SCHEDULE G

Project Completion Report

Instructions

Requirement

You must submit a Project Completion Report as a condition of the Final Loan Disbursement.

Purpose

Your Project Completion Report has three purposes:

1. **Project tracking:** This report enables FCM to confirm that your project was completed as described in the Agreement.

2. **Reporting on the impacts and lessons learned during the construction of the project:** This report describes any environmental, social and economic results as well as lessons learned during the **planning, design and construction of the project**. Ensure that you include in the report any processes or techniques used at these stages to address triple bottom line impacts (e.g. dust minimization measures or the onsite use of electric vehicles instead of gas-powered vehicles). All environmental, social and economic results **from the operation** of the project will be reported under a separate Environmental Results Report in the form set out in one of the schedules to the Agreement.

3. **Knowledge sharing:** FCM shares the lessons and expertise gained through GMF-funded initiatives with other communities across Canada. The findings and lessons learned documented in your Project Completion Report could be valuable for other municipal governments that are seeking to address sustainability issues in their own communities. FCM will post your reports on its website at the approved projects database.[1] This is the most frequently visited part of the GMF website. Your report will assist FCM in producing other materials related to your project, including a GMF case study. In addition, other municipalities may view your Project Completion Report to improve the success of their projects.

Copyright

You must hold the copyright to the reports that you submit to us and provide FCM with rights to reproduce and distribute it as set out in the Agreement.

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] http://www.fcm.ca/home/programs/green-municipal-fund/funded-initiatives.htm

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1. **A complete report including confidential information:** Please clearly label this report with the word "**Confidential.**" FCM will treat it as confidential.

2. **An abridged report excluding confidential information:** This report may be posted on the FCM website and otherwise made available to interested third parties.

Content

Your Project Completion Report should be approximately **9 to 15 pages**. Some reports may be longer or shorter, depending on the complexity of the project. While there are no prescribed word counts for each section, the most pertinent section of the report, Lessons Learned, should be given more weight.

Because your report may be read by non-technical municipal staff and similar readers, please assume a low to moderate level of technical knowledge and a preference for clear, direct and focused writing. Use simple language, and explain any highly technical terms or acronyms.

REPORT FORMAT: FCM endeavors to collect the most relevant project information and as such may amend the form of Project Completion Report from time to time. Please request an electronic form of Project Completion Report from the GMF Project Officer to ensure that you complete the latest version of Project Completion Report. The Project Completion Report is to be submitted in either MS Word format (.doc or .docx) or PDF (searchable) format. A scanned copy of the Project Completion Report will not be accepted.

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Project Completion Report

Project information

GMF number: 15046
Name of funding recipient: Corporation of the District of Saanich
Project title: Saanich Gordon Head Recreation Centre Boiler Replacement
Date of Project Completion Report: June 20, 2017
Project construction start date (MM/DD/YYYY): 03/30/2016
Project substantial completion date (MM/DD/YYYY): 03/31/2017
Total project cost (actual): $1,587,203.00 *(Note: We anticipate one final change order valued at approximately $1500)*

Project implementation

1. Was the project implemented as outlined in the contract (or as amended)? Please identify any substantial changes, explaining why they happened (e.g. getting a new system to operate correctly, delays due to bad weather, labour availability, etc.) and their impact on the project (e.g. higher overall costs, more staff training required, etc.).

   The project was implemented as outlined in the contract. Incremental changes occurred due to unforeseen circumstances. For example, the heat reclaim coil of the main dehumidifier was identified to have a 'few more years of life' left and was therefore not planned to be replaced as part of this project. Unfortunately, the improved performance of other parts of the system placed additional pressure on the coil and it started showing signs of early failure.

   The risk of an unscheduled shutdown to address the coil, especially given long lead times would have undermined the overall performance of the building for a prolonged period.

Lessons learned

Lessons learned capture knowledge gained from the project that can be applied to other situations. For this report, GMF is interested in the lessons learned from the **design, planning and construction phases** of the project.

Answers in this section may refer to **positive** experiences (i.e. what worked or went well, and could serve as a model for future projects) or **negative** experiences (i.e. what didn't work, or went poorly, and should be avoided in future projects).

2. Describe what worked well and what did not work well, and why, for the project elements below. Include a description of any solutions implemented to address challenges.

   a. Design, procurement and contracting

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The Air Source Heat Pump serves as the primary piece of equipment responsible for GHG reduction. It was therefore the most critical piece of the project to 'get right'. The electrical system (i.e. power supply) for the unit was designed according to the manufacturer's specifications, but the unit that arrived required a larger electrical service than was specified. The discrepancy required unforeseen electrical infrastructure changes to the project. Although the costs were borne by the manufacturer the change challenged the schedule and ability for the building to maintain its operations and uninterrupted services to the public. To achieve this the work was parsed into several evenings and special consideration was given to the contractors to ensure that all materials (i.e. screws) were removed from the pool deck before opening.

To ensure the critical timing of boiler installation was completed during a very fixed shutdown timeline, the contract offered a bonus to the proponent as an incentive to complete early and/or on-time. The importance for keeping to the schedule was compounded since a penalty would also be imposed for not meeting the deadline.

The performance parameters of the Air Source Heat Pump system was particularly sensitive topic due to the Municipalities noise bylaws for such equipment and the proximity to certain residents/property owners. Acoustic baselines were established for the area, but the unit supplied was an approved 'alternate' with a note given to the contractor to uphold the sound requirements/specifications. Special considerations were given toward acoustic blanketing and sound attenuation barriers.

b. Consultation and community engagement (prior to and during construction)

Extensive consultation with operating staff was conducted through the design process to identify current issues and engineer solutions for future operations. For example, the accessibility of some key equipment was too restricted and did not allow for good preventative maintenance practices in certain areas of the building. The design allowed for these improvements and has realized a very accessible and much improved O&M regiment of the system.

c. Construction

The construction activities were incorporated in the design to ensure work could be completed under extremely tight schedules. For example, the 3-dimensional model of all new pipework in a physically constrained space provided a roadmap for the contractor to effectively construct the new system. Given the physical dimensions of the spaces, there was very little margin of error for large (critical) equipment. The 3-D model allowed the contractor to identify ahead of time potential issues and opportunities for adjustments before construction commenced rather than 'on the fly' during a finite shutdown period.

d. Completing the project on time and on budget

A carefully planned design allowed for the project to progress well with very few interruptions to the building operations and services to the public. Unfortunately, the

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risk of deferring maintenance on other key pieces of equipment were realized and consequently increased the anticipated project costs.

3. Describe your experience (e.g. trade-offs, surprises) when choosing a particular approach, technology or solution for this project. What would you do differently?

   There were two major capital projects implemented concurrently (i.e. boilers and envelope). Although the two projects were able to occur simultaneously, the Air Source Heat Pump was the one item most needed to 'dovetail' with the other project. Unfortunately, there were significant unforeseen issues with the envelope project which undermined the ability to install and commission the ASHP sooner than realized.

4. Has the business case associated with the project changed since the planning stage (e.g. changes in the level of service delivered by the project, expected revenues, capital or operating costs, payback, etc.)? Could anything have been done to better understand the business case at the application stage?

   The implementation and unforeseen issues that arose have slightly skewed the business case. Although the boiler change instantly created energy savings, the potential of the entire project was not realized right away due to the issues aforementioned.

5. Did you use any approach(es) that are not business as usual over the course of the project (e.g. decision-making approach, consultation methodology, non-typical procurement, full-cost accounting)? Did this approach have any benefits or drawbacks?

   The bonus/penalty for completion of key milestones was an approach not typically taken within the Municipal procurement strategies, but proved effective for absolutely critical timelines of ensuring uninterrupted building operations and/or services to the public. It was important to weigh the balance of benefits to ensuring the milestone was achieved on time and appearing fiscally prudent in the event that the contractor was able to complete in an exceptionally early fashion.

Sustainable design and construction

6. In your GMF application, you noted that the project would include sustainable design and construction measures, as set out in column B of the table below.

   Please complete the table below by inserting into column C the following information:

   - Did the project implement the measures as described?
   - Describe the effectiveness of the measures.
   - Please provide reasons for any changes to the measures.
   - Please include any measures taken beyond what you committed to in the application from.

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A	B	C
Sustainable design and construction element	**As described in your GMF application**	**Describe the implementation of the measure** (one paragraph)
Site characteristics		
Uses a remediated brownfield or underutilized site (i.e. not a greenfield)		
Uses existing buildings/ infrastructure/equipment	This project is a significant, forward-looking project for Saanich. With the increasing costs of labour and services, making this kind of investment in an existing building will support its long-term sustainability of this building. The modulating boiler system that will be a part of this system, will allow for flexibility in any future expansion considerations as well. The project is using the existing solar hot water system as well, with the goal of maximizing a technology that is performing better than initially expected.	The design was modelled in 3D to assist with the complexity of plumbing and help to ensure the new system was achievable given the physical space constraints. The design also considered the phasing of key installations to ensure the heating plant was 'operational' given the tight shutdown schedule. The layout of key equipment was reconfigured slightly to improve accessibility and make it considerably easier to service/maintain. The ASHP is a sophisticated piece of equipment with intricate control wiring. The unit also requires 'high voltage' electricity, but will need to be serviced/maintained. Given its location and proximity to public spaces it was important to ensure its security and protect the public, yet still have it serviceable for maintenance. Although the security was not originally incorporated, this was achieved by installing heavy gauge commercial grade chain link fence with multiple gates. There were other minor changes through the duration of the project which were made to primarily address the physical space requirement. The new equipment (i.e. Air Source Heat Pump) required extensive additional 'plumbing' over and above the original heating plant requirements. Other changes were made to address pre-existing components/equipment that were limiting the performance of the new system. For example, existing valves not planned for replacement were found during commissioning to undermine the performance of the new system. The region typically has moderate winters, however the 2016/2017 winter was abnormally cold and consequently delayed the schedule for commissioning the new ASHP. There was a manufacturing defect to a

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		critical component that was not visibly detected. Consequently, the equipment 'failed' during commissioning and threatened the integrity of certain systems. Considerable time was lost to remediate the issues before subsequent commissioning could commence.
Avoids, protects or enhances sensitive environmental areas		
Restores land for wildlife habitat		
Utilizes natural systems to provide environmental benefits within the project (e.g. wetlands)		
Does not contribute to urban sprawl		
Part of the urban transport network and encourages the use of sustainable transportation		
Project Activities During Construction:		
Green Procurement		
Use of energy efficient practices (e.g. reducing fuel consumption from transportation)	The integration of an air source heat pump into the energy system design is a significant improvement on energy efficiency. This proven technology is ideally suited for the west coast climate, increasingly being used to improve the energy efficiency of commercial and residential buildings. The Municipality is looking to maximize this opportunity by incorporating several important additional upgrades that are needed to optimize the entire system. By doing this, we are looking at the system as a whole and looking beyond band aid, short-term solutions that result in increased costs in the future.	The overall effectiveness of the ASHP technology is still to be determined due to inclement weather and issues with pre-existing equipment found to hinder the final commissioning of the system. With that said, the new boiler plant is observed to dramatically lower the facility's total energy consumption. It should be noted that the project was undertaken concurrent to a major remediation to the natatorium envelope. The envelope to the pool area was literally uninsulated (open to heat loss) for the last half of 2016 and early 2017. Therefore, any savings resulting from the replacement of the boiler during these months were 'masked' due to the lack of insulation in the envelope. Furthermore, the abnormally colder winter temperatures compounded the heating demand. With that said, if the new boilers were not in place at the time, the organization would have incurred considerably higher consumption and GHG numbers than realized. Now that the envelope is in place, the boiler performance without being augmented by ASHP is found to dramatically lower the total energy consumption compared to historical values

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		(please see figure below).
Consideration of renewable energy	While this project does incorporate several aspects of sustainable design these set the stage for renewable energy use. Renewable energy integration is a significant consideration for this project as there is the potential result of a 100% renewable energy building via retrofit. Saanich's natural gas provider, FortisBC is now offering renewable natural gas purchases to its customers. Electricity for the building is provided by BC Hydro in the form of hydroelectricity. Following the installation of the ASHP, Saanich will explore the purchase of this product, with the hope of turning this building into one that is operated completely on renewable hydroelectricity and renewable natural gas.	The organization is now looking to develop a framework for supplementing natural gas with renewable natural gas. The ASHP project at Gordon Head has catalyzed the process for reviewing renewable natural gas strategies and directly supports the efforts to reducing the carbon footprint of the facility and Corporation.
Minimal site disturbance, use of in-situ options if available		
Re-use of available construction material on-site		
Uses construction materials with recycled content		
Construction site waste management, including diverting construction waste from the landfill through recycling and reuse (off-site)		
Minimizes expected impacts of construction activities (e.g. dust creation or soil erosion)		The project was designed to enable the replacement of critical infrastructure during an annually scheduled shutdown of only 2 weeks. Despite being a considerable challenge the new boiler plant was operational within this timeframe. Having the facility open on time ensured that the organization did not experience financial impacts due to lost revenues and expected service levels were upheld for the user groups.
Other (please specify)		

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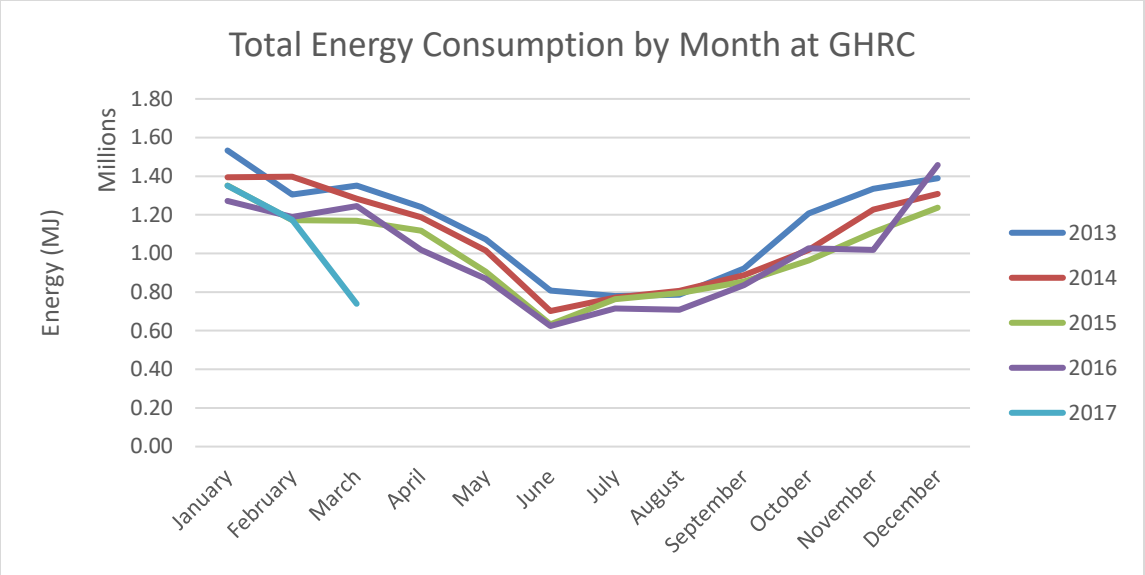

Environmental, social and economic outcomes

7. Please describe any additional environmental, social and economic outcomes your project has achieved during the design, procurement and construction phases.

This is an innovative and unique project that could provide an example for many other large building owners in the Region and Province of BC. This is a retrofit project, taking an old inefficient boiler and replacing it with a clean, low-carbon air source heat pump (ASHP). There are many buildings in Canada that were built in the 1960's and 1970's where owners are struggling to identify low-carbon retrofit solutions. The success of a project this size could lead to other building owners to consider this option, particularly on the west coast where heat pumps are most effective.

This project will benefit the Saanich taxpayers and recreation centre users from across the capital region. This is a reinvestment in a significant community asset that is used by thousands each year. In particular, Saanich's recreation centres provide affordable access and support to programs for youth, families and seniors. The resulting lower energy bills from this project will help keep user fees stable.

This project will also greatly assist the Municipality in its efforts to reduce greenhouse gas emissions in municipal operations 50% by 2020 based on 2007 levels. The municipality was on track to reaching these targets with a 15% reduction in emissions by the end of 2015. The estimated carbon reductions from this project would reduce corporate emissions by an additional 7%. The successful completion of this project will likely spur similar low-carbon building projects leading to 2020.

Preliminary plans are also in place to partner with local institutions to offer education and training to students studying building sciences. This would also include hands-on' opportunities for students to perform actual maintenance activities on the particular systems (e.g. ASHP, solar thermal, boiler plant programming, etc.)

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Project champion

8. Do you have a project champion who has been instrumental to the project to date (during design, procurement or construction)? If so, please include his or her name, title and contact information, and describe his or her role in the project.

   John McKain is the Technical and Building Services Supervisor at Gordon Head Recreation Centre. His role at the facility and ability to liase with the contractors on site has been instrumental in the success of the project. Although he was not the direct project lead for this project, his involvement and willingness to see the project be a success is rarely found. John played an invaluable role in assisting with the sequencing of work and identifying critical paths to implementation during the scheduled shutdown and throughout the duration of the project.

   His contact info is as follows:
   John McKain, Technical and Building Services Supervisor
   Cell: 250-704-6351

Next steps

9. Please describe any steps you have taken or plan to take to ensure that the people, internal groups or other key stakeholders that are important to the operation of the project adopt the necessary behaviours and other practices to ensure successful project performance.

As part of the contract agreement with the contractor facility operators will be provided on site, hands-on training for the day to day operation of the system and maintenance manuals good preventative maintenance to ensure the longevity of critical equipment. The system also has alarms in place to alert operators of certain system variances that are outside acceptable tolerances.

10. Have systems and technologies been established for measuring and monitoring the performance of the project during operation?

A Direct Digital Control (DDC) system is currently in place to measure and monitor the performance of the system. This various technologies employed (eg. Variable Frequencies, Modulating Valves, Boilers, etc) have individual sensors in place to continually monitor/track the system performance and enable operators to make 'tweaks' and optimize the overall performance.

Publicity

11. Briefly describe any recognition, media coverage, awards or public support the project has received to date.

The Times Colonist is a local newspaper which has reported on the project:
http://www.timescolonist.com/news/local/saanich-rec-centre-upgrade-aims-to-cut-carbon-emissions-1.2195773

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Future media releases will be issued once the entire system is fully commissioned and the utility data is received to accurately report out on the performance of the new heating plant.

Photos and materials

FCM includes project photos and links to project materials in GMF case studies, website content and other communication vehicles.

1. Identify and attach any materials resulting from the project that would be useful to share with other communities, such as checklists, toolkits, guidelines, bylaws, videos or information brochures. If the material is available on your website, simply include the link to it.

   The ASHP equipment is a considerably large piece of equipment which contains multiple compressors and fans. The unit specified is 'high efficiency' to ensure the quietest model available was installed for conformance to the Municipality's Noise Suppression Bylaw. The District of Saanich Noise Suppression Bylaw, 1993, No. 7059 states:

   > 7. HEAT PUMPS AND WATER PUMPS
   >
   > (a) The Council is of the opinion that the operation of a heat pump or water pump resulting in a sound level at a point of reception located in a Quiet Zone in excess of 50 decibels between 7:00 a.m. and 10:00 p.m. on any day, or in excess of 45 decibels between 10:00 p.m. and 7:00 a.m. of the following day is objectionable and liable to disturb the quiet, peace, rest, enjoyment, comfort or convenience of individuals or the public.
   >
   > (b) No person shall emit or cause, suffer or permit the emission of sound from the operation of a heat pump or a water pump resulting in a sound level at a point of reception located in a Quiet Zone in excess of:
   > i. 50 decibels between 7:00 a.m. and 10:00 p.m. on any day, or
   > ii. 45 decibels between 10:00 p.m. and 7:00 a.m. of the following day.

2. Attach five high-quality photographs of the project. Where possible, include photos that feature people in action, illustrate the progress of the project, or feature "before" and "after" perspectives. The photos must be in JPEG or TIFF format and at least 300 dpi (between 1 MB / 1,000 KB and 10 MB / 10,000 KB in file size).

   For each photo, please include:

   a. A caption describing what is featured in the photo.

   b. A photo credit that indicates the copyright holder and the photographer (e.g. © 2010, City of Ottawa/Madison Brown).

   c. A written release signed by the individuals depicted in the photo granting FCM permission to use the images. **Please request an FCM Photo Consent Form from the GMF Project Officer.**

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Location prepared for new ASHP includes plumbing and electrical 'rough-in' as well as seismically rated concrete pad.

New ASHP secured with unclimbable chainlik fencing.

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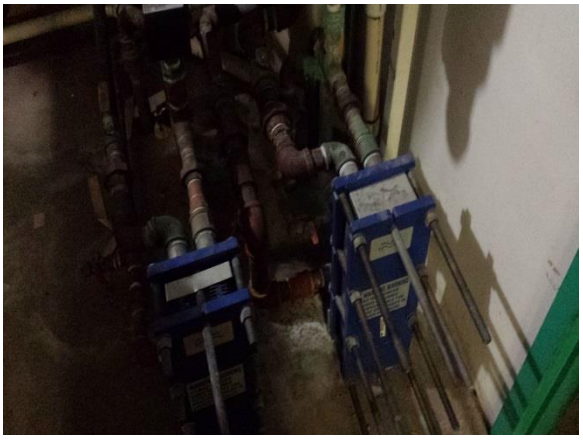

Limited Access to key pieces of equipment made it difficult to maintain the original system.

New installation is easily accessible for inspection and ongoing maintenance. Raising the equipment also provides valuable floor space within a limited footprint.

Original boiler plant was cluttered and inaccessible

New plant is fully automated and more efficient

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