OPUS

*Environmental Impact Assessment (EIA)*
*Registration Document*

# Wastewater Treatment Facility Replacement

## Village of Chipman, NB

## *FINAL - Part 1 of 2*

*Environmental Impact Assessment (EIA) Registration Document*

# Wastewater Treatment Facility Replacement

## Village of Chipman, NB


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# Appendices

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# 1 The Proponent

| | |
|---|---|
| **Name of Proponent:** | Village of Chipman |
| **Address of Proponent:** | 10 Civic Court, Unit 1<br>Chipman, New Brunswick<br>E4A 2H9 |
| **Village Clerk:** | Susan Kennedy |
| **Property Owners:** | Village of Chipman<br>PID 450779324<br>Deed 56845, Reg. 1973, Bk. 4, Pg. 848, Plan 14510664 Q.C.R.O. |
| **Document Preparation:** | The Village of Chipman has retained Opus International Consultants (Canada) Ltd. of Fredericton, NB to prepare the EIA Registration Document and to conduct the Environmental Impact Assessment (EIA) Process for the proposed undertaking, on the behalf of the Village. |
| **EIA Contact Person:** | Stephen R. Pyke, M.A.Sc., P.Eng.<br>Senior Environmental Engineer<br>Opus International Consultants (Canada) Ltd.<br>80 Bishop Drive<br>Fredericton, NB<br>E3C 1B2<br>*E-mail: Stephen.Pyke@opusinternational.ca*<br>*Tel: (506) 451-0076*<br>*Fax: (506) 450-4838*<br>*Mobile: (506) 261-6681* |

# 2 The Undertaking

## 2.1 Name of the Undertaking

**Village of Chipman Wastewater Treatment Facility Replacement**

## 2.2 Project Overview

### 2.2.1 Key Plan and Site Plan

The Proponent for this undertaking (project) is the **Village of Chipman** (Village).

The proposed undertaking involves planning, development, design, tendering, construction, start-up, and commissioning of a new wastewater treatment facility (WwTF) and outfall pipe. The new WwTF and outfall is to serve as a full replacement of the Village's existing WwTF and outfall.

A *Key Plan* locating the proposed undertaking Project Area within the Village's municipal boundaries is provided in Figure 1, Appendix A.

A proposed *Site Plan* of the Project Area is provided in Figure 2, Appendix B. The Site Plan identifies the locations of the existing WwTF and the proposed new WwTF.

### 2.2.2 Raw Wastewater Contribution Sources

Raw wastewater is generated from within the Village boundaries from residential, commercial, industrial and institutional sources. Raw wastewater is additionally impacted by extraneous inflow and infiltration (I/I) contributions occurring throughout the Village's sanitary sewer collection system.

The Village identifies a current total of 566 sewer billing accounts, which are further categorized as follows:

- Residential = 514
- Commercial = 45
- Industrial = 2
- Institutional = 5

A detailed listing of sewerage connection accounts in the Village is provided in Appendix K.

### 2.2.3 Existing WwTF

The existing WwTF was constructed in the early 1970's and has been in continuous service for more than 45-years. This facility has served the community well. It has provided, and continues to provide, a very good level of wastewater treatment performance.

The existing WwTF consists of an activated sludge-type treatment process known as an oxidation ditch. Raw wastewater enters the existing WwTF by gravity from an influent sanitary sewer connecting from Route 10. Wastewater flows by gravity through the treatment system process equipment and into the receiving stream. This facility generally consists of the following process components:

- Influent gravity sewer from Route 10;
- Manually-raked influent bar screen;
- Oxidation ditch, complete with two (2) surface aspirating aerators;
- Secondary clarifier, with return and waste activated sludge pumping;
- Chlorine contact chamber;
- Metered liquid chlorine addition;
- Outfall pipe discharging into Henderson Brook;
- Control building; electrical building; chlorine metering pump enclosure.

Photos of the existing WwTF are provided in Appendix L.

### 2.2.4 New WwTF

Raw wastewater will be pumped into the new WwTF from the influent gravity sewer connecting to the existing WwTF. The new WwTF will provide biological conversion of the raw wastewater organic matter, will provide chemical precipitation of phosphorus, and will discharge a consistently high-quality treated effluent directly into the Salmon River. The new WwTF is anticipated to consist of the following features and components:

- **Proposed WwTF site** positioned within the Village's municipal boundaries and adjacent to the existing WwTF (see Figure 2, Appendix B);

- **Influent sanitary pumping station** that will lift raw wastewater from the existing influent sanitary sewer into the proposed wastewater treatment process;

- **Wastewater treatment process** capable of biological conversion of organic wastewater to a non-toxic treated effluent flow, plus a stabilized residual waste biomass (sludge), meeting the 2019 Canadian Council of Ministers of the Environment (CCME) federal municipal wastewater effluent discharge standards;

- **Mechanical process equipment** potentially consisting of, but not all, of the following: raw sewage lift pumps; chemical injection pumps; chemical flash and flocculation mixers, aeration blowers, aeration headers and laterals; sub-surface air diffusers; UV disinfection system; fine screening; primary clarification; sludge wasting pumps;

- **Electrical control equipment** consisting of process equipment control panels, and site power entrance and distribution equipment.

- **Interconnecting piping and chambers** hydraulically linking the various wastewater treatment unit processes and operations;

- **Treated effluent outfall pipe** connecting the treatment process effluent directly to the receiving stream (Salmon River);

- **Emergency stand-by generator** to provide on-site power to operate essential treatment system components during power outages.

- **Process Control Building** housing mechanical process equipment, electrical control equipment, stand-by power generator, on-site lab, office area, storage area, toilet and shower facilities.

Sufficient treatment capacity will be provided in the new WwTF to accommodate current hydraulic and organic loadings. Archived flow data obtained from the current WwTF was used to determine current hydraulic loading conditions. Typical organic loading contributions, as provided in the document titled - *Atlantic Canada Waster Water Guidelines Manual*, were used to determine design organic loading conditions. Statistics Canada's census data for the Village was used to assess recent and anticipated future serviced population growth trends.

It is proposed that the existing WwTF remain in full operation until the new facility is fully constructed, commissioned, and placed into full and continuous operation. Upon achieving full operation of the new WwTF, it is proposed that the existing WwTF be decommissioned and demolished, and/or partially re-purposed.

### 2.2.5 Funding of Capital Costs

The Proponent received official written notification from the Province of New Brunswick of funding for the proposed undertaking in a letter dated January 3, 2017.

Based on a *preliminary* opinion of probable costs prepared as part of the Proponent's funding application to the Clean Water and Wastewater Fund, overall project costs are anticipated to be **$ 3 572 000**. This cost figure includes: planning, preliminary design, EIA Process, detailed design, tendering, construction, commissioning, signage, contingency amount, and a rebated HST (calculated at 4.2855%).

The funding agreement for the proposed undertaking requires the Proponent to be responsible for funding the following portions:

1. 25% of all capital cost expenditures up to $ 3 572 000;

2. 100% of all capital cost expenditures in excess of $ 3 572 000;

3. 100% of all operation and maintenance cost expenditures. *Note: Anticipated O&M costs have not yet been determined for the proposed undertaking*.

The Proponent's financial obligations for this undertaking will be obtained through sewer user fees from all residential, commercial, institutional and industrial wastewater contributors. Sewer user fee will consist of capital, operation and maintenance costs apportioned to the Village as noted above.

### 2.2.6 Scheduling

The agreement among the federal, provincial and municipal government requires completion of the proposed undertaking no later than **March 31, 2018**. Given the undertaking's magnitude and degree of complexity, the period available for its execution and completion is considered to be extremely limited. Sequencing and execution of specific planning, development, design, tendering and construction tasks will invariably be dictated by environmental and climatic constraints. This exposes the undertaking to scheduling risks and potential additional cost burdens.

Therefore, to provide sufficient project schedule, and especially to avoid additional cost associated with a winter construction schedule, the Proponent has requested from the federal government a schedule extension to **March 31, 2019**.

With the submission of this document and EIA registration of this undertaking, the Proponent continues to advance the project schedule by proceeding forward with preliminary and detailed design tasks during the progression of the EIA Process.

## 2.3 Rationale/Purpose/Need for the Undertaking

### 2.3.1 Rationale

However, during its lifetime it has undergone only minor process updates and upgrades (i.e., secondary clarifier enclosure, new sand-drying beds, chlorination chamber upgrades), along with some process equipment replacements (i.e., aerators, pumps). There remain a number of mechanical, electrical and process component upgrades needed to maintain continued operation, minimize the potential for process failures, and to address operator safety concerns.

Given its advanced age and lack of significant process upgrades, the existing WwTF represents a high-risk potential for process failure and subsequent system by-passing. Therefore, given this situation, the Proponent wishes to secure long-term environmentally acceptable and affordable wastewater treatment services into the future. This will enable the Proponent to maintain acceptable and stable wastewater services in the Village so that may continue to serve its existing residential, commercial, institutional, and industrial wastewater customers.

Therefore, the Proponent can rationalize replacement of the existing WwTF with current innovative and proven technology advancements to enhance process performance, reliability, and greater overall operating efficiencies.

### 2.3.2 Purpose

In 2012-13 an Environmental Risk Assessment (ERA) study was conducted on the Village's existing WwTF in accordance with the requirements of the *Canadian Council of Ministers of the Environment (CCME) Canada-wide Strategy for the Management of Municipal Wastewater Effluent*. This study identified that process performance enhancements are required to achieve new federal municipal wastewater Effluent Discharge Objectives (EDOs) specific to nutrient (i.e., nitrogen, phosphorus), bacteria (i.e., E. coli) and aquatic environment toxicity reductions.

Therefore, the purpose of this proposed undertaking is to provide the Village with updated wastewater treatment technology that will resolve existing treatment process and treatment performance shortcomings, and which will be capable of achieving EDO requirements, along with providing improved long-term operating reliability, performance and safety.

### 2.3.3 Need

Treatment performance improvements needed to meet federal municipal wastewater discharge guidelines relate primarily to new effluent discharge objectives for nutrients (i.e., nitrogen, phosphorus), bacteria (i.e., E. coli) and aquatic environment toxicity.

Therefore, the need for this undertaking is based primarily on achieving the following treatment enhancements:

- Chemical addition/flocculation process - for phosphorus precipitation/reduction;
- Nitrification process - for biological nitrogen conversion/reduction;
- Environmentally sustainable disinfection process - for effective pathogenic bacteria reduction without toxic impacts;
- Outfall re-positioning into the Salmon River - to access greater effluent dilution ratios and to reduce organic loadings on the Henderson Brook aquatic environment;
- Aquatic environment toxicity reduction - by eliminating impacts resulting from chlorine disinfection;
- Affordable wastewater treatment services.

## 2.4 Project Location

A *Key Plan* showing the Project Area for the proposed undertaking within the Village of Chipman, is provided in Figure 1, Appendix A. The Project Area generally includes municipally-owned property, adjacent privately-owned properties, Henderson Brook, Salmon River and the surrounding environs.

A *Site Plan* positioning the proposed WwTF and effluent discharge piping (outfall) on municipal-owned property located within the Project Area, is provided in Figure 2, Appendix B. This municipally-owned property is generally identified as follows:

- PID: 45079324
- Street address: Off of Route 10
- Community: Village of Chipman, New Brunswick
- Parish: Chipman
- County: Queens

Coordinates for the approximate center of the proposed new WwTF site are:

- *Latitude* - 46° 9' 57.7224" N;
- Longitude - 65° 53' 9.3336" W.

## 2.5 Environmental Risk Assessment

### 2.5.1 ERA Report Findings

An Environmental Risk Assessment (ERA) was undertaken on the Village's existing WwTF in 2012-13. This ERA was conducted in accordance with the Canada-Wide Strategy for Municipal Wastewater Effluent. The ERA was summarized in a report titled – *Environmental Risk Assessment for the Chipman Wastewater Treatment Plant in Accordance with the Canada-Wide Strategy for Municipal Wastewater Effluent*, Natech Environmental Services Inc., June 30, 2014.

The ERA undertaken for the Village's existing WwTF noted the following general findings:

1. Substrate (i.e., bottom layer) areas within Henderson Brook appear to turn anaerobic (i.e., devoid of oxygen) during summer low flow conditions. It is suspected that this is due to a combination of wastewater and wood waste from the adjacent mill.

2. Significant inflow and infiltration (I/I) appear to occur in the municipal system during rain and snowmelt events.

3. Treated effluent was observed to mix slowly into Henderson Brook.

4. Henderson Brook provides very limited dilution of treated effluent during dry weather conditions, thus resulting in the following Effluent Discharge Objectives being relatively strict:

    - *Regular* EDO for Carbonaceous Bio-chemical Demand ($CBOD_5$) < 15 mg/L;

    - *Regular* EDO for E. Coli was formerly < 1 900 MPN/100 ml based on a calculated end-of-mixing zone concentration, but has been recently changed by DELG to < 1 000 MPN/100 ml based on an end-of-pipe concentration;

    - *Theoretical* EDOs for TKN, TP, fluoride and copper are strict and are not achieved by the existing WwTF treated effluent quality;

    - *Theoretical* EDOs for aluminum and cadmium are strict due to their elevated background concentrations in Henderson Brook, and the need for low environmental guideline concentrations to protect aquatic life.

5. Need to eliminate chlorine discharges.

6. Need to eliminate release of pathogens into local watercourses by carrying out more effective disinfection.

7. Consideration for repositioning the treated effluent point-of-discharge into the middle of the Salmon River to improve the effluent mixing regime.

### 2.5.2 Effluent Discharge Objectives

Effluent Discharge Objectives (EDOs) were calculated as part of the 2012-13 ERA report for the existing WwTF, based on the scenario of Henderson Brook as the receiving stream. The Henderson Brook EDOs are presented in NATECH's 2014 report, and are partially summarized below in Table 1.

The 2012-13 ERA report determined that the available mixing zone in Henderson Brook provided a dilution factor of only 1:2.2, under the worst-case conditions (i.e., 7-day, 10-year low flows). A review of historical aerial photography shows significant encroachment (infilling) of Henderson Brook along its north bank over the past 40+/- years, potentially creating detrimental impacts on flow characteristics and this estuary's benthic zone quality.

**Table 1 - Effluent Discharge Objectives for Salmon River, Henderson Brook**

| No. | Effluent Parameter | Unit | Effluent Discharge Objectives (EDOs) | | Exist. WwTF Avg. Effluent Quality (2012-13) |
|---|---|---|---|---|---|
| | | | Discharge to Salmon River *At 1:100 Dilution* | Discharge to Henderson Brook *At 1:2.2 Dilution* | |
| 1. | Total Residual Chlorine **(TRC)** | *mg/L* | **<0.02 (NPS)** | **<0.02 (NPS)** | 0.4 |
| 2. | Carbonaceous Biochemical Oxygen Demand **($CBOD_5$)** | *mg/L* | **<25 (NPS)** | **<15 (NPS)** | <8 |
| 3. | Total Suspended Solids **(TSS)** | *mg/L* | **<25 (NPS)** | **<25 (NPS)** | 9 |
| 4. | Unionized Ammonia **($NH_3$-N)** | *mg/L* | **<1.25 (NPS)** | **<1.25 (NPS)** | 0.001 |
| 5. | Total Ammonia **($NH_3$-N)** | *mg/L* | **<88 (1); <269 (2)** | **<1.9 (1); <5.8 (2)** | 0.6 (1); 0.3 (2) |
| 6. | Nitrate-N | *mg/L* | **<290** | **<28** | 12.4 |
| 7. | Nitrite-N | *mg/L* | **<6.0** | **<0.13** | 0.31 |
| 8. | Total Kjeldahl Nitrogen **(TKN)** | *mg/L* | **<25** | **<0.7** | 1.7 |
| 9. | Total Phosphorus **(TP)** | *mg/L* | **<1.5** | **<0.04** | 1.3 |
| 10. | pH | *units* | **6.5 to 11.0** | **6.7 to 9.3** | 6.3 to 8.1 |
| 11. | E. coli | *MPN/100 mL* | **<1 000(3) (May-Oct.)** | **<1 000 (4) (May-Oct.)** | 79 900 (May-Oct.) |
| 12. | Cyanide | *mg/L* | **<0.5** | **<0.01** | <0.01 |
| 13. | Fluoride | *mg/L* | **<12** | **<0.26** | 0.43 |
| 14. | Aluminum | *µg/L* | **<100** | **<100** | 83 |
| 15. | Arsenic | *µg/L* | **<400** | **<10** | 1 |
| 16. | Boron | *µg/L* | **<149 500** | **<3 200** | 104 |
| 17. | Cadmium | *µg/L* | **<2.1** | **<0.05** | 0.07 |
| 18. | Copper | *µg/L* | **<150** | **<3.2** | 25 |
| 19. | Iron | *µg/L* | **<20 000** | **<530** | 220 |
| 20. | Lead | *µg/L* | **<50** | **<1.2** | 0.6 |
| 21. | Mercury | *µg/L* | **<2.6** | **<0.056** | <0.025 to 0.060 |
| 22. | Molybdenum | *µg/L* | **<7 290** | **<158** | 2.7 |
| 23. | Nickel | *µg/L* | **<2 500** | **<52** | 1.8 |
| 24. | Zinc | *µg/L* | **<2 500** | **<58** | 39 |
| 25. | Phenanthrene | *µg/L* | **<40** | **<0.9** | <0.02 |
| 26. | Anthracene | *µg/L* | **<1.2** | **<0.03** | <0.02 |
| 27. | Toluene | *µg/L* | **<200** | **<4** | <0.5 to 0.5 |
| 28. | Chloroform (VOC) | *µg/L* | **<180** | **<4** | <0.5 to 1.0 |
| 29. | Acute Toxicity | *Toxicity Unit* | **<1** | **<1** | <1 |
| 30. | Chronic Toxicity | *Toxicity Unit* | **<100** | **<2.2** | <1 to 1.4 |

***Notes:***
*(NPS) - National Performance Standard – to be achieved at end-of-pipe prior to receiving stream discharge.*
*(1) - From June to September only*
*(2) - Outside of June to September*
*(3) - Based on end-of-pipe concentration.*
*(4) - Based on end-of-pipe concentration. Previously < 1 900 MPN/100 mL based on a calculated end-of-mixing zone concentration.*

The 2013-14 ERA report noted that an improved mixing regime could be obtained by extending the outfall into the middle of the Salmon River. Flows in the Salmon River would provide for a better background water quality and significantly greater dilution opportunities. Subsequently, a second set of EDOs were calculated for this EIA Process, based on the scenario of the Salmon River as the receiving stream. These *preliminary* Salmon River EDOs are documented in a March 23, 2017 letter report by NATECH (see Appendix M). They are summarized for comparative purposes in Table 1, along with the Henderson Brook EDOs, as well as, the existing WwTF average effluent quality for 2012-13.

Regardless of available dilution provided by the receiving stream, Effluent Discharge Objectives (EDOs) based on National Performance Standards (NPS) for Total Residual Chlorine (TRC), Carbonaceous Biochemical Oxygen Demand ($CBOD_5$), Total Suspended Solids (TSS), and Unionized Ammonia ($NH_3$-N) must be achieved at the end-of-pipe, prior to discharge to the receiving stream and without the benefit of dilution. *For example: $CBOD_5$ concentrations < 25 mg/L must be achieved prior to discharge into the Salmon River; $CBOD_5$ < 15 mg/L prior to discharge into Henderson Brook.*

Likewise, E. coli has recently been designated by DELG as an end-of-pipe EDO. Thus, E. coli concentrations < 1 000 MPN/100 mL must be achieved at the treatment process end-of-pipe not accounting for any receiving stream dilution, prior to discharge to either the Salmon River or Henderson Brook.

All remaining EDOs are established based on calculated concentrations achieved at the end of the in-stream mixing zone, based on available dilutions in the Salmon River (i.e., 1:100) and in Henderson Brook (i.e., 1:2.2).

A Salmon River point of discharge is assumed for the proposed undertaking. Therefore, the EDOs presented in Table 1 for discharge to Salmon River form the bases for the required level of treatment performance that is to be achieved by the proposed new WwTF.

## 2.6 Siting Considerations

### 2.6.1 WwTF

The Proponent proposes, with this undertaking, to replace the existing Village WwTF with a new wastewater treatment process located at a new site. The site of the proposed new WwTF is positioned within the same Village-owned property boundaries on which the existing WwTF is located (see Figure 2, Appendix B and Figure 3, Appendix C).

Attributes of the new site are:

- Village owned site does not require purchasing or expropriation;
- Pre-existing condition - located on the same property, the existing WwTF has established a pre-existing condition for wastewater treatment services on this property;

- Existing influent sewer - located nearby connecting to existing WwTF and adjacent to the proposed WwTF site, thus providing ready access to the source of raw wastewater;
- Receiving stream access - provides for direct access to discharge treated effluent into the preferred receiving stream - Salmon River;
- Land availability - potentially sufficient area to accommodate a variety of wastewater treatment alternatives, including either aerated lagoon or engineered wetland based technologies;
- Isolated location - positioned away from the vast majority of the Village's residential dwelling units. However, the proposed new WwTF site does share property boundaries with several residences and commercial establishments fronting on Route 10.

### 2.6.2 Outfall/Receiving Stream

The existing WwTF outfall structure discharges directly into Henderson Brook. It consists of a 250 mm (10") diameter PVC pipe, approximately 110 metres in overall length. The outfall pipe extends approximately 3 to 4 meters into the receiving stream and remains partly submerged under most operating conditions. The outfall pipe has been known to be exposed and free fall into the receiving stream during periods of extended low water levels in the Henderson Brook/Salmon River estuary.

The relatively small drainage area (i.e., 11 $km^2$) contributing to Henderson Brook generates limited dilution flows in the brook. Thus, an outfall discharge into Henderson Brook provides for very limited dilution opportunities, especially during extended dry-weather conditions. This results in relatively strict effluent quality performance objectives, and translates directly into the need for greater treatment performance to achieve calculated EDO performance levels.

Preliminary modeling of mixing zone conditions in the Salmon River suggest that dilution rates as high as 1:184 are achievable within 250 m downstream from the end of the outfall under worst-case flow conditions (i.e., 7-day, 10-year low flows). However, the maximum dilution factor is purposely limited to 1:100 at the edge of the mixing zone (NBDELG, 2011). Therefore, to gain this dilution advantage, the Proponent proposes to install a treated effluent outfall pipe with direct discharge into the Salmon River's main channel. *Note: The routing and point-of-discharge for the proposed new outfall was discussed at pre-submission consultation meetings held with DELG on March 1st and 22nd, 2017.*

A plan and profile of the proposed new outfall routing and point-of-discharge location are provided in Figure 4, Appendix D.

### 2.6.3 Flood Levels

Siting for the proposed new WwTF takes into account on-site flooding. It is understood that the highest flood level on record for the proposed site is based on Service New Brunswick (SNB) 2008 flood delineation data, where 2008 flood levels were determined from aerial photography taken between May 3rd and 6th, 2008.

Although the 2008 flood event represented a significant flow event within the St. John River, a review of data obtained from Hydro-metric Gauge No. 01AN002, positioned on the Salmon River at Castaway (approximately 18km upstream), shows that the 2008 event was not the most significant event recorded for the Salmon River. Return interval flows for this gauge were calculated based on related equations and coefficients (i.e., Equation 7; Table 5) obtained for New Brunswick from the *Canadian Technical Report of Fisheries and Aquatic Sciences 2843*. Calculated return intervals and associated flows are summarized in Table 2 below.

**Table 2 - Salmon River Return Intervals/Flows**

| Item No. | Return Interval | Flow *($m^3/s$)* |
|---|---|---|
| 1. | 2-year | 204 |
| 2. | 5-year | 281 |
| 3. | 10-year | 332 |
| 4. | 20-year | 381 |
| 5. | 50-year | 450 |
| 6. | 100-year | 504 |

Additional data obtained from the Gauge No. 01AN002 shows that a flow of 557 $m^3/s$ was recorded on Dec. 11th, 2014. This flow exceeds the Salmon River 100-year return interval of 504 $m^3/d$ noted in Table 2 above. A review with Chipman WwTF operators confirmed that the Dec. 11th, 2014 flow event did <u>not</u> exceed the 2008 delineated flood line. Spring 2017 freshet resulted in flood levels that were very close to the delineated 2008 flood line.

### 2.6.4 Miscellaneous Siting Requirements

The *Atlantic Canada Wastewater Guidelines Manual* recommends flood protection as follows:

1. Components to be protection from physical damage in a 100-year return flood:
    - Treatment works structures;
    - Waste sludge (biomass) handling facilities;
    - Sewage pumping station structures;
    - Electrical and mechanical equipment.

2. Components to be located outside of a 100-year return floodplain:
    - Earthen-berm ponds.

3. Components to remain fully operational and accessible during a 25-year return flood:
    - Treatment works, both new and existing facilities undergoing major modifications;
    - Sewage pumping stations.

The new WwTF will be sited to accommodate the above noted process component flood protection recommendations.

### 2.6.5 Site Access Roadway

Access to the existing WwTF is gained from Route 10 along an existing access roadway. Although this roadway services the existing WwTF site, it is positioned nearly entirely on the adjacent property (PID 45079068). It is proposed that the current roadway will continue to serve as access to the new WwTF site. The Proponent will discuss with the adjacent property owner to obtain the necessary easements to ensure continued use of this roadway as part of the new WwTF.

The access roadway surface will be maintained throughout the project construction phase to a standard capable of withstanding construction vehicular traffic loadings. Dust control will also be maintained along the access roadway to minimize dust formation, dust movement around the site, and dust migration onto adjacent properties.

Following the project construction phase, the access roadway surface will upgraded/restored to an acceptable standard to accommodate year-round operation and maintenance vehicular traffic.

### 2.6.6 Influent Gravity Sewer

The influent sanitary sewer enters the Proponent's property from Route 10 and connects to the existing WwTF. A small portion of this sanitary sewer crosses the adjacent property (PID 45079068) from Route 10 before entering the Proponent's property.

The existing influent sanitary sewer will also serve the proposed new WwTF. Therefore, the Proponent will discuss with the adjacent property owner to obtain the necessary easements to ensure continued use and access to the sanitary sewer as part of the operation and maintenance of the new WwTF.

### 2.6.7 Site Power Supply

Similar to the existing site access roadway, the NB Power supply enters from Route 10 and travels along the access roadway to the existing WwTF. As such, a large portion of the existing 3-phase power supply pole line is positioned on the adjacent property (PID 45079068).

The same power supply line will be used to gain 3-phase power for the proposed new WwTF. Therefore, the Proponent will discuss with NB Power to confirm that adequate easements are in place, or are put in place, to ensure continued use of this power supply for the new WwTF.

### 2.6.8 Geotechnical Investigation

A geotechnical and hydro-geotechnical assessment of the proposed WwTF site was undertaken by GHD between March 27 and May 4, 2017. The results of this investigation are summarized in a draft report titled – *DRAFT Geotechnical Baseline Report and Hydrogeology Study, Proposed Wastewater Treatment Facility, Route #10 (PID #45079324), Chipman, New Brunswick, GHD, May 8, 2017.*

The geotechnical/hydro-geotechnical site investigation included excavation of test pits and drilling of boreholes and monitoring wells. Test pit, borehole and monitoring well site locations are shown in Figure 7, Appendix G.

Soil samples obtained from the field during this investigation were analysed by GHD in a soils lab to confirm the site's soil suitability for earthen-berm lagoon cell construction. The soils found were sorted into the following four (4) categories: Organics, Alluvial Granular Soils, Finer-Grained Soils and Bedrock. These soils were found to layers varying in depth, thickness and specific composition. They are briefly described below.

- *Organics* - include topsoil and decaying material at the top of the ground and was found up to a thickness of 0.8m. This material will need to be stripped off the site prior to construction, but could be reused to dress the final slopes for seeding and erosion stabilization.

- *Alluvial Granular Soils* - include the sands found on the site, with varying amounts of silt and clay in its composition. This layer varies between 1.2 and 3.0m thick with the bottom being delineated between 4.5m and 6m geodetic.

- *Finer-Grained Soils* - include silt with varying amounts of sand and clay in its composition. This layer varies between 0.6 to over 3.0m thick, with the bottom being delineated between 2.5m and 5m geodetic.

- *Bedrock* – consists of highly weathered conglomerate.

GHD reported that the site offers good potential for construction of earthen-berm lagoon cells. In-situ soil and shallow bedrock characteristics would provide for a solid foundation on which to construct a wastewater treatment system. Excavated soils can potentially be used for earthen-berm construction to minimize soil importing requirements, assuming the soils are dewatered.

The variability of soils will require experienced on-site supervision during excavation to ensure proper sorting/stockpiling of the different soil types for reuse. Soil characteristics near the surface may prove to be challenging for accommodating traditional open-cut trench excavation (i.e., for installing the overland outfall portion). Consideration of alternative excavation methods, such as horizontal directional drilling (HDD) is recommended. Soils characteristics appear to support a HDD approach for outfall pipe installation.

The presence of a high groundwater table will present challenges for both the design and construction of earthen-berm lagoon cells. Underdrainage of the lagoon cell bottom and perimeter will likely be necessary to ensure stability and protection of a synthetic lagoon cell liner.

## 2.7 Physical Components and Dimensions of the Project

### 2.7.1 General

A preliminary site plan of the proposed undertaking is provided in Figure 2, Appendix B. This site plan depicts the following features of the proposed undertaking:

- Village's existing WwTF footprint and outfall location;
- Village's proposed new WwTF development area and outfall location;
- Property boundaries of Village's WwTF property and adjacent properties;
- Parcel identification (PID) numbers;
- Geodetic contour elevations;
- Delineated wetland and wetland buffer setbacks;
- 2008 delineated floodplain;
- Nature trail footpath delineation;
- Location of rare plant species.

### 2.7.2 Property Area

The property parcel (PID 45079324) on which the proposed undertaking is located (i.e., subject property) is owned by the Village of Chipman. The subject property occupies a total area of 14.4 hectares (35.7 acres) and is generally bounded primarily by Route 10, Henderson Brook and the Salmon River.

The subject property is currently occupied by the Village's existing WwTF footprint (0.3 ha) and the 2008 delineated floodplain zone (8.4 ha). The remaining area available for locating a new WwTF is: 14.4 - 0. 3 - 8.4 = 5.7 ha (14.1 acres). This remaining areas represents approximately 40% of the total subject property area. The footprint anticipated for a new WwTF is estimated at 19 000 $m^2$, or 1.9 hectares (4.7 acres), which represents approximately 13% of the total subject property area.

A breakdown of the various property area components is provided in Table 3 below.

**Table 3 - Village WwTF Property Areas**

| Item No. | Village of Chipman PID 45079324 | Area | | | |
|---|---|---|---|---|---|
| | | *m²* | *Hectares* | *Acres* | *% of Total* |
| 1. | Total area of PID 45079324 | 144 376 | 14.4 | 35.7 | 100 |
| 2. | Area occupied by 2008 flood zone | 83 892 | 8.4 | 20.7 | 58.1 |
| 3. | Area occupied by exist. WwTF | 3 594 | 0.3 | 0.9 | 2.5 |
| 4. | Area remaining for new WwTF | 56 885 | 5.7 | 14.1 | 39.4 |
| 5. | Area of WwTF footprint | 19 000 | 1.9 | 4.7 | 13.0 |

### 2.7.3 Design Population and Density

Statistics Canada census data for the Village for the 20-year period from 1996 to 2016 is summarized in Table 4 as follows:

**Table 4 - Village Census Population Data (1996-2016)**

| Census Year | Population | Change | Accumulative Change Since 1996 |
|---|---|---|---|
| 2016 | 1104 | -132 | -414 |
| 2011 | 1236 | -55 | -282 |
| 2006 | 1291 | -141 | -227 |
| 2001 | 1432 | -86 | -86 |
| 1996 | 1518 | - | - |

The Village's residential design population for the proposed undertaking, based on Statistics Canada 2016 census data, is **1 104 persons**.

Village data identifies a total of **514** residential sanitary sewer lateral connections. The average number of persons per residential connection (i.e., the residential dwelling unit density) is therefore calculated as: 1 104 ÷ 514 = 2.15 persons per dwelling unit.

### 2.7.4 Measured Hydraulic Loadings

Treated effluent wastewater volume discharged from the existing WwTF into Henderson Brook is measured on a continuous basis. An ultra-sonic level measuring device positioned over a V-notch weir located within the chlorine contact chamber is used for flow measurement of the treated effluent discharged into Henderson Brook.

Daily total effluent wastewater flows recorded at the existing WwTF for the period from 2011 to 2016 were obtained from the Village. This data was reviewed in determining the design hydraulic loadings for the proposed new WwTF. Measured daily effluent flow volumes discharged to Henderson Brook from 2011 to 2016 are provided in Appendix I.

Specific flow information extracted for each year from 2011 to 2016 is present in Table 5 below.

**Table 5 - WwTF Effluent Flow Summary for 2011 to 2016**

| Year | Annual Avg. Daily Flow | Annual Max. Daily Flow | Max. 7-day Avg. Day Flow | Max. Month Avg. Day Flow | Min. Month Avg. Day Flow |
|---|---|---|---|---|---|
| | *$m^3/d$* | *$m^3/d$* | *$m^3/d$* | *$m^3/d$* | *$m^3/d$* |
| 2011 | 684 | 2 697 | 1 764 | 1 183 | 264 |
| 2012 | 551 | 2 562 | 1 440 | 875 | 263 |
| 2013 | 601 | 2 053 | 1 433 | 835 | 364 |
| 2014 | 728 | 2 949 | 2 094 | 1 407 | 351 |
| 2015 | 645 | 1 580 | 1 199 | 1 063 | 306 |
| 2016 | 502 | 1 290 | 1 071 | 864 | 288 |
| | *Avg. = 619* | *Max. = 2 949* | *Max. = 2 094* | *Avg. = 1 038* | *Avg. = 306* |

Based on flow data presented in Table 5 above, measured flows for the period from 2011 to 2016 are summarized as follows:

- Annual Average Daily Flow = 619, say **620 $m^3/d$**;
- Maximum Day Flow = 2 949, say **2 950 $m^3/d$**;
- *Maximum of* Max. 7-day Average Day Flow = 2 094, say **2 100 $m^3/d$**;
- *Average of* Max. Month Average Day Flow = 1 038, say **1 050 $m^3/d$**.
- *Average of* Min. Month Average Day Flow = 306, say **310 $m^3/d$**.

### 2.7.5 Calculated Hydraulic Loadings

Hydraulic loadings were calculated based on assumed per capita domestic wastewater loadings for residential dwelling units, and typical loading rates for commercial, institutional and industrial facilities, as provided in the *Atlantic Canada Wastewater Guidelines Manual*.

Hydraulic loading calculations are summarized as follows:

- *Residential Contributions:* Average daily design hydraulic loadings were calculated based on a per capita loading of 340 litres per capita per day (Lpcd). This per capita loading includes an inflow/infiltration allowance. The residential contribution to the overall wastewater flow was determined as: 1 104 residents x 340 Lpcd = 375 360 L/d, or **375 m³/d**.

- *Commercial/Institutional/Industrial Contributions:* Average daily design hydraulic loadings were calculated based on typical Atlantic Canada Wastewater Guideline hydraulic loadings for individual establishments. Total of all commercial, institutional, and industrial contributions within the Village was determined to be 220 000 L/d, or **220 m³/d**. This loading includes an allowance for I/I. Details of these calculated contributions are provided in Appendix K.

Therefore, the calculated total average daily design hydraulic loading is 375 + 220 = 595, say **600 m³/d**. This figure is very similar to the measured Annual Average Daily Flow of **620 m³/d** (2011-2016), as determined in the previous section.

The calculated peak day design flow is based on the calculated average daily flow of 600 m³/d (see above) multiplied by peaking factor (PF). The PF was determined using the Harmon Formula as follows:

$$PF = 1 + [14 \div (4 + p^{0.5})]; \text{ where } p = \text{equivalent population in thousands.}$$

Assuming an equivalent contributing population of 1 750 people (see determination of this figure in Calculated Organic Loadings below), the peaking factor is calculated as follows:

$$PF = 1 + [14 \div (4 + p^{0.5})]$$

$$PF = 1 + [14 \div (4 + 1.75^{0.5})] = 3.63$$

Therefore, the calculated peak day design flow is:

$$600\ m^3/d \times 3.63\ (PF) = 2\ 180\ m^3/d.$$

This flow figure is similar to the measured Max. 7-day Average Day Flow of 2 100 m³/d, but is significantly less than the measured Maximum Day Flow of 2 950 m³/d (see Measured Hydraulic Loadings above).

### 2.7.6 Extraneous Flow Contributions

Extraneous flows contributions due to inflow (i.e., water entering from overland surface flow) and infiltration (i.e., water entering through pipe and manhole/chamber leaks) are experienced in all sanitary sewer collection systems. A reasonable level of inflow/infiltration (I/I) is typically accounted for in determining design hydraulic loadings.

The level of extraneous I/I is revealed in the 2011-2016 flow data is at times high. Flow data measured at the WwTF (see Table 5 above), identifies average daily flows sustained over a one month period as high as 1 407 $m^3/d$, and average daily flow sustained over a 7-day period as high as 2 094 $m^3/d$. Such elevated sustained flows rates indicate that the Village's wastewater collection system is highly susceptible to high I/I, especially during the spring freshet period.

Comparing the *calculated* peak day design flow of 2 180 $m^3/d$ (see Calculated Hydraulic Loadings above) with a *measured* maximum day flow of 2 950 $m^3/d$ (see Measured Hydraulic Loadings above), also indicates that the Village's sanitary collection system is at times highly susceptible to significant I/I impacts.

### 2.7.7 Measured Organic Loadings

The existing WwTF influent raw wastewater characterization includes total suspended solids (TSS) and occasional carbonaceous bio-chemical oxygen demand ($CBOD_5$) analysis. TSS measurements for portions of 2010 to 2016 are provided in Appendix J.

Given the low frequency of these parameters, influent organic loadings haven't been calculated and have not been used for design purposes. Calculated organic loadings (see section below) will be relied upon for process design purposes.

### 2.7.8 Calculated Organic Loadings

Calculated organic loadings were determined based on typical per capita domestic wastewater organic loadings and a total equivalent contributing population. Organic loading calculations are summarized as follows:

- *Residential:* Equivalent contributing residential population = **1 104** equivalent people.
- *Commercial/Institutional/Industrial:* Equivalent commercial/institutional/industrial population = 220 000 L/day ÷ 340 Lpcd = **647** equivalent people.

Therefore, the total equivalent contributing population = 1 104 (residential) + 647 (commercial, institutional, industrial) = 1 751, say **1 750 equivalent people**.

The per capita design organic loadings (Kg/capita/d) used for calculation purposes are:

- Carbonaceous bio-chemical oxygen demand ($CBOD_5$) = 0.080 Kg/capita/d;
- Total suspended solids (TSS) = 0.090 Kg/capita/d;
- Total phosphorus (TP) = 0.0035 Kg/capita/d;
- Total nitrogen (TN) = 0.014 Kg/capita/d.

Therefore, the design organic loadings were determined as follows:

- $CBOD_5$ = 0.080 Kg/capita/d x 1 750 people = **140 Kg/d**;
- TSS = 0.090 Kg/capita/d x 1 750 people = 157.5, say **160 Kg/d**;
- TP = 0.0035 Kg/capita/d x 1 750 people = 6.1, say **6 Kg/d**;
- TN = 0.014 Kg/capita/d x 1 750 people = 24.5, say **25 Kg/d**.

Assuming a calculated Average Daily Flow of 600 $m^3/d$ (see Calculated Hydraulic Loadings above), influent design organic loading concentrations are determined as follows:

- $CBOD_5$ = 140 Kg/d ÷ 600 $m^3/d$ x $10^3$ = **233 mg/L**;
- TSS = 160 Kg/d ÷ 600 $m^3/d$ x $10^3$ = **267 mg/L**;
- TP = 6 Kg/d ÷ 600 $m^3/d$ x $10^3$ = **10 mg/L**;
- TN = 25 Kg/d ÷ 600 $m^3/d$ x $10^3$ = **42 mg/L**.

### 2.7.9 Design Treatment Capacity Requirements

Treatment capacities for the new WwTF are based on the following assumptions:

- Residential populations in the Village have been in decline and are unlikely to increase from current levels;
- Future demands for commercial, institutional and industrial treatment capacity are unlikely to increase from current contribution levels;
- Future treatment capacity gains are to be obtained from reductions in inflow and infiltration contributions to the sanitary collection system.

Therefore, design organic and hydraulic loadings for the new WwTF are based on accommodating existing raw wastewater contributions only, and do not allow for future growth. Design hydraulic and organic loadings developed in the preceding sections are summarized below in Table 6.

**Table 6 - Design Loading Summary**

| Design Parameter | Design Value | |
|---|---|---|
| | Hydraulic and Organic Loads | Concentration at Avg. Daily Flow = 620 $m^3/d$ |
| ***Design Hydraulic Loadings:*** | | |
| Annual Average Daily Flow | 600 $m^3/d$ | - |
| Sustained 30-day Average Daily Flow | 1 050 $m^3/d$ | - |
| Sustained 7-day Average Daily Flow | 2 100 $m^3/d$ | - |
| Peak Day Flow | 2 950 $m^3/d$ | - |
| ***Design Organic Loadings:*** | | |
| Carbonaceous bio-chemical oxygen demand $CBOD_5$ | 140 Kg/d | 230 mg/L |
| Total suspended solids - TSS | 160 Kg/d | 260 mg/L |
| Total phosphorus - TP | 6 Kg/d | 10 mg/L |
| Total nitrogen - TN | 25 Kg/d | 40 mg/L |

## 2.7.10 Treatment Process Separation Distances

Anticipated separation distances, based on preliminary WwTF site layouts, are identified below in Table 7, along with the recommended minimum separation distances stated in the *Atlantic Canada Wastewater Guidelines Manual*.

**Table 7 - Treatment System Separation Distances**

| Source | Separation Distances | | |
|---|---|---|---|
| | Residence | Commercial-Industrial | Property Line |
| Mechanical Aerated Lagoon *or* Engineered Wetland Treatment Process Options | 85 m (279 ft.) | 65 m (213 ft.) | 58 m (190 ft.) |
| Atlantic Canada Wastewater Guidelines Manual – Recommended Minimum | 150 m (492 ft.) | 30 m (98 ft.) | 30 m (98 ft.) |

Based on the data provided in Table 7, anticipated separation distances from residence are less than the *Atlantic Canada Wastewater Guidelines Manual* recommended minimums. However, discussions to date with DELG has indicated that less-than-recommended separation distances have been applied at other WwTF within the province. The *Guideline Manual* also states:

- *"Lesser separation distances may be approved upon receipt of permission from adjacent or nearby property owners."*, and;

- *"Under special circumstances a lesser separation distance may be adopted, provided provisions for odour control equipment are provided at the plant."*

Given the anticipated separation distances for this proposed undertaking, the Proponent will seek approval for adopting lesser distances based on the provision of odour control equipment at the WwTF. Additional information on proposed odour control measures to mitigate these lesser separation distances is provided in subsequent sections.

### 2.7.11 Existing Sanitary Collection System

The Proponent's existing sanitary sewer collection system generally consists of 200 and 250 mm diameter PVC gravity sanitary sewers, nine (9) sanitary pumping stations, and 150 mm diameter pumping station force mains. A final section of 250 mm diameter gravity sewer system links the sanitary sewer on Route 10 to the WwTF.

As-build drawings for the Village's original sanitary system and WwTF are available, but have not been included as part of this submission document.

Based on a review of measured flow data from 2011 to 2016, the Village's sanitary collection system experiences significant inflow and infiltration during periods of high precipitation and/or snow melt conditions (see discussion under Extraneous Flow Contributions above).

### 2.7.12 Proposed Treatment System Components

The Proponent proposes to incorporate at wastewater treatment system based on one of the following treatment processes:

- **Aerated Lagoon Treatment Process** - see simplified process schematic - Figure 6a, Appendix F;

- **Engineered Wetland Treatment Process** - see simplified process schematic - Figure 6b, Appendix F;

Process components for each of these treatment options are listed in Table 8 below. Additional process component details are provided in the following sub-sections.

### Table 8 - Components for Treatment System Options

| Item No. | Treatment System Component | Aerated Lagoon Option | Engineered Wetland Option |
|---|---|---|---|
| 1. | Influent pumping station, w. emergency overflow by-pass piping. | ***Yes*** | ***Yes*** |
| 2. | Chemical addition system, w. inline static mixer. | ***Yes*** | ***Yes*** |
| 3. | Flocculation chamber, w. variable-speed mixer. | ***Yes*** | ***Yes*** |
| 4. | *Aerated Lagoon Treatment Option:* | ***Yes*** | No |
| | • Primary and secondary aeration basins (cells), w. synthetic liner. | ***Yes*** | No |
| | • Nitrification process (cells), w. synthetic liner. | ***Yes*** | No |
| | • Aeration blowers; air header/lateral piping; fine bubble diffusers. | ***Yes*** | No |
| | • Interconnecting process piping, chambers and isolation valving. | ***Yes*** | ***Yes*** |
| | • Waste bio-solids handling. | ***Yes*** | No |
| 5. | *Engineered Wetland Treatment Option:* | No | ***Yes*** |
| | • Fine screening (6 mm), w. screenings disposal bin/bagger. | No | ***Yes*** |
| | • Primary clarifiers, w. scrapers, waste sludge pumps, scum pump. | No | ***Yes*** |
| | • Horizontal wetland beds, w. inlet hydraulic flow splitter. | No | ***Yes*** |
| | • Sludge wetland beds, w. effluent return pipe to infl. pump station. | No | ***Yes*** |
| | • Ultraviolet (UV) disinfection process. | No | ***Yes*** |
| | • Interconnecting process piping, chambers and isolation valving. | ***Yes*** | ***Yes*** |
| 6. | Outfall pipe (land, underwater portions) into the Salmon River. | ***Yes*** | ***Yes*** |
| 7. | Odour control system. | ***Yes*** | ***Yes*** |
| 8. | Control bldg. for infl. pump stn. controls, chemical dosing, aeration blowers, lab/office/restroom, storage, emergency power. | ***Yes*** | No |
| 9. | Control bldg. for infl. pump stn. controls, lab/office/restroom, storage, emergency power. | No | ***Yes*** |
| 10. | Process equip. bldg. for fine screening, chemical dosing equip. | No | ***Yes*** |
| 11. | Process equip. bldg. for UV disinfection system. | No | ***Yes*** |
| 12. | SCADA communication system. | ***Yes*** | ***Yes*** |
| 13. | 3-phase site power supply. | ***Yes*** | ***Yes*** |
| 14. | Emergency stand-by power generator. | ***Yes*** | ***Yes*** |
| 15. | Non-potable water supply well. | ***Yes*** | ***Yes*** |
| 16. | Site access – service vehicle access roadway, parking areas. | ***Yes*** | ***Yes*** |
| 17. | Security fencing. | ***Yes*** | ***Yes*** |
| 18. | Fate of existing WwTF - demolition/decommissioning/re-purposing. | ***Yes*** | ***Yes*** |

### 2.7.1 Influent Sanitary Pumping Station

A new influent pumping station will be integrated into the existing influent gravity sanitary sewer that links Route 10 to the existing WwTF. This new pumping station will be positioned to intercept influent wastewater and lift it into the proposed new WwTF.

This pumping station will consist of a pre-cast concrete wet well chamber, incorporating two (2) submersible raw sewage pumps. Each as these pumps will be sized to handle the peak hourly design flow rate (i.e., 1-duty, 1-100% stand-by).

The pumping station wet well chamber will be equipped with emergency overflow (by-pass) piping that will enable full plant by-passing. This by-pass piping will be connected to either the proposed new outfall pipe (for discharge into the Salmon River), or to a re-purposed existing WwTF outfall pipe (for discharge into Henderson Brook).

Electrical controls for the pumping station pumps will be housed in a process control building.

Influent pump discharge piping will be directed downstream to either an isolation valve chamber (aerated lagoon treatment process), or to an automated fine screen (engineered wetland treatment process).

### 2.7.1 Chemical Addition System

The need for total phosphorus reduction prior to the treated effluent discharge will rely, in part, on precipitating phosphorus from solution using aluminum sulphate (alum), or ferric chloride (ferric). The resulting chemical reaction will form a chemical precipitate (floc), which will be settled from solution in a downstream process.

Chemical addition will be administered at a controlled rate using an automated dosing pump system. A downstream in-line static mixer will be used to ensure a rapid and thorough dispersion of the chemical into the raw wastewater flow stream. The chemical addition system and associated controls will be located within a heated and ventilated building enclosure.

### 2.7.2 Flocculation Chamber

A flocculation chamber will be positioned immediately downstream from the point of chemical addition. This chamber will provide several minutes of hydraulic retention time and will incorporate a variable slow-speed mixer to promote and maintain chemical floc formation. The chemical floc will be will be settled from the waste stream in a downstream treatment process as a chemical sludge.

### 2.7.3 Aerated Lagoon Treatment Process Option

A general layout of the proposed aerated lagoon treatment option is provided in Figure 5a, Appendix E. A simplified process flow schematic is provided in Figure 6a, Appendix F. This option will incorporate the following process components, as further described below:

- Primary and secondary aeration basins (cells), w. synthetic liner.
- Nitrification process (cells), w. synthetic liner.
- Aeration, including: blowers; aeration header/laterals; fine bubble diffusers.
- Interconnecting process piping, chambers and isolation valving.
- Waste bio-solids handling.
- Miscellaneous.

***Primary and Secondary Aeration Basins:*** The aerated lagoon treatment approach is based on utilizing common aerobic biological treatment processing to convert organic waste to the stabilized end-products of a treated wastewater flow stream and waste sludge (biomass). This treatment process generally consists of primary and secondary aeration basins (cells) followed by two (2) nitrification cells. Mechanical aeration is required to ensure adequate dissolved oxygen levels are maintained throughout all cells.

A primary sizing criteria for the aerated lagoon option is based on the requirement for treating a 30-day sustained Average Daily Flow of 1 050 $m^3$/d. The aerated lagoon process consists of equally-sized primary and secondary aerated cells (lagoons), having an anticipated total volumetric capacity of approximately 26 000 $m^3$, and providing a hydraulic retention time of nearly 25 days under the design flow conditions of 1 050 $m^3$/d.

The aeration cells will be constructed using earthen berms and a geo-synthetic liner. The top of the berms will be positioned, as a minimum, at a reasonably accepted height above previously recorded flood elevations for this area.

An underdrain system will be installed beneath both aeration cell bottom liners to maintain low groundwater levels, and to minimize upward groundwater hydrostatic pressure on the liner. This underdrain system will also be used for monitoring liner leakage. The underdrain system will outlet by gravity to the ground surface at a lower elevation point on the WwTF site. Alternatively, the underdrain system will outlet to a chamber, from which groundwater will be pumped to a convenient surface discharge disposal point.

Waste solids will accumulate over time in both aeration cells, where they will undergo further long-term organic conversion and physical reduction. Eventually, these solids will accumulate to a level where they must be removed, dewatered and disposed.

***Nitrification Cells:*** The nitrification cells will be positioned immediately downstream from the secondary aeration cell. The proposed nitrification process is to be based on a proven proprietary design suitable for cold-climate applications. One such nitrification cells design approach will be based on a gravity flow-through cell filled with a rock media, on which natural occurring nitrifying bacteria will be established. These nitrification cells will be constructed from earthen berms and will incorporate a geo-synthetic liner.

The nitrification cells will be aerated to maintain an aerobic environment required by the nitrifying bacteria. The cells will enable biological conversion of organic nitrogen to produce acceptably low un-ionized ammonia, nitrite and nitrate concentrations. This will ensure that the treated effluent will consistently remain non-toxic to the aquatic environment.

***Aeration:*** Pressurized air flow to all aeration and nitrification cells will be provided using positive-displacement type blowers. The aeration blowers will generally consist of three (3) equally-sized blowers (i.e., 2-duty, 1-50% stand-by) housed within a process control building. Air flow will be conveyed from the blowers through a common air-header pipe, individual air-header laterals, and submerged fine-bubble diffusers, to the bottom of the aeration and nitrification cells.

***Interconnecting Piping, Chamber and Isolation Valves:*** The overall process treatment train will be linked by interconnecting piping, chamber and isolation valves. Piping will consist of a force main connecting the influent pumping station with the flocculation chamber. All remaining process piping will be gravity flow, including the outfall. Chambers will consist of isolation valve chambers, hydraulic flow splitting chambers, flow convergence chambers and a final treated effluent chamber.

***Waste Bio-solids Handling:*** Waste solids will be generated from bio-chemical and chemical reactions occurring within the primary and secondary aeration cells. These solids will accumulate over time in the bottom of both aeration cells, where they will undergo further digestion and volume reduction. These solids will accumulate until removed every 10 to 15-years as part of a dewatering/disposal process known as lagoon de-sludging.

A portion of the aeration cell top-of-berm area will be established for locating a flexible dewatering bag. This area will be positioned and graded in such a way that drainage water excreted from the dewatering bag will gravity flow into the aeration cell. During the de-sludging operation, accumulated solids are pumped from the bottom of the aeration cell into the dewatering bag. Prior to entering the bag, a chemical polymer is injected (by metering pump) into the pumped flow to serve as a coagulant and dewatering aid. Water-solids separation, solids retention and water excretion occur simultaneously in the dewatering bag.

The dewatering bag can remain full, or partially full for extended periods (months) at the edge of the aeration cell. Winter freeze-thaw cycles enhance the dewatering process. After sufficient dewatering is achieved, the bag is opened allowing removal of the dewatered solids using a front-end loader. Solids are then disposed of on-site or off-site at an approved facility.

***Miscellaneous:*** An emergency overflow pipe will be incorporated in the influent pumping station wet well that will enable by-passing of raw wastewater around the entire treatment process, direct to either Henderson Brook or the Salmon River. Interconnecting piping and isolation valve provisions will be incorporated in the design to permit temporary by-passing of the primary or secondary aeration cells for cell servicing purposes. Nitrification cell by-passing will also be included in the design.

Reduction in E. coli concentrations to an end-of-pipe concentration of less than 1 000 MPN/100 mL will be required to meet the disinfection effluent discharge objective (EDO) determined for this facility for discharge into the Salmon River. Based on our preliminary review, the aerated lagoon treatment option is very capable of meeting this disinfection criteria upon discharge from the nitrification cells. Therefore, a separate disinfection process is not require for this treatment option.

The total anticipated footprint to be occupied by the aerated lagoon treatment system option, including all process components and building, is approximately 19 000 m$^2$ (1.9 hectares; 4.6 acres). This area does not include the footprint occupied by the outfall.

### 2.7.4 Engineered Wetland Treatment Process Option

A general layout of the proposed engineered wetland treatment option is provided in Figure 5b, Appendix E. A simplified process flow schematic is provided in Figure 6b, Appendix F. This option will incorporate the following process components, as further described below:

- Automated fine screen (6 mm), w. screenings disposal bin/bagger.
- Primary clarifiers, w. chain and flight scrapers, waste sludge pumps, scum pump.
- Horizontal wetland beds, w. inlet hydraulic flow splitter.
- Sludge wetland beds, w. effluent return pipe to influent pumping station.
- Ultraviolet (UV) disinfection process.
- Interconnecting process piping, chambers and isolation valving.

***Fine Screening:*** Fine screening of the raw wastewater flow stream is recommended for the engineered wetland treatment process option prior to primary clarification. The fine screening operation will generally consist of a motorized drum or channel-type screen incorporated within a metal holding tank. The fine screen device will receive pumped flow directly from the influent pumping station and will be sized to retain screenings larger than 6 mm in size. Screening will be deposited into a bin or bagger for eventual off-site disposal. The entire unit will be positioned above-grade, in a separate heated and ventilated enclosure.

***Primary Clarification:*** Following the fine screen, two (2) rectangular primary clarifiers provide gravity clarification of the raw wastewater for both suspended solids (SS) and biochemical oxygen demand (BOD) reduction. Primary clarification will be based on a rectangular clarifier design, consisting of two (2) equally sized clarifiers having a total combined surface area of approximately 100 m$^2$ and an operating depth of 3.5 to 4.0 metres. Clarifier sizing will be established to meet the *Atlantic Canada Wastewater Guidelines Manual* criteria for average day, maximum day and peak hour hydraulic surface loading rates.

Solids wasting pumps will be incorporated in the clarifier design to enable semi-continuous removal of primary solids from the clarifier to the sludge wetland beds for further treatment. Fat, oil and grease solids (scum) removed from the clarifier surface will be manually skimmed from the clarifier surface and pumped to temporary storage for eventual off-site disposal.

***Horizontal Wetland Beds:*** The engineered wetland treatment process option is based on a proven proprietary wetland system. This system relies on the use of specialized plant vegetation. The plant vegetation provides oxygen via the plant root system to bacteria that is located within a soil/rock matrix. This oxygenation approach, known as passive aeration, is the primary differentiator to the mechanical (active) aeration approach performed in the aerated lagoon treatment process option. The soil bacteria performs the biodegradation/conversion of the municipal wastewater.

The primary sizing criteria used to size the engineered wetland option is based on the requirement for treating a 30-day sustained Average Daily Flow of 1 050 $m^3$/d. The horizontal wetland beds are designed and sized to provide sufficient hydraulic storage capacity to accommodate and attenuate the 30-day sustained flow volumes. The total wetland surface area of 10 600 $m^2$ is provided by the four (4) horizontal beds at 2 650 $m^2$ for each bed.

Effluent from the primary clarifier flows by gravity to a hydraulic flow splitting device. The splitter evenly distributes the primary clarifier effluent into four (4) equally-sized horizontal wetland beds. The wetland beds generally consist of a soil/rock matrix in which the specialized plants grow. Upon entering the wetland beds, the wastewater flows through the soil/rock matrix. Once the plant root structure is established, organic conversion of wastewater takes place by means of solids filtering and bacteria activity within the matrix layer. The plant root structure provides the necessary dissolved oxygen concentrations (i.e., oxygenation) within the wetland beds. Eventually, the wetland bed soil/rock matrix must be cleaned to remove accumulated solids.

***Sludge Wetland Beds:*** The sludge wetland beds are designed and operated in a similar fashion to the horizontal wetland beds. The sludge beds generally consist of a soil/rock matrix in which the specialized plants grow. Primary clarifier waste solids are pumped directly to one of the sludge wetland beds, where they undergo further organic conversion to more biologically stabilized solids. Eventually, the wetland bed soil/rock matrix must be cleaned to remove accumulated solids. The anticipated total sludge wetland bed area is 1 280 $m^2$. These beds would constructed as six (6) equally-sized units at approximately 215 $m^2$ for each bed.

***UV Disinfection:*** Reduction in E. coli concentrations less than 1 000 MPN/100 mL will be required to meet the disinfection effluent discharge objective (EDO) determined for this facility for discharge into the Salmon River. The engineered wetland treatment option is unable to achieve this objective without supplemental disinfection, thus will require a ultra-violet (UV) disinfection process. The UV disinfection process will be positioned to treat effluent discharges from the horizontal wetland beds, prior to the outfall discharge pipe. The UV disinfection process and associated electrical controls, will be housed in a heated and ventilated enclosure.

***Interconnecting Piping, Chamber and Isolation Valves:*** The overall process treatment train will be linked by interconnecting piping, chamber and isolation valves. Piping will consist of a force main connecting the influent pumping station direct to the fine screening process. The wastewater flow stream downstream of the fine screen will be gravity flow through the flocculation chamber, primary clarifier and horizontal wetland beds, UV disinfection, outfall pipe and receiving stream. Chambers will consist of isolation valve chambers, hydraulic flow splitting chambers, flow convergence chambers and a final treated effluent chamber.

An emergency overflow pipe will be incorporated in the influent pumping station wet well that will enable by-passing of raw wastewater around the entire treatment process direct to either Henderson Brook or the Salmon River.

The total anticipated footprint to be occupied by the engineered wetland treatment system option, including all process components and buildings, is 19 000 $m^2$ (1.9 hectares; 4.6 acres). This area does not include the footprint occupied by the outfall.

### 2.7.5 Outfall Piping

Effluent from the treatment process will be conveyed, by gravity, directly into the Salmon River through an outfall pipe. Preliminary design indicates that a minimum pipe diameter of 300 mm (12 inch) will be required. Siting of the treatment process will require approximately a 300 m long overland section, followed by approximately a 200 m long underwater section into the Salmon River. A general layout of the proposed outfall routing is provided in Figure 4, Appendix D.

The outfall will likely be constructed in two parts. The overland section will be installed using a traditional open-trench with a 2 metre depth of bury, or using a shallow bury of 1 metre with a 1 metre high berm (to provide sufficient frost protection). Alternatively, a horizontal directional drill (HDD) method will also be considered. The portion under the Salmon River will be installed using a HDD method.

A chamber will be positioned at the outfall pipe inlet to provide a point of treated effluent flow convergence. The outfall pipe will protrude into a deeper section of the Salmon River flow stream from an underwater embankment. The underwater point of discharge will be outfitted with a multi-port diffuser manifold to assist with rapid flow dispersion into the main receiving stream channel.

### 2.7.6 Odour Control - *Aerated Lagoon Treatment Process Option*

The proposed aerated lagoon treatment process option will generate characteristic wastewater treatment system odours. Typically, these odours are characterized as ‘earthy’, but are not pungent. The greatest potential for odour production for the aerated lagoon treatment process option will be at more turbulent sections of the wastewater stream flow, such as: influent pumping station wet well; chemical flocculation chamber; aeration cells, and; during aeration cell de-sludging operations.

Proposed separation distances between the aerated lagoons and the adjacent residences and commercial establishments along Route 10 are less than those typically recommended for wastewater treatment systems (see Table 7). Therefore, for this treatment option the Proponent plans to handle potential odour sources as follows:

- *Influent pumping station wet well* - using an activated-carbon filter to extract odour causing compounds from the wet well headspace. The odour control filter will be positioned outside and adjacent to the influent pumping station. This filter will extract air from the wet well headspace and draw it through the filter to remove odour causing compounds. Treated air will be exhausted to atmosphere. This unit will be operated on a semi-continuous basis and will be shared with the chemical flocculation chamber process (see below).

- *Chemical flocculation chamber* - using the same activated-carbon filter unit provided for the influent pumping station wet well (see above). The same unit will extract air from air within the flocculation chamber headspace and draw it through the filter to remove odour causing compounds. Treated air will be exhausted to atmosphere. This unit will be operated on a semi-continuous basis.

- *Aeration cells* - A second and separate odour control system will be used to combat air borne odorous compounds emitted from the aeration cells. This system will be positioned along the south-east boundary perimeter fencing separating the WwTF from the adjacent residences along Route 10. This system will employ a natural, non-toxic, neutralizing (not masking) compound emitted through a vapourization system. This system will be operated on a semi-continuous basis.

- *De-sludging* - aeration cell de-sludging is anticipated to occur every 10 to 15-years over a relatively short 1 to 2 week period. Odour control measures will be based on maintaining a closed waste sludge pumping and dewatering bag system, thus minimizing exposure of raw waste sludge to the atmosphere and limiting odour liberation/escape to the surrounding atmosphere. The same vapourization odour control system noted above for the aeration cells will also serve to combat potential odours during de-sludging operations. This system will be operated on a continuous basis during de-sludging operations.

A minimum 25 metre wide coniferous tree buffer will be maintained along the south-east property boundary between the aeration cells and residences along Route 10. Portable gas detectors will be installed at two (2) points along the treatment facility's south-east property boundary security fence to continuously monitor hydrogen sulphide ($H_2S$) concentrations (one of the main odour causing compounds in these situations) in the atmosphere. This will provide odour (hydrogen sulphide) concentration data for evaluation and reporting purposes.

### 2.7.7 Odour Control – *Engineered Wetland Treatment Process Option*

The proposed engineered wetland treatment process option has a high potential for generating odours. The greatest potential for odour production for the engineered wetland treatment process option will occur at the influent pumping station wet well, chemical flocculation chamber, fine screening, horizontal wetland beds, and sludge wetland beds. Given the close proximity of adjacent residence, the Proponent plans to combat these potential odour sources for this treatment option as follows:

- *Influent pumping station wet well* – using an activated-carbon filter to extract odour causing compounds from the wet well headspace. The odour control filter will be positioned outside and adjacent to the influent pumping station. This filter will extract air from the wet well headspace and draw it through the filter to remove odour causing compounds. Treated air will be exhausted to atmosphere. This unit will be operated on a semi-continuous basis and will be shared with the fine screening and chemical flocculation chamber process (see below).

- *Fine screening* – using the same activated-carbon filter unit provided for the influent pumping station wet well (see above). This unit will also extract air from within the fine screening enclosure and draw it through the filter to remove odour causing compounds. Treated air will be exhausted to atmosphere. This unit will be operated on a semi-continuous basis.

- *Chemical flocculation chamber* – using the same activated-carbon filter unit provided for the influent pumping station wet well (see above). This unit will extract air from air within the flocculation chamber headspace and draw it through the filter to remove odour causing compounds. Treated air will be exhausted to atmosphere. This unit will be operated on a semi-continuous basis.

- *Horizontal wetland beds* – a second and separate odour control system will be used to combat air borne odorous compounds emitted from the horizontal wetland beds. This system will be positioned along the south-east boundary perimeter fencing separating the WwTF from the adjacent residences along Route 10. It will employ a natural, non-toxic, neutralizing (not masking) compound emitted through a vaporization system. This system will be operated on a semi-continuous basis.

- *Sludge bed wetlands* – same unit used for horizontal wetlands beds (see above). This system will be operated on a semi-continuous basis.

A minimum 25 metre wide coniferous tree buffer will be maintained along the south-east property boundary between the aeration cells and residences along Route 10. Portable gas detectors will be installed at two (2) points along the treatment facility's south-east property boundary security fence to continuously monitor hydrogen sulphide (H2S) concentrations (one of the main odour causing compounds in these situations) in the atmosphere. This will provide odour (hydrogen sulphide) concentration data for evaluation and reporting purposes.

### 2.7.8 Buildings - *Aerated Lagoon Treatment Process Option*

It is proposed that a single control building consisting of the following features be provided for the aerated lagoon treatment process option:

- Foundation - reinforced and insulated concrete slab-on-grade;
- Superstructure - modular and pre-engineered insulated fibreglass shell;
- Single and double man-doors (fibreglass), without windows;
- Interior partition walls (fibreglass);
- Interior/exterior lighting;
- Heating, incl. electric unit heaters and heat pump for heating/cooling;
- Ventilation, incl. motorized intake louvres and exhaust fans.
- Surface mounted electrical wiring and components (lights, receptacles, etc.).

This control building will be positioned adjacent to the influent pumping station and near the primary aeration cell, and will house the process equipment and components listed below.

- Influent pumping station electrical control panel;
- Chemical addition system, incl. dosing pumps, controls, and chemical storage tank;
- Aeration blowers, incl. sound attenuation enclosures, controls, and isolation valves;
- Lab/office area, incl. counter top, storage drawers/cabinets, computer desk;
- Restroom and sink;
- Clean/dirty clothes locker area and showering facilities;
- Storage shelving units;
- Emergency stand-by power generator.

### 2.7.9 Buildings – *Engineered Wetland Treatment Process Option*

Based on layout and process equipment requirements, it is proposed that multiple buildings/enclosures consisting of the following features be provided for the engineered wetland treatment process option:

- Foundation - reinforced and insulated concrete slab-on-grade;
- Superstructure - modular and pre-engineered insulated fibreglass shell;
- Single and double man-doors (fibreglass), without windows;
- Interior partition walls (fibreglass);
- Interior/exterior lighting;
- Heating, incl. electric unit heaters and heat pump for heating/cooling;
- Ventilation, incl. motorized intake louvres and exhaust fans.
- Surface mounted electrical wiring and components (lights, receptacles, etc.).

A control building, to be positioned adjacent to the influent pumping station and near the primary clarification process, and will house the process equipment and components listed below.

- Influent pumping station electrical control panel;
- Lab/office area, incl. counter top, storage drawers/cabinets, computer desk;
- Restroom and sink;
- Clean/dirty clothes locker area and showering facilities;
- Storage shelving units;
- Emergency stand-by power generator.

A separate process equipment building/enclosure will be positioned near the influent pumping station for housing fine screening (incl. controls) and chemical addition (incl. dosing pumps, controls, and chemical storage tank. A third separate building/enclosure will be positioned near the point of treated effluent discharge (into the outfall) for housing the UV disinfection system. All of these structures will be heated and ventilated.

### 2.7.10 SCADA Communication System

A Supervisory Control and Data Acquisition (SCADA) communication system will be provided at the proposed new WwTF. This system will have the capabilities of both data logging (i.e., to log influent pumping station operation and raw wastewater influent flows) and alarm monitoring (i.e., to log, annunciate and acknowledge alarm conditions).

Data logging will be available for viewing locally at process equipment control panels and remotely by computer screen. Alarm condition monitoring will be done through cellphone and computer e-mail/text messaging communications. Remote re-start of specific process equipment following power disruptions (i.e. aeration blowers; clarifier chain and flight mechanisms and waste sludge pumps), is available through a SCADA communication system and will be given consideration during detailed design.

### 2.7.11 Site Power

Power to the Proponent's existing WwTF is provided from an overhead 3-phase power supply line entering from Route 10. This power supply line first enters onto the adjacent property (PID No. 45079068), before entering onto the Proponent's property (PID No. 45079324 – Village of Chipman).

Site power for the proposed undertaking will be intercepted from the existing powerline and redirected underground to the control building for either of the proposed treatment system options. The remaining power line serving the existing WwTF will be removed as part of the eventual decommissioning of the existing WwTF.

### 2.7.12 Emergency Site Power

It is proposed that emergency site power be provided to accommodate prolonged power outages in the form of a stand-by generator. This generator would be either a diesel or propane powered unit. It would be permanently located in a separate room within the control building, and would include a fuel tank, and dedicated intake louvre and exhaust fan/louvre.

It is anticipated that the emergency generator will be sized to power the following components of the proposed aerated lagoon treatment process option:

- Single influent pumping station pump;
- Control building heating/ventilation/emergency interior lighting;
- Single aeration blower;
- Non-potable water supply well and electric hot water heater;
- SCADA communications system.

It is anticipated that the emergency generator will be sized to power the following components of the engineered wetland treatment process option:

- Single influent pumping station pump;
- Control building heating/ventilation/emergency interior lighting;
- Both primary clarification chain and flight mechanisms, and both waste sludge pumps;
- Non-potable water supply well and electric hot water heater;
- SCADA communications system.

### 2.7.13 Water Supply Well

A drilled well and submersible water supply pump will provide a water supply source for general process wash down, laboratory and restroom purposes. An electric hot water heater will be provided to supply hot water for general clean-up and handwashing.

The well will be non-chlorinated and thus will be designated as a non-potable (i.e., non-drinking) water supply. Water uses will include the following:

*Aerated Lagoon Treatment Process Option:*

- Control building hose-bibs for general building interior wash down purposes;
- Control building hose-bibs for general exterior process wash down purposes;
- Control building laboratory sink;
- Control building restroom toilet and sink;
- Control building shower.

*Engineered Wetland Treatment Process Option:*

- Control building hose-bibs for general building interior wash down purposes;
- Control building hose-bibs for general exterior process wash down purposes;
- Fine screening enclosure hose-bib for process and wash down purposes;
- Control building laboratory sink;
- Control building restroom toilet and sink;
- Control building shower.

### 2.7.14 Site Access

The existing WwTF site access roadway exits from Route 10 directly onto the adjacent property (PID No. 45079068). It remains on the adjacent property for the majority of roadway length, and only crosses onto the Proponent's property near the WwTF structures.

It is proposed that the existing WwTF's service vehicle access roadway be maintained as the primary means of site entry and exit for the following uses:

- Operation and maintenance of the existing WwTF until it is demolished/re-purposed;
- Construction of the proposed new WwTF;
- Operation and maintenance of the proposed new WwTF;
- Chipman Garden Club Nature Trail – *Note: This local club has established a shelter and nature walking paths on the Village WwTF property for general public use.*

The Proponent will seek a municipal services easement from the adjacent property owner in order to maintain the current access roadway alignment for use by the proposed WwTF. Should a satisfactory arrangement for continued use of the existing access roadway not be obtainable, the Proponent can develop an alternate direct access roadway to the proposed site shown in Figure 3, Appendix C from its own property frontage along Route 10.

The proposed new WwTF will also include a permanent service vehicle turn-around and parking area for long-term operation and maintenance of the proposed new WwTF. This feature will be positioned on the Proponent's property (PID No. 45079324).

### 2.7.15 Security Fencing

Both the proposed treatment system options will be contained within a 2-meter high chain-link security fence. This fence will isolate the influent pumping station, all treatment processing components (i.e., aeration/nitrification cells; horizontal/sludge wetland beds), buildings, enclosures, and the treated effluent outfall chamber. The buried outfall will not be contained within the security fence perimeter. Vehicle gates and operator man-gates will be strategically positioned for ease of operation and maintenance access. All fence gates will remain locked at all times when the operations staff or service maintenance sub-contractors are not present on-site. Based on layouts currently developed, security fencing is anticipated to be 550 m in overall length for either treatment system option.

### 2.7.16 Fate of Existing WwTF

The fate of the existing WwTF will ultimately be determined based on the final design preferences. Upon commissioning of the new WwTF, it is anticipated that the existing WwTF will either undergo demolition/decommissioning, or partial demolition/re-purposing.

Re-purposing options include:

- Utilizing the existing oxidation ditch (aeration cell), chlorine contact chamber and outfall (to Henderson Brook) as a storm water retention pond for attenuating storm water run-off from the new WwTF site;

- Utilizing the existing influent sanitary sewer, chlorine contact chamber and outfall (to Henderson Brook) as a point of discharge from the new influent pumping station wet well emergency overflow by-pass.

- Land application of stabilized and dewatered waste sludge from the aeration cells (i.e., aerated lagoon treatment process option), or from the horizontal and sludge wetland beds (i.e., engineered wetland treatment process option).

Anticipated fate of existing WwTF process components are:

- Influent bar screen - demolish/disassemble and remove from site;
- Oxidation ditch – re-purpose as a storm water retention pond, or abandon and fill in;
- Oxidation ditch walkway - demolish/disassemble and remove from site;
- Oxidation ditch walkway concrete abutments - abandon in-situ;
- Oxidation ditch asphaltic liner - abandon in-situ;
- Oxidation ditch aerators – remove from site;
- Secondary clarifier tankage - abandon in-situ and fill in;
- Secondary clarifier scraper mechanism - demolish/disassemble and remove from site;
- Secondary clarifier enclosure (dome) - demolish/disassemble and remove from site;
- Chlorine contact chamber - re-purpose as part of storm water retention pond, or re-purpose as influent pumping station emergency overflow by-pass, or abandon in-situ and fill in;
- Buildings - demolish/disassemble and remove from site;
- Outfall pipe - re-purpose as part of storm water retention pond, or re-purpose as influent pumping station emergency overflow by-pass, or abandon in-situ;
- Site power supply line - remove from site;
- Security fencing – maintain if site is re-purposed as a storm water retention pond, or demolish/disassemble and remove from site.

## 2.8 Construction Details

### 2.8.1 Milestone Construction Activities, Periods

Construction details for the proposed undertaking are provided in this section, based on a preliminary assumption of the aerated lagoon treatment process option being the preferred treatment approach. Based on this assumption, anticipated project milestone construction activities (and the associated calendar periods) are identified in Table 9 below.

The schedule provided in Table 9 is based on an assumed project completion date of March 31, 2018. This schedule is considered to be extremely limiting to the project. The Proponent has requested that the federal government extend the schedule to March 31, 2019 to provide a more reasonable time frame in which to complete the proposed undertaking.

The initial physical construction related activity anticipated on the proposed site is early July 2017. A typical construction work day is anticipated to be from 7 AM to 7 PM, Monday to Friday. The construction week may be extended to include Saturdays, where required by the contractor to make-up for time lost due to inclement weather, and/or to assist in accelerating the construction schedule.

**Table 9 - Project Milestone Construction Activities and Calendar Periods**

| No. | Milestone Construction Activity | Calendar Period | Duration (weeks) |
|---|---|---|---|
| 1. | Grubbing - portion of site footprint already cleared. | July 4 – 14, 2017 | 2 |
| 2. | Install aeration cell underdrain system on proposed site. | August 1 to 18, 2017 | 3 |
| 3. | Install underwater portion of outfall. | August 1 to 25, 2017 | 4 |
| 4. | Install land portion of outfall. | August 1 to 25, 2017 | 4 |
| 5. | Clear and grub remaining site footprint. | September 4 to 15. 2017 | 2 |
| 6. | Construct aerated lagoon treatment process option, incl.; aeration/nitrification cells, control building, infl. pumping station, flocculation tank, interconnecting piping. | October 16, 2017 – March 31, 2018 | 24 |
| 7. | Start-up/commissioning of treatment process. | February 1 – 28, 2017 | 4 |
| 8. | Completion of New WwTF. | March 31, 2018 | - |
| 9. | Existing WwTF Decommissioning, Demolition, Re-purposing. | April 3 – 28, 2018 | 4 |

## 2.8.2 Construction Activities, Related Equipment

Construction activities and the related construction equipment needed for construction and installation of the major components, are summarized in Table 10 for the aerated lagoon treatment process option and in Table 11 for the engineered wetland treatment process option.

Approximately 40% of the proposed treatment facility site was cleared in advance of the migratory bird nesting period (i.e., prior to mid-April). Initial site construction activities are anticipated to involve installation of a site drainage system to achieve (and maintain) low groundwater levels in advance of earthwork construction at the site. This activity will involve clearing of select treed areas from the site.

Installation of the underwater outfall section, followed by the outfall overland portion, may require removal of trees along the outfall alignment. This will depend upon the initial site construction related activity will involve clearing and grubbing of the site footprint and potentially the land portion of the outfall pipeline alignment. The activity is anticipated to occur mid-September after the nesting season has ended. This would be followed by mobilization of major equipment to the site and work on constructing the lagoons would commence.

The tree-cutting contractor will be responsible for removing and disposing of all cut trees and vegetation, and for obtaining any merchantable value from cut trees. Cut trees and vegetation not considered as merchantable, will be chipped and utilized for erosion control ground cover. Organic material and topsoil resulting from excavation activities will be stockpiled separately from inorganics and rock for re-use at the construction site.

**Table 10 - Construction Equipment and Procedures – Aerated Lagoon Treatment Process**

| No. | Construction Activity | Related Construction Equipment |
|---|---|---|
| 1. | **Project Mobilization:** Construction equipment and labour to site; set-up equip. lay down area; initial construction layout. | Transporting equip. (floats); materials delivery trucks; backhoes; dozers; construction pick-up trucks; temporary site power generators. |
| 2. | **Clearing/Grubbing:** WwTF footprint area and possibly the outfall routing alignment. | Pick-up trucks; tree cutting equipment (chain saws; harvesters) construction vehicles (half-ton trucks); skidders; porters. |
| 3. | **Underdrain System:** Install aeration cell underdrain piping system to maintain low groundwater levels. | Excavator; dump-truck; compactors; construction pick-up trucks; front-end loader. |
| 4. | **Outfall –Underwater Portion (Directional Drill Method):** Direction drilling outfall pipe out under Salmon River; attaching diffuser. | Directional drilling equipment; barge; winch; plastic pipe welder; boat; SCUBA support equip.; construction pick-up trucks. |
| 5. | **Outfall – Land Portion (Open Trench Method):** Excavation of trench for installation of outfall pipeline and outfall chamber; import material for pipeline trench and chamber backfill; import material for pipeline berm where necessary. | Excavator; dozer; dump-truck; construction pick-up trucks; compactors. |

| No. | Construction Activity | Related Construction Equipment |
|---|---|---|
| 6. | **Outfall – Land Portion (Directional Drill Method - Optional):** Direction drilling outfall pipe from outfall chamber to connection point w. underwater outfall pipe; excavation for installation of outfall chamber; import material for chamber backfill. | Directional drilling equipment; excavator; dozer; dump-truck; construction pick-up trucks. |
| 7. | **Aeration Cell Construction:** Grade and build aeration cell berms; import materials for berm construction. Installation of: interconnecting pipes, valves and chambers to/from cells; cell liners; baffle curtain and support posts; air header piping, air laterals/support ports, air diffusers. Import backfill materials for interconnecting pipe trench, chambers. | Excavator; dozer; dump-truck; compactors; sheep's-foot roller; construction pick-up trucks; front-end loader. |
| 8. | **Nitrification Cell Construction:** Grade and build nitrification cell berms; import materials for berm construction. Installation of: interconnecting pipes, valves and chambers to/from cells; cell liners; air header piping, air laterals and air diffusers; import backfill materials for chamber and pipe trench. | Excavator; dozer; dump-truck; compactors; sheep's-foot roller; construction pick-up trucks; front-end loader. |
| 9. | **Building – Foundation:** Erection of formwork, rebar installation, pouring concrete, troweling and treating concrete. | Materials delivery trucks; excavator; boom-truck; construction pick-up trucks; temporary site power generator. |
| 10. | **Building – Superstructure:** Assembly of building panels, placement of anchors, seal joints. | Materials delivery trucks; excavator; boom-truck; construction pick-up trucks; temporary site power generator. |
| 11. | **Building – Electrical, Mechanical:** Installation of: electrical power supply entrance equipment; power distribution and control wiring; lighting, heating, ventilation equip.; below slab mechanical piping; water supply plumbing, incl. water heater. | Construction pick-up trucks; materials delivery trucks; temporary site power generator. |
| 12. | **Building – Misc. Components:** Installation of: restroom; lab counter; storage cabinets and shelves; lab sink; office desk. | Construction pick-up trucks; materials delivery trucks. |
| 13. | **Building – Treatment Process Equip.:** Installation of: aeration blowers/controls; chemical add'n system/controls; chemical storage tank; infl. pumping station control panel; emergency power generator/controls. | Construction pick-up trucks; material delivery trucks; boom-truck; temporary site power generator. |
| 14. | **Influent Sanitary Pumping Station:** Excavation for, and installation of, intercepting chamber, pump stn. wet well chamber and interconnecting pipe; import backfill materials for chambers and pipe trench. | Excavator; dump-truck; construction pick-up trucks; compactors. |
| 15. | **Flocculation Chamber:** Excavation for, and installation of, floc chamber and interconnecting pipe; import backfill materials for chamber and pipe trench. | Excavator; dump-truck; construction pick-up trucks; compactors. |
| 16. | **Odour Control Systems:** Construction of support pad/foundation; installation of intake ducting (pipe); installation of protective enclosure. | Excavator; dump-truck; construction pick-up trucks; compactors; boom truck. |
| 17. | **Landscaping:** Rough-grading, topsoil, fine-grading, hydro-seeding of earthen berms and disturbed areas. Install security fencing. | Tandem delivery trucks; dozers; hydro-seeding spraying equipment; fine-grading equipment; lawn rollers; construction pick-up trucks. |
| 18. | **Commissioning, Start-up:** Fill process train (aeration, nitrification cells) with raw wastewater. Undertake start-up of individual processes and process equipment components; commence full treatment process operation. | Construction pick-up trucks. |

| No. | Construction Activity | Related Construction Equipment |
|---|---|---|
| 19. | **Operator Training, System Operating Transition Period:** On-site hands-on training of operations staff individual process equipment components and the overall treatment process train. | Construction pick-up trucks. |
| 20. | **Existing WwTF Decommissioning, Demolition, Re-purposing:** Commence decommissioning, demolition and/or re-purposing of the existing WwTP after new WwTF is deemed fully operational. | Excavator; dozer; dump-truck; compactors; construction pick-up trucks; front-end loader. |
| 21. | **Site Clean-up:** Removal of all residual construction debris and remnant earthen materials. | Construction pick-up trucks; front-end loader. |

### Table 11 – Construction Equipment and Procedures –Engineered Wetland Treatment Process

| No. | Construction Activity | Related Construction Equipment |
|---|---|---|
| 1. | **Project Mobilization:** Construction equipment and labour to site; set-up equip. lay down area; initial construction layout. | Transporting equip. (floats); materials delivery trucks; backhoes; dozers; construction pick-up trucks; temporary site power generators. |
| 2. | **Clearing/Grubbing:** WwTF footprint area and possibly the outfall routing alignment. | Pick-up trucks; tree cutting equipment (chain saws; harvesters) construction vehicles (half-ton trucks); skidders; porters. |
| 3. | **Underdrain System:** Install aeration cell underdrain piping system to maintain low groundwater levels. | Excavator; dump-truck; compactors; construction pick-up trucks; front-end loader. |
| 4. | **Outfall –Underwater Portion (Directional Drill Method):** Direction drilling outfall pipe out under Salmon River; attaching diffuser. | Directional drilling equipment; barge; winch; plastic pipe welder; boat; SCUBA support equip.; construction pick-up trucks. |
| 5. | **Outfall – Land Portion (Open Trench Method):** Excavation of trench for installation of outfall pipeline and outfall chamber; import material for pipeline trench and chamber backfill; import material for pipeline berm where necessary. | Excavator; dozer; dump-truck; construction pick-up trucks; compactors. |
| 6. | **Outfall – Land Portion (Directional Drill Method - Optional):** Direction drilling outfall pipe from outfall chamber to connection point w. underwater outfall pipe; excavation for installation of outfall chamber; import material for chamber backfill. | Directional drilling equipment; excavator; dozer; dump-truck; construction pick-up trucks. |
| 7. | **Horizontal Wetland Beds:** Grade and build engineered wetland berms; import materials for berm construction. Installation of: interconnecting pipes, valves and chambers to/from cells; cell liners; import growth matrix to cells for reed planting. Import backfill materials for interconnecting pipe trench, chambers. | Excavator; dozer; dump-truck; compactors; sheep's-foot roller; construction pick-up trucks; front-end loader. |
| 8. | **Sludge Wetland Beds:** Grade and build sludge handling bed berms; import materials for berm construction. Installation of: interconnecting pipes, valves and chambers to/from cells; cell liners; import growth matrix for reeds; import backfill materials for chamber and pipe trench. | Excavator; dozer; dump-truck; compactors; sheep's-foot roller; construction pick-up trucks; front-end loader. |
| 9. | **Building – Foundation:** Erection of formwork, rebar installation, pouring concrete, troweling and treating concrete. | Materials delivery trucks; excavator; boom-truck; construction pick-up trucks; temporary site power generator. |

| No. | Construction Activity | Related Construction Equipment |
|---|---|---|
| 10. | **Building – Superstructure:** Assembly of building panels, placement of anchors, seal joints. | Materials delivery trucks; excavator; boom-truck; construction pick-up trucks; temporary site power generator. |
| 11. | **Building – Electrical, Mechanical:** Installation of: electrical power supply entrance equipment; power distribution and control wiring; lighting, heating, ventilation equip.; below slab mechanical piping; water supply plumbing, incl. water heater. | Construction pick-up trucks; materials delivery trucks; temporary site power generator. |
| 12. | **Building – Misc. Components:** Installation of: restroom; lab counter; storage cabinets and shelves; lab sink; office desk. | Construction pick-up trucks; materials delivery trucks. |
| 13. | **Building – Treatment Process Equip.:** Installation of: chemical add'n system/controls; chemical storage tank; infl. pumping station control panel; emergency power generator/controls. | Construction pick-up trucks; material delivery trucks; boom-truck; temporary site power generator. |
| 14. | **Influent Sanitary Pumping Station:** Excavation for, and installation of, intercepting chamber, pump stn. wet well chamber and interconnecting pipe; import backfill materials for chambers and pipe trench. | Excavator; dump-truck; construction pick-up trucks; compactors. |
| 15. | **Clarifier – Foundation:** Erection of formwork, rebar installation, pouring concrete, troweling and treating concrete. | Materials delivery trucks; excavator; boom-truck; construction pick-up trucks; temporary site power generator. |
| 16. | **Clarifier – Electrical, Mechanical:** Installation of: motor, gear reduction mechanism, shafts, bearings, sprockets, sludge pumps, chain and flight mechanism. | Construction pick-up trucks; materials delivery trucks; temporary site power generator. |
| 17. | **Fine Screening** – Installation of fine screening device and controls. | Construction pick-up trucks; materials delivery trucks. |
| 18. | **UV Treatment System:** Installation of pre-packaged UV disinfection unit, controls and electrical wiring. | Materials delivery trucks; boom-truck; pick-up trucks; power generator. |
| 19. | **Flocculation Chamber:** Excavation for, and installation of, floc chamber and interconnecting pipe; import backfill materials for chamber and pipe trench. | Excavator; dump-truck; construction pick-up trucks; compactors. |
| 20. | **Odour Control Systems:** Construction of support pad/foundation; installation of intake ducting (pipe); installation of protective enclosure. | Excavator; dump-truck; construction pick-up trucks; compactors; boom truck. |
| 21. | **Landscaping:** Rough-grading, topsoil, fine-grading, hydro-seeding of earthen berms and disturbed areas. Install security fencing. | Tandem delivery trucks; dozers; hydro-seeding spraying equipment; fine-grading equipment; lawn rollers; pick-up trucks. |
| 22. | **Commissioning, Start-up:** Fill process train (primary clarifier, horizontal wetland beds) with raw wastewater. Undertake start-up of individual processes and process equipment components; commence full treatment process operation. | Construction pick-up trucks. |
| 23. | **Operator Training, System Operating Transition Period:** On-site hands-on training of operations staff individual process equipment components and the overall treatment process train. | Construction pick-up trucks. |
| 24. | **Existing WwTF Decommissioning, Demolition, Re-purposing:** Commence decommissioning, demolition and/or re-purposing of the existing WwTP after new WwTF is deemed fully operational. | Excavator; dozer; dump-truck; compactors; construction pick-up trucks; front-end loader. |
| 25. | **Site Clean-up:** Removal of all residual construction debris and remnant earthen materials. | Construction pick-up trucks; front-end loader. |

### 2.8.3 Earthen Berm Construction

Earthen berms will be used to construct the aeration and nitrification cells (aerated lagoon treatment process option), and the wetland beds (engineered wetland treatment process option). These components will be positioned at a suitable geodetic elevation to provide sufficient head pressure to permit passage of the design flow, by gravity, through the outfall when under high river level conditions. Geodetic positioning of these will also account for a balanced cut and fill of earthen material.

The GHD geotechnical report suggests that the existing in-situ earthen materials could possibly be used for berm construction, assuming that they can be suitably dewatered. Additional imported fill material is anticipated to account for potentially unusable cut materials, as well as, an anticipated deficiency in available fill quantities. Import fill will be sources from local pits, based on a specified soil gradation.

Earthen berms will be constructed using specified soil materials installed in 300 mm compacted lifts. Soils gradations and compaction testing will be undertaken in the field at regular frequency to ensure the earthen berm construction meets the technical specifications. Internal and external side slopes will be limited to no greater than 3:1 (horizontal to vertical). Side slopes will be shaped by dozers to the specified slopes. Earthen berms will be constructed by experienced earth-moving contractors under full-time observation services provided by experienced site personnel representing the interests of the Proponent.

Earthen berms will be lined with geo-synthetic (HDPE) liners having a minimum thickness of 60 mil. The liners will be installed in the field by an experienced liner installation sub-contractor. The liner will be solidly keyed into the top of the berm to prevent shifting and/or slipping. The integrity of all liner seams will undergo witnessed field testing.

An underdrain piping system will be installed below the bottom of the aeration cells to prevent potential lifting of the liner resulting from high groundwater levels and underlying organic soil off-gassing. The underdrain system will outlet by gravity to a drainage course for discharge into Henderson Brook, or to a chamber for pumped discharge into Henderson Brook through the existing WwTF outfall. Off-gassing pipes will vent to atmosphere through the liner at a point above the aeration cell water level. An underdrain piping system is not anticipated for the engineered wetland beds.

### 2.8.4 Outfall Construction

It is anticipated that the outfall will be construction as two (2) components - an overland section and an underwater section. A 300 mm diameter outfall overland section will commence at an outlet chamber and continue approximately 300 m to a point near the edge of the Salmon River. The underwater section will continue from this point under the Salmon River to the mid-point of the main channel, an additional distance of approximately 200 m. The outfall will protrude from an underwater bank into a deeper section of the Salmon River and will be outfitted with a multi-port diffuser manifold to assist with flow dispersion into the main channel of the Salmon River.

The overland portion will be installed using one of the following approaches:

- Traditional open-trench with a 2 metre depth of bury;
- Shallow open-trench with a 1 metre depth of bury and a 1 metre high berm cover (for added frost protection);
- Horizontal directional drill (HDD) method.

The overland piping material will be either PVC or high density polyethylene (HDPE) for open-trench installation, or HDPE for directional drilling. An open-trench approach will make use of a trench-box to minimize the excavated trench width, thus reducing the amount of tree removal, and a large capacity pump to combat high groundwater levels anticipated during the pipe installation.

Manholes, if positioned along the overland portion, will be sealed to prevent inflow during high water levels, and will include lockdown covers to prevent cover blow-off when operating under a positive head pressure. No manholes will be installed along the underwater portion.

The underwater portion will be installed using a HDD method and HDPE pipe material. The HDD method involves specialized horizontal drilling equipment to bore a slightly oversized hole along the entire length of the pipe alignment. Individual pipe sections are then fused together on-site to create a continuous pipeline length that is then pulled through the borehole. For the underwater portion, a separate diffuser manifold (pipe) will be lowered into position at the outfall end protruding from the underwater bank, and mechanically attached to the outfall pipe using an underwater dive crew.

If necessary, the overland and underwater portions of the outfall will be connected using a specialized articulating joint capable of adapting to any slight pipeline misalignments.

### 2.8.5 Construction Sequencing – Aerated Lagoon Treatment Process

Sequencing of construction activities for the aerated lagoon treatment process option is provided below in the anticipated construction order.

1. Grub that portion of proposed treatment site footprint already cleared.
2. Install underdrain piping system on proposed treatment system site to assist with lowering groundwater levels across the site.
3. Install underwater portion of outfall.
   Install overland portion of outfall.
4. Clear and grub remaining portion of proposed treatment site.

5. Mobilize equipment and labour for construction of new treatment process.
   Set-up construction lay-down area.
   Construct aeration cells.
   Construct nitrification cells.
   Construct flocculation chamber.
   Install interconnecting piping/chambers/valving.
   Install aeration header piping system to aeration and nitrification cells.
   Construct influent sanitary pumping station wet well.
   Construct control building foundation and superstructure.
   Install site drainage system.

6. Drill water supply well.
   Install liner in aeration and nitrification cells.
   Install control building electrical and mechanical equipment.
   Install site power to control building.
   Install process equipment, controls, instrumentation.
   Install lab/office/restroom/locker/shower areas in control building.
   Install odour control systems.
   Construct service vehicle turn-around/parking area.

7. Start-up influent sanitary pumping station.
   Commence filling of aeration and nitrification cells with raw wastewater.
   Start-up aeration blowers.
   Start-up chemical addition system.
   Start-up flocculation chamber.

8. Install aeration cell air header laterals and aeration diffusers.
   Install aeration cell curtain wall (baffle).
   Install landscaping (trees, hydro-seeding)
   Install site security fencing.

9. Commence commissioning of overall treatment system.
   Operator training for new treatment system.
   Site clean-up.

10. Idle existing WwTF operations.
    Commence full operation of new WwTF.

11. Decommission/demolish all or portions of existing WwTF site.
    Install components needed to re-purpose existing WwTF site.

### 2.8.6 Construction Sequencing –Engineered Wetland Treatment Process

Sequencing of construction activities for the engineered wetland treatment process option is provided below in the anticipated construction order.

1. Grub that portion of proposed treatment site footprint already cleared.

2. Install underwater portion of outfall.
   Install overland portion of outfall.

3. Clear and grub remaining portion of proposed treatment site.

4. Mobilize equipment and labour for construction of new treatment process.
   Set-up construction lay-down area.
   Construct primary clarifier.
   Construct fine screening process, incl. fine screen enclosure.
   Construct flocculation chamber.
   Construct horizontal wetland beds.
   Construct sludge wetland beds.
   Construct UV disinfection process, incl. UV disinfection enclosure.
   Install interconnecting piping/chambers/valving.
   Construct influent sanitary pumping station wet well.
   Construct control building foundation and superstructure.

5. Drill water supply well.
   Install liner in aeration and nitrification cells.
   Install control building electrical and mechanical equipment.
   Install site power to control building.
   Install process equipment, controls, instrumentation.
   Install lab/office/restroom/locker/shower areas in control building.
   Install odour control systems.
   Construct service vehicle turn-around/parking area.

6. Start-up influent sanitary pumping station.
   Start-up fine screening process.
   Start-up chemical addition system.
   Start-up flocculation chamber.
   Commence filling of primary clarifiers, horizontal wetland beds with raw wastewater.
   Start-up sludge wetland beds.

7. Install landscaping (trees, hydro-seeding)
   Install site security fencing.

8. Commence commissioning of overall treatment system.
   Operator training for new treatment system.
   Site clean-up.

9. Idle existing WwTF operations.
   Commence full operation of new WwTF.

10. Decommission/demolish all or portions of existing WwTF site.
    Install components needed to re-purpose existing WwTF site.

### 2.8.7 Potential Pollution Sources - Construction Phase

Potential pollution sources occurring during the construction phase of the proposed undertaking include noise, airborne emissions, storm water surface run-off, liquid effluents, hazardous materials and solid waste materials.

Potential noise pollution sources are associated with construction equipment and associated activities. Where required, all heavy construction equipment, construction vehicles, portable power generators and tree cutting equipment (i.e., chainsaws) will be mandated to provide and maintain legally required noise attenuation (muffling) devices. Construction activities will be restricted between 7 AM to 7 PM, Monday to Friday. Under special circumstances where acceleration of the project schedule is required or desired, construction activities may occur on Saturdays from 7 AM to 7PM.

Air emissions during the construction phase will be limited to exhaust emissions produced from fossil-fuel burning construction vehicles and equipment (i.e., excavators, dozers, dump-trucks, portable power generators). The contractor will be mandated to ensure that all construction related vehicles and equipment are adequately equipped with proper air emission control devices, and that these devices are regularly maintained and serviced.

Where surface vegetation is disturbed to construct earthworks, surface sheet flow run-off from the construction site will be controlled using surface drainage ditching, attenuation ponds (where required) and erosion control devices (i.e., siltation fencing). The contractor will be responsible for preparing a surface water drainage and erosion control management plan for submission to, and approval by, the consultant prior to commencing any on-site construction activities.

Water used to clean concrete haulage trucks and associated pumping equipment will require containment for off-site disposal at an approved facility, and will not be permitted to be disposed of on-site.

Portable toilets will be used for collection of on-site human wastes during the construction phase. The toilets will be serviced regularly by a licenced septage hauler and disposed of at an approved septage disposal facility. Toilet waste will not be discharged into the Village's sanitary collection system, or existing WwTF, unless pre-approved disposal clearance is obtained from the Village.

Hazardous substances used for this project will typically include:

- Hydrocarbon-based fuels – diesel fuel, gasoline;
- Hydrocarbon-based hydraulic fluids and lubricants;
- Solvents;
- Latex, acrylic and epoxy-based paints;
- Concrete and concrete form release agents;
- Concrete joint-fillers, sealers, mastics and grouts; waterproofing agents;
- Horizontal directional drilling fluids (mud).

Limiting onsite storage and handling will minimize the potential risk for unintended release of hazardous substances into the environment. The contractor will be encouraged to store all hazardous substances at an off-site location, where possible, and only transport these substances to the site, as and when required. All potentially hazardous substances requiring on-site storage during the project construction phase, are to be handled and securely stored in accordance with the Material Safety Data Sheets (MSDS) requirements for that substance. Storage will include protection from weather, vandalism and theft. The contractor will be required to maintain a log of all hazardous substances stored and used at the construction site.

Re-fuelling of construction equipment will be conducted at a temporary designated construction site location. Re-fueling and lubrication of construction equipment other than at this designated site will not be permitted. The re-fuelling site will be positioned a minimum distance of 30 metres from the designed water supply well location and outside of any delineated wetland buffer zones. This site will be constructed using a gravel pad, on which the construction equipment will be parked for re-fuelling and lubrication purposes. The gravel pad will include a continuous underlying liner to capture and contain potential fuel or lubricant spills. The contractor will be required to provide fuel spill kits at this site.

All refuse generated on-site will be collected and stored in covered containers for daily disposal off-site. Waste construction materials will be collected in covered dumpsters and disposed off-site on a weekly basis. Refuse and waste construction materials will be disposed off-site at an approved landfill facility.

Should soil become contaminated as a result of a hazardous materials spill, the contaminated soil will be collected, contained and disposed of off-site at an approved facility, in accordance with approved practices for the substance and quantity contaminated. The contractor will be required to prepare and submit a written hazardous waste site management plan, specifically tailored to this project and site.

All organic material and topsoil stripped from the construction site will be stockpiled separately from inorganics and rock for re-use as part of site landscaping. Common backfill, rock fill, granulars and topsoil materials necessary for site construction purposes (i.e., earthen berm construction, pipe trenching, road beds, culverts, building foundation and landscaping), that is not available from onsite cut and fill quantities, will be imported from off-site sources.

## 2.9 Operation and Maintenance Details

### 2.9.1 O&M Details - Aerated Lagoon Treatment Process

Key operation and maintenance (O&M) features of the proposed aerated lagoon treatment process option are as follows:

1. **Influent Sanitary Pumping Station:**
   - Two (2) pumps are operated on an automated alternating ON/OFF cycle based on liquid level control in the wet well.
   - Automated variable speed control of the pumps will be considered, based on maintaining a constant liquid level in the wet well.
   - System monitoring to include pump run times, amperage draw, raw power voltage, over temperature.
   - Automated alarm system to notify operator of pump failure. Requires operator to visit facility to confirm reason for failure.
   - Regular general pump maintenance to include discharge flow rate checks, impeller wear, condition of power cable and control panel electronics.
   - Regular exercising of valves in isolation valve chamber.
   - Monthly raw influent wastewater 24-hour composite sampling and analysis.

2. **Chemical Addition System:**
   - Two (2) chemical metering pumps are operated on a flow-paced basis in accordance with pumped raw wastewater flow from influent sanitary pumping station.
   - Metering pump controls to monitor a number of pump operating conditions.
   - Automatic metering pump stoppage and switchover to stand-by pump.
   - Automated alarm system to notify operator of pump failure. Requires operator to visit facility to confirm reason for pump failure.
   - Regular cleaning of metering pump head and discharge tubing is required to purge chemical solids accumulations to avoid blockages.
   - Regular replacement of chemical dosing pump discharge tubing.
   - Heat-tracing of metering pump discharge lines may be required.
   - Regular cleaning of chemical injection quill.

3. **Flocculation Chamber Mixer:**
   - One (1) variable-speed shaft and propeller-type mixer is operated continuously at a selected speed to impart a level of mixing energy to achieve proper floc formation.
   - System monitoring to include mixer run time, amperage draw, raw power voltage, over temperature.
   - Automated alarm system to notify operator of mixer failure. Requires operator to visit facility to confirm reason for failure.
   - Regular inspection of electric motor, shaft and propeller for accumulation of debris on propeller.

- Regular inspection of chemical floc formation to confirm appropriate mixer speed and floc formation.
- Regular control panel electronics check.

4. **Aeration Blowers:**
   - Two of three (2 of 3) positive displacement-type aeration blowers are operated continuously under manually selected variable-speed control.
   - Manual selection of duty and stand-by blowers.
   - Blowers variable speed control is selected to maintain aeration cell dissolved oxygen levels at 2 mg/L minimum.
   - System monitoring to include blower run times, amperage draw, raw power voltage, over temperature, discharge pressure.
   - Automatic blower shut-down upon failure condition.
   - Automated alarm system to notify operator of blower failure. Site visit required to confirm reason for pump failure and to rotate stand-by unit into operation.
   - Maintenance at prescribed hours of operation to include oil changes, intake filter cleaning/replacement and control panel electronics check.

5. **Primary and Secondary Aeration Cells:**
   - See also Aeration Blowers above for operation and maintenance of air supply.
   - Continuous gravity flow through from flocculation chamber to the Primary Aeration Cell to Secondary Aeration Cell to outlet chamber.
   - Regular visual checks on interconnecting chambers.
   - Regular exercising of interconnecting pipe isolation valves.
   - Primary and secondary aeration cell sludge depth profiling, sludge core sampling, and calculation of accumulated bio-solids mass at 5 to 10-year intervals.
   - Regular visual inspection of air header laterals.
   - Regular exercising of air header lateral isolation valves.
   - Regular visual inspection of exposed aeration cell liner and secondary aeration cell curtain wall (baffle) for damage.
   - Regular visual inspection of air bubble distribution at aeration cell surface.
   - Regular visual inspection of integrity of earthen berms.
   - Monthly secondary aeration cell influent/effluent 24-hour composite sampling and analysis.
   - Annual visual inspection of submerged aeration diffusers.
   - Bio-solids removal (de-sludging) is anticipated from the primary aeration cell every 10 to 15-years depending upon measured waste solids accumulations. *Note: A specific procedure, equipment set-up and sub-contracting are required to undertake the aeration cell de-sludging operation. Additional efforts are required to dispose of dewatered bio-solids, either at the WwTF site or off-site at an approved landfill facility.*

6. **Nitrification Cells:**
    - See also Aeration Blowers above for operation and maintenance of air supply.
    - Gravity flow through the nitrification cells.
    - Annual check of insulating wood chip layer covering top of cells. Top up wood chip layer as required to maintain minimum insulation thickness.
    - Monthly effluent wastewater 24-hour composite sampling and analysis.

7. **Outfall**:
    - Gravity flow of treated wastewater from nitrification cells to the Salmon River underwater discharge.
    - No regular maintenance required, unless blockage is suspected.
    - Video inspection every 10-years of entire length of land and underwater portions.

8. **Control Building:**
    - Annual interior/exterior inspection of integrity of superstructure panels and fasteners.
    - Annual inspection and lubrication of door seals.
    - Regular inspection of all mechanical and electrical devices (i.e., unit heaters, plumbing system, heat pump, interior/exterior lighting).

9. **Emergency Stand-by Generator**
    - Automatic operation following detection of a power outage, including a pre-set time-out delay;
    - Regular engine maintenance (i.e., oil/filter changes) and service checks in accordance manufacturer's requirements.
    - Bi-monthly manual exercising.
    - Maintain fuel supply (i.e. diesel fuel or liquid propane).

10. **Activated Carbon Odour Control Systems:**
    - Operated continuously, or in conjunction with sanitary pumping station pumps;
    - Operated during non-freezing weather conditions (i.e., May to November).
    - Annual inspection and sampling of activated carbon media (to gauge percent of remaining life).
    - Annual visual check/cleaning of the inline moisture trap.
    - Regular visual check of blower motor, silencer and tankage.
    - Annual winterizing of unit.

11. **Vaporization Odour Control System:**
    - Operated as-required pending odour level conditions at the aeration cells.
    - Operated continuously during aeration cell de-sludging procedures.
    - Operated during non-freezing weather conditions (i.e., May to November).
    - Top-up of liquid odour neutralizing chemical compound.
    - Regular visual check of vaporization device and annual winterizing of unit.

12. **Water Supply Well:**
    - Well pump is operated on demand.
    - Annual super-chlorination of drilled well.
    - Annual water quality sampling/analysis.

13. **WwTF Site:**
    - Grass cutting and weed control of landscaping around Control Building.
    - Bi-annual inspection of security fencing and gates.
    - Snow-plowing of access roadway and service vehicle parking area.
    - Removal of bush and tree growth from earthen berms.
    - Removal/off-site disposal of refuse.

### 2.9.2 O&M Details – Engineered Wetland Treatment Process

Key operation and maintenance (O&M) features of the proposed engineered wetland treatment process option are as follows:

1. **Influent Sanitary Pumping Station:**
    - Two (2) pumps are operated on an automated alternating ON/OFF cycle based on liquid level control in the wet well.
    - Automated variable speed control of the pumps will be considered, based on maintaining a constant liquid level in the wet well.
    - System monitoring to include pump run times, amperage draw, raw power voltage, over temperature.
    - Automated alarm system to notify operator of pump failure. Requires operator to visit facility to confirm reason for failure.
    - Regular general pump maintenance to include discharge flow rate checks, impeller wear, condition of power cable and control panel electronics.
    - Regular exercising of valves in isolation valve chamber.
    - Monthly raw influent wastewater 24-hour composite sampling and analysis.

2. **Fine Screening**
    - Regularly remove collected screenings for off-site disposal at an approved facility.
    - Regular visual checks to confirm proper and safe operation.

3. **Chemical Addition System:**
    - Two (2) chemical metering pumps are operated on a flow-paced basis in accordance with pumped raw wastewater flow from influent sanitary pumping station.
    - Metering pump controls to monitor a number of pump operating conditions.
    - Automatic metering pump stoppage and switchover to stand-by pump.
    - Automated alarm system to notify operator of pump failure. Requires operator to visit facility to confirm reason for pump failure.
    - Regular cleaning of metering pump head and discharge tubing is required to purge chemical solids accumulations to avoid blockages.

- Regular replacement of chemical dosing pump discharge tubing.
- Heat-tracing of metering pump discharge lines may be required.
- Regular cleaning of chemical injection quill.

4. **Flocculation Chamber Mixer:**
   - One (1) variable-speed shaft and propeller-type mixer is operated continuously at a selected speed to impart a level of mixing energy to achieve proper floc formation.
   - System monitoring to include mixer run time, amperage draw, raw power voltage, over temperature.
   - Automated alarm system to notify operator of mixer failure. Requires operator to visit facility to confirm reason for failure.
   - Regular inspection of electric motor, shaft and propeller for accumulation of debris on propeller.
   - Regular inspection of chemical floc formation to confirm appropriate mixer speed and floc formation.
   - Regular control panel electronics check.

5. **Primary Clarifiers:**
   - Automated waste solids removal using clarifier sludge pumps operated on an adjustable timer will occur 24/7.
   - Regular manual skimming of accumulated surface fat/oil/grease (scum).
   - Regular disposal of clarifier fat/oil/grease to a holding vessel for off-site disposal.
   - Regular visual inspection of clarifier chain and flight scraper mechanisms.
   - Regular greasing of bearings.
   - Annual draining and inspection of clarifier tankage for visual inspection of drive chain linkages, shafts, bearings, sprockets, flight wear shoes/strips, flight return tracks, and submersible sludge pumps.

6. **Horizontal Wetland Beds:**
   - Monthly effluent wastewater 24-hour composite sampling and analysis.
   - Regular visual checks on interconnecting chambers.
   - Regular exercising of interconnecting pipe isolation valves.
   - Regular visual inspection of integrity of earthen berms.
   - Regular visual inspection of plant growth and density.
   - Annual backwashing of media.
   - Removal of accumulated solids (de-sludging) is anticipated from each horizontal wetland beds every 10 to 15-years, depending upon measured waste solids accumulations. The four (4) horizontal wetland beds would be de-sludged in rotation (i.e., one bed per year) over a 4-year cycle period. *Note: A specific procedure, equipment set-up and sub-contracting are required to undertake the wetland bed de-sludging operation. Solids removed from the wetland beds are to be disposed of either at the WwTF site (as a soil amendment) or off-site at an approved facility.*

7. **Sludge Wetland Beds:**
    - Regular visual checks on interconnecting chambers.
    - Regular exercising of interconnecting pipe isolation valves.
    - Regular visual inspection of integrity of earthen berms.
    - Regular visual inspection of plant growth and density.
    - Regular visual inspection of sludge dispersion within wetland beds.
    - Removal of treated sludge (de-sludge) from the sludge wetland beds is anticipated every 10 to 15-years depending upon measured waste solids accumulations. *Note: A specific procedure, equipment set-up are required to undertake the removal of accumulated solids from the sludge wetland beds. Solids removed from the wetland beds are to be disposed of either at the WwTF site (as a soil amendment) or off-site at an approved facility.*

8. **UV disinfection System**:
    - Gravity flow of horizontal wetland bed effluent to the UV disinfection system.
    - Regular visual inspection of UV disinfection system.
    - Replacement of UV lamps, as specified by the equipment manufacturer.
    - Regular cleaning of protective quartz sleeves.

9. **Outfall**:
    - Gravity flow from UV disinfection system through the outfall pipe and into the Salmon River.
    - No regular maintenance required, unless blockage is suspected.
    - Video inspection of entire length of land and underwater portions every 10-years, if tethered length of video camera equipment permits.

10. **Control Building:**
    - Annual interior/exterior inspection of integrity of superstructure panels and fasteners.
    - Annual inspection and lubrication of door seals.
    - Regular inspection of all mechanical and electrical devices (i.e., unit heaters, plumbing system, heat pump, interior/exterior lighting).
    - Regular housekeeping, cleaning.

11. **Emergency Stand-by Generator:**
    - Automatic operation following detection of a power outage, including a pre-set time-out delay;
    - Regular engine maintenance (i.e., oil/filter changes) and service checks in accordance manufacturer's requirements.
    - Bi-monthly manual exercising.
    - Maintain fuel supply (i.e. diesel fuel or liquid propane).

**12. Activated Carbon Odour Control Systems:**
- Operated either continuously, or semi-continuously conjunction with the sanitary pumping station pumps.
- Operated during non-freezing weather conditions (i.e., May to November).
- Annual inspection and sampling of activated carbon media (to gauge percent remaining life).
- Annual visual check/cleaning of the inline moisture trap.
- Regular visual check of blower motor, silencer and tankage.
- Annual winterizing of unit.

**13. Vaporization Odour Control System:**
- Operated as-required pending odour level conditions at the wetland beds.
- Operated during non-freezing weather conditions (i.e., May to November).
- Top-up of liquid odour neutralizing chemical compound.
- Regular visual check of vaporization device and annual winterizing of unit.

**14. Water Supply Well:**
- Well pump is operated on a demand basis.
- Annual super-chlorination of drilled well and water supply piping system.
- Annual water quality sampling/analysis.

**15. WwTF Site:**
- Grass cutting and weed control of landscaping around Control Building.
- Bi-annual inspection of security fencing and gates.
- Snow-plowing of access roadway and service vehicle parking area.
- Removal of bush and tree growth from earthen berms.
- Removal/off-site disposal of refuse.

## 2.10 Project-Related Documents

The following are technical documents prepared or referenced to-date that relate to the proposed undertaking:

1. *Environmental Risk Assessment for the Chipman Wastewater Treatment Plant, in Accordance with the Canada-Wide Strategy for Municipal Wastewater Effluent,* NATECH Environmental Services Inc., June 30, 2014.

2. *Data Report 5772: Chipman, NB,* Atlantic Canada Conservation Data Centre, February 22, 2017.

3. *Village of Chipman Wastewater Project (Habitat Assessment),* Rod Currie, March 15, 2017.

4. *Canadian Technical Report of Fisheries and Aquatic Sciences 2843,* D. Caissie and S. Robichaud, 2009.

5. *Geotechnical Baseline Report and Hydrogeology Study, Proposed Wastewater Treatment Facility (Draft)*, GHD, May 8, 2017.

# 3 Description of the Existing Environment

## 3.1 Physical and Natural Features

### 3.1.1 Site Topography and Drainage

Light Detection and Ranging (LiDAR) mapping data of the project area, as obtained from Service New Brunswick, is provided in Figure 3, Appendix C. Maximum and minimum geodetic elevations within the proposed undertaking property boundaries are 19.9 and 0.5 m, respectively. The property has a mean gradient of 4.9%, draining from east to west.

Henderson Brook is located along the northern property boundary and the Salmon River is located along the western property boundary. No other watercourses are located on or around the subject property. A drainage swale runs south-east to north-west on the adjacent property and drains into the Henderson Brook backwater.

### 3.1.2 Geotechnical Investigation

A geotechnical and hydro-geotechnical investigation was performed by GHD in March 2017 at the proposed WwTF site and along the proposed outfall alignment. The resulting investigation report identifies that the proposed site offers potential for construction of a new WwTF. Site soils and shallow bedrock conditions provide for a solid foundation for earthworks construction. Existing soil conditions appear favourable for earthen berm construction and horizontal directional drilling (HDD) of the outfall pipe.

Materials sampling and field measurements were undertaken at boreholes, test-pits and monitoring wells. Site soils exist as four (4) layers varying in depth, thickness and specific composition. These soil layers and types were reported as follows:

1. *Organics* - includes topsoil and decaying material at the top of the ground found in thickness up to 0.8 m. This material will need to be stripped from the site prior to construction, but could be reused to top-dress the final slopes for seeding and erosion stabilization.

2. *Alluvial Granular Soils* - includes the sands found on the site, with varying amounts of silt and clay in its composition. This layer varies between 1.2 and 3.0m thick, with the bottom delineated between 4.5 m and 6m geodetic.

3. *Finer-Grained Soils* - includes silt with varying amounts of sand and clay in its composition. This layer varies from 0.6 m to over 3.0 m in thickness, with the bottom delineated between 2.5 m and 5 m geodetic.

4. *Bedrock* - made of a highly weathered conglomerate.

The variability in soil conditions will require that site excavation be undertaken with on-site geotechnical assistance to ensure useable and non-usable soils are appropriately sorted. Soils characteristics near the surface may prove challenging for use of open-trench excavation methods (i.e., for land portion of outfall pipe). In such cases, horizontal directional drilling may prove to be a more favourable pipeline installation technique.

A high groundwater table at the proposed site presents design and construction challenges for the use of earthen berms of any significant depth. Aeration cell underdrains and earthen berm perimeter drains will likely be needed to avoid floatation of the aeration cell liners. Underdrain and perimeter drain discharges could potentially be directed through to the existing WwTF outfall and into Henderson Brook.

### 3.1.3 Current Uses of Surrounding Environment

As the major tributary to Grand Lake, the Salmon River is frequented by anglers and recreational boaters. The WwTF site provides pedestrian access to walking trails.

The Chipman Waterfront Campground, a recreational vehicle park and campground, is located immediately adjacent to the Salmon River and downstream from the proposed WwTF site. The campground is approximately 0.5 Km downstream from the proposed outfall discharge point. It offers direct access to the Salmon River for boating and swimming. Effluent requirements were reviewed against the *Guidelines for Canadian Recreational Water Quality: Third Edition* guidelines for both primary and secondary receiving stream.

A series of nature walking trails created by a local nature group, The Chipman Garden Club, are located within the existing WwTF property boundaries. These trails run through the proposed site of the new WwTF, where shown in Figure 2, Appendix B. These trails are accessible by the general public.

### 3.1.4 Water Supply Wells

The Village is not serviced by communal potable water supply system. Village residences, businesses, and institutional and industrial facilities are serviced individually by drilled water supply wells which are privately-owned. A total of 86 existing properties (77 residential, 9 commercial/industrial) located within the Village boundaries are positioned within a 0.5 Km (500 m) off-set distance from the edge of the WwTF property boundaries. Aerial mapping showing the 0.5 Km off-set area is provided in Figure 8, Appendix H.

The 86 properties are located on the Village's First, Second, Dufferin, Smythe and Main Streets. The number of properties for each street located within the 0.5 Km off-set distance are summarized below in Table 12.

Water supply wells positioned on properties located immediately adjacent to the WwTF property boundaries (i.e. sharing the property boundary) will, with the permission of the property owners, be sampled and analyzed for general chemistry and bacteriological parameters.

**Table 12 – Properties within 0.5 Km Off-set from WwTF Property Boundaries**

| Street Name | No. of Addresses | |
|---|---|---|
| | Residential | Industrial/Commercial |
| First | 4 | 0 |
| Second | 2 | 0 |
| Smythe | 9 | 0 |
| Dufferin | 16 | 0 |
| Main | 46 | 9 |
| *Totals* | *77* | *9* |

## 3.2 Environmentally Sensitive Features

### 3.2.1 General

Site assessments of the Project Area were conducted as follows:

- Flora and fauna assessment - Rod Currie, Biologist; site visit conducted March 3, 2017.
- Rare plant assessment - Gart Bishop, Botanist; site visit conducted June 6, 2017.

Site assessment results are summarized in the following sections.

### 3.2.2 Rare and Endangered Taxa – Flora

The flora and fauna site assessment conducted on March 3, 2017 by Rod Currie, Biologist included a request to the Atlantic Canada Conservation Data Centre (ACCDC) for a database report relating to rare and endangered species in the Project Area. A search of the ACCDC data base identified 4 records of 4 rare or endangered vascular plants occurring within a 5 km radius of the Project Area centre. The species are summarized below in Table 13.

It is important to note that of these 4 records, only the *Canada Cinquefoil* is noted as close to the project worksite, but is in a location that can be isolated from construction activities. This species has a provincial rarity ranking of S1, and a provincial GS ranking of 5 (undetermined).

No records of rare or endangered non-vascular flora within 5 km of the Project Area centre were found.

**Table 13 - Rare or Endangered Vascular Plants**

| Common Name | Scientific Name | No. of Records |
|---|---|---|
| Canada Cinquefoil | *Potentilla Canadensis* | 1 |
| Long-leaved Starwort | *Stellaria longfolia* | 1 |
| Tuckerman's Sedge | *Carex tuckermanii* | 1 |
| Russet Cottongrass | *Eriophorum russeolum* | 1 |

### 3.2.3 Rare and Endangered Taxa – Vertebrate Fauna

A search of ACCDC data base identified 28 records of 13 rare or endangered vertebrate fauna within a 5 km radius of the Project Area center, which are summarized below in Table 14.

All of the rare vertebrate fauna represent bird species that have been spotted within 5 km of the project location at some time in the past. All of the birds, with the possible exception of the ring-billed gull, are migratory species. A noted decline in these bird species may be the result of factors occurring on their winter range outside of the province. However, the site visit did not reveal habitat features that would be critical for the continued survival, or well-being of any of these bird species.

Some species such as cliff swallow, chimney swift, purple martin, bank swallow and barn swallow require specialized nesting sites that the project site does not provide. Other species such as bobolink, brown-headed cowbird, killdeer and eastern kingbird are more likely to be associated with agricultural lands, rather than the forest habitat that occupies the project site.

Similarly, the forest habitat of the project site is unlikely to appeal to species such as the common nighthawk and ring-billed gull. It should be noted, the disturbed lands associated with the coal strip-mining operations in the Minto area, are likely to provide abundant nesting habitat for common nighthawk and killdeer, which require bare, open areas to nest and raise their young.

Similarly, the ring-billed gull is more closely identified urban development, as well as, agricultural settings and shorelines. Historically, the ring-billed gull originated from its western range outside of the province. Over the past 80 to 90 years this gull began inhabiting coastal habitats along the northern and eastern shores of NB, and more recently occupying inland sites along the Saint John River and Grand Lake (Erskine, 1992). The current status of this species indicates it is well established within the range it inhabits.

**Table 14 - Rare or Endangered Vertebrate Fauna**

| Common Name | Scientific Name | No. of Records |
|---|---|---|
| Chimney Swift | *Chaetura pelagic* | 4 |
| Bank Swallow | *Riparia riparia* | 1 |
| Barn Swallow | *Hirundo rustica* | 3 |
| Bobolink | *Dolichonyx oryzivorus* | 2 |
| Common Nighthawk | *Chordeiles minor* | 3 |
| Common Tern | *Sterna hirundo* | 1 |
| Purple Martin | *Progne subis* | 3 |
| Cliff Swallow | *Petrochelidon pyrrhonota* | 3 |
| Killdeer | *Charadrius vociferous* | 2 |
| Brown-headed Cowbird | *Molothrus ater* | 1 |
| Eastern Kingbird | *Tyrannus tyrannus* | 1 |
| Spotted Sandpiper | *Actitis macularlus* | 1 |
| Ring-billed Gull | *Larus delawarensis* | 3 |

### 3.2.4 Rare and Endangered Taxa – Invertebrate Fauna

A search of ACCDC data base identified 10 records of 6 invertebrate fauna within a 5 km radius of the Project Area centre. These species are summarized below in Table 15.

The list of rare invertebrate fauna includes 1 bee, 3 dragonflies and 2 species of mollusk. For the most part, these organisms were not reported in the immediate vicinity of the project. Three of the dragonflies (i.e., petite emerald, skimming bluet and orange bluet) were report at a location in the vicinity of the Redbank Creek Marsh, several kilometers from the project site.

The yellow-banded bumblebee and the tidewater mucket (an aquatic mollusk), were report in the general vicinity of the Route 10 bridge, approximately 1 km upstream of the location of the project. However, the remaining invertebrate, the spike-lipped crater (a terrestrial snail), was reported in the vicinity of Route 10, as close as 0.2 Km from the project. It is important to note however, that although the presence of this particular organism was flagged during the ACCDC data search, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) describes the Canadian status of this organism as “not at risk”. Similarly, this organism is listed provincially as having a rarity status of S3, suggesting its population status is likely secure, but definitive information is lacking.

**Table 15 - Rare or Endangered Invertebrate Fauna**

| Common Name | Scientific Name | No. of Records |
|---|---|---|
| Yellow-banded Bumblebee | *Bombus terricola* | 1 |
| Spike-lip Crater | *Appalachina sayana* | 1 |
| Petite Emerald | *Dorocordulia lepida* | 2 |
| Skimming Bluet | *Enallagma geminatum* | 4 |
| Orange Bluet | *Enallagma signatum* | 1 |
| Tidewater Mucket | *Leptodea ochracea* | 1 |

### 3.2.5 Rare Plants

A rare plant site survey was conducted by Gart Bishop, Botanist on June 6th, 2017. Details of the rare plant survey results are not currently available. When details of the field report are made available they will be provided in Appendix N.

The ACCDC data report had previously identified the *Canada Cinquefoil (Potentilla Canadensis)* as being present at the existing WwTF site. The June 6th survey confirmed the presence of this flower species in the field and identified it as the *Dwarf Cinquefoil*. The June 6th, 2017 survey noted that this species has expanded beyond the original 'single patch' and is now positioned along the north-western edge of the fence behind the existing WwTF.

The proposed new WwTF footprint does not currently encroach on the area in which the *Dwarf Cinquefoil* was found. Construction, operation and maintenance access to the new WwTF site will be planned to avoid travel through the area in which the *Dwarf Cinquefoil* has been located. All construction activities associated with re-purposing of the existing WwTF will also be sensitive to the presence of this rare plant.

Erosion control methods will be employed to prevent any excess overland run-off from being directed toward this area. Dust control measures will be imposed to minimize impacts on this plant.

### 3.2.6 Special Areas

In addition to identifying records of rare species, the ACCDC data search also identifies "special areas" that occur in the vicinity of the proposed project. Special areas are divided into two categories - *Managed* and *Significant*.

*Managed* areas are sites with some form of legislated protection, such as provincial or federal parks. The data search from the ACCDC revealed there are no managed areas within 5 km of the project site.

*Significant* areas are recognized for their biological or ecological attributes, but have no legislated protection. The ACCDC records search identified one biologically significant site within 5 km of the project location. This site was identified as a wetland habitat, and is located approximately 4 Km northeast from the proposed undertaking at Redbank Creek Marsh.

### 3.2.7 Location Sensitive Species

The ACCDC data search also provided data on species that the Department of Energy and Resource Development (formerly the Department of Natural Resources) has flagged as "location sensitive". Specific coordinates of these species' critical habitat is not reported in an attempt to minimize public activity and species impacts at these locations.

ACCDC records indicate bald eagles are known to occur within 5 km of the proposed undertaking location. It is interesting to note, that a mature bald eagle was observed flying over the site during the course of the March 3, 2017 field investigation. As a result, careful attention was paid to large trees, on and near the project site, in an attempt to identify possible eagle nest sites. No such evidence was found.

Additionally, the presence of the eagle was reported to Elwood Wishart, a Village WwTF operations staff. Mr. Wishart regularly visits the site as part of his duties of maintaining the existing WwTF. He noted that it is not unusual to observe eagles along the Salmon River and surrounding areas. However, he has never observed unusually high levels of eagle activity at the site during the spring and summer, when parents would normally be involved in nest building and rearing young (Elwood Wishart, pers. comm.). Based on this information, it is suggested that although eagles may occasionally visit the vicinity of the project, the site does not provide critical habitat or nest sites for this species.

During the rare plant survey on June 6, 2017, a group of painted turtles was spotted basking on a log in Henderson Brook. This information was shared with the WwTF operating staff, who confirmed that they have previously spotted painted turtles near the existing WwTF site.

During the archaeological site assessment on June 20, 2017, a snapping turtle was spotted preparing a nest (burrow) near the existing WwTF. This information was shared with the WwTF operating staff, who confirmed that they have previously spotted turtles nesting (laying eggs) within this same area.

### 3.2.8 Human Activity

The Chipman Garden Club, a local nature group, has developed nature walking trail on the WwTF property for public use. The trail system was surveyed and photographed and is delineated in Figure 2, Appendix B.

## 3.3 Cultural Features

### 3.3.1 Archaeological Assessment

An archaeological assessment of the proposed site was undertaken by Jason Jeandron of Archaeological Prospectors on June 20, 2017.

Details of the archaeological assessment are not currently available. When made available, field report details will be provided in Appendix O, and a copy of the archaeological assessment report will be submitted to DELG for review and record purposes.

## 3.4 Existing and Historic Land Uses

### 3.4.1 Existing WwTF Property Features and Adjacent Property PIDs

Existing land uses within the property boundaries on which Village's WwTF is located are provided in Figure 2, Appendix B. Figure 2 identifies the existing WwTF site, the nature walking trail network and shelter area, and the WwTF site access roadway. The WwTF and access roadway has been on this site for approximately 45+ years.

Figure 2 also identifies those properties that are positioned immediately adjacent to the subject property. PIDs of the adjacent properties are listed below in Table 16.

**Table 16 - Property PIDs/Registered Owners Adjacent to WwTF Property**

| Item No. | Property PID |
|---|---|
| 1. | 45076114 |
| 2. | 45079928 |
| 3. | 45163581 |
| 4. | 45163599 |
| 5. | 45079068 |
| 6. | 45049301 |
| 7. | 45078375 |
| 8. | 45077856 |
| 9. | 45194370 |
| 10. | 45182029 |
| 11. | 45074929 |
| 12. | 45184223 |
| 13. | 45176955 |

# 4 Summary of Environmental Impacts and Proposed Mitigation

## 4.1 Construction Phase

Environmental concerns and potential impacts anticipated during the Construction Phase of the proposed undertaking, and the proposed mitigating measure(s) to reduce or minimize potential impacts, are identified below in Table 17.

**Table 17 - Construction Phase Mitigating Measures**

| No. | Construction Phase Environmental Concerns and Potential Impacts | Mitigating Measures |
|---|---|---|
| 1. | General site environmental protection policies, controls and procedures during the course of the construction process. | • Technical specifications for this project will require the Contractor to prepare a written 'Construction Operations Plan' (Plan).<br>• The Plan will identify the policies and controls that the Contractor proposes for managing all construction activities, as well as, the procedures for the purpose of minimizing actual and/or potential impacts on the surrounding terrestrial and aquatic environments.<br>• The Plan will incorporate site management (incl., pre-construction, construction and post-construction monitoring; emergency evacuation), construction site and equipment monitoring (i.e., leak and spill prevention), site drainage management, and site materials management (incl., emergency spill notification; clean-up contingencies). |
| 2. | Soil erosion and discharge of sediment-laden water into nearby watercourses or wetland areas, resulting in habitat deterioration. | • Erosion control structures, incl. sediment control fences will be used to limit soil erosion migration.<br>• Exposed areas not subject to ongoing disturbance shall be stabilized within 30-days of grubbing. |
| 3. | Slash, trees (logs) and other cleared vegetation may result in a fire hazard, or disrupt other standing vegetation and/or the wetland areas. | • Chainsaws, or other hand-held cutting equipment, shall be used to clear vegetation, except where alternative methods or equipment are approved.<br>• No clearing will occur within 30 m of the wetland delineated in Figure 2, Appendix B.<br>• Exposed areas will be stabilized typically within 30-days of grubbing.<br>• The use of mechanical clearing methods (i.e., dozers) shall not occur, except where the resulting terrain disturbance and erosion will not result in the sedimentation of watercourses or loss of topsoil.<br>• Trees will be felled to avoid damaging other standing vegetation and will be felled away from watercourses.<br>• No vegetation within 30 m of the delineated wetland area boundaries will be removed.<br>• Cut material may be disposed of through chipping. Chips may be spread on site as a form of erosion control.<br>• Stabilization and re-vegetation of disturbed areas will be done concurrently with construction as appropriate. |

| No. | Construction Phase Environmental Concerns and Potential Impacts | Mitigating Measures |
|---|---|---|
| 4. | Grubbing disturbs the ground surface, exposing erodible soils. The roots and stumps removed may disrupt surface drainage and watercourses. | • Grubbing will not take place within 30 m of a watercourse/wetland until such time as all the appropriate erosion control devices are in place and drainage structures are in place.<br>• After grubbing, the edges of the grubbed area will be checked and any trees damaged as a result of grubbing will be removed.<br>• Stabilization and re-vegetation of disturbed areas will be done concurrently with construction, where appropriate. Exposed areas not subject to ongoing disturbance will be stabilized within 30-days of grubbing.<br>• The grubbing of unstable or erodible soil will be limited to that which is absolutely necessary to satisfy the construction requirements of the project. Where construction can be completed without grubbing, no grubbing shall occur.<br>• The length of time that grubbed areas are left exposed shall be minimized to prevent unnecessary exposure to erosive forces.<br>• Organic vegetation mat and upper soil horizon material that is grubbed will be spoiled in a manner which attempts to cover exposed areas to promote natural re-vegetation within disturbed areas.<br>• Organic material and topsoil will be stockpiled separately from inorganics and rock for use on the construction site. |
| 5. | Exposure of material through earthwork activities (i.e., trenching) and stockpiling or spoil disposal has potential to cause erosion and sedimentation impacts. Drainage of runoff may impact on watercourse or wetland area aquatic life habitat. | • Sediment control facilities may include drainage ditches, storm water management ponds, sediment filters, and check dams, as required. These shall include sediment fences with straw bales placed on the upstream side of the fence.<br>• All work associated with cutting and filling activities in the vicinity of the wetland area shall be performed in strict compliance with any permits that may be issued by DELG.<br>• Temporary and permanent stockpile/spoil disposal areas shall not be located within 30 m of the wetland area. The location of stockpile areas shall be approved as part of the site drainage management plan.<br>• Wherever possible, a buffer zone of undisturbed vegetation shall be maintained between construction areas and the delineated watercourse/wetland area. |
| 6. | Improper disposal of food wastes that may attract wildlife, creating nuisance problems. | • Domestic type waste shall be gathered daily and stored in closed steel containers until disposed of at an approved waste disposal site.<br>• Food waste shall be stored in a manner which ensures that wildlife shall not be attracted. |
| 7. | Air and noise emissions from construction equipment. | • Dust control measures shall be undertaken to limit dust from leaving the site.<br>• Construction equipment shall be equipped with appropriate air quality control and noise attenuation devices. These devices are to be maintained in good repair to minimize air and noise emissions.<br>• Monitoring to be carried out to ensure noise and dust emission compliance.<br>• Contractor will be required to abide by all air emissions requirements in accordance with provisions contained in the Clean Air Act.<br>• Contractor to be responsible for ensuring no construction equipment or vehicles comply with national ambient air quality objectives, as published under the Canadian Environmental Protection Act (CEPA). |

| No. | Construction Phase Environmental Concerns and Potential Impacts | Mitigating Measures |
|---|---|---|
| 8. | Construction site dewatering can be of concern with respect to discharge of water containing suspended sediments and the resulting impact on aquatic life habitat. | • Where necessary, filtration or other suitable measures (i.e., settling ponds, silt fences, dykes) shall be provided to remove silt and reduce the turbidity of water pumped from work areas prior to discharge from the site. Sediment control structures (i.e., sediment fences and straw bales), shall be installed a minimum of 30 m up-gradient of the delineated watercourse or wetland buffer.<br>• If required, settling ponds shall be sized to accommodate the anticipated volume of water requiring treatment.<br>• Discharged water is to be directed to follow natural surface drainage patterns when possible and where possible is to be directed into a vegetated area to permit further removal of fines.<br>• Contractor will be required to abide by all water discharge requirements in accordance with provisions contained in the Clean Water Act and the Clean Environment Act. |
| 9. | Construction Site Safety | • Contractor shall comply with all requirements under the Occupational Health and Safety Act and its Regulations.<br>• Construction activities shall be monitored to ensure compliance with construction project occupational health and safety regulations. |
| 10. | Historical artefacts will be damaged and/or lost if encountered during construction. | • If any items suspected to be of archaeological significance are encountered during construction, all work in the vicinity of the find will cease and the Director of the Archaeological Services Branch will be contacted at (506) 453-3014 - phone no. to be confirmed. |
| 11. | The accidental release of hazardous materials that may adversely affect human life, aquatic life and habitat, vegetation, soil, migratory birds, or the quality of surface water and groundwater. *Note: Federal legislation prohibits deposit of deleterious substances harmful to fish or migratory birds.* | • Delivery of hazardous materials including petroleum products to the site shall be undertaken by qualified companies, in accordance with the Transportation of Dangerous Goods Act.<br>• Fuel storage shall be undertaken in compliance with applicable provincial and federal regulations, codes, and guidelines in designated areas.<br>• All spills of petroleum products, regardless of size, shall be reported immediately to the Construction Manager, who shall report the spill immediately to DELG and the NB Emergency Measures Organization contacts, as listed in an Emergency Response Plan. Remediation shall be carried out to meet provincial and federal clean-up requirements. |
| 12. | Tree removal destroys bird nest and wildlife habitat. | • It is anticipated all tree cutting and clearing will be conducted outside of the migratory bird nesting period (April 1 - September 1).<br>• If tree cutting and clearing is required to be undertaken within the designated migratory bird nesting period, then a qualified biologist will conduct a bird migratory survey and submit the survey results to the DELG for review and approval. DELG approval to be obtained in advance of any tree cutting.<br>• No result in the loss of individuals of a threatened or endangered species, as listed by the federal Species at Risk Act (SARA), Committee on the Status of Endangered Wildlife in Canada (COSEWIC), or the New Brunswick Endangered Species Act.<br>• No damage to or destruction of an individual wildlife residence or critical habitat, as defined by SARA.<br>• No compromise of a species listed as *'Special Concern'* by SARA or COSEWIC, or a species listed as *'Sensitive'* or *'May Be At Risk'* by the New Brunswick Department of Natural Resources.<br>• No compromise of a species listed by ACCDC as *'S1, S2 or S3'*. |

| No. | Construction Phase Environmental Concerns and Potential Impacts | Mitigating Measures |
|---|---|---|
| 13. | Loss of wetland.<br>*Note: The federal policy on wetland conservation is aimed at achieving no-net loss of wetlands. The provincial wetland conservation policy prohibits destruction of provincially significant wetland.* | • The proposed area required for construction of the site access roadway and the Process Control Bldg.(s) is outside of the 30 metre buffer area for the delineated wetland boundary where shown in Figure 2, Appendix B.<br>• The proposed undertaking construction area will not result in a loss of any delineated wetland. |
| 14. | Detailed design standards. | • All aspects of the project will be designed and managed by professional engineers, incl. municipal, geotechnical, structural, mechanical, electrical, environmental disciplines, who are experienced in the components specific to this undertaking, |
| 15. | Compliance with technical specifications and drawings. | • The Proponent will provide for contract administration and full-time on site observation services to ensure all materials, equipment and construction techniques are in accordance with the contract documents. |
| 16. | Impact access to nature trail network; safety of users | • General public access to the nature trail network will be restricted during the project construction phase.<br>• The Proponent will require work be carried out in a way that least impacts the walking trail, or access to it.<br>• Signage will be posted near the trail head to advise the general public of the restricted access and the need to stay off of the construction site for safety reasons.<br>• Where necessary, the Contractor will be required to erect and maintain pedestrian barriers/fencing to restrict public access from the trail network.<br>• Re-configuration will be undertaken during construction on those portions of the existing trail network impacted by the WwTF construction, such that the affected trail alignment will be modified and re-routed around the WwTF security fencing. |
| 17. | Painted turtles. | • If spotted, re-position turtles out of the immediate construction area.<br>• Prior to back-filling, inspect any trench work using a pole-mounted mirror to inspect for turtles under any covered areas. |

## 4.2 Operation and Maintenance Phase

Environmental concerns and potential impacts anticipated during the Operation and Maintenance Phase of the proposed undertaking, and the proposed mitigating measure(s) to reduce or minimize potential impacts, are identified below in Table 18.

### Table 18 – Operation and Maintenance Phase Mitigating Measures

| No. | Operation/Maint. Phase Environmental Concerns and Potential Impacts | Mitigating Measures |
|---|---|---|
| 1. | Concern for lack of regular process operation and maintenance, resulting in underachieving treatment targets or premature failure of the treatment process and/or process equipment. | • The Proponent shall provide qualified and certified O&M staff to operate and maintain the WwTF<br>• O&M personnel shall perform regular and corrective preventative maintenance to ensure all pumping, treatment and electrical systems are functioning within the recognized AWWA standards for safe and efficient equipment operation. Maintenance shall be performed in accordance with equip. manufacturer's recommended schedules.<br>• O&M personnel shall undertake frequent (daily) site visits to inspect treatment process and control equipment, and shall perform regular effluent sampling and analysis in accordance with regulatory requirements.<br>• Where required, licenced electricians and/or certified instrumentation and controls technicians will be used to troubleshoot, service and maintain the various instrumentation and controls equipment and building, and the SCADA communications system.<br>• Replacement components will be provided for critical process equipment and controls as on-the-shelf spare equipment or parts at the Process Bldg.<br>• The project will be supplied with Equipment Operating and Maintenance Manuals, a copy of which will be maintained in the Process Bldg.<br>• O&M personnel shall be instructed on the operation and maintenance of the process equipment by qualified manufactures' equipment representatives during the process start-up and commissioning phase.<br>• O&M personnel shall undertake regular effluent testing between treatment processes to determine functionality and ensure required environmental targets are being met.<br>• O&M personnel shall undertake regular water sampling and levelling measurements at monitoring wells to ensure lagoon liners are functioning properly and no leachate is present. |
| 2. | Slow response to an alarm condition might compromise treatment performance, or result in prolonged system shutdown. | • Alarm conditions will be automatically received, logged and annunciated through the Proponent's existing SCADA system.<br>• On call O&M personnel will receive pager or text message alarm notification within minutes of a detected alarm condition.<br>• In the event of the need for a prolonged treatment process shutdown, process piping and valving provisions will be included to permit temporary by-passing of any cells within the treatment lagoons |
| 3. | Potential contamination of the surrounding environment resulting from ruptured lagoons, holding tanks or piping. | • Yard-piping (buried) and process piping systems will be appropriately pressure rated for the intended service application. All piping systems will be installed in accordance with APEGNB Recommended Standards – Water and Sewer Projects.<br>• The Proponent will provide on-site observation services during piping and process equipment installation to ensure proper installation of all integrated system components.<br>• Underground piping will be installed below frost penetration depths for this area, or otherwise insulated and/or heat-traced to prevent winter freeze-up.<br>• Ongoing sampling and testing from monitoring well between site and residential area.<br>• Continued sampling and testing in compliance with DELG guidelines to confirm achievement of effluent discharge objective's (EDO's). |

| No. | Operation/Maint. Phase Environmental Concerns and Potential Impacts | Mitigating Measures |
|---|---|---|
| 4. | Failure of the sanitary pumping station force main. | • The force main piping will be appropriately pressure rated for the intended service, and will be installed in accordance with best practices.<br>• The Proponent will provide full-time on-site observation services during construction to ensure specified materials and proper installation methods/techniques.<br>• Underground piping will be installed below frost penetration depths for this area, or otherwise insulated and/or heat-traced to prevent freeze-up during winter operation. |
| 5. | Overland flow during rain event or snow melt. | • Site will be graded to re-direct overland storm water flows around construction areas. |
| 6. | Loss of trees vegetation will occur. | • Construction of the treatment process (aerated lagoons or engineered wetlands) will result in tree and surface vegetation losses. Tree removal will occur outside of the designated migratory bird nesting period. The impact of loss wildlife habitat resulting from tree cutting and vegetation removal is considered minimal. |
| 7. | Contamination of groundwater | • Wells will be setup around site to monitor ground water levels and testing will occur to ensure the integrity of sub-surface water.<br>• Sampling/testing of water supply wells on adjacent properties along Route 10 will be performed to establish baseline water quality conditions. |
| 8. | Air quality (i.e., emissions and potential odours) impacts on existing residents. | • Contractor will be required to abide by all air emissions requirements of the Clean Air Act.<br>• Proponent will be responsible for ensuring that no air emissions exceed national ambient air quality objectives, as published under the Canadian Environmental Protection Act (CEPA).<br>• Use of a submerged fine bubble membrane diffuser membranes, will provide aeration to lagoons without increasing aerosols. |
| 9. | Visibility impacts on existing and potential future surrounding developments. | • The treatment process (aerated lagoons or engineered wetlands) will utilize earthen berm construction and will be elevated to eliminate surface visibility from off-site vantage points.<br>• Project features constructed above grade and visible from an off-site vantage point include: top of influent pumping station wet well chamber, top of flocculation chamber, top of isolation valve chamber, odour control system and enclosure, primary clarifier sidewalls, fine screenings enclosure, Process Control Bldg., security fencing. These features will be designed as to not aesthetically impact adjacent property owners. |
| 10. | Water quality in Henderson Brook | • Improved aquatic conditions in Henderson Brook are anticipated once the new WwTF outfall (to Salmon River) is put into service and the existing WwTF outfall has been potentially re-purposed. |
| 11. | Water quality in Salmon River | • New WwTF will produce improved treated effluent quality for discharge to the Salmon River. Higher dilution capabilities of the receiving stream will result nearly all EDOs being met at the end-of-pipe, or at the edge of the mixing zone 250 m downstream from the point of outfall discharge. |
| 12. | Release of odourous compounds from various points within the treatment process. | • A 25 m wide treed buffer zone will be maintain between residential property positioned along Route 10 and the edge of the treatment process (aerated lagoons or engineered wetlands).<br>• Portable gas detectors will be installed on WwTF's south-east property boundary security fence to monitor for hydrogen sulfide ($H_2S$).<br>• An activated carbon filter will extract and remove odour causing compounds from the headspace of the influent pumping station wet well chamber, flocculation chamber, and fine screening enclosure.<br>• An odour control vaporization system will be used to emit a natural, non-toxic, neutralizing (not masking) compound at the property boundary separating the treatment process (aerated lagoons or engineered wetlands) from the adjoining properties. |

## 4.3 Extreme Environmental Impacts on the Project

### 4.3.1 Winter Construction

Milestone construction activities and periods presented in Table 9 indicate that portions of the project will be forced into a winter construction schedule. This is less than an ideal situation for both the project schedule and economics, but will be require to meeting the current project completion deadline date of March 31, 2018.

Ideally, all earthworks and synthetic liner components will take place during the fall prior to the onset of winter conditions. Discussions with a synthetic liner supplier/installer indicate that any liners typically must be completed by the end of October in Atlantic Canada to avoid climatic conditions that will prevent proper bonding/fusion of the liner materials. Without a properly installed liner, completion of the treatment process (i.e., aeration/nitrification cells; horizontal/sludge wetland beds) must be halted until appropriate construction weather returns in late spring of 2018 - beyond the March 31, 2018 deadline.

### 4.3.2 Winter Operation – Snow, Freezing Temperatures

The impact of severe winter operation, including maximum snowfall and/or freezing temperatures conditions, on the day-to-day operation of the wastewater treatment process is anticipated to be minor, albeit at times potentially inconvenient.

Process equipment and associated electrical controls will suitably protected from severe weather conditions within heated and ventilated buildings or enclosures, or otherwise will be positioned below frost depth in a pre-cast concrete chamber. All yard-piping will be buried below typical frost penetration depths for freeze protection. Piping or conduits that are exposed to frost zones, will be suitable insulated and/or heat traced to avoid the potential for freezing.

The Process Control Building in which the lab, office, toilet, locker and showers areas will be located will be heated and ventilated. All buildings/enclosures will be designed to withstand all current and applicable snow loading conditions for this region, in accordance with the National Building Code of Canada.

Regular snow clearing will during winter operation to ensure adequate access is maintain from Route 10 and along the site access roadway to the Process Control Building and the sanitary influent pumping station. Design provisions will be made for on-site snow management and stockpiling, so as to maintain suitable vehicle parking and turn-around areas during extended snow fall conditions. In the event that vehicle passage along the access roadway is temporarily suspended due to excessive snowfall, site access can be achieved by snowmobile or a tracked snow-vehicle.

Treatment process operation will be based on partial or fully automated programmable control of key process components. Thus, full-time or frequent operator attention is not required. SCADA capabilities will enable the operating staff to view the operating status of key process equipment components remotely. In the event the operating staff is unable to access the site due to weather conditions, a site visit delay of several days will not typically affect the day-to-day operation of the WwTF.

### 4.3.3 Maximum Rainfall

During the construction phase, excessive rainfall could will impact on construction site conditions. The Contractor will be required to provide and maintain proper grading and storm water drainage/handling features and facilities at the site to minimize overland surface water drainage impacts.

Drainage features will be incorporated into the site access roadway design to ensure proper surface water drainage during the operation and maintenance phase. Where required, culverts will be positioned at strategic locations across the access roadway to permit surface water migration. The existing oxidation ditch offers potential as a re-purposed storm-water retention pond, discharging through the existing outfall into Henderson Brook.

The access roadway and building/enclosure foundations will be positioned at geodetic elevations to mitigate again rainfall impacts.

### 4.3.4 Prolonged Power Outage

During the construction phase the Contractor will be responsible for providing temporary site power (i.e., portable power generators). A prolonged power outage event at the site is not expected to impact on construction progress.

During the project's operation and maintenance phase, a permanent stand-by emergency generator (gen-set) will be available in the event of a loss of site power. The gen-set will power essential process equipment (i.e., influent pumping, aeration, primary clarifier chain and flight, and primary clarifier waste pumps), emergency stand-by power generator ventilation, Process Control Bldg. lighting/heating/ventilation systems, water supply well pump, and the water supply hot water heater. Sufficient fuel tank capacity will be provided to enable a minimum of 48-hours of continuous gen-set operation before re-fueling is required.

### 4.3.5 High Winds

Removal of trees on the site to accommodate the treatment process (i.e., aerated lagoon or engineered wetland), will create greater exposure of the WwTF site to the effects of high winds. The remaining treed areas surrounding the treatment process site will continue to offer some wind buffeting protection. Excessively high wind conditions during the construction phase, especially during earthen berm construction and liner installation, will require the Contractor to take necessary precautions and assess if work stoppage is warranted.

Extreme wind conditions could potentially impact on the operation of the WwTF. The site's overhead power supply line will be susceptible to power interruption resulting from power line knockdown caused by falling trees. To mitigate against such potential power outages, the Proponent will periodically inspect the overhead power line for potential tree limb interferences and request that NB Power undertake to trim back and remove tree branches on an as-required basis. The stand-by emergency power will enable continued operation of the WwTF in the event of disruption of the site power supply.

### 4.3.6 High Water/Spring Freshet

Due to the project's proximity to the Salmon River and low-lying site topography, there is very high potential for parts of this property to be flooded during large rainfall events and especially during high spring freshets. For example, flooding caused by a spring 2017 storm event resulted in flood levels nearing the flood plain delineated in 2008.

The requirement to build the WwTF above the 1:100 year flood event level is accomplished by locating the treatment process components (i.e., aerated lagoons or engineered wetlands) on the higher ground positioned on the eastern section of the site property. The WwTF components must remain assessable in a 1:25 year flood event. The overland portion of the outfall line will unavoidably be built across this floodplain. However, the outfall pipe will be buried and buoyancy of the pipeline is not of concern. Should the pipeline be installed in a shallow trench, and a protective earthen berm is placed over the pipeline, then the integrity of this berm will be periodically inspected along its entire length for signs of erosion.

## 4.4 By-laws

Treatment capacity of the new WwTF accounts for contributions from residential, commercial, institutional, and industrial wastewater sources. It will also accounts for and accommodate inflow and infiltration sources contributing to the sanitary sewer collection system.

It is intended that the Proponent's sewerage rate charges distribute WwTF operation and maintenance costs fairly and equitably among all of its wastewater connections and contributors. It is also intended that the Proponent identify wastewater sources that contain excessively high concentration wastewater constituents that could negatively impact on treatment performance and/or the ability of the WwTF to achieve designated CCME Effluent Discharge Objectives (EDOs).

Therefore, the Proponent will be considering municipal by-laws to address the following:

- Sewerage rate charges to individual residential, commercial, institutional, and industrial connections on a calculated equivalent residential connection basis;
- Limitations on the concentrations of specific organic and inorganic wastewater constituents from commercial, institutional, and industrial wastewater sources.

# 5 Public Involvement

## 5.1 General

The Environmental Impact Assessment (EIA) process requires public involvement based on an open and transparent public engagement process. Therefore, public consultation is a key component in the development of the Proponent's proposed undertaking.

The primary goal of public consultation is to ensure that those persons, property owners and stakeholders potentially affected by the proposed undertaking (project) are afforded opportunities to become aware of the project, have access to the appropriate level of project information, and are provided with an opportunity or opportunities to express any questions, comments or concerns relating to the proposed undertaking.

The Proponent is obligated to respond in an open and forthright manner to questions, comments or concerns submitted by the public. Within 60-days of registering the project, the Proponent must submit to DENV's Project Assessment Branch a written public involvement activities report. This report will include copies of all property owner and public notifications, written questions, comments and concerns received from the public, the Proponent's responses to public questions, comment and concerns.

## 5.2 Public Information Sessions

The project represented by this EIA Registration Document has been the culmination of work commenced by the Proponent in 2013. In 2013, the Proponent initiated an Environmental Risk Assessment (ERA) of its wastewater treatment facility. This included regular wastewater effluent sampling and analysis to determine the overall treatment performance of the Proponent's current WwTF, as well as, to establish Effluent Discharge Objectives (EDOs) for various effluent quality parameters.

Opportunities for public participation in this EIA process will include a Public Open House scheduled for Wednesday, July 5, 2017, from 12 noon to 8 PM at the Village of Chipman Heritage Centre. This open house event will include various poster-sized presentation boards describing the proposed undertaking, including: the proposed site location, anticipated footprint requirements, anticipated wastewater flow contributions, treatment solutions and treatment process components being considered, anticipated capital and operation and maintenance costs. The need for additional public open houses for public engagement purposes will be will be determined by the Proponent following the initial open house venue.

The open house will be attended by the Proponent and representatives of the engineering consulting firm tasked with conduction the EIA Process on the Proponent's behalf. This representative will be able for one-on-one discussions with the general public and other interested stakeholders. Opportunities for written submissions of questions, comments and concerns will be provided at and following the open house.

Following this open house, and within 60-days following submission of this EIA Registration Document, the Proponent will submit to DELG a report documenting all public involvement activities undertaken for this project.

# 6 Approval of the Undertaking

## 6.1 Environmental Impact Assessment Process

This proposed undertaking is subject to an EIA Process pursuant with the NB EIA Regulation 87-83. The initial step of the EIA process involves a formal registration of the project details with the DELG. This report represents the EIA Registration Document for the proposed undertaking.

Following submission of the EIA registration document, the proposed undertaking will undergo a Determination Review coordinated by DELG's Project Assessment Branch. This review will be assisted by a specially constituted Technical Review Committee (TRC) comprised of technical experts and specialists from federal agencies and various provincial government departments.

The TRC review is aimed at identifying and evaluating environmental issues associated with the proposed undertaking. Feedback is anticipated from the TRC in the form of questions, comment and concerns. The project Proponent (Village) will be required to prepare written responses to issues identified by the TRC.

During the Determination Review period, consultations involving the public and affected stakeholders are to be conducted to provide public review of the proposed undertaking, and to offer opportunities to receive questions and concerns from the public. The EIA process requires that the Proponent demonstrate that such review opportunities have been provided, and that any questions and concerns have been satisfactorily considered or otherwise addressed. The Proponent will receive and respond to all questions, comments or concerns from the public regarding the proposed undertaking.

Upon receiving sufficient information about the proposed undertaking, the Proponent will be informed as to whether a Comprehensive Review is warranted by the Minister. The Project Assessment Branch is to complete the Determination Review within 120-days of the project's date of registration. If it is decided that the EIA process is sufficient, the Minister will issue a Certification of Determination, subject to terms and/or conditions.

Further EIA process information can be obtained from:

- A Guide to Environmental Impact Assessment in New Brunswick, Department of the Environment, April 2012. This document is available directly from the EIA website at:

  http://www2.gnb.ca/content/dam/gnb/Departments/env/pdf/EIA-EIE/GuideEnvironmentalImpactAssessment.pdf

- Additional Information Requirements for Wastewater Treatment Projects, Department of Environment and Local Government, January 2014. This document is available directly from the EIA website at:

  http://www2.gnb.ca/content/dam/gnb/Departments/env/pdf/EIA-EIE/SectorGuidelines/WastewaterTreatment.pdf

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## 6.2 Watercourse and Wetland Alteration Permit

Construction of the underwater portion of the outfall pipe will involve horizontal directional drilling under the Salmon River. In-water activates will be required to install the diffuser header manifold to the end of the effluent pipe. A Watercourse and Wetland Alteration (WAWA) permit will be required from DELG prior to proceeding with this portion of the site works.

## 6.3 Approval to Construct, Approval to Operate

An Approval to Construct (to be obtained prior to commencing onsite construction activities) and an Approval to Operate (to be obtained prior to commencing operation), as issued by DELG under the Clean Environment Act, will be required for the proposed undertaking.

# 7 Funding

Funding for this project has been secured in part through the *Clean Water and Wastewater*. The Proponent will be responsible for financing 25% of the capital portion of this project, with the Provincial and Federal Government financing the remaining 75%. The Proponent has applied to the Environment and Local Government Municipal Capital Borrowing Board to borrow its capital portion.

The Proponent will be also responsible for financing 100% of the proposed undertaking's operation and maintenance costs. These costs will be collected from its ratepayers through Village sewer user fees.

# 8 Signature

June 23, 2017
Date

Susan Kennedy
Signature of Village of Chipman
Chief Executive Officer

# 9 Glossary of Technical Terms

| | |
|---|---|
| ACCDC | Atlantic Canada Conservation Data Centre |
| AO | aesthetic objective |
| CCME | Canadian Council of Ministers of the Environment |
| CFU | colony forming units |
| DELG | Department of Environment and Local Government |
| EDO | effluent discharge objective |
| EIA | Environmental Impact Assessment |
| ERA | Environmental Risk Assessment |
| EQO | Environmental Quality Objective |
| ft. | feet (length) |
| g | gram (mass) |
| ha | hectare (area) |
| HDD | horizontal directional drilling |
| HDPE | high density polyethylene |
| $H_2S$ | hydrogen sulfide |
| in. | inches (length) |
| Kg | kilogram (mass) |
| Km | kilometre (length) |
| L | litre (volume) |
| L/s | litres per second (flow) |
| Lpcd | Litres per capita per day (hydraulic loading) |
| m | metre (length) |
| mm | millimetre (length) |
| $m^2$ | square metre (area) |
| $m^3$ | cubic metre (volume) |
| $m^3/d$ | cubic metre per day (flow) |
| $m^3/s$ | cubic metre per second (flow) |
| MAC | maximum acceptable concentration |
| mg | milligram (mass) |
| mL | millilitre (volume) |
| MPN | most probable number |
| O&M | operation and maintenance |

| | |
|---|---|
| PID | parcel identification |
| PF | peaking factor |
| RL | Reporting limit |
| SCADA | supervisory control and data acquisition |
| SNB | Service New Brunswick |
| TRC | Technical Review Committee |
| UV | ultraviolet |
| WAWA | Watercourse and Wetland Alteration |
| WwTF | wastewater treatment facility |

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