Metro Vancouver Regional Planning Committee Meeting, September 8, 2022

City of Pitt Meadows Regional Context Statement Presentation Outline

1. City of Pitt Meadows Community Highlights
    a. Location / regional context
    b. Land use and natural features
    c. Demographics – present and future
    d. Economy (agriculture)
    e. Transportation
    f. Metro Vancouver parks, trails, infrastructure

2. Community Issues
    a. Small urban area / large farming area
    b. Floodplain
    c. Transportation

3. City of Pitt Meadows Official Community Plan
    a. Highlights
        - New policies addressing reconciliation with Katzie First Nation, hazard and emergency management, climate change, community well-being
    b. Process and public consultation

4. City of Pitt Meadows Regional Context Statement
    a. Alignment with the Metro 2040 Goals:
        - Goal 1: Create a compact urban area
        - Goal 2: Support a sustainable economy
        - Goal 3: Protect the environment and respond to climate change impacts
        - Goal 4: Develop communities
        - Goal 5: Support sustainable transportation choices

5. Addressing Mapping Inconsistencies

CONWEST

#401 – 1930 Pandora Street, Vancouver, BC V5L 0C7

LORVAL

9785 201 Street, Langley, BC V1M 3E7

August 24, 2022

EMAILED
Attention: Chair Coté and Members of the Metro Vancouver Regional Planning Committee
Metro Vancouver
Metrotower III, 4515 Central Boulevard,
Burnaby, BC, V5H 0C6

Re: Metro Type 3 RGS Amendment Application – Township of Langley – Gloucester Industrial Park Proposed Industrial Development, Gloucester Industrial Estates, Langley, BC

Township of Langley Rezoning File Number: 14-07-0056

Please accept this written submission to be included on the Agenda of the upcoming September 8th, 2022, Metro Vancouver Regional Planning Committee meeting. On behalf of Conwest and Lorval Developments Ltd., Joe Carreira, Vice President of Development at Conwest Developments, respectfully requests the opportunity to present to the Regional Planning Committee.

On May 18th, 2022, the Township of Langley submitted a request for a Type 3 Regional Growth Strategy amendment for consideration. As an authorized agent and property owner of the subject lands we respectfully request that the subject application be processed as an amendment to the 2040 Regional Growth Strategy. This request is also aligned with the Township of Langley's written submission of May 18th and July 27th 2022, attached.

The amending zoning bylaw received Third Reading from The Township of Langley Council on May 9th, 2022, for the development of approximately 35-acres of much needed industrial employment land at 264 Street and 56 Avenue. The Metro Vancouver Industrial Land Strategy identifies the critical shortage of industrial land facing the region and this application is at risk of undetermined delays. Unfortunately, the delays are an unintended consequence of the protracted adoption of 2050, but it is our understanding that further delays can be mitigated if the application is processed as a 2040 Regional Growth Strategy Amendment.

In addition to the significant employment opportunities for the region, the proposal also includes the creation of six acres of fish habitat enhancement on the Salmon River and an educational farming opportunity in partnership with Kwantlen First Nation and Kwantlen Polytechnic University.

We respectfully ask that the Regional Planning Advisory Committee request staff to process the subject application as a 2040 Regional Growth Strategy Amendment.

Thank you for your time and consideration to this matter.

Sincerely,

Joe Carreira
Vice President of Development
Conwest Developments Ltd.
[redacted]
joe.carreira@conwest.com

Marlene Best
Vice President of Development
Lorval Developments Ltd.
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To: Climate Action Committee

From: Johann Zerbe, Policy Analyst
Conor Reynolds, Division Manager, Air Quality and Climate Change Policy
Parks and Environment Department

Date: August 15, 2022 Meeting Date: September 9, 2022

Subject: **BC Local Government Climate Action Program (LGCAP)**

RECOMMENDATION

That the Climate Action Committee receive for information the report dated August 15, 2022, titled "BC Local Government Climate Action Program (LGCAP)".

EXECUTIVE SUMMARY

In May 2022, the BC government announced the new Local Government Climate Action Program (LGCAP), which will provide funding to eligible local governments and Modern Treaty Nations for climate action initiatives to reduce emissions and increase climate resilience. LGCAP replaces the Climate Action Revenue Incentive Program (CARIP) which was cancelled in 2021.

Funding under LGCAP is based on each community's population and a base amount, and most communities will receive an increase in provincial funding for climate action compared to CARIP. From 2022 to 2025, Metro Vancouver will receive $250,000 per year under LGCAP, compared to amounts ranging from 200,000 to 220,000 in recent years.

LGCAP includes a number of reporting requirements for 2022, including reporting on corporate greenhouse gas (GHG) emissions, community GHG emissions, and reporting on projects linked to the objectives of the provincial *CleanBC Roadmap to 2030* and/or the *Climate Preparedness and Adaptation Strategy*.

PURPOSE

To inform the Climate Action Committee of the new LGCAP program, expected funding under the program, and eligibility and reporting requirements of local governments.

BACKGROUND

On May 11, 2021, the BC government announced the cancellation of the Climate Action Revenue Incentive Program (CARIP) without prior consultation with local governments. The Mayors Committee and MVRD Board considered this matter, recognizing the potential impact on local government climate action, and referred the matter to the Climate Action Committee. At its meeting on June 10, 2021, the Climate Action Committee considered the report titled "Cancellation of Provincial Climate Action Revenue Incentive Program (CARIP)", and approved the following recommendation:

That the MVRD Board authorize the Board Chair to write a letter to the Provincial Minister of Municipal Affairs, Minister of Environment and Climate Change Strategy, and Minister of Finance, regarding the cancellation of the Climate Action Revenue Incentive Program, providing details of key elements to be retained in a replacement program and suggested improvements, based on the analysis in the report dated May 27, 2021, titled "Cancellation of Provincial Climate Action Revenue Incentive Program (CARIP)".

In May 2022, following a period of consultation with local governments, the new BC Local Government Climate Action Program (LGCAP) was announced. This report describes the new program, including the flexible and consistent funding that it provides, and conveys the first year of Metro Vancouver's reporting to the Province under this program.

BC LOCAL GOVERNMENT CLIMATE ACTION PROGRAM (LGCAP)

BC Climate Action Charter

As signatories to the BC Climate Action Charter, local governments have committed to measure and report GHG emissions, aim for carbon neutrality in their own operations, and plan compact, energy efficient communities. CARIP was created by the Province as a reporting and funding framework for signatories to the Charter. Participants were required to annually report their climate actions, quantify the GHG emissions associated with corporate operations, and demonstrate progress towards carbon neutrality. Local governments that fulfilled these requirements were eligible to receive a refund of their carbon taxes paid on direct fuel purchases. Since the inception of the Climate Action Charter, 187 of 190 municipalities, regional districts and the Islands Trust have signed on and have been publicly reporting their climate actions, including Metro Vancouver and all of its member municipalities.

As a signatory to the Charter, Metro Vancouver has committed to measuring and reporting GHG emissions, reducing corporate emissions, and becoming carbon neutral in its operations. Report 5.3 in this agenda package, dated August 15, 2022, titled "Managing Metro Vancouver's Corporate Energy and Greenhouse Gas Emissions (2017 to 2021)", provides quantitative information on Metro Vancouver's corporate emissions as well as its carbon neutral reporting.

Announcement of BC Local Government Climate Action Program

On May 16, 2022, the BC government announced the Local Government Climate Action Program (LGCAP), which provides funding to local governments and Modern Treaty Nations to support the implementation of climate change mitigation and adaptation projects (Reference 1). Similar to CARIP, LGCAP provides stable, predictable funding to local governments for climate action initiatives, and includes annual reporting requirements, including to measure and report corporate and community GHG emissions, demonstrate investment in climate action initiatives, and report on projects linked to the objectives of the provincial *CleanBC Roadmap to 2030* and/or the *Climate Preparedness and Adaptation Strategy*.

Funding for Climate Action

The LGCAP funding model aims to distribute funding more equitably between smaller and larger communities. Funding is based on each community's population and a base amount, and most

communities will receive an increase in provincial funding for climate action compared to CARIP, with smaller communities receiving the largest proportional increase. Previously, funding was distributed to local governments based on the amount of carbon tax paid. For 2022, Metro Vancouver will receive $250,000, similar to what was received in 2021. Funding amounts will not change for the first 3 years. In their annual reporting, local governments must confirm commitment of matching funds equivalent to 20% of the amount received. Funding for the first year of the program will be disbursed on August 31, 2022.

New Reporting Requirements

In addition to being signatories to the BC Climate Action Charter, local governments are required to meet a number of reporting requirements to be eligible for the first year of funding. For the first year of the program, local governments are required to: measure and report corporate GHG emissions; report on community emissions where data is available; report on projects linked to one or more objectives from the *CleanBC Roadmap to 2030* and/or the *Climate Preparedness and Adaptation Strategy*, including climate action initiatives related to buildings, transportation, community initiatives, and climate resilience. For 2022, local governments fulfilled these reporting requirements by completing an online survey form, which they are required to publicly post online. Additional reporting requirements are expected to be introduced in future years of the program.

The province of BC will use information collected in its annual Climate Change Accountability Report, to track progress, highlight climate leadership and advance further action. For 2022, Metro Vancouver's survey highlights a number of initiatives implemented in 2021, many of which were included in the Climate 2050 Snapshot (Reference 2), reported to the Committee in June 2022. As per the Provincial requirements, Metro Vancouver has posted its survey responses on the Metro Vancouver website (Reference 3 - 'Metro Vancouver's Local Government Climate Action Program Response').

The BC Climate Action Toolkit (Reference 4) is a website available to help local governments meet the new program requirements. The website has been redesigned to further highlight best practices and other resources for local government climate action.

ALTERNATIVES

This is an information report. No alternatives are presented.

FINANCIAL IMPLICATIONS

Metro Vancouver will receive LGCAP funding of $250,000 in 2022, and the following two years, which will be used to directly support Metro Vancouver's corporate and regional climate action projects and programs. This new climate action funding program provides a continuation of provincial funding that was previously delivered under the Climate Action Revenue Incentive Program (CARIP). Consistent funding for Metro Vancouver's climate action projects and program is critical for the implementation of actions in the *Climate 2050 strategy*, which in turn are needed if the province is to reach its GHG reduction targets in the *CleanBC Roadmap to 2030.*

CONCLUSION

Metro Vancouver and its member jurisdictions are advancing innovative climate actions that are critical to enabling the Province to meet its *CleanBC* GHG reduction targets. The provision of consistent flexible funding for climate action under the LGCAP will directly support Metro Vancouver's corporate and regional climate action projects and programs as outlined in *Climate 2050*, which aim to reduce emissions and transition to a more resilient region. The reporting requirements under LGCAP align with Metro Vancouver's existing climate reporting practices, and support Metro Vancouver's commitment to provide transparent reporting on progress to implement the Climate 2050 roadmaps.

References

1. News Release: BC launches new program to accelerate local climate action (May 16, 2022)
2. Metro Vancouver Climate 2050 Snapshot 2021/2022
3. Metro Vancouver's Local Government Climate Action Program – 2022 Response
4. BC Climate Action Toolkit

54093289

To: Climate Action Committee

From: George Friedrich, Senior Project Engineer, Liquid Waste Services Department
Johann Zerbe, Policy Analyst, Parks and Environment Department
Nicole Chan, Project Engineer, Parks and Environment Department

Date: July 19, 2022 Meeting Date: September 9, 2022

Subject: **Managing Metro Vancouver's Corporate Energy and Greenhouse Gas Emissions (2017 to 2021)**

RECOMMENDATION

That the Climate Action Committee receive for information the report dated July 19, 2022, titled "Managing Metro Vancouver's Corporate Energy and Greenhouse Gas Emissions (2017 to 2021)".

EXECUTIVE SUMMARY

Metro Vancouver uses energy to provide services to the region. While some energy use generates greenhouse gas emissions, Metro Vancouver also produces clean, renewable energy for internal use and for sale to others. Metro Vancouver spent over $32 million in 2021 to purchase energy and maintain its energy generation systems. Metro Vancouver's 2021 energy use (1.6 million GJ), energy-related GHG emissions (25,300 tonnes CO2e), and costs ($32.4 million), were up 11%, 14%, and 30%, respectively, compared to 2014 (baseline year), while population has grown by 12%. Increases were driven by the need to transport the historic stockpile of land-dried biosolids at Iona Island Wastewater Treatment Plant, increased electricity purchases during the Annacis Island Wastewater Treatment Plant cogeneration system upgrade, and the installation of larger natural gas burners at the Waste-to-Energy Facility to meet new regulatory requirements. To help manage energy costs and reduce greenhouse gas emissions, Metro Vancouver is working on developing corporate energy and GHG emissions reduction targets in 2022 that align with *Climate 2050* targets.

PURPOSE

To inform the Climate Action Committee of trends in Metro Vancouver's corporate energy use, energy costs, and greenhouse gas (GHG) emissions for 2017 through 2021 and to provide an overview of energy and GHG emissions management actions.

BACKGROUND

As a signatory to the BC Climate Action Charter, Metro Vancouver has committed to measuring and reporting greenhouse gas emissions, reducing corporate emissions, and becoming carbon neutral in its operations. In 2022, the BC government replaced the Climate Action Revenue Incentive Program (CARIP) with the Local Government Climate Action Program (LGCAP). Like CARIP, LGCAP provides stable, predictable funding to local governments for climate action initiatives, and includes annual reporting requirements. Report 5.2 in this agenda, titled "BC Local Government Climate Action Program (LGCAP)", provides additional information on the new program.

As part of the *Climate 2050* strategy, the Metro Vancouver Board has adopted regional targets to become a carbon neutral region by 2050, with an interim target of reducing GHG emissions by 45% from 2010 levels by 2030. Corporate energy and GHG management will seek to align with *Climate 2050* targets, while maintaining delivery of all Metro Vancouver's services.

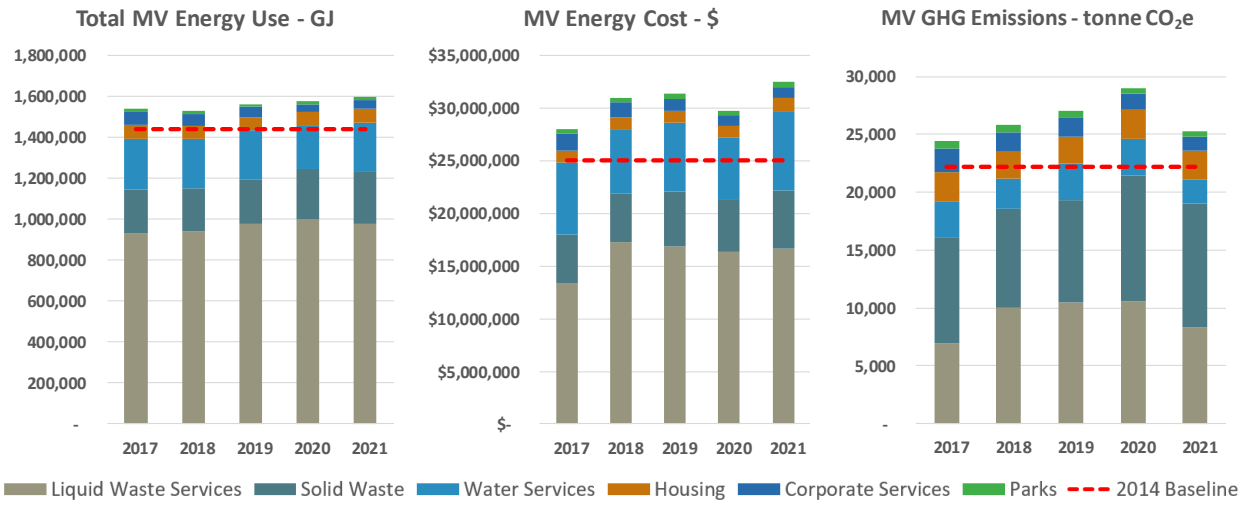
A suite of corporate policies that emphasize Metro Vancouver energy and GHG management have been adopted since 2014, including the *Corporate Energy Management Policy*, *Carbon Price Policy*, *Fleet Planning and Acquisition Policy*, *Sewage and Waste Heat Recovery Policy*, and the *Sustainable Infrastructure and Buildings Policy*. Specifically, the *Corporate Energy Management Policy* articulates Metro Vancouver's commitment to continuously improving the efficiency of its energy use, production, generation, and recovery, as well as establishing energy targets, and regularly reporting on progress toward those targets.

METRO VANCOUVER'S ENERGY AND EMISSIONS PROFILE

Metro Vancouver and its contractors purchase energy to power facilities, buildings, and fleets in order to provide vital services to the region. In addition to using purchased energy, Metro Vancouver also "self-generates" a substantial amount of energy. In most cases, this self-generated energy is used by Metro Vancouver, though Metro Vancouver does sell energy to BC Hydro and FortisBC.

Metro Vancouver's purchased energy cost (primarily electricity, natural gas, diesel, and gasoline) exceeded $32.4 million in 2021, an increase of 30% over the baseline year of 2014. Total energy use (including both purchased and self-generated energy) for 2021 was 1.6 million GJ, an increase of 11% over the 2014 baseline. Total energy use resulted in corporate GHG emissions of 25,300 tonnes carbon dioxide-equivalent (CO_2e) in 2021, an increase of 14% over 2014. Regional population has increased approximately 12% over this same time period.

"Metro Vancouver Annual Corporate Energy and Greenhouse Gas Emissions Management Report 2017 to 2021" (Attachment 1) summarizes the five-year trend in energy and emissions for Metro Vancouver's operations. It provides details on trends in energy use, energy costs, and GHG emissions by service area. The 5 year trends are summarized as follows.



Establishing Corporate Energy and GHG Emissions Reduction Targets

In its 10-Year Plan (published in 2019), Metro Vancouver Housing committed to reducing energy consumption by 25% (from 2015 National Energy Code for Buildings) for major rehabilitations and new construction, and to reducing GHG emissions in the Housing portfolio by 45% by 2030 compared to 2010 levels. Liquid Waste Services has committed to reducing energy use by 10% compared to 2019, by 2030. In 2020, all Metro Vancouver departments committed to setting energy and GHG emissions targets. This process is ongoing and the targets will be established in 2022.

Managing Energy Use and Energy Costs

Metro Vancouver's Corporate Energy Management Program aims to identify and implement energy savings opportunities in the operation and maintenance of existing facilities, and to ensure new facilities are designed with an energy-efficiency lens. Since the *Corporate Energy Management Policy* was adopted in 2014, up to the end of 2021, energy conservation projects implemented by the program have resulted in cumulative energy savings of more than 324,000 GJ, resulting in cumulative operating cost savings of approximately $8.5 million and ongoing savings of over $1.7 million per year. Despite these efforts, Metro Vancouver's total energy use has been trending upwards, increasing 11% in 2021 compared to 2014, though per-capita energy use has remained relatively constant. Much of the increased energy usage can be attributed to the operation of major new facilities such as the Capilano Raw Water Pump Station (2015) as well as increases in fossil fuel use for Iona Island WWTP residuals hauling and Waste-to-Energy Facility operation.

Corporate GHG Emissions and Trends

Total corporate GHG emissions from all energy use were 25,300 tonnes carbon dioxide-equivalent (CO_2e) in 2021, an increase of 14% over 2014. This increase is driven by increases in fossil fuel use for transporting the historic stockpile of land-dried biosolids at Iona Island WWTP, and increased natural gas use at the Waste-to-Energy Facility after the installation of larger natural gas burners in 2018 to meet new regulatory requirements in the facility's provincial Operational Certificate.

Fossil-based emissions from combustion of municipal solid waste at the Waste-to-Energy Facility were 131,820 tonnes CO_2, an increase of 22% compared to 2014, as the disposal ban on organic materials in 2015 has led to an increase in the proportion of non-biogenic GHG emissions, along with the increase in natural gas use noted above.

2021 Carbon Neutral Reporting

"Metro Vancouver's 2021 Carbon Neutral Reporting" (Attachment 2) reports on a subset of energy-related emissions associated with the delivery of "traditional local government services", which excludes emissions such as those from Metro Vancouver Housing services, the Waste-to-Energy Facility, and certain contracted emissions. This scope of services is defined in the provincial Carbon Neutral Framework for local governments, which was established under the BC Climate Action Charter. In 2021, these emissions were 18,102 tonnes CO_2e. Metro Vancouver implements a portfolio of non-energy related emission reduction projects to achieve measurable and verifiable regional GHG emissions reductions, and claims GHG reduction credits from these projects to balance emissions from traditional local government services. For 2021 these projects include a landfill gas collection system, several avoided forest conversion projects and the ecological restoration of Burns Bog. As a result of these credit projects, Metro Vancouver has maintained carbon neutrality for 2021, which is

the third consecutive year that carbon neutrality has been achieved, under the provincial Carbon Neutral Framework.

Regional Clean, Renewable Energy Projects

Metro Vancouver produces, recovers, and uses substantial amounts of clean and renewable energy as part of its operations, which can affect the cost and emissions associated with purchased energy. Although energy recovery and production is not part of Metro Vancouver's core mandate, energy opportunities are examined where there is the potential for regional emissions reductions, renewable energy provision to the region, or significant revenue generation. As part of its *Climate 2050* strategy, Metro Vancouver has developed the draft Energy Roadmap that includes strategies and actions to transition to 100% clean, renewable and resilient energy in the region by 2050; this Roadmap will include regionally significant corporate actions that support this goal.

Metro Vancouver is pursuing a number of projects to produce, recover, and use or sell clean, renewable energy, which include: production of biogas and upgrade of this to renewable natural gas; production of biocrude through hydrothermal processing; electricity generation; alternative fuel recovery from solid waste; and recovery of waste heat from the Waste-to-Energy Facility and sewage collection network. A complete list of projects and opportunities, which are either underway or are being explored, is included in Attachment 1.

ALTERNATIVES

This is an information report. No alternatives are presented.

FINANCIAL IMPLICATIONS

There are no financial implications to this report. Energy purchases and resources associated with corporate energy and GHG reduction actions were included and approved under the 2022 budget. Continued action on energy and GHG reduction will be brought back to the Committee and Board in coordination with departmental budgeting and work planning processes.

CONCLUSION

Metro Vancouver aims to manage both energy and GHG emissions in a manner that balances service quality and reliability, fiscal responsibility, and works towards Metro Vancouver's commitment to reducing corporate emissions, achieving corporate carbon neutrality, and a carbon-neutral region. Metro Vancouver undertakes a range of regionally significant clean, renewable energy projects to work towards these goals. However, energy use and costs, as well as GHG emissions, continue to increase. As part of the implementation of the *Corporate Energy Management Policy* and *Climate 2050*, Metro Vancouver seeks to reduce energy use and costs by setting energy and GHG emissions targets by service area. Reporting on progress toward achieving these targets will be provided at regular intervals.

Attachments

1. "Metro Vancouver's Annual Corporate Energy and GHG Emissions Management Report: 2017 to 2021", dated, July 15, 2022
2. "Metro Vancouver's 2021 Carbon Neutral Reporting", dated July 15, 2022

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Metro Vancouver Annual Corporate Energy and Greenhouse Gas Emissions Management Report

2017 to 2021

15 July, 2022

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1. EXECUTIVE SUMMARY

Metro Vancouver and its contractors used more than 1.6 million gigajoules (GJ) of energy in 2021 costing $32.4 million and resulting in 25,300 tonnes of carbon dioxide equivalent (CO_2e) greenhouse gas (GHG) emissions. In 2021, Liquid Waste Services was Metro Vancouver's largest energy user followed by Solid Waste Services, Water Services, Housing, Corporate Services, and Regional Parks. Figure 1, below, summarizes five-year trends in energy use, energy costs, and GHG emissions from energy use.

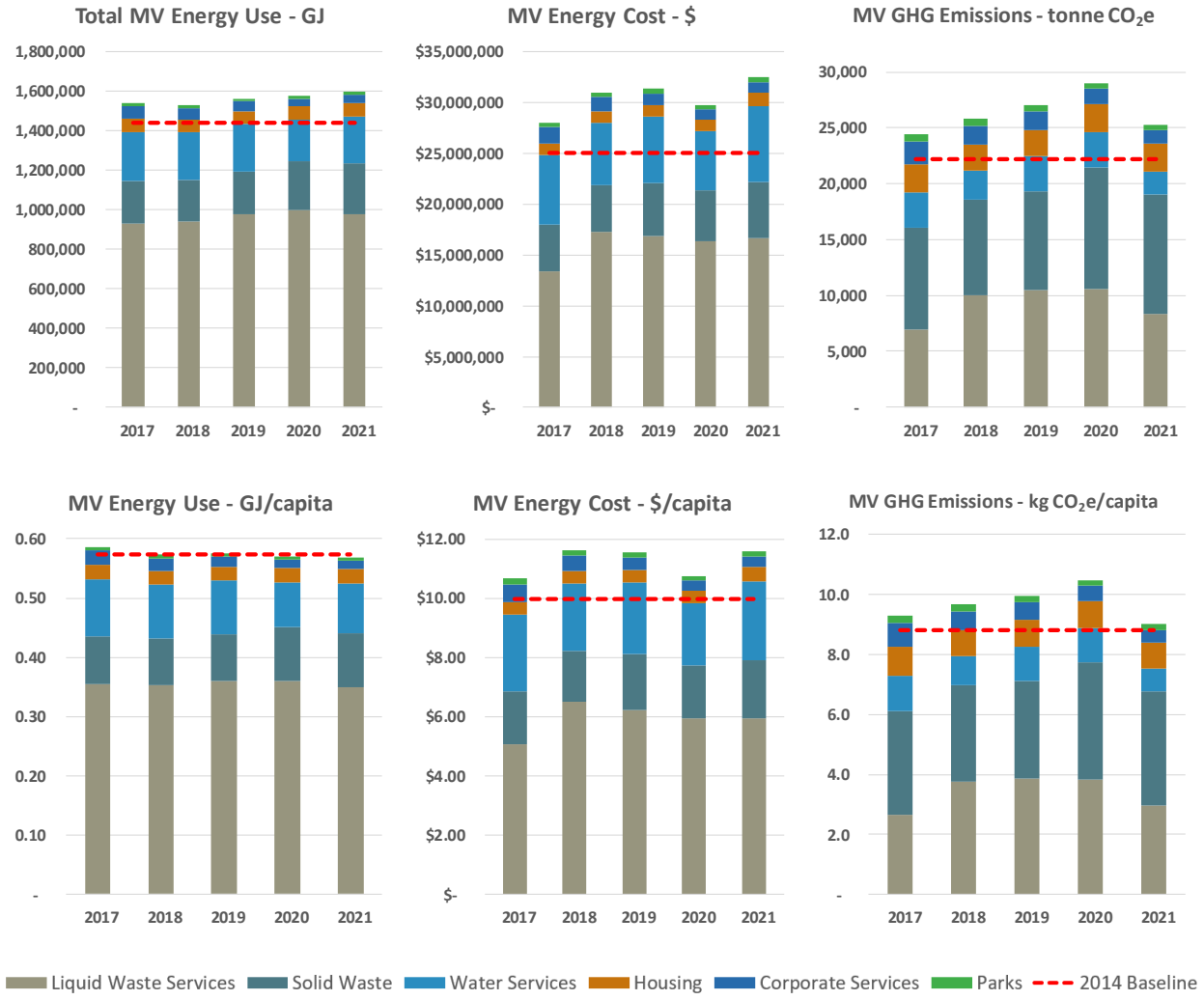

Figure 1: Five-Year Trends by Service Area

As shown in Figure 1, 2021 Corporate energy use has increased by 11% compared to 2014 (Metro Vancouver's energy management baseline year), energy costs have increased by 30%, and GHG emissions associated with energy use have increased by 14%. Much of the cost increase seen from 2017 to 2021 was the result of increased electricity purchases required while the Annacis Island Wastewater Treatment Plant cogeneration engines were taken out of service in late 2017 to enable the cogeneration system upgrade. Commissioning of the new upgraded system began in 2020 and continued to mid-2021. Also

shown in Figure 1 and compared to 2014, per capita energy use has remained relatively constant, per capita energy cost has increased by 16% and per capita GHG emissions have increased by 2%. Variability in GHG emissions is driven largely by increases in Liquid Waste Services purchased electricity and fossil fuel use for residuals management, Solid Waste Services fossil fuel use for Waste-to-Energy Facility operation, and annual changes to the GHG emissions intensity factor for grid electricity.

Energy efficiency projects completed from 2014 through 2021 have contributed to savings of nearly 47,000 GJ per year. Cumulative cost savings from these projects over this period are estimated at $8.5 million and cumulative GHG emissions reductions are 4,564 tonnes CO_2e.

Progress has been made toward implementing corporate policies related to energy use and GHG emissions including the *Corporate Energy Management Policy*, the *Sustainable Infrastructure and Buildings Policy*, the suite of *Asset Management* policies, and development of the *Climate 2050* Roadmaps. Development of a Corporate Strategic Energy Management Plan including energy targets and establishing corporate GHG targets is underway for all service areas and is expected to be complete in 2022.

As part of the Climate 2050 Strategy, which commits to achieving a carbon neutral, resilient region by 2050, Metro Vancouver is committed to tracking and reporting its corporate GHG emissions, and working towards corporate carbon neutrality. In 2021, Metro Vancouver implemented emissions reduction projects to maintain carbon neutrality status for its delivery of traditional local government services, as defined in the provincial Carbon Neutral Framework for local governments, which was established under the BC Climate Action Charter.

2. INTRODUCTION

Energy plays a fundamental role in allowing Metro Vancouver to provide services to the region. Energy use represents one of Metro Vancouver's largest operating costs – totaling over $32 million in 2021 – and is Metro Vancouver's second-largest[1] source of presently-quantified corporate greenhouse gas (GHG) emissions. In 2021, Metro Vancouver used more than 1,500,000 gigajoules (GJ) of energy including both purchased energy – such as electricity, natural gas, diesel, gasoline, propane, and steam – and energy that Metro Vancouver self-generated. In addition to the energy that Metro Vancouver uses, it also generates and exports electricity at its Waste-to-Energy facility through combustion of municipal solid waste. This electricity is sold to BC Hydro. Liquid Waste Services has invested in a new biogas upgrading system and began selling renewable natural gas to FortisBC in 2021.

Effective energy and GHG emissions management is therefore critical to demonstrating Metro Vancouver's corporate fiscal responsibility and commitment to achieving corporate carbon neutrality.

This report presents Metro Vancouver corporate trends in energy use, energy cost, and GHG emissions for each service area from 2017 through 2021. All costs presented are actual costs in the year that they were incurred. Service areas examined in this report comprise Liquid Waste Services, Water Services, Solid Waste Services, Metro Vancouver Housing Corporation (Housing), Regional Parks (Parks), and Corporate Services. The report also provides updates on progress that Metro Vancouver has made in implementing corporate policies related to energy and GHG emissions management and an update on the role that Metro Vancouver staff play in participating in various energy and climate-related corporate initiatives.

[1] GHG emissions from the combustion of municipal solid waste at the Waste-to-Energy Facility are Metro Vancouver's largest source of corporate GHG emissions.

3. ENERGY PRODUCTION/GENERATION[2], USE, COST AND GHG EMISSIONS TRENDS

With the objectives of managing corporate GHG emissions and energy-related operating costs, Metro Vancouver's *Corporate Energy Management Policy* commits the organization to continuously improving the efficiency with which it uses and produces energy. This section summarizes trends in corporate Metro Vancouver energy use, energy costs (both purchased and self-generated), and GHG emissions related to energy use as well as trends in energy production/generation. These trends are compared to data from 2014: the year that the *Corporate Energy Management Policy* was adopted.

3.1 ENERGY UNIT COSTS

Energy costs play a significant role in the analyses and discussions that follow. Energy costs are driven by a combination of energy consumption – which Metro Vancouver can manage by establishing processes to design efficient systems and to operate and maintain those systems for peak efficiency – and energy unit rates over which Metro Vancouver has no control.

On a GJ basis, electricity represented 65% of the energy that Metro Vancouver and its contractors purchased in 2021 followed by fuel for mobile vehicles/equipment (20%), and natural gas for stationary equipment (14%). Small amounts of other stationary fossil fuels (diesel, gasoline, and propane) and steam were also purchased. Table 1 provides trends for aggregate energy unit rates (total cost divided by total energy use) for Metro Vancouver.

Table 1: Aggregate Energy Unit Rates

Metro Vancouver Aggregate Energy Unit Rates ($/GJ)											
	Year						Percent Change Relative to Baseline (2014)				
	Baseline (2014)	2017	2018	2019	2020	2021	2017	2018	2019	2020	2021
Electricity	$ 23.01	$ 26.72	$ 25.19	$ 25.52	$ 26.51	$ 26.04	16%	9%	11%	15%	13%
Stationary Fuels	$ 12.39	$ 9.04	$ 11.04	$ 10.30	$ 11.50	$ 12.86	-27%	-11%	-17%	-7%	4%
Steam	$ 20.43	$ 19.91	$ 20.88	$ 25.20	$ 25.29	$ 26.51	-3%	2%	23%	24%	30%
Mobile Energy	$ 36.28	$ 25.51	$ 32.39	$ 32.78	$ 25.60	$ 31.69	-30%	-11%	-10%	-29%	-13%

Notes:
Decrease (change less than zero)
Increase (change greater than zero)

With electricity representing 65% of energy purchases, electricity unit rates – which have increased by 13% compared to 2014 – largely drive corporate energy cost increases. From 2017 through 2020, fossil fuel unit rates have generally decreased compared to 2014, with the exception of the increase seen in 2021. Only one Metro Vancouver site (Housing's Regal Place) purchases steam, which is generated by Creative Energy using natural gas.

[2] In this report, *energy production* refers to the production of sources of energy (such as biogas produced at wastewater treatment plants) and *energy generation* refers to the conversion of energy sources into usable energy (electricity and heat)

3.2 ENERGY USE, COST, AND GHG EMISSIONS TRENDS BY SERVICE AREA

2021 Energy Use, Cost, and GHG Emissions Distribution by Service Area

Figure 2 presents the distribution of 2021 energy use, energy costs[3], and GHG emissions from energy use amongst all Metro Vancouver service areas. Energy costs presented in this report include costs for purchased energy (by Metro Vancouver and its contractors) as well as maintenance costs Metro Vancouver incurs in maintaining its own energy generation systems. GHG emissions from other sources are discussed in Section 4.

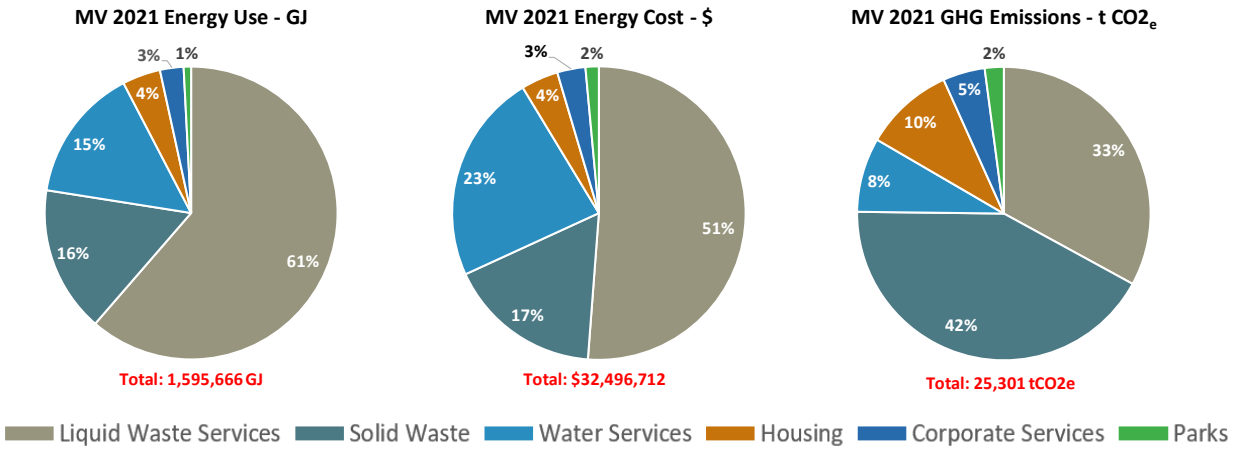

Figure 2: 2018 Energy Use, Cost, and GHG Emissions Distribution by Service Area

In recent years, Provincial guidelines for calculating GHG emissions from electricity use have used GHG emissions intensity factors that reflect only emissions from electricity generated within BC. In 2021, the Climate Action Secretariat announced that local governments will be required to use new annual emissions intensities – going back to 2010 – that also include emissions related to electricity imported into BC. These "Integrated Grid" factors are used throughout this report and have resulted in significantly increasing Metro Vancouver's corporate GHG emissions compared to the earlier reporting protocol. Future Integrated Grid factors will be incorporated into Metro Vancouver's reporting methodology as the Provincial Government updates the factors.

Table 2 provides annual integrated electricity grid GHG emissions intensities used in this report.

[3] All energy costs presented in this report are actual for the year those costs were incurred.

Table 2: Annual Integrated Grid Electricity Emission Intensity Factors

Year	tonnes CO_2e/GWh
2014	31.6
2015	34.2
2016	32.8
2017	31.7
2018	25.3
2019	29.9
2020	40.1
2021	9.7

The significant drop in 2021 relative to previous years is due to two primary changes in the methodology used to determine the intensity factor: a move from a "gross imports" basis to a "net imports" basis and from a 3-year rolling average to a 4-year rolling average. This updated methodology will be used going forward.

In 2021, Liquid Waste Services was the largest corporate energy user followed in order by Solid Waste Services, Water Services, Housing, Corporate Services, and Regional Parks. Energy costs in 2021 followed the same general trends with the exception of Water Services costs exceeding Solid Waste Services costs. GHG emissions intensities (mass of CO_2e emitted per unit of energy used) are greatest for fossil fuels such as natural gas, diesel, gasoline, and propane. In contrast, the majority of grid electricity in British Columbia is hydroelectrically generated and therefore considered a clean, renewable source of energy with low GHG emissions intensity. These relative differences in GHG emissions intensities is the reason that the GHG emissions pie chart shown in Figure 2 appear very different to the Energy Use and Energy Cost pie charts. Liquid Waste Services and Solid Waste Services use large amounts of fossil fuels to transport wastewater treatment residuals (biosolids, grit, and scum) and municipal solid waste, respectively; Solid Waste Services, Housing, and Corporate Services use significant quantities of natural gas. Water Services energy use is predominantly low-emissions – but high cost – electricity plus some fossil fuel use for managing residuals generated through the water treatment process at Seymour Capilano Filtration Plant.

The following sections present five-year trends in energy use, energy cost, and GHG emissions associated with energy use for Corporate Metro Vancouver and for each service area.

Metro Vancouver's Corporate Energy Management Policy commits the organization to continuous improvement in energy performance. Because energy use is often driven by variables outside Metro Vancouver's control, key performance indicators (KPIs) have been established for Corporate Metro Vancouver and for each service area to monitor progress toward meeting the continuous improvement objective. The following sections also present five-year KPI trends for the corporation and for each service area. For each metric, comparisons are drawn against 2014, Metro Vancouver's energy management baseline year.

Corporate Metro Vancouver

This section discusses energy trends for Corporate Metro Vancouver, the aggregate of all services areas: Liquid Waste Services, Solid Waste Services, Water Services, Housing, Parks, and Corporate Services. Figure 3 presents Metro Vancouver corporate five-year trends by service area for energy use, energy cost (including energy production/generation maintenance costs), and GHG emissions from energy use both gross and KPI-normalized; these data are tabulated in Table 3.

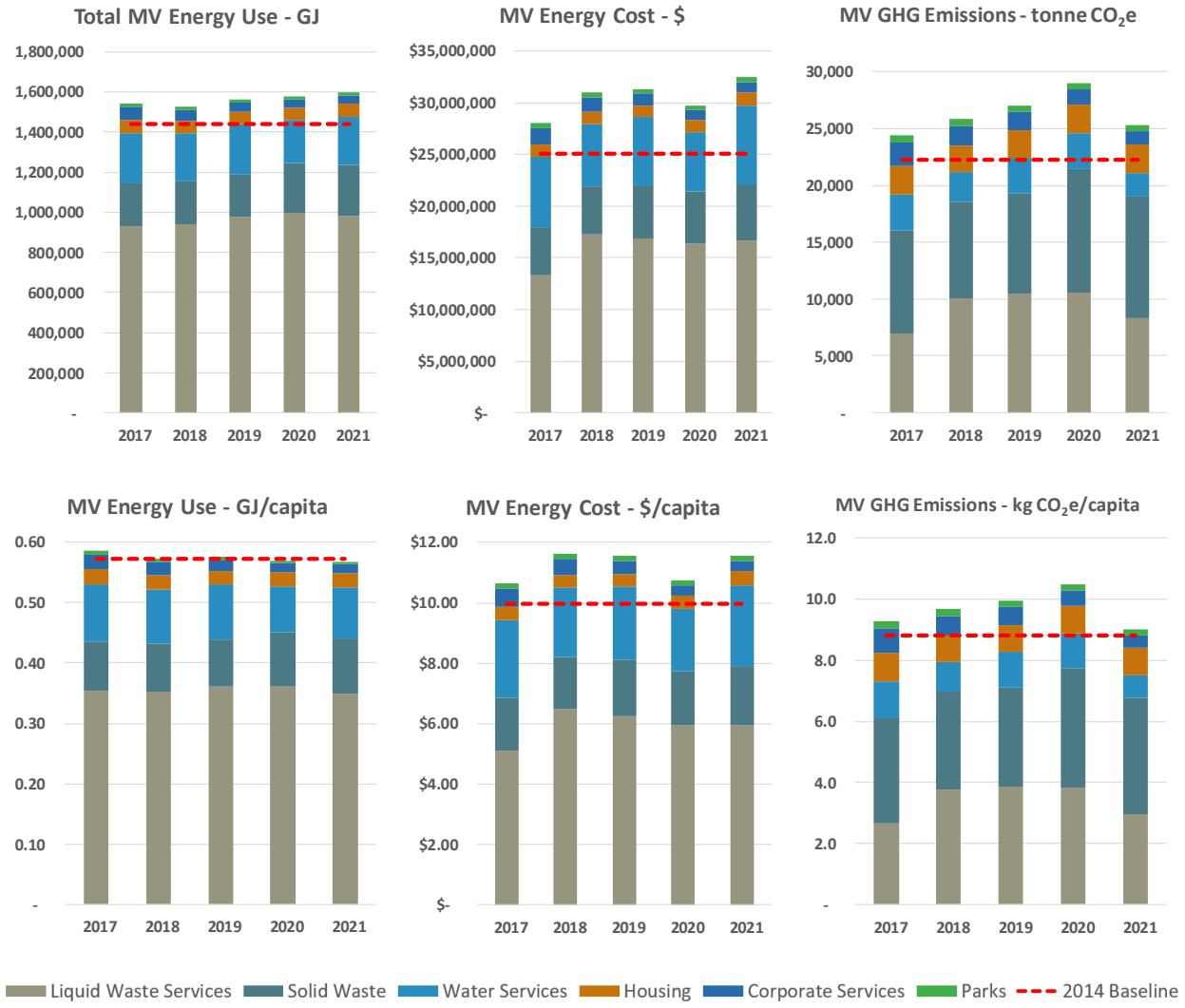

Figure 3: **Five-Year Trends by Service Area**

Table 3 also provides percent changes for each metric compared to 2014, the energy management baseline year. Throughout this report, percent changes highlighted green indicate performance improvements or changes favourable to energy or GHG emissions management (e.g. a decrease in annual wastewater volume requiring treatment); percent changes highlighted red indicate a degradation in performance or changes unfavourable to energy or GHG emissions management (e.g. an increase in annual wastewater volume requiring treatment).

Table 3: Five-Year Energy and GHG Emissions Trends – Corporate Metro Vancouver

Metro Vancouver											
	Year						Percent Change Relative to Baseline (2014)				
	Baseline (2014)	2017	2018	2019	2020	2021	2017	2018	2019	2020	2021
Total Energy Use (GJ)	1,442,301	1,540,707	1,527,555	1,561,772	1,576,526	1,595,666	7%	6%	8%	9%	11%
Total Cost ($)	$ 25,083,905	$ 28,021,285	$ 31,012,517	$ 31,343,756	$ 29,701,540	$ 32,496,712	12%	24%	25%	18%	30%
Total GHG Emissions (t CO2e)	22,225	24,446	25,838	27,014	29,021	25,301	10%	16%	22%	31%	14%
Population	2,517,276	2,629,574	2,666,670	2,714,794	2,766,954	2,807,469	4%	6%	8%	10%	12%
GJ/capita	0.573	0.586	0.573	0.575	0.570	0.568	2%	0%	0%	-1%	-1%
$/capita	$ 9.96	$ 10.66	$ 11.63	$ 11.55	$ 10.73	$ 11.58	7%	17%	16%	8%	16%
kg CO2e/capita	8.8	9.3	9.7	10.0	10.5	9.0	5%	10%	13%	19%	2%

Notes:
Improvement / Favourable (change less than zero)
Degradation / Unfavourable (change greater than zero)

Since 2014, Metro Vancouver has experienced an increase of approximately 11% in energy use with costs increasing by 30% over the same period. Cost increases are largely driven by increases in electricity rates. Much of the cost increase seen from 2017 through to 2021 was the result of increased electricity purchases required when the Annacis Island Wastewater Treatment Plant cogeneration engines were taken out of service in late 2017 to enable the cogeneration system upgrade, the commissioning of which began in 2020 and continued into 2021. Increases in GHG emissions experienced in 2018 through 2021 were driven by these increases in electricity purchases and fossil fuel use by Liquid Waste Services (for transportation of wastewater treatment plant residuals) and Solid Waste Services Waste-to-Energy facility operation. Variability in GHG emissions is also the result of annual changes in electricity GHG emissions intensities.

Corporate Metro Vancouver KPIs for energy use, energy costs, and GHG emissions from energy use are calculated per capita total regional population as summarized in Table 3. Corporate energy use per capita has remained relatively constant since 2014. Reasons for increases in energy cost per capita and GHG emissions per capita are provided in the preceding paragraph.

Liquid Waste Services

Table 4 summarizes Liquid Waste Services gross energy and GHG emissions trends, as well as those trends normalized against the Liquid Waste Services KPI: per megalitre[4] of wastewater collected and treated.

Table 4: Five-Year Energy and GHG Emissions Trends – Liquid Waste Services

Liquid Waste Services											
	Year						Percent Change Relative to Baseline (2014)				
	Baseline (2014)	2017	2018	2019	2020	2021	2017	2018	2019	2020	2021
Total Energy Use (GJ)	948,600	932,641	938,919	977,812	997,371	979,181	-2%	-1%	3%	5%	3%
Total Cost ($)	$ 12,604,704	$ 13,355,039	$ 17,311,459	$ 16,910,763	$ 16,401,565	$ 16,637,560	6%	37%	34%	30%	32%
Total GHG Emissions (t CO2e)	7,591	6,990	10,016	10,500	10,558	8,339	-8%	32%	38%	39%	10%
ML Collected & Treated	440,763	449,542	455,545	434,466	459,118	451,732	2%	3%	-1%	4%	2%
GJ/ML Collected & Treated	2.15	2.07	2.06	2.25	2.17	2.17	-4%	-4%	5%	1%	1%
$/ML	$ 28.60	$ 29.71	$ 38.00	$ 38.92	$ 35.72	$ 36.83	4%	33%	36%	25%	29%
kg CO2e/ML	17.2	15.5	22.0	24.2	23.0	18.5	-10%	28%	40%	34%	7%

Notes:
Improvement / Favourable (change less than zero)
Degradation / Unfavourable (change greater than zero)

As Metro Vancouver's largest energy user, Liquid Waste Services significantly influences overall Metro Vancouver energy and GHG emissions trends. Over the period of 2017 through 2021, Liquid Waste Services experienced average increases in energy use, energy costs, and GHG emissions associated with

[4] One megalitre equals one million litres

energy use of 2%, 28%, and 2%, respectively. Significant Liquid Waste Services energy cost increases are predominantly the result of increasing purchased electricity use coupled with increasing electricity unit rates. Since the late 1990s, Annacis Island Wastewater Treatment Plant has used biogas produced in the wastewater treatment process to power engines that cogenerate electricity and heat for use in the plant. In December 2017, the cogeneration system was taken out of service to allow the installation of new engines and generators with significantly higher cogeneration capacity. The cogeneration system remained out of service for the duration of 2018 and 2019. Since the cogeneration system was decommissioned, electricity that would have been generated on-site had to be purchased from BC Hydro. This was a significant contributor to the cost increases seen in 2017 through 2021. Commissioning of the new cogeneration system began in the spring of 2020 and continued into 2021. The Iona Island cogeneration system experienced sporadic downtime in 2020 and 2021, which also contributed to increased electricity purchase costs in those years. The cogeneration issues have since been resolved.

Increases in GHG emissions that began in 2018 and continued through 2020 are primarily a result of increased use of fossil fuels for transportation of the historic stockpile of land-dried biosolids at Iona Island Wastewater Treatment Plant to beneficial use sites and landfill for non-conforming materials. This work will continue for several more years until the stockpile is removed in preparation for the secondary upgrade of the treatment plant. As a result of the Annacis Island cogeneration engines being taken out of service in December 2017, GHG emissions from Annacis Island electricity purchases also contribute significantly to this trend.

Over the period of 2017 through 2021, average increases in energy use per megalitre treated, energy costs per megalitre treated, and GHG emissions associated with energy use per megalitre treated were 0%, 25%, and 20%, respectively. The average increase in the volume of wastewater collected and treated over the same period was 2%.

Solid Waste Services

Solid Waste Services is Metro Vancouver's second largest energy user in 2021. Table 5 summarizes Solid Waste Services gross energy and GHG emissions trends, as well as those trends normalized against the Solid Waste Services KPI: per tonne of municipal solid waste disposed.

Table 5: Five-Year Energy and GHG Emissions Trends – Solid Waste Services

Solid Waste Services												
	Year						Percent Change Relative to Baseline (2014)				
	Baseline (2014)	2017	2018	2019	2020	2021	2017	2018	2019	2020	2021
Total Energy Use (GJ)	192,026	212,532	214,401	213,564	250,156	257,372	11%	12%	11%	30%	34%
Total Cost ($)	$ 5,246,106	$ 4,631,611	$ 4,580,528	$ 5,116,817	$ 4,994,201	$ 5,511,659	-12%	-13%	-2%	-5%	5%
Total GHG Emissions (t CO2e)	7,570	9,042	8,593	8,788	10,854	10,685	19%	14%	16%	43%	41%
Mass Disposed (tonnes)	542,477	590,002	590,805	577,950	572,222	589,929	9%	9%	7%	5%	9%
GJ/tonne disposed	0.35	0.36	0.36	0.37	0.44	0.44	2%	3%	4%	23%	23%
$/tonne disposed	$ 9.67	$ 7.85	$ 7.75	$ 8.85	$ 8.73	$ 9.34	-19%	-20%	-8%	-10%	-3%
kg CO2e/tonne disposed	14.0	15.3	14.5	15.2	19.0	18.1	10%	4%	9%	36%	30%

Notes:

Improvement / Favourable (change less than zero)

Degradation / Unfavourable (change greater than zero)

Mass disposed data in Table 5 includes garbage and organics. Solid Waste Services energy use, cost and CO2 emissions related to fuel use have stayed flat since 2017 except for impacts of increased natural gas use at the Waste-to-Energy Facility starting in 2018 and increasing in 2020. Increased natural gas use at the Waste-to-Energy Facility is the result of changes to regulatory requirements for the facility in the 2016 Provincial Operational Certificate that required larger natural gas burners to meet response limit

requirements during periods of volatile fuel and during start-up and shut-down to maintain the temperature in the furnace to ensure complete combustion. Comparisons of emissions with the 2014 baseline year are challenging as Metro Vancouver entered into new contracts in 2017 for operation of recycling and waste centres as well as waste transportation that used different basis of calculation to determine GHG emissions and energy use.

Water Services

Table 6 summarizes Water Services gross energy and GHG emissions trends, as well as those trends normalized against the Water Services KPI: per megalitre of drinking water treated and delivered.

Table 6: Five-Year Energy and GHG Emissions Trends – Water Services

Water Services											
	Year						Percent Change Relative to Baseline (2014)				
	Baseline (2014)	2017	2018	2019	2020	2021	2017	2018	2019	2020	2021
Total Energy Use (GJ)	181,141	250,564	240,304	246,415	211,273	237,266	38%	33%	36%	17%	31%
Total Cost ($)	$ 4,564,972	$ 6,831,447	$ 6,091,365	$ 6,602,055	$ 5,762,478	$ 7,529,294	50%	33%	45%	26%	65%
Total GHG Emissions (t CO2e)	2,698	3,183	2,560	3,171	3,206	2,074	18%	-5%	18%	19%	-23%
ML Treated & Delivered	381,261	389,177	389,800	383,400	378,734	391,709	2%	2%	1%	-1%	3%
GJ/ML Treated & Delivered	0.475	0.64	0.62	0.64	0.56	0.61	36%	30%	35%	17%	27%
$/ML	$ 11.97	$ 17.55	$ 15.63	$ 17.22	$ 15.22	$ 19.22	47%	31%	44%	27%	61%
kg CO2e/ML	7.1	8.2	6.6	8.3	8.5	5.3	16%	-7%	17%	20%	-25%

Notes:
Improvement / Favourable (change less than zero)
Degradation / Unfavourable (change greater than zero)

Water Services was Metro Vancouver's third-largest energy user in 2021. Over the period of 2017 through 2021, Water Services experienced average increases in energy use, energy costs, and GHG emissions associated with energy use of 31%, 44%, and 5%, respectively. Increases in energy use and energy costs compared to 2014 are largely attributed to the completion of the Twin Tunnels in early 2015. Prior to 2015, approximately 17% of water delivered to member jurisdictions originated from Capilano Lake and was treated by chemical disinfection but not filtration. Since the completion of the Twin Tunnels, Capilano Lake water is pumped by the Capilano Raw Water Pump Station (CRWPS) to Seymour Capilano Filtration Plant (SCFP) where it is filtered and disinfected. Changes in GHG emissions are largely driven by annual variability in grid electricity GHG emissions intensities.

Over the period of 2017 through 2021, average increases in energy use per megalitre treated, energy costs per megalitre treated, and GHG emissions associated with energy use per megalitre treated were 29%, 42%, and 4%, respectively. The average increase in the volume of drinking water treated and delivered over the same period was 1%.

Housing

Table 7 summarizes Housing gross energy and GHG emissions trends and those trends normalized against the Housing KPI: per million square metres of conditioned floorspace per heating degree day (HDD)[5].

[5] The heating degree day (HDD) is the recognized energy management metric used to quantify the energy required to heat a building. It is the number of degrees that a day's average temperature is below 18 °Celsius. Annual HDD is the summation of daily HDDs over the course of a year.

Table 7: Five-Year Energy and GHG Emissions Trends – Housing

Housing											
	Year						Percent Change Relative to Baseline (2014)				
	Baseline (2014)	2017	2018	2019	2020	2021	2017	2018	2019	2020	2021
Total Energy Use (GJ)	66,969	66,785	62,263	61,917	63,965	67,232	0%	-7%	-8%	-4%	0%
Total Cost ($)	$ 1,133,904	$ 1,157,065	$ 1,129,645	$ 1,110,182	$ 1,161,536	$ 1,331,473	2%	0%	-2%	2%	17%
Total GHG Emissions (t CO2e)	2,490	2,496	2,357	2,365	2,476	2,500	0%	-5%	-5%	-1%	0%
Million m^2*HDD	750	833	774	810	787	820	11%	3%	8%	5%	9%
kJ/(m^2*HDD)	89.283	80.18	80.47	76.45	81.30	82.00	-10%	-10%	-14%	-9%	-8%
$/(million m^2*HDD)	$ 1,511.71	$ 1,389	$ 1,460	$ 1,371	$ 1,476	$ 1,624	-8%	-3%	-9%	-2%	7%
g CO2e/(m^2*HDD)	3.3	3.00	3.05	2.92	3.15	3.05	-10%	-8%	-12%	-5%	-8%

Notes:
Improvement / Favourable (change less than zero)
Degradation / Unfavourable (change greater than zero)

Since 2014, Housing has made significant investments in energy-efficient condensing natural gas space heating and domestic hot water heating equipment, low-carbon electric make-up air units, building envelope upgrades at two sites, targeted window replacements, LED lighting efficiency upgrades, and laundry appliance efficiency improvements. Additional natural gas savings have been realized through tenant energy awareness campaigns conducted at eleven Housing sites. These investments have translated into the performance improvements noted in Table 7. The 2020 and 2021 increases in energy use, energy cost, and GHG emissions are partially a result of completing and opening Heather Place A, which uses natural gas for space heating and domestic hot water heating.

Corporate Services

Corporate Services includes Corporate Safety, Human Resources, Fleet Management, and Corporate Facilities. Throughout this report, energy use, energy costs, and GHG emissions associated with energy use specific to fleet vehicles and equipment have been allocated to individual service areas where specific vehicles and equipment are assigned to those service areas. Energy data for vehicles and equipment that are not assigned to individual departments (pool vehicles and loaner vehicles, for example) are reported in Corporate Services. Table 8 summarizes Corporate Services gross energy and GHG emissions trends and those trends normalized against the Corporate Services KPI: per capita regional population.

Table 8: Five-Year Energy and GHG Emissions Trends – Corporate Services

Corporate Services											
	Year						Percent Change Relative to Baseline (2014)				
	Baseline (2014)	2017	2018	2019	2020	2021	2017	2018	2019	2020	2021
Total Energy Use (GJ)	36,556	62,961	56,933	48,972	41,145	41,546	72%	56%	34%	13%	14%
Total Cost ($)	$ 872,617	$ 1,576,220	$ 1,424,627	$ 1,170,396	$ 968,381	$ 1,010,175	81%	63%	34%	11%	16%
Total GHG Emissions (t CO2e)	1,080	2,072	1,679	1,628	1,379	1,173	92%	55%	51%	28%	9%
Population	2,517,276	2,629,574	2,666,670	2,714,794	2,766,954	2,807,469	4%	6%	8%	10%	12%
GJ/capita	0.015	0.02	0.02	0.02	0.01	0.01	65%	47%	24%	2%	2%
$/capita	$ 0.35	$ 0.60	$ 0.53	$ 0.43	$ 0.35	$ 0.36	73%	54%	24%	1%	4%
kg CO2e/capita	0.4	0.8	0.6	0.6	0.5	0.4	84%	47%	40%	16%	-3%

Notes:
Improvement / Favourable (change less than zero)
Degradation / Unfavourable (change greater than zero)

From the time that Metro Vancouver purchased Metrotower III as its new Head Office building in January 2016, until the former two Head Office buildings were sold in early 2019, Metro Vancouver operated all three buildings. This is the primary reason for the significant increases in all Table 8 indicators up to 2018. Following the sale of the former Head Office buildings in early 2019 and completion of energy efficiency improvements late in 2018 at Metrotower III, energy and GHG emissions trends improved in 2019 but increased in 2020 and 2021 as a result of energy use associated with increased ventilation rates in Metrotower III during the COVID-19 pandemic.

Regional Parks

Table 9 summarizes Regional Parks gross energy and GHG emissions trends and those trends normalized against the Regional Parks KPI: per capita regional population.

Table 9: Five-Year Energy and GHG Emissions Trends – Regional Parks

Parks											
	Year						Percent Change Relative to Baseline (2014)				
	Baseline (2014)	2017	2018	2019	2020	2021	2017	2018	2019	2020	2021
Total Energy Use (GJ)	17,008	15,224	14,736	13,092	12,615	13,069	-10%	-13%	-23%	-26%	-23%
Total Cost ($)	$ 531,123	$ 469,903	$ 474,892	$ 433,542	$ 413,380	$ 476,549	-12%	-11%	-18%	-22%	-10%
Total GHG Emissions (t CO2e)	797	663	632	562	549	529	-17%	-21%	-29%	-31%	-34%
Population	2,517,276	2,629,574	2,666,670	2,714,794	2,766,954	2,807,469	4%	6%	8%	10%	12%
MJ/capita	6.756	5.79	5.53	4.82	4.56	4.65	-14%	-18%	-29%	-33%	-31%
$/capita	$ 0.21	$ 0.18	$ 0.18	$ 0.16	$ 0.15	$ 0.17	-15%	-16%	-24%	-29%	-20%
kg CO2e/capita	0.3	0.25	0.24	0.21	0.20	0.19	-20%	-25%	-35%	-37%	-40%

Notes:
Improvement / Favourable (change less than zero)
Degradation / Unfavourable (change greater than zero)

Savings shown for all indicators in Table 9 are primarily attributed to fuel reductions for the Parks fleet since 2014 and winter shut-down of the swimming pool at Capilano River Regional Park beginning in 2019.

Corporate Carbon Neutrality

In addition to Metro Vancouver's total corporate GHG emissions of 25,300 tonnes CO_2e presented in this report, "Metro Vancouver's 2021 Carbon Neutral Reporting" (Attachment 2) reports on a subset of energy-related emissions associated with the delivery of "traditional local government services", which excludes emissions such as those from Metro Vancouver Housing services, the Waste-to-Energy Facility, and certain contracted emissions. This scope of services is defined in the provincial Carbon Neutral Framework for local governments, which was established under the BC Climate Action Charter. In 2021, these emissions were 18,102 tonnes CO2e. Metro Vancouver implements a portfolio of non-energy related emission reduction projects to achieve measurable and verifiable regional GHG emissions reductions, and claims GHG reduction credits from these projects to balance emissions from traditional local government services. For 2021 these projects include a landfill gas collection system, several avoided forest conversion projects and the ecological restoration of Burns Bog. As a result of these credit projects, Metro Vancouver has maintained carbon neutrality for 2021, which is the third consecutive year that carbon neutrality has been achieved, under the provincial Carbon Neutral Framework.

3.3 ENERGY PRODUCTION/GENERATION TRENDS BY SERVICE AREA

This section summarizes trends in Metro Vancouver corporate energy production/generation from 2017 through 2021 for the three Metro Vancouver service areas that generate energy: Liquid Waste Services (Metro Vancouver's largest energy generator), Solid Waste Services, and Water Services. Annual trend data is compared against the 2014 energy baseline year: the year that the Corporate Energy Management Policy was adopted. In this report, *energy production* refers to the production of sources of energy (such as biogas produced at wastewater treatment plants) and *energy generation* refers to the conversion of energy sources into usable energy (electricity and heat).

Liquid Waste Services

Liquid Waste Services produces methane-rich biogas – a clean, renewable energy source – at four of its five wastewater treatment plants when volatile suspended solids in the wastewater are metabolized (destroyed) by micro-organisms in the solids treatment processes. Most of the biogas produced is used within the plants for beneficial purposes: to generate heat and/or electricity or to power pumps. Table 10 summarizes biogas uses at the four wastewater treatment plants where biogas is produced. Biogas production in excess of what can be used by each plant is flared to the atmosphere ("wasted") or upgraded and sold to FortisBC (see Sections 6.2 and 6.3).

Table 10: Wastewater Treatment Plant Biogas Uses – Liquid Waste Services

Wastewater Treatment Plant	Biogas Uses
Annacis Island	• Electricity and heat generation in cogeneration engines • Heat generation in boilers
Iona Island	• Electricity and heat generation in cogeneration engines
Lulu Island	• Heat generation in boilers
Lions Gate	• Heat generation in boilers • Wastewater pump engines
Northwest Langley	• This facility does not produce biogas

Table 11 provides trends in total biogas production, percent of biogas used, and biogas production per tonne of volatile suspended solids removed from the wastewater. Most of the energy used by Liquid Waste Services is derived from clean, renewable sources: purchased electricity and energy derived from biogas. Non-renewable (fossil) energy is used primarily to transport wastewater treatment residuals to beneficial use sites and landfills (for material that can't be beneficially used). Table 11 also provides trends in the percentage of energy used by Liquid Waste Services that is derived from renewable sources. Changes are measured relative to the energy management baseline year of 2014: the year that the Corporate Energy Management Policy was adopted.

Table 11: Biogas Production and Utilization Trends – Liquid Waste Services

LIQUID WASTE SERVICES - BIOGAS PRODUCED AND USED											
	Year						Percent Change Relative to Baseline (2014)				
	Baseline (2014)	2017	2018	2019	2020	2021	2017	2018	2019	2020	2021
Mass Volatile Solids Destroyed (tonne)	40,791	41,780	42,940	42,914	40,553	42,153	2%	5%	5%	-1%	3%
Volume Biogas Produced (m3)	33,586,289	33,889,059	35,707,557	37,423,064	35,701,917	34,797,702	1%	6%	11%	6%	4%
Volume Biogas Produced per Mass Volatile Solids Destroyed (m3/tonne)	823	811	832	872	880	826	-1%	1%	6%	7%	0%
Biogas Systems Maintenance Costs[+]	$ 3,515,945	$ 3,308,403	$ 3,858,870	$ 3,957,481	$ 4,371,745	$ 3,953,874	-6%	10%	13%	24%	12%
% Biogas Used	69%	69%	50%	54%	62%	61%	0%	-27%	-22%	-10%	-11%
% Renewable Energy Use	92%	94%	89%	89%	91%	89%	2%	-4%	-3%	-2%	-4%

Notes:

Improvement / Favourable

Degradation / Unfavourable

Renewable Energy** = Electricity Purchased + Biogas-Derived Energy Used

[+] - includes costs to maintain digestion systems, cogeneration equipment, and Lions Gate influent pump engines

Over the period of 2017 through 2021 biogas production and biogas production per mass of volatile solids destroyed have improved on average by 3%. Percent biogas used over the same period has decreased on average by 14%, due to the Annacis Island cogeneration engines being taken out of service in late 2017 and sporadic downtime for the Iona Island cogeneration engines in 2020 and 2021. With commissioning

of the new cogeneration system at Annacis Island complete and the Iona Island cogeneration issued resolved, biogas utilization is expected to increase in 2022.

Costs to maintain Annacis Island digestion and cogeneration systems increased in 2016, 2018, 2019, and 2020. The decrease in percent renewable energy use seen starting in 2018 was primarily the result of increased fossil fuel used for hauling larger quantities of the historic biosolids stockpile in preparation for the upgrade of the Iona Island Wastewater Treatment Plant.

Table 12 provides trends for combined electricity production from biogas at Annacis Island and Iona Island Wastewater Treatment Plants.

Table 12: Electricity Generation from Biogas Trends – Liquid Waste Services

LIQUID WASTE SERVICES - COGENERATION											
	Year						Percent Change Relative to Baseline (2014)				
	Baseline (2014)	2017	2018	2019	2020	2021	2017	2018	2019	2020	2021
Biogas Used in Cogens (m3)	18,679,458	17,316,388	8,024,538	9,003,155	13,052,865	13,433,018	-7%	-57%	-52%	-30%	-28%
Electricity Self-Generated (GJ)	149,610	132,972	61,035	67,673	104,376	130,140	-11%	-59%	-55%	-30%	-13%
Electricity Generated per Volume Biogas Burned (MJ/m3)	8.0	7.7	7.6	7.5	8.0	9.7	-4%	-5%	-6%	0%	21%
Cogen Maintenance Costs*	$1,625,226	$1,860,029	$617,200	$1,179,729	$1,758,149	$1,397,684	14%	-62%	-27%	8%	-14%
Cogen Maintenance Costs per Unit Electricity Generated ($/kWh)	$ 0.039	$ 0.050	$ 0.036	$ 0.063	$ 0.061	$ 0.039	29%	-7%	60%	55%	-1%
Blended BC Hydro Purchase Price+ ($/kWh)	$ 0.075	$ 0.085	$ 0.078	$ 0.076	$ 0.083	$ 0.085	13%	3%	1%	11%	13%

Notes:

Improvement / Favourable

Degradation / Unfavourable

* - Annacis maintenance costs excluded during cogen upgrade (2018 and 2019)

+ - Annual blended rate (energy and peak demand) Iona Island amd Annacis Island WWTPs

Liquid Waste Services, in partnership with BC Hydro, completed a project in 2015 that has allowed additional electricity generation of approximately 12,600 GJ per year from the Iona Island Wastewater Treatment Plant cogeneration engines. This improvement reduces electricity purchases from BC Hydro and results in significantly less flaring of biogas.

The Annacis Island cogeneration engines were out of service from December 2017 through to the spring of 2020 when commissioning of the new engines began. The volume of gas utilized by the cogeneration systems, electricity production, and electricity generated per volume of biogas combusted all began to improve in 2020 as the new Annacis Island cogeneration engines were commissioned. System commissioning was complete by mid-2021. As previously discussed, Iona Island cogeneration system experienced higher than normal downtime in 2020 and 2021 resulting in reduced electricity generation during those years.

Maintenance costs for the Annacis cogeneration system are not included in the table above during the period that the system was out of service for upgrade (2018 and 2019). From 2017 through 2021, cogeneration system maintenance costs per unit of electricity generated were higher than in the baseline year but remained below the blended (including energy and peak demand charges) electricity rate for electricity paid by Iona Island and Annacis Island Wastewater Treatment Plants. This performance metric is expected to improve once the Annacis cogeneration system is fully commissioned.

Solid Waste Services

Since 1988, Solid Waste Services has generated steam, and later electricity, through burning municipal solid waste at its Waste-to-Energy facility that manages roughly a quarter of the region's municipal solid waste. As the waste burns, the hot gases from the combustion process pass into a boiler area where they

heat water-filled tubes. The water boils to become steam while the gas passes through an air pollution control process. The steam powers a turbine to generate electricity. The facility produces enough electricity to power 16,000 homes per year. The electricity is sold to BC Hydro generating more than $7 million in revenue each year. Table 13 summarizes Waste-to-Energy Facility electricity generation trends from 2017 through 2021 with comparisons drawn to the 2014 energy management baseline year.

Table 13: Metro Vancouver Waste-to-Energy Facility Electricity Generation Trends – Solid Waste Services

WTEF ELECTRICITY GENERATION											
	Year						Percent Change Relative to Baseline (2014)				
	Baseline (2014)	2017	2018	2019	2020	2021	2017	2018	2019	2020	2021
Inbound Tonnage (tonne)	275,266	259,747	253,123	253,184	244,362	241,531	-6%	-8%	-8%	-11%	-12%
Electricity Generation (GJ)	537,110	611,018	587,633	621,374	544,558	599,656	14%	9%	16%	1%	12%
Electricity Generation per Tonne Municipal Solid Waste Burned (GJ/tonne)	1.95	2.35	2.32	2.45	2.23	2.48	21%	19%	26%	14%	27%

Notes:
Improvement / Favourable (change greater than zero)
Degradation / Unfavourable (change less than zero)

Tonnage managed by the Waste-to-Energy Facility has decreased compared to 2014 while electricity generation per tonne of municipal solid waste processed has increased compared to 2014. The overall increase in electricity generation with decreasing waste flows can be attributed to multiple factors. A disposal ban on organic materials such as food scraps that Metro Vancouver put in place in January 2015. With organics removed from the Waste-to-Energy process stream, there has been a relative increase in proportion of municipal solid waste of higher heating value which provides more heat when burned. As the boilers are heat-limited, this allows the facility to generate more electricity per tonne of municipal solid waste. The air cooled condenser at the Waste-to-Energy Facility was upgraded in April 2014, this improvement allowed for more overall electrical generation with the same steam flows.

Water Services

The elevations of the Seymour Capilano Filtration Plan and the Coquitlam Water Treatment Plant provide the water transmission system with a significant amount of “free” energy in the form of gravity-generated hydraulic pressure. Using gravity supply, the water utility is able to avoid pumping in much of the transmission system when regional water demands are low enough to allow this practice. Gravity transmission contributes to energy cost savings.

Water Services produces hydroelectricity as treated drinking water flows from Seymour Capilano Filtration Plant to Capilano Energy Recovery Facility where the water turns a turbine and generates electricity. This electricity is used to offset a portion of the purchased electricity required to operate pumps at the Capilano Raw Water Pump Station. Table 14 summarizes trends in Capilano Energy Recovery Facility electricity generation and maintenance costs since the facility was commissioned in February 2016. The table also includes percent changes relative to 2016.

Table 14: Capilano Energy Recovery Facility Electricity Generation Trends – Water Services

CERF ELECTRICITY GENERATION											
	Year						Percent Change Relative to Baseline 2016				
	Baseline 2016	2017	2018	2019	2020	2021	2017	2018	2019	2020	2021
Treated Water Tunnel Flow (ML)	146,745	144,482	156,324	149,521	140,293	132,455	-2%	7%	2%	-4%	-10%
Electricity Generation (GJ)	14,482	10,658	31,217	20,987	24,282	3,976	-26%	116%	45%	68%	-73%
Flow Utilization (MJ/ML)	99	74	200	140	173	30	-25%	102%	42%	75%	-70%
Generation Capacity Utilization[+++]	27%	20%	58%	39%	45%	7%	-26%	116%	45%	68%	-72%
% BC Hydro Generation Requirement	42%	31%	91%	61%	71%	12%	-26%	116%	45%	68%	-73%
Annual Maintenance Costs	$ 48,105	$ 130,594	$ 56,920	$ 138,797	$ 140,988	$ 378,466	171%	18%	189%	193%	687%
BC Hydro Incentive Clawback Payments	$ 45,499	$ 36,643	$ -	$ -	$ -	$ -	-19%	n/a	n/a	n/a	n/a
(O&M Costs* + Clawback) per Unit Electricity Generated ($/kWh)	$ 0.02	$ 0.06	$ 0.01	$ 0.02	$ 0.02	$ 0.34	143%	-72%	2%	-10%	1373%
BC Hydro Purchase Price ($/kWh)	$ 0.04	$ 0.05	$ 0.05	$ 0.05	$ 0.05	$ 0.05	4%	7%	14%	13%	13%

Notes:

Generation Capacity Utilization[+++] - based on 1.7MW generator operating continuously

Improvement / Favourable (change greater than zero)

Degradation / Unfavourable (change less than zero)

O&M Costs* - costs for Operations site visit labour plus all site maintenance

n/a - not applicable

Since its commissioning in 2016, the facility has experienced several operational issues each year except 2018, which have resulted in lower than expected electricity generation. Generation capacity utilization – the percentage of actual electricity generation compared to theoretical generation potential of the 1.7 megawatt (MW) turbine – has ranged from a minimum of 7% in 2021 to a maximum of 58% in 2018. The primary reasons for low generation in 2021 were due to an extended outage of the turbine and generator, initially for planned maintenance, and then due to equipment failure. Water Services is developing operational strategies to maximize the flow passing through the turbine and maintenance strategies to minimize turbine down-time. These strategies are intended to maximize Capilano Energy Recovery Facility electricity generation.

Annual costs for facility maintenance and labour for facility site visits have ranged from a minimum of approximately $57,000 in 2018 to $378,000 in 2021.

Water Services received approximately $2.7 million incentive funding from BC Hydro for the construction of Capilano Energy Recovery Facility. The funding agreement requires Water Services generate 9.5 gigawatt hours of electricity per year (34,200 GJ/year) to avoid clawback payments to BC Hydro (pro-rated to the amount of the shortfall). The shortfalls during the first and second years of operation (2016 and 2017) required Water Services to repay BC Hydro $45,498 and $36,643 in 2019 and 2021, respectively. Clawback payments for generation shortfalls in subsequent years have not yet been determined with BC Hydro.

Electricity generated by Capilano Energy Recovery Facility is used by the Capilano Raw Water Pump Station thus offsetting electricity that would have had to have been purchased from BC Hydro to operate the Pump Station. Considering all costs of generation (annual Operations labour costs, maintenance costs, and BC Hydro clawbacks paid to date), costs per unit electricity generated have remained below the rate that would have been paid to BC Hydro for Pump Station electricity for all years reported except 2021. This analysis does not include debt financing for facility construction.

Water Services recovers energy from water pressure at three additional facilities: turbines at Seymour Falls Dam and Cleveland Dam generate electricity; and water pressure at Cleveland Dam Pump House is used to drive water distribution pumps. Table 15 summarizes energy generation trends at these facilities from 2017 through 2021 with comparisons drawn to the baseline year.

Table 15: Other Energy Generation Trends – Water Services

OTHER ENERGY GENERATION											
	Year						Percent Change Relative to Baseline (2014)				
	Baseline (2014)	2017	2018	2019	2020	2021	2017	2018	2019	2020	2021
Cleveland Dam Pump House (GJ)*	2,574	2,619	2,805	2,771	2,573	2,686	2%	9%	8%	0%	4%
Cleveland Dam Turbine (GJ)+	2,475	2,424	2,518	2,450	2,541	2,399	-2%	2%	-1%	3%	-3%
SFD Turbine (GJ)	1,611	1,696	1,569	1,473	1,561	1,586	5%	-3%	-9%	-3%	-2%
Total	**6,660**	**6,738**	**6,892**	**6,694**	**6,674**	**6,671**	**1%**	**3%**	**1%**	**0%**	**0%**

Notes

* - Calculated pump house flows

+ - Calculated from the turbine generation curve for an average annual Capilano Lake level

Improvement / Favourable (change greater than zero)

Degradation / Unfavourable (change less than zero)

4. OTHER GHG EMISSIONS TRENDS

In addition to GHG emissions originating directly from energy use (discussed above), Metro Vancouver's total corporate GHG emissions also include emissions originating from other sources.

Solid Waste Services' Waste-to-Energy Facility is Metro Vancouver's largest source of quantified non-energy GHG emissions. The facility emits GHGs through the combustion of municipal solid waste and natural gas to fuel the process burners. Emissions from municipal solid waste are classified as either biogenic (derived through the combustion of organic material) or fossil-based (derived through the combustion of fossil-based materials such as plastics and natural gas). Table 16 summarizes the facility's trends in biogenic (organics-derived) and fossil-derived GHG emissions.

Table 16: GHG Emissions from Metro Vancouver Waste-to-Energy Facility – Solid Waste Services

GHG Emissions (t CO2e) - Solid Waste Services Waste-to-Energy Facility											
	Year						Percent Change Relative to Baseline (2014)				
	Baseline (2014)	2017	2018	2019	2020	2021	2017	2018	2019	2020	2021
Inbound Tonnage (tonne)	275,266	259,747	253,123	253,184	244,362	241,531	-6%	-8%	-8%	-11%	-12%
Biogenic Emissions from MSW	158,383	168,676	147,857	152,646	151,015	171,214	6%	-7%	-4%	-5%	8%
Fossil Emissions from MSW	108,171	112,451	122,201	115,154	135,269	131,820	4%	13%	6%	25%	22%
Fossil Emissions from Natural Gas	563	1,032	2,006	2,191	3,416	3,570	83%	256%	289%	507%	534%
Total GHG Emissions	**267,117**	**282,159**	**272,064**	**269,991**	**289,700**	**306,605**	6%	2%	1%	8%	15%
Total GHG Emissions from MSW	**266,554**	**281,127**	**270,058**	**267,800**	**286,284**	**303,034**	5%	1%	0%	7%	14%
Total GHG Emissions per Tonne MSW	**0.97**	**1.09**	**1.07**	**1.07**	**1.19**	**1.27**	12%	11%	10%	22%	31%

Notes:
Improvement / Favourable (change less than zero)
Degradation / Unfavourable (change greater than zero)

Biogenic emissions from waste combustion have decreased three out of the last five years, which can be attributed to the disposal ban on organic materials that Metro Vancouver introduced in 2015. This has led to a corresponding increase in fossil-based emissions from waste combustion as the proportion of non-biogenic material managed at the facility has increased. The increase in natural gas emissions at the Waste-to-Energy Facility is due to the installation of larger capacity gas burners in 2018, as required by the facility's Operational Certificate. These gas burners are used to maintain furnace temperatures during start up and shut down events and any other time as necessary to maintain the secondary combustion zone temperature and control carbon monoxide emissions. Metro Vancouver is working with the Waste-to-Energy Facility operator to ensure natural gas is used only when necessary.

Liquid Waste Services has several other potential sources of other GHG emissions. Of these emissions, those resulting from flared biogas are the only emissions that have thus far been quantified and tracked as summarized in Table 17.

Table 17: GHG Emissions from Wasted Biogas – Liquid Waste Services

LIQUID WASTE SERVICES - GHG EMISSIONS FROM WASTED BIOGAS											
	Year						Percent Change Relative to Baseline (2014)				
	Baseline (2014)	2017	2018	2019	2020	2021	2017	2018	2019	2020	2021
Energy Wasted (GJ)	260,937	244,897	412,074	404,243	313,395	315,842	-6%	58%	55%	20%	21%
GHG Emissions from Energy Wasted (t CO2e)	76	71	120	117	91	92	-6%	58%	55%	20%	21%

Notes:
Improvement / Favourable (change less than zero)
Degradation / Unfavourable (change greater than zero)

The amount of biogas flared and associated GHG emissions increased significantly in 2018 primarily due to the decommissioning of the Annacis Island Wastewater Treatment Plant cogeneration engines in

December 2017 to make way for higher capacity units. Since that time and throughout 2018 and 2019, biogas was used to directly fire the plant's boilers but because boiler demand alone is less than cogeneration engine demand (which supplied both heat and electricity to the plant), more biogas was flared (wasted). These emissions began to decrease in 2020 as commissioning of the upgraded Annacis cogeneration system began. The Iona Island Wastewater Treatment Plant cogeneration system experienced sporadic downtime in 2020 and 2021, which also contributed higher than normal biogas flaring in those years. The Iona cogeneration issues have since been resolved.

Other potential sources of non-energy-related Liquid Waste Services GHG emissions include fugitive emissions of biogas and nitrous oxide – both very potent GHGs – from the collections system, the wastewater treatment process, lagoons, and stockpiles. Although studies were conducted several years ago to estimate GHG emissions from lagoons and stockpiles at the Iona Island Wastewater Treatment Plant, the results were inconclusive due to high levels of uncertainty in measurements and methods used. Similarly, investigations in 2019 by UBC Sustainability Scholars regarding potential sources of fugitive methane and nitrous oxide emissions from Annacis Island Wastewater Treatment Plant demonstrated high uncertainties in estimating fugitive emissions. Liquid Waste Services has not yet quantified emissions associated with refrigerant use and the production, transportation, and use of chemicals used in treatment processes and consumables. Liquid Waste Services will continue to investigate these non-energy GHG emissions sources to determine if any are significant and will develop emissions management strategies for those deemed significant.

Similarly, the remaining service areas (Water Services, Solid Waste Services, Housing, Corporate Services, and Regional Parks) will also investigate other potential sources of GHG emissions and develop management strategies for those found to be significant.

5. CORPORATE POLICY IMPLEMENTATION AND INITIATIVE UPDATE

Since 2014, Metro Vancouver has developed a number of policies and initiatives aimed at managing energy costs and GHG emissions. This section provides an update on Metro Vancouver's progress toward implementing these policies and participating in these initiatives.

5.1 CORPORATE ENERGY MANAGEMENT POLICY

The *Corporate Energy Management Policy* was adopted by the Board in 2014. The policy articulates Metro Vancouver's commitment to continuously improving energy efficiency in its operations, and to continuously improving the efficiency of energy production, generation, and recovery. It also provides direction for staff to put processes in place to effectively manage energy following International Organization for Standardization (ISO) energy management practices. The following table provides a summary of progress Metro Vancouver has made in completing the directives defined in the *Corporate Energy Management Policy*.

Table 18: *Corporate Energy Management Policy* Implementation Status

Policy Directive	Status
• Establish substantiated, realistic, and measurable targets that motivate continuous improvement and are consistent with other objectives.	• In 2018, Housing became the first department to set a GHG emissions reduction target which was published in its 2019 Work Plan. Both GHG emissions reduction targets and energy performance targets have been set in the Housing 10-Year Plan published in 2019. • In 2019, Liquid Waste Services committed to reducing energy use by 10% by 2030 compared to 2019 energy use. • In 2020, all service areas (Liquid Waste Services, Water Services, Solid Waste Services, Corporate Services, and Regional Parks) committed to setting energy and GHG emissions management targets in 2020 and establishing reporting systems to monitor progress toward meeting those targets. This work is ongoing and is expected to be complete in 2022.
• Develop a strategic energy management planning process for achieving these targets using triple bottom line analysis methods.	• Housing undertakes triple bottom line life-cycle cost analyses on all mechanical equipment upgrades. Housing is currently developing a strategic plan to meet the energy and GHG emissions targets set in its 10-Year Plan (2019). • The Corporate Energy Management Steering Committee was re-established in 2022. Representatives from each service area will work with the Energy Management team to develop detailed Strategic Energy Management Plans for each service area. Actions and priorities will be established in reference to the Corporate Energy Management Assessment completed by BC Hydro in early 2022.
• Regularly monitor and report on progress toward meeting these	• Metro Vancouver invested in software as service in 2013 to establish its corporate energy and GHG emissions database.

Policy Directive	Status
targets using a corporate energy and GHG tracking system.	The database will be used to report on progress toward meeting targets as they are established. • Housing is participating in Building Benchmark BC, which encourages building owners and managers to measure and disclose their energy use and GHG emissions. By measuring and comparing this data, resources can be funneled towards the best interventions, in the right buildings, to achieve the highest climate benefit. In parallel, Housing has benchmarked its building portfolio to compare the performance of its existing building stock. • Water Services and Housing report energy use per megalitres treated and GHG emissions respectively on Metro Vancouver's publicly-accessible Performance Monitoring Dashboard. • Liquid Waste monitors energy use through its Balanced Scorecard • Annual reporting to the Climate Action Committee and Board will continue.
• Establish processes that continuously improve Energy Performance in planning, design, procurement, construction, operation, and maintenance of Metro Vancouver assets and services.	• Energy efficiency and GHG emissions management content based on life-cycle options analysis has been included in Metro Vancouver's Project Management Guidelines. • Housing included energy efficiency considerations in the 2018 update of its Unit Standards. • Options analysis processes have been developed for Housing and are being carried out on all mechanical equipment upgrades to identify the most energy efficient and least GHG intensive solutions on a life cycle net present value basis. This process will be formalized once refined. • Housing implements options that improve building energy performance through the guidance of industry standards, BC Energy Step Code, options analysis, energy studies and modelling. • Housing is a partner (along with BC Housing, BC Non-Profit Housing Association, and City of Vancouver) in the Reframed initiative led by Pembina Institute. The initiative is intended to develop a systematic approach to deep energy retrofits in the low income housing sector. • Energy efficiency and GHG emissions have been or are being considered for a number of large Liquid Waste Services and Solid Waste Services capital projects. Formal processes will be developed for capital projects and for operations and maintenance projects. • Energy efficiency and GHG emissions impacts have been considered in development of guidelines for the *Sustainable Infrastructure and Buildings Policy* (discussed in Section 5.4).
• Provide access to energy information and training for staff.	• A corporate energy management communication strategy is under development. The reporting system described above will become an integral component of this strategy. • A Corporate Energy Management Newsletter is published on a periodic basis.

Policy Directive	Status
	• Energy management workshops were delivered for O&M staff at Lulu Island Wastewater Treatment Plant, Seymour-Capilano Filtration Plant, and Coquitlam Water Treatment Plant. • Iona Island and Lulu Island Wastewater Treatment Plants participated in a provincial two-year (2019 to 2021) wastewater treatment cohort funded by BC Hydro. • A formal process for identifying training needs will be initiated. • Housing has included an energy efficiency section in its regular newsletters to tenants and creates energy conservation posters for those residences participating in natural gas conservation competitions. The Metro Vancouver Energy Management Group presents annual energy and GHG emissions performance updates to Housing management and field staff.
• Empower staff to generate solutions that meet the objectives of this policy.	• Liquid Waste Services Management has established Incubator workshops to encourage staff to bring forward ideas for innovation and efficiency that promote continuous improvement. • Tenant energy awareness campaigns conducted at seven Housing sites.

5.2 CARBON PRICE POLICY

In June 2017, the MVRD Board approved Metro Vancouver's Carbon Price Policy. The policy is being incorporated into life cycle cost analyses during Metro Vancouver's capital planning processes, and in particular, into financial business casing tools used for options analyses that concern energy decisions. In light of the announced increases to the carbon tax to $170 per tonne of CO2e emissions by 2030, this policy is being reviewed and an update is planned for early 2023 to reflect the increased carbon tax.

Metro Vancouver's corporate carbon price of $150 per tonne of CO2e emissions was applied to the business case for Liquid Waste Services' effluent heat recovery project at the new North Shore Wastewater Treatment Plant. Heat recovered from treated effluent will provide heating to Lonsdale Energy Corporation's district energy customers, displacing natural gas use and reducing regional GHG emissions. The $17 million cost of investing in these GHG reductions, which equates to approximately $120 per tonne on a life-cycle basis, is lower than the price of carbon established in the Carbon Price Policy and is therefore a cost-effective GHG emission reduction investment.

Housing completes options analyses on all lighting and mechanical equipment (boilers, water heaters, ventilation systems, etc.) replacement projects to identify the option with the lowest life cycle net present value cost while factoring in Metro Vancouver's corporate carbon price. In 2021, Housing expanded this decision-making process to new construction projects such as Welcher Avenue and Kingston Gardens.

Currently-available electric heat pump technology could replace natural gas use and reduce Housing GHG emissions from building energy use by more than 90%. To date, the carbon price has strengthened the already-positive business case for high efficiency natural gas equipment but has not been successful in financially justifying investment in the lowest-carbon electric option.

Solid Waste Services is exploring ways to incorporate carbon pricing into its procurement processes. For a contingency waste disposal hauling project currently underway, the impact of greenhouse gas emissions is being factored into the technical evaluation criteria as part of the request for proposals process. Proponents will be asked to provide emission details associated with their proposed transportation route including tonnes of CO_2e/km and tonnes of particulate matter/km, and will be given weighted scores accordingly. Future procurements could use the carbon price to translate greenhouse gas emissions into a value using the carbon price so they could be evaluated as part of the financial criteria.

The corporate carbon price is also used in fleet procurement decisions discussed in Section 5.3 and sewer heat recovery business-casing discussed in Section 6.2.

5.3 FLEET PLANNING AND ACQUISITION POLICY

In September 2016, the Metro Vancouver Board adopted the *Fleet Planning and Acquisition Policy* aimed at:

- Reducing overall size of fleet
- Rightsizing vehicles (transitioning to smaller, more fuel-efficient vehicles)
- Transitioning to lower-carbon vehicles (reducing GHG emissions per km traveled)

Implementation of the policy is the responsibility of MetroFleet Services. MetroFleet evaluates market options for replacement of aging compact sedans and sport utility vehicles in the context of meeting the objectives of the Fleet Planning and Acquisition Policy. The evaluation involves life-cycle net present value costing (including the Corporate Carbon Price) for purchase and operation of each powertrain option. Makes and models of preferred powertrain options become those recommended in the Low Emissions Vehicle Standards – a hierarchy of most-preferred to least preferred technologies based on GHG emissions – for vehicle replacements made in the following year.

Global positioning systems (GPSs) have been installed in all fleet vehicles. The system is being used to track utilization and could be used in the future to improve route planning and thereby reduce fuel use and GHG emissions.

Table 19 compares trends in Metro Vancouver fleet energy and GHG emissions performance indicators for 2016 (the year the policy was adopted) through 2021.

Table 19: Fleet Energy and GHG Emissions Reduction Performance Trends

Metro Vancouver							Percent Change Relative to Baseline (2016)				
	Baseline (2016)	2017	2018	2019	2020	2021	2017	2018	2019	2020	2021
Fleet Size (no. vehicles)	420	424	452	456	494	476	1%	8%	9%	18%	13%
Percent Fuelled Solely from Fossil Sources	87.4%	85.6%	84.5%	84.9%	83.8%	81.3%	-2%	-3%	-3%	-4%	-7%
Fossil Fuel Use (GJ)	39,953	38,623	37,790	36,645	35,359	34,550	-3%	-5%	-8%	-11%	-14%
Fossil Fuel Cost	1,224,968	1,332,922	1,467,473	1,403,220	1,143,542	1,394,628	9%	20%	15%	-7%	14%
GHG Emissions from Fossil Fuel Use (t CO_2e)	2,722	2,626	2,571	2,492	2,404	2,349	-4%	-6%	-8%	-12%	-14%

Notes:
Improvement / Favourable (change less than zero)
Degradation / Unfavourable (change greater than zero)

Since adoption of the Fleet Planning and Acquisition Policy in 2016, the size of the corporate fleet has increased by 13% while the percentage of vehicles fueled only by fossil fuels has decreased by 7%. Total emissions from the corporate fleet have decreased by 14% since 2016. MetroFleet is working to improve mileage data collection to allow the indicators shown in Table 19 to be normalized against distance traveled.

Other recent MetroFleet activities include:

- Implementation of Fleet standardization contracts with access to Battery Electric Vehicles (BEV)
    - 30 electric pickup trucks on order
    - Preparing orders for electric panel vans
- Feasibility study for electric vehicle infrastructure at Lake City Operations Centre and Production Way Operations Centre in progress
- Onboarding to new fuel agreement with access to renewable fuels in progress
- Compressed Natural Gas Maintenance Facility feasibility study for Lake City Operations Centre

Metro Vancouver is also working to support electric vehicle adoption by staff and the public. This includes developing consistent practices for planning, purchasing, installing, maintaining, and using both fleet and non-fleet electric vehicle infrastructure.

5.4 SUSTAINABLE INFRASTRUCTURE AND BUILDINGS POLICY

In October 2018 the Metro Vancouver Board adopted the Sustainable Infrastructure and Buildings Policy. This policy aims to ensure infrastructure and buildings projects incorporate performance-based considerations for energy efficiency and GHG emissions, sustainable and efficient use of resources, and ecological health. The policy targets Leadership in Energy and Environmental Design (LEED) Gold and BC Energy Step Code Level 3 as minimum standards for occupied buildings and Envision Gold for eligible infrastructure.

In 2021, with support from the Sustainability Innovation Fund, staff in Air Quality and Climate Change and the CAO's Office completed a Sustainable Infrastructure and Buildings Policy Design Guide to provide detailed technical guidelines to be used by Metro Vancouver staff and consulting teams to assist delivering high performance, sustainable infrastructure and building projects. Since the completion of the Guide, staff are now developing instructional materials to train staff on the use of the Guide, which will be largely informed through feedback and learning from using the Guide on real projects. Currently, staff are advising other groups on the Guide and policy outcomes, and are also working with Water Services to pilot the Guide throughout the preliminary design phase of the Cape Horn, Pitt River, and Clayton re-chlorination station upgrades. This phase is anticipated to run from June 2022 to June 2023. Further piloting may also be done on later stages of the project while concurrently applying those learnings to the broader list of capital projects at Metro Vancouver.

Staff intend to bring a report in late 2022 or early 2023 to convey progress and learnings on implementation of the Guide and Policy. The Guide has been published on Metro Vancouver's public website, to inform the public, member municipalities and future consultants of the sustainability requirements that are central to delivering Metro Vancouver's infrastructure and buildings projects.

5.5 SEWAGE AND WASTE: HEAT RECOVERY POLICY

This policy aims to encourage beneficial use of waste heat from Metro Vancouver's liquid waste and solid waste systems, and to maximize greenhouse gas emission reductions by using the heat to displace fossil fuel use, in support of Metro Vancouver's *Climate 2050* strategy. This policy will replace the Liquid Waste Heat Recovery Policy.

In 2014, the GVS&DD Board first adopted an Interim Sewer Heat Policy to enable beneficial use of sewer heat in 2014. There is enough excess heat energy in the liquid waste collection system to heat 100,000 homes throughout the region, which could reduce GHG emissions by nearly 250,000 tonnes per year. The Policy was later amended and renamed to the Liquid Waste Heat Recovery Policy to broaden the scope and to allow for potential GVS&DD investments in sewer heat projects. The most recent proposed amendment will replace the existing policy with an overarching Sewage and Waste: Heat Recovery Policy for liquid waste and solid waste projects. The Policy provides guidelines for greenhouse gas emission reduction calculations, calculation and allocation of environmental attributes, and application of the Carbon Price Policy. The proposed policy was endorsed by the Liquid Waste Committee in July 2022. It will be considered by the Zero Waste Committee in July 2022 as well, and reviewed for potential approval by GVS&DD Board in July 2022.

Policy implementation began in 2016 and continues to develop. The GVS&DD Board has approved capital investments in two sewer/effluent heat projects to date, at the North Shore Wastewater Treatment Plant in coordination with Lonsdale Energy Corporation, and in coordination with the City of New Westminster, for the Sapperton District project, and has approved a project at the Waste-to-Energy Facility in Burnaby in coordination with River District. The GVS&DD Board will be considering a third investment for a project in coordination with the City of Surrey in July 2022. This proposed investment was endorsed by the Liquid Waste Committee in July 2022. Other projects are underway that do not involve a GVS&DD capital investment, including a project in North Richmond. Several additional sewer heat recovery projects are under development or assessment.

5.6 ASSET MANAGEMENT POLICIES

Metro Vancouver delivers its services through an extensive and complex portfolio of assets. In 2018 and 2019, the Board approved separate asset management policies for Liquid Waste Services, Water Services, Solid Waste Services, Housing, and Regional Parks. These policies establish asset management principles and frameworks to balance asset performance, risk, and cost to deliver Metro Vancouver services. Staff are currently developing the methodology to manage these assets in a manner that minimizes asset failure risks and impact to customers, and optimizes the lifecycle value of assets. Energy represents a major component of the life-cycle operating costs and GHG emissions and energy performance can be a measure of asset condition and functionality. Energy will therefore be included in processes for monitoring annual asset performance and operation costs.

5.7 *CLIMATE 2050*

In 2018, Metro Vancouver's Board adopted the *Climate 2050*[1] *Strategic Framework*, and amended it in 2019 to set more aggressive GHG reduction targets. *Climate 2050* aims to demonstrate bold leadership in responding to climate change by ensuring our infrastructure, ecosystems, and communities are resilient to the impacts of climate change, and by pursuing a carbon neutral region by 2050, with an interim target of reducing greenhouse gas emissions by 45% from 2010 levels by 2030. To implement this strategy, Metro Vancouver is currently developing a series of Roadmaps, which will include specific actions to reduce

[1] *Climate 2050* Website: http://www.metrovancouver.org/climate2050

greenhouse gas emissions. Metro Vancouver can set the path towards carbon neutrality, but it will not be able to achieve the targets on its own without significant cooperation, collaboration, and commitment from member jurisdictions, other orders of government, partner organizations, stakeholders, and the public. With its regional partners, Metro Vancouver is developing the first iterations of the *Climate 2050* Roadmaps between 2021 and 2023.

Metro Vancouver is committed to pursuing carbon neutral status on an ongoing basis. Efforts are underway to support this commitment, including the establishment of a Liquid Waste Services department team to develop and implement projects for this purpose. The Liquid Waste Services department team is also developing corresponding plans for addressing and reducing the impacts of climate change on liquid waste infrastructure and operations, to continue to protect human health and the environment.

6. ENERGY- AND CLIMATE-RELATED PROJECTS

As a signatory to the B.C. Climate Action Charter, Metro Vancouver is committed to pursuing carbon neutrality. To help facilitate this goal, the *Corporate Climate Action Plan* was developed and presented to the GVRD Board in 2010. The objective of the Plan is to become a "carbon neutral corporation resilient to the impacts of climate change". This objective is to be achieved through three strategies:

- Reducing energy consumption through efficiencies;
- Transitioning to renewable energy; and
- Maximizing energy recovery.

Aligning with these strategies, this section provides an update regarding energy- and climate-related projects that have been completed by Metro Vancouver from 2014 through 2021.

6.1 ENERGY EFFICIENCY

Table 20 summarizes estimated annual energy savings for energy efficiency projects completed by each department from 2014 through 2021. Annual savings realized in each year perpetuate in subsequent years, summing to the Cumulative Savings shown in Table 20.

Table 20: Energy Efficiency Project Activities by Service Area

Completed Energy Efficiency Projects - Estimated Annual and Cumulative Savings								
Project Completion Year		Liquid Waste Services	Water Services	Solid Waste Services	Housing	Corporate Services	Parks	Metro Vancouver Total
Estimated Annual Savings (GJ)	2014	772	2,703	-	-	-	-	3,475
	2015	-	190	-	-	-	-	190
	2016	4,579	623	-	2,801	-	1,124	9,127
	2017	3,152	818	-	1,338	-	10	5,318
	2018	2,530	1,688	60	525	2,484	572	7,860
	2019	1,293	2,196	-	3,628	738	-	7,856
	2020	-	2,385	-	905	-	-	3,290
	2021	8,855	-	-	863	-	-	9,718
Total		**21,181**	**10,604**	**60**	**10,060**	**3,222**	**1,707**	**46,834**
Cumulative Savings*	Energy (GJ)	109,965	142,650	220	54,168	9,443	8,040	324,486
	Cost	$ 3,116,501	$ 4,143,222	$ 6,568	$ 990,586	$ 186,311	$ 75,874	$ 8,519,062
	GHG Emissions (t CO2e)	1060	1140	2	1692	272	399	4,564

* - cumulative savings for projects completed in 2014 through 2021

From 2014 through 2021, Metro Vancouver completed energy efficiency projects that saved nearly 47,000 GJ per year. Cumulatively these projects have reduced energy use by over 324,000 GJ, energy costs by $8.5 million, and GHG emissions by 4,564 tonnes CO_2e.

Liquid Waste Services

Liquid Waste Services energy efficiency and energy generation improvement projects account for approximately 45% of total Metro Vancouver annual savings from 2014 through 2021. These include both energy efficiency upgrades to capital equipment as well as process optimization projects. Total estimated savings for Liquid Waste Services energy efficiency project completions are 24,200 GJ/year; cumulative savings from 2014 through 2021 are estimated at 113,900 GJ, $3.2 million, and 1,069 tonnes CO_2e. In addition to energy efficiency projects, Liquid Waste Services in partnership with BC Hydro completed a project in 2015 that has allowed an average 7% increase in annual electricity generation compared to the four-year period prior to the change. This improvement reduces electricity purchases from BC Hydro and results in significantly less flaring of biogas.

Water Services

Water Services energy efficiency projects account for approximately 23% of total Metro Vancouver annual savings for the period reported. These projects include both energy efficiency upgrades to capital equipment as well as process optimization projects. Total estimated savings for energy efficiency project completions are 10,600 GJ/year; cumulative savings since 2014 are estimated at 143,000 GJ ($4,1 million) and 102 tonnes CO_2e. In addition to these energy efficiency projects, Capilano Energy Recovery Facility began generating electricity in 2016. From 2016 through 2021, the facility generated over 106,000 GJ of electricity that was used by the Capilano Raw Water Pump Station. The Capilano Energy Recovery Facility is expected to generate 34,200 GJ of electricity per year once operation is fully optimized.

Solid Waste Services

The new United Boulevard Recycling and Waste Centre – opened on March 14, 2022 – includes energy-efficient features such as translucent panels to reduce the need for electrical lighting, LED lighting, air-source heat pumps for space heating, and variable speed ventilation control. Similar energy-efficient features have been included in the design of new Central Surrey Recycling and Waste Centre – expected to be complete in summer 2022 and opening shortly after. This facility is being constructed under the guidance of the Metro Vancouver Sustainable Infrastructure and Buildings Policy.

The non-ferrous recovery system at the Waste-to-Energy Facility recovers non-ferrous metals and additional ferrous metals from the bottom ash by using magnetic and eddy current separation technology. Recovered non-ferrous metals are sold to a third-party metals recycling company. The project was commissioned in the fall of 2018 and recovers approximately 250-500 tonnes per year of non-ferrous metals and an additional 400-500 tonnes per year of ferrous metals. Based on non-ferrous metals recovery data from 2019, 2020, and 2021, project emissions reductions were calculated to be 969 tonnes CO_2e, 755 tonnes CO_2e, and 1,030 tonnes CO2e respectively. Metro Vancouver is working with a consultant for validation of this project plan, and annual third party verification of emissions reductions calculated under the validated plan. Verified emissions reductions can be claimed as carbon credits to offset Metro Vancouver's carbon footprint for "traditional local government services" (see Section 3.2 for more information). These are reported in Metro Vancouver's Carbon Neutral Reporting in the year they are claimed.

The beneficial use of bottom ash from the Waste-to-Energy Facility could result in a reduction of up to 40,000 tonnes per year of material requiring disposal. Implementation of the non-ferrous metal recovery system has improved both the physical and chemical characteristics of the bottom ash, increasing options for beneficial use of the material. At full scale, beneficial use of bottom ash could reduce regional disposal requirements by approximately 5% and reduce greenhouse gas emissions associated with mining and transporting raw materials. Metro Vancouver has engaged Birco Environmental Services to complete pilot testing in support of full scale beneficial use of bottom ash. The pilot test will include processing 1,000 tonnes of bottom ash to remove recyclable metals, crushing, then use as a feedstock in cement production at the Lehigh Cement Plant in Delta BC. Extensive analytical testing of both the ash and the emissions at the cement kiln will be used to evaluate the success of the pilot test.

Solid Waste Services' increased waste diversion efforts and disposal bans for recyclable materials have contributed to increased recycling rates and reduced regional GHG emissions from waste disposal.

Housing

Housing energy efficiency projects account for approximately 21% of total corporate Metro Vancouver annual savings from 2014 through 2021. Total estimated savings for Housing energy efficiency project completions exceed 10,000 GJ per year; cumulative savings since 2014 are estimated at 54,000 GJ ($186,000) with GHG emissions reductions of 272 tonnes CO_2e. Housing has strategically invested in energy-efficient mechanical equipment (boilers and hot water heaters), laundry equipment, and lighting systems. Housing has also taken advantage of FortisBC incentives that installed equipment – free of charge – to reduce residential hot water use.

In its 10-Year Plan (published in 2019) Housing has committed to reducing energy consumption by 25% for major rehabilitations, such as comprehensive building envelope upgrades, and for new construction (from 2015 National Energy Code for Buildings). The 10-Year Plan also commits to reducing GHG emissions in the Housing portfolio by 45% over the next 10 years (compared to 2010 levels).

In 2019 a Sustainability Innovation Fund application was approved for Housing: *Energy Step Code Implementation Impacts for Building Envelope Rehabilitations of Existing Buildings*. The study will investigate the energy use, financial implications, and GHG emissions reduction impacts that the different levels of the BC Energy Step Code could have on rehabilitation of the existing Housing portfolio. Housing intends to engage a consultant in 2022 to begin this work.

The NetZero Feasibility Study for the Welcher Affordable Housing Development was completed in July 2021. The final energy model in the study outlined key design changes that would reduce the operational energy usage from the minimum BC Step Code 3 value of 120 kWh/m^2/year to approximately 60 kWh/m^2/year, and operational GHG emissions from 6.5 $kgCO_2eq/m2$/year to 0.7 $kgCO_2eq/m2$/year. Over a 50-year timeframe, this translates into an overall GHG emissions reduction of approximately 1,700 tonnes of CO_2. The reductions would be achieved through a combination of improvements to the building enclosure design and mechanical and electrical systems, and converting the building's energy source to fully electric from a combination of electricity and natural gas. Following the issue of the report, the MVHC Board approved proceeding with the implementation of the identified energy and GHG emission reduction design measures into the project design. Construction of the Welcher Affordable Housing Development is anticipated to begin in the third quarter of 2022.

With a focus on meeting the energy usage targets of MHV's 10-year plan with an expanding portfolio, while also complying with the requirements of member municipalities and funding partners, current new construction projects are designed with energy efficiency at the forefront. All current development projects in the design phase are pursuing high-performance building envelope designs along with the incorporation of energy efficient mechanical and electrical systems. Current projects are targeting operational energy usage values consistent with BC Energy Step Code level 3 and above.

Corporate Services

Colliers International (Colliers) has managed Metro Vancouver's Head Office building, Metrotower III, since mid-2018. Since then and to the end of 2021, Colliers completed several projects targeting energy efficiency improvements. These include programming adjustments of building systems (heating, ventilation, DDC and lighting controls), upgrading most of the of base building lighting fixtures to LED (office space floors 7-29, stair wells, lobby, parkade, loading bay), and improvement/repairs to the

building's three boilers. Projects completed to the end of 2021 have cumulatively reduced energy consumption by approximately 190 GJ despite building ventilation increases required in response to COVID-19. Collier's water conservation initiatives have reduced building water usage by 7%. Colliers has commissioned a series of studies to identify future projects that reduce energy use and GHG emissions in the future. These include a 2019 solid waste audit, a 2020 low carbon electrification study that is being followed up with an in progress Net Zero Roadmap study. Recommendations to be presented in 2022.

Regional Parks

In the autumn of 2018, Regional Parks began shutting down the pool annually from the end of September through to the beginning of March. Regional Parks also installed programmable thermostats to control electric baseboard heater at its Central Area Office. From 2016 through 2018, these improvements have saved over $25,000 in energy costs and reduced GHG emissions by 145 tonnes CO_2e.

Additional energy efficiency initiatives undertaken by Regional Parks since 2017 include:

- A lawn mowing reduction program at Pacific Spirit, Iona Beach, Derby Reach, and Aldergrove Regional Parks that have reduced diesel use for lawn mowing at these sites by 30 to 50%;
- Mechanical and electrical upgrades to Campbell Valley washroom building that included new LED lights, sensor faucets, lower flow toilets, low VOC paint and programmable ventilation system;
- Efficiency upgrades with LED lighting and double-pane windows at various building locations across the system;
- Energy-efficient design features of the Kanaka Creek Watershed Stewardship Centre that opened in 2017;
- The new Nature Discovery Area at Aldergrove Regional Park, the area includes xeriscape planting and uses site water sources to establish new trees rather than trucking water;
- Service yard replacement projects are underway at Colony Farm (2019), Crippen (2021) and Capilano River (2022) and will include energy-efficient design to replace aged inefficient facilities; and
- Traffic / demand management strategies (including pay parking) have been implemented at several sites to encourage park visitors to carpool and use other means of travel (including public transit). These measures are expected to reduce regional energy use and GHG emissions.

Fleet

Refer to Section 5.3 for a summary of activities related to energy efficiency improvements for the Metro Vancouver fleet.

6.2 ENERGY RECOVERY

Liquid Waste Services

Biogas Production and On-site Utilization

Liquid Waste Services has produced biogas from treatment processes at four of its five wastewater treatment plants for decades and this is the utility's largest existing energy recovery endeavour. The majority of the biogas is used within the four treatment plants to produce heat, electricity, and/or mechanical energy thus offsetting the purchase of fossil natural gas and grid electricity. Pursuing efficiency

improvements in biogas production would increase energy recovery rates and further reduce Liquid Waste Services fossil fuel dependence and grid electricity purchases as well as enhance opportunities for sale of renewable natural gas to mitigate regional GHG emissions.

In 2015, a multi-year project was completed by Liquid Waste Services and BC Hydro that allowed more biogas to be used by the Iona Island Wastewater Treatment Plant cogeneration engines than had been previously permitted. These improvements resulted in annual biogas utilization increasing from an average of 73% for 2010 to 2014 to an average of 77% for 2015 to 2021. This has translated to an increase of 5% in annual electricity generation comparing the same two periods.

Late in 2017, the Annacis Island Wastewater Treatment Plant cogeneration system was taken out of service and the construction phase of upgrading the system with increased generation capacity began. The new cogeneration system is expected to significantly reduce the amount of biogas that needs to be flared (wasted) and is expected to significantly increase electricity generation. Annacis Island Wastewater Treatment Plant will use all electricity generated to reduce electricity purchases from BC Hydro. Commissioning of the new system began in spring 2020 by August 2021 was mostly complete with the system operating reliably. Annacis Island electricity generation for August through December 2021 exceeded the average generation for those months from 2014 through 2017 (the four years preceding the upgrade) by more than 840,000 kWh.

Heat Recovery

The North Shore Wastewater Treatment Plant, currently under construction, will include a systems that will recover heat from the plant effluent for on-site use and for sale to Lonsdale Energy Corporation (LEC), which will significantly reduce the use of fossil natural gas in LEC's district energy system. The effluent heat recovery systems will be commissioned along with the wastewater treatment processes.

In 2020, Metro Vancouver staff determined that recovering heat from the Lulu Island Wastewater Treatment Plant effluent for on-site use is financially viable under certain conditions, which are being pursued. The project proceeded to preliminary design stage in 2021. The Effluent Heat for RNG project at Lulu Island will reduce the amount of biogas required by the plant to meet its thermal demands thus liberating additional quantities of biogas for clean-up and sale to FortisBC as described in Section 6.3.

Sewer heat and effluent heat recovery within the Liquid Waste Services utility have the potential to contribute enough energy to heat approximately 700 high rise buildings in the region. The most promising opportunities to establish financially feasible sewer heat recovery facilities will often be new high-density development close to large sewer lines. In addition to the North Shore Wastewater Treatment Plant effluent heat recovery project described above, several municipalities, including Richmond, New Westminster, and Surrey, are currently planning large district energy systems. In 2020, preliminary design work was initiated for a sewer heat recovery project in north Richmond. The Sewer Heat Policy, which enables sewer heat recovery projects, was revised in 2021 to enable capital investments in such projects. Detailed implementation protocols are under development in 2022. Initial assessments indicate that sewer heat is the most reliable and cost-effective energy source for such systems. Assuming that this heat displaces heat that would have been generated by natural gas, these systems are capable of reducing greenhouse gas emissions by tens of thousands of tonnes per year by 2030, and potentially by hundreds of thousands of tonnes per year by 2050.

Renewable Natural Gas

Biogas produced at wastewater treatment plants can be cleaned up and sold as renewable natural gas (RNG), a renewable source of energy. FortisBC buys RNG and delivers it to a growing market, displacing fossil natural gas use and thus reducing greenhouse gas emissions. One project of this kind began construction in July 2019 at the Lulu Island Wastewater Treatment Plant. The system was tested and commissioned in 2021. Testing and performance improvements continue in 2022. In 2021, Lulu Island sold over 3,600 GJ of RNG to FortisBC for a revenue of over $74,000. This concept could be applied to other new wastewater treatment plants in the region, and could generate revenue and reduce regional greenhouse gas emissions by tens of thousands of tonnes per year. Assessments of the potential for applying this approach at several other Metro Vancouver wastewater treatment plants have been initiated.

Research has shown that the methane content in biogas can be increased by promoting the right microbial communities within the anaerobic digesters that produce the biogas. Given the current and increasing capacity of Metro Vancouver's digesters, a team of innovators are developing a renewable natural gas (RNG) Optimizer for future trials at the Lulu Island Wastewater Treatment Plant. The RNG Optimizer could boost methane generation by 15% to 25%. This will help reduce RNG cleanup requirements and substantially increase generation of GHG credits and revenues from RNG sales. The successful implementation of the RNG Optimizer at wastewater treatment facilities could motivate its application at other anaerobic digestion facilities processing agricultural or food wastes. Bench-scale testing was initiated in 2021 and will continue in 2022. If successful, Metro Vancouver plans to develop and test a pilot-scale unit at Lulu Island.

Biocrude

Metro Vancouver is implementing the world's first hydrothermal processing (HTP) demonstration system integrated with an operating wastewater treatment facility. HTP converts wastewater biomass into biocrude, a renewable and low carbon version of crude oil, while minimizing the production, transportation and disposal of solid residuals from the wastewater treatment process. A local refinery and project partner will process the biocrude into low-carbon transportation fuels such as marine biofuel, sustainable aviation fuel, or biodiesel. The first barrels of biocrude from wastewater are scheduled for production in 2024. This circular economy demonstration could reduce GHG emissions by 80% at equivalent or lower costs than current processes. If the demonstration is successful, HTP systems can be scaled up for Metro Vancouver and other wastewater treatment facilities globally. Further, wet feedstocks from other industries such as municipal solid waste, agriculture, and forestry could provide additional decarbonization opportunities.

Water Services

Water Services has opportunities to recover energy from water flowing in pipes. From its commissioning in 2016 to the end of 2021, Capilano Energy Recovery Facility generated over 106,000 GJ of electricity that was used to offset a portion of electricity purchases to operate the Capilano Raw Water Pump Station.

Staff have investigated additional opportunities to generate electricity at two pump stations and at Seymour Capilano Filtration Plant from Seymour Lake where pressure reduction is required. The BC Hydro Standing Offer Program that would allow generation at the pump stations was suspended indefinitely in

2017, thus temporarily precluding pursuit of these generation opportunities. Further steps related to energy recovery at Seymour Capilano Filtration Plant are on hold until a decision to proceed with full twinning of Seymour Lake water main line is made, which is not anticipated for several years.

The Angus Drive Pressure Reducing Valve Chamber, constructed in 2016, was designed to accommodate the future addition of a turbine to generate electricity as water flows from Kersland Reservoir to the City of Richmond. The project is on the Long Range Plan potentially scheduled for 2028/2029, providing BC Hydro's Standing Offer Program is reinstated.

As part of the long-term Joint Water Use Plan planning process, Water Services is evaluating the viability of using a turbine to produce electricity from water leaving the Capilano Reservoir. The electricity generated could be used at existing water facilities such as Capilano Raw Water Pump Station or sold to BC Hydro if and when its Standing Offer Program is reinstated. In 2023, green hydrogen production may also be investigated as a potential end use for power generation at this site.

Solid Waste Services

The Waste-to-Energy District Energy System will use heat generated at the Waste-to-Energy Facility to provide heat and domestic hot water to nearby residential and commercial developments. According to technical, environmental and economic assessments, a district energy project using heat from the Waste-to-Energy Facility could result in greenhouse gas emission reductions of up to 45,000 tonnes CO_2e per year. Metro Vancouver has signed an Agreement with River District Energy, and is working with the cities of Vancouver and Burnaby to develop access agreements for the necessary infrastructure. A consultant is being engaged to complete detailed design of the project.

The new United Boulevard Recycling and Waste Centre has been designed to reduce heating energy requirements by recovering heat from ventilation air to pre-heat fresh air entering the ventilation system. These features were also included in the new Central Surrey Recycling and Waste Centre.

The Alternative Fuel and Recyclables Recovery Project will involve processing approximately 60,000 tonnes per year (more than 5% of all regional garbage) of small load waste received at Metro Vancouver recycling and waste centres to recover recyclables and alternative fuel. This project will reduce overall waste disposal and eliminate up to 20,000 tonnes per year of regional GHG emissions by using small load-based alternative fuel in place of fossil fuels. Metro Vancouver envisions small loads will be processed at an existing licensed private facility, and is currently obtaining a proposal to undertake this project.

Housing, Corporate Services, and Regional Parks

Housing, Corporate Services, and Regional Parks did not undertake any energy recovery projects during the period reported. However, opportunities for heat recovery have been identified (e.g., recovering heat from ventilation systems) and will be evaluated as part of the capital improvement options analysis process.

6.3 TRANSITION TO RENEWABLE ENERGY

Liquid Waste Services

Liquid Waste Services' primary sources of stationary energy – electricity and biogas – are renewable. Opportunities nonetheless exist to transition from natural gas and mobile fossil fuels. For example, improving efficiencies of biogas production will reduce Liquid Waste Services use of fossil natural gas.

Except during the coldest days in winter, Lulu Island Wastewater Treatment Plant typically produces more biogas than it requires to meet the plant's thermal demands, with excess gas flared to the atmosphere. As mentioned in Section 6.2 (Energy Recovery), construction began in 2019 to build a facility at Lulu Island Wastewater Treatment Plant to purify the excess biogas to pipeline quality and sell the gas to FortisBC as renewable natural gas. Sales of renewable natural gas from Lulu Island to FortisBC began in 2021. The sale of this gas by FortisBC will allow others in the region to transition from fossil natural gas to renewable energy.

Contracted residuals hauling services are Liquid Waste Services' largest users of fossil fuels. As of 2021, the biosolids hauling contractor transitioned from provincially-mandated 4% biodiesel-based fuel to a 5% biodiesel-based fuel. The contractor also has a short term emissions reduction strategy which uses driver performance metrics to moderate driving behaviour and promote fuel efficient driving habits. Future opportunities might exist to transition contractors' vehicles to lower-carbon fuel sources such as hydrogen, electricity, and renewable natural gas.

With respect to transitioning fleet vehicles to lower-carbon fuel sources, the impacts of changes to the Liquid Waste Services fleet are discussed in Section 5.3.

Water Services

Currently, the primary source of stationary energy used by the water utility is purchased hydroelectricity which, in British Columbia, is considered a clean, renewable energy. Water Services fleet and residuals management use fossil fuels to operate vehicles. Transitioning these mobile fuels to less carbon-intensive energy sources may provide opportunities to reduce GHG emissions from these sources. Water Services is also responsible for the operation of a small number of facilities that use fossil natural gas for space heating. The technical and financial feasibility of meeting these space heating loads using electric air-source heat pumps will be investigated in the future. Beyond transitioning the Water Services fleet to less carbon-intensive fuel sources discussed in Section 5.3, no other Water Services projects are currently planned for transition to renewable energy.

As is the case with Liquid Waste Services, contracted residuals hauling services are also the largest users of fossil fuels for Water Services. Opportunities might exist to encourage these contractors to transition to lower-carbon fuel sources.

Solid Waste Services

Fuels used by solid waste transfer service trucks are one of Metro Vancouver's largest users of fossil fuels. Opportunities might exist to encourage these contractors to transition to lower-carbon fuel sources. The operations contractor of the Central Surrey Recycling and Waste Centre will be using an electric front end loader and forklift as part of the operation of that site. In 2023, Metro Vancouver is also switching 25% of

the natural gas used at the Waste-to-Energy Facility to renewable natural gas, reducing GHG emissions by approximately 750 tonnes CO_2e per year.

Electric vehicle charging stations have been included at the new United Boulevard and Central Surrey Recycling and Waste Centres, and are being investigated for the Waste-to-Energy Facility. Natural gas will not be used at either of the two new recycling and waste centres; all heating requirements will be met with electricity.

The CarbMin Lab at the University of British Columbia is a world leader in carbon mineralization research in industrial alkaline waste and geological materials. They are currently evaluating the potential to use a variety of locally-sourced industrial waste materials, including bottom ash, in carbon sequestration. Initial lab work has confirmed reactivity to CO_2 and the CarbMin Lab estimates a capacity of 100+ tonnes CO_2 per year based on 45,000 tonnes of bottom ash. An in-depth assessment of the mineralization potential is underway. Metro Vancouver has an active procurement process to use bottom ash as a feedstock for cement production.

Housing

Housing is historically[6] Metro Vancouver's largest consumer of fossil natural gas, which is used for space heating and hot water heating. As mentioned earlier, electricity in British Columbia is considered a clean, renewable source of energy. Transitioning from natural gas space heating to electric space heating using high-efficiency heat pumps in Housing buildings is seen as one of the most promising opportunities for Housing to transition to renewable energy. Unfortunately, even when factoring in Metro Vancouver's internal carbon price of $150 per tonne of carbon dioxide equivalent emissions, business cases completed to date have shown that it is not yet financially viable to invest in electric heat pump technology for end-of-life mechanical system upgrades. Improved financial incentives from BC Hydro, the Provincial Government, and/or Federal Government could tip the business case to the positive in the future. In the meantime, Housing will continue to evaluate how heat pump technology could play a role in achieving the GHG emissions reduction targets set out in Housing's 10-Year Plan and in Climate 2050. Housing's focus over the next 10 years will be on new construction and major rehabilitation, and this presents a significant opportunity to shift towards electrification to meet its energy and climate objectives. Although transitioning from natural gas to electricity for facility thermal demands will significantly reduce GHG emissions related to these demands, electrification options tend to carry significantly higher capital, operations, and maintenance costs. Metro Vancouver staff are investigating means by which Housing will be able to fund these additional costs to make the transition away from natural gas financially sustainable while keeping rents affordable.

Housing has taken on two projects within the Sustainability Innovation Fund. *Building Resilience: Exploring the Potential of Renewable Energy Building Infrastructure* will investigate types of renewable energy infrastructure for domestic hot water in affordable housing. This study will help Housing meet Metro Vancouver's Climate 2050 strategy target of a 45% reduction in greenhouse gas emissions by 2030. The *Netzero Feasibility Study* for Metro Vancouver Housing's Welcher redevelopment project was completed

[6] For the first time, natural gas use at the Waste-to-Energy exceed natural gas used by the entire Housing portfolio in 2020.

in 2021. The study provided valuable insight into operational building energy usage and greenhouse gas emissions, as well as effective methods to reduce them through the project design. Following the lessons learned from the feasibility study, energy use and greenhouse gas emission reduction measures were incorporated into the design resulting in an expected energy use reduction of 50% and greenhouse gas emission reduction of 87% once the building is in operation. Additional benefits of these design measures will include higher resiliency under changing climate conditions and power interruptions, along with lower energy costs for the tenants. Lessons learned from the Welcher *Netzero Feasibility Study* will be applied to future Housing projects, thereby contributing to improvements in energy use and greenhouse gas emission performance.

Corporate Services

Before sale of the its former Head Office building, Metro Vancouver evaluated the option to relocate the solar thermal collectors on that building to its new Head Office building, but costs to do so could not be justified and the project did not proceed.

Regional Parks

The works yard at Colony Farm Regional Park does not have access to grid electricity. In 2018, Regional Parks installed solar panels at the works yard to generate electricity that, until then, had to be generated by a gasoline-powered generator. The initiative was funded by Metro Vancouver's Sustainability Innovation Program and will reduce GHG emissions and noise pollution associated with generator operation. Staff are monitoring the effectiveness and efficiency of this pilot project to determine whether similar installations are feasible at other park or utility sites that currently rely on gas-powered generators.

Regional Parks has increased use of emissions-free, battery-powered power tools and small equipment (weed-eaters) to reduce fossil fuel use and its associated GHG emissions.

To help reduce regional energy use and GHG emissions, Regional Parks has installed electric vehicle chargers for public and Metro Vancouver fleet use and is bringing forward a clean air incentive for film companies to use existing grid electricity tie-ins to replace diesel generators for local film projects.

Fleet

Refer to Section 5.3 for a summary of activities related to transitioning the Metro Vancouver fleet to less carbon-intensive fuel sources.

7. SUMMARY

Metro Vancouver and its contractors used 1.6 million GJ of energy in 2021 costing $32.4 million and resulting in 25,300 tonnes of carbon dioxide equivalent (CO_2e) greenhouse gas (GHG) emissions. Corporate energy use has increased by 11% since 2014, energy costs have increased by 30%, and GHG emissions associated with energy use have increased by 14%. Per capita energy use has decreased by 1%, per capita energy cost has increased by 16% and per capita GHG emissions have increased by 2%.

Energy efficiency projects completed from 2014 through 2021 have contributed to savings of nearly 47,000 GJ per year. Cumulative cost savings from these projects over this period are estimated at $8.5 million and cumulative GHG emissions reductions are 4,564 tonnes CO_2e.

Progress has been made toward implementing corporate policies related to energy use and GHG emissions including the *Corporate Energy Management Policy*, the *Sustainable Infrastructure and Buildings Policy*, the suite of *Asset Management* policies, and development of the *Climate 2050* Roadmaps. Development of a Corporate Strategic Energy Management Plan including energy targets is underway for all service areas and is expected to be complete in 2022.

For its corporate GHG emissions, Metro Vancouver is committed to tracking and reporting its corporate GHG emissions, and pursuing carbon neutrality status on an ongoing basis.

APPENDIX A

SUPPLEMENTAL DATA

Table A1: Summary of Departmental Energy and GHG Emissions Trends

Metro Vancouver											
	Year						Percent Change Relative to Baseline (2014)				
	Baseline (2014)	2017	2018	2019	2020	2021	2017	2018	2019	2020	2021
Total Energy Use (GJ)	1,442,301	1,540,707	1,527,555	1,561,772	1,576,526	1,595,666	7%	6%	8%	9%	11%
Total Cost ($)	$ 25,083,905	$ 28,021,285	$ 31,012,517	$ 31,343,756	$ 29,701,540	$ 32,496,712	12%	24%	25%	18%	30%
Total GHG Emissions (t CO2e)	22,225	24,446	25,838	27,014	29,021	25,301	10%	16%	22%	31%	14%
Population	2,517,276	2,629,574	2,666,670	2,714,794	2,766,954	2,807,469	4%	6%	8%	10%	12%
GJ/capita	0.573	0.586	0.573	0.575	0.570	0.568	2%	0%	0%	-1%	-1%
$/capita	$ 9.96	$ 10.66	$ 11.63	$ 11.55	$ 10.73	$ 11.58	7%	17%	16%	8%	16%
kg CO2e/capita	8.8	9.3	9.7	10.0	10.5	9.0	5%	10%	13%	19%	2%
Liquid Waste Services											
	Year						Percent Change Relative to Baseline (2014)				
	Baseline (2014)	2017	2018	2019	2020	2021	2017	2018	2019	2020	2021
Total Energy Use (GJ)	948,600	932,641	938,919	977,812	997,371	979,181	-2%	-1%	3%	5%	3%
Total Cost ($)	$ 12,604,704	$ 13,355,039	$ 17,311,459	$ 16,910,763	$ 16,401,565	$ 16,637,560	6%	37%	34%	30%	32%
Total GHG Emissions (t CO2e)	7,591	6,990	10,016	10,500	10,558	8,339	-8%	32%	38%	39%	10%
ML Collected & Treated	440,763	449,542	455,545	434,466	459,118	451,732	2%	3%	-1%	4%	2%
GJ/ML Collected & Treated	2.15	2.07	2.06	2.25	2.17	2.17	-4%	-4%	5%	1%	1%
$/ML	$ 28.60	$ 29.71	$ 38.00	$ 38.92	$ 35.72	$ 36.83	4%	33%	36%	25%	29%
kg CO2e/ML	17.2	15.5	22.0	24.2	23.0	18.5	-10%	28%	40%	34%	7%
Water Services											
	Year						Percent Change Relative to Baseline (2014)				
	Baseline (2014)	2017	2018	2019	2020	2021	2017	2018	2019	2020	2021
Total Energy Use (GJ)	181,141	250,564	240,304	246,415	211,273	237,266	38%	33%	36%	17%	31%
Total Cost ($)	$ 4,564,972	$ 6,831,447	$ 6,091,365	$ 6,602,055	$ 5,762,478	$ 7,529,294	50%	33%	45%	26%	65%
Total GHG Emissions (t CO2e)	2,698	3,183	2,560	3,171	3,206	2,074	18%	-5%	18%	19%	-23%
ML Treated & Delivered	381,261	389,177	389,800	383,400	378,734	391,709	2%	2%	1%	-1%	3%
GJ/ML Treated & Delivered	0.475	0.64	0.62	0.64	0.56	0.61	36%	30%	35%	17%	27%
$/ML	$ 11.97	$ 17.55	$ 15.63	$ 17.22	$ 15.22	$ 19.22	47%	31%	44%	27%	61%
kg CO2e/ML	7.1	8.2	6.6	8.3	8.5	5.3	16%	-7%	17%	20%	-25%
Solid Waste Services											
	Year						Percent Change Relative to Baseline (2014)				
	Baseline (2014)	2017	2018	2019	2020	2021	2017	2018	2019	2020	2021
Total Energy Use (GJ)	192,026	212,532	214,401	213,564	250,156	257,372	11%	12%	11%	30%	34%
Total Cost ($)	$ 5,246,106	$ 4,631,611	$ 4,580,528	$ 5,116,817	$ 4,994,201	$ 5,511,659	-12%	-13%	-2%	-5%	5%
Total GHG Emissions (t CO2e)	7,570	9,042	8,593	8,788	10,854	10,685	19%	14%	16%	43%	41%
Mass Disposed (tonnes)	542,477	590,002	590,805	577,950	572,222	589,929	9%	9%	7%	5%	9%
GJ/tonne disposed	0.35	0.36	0.36	0.37	0.44	0.44	2%	3%	4%	23%	23%
$/tonne disposed	$ 9.67	$ 7.85	$ 7.75	$ 8.85	$ 8.73	$ 9.34	-19%	-20%	-8%	-10%	-3%
kg CO2e/tonne disposed	14.0	15.3	14.5	15.2	19.0	18.1	10%	4%	9%	36%	30%
Housing											
	Year						Percent Change Relative to Baseline (2014)				
	Baseline (2014)	2017	2018	2019	2020	2021	2017	2018	2019	2020	2021
Total Energy Use (GJ)	66,969	66,785	62,263	61,917	63,965	67,232	0%	-7%	-8%	-4%	0%
Total Cost ($)	$ 1,133,904	$ 1,157,065	$ 1,129,645	$ 1,110,182	$ 1,161,536	$ 1,331,473	2%	0%	-2%	2%	17%
Total GHG Emissions (t CO2e)	2,490	2,496	2,357	2,365	2,476	2,500	0%	-5%	-5%	-1%	0%
Million m^2*HDD	750	833	774	810	787	820	11%	3%	8%	5%	9%
kJ/(m^2*HDD)	89.283	80.18	80.47	76.45	81.30	82.00	-10%	-10%	-14%	-9%	-8%
$/(million m^2*HDD)	$ 1,511.71	$ 1,389	$ 1,460	$ 1,371	$ 1,476	$ 1,624	-8%	-3%	-9%	-2%	7%
g CO2e/(m^2*HDD)	3.3	3.00	3.05	2.92	3.15	3.05	-10%	-8%	-12%	-5%	-8%
Corporate Services											
	Year						Percent Change Relative to Baseline (2014)				
	Baseline (2014)	2017	2018	2019	2020	2021	2017	2018	2019	2020	2021
Total Energy Use (GJ)	36,556	62,961	56,933	48,972	41,145	41,546	72%	56%	34%	13%	14%
Total Cost ($)	$ 872,617	$ 1,576,220	$ 1,424,627	$ 1,170,396	$ 968,381	$ 1,010,175	81%	63%	34%	11%	16%
Total GHG Emissions (t CO2e)	1,080	2,072	1,679	1,628	1,379	1,173	92%	55%	51%	28%	9%
Population	2,517,276	2,629,574	2,666,670	2,714,794	2,766,954	2,807,469	4%	6%	8%	10%	12%
GJ/capita	0.015	0.02	0.02	0.02	0.01	0.01	65%	47%	24%	2%	2%
$/capita	$ 0.35	$ 0.60	$ 0.53	$ 0.43	$ 0.35	$ 0.36	73%	54%	24%	1%	4%
kg CO2e/capita	0.4	0.8	0.6	0.6	0.5	0.4	84%	47%	40%	16%	-3%
Parks											
	Year						Percent Change Relative to Baseline (2014)				
	Baseline (2014)	2017	2018	2019	2020	2021	2017	2018	2019	2020	2021
Total Energy Use (GJ)	17,008	15,224	14,736	13,092	12,615	13,069	-10%	-13%	-23%	-26%	-23%
Total Cost ($)	$ 531,123	$ 469,903	$ 474,892	$ 433,542	$ 413,380	$ 476,549	-12%	-11%	-18%	-22%	-10%
Total GHG Emissions (t CO2e)	797	663	632	562	549	529	-17%	-21%	-29%	-31%	-34%
Population	2,517,276	2,629,574	2,666,670	2,714,794	2,766,954	2,807,469	4%	6%	8%	10%	12%
MJ/capita	6.756	5.79	5.53	4.82	4.56	4.65	-14%	-18%	-29%	-33%	-31%
$/capita	$ 0.21	$ 0.18	$ 0.18	$ 0.16	$ 0.15	$ 0.17	-15%	-16%	-24%	-29%	-20%
kg CO2e/capita	0.3	0.25	0.24	0.21	0.20	0.19	-20%	-25%	-35%	-37%	-40%

Notes:

Improvement / Favourable (change less than zero)

Degradation / Unfavourable (change greater than zero)


metrovancouver
SERVICES AND SOLUTIONS FOR A LIVABLE REGION

Metro Vancouver's 2021 Carbon Neutral Reporting

15 July, 2022

As a signatory to the BC Climate Action Charter, and in accordance with requirements of the Climate Action Revenue Incentive Program (CARIP), Metro Vancouver has reported annually on its actions to reduce greenhouse (GHG emissions) and adapt to a changing climate. In 2022, CARIP was replaced with the Local Government Climate Action Program (LGCAP). While no longer a provincial requirement under LGCAP, Metro Vancouver continues to report carbon credits claimed from greenhouse gas (GHG) emissions reduction projects to balance GHG emissions from traditional local government services (a subset of Metro Vancouver's total GHG emissions). This scope of services is defined in the provincial Carbon Neutral Framework for local governments, which was established under the BC Climate Action Charter.

Metro Vancouver's 2021 Carbon Neutral Reporting includes direct and contracted 2021 GHG emissions associated with the delivery of traditional local government services, in line with established provincial reporting practices. This excludes emissions from Metro Vancouver Housing services and the Waste-to-Energy Facility, and certain contracted emissions. To balance these emissions, Metro Vancouver implements a portfolio of emission reduction projects to achieve real, measurable, and verifiable regional GHG emissions reductions, or avoid the release of GHGs altogether. For 2021, these projects include a landfill gas capture project, several avoided forest conversion projects and the ecological restoration of Burns Bog. These emission reductions are claimed by Metro Vancouver as GHG reduction credits. Metro Vancouver reports and tracks projects with GHG emissions reduction credits through the Local Carbon Registry, which includes project planning, and third-party validation and verification documents for each project. As a result of these credit projects, Metro Vancouver has maintained carbon neutrality related to delivery of traditional local government services in 2021, which is the third consecutive year that carbon neutrality has been achieved, under the methodology used.

Metro Vancouver reports on a wider set of energy-related GHG emissions through *Managing Metro Vancouver's Corporate Energy and Greenhouse Gas Emissions (2017 to 2021).* Metro Vancouver also reports on climate action initiatives, and progress on *Climate 2050,* through the *Climate 2050 Snapshot,* which reports on a number of corporate and regional climate action projects implemented in 2021 and 2022 to reduce GHG emissions and support climate adaptation and resilience. Metro Vancouver is also completing public reporting for 2021 to meet LGCAP reporting requirements. These public reports are available to stakeholders and residents to promote awareness of the range of climate actions Metro Vancouver is undertaking.

Metro Vancouver has used *Becoming Carbon Neutral: A Guidebook for Local Governments in British Columbia* and reports on Green Communities Committee-supported Option 1 and Option 2 Projects.

Reporting on Direct GHG Emissions

Direct emissions covered in this report include "traditional local government services" and are primarily related to electricity and fuel use for: Buildings; Wastewater collection and treatment; Water treatment and transmission; and Corporate fleet mobile emission sources.

Reporting on Contracted GHG Emissions

Metro Vancouver's corporate GHG emissions from contracted services included in this report are primarily related to hauling of solid waste, biosolids, and residual material from corporate facilities to final disposal or use sites, such as landfills, beneficial use sites, or biofuel facilities.

Metro Vancouver reports its contracted emissions in accordance with reporting guidance provided by the joint Provincial-UBCM Green Communities Committee's Workbooks and Guidebook. The *"Guidance on Including Contracted Emissions in Local Government Corporate Inventories"* describes what contracts should be included in corporate inventories, what emissions data needs to be collected, and the steps that a local government can undertake to achieve this. It directs local governments to report emissions from new contracts and upon renewal of existing contracts.

Metro Vancouver 2021 Carbon Neutral Reporting

2021 Carbon Emissions

Corporate GHG emissions (in tonnes of carbon dioxide equivalent) from services delivered directly by your local government:	7,086
Corporate GHG emissions (in tonnes of carbon dioxide equivalent) from contracted services:	11,016
TOTAL A: CORPORATE GHG EMISSIONS FOR 2021	**18,102 tCO_2e**

2021 Carbon Reductions

In order to ensure transparency of Metro Vancouver GHG reduction projects, projects are registered to the Local Carbon Registry (https://www.localcarbonregistry.org/), which is a publicly accessible platform that can be utilized by local and regional governments to set up their GHG inventory, and register their emission reduction projects and carbon neutrality progress.

To be carbon neutral, a local government must balance its TOTAL corporate GHG emissions generated in 2021 by one or a combination of the following actions:

- Undertake Green Communities Committee-supported Option 1 Project(s)
- Undertake Green Communities Committee-supported Option 2 Project(s)
- Purchase carbon offsets from a credible offset provider

If applicable, please report the 2021 GHG emissions reductions (in tonnes of carbon dioxide equivalent (tCO_2e)) being claimed from Option 1 GHG Reduction Projects:

OPTION 1 PROJECTS	**REDUCTIONS**
1E Avoided Forest Conversion	
Barker Property	2,786
Thompson Mountain Property	366
Grant Hill (Kanaka Creek Regional Park)	185
Minnekhada Quarry Road (Minnekhada Regional Park)	76
Lane Property (Kanaka Creek Regional Park)	58
TOTAL B: REDUCTIONS FROM OPTION 1 PROJECTS FOR 2021	**3,471 tCO_2e**

If applicable, please report the names and 2021 GHG emissions reductions (in tonnes of carbon dioxide equivalent (tCO2e)) being claimed from Option 2 GHG Reduction Projects:

OPTION 2 PROJECT NAME	**REDUCTIONS**
Coquitlam Landfill Gas Collection System (2019 and 2020)	3,535

Ecosystem Restoration of the Burns Bog Ecological Conservancy Area (2012-2016)[1]	12,647
TOTAL C: REDUCTIONS FROM OPTION 2 PROJECTS FOR 2021	**16,182 tCO_2e**

2021 Carbon Offsets

If applicable, please report the number of offsets purchased (in tonnes of carbon dioxide equivalent (tCO2e)) from an offset provider for the 2021 reporting year:

OFFSET PROVIDER	REDUCTIONS
Not applicable	N/A
TOTAL D: OFFSETS PURCHASED FOR 2021	**0 tCO_2e**

TOTAL REDUCTION AND OFFSETS FOR 2021 (Total B+C+D) = 19,653 tCO_2e

Corporate GHG Emissions Balance for 2021

Your local government's Corporate GHG Emissions Balance is the difference between total corporate GHG emissions (direct + contracted emissions) and the GHG emissions reduced through GCC Option 1 and Option 2 projects and/or the purchase of offsets.

CORPORATE GHG EMISSIONS BALANCE FOR 2021 = (A – (B+C+D)) = -1,551 tCO_2e

If your local government was carbon neutral in 2021, please record any emissions reductions you will be carrying over for future years and the source of the reductions, including the year they were earned (e.g. organics diversion, 2020 100 tCO2e):

	Source of Carryover Emission Reduction	Year Earned	GHG Emissions Reductions
1.	Ecosystem Restoration of the Burns Bog Ecological Conservancy Area	2012-2016	1,551
TOTAL E - BALANCE OF REDUCTIONS ELIGIBLE FOR CARRY OVER TO NEXT YEAR			**1,551 tCO_2e**

References

1. Local Government Climate Action Program
2. BC Carbon Neutral Framework
3. BC Local Carbon Registry

[1] The 12,647 tonnes is a portion of the total GHG emissions reductions credits from the years 2012-2016, and represents credits from the project that were carried forward from the previous year's carbon neutral reporting.

To: Climate Action Committee

From: Laurie Bates-Frymel, Senior Planner
Regional Planning and Housing Services Department

Date: July 29, 2022 Meeting Date: September 9, 2022

Subject: **Climate Change and Habitat Suitability for New Invasive Plants in Metro Vancouver**

RECOMMENDATION

That the Climate Action Committee receive for information the report dated July 29, 2022, titled "Climate Change and Habitat Suitability for New Invasive Plants in Metro Vancouver".

EXECUTIVE SUMMARY

Invasive species can negatively impact property and recreational values, infrastructure, agriculture, public health and safety, and the ecosystem services provided by natural spaces. To improve local understanding of the role climate change plays in spreading invasive plant species, Metro Vancouver partnered with local researchers at the University of British Columbia and Trinity Western University. The research team used local climate projections and a habitat suitability model to predict habitat suitability changes for four high-risk invasive plants. The researchers found that some species will gain and some will lose suitable habitat in the future with climate change, but local efforts should continue to contain or eradicate existing infestations and prevent further introductions. This regional-scale model could be used to assess future habitat suitability for additional invasive species of concern. This research is an example of how Metro Vancouver is supporting member jurisdictions and other land managers with tools to inform risk management, best practices, and coordination of measures to prevent the spread of highly invasive species across the region.

PURPOSE

To provide the Climate Action Committee with an overview of local research supported by Metro Vancouver and other partners to better understand how new high-risk invasive plant species may respond as the climate continues to change.

BACKGROUND

Since 2018, the Climate Action Committee has received staff reports regarding best management practices and guides that have been developed to combat local priority invasive species. Each best management practice guide includes a 'Climate Change Adaptation' section that theorizes how each species may withstand, and possibly thrive, with the changing climate conditions in this region. While these guides solely focus on invasive species that have already established throughout this region, other high-risk species have been detected in adjacent jurisdictions (or within this region in small quantities); these other species also have the potential to spread into, within, and beyond this region.

THE NEED FOR CLIMATE CHANGE AND HABITAT SUITABILITY RESEARCH

Academics recently identified a local knowledge gap regarding whether the future local climate conditions (e.g. an extended growing season, fewer frost days, hotter drier summers, warmer wetter

winters) will change the suitability of local habitats for new high-risk invasive species. In 2019, Trinity Western University professor, Dr. David Clements, presented a proposal to the Regional Planning Advisory Committee – Invasive Species Subcommittee to develop a habitat suitability model that would use Metro Vancouver's downscaled climate change projections to predict how new high-risk invasive plants may spread locally. Recognizing the value of this research for local preventive management, Metro Vancouver became a partner in this study.

RESEARCH TEAM AND PARTNERS

To guide this project, Trinity Western University established a team of non-academic partners (i.e. B.C. Ministry of Agriculture, the Invasive Species Council of Metro Vancouver, and Metro Vancouver) and researchers, including:

- Emma Nikkel, Master's candidate at the University of British Columbia – Researcher;
- Dr. David Clements, Co-Chair, Department of Geography and Environment and Professor, Department of Biology at Trinity Western University – Research team lead and co-supervisor; and
- Dr. Jennifer Williams, Associate Professor, Department of Geography at the University of British Columbia – Co-supervisor

Metro Vancouver provided seed funding to bolster the research team's application for grant funding through the Natural Sciences and Engineering Research Council of Canada Alliance Program.

STUDY OBJECTIVES AND METHODOLOGY

The main objective of this study was to predict how suitable habitats may change due to climate change for four relatively new invasive plants species in the Pacific Northwest region of North America, which is a particularly vulnerable area due to its mild climate. The four invasive plant species that were selected from the Provincial Early Detection and Rapid Response (EDRR) list have varied habitat requirements and invasion status; two are terrestrial plants (i.e. shiny geranium and mouse-ear hawkweed), and two are aquatic plants (i.e. flowering rush and water hyacinth). These species were chosen based on their current limited establishment in the region, and the major impacts they can have in their introduced ranges. Possible impacts are shown in Table 1.

Table 1. Potential impacts from selected invasive plant species

Species	**Potential Impacts (References 1-4)**
Shiny geranium	- Dominates forest understories - Threatens species at risk
Mouse-ear hawkweed	- Degrades forage for livestock; reduces the quality and value of crops - Dominates beneficial native plant communities
Flowering rush	- Impedes the use of shallow waters for recreation, irrigation and industrial activities - Alters sensitive ecosystems
Water hyacinth	- Slows water flow and can block drainage - Can disrupt recreational activities, boating, swimming and fishing

The researchers assembled species occurrence, land cover, human influence, bioclimatic, current climate, and future climate scenarios datasets as inputs to run a habitat suitability model. Changes in suitable habitat for each of the species were projected to the years 2050 and 2080 using IPCC scenarios RCP 4.5, 7.0, and 8.5.

STUDY FINDINGS

Table 2 below summarizes the predicted habitat suitability changes by 2050, and the Attachment provides snapshots of the model outputs for each species. The study's main researcher also provided recommendations regarding current management efforts based in her results.

Table 2. Predicted Habitat Suitability Changes within Metro Vancouver by 2050

Species	Current Suitability	Future Suitability (2050)	Recommendations
Shiny geranium	Many areas in Metro Vancouver are moderately to highly suitable	Likely to **gain** suitable habitat, potential expansion poleward	- Contain 11 existing sites and take measures to prevent further spread*
Mouse-ear hawkweed	Many areas in Metro Vancouver are highly suitable	Likely to **lose** habitat suitability	- Continue with efforts to eradicate 16 existing sites and prevent further spread*
Flowering rush	Eastern areas of Metro Vancouver are highly suitable	Likely to **gain** moderately suitable habitat inland and **lose** suitability in a some areas	- Monitor and take measures to prevent establishment**
Water hyacinth	Moderately to highly suitable in coastal lowland areas of Metro Vancouver	**Remains** moderately to highly suitable in coastal lowland areas	- Eradicate from one existing site - Monitor and take measures to prevent establishment**

*For shiny geranium and mouse-eared hawkweed, it is important to clean clothing, vehicles, and equipment before leaving an infested site.
**For flowering rush and water hyacinth, the main pathway for introduction is nursery sales.

The general conclusion from this research is that invasive plant species are not and will not be impacted by climate change equally; local habitats will likely become more suitable for some of the four species studied, while others will lose suitable habitat. However, local efforts should continue to contain or eradicate existing infestations and measures should also be taken to prevent further introductions.

NEXT STEPS

This study's regional-scale model can be used as a template to model future habitat suitability for additional invasive species of concern. Coupled with local invasive species risk assessments, such modelling will assist member jurisdictions and other local land managers to develop and implement targeted, preventative management strategies.

ALTERNATIVES

As this is an information report, no alternatives are provided.

FINANCIAL IMPLICATIONS

The 2020 and 2021 MVRD Board-approved Regional Planning budgets each included $15,000 to support this research. The research team also secured $57,000 in grant funding for this project from the Natural Sciences and Engineering Research Council of Canada Alliance Program.

CONCLUSION

Metro Vancouver recently supported a team of researchers at the University of British Columbia and Trinity Western University to investigate how climate change could impact the spread of four identified high-risk invasive plants. The results suggest that while some species will gain and some will lose suitable habitat in the future with a changing climate, local efforts should continue to contain or eradicate existing shiny geranium, mouse-ear hawkweed, and water hyacinth infestations. Measures should also be taken to prevent further introductions of those species and new introductions of flowering rush. This research will help member jurisdictions and other land managers to better understand the influence of climate change on the potential spread of highly invasive species across the region, and the need to take targeted, preventative action.

Attachment

Invasive plants in a changing climate – Research Summary

References

1. Shiny Geranium – Provincial Alert
2. Mouse-ear Hawkweed – Provincial Alert
3. Flowering Rush – Provincial Alert
4. Water hyacinth

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Invasive plants in a changing climate

Invasive plants can pose a significant threat to the environment, economy, infrastructure, agriculture, and/or human health. Ongoing climate change impacts (such as a longer growing season, hotter drier summers, warmer wetter winters) will influence the ability of invasive plants to establish and spread across the Metro Vancouver region. Employing a habitat suitability model, researchers at the University of British Columbia and Trinity Western University predicted how the distribution of four high-risk invasive species may evolve under future climate scenarios.

From left to right: shiny geranium (credit: D. Clements), mouse-ear hawkweed (credit: L. Michels), flowering rush (credit: C. Fischer), and water hyacinth (credit: aquaticbiologists.com)

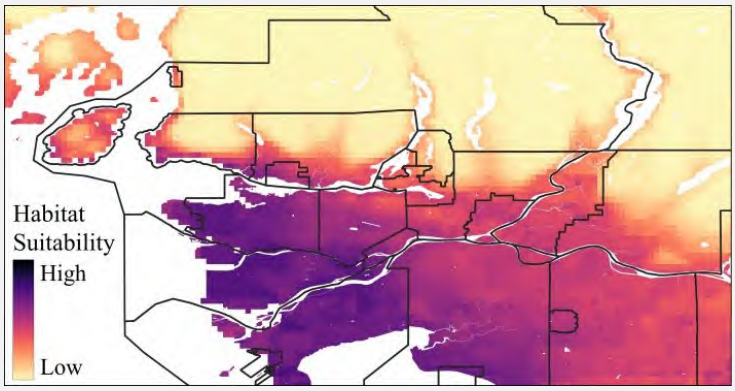
These species appear on the Provincial Early Detection and Rapid Response list, which means the Provincial government regards them as high priority for eradication. With unique habitat requirements and climate tolerances, each species was studied under current and future climate conditions. The Metro Vancouver region was found to be particularly suitable and hence vulnerable to invasion.

Species	Origin	Preferred Habitat	Current MV Sites
Shiny geranium (*Geranium lucidum*)	Temperate Europe and Asia	Terrestrial; shaded conifer and riparian forests	11
Mouse-ear hawkweed (*Pilosella officinarum*)	Temperate and sub-arctic Europe	Terrestrial; exposed grassland, roadsides, and disturbed areas	16
Flowering rush (*Butomus umbellatus*)	Europe and Western Asia	Aquatic; lake shores, slow-moving waterways, ditches, and wetlands	0
Water hyacinth (*Pontederia crassipes*)	Amazon Basin, South America	Aquatic; lakes, ponds, rivers, wetlands, and marshes	1

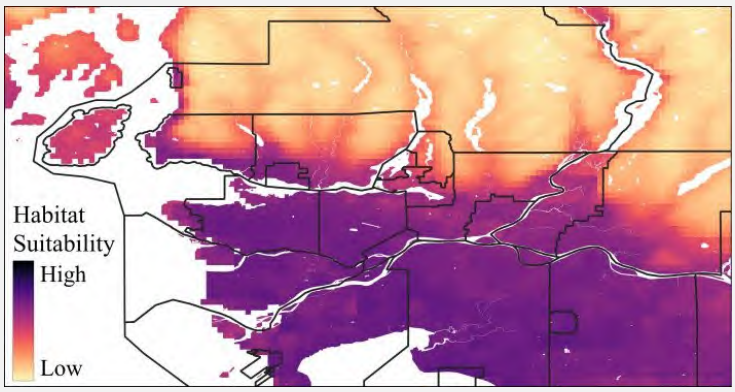
Shiny geranium

Under current climate, the Metro Vancouver region is moderately to highly suitable for the establishment of shiny geranium. In fact, this species has already been found in 11 sites within Metro Vancouver. By 2050, under future climate scenarios, the Metro Vancouver region is predicted to remain or become more highly suitable for invasion.

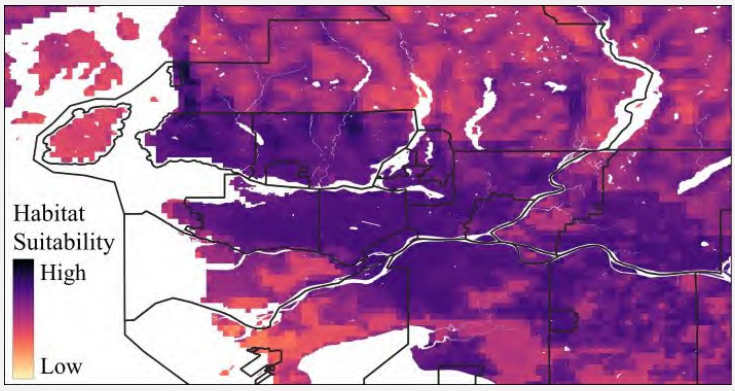
Containment of existing shiny geranium sites and prevention of further spread is critical as climate change may increase the susceptibility of the Metro Vancouver region to further invasion, particularly the eastern portions and areas north of Burrard Inlet. Unfortunately, the Province removed shiny geranium from the early detection and rapid response list in October 2021 and has shifted the management approach from eradication to containment.



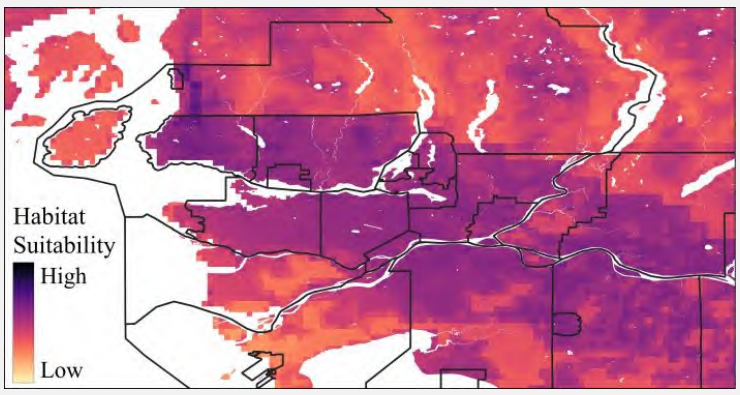
Current suitable habitat



Climate scenario RCP 8.5 2050



Current suitable habitat



Climate scenario RCP 8.5 2050

Mouse-ear hawkweed

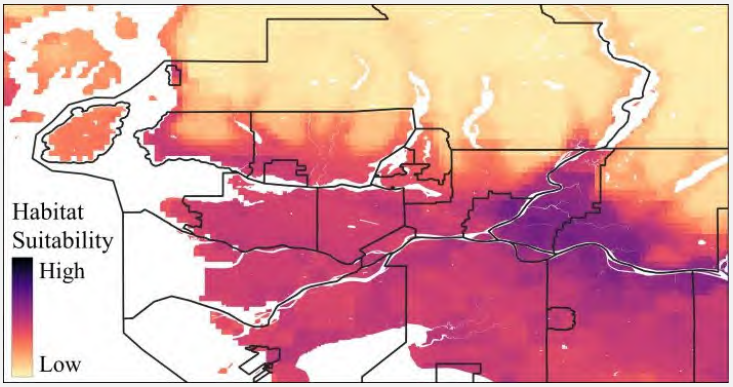
At present, many areas of the Metro Vancouver region are highly suitable for the establishment of mouse-ear hawkweed. There are currently 16 sites with mouse-ear hawkweed in Metro Vancouver, but these sites are actively being contained within the City of Vancouver. By 2050, under future climate scenarios, habitat in Metro Vancouver is predicted to become less suitable for mouse-ear hawkweed. However, populations that have already become established will likely remain viable.

Although mouse-ear hawkweed may not be a high priority species when considering climate change impacts, eradication and prevention efforts should continue.

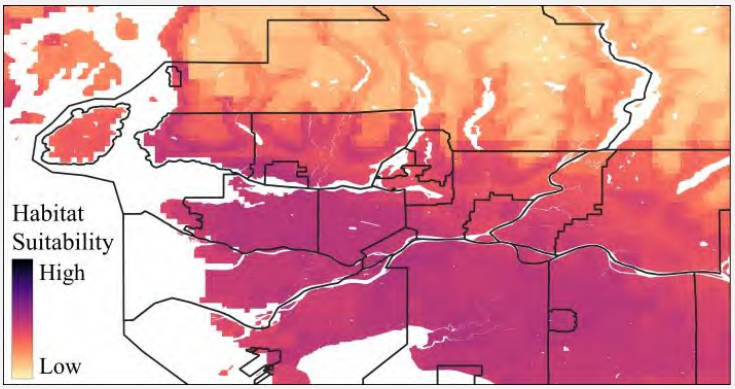
Flowering rush

Currently, eastern areas of the Metro Vancouver region are highly suitable for the establishment of flowering rush. While there are no known sites in Metro Vancouver currently, flowering rush has been detected in the Hatzic area of the Fraser Valley. By 2050, the region as a whole will be moderately suitable for flowering rush. Moderate suitability combined with high risk of introduction may result in the establishment and proliferation of flowering rush.

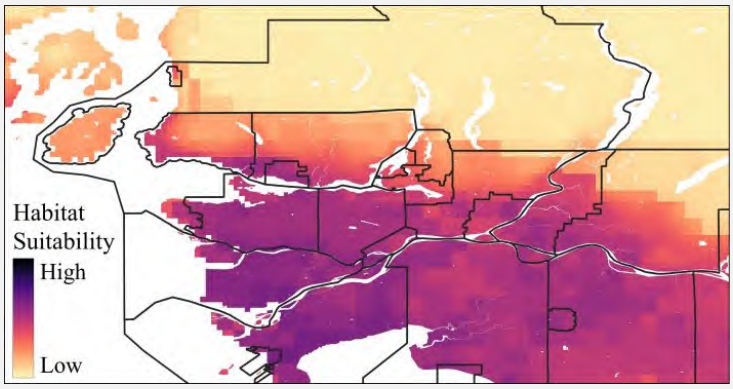
Local risk assessments combined with this modelled suitability map suggest areas for targeted monitoring and prevention of this species. Flowering rush spreads mainly by human water recreation (boats moving between water bodies without cleaning) and improper garden plant disposal. However, nursery sales are the main pathway for long distance dispersal.



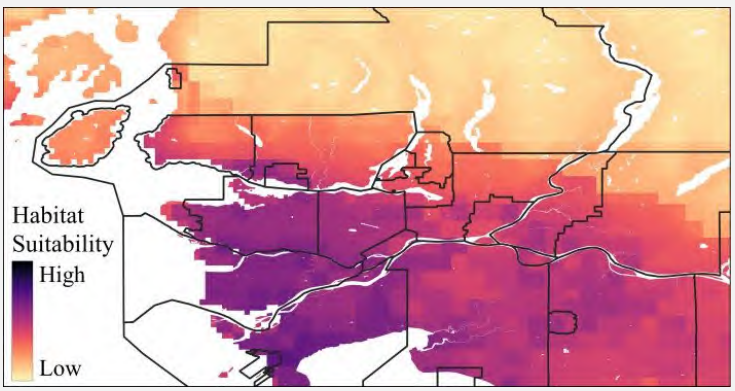
Current suitable habitat



Climate scenario RCP 8.5 2050



Current suitable habitat



Climate scenario RCP 8.5 2050

Water hyacinth

The current climate of the Metro Vancouver region suggests that the habitat is already moderately to highly suitable for water hyacinth. The model predicts that this suitability may only result in year-round establishment approximately 50% of the time. Under future climates, the suitability of the region remains moderately to highly suitable; however, fewer frost days may increase the likelihood that water hyacinth will over winter and spread.

Given water hyacinth's status as a high-risk species, and the habitat suitability of the region, close monitoring and prevention is highly recommended for this species. While nursery sales are the main vector of spread, the increased frequency of flooding, such as the November 2021 flood event, increases the likelihood of seeds spreading and remaining dormant for many years.

To: Regional Parks Committee

From: David Leavers, Division Manager, Visitor & Operations Services

Date: August 24, 2022 Meeting Date: September 21, 2022

Subject: **Community Involvement Review Update**

RECOMMENDATION

That the Regional Parks Committee receive for information the report dated August 24, 2022, titled "Community Involvement Review Update."

EXECUTIVE SUMMARY

Strong community partnerships are critical in engaging the diverse communities in Metro Vancouver's regional park system. Through interpretive programming, education, and volunteering opportunities, Metro Vancouver fosters a deep connection between the region's growing diverse population and the natural world. Currently there are formal agreements with six community associations for service delivery. Each agreement is unique with respect to the park, the activities and the association involved.

In support of the 2022 Regional Parks Committee work plan, a review of the Regional Parks - Park Partnership Program was completed. The consultant firm "Park People" was retained to assist Regional Parks with this review. The *Community Involvement Review* provides a systems thinking framework including guiding principles, strategic directions and actions to continue supporting and effectively engaging current and future community partners.

PURPOSE

To provide the Regional Parks Committee with an update regarding the 2022 *Community Involvement Review.*

BACKGROUND

The current park partnership model was envisioned in 1995 through a policy developed to support Park Associations as an alternative to staff-run volunteer programs and provided enhanced community led opportunities. This included the provision of annual funding through formal contribution agreements to support association activities. The Park Partnership model was revised in 1998, and 2014 building on the long history of community involvement and further articulating the Park Association model based on past priorities and community development principles.

In 2022, there are currently six Park Associations in six of Metro Vancouver's 23 regional parks, each association receives contribution funding through agreements with Metro Vancouver to support the provision of stewardship and nature education programs.

These Community Associations are:

- Burnaby Lake Park Association
- Colony Farm Park Association
- Derby Reach / Brae Island Parks Association
- Kanaka Education and Environmental Partnership Society
- Minnekhada Park Association
- Pacific Spirit Park Society

Challenges and Opportunities
Since the last review of the program in 2014, there have been changes in the focus for Regional Park programming, in particular, the 2016 and 2022 *Regional Parks Plans* both focused on Regional Parks' mandate to 'protect and connect'. Nature based programming became a focus and general community interest in supporting stewardship initiatives in Regional Parks became increasingly more popular. On review it is noted that the traditional Park Association agreements and activities can also benefit from, and be strengthened, with thoughtful consideration of First Nation interests in the Regional Park system.

Volunteerism within Regional Parks has also changed over the past several years. There has been a significant growth of volunteerism in the ecological stewardship program and a decreased desire for volunteers to be involved in the long-term traditional governance of Park Associations. For example, volunteers are preferring to support episodic events such as stewardship or "one-off" activities. Corporate social responsibility initiatives are also now more common with the emergence of corporate and community targeted events.

Over time, some community associations have also decided that their volunteer efforts would be better suited with no formal agreement in place and have chosen to dissolve, this was recently evident with both the Campbell Valley Park Association and the Boundary Bay Park Association.

Alignment with Board Strategic Plan and 2022 Regional Parks Plan Strategies and Actions:
The *Community Involvement Review* supports the 2019-2022 Metro Vancouver Board Strategic Plan – Regional Parks Services goal three:

> *"FOSTERING COLLABORATION & PARTNERSHIPS: Strengthen awareness and engagement with the public, members, other orders of government, and key stakeholders on a range of initiatives regarding the role and value of regional parks."*

Also supported is strategy 12 from the Board approved 2022 Regional Parks Plan: Protect and Connect, to Provide Diverse and meaningful learning and volunteer opportunities that deepen people's connection to nature, and strategy 8: Protect and manage cultural resources in regional parks. Specifically, the following actions are supported:

> 8.3: "*Work with cultural organizations and communities to incorporate cultural information into planning and management."*

12.1: *"Implement the Public Programming Strategy to provide relevant content for the region's growing, diverse population."*

12.8: "Seek partnerships in program delivery, community engagement and provision of special programs where others have expertise."

Finally, there is a strong Metro Vancouver desire to incorporate diversity, equity, and inclusion goals by intentionally including community groups that better represent the region's demographics.

Strategic Review:
Regional Parks retained the consultants "Park People" to review the existing Park Partnership program and provide recommendations for enhancing the program, specifically:

- Metro Vancouver Regional Parks' approach to managing community relationships
- The potential for broadening and enhancement of Metro Vancouver Regional Parks' community relationships
- To assist in resource allocation and prioritization for the allocation of staff and budget resources to address these opportunities

The *Community Involvement Review*, (Attachment) focused on understanding why Metro Vancouver works with community partners and made strategic recommendations to broaden and enhance Regional Parks' community relationships by:

- Confirming the vision, goals, and desired outcomes of community relationships and partnerships
- Evaluating the existing relationships against the vision, goals, and desired outcomes
- Identifying community interests and gaps in the current relationship
- Identifying ways to work with other potential types of community partners to help achieve goals
- Sharing best practices and approaches to relationship building with community partners
- Providing recommendations on Regional Parks' approach to managing community relationships
- Determining the functional relationships among staff that are involved with community involvement and relationship building within Metro Vancouver Regional Parks

THREE PHASES (CONSULTATION, ANALYSIS, RECOMMENDATIONS)
The *Community Involvement Review* was divided into three phases. Phase one focused on consultation. "Park People" reviewed key documents, conducted interviews, consultations and focus groups with staff, management, and community partners, conducted research on comparable partnership programs and interviewed key peers in park departments and partnership programs in other cities.

Phase two was the analysis phase of the review. It involved reviewing staff and partner feedback from the consultation phase, scholarly research, leading practices research, and external interviews

with park departments or organizations working on a similar scale of community partnerships. This research uncovered several key insights that will guide an enhanced community partnership program.

Phase three involved drafting recommendations for an evolving *Park Partnership Program*. Eleven recommendations were divided into three strategic directions. These recommendations aim to formalize some of the work currently being undertaken by Regional Parks staff in managing relationships with community partners while working to develop more consistency across relationships with partners, and creating more opportunities to connect with under-represented community partners.

The strategy provides a set of tools for staff to better assess partnerships and make decisions on how to allocate resources in order to best serve the community. These recommendations will help to efficiently manage existing relationships and provide space for new relationships that would be strategic for Metro Vancouver Regional Parks.

Each recommendation includes a description of the current situation, a rationale, an example of a best practice of similar processes across the North America, and implementation considerations. A summary of the recommendations is provided in the attachment.

Next Steps
In support of the implementation of the Regional Parks Plan, the *Community Involvement Review* will be used by staff as a tool/guide to cultivate new relationships, nurture and develop existing relationships and to foster strengthened community capacity across the Regional Park system. The plan will also be shared with municipal partners through the Regional Parks Advisory Committee.

ALTERNATIVES
This is an information report. No alternatives are presented.

FINANCIAL IMPLICATIONS
None at this time. Should the implementation of any of the recommendations require new or additional budget resources, these will be built into future annual budget requests.

CONCLUSION
The *Community Involvement Review* analyzed the existing Regional Parks' community partnership program to develop further understanding of the program's impact while evaluating it against leading practice models, identifying areas for enhancement of engagement and improvements to how the program is resourced. Attention was given to determine how Regional Parks can achieve greater diversity amongst partners, including multicultural groups.

Strong community partnerships are critical in engaging diverse communities in Metro Vancouver's Regional Parks system. Throughout Metro Vancouver Regional Parks' history, many citizens have demonstrated that they want sustained involvement in the system. This involvement is valued and the recommendations within this *Community Involvement Review* will continue to foster and strengthen these relationships for the future. This will help grow the individual capacity of groups, and encourage greater involvement and deeper engagement of partnerships in Regional Parks.

Attachment
Community Involvement Review - Executive Summary

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Metro Vancouver Regional Parks

Community Involvement Review

2021

EXECUTIVE SUMMARY

Strong community partnerships are critical in engaging diverse communities in Metro Vancouver's Regional Parks system. Throughout Metro Vancouver Regional Park's history, many citizens have demonstrated that they want sustained involvement in the system beyond just being park visitors and using park facilities and trails.

Following recent 2020 reviews of the Metro Vancouver Regional Parks Public Programming Strategy and the Regional Parks Natural Resource Management Framework, a final review was required of the Community Relationships Strategy to update Metro Vancouver's partnership approach.

Park People was retained to support Metro Vancouver Regional Parks with a review of their current partnership work to guide the development of an enhanced Community Relationships Approach.

This strategy has been informed by a thorough review of current practices in Metro Vancouver across the staff teams whose work intersects with community engagement, relationship building and partnership work, as well as a review of best practices and growing trends in park partnerships across North America.

The proposed **Community Relationships Approach** is informed by the following guiding principles:

Clarity and definition of roles and expectations for both community partners and Metro Vancouver Regional Parks

Consistency of messaging and approach embedded across the system

Equitable and effective allocation of resources, staff time and expertise across the whole partnership approach

Increase equity and diversity of partnerships through the intentional inclusion of community groups that better represent the region's demographics

Instill flexibility and an iterative process of evaluation to allow groups to engage in the most relevant type of relationship with Metro Vancouver Regional Parks as their groups grow or subside

Relationships based on clearly defined expectations and outcomes (as opposed to a fixed definition) to allow for periodic review and reconsideration

Balancing community leadership and autonomy with Metro Vancouver Regional Parks' priorities and responsibilities as land managers

The following **three strategic directions and 11 recommendations** are articulated in full in an internal working document to be refined into an implementation plan by Metro Vancouver Regional Parks staff and management:

Improving consistency across the system

These recommendations will help ensure that partners are treated fairly across the spectrum of engagement with clarity on how to access an integrated team of Metro Vancouver staff and what to expect from the partnership:

1. Working as a partnership team
2. Clarifying expectations for partners and Regional Parks
3. Partner evaluation to suit engagement level

Growing a Park Partner Network

These recommendations will help grow both the individual capacity of groups as well as the impact of the whole system of park partners, encouraging greater involvement and deeper engagement in Regional Parks:

4. Balancing support for different types of partnerships
5. Invest in volunteer coordination
6. Use regular training opportunities / offerings to grow capacity across the Park Network
7. Reinstate an annual event
8. Communications and user-friendliness

Growing Internal Capacity

These recommendations will help ensure that Regional Parks has the financial resources to support a growing park partnership program that embodies equity and is designed to grow and evolve to continue to best meet its goals:

9. Explore creative funding + granting models
10. Incorporate Equity, Inclusion + diversity goals
11. Overall Program Evaluation

Derby Reach Brae Island Park Association

To: Regional Parks Committee

From: David Leavers, Division Manager, Visitor & Operations Services

Date: August 24, 2022 Meeting Date: September 21, 2022

Subject: **Regional Parks Public Programming Strategy Implementation Update**

RECOMMENDATION

That the Regional Parks Committee receive for information the report dated August 24, 2022, titled "Regional Parks Public Programming Strategy Implementation Update."

EXECUTIVE SUMMARY

Since the April 2020 MVRD Board approval of the Regional Parks Public Programming Strategy, several initiatives have been completed or are ongoing to advance implementation of the strategic goals. This report provides an update on the deliverables of the strategy in the following five strategic theme areas described in the report:

- Broaden Your Base
- Extend Your Reach
- Make a Deeper Connection
- Invest in Children and Youth
- Ensure Financial Sustainability

The report fulfills the commitment to report out on the progress of the strategy as part of the Regional Parks Committee 2022 Work Plan.

PURPOSE

To provide the Regional Parks Committee with an implementation update regarding the *Metro Vancouver Regional Parks Public Programming Strategy* (2020).

BACKGROUND

The *Metro Vancouver Regional Parks Public Programming Strategy* received the endorsement of the MVRD Board on April 24, 2020. The strategy provides strategic direction for interpretive staff delivering public programs and events within regional parks. The strategy includes a number of recommendations and deliverables for implementation between 2021-2025, grouped within the following five themes:

Broaden Your Base: Metro Vancouver is one of the most culturally diverse of Canada's metropolitan areas, yet that diversity is not reflected in Metro Vancouver Regional Parks' programming audiences. Work needs to be done to expand programming styles to connect with culturally diverse families, seniors, young adults and older teens. To ensure continued relevance, programming will need to acknowledge the full diversity of the public.

Extend Your Reach: According to the 2017 Coleman Canada Get Outside survey, 29% of Canadians say they spend less than a half hour per week outside, and 64% are enjoying the outdoors for less than two hours per week. In Metro Vancouver, awareness of Metro Vancouver Regional Parks' outdoor programming is still low. Public programs are not always fully subscribed, and many new programs are only offered once. Over 300 regional schools have never taken advantage of the high quality, low fee experiences offered in regional parks. The program's potential is unrealized; as regional residents are increasingly disconnected from nature.

Make a Deeper Connection: Currently, the role of Indigenous themes and Indigenous people in programming is vague and falls short of its potential and staff lack specialized training in programming techniques beyond the "by-naturalists-for-naturalists" paradigm.

The deliverables here aim to increase the quality and memorability of programs and events by updating professional skills; adding a cultural component to nature programs; partnering with Indigenous programmers to present relevant Indigenous content; increasing experiential and dialogic programming and continuing to move away from presentational programming styles.

Invest in Children and Youth: Children today lead structured lives, and much of that structure keeps them indoors. Today's children spend an average of seven hours each day looking at screens. When they do get outside, they may be carefully constrained and supervised by parents worried about their safety. Many of the region's children live too far to walk to a green space or a regional park. Research shows that for children, a profound experience in nature facilitated by a trusted mentor can foster a lifetime of environmental engagement.

To achieve Metro Vancouver's long-term vision of a community of engaged stewards of their environment, public and school programs should continue to connect with children and youth.

Ensure Financial Sustainability: Program fees are currently set based on an analysis of operating costs against a detailed review of fees for services offered by member municipalities and other government and non-profit agencies. Research is completed on comparable programs and events in municipal park systems in Metro Vancouver. A median rate is targeted for Metro Vancouver's fees as to generally stay in line with comparable market rates and not unduly subsidize program and event costs through the tax levy. Educational programming is relatively expensive, and Metro Vancouver Regional Parks must adhere to sound financial management and strategic long term planning.

Alignment with Board Strategic Plan and 2022 Regional Parks Plan Strategies and Actions:
The Public Programming Strategy supports the 2019-2022 Metro Vancouver Board Strategic Plan – Regional Parks Services goal three:

> *"FOSTERING COLLABORATION & PARTNERSHIPS: Strengthen awareness and engagement with the public, members, other orders of government, and key stakeholders on a range of initiatives regarding the role and value of regional parks."*

Also supported is strategy 12 from the Board approved 2022 *Regional Parks Plan*: Protect and Connect, to provide diverse and meaningful learning and volunteer opportunities that deepen people's connection to nature. Specifically,

> 12.1: *"Implement the Public Programming Strategy to provide relevant content for the region's growing, diverse population."*
>
> *12.3: "Deliver events that provide equitable opportunities for many people to experience interpretive and educational programming in regional parks."*
>
> *12.7: "Develop interpretive plans for each regional park that tell the story of the park, incorporating natural and cultural history."*
>
> *12.8: "Seek partnerships in program delivery, community engagement and provision of special programs where others have expertise."*

The strategy makes recommendations to streamline program and event development and delivery, and to increase the return on investment.

IMPLEMENTATION FOCUS 2021 - 2025

Guided by the five strategic directions, the *Metro Vancouver Regional Parks Public Programing Strategy* identifies milestones and actions looking out to the year 2025. Staff have been committed to these new directions despite the challenges faced during the pandemic. The attachment (Implementation Focus – Regional Parks Public Programming Strategy) provides a summary of the completed and ongoing actions grouped by strategic theme.

ALTERNATIVES

This is an information report. No alternatives are presented.

FINANCIAL IMPLICATIONS

None at this time. Any additional financial implications to advance the implementation of the Regional Parks Public Programming Strategy will be considered as part of the annual budgeting process.

CONCLUSION

The Public Programming Strategy confirmed the need for regionally provided nature-based public programs and events and provided clear recommendations on how Regional Parks programming and interpretation will help Metro Vancouver Regional Parks meet the future needs of the region's growing diverse population. Of the 31 deliverables created as a result of the Strategy, several are now complete, and many are underway.

Staff working on each of the five strategic themes continue to successfully implement the deliverables, and have a clear plan to help guide them over the coming years. The implementation of the deliverables will ensure Metro Vancouver Regional Parks programs are engaging, high quality,

memorable, authentic experiences that reach a representative sample of Metro Vancouver's regional population.

Attachment
Regional Parks- Public Programming Strategy Implementation Focus Update 2022

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Regional Parks- Public Programming Strategy Implementation Focus Update 2022

BROADEN YOUR BASE

Currently Regional Parks is not engaging all segments of the community and the goal of the Broaden Your Base deliverable is to improve upon that. To create a sense of belonging, all community members need to see themselves and their culture in regional parks. Connection to these audiences will come through development of new programming that acknowledges diversity and attracts these new audiences on their own terms. There are ways that Regional Parks can create a more inclusive environment and encourage new audiences to explore and connect.

Deliverable: Regional parks programming audience will reflect the demographic diversity of the Metro Vancouver community.

Deliverable: Underserved municipalities will be better represented in public programming audiences through targeted programming and promotion.

The desired outcome is to connect with new audiences that will include the four priority audiences as identified in the PPS.

- Unserved school groups: Lesser-served schools; schools with high economic need and those where children have limited access to nature.
- Culturally diverse families: Ethnically diverse group of first and second generation immigrant families with younger children.
- Existing adult audiences: Educated, middle-class people with a strong level of environmental literacy and commitment, who seek to solidify their relationship with nature through educations programs.
- Young adults: Young millennial/Gen Z (Age 20s) who are trying to balance the pressures of school, part-time jobs, lower income revenue and the demands of the dating scene.

Other priority audiences include seniors, older teens, and underserved municipalities.

To better understand the target audience segments listed above and the barriers they face in accessing public programming, and to understand what kind of programs people are interested in, In August, 2022, a survey was designed and launched by a contractor, *Sentis*, in collaboration with staff from External Relations.

The survey aimed to gain a deeper understanding of the audiences who are under-represented when it comes to their participation in Regional Parks public programming. The survey had a strong focus within the municipalities of Richmond and Surrey in order to understand the lack of representation within these jurisdictions, as identified in the PPS. The survey closed at the beginning of August and interpretive staff are awaiting a draft report.

The results of the survey will help staff develop programming for these under-represented audiences. Once the initial data has been compiled, staff will identify gaps and offer the survey in Chinese and Punjabi to ensure we fully engage with the target audiences.

The survey will also establish baseline data for goals, understand what kind of programs people are interested in (gain a better perception of both current offerings and new ideas among specific audience segments) and inform the future development of a marketing and promotion strategy for public programs, which is another deliverable identified in the PPS.

EXTEND YOUR REACH

The Extend Your Reach implementation plan focuses on the following strategies recommended in the PPS including considering a full marketing plan, including more interpretive nature content in social media and revamping the program registration process.

These recommendations will enable staff to increase the reach of nature-based interpretive offerings promoting to priority audiences, growing the awareness of public programming, and nurturing a sustained relationship with existing clients. The plan represents an ambitious shift in current practices with the main goal of increasing the number of regional residents connecting with nature in meaningful ways through public programming.

Deliverable: Metro Vancouver will have an ongoing relationship with public programming clients, not a one-off affair with each booking.

Deliverable: Repeat clientele for public programming will have increased 30%.

For the above two deliverables, the Extend Your Reach working group researched how to communicate with past program participants via ActiveNet, the current registration software. Staff discovered that they can email past participants about upcoming programs similar to ones they have already registered for. Because ActiveNet has a built in unsubscribe option, staff have ensured that Metro Vancouver is abiding by Canada's anti-spam legislation. In the fall, staff will utilize this feature to promote programs to past participants.

Deliverable: The possibility of a Metro Vancouver Regional Parks Instagram channel will be investigated.

Deliverable: Metro Vancouver Regional Park's social media will include more interpretive content, presented in a voice that is appropriate to priority audiences.

For these deliverables, three Regional Parks staff were given access to post to Metro Vancouver's corporate Instagram account. Staff have been provided with an overview of procedures and protocol, password access and scheduling options with Facebook and Hootsuite. This is a trial to determine if using Instagram is a helpful platform to promote Regional Parks programs and interpretive content, if Regional Parks staff have the capacity to maintain an Instagram channel, and if Regional Parks should create and manage a separate Instagram profile. The trial will be run over the summer of 2022 and then assessed to see if staff wish to continue to the end of the year.

Deliverable: Public programs will be 90% subscribed.

Deliverable: Regional awareness of Metro Vancouver Regional Parks public programming will increase by at least 15%.

These deliverables are more *measures/outcomes* but actions are still required to achieve them. Increasing awareness of Metro Vancouver Regional Parks public programming will help interpreters move towards equity in access to parks programming. Increased awareness will also help achieve other objectives in the PPS The Extend Your Reach team will utilize the results of the survey that the Broaden Your Base team conducted, and this will inform a marketing strategy.

MAKE A DEEPER CONNECTION

The Make a Deeper Connection plan is to create a foundation to guide interpreters to create the best programs and experiences that connect Metro Vancouver residents to the regional parks. The population and landscape of Metro Vancouver has transformed in the past 25 years and programs need to respond to these changes. In this time of Indigenous reconciliation, park interpretation is moving to a cultural landscape approach to storytelling. Audiences expect deeper, more personal experiences from their outdoor pursuits.

Deliverable: Each Regional Park that hosts programming will have its own interpretive plan. Within the plan, programs will be crafted around strong interpretive themes or Big Ideas, and evaluated against visitors' understanding and feelings of connection to them.

Campbell Valley Regional Park will become the first park with its own interpretive plan. The park's new management plan will help inform the interpretive plan. A consultant will be hired to assist in writing, formatting and editing the plan that will be completed by end of summer. This new interpretive plan will provide a template for other interpretive plans to follow. Grouse Mountain Regional Park and Widgeon Marsh Regional Park will be the next two regional parks to have an interpretive plan developed.

Deliverable: Interpreters will begin professional development and networking in up-to-date programming techniques, and new hires will have current skill sets.

Interpretive staff started taking virtual training in Dialogic Interpretation in 2021 and continue to do so in 2022. Staff who attended training have shared their learnings with all interpreters in the system.

Deliverable: Traditional territory will be meaningfully and sincerely acknowledged at all Metro Vancouver Regional Parks programs and events.

All programs and events now begin with a site specific traditional territory acknowledgement.
Acknowledging territory is a way of honouring and showing respect for Indigenous Peoples. It is recognition of their presence both in the past and the present. Recognition and respect are essential elements of establishing healthy, reciprocal relations. These relationships are key to reconciliation.
Staff undertook training, and worked closely with colleagues from Indigenous Relations to come up with ways to acknowledge traditional territory in authentic ways.

Deliverable: Each public program will have its own evaluation framework with benchmarks and standards for attendance, revenue, satisfaction, thematic learning and feelings of connection.

Research of best practices for evaluation and assessment is currently underway. A high level assessment tool is being crafted for current and new programs. This will ensure all programs meet the vision and mission of the new Regional Parks Plan, Deliverables of the PPS will contain themes identified in the park's

interpretive plan. A detailed program scoring tool will ensure that all programs measure success through attendance, ecological indicators, feelings of connection, intention to change behavior and cost. Staff expect to have a completed evaluation framework by year end.

INVEST IN CHILDREN AND YOUTH

The recommended actions set forth in this implementation plan will result in investing in children and youth through a variety of avenues (such as schools, community groups and volunteer opportunities), while paying close attention to those who come from under-served communities, those who have financial need and those with limited access to nature.

Deliverable: Create online and physical Nature Connection Kits (referred to in the PPS as "Turnkey Kits").

Staff have created Nature Connection Kits to increase the knowledge and awareness of Regional Parks to youth across the region, and to align the content of the kits with both school curriculum and the Regional Parks mission to 'protect and connect.' The online kits will provide free and accessible resources to teachers and empower them to independently lead meaningful nature experiences for youth. Market research on similar kits has been completed.

Staff are excited to develop and move forward with these online resources to support educators who face barriers to getting to regional parks with their classes and to connect older youth to the diversity found in regional parks. After the online kits have been created, staff will create physical kits, so teachers and students will be able to get more out of their park visit when they come in person.

Deliverable: Gain a better understanding of barriers facing underserved communities.

Richmond and Surrey were identified as under-served communities in the PPS. In spring, 2021 Regional Parks strategically provided lower-income schools (formerly called "inner-city schools") in Richmond and Surrey the first opportunity to book a new virtual pond peeking field trip for grades 2/3 free of charge. Over 60 classes booked, indicating the need to hold space for these under-served communities to facilitate access. Regional Parks will continue to ensure there is space for these under-served communities by setting aside program opportunities.

Staff have also planned programs with the Pacific Immigrant Resources Society and are collaborating with Mosaic to offer programs to immigrants and refugees. The goals of these programs are to help participants feel more comfortable accessing nature on their own and introduce them to Regional Parks.

Deliverable: Create an Educators and Youth Advisory Committee (EYAC) that consists of separate nuclei of teachers, students and community partners.

The Invest in Children and Youth team is working with External Relations to create a mutually beneficial opportunity for youth and K-12 educators to provide input to Metro Vancouver programs, projects, and policies while creating an engaging experience for them to learn more about Metro Vancouver, local government, and various initiatives. Proposed make-up of the Committee is: five people aged 13-18 (high school youth), five people aged 18-25 (post secondary youth), and five people who work in K-12 education. After the initiative receives Board approval of the Committee's Terms of Reference, there will be a soft outreach to schools in the fall for recruitment. This Committee will benefit Regional Parks in the future by providing a forum to seek input from regarding program planning.

ENSURE FINANCIAL SUSTAINABILITY

The PPS stated that Regional Parks interpreters will continue to prioritize high-quality, interactive, experiential, nature-based programs and events; that Regional Parks will seek to manage the costs of providing its programming services while seeking opportunities to increase its overall revenue generation where appropriate; and that Metro Vancouver will consider opportunities to generate increased revenues from program registration (i.e. high-yield, low-ratio programs) as well as alternate forms of revenue including fund raising, donations and corporate sponsorship.

Deliverable: Assess the Cost Recovery - Pyramid Model for Revenue Generation and determine its relevance to regional park public programming.

One of the first steps to achieve these goals of this strategy was to develop a cost recovery model that would guide future decisions regarding pricing and investment. The model would help determine which costs to include when calculating cost recovery; classify programs into cost recovery tiers; calculate current cost recovery levels; and identify potential cost-plus opportunities (>100% cost recovery). Regional Parks contracted *Ryan Schwartz Consulting* to create a custom cost recovery model and pricing strategy for its public programming fees. The consultant evaluated current program prices and created a model that will assist staff to determine and evaluate pricing decisions for both current and future programs.

The consultant worked with staff to categorize programs and tally costs and then built a spreadsheet tool that will help staff to set public programming fees. The consultant suggested Regional Parks use a benefits based approach, meaning if more community benefit accrues from a service, then a lower cost recovery rate is justified (lower fees; higher subsidy); if more personal benefit accrues from a service, then a higher cost recovery rate is justified (higher fees; lower subsidy).

Deliverable: Recover 25%-50% of immediate staff and materials costs through program fees by 2025.

Using the Cost Recovery Model, the consultant examined several scenarios to determine if achieving 50% cost recovery was possible, or even reasonable. After this examination, the consultant assessed that the current cost recovery is only 11%, and that prices for public programs are generally appropriate. The consultant suggested several ways that Regional Parks could increase revenues, and noted that raising fees is not the only way to achieve this cost recovery goal. The new model enables staff to understand all the variables that contribute to cost recovery. However, it is <u>not</u> expected that cost recovery between 25%-50% can be achieved while keeping public program costs accessible for many in our communities.

Deliverable: Invest cautiously, in high-yield, low-ratio experiential programming that recovers full costs + profit.

The consultant suggested that introducing cost-plus programs may seem like a good idea to help increase cost recovery, but it's not worth it given the financial risks involved. There isn't enough certainty that enough people would register for these types of programs, and the consultant recommended we leave these types of programs for the private sector to offer. Staff will discontinue its consideration of this program direction based on this advice.