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	GMF16853
Name of lead applicant (municipality or other partner)	Town of Halton Hills
Name, title, full address, phone, fax and e-mail address of lead technical contact for this study	Michael Dean, Sr. Climate Change & Energy Planner Climate Change and Asset Management Town of Halton Hills, 1 Halton Hills Drive, Halton Hills, L7G 5G2, Cell: 289-541-6135, mdean@haltonhills.ca
Date of the report	February 26, 2021

1. Introduction

a) Who was involved in doing the Feasibility Study, and what are their affiliations? Please include name, title and contact information. Those involved could include municipal staff, engineers and other consultants, a representative from a non-governmental organization, and others.

The Study involved the following Town departments and staff:

- Climate Change & Asset Management (Michael Dean – Senior Climate Change & Energy Planner, and Dharmen Dhaliah – Senior Manager, Climate Change & Asset Management)
- Recreation & Facilities (Stephen Hamilton – Manager, Facility Capital Projects)

The Study was led by a Consultant, Internat Energy Solutions, whose team included:

- Livio Nichilo, P. Eng., M. Eng., CEM
- Matthew Hudson, M.BSc., EIT

2. The Feasibility Study

a) Describe the process that you undertook to make this feasibility study a reality, from concept, to council approval, to RFP, to final deliverable.

In 2019, Town Council declared a climate emergency and set a new target for the municipality to be net-zero by 2030. In 2019, the Town also adopted an updated Corporate Energy Plan, that aimed to systematically introduce no/low-carbon decision-making while demonstrating substantial emissions reductions, and recognized that all new buildings, major renovations and equipment replacements should be planned and implemented to achieve low or no-carbon performance. At this time, a major renovation/expansion for the Town Hall facility was also expected and the Town had engaged a consultant to assist with developing a Town Master Plan, to assess future expansion needs and opportunities for the building and address potential accommodation strategies/concepts.

In 2020, the Town intended to replace the majority of its heat pumps at the Town Hall and acquire an integrated BAS for the mechanical systems at the facility. In advance of replacing the heat pumps, and with all of the above in mind, staff recognized that the Town Hall facility presented a strong case to apply the 'Zero-over-Time' approach, to achieve a net-zero carbon building in the short-term. The objective of this approach was to develop a roadmap to achieve cost-effective deep energy retrofits overtime. The approach focuses on long-term planning to deliver a series of cost-effective projects that, together, amount to zero energy status for the facility. This approach would incorporate recommendations for replacing the heat pumps, introducing a BAS, as well as other planned capital projects over the next 5-10 years.

In February 2020, an RFP for the Town Hall Low-Carbon Design Brief was issued, seeking a qualified consultant to conduct a feasibility study for the Town Hall facility to get to net-zero. The aim of this project was to evaluate all possible pathways and timeframes to achieve a net-zero Town Hall and develop a tailored strategy that the Town can implement.

b) What were the objectives of the Feasibility Study (what was it seeking to determine)?

The purpose of the study was to assess the technical and financial feasibility, as well as the environmental, social, and economic impacts of retrofitting the existing Town Hall building to achieve net-zero carbon over the next 10 years (i.e. “zero-over-time approach). This included the following objectives:

- Complete an evaluation and analysis of the facility’s current energy needs and capacity to improve efficiency
- Provide a recommended strategic course of action to:
  - Achieve net-zero carbon by 2030
  - Achieve an energy reduction of at least 40% over 2018 energy consumption within the next five (5) years
  - Maximize opportunities for renewable energy
  - Achieve financial return within a maximum of 20 years using the Town’s applicable interest rates

The objective of the ‘zero-over-time’ approach is to develop a roadmap to achieve cost-effective deep energy retrofits overtime. The approach focuses on long-term planning to deliver a series of cost-effective projects that, together, amount to zero energy status for the facility.

c) What approach (or methodology) was used in the Feasibility Study to meet these objectives?

This Study used a systems approach to determine how to make this facility as energy efficient as possible, and so that other potential building renewals or new constructions can also apply the lessons learned and replicate the findings. The study was conducted through the following phases, aiming to follow Rocky Mountain Institute’s "Zero-over-time" approach:

1. Research and baseline analysis

- Conducting a jurisdictional best practice scan of similar projects across Ontario and Canada
- Review of current policies and relevant Town materials (e.g. Corporate Energy Plan, facility energy consumption data) to develop a baseline for the facility

2. Energy efficient options and parametric energy modeling of design options

- Achieve net-zero carbon by 2030
- Achieve an energy reduction of at least 40% over 2018 energy consumption within the next five years
- Maximize opportunities for renewable energy
- Parametric energy modeling to evaluate retrofit and design options

3. Financial analysis

- Financial/life cycle cost analysis
- Achieve financial return within a maximum of 20 years using the Town’s applicable interest rates
- Evaluation of other socio-economic benefits, including education/awareness building opportunities

4. Recommendations and implementation

- Document results of study and provide recommendation to move forward

A systems approach was beneficial as it allowed the team to evaluate and conduct the study with the life cycle perspective at the forefront. Keeping in mind the ultimate goal (retrofitting to be as energy efficient as possible, targeting net-zero carbon), systems thinking guiding the project helped maintain a holistic view within a greater whole, rather than treat the problem (wasted energy and high GHG emissions in facilities) in a vacuum. Our intent is to use this study to not only renew one building, but to help guide sustainable building and set a standard moving forward; this project has a larger purpose than just retrofitting one building.

d) Please describe any public consultations conducted as part of the Feasibility Study and their impact on the Study.

There were no public consultations, however findings of the study were presented to Town Council.

3. Feasibility Study Findings and Recommendations

a) What were the environmental findings related to the options explored in the Feasibility Study? Please provide quantitative results and summary tables of these results (or the page numbers from the Feasibility Study report).

The Town Hall LCBD outlines four 'pathways' for energy efficiency and renewable energy projects at the Town. Although none of the recommended pathways reach the target of 90% reduction in GHGs before purchasing offsets, three of the four achieve reductions of greater than 80%. Table 1 below summarizes the energy and GHG reductions associated with the four pathways

Pathway	Description	Total Construction Costs	Annual Energy Costs (present value)	Annual Energy Consumption	Annual GHG Emissions
		$CAD		ekWh	$kgCO_2e$
1	Optimize Existing	$3,220,900	$81,305 (21%↓)	596,240 (30%↓)	35,167 (45%↓)
2	Geothermal	$3,559,200	$86,972 (16%↓)	511,601 (40%↓)	10,232 (84%↓)
3	HVAC Overhaul	$3,311,500	$90,490 (12%↓)	532,292 (37%↓)	10,646 (83%↓)
4	Maximum Savings	$3,815,100	$83,691 (19%↓)	494,298 (42%↓	9,846 (85%↓)

b) What were the financial findings related to the options explored in the Feasibility Study (for example, results of a cost-benefit analysis, financial savings identified, and so on)? Please provide quantitative results and summary tables of these results (or the page numbers from the Feasibility Study report).

IESC completed lifecycle cost (LCC) analyses for each of the retrofit Pathways identified. LCC analyses allow for the evaluation of the economic performance of a project, typically for the duration of its projected lifetime, taking into account the time value of money and various cash-flows in each year.

In the case of this design brief, where projects are expected to be completed over a 10-year time period, the LCC analysis has been initiated in year 10, when all projects have been implemented. It has been assumed that the total project cost will be incurred in year 10, as well as the total amount of operational cost savings. A 20-year projection has been analyzed in the LCC analyses, as a requirement of the Town is that a financial return be achieved within 20 years of project implementation.

In reality, there will be incremental costs and savings seen from year 1 to year 10 (10-year implementation period), with the total savings being realized after all projects are completed in year

10. Although high level project scheduling has been proposed, at this stage a detailed project implementation schedule cannot be assumed for LCC analysis purposes, which is why the above strategy has been used. The following costs and savings have been considered in each LCC analysis:

- Capital costs
- Building certification costs
- Operations & Maintenance (O&M) costs
- Replacement costs
- Utility cost savings
- Greenhouse gas (GHG) emissions savings
- Potential funding and incentive programs available
- An annual escalation rate applied to each energy utility:
- Discount rate of 2.5%

The Net Present Value (NPV) and Internal Rate of Return (IRR) were calculated for each option.

The results of the financial analysis are summarized in table 2 below:

Pathway	Description	Total Construction Costs	Annual Energy Costs (present value)	Net Present Value	Internal Rate of Return
		$CAD		$CAD	-
1	Optimize Existing	$3,220,900	$81,305 (21%↓)	$422,238	3.7%
2	Geothermal	$3,559,200	$86,972 (16%↓)	($25,697)	2.4%
3	HVAC Overhaul	$3,311,500	$90,490 (12%↓)	$30,383	2.6%
4	Maximum Savings	$3,815,100	$83,691 (19%↓)	$59,818	2.7%

Furthermore, by aligning the recommended measures with the planned capital improvements for the facility it was possible to reduce total new expenditures required for the recommended pathway. Out of the total $3,560,000, $906,000 of Town Hall related projects have already been identified in the 9-year capital forecast (2021-2029) approved in principle as part of the 2020 budget process. As a result, an additional funding of $2,654,000 required in order to implement the Pathway 2 program between 2021 and 2030.

c) Based on the environmental and financial findings above, what does the Feasibility Study recommend?

The study ultimately recommended that the Town pursue Pathway 2: Geothermal, which involves an overhaul of the building's central heating and cooling plants to incorporate a geothermal exchange-based system. The existing heat pump hydronic loop will remain in place. Improvements to building automation and controls, as well as building envelope retrofit work will be included.

This approach has several advantages. It utilizes a renewable and passive source of energy and allows for the complete electrification of the site, the Town has experience with the implementation

and operation of these systems in other buildings which will serve as an advantage. Although Pathway 4 is slightly more attractive from a financial perspective, key advantages to Pathway 2 over Pathway 4 include a lower associated residual value (decommissioning of building equipment before end of useful life), a less complex design and implementation process, and decreased staff impact. Pathway 2 – Geothermal... based on feasibility

Actions to be completed include:

- Replace all existing units with new insulated glass units (IGU), or curtain wall façade
- Install Building Automation System (BAS) equipped with various controls including Central plant monitoring and control, Zone temperature and humidity monitoring and control, Lighting control (ON/OFF scheduling), Occupancy sensor-based control system.
- Replace all existing lighting systems, fixtures/lamps with their LED equivalent
- Install EnergyStar rated appliances and office equipment
- Installation of a carport solar photovoltaic (PV) system in the existing outdoor parking lot with a total capacity of 190 kW
- Install geothermal system and borehole field to provide heat rejection/absorption to existing heat pump loop
- Existing heating boilers and cooling tower to be used as backup for geothermal system
- Replace existing MUA with a water source heat pump unit to be integrated into existing heat pump loop, and geothermal loop
- Replace all water source heat pumps with high efficiency units
- Replace existing gas fired DHW heater with a hybrid heat pump water heater

The recommended implementation process involves two 5-year stages:

First stage (Years 1 to 5)

Capital projects already planned:

- MUA replacement
- BAS installation
- Water source heat pump replacement with high efficiency units

Other recommended project implementations:

- replace all existing Window units with new high-performance insulated glass units (IGU)
- Replace all existing lighting systems, fixtures/lamps with their LED equivalent, and install EnergyStar rated appliances and office equipment

Second stage (Years 6 to 10) – Target ZCB Certification

- Central plant: Install geothermal system and integrate into existing hydronic heat pump loop
- Domestic hot water (DHW): replace existing gas fired heater with a hybrid heat pump water heater
- Renewable energy systems: Installation of a carport solar photovoltaic (PV) system in the existing outdoor parking lot

4. Lead Applicant's Next Steps

a) Taking the Feasibility Study's recommendations into account, what next steps do you as the municipality plan to take? What potential benefits or internal municipal improvements would result from these next steps?

The town has initiated the implementation of the recommended pathway. Project costs have been included in the 10-year capital forecast and funding has been allocated for the first year of projects including replacement of all heat pumps and installation of building automation system.

5. Lessons Learned

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

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

Overall the design and execution of the project was very successful. I would recommend that other municipalities follow a very similar approach.

The process could have been improved by including financial staff earlier in the development. In particular coordinating with long-term financial plan and annual budgeting process are necessary throughout. We were able to gain support for the project from finance staff, but they should have been engaged earlier.

Ideally this could also be directly linked to the detailed design and implementation process through a complete performance based process. Lag between project completion and implementation could be a risk for many organizations.

b) What barriers or challenges (if any) did you encounter in doing this Feasibility Study? How did you overcome them?

One unique challenge associated with this project was the need to reassess our workplan as a result of the COVID-19 situation. With limited access to the site and all project team members working remotely, coordinating and accessing necessary data were challenging. In order to address this challenge, we built in longer timeframes for data collections and made efforts to ensure that all participants were available for remote meetings as necessary.

Aligning the capital investments recommended in the project with long-term facility capital plans was also a challenge. Understanding how existing projects could be restructured or modified in order to align with the LCDB required some effort, but was completed through detailed conversations with Finance staff as well as Facilities. Involving Finance earlier in the process would have smoothed this aspect of the project.

6. Knowledge Sharing

a) Is there a website where more information about the Feasibility Study can be found? If so, please provide the relevant URL.

Town of Halton Hills Climate Change Page is being updated to include information about the study and progress with implementation. (https://www.haltonhills.ca/en/your-government/climate-change.aspx)

b) In addition to the Feasibility Study results, has your Feasibility Study led to other activities that could be of interest to another municipality (for example, a new policy for sustainable community development, a series of model by-laws, the design of a new operating practice, a manual on public consultation or a measurement tool to assess progress in moving toward greater sustainability)? If so, please list these outcomes, and include copies of the relevant documents (or website links).

As a result of the success of the study, the Town of Halton Hills is pursuing a similar process with all remaining facilities. Including by participating in the Mayor's Megawatt Challenge Net Zero Arena Feasibility Study. Currently similar processes are completed or underway in facilities representing approximately 80% of the Town's corporate stationary GHG emissions.

(https://mayorsmegawattchallenge.com/ice-rinks/)

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.