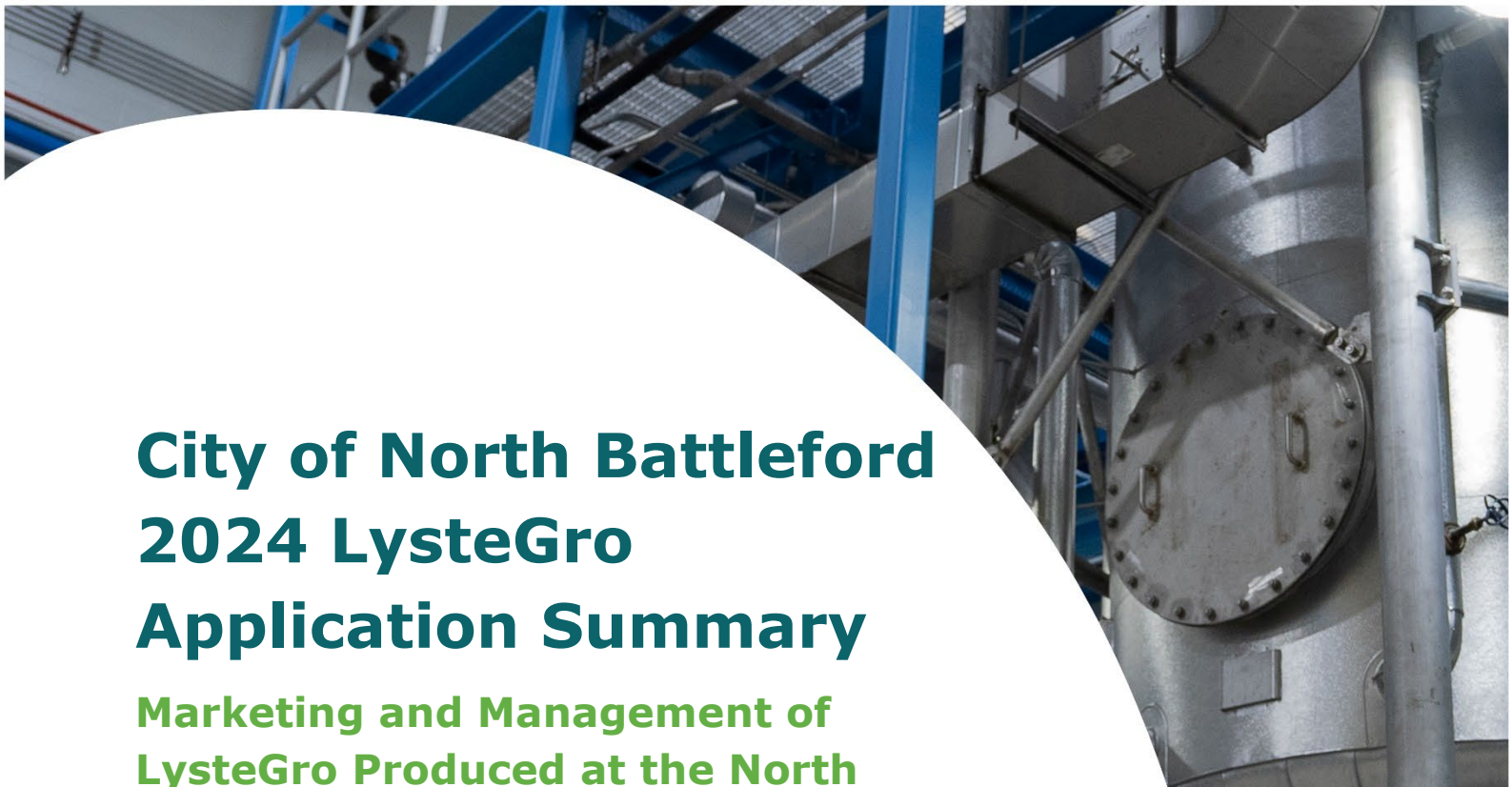
Parameter	Units	Results			
Inorganic		January	February	March	April
Phosphorus	mg/kg	19000	18000	20000	18000
Nitrate as N	mg/kg	<5	<5	<5	<5
Nitrite as N	mg/kg	0.83	0.81	<0.50	0.6
Ammonia as N	µg/g	87	120	1600	190
Total Organic Carbon	%	37	35	26	34
Total Kjeldahl Nitrogen	mg/kg	72000	50000	60000	79000
Moisture	%	92	92	92	91
Metals					
Aluminum	µg/g	1600	2100	2200	3000
Antimony	µg/g	0.97	1.2	1.9	1.5
Arsenic	µg/g	1.8	7	2.4	3.2
Barium	µg/g	120	120	140	130
Beryllium	µg/g	<0.20	<0.20	<0.20	<0.20
Boron	µg/g	19	16	15	16
Cadmium	µg/g	0.38	0.52	0.68	0.4
Calcium	µg/g	11000	12000	14000	14000
Chromium	µg/g	9.6	11	12	14
Cobalt	µg/g	1.6	2.1	2.1	2.3
Copper	µg/g	720	670	780	670
Iron	µg/g	4300	5200	5800	7200
Lead	µg/g	6.8	8.3	8.7	8.6
Magnesium	µg/g	6300	6900	7000	7400
Manganese	µg/g	160	110	180	140
Mercury	µg/g	0.27	0.28	0.23	0.25
Molybdenum	µg/g	5.6	6.6	6.5	5.9
Nickel	µg/g	9	10	11	13
Potassium	µg/g	57000	55000	60000	47000
Selenium	µg/g	2.6	2.3	2.2	2.4
Silver	µg/g	0.68	0.68	0.6	0.58
Strontium	µg/g	72	65	83	82
Thallium	µg/g	<0.050	0.053	0.06	0.083
Tin	µg/g	13	11	13	7.8
Uranium	µg/g	6.9	5.8	6.2	7.3
Vanadium	µg/g	<5.0	6.6	6.9	9.9
Zinc	µg/g	190	230	230	200
Microbiology					
Fecal Coliforms	MPN/g	<2	<2	<2	<2
Salmonella spp.	MPN/25g	<1	<1	<1	<1

Parameter	Units	Results			
Inorganic		May	June	July	August
Phosphorus	mg/kg	16000	17000	16000	19000
Nitrate as N	mg/kg	<5	<5	<5	<5
Nitrite as N	mg/kg	<0.50	0.97	0.93	<0.50
Ammonia as N	mg/kg	2100	110	3000	820
Total Organic Carbon	%	35	31	31	32
Total Kjeldahl Nitrogen	mg/kg	62000	92000	67000	62000
Moisture	%	90	90	91	91
Metals					
Aluminum	µg/g	3800	3800	3200	2400
Antimony	µg/g	1.4	1.2	1.4	1.4
Arsenic	µg/g	3.5	3.1	2.9	2.6
Barium	µg/g	130	120	140	140
Beryllium	µg/g	<0.20	<0.20	<0.20	<0.20
Boron	µg/g	15	22	24	72
Cadmium	µg/g	0.32	0.28	0.43	0.55
Calcium	µg/g	16000	16000	17000	16000
Chromium	µg/g	14	14	14	13
Cobalt	µg/g	2.6	2.6	2.3	2.3
Copper	µg/g	640	610	700	780
Iron	µg/g	8100	8400	7600	6800
Lead	µg/g	8.2	7.6	9.9	14
Magnesium	µg/g	8600	8300	7500	7400
Manganese	µg/g	150	160	220	340
Mercury	µg/g	0.27	0.26	0.30	0.52
Molybdenum	µg/g	5.3	5.1	6.9	8
Nickel	µg/g	14	14	14	13
Potassium	µg/g	54000	48000	50000	55000
Selenium	µg/g	3	4.4	7.7	6.7
Silver	µg/g	0.63	0.64	0.73	1
Strontium	µg/g	77	77	86	91
Thallium	µg/g	0.09	0.092	0.095	0.084
Tin	µg/g	7.1	180	12	7.3
Uranium	µg/g	11	11	9.3	10
Vanadium	µg/g	12	11	9.6	6.7
Zinc	µg/g	180	180	250	320
Microbiology					
Fecal Coliforms	MPN/g	<2	<2	<2	<2
Salmonella spp.	MPN/25g	<1	<1	<1	<1

Parameter	Units	Results			
Inorganic		September	October	November	December
Phosphorus	mg/kg	20000	19000	20000	23000
Nitrate as N	mg/kg	<5	<5	<5	<5
Nitrite as N	mg/kg	<0.50	<0.50	<0.50	<0.50
Ammonia as N	mg/kg	2100	1600	2000	1900
Total Organic Carbon	%	*350000mg/kg	30	31	36
Total Kjeldahl Nitrogen	mg/kg	79000	63000	65000	66000
Moisture	%	93	91	91	92
Metals					
Aluminum	µg/g	2400	2600	3200	2500
Antimony	µg/g	1.5	1.5	1.4	1.4
Arsenic	µg/g	2.8	2.7	3.1	2.3
Barium	µg/g	150	170	140	140
Beryllium	µg/g	<0.20	<0.20	<0.20	<0.20
Boron	µg/g	120	53	25	25
Cadmium	µg/g	0.61	0.59	0.57	0.56
Calcium	µg/g	15000	17000	16000	15000
Chromium	µg/g	13	14	13	12
Cobalt	µg/g	2.5	3	3.3	2.7
Copper	µg/g	970	930	870	810
Iron	µg/g	6400	6300	7100	6500
Lead	µg/g	13	13	12	11
Magnesium	µg/g	7600	7100	8500	11000
Manganese	µg/g	380	610	590	540
Mercury	µg/g	0.42	0.36	0.27	0.27
Molybdenum	µg/g	11	9.3	8.9	7.6
Nickel	µg/g	15	16	14	12
Potassium	µg/g	54000	46000	49000	29000
Selenium	µg/g	6.2	7.3	5.2	4.2
Silver	µg/g	1.1	1.1	0.82	1.1
Strontium	µg/g	96	120	92	91
Thallium	µg/g	0.078	0.069	0.086	0.073
Tin	µg/g	16	10.0	9	16
Uranium	µg/g	14	12	12	12
Vanadium	µg/g	6.6	6.8	9.5	7.5
Zinc	µg/g	390	330	290	280
Microbiology					
Fecal Coliforms	MPN/g	19	<2	**37000	4900
Salmonella spp.	MPN/25g	<1	<1	<1	<1

*Test results reported as mg/kg instead of as a % for September due to samples not arriving to lab within hold time.

** Fecal Coliforms higher than normal for November's sample due to samples not arriving to lab within hold time.



City of North Battleford 2024 LysteGro Application Summary

Marketing and Management of LysteGro Produced at the North Battleford Wastewater Treatment Plant

January, 2025

Lystek
Nothing wasted.
Everything to gain.

City of North Battleford

2024 LysteGro Application Summary

Prepared For:

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1 INTRODUCTION

In 2019, Lystek International Corp, entered into a three-year agreement for the marketing and management of LysteGro fertilizer produced at the North Battleford Wastewater Treatment Plant (WWTP) located at 1 Canola Ave, North Battleford, SK S0M 0E0. As per the agreement and subsequent amendments extending the agreement, Lystek is responsible for all aspects of the marketing and application of LysteGro fertilizer produced at the facility from 2024-2027.

In 2024, the City of North Battleford recycled 4,297 m^3 of biosolids to agricultural land.

LysteGro is a valuable fertilizer for crop production and is valued by farmers in the region. LysteGro has a good concentration of nitrogen (N), phosphorus (P) and potassium (K), micronutrients such as sulfur (S) and calcium (Ca), as well as organic matter. There is an increasing recognition by the agricultural community of the value of organic amendments, such as LysteGro, in building soil health and long-term improvements in yield. Third party trials in Ontario have shown that farmers can completely replace their commercial fertilizer with LysteGro and achieve comparable or higher corn yields.

In 2024, 4,297.69 cubic metres (m^3) of LysteGro was hauled from the North Battleford WWTP and directly injected into approximately 231 acres (ac). All hauling and land application activities proceeded as normal.

This report is a summary of the City of North Battleford's 2024 LysteGro application program. It will provide more information about the product, volumes hauled and applied and details of the application.

2 PRODUCT CHARACTERIZATION AND VALUE SUMMARY

2.1 LYSTEGRO FERTILIZER LABEL

The material produced at the North Battleford WWTP with the Lystek-patented technology is a regulated fertilizer product through the Canadian Food Inspection Agency (CFIA), as shown in Appendix A. As such, the material is applied as a fertilizer, where the rate of application is based on soil characteristics and crop requirements. The requirements of the product characteristics under the Federal *Fertilizers Act* include:

- Reduced pathogen content (Fecal Coliforms <1,000 MPN/gram, Salmonella Absence/25 grams)
- Dioxin & furan analysis and meeting regulatory limits
- Guaranteed minimum nutrient analysis (NPK)
- Analysis of 11 Regulated Metals and application rate maximums based on concentrations

According to the product label, the fertilizer has a minimum guaranteed analysis of 3-3-3 % on a dry weight basis for Total N, Total Available Phosphoric Acid (P_2O_5), and Soluble Potash (K_2O), respectively. However, based on the mean of 12 samples collected monthly during the

2024 production period, the actual analysis of the material is 6-4-6. A product analysis is available in Appendix B. The actual product analysis is always used by Lystek's Certified Crop Advisors when making application rate recommendations, while both the actual analysis and the fertilizer label is provided to the farmer.

2.2 VALUE OF LYSTEGRO FERTILIZER

The ***Ontario Farm Monitoring Project*** is an effort by the University of Guelph to gather information about the cost of farm inputs (fertilizer, pesticides, fuel) in Ontario. As no such publication could be found for Saskatchewan, the pricing for Ontario will be used to evaluate the equivalent fertilizer value of LysteGro compared to commercial fertilizer: Urea (primary source of N), mono-ammonium phosphate (MAP) (primary source of P) and Muriate of Potash (primary source of K). Based on their most current 2024 surveys average fertilizer prices, the equivalent value of LysteGro product produced at the North Battleford WWTP is $101.38 /1,000 imperial gallons (imp gal) based on total N, P_2O_5 and K_2O and $54.63 /1,000 imp gal based on predicted availability of nutrients in the first growing season.

Recycling nutrients from the WWTP back to farm fields provides local farmers with benefits in the form of reduced costs for fertilizer and improving their overall soil fertility. The price charged to customers in 2024 was $17.50/1,000 imp gal. As commercial granular fertilizer prices have remained stable it is expected that the sale price will remain the same in 2025 for North Battleford LysteGro.

3 VOLUMES REMOVED AND APPLICATION SITES

3.1 FERTILIZER VOLUMES

Table 3-1 and outlines the LysteGro hauling and land application volumes from the North Battleford WWTP for 2024. In total, 4,297 m^3 of LysteGro was hauled and applied. Further details of each application are described below.

Table 3-1 Land Application Events from North Battleford WWTP in 2024

Hauling Date (from plant)	Farmer	Interim Storage	Volume (m^3)	Land App dates	Acres	App Rate (imp gal./ac)
September 16 – 26, 2024		NO	4,297	Same as hauling	231	4,093

3.2 HAULING SUMMARIES & APPLICATION SITES

There was one hauling event from the North Battleford WWTP in 2024. Maps showing the location of the application sites are available in Appendix C. Bills of sale for LysteGro

fertilizer sold to the end customer are in Appendix D. Between September 16 - 26, approximately 4,297 m^3 was hauled from the North Battleford WWTP to land farmed by Dan Bartko, east of the WWTP on Russet Rd.

3.3 DISTANCE FROM WWTP TO SITES

Lystek's focus is on fertilizer program efficiency and delivering fertilizer to the farm customer when it is most beneficial for their program. Reducing hauling distance increases efficiency of the program and reduces greenhouse gas emissions. In 2024, the application site was adjacent to the WWTP, eliminating the need for hauling.

4 THE LYSTEK PRODUCT MANAGEMENT APPROACH

4.1 APPLICATION METHOD

All material was sub-surface injected using a tanker-mounted injection system. The benefits of subsurface injection are summarized in Figure 4-1. The injection equipment is designed to ensure all material is applied below the soil surface, causing minimal disturbance, reducing odours, improving optics and maximizing the nutrient value of the product.

Ammonia-nitrogen (NH_4-N) will be lost to the atmosphere if it is top-spread, therefore subsurface injection allows for higher retention of nitrogen, and greater value for the farmer. The application equipment is also able to apply the material evenly throughout the application area through a combination of hydraulics, pumping rate control and vehicle speed.

4.2 BEST MANAGEMENT PRACTISES

The Product Management staff at Lystek are all professionals with experience in nutrient management principles and a commitment to environmental stewardship. As such, in addition to ensuring that all LysteGro is subsurface injected rather than top spread, Lystek also employs additional voluntary best management practises (BMPs). These BMPs include setback guidelines from waterways and dwellings, minimum groundwater depth requirements, and refraining from applying any material to frozen or snow-covered soil. These BMPs are clearly communicated to all land application contractors that Lystek works with and monitored by Lystek staff oversight.

Lystek's full voluntary best management practises are included in Appendix E.

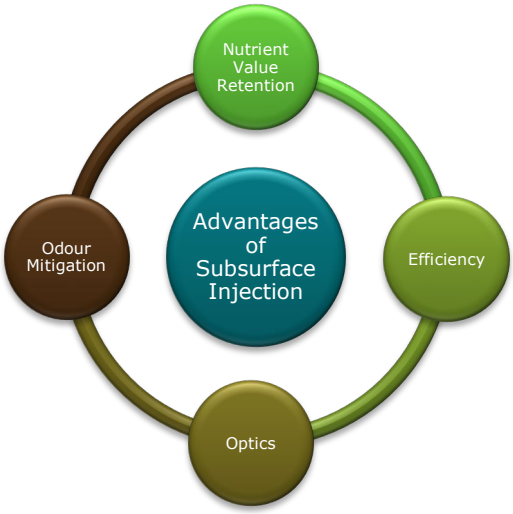


Figure 4-1. Advantages of Subsurface Injection.

4.3 PROFESSIONAL SERVICES

Lystek product management staff are certified crop advisors and/or professional agronomists committed to serving the needs of our agricultural customers, while practising environmental

stewardship. Along with ensuring regulatory compliance for the use of LysteGro and overseeing all hauling/land application activities, we are active in the Canadian agricultural and biosolids industries. We attended various tradeshows and begun a major research project in 2024, including:

- Conducting the LysteMize Livestock Waste Characterization Study with support from the Canadian Department of

Lystek also Co-organized the Water Environment Association of Ontario (WEAO) Residuals and Biosolids Field Tour. This seminar included a field demonstration of LysteGro application from Elora and Guelph. This event showcased the benefits of LysteGro Fertilizer as well as Best Management Practices associated with transportation, offloading, application of the material, use of cover crops and minimal-tillage practices to maximize nutrient retention and uptake. Participants had a chance to engage with a long-time LysteGro farming customer as well as our application partners. Representatives from the MECP and OMAFRA attended, answered various questions, and praised the LysteGro program as leaders and good stewards in the sector.

5 APPLICATION RATE DETERMINATION

Application rates for LysteGro fertilizer are based on several factors, including but not limited to soil characteristics and crop plans. LysteGro is used as a fertilizer, with the additional benefit of providing organic matter to the soil, so application is based primarily on nutrient concentration, while also accounting for metal additions to soils.

The City of North Battleford recycled:

- **25 tonnes of Nitrogen**
- **16 tonnes of P_2O_5**

to local farmland as a result of their LysteGro program in 2024.

5.1 NUTRIENT MANAGEMENT

Application rates of LysteGro fertilizer are primarily dependant upon crop nutrient requirements and pre-existing soil nutrient concentrations. The average application rate in 2024 was 4,000 imp gal/ac.

Land used for cash cropping with limited addition of organic amendments (manure, compost, biosolids, etc) will often see a depletion in P, K and organic matter. In addition, depending on parent material and soil characteristics, secondary and micronutrients can also be deficient in soils that are intensively cropped. Farmers often apply large amounts of P and K fertilizers to overcome deficiencies in the current crop year as well as build up the supply of P and K in the soil for future years. LysteGro applied at the appropriate rates to fields will provide adequate nutrition for the next crop, while also increasing concentrations of organic matter, macro and micronutrients, providing multi-year value to the customer.

5.2 HEAVY METALS

Heavy metals generally refer to the 11 regulated metals which are monitored for their inputs to agricultural soils. The addition of heavy metals to the soil through fertilizers and amendments is regulated under the federal ***Fertilizers Act***. LysteGro is a fertilizer regulated

by the CFIA, and therefore falls under the *Fertilizers Act*. The federal *Fertilizers Act* limits metal addition to soils by assigning maximum annual application rates based on metal concentrations of the fertilizer. Therefore, the metal concentrations also play a role in determining the application rate for LysteGro. Maximum annual application rate for North Battleford LysteGro for CFIA based on 2024 analysis was 4,371 imp gal/ac. This application rate is based on the nutrient which is closest to its 45-year maximum addition to soils based on annual applications (Copper). A table describing the maximum annual application rates is available in Appendix G.

The maximum application rate of North Battleford LysteGro applied to land in 2024 was 4,093.04 imp gal/ac. In addition, LysteGro application is rotated each year to ensure that the same piece of land does not receive LysteGro in subsequent years meaning the 2024 application rate is far below the 45-year addition referenced application rate. Field rotation is not a regulatory requirement but is in line with best practises for the industry.

6 SUMMARY

The 2024 application season was successful, as the North Battleford LysteGro was applied responsibly as a fertilizer. The Lystek application program managed 4,297 m^3 of product and was completed as a fertilizer program, based on agronomics and best management practices.

To date, the City of North Battleford has produced 47,640 m^3 of LysteGro fertilizer from its biosolids. We look forward to continuing to work in partnership with the City to divert valuable nutrients from landfill and return them back to the soil in an environmentally responsible manner as part of a circular economy.

APPENDICES

APPENDIX A

CFIA Fertilizer Label

LYSTEGRO 3-3-3

Guaranteed minimum analysis (dry weight basis)		**Analyse minimale garantie**	
Total nitrogen (N)	3%	Azote total (N)	3%
Available phosphoric acid (P_2O_5)	3%	Acide phosphorique assimilable (P_2O_5)	3%
Total phosphoric acid 3%		Acide phosphorique total 3%	
Soluble potash (K_2O)	3%	Potasse soluble (K_2O)	3%
Organic Matter	45%	Matière organique	45%
Maximum Moisture	92%	Humidité maximale	92%

Active ingredient derived from municipal biosolids.

Lot #:1-2024
Net Weight: 40,000 kg

Manufactured By:
The City of North Battleford Wastewater Treatment Plant
1 Canola Avenue
North Battleford, SK, S9A 2Y6

Directions for use: Maximum annual application rates for LysteGro fertilizer should not exceed 4 dry tonnes per hectare.

User should seek the advice of a county agricultural representative or professional agricultural consultant. This product should be used based on soil and/or tissue analysis and incorporated following application.

Not to be applied to land during the production of ready-to-eat crops that may come in contact with the soil. When applied to pastureland, do not allow animals to graze for at least one month from the date of application. When applied to land on which forage crops are grown, do not harvest crop for at least one month from the date of application.

Keep out of reach of children
Read label before use.

Protective eyewear and gloves recommended.
If on skin: wash with water and soap.
If in eyes: flush with water thoroughly. If irritation persists, seek medical advice.

Matières actives dérivées des biosolides municipaux.

No. de lot: 1-2024
Poids net: 40,000 kg

Fabriqué par:
The City of North Battleford Wastewater Treatment Plant
1, Canola Avenure
North Battleford (Saskatchewan), S9A 2Y6

Mode d'emploi: La dose maximale annuelle d'application d'engrais de LysteGro ne devrait pas dépasser 4 tonnes sèches par hectare.

L'utilisateur devrait demander conseil à un représentant agricole du compté ou un consultant agricole professionnel. Ce produit devrait être utilisé basé sur une analyse de sol et/ou de tissus et incorporé suivant l'application.

Ne pas appliquer à la terre pendant la production de cultures prêtes à manger qui peuvent entrer en contact avec le sol. Lorsque appliqué sur les pâturages, ne pas laisser les animaux paître pendant au moins un mois à partir de la date d'application. Lorsque appliqué sur les terres fourragères, ne pas récolter de cultures pendant au moins un mois à partir de la date d'application.

Tenir hors de la portée des enfants.
Lire l'étiquette avant d'utiliser.

Il est conseillé de porter des lunettes et des gants de protection.
En cas de contact avec la peau : Laver avec de l'eau et du savon.
En cas de contact avec les yeux : Rincer à fond avec de l'eau. Si l'irritation persiste, consultez un médecin.

APPENDIX B

Fertilizer Composition

North Battleford Wastewater Treatment Facility
1 Canola Ave, North Battleford, SK S0M 0E0

LysteGro Biofertilizer

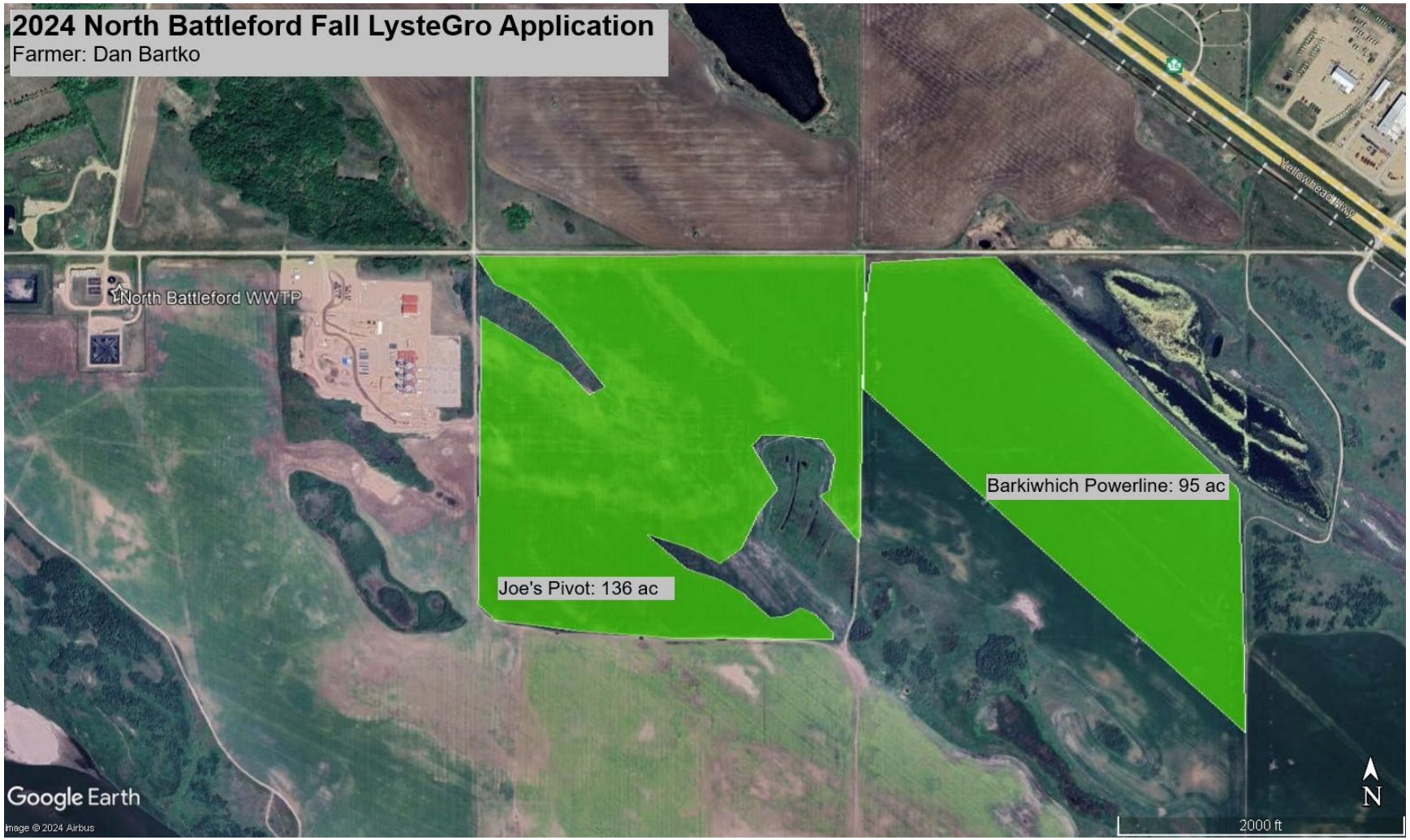
LysteGro Fertilizer Composition

	LysteGro Average[a]	Units
Organic Matter Content	4.88	% on a wet weight basis
Total Organic Carbon	2.84	% on a wet weight basis
Total Nutrient Content		
Total Nitrogen (TKN)	6.81	% on a dry weight basis
Total Available Nitrogen (Ammonium + Nitr	0.13	% on a dry weight basis
Total Phosphorus (P_2O_5)	4.29	% on a dry weight basis
Total Potassium (K_2O)	6.06	% on a dry weight basis
Metals Regulated by Fertilizers Act		
Arsenic	3.12	mg/kg
Cadmium	0.49	mg/kg
Cobalt	2.45	mg/kg
Chromium	12.80	mg/kg
Copper	763	mg/kg
Mercury	0.31	mg/kg
Molybdenum	7.23	mg/kg
Nickel	12.92	mg/kg
Lead	10.09	mg/kg
Selenium	4.52	mg/kg
Zinc	256	mg/kg
Relevant Micronutrients		
Calcium	12.9	lbs/1,000 gallons
Copper	0.66	lbs/1,000 gallons
Iron	5.75	lbs/1,000 gallons
Magnesium	6.76	lbs/1,000 gallons
Manganese	0.26	lbs/1,000 gallons
Sulphur	6.46	lbs/1,000 gallons
Zinc	0.22	lbs/1,000 gallons
Total and Available Nutrients (during 1st growing season) - Imperial		
Total Nitrogen	58.99	lbs/1,000 gallons
Total Available Nitrogen[b]	24.29	lbs/1,000 gallons
Total Phosphorus (P_2O_5)[c]	37.18	lbs/1,000 gallons
Total Potassium (K_2O)	52.55	lbs/1,000 gallons
Total Available Potassium (K_2O)[d]	47.29	lbs/1,000 gallons
Pathogens		
Fecal Coliform	<2.0[e]	MPN/g(ml)
Salmonella spp	Absent[e]	P-A/25g(ml)

[a] Values represent the mean of 12 samples collected monthly from January - December 2024
[b] Ammonium + Nitrate + assume 40% mineralization of Organic N during first growing season
[c] Assume 40 % availability of Phosphorus during first growing season
[d] Assume 90% availability of Potassium during first growing season
[e] Results were consistent for all sampling events
BDL - Below Detectable Limit

APPENDIX C

Maps of Land Application Sites


2024 North Battleford Fall LysteGro Application
Farmer: Dan Bartko
North Battleford WWTP
Joe's Pivot: 136 ac
Barkiwhich Powerline: 95 ac
Yellowhead Hwy
Google Earth
Image © 2024 Airbus
N
2000 ft

APPENDIX D

Bills of Sale for Fertilizer sold to Farmers

APPENDIX E

Photos of Land Application

APPENDIX F

Lystek Best Management Practices

LysteGro – Application and Setback Guidelines

Application Method

LysteGro must be **sub-surface injected.**

> Sub-surface injection is defined as the placement of nutrients to 10 – 30 cm below the soil surface in the crop root zone using equipment specifically designed for that purpose, when the applied material is retained by the soil.
>
> Surface application is to be only used as an application method by the approval of a Lystek staff agronomist and must be incorporated within 12 hours.

Application – Ground Condition

LysteGro cannot be applied to Frozen or Snow-covered soil.

> "Frozen", when used in reference to soil, means that a layer of soil with an average minimum depth of five centimetres, located within the top 15 centimetres of the soil, is consolidated by the presence of frozen moisture;
>
> "snow-covered", when used in reference to soil, means that there is a layer of snow with an average minimum depth of five centimetres.

Depth to Groundwater

There must be at least 30 cm of unsaturated soil at the surface of the land at the time of application.

Depth to Bedrock

There must be at least 1 m separation distance from ground surface to bedrock.

Set-backs

- **100 m** from municipal wells for all applied nutrients
  - 30 m from any other well
- No application is permitted within **25 m** of a dwelling

Last Updated: May 2023
Updated By: Simon Meulendyk

- No application is permitted within **50 m** of a residential area or commercial, community or institutional use.
- **3 to 20 m** from the bank of surface water (as defined by the Nutrient Management Act, 2002). This setback depends on a number of factors such as the slope near the watercourse and whether there is a presence of a vegetated buffer strip along water body. i.e. If no buffer strip, a setback on the higher end (**20 m**) will be the course of action.

For LysteGro application, the following setbacks are to be adhered to:

- **100 m** distance buffer from municipal wells
- **30 m** distance buffer for all other wells
- **50 m** distance buffer from residential, commercial, community or institutional areas
- **25 m** distance buffer from house dwellings
- For surface water without a vegetated buffer strip, a **20 m** distance buffer from top of bank will be used
- For surface water with a vegetated buffer strip a **10 m** distance buffer from top of bank will be used

Note: This document is a summary of Guidelines which all companies applying LysteGro originating from the Southgate Organic Materials Recovery Centre or other Lystek managed programs as an agricultural fertilizer must adhere to, unless otherwise approved by a qualified Lystek representative. The above noted criteria are Guidelines voluntarily enforced by Lystek International Corp. and Lystek International Corp. as Best Management Practices.

I, _____ have read and understood this document and will adhere to the practices described herein related to my work on behalf of Lystek International Corp. Should I have any questions about them, I will inquire with a Lystek representative.

Date: _____ Signature: _____

Last Updated: May 2023
Updated By: Simon Meulendyk

APPENDIX G

Heavy Metal Application to Soils

North Battleford LysteGro Fertilizer Heavy Metal Analysis and Maximum Application Rates

Heavy Metals	LysteGro Average (mg/kg)a	Maximum Acceptable Product Metal Concentration based on Annual Application rates (mg metal/kg product) 500 kg/ha/yr[b]	Maximum Acceptable Application Rate Based on Average Metal Concentrations (dry kg/ha/year)
Arsenic	3.12	666	106,845
Cadmium	0.49	177	180,306
Cobalt	2.45	9,333	1,904,694
Chromium	12.80	1,333	52,070
Copper	762.50	6,666	4,371
Mercury	0.31	44	71,351
Molybdenum	7.23	177	12,249
Nickel	12.92	1,600	61,935
Lead	10.09	4,444	220,182
Selenium	4.52	124	13,727
Zinc	255.83	16,444	32,138

[a] Values represent the mean of 12 samples collected from January - December, 2024

[b] As per T-4-93 of the *Fertilizers Act* under the *CFIA*

City of North Battleford
Wastewater Treatment Plant
2024 Report
Appendix F: Glossary

Glossary

Ammonia – Ammonia as N (NH_3-N) – Ammonia as N is an inorganic, dissolved form of nitrogen that can be found in water and is the preferred form for algae and plant growth. The term ammonia refers to two chemical species which are in equilibrium in water. They are NH_4^+ (ionized) and NH_3 (un-ionized). Tests for ammonia usually measure total ammonia.

Biosolids – also knows as sewage sludge, is a solid, semi-solid, or liquid residue generated during treatment of domestic sewage in a treatment works. It consists mainly of water (90 to 99%) and settleable solids. The solids are mostly organics that are removed during primary, secondary or advanced wastewater treatment processes.

BOD – Biochemical Oxygen Demand is the amount of dissolved oxygen needed by aerobic organisms in water to break down organic material present.

BTEX – Benzene, Toluene, Ethylbenzene, and Xylene are volatile organic compounds typically found in petroleum products such as gasoline and diesel.

CBOD – Carbonaceous Biochemical Demand measures the amount of oxygen consumed by living organisms (bacteria) in decomposing the organic waste.

EC – is a measure of water's ability to conduct electricity, the higher the concentration of dissolved ions, the higher the conductivity. It is most often measured in µS/cm – microSiemens per centimetre.

E. coli – is the only member of the total coliform group of bacteria that is found only in the intestines of mammals. The presence of E. coli in water indicates recent fecal contamination and may indicate the possible presence of disease-causing pathogens

MAC - Maximum Acceptable Limit and is health based

mg/l – milligrams per litre

NTU – Nephelometric Turbidity Unit is based on the amount of light that is scattered by particles

Pathogen – is a disease causing microorganism such as a virus or bacterium.

pH – is a measure of how acidic or basic a solution is. It ranges from 0 to 14. A pH of 7 is neutral. A pH less than 7 is acidic while a pH greater than 7 is basic.

S.E. – Saskatchewan Ministry of the Environment is the department that oversees solid waste disposal

SWSA – The Saskatchewan Water Security Agency was created on October 1, 2012. The former Saskatchewan Watershed Authority is now part of this new provincial water organization. This agency regulates and monitors waterworks and wastewater works.

THMs – Trihalomethanes are disinfection by-products that form when chlorine is added to water that contains natural organic matter.

TKN – Total Kjedahl nitrogen is the sum of organic nitrogen, ammonia, and ammonium.

Total Coliforms – are a group of bacteria commonly found in the environment. They are not likely to cause illness, but their presence indicates the water supply may be vulnerable to contamination by more harmful microorganisms.

Total P – Total Phosphorus is a measure of all the forms of phosphorus in a sample

TSS – Total Suspended Solids includes all particles suspended in water which will not pass through a filter.

Turbidity – is a measure of relative clarity of a liquid. Guidelines for turbidity are a safeguard against pathogens in drinking water.

Un-ionized Ammonia – NH_3 is the un-ionized form of ammonia. It is the toxic form of ammonia. In general, the un-ionized ammonia is highly toxic to fish and other aquatic life. Toxicity increases as pH and temperature increase.

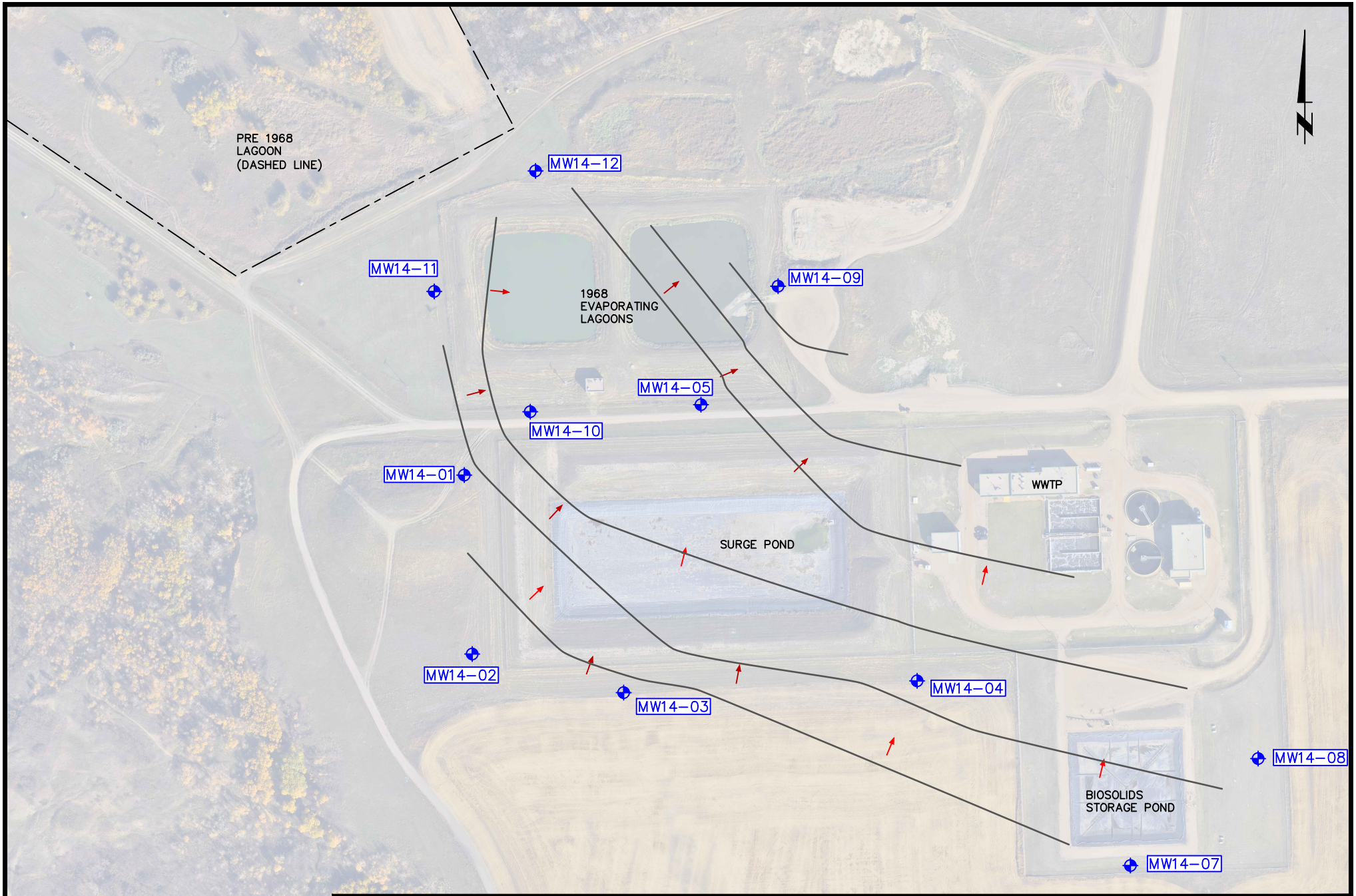
VSS – Volatile Suspended Solids is the portion of Total Suspended Solids that can be ignited and is made up of organic material.

WMF – Waste Management Facility

WSA – The Water Security Agency was created on October 1, 2012. The former Saskatchewan Watershed Authority is now part of this new provincial water organization.

WWTP – Wastewater Treatment Plant

City of North Battleford
Wastewater Treatment Plant
2024 Report
Figure 1: Water Table Level and Flow



North Battleford

Treaty Six Territory | Heartland of the Métis | Saskatchewan | Canada

WWTP

DATE REVISED	BY

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THT	03-19-2025	NTS	1 / 1

CHECKED BY:

JOB NO.:

PROJECT:

GROUNDWATER ELEVATION AND FLOW