

SCHEDULE F – PROJECT COMPLETION REPORT TEMPLATE

VERY IMPORTANT:

Timing: You need to email a report, to your GMF project officer (contact info is in Schedule C), on the dates indicated in Schedule C or whenever FCM asks for such a report.

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Please contact your project officer to receive an electronic copy of the Completion Report Template.

Upon completion of the project, a copy of the Final Deliverable must be submitted along with this Completion Report.

FCM will post your report on the [Green Municipal Fund™ \(GMF\) website](#). This is because one of FCM's mandates is to help municipal governments share their knowledge and expertise regarding municipal environmental projects, plans and studies.

How to complete the Completion Report

The purpose of the Completion Report is to share the story of your community's experience in undertaking your project with others seeking to address similar issues in their own communities.

Please write the report in plain language that can be understood by people who are not specialists on the subject. A Completion Report is typically in the range of 5–10 pages, but may be longer or shorter, depending on the complexity of the project.

GMF grant recipients must enclose **final** copies of the Completion Report and the Final Deliverable with their final Request for Contribution. The reports, including all attachments and appendices, must be submitted in PDF format with searchable text functionality. Reports that are not clearly identifiable as final reports, such as those displaying headers, footers, titles or watermarks containing terms like "draft" or "for internal use only," will not be accepted by GMF. Additionally, reports must be dated. If you have questions about completing this report, please consult GMF staff.

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| GMF number | GMF 16842 |
| Name of lead applicant (municipality or other partner) | Town of Bradford West Gwillimbury |
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| Date of the report | December 18, 2020 |

1. Introduction

In January 2019, the Town of Bradford West Gwillimbury (Town) started the Bradford Water Pollution Control Plant Optimization and State of Good Repair Study, a feasibility study to address operation and maintenance concerns of the Town's wastewater treatment plant (Plant). The goal of the Study was to develop strategies for preserving the Plant's wastewater treatment capacity and optimizing processes to ensure that there is adequate capacity to service the Town's population growth to 2031.

The project team for the Study included the following Town and Consultant staff.

Ainley / Black & Veatch (Consultant) staff

- Gustavo Jacome, Project Manager, jacome@ainleygroup.com
- Germana Nunes, Deputy Project Manager & Design Lead, nunesg@bv.com
- Jim Fitzpatrick, Lead Engineer, FitzpatrickJD@bv.com

Town staff

- Tony Desroches, Manager of Wastewater, tdesroches@townofbwg.com
- Samantha Mackenzie, Manager of Compliance, smackenzie@townofbwg.com
- Mahesh Ramdeo, Manager of Capital Projects, mramdeo@townofbwg.com
- John Mabira, Senior Project Manager – Capital Projects, jmabira@townofbwg.com

2. The Feasibility Study

a) Feasibility Study Process

In 2012, the Town completed a Schedule C Class Environmental Assessment (EA) study, along with a Preliminary Design Report (2012 PDR) for the Plant. The EA recommended the expansion of the Plant's capacity from 19.4 million litres per day (MLD) to 23.3 MLD with upgrades to the Plant's headworks building, tertiary treatment and sludge management systems.

In 2019, the Town carried a review of the Plant's operations including the amount of wastewater treated as compared to population growth rates of the service area. This review revealed that the expansion recommended by the EA would not be required at the time. The review established that numerous Plant operation and maintenance issues required immediate attention.

The operation and maintenance issues identified included that the Plant:

- could no longer achieve its rated capacity of 19.4 MLD
- was in poor state of good repair, especially the condition of one of the Plant's three treatment trains
- may not be able to meet effluent quality requirements under extreme operating conditions
- was experiencing an increase in energy requirements resulting from treatment of higher concentrations of wastewater from the service area

In August 2019, the Town decided to investigate ways to address these issues including looking into the viability of mitigating the issues by implementing some of the upgrades recommended by the EA and 2012 PDR.

The Town initiated the Bradford Water Pollution Control Plant Reviews and Upgrades project (Project) to address these concerns. This project would preserve the Plant's wastewater treatment capacity and optimize processes to ensure that there is adequate capacity to service the Town's population growth to 2031.

The Project consisted of three stages. The first stage is the Feasibility Study (Study) with three components:

1. A Plant state of good repair (SOGR) analysis (SOGR Review) that would establish the Plant's SOGR status and identify SOGR upgrade requirements making use of the most up to date information including the recent wastewater treatment technologies.
2. A Plant upgrades validation study (Validation Review) that would validate and update recommendations of previous decision (documented in the 2012 PDR). The validation would take into consideration the most up to date information on the Plant's state, regulatory requirements and best practices.
3. A process optimization analysis (Optimization Review) that would investigate options (through a process optimization) for refurbishment and increasing capacities of the Plant's three existing treatment trains B, C and D.

The second two stages of the Project will involve the design and construction of critical upgrades established from the validation component of the Study.

In September 2019, the Town issued a request for proposals inviting firms to submit proposals for professional engineering consulting services for the Project. In December 2019, the Town retained Ainley / Black & Veatch to provide the engineering services required for the Project.

The Project started on January 9, 2020 with a kickoff meeting. Study workshops to review draft reports were held in July and August 2020. The Consultant submitted final draft reports in September and October 2020 with the final Study reports submitted in November 2020.

b) Objectives of the Feasibility Study

The overall goal of the Study was to address the Plant's operational and treatment objectives by ensuring that there is adequate wastewater treatment capacity to service the Town and that the Plant meets all regulatory requirement for protecting the environment.

The goal of the Validation and Optimization components of the Study was to improve the performance, reliability, flexibility and robustness of the Plant's treatment processes. This would ensure that the Plant is easier to operate and maintain at reduced costs. It would also ensure that the Plant meets anticipated stringent regulatory requirements.

The objective of the Optimization review was to assess and analyze the capacity of the Plant's treatment processes and recommend upgrades to optimize their performance and efficiency. The objective of the Validation review was to assess the Plant upgrades recommended by the 2012 PDR with the goal of ensuring that they are still the right investment for the Town.

The goal of the Plant SOGR analysis component of the Study was to improve the Plant's operation and maintenance efficiencies, avoid catastrophic failures and improve service levels. This would be achieved through the establishment of the current state of the Plant's infrastructure, remaining useful life and maintenance / replacement needs.

Ultimately, implementation of the Study's recommendations will lead to improved Plant operation efficiency, redundancy and flexibility.

c) Feasibility Study Approach

General

To achieve maximum long-term benefits, the project team used an integrated and holistic approach to implement the Study. This included building consensus and effectively communicating with Study stakeholders including Town operations and project management staff, senior management and the Consultant's team.

The Study used a comprehensive process and analysis methodology to evaluate optimization and upgrade options. The methodology utilized a qualitative rating scale to indicate the level of risk associated with various aspects of the alternatives. The project team used the following criteria to evaluate alternatives:

- Life cycle cost – This is the net present value of the capital cost and the 20-year operational cost.
- Cost penalty - This criterion captured the investment that would be required elsewhere on the site if an option were selected.
- Greenhouse Gas (GHG) emissions and energy performance - This criterion captured the life cycle cost of energy and carbon based on the federal carbon pollution pricing on the Greenhouse Gas Pollution Pricing Act (carbon tax) and projections over the next 20 years.
- Process capacity – This criterion captured the ability to meet the required 19.4 MLD capacity
- Operation and maintenance - This criterion ranked the operation and maintenance requirements of each option.
- Regulatory acceptance - This criterion assessed the risk to the timeframe in which the option could be implemented.
- Constructability and schedule - This criterion evaluated the impact of construction on the operation of the Plant.
- Sustainability - This criterion evaluated the impact on the environment including changes to greenhouse gas emissions, boundary noise levels, ability to manage odorous air, and traffic to and from the site.
- Future requirements - This criterion assessed how the option fits in with the plans for the facility.
- Proven technology (robustness) - This criterion assessed if the option has been implemented at plants of similar size, in similar climates and in North America

SOGR Review

The Town carried out the SOGR review to assess the status of the Plant's infrastructure. The primary objective of the SOGR review was to develop a long-term investment and maintenance strategy for the Plant that will mitigate risks and ensure that the Plant is in a good working condition.

The SOGR review consisted of a Plant assets inspection exercise, an asset database development and the establishment of upgrade projects required to refurbish and replace existing assets.

The WPCP State of Good Repair report, by Ainley / Black & Veatch of November 2020 (SOGR report), attached to the report documents the findings of the SOGR review.

Implementing upgrades recommended by the SOGR review will improve the Plant's operation efficiency, redundancy and flexibility and will ensure the provision of a reliable, efficient and sustainable wastewater treatment service and capacity to 2031 and beyond.

Validation Review

The Town carried out a Validation review to assess Plant upgrades recommended by the 2012 PDR with the goal of ensuring that they are still the right investment for the Town. The assessment included investigation of alternatives for upgrading and restoring the Plant's rated capacity.

The Validation review approach included a review of the design criteria with a cost and a non-economic comparison of treatment technologies. The Consultant team carried out the review in six (6) parts based on the treatment process. The team prepared the following technical memoranda (TM) for each part to document the validation process.

1. TM1a - Headworks odour control system
2. TM1b - Inlet screen and vortex grit chamber
3. TM1c - Alum dosing system
4. TM1d - New sludge thickening system
5. TM1e - Digester and storage odour control
6. TM1f - Aerobic digester aeration requirements

The WPCP Validation Phase report, by Ainley / Black & Veatch of November 2020 (Validation report), attached to the report documents the findings of the review. The report provides a summary of the upgrades recommended by the Validation review with the technical memoranda included as appendices.

The technical memoranda include the following tables with summaries of evaluations done under the Validation review.

- Headworks odour control system – Table 4-3 (pdf page 38)
- Inlet screen and vortex grit chamber – Table 5-1 (pdf page 113)
- Alum dosing system – Tables 3-1 and 3-2 (pdf pages 153 and 155)
- New sludge thickening system – Table 10 (pdf page 187)
- Digester and storage odour control – Table 4-1 (pdf page 313)

Implementing upgrades recommended by the Validation review will improve the Plant's operation efficiency, redundancy and flexibility and will ensure the provision of a reliable, efficient and sustainable wastewater treatment service and capacity to 2031 and beyond.

Optimization Review

The Town carried out the process optimization review to assess the capacity, performance and robustness of the treatment processes of the Plant.

The Consultant team carried out the following tasks as part of the Optimization review:

- Review of existing facilities and operations
- Hydraulic, process and energy modeling
- Site development
- Aeration and clarification system evaluation
- Optimization workshops to review options and draft reports

The Optimization review investigated two alternatives for upgrading and restoring the Plant's rated capacity of 19 MLD:

- Option 1 – Plant train B state of good repair upgrades with minor Plant train D upgrades
- Option 2 – Decommission Plant train B with major Plant train D upgrades

The Process Optimization Technical Memorandum, by Ainley / Black & Veatch of November 2020 (Optimization TM), attached to the report documents the findings of the Optimization review.

Implementing upgrades recommended by the Optimization review will improve the operation efficiency, redundancy and flexibility. The upgrades will contribute to the reduction in the nutrient load and contaminant level in the effluent water discharged into the Lake Simcoe watershed. They

will also lead to a reduction in the Plant's energy consumption and greenhouse gas emissions. This will ensure the provision of a reliable, efficient and sustainable wastewater treatment service and capacity to 2031 and beyond.

d) Public Consultations

The project team did not conduct any public consultations. It was determined that public consultations were not necessary at this time because the Study had no direct impact to the public.

However, the project team identified and carried out extensive stakeholder consultation including consultations with Ministry of Environment Conservations and Parks (MECP) approvals branch, equipment suppliers, senior management, and operations staff.

3. Feasibility Study Findings and Recommendations

a) Environmental findings of the Study

SOGR Review

Environmental findings of the SOGR review include that:

- Plant train B is in a very poor condition and has not been in service for 9 years. Extensive rehabilitation and replacement of the majority of equipment will be required in order to operate the train.
- The existing blowers and aeration systems of Plant trains C and D are approaching the end of their useful life and need replacement.
- The process tanks of Plant train C have critical structural issues caused by the surcharging of soil on the south side of the tanks. Additional investigation and rehabilitation work of the tanks is required in the near term.

The WPCP Asset Condition Assessment Database attached to the SOGR report provides more details regarding the SOGR review findings. Details include asset replacement planning and condition assessment findings.

Validation Review

Environmental findings of the Validation review include that:

- The dry media adsorption is the most suitable odour treatment technology for the Plant headworks building (Validation report, TM1a Table 4-3, page 12 - pdf page 38).
- The existing automatic screens are capable of handling an increase in flows (Validation report, TM1b section 4.1.1 page 6 - pdf page 107).
- To increase the Plant's resilience and robustness, the existing manual screen needs to be replaced with an automatic one (Validation report, TM1b section 4.2.1, page 7 - pdf page 108)
- Installation of a second grit classifier will increase the Plant's resilience and robustness. A third grit vortex chamber will not be required for additional resilience (Validation report, TM1b Table 5-1, page 12 - pdf page 113)
- A two-stage alum dosing system is much more efficient than a one-stage dosing system. (Validation report, TM1c Table 3-1, page 7 - pdf page 153)
- The Rotating Drum Thickener is the most suitable technology for the new sludge thickening facility (Validation report, TM1d Table 10, page 20 - pdf page 18)

Optimization Review

Environmental findings of the Optimization review include that:

- Plant train B capacity is currently not available (SOGR report section 5.7.1 and 5.7.2, page 28 - pdf page 38)

- The Plant can no longer achieve its rated capacity of 19.4 MLD; even with the recovery of Plant train B's capacity after refurbishment (Optimization report Table 5-2, page 20 - pdf page 22).
- There is a need to carry out capital upgrades to restore capacity and improve the operation and maintenance efficiencies of the Plant (Optimization report section 6, page 45 - pdf page 47).

b) Financial findings of the Study

SOGR Review

Financial findings of the SOGR review include that:

- The existing blowers and aeration systems of Plant trains C and D are inefficient and consume a lot of energy, leading to increased energy costs
- There is need to plan and budget for long-term capital upgrades and replacements including:
 - Fifty-three (53) projects over the next 10 years at total estimated cost of \$6,034,700 (2020 dollars)
 - Twenty-eight (28) projects over the next 10-25 year time horizon at a total estimated cost of \$2,575,500 (2020 dollars).
 - Decommissioning of Plant train B at an estimated cost of \$900,000.

The SOGR report (Table 3, pages 67 to 69 / pdf pages 77 to 79) and the WPCP Asset Replacement Projects NPV report attached to the SOGR report provide more details regarding the SOGR financial findings.

Validation Review

Financial findings of the Validation review include that:

- The dry media adsorption is the most suitable odour treatment technology - with the lowest life cycle cost - for the Plant headworks building (Validation report, TM1a Table 4-3, page 12 - pdf page 38).
- The Rotating Drum Thickener is the most suitable technology - with the lowest life cycle cost - for the new sludge thickening facility (Validation report, TM1d Table 10, page 20 - pdf page 18)

Optimization Review

Financial findings of the Optimization review included that:

- The lifecycle cost of decommissioning Plant train B with a major Plant train D upgrade is lower than the lifecycle cost of refurbishing Plant train B with a minor Plant train D upgrade (Optimization report Table 5-11, page 45 (pdf page 45)).
- Optimization upgrade Option 2 is the preferred alternative for restoring the Plant's capacity (report Table 5-13 and section 6, pages 44 & 45 / pdf pages 46 & 47).

c) Study recommendations

SOGR Review

The SOGR review is recommending that the Town implements within the next two years, the following Plant upgrades that will contribute to the restoration and maintenance of the Plant's capacity:

1. Upgrade and replace the Plant's Supervisory Control and Data Acquisition (SCADA) and network system. The system requires replacement because it has reached the end of its useful life. The upgrades are required immediately since technical support for these systems will no longer be available in the next two years.
2. Upgrade the Plant's programmable logic controllers to ensure that they are compatible with the updated SCADA network.
3. Carry out structural repairs and reinforcement to Plant train C tanks.

4. Replace one (1) existing Plant train C constant speed blower with a high-speed gearless turbo blower to improve efficiency, energy consumption and reduce greenhouse gas emissions

Table 3 on page 67 (pdf page 77) of the SOGR report gives a summary of upgrade projects recommended by the SOGR review. The report provides more details regarding the SOGR review.

Validation Review

The Validation review is recommending that the Town implements within the next two years, the following Plant upgrades that will contribute to the restoration and maintenance of the Plant's capacity:

1. Headworks building odour control system - replace the existing biological odour treatment system with a dry media (carbon) adsorption system.
2. Inlet screen and grit classifier upgrade - re-rate the existing mechanical screens, replace the manual bar screen with a mechanical screen and add a second grit classifier unit
3. Alum dosing system upgrades – install a two-stage alum dosing system for all process trains; upgrades include adding feed pumps, piping and changing dosing locations
4. New sludge thickening system – install a new sludge thickening system facility (Rotating Drum Thickener) with a capacity to treat 720 m³/d
5. Biosolids Odour Control System - Install a new dry media odour control system for the biosolids facility, to treat odour emissions from the Plant digesters, biosolids storage tanks and new sludge thickening facility

Table 8-1 on page 5 (pdf page 47) of the Validation report gives a summary of capital cost estimates for the proposed Validation upgrades. The report provides more details regarding the Validation review.

Optimization Review

The Optimization review is recommending that the Town implements within the next two years, the following Plant upgrades that contribute to the restoration and maintenance of the Plant's capacity:

1. Replace one (1) existing Plant train D multistage centrifugal blower with a high-speed gearless turbo blower to improve efficiency.
2. Increase Plant D's efficiency, robustness and treatment capacity by:
 - Replacing existing Plant train D aeration equipment including diffuser grids (with new fine-bubble diffusers), drop legs, supports, air piping, valves and flow meters.
 - Installing baffles and anoxic mixing equipment to of each Plant train D's aeration tank.
 - Upgrading Plant train D aeration tanks feed channels, effluent channels and effluent chamber with the addition of a compressed air mixing system or coarse bubble diffusers

Section 6 on page 45 (pdf page 47) of the Optimization TM gives a summary of upgrade projects recommended by the Optimization review. The TM provides more details regarding the Optimization review.

4. Lead Applicant's Next Steps

- a) The Town is proceeding with the implementation of upgrades recommended by the Study. These include upgrades recommended by SOGR, Validation and Optimization reviews as outlined in the previous section.

The design phase of the upgrades recommended by the Validation review started in November 2020 with the construction phase commencing end of 2021. The design phase of the upgrades recommended by the SOGR and Optimization reviews will start second quarter of 2021 with construction phase commencing early 2022.

Implementation of the Study's recommendations will improve the Plant's operation and maintenance efficiencies, redundancy and flexibility and ensure the provision of a reliable, efficient and sustainable wastewater treatment service and capacity to 2031 and beyond.

The upgrades will contribute to the reduction in the nutrient load and contaminant level in the effluent water discharged into the Lake Simcoe watershed. They will also lead to a reduction in the Plant's energy consumption and greenhouse gas emissions.

5. Lessons Learned

a) Lessons learned - recommendations for other municipalities

1. Identify and get to know the project's stakeholders
 - Prior to initiating the Study, Town staff carried out pre-consultations with the Ministry of Environment Conservation and Parks. The Town incorporated feedback received into the Study.
 - A lesson learned from this is that before proceeding with any project, proponents should identify and get to know the project's stakeholders. They should carry out extensive pre-consultations with both internal and external stakeholders in order to determine the project requirements and expectations of all parties involved. These consultations will ensure that the project addresses stakeholder concerns and expectations.
2. Communicate continuously throughout the project life cycle
 - During the later stages of the Study, Operations staff raised issues and concerns that affected previously made decisions.
 - A lesson learned from this is that the project team should communicate continuously throughout the project life cycle to ensure all stakeholders concerns are addressed in a timely manner.
3. Manage stakeholder expectations
 - Unrealistic stakeholder expectations affected the process of establishing the preferred strategy for the Study.
 - A lesson learned from this is that the project stakeholder consultations should anticipate and find ways to manage and deal with stakeholder expectations that are out of line with project realities.
4. Operations staff consultation
 - Consultation and input from Operations staff was important for the Study.
 - A lesson learned from this is that the project team should ensure that Operations staff are at the core of the decision making process. The team should rigorously consult Operations staff for their input and perspective.
5. Use of a comprehensive process and analysis methodology
 - The Study's approach of using a comprehensive process and analysis methodology assisted with the establishment of the best optimization and upgrade strategies for the Plant.
 - A lesson learned from this is that the use of a similar methodology to review options for improving plants operations and choosing the best technologies can be useful when planning upgrades.

b) Lessons learned - barriers or challenges encountered

1. Budget insufficient for project scope

Budget constraints affected the project team's decision for preferred strategies. The team had to identify priorities based on the available budget. The team recommended that value-engineering exercises should be done during the design phase to confirm upgrades timing, scope and budget.

2. COVID-19 impacts

- COVID-19 presented a potential risk to the project schedule, scope and budget. The team put in place mitigation measures to limit the impact of COVID-19 and ensure that project tasks went on as previously planned.
- Measures put in place included:
 - Protocols to ensure that work continues on project tasks with minimal disruption, while practicing social distancing / COVID health guidelines. Site visit activities were done as long as there was no face-to-face contact with staff.
 - Meetings and workshops were conducted via conference calls or web-based forums
 - The project team continuously monitored COVID-19 risks to ensure timely identification of any potential impacts to project schedule, cost and budget.

6. Knowledge Sharing

a) Study website

The Town has not set up a website for the Study

b) Other activities from the Study

The Town has not done any activities beyond the Study's findings and recommendations

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