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	16903
Name of lead applicant (municipality or other partner)	The Corporation of the City of New Westminster
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Date of the report	May 30, 2021

1. Introduction

The feasibility study on the proposed Sapperton District Energy System (SDES) was completed by the City of New Westminster. KWL was the prime consultant on the project with support from MMK Consulting. The project also received support from key stakeholders including Fraser Health Authority and QuadReal Property Group.

The primary team included:

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Supporting the primary team, the following individuals provided organizational or technical input for the feasibility study:

Name	Title	Organization
Denise Tambellini	Manager Intergovernmental and Community Relations	City of New Westminster
Rod Carle	General Manager Electrical Utility	City of New Westminster
Harji Varn	Director of Finance	City of New Westminster
Eugene Wat	Manager Infrastructure Planning	City of New Westminster
Mike Watson	Development Services	City of New Westminster
Mauricio Acosta	Executive Director Facilities Management Business Performance & Corporate Support	Fraser Health Authority
Martin Wright	Senior Manager - Facilities Maintenance & Operations	Fraser Health Authority
John Cordonier	Senior Vice President, Development	QuadReal Property Group
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Jeff Carmichael	Division Manager, Utility Research and Innovation	Metro Vancouver
Colwyn Sunderland	Infrastructure Planning Engineer	KWL
Karl Mueller	Senior Project Engineer & Technical Reviewer	KWL
Kevin Sundberg	Senior Electrical Engineer	KWL
Colin Jeffery	Project Engineer	KWL
Sarah Abd El Motaleb	Project Engineer	KWL
Kevin D'Netto	Junior Electrical Engineer	KWL
Graeme Johnsen	Senior Associate	MMK Consulting

2. The Feasibility Study

2.1 Process

Dating back to 2011 when the Community Energy and Emissions Plan ("CEEP") was published, and perhaps even further, the City identified the need and strategy to reduce community GHG emissions, and the value that a District Energy System (DES) could bring to the community through the decarbonization of the built environment, energy resiliency, and energy affordability. Over the past decade, carbon targets have dialed up, and incremental steps have been taken to progress through the feasibility, due-diligence, and public consultation stages of the SDES project. After a decade of lead-up, the City is now at a pivotal point and ready to bring the Sapperton District Energy System (SDES) project from concept to reality – the single biggest undertaking to reduce greenhouses gases within the New Westminster community.

In 2019, council declared a Climate Emergency. This declaration outlined aspirational goals as well as renewed carbon targets that align with the United Nations Intergovernmental Panel on Climate Change. The new targets, significantly more ambitious than those outlined in the 2011 CEEP, include reaching 45% GHG reductions by 2030, 65% by 2040, and 100% by 2050. The City also identified the Sapperton District Energy Project as the single largest source of community carbon reductions.

The next step in moving forward with the project was to complete a feasibility study on the business case for the SDES and fill in the knowledge gaps in the project. The City of New Westminster and KWL had been previously engaged in the concept development stage and worked together to scope the next stage of the project.

Recognizing the project aligned with the objectives of the Green Municipal Fund (GMF) administered by the Federation of Canadian Municipalities (FCM), the project team put together a project proposal and approached the stakeholders and council to get their endorsement for the project. With all stakeholders wanting to move forward wit the project, the application was completed.

Once the GMF proposal was approved, the project team proceeded with the feasibility study. This included three main components: Engineering design update, business case development, and stakeholder engagement.

Updating the engineering design focused on updating the previous concepts to align with current conditions and new information provided by the stakeholders.

Once the engineering concept was updated, the project cost estimate and business case analysis were completed. This included evaluating a variety of scenarios and engaging with the stakeholders to ensure it met their objectives as well. With input and feedback from each of the stakeholders, the final report was completed to present the updated design and business case options for the SDES.
The final stage of the project involved engaging with the stakeholders to present the final report and meeting with the City Council to present the findings of the study. The project was presented to City Council on April 26, 2021.

2.2 Objectives

The SDES is a project proposed by the City of New Westminster to reduce community greenhouse gas (GHG) emissions. The SDES is proposed as a sewer heat recovery-based DES with the central plant located on a brownfield industrial site. The SDES will achieve emissions reduction by displacing existing and future natural gas use. The major opportunities are with the Sapperton Green mixed-use development project and Royal Columbian Hospital (RCH). The objective of this feasibility study was to provide a detailed business case evaluation and provide recommendations for project delivery methods. The objective was also to confirm opportunities for technological innovation and optimize the social, economic and environmental performance of the project.
The overall objective of the study was to confirm the feasibility of proceeding with the SDES, and the preferred project delivery method.

2.3 Approach

To date the City has conducted several iterations of feasibility analysis, and the technical considerations for this project are generally well-understood. The largest challenges on this project were related to funding and project delivery. As the landscape changed in the project area, there was still a need to close several gaps in defining project requirements, including technical, financial and stakeholder needs. The City also determined that it needed assistance from a private sector utility partner, for which it has already received expressions of interest. The integration of a private sector partner into the business model was not fully understood and was evaluated in the feasibility study.

2.4 Consultation

There were multiple external stakeholders involved in the project including Metro Vancouver, Fraser Health Authority, and Quadreal, the Sapperton Green developer. The feasibility study included scope for conducting stakeholder engagement work that was critical to defining the project's service delivery requirements. Engagement was completed throughout the project to receive feedback and update the stakeholders on the study progress. Stakeholders were fully engaged, providing important information to the project as well as providing feedback on their needs. The following stakeholders participated in the project to date:

1. Metro Vancouver has been engaged as owner of the New Westminster Interceptor Sewer and is a potential project partner.
2. Fraser Health Authority as the owner of Royal Columbian Hospital (RCH), recently expanded with a new energy centre that is capable of receiving the proposed heat source. As one of the largest GHG emitters in the City, as well as having a steady base load, connecting the system with RCH would help the City and Fraser Health meet their environmental objectives.
3. Sapperton Green is a 15-hectare (38 acres) mixed-use redevelopment by QuadReal. The SDES is intended to deliver low-carbon heating and efficient cooling to Sapperton Green and surrounding developments in the Braid/Brunette area.

3. Feasibility Study Findings and Recommendations

3.1 Environmental

The SDES project would be a major step toward the City's GHG emissions reduction goals, which is the primary purpose of the project. Other sustainability considerations for the project include the following:

1. Community: the project is in the early stages, but a detailed planning process is needed in 2021 to address development permit requirements and initiate community engagement. There are potential project co-benefits for the community relating to accessibility, sustainable transportation, and public realm improvements, through the redevelopment of the 151 Spruce Street site;
2. Leadership and Collaboration: this project potentially involves multiple public sector partners and innovative technology;
3. Resource Use: this project will improve overall neighbourhood energy efficiency and there are opportunities to re-use existing infrastructure;
4. Natural Environment: the project will be placed on a brownfield site, though it borders on the right bank of the Brunette River; and
5. Climate and Resiliency: this project will reduce GHG emissions and there are several resiliency measures built-in, including the structure and some equipment being designed to function post-disaster. The facility is planned to be above the flood construction level.

The following table summarizes the key sustainability features of the project.

Consideration	Business As Planned	Proposed SDES	Risks	Opportunities
Community	Heating and cooling equipment located in buildings	**Centralized energy plant frees up more space on site**	Construction at 151 Spruce Street will generate traffic	Integrated public space program linking Skytrain to greenway
Leadership & Innovation	Status Quo	**Uses waste by-product for beneficial use, collaboration between multiple partners**	Unconventional design concept Partnership stability	Leverage partnerships to provide capital grants to project Green jobs
Resource Use	Higher energy consumption	**More infrastructure but lower energy consumption**	Increased water use versus lower energy use	Re-use parts of the existing building at 151 Spruce Street
Natural Environment	Status Quo	**Catalyst project to redevelop existing industrial site**	Existing site contamination affects excavations	Environmental restoration/ enhancement on Brunette River shoreline
Climate & Risk	300,000 tCO_2e emitted over 25 years	**30 to 40 percent reduction in GHG emissions from Business As Planned case**	REC located in the floodplain	Adapt system operation and or future equipment selection based on climate trends

3.2 Financial

The updated capital cost opinion accounted for the phasing of the project and the noted changes in the project design concept. Due to the scale of the project and that the energy demand will increase gradually over time, the project is proposed in phases to align expenditures with expected revenues:

- Phase 1 in 2023 would provide the TEC at Sapperton Green;
- Phase 2 would develop the REC at 151 Spruce Street and connect it with RCH in 2025;
- Phase 3 would add a pipeline to connect with Sapperton Green in 2027 to meet expanded demand and relocated the TEC to the roof of the REC; and
- Phase 4 would expand the system adding capacity to the REC and expanding the DPS to the rest of Sapperton Green and the surrounding neighbourhoods in 2030 and beyond.

The project concept is flexible and scalable to different servicing scenarios as well. The project team and the City identified three possible servicing options, namely 1) RCH-Only, 2) Braid Node Only (Sapperton Green), and 3) Full System buildout. The updated Class D cost opinion is about

$83M for the full scope of the project, which is summarized by phase in the following table in millions of dollars.

Scenario		Pre Design 2021 22	Phase 1 2022 23	Phase 2 2023 25	Phase 3 2025 27	Phase 4 2027 30+	Total	Annual Avoided Emissions (2036, t CO2e)
1	RCH and Neighbourhood	0.7	-	25.1	-	2.3	**28.1**	**3,400**
1a	RCH 1.5 MW	0.2	-	14.4	-	-	**14.6**	**2,400**
2	Braid Node Only	2.3	7.7	30.4	13.4	7.0	**60.9**	**2,500**
3	Full System	2.3	7.7	41.1	21.8	9.5	**82.5**	**6,400**

The financial analysis was conducted by MMK Consultants Ltd. and used an undiscounted cash flow model based on assumptions developed for the study. The key findings of this analysis included:

- Option 1 and 1a (RCH) would require nearly all of the project capital costs to be financed through non-repayable grants ($14.5 million to $25 million). The current cost for RCH is about $37/MWh in 2020, but that could rise to about $70/MWh by 2030 if the federal carbon tax target of $170/t CO2e is adopted. Option 1a would have a slightly better financial outlook because it has higher overall system utilization and lower overall costs. The estimated breakeven price for Option 1 and 1a is between $69/MWh (Opt. 1a) and $80/MWh (Opt. 1). RCH would need to pay the breakeven rate for these options to be viable.
- Option 2 (Braid Node) is potentially viable without external funding assistance and could also be fully-developed under private ownership. Debt repayment is estimated to occur within 20 years with $15 million in developer-contributed capital and the remaining $46 million being provided by the project owner(s). An energy service cost of $12/m2 in 2020$ was assumed for heating/cooling service.
- Option 3 (Full System, Public Financing) has an economy-of-scale benefit that provides an improved business case compared to Options 1 and 2, with debt retirement as early as the late 2030s. This assumes the breakeven scenario for Option 1 is included. The City would need to provide approximately $51 million in capital financing.
- Option 3a (Full System, Partial Concession) would be the same as Option 3 but would bring in a private-sector utility partner to deliver a portion of the infrastructure for service to the Braid Node, totalling at least $30 million. The City is still assumed to carry a portion of capital cost in this scenario. The overall cost of capital between the public sector and private sector is similar.

The overall results of the financial analysis in terms of year-end financial position are provided in the final report. Only scenarios with positive or break-even financial results are shown. The following table summarizes some key assumptions of the financial analysis.

	1 RCH + Columbia	1a RCH Only	2 Braid Node Only	3 Full System, Public Financing	3a Full System, Partial Concession
Heat Pump Capacity (MW)	4	1.5	7.4	11.4	11.4
2030 RCH Energy Demand (MWh)	16,000	11,800	0	16,200	16,200
2030 Neighbourhood Energy Demand (MWh)	1,700	0	28,000	32,000	32,000
Capital Cost ($ millions, 2020)	28.1	14.5	61	82	82
Years to Debt Retirement	25	25	19	18	18
Note: 2030 is referenced as most of the system demand will be realized by this time.					

3.3 Recommendations

The feasibility study identified three possible options for moving forward to the next stage. The proposed concept can be viewed as two projects in one, with a common source of energy:

- Subject to sufficient capital funding and a suitable operating agreement, the City may wish to proceed with developing Option 1 (RCH), with the ability to expand the system to the scope of Option 3 (RCH and Sapperton Green).
- Option 2 (Sapperton Green) could initially be executed independently and would be amenable to an alternate delivery model involving a private sector partner. Since temporary servicing is proposed for Sapperton Green's first phase, this pathway could migrate to Option 3 as well.
- The next stage of design should address any gaps in the design and make provisions for the two 'legs' of the project to be executed semi-independently.
- The City will need to work with Metro Vancouver to develop the sewer heat resource and secure funding and carbon credit exchange agreements. Servicing agreements with Fraser Health Authority and QuadReal will be required prior to design, and the City is encouraged to enact a District Energy connection bylaw for proposed service areas.

4. Lead Applicant's Next Steps

The City is currently seeking project funding and prior to a final investment decision, a preliminary design including site investigations at 151 Spruce Street should be completed. The following table outlines a 5-year implementation plan.

Year	2021	2022	2023	2024	2025
Planning	Comprehensive Site Plan 151 Spruce Street	Development Permit Application	CPR/BNSF/ SkyTrain/ MOTI Crossing Agreements		Prepare for Phase 3 Expansion
Engineering & Project Management	Pre-Design	• Detailed Design: TEC • Detailed Design: Keary Street Pipe/Electrical Crossing	• Detailed Design: REC • Contract Administration	• Detailed Design: REC • Contract Administration	• Plant Commissioning • Contract Administration
Procurement	• Engineering Services: Pre-Design • Architect Services: Site Planning	Engineering & Architecture Services: Detailed Design	• Long-Lead Time Equip. Supply • TEC Contractor • Pipe Contractor	• REC Contractor • Process Change Orders	Process Change Orders
Construction			• Phase 1: TEC • Phase 2: 151 Spruce Street Site Preparation	• Phase 1: Keary Street Pipe Crossing • Phase 2: REC	REC Completion & Startup
Utility/ Business	• MOUs: MV & FHA • Final Investment Decision	• Definitive Agreements • Phase 1 Financing	• Phase 2 Financing • Phase 1 Service Contracts	• Phase 2 Service Contract • Hire Operations Staff	RCH Service Begins

The benefits of moving forward with these next steps would be progressing to the design and construction phase of the project and ultimately reaching operation. Progressing with the project will aid the City in meeting its carbon reduction targets, improving the quality of life in the city and establishing a low carbon district energy system in the community.

5. Lessons Learned

In preparing the lessons learned section, all aspects of undertaking the Study — from the initial planning through each essential task until the Final Study was prepared were considered.

5.1 Recommendations

The feasibility study was an opportunity to evaluate the SDES project and develop an updated business case that filled in the gaps and developed a business case for the project. This is a valuable tool in moving the project towards design and getting buy-in form key stakeholders, including the City Council. Other municipalities looking to complete similar feasibility studies should proceed with it at the right stage of the project. Our experience showed that having the background information on the concept design was important to understanding the scope of the feasibility study and getting endorsement for the project.

Once the feasibility study begins, stakeholders should be engaged throughout the process to ensure that everyone is on the same page and input from all stakeholders can be incorporated into the study. This is important to ensure a complete report, and to get buy-in and support on the final report.

In completing the final report, our timeline was pushed back by four months in part due to discovery of new information that had a major impact on the final analysis. Our recommendation is to be flexible to changes in the project and adjust as new information becomes available. While this delayed the results of the project, the report is now more complete and better reflects the actual conditions that the SDES will operate under.

5.2 Challenges

The project encountered two areas that were challenging and related; Time and scope.

The project was originally planned to start in March 2020 and be completed in December 2020. With a global pandemic, and teams adjusting to working from home, some delays were inevitable. Beyond this, through various stakeholder engagement sessions, new information on the project was gathered, that required additional time to analyze and update the project design.

As the stakeholder engagement took place, the scope of the project expanded as well. Information was presented on energy consumption at RCH, and the design plans for Sapperton Green were modified based on the pandemic, and therefore the project team had to re-evaluate the options, and adjust timelines based on the stakeholders needs. This change in scope led to a more comprehensive report that will better meet the stakeholders objectives.

To address changes in scope and timeline, the project team worked closely with the stakeholders and FCM to keep everyone informed and up-to-date on the most recent changes to the study and project. Working with FCM, the project was able to adjust the timeline to accommodate the new information.

While the project received additional information that resulted in additional scenarios being considered, the overall scope of the project remained within the original work plan presented for the GMP application.

In addition, we were also not able to complete one of the objectives we had initially intended to achieve through this process namely reaching a recommendation on the delivery method. Although this topic was brought up in several meetings, it was deemed requiring additional consultation with various stakeholders in order to properly ascertain the most suitable method(s) for this specific project in order to make recommendations to council. Council requested holding a workshop where these various methods would be presented and discussed before moving forward with a recommendation and resolution.

6. Knowledge Sharing

The business case analysis presents an analysis of a low carbon energy system that can be used as an example for other municipalities. As more municipalities begin to set goals for reducing GHG emissions in their communities, they will need to explore the trade-offs between the environment, costs, and the community needs.

As the project progresses, more public information will be shared through the City Website. The recommendations indicate that a district energy connection bylaw be developed. While this has not been implemented at this time, it could be available in the future.

https://www.newwestcity.ca/planning-building-and-development/projects-on-the-go/articles/2910.php

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