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.

Copyright: Before you submit a report to FCM, make sure you hold the copyright for the report. If you're hiring a consultant to prepare the report, please make sure to get the copyright (see FCM's copyright tips document), or else FCM will not be able to disburse the Grant Amount.

Accessibility for people with disabilities: Please do not change the format, font, layout, etc. of this report. This template has been specially designed, following FCM's Accessibility Guidelines, in order to be accessible to people with disabilities.

Confidentiality: If your report contains any Confidential Information that you would prefer not be made available to the public (e.g. through a case study or other materials produced by FCM that relate to your Project), please submit two versions of the report:

1. **Complete report including Confidential Information:** Please clearly label this report with the word "**Confidential**" or similar wording and FCM will treat it as confidential.

2. **Abridged report excluding Confidential Information:** This report may be posted on the FCM website and otherwise made available to interested third parties, to help FCM meet its knowledge sharing objectives.

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.

GMF number	
Name of the lead applicant (municipality or other partner)	Rural Municipality of Taché
Name, title, full address, phone, fax, e-mail of lead technical contact for this Pilot Project	
Date of the Report	October 26, 2022

1. Introduction

a) Who was involved in doing the Pilot Project, and what are their affiliations? Please include name, title and contact information. Those involved could include municipal staff, engineering and other consultants, a representative from a nongovernmental organization, and others.

1. Gavin Van der Linde – Project Manager (InnoVantage)
2. Arman Vahedi, PhD, P.Eng. – Wastewater Engineering Technical Lead (InnoVantage)
3. Mengmeng Tian, M.Sc. – Wastewater Research Scientist (InnoVantage)

Note: InnoVantage Inc. (InnoVantage) is a company based in Winnipeg, MB and specializes in providing innovative solutions for a wide range of water, wastewater, and waste management issues. InnoVantage is specialized in working with municipalities and uses the approach of value engineering in providing the most cost effective solutions for environmental problems.

2. The Pilot Project

a) Please describe the project objectives and the approach used to meet these objectives. Include details on what technology or solution was tested during the Pilot Project. (Indicate relevant sections/pages of the Final Pilot Project Report)

Objectives:

1. Developing the in-line phosphorous removal and recovery (IPRR) system Taché's wastewater lagoons located in Landmark, MB with the minimum capacity if 150 gallons per minute.
2. Running the IPRR system for a minimum of 6 weeks with different configurations to test various chemical, environmental, and hydraulic parameters affecting the performance of the system.
3. Work with Taché staff to develop a treatment plan for Landmark lagoons by using a combination of IPRR system and other methods (if applicable).
4. Developing a preliminary design of a full scale IPRR system based on the findings of the pilot project.

These objectives can be found in the final report in page 9.

Approach:

InnoVantage has configured a treatment process specifically for phosphorous removal and recovery. The process is called in-line phosphorous removal and recovery (IPRR) and is based on the chemical coagulation and flocculation processes. In the IPRR system, Alum is used for the coagulation process. In IPRR system, wastewater is pumped through a pipe where Alum is injected into the pipe immediately after the pump. After mixing in the pipe, a specific polymer that is customized based on the characteristics of the wastewater is injected to the flow to flocculate the formed particles into large flocs that are later separated from wastewater.

In our pilot study in 2021 at the RM of Taché, we tested two different configurations of the IPRR; a stationary system and a mobile system. The main difference in these two configurations is their particle separation processes. In the stationary process, a separation tank is used for particle separation and geotextile bags are used for sludge dewatering. In the mobile system, the wastewater is pumped directly into the geotextile bags for particle separation and dewatering. These details of these two configurations can be found in the final report (pages 20-24).

Both configurations were tested in summer 2021 and the total phosphorous for raw wastewater and treated wastewater were tested and recorded to evaluate the performance of the processes. In addition, total suspended solids (TSS) and biological oxygen demand (BOD) for selected samples were measured to evaluate the impact of the process on those key parameters.

b) Did the pilot project include a methodology or approach for verifying or testing the performance of the technology or solution? Please respond Yes or No.

Yes [X] No [ ]

If you answered yes to Question #3, which methodology did you use in this pilot project for testing the performance of the technology or solution?

The Total Phosphorous (TP) was the main parameter that was measured to test the performance of the technology. Samples of wastewater were collected daily from inflow and outflow. RM of Taché has a Hach DR1900 equipment that was used by InnoVantage staff for testing total phosphorous in this pilot project. Selected samples were done at ALS Laboratories in Winnipeg for validation of analysis. Also, BOD and TSS analysis were done by ALS Laboratories.

- Environmental Technology Verification Program
- Engineering Consultant
- Other (please specify) _____

3. Pilot Project Results

a) What are the Pilot Project's recommendations? (You may point to the relevant sections/pages of the Final Pilot Project Report if relevant.)

1. Both mobile and stationary configurations of the in-line phosphorous removal and recovery (IPRR) system are capable of reducing the total phosphorous to below 1 mg/L efficiently and consistently.
2. The total chemical consumption in the IPRR system is approximately 40% less than in-situ chemical coagulation processes.
3. The formed particles in the process can be successfully separated in the form of dried sludge which provides an opportunity for a complete phosphorous containment and recovery.
4. The preliminary results of composting indicate that the composting process is feasible. The research on the bioavailability of nutrients in the compost and the toxicity of the final compost product is ongoing at the University of Manitoba.
5. The IPRR system that was tested in this pilot project provides a great opportunity for small municipalities to remove and recover phosphorous efficiently. In addition, compared to similar systems and other phosphorous removal methods, the IPRR system is significantly less expensive and has smaller footprint. The implementation of a large scale IPRR system would benefit municipalities in the Province of Manitoba and throughout Canada.

b) Is the Pilot Project *technically feasible* for full-scale implementation? Please comment on why or why not.

Yes, even though, the tested system was a "pilot" system, it had a capacity of 350-750 gallons per minute which can be sufficient for small communities. The process can be simply scaled up to 3000 gallon per minutes or more by using larger pumps, pipes, and a particle separation tank.

c) What were the financial results of the Pilot Project and is the Pilot Project *financially feasible* for full-scale implementation? Please comment on why or why not.

Yes, the system is financially feasible for full-scale implementation. As a part of the project, InnoVantage worked on a preliminary design of a full-scale IPRR system with flow parameters at RM of Taché. Similar implemented processes with in the Province of Manitoba cost $2M-$5M while the estimated overall cost of the IPRR system is less than $1M.

d) Please complete the following table that was part of your pilot project application with the actual results from your pilot project. Please also provide the page numbers where the environmental results of the pilot project can be found in the final report.

Project parameter	Units	Baseline performance before project	Anticipated performance after project completion
Wastewater Quality (Phosphorus)	Mg/l	5	0.5
Wastewater Treated to Regulatory Standards	M3	110,000	50,000
BOD	Mg/l	35	10
TSS	Mg/l	65	20

e) Please describe all of the environmental results including any potential negative results or trade-offs that need to be considered.

1. The system successfully lowered the TP of wastewater to below 1 mg/L.
2. The system was capable of capturing and separating phosphorous which provides a great opportunity for full phosphorous recovery.
3. By capturing the particles in the form of sludge, the process reduces the total sludge accumulation in lagoons and reduces the maintenance costs of lagoons.
4. The BOD and TSS of the wastewater is also reduced by the process which is an additional advantage of using the system.
5. There is no negative environmental results.

f) Based on the experience gained in the pilot, please update the anticipated social and economic outcomes (community benefits) of full scale implementation of the pilot project. Column B of the following tables shows the anticipated economic and social benefits you noted in your application.

Please complete the table below by describing in Column C the anticipated economic benefits of the pilot project at full scale implementation. Please complete for all that apply in the list below. If there are additional economic benefits, please describe these in the last row of the table.

Figure 1 – Economic benefits

A	B	C
Economic benefit	**As described in your GMF application**	**Anticipated economic benefits of the pilot project at full scale based on pilot experience.** If the result is different than what was expected in the application form, please indicate **why**.
Increased return on investment		
Deferred or avoided capital expenditures	Removal of sludge will defer the need to build another lagoon	Removal of sludge will defer the need to build another lagoon. This was verified in the pilot project as the process showed great results in removing TSS and separating and capturing the sludge.
Decrease in facility operating or maintenance costs	Current costs to remove phosphorus precipitated sludge	This system will reduce the costs of removing phosphorous precipitated sludge. The preliminary design of the full-

A	B	C
	are very high and this system will reduce that cost	scale IPRR and the estimated lifecycle costs of the process shows that the overall costs of the system is significantly lower than similar implemented technologies in Manitoba.
Extended lifespan for facility	Removing sludge increases the lifespan of the current facility	Removing the sludge increases the lifespan of the current facility. The IPRR system is specifically configured for wastewater lagoons. The results of the pilot testing showed that IPRR system is capable of capturing and removing sludge and hence, reduces the total amount of accumulated sludge in the lagoons and increases the lifespan of lagoons and reduces the maintenance costs.
Increased municipal revenue streams (e.g. property tax, user fees, etc.)		
Lower taxes		
Stimulus for local economy (use of local business, capacity for local business development)		
Increased employment options or job retention		
Increased transit ridership		
Attraction of new businesses		
Other (please specify)		

g) Please complete the table below by describing in Column C the anticipated social benefits of the pilot project at full scale implementation. Please complete for all that apply in the list below. If there are additional social benefits, please describe these in the last row of the table.

Figure 2- Social benefits

A	B	C
Social benefits	**As described in your GMF application**	**Anticipated social benefits of the pilot project at full scale implementation based on pilot experience** If the result is different than what was expected in the application form, please indicate **why.**
Improvements to public health	Improved public health	The system is a process that can lead to improved public health. The excess discharge of phosphorous into water resources results in algae growth in lakes which puts a risk on aquatic life and negatively affects the water quality in water resources and beaches. The tested process in this pilot project is an affordable technology that specifically

A	B	C
		targets total phosphorous and results in healthier water resources.
Improvements to public safety		
Improvements to community quality of life	Improvement of water quality being released by the lagoon and elimination of the need to spread sludge on fields, which harm waterways	The process removes the phosphorous and captures the formed sludge. The captured sludge can be processed for full phosphorous recovery and there is no need for land application or landfilling. The results of the pilot study show that the system can be implemented in full scale.
Increased opportunities for community engagement	All tied to improving water quality within the entire red river basin and lake Winnipeg system	Red River Basin and Lake Winnipeg face the issue of eutrophication due to the discharge of phosphorous from a number of sources including wastewater from municipalities and communities. The IPRR system is configured for phosphorous removal from wastewater lagoons. The results showed that the system can successfully remove phosphorous from wastewater lagoons and therefore, it is a technology that will eventually improve the water quality in the entire Red River Basin and Lake Winnipeg.
Increased public education or awareness	All tied to improving water quality within the entire red river basin and lake Winnipeg system.	Red River Basin and Lake Winnipeg face the issue of eutrophication due to the discharge of phosphorous from a number of sources including wastewater from municipalities and communities. The IPRR system is configured for phosphorous removal from wastewater lagoons. The results showed that the system can successfully remove phosphorous from wastewater lagoons and therefore, it is a technology that will eventually improve the water quality in the entire Red River Basin and Lake Winnipeg.
Community revitalization		
New housing and infrastructure		
New or enhanced public space or public facilities		
Improved access to recreation and physical activities		
Reduced urban sprawl		
Increased civic pride, ownership and participation	Will be a pioneer in the Manitoba municipal sector to implement this innovative treatment of phosphorus precipitated sludge	In order to improve the health of Lake Winnipeg, attempts have been undertaken to control the amount of phosphorous that enter surface waters in Lake Winnipeg watershed. Particularly, the Province of Manitoba has established a regulation for TP with the limit of 1 mg/L for all wastewater treatment plants. A

A	B	C
		number of solutions have been suggested and implemented by different companies; however, these solutions are either ineffective or too expensive and none of them provide a practical phosphorous recovery strategy. The pilot project was a successful project that showed that a complete removal and recovery of phosphorous at an affordable cost is possible and RM of Taché takes pride in supporting such an innovative project.
Improved quality and efficiency of service provision to residents	The municipality will improve how it manages its wastewater, reduce costs of long-term sludge handling and improve the quality of the water being released	The IPRR process is has two major benefits that can improve the management of wastewater: 1) It consistently and effectively reduces the total phosphorous to below 1 mg/L provincial guidelines. 2) It captures the formed sludge and reduces the accumulated sludge in lagoons which reduces the maintenance costs.
Reduced opportunities for crime		
Other (please specify)		

4. Lead Applicant's Next Steps

a) What next steps does your municipality plan to take based on the findings and recommendations of the Pilot Project?

RM of Taché is in the process of establishing a long-term plan for wastewater treatment. Depending on the future plans, the tested process may or may not fit in the future plans.

5. Lessons Learned

In answering the questions in this section, please consider all aspects of the Pilot Project —from the initial planning through each of the essential task until the Final Report of the Pilot Project was prepared.

a) What would you recommend to other municipalities interested in doing a similar Pilot Project? What would you do differently if you were to do this again?

The pilot project was done successfully and all expectations were met. The project was mainly led by InnoVantage that showed a strong commitment to the project. Unfortunately, due to COVID it was not easily possible to provide tours for the public and other municipalities. We recommend that if other municipalities want to do similar projects, provide such tours to the public, other companies, and other municipalities.

b) What barriers/challenges (if any) did you encounter in doing this Pilot Project? How did you overcome them?

The main issue was the weather which was not predictable. The roads and dykes at the lagoon could not be used during rainy days and could delay the project. InnoVantage and RM of Taché had to work closely to revise the schedule and complete the project on time by working longer hours and additional days in September and October 2021.

6. Knowledge Sharing

a) Is there a website where more information about the Pilot Project can be found? If so, please provide the URL.
b) In addition to the Pilot Project results, has your Pilot Project led to other activities that could be of interest to another municipality (for example, another pilot project, sharing of the results of this pilot project with other municipalities formally or informally, changes to existing policies and/or practices etc.)? If so, please list these outcomes and include copies of the relevant documents (or website links).

The results of the project were presented in Manitoba Water & Wastewater Association (MWWA) annual conference (April 2022, Brandon, MB) as well as Red River International Joint Commission (June 2022, Online). More information and description of the technology and the pilot project can be found on InnoVantage website at: www.innovantagecanada.ca.

This project was carried out with assistance from the Green Municipal Fund, a Fund financed by the Government of Canada and administered by the Federation of Canadian Municipalities. Notwithstanding this support, the views expressed are the personal views of the authors, and the Federation of Canadian Municipalities and the Government of Canada accept no responsibility for them