City of Richmond

Report to Committee

To:	Public Works and Transportation Committee	**Date:**	January 18, 2016
From:	John Irving, P.Eng. MPA Director, Engineering	**File:**	10-6600-10-02/2016-Vol 01
Re:	**Sewer Heat Recovery in Richmond Update**		

Staff Recommendation

That:

1. The staff report titled "Sewer Heat Recovery in Richmond Update" from the Director, Engineering, dated January 18, 2016, be received for information;

2. The scope of work and budget for a Micro-Sewer Heat Recovery Study identified in the "Sewer Heat Recovery in Richmond Update" from the Director, Engineering, dated January 18, 2016, be approved with funding from the Carbon Tax Provision and included as an amendment to the Five Year Financial Plan (2016-2020) Bylaw;

3. The application to the Federation of Canadian Municipalities for up to 50 percent of eligible costs to complete Micro-Sewer Heat Recovery Study, be endorsed; and

4. Should the funding application be successful, the Chief Administrative Officer and the General Manager of Engineering and Public Works be authorized to execute the agreement with the Federation of Canadian Municipalities on behalf of the City.

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Director, Engineering
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REPORT CONCURRENCE		
ROUTED TO:	**CONCURRENCE**	**CONCURRENCE OF GENERAL MANAGER**
Finance Department	☑	
REVIEWED BY STAFF REPORT / AGENDA REVIEW SUBCOMMITTEE	**INITIALS:** DW	**APPROVED BY CAO**

Staff Report

Origin

This report responds to a referral from the September 23, 2015 Public Works and Transportation Committee meeting, in which it was requested:

"that staff report back on the potential to recover heat from the Gilbert Trunk sewer line."

This report includes a recommendation to complete a new study to assess further opportunities in Richmond to recover renewable energy from the City's sanitary sewer system.

This report supports Council's 2014-2018 Term Goal #4 Leadership in Sustainability:

> *Continue advancement of the City's sustainability framework and initiatives to improve the short and long term livability of our City, and that maintain Richmond's position as a leader in sustainable programs, practices and innovations.*
>
> *4.1. Continued implementation of the sustainability framework.*
>
> *4.2. Innovative projects and initiatives to advance sustainability.*

Background

In 2010, Council adopted targets in Richmond's Official Community Plan to reduce community greenhouse gas (GHG) emissions 33% below 2007 levels by 2020, and 80% below 2007 levels by 2050. The 2041 Official Community Plan also includes a target to reduce energy use 10% by 2020 below 2007 levels. Richmond's 2014 Community Energy and Emissions Plan (CEEP) outlines an array of strategies and actions for the City to meet these targets. Many of these strategies and actions relate to renewable energy, including:

> ***Strategy 10:*** Utilize Local Energy Sources
>
> - **Action 26:** Promote building scale renewable energy - explore opportunities to implement education, incentives and requirements.
>
> ***Strategy 13:*** "Lead by example" with City Operations Energy Management

With respect to renewable sewer heat, the City has engaged in multiple studies and initiatives which have explored the potential of sewer heat recovery (SHR) as an energy source within the City of Richmond. Below is a list highlighting several of these projects:

1. Gilbert Trunk Sewer Main and Oval Village District Energy Utility

   In 2012, the City and Metro Vancouver retained a consultant to assess the feasibility of recovering sewer heat from the new Gilbert Road Trunk Sewer Main in the Oval Village area in order to service the demands of upcoming development within the Oval Village

District Energy Utility (OVDEU) Service Area. The study indicated that the new Gilbert Trunk Sewer Main system could provide the desired 4 megawatt (MW) of renewable power from sewage heat. Integrating this energy source is in the current OVDEU business plan and it will be integrated after a critical mass of buildings has been connected.

2. Gateway Theatre

   At the Gateway Theatre, the City and its partners successfully integrated a sewage heat recovery system into the building's heating system. The location of a sewer wet well under the theatre proved to be an ideal location to install the heat recovery system due to the limited infrastructure required to connect the building to the sewage heat source. The system has been successfully operating since April 2013, with an estimated displacement of over 900 gigajoules (GJ) of natural gas annually, a 35% reduction, and an estimated reduction in greenhouse gas emissions of over 45 tonnes annually, also a 35% reduction. The City continues to monitor and analyze the performance of this system.

3. Lulu Island Waste Water Treatment Plant – Energy Provision for Richmond City Centre

   A study of effluent heat recovery potential at the Lulu Island Wastewater Treatment Plant (LIWWTP) has been completed. The study analyzed the feasibility of using heat energy generated by sewage at the LIWWTP to service a District Energy Utility in the Richmond City Centre area. A review of the potential energy loads that could be served by the LIWWTP and analysis of the feasibility of installing distribution piping alongside the planned sewer main upgrades in Gilbert Road was conducted. The studies illustrated that there is potential for the effluent heat source to service the projected energy demands of the development within the City Centre area. The analysis showed favourable results for the feasibility of this concept. However, further detailed analysis and planning is required prior to any additional action. The City will continue to work with Metro Vancouver to explore this as a potential renewable energy source.

4. Vancouver Sewerage Area - Integrated Resource Recovery Study

   Metro Vancouver's Integrated Resource Recovery (IRR) Study for the Vancouver Sewerage Area (VSA) was a multi-phase project that involved evaluating potential resource recovery opportunities associated with the liquid and solid waste streams originating within the VSA. As part of this study, the Iona Island Waste Water Treatment Plant was identified as a high potential source of sewer heat energy. However, the location is not considered ideal due to the distance from the City of Richmond's potential energy loads and the poor geotechnical conditions on site.

5. Lulu Island Sewerage Area - Integrated Resource Recovery Study

   Similar to the VSA IRR Study above, this initiative was just launched and will look to create an overall strategy for developing opportunities for the recovery of energy, reclaimed water, and other materials in the Lulu Island Sewerage Area. This includes

opportunities for sewer heat recovery from the Lulu Island Wastewater Treatment Plant. This study is in its early stages and will be continuing throughout 2016.

6. Kwantlen Polytechnic University Micro-Sewer Heat Recovery Study

   Based on a request from Kwantlen Polytechnic University (KPU), the City completed a feasibility study for the utilization of recovered sewage heat energy from its Alderbridge Sanitary Pump Station (ASPS) on Kwantlen St. to potentially service a new facility at KPU. The study included analyzing the potential energy generation at this pump station, the energy demands of the new facility and estimates of implementation costs for a micro-scaled sewer heat recovery system similar to the Gateway project. The study showed promising results for a system of this kind.

Analysis

Metro Vancouver's sewer network and waste water treatment plants within Richmond appear to be able to provide energy for a large scale energy system. To date, the focus of the analysis of sewer heat recovery options in the City of Richmond has mainly been on larger projects and opportunities. Staff remain engaged on all the opportunities outlined above and will bring forward discrete opportunities for Council's consideration as they arise. In the case of the OVDEU, the proximity of the new Gilbert Road Trunk Sewer Main creates a scenario which is feasible for a direct connection to Metro Vancouver's sewer network. Staff will continue to work with stakeholders to explore these projects as a potential renewable energy source.

The above projects have focused mainly on larger scale projects, with the exception of the Gateway project and KPU study. Given the promising results that these projects two have shown, it is worth considering similar opportunities across the City. The sewer heat energy that is available within the City of Richmond's own sewer pipe network is unknown however. For this reason, there is value in assessing available energy within the City's own sewer network with the intent of identifying the potential for smaller scale projects that maximize heat recovery in Richmond. The network comprises pump stations, forcemains and gravity collectors; pump stations and larger forcemains have the highest potential for economic sewer heat recovery.

In this context, it is proposed to conduct a study to assess micro-Sewer Heat Recovery (mSHR) opportunities across all urban areas of Richmond. An mSHR system is envisioned to be defined by a series of mSHR energy plants which will provide thermal energy to either public or private buildings, as seen at the City's current demonstration project at the Gateway Theatre.

Traditional, larger scale SHR systems require significant capital investment to develop the energy plant. The density of energy demand in the Richmond's City Centre area will support these types of investments. mSHR is anticipated to carry lower capital costs however and as a result has potential for application in other areas of the community. The proposed study will investigate the feasibility of using standalone micro sewer heat recovery plants that will be housed in new developments or within existing pump stations. The study will firstly assess and identify recoverable heat in the City's sanitary sewer network, focusing on forcemains and pump stations. This work will build on the study that examined sewer heat in Metro Vancouver's

sewer forcemains. This information will then be compared against current and future land use identified in the Official Community Plan for the whole city in an effort to identify potential candidate locations that mSHR could be feasibly employed. With a shortlist of candidate areas identified, conceptual design and costing would be completed to better understand how the service can be delivered most effectively. This will include an estimation of costs, financing strategies and revenues for the City's district energy company, the Lulu Island Energy Company.

The KPU study showed promise for harvesting sewer heat at this scale. Applying this approach more broadly across the City is expected to reveal opportunities in other areas of the community for sewer heat recovery. In the KPU study, it was estimated that greenhouse gas (GHG) emission reductions would range from ~3.9 to 5 tonnes per annum for the one connected building. On the surface and with these possible outcomes, staff consider that sewer heat recovery of this scale has potential for connecting buildings to renewable energy sources throughout all parts of the community. If the study identifies that mSHR is technically feasible in any specific area, staff will bring information to Council identifying this feasibility, the catchment area and potential mechanisms available to the City for pursuing the establishment of a mSHR system based on both the technical feasibility and the viability of a business case analysis. For the reasons identified above, a recommendation is included to approve the general scope and budget for the study. To offset costs, staff have initiated an application for the Federation of Canadian Municipalities' Green Municipal Fund, which provides up to 50% of eligible costs to a maximum contribution of $175,000 for feasibility studies.

Financial Impact

The anticipated cost of the proposed study is $170,000 with a potential grant contribution from the Federation of Canadian Municipalities (FCM) of up to 50%. As this grant also accepts in-kind contributions as project cost, the FCM grant for this proposed study could be up to $100,000. If the grant is successful, the City's total contribution will be no more than $70,000. Funds are currently available for the study in the Carbon Tax Provision account. All FCM reimbursements would be returned to this account. An amendment to the City's 5 Year Financial Plan (2016-2020) will be required based on approval of this request.

Conclusion

The City remains engaged in multiple studies and initiatives which have explored the potential of using recovered sewer heat as an energy source for heating buildings in Richmond. With the focus of many of the previous investigations being on larger scale SHR systems, the feasibility of implementing smaller, decentralized systems in unknown. It is proposed to look further in to micro-Sewer Heat Recovery (MSHR) across all urban areas of Richmond by conducting a study to identify and analyze potential MSHR opportunities.

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