



June 19, 2024

DISTRICT OF MACKENZIE WATER SYSTEM ANNUAL REPORT - 2023

Client: District of Mackenzie

L&M Project No.: 1044-67

L&M ENGINEERING LIMITED

1210 Fourth Avenue, Prince George, BC V2L 3J4

Phone: (250) 562-1977

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1 INTRODUCTION

The District of Mackenzie (“The District”) operates three separate water distribution systems (Town, Airport, & Gantahaz) which are permitted by the Northern Health Authority (NHA). This 2023 Water System Annual Report has been prepared on behalf of the District as part of the District’s Water System Operating Permit conditions. This report summarizes the following for each of the systems:

- Water System Infrastructure;
- Operation and maintenance activities;
- Water quality monitoring; and
- Recently completed and upcoming capital initiatives.

To maintain compliance with the Drinking Water Protection Act, this annual report must be made available to the water system users within 6 months of the end of the calendar year.

Please refer to Appendix E for the operating permits for each water system and for questions please contact Jim Fast, Lead Operator, for the District at 250-997-3761 or at utilities@districtofmackenzie.ca.

2 COMMUNITY PROFILE

2.1 *Community*

Mackenzie sits in the Rocky Mountain Trench with the Omineca Mountain Range and Williston Lake to the west and the Rocky Mountains to the east. It is approximately 180 km, by road, northwest of Prince George at 55 N 18' north latitude and 123 N 8' west longitude. Mackenzie is within the traditional territory of the Sekani People and the Town was established in 1966 after the completion of the W.A.C. Bennet Dam and the creation of the Williston Reservoir. Mackenzie is located on glacial soil mostly composed of sand and gravel that is relatively infertile and therefore has no commercial farming using the town’s water.

2.2 Population

Mackenzie is a town dependent on resource industries and as such the population fluctuates based on commodity market conditions. The District of Mackenzie is working hard to diversify its economy to ensure it can weather downturns in the resource industries. As shown in Table 1: Mackenzie Population Summary the population of Mackenzie has stabilized since the dramatic downturn of the local economy that happened in 2009 and the resulting population decrease. Based on information from the District the population has remained unchanged since the last census in 2021. Currently, the population of the community is projected to remain relatively constant with a net population increase of four percent between 2011 and 2036.

Table 1: Mackenzie Population Summary

| Year | Total Population | Total Connections | Townsite Population | Townsite Connections | Gantahaz Population | Gantahaz Connections |
|------|------------------|-------------------|---------------------|----------------------|---------------------|----------------------|
| 2011 | 3507 | 1513 | 3257 | 1429 | 250 | 84 |
| 2012 | 3548 | 1532 | 3295 | 1447 | 253 | 85 |
| 2013 | 3590 | 1552 | 3334 | 1466 | 256 | 86 |
| 2014 | 3631 | 1571 | 3372 | 1484 | 259 | 87 |
| 2015 | 3673 | 1591 | 3411 | 1502 | 262 | 88 |
| 2016 | 3714 | 1610 | 3449 | 1521 | 265 | 89 |
| 2017 | 3714 | 1610 | 3449 | 1521 | 265 | 89 |
| 2018 | 3714 | 1610 | 3449 | 1521 | 265 | 89 |
| 2019 | 3714 | 1610 | 3449 | 1521 | 265 | 89 |
| 2020 | 3714 | 1610 | 3449 | 1521 | 265 | 89 |
| 2021 | 3281 | 1610 | 3449 | 1521 | 265 | 89 |
| 2021 | 3281 | 1610 | 3449 | 1521 | 265 | 89 |
| 2022 | 3281 | 1610 | 3449 | 1521 | 265 | 89 |

Notes:

 Census Data

2.3 Climate

Mackenzie has cold winters and warm summers with a substantial significant number of days without rain as shown in Table 2: Mackenzie Climate Summary below. In the winter there is generally snow cover from November until April each year. There is consistent precipitation throughout the whole year, however, in the summer the rainfall often comes

in short heavy rains. On the Environment Canada website, the Precipitation Data from March to June 2022 looks to be missing but not flagged.

Table 2: Mackenzie Climate Summary

| | Average Maximum Temperature (°C) | | Precipitation (mm) | | Maximum Summer Temperature (°C) | Summer Days Without Rain |
|-------------------------|----------------------------------|-----------|--------------------|-----------|---------------------------------|--------------------------|
| | May - Oct | Nov - Apr | May - Oct | Nov - Apr | | |
| 2011 | 16.1 | -1.1 | 368 | 187 | 28.4 | 42 |
| 2012 | 17.0 | -0.5 | 227 | 141 | 30.6 | 54 |
| 2013 | 18.8 | -0.2 | 277 | 194 | 31.8 | 56 |
| 2014 | 18.8 | -1.6 | 279 | 202 | 34.2 | 64 |
| 2015¹ | 18.2 | 1.0 | 101 | 148 | 31.5 | 78 |
| 2016¹ | 17.4 | 1.7 | 186 | 78 | 28.5 | 73 |
| 2017 | 18.1 | -2.1 | 288 | 135 | 32 | 70 |
| 2018¹ | 17.8 | -1.0 | 141 | 51 | 33.4 | 70 |
| 2019 | 16.5 | -0.3 | 305 | 180 | 27.8 | 48 |
| 2020¹ | 16.5 | 0.0 | 393 | 143 | 29.7 | 40 |
| 2021 | 18 | -1.1 | 257 | 335 | 38.7 | 58 |
| 2022¹ | 19.0 | -2.0 | 74.4 | 77.9 | 28.4 | 91 |
| 2023 | 20.2 | 1.6 | 30.1 | 56.1 | 32.7 | 69 |

Notes:

Source: Environment Canada Historical Climate Data

(https://climate.weather.gc.ca/climate_data/daily_data_e.html?StationID=48370)

¹ Missing Precipitation Data

3 MACKENZIE WATER SYSTEM OVERVIEW

3.1 Town Water System

The District of Mackenzie currently obtains its drinking water from three relatively shallow wells west of the townsite adjacent to Morfee Lake.

- Well # 1 & # 5 are located in Pumphouse # 1, at First Beach.
- Well # 4 located in Pumphouse #2, at Second Beach

Table 3: Town Water System Well Identification Numbers

| Well # | WIN | Pumphouse |
|--------|-------|-----------|
| 1 | 28314 | 1 |
| 5 | 20900 | 1 |
| 4 | 28315 | 2 |

Note, due to age and underperformance, Well #2, referenced in past reports was replaced in July 2018 with a new drilled well (Well #5). Well #5 that has a capacity of 70 L/s.



Figure 1: Town Reservoir & Booster Station

Water is pumped from pumphouses 1 & 2 into a 500,000 lgal above grade concrete reservoir. A booster station then pumps the water throughout the distribution system. The Town booster station has three electric booster pumps and an emergency diesel fire pump.

Booster pumps turn on and off as necessary to maintain pressure in the distribution system. Boosting the pressure is required as the reservoir is too low to provide sufficient pressure to the network. The fire pump operates when there is insufficient system pressure to fight a fire and can be started with a cell phone or manually by the Fire Department or by Public Works.

The Town distribution system is approximately divided between asbestos cement (AC) pipe in the older, eastern portion of the network, and newer polyvinyl chloride (PVC) pipe in the western, newer portion of the network. There are five pressure-reducing valve (PRV) stations that divide the Town distribution system into six pressure zones which ensure that pressures are within acceptable ranges throughout the distribution system. For reference, a copy of the water system map for the townsite is attached in Appendix D.

In 1998 a Water System Study was performed by L&M Engineering Limited that examined water system flows and pressure throughout the distribution network. The study also reviewed the recommended and available fire flows. The conclusions and recommendations are based on the Insurance Bureau of Canada Guidelines, however, there are no government regulations requiring any given volume of storage and the District can decide based on financial and other considerations.

The significant conclusions of the study were as follows:

- The existing booster station is capable of meeting existing and projected future demands without upgrading the capacity of the pumps.
- Like many towns the District's fire water storage capacity was identified by previous reporting as being 2,660,000 lgal (12,103,000 L) below the amount recommended by the Insurance Bureau of Canada ("IBC"); and
- With the future addition of a new reservoir, the District's distribution system can supply all the firefighting demands in accordance with the Insurance Bureau of Canada guidelines with the sole exception of a fire at the Pinedale Apartments.

The recommendations of the study were as follows:

- The District should construct a new reservoir to provide additional storage volume. The final location will be confirmed during the design process based on current needs and anticipated future demands. The minimum size of the reservoir should be 1,000,000 lgal (4,540,000 L) although as stated in the conclusions a larger size of 2,660,000 lgal is desirable;

- The District should consider a pipe cleaning program of all distribution pipes to increase pipe smoothness areas of reduced flow

Improvements are planned for the Town water system in summer 2024 as follows:

- Six Hydrants are to be rebuilt.
- One Hydrant to be replaced.
- Continued cross connection awareness and remediation.
- Reservoir cleaning
- Ongoing training.

3.2 *Gantahaz Water System*

Water for Gantahaz residents is supplied from two deep low-capacity wells positioned in a confined aquifer with pitless adapter connections.

- Well #1 is located on Columbia Drive next to the storage reservoir
- Well #4 is located on Alberta Drive

Table: Gantahaz Water System, Well Identification Numbers.

| Well # | WIN |
|--------|-------|
| 1 | 21376 |
| 4 | 21356 |

Both wells pump water to a 1,350 m³ (300,000 lgal) storage reservoir next to Well #1 on Columbia Drive. This reservoir is an above-ground, insulated, metal structure.

The Gantahaz water distribution network is pressurized by a booster station located on Columbia Drive next to the storage reservoir and Well #1. The booster station has an electric booster pump with a spare pump and motor located in the building for maintenance purposes. The booster pump increases the water pressure level to approximately 55 psi and services all 90 residences (approximately 265 people).

An emergency natural gas fire pump is available to supplement system pressures during a fire flow event. The fire pump can be started with a cell phone or manually by the Fire Department or by Public Works. The booster station is also equipped with a portable,

manually operated gas-powered generator that can be used to power the station in a power outage.

Booster station controls, variable frequency drives, and other building envelope improvements were completed in 2019.



Figure 2: Gantahaz Booster Station and Reservoir

The Gantahaz distribution system is composed of primarily PVC pipes. For reference, we have enclosed a copy of the water system map for the Gantahaz subdivision in Appendix D.

Improvements are planned for the Gantahaz water system in 2024 as follows:

- New Water Treatment Plant
- Hydrant rebuild and maintenance.
- Continued cross connection awareness and remediation.
- Ongoing training.

3.3 Airport Water System

The Airport system consists of one well, an open water reservoir, and a fire pump. The primary purpose of the airport system is to provide water for firefighting purposes for several industrial sites in the area, however, the airport system also supplies six structures.

In the summer of 2021 a new well and well pump along with associated equipment and controls were installed to service the fire lagoon. The new well is located near the pump house and the pump house has a wet well that is interconnected to the reservoir, so they are both at the same water level. The fire water reservoir is located adjacent to the pump house and is surrounded by a fence.

The fire suppression reservoir now fills automatically based on the water level of the wet well. Inside the pump house there is an electric jockey pump and in the event of a fire a diesel fire pump operates automatically.

4 TREATMENT & DISINFECTION

4.1 Town Water System

The Town water system supply wells are positioned within Aquifer 431 which is categorized as an unconfined sand and gravel aquifer. Source protection plans completed by Kala Geoscience Ltd. in 2015 found that Town Wells #1 and #4 are not under the direct influence of surface water (non-GWUDI). Furthermore, the Well # 5 Drilling and Completion report completed by Western Water Associates Ltd. in 2018 found that Well # 5 was not under the direct influence of surface water (non-GWUDI) nor groundwater at risk of containing pathogens (non-GARP) Seasonal water level fluctuations are not expected to impact the well yields unless there is a very prolonged drought in the region.

The water quality of the Town water supply wells meets all Northern Health health-based objectives and therefore does not require treatment or disinfection but does require long-term water quality monitoring, the results of which are shown in Section 7.

4.2 *Gantahaz Water System*

The Gantahaz water system supply wells are positioned in a deep confined aquifer and are considered not groundwater under direct influence (GWUDI) and not groundwater at risk of pathogens (GARP). Historically, aquifer water quality results have complied with all Northern Health's health-based objectives. However, in 2019 a new maximum allowable concentration of manganese was implemented by Northern Health.

However, over the past several years the levels of iron and manganese in the source water have fluctuated, with the total metal analysis showing the presence of iron ranging from 0.030 to 1.47 mg/L (aesthetic objective: 0.3 mg/L) and manganese ranging from 0.005 to 0.145 mg/L (maximum allowable concentration: 0.12 mg/L and aesthetic objective: 0.02 mg/L).

Testing completed in 2021 throughout the distribution network has indicated the accumulation of manganese in the network is causing significant but inconsistent exceedances of the MAC for manganese.

Based on the monitoring performed in 2021 and the new MAC for manganese, treatment of this water supply will be necessary in the future to reduce source levels and mitigate accumulation in the water network.

The District should monitor the concentrations and develop a plan to decrease concentrations. These plans could be as simple as more frequent flushing or implementing some of the recommendations from the study that the District of Mackenzie engaged L&M Engineering and Conestoga Rover Associates to undertake in 2008. The study researched the following concerns:

- Mitigate the residents' request for improved quality of water;
- Provide a water treatment system that is simple to operate by the householder;
- Provide a water treatment system that is "eco-friendly" and does not introduce chemicals into the environment; and
- Minimize the potential for future maintenance cost expenditures by the District of Mackenzie.

The conclusion of the study was that a new water treatment plant is required to reduce the levels of iron and manganese at that time to acceptable levels. The District has selected a

Design-Build Contractor to design and construct a new water treatment plant with an anticipated operational date of December 2024.

5 WATER SYSTEM OPERATION & MAINTENANCE

The District's water system was upgraded from a Class II to a Class III distribution system in April 2018. The District employs one Class II distribution system operator, Jim Fast, Class 2 ECOP number 8864, and Mark Turnbull, trainee operator. Jim Fast is in the process of obtaining a sufficient number of direct responsible charge (DRC) credits to take the Environmental Operators Certification Program (EOCP) Class III Distribution course.

Regular inspections, maintenance, and water quality testing are performed by the system operators to ensure optimal operation of the District's water system. Operation and maintenance of the water system involve several daily, weekly, periodic, and/or 'as-needed' tasks.

Daily tasks performed in 2023 include:

- Record well pump run times at each well;
- Record flow meter totalizer and flow; and
- Inspect the well and booster station pumps to ensure normal operation.

Weekly tasks performed in 2023 include:

- Inspect pressure-reducing valves; and
- Clean water system buildings.

Monthly tasks performed in 2023 include:

- Check static water levels in wells; and
- Inspect backup motors and run motors for 60 minutes.

Periodic, or "as-needed" tasks include:

- Troubleshoot minor electrical and mechanical equipment problems;
- Check propane heaters and propane tanks (winter);
- Record the time and nature of any alarms received on the water system and take appropriate action;
- Flush and clean the water mains (twice annually); and
- Exercise control valves, isolation valves, hydrants, and related appurtenances (annually).

- Water quality is discussed in Section 7.

6 WATER CONSUMPTION - 2023

6.1 Town Water System

The total water distributed to the Town distribution system in 2023 was 627,853 m³. Table 4: Town Water System Consumption shows the monthly water consumption for the Town Water system. The average daily flow and average daily per/capita flow for 2023 was 1,719 m³/day and 499 L/day/person respectively. The average daily flow in 2023 was slightly higher than 2022, 2021, 2020, 2019 and 2018 which were 1,617 m³/day 1,513 m³/day 1,432 m³/day, 1,483 m³/day, and 1,580 m³/day respectively.

Table 4: Town Water System Consumption

| Month | Total Monthly Flow (m ³) | Average Daily Flow (L/s) |
|-----------|--------------------------------------|--------------------------|
| January | 55110.1 | 20.58 |
| February | 51124.1 | 21.14 |
| March | 61084.6 | 22.81 |
| April | 43149.0 | 16.65 |
| May | 45826.6 | 17.11 |
| June | 43706.3 | 16.86 |
| July | 50271.9 | 18.77 |
| August | 53260.3 | 19.89 |
| September | 38730.3 | 14.94 |
| October | 43358.2 | 16.19 |
| November | 41292.6 | 15.93 |
| December | 63235.4 | 23.61 |

6.2 Gantahaz Water System

The total water distributed to the Gantahaz distribution system 2023 was 45,823 m³. Table 5: Gantahaz Water System Consumption shows the monthly water consumption for the Gantahaz system. The average daily flow and average daily per/capita flow for 2023 was 125 m³/day and 474 L/day/person respectively. The average daily flow in 2023 was significantly higher than 2022, 2021, 2020, 2019, and 2018 which were 104 m³/day, 119 m³/day, 71 m³/day, 87 m³/day, and 90 m³/day respectively.

Table 5: Gantahaz Water System Consumption

| Month | Total Monthly Flow (m ³) | Average Daily Flow (L/s) |
|-----------|--------------------------------------|--------------------------|
| January | 2663.2 | 0.99 |
| February | 2208.3 | 0.91 |
| March | 1384.1 | 0.52 |
| April | 4790.3 | 1.85 |
| May | 6019.5 | 2.25 |
| June | 8992.5 | 3.47 |
| July | 6337.2 | 2.37 |
| August | 5511.8 | 2.06 |
| September | 2645.5 | 1.02 |
| October | 1842.9 | 0.69 |
| November | 1627.3 | 0.63 |
| December | 1800.5 | 0.67 |

6.3 Airport Water System

There are no flow records available for the Airport system. Since this system is mainly providing firefighting water, with only six service connections, the water consumption is expected to be low.

7 WATER QUALITY MONITORING

In order to ensure continued high standards of drinking water quality and delivery for the District of Mackenzie, the District sends water samples to ALS Analytical Services for bacteriological and chemical testing. The District's sampling program has been designed to meet the requirements of the Water System Operation permits and the Drinking Water Protection Regulation.

7.1 Chemical Testing Requirements:

The District's Operating Permits require the submittal of water chemistry data annually to Northern health for the Town system, every three years for the Gantahaz system, and every five years for the Airport system. Annual chemical water quality results are assessed to ensure compliance with the Guidelines for Canadian Drinking Water Quality (GCDWQ) published by Health Canada. Additional Testing has been performed to determine where elevated metals are occurring.

7.2 Bacteriological Testing Requirements:

The District’s Operating Permits require the submittal of a minimum of five water bacteriological samples per month for the Town system, two bacteriological samples per month for the Gantahaz system, and one bacteriological sample per month for the Airport System. The Drinking Water Protection Regulation (DWPR) requires that water suppliers monitor for total coliform bacteria and Escherichia coli at a certified lab. This testing is used to monitor the distribution system, and not notify users of potential issues.

The standards for water quality are set out in Schedule A of the DWPR as follows:

Table 6: DWPR Water Quality Standards

| Parameter | Standard |
|---|--|
| Fecal coliform bacteria | No detectable fecal coliform bacteria per 100 ml |
| Escherichia coli | No detectable Escherichia coli per 100 ml |
| Total coliform bacteria | |
| (a) 1 sample in a 30 day period | No detectable total coliform bacteria per 100 ml |
| (b) more than 1 sample in a 30 day period | At least 90% of samples have no detectable total coliform bacteria per 100 ml and no sample has more than 10 total coliform bacterial per 100 ml |

The water sampling parameters, locations, and frequency for the District’s water system are shown in Table 7: Water Sampling Parameters, Locations, and Frequency. All samples are sent to an accredited laboratory (ALS Analytical Services). This sampling program meets the requirements outlined in the District’s Water System Operating Permits.

Table 7: Water Sampling Parameters, Locations, and Frequency

| Parameter | Frequency | Locations | Comments |
|--------------------------------------|------------------------------|--|------------------------------|
| Town System | | | |
| Escherichia coli, Total Coliforms | Minimum five per month | <ul style="list-style-type: none"> Mackenzie Hospital Pumphouse #1 (Well #1 & #5) Pumphouse #2 (Well #4) Public works office Town Booster Station Northwest Quadrant (Munro Crescent, Blackwater Crescent, Crooked River Crescent) Southeast Quadrant (Pine Crescent, Parsnip Crescent) | Sample locations are rotated |

| | | | |
|-----------------------------------|--------------------------------|---|---------------------------------------|
| Comprehensive Drinking Water Test | Minimum Annually | Town booster station, and various locations throughout the town system. | Including total and dissolved metals. |
| Gantahaz System | | | |
| Escherichia coli, Total Coliforms | Minimum twice per month | <ul style="list-style-type: none"> • Gantahaz booster station • Gantahaz Well #4 • Gantahaz Well # 1. • Distribution System (including Columbia Drive, Manitoba Drive, Yukon Drive, and Saskatchewan Drive) | Sample locations are rotated |
| Comprehensive Drinking Water Test | Minimum Once every three years | Gantahaz booster station, Well #1, Well #4, and various locations throughout the Gantahaz subdivision. | Including total and dissolved metals. |
| Airport System | | | |
| Escherichia coli, Total Coliforms | Monthly | Airport | |
| Comprehensive Drinking Water Test | Once every five years | Airport | Including total and dissolved metals. |

8 WATER QUALITY RESULTS

Water samples were sent to ALS Analytical Services for bacteriological and water chemistry laboratory testing. A complete set of lab results can be found on Northern Health’s website: https://www.healthspace.ca/Clients/NHA/NHA_Website.nsf.

Based on the chemistry sampling that was completed, the majority of water samples conformed to the GCDWQ, and overall the groundwater quality is very good which is why the systems are being operated without treatment/disinfection. Please note that Northern Health recommends the following caveat for all water systems:

No water supply is 100 percent safe, and sudden water quality failures can take hours or even days to identify and communicate to the entire community. People who have HIV/AIDs, are undergoing chemotherapy, or have compromised immune systems are advised to consider boiling their water or installing an in-home drinking water treatment device capable of reducing their risk of illness. For additional info, please refer to the

following: <https://www.healthlinkbc.ca/healthlinkbc-files/preventing-water-borne-infection>.

With regards to the 2023 water quality testing summarized below, there are a few parameters that exceed the guidelines or exceeded the guidelines in previous years. The parameters that were above the guidelines or were above the guidelines in previous years are the following:

Table 8: Parameters Exceeding Guidelines

| Location | Parameter | Guideline | Number of Samples | Number of Samples Over Guideline | Minimum | Average | Maximum |
|---------------------|------------------------|-----------------------------------|-------------------|----------------------------------|---------|---------|---------|
| Town (Source) | Manganese (Mn) - Total | MAC ≤ 0.12 mg/L AO ≤ 0.02 mg/L | 1 | Above AO = 1 | 0.065 | 0.065 | 0.065 |
| Town (Source) | Iron (Fe) - Total | AO ≤ 0.3 mg/L | 1 | Above AO = 0 | 0.097 | 0.097 | 0.097 |
| Town (Distribution) | Manganese (Mn) - Total | MAC ≤ 0.12 mg/L AO ≤ 0.02 mg/L | 4 | Above AO = 4 | 0.030 | 0.041 | 0.071 |
| Town (Distribution) | Iron (Fe) - Total | AO ≤ 0.3 mg/L | 4 | Above AO = 0 | 0.064 | 0.117 | 0.254 |
| Town (Distribution) | Turbidity | OG ≤ 1 NTU | 4 | Above OG = 2 | 0.50 | 1.40 | 2.37 |
| Gantahaz (Source) | Iron (Fe) - Total | AO ≤ 0.3 mg/L | 1 | Above AO = 0 | 0.138 | 0.138 | 0.138 |
| Gantahaz (Source) | Manganese (Mn) - Total | MAC ≤ 0.12 mg/L AO ≤ 0.02 mg/L | 1 | Above AO = 1 | 0.117 | 0.117 | 0.117 |

MAC = Guidelines for Canadian Drinking Water Quality Maximum Acceptable Concentration

AO = Guidelines for Canadian Drinking Water Quality Maximum Aesthetic Objective

OG = Guidelines for Canadian Drinking Water Quality recommend that turbidity should generally be below 1.0 NTU for groundwater systems. In some cases, a less stringent value for turbidity may be acceptable if it is demonstrated that the system has a history of acceptable microbiological quality and that a higher turbidity value will not compromise disinfection.

8.1 Bacteriological Testing Results

In 2023, there were 114 Bacteriological Samples taken throughout the District's three systems with each sample tested for E. Coli and Total Coliforms. The Town System had 90 samples taken, Gantahaz System had 12 samples with 1 rejected due to a delay in the lab receiving the sample, and the Airport System had 12 samples taken. A summary of the results of the bacteriological water quality sampling is provided in Table 9: Bacteriological

Sampling Results. There were no samples in the last year that detected the presence of E. Coli or Total Coliforms.

Table 9: Bacteriological Sampling Results Summary

| Parameter | Location | Number of Samples | Minimum | Maximum | Average | Guideline |
|------------------------------|-----------------|-------------------|---------|---------|---------|--------------------|
| E. Coli (MPN/100 mL) | Town System | 90 | <1 | <1 | <1 | MAC < 1 MPN/100 mL |
| | Gantahaz System | 11 | <1 | <1 | <1 | |
| | Airport System | 12 | <1 | <1 | <1 | |
| Total Coliforms (MPN/100 mL) | Town System | 90 | <1 | 1 | <1 | MAC < 1 MPN/100 mL |
| | Gantahaz System | 11 | <1 | 1 | <1 | |
| | Airport System | 12 | <1 | <1 | <1 | |

8.2 Water Chemistry Testing Results

Summaries of the chemical laboratory testing results are provided in Table 10 to Table 12. For clarity, only chemical testing parameters with a Maximum Allowable Concentration (MAC) or Aesthetic Objective (AO) in the Guidelines for Canadian Drinking Water Quality (GCDWQ) or parameters that indicate the overall water quality are shown. The full water chemistry summaries can be found in Appendix A – Water Chemistry Results Summaries.

Table 10: Town System - Source Water Chemistry

| Date Sampled | | | | | 5-Feb-2024 |
|----------------------------------|-------|-------|----|------|-----------------|
| Lab Sample ID | | | | | KS2400367-001 |
| Parameter | Units | GCDWQ | | | Town Water |
| | | MAC | AO | OG | Laurier Booster |
| Physical Tests (Water) | | | | | |
| Hardness (as CaCO ₃) | mg/L | | | | 147 |
| Total Metals (Water) | | | | | |
| Aluminum (Al)-Total | mg/L | | | >0.1 | <0.0030 |
| Antimony (Sb)-Total | mg/L | 0.006 | | | <0.00010 |
| Arsenic (As)-Total | mg/L | 0.01 | | | 0.00258 |
| Barium (Ba)-Total | mg/L | 2 | | | 0.0629 |
| Boron (B)-Total | mg/L | 5 | | | <0.010 |
| Cadmium (Cd)-Total | mg/L | 0.005 | | | <0.0000050 |
| Calcium (Ca)-Total | mg/L | | | | 47 |

| | | | | | |
|-----------------------|------|-------|-------|--|------------|
| Chromium (Cr)-Total | mg/L | 0.05 | | | <0.00050 |
| Cobalt (Co)-Total | mg/L | | | | <0.00010 |
| Copper (Cu)-Total | mg/L | 2 | ≥1 | | 0.0008 |
| Iron (Fe)-Total | mg/L | | ≥0.3 | | 0.097 |
| Lead (Pb)-Total | mg/L | 0.005 | | | 0.000259 |
| Magnesium (Mg)-Total | mg/L | | | | 7.22 |
| Manganese (Mn)-Total | mg/L | 0.12 | ≥0.02 | | 0.065 |
| Mercury (Hg)-Total | mg/L | 0.001 | | | <0.0000050 |
| Molybdenum (Mo)-Total | mg/L | | | | 0.000508 |
| Nickel (Ni)-Total | mg/L | | | | <0.00050 |
| Potassium (K)-Total | mg/L | | | | 0.589 |
| Selenium (Se)-Total | mg/L | 0.05 | | | <0.000050 |
| Sodium (Na)-Total | mg/L | | ≥200 | | 2.94 |
| Uranium (U)-Total | mg/L | 0.02 | | | 0.00159 |
| Zinc (Zn)-Total | mg/L | | ≥5 | | 0.0219 |

Table 11: Town System - Distribution Water Chemistry

| Parameter | GCDWQ | | | Distribution System | | | | |
|----------------------------------|-------|-------|------|---------------------|-----------------------|------------|------------|------------|
| | MAC | AO | OG | Samples | Below Detection Limit | Minimum | Average | Maximum |
| Physical Tests (Water) | | | | | | | | |
| Hardness (as CaCO ₃) | | | | 4 | 0 | 149 | 154 | 159 |
| Total Metals (Water) | | | | | | | | |
| Aluminum (Al) | | | <0.1 | 4 | 4 | <0.0030 | <0.0030 | <0.0030 |
| Antimony (Sb) | 0.006 | | | 4 | 4 | <0.00010 | <0.00010 | <0.00010 |
| Arsenic (As) | 0.01 | | | 4 | 0 | 0.003 | 0.003 | 0.004 |
| Barium (Ba) | 1 | | | 4 | 0 | 0.066 | 0.069 | 0.073 |
| Boron (B) | 5 | | | 4 | 4 | <0.010 | <0.010 | <0.010 |
| Cadmium (Cd) | 0.005 | | | 4 | 3 | <0.0000050 | 0.0000089 | 0.0000089 |
| Chromium (Cr) | 0.05 | | | 4 | 4 | <0.00050 | <0.00050 | <0.00050 |
| Copper (Cu) | 2 | ≤1 | | 4 | 0 | 0.023 | 0.065 | 0.126 |
| Iron (Fe) | | ≤0.3 | | 4 | 0 | 0.064 | 0.117 | 0.254 |
| Lead (Pb) | 0.005 | | | 4 | 1 | <0.000050 | 0.0014 | 0.0038 |
| Manganese (Mn) | 0.12 | ≤0.02 | | 4 | 0 | 0.030 | 0.041 | 0.071 |
| Mercury (Hg) | 0.001 | | | 4 | 4 | <0.0000050 | <0.0000050 | <0.0000050 |
| Selenium (Se) | 0.05 | | | 4 | 4 | 0.000054 | 0.000054 | 0.000054 |
| Sodium (Na) | | ≤200 | | 4 | 0 | 3.590 | 3.703 | 3.800 |
| Uranium (U) | 0.02 | | | 4 | 0 | 0.002 | 0.002 | 0.002 |
| Zinc (Zn) | | ≤5 | | 4 | 2 | <0.0030 | 0.016 | 0.025 |
| General Parameters | | | | | | | | |

| | | | | | | | | |
|---|-----|----------|----|---|---|---------|---------|---------|
| Chloride | | ≤250 | | 4 | 0 | 6.69 | 6.82 | 6.94 |
| Fluoride | 1.5 | | | 4 | 0 | 0.045 | 0.046 | 0.047 |
| Nitrate (as N) | 10 | | | 4 | 0 | 0.044 | 0.048 | 0.052 |
| Nitrite (as N) | 1 | | | 4 | 4 | <0.0010 | <0.0010 | <0.0010 |
| Sulfate | | ≤500 | | 4 | 0 | 7.26 | 7.42 | 7.60 |
| Langelier Index | | | | 4 | 0 | 0.515 | 0.531 | 0.554 |
| Solids, Total Dissolved (calc) | | ≤500 | | 4 | 0 | 187 | 198 | 212 |
| Colour, True | | ≤15 | | 4 | 4 | <5.0 | <5.0 | <5.0 |
| Alkalinity, Total (as CaCO ₃) | | | | 4 | 0 | 154 | 154 | 154 |
| Turbidity | | | ≤1 | 4 | 0 | 0.50 | 1.40 | 2.37 |
| pH | | 7.0-10.5 | | 4 | 0 | 8.26 | 8.30 | 8.33 |

Table 12: Gantahaz System - Source Water Chemistry

| | | Date Sampled | | | 5-Feb-2024 |
|----------------------------------|-------|--------------|-------|----|-----------------|
| | | GCDWQ | | | Gantahaz Source |
| Parameter | Units | MAC | AO | OG | Booster Station |
| Physical Tests (Water) | | | | | |
| Hardness (as CaCO ₃) | mg/L | | | | 167 |
| Total Metals (Water) | | | | | |
| Antimony (Sb)-Total | mg/L | 0.006 | | | <0.0030 |
| Arsenic (As)-Total | mg/L | 0.01 | | | <0.00010 |
| Barium (Ba)-Total | mg/L | 2 | | | 0.00347 |
| Boron (B)-Total | mg/L | 5 | | | 0.1010 |
| Cadmium (Cd)-Total | mg/L | 0.005 | | | <0.010 |
| Chromium (Cr)-Total | mg/L | 0.05 | | | <0.0000050 |
| Copper (Cu)-Total | mg/L | 2 | ≥1 | | 52.4 |
| Iron (Fe)-Total | mg/L | | ≥0.3 | | <0.00010 |
| Lead (Pb)-Total | mg/L | 0.005 | | | <0.00010 |
| Magnesium (Mg)-Total | mg/L | | | | 0.00080 |
| Manganese (Mn)-Total | mg/L | 0.12 | ≥0.02 | | 0.138 |
| Mercury (Hg)-Total | mg/L | 0.001 | | | 0.000073 |
| Selenium (Se)-Total | mg/L | 0.05 | | | 8.87 |
| Sodium (Na)-Total | mg/L | | ≥200 | | 0.117 |
| Uranium (U)-Total | mg/L | 0.02 | | | <0.0000050 |
| Zinc (Zn)-Total | mg/L | | ≥5 | | 0.0013 |

8.2.1 Turbidity

The GCDWQ recommends that turbidity is typically below 1.0 NTU for groundwater sources. In some cases, a less stringent value may be acceptable if it is demonstrated that

the system has a history of acceptable microbiological quality and that a higher value for turbidity will not compromise disinfection (which is not applicable in this case).

In the Town System distribution network, turbidity results exceeded 1.0 NTU in two of four samples. The average of the samples is 1.40 NTU.

Future analysis including field testing of the turbidity in the raw water is recommended to determine whether the turbidity exceedances observed in both the Town and Gantahaz are a cause for concern.

8.2.2 Iron

The GCDWQ has an aesthetic objective of 0.3 mg/L for iron. Iron is objectionable in water supplies for several reasons unrelated to health. Iron can precipitate as rust-colored silt which can result in an unpalatable taste as well as stain laundry and plumbing fixtures. In addition, iron can promote the growth of “iron bacteria” which can cause a slimy coating in water distribution pipes.

In past years exceedances occurred in the Gantahaz subdivision but results this year for all water systems are below the AO.

Given that the primary concern for iron concentrations above the AO is colour and taste, the system should be monitored and any complaints about the aesthetic should be recorded for future consideration.

Appendix B and C contains graphs showing all the iron concentrations from sampling taken between 2018 and February 2023 for the Town and Gantahaz Water Systems.

8.2.3 Manganese

Similar to iron, manganese can form a precipitate that can cause maintenance issues in distribution systems, resulting in laundry/plumbing staining in households, and cause objectionable taste issues. In the past, the GCDWQ had only an aesthetic objective of 0.05 mg/L for manganese. However, as of May 10, 2019, the guideline was updated to include a new Maximum Acceptable Concentration (MAC) of 0.12 mg/L and a reduced Aesthetic Objective (AO) of 0.02 mg/L.

The MAC was added because new research has shown that at higher concentrations it can pose adverse neurological effects in infants and children, primarily to the central

nervous system, followed by the reproductive system. Infants who consume powdered baby formula reconstituted from water that is high in manganese are the greatest risk. Although the MAC was established based on infants, this value is intended to protect all Canadians. The AO was reduced to minimize the occurrence of discolored water due to manganese and to improve consumer confidence in drinking water quality.

As noted in Table 8: Parameters Exceeding Guidelines the manganese results are somewhat variable for both the Town and Gantahaz water systems. The results vary depending on the location and are sometimes below the AO, and some of the results exceed the new MAC. Appendix B and C contains graphs showing all the manganese concentrations from sampling taken between 2018 and February 2024 for the Town and Gantahaz Systems.

In the Town System, manganese AO exceedances were observed in 4 of the 4 samples but no sample exceeded the MAC. In the distribution network, the results ranged from 0.0298 to 0.0707 mg/L with an average of 0.041 mg/L from four samples.

The Gantahaz subdivision exceeded the aesthetic objective with a concentration of 0.117 mg/L.

The District flushes each distribution system twice annually to control the iron and manganese concentrations due to accumulation in the network. The highest concentrations of iron and manganese exceedances occurred at multiple points throughout the distribution system. This indicates that those exceedances are primarily due to the accumulation and release of minerals.

8.2.4 Arsenic

Arsenic is naturally occurring from weathering of soils and minerals and is classified as a human carcinogen. The GCDWQ has a Maximum Acceptable Concentration (MAC) of 0.01 mg/L with a recommendation to achieve an arsenic concentration As Low As Reasonably Achievable (ALARA).

No exceedances were found in the Town Water System and the Gantahaz Water System. In previous years the Gantahaz distribution network has exceeded the maximum allowable concentration. In the Gantahaz system past samples having concentrations above the maximum concentration were detected in the distribution system indicating this is a potential accumulation and release issue. Appendix B contains a graph showing

all the arsenic concentrations from sampling taken between 2018 and February 2024 for the Gantahaz Systems.

As with all of the metal concentrations, the arsenic level should be closely monitored, and it is recommended that additional system flushing should occur.

9 CONCLUSION & RECOMMENDATIONS

The water quality of the three water systems in the District of Mackenzie are of good water chemistry with no exceedances of any MAC. The concentration of the Manganese have exceeded the AO in the Town and Gantahaz Systems. The microbiological quality of the water is excellent with no E. Coli and Total Coliforms found in the water system.

The District of Mackenzie is committed to ensuring that the community has safe and secure drinking water. In 2024, the District has contracted a new Gantahaz Water Treatment Plant to be designed and under construction which will improve water quality for the end-users.

If you have any questions or comments regarding the content of this report please contact Jim Fast, Lead Operator, for the District at 250-997-3761 or at utilities@districtofmackenzie.ca.

APPENDIX A – 2023 WATER CHEMISTRY RESULTS SUMMARY

Table 13: Town System - Water Chemistry

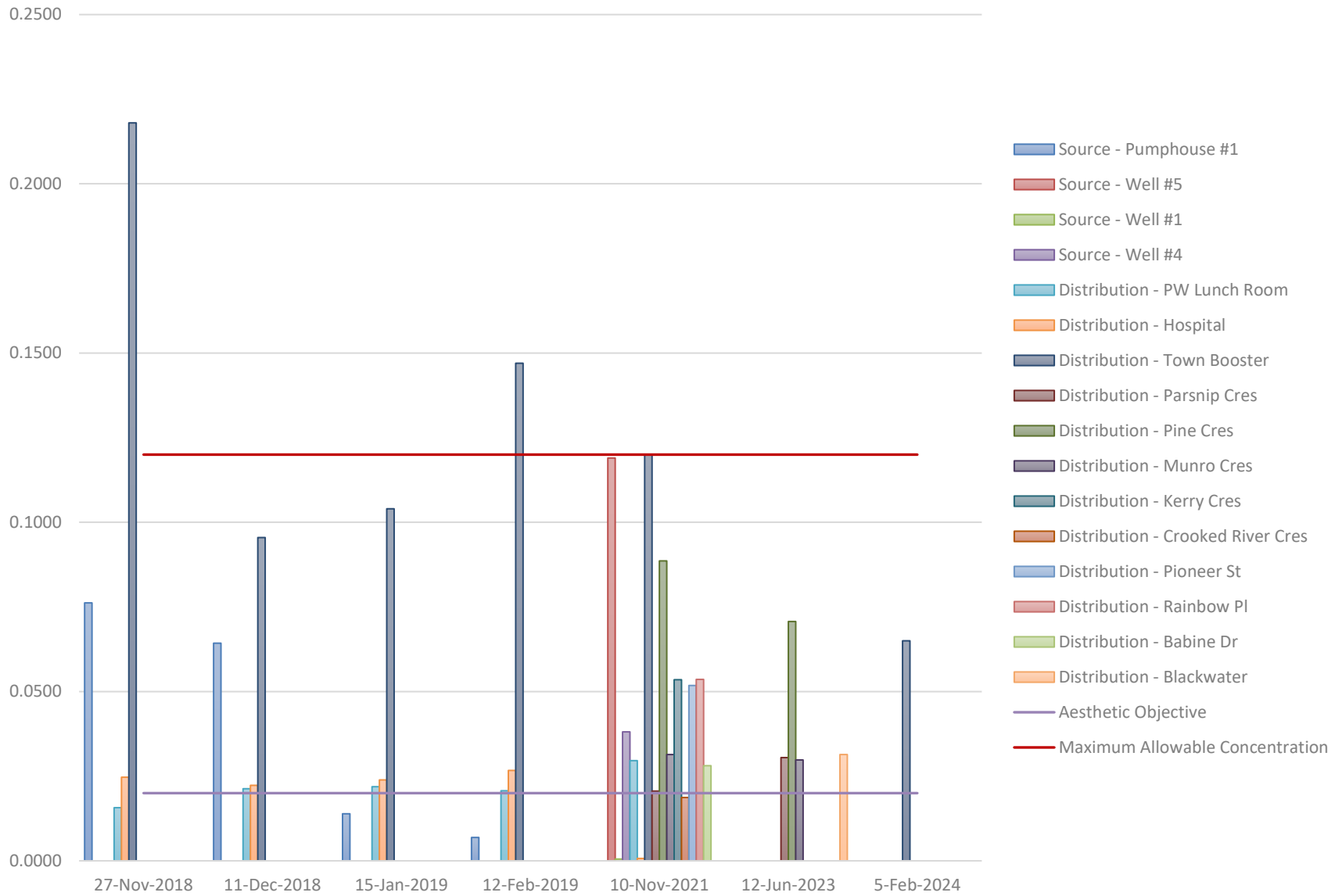
| Date Sampled | | | | 12-Jun-2023 | 12-Jun-2023 | 12-Jun-2023 | 12-Jun-2023 | 5-Feb-2024 | |
|-------------------------------|-------|-------|-------|---------------|---------------|---------------|----------------|---------------|--------------|
| Lab Sample ID | | | | VA23B3232-001 | VA23B3232-002 | VA23B3232-003 | VA23B3232-004 | KS2400367-001 | |
| Parameter | Units | GCDWQ | | | Town Water | Town Water | Town Water | Town Water | Town Water |
| | | | | | 23 Pine | 44 Munro | 216 Blackwater | #4 Parsnip | Town Booster |
| | | MAC | AO | OG | | | | | |
| Physical Tests (Water) | | | | | | | | | |
| Hardness (as CaCO3) | mg/L | | | | 156 | 159 | 150 | 149 | 147 |
| Total Metals (Water) | | | | | | | | | |
| Aluminum (Al)-Total | mg/L | | | <0.1 | <0.0030 | <0.0030 | <0.0030 | <0.0030 | <0.0030 |
| Antimony (Sb)-Total | mg/L | 0.006 | | | <0.00010 | <0.00010 | <0.00010 | <0.00010 | <0.00010 |
| Arsenic (As)-Total | mg/L | 0.01 | | | 0.00430 | 0.00286 | 0.00276 | 0.00291 | 0.00258 |
| Barium (Ba)-Total | mg/L | 2 | | | 0.0734 | 0.0692 | 0.0658 | 0.0678 | 0.0629 |
| Beryllium (Be)-Total | mg/L | | | | <0.000100 | <0.000100 | <0.000100 | <0.000100 | <0.000100 |
| Boron (B)-Total | mg/L | 5 | | | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| Cadmium (Cd)-Total | mg/L | 0.005 | | | <0.0000050 | 0.0000089 | <0.0000050 | <0.0000050 | <0.0000050 |
| Calcium (Ca)-Total | mg/L | | | | 49.9 | 51.5 | 47.9 | 47.5 | 47 |
| Chromium (Cr)-Total | mg/L | 0.05 | | | <0.00050 | <0.00050 | <0.00050 | <0.00050 | <0.00050 |
| Cobalt (Co)-Total | mg/L | | | | <0.00010 | <0.00010 | <0.00010 | <0.00010 | <0.00010 |
| Copper (Cu)-Total | mg/L | 2 | ≤1 | | 0.0871 | 0.126 | 0.0226 | 0.0242 | 0.0008 |
| Iron (Fe)-Total | mg/L | | ≤0.3 | | 0.254 | 0.067 | 0.064 | 0.081 | 0.097 |
| Lead (Pb)-Total | mg/L | 0.005 | | | 0.000407 | 0.00381 | <0.000050 | 0.000056 | 0.000259 |
| Lithium (Li)-Total | mg/L | | | | 0.0040 | 0.0041 | 0.0038 | 0.0039 | 0.0041 |
| Magnesium (Mg)-Total | mg/L | | | | 7.65 | 7.50 | 7.44 | 7.33 | 7.22 |
| Manganese (Mn)-Total | mg/L | 0.12 | ≤0.02 | | 0.0707 | 0.0298 | 0.0314 | 0.0305 | 0.065 |
| Mercury (Hg)-Total | mg/L | 0.001 | | | <0.0000050 | <0.0000050 | <0.0000050 | <0.0000050 | <0.0000050 |

| | | | | | | | | | |
|---|----------|------|----------|----|-----------|-----------|-----------|-----------|-----------|
| Molybdenum (Mo)-Total | mg/L | | | | 0.000462 | 0.000438 | 0.000456 | 0.000459 | 0.000508 |
| Nickel (Ni)-Total | mg/L | | | | <0.00050 | <0.00050 | <0.00050 | <0.00050 | <0.00050 |
| Potassium (K)-Total | mg/L | | | | 0.646 | 0.672 | 0.635 | 0.645 | 0.589 |
| Selenium (Se)-Total | mg/L | 0.05 | | | <0.000050 | <0.000050 | 0.000054 | <0.000050 | <0.000050 |
| Silver (Ag)-Total | mg/L | | | | <0.000010 | 0.000041 | <0.000010 | <0.000010 | <0.000010 |
| Sodium (Na)-Total | mg/L | | ≤200 | | 3.64 | 3.80 | 3.78 | 3.59 | 2.94 |
| Thallium (Tl)-Total | mg/L | | | | <0.000010 | <0.000010 | <0.000010 | <0.000010 | <0.000010 |
| Tin (Sn)-Total | mg/L | | | | <0.00010 | 0.00454 | <0.00010 | <0.00010 | <0.00010 |
| Titanium (Ti)-Total | mg/L | | | | <0.00030 | <0.00030 | <0.00030 | <0.00030 | <0.00030 |
| Uranium (U)-Total | mg/L | 0.02 | | | 0.00201 | 0.00200 | 0.00191 | 0.00198 | 0.00159 |
| Vanadium (V)-Total | mg/L | | | | <0.00050 | <0.00050 | <0.00050 | <0.00050 | <0.00050 |
| Zinc (Zn)-Total | mg/L | | ≤5 | | 0.0072 | 0.0248 | <0.0030 | <0.0030 | 0.0219 |
| General Parameters | | | | | | | | | |
| Chloride | mg/L | | ≤250 | | 6.75 | 6.90 | 6.94 | 6.69 | 4.05 |
| Fluoride | mg/L | 1.5 | | | 0.046 | 0.046 | 0.045 | 0.047 | 0.049 |
| Nitrate (as N) | mg/L | 10 | | | 0.0456 | 0.0523 | 0.0523 | 0.0436 | 0.032 |
| Nitrite (as N) | mg/L | 1 | | | <0.0010 | <0.0010 | <0.0010 | <0.0010 | <0.0010 |
| Sulfate | mg/L | | ≤500 | | 7.49 | 7.33 | 7.26 | 7.60 | 9.23 |
| Langelier Index | - | | | | 0.528 | 0.515 | 0.528 | 0.554 | |
| Solids, Total Dissolved (calc) | mg/L | | ≤500 | | 212 | 202 | 189 | 187 | 173 |
| Colour, True | CU | | ≤15 | | <5.0 | <5.0 | <5.0 | <5.0 | |
| Alkalinity, Total (as CaCO ₃) | mg/L | | | | 154 | 154 | 154 | 154 | 154 |
| Cyanide, Total | mg/L | 0.2 | | | | | | | |
| Turbidity | NTU | | | ≤1 | 1.77 | 0.50 | 0.97 | 2.37 | |
| pH | pH units | | 7.0-10.5 | | 8.29 | 8.26 | 8.30 | 8.33 | |
| Conductivity (EC) | uS/cm | | | | 306 | 308 | 312 | 310 | |

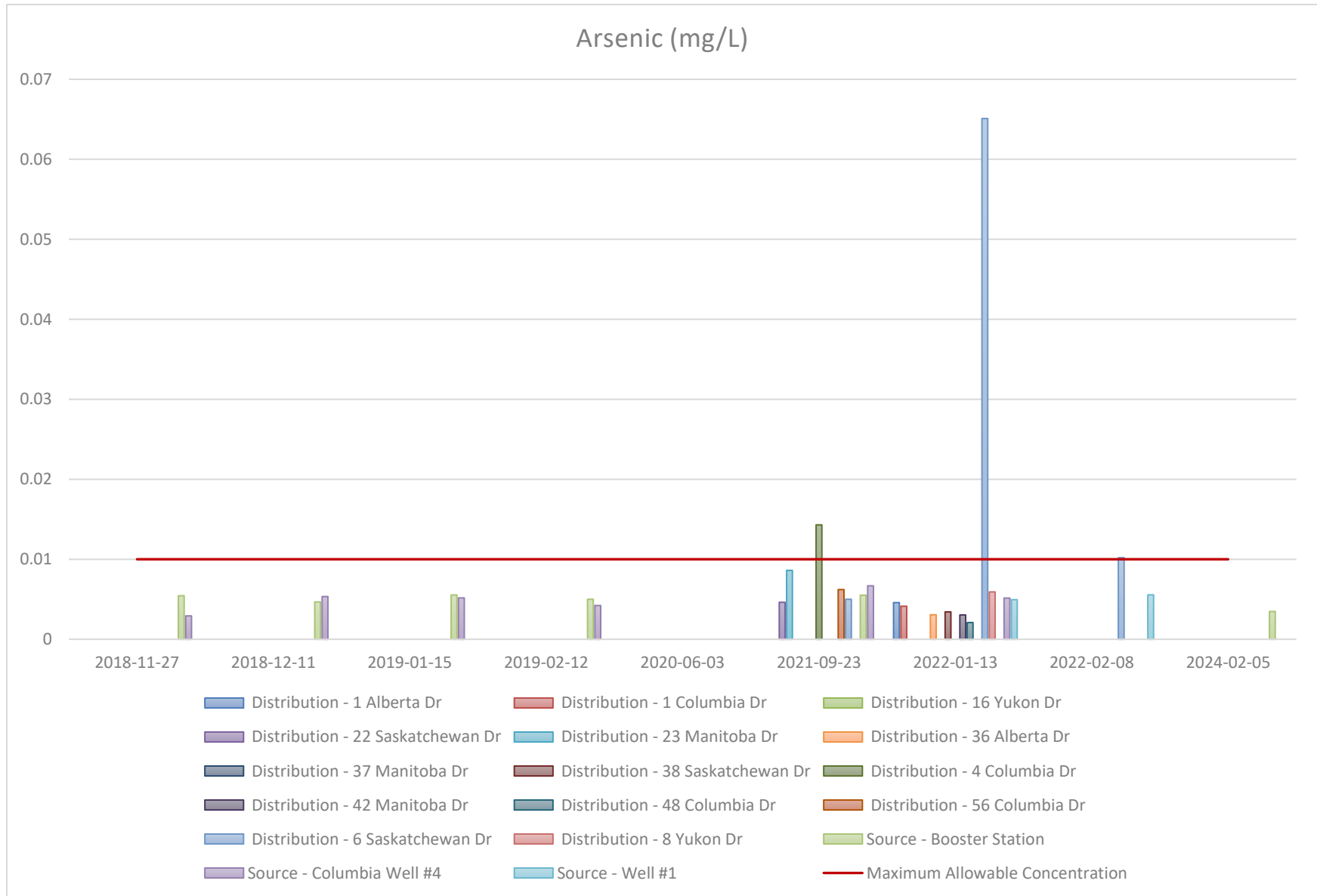
Table 14: Gantahaz System - Water Chemistry

| Date Sampled | | | | | 5-Feb-2024 |
|-------------------------------|-------|-------|-------|------|-----------------|
| Lab Sample ID | | | | | KS2400366-001 |
| Parameter | Units | GCDWQ | | | Gantahaz Water |
| | | MAC | AO | OG | Booster Station |
| Physical Tests (Water) | | | | | |
| Hardness (as CaCO3) | mg/L | | | | 167 |
| Total Metals (Water) | | | | | |
| Aluminum (Al)-Total | mg/L | | | >0.1 | <0.0030 |
| Antimony (Sb)-Total | mg/L | 0.006 | | | <0.00010 |
| Arsenic (As)-Total | mg/L | 0.01 | | | 0.00347 |
| Barium (Ba)-Total | mg/L | 2 | | | 0.1010 |
| Beryllium (Be)-Total | mg/L | | | | <0.000100 |
| Boron (B)-Total | mg/L | 5 | | | <0.010 |
| Cadmium (Cd)-Total | mg/L | 0.005 | | | <0.0000050 |
| Calcium (Ca)-Total | mg/L | | | | 52.4 |
| Chromium (Cr)-Total | mg/L | 0.05 | | | <0.00010 |
| Cobalt (Co)-Total | mg/L | | | | <0.00010 |
| Copper (Cu)-Total | mg/L | 2 | ≥1 | | 0.00080 |
| Iron (Fe)-Total | mg/L | | ≥0.3 | | 0.138 |
| Lead (Pb)-Total | mg/L | 0.005 | | | 0.000073 |
| Lithium (Li)-Total | mg/L | | | | 0.0035 |
| Magnesium (Mg)-Total | mg/L | | | | 8.87 |
| Manganese (Mn)-Total | mg/L | 0.12 | ≥0.02 | | 0.117 |
| Mercury (Hg)-Total | mg/L | 0.001 | | | <0.0000050 |
| Molybdenum (Mo)-Total | mg/L | | | | 0.0013 |
| Nickel (Ni)-Total | mg/L | | | | <0.00050 |
| Potassium (K)-Total | mg/L | | | | 0.711 |
| Selenium (Se)-Total | mg/L | 0.05 | | | <0.000050 |
| Silver (Ag)-Total | mg/L | | | | <0.000010 |
| Sodium (Na)-Total | mg/L | | ≥200 | | 2.52 |
| Thallium (Tl)-Total | mg/L | | | | <0.000010 |
| Tin (Sn)-Total | mg/L | | | | <0.00010 |
| Titanium (Ti)-Total | mg/L | | | | <0.00030 |
| Uranium (U)-Total | mg/L | 0.02 | | | 0.00314 |
| Vanadium (V)-Total | mg/L | | | | <0.00050 |
| Zinc (Zn)-Total | mg/L | | ≥5 | | 0.0128 |

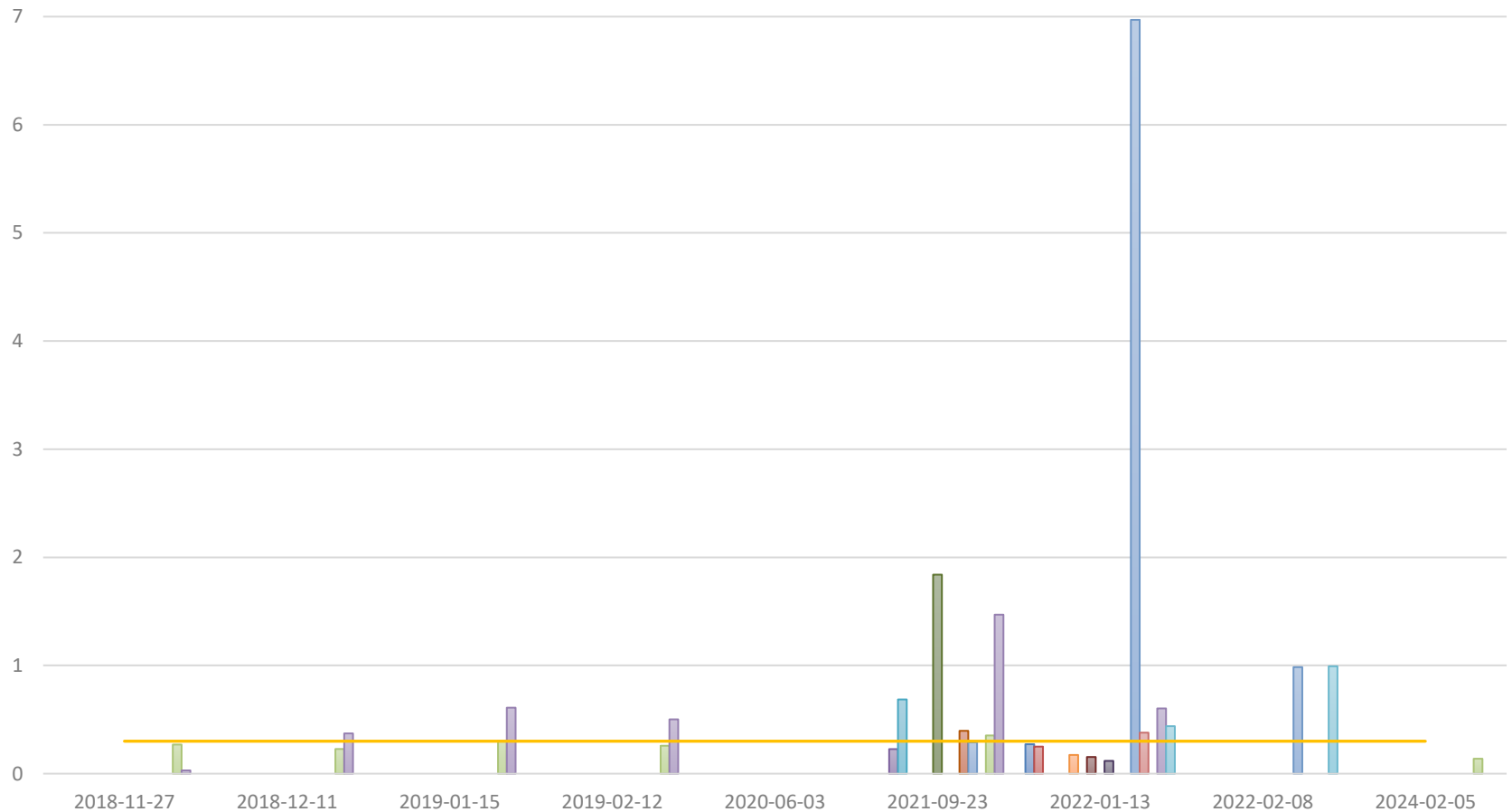
Manganese (mg/L)



APPENDIX C – GANTHAZ SYSTEM EXCEEDANCES (2018-2023)

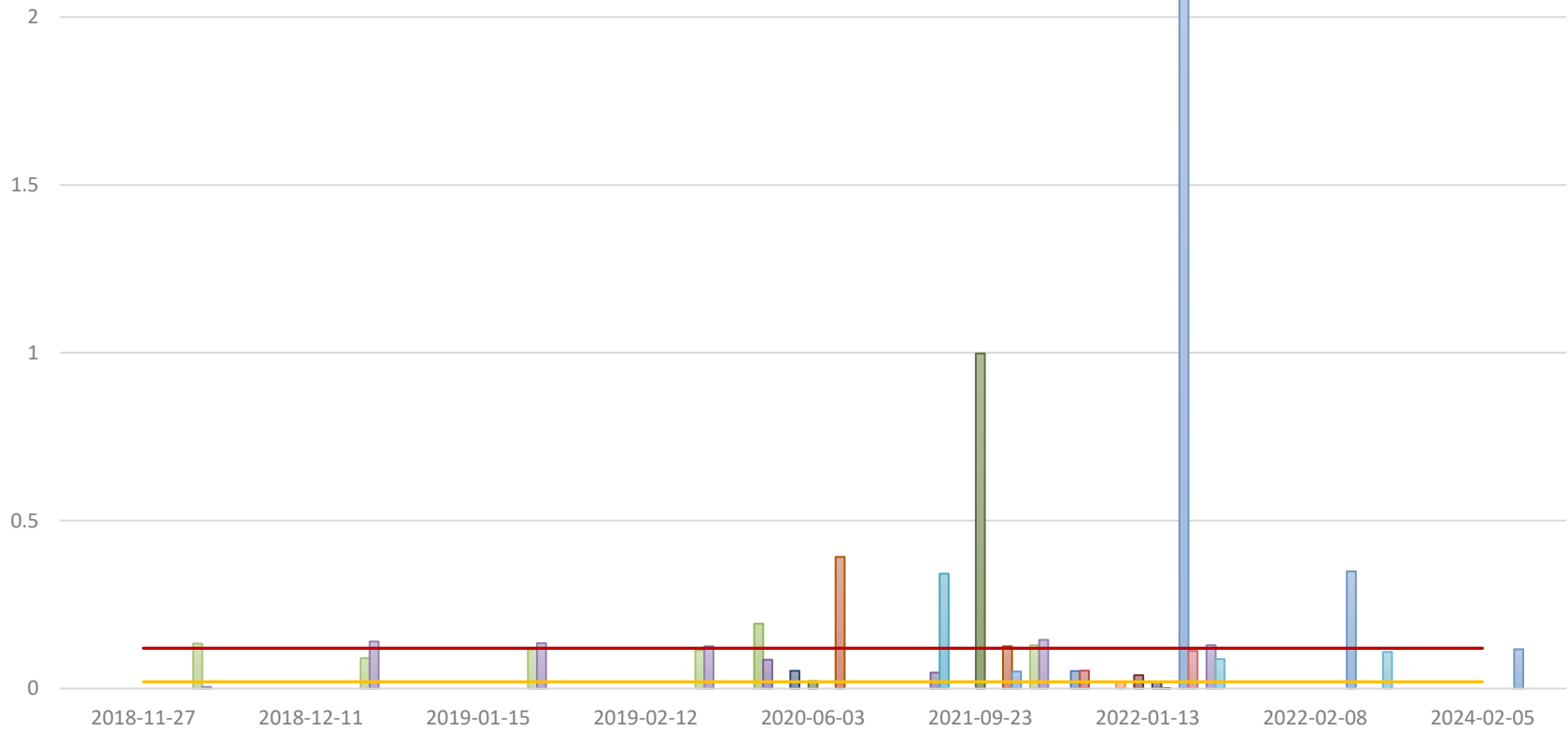


Iron (mg/L)



- Distribution - 1 Alberta Dr
- Distribution - 22 Saskatchewan Dr
- Distribution - 37 Manitoba Dr
- Distribution - 42 Manitoba Dr
- Distribution - 6 Saskatchewan Dr
- Source - Columbia Well #4
- Distribution - 1 Columbia Dr
- Distribution - 23 Manitoba Dr
- Distribution - 38 Saskatchewan Dr
- Distribution - 48 Columbia Dr
- Distribution - 8 Yukon Dr
- Source - Well #1
- Distribution - 16 Yukon Dr
- Distribution - 4 Columbia Dr
- Distribution - 36 Alberta Dr
- Distribution - 56 Columbia Dr
- Source - Booster Station
- Aesthetic Objective

Manganese (mg/L)



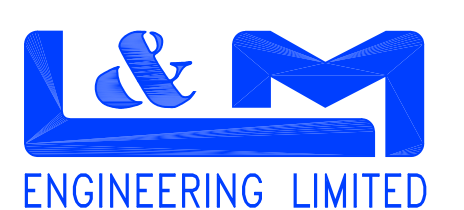
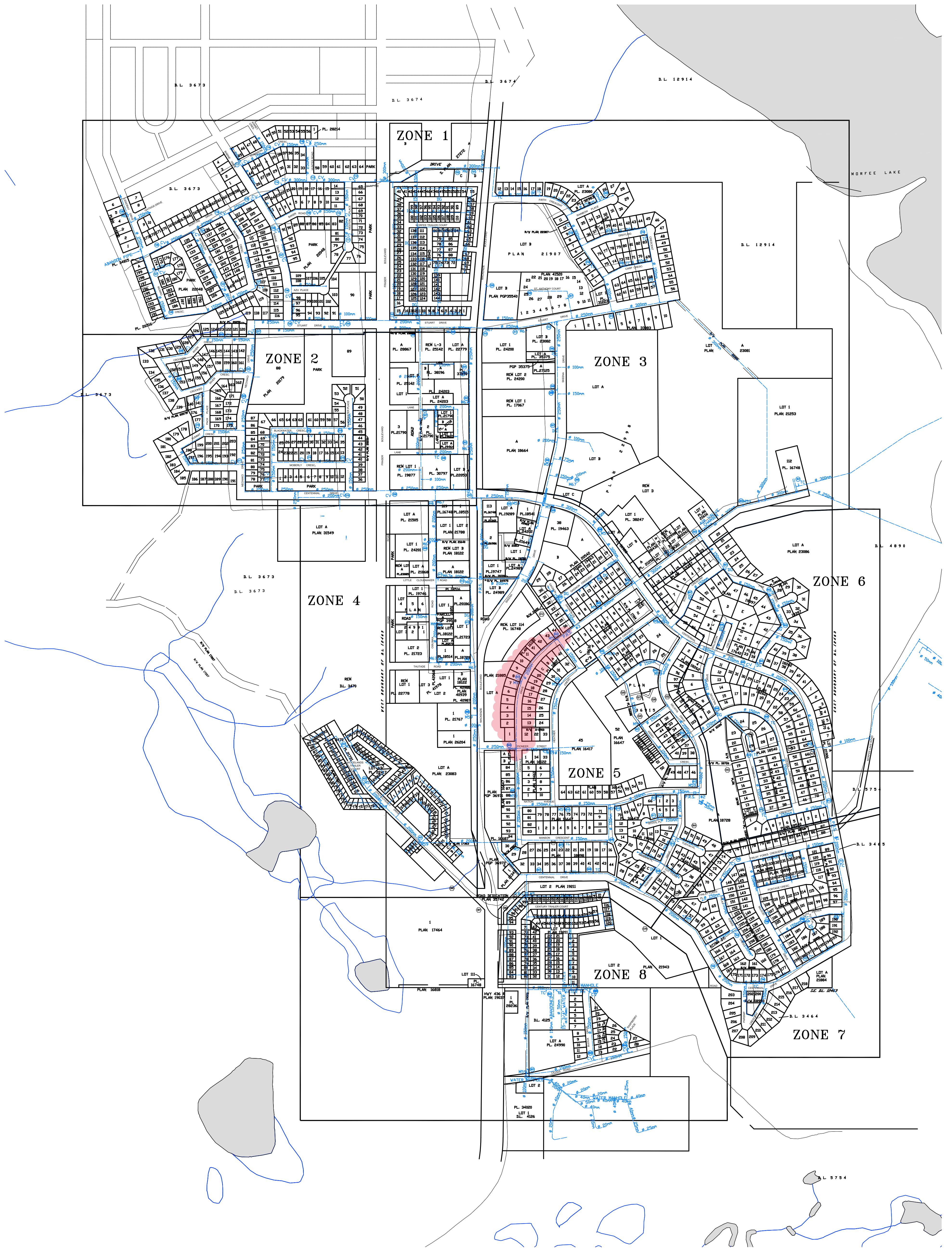
- Distribution - 1 Alberta Dr
 - Distribution - 22 Saskatchewan Dr
 - Distribution - 37 Manitoba Dr
 - Distribution - 42 Manitoba Dr
 - Distribution - 6 Saskatchewan Dr
 - Source - Columbia Well #4
- Distribution - 1 Columbia Dr
 - Distribution - 23 Manitoba Dr
 - Distribution - 38 Saskatchewan Dr
 - Distribution - 48 Columbia Dr
 - Distribution - 8 Yukon Dr
 - Source - Well #1
- Distribution - 16 Yukon Dr
 - Distribution - 36 Alberta Dr
 - Distribution - 4 Columbia Dr
 - Distribution - 56 Columbia Dr
 - Source - Booster Station
 - Aesthetic Objective
 - Maximum Allowable Concentration

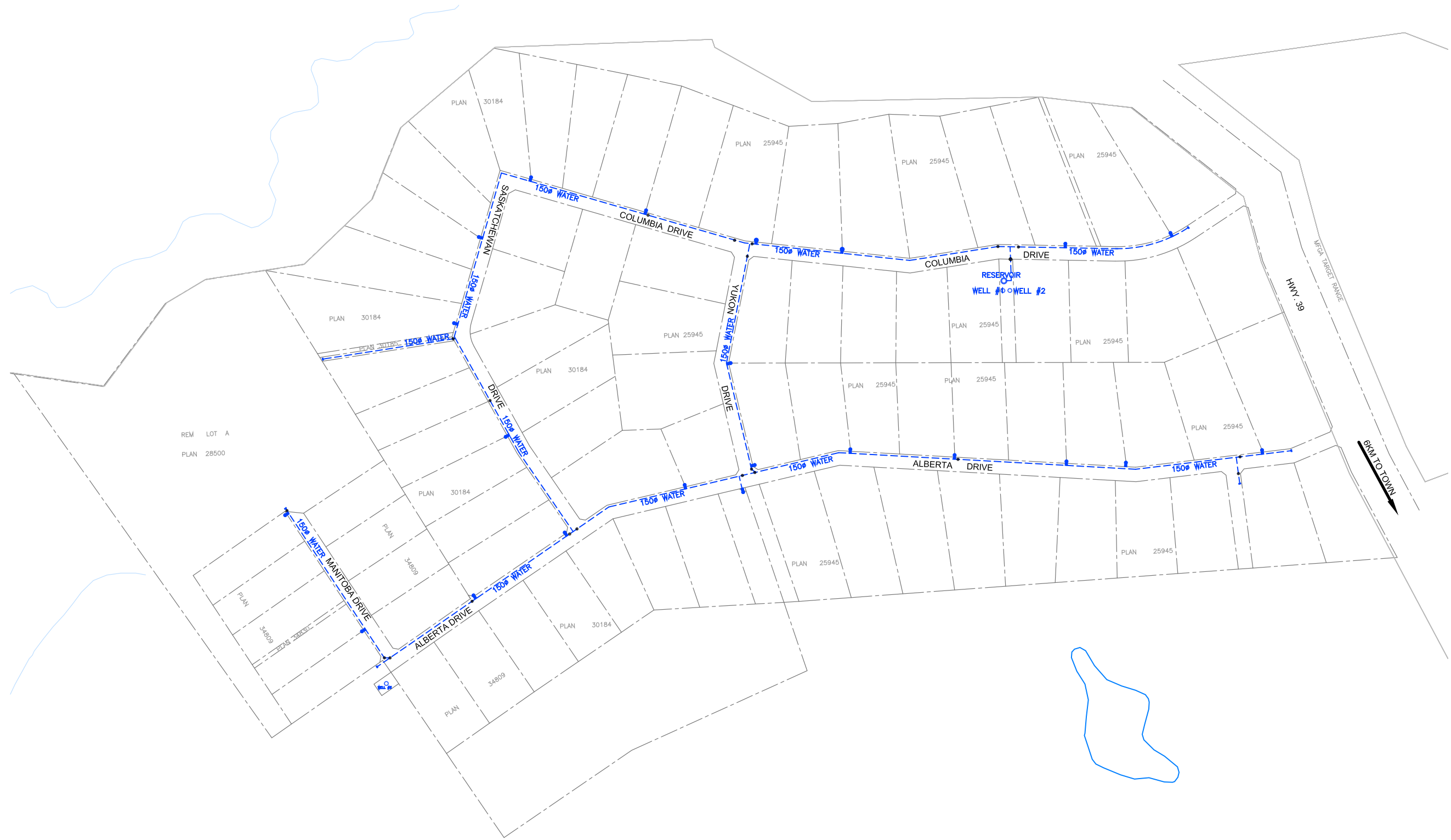
APPENDIX D – TOWN AND GANTHAZ WATER SYSTEM MAPS



DISTRICT OF MACKENZIE








WATER SYSTEM SERVICING LAYOUT





REM LOT A
PLAN 28500

LEGEND

-  FIRE HYDRANT
-  VALVE
-  WELL
-  PUMP HOUSE
-  RESERVOIR
-  WATER LINE
-  EXISTING LEGAL



| NO. | DATE | REVISION | DR. |
|-----|------|----------|-----|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |



ENGINEERING LIMITED
 1210 FOURTH AVENUE
 PRINCE GEORGE, B.C.
 V2L 3J4
 TEL. (250) 562-1977
 FAX (250) 562-1967

| | |
|-----------------|---------------------------|
| DRAWN: | NP |
| CHECKED: | |
| ENGINEER: | LR |
| SURVEY FILE: | |
| DRAWING FILE: | Gantahaz_water_system.dwg |
| CORRESPONDENCE: | CPG |
| GRID: | |
| DATE: | 12/02/08 |
| SCALE: | 1:3000 |

MACKENZIE DISTRICT
 GANTHAZ RURAL SUBDIVISION
 WATER SYSTEM

CONSULTANTS PROJECT No.
1044-00-00
 DRAWING No.
MAP 01

**ISSUED FOR
 INFORMATION ONLY**

| | |
|---------------------|---------------|
| SHEET No. 1 OF 1 | REV. No. 0 |
|---------------------|---------------|

G:\Job Files\1000\1044 - District of Mackenzie\10 GANTHAZ_RURAL\Gantahaz_water_system.dwg

APPENDIX E – WATER SYSTEM OPERATING PERMITS

PERMIT TO OPERATE

A Drinking Water System with
301-10000 Connections

System Name: Mackenzie CWS Morfee Lake

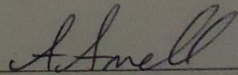
Physical Location : Mackenzie CWS
1 Mackenzie Boulevard
Mackenzie BC

Owner Name: District Of Mackenzie

Conditions of Permit

- > Maintain a minimum of 5 water bacteriology samples per month unless the Environmental Health Officer requests a greater frequency.
- > Maintain an up-to-date Emergency Response Plan.
- > Operator must be trained and certified at the level specified by the Environmental Operator Certification Program.
- > Submit water chemistry data every 1 years, unless the Environmental Health Officer requests a greater frequency.

30-Mar-1996
Effective Permit Date


Environmental Health Officer

2-Jul-2019
Permit Revised Date



PERMIT TO OPERATE

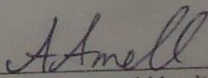
A Drinking Water System with
1 Public Connection

System Name: Mackenzie CWS Airport
Physical Location: Mackenzie CWS
1 Mackenzie Boulevard
Mackenzie BC
Owner Name: District Of Mackenzie

Conditions of Permit

- > Maintain a minimum of one water bacteriology sample per month unless the Environmental Health Officer requests a greater frequency.
- > Maintain an up-to-date Emergency Response Plan.
- > Submit water chemistry data every 5 years, unless the Environmental Health Officer requests a greater frequency.

25-May-2005
Effective Permit Date


Environmental Health Officer

3-July-2019
Permit Revised Date

**DECAL
NOT REQUIRED**

PERMIT TO OPERATE

A Drinking Water System with
15-300 Connections

System Name: Mackenzie CWS Gantahaz Subdivision

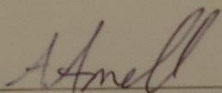
Physical Location: Mackenzie CWS
1 Mackenzie Boulevard
Mackenzie BC

Owner Name: District Of Mackenzie

Conditions of Permit

- > Maintain a minimum of 2 water bacteriology samples per month unless the Environmental Health Officer requests a greater frequency.
- > Maintain an up-to-date Emergency Response Plan.
- > Operator must be trained and certified at the level specified by the Environmental Operators Certification Program.
- > Submit water chemistry data every 3 years, unless the Environmental Health Officer requests a greater frequency.

30-Mar-2001
Effective Permit Date


Environmental Health Officer

2-Jul-2019
Permit Revised Date

