Brazeau County

7401 – Twp Rd 494, P.O. Box 77, Drayton Valley, Alberta T7A-1R1
PHONE: (780) 542-7777 - FAX: (780) 542-7770
www.brazeau.ab.ca

SCHEDULE F – PROJECT COMPLETION REPORT

GMF number	17267
Name of the lead applicant (municipality or other partner)	Brazeau County
Name, title, full address, phone, fax e-mail of lead technical contact for this Pilot Project	Zimran Khokhar, Project Manager, Box 77, 7401 Township Road 494, Drayton Valley, AB, T7A 1R1, Ph: (780) 542-7777, Fax: (780) 542-7770, e-mail: ZKhokhar@brazeau.ab.ca
Date of the Report	March 2, 2022

1. Introduction

a) Below is the list of staff involved in the project:
   i. Zimran Khokhar – Brazeau County Project Lead
   ii. Darcy Mulroy – Brazeau County In-House Utilities Supervisor
   iii. Blair Myrfield – Brazeau County In-House Utilities Assistant Supervisor
   iv. Dr. Christopher Walker – Project Consultant
   v. Dr. Terry Lucke – Water Engineering Expert
   vi. Dr. Mohamed Gamal El-Din – University of Alberta's Wastewater Research Team Lead
   vii. Dr. M Anne Naeth - University of Alberta's Plant Research Team Lead

2. The Pilot Project

a) The project objectives were to (Consultant's Project Outcomes Report, pg. 1):
   i. To determine the overall water quality improvement of the combined lagoon and Constructed Floating Wetlands (CFW) treatment system from the lagoon inlet to the lagoon outlet;
   ii. To try to establish how much of the overall water quality improvement in the lagoon could be attributed to the CFW treatment;
   iii. To investigate whether providing aeration beneath the wetlands improves the treatment performance of CFWs; and

iv. To investigate whether there were any differences in biomass accumulation and nutrient removal rates between the different plant species because of aeration.

The approach to meet these goals was to expand the existing wetlands system with additional modules and install aeration system was installed. The wastewater was tested at the pond inlet and outlet 21 days apart to compare improvement in quality. There were two testing/sampling events for the pond wastewater quality analysis. Furthermore, intermediate bulk containers were set-up adjacent to the lagoon cell and filled with wastewater from the pond to test for wastewater quality. These tanks were planted, aerated, and wrapped for three 14-day testing/sampling periods. Please refer to the consultant's Project Outcomes Report pages 2 to 5 for additional details on this water quality analysis. Plant monitoring, sampling, and testing was also completed throughout the pilot project. Please refer to the consultant's Project Outcomes Report page 5 to 6 for details on the plant study.

b) Did the pilot project include a methodology or approach for verifying or testing the performance of the technology or solution?

Yes [✓] No [ ]

The following methodology was used in this pilot project for testing the performance of the technology or solution?

- Engineering Consultant

3. Pilot Project Results

a) The Pilot Project's recommendation, as per the consultant's Project Outcomes Report, is the "…installation of a larger, aerated CFW system would significantly improve the overall water quality in the pond and the discharge water." (pg. 24).

b) The Pilot Project is technically feasible for full-scale implementation as University of Alberta's report on wastewater quality analysis, prepared by Dr. Gamal El-Din and his team, suggests that the Constructed Floating Wetlands in the lagoon was effective in reducing pollutants by 10% to 40% (Evaluating the Performance of Constructed Floating Wetlands in Treating Wastewater in Cold Climates – A Mesocosm Study, page 10). Furthermore, the uptake of pollutants by the wetland plants can be seen in table 9 and 10 of the University of Alberta's report on plant

testing and analysis, prepared by Dr. M Anne Naeth and her team (Evaluating the Performance of Constructed Floating Wetlands in Treating Wastewater in Cold Climates, page 23 - 24).

c) The pilot project was completed within the allotted budget and the timeline. However, the Pilot Project is not financially feasible for full-scale implementation using the same methodology and setting i.e., outdoor within the lagoon. This is due to the limited summertime (roughly six months) available for the plants to perform effective treatment. During the winter (six months) the plants are not effectively treating the wastewater.

d) Please refer to the consultant's Project Outcomes Report on page 14 table 3-2 for the results of the pilot project stipulated below:

Parameters	Units	Baseline performance before project‡	Anticipated performance after project completion	Actual performance after project completion†
Wastewater Quality (TSS)	mg/L	52	32	35.9
Carbonaceous Biochemical Oxygen Demand	mg/L	10.5	9.5	16.7
Total Suspended Solids	mg/L	52	32	35.9
Nitrogen (TN)	mg/L	9.5	7.5	30.5§
Phosphorous (TP)	mg/L	1.5	1.2	13.5§

† The results show average reduction of the August and September testing.

‡ The baseline performance data is based on the annual testing of wastewater during the discharge of the treated wastewater from the storage cell. This comparison is very ambitious, given the location of the CFWs is on the facultative cell.

§ The higher TN and TP results, compared to the baseline, just depict the limitation of the CFWs in improving the quality of wastewater, and shows the need for further treatment in the storage cell where the effluent is held for 365 days prior to being discharged.

e) The baseline performance data in the table found in item 3.d above is from the testing of the wastewater discharged annually from the storage cell. The wastewater in the lagoon is first received in the facultative cell that holds it for 60 days, prior to it being transferred into the storage cell. The storage cell treats the wastewater year around and is discharged annually between the months of September or October.

The piloted Constructed Floating Wetlands system is located on the facultative cell. Therefore, while the piloted solution showed improvement in wastewater quality in the tested parameters, it falls short when comparing the results to the discharge data of the wastewater tested at the time of annual discharge from the storage cell.

Based on the experience gained in the pilot, please refer to figure 1 below for the anticipated social and economic outcomes (community benefits) of full-scale implementation of the pilot project.

Figure 1 – Economic Benefits

A	B	C
Economic benefit	**As described in 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**.
Deferred or avoided capital expenditures	Floating wetlands if proven, can increase the quality of the wastewater discharged and expedite the treatment process. This can allow for multiple discharge events (if approved by Alberta Environment and Parks) throughout the year as opposed to only once. This creates capacity without the need to construct additional lagoon cells.	
Stimulus for local economy (use of local business, capacity for local business development)	As the Floating Wetlands will be installed by a local contractor, this will enhance their skills portfolio. If the pilot project gets the full-scale approval by Council, the new skills acquired by the local labor force can be used in that project.	For the pilot project the Floating Wetlands system was installed using in-house forces, because the local contractor was unavailable. However, if a full-scale system is being constructed by interested

		municipalities local contractor should be utilized to provide work and new skills opportunity to the economy.

f) 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 benefit	**As described in 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 safety	The purpose of installing Floating Wetlands is to enhance the quality of treated effluent that is released into the nearby watercourse. Lowering the quantity of pollutants in the effluent is a direct benefit to public safety as the creek drains into the North Saskatchewan River. The river is utilized by public for recreational purposes and/fishing.	Expanding the pilot project to full scale implementation would enhance the quality of treated effluent from the lagoon throughout the growing season.
Increased public education or awareness	The Climate Resilience Action Plan highlighted the dangerous rate at which the wetland areas are depleting. This project, if	Full scale implementation of this pilot project to all the County's six lagoon systems would further increase the

	expanded to other Brazeau County Lagoons, can be promoted to residents to show the importance of wetlands and their function in the ecosystem.	wetland habitat. This in return could allow learning opportunities to the residents via events such as site visits or townhalls.

4. Lead Applicant's Next Steps

a) Brazeau County is seeking to build on the knowledge gained by the implementation of this system to improve the capacity of the treatment from only summer (6 months) to year around. Subject to regulatory requirements, performance of the treatment and financial availability, Brazeau County's conceptual idea would entail wastewater reusage.

5. Lessons Learned

a) We would recommend to other municipalities interested in doing a similar Pilot Project to consider engaging a Canadian consulting firm with expertise in similar work. This can be difficult with innovative projects such as the Constructed Floating Wetlands; however, skills are transferable within given engineering disciplines. What we would do differently is to source the floatable platforms manufactured in Canada.

b) We encountered delays in the shipment of the aeration motor for powering the lagoon's CFW aeration system from the United States. This delay was caused by the COVID-19 pandemic as intercountry shipping effected all the industries between Canada and the United States. We were able to initiate the study without the aeration system at the start until it was delivered.

6. Knowledge Sharing

a) Interested municipalities can connect with Mr. Zimran Khokhar via email at zkhokhar@brazeau.ab.ca for more information about the pilot project.

b) Although the pilot project's results can be found in the final outcomes report of the project, interested municipalities are encouraged to connect with Mr. Zimran Khokhar via email at zkhokhar@brazeau.ab.ca for details of this pilot project.

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